



**PHASE TWO:  
ROCKAWAY BEACH BRANCH / JFK ONE SEAT RIDE RAIL STUDY  
LIRR CONTRACT 6168C-10-09, RELEASE "A"**

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## 1. INTRODUCTION

### 1.1 PROJECT GOALS AND OBJECTIVES

The Phase Two portion of the LIRR Rockaway Beach Branch/JFK Airport One-Seat Ride Rail Study included an evaluation of the feasibility of new Long Island Rail Road (LIRR) service from Midtown Manhattan to the John F. Kennedy (JFK) Airport Central Terminal Area (CTA). The service would provide a single seat ride with no transfer except at the JFK CTA. Two of the three alignments reviewed would use the LIRR Main Line to access a restored Rockaway Beach Branch (RBB), which is documented in the *“Phase One Rockaway Beach Branch Sketch Assessment Draft White Paper.”* The third alignment would use a connection between the LIRR Main Line and the AirTrain infrastructure at Jamaica Station.

This memorandum, *Rockaway Beach Branch/JFK Airport One-Seat Ride Rail Study Draft Technical Memo #3*, further explores the feasibility of three alignments considered in the *“Phase Two: Rockaway Beach Branch/JFK Airport One-Seat Ride Rail Study Draft Technical Memo #2 (Tech Memo #2),* alignments *“North of Howard Beach”* and *“South of Howard Beach.”* The three alignments are being examined more closely as they pertain to constructability, travel demands, service and operation, and potential costs.



## 2. PRELIMINARY ALTERNATIVES ANALYSIS

### 2.1 PRELIMINARY FEASIBILITY ANALYSIS

The table shown below assesses the impacts and obstacles for the proposed LIRR alignment options. These alignments have many similarities but also have varied issues, ranging from condition of the Right-of-Way (ROW), constructability, and environmental concerns. Examining each alternative by section provides a more comparative and thorough assessment. Continued coordination with the PANYNJ JFK Master Planning effort is critical to all future analysis.

LIRR MAINLINE TO JFK CENTRAL TERMINAL AREA			
	NORTH OF HOWARD BEACH	SOUTH OF HOWARD BEACH	HYBRID VEHICLE
	Findings	Findings	Findings
<b>Cost Effectiveness</b>	<ul style="list-style-type: none"> <li>Less underground construction, but more surface impacts</li> </ul>	<ul style="list-style-type: none"> <li>High cost of tunnel construction through most of the alignment</li> </ul>	<ul style="list-style-type: none"> <li>Construction cost mainly limited to Jamaica Station area</li> <li>Requires Hybrid vehicle technology</li> </ul>
<b>User Benefits</b>	<ul style="list-style-type: none"> <li>Travel time savings</li> <li>One-Seat Ride</li> </ul>	<ul style="list-style-type: none"> <li>Travel time savings</li> <li>One-Seat Ride</li> </ul>	<ul style="list-style-type: none"> <li>Travel time savings</li> <li>One-Seat Ride</li> </ul>
<b>Ease of Implementation/Constructability</b>	<ul style="list-style-type: none"> <li>Less tunneling but more surface interference</li> </ul>	<ul style="list-style-type: none"> <li>Less surface interference but more underground construction</li> </ul>	<ul style="list-style-type: none"> <li>Numerous impacts to existing LIRR and surrounding infrastructure at Jamaica</li> <li>Compatibility issues with existing LIRR infrastructure and Systems</li> </ul>
<b>Origin and Destination Run Time Measurements</b>	<ul style="list-style-type: none"> <li>Equal to south alignment option</li> </ul>	<ul style="list-style-type: none"> <li>Equal to north alignment option</li> </ul>	<ul style="list-style-type: none"> <li>Consistent with existing travel times but impacted by vehicle transition delay</li> </ul>
<b>Condition of ROW/Structures</b>	<ul style="list-style-type: none"> <li>All new construction East of Woodside</li> </ul>	<ul style="list-style-type: none"> <li>All new construction East of Woodside</li> </ul>	<ul style="list-style-type: none"> <li>New construction for connection but uses existing LIRR and AirTrain infrastructure.</li> <li>Remaining useful life to be determined</li> </ul>
<b>Alignment Concerns/ROW Encroachment</b>	<ul style="list-style-type: none"> <li>Non-residential encroachments</li> </ul>	<ul style="list-style-type: none"> <li>Non-Residential encroachments</li> <li>Bergen Basin depth affects grades and construction</li> </ul>	<ul style="list-style-type: none"> <li>Numerous encroachments to LIRR ROW and adjacent roadway network</li> </ul>
<b>Environmental Sensitivities</b>	<ul style="list-style-type: none"> <li>No significant impacts</li> </ul>	<ul style="list-style-type: none"> <li>No significant impacts</li> </ul>	<ul style="list-style-type: none"> <li>No significant impacts</li> </ul>
<b>Park Impacts</b>	<ul style="list-style-type: none"> <li>No significant impacts</li> </ul>	<ul style="list-style-type: none"> <li>No significant impacts</li> </ul>	<ul style="list-style-type: none"> <li>No significant impacts</li> </ul>
<b>Land Use Compatibility</b>	<ul style="list-style-type: none"> <li>None</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>



## 2.2 SELECTION OF ALTERNATIVES FOR FURTHER ANALYSIS

### 2.2.1 RBB North and South Alignments

As noted in *Tech Memo #2*, the SYSTRA Team recommended advancing the two Rockaway Beach Branch alternatives for further study. These two alternatives will be analyzed in *Technical Memo #4*, which will also address potential community impacts. In addition, *Technical Memo #4* will address the recommended strategy going forward and select one alternative for further in-depth analysis.

## 3. DETERMINATION OF ENGINEERING FEASIBILITY AND CONSTRUCTABILITY

### 3.1 TRACK

At-grade segments of the track bed are described in the “*Phase One: Rockaway Beach Branch Sketch Assessment Draft White Paper*” and apply to the portions of the alignment along the RBB from Howard Beach north. Segments of track located on viaduct may use either direct fixation or ballasted type track. Segments in tunnels will utilize direct fixation track in accordance with LIRR’s track standards (MW-2000). The direct fixation track will be designed to use a second pour concrete plinth method of construction and will have continuous welded rail as shown in Figures 1 and 2 below or may utilize a dual block booted concrete tie. See Section 3.3 and Appendix C for typical section on viaduct using the ballasted track option. All clearances will conform to Long Island Rail Road Minimum Roadway Clearances Drawing CE-1.

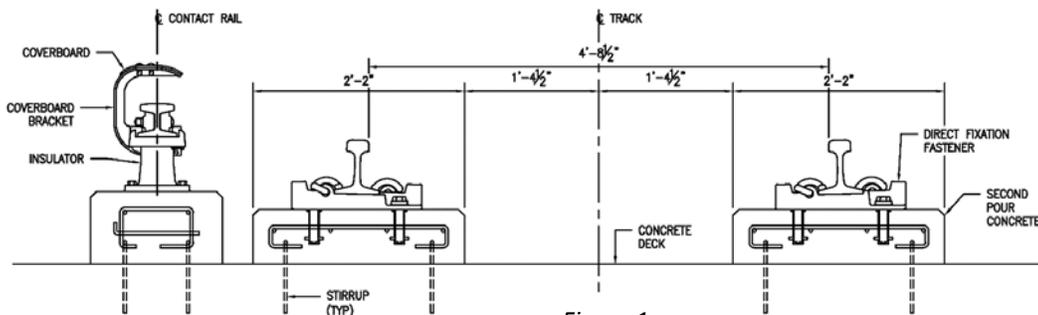


Figure 1

#### TANGENT TRACK ON VIADUCT

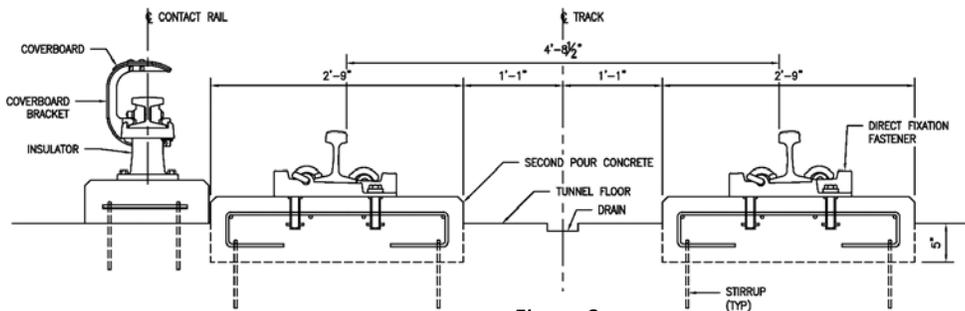


Figure 2

#### TANGENT TRACK IN TUNNEL



Analysis of the South of Howard Beach track profile yields a need to increase the descending grade from the area of the Nassau Expressway to below the Bergen Basin to 2.5%, in order to achieve the required two diameter tunnel section depth below the bottom of the Bergen Basin. This will require approval by the LIRR Chief Engineer. Further analysis of the elevation over Nassau Expressway, depth of the Bergen Basin and tunnel section design will be required to determine the final grade requirements. See Figures 3 and 4 below for track alignments and Appendices A and B for track profiles.

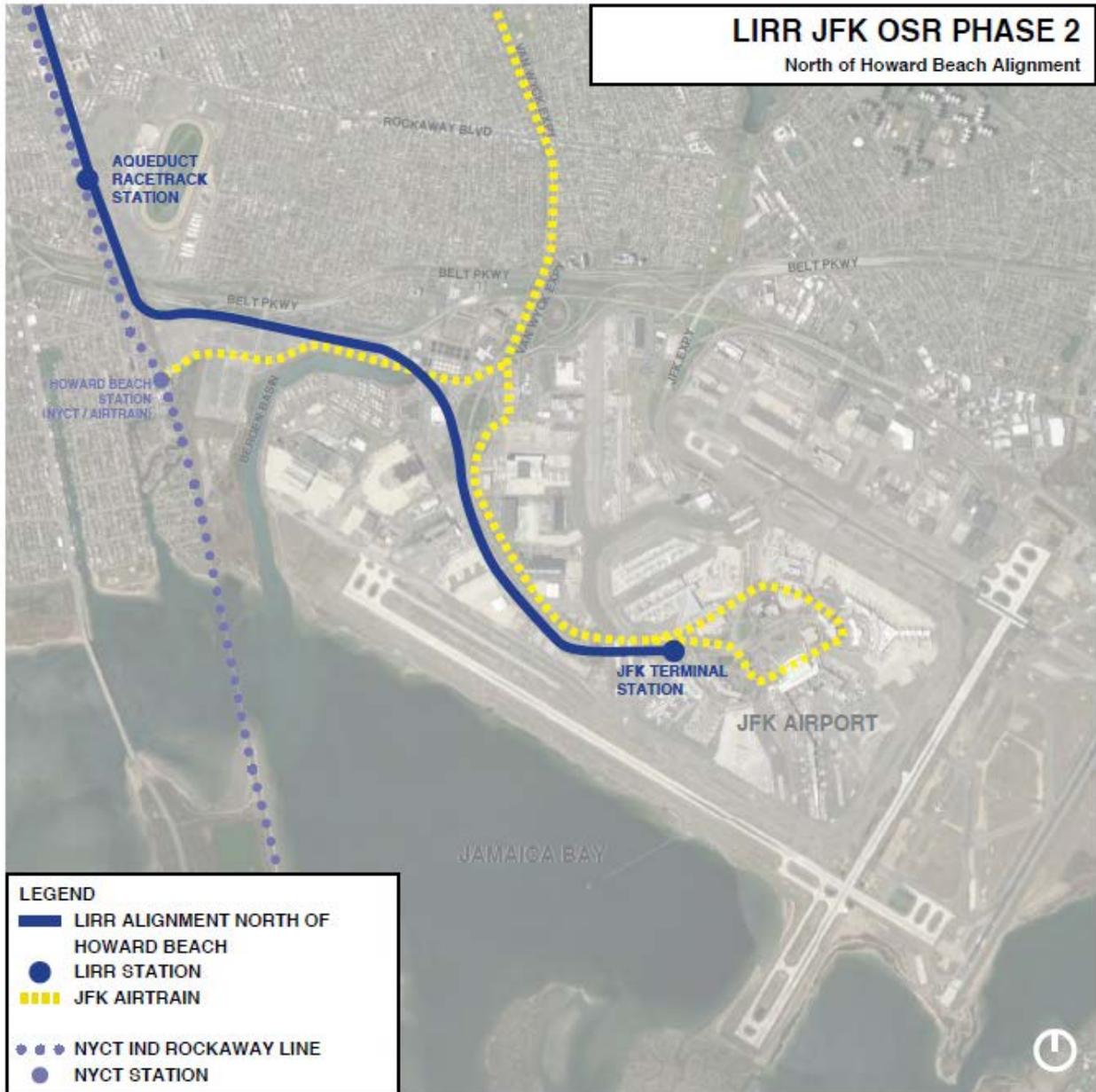


Figure 3



Figure 4

### 3.2 GEOTECHNICAL

Both the alignments proposed, North of Howard Beach and South of Howard Beach (Figures 3 & 4, above), will fall within the soft ground. The anticipated subsurface geology at both sites will consist of Fill and Organic Silty Clay underlain by glacial deposits consisting of Varved Silt, Clay, Fine Sand, Glacial Outwash Sand and Glacial Till deposits extending to an approximate depth of 100 feet below the existing surface. This in turn is underlain with Raritan Clay and Lloyd Sand deposits extending to approximate depths of 350 feet and 400 feet, respectively. Bedrock consisting of Gneiss and Schist occur at an approximate depth of 400 feet below the existing surface. Groundwater is likely to be encountered at shallower depths.



South of the proposed alignments, towards Rockaway Boulevard and Howard Boulevard, the thickness of the above-mentioned soil layers increase in direct correlation to an increase in the thickness of the Glacial Till layer. It is likely that this layer will be underlain by Glacial Gardiners Clay and Jameco Gravel deposits. The depth of bedrock increases to approximately 600 ft.

Further south of the proposed alignments closer to JFK, the in-situ soils include an approximately 10-foot-thick organic silty clay layer below the fill layer. The Gneiss and Schist Bedrock is likely to be encountered below a depth of 800 feet. The proposed tunnel alignment will likely pass through glacial outwash sand deposits.

The North of Howard Beach alignment will mainly run on a viaduct structure before descending into a tunnel upon approaching the CTA of JFK. The anticipated viaduct will need to be constructed on deep foundations, either driven or drilled piles. Several road segments and sidewalks in the vicinity will need to be closed for the duration of construction, adversely impacting traffic. Test borings will need to be drilled to specific depths to evaluate subsurface materials at the proposed viaduct pier locations. The driving and or drilling of piles for the pier foundations will create ground borne noise and vibrations.

The South of Howard Beach alignment will consist of mostly tunnel into the CTA of JFK. Several borings will be required to more accurately determine the subsurface and ground water conditions as well as the appropriateness for use of the Tunnel Boring Machine (TBM) along the alignment. Several multi-story buildings along the alignment likely occur on deep foundations and may be impacted by tunneling. In addition to privately owned structures, there may be situations where the proposed tunnel will affect the foundation of a structure in the public ROW. Buildings not situated on piles may be able to remain in place, with a compensation grouting program to account and adjust for settlement during the TBM drive. Existing structures and foundations will be individually evaluated during preliminary engineering and based on the findings will be secured or acquired accordingly.

Based on the previous NYCT subway tunnel project in this area, tunneling through sand and gravel with occasional boulders (soft ground) will be challenging, but constructible. The general quality of ground can be described as granular, uncemented and medium dense to dense material. Tunneling problems arise when the ground is unstable (running ground/flowing ground). Should unstable ground be encountered installation of deep dewatering wells may be required to counteract the effect of the water.



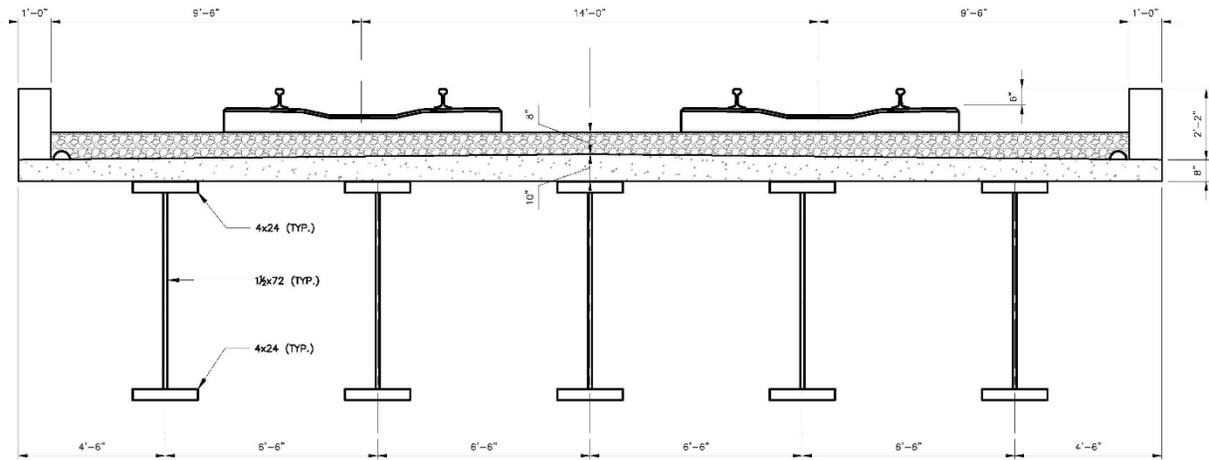


Figure 7 – Typical Section – Deck Girder Viaduct

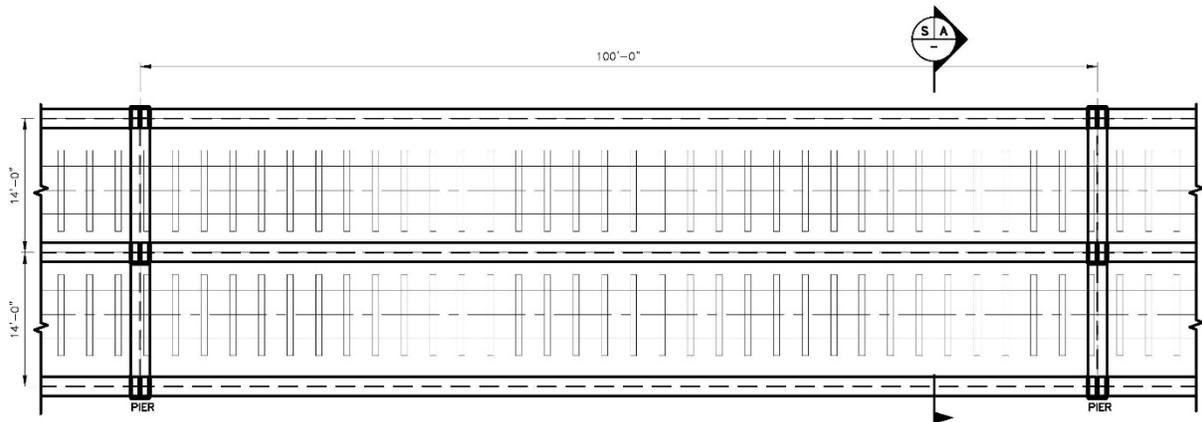


Figure 8 – Partial Plan – Thru Girder Viaduct

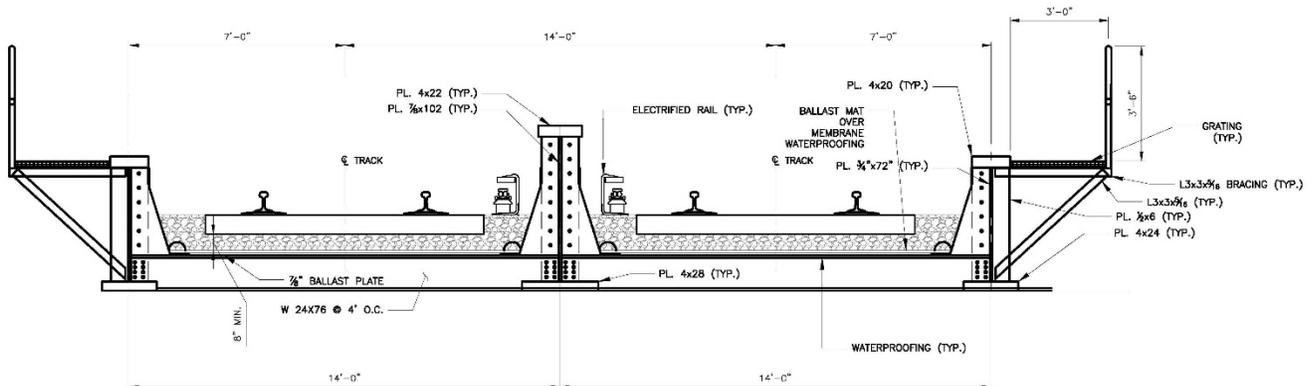


Figure 9 – Typical Section – Thru Girder Viaduct

The top of rail elevation at the majority of the viaduct is approximately 23 feet above grade elevation. Therefore, there should not be an issue with clearances over roadways. However, the current viaduct alignment is crossing several roadways at a slight angle which may require longer spans or some modifications to the roadways.

For full sized drawings in this section please see Appendix C.



### 3.3.1.2. JFK Terminal Station Constructability

The JFK Terminal Station will consist of two levels: a platform level and a mezzanine level (see Figure 10). The rail elevations will be approximately 60 feet below the street level.

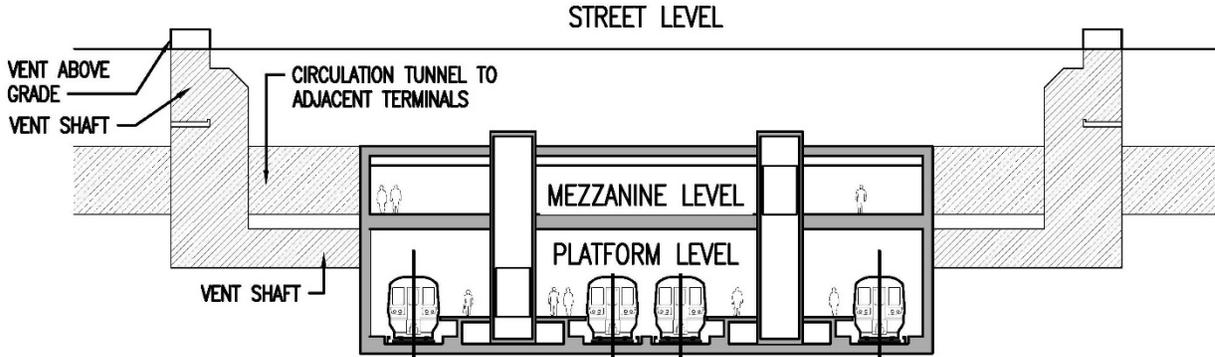
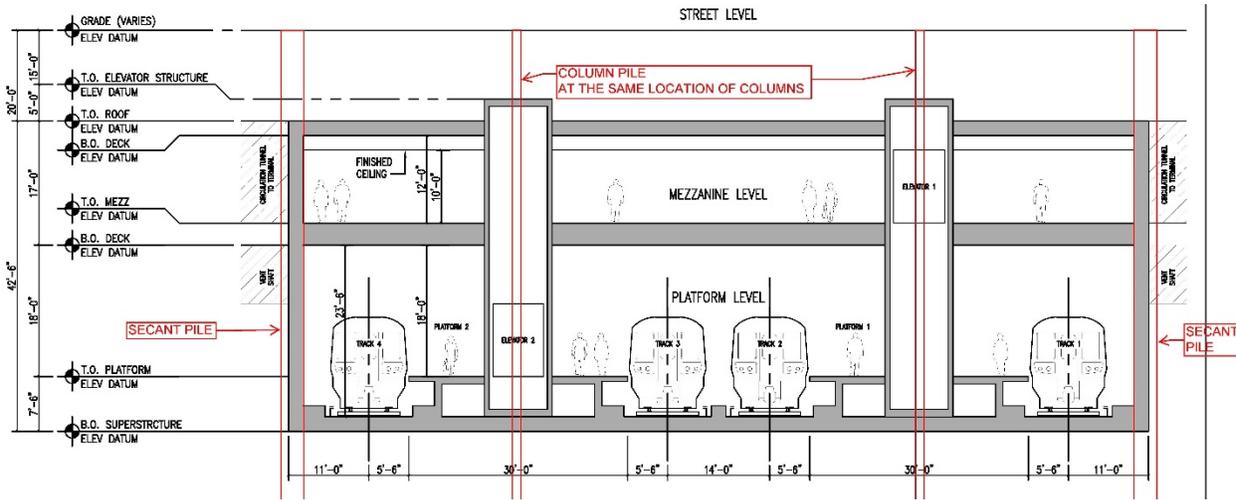


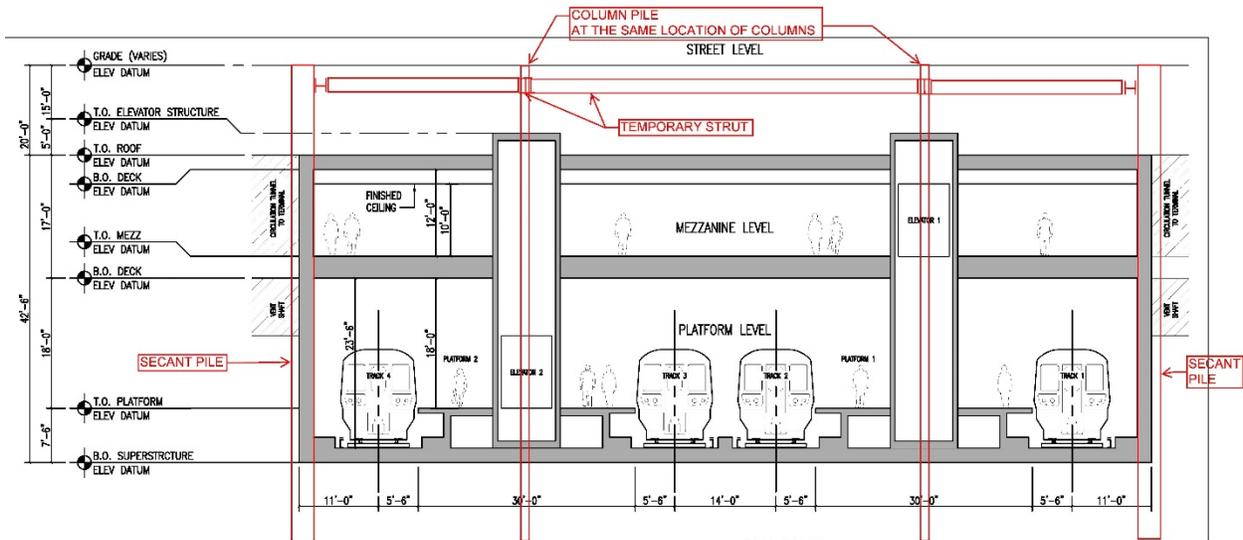
Figure 10 – JFK Station

It is anticipated that a braced excavation system consisting of steel sheeting installed along the outside walls of the terminal and braced with longitudinal walers and horizontal struts with intermediate steel columns would support excavation for the construction of the terminal station.

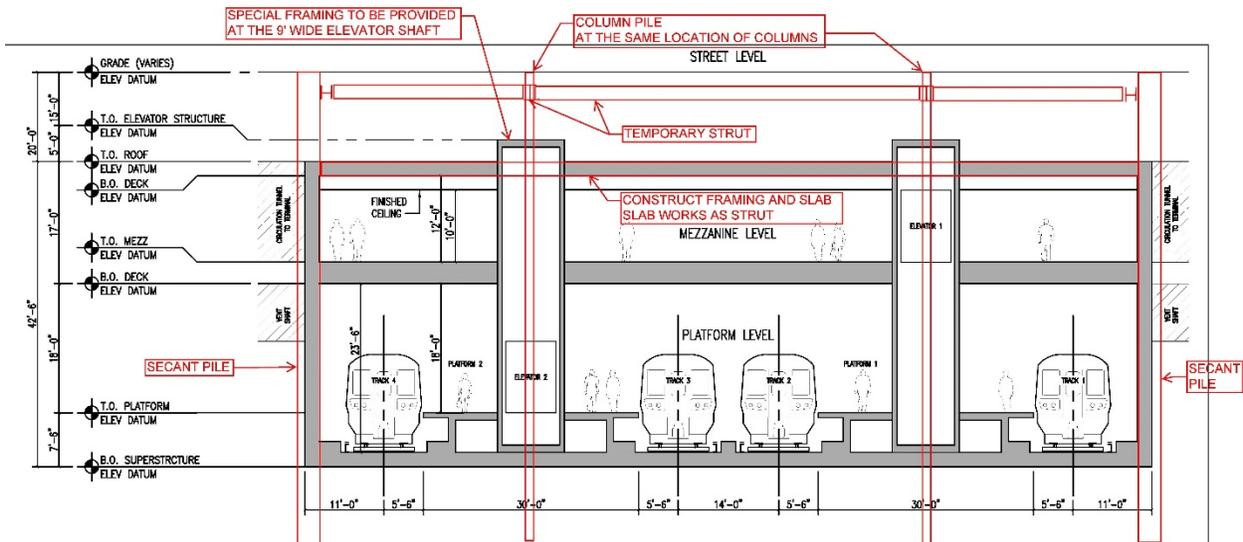
The suggested construction sequence is as follows:



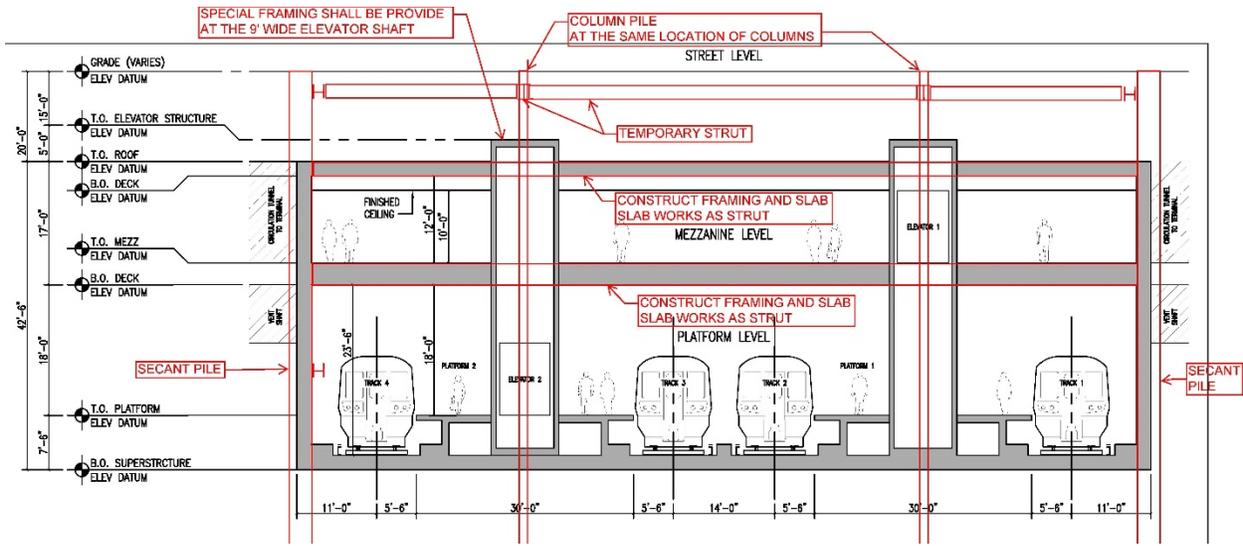
Stage 1



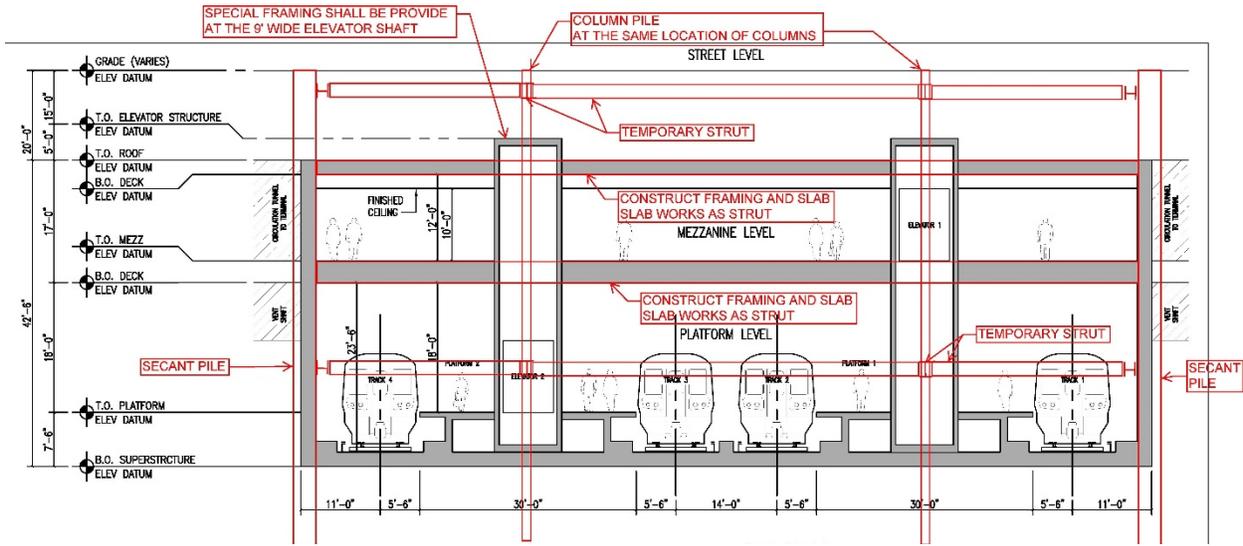
Stage 2



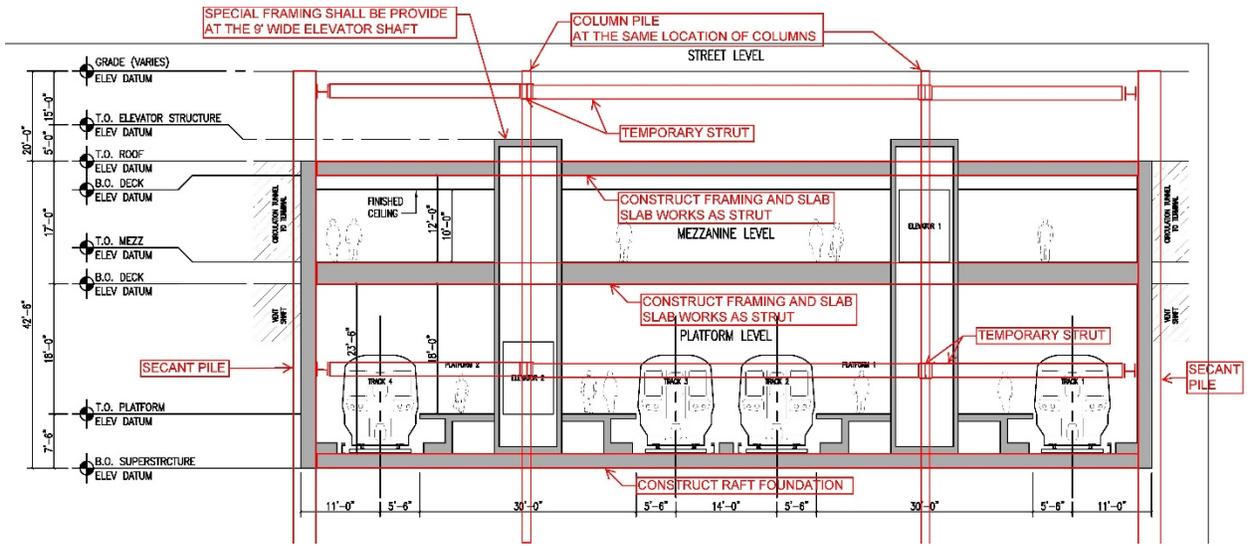
Stage 3



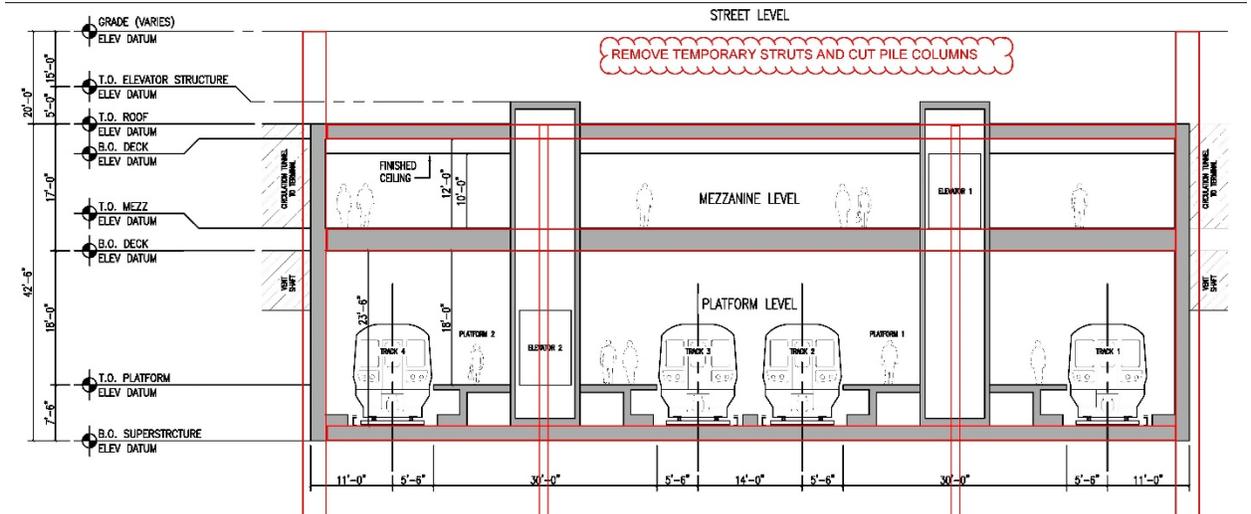
Stage 4



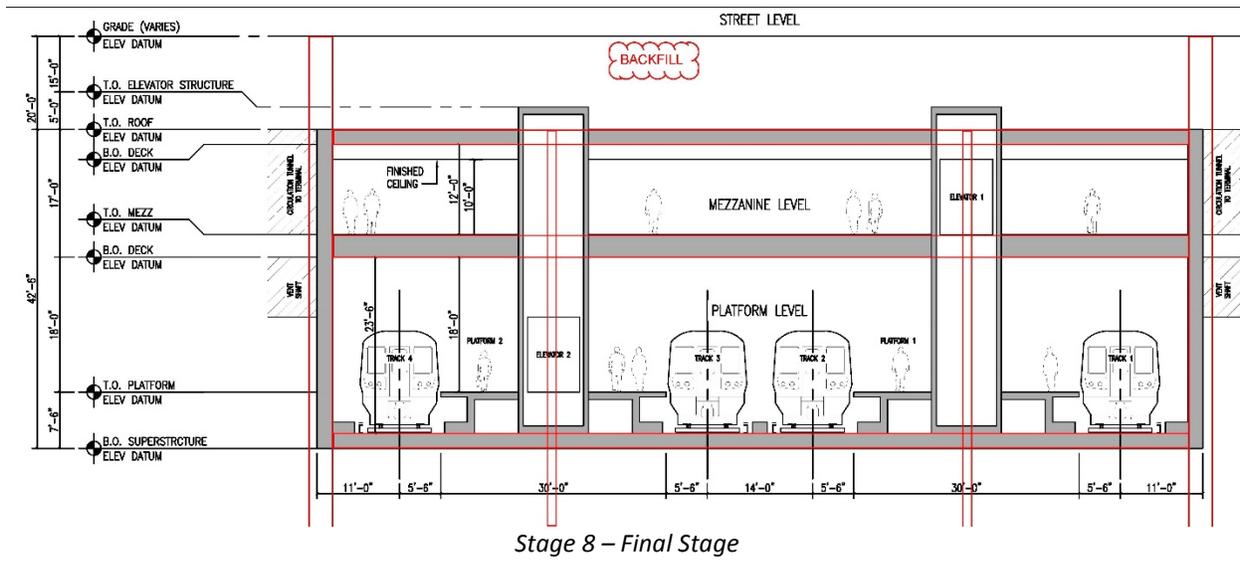
Stage 5



Stage 6



Stage 7



Stage 8 – Final Stage

### 3.3.2. Hybrid Constructability

The alignments shown in Appendix D require construction of track viaducts in congested areas of the LIRR mainline tracks/yards, interstate highways, major arterials, local streets, JFK AirTrain viaduct, and Jamaica Station. There are numerous challenges that will require additional engineering assessments.

#### 3.3.2.1. Westbound Viaduct

The westbound (WB) alignment starts from the Jamaica Station and heads west to northwest across the JFK AirTrain viaduct, Van Wyck Expressway, the proposed eastbound (EB) viaduct, LIRR yards, and mainline tracks. The alignment proceeds with a 5.75% up and 2% down grades and transitions to a 1.5% grade to cross Jamaica Avenue to meet with the WB mainline track at Hillside Avenue.

Construction of the viaduct and its columns near Jamaica Station will impose permanent impacts to parking lots where support columns are required. There will also be impacts to AirTrain service operation during construction of the tie-in at Jamaica Station. Where the WB viaduct crosses the existing AirTrain viaduct, the structure will need to span approximately 230 feet. This can be accomplished by either utilizing a steel structure or segmental pre-tensioned structure as dictated by the available vertical clearances over the existing AirTrain viaduct. If vertical clearances cannot be met utilizing the long span, two columns can be constructed (one on each side of the existing AirTrain viaduct) with a cross beam to form a frame type support allowing for the reduction of the span length. See column renderings in Appendix D.

The Van Wyck Expressway crossing will require a support column in the median area to reduce the overall span length. Due to the narrow median width, the placement of a column may require realignment of the southbound side of the Expressway. Both steel and segmental pre-tensioned structures are feasible for the viaduct at this crossing. A two-level frame support system is most likely required on the west end of the Van Wyck Expressway crossing due to overlapping between the Eastbound (EB) and WB alignments at this location. The two-level frame support system consists of two cross beams with columns on each side of the overlapped alignments to support the two viaducts at different levels. The design of this type of frame support needs further evaluation to ensure the minimum and maximum vertical clearances can be provided between top of rail elevations on the upper and lower levels.

Where the WB viaduct crosses the LIRR yards and mainline tracks, there is ample room for the viaduct columns, however, a frame support can be considered if deemed necessary over the LIRR WB mainline tracks to reduce span length.



The remainder of the WB viaduct runs parallel to the LIRR WB mainline tracks and requires numerous columns, however there are no issues regarding constructability. Both steel and segmental pre-tensioned structures are feasible for the WB viaduct in this area.

At the crossing over Jamaica Avenue, the skewed back wingwall and the abutting local street (130<sup>th</sup> Street.) pose challenges for the viaduct structure. At this location, the WB viaduct profile needs to be at the same elevation as the mainline tracks in order to tie-in, while the bottom of the viaduct structure must maintain the same bottom elevation as the existing bridge to avoid reduction in vertical clearance issues on Jamaica Avenue. Due to these constraints, a set of piers are most likely required on the west end of the bridge. The locations of the piers will impact 130<sup>th</sup> Street and require closure of its access to Jamaica Avenue.

### **3.3.2.2. Eastbound Viaduct**

The EB alignment diverges from a point adjacent to the portal of the New York City Transit (NYCT) J & Z subway lines, heads southeast to cross the LIRR yards and Van Wyck Expressway and continues south to connect to Jamaica Station with 2.5% up and 2% down grades, levelling out before terminating at Jamaica Station.

Where the EB track diverges from the LIRR mainline tracks, the EB track will run on top of the existing NYCT subway tunnel utilized by the J and Z lines. This portion of the tunnel will provide cover to hold the embankment on top. However, the tunnel may not be strong enough to support the train load and will likely require structural modifications. Further structural evaluation of the proposed and existing tunnels will need to be conducted during the preliminary engineering phases to determine the extent of the structural modification necessary. The reconstruction of this tunnel could significantly impact subway operation. Further, modifications to the tunnel in this area would require the demolition/relocation of the existing structure and power substation located nearby.

The EB alignment proceeds southeast crossing LIRR yards via viaduct, which will require the construction of multiple support columns. The majority of these columns can be a single column and can be accommodated within LIRR yards. However, one span may require a frame support in order to reduce the overall span length. Both steel and segmental pre-tensioned structures are feasible for the viaduct in this area.

Similar to the WB viaduct at the Van Wyck Expressway crossing, the EB viaduct will also require a support column in the median area to reduce span length. Due to the narrow median width, the placement of a column may require realignment of the southbound side of the Expressway. Both a steel and segmental pre-tensioned structures are feasible for the viaduct at this crossing. A two-level frame support system will most likely be required on the west end of this crossing due to the overlapping between the EB and WB alignments at this location. This two-level frame support system consists of two cross beams with columns on each side of the overlapped alignments to support the two viaducts at different levels. The design of this frame support needs further evaluation to ensure the minimum and maximum vertical clearances can be provided between top of rail elevations on the upper and lower levels.

The segment between the Van Wyck Expressway crossing and Jamaica Station requires multiple columns to support the viaduct. These columns would need to be constructed within the LIRR Johnson Avenue Yard located below, which would inhibit the use of this yard in the future. It should be noted that this concept was developed based upon the existing alignment of the Van Wyck Expressway, not accounting for any future scenarios, including expressway widening and/or modification of existing infrastructure. Both steel and segmental pre-tensioned structures are feasible for this segment of the viaduct. A cooperative strategy with the NY State Department of Transportation (NYSDOT) would be required for future engineering evaluation.

### **3.3.2.3. Outbound Track**

The outbound viaduct begins at Jamaica Station and runs westerly before turning south to run parallel to the existing JFK AirTrain viaduct for tie-in.

The segment between the Van Wyck Expressway and Jamaica Station requires the installation of multiple support columns along 94<sup>th</sup> Avenue, a two-way street. Installation of the columns will prohibit the use of 94<sup>th</sup> Avenue in the future and will significantly affect the buildings located along the street. However, it may be feasible to reconfigure the bi-directional street



into a one-way, which would limit adverse impacts to transportation. Both steel and segmental pre-tensioned structures are feasible for this segment of the viaduct.

Where the alignment runs along the median of the Van Wyck Expressway and adjacent to the existing AirTrain viaduct, the new outbound viaduct will need to be buttressed utilizing multiple frame supports due to the location of the Van Wyck Expressway roadway below. Realignment of the existing roadway ramp will be required since roughly half of the columns of the frame supports will impact the Expressway exit ramp. Remaining columns of each of the frame supports (the second leg) need to be placed at the median of the Expressway. The construction of these columns can pose significant impacts to the operation of the existing AirTrain and will require modification of the existing viaduct for the new viaduct tie-in. A cooperative strategy with NYSDOT would be required for future engineering evaluation.

## **3.4 TUNNEL**

### **3.4.1. Scope**

The LIRR extension of the RBB to JFK International Airport provides a direct underground tunneling connection to the proposed JFK CTA and station(s). There are two proposed tunneling alignments identified, South of Howard Beach Alignment (SHBA) and North of Howard Beach Alignment (NHBA).

The SHBA tunneling begins at Station 424+25 and ends at Station 590+67.6. The NHBA tunneling section begins at Station 510+50 and ends at station 597+61.37. Alignments converge at SHBA Station 554+00 and NHBA Station 560+00, at the TBM reception pit for both alignments. Both alignments and profiles are identical from the reception pit through the JFK CTA. The profile for SHBA is shown in Appendix A and NHBA is shown in Appendix B. Several tunneling methods are considered for the feasibility evaluation; twin TBM tunnels with segmental precast concrete liner (Figure 11, Typical TBM Section), mining Sequence Excavation Method (SEM); and Cut-and-Cover and Boat Sections using cast-in-place concrete.

### **3.4.2. Geotechnical Setting**

As detailed in Section 3.2 Geotechnical, the geotechnical regional geology is not well defined at this time, however, based on a review of existing geodetic surveys, it is anticipated that bedrock is deep, and overburden consists of fill, varved clay and silts, and sands with high phreatic groundwater and lower aquifer. Tunneling under these ground conditions will be challenging, but constructible.

### **3.4.3. Tunnel Engineering Constructability**

#### **3.4.3.1. South of Howard Beach Alignment**

SHBA tunneling begins south of the Nassau Expressway housing both trackways and connects to the cut-and-cover TBM launch pit portal. The TBM launches through the portal headwall at Station 445+00 which provides adequate ground cover for the TBM. The launch pit will be 85 feet wide and 200 feet long. The closed-face pressurized twin TBM has an outside diameter (OD) of 24 feet and inside diameter (ID) of 21 feet. The TBM drive will end for the SHBA and NHBA and the TBM will be extracted from the reception pit at Station 554+00.

Tunneling through the SHBA will pose significant challenges including: the implementation of underpinning techniques required for boat section construction and crossing JFK AirTrain and Howard Beach Station areas; as well as boat structure construction through a local small pond (wetlands) area requiring marine construction techniques. Construction staging facilities will be necessary for TBM operations, include contractor storage, TBM substation power, muck disposal, trucking operations, and liner storage. Truck access will be from local nonresidential streets in the proximity of major highway routes with no impact on surrounding residential or public use facilities along the existing ROW. The TBM drive will pass deep beneath the Bergen Basin.

The SHBA and NHBA may require the underpinning of the airplane taxi bridges at JFK and management of street and highway traffic and airport traffic will also be required along the proposed alignments.



Utilities, temporary or permanent are always a concern in urban and airport tunneling construction. Available data indicates the potential presence a fuel storage facility and utilities at SHBA Station 540+00. The location of potential fuel tanks and existing utility lines will require further evaluation. In general, TBM profiles will be below most utilities.

Fire life safety requirements, in accordance with local and national codes, are required for the station and tunneling. Tunnel cross passages (Figure 12 – Typical Cross Passage Section) will be provided at approximately 750 foot spacing as emergency egresses from one tunnel to the adjacent tunnel. Construction will consist of mined Sequential Excavation Method (SEM) techniques for tunneling cross passages between the twin TBM's. Cross passage fire doors through center walls of cut-and-cover tunnels will be provided. Ventilation and fire life safety are required at the new JFK CTA in accordance with local and national codes. Fan structures will be required at each end of the station and TBM tunnel portals.

#### **3.4.3.2. North of Howard Beach Alignment**

NHBA tunneling begins at Station 510+50, south of the elevated viaduct section, housing both trackways and connects to the cut-and-cover TBM launch pit and portal at Station 531+00. The twin closed-face pressurized TBM will continue and converge at Station 560+00, the TBM reception pit. Typical TBM and cross passage sections are shown in Figure 11 and 12. Major challenges of underpinning or tunneling interfaces that would impact the TBM tunnel drive along the NHBA are not apparent. Tunnel cross passages will be required to meet the fire life safety requirements within the TBM tunnel. Similar utility issues, ROW, TBM operation requirements, construction staging areas and maintenance of traffic as detailed under the SHBA will need detailed evaluation.

#### **3.4.3.3. General Design Conditions**

The LIRR extension of RBB to JFK International Airport will provide a direct underground connection to the proposed JFK CTA. This task will require (but is not limited to) the following additional studies during preliminary engineering and design of the alignment:

- Geotechnical subsurface exploration program and literature search of existing construction in the area, including foundations of impacted existing buildings.
- Extensive utility review effort and interface with third parties.
- ROW clearances and temporary construction easements.
- Preliminary design of tunnel sections, underpinning, systems, risk analysis, civil works.
- Evaluation of the tunnel ventilation system for new stations and future tunneling, communications, and security connections. Tunnel ventilation will require fan structures to meet present code requirements.
- Establish an Instrumentation and Monitoring Program system for adjacent buildings, LIRR Main Line and NYCT Lines.

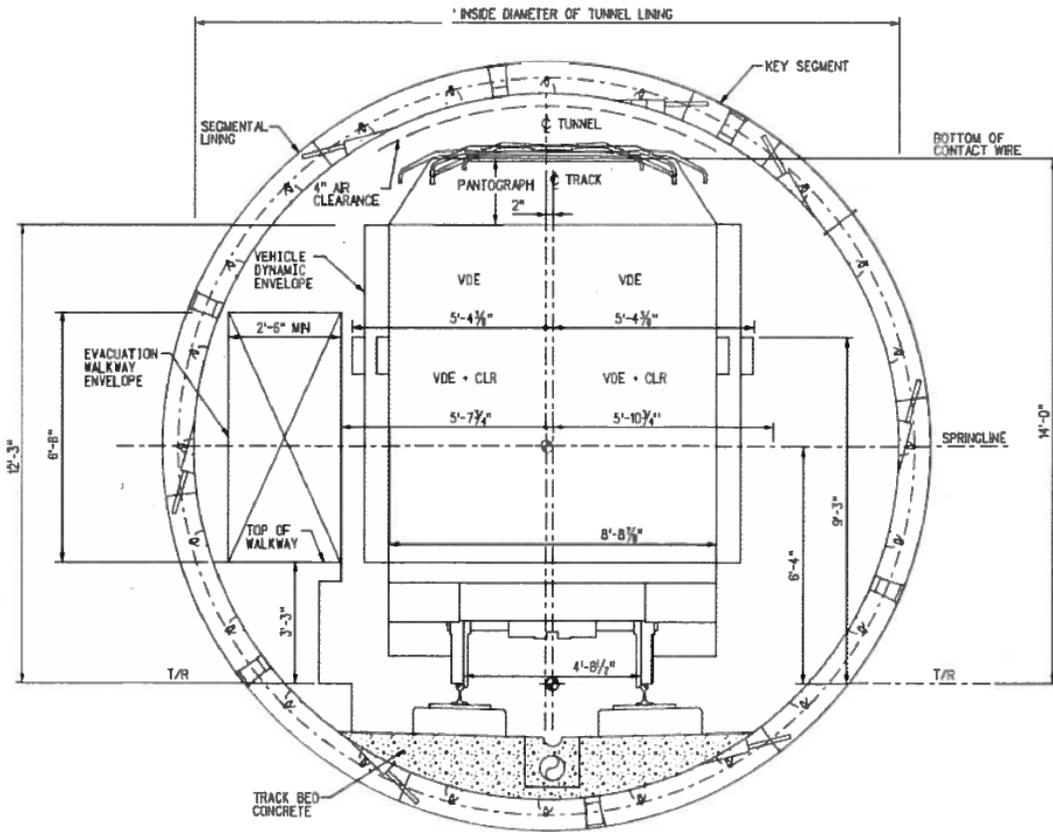


Figure 11 – Typical Tunnel Boring Machine

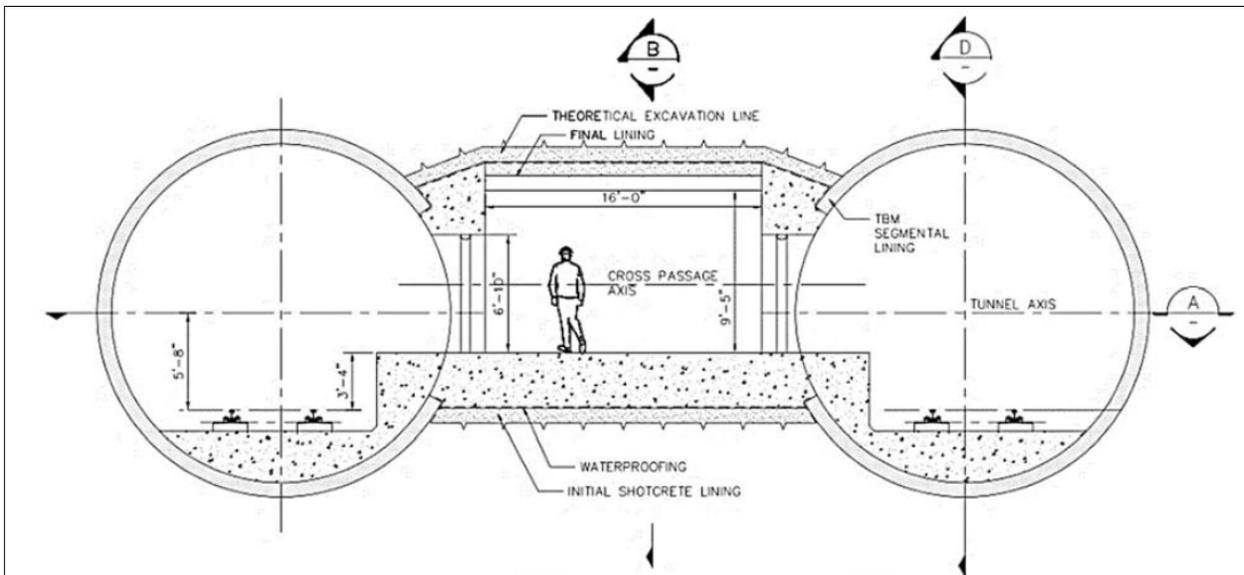


Figure 12 – Typical Cross Passage



### 3.5 CENTRAL TERMINAL AREA (CTA) STATION – TYPICAL STATION COMPONENTS

#### 3.5.1 Overall Station Intent

The LIRR station being proposed at the CTA will be below grade. A typical platform will have a minimum of two stairs, one elevator, and one pair of escalators. Vertical Circulation Elements (VCEs) will go from platform level to mezzanine level. From the mezzanine level, additional circulation tunnels running horizontally will connect into adjacent airport terminals (separate study). See Appendix E for Station Drawings.

Per LIRR Standards, CTA station(s) will have an open platform configuration. This station will be used primarily by airport passengers and therefore the VCE's; including stairs, escalators, and elevators; will be sized to adequately manage passengers and their luggage.

#### 3.5.2 Station Platforms

Platform length is typically 700', to accommodate eight-car standard M7 or M9 train cars. There will be four tracks entering the station. Two center island-type platforms shall maintain a minimum of 30' width along the entire length of the platform. The station will have Ticket Vending Machines (TVMs) and priority station amenities located on the mezzanine level.

#### 3.5.3 Station Mezzanine

It is assumed that connection between platforms will be available on the mezzanine level. The mezzanine will house the majority of the station's amenities and ancillary support spaces. Programming and assumed square footage allocations are indicated below. The total area of the station mezzanine is approximately 95,200 square feet. Circulation space will be approximately 47,000 square feet or close to 50 percent of the total.

##### Programming

Back Office Space.....	2,500 S.F.
LIRR Crew	
Terminal Superintendent	
Security Monitoring	
MTA Police	
Ticket Office/Information	
Traction Power Substation.....	5,000 S.F.
Additional Back of House/Retail (Use TBD) .....	40,500 S.F.
Circulation.....	47,000 S.F.

#### 3.5.4 Station Ventilation

Station ventilation will be provided by ventilation tunnels that terminate at grade.

#### 3.5.5 Proposed Concept

The CTA station would be constructed utilizing the cut and fill method. The TBMs will enter an area that will be excavated. This excavated area is the extent of both the platform and mezzanine levels. The walls will be constructed of reinforced concrete. The proposed platform will be typical of an underground station, consisting of a concrete slab resting on concrete column footings. The stairs from the mezzanine level will be closed, with slip resistant treads and a closed riser assembly. The proposed elevator will be a machine room-less-type elevator, with a glass enclosure system. The elevator will be sized as large as dimensional constraints allow to accommodate a growing transportation hub and significant luggage.

##### Additional Studies needed:

- Dimensional constraints at elevator.
- Number of elevators.
- Pedestrian circulation paths to adjacent terminals.



### **3.6 SIGNALS AND INTERLOCKINGS**

The alignment will support a fully signalized bi-directional train signal system with automatic speed control and the required wayside signaling components and incorporation of the Positive Train Control (PTC) application. The signal system will include a vital microprocessor-based system that is compliant with Part 236 of Title 49 of the Code of Federal Regulations. Interlockings will be required as follows:

- A set of universal crossovers in the vicinity of Howard Beach on the at-grade section prior to entering the viaduct or tunnel portion of the North or South of Howard Beach alignments. This will allow access to either track on the viaduct or the tunnel from the RBB main line track.
- A double crossover in advance of the CTA platform in addition to two single turnouts to widen out to four tracks adjacent to the two island platforms. This will allow full flexibility to any station track.
- Two sets of crossovers beyond or east of the CTA island platforms in the tail tracks to allow moves from the outer tracks to the inner tracks.

Signal huts will have the ability for local control at both the interlocking and at the CTA Terminal. All track switches will be electrically driven and interlocked to meet Federal Railroad Administration (FRA) testing and inspection requirements. Signal huts and other wayside cabinets need to be accounted for in determining space requirements in the CTA station area.

The new signal system will be controlled from the Jamaica Central Control (JCC).

### **3.7 POWER**

One additional substation is assumed to be required in addition to those required on the at-grade sections of the RBB. The substation could be located on the mezzanine level of the CTA station and would occupy an area of about 5,000 square feet. The substation will require incoming alternating current (a.c.) utility service and associated medium or high voltage switchgear, along with rectifier transformers to step down and convert the voltage to direct current (d.c.) power. The output of the rectifier transformers will then be connected to d.c. switchgear where the d.c. circuit breakers connect to the track switches via 2000kcmil copper cable feeders. The negative cables will return through reactors at the substation.

The track-side power equipment includes a new third rail and protection board, which will have track switches to isolate power to the third rail from the tracks. Depending on the operational requirements, the contact rail switches can be load breaking and/or electrically operated. The switches' Supervisory Control and Data Acquisition (SCADA) infrastructure will need to be added to tie the switches to the substation SCADA system. Jumper cables are also required between sections of the third rail, as well as negative return cables back to the substations. All these components will be routed in concrete encased duct banks.

## **4. ENVIRONMENTAL CONDITIONS**

The purpose of this section is to identify chief environmental concerns along the North of Howard Beach and South of Howard Beach alignments to inform future, more detailed environmental studies. Specific environmental impacts based on each topic are presented below. This data was obtained from online state and federal database sources; no field studies were conducted. Additional environmental analysis will be required.

### **4.1 CULTURAL RESOURCES**

Historic and cultural resources include archaeological (buried) resources and architectural (historic standing structure) resources. Nationally, the National Register of Historic Places, administered by the National Park Service, is part of a federal program to recognize the nation's historic and archeological resources. The New York State Historic Preservation Office (SHPO) administers programs authorized by both the National Historic Preservation Act of 1966 and the New York State Historic Preservation Act of 1980 (SHPA). These programs include the Statewide Historic Resources Survey and the New York State and National Registers of Historic Places.



#### **4.1.1. North of Howard Beach On-Airport Sub-Alignment**

This alignment alternative would require significant grading and excavation to construct the new ROW off the RBB, viaduct and tunneled portion near JFK. At present, an archeological survey (Survey Number: 05SR55512) is underway along the Belt Parkway, near the intersection of the Nassau Expressway and Lefferts Boulevard, in close proximity to this alignment. Lefferts Bridge over the Belt Parkway (400 feet north of the alignment) was determined not eligible for the National Register in 2016. No sensitive archeological regions were noted, and the presence of such resources would be unlikely due to the disturbed nature of soils between the Nassau Expressway and Aqueduct Road.

#### **4.1.2. South of Howard Beach On-Airport Sub-Alignment**

There are no structures situated adjacent to the RBB and the majority of this alignment is tunneled; therefore, no impacts to historic structures are expected. Further, since soils underlying the RBB alignment have been significantly disturbed in the past, it is unlikely that archeological resources would be found along the at-grade portion of the alignment.

#### **4.1.3. Summary**

Impacts to Cultural Resources from either alignment option appear to be slight. The only structure listed on the National Register near the project vicinity is the Trans World Airlines Flight Center situated on the eastern perimeter of JFK, over one-half mile from the eastern terminus of the alignments. The project will require coordination with the New York City Landmarks Preservation Commission (LPC) regarding potential archaeological sensitivity and the New York State Office of Parks, Recreation, and Historic Preservation (OPRHP) should also be consulted to determine if any affected buildings or structures are protected as important cultural resources.

## **4.2 HAZARDOUS MATERIALS AND WASTE**

For hazardous materials, the goal for further environmental study is to determine whether the proposed project may increase the exposure of people or the environment to hazardous materials, and, if so, whether this increased exposure would result in potential significant public health or environmental impacts. If significant adverse impacts are identified, the impacts must be disclosed, mitigated, and/or avoided to the greatest extent practicable. Contaminated soil and groundwater, asbestos, lead-based paint and other hazardous materials from historic land use and/or existing structures and adjacent development represent the greatest concern with respect to hazardous waste. Since both alignments involve tunneling, a comprehensive hazardous waste study should be completed.

#### **4.2.1. North of Howard Beach On-Airport Sub-Alignment**

PANYNJ Hanger 15 (Site No.: 2-214515) is situated in close proximity to where the alignment changes from elevated to tunnel. Hanger 15 is listed as a Petroleum Bulk Storage Facility with five storage tanks. Two tanks are in service, two are closed in place, and one is removed.

The Sky Chef building on Brookfield Boulevard, would have to be demolished and the occupying business would have to be relocated under this alternative. However, since this structure was constructed in 1994, it is unlikely that it contains materials or products containing asbestos, PCBs, or lead-based paint.

#### **4.2.2. South of Howard Beach On-Airport Sub-Alignment**

Pan American World Airways JFK International Airport (Bldg 208), listed on the federal Toxic Release Inventory (TRI) database, is situated east of Bergen Basin, abutting the northern boundary of this alignment. Inclusion on the TRI list does not mean the property is contaminated, only that the site is tracked for toxic chemicals that may pose a threat to human health and the environment. The facility utilizes chemicals associated with electroplating, plating, polishing, anodizing and coloring. According to the federal database, there are no reported violations with this facility, but due to its proximity to proposed tunneling operations, site records should be investigated fully.

Allied New York Services (Site 2-2830) abuts the northern boundary of this alignment. Allied is listed by New York State as a Major Oil Storage Facility. No further information relative to on-site tanks was available.



### 4.2.3. Summary

There are no federal or state Superfund nor Brownfield sites mapped within a mile of either alignment. However, both alignment options involve tunneling in the same general direction underneath the CTA. The list below includes sites recorded on federal and state databases as having underground storage tanks.

- A PANYNJ 25,000-gallon petroleum storage tank (Site No: 2-603777), closed in place, is situated under the terminus of both alignments south of Terminal 8. The tank was installed in 1955 and was closed in 2015. The tank was used to hold #6 fuel oil for on-site consumption.
- Federal Aviation Administration, JFK International Airport Air Traffic Control Tower (Site No.: 2-600412) lists 42 tanks, 27 of which are no longer in service and reportedly have been removed. Of the 15 in-service tanks, 12 are located above-ground, while three are underground, fiberglass tanks (Nos. 26, 31, and 38). Tank 26 holds 600 gallons and Tanks 31 and 38 each hold 1,000 gallons of diesel fuel.
- Resource Conservation and Recovery Act Information (RCRA Info) includes an inventory on all generators, transporters, treaters, storers, and disposers of hazardous waste that are required to provide information about their activities. A facility named Bombardier (RCRA # NYR000115360) is situated at the eastern terminus of both alignments. This facility has been classified by the EPA as a “significant non-complier” since January 2017.
- Another RCRA site - 602-L Release Site (Handler ID: NYR000175851), involved with pipeline transportation of refined petroleum products, is listed as a Large Quantity Generator of hazardous waste. This facility is situated near the taxiway by the entrance to the CTA where both alignments would cross.

To determine potential impacts related to hazardous waste issues, a review of NEPAAssist, NYSDEC database, and other federal and state databases and site-specific assessments is necessary to identify any toxic or radioactive substances on, adjacent to, or near the project alignments. If the studies reveal any reason that there might be site contamination, a Phase II Environmental Site Assessment (ESA) should be prepared. In addition, all properties impacted by the project should be surveyed for asbestos in accordance with the NYS and NYC asbestos standards. Any materials that would be disturbed by project activities would require abatement according to those standards. Further, proposed activities may require removal of materials that include lead-based paint; all such activities must comply with applicable federal, state, and local laws and regulations regarding lead-based paint. Any remediation should be appropriately scheduled and coordinated with construction activities.

## 4.3 NATURAL RESOURCES

Natural resources include plants, wildlife, aquatic or terrestrial ecosystems capable of providing suitable habitat to sustain the life processes of plants, wildlife and other organisms. Protected resources in this category include rare plants and animals, surface waterbodies as well as wetlands. Impacts to these features are regulated by numerous federal and state agencies including the U.S. Army Corps of Engineers and New York State Department of Conservation. There are four federally listed species that have the potential to be present in Queens County: piping plover (*Charadrius melodus*), red knot (*Calidris canutus rufa*), roseate tern (*Sterna dougallii dougallii*) and seabeach amaranth (*Amaranthus pumilus*). There are also estuarine and freshwater wetlands as well as surface water features in proximity to the alignments.

### 4.3.1. North of Howard Beach On-Airport Sub-Alignment

This alignment passes through a freshwater emergent wetland as it curves from the RBB to run parallel with Aqueduct Road. Construction of support structures needed for the proposed viaduct in this area would require a freshwater wetlands permit. Construction in this location would also impact the narrow greenspace and associated trees found between the Nassau Expressway and Aqueduct Road. Impacts to federally listed species are not likely as there is no suitable habitat along this alignment that would support such species.

### 4.3.2. South of Howard Beach On-Airport Sub-Alignment

Constructing the alignment parallel to the RBB in the area south of the Nassau Expressway would result in impacts to trees and shrubs along the ROW. The alignment then transects a small area of estuarine wetland and deepwater habitat situated east of Howard Beach Station. However, the tracks would be tunneled at this point; therefore, no impact to these features



or nearby Bergen Basin (an impaired surface water body) is expected. Impacts to natural resources from construction of the tunnel would be primarily related to activities at the tunnel portals and intermediate construction portals.

### **4.3.3. Summary**

Impacts to Natural Resources from either alignment option appear to be minimal due to the urbanized condition of land surrounding JFK. Under either scenario, construction would occur in areas that are already developed or have been previously cleared of native vegetation. Regardless, the project would require review by the New York State Department of Environmental Conservation and the U.S. Fish and Wildlife Service.

## **4.4 SOLE SOURCE AQUIFER, COASTAL ZONE MANAGEMENT AND FLOODPLAINS**

The Environmental Protection Agency (EPA) defines a Sole or principal Source Aquifer (SSA) as one which supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. EPA guidelines also stipulate that these areas can have no alternative drinking water source(s) which could physically, legally, and economically supply all those who depend upon the aquifer for drinking water. The SSA program is authorized by Section 1424(e) of the Safe Drinking Water Act of 1974 (Public Law 93-523, 42 U.S.C. 300 et. seq).

The New York State Coastal Management Program has established statewide boundaries in accordance with the requirements of the federal Coastal Zone Management Act (CZMA) of 1972, as amended, and its subsequently issued rules and regulations. The New York City Waterfront Revitalization Program (WRP) is the City's principal coastal zone management tool as it establishes the City's policies for development and use of the waterfront. All projects subject to local, state, or federal agency discretionary actions that are situated within New York City's designated Coastal Zone Boundary must be reviewed and assessed for their consistency with the WRP.

Additionally, construction within the Federal Emergency Management Agency (FEMA)-designated floodplain requires adherence to floodplain regulations for construction or development within the Special Flood Hazard Area. Best available flood hazard data should be used to determine elevation and construction requirements. Best available flood hazard data is derived from the most current and restrictive of the following: FEMA Flood Insurance Rate Map (FIRM), FEMA Advisory Base Flood Elevation Map, FEMA publicly released working map, or FEMA Preliminary Flood Insurance Rate Map (PFIRM). Currently, for New York City, the PFIRM is known to contain the most accurate data.

### **4.4.1. North of Howard Beach On-Airport Sub-Alignment**

This alignment overlies the Brooklyn-Queens Sole Source Aquifer. Consequently, the project must comply with EPA's project review steps to ensure that the aquifer underlying Queens County remains free of pollutants. The Coastal Zone Management Act and the New York City Waterfront Revitalization Program boundary lines are situated east to west along the Belt Parkway, just south of Aqueduct Raceway Train Station. As such, rail service within this alignment would be subject to the Coastal Zone Management Act as well as the New York City WRP requirements.

### **4.4.2. South of Howard Beach On-Airport Sub-Alignment**

The south alignment also overlies the Brooklyn-Queens Sole Source Aquifer. Consequently, the project must comply with EPA's project review steps to ensure that the aquifer underlying Queens County remains free of pollutants. The Coastal Zone Management Act and the New York City Waterfront Revitalization Program boundary lines are situated east to west along the Belt Parkway, just south of Aqueduct Raceway Train Station. As such, rail service within this alignment would be subject to the Coastal Zone Management Act (CZMA) as well as the New York City WRP requirements. It should be noted that approximately 1,000 feet of the south alignment (south of Aqueduct Road and adjacent to the RBB) falls within a Special Flood Hazard Area (100-year floodplain).

### **4.4.3. Summary**

Selection of either alignment would necessitate SSA review by Region 2 of the EPA as well as state and local coastal consistency review. Construction of the south alignment would also involve compliance with FEMA regulations. Pursuant to the Coastal Zone Management Act, a request for general consistency concurrence, including a completed Federal Consistency



Assessment Form and an analysis of the applicable policies, should be sent to the Consistency Review Unit, Division of Coastal Resources, New York State Department of State. To comply with NYC's Local Waterfront Revitalization Program, a request for WRP consistency concurrence, including a completed WRP Consistency Assessment Form and an analysis of the applicable policies should be sent to the New York Department of City Planning, NYC Waterfront and Open Space Division to determine whether the project is consistent with applicable policies. Development in the 100-year floodplain may require design considerations in compliance with floodplain regulations.

## **4.5 AIR, NOISE AND VIBRATION CONSIDERATIONS**

Ambient air quality, or the quality of the surrounding air, may be affected by air pollutants produced by motor vehicles, ("mobile sources"); by fixed facilities, ("stationary sources"); or by a combination of both. Construction of new rail service would result in the disturbance of varying amounts of soil and areas of exposed soil can generate fugitive dust emissions, which can cause air quality impacts in the immediate vicinity of the work. Construction would involve the use of heavy equipment which can create a high level of noise which can be disruptive to people nearby. Tunneling, from both the construction and operation, creates the potential for ground borne noise and vibration which may affect people and properties above the entire tunnel corridor.

### ***4.5.1. North of Howard Beach On-Airport Sub-Alignment***

This alignment is situated within a nonattainment area for inhalable particulate matter (PM<sub>2.5</sub>), a marginal nonattainment area for the eight-hour ozone standard and considered an area source for hazardous air pollutants (HAPs) emissions. Impacts resulting from noise would be slightly higher than those resulting from utilizing the south alignment due to the fact that the significant portion of this alignment is above ground; however, there are no churches or hospitals in the area and the closest school is PS 124, approximately 1,000 feet north of the alignment near Maintenance Shop Building 402. The tunneled portion of the alignment begins adjacent to the Van Wyck Expressway, near an active runway and airport operations buildings. There are no sensitive receptors in this area.

### ***4.5.2. South of Howard Beach On-Airport Sub-Alignment***

This alignment is also situated within a nonattainment area for inhalable particulate matter (PM<sub>2.5</sub>), a marginal nonattainment area for the eight-hour ozone standard and considered an area source for hazardous air pollutants (HAPs) emissions. Noise impacts may occur to residential properties situated near the proposed tunneling portals north of Howard Beach Station. The remainder of the alignment would be tunneled through heavily developed portions of JFK.

### ***4.5.3. Summary***

Impacts relating to air, noise and vibration from either alignment option appear to be minimal due to the urbanized condition of land surrounding JFK. The air quality studies for the proposed project should include both mobile and stationary source analyses. The mobile source air quality impact analysis will assess the potential for PM and CO from mobile-generated emissions. The stationary source air quality impact analysis should address the effects of emissions from combustion sources of emissions on pollutant levels. Based on an analysis of baseline conditions throughout both alignments, noise and vibration levels should be determined at the closest noise-sensitive receptor location within the applicable Federal Transit Administration (FTA) screening distance. FTA Transit Noise and Vibration Impact Assessment guidelines and methodologies should be employed. The predicted noise and vibration levels will be compared with the FTA's relative increase criteria to determine the potential for impacts.

## **4.6 PARKS, COMMUNITY FACILITIES AND VISUAL IMPACTS**

The New York City Department of Parks & Recreation (Parks) has jurisdiction over all public parkland and trees growing in the public right-of-way—including street and parkway trees—as well as those in parks, playgrounds and greenstreets. Community facilities include public or publicly-funded facilities, including schools, health care, child care, libraries, and police and fire protection services. Visual resources involve the connection from the public realm to significant natural or built features,



including views of the waterfront, public parks, landmark structures or districts, otherwise distinct buildings or groups of buildings or natural resources.

#### **4.6.1. North of Howard Beach On-Airport Sub-Alignment**

Selection of the north alternative is not expected to result in adverse impacts to Southpark ballfields and Leffert's playground because these parks are located across the Belt Parkway approximately 700 feet north of the proposed alignment. Impacts to trees found in the small, linear greenspace which extends along the Nassau Expressway, would likely occur from construction of the viaduct. In addition, the baseball field located southwest of Federal Circle where the alignment goes from viaduct to existing grade would likely be impacted by this alternative. However, the aforementioned greenspace and the ball field near Federal Circle are mapped as vacant land and are not part of the New York City Park system. No community facilities (schools, churches, hospitals or police/fire stations) are found in close proximity to the north alignment. The new, elevated viaduct would be a new visual element in this area, however, due to its location (adjacent to several highways) no significant adverse impacts are expected.

#### **4.6.2. South of Howard Beach On-Airport Sub-Alignment**

Selection of the South alignment would not result in any direct impacts to New York City parkland, although use of this alternative may impact some trees along the alignment north and south of the Belt Parkway. The closest New York City park to the alignment is the Southpark ballfields situated north of the Belt Parkway, approximately 500 feet east of this alignment. No community facilities (schools, churches, hospitals or police/fire stations) are found in close proximity to the south alignment and selection of this alternative would not result in significant adverse visual impacts since the above ground portion of the alignment would parallel the existing RBB. There are no sensitive receptors located in the area where the tracks diverge east from the RBB, as that land is used for parking. The rest of the segment would be tunneled through JFK airport and would not result in impacts to parks or community facilities, nor would it result in adverse visual impacts.

#### **4.6.3. Summary**

No impacts to community facilities including schools, health care, child care, libraries, and police and fire protection services would occur under either alternative. No impacts to parkland are expected, since neither alignment would impact New York City designated parks. The new, elevated viaduct proposed as part of the north of Howard Beach Alternative would introduce a new visual element in the area, however, due to its location adjacent to several highways, only minor impacts would be expected.

### **4.7 NEPA/SEQR COMPLIANCE**

The available funding source for the project will determine whether National Environmental Policy Act (NEPA) or State Environmental Quality Review Act (SEQR) is required. If federal funding was utilized to construct rail service on the RBB, the FTA would likely be the funding agency. In this case, the NEPA process would be followed. The FTA would likely be the federal sponsor leading the EIS process following the NEPA statutes in accordance with FTA Environmental Impact and Related Procedures (23 C.F.R 771). Regardless of whether federal funding is used, the New York SEQR must also be satisfied. All NEPA EIS documents would be utilized to comply with SEQR; the New York SEQR review process would require a state-level EIS for the project.



## 5. TRAVEL DEMAND FORECASTS

Ridership forecasts were prepared for an average weekday using two methods. For the “commuter” market, the Regional Transit Forecasting Model (RTFM) was used to forecast 4-hour AM Peak Period ridership which uses highway and transit utilities to estimate transit riders for Home Based Work, Home Based Other, and Non-Home Based travel. These are riders on the service who would use it to commute to work, run errands, or other daily activities. The RTFM does not reflect local travel to / from airports by airline passengers. In order to account for air passengers, the Port Authority of New York and New Jersey (PANYNJ) developed forecasts of average weekday air passengers that would utilize a one seat ride service between Manhattan and JFK. These air passenger forecasts are high level and may be impacted by additional factors such as pricing, service and journey times, quality, services provided, and other factors that were not taken into account when developing the air passenger forecasts and mode share.

In the following sections, ridership is separated into “commuter” trips, “air passengers” trips, and “total trips.” Tables 1 through 4 show 4 hour AM Peak ridership and Table 5 shows ridership for a full average weekday for the scenarios. The commuter trips come from RTFM forecasts. The air passenger trips come from the PANYNJ forecasts for air passengers who would divert to a One Seat Ride between Manhattan and JFK. The total trips combine the commuter and air passenger forecasts for total ridership that are forecasted to use the service. Assumptions behind each market and time period are discussed in detail in the following sections for the Rockaway Beach Branch and Hybrid Alignments.

### 5.1 ROCKAWAY BEACH BRANCH ALIGNMENTS

The LIRR service options that utilize the Rockaway Beach Branch were modeled with 20 minute headways in both directions in the 4-hour AM Peak Period. An assumed runtime of 10 minutes was used for travel time between the Aqueduct Station and JFK Terminal for both the North and South of Howard Beach alignments making their project ridership the same. The LIRR is at capacity on the west end of their system. In order to accommodate LIRR service to JFK service to other LIRR branches would be impacted. For example purposes, the following scenario was created to reduce service on other branches:

- Port Jefferson/Huntington Branch increased Manhattan bound train headways from 14 minute to 17 minute, eastbound trains increased headways to Long Island from 48 to 60 minute headways.
- Ronkonkoma Branch increased Manhattan bound train headways from 10 minute to 11 minute headways, eastbound trains reduced service from Manhattan from 30 minute headways to 34 minute headways.
- Hempstead Branch increased Manhattan bound train headways from 24 minute to 27 minute headways.
- Babylon Branch increased Manhattan bound train headways from 7 minute to 8 minute headways.

Table 1 shows the projected year 2025 station level ons and offs for the Rockaway Beach Branch for the 4-hour AM Peak Period as well as AM Peak boardings as modeled by the RTFM. Using an AM peak period to daily factor of 2.678 for LIRR ridership for daily boardings between Midtown Manhattan and Aqueduct Station and AirTrain AM peak period to daily factor of 2.41 for JFK boardings, the branch level daily ridership is forecasted to be approximately 11,200 commuter trips per average weekday.

The peak to daily factor for AirTrain stations was developed using the 2015 modeled ridership for the AirTrain at non-JFK terminal stations of 10,200 boardings compared to the average weekday boardings at non-JFK terminal stations from August 2017 with observed data of 24,800 boardings for a peak to daily factor of 2.41 for AirTrain Station boardings.

The RTFM model forecasts average weekday ridership for “regular” work and non-work travel but does not take into account air passenger travel in a meaningful way. In order to estimate air passengers that would potentially use a One Seat Ride (OSR) service, the PANYNJ developed forecasts to estimate the mode split a OSR service would be based on using the current model splits at JFK and selected airports worldwide. Based on a forecasted 237,635 average daily passengers at the airport, 18.7%



of whom transfer to connecting flights within the airport from the “PANYNJ, John F. Kennedy International Airport: 2016-2050 Unconstrained Forecast”, the PANYNJ estimated average weekday ridership on an OSR service for air passengers to be between 9,000 and 16,700 passengers per day. Their estimates factor in current AirTrain ridership from the “JFK 2017 Air Passengers Survey – Modal Split O/D Manhattan” and “2017 AirTrain Survey”, the proportion of air passengers that are coming from or traveling to Manhattan from the “2017 JFK CTA Data Collection – Frontage Passenger Survey”, group size from the “JFK 2017 Air Passengers Survey – Group Size Frontage Survey” for trips with Manhattan only, and asserted modal shift from other modes to an OSR from between 10 and 25% for eligible trips. For these forecasts the lower forecast of 9,000 air passengers per day was used as the forecasts treated all of Manhattan air passengers equally as the travel market, and mode shares for the high end were based on Heathrow Express ridership in London which operates as a non-stop premium rail service to and from the airport terminal and operates off of dedicated platforms at a central London train station which are features that will not exist in this scenario. The PANYNJ’s travel model identifies origins and destinations within Manhattan but does not provide data at the more localized level (neighborhood, TAZ, etc). As such all Manhattan trips are treated equally, regardless of their distance from Penn Station or Grand Central Terminal. Proximity and ease of access to Penn Station and Grand Central Terminal will influence modal choice.

Table 1 also shows the projected AM Peak period air passenger riders by applying the 2.41 AM Peak Period to Daily factor to the forecasted 9,000 daily riders from the PANYNJ estimates, split evenly between JFK and Manhattan, as only Manhattan air passengers were assumed to use the OSR. Adding the RTFM weekday forecast with the average daily OSR estimated air passenger ridership from PANYNJ, an average of 20,200 daily riders would utilize the service per average weekday.



**Table 1- Year 2025 LIRR Rockaway Beach Branch Ridership by Station  
4-Hour AM Peak Period Ridership**

	Commuter Trips					Air Passenger Trips <sup>1</sup>					Total Trips				
	Westbound		Eastbound		Total	Westbound		Eastbound		Total	Westbound		Eastbound		Total
	Ons	Offs	Ons	Offs	Ons+Offs	Ons	Offs	Ons	Offs	Ons+Offs	Ons	Offs	Ons	Offs	Ons+Offs
<b>JFK Central<sup>2</sup></b>	207	0	0	125	331	1,870	0	0	1,870	3,740	2,077	0	0	1,995	4,071
<b>Aqueduct</b>	156	5	2	53	217	-	-	-	-	-	156	5	2	53	217
<b>Ozone Park</b>	227	18	5	106	356	-	-	-	-	-	227	18	5	106	356
<b>Woodhaven</b>	371	22	7	128	528	-	-	-	-	-	371	22	7	128	528
<b>Parkside</b>	285	15	9	93	403	-	-	-	-	-	285	15	9	93	403
<b>Rego Park</b>	929	45	22	288	1,284	-	-	-	-	-	929	45	22	288	1,284
<b>Woodside</b>	1,029	106	72	215	1,422	-	-	-	-	-	1,029	106	72	215	1,422
<b>PSNY or GCT</b>	0	2,994	893	0	3,887	0	1,870	1,870	0	3,740	0	4,864	2,763	0	7,627
<b>Peak Total</b>	<b>3,205</b>	<b>3,205</b>	<b>1,009</b>	<b>1,009</b>	<b>8,427</b>	<b>1,870</b>	<b>1,870</b>	<b>1,870</b>	<b>1,870</b>	<b>7,480</b>	<b>5,075</b>	<b>5,075</b>	<b>2,879</b>	<b>2,879</b>	<b>15,907</b>
<sup>1</sup> Air Passenger trips are based on PANYNJ estimates which only forecasted trips between Manhattan and JFK and did not include intermediate stops															
<sup>2</sup> JFK Commuter Trips include workers or visitors to/ from the airport area and does not include air passengers															

A second set of forecasts were also performed for the Rockaway Beach Branch wherein trains would only stop at three locations: Manhattan (PSNY or GCT), Woodside, and the JFK terminal. For these scenarios the same 20 minute headways and changes to other train branch schedules were assumed as the initial Rockaway Beach forecasts with the same travel time between Manhattan and Woodside. From Woodside to JFK the North alignment assumes a 13.6 minute runtime eastbound and 14.3 minute runtime westbound. For the South alignment from Woodside to JFK there is an assumed 12.5 minute runtime eastbound and 13.2 minute runtime westbound.

Tables 2 and 3 show the average weekday AM peak ridership for commuters, air passengers, and total riders. The commuter ridership comes from the RTFM forecasts, while the air passengers are the same projections from the PANYNJ for 2025 for an OSR. Using an AM peak period to daily factor of 2.678 for LIRR ridership for daily boardings between Midtown Manhattan and Woodside Station and AirTrain AM peak period to daily factor of 2.41 for JFK boardings, the line level daily ridership is forecasted to be approximately 3,900 commuter trips per average weekday for the North alignment and 4,200 commuter trips per average weekday for the South alignment. Adding the RTFM weekday forecast with the average daily OSR estimated air passenger ridership from PANYNJ, an average of 12,900 daily riders on the North alignment and 13,200 riders on the South alignment would utilize the service per average weekday.



**Table 2 - Year 2025 LIRR Rockaway Beach Branch – Woodside Only – North Alignment Ridership by Station  
4-Hour AM Peak Period Ridership**

	Commuter Trips					Air Passenger Trips <sup>1</sup>					Total Trips				
	Westbound		Eastbound		Total	Westbound		Eastbound		Total	Westbound		Eastbound		Total
	Ons	Offs	Ons	Offs	Ons+Offs	Ons	Offs	Ons	Offs	Ons+Offs	Ons	Offs	Ons	Offs	Ons+Offs
<b>JFK Central<sup>2</sup></b>	153	0	0	115	268	1,870	0	0	1,870	3,740	2,023	0	0	1,985	4,008
<b>Woodside</b>	963	76	34	246	1,319	-	-	-	-	-	963	76	34	246	1,319
<b>PSNY or GCT</b>	0	1,039	327	0	1,367	0	1,870	1,870	0	3,740	0	2,909	2,197	0	5,107
<b>Peak Total</b>	<b>1,116</b>	<b>1,116</b>	<b>361</b>	<b>361</b>	<b>1,480</b>	<b>1,870</b>	<b>1,870</b>	<b>1,870</b>	<b>1,870</b>	<b>7,480</b>	<b>2,986</b>	<b>2,986</b>	<b>2,231</b>	<b>2,231</b>	<b>8,960</b>
<sup>1</sup> Air Passenger trips are based on PANYNJ estimates which only forecasted trips between Manhattan and JFK and did not include intermediate stops															
<sup>2</sup> JFK Commuter Trips include workers or visitors to/ from the airport area and does not include air passengers															

**Table 3 - Year 2025 LIRR Rockaway Beach Branch – Woodside Only – South Alignment Ridership by Station  
4-Hour AM Peak Period Ridership**

	Commuter Trips					Air Passenger Trips <sup>1</sup>					Total Trips				
	Westbound		Eastbound		Total	Westbound		Eastbound		Total	Westbound		Eastbound		Total
	Ons	Offs	Ons	Offs	Ons+Offs	Ons	Offs	Ons	Offs	Ons+Offs	Ons	Offs	Ons	Offs	Ons+Offs
<b>JFK Central<sup>2</sup></b>	166	0	0	138	304	1,870	0	0	1,870	3,740	2,036	0	0	2,008	4,044
<b>Woodside</b>	1,056	79	38	235	1,408	-	-	-	-	-	1,056	79	38	235	1,408
<b>PSNY or GCT</b>	0	1,142	335	0	1,477	0	1,870	1,870	0	3,740	0	3,012	2,205	0	5,217
<b>Peak Total</b>	<b>1,222</b>	<b>1,222</b>	<b>373</b>	<b>373</b>	<b>1,590</b>	<b>1,870</b>	<b>1,870</b>	<b>1,870</b>	<b>1,870</b>	<b>7,480</b>	<b>3,092</b>	<b>3,092</b>	<b>2,243</b>	<b>2,243</b>	<b>9,070</b>
<sup>1</sup> Air Passenger trips are based on PANYNJ estimates which only forecasted trips between Manhattan and JFK and did not include intermediate stops															
<sup>2</sup> JFK Commuter Trips include workers or visitors to/ from the airport area and does not include air passengers															



## 5.2 HYBRID ALIGNMENT

For the Hybrid option the service was modeled with 20 minute headways in both directions in the 4-hour AM Peak Period. An assumed runtime between Midtown Manhattan (PSNY or GCT) and LIRR's Jamaica Station of 35 minutes was used to account for the scheduled 20 minute runtime between Manhattan and Jamaica on LIRR as well as the 15 minute time for the vehicle to move from the LIRR railway to the AirTrain track and to switch between operating systems. The same runtime as the existing AirTrain service was used between Jamaica and JFK. In order to create capacity between Manhattan and Long Island the same service reductions were used as the LIRR RBB alternatives to test this alignment scenario.

Table 4 shows the year 2025 station level ons and offs for the Hybrid service for the 4-hour AM Peak Period as well as AM Peak boardings for commuter trips and estimated air passengers from the PANYNJ estimates. A peak to daily factor for AirTrain stations was developed using the 2015 modeled ridership for the AirTrain at non-JFK terminal stations of 10,200 boardings compared to the average weekday boardings at non-JFK terminal stations from August 2017 with observed data of 24,800 boardings for a peak to daily factor of 2.41 for AirTrain Station boardings. Using the AM peak period to daily factor of 2.41, the line level daily commuter ridership is forecasted to be approximately 1,300 riders per average weekday from the RTFM. Adding the additional 9,000 average daily air passenger trips forecasted by PANYNJ for an OSR service, the total daily ridership is estimated to be approximately 10,300 riders for the hybrid alignment.



**Table 4- Year 2025 Hybrid JFK One Seat Ride Ridership by Station  
4-Hour AM Peak Period Ridership**

	Commuter Trips				Air Passenger Trips <sup>1</sup>						Total Trips				
	Inbound		Outbound		Total	Westbound		Eastbound		Total	Westbound		Eastbound		Total
	Ons	Offs	Ons	Offs	Ons+Offs	Ons	Offs	Ons	Offs	Ons+Offs	Ons	Offs	Ons	Offs	Ons+Offs
<b>JFK Airport<sup>2</sup></b>	172	0	0	179	351	1,870	0	0	1,870	3,740	2,042	0	0	2,049	4,091
<b>Federal Circle</b>	10	0	0	39	50	-	-	-	-	-	10	0	0	39	50
<b>Jamaica</b>	0	135	161	149	446	-	-	-	-	-	0	135	161	149	446
<b>PSNY or GCT</b>	0	47	206	0	253	0	1,870	1,870	0	3,740	0	1,917	2,076	0	3,993
<b>AM Peak Total</b>	<b>182</b>	<b>182</b>	<b>368</b>	<b>368</b>	<b>1,100</b>	<b>1,870</b>	<b>1,870</b>	<b>1,870</b>	<b>1,870</b>	<b>7,480</b>	<b>2,052</b>	<b>2,052</b>	<b>2,238</b>	<b>2,238</b>	<b>8,580</b>
<sup>1</sup> Air Passenger trips are based on PANYNJ estimates which only forecasted trips between Manhattan and JFK and did not include intermediate stops															
<sup>2</sup> JFK Commuter Trips include workers or visitors to/ from the airport area and does not include air passengers															



### 5.3 ALIGNMENT COMPARISONS

Table 5 shows the average weekday total line boardings as well as the JFK terminal station for each scenario. The LIRR alternatives use the JFK Central Terminal while the Hybrid alternative would use existing AirTrain stations. Each alternative has approximately the same number of boardings at JFK with the hybrid alternative’s 15 minute layover at Jamaica to switch between LIRR and AirTrain hindering it from being more attractive travel option from Manhattan. Each forecast includes the estimated 9,000 daily air passengers who would shift to the service estimated by PANYNJ with half being attributed to the Manhattan station and half to the JFK terminal.

**Table 5 - Average Weekday Total Boardings**

Ridership Type	LIRR RBB Branch North or South of Howard Beach All Stops			LIRR RBB Branch North Alignment Woodside Only			LIRR RBB Branch South Alignment Woodside Only			Hybrid Alternative		
	Commuter	Air Passenger	Total	Commuter	Air Passenger	Total	Commuter	Air Passenger	Total	Commuter	Air Passenger	Total
Daily JFK Station Boardings <sup>1</sup>	400	4,500	4,900	320	4,500	4,820	370	4,500	4,870	420	4,500	4,920
Daily Total Line Boardings	11,240	9,000	20,240	3,920	9,000	12,920	4,240	9,000	13,240	1,330	9,000	10,330

<sup>1</sup>Hybrid Alternative goes to existing JFK AirTrain Stations, LIRR alternatives go to JFK CTA Station



## 6. SERVICE AND OPERATING PLANS

### 6.1 HOWARD BEACH ALIGNMENTS

Aside from the differences in location and accessibility from the below ground airport terminal station in Phase II versus the Howard Beach Station and Yard design in Phase I, there are operational differences.

The at-grade single track platform at Howard Beach Station with four yard tracks, discussed in the “Phase One Rockaway Beach Branch Sketch Assessment Draft White Paper” is compared to the below ground airport train station(s) option comprised of two island platforms, with tail tracks and crossovers, directly serving the the CTA. Track schematics of these alignment are shown in Figures 13 and 14 below.

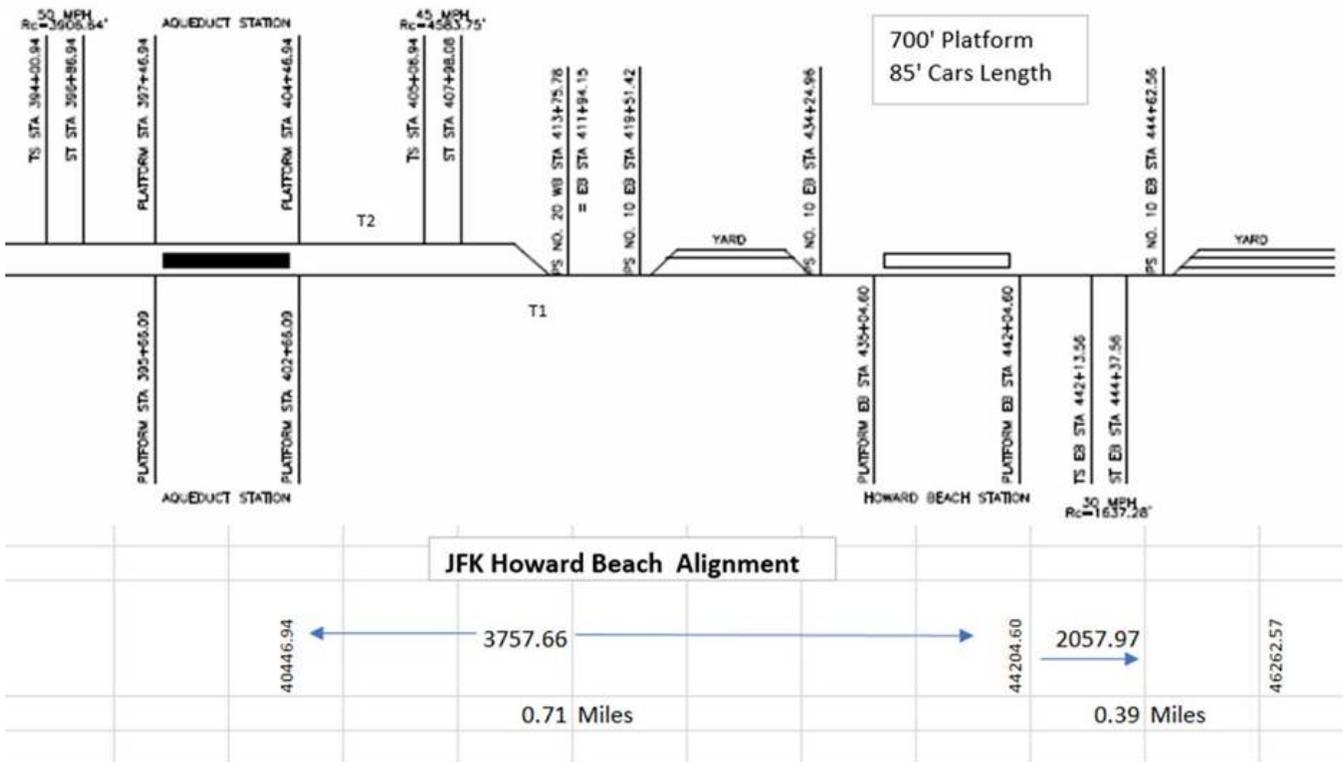


Figure 13 – Phase I Track Schematic

In the Howard Beach alignments, Figure 13, the distance from the eastern end of the platform at Aqueduct Station to the eastern end of the Howard Beach Station platform is ~3,758 feet (approximately .71 miles).

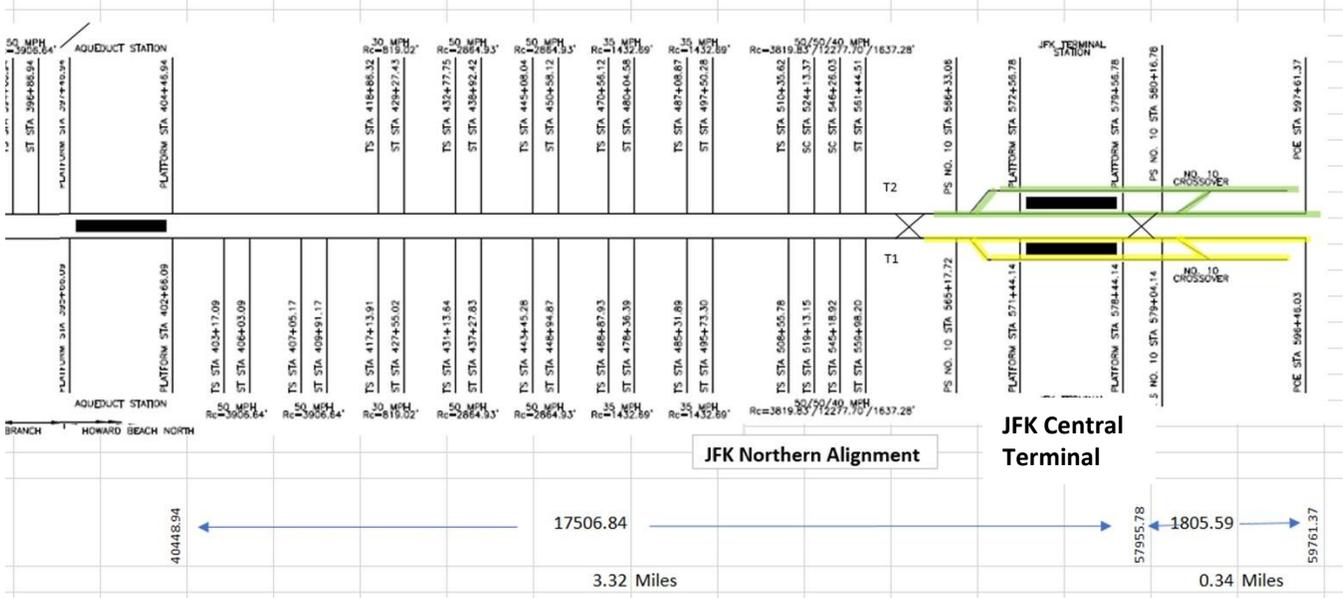


Figure 14 – Phase 2 Track Schematic

In the JFK Central Terminal Station(s) alignment (Figure 14) the distance from the eastern end of the platform at Aqueduct Station to the eastern end of the JFK Station(s) platform is ~17,506 feet (about 3.32 miles).

In this configuration, the scissor crossovers west of JFK Station allows for inbound Track 1 (T1) and outbound Track 2 (T2) crossing moves. The reverse tail track system east of the station serves as a yard and also accommodates inbound and outbound train moves. An additional pair of scissor crossover tracks is also recommended for the east end of the platform to allow for operational flexibility EB and WB.

SYSTRA modeled unimpeded trains using the Railsim© Train Performance Calculator (TPC) for both the JFK Northern and Southern alignments with various grades and curvature differences. The point to point and end to end run times varied minimally. Results are shown in Exhibits G and H on the pages below.

JFK North of Howard Beach and South of Howard Beach Alignments run times, speeds, and power consumption TPC results show subtle differences based on grades and curvature and distance traveled. The nominal run time from midtown Manhattan to Woodside Station is 10 minutes in duration for both the north and south instances, same as the timetable run time in the Howard Beach option.

The maximum achievable speed in both alignments is 67 mph. The run westbound time from JFK Central Terminal Station to Penn Station/ GCT is a nominal 30 minutes for the northern alignment and about 29 minutes for the southern alignment attributable to modest alignment differences in track feet.

Run time measurements for the North and South Alignments may be summarized as follows:

	Westbound Interval Time	Eastbound Interval Time
<b>LIRR JFK North of Howard Beach Alignment</b>	<b>Hrs:Min:Sec</b>	<b>Hrs:Min:Sec</b>
Run Total (with Dwells)	29:39:00	28:59:00
Run Total (without Dwells)	26:39:00	25:59:00
<b>LIRR JFK South of Howard Beach Alignment</b>		
Run Total (with Dwells)	28:34:00	28:50:00
Run Total (without Dwells)	25:34:00	25:50:00



The proposed on-airport alignment to JFK Central Terminal Station compared to the proposed RBB alignment to Howard Beach Station is approximately 4 to 5 minutes longer in duration.

**JFK Terminal Station North of Howard Beach Alignment TPC Results  
Westbound**

LIRR JFK North Alignment	Event	Interval Time	Time	Distance	Average Spd.	Max. Spd.	Make Up	Peak Power	Energy Cons.
Station ID	State	Hrs:Min:Sec	Hrs:Min:Sec	Feet	Mph	Mph	Percent	kw	kwh
JFK Terminal	Departure	00:00	00:00	0			N.A.		0
Aqueduct	Arrival	05:22	05:22	17509.84	37.09	50	0	4855.85	221.01213
Aqueduct	Departure	00:30	05:52	0	33.93		0	640	5.35111
Ozone Park	Arrival	01:43	07:35	5426.19	35.78	50	0	4850.92	75.94313
Ozone Park	Departure	00:30	08:05	0	27.73		0	640	5.35111
Woodhaven	Arrival	00:55	09:00	1994.36	24.77	43.27	0	4853.23	46.07749
Woodhaven	Departure	00:30	09:30	0	16.02		0	640	5.35111
Parkside	Arrival	02:32	12:02	8493.51	38.17	50	0	4855.6	102.90674
Parkside	Departure	00:30	12:32	0	31.87		0	640	5.35111
Rego Park	Arrival	02:58	15:30	8698.53	33.28	50	0	4861.06	107.17658
Rego Park	Departure	00:30	16:00	0	28.49		0	640	5.35111
WOODSIDE	Arrival	03:09	19:09	12833.35	46.35	61.29	0	4858.27	157.23241
WOODSIDE	Departure	00:30	19:39	0	41.74		0	640	5.35111
PENN or GCT	Arrival	10:00	26:39	26787.57	41.74	60	0	5323	216.7734
<b>Run Total (With Dwells)</b>		29:39		81743.35	32.61	61.29	0	4861.06	959.22854
<b>Run Total (Without Dwells)</b>		26:39		81743.35	37.51	61.29	N.A.	4861.06	927.12188



**JFK Terminal Station North of Howard Beach Alignment TPC Results  
Eastbound**

LIRR JFK North Alignment	Event	Interval Time	Time	Distance	Average Spd.	Max. Spd.	Make Up	Peak Power	Energy Cons.
Station ID	State	Hrs:Min:Sec	Hrs:Min:Sec	Feet	Mph	Mph	Percent	kw	kwh
PENN or GCT	Departure	00:00	00:00	0			N.A.		0
WOODSIDE	Arrival	10:00	10:00	26939.3	44.21	60	0	5327.53	286.79203
WOODSIDE	Departure	00:30	10:30	0	27.83		0	640	330.27647
Rego Park	Arrival	03:06	13:36	12499.69	45.8	66.7	0	4857.03	159.67846
Rego Park	Departure	00:30	14:06	0	39.44		0	640	5.35111
Parkside	Arrival	02:29	16:35	8461.85	38.8	50	0	4851.85	102.81355
Parkside	Departure	00:30	17:05	0	32.29		0	640	5.35111
Woodhaven	Arrival	02:28	19:33	8497.44	39.12	50	0	4849.09	83.94522
Woodhaven	Departure	00:30	20:03	0	32.53		0	640	5.35111
Ozone Park	Arrival	00:54	20:57	1994.36	25.04	43.77	0	4856.76	44.99499
Ozone Park	Departure	00:30	21:27	0	16.13		0	640	5.35111
Aqueduct	Arrival	01:42	23:09	5425.75	36.41	50	0	4858.46	67.58165
Aqueduct	Departure	00:30	23:39	0	28.11		0	640	5.35111
JFK Terminal	Arrival	05:20	28:59	17578.05	37.41	50	0	4858.41	164.85934
<b>Run Total (With Dwells)</b>		28:59		81396.44	33.47	66.7	0	4858.46	1267.69726
<b>Run Total (Without Dwells)</b>		25:59		81396.44	38.71	66.7	N.A.	4858.46	910.66524



**JFK Terminal Station South of Howard Beach Alignment TPC Results  
Westbound**

LIRR JFK South Alignment	Event	Interval Time	Time	Distance	Average Spd.	Max. Spd.	Make Up	Peak Power	Energy Cons.
Station ID	State	Hrs:Min:Sec	Hrs:Min:Sec	Feet	Mph	Mph	Percent	kw	kwh
JFK Terminal	Departure	00:00	00:00	0			N.A.		0
Aqueduct	Arrival	04:17	04:17	16816.06	44.63	50	0	4855.85	167.00051
Aqueduct	Departure	00:30	04:47	0	39.96		0	640	5.35111
Ozone Park	Arrival	01:43	06:30	5426.19	35.78	50	0	4850.92	75.94313
Ozone Park	Departure	00:30	07:00	0	27.73		0	640	5.35111
Woodhaven	Arrival	00:55	07:55	1994.36	24.77	43.27	0	4853.23	46.07749
Woodhaven	Departure	00:30	08:25	0	16.02		0	640	5.35111
Parkside	Arrival	02:32	10:57	8493.51	38.17	50	0	4855.6	102.90674
Parkside	Departure	00:30	11:27	0	31.87		0	640	5.35111
Rego Park	Arrival	02:58	14:25	8698.53	33.28	50	0	4861.06	107.17658
Rego Park	Departure	00:30	14:55	0	28.49		0	640	5.35111
WOODSIDE	Arrival	03:09	18:04	12833.35	46.35	61.29	0	4858.27	157.23241
WOODSIDE	Departure	00:30	18:34	0	39.98		0	640	5.35111
PENN or GCT	Arrival	10:00	28:34	26787.57	41.74	60	0	5323.00	216.7734
<b>Run Total (With Dwells)</b>		28:34		81049.57	35.62	61.29	0	5323.00	905.21692
<b>Run Total (Without Dwells)</b>		25:34		81049.57	40.29	61.29	N.A.	5323.00	873.11026



**JFK Terminal Station South of Howard Beach Alignment TPC Results  
Eastbound**

LIRR JFK South Alignment	Event	Interval Time	Time	Distance	Average Spd.	Max. Spd.	Make Up	Peak Power	Energy Cons.
Station ID	State	Hrs:Min:Sec	Hrs:Min:Sec	Feet	Mph	Mph	Percent	kw	kwh
PENN or GCT	Departure	00:00	00:00	0			N.A.		0
WOODSIDE	Arrival	10:55	06:55	26939.3	44.21	60	0	5327.53	286.79203
WOODSIDE	Departure	00:30	07:25	0	27.83		N.A.	640	5.35111
Rego Park	Arrival	03:06	10:32	12499.69	45.8	66.7	0	4857.03	159.67846
Rego Park	Departure	00:30	11:02	0	39.44		0	640	5.35111
Parkside	Arrival	02:29	13:30	8461.85	38.8	50	0	4851.85	102.81355
Parkside	Departure	00:30	14:00	0	32.29		0	640	5.35111
Woodhaven	Arrival	02:28	16:28	8497.44	39.12	50	0	4849.09	83.94522
Woodhaven	Departure	00:30	16:58	0	32.53		0	640	5.35111
Ozone Park	Arrival	00:54	17:53	1994.36	25.04	43.77	0	4856.76	44.99499
Ozone Park	Departure	00:30	18:23	0	16.13		0	640	5.35111
Aqueduct	Arrival	01:42	20:04	5425.75	36.41	50	0	4858.46	67.58165
Aqueduct	Departure	00:30	20:34	0	28.11		0	640	5.35111
JFK Terminal	Arrival	04:16	24:51	16881.19	44.89	50	0	4858.41	108.42606
<b>Run Total (With Dwells)</b>		28:50		80699.58	36.90	66.7	0	5327.53	886.33862
<b>Run Total (Without Dwells)</b>		25:50		80699.58	41.97	66.7	N.A.	5327.53	854.23196







Northern Alignment Westbound							
Station ID	Event State	Interval Time Hrs:Min:Sec	Cumulative Time Hrs:Min:Sec	Distance Feet	Average Spd. Mph	Max. Spd. Mph	Energy Consumption kwh
JFK Terminal	Departure	00:00.0	00:00.0	0			0
Aqueduct	Pass	05:13.6	05:13.6	17511.46		50.00	225.10143
Ozone Park	Pass	01:14.5	06:28.1	5428.28		50.00	37.96078
Woodhaven	Pass	00:27.2	06:55.3	1994.67		50.00	10.02341
Parkside	Pass	02:03.6	08:58.9	8492.09		50.00	65.20383
Rego Park	Pass	02:33.4	11:32.3	8702.21		50.00	77.76093
WOODSIDE	Arrival	02:46.9	14:19.2	12827.07	43.61	68.40	129.14673
<b>Totals</b>		<b>14:19.2</b>		<b>54955.78</b>	<b>43.61</b>	<b>68.40</b>	<b>545.19711</b>

Southern Alignment Westbound							
Station ID	Event State	Interval Time Hrs:Min:Sec	Cumulative Time Hrs:Min:Sec	Distance Feet	Average Spd. Mph	Max. Spd. Mph	Energy Consumption kwh
JFK Terminal	Departure	00:00.0	00:00.0	0			0
Aqueduct	Pass	04:07.0	04:07.0	16822.62		50.00	171.76893
Ozone Park	Pass	01:14.0	05:21.0	5426.67		50.00	30.50325
Woodhaven	Pass	00:27.1	05:48.1	1987.33		50.00	9.97644
Parkside	Pass	02:03.7	07:51.8	8499.12		50.00	65.31656
Rego Park	Pass	02:33.3	10:25.1	8698.02		50.00	77.63445
WOODSIDE	Arrival	02:46.9	13:12.0	12828.24	46.71	68.45	129.25421
<b>Totals</b>		<b>13:12.0</b>		<b>54262.00</b>	<b>46.71</b>	<b>68.45</b>	<b>484.45384</b>

The westbound run times for the Northern Alignment with all station stops and 30 second dwells at the five stations between JFK and Woodside, was calculated to be 19:09 (arrival time) while the westbound run time for the Southern Alignment with all stops was calculated to be 18:04, a difference of about 5:00 less travel time in each scenario.

Using the SYSTRA© TPC, the eastbound run times without station stops Woodside to JFK for the Northern and Southern Alignments are shown in the exhibit below. The average speed is between 40 and 50 MPH and maximum achievable speed is roughly 66 MPH.



Northern Alignment Eastbound							
Station ID	Event State	Interval Time Hrs:Min:Sec	Cumulative Time Hrs:Min:Sec	Distance Feet	Average Spd. Mph	Max. Spd. Mph	Energy Consumption kwh
WOODSIDE	Departure	00:00.0	00:00.0	0			0
Rego Park	Pass	02:54.5	02:54.5	12507.67		66.70	170.43555
Parkside	Pass	01:55.7	04:50.2	8460.51		66.96	71.02287
Woodhaven	Pass	01:59.9	06:50.1	8493.16		50.00	42.84679
Ozone Park	Pass	00:27.2	07:17.3	1994.67		50.00	8.02334
Aqueduct	Pass	01:14.0	08:31.3	5426.67		50.00	19.88464
JFK Terminal	Arrival	05:05.0	13:36.3	17574.46	45.49	50.00	135.99103
<b>Totals</b>		<b>13:36.3</b>		<b>54457.14</b>	<b>45.49</b>	<b>66.96</b>	<b>448.20422</b>

Southern Alignment Eastbound							
Station ID	Event State	Interval Time Hrs:Min:Sec	Cumulative Time Hrs:Min:Sec	Distance Feet	Average Spd. Mph	Max. Spd. Mph	Energy Consumption kwh
WOODSIDE	Departure	00:00.0	00:00.0	0			0
Rego Park	Pass	02:54.5	02:54.5	12507.67		66.70	170.43555
Parkside	Pass	01:55.7	04:50.2	8460.51		66.96	71.02287
Woodhaven	Pass	01:59.9	06:50.1	8493.16		50.00	42.84679
Ozone Park	Pass	00:27.2	07:17.3	1994.67		50.00	8.02334
Aqueduct	Pass	01:14.0	08:31.3	5426.67		50.00	19.88464
JFK Terminal	Arrival	03:59.9	12:31.2	16877.6	48.79	50.00	78.46252
<b>Totals</b>		<b>12:31.2</b>		<b>53760.28</b>	<b>48.79</b>	<b>66.96</b>	<b>390.6757</b>

As compared to the analysis in Section 6.2, the eastbound run times for the Northern Alignment with all station stops and 30 second dwells at the five stations between Woodside and JFK, was calculated to be 18:29 while the eastbound run time for the Southern Alignment was calculated to be 17:25, a difference of about 5:30 less travel time in each scenario.

Please note that the published timetable run time from New York Penn Station to Woodside Station is 10 minutes in duration for both the northern and southern instances. JFK Northern and Southern Alignments run times, speeds, and power consumption TPC results show differences based on grades and curvature and distance traveled particularly at the JFK on-airport alignments.

Although running each train as an express Woodside - JFK International shortens the run time between five and six minutes, no difference in headway or in the number of trains operated was calculated for this exercise and there are no discernable differences in capacity predicted.

### 6.3 HYBRID VEHICLE

In the hybrid vehicle scenario is introduced, service will run between Penn Station/ GCT and Jamaica over the LIRR Main Line. In Jamaica, trains will use a new connection to be built to enter/leave the Jamaica AirTrain terminal. At that point, trains will reverse ends. Airport bound trains will be switched over to the AirTrain Automatic Train Control (ATC) system, as well as any other operations necessary to make them AirTrain compatible. Westbound trains will have the reverse operations performed. Airport bound trains will then proceed to operate over the AirTrain system into the airport, making all regular AirTrain stops.

Running times between Manhattan and Jamaica are approximately 18 minutes for non-stop trains, and 22 minutes for trains making all local stops (Woodside, Forest Hills, Kew Gardens) per the LIRR employee timetable. According to the PANYNJ website the AirTrain travels to the airport from Jamaica every 4 to 12 minutes and the run time is about 10 minutes. <https://www.panynj.gov/airports/jfk-airtrain.html>



## 7. COST ESTIMATES

### 7.1 CAPITAL COSTS

The capital cost estimates presented in the “Phase One Rockaway Beach Branch Sketch Assessment Draft White Paper” were amended to prepare an estimate for both the North and South of Howard Beach alignments. The alignment estimates take into account the required changes in the infrastructure from the vicinity of Aqueduct Station to the JFK CTA. All costs were developed on an order of magnitude basis and in accordance with the LIRR’s estimating format. The basis of estimate items noted in the “Phase One Rockaway Beach Branch Sketch Assessment Draft White Paper” apply to these estimates and are only amended by the following items:

- Soft cost for agency service support costs (Utility Companies, etc.) assumed at 5% of cost.
- Force accounts costs as shown for each work category.
- No costs are included for pedestrian access to air terminal from rail terminal station(s).
- Estimate developed for one station at JFK in CTA.
- Costs associated with any additional fleet/rolling stock that may be needed for this service are not being analyzed or estimated in this study.

The total cost of each alignment option is shown in the table below. See Appendix F for the detailed cost breakdown for each alignment.

Alternative	Capital Cost Estimate
North of Howard Beach	\$19,346,000,000
South of Howard Beach	\$19,488,000,000

Note: The total above are inclusive of phase 1 and phase 2.

The cost table breakdown below is a summary of associated costs from Aqueduct station to JFK CTA as prepared as part of Phase 2.

Cost Categories	South of Howard Beach	North of Howard Beach
Bridge Replacements	\$43,001,065	\$0
Retained Cuts	\$438,477,308	\$578,649,938
Viaducts	\$0	\$943,975,751
Tunnels	\$4,756,830,278	\$3,927,115,698
Site Work	\$345,682,788	\$225,231,626
Stations	\$1,434,268,125	\$1,434,268,125
Trackwork	\$83,373,601	\$78,424,734
Systems	\$456,158,652	\$456,792,918
Force Account Construction	\$1,233,528,673	\$1,246,312,989
Soft Costs	\$3,780,267,811	\$3,823,031,865
<b>Totals</b>	<b>\$12,571,588,300</b>	<b>\$12,713,803,645</b>

Notes:

1. Values shown include all cost estimate mark-ups (i.e. General Conditions, OH&P, Insurance & Bonding, Contingency, Escalation).
2. Site Work Category includes: Retaining Walls, Sound Walls, Embankments & ROW Vegetation Removal.
3. Values do not include any hybrid fleet costs.



## 8. NEXT STEPS

### 8.1 ANALYSIS OF IMPACTS ON JFK AIRPORT OPERATIONS

The SYSTRA Team met with the PANYNJ along with LIRR and the MTA, on November 8<sup>th</sup>, 2017 to discuss the JFK “Vision Plan” to better understand the status of rebuilding of the individual terminals and vision of the master planning effort. The PANYNJ is in the very early stages of their project and their consulting team was recently contracted, thus only a minimal amount of work has been performed. It will take the PANYNJ’s team a several months to develop some concepts to better define the CTA, however this will be beyond the timeframe of the SYSTRA Team’s project. As part of the meeting, the SYSTRA Team/LIRR provided to the PANYNJ the concept track alignments and general requirements of what would be needed for the terminal railroad station. A second meeting was held on February 5, 2018 to discuss PANYNJ comments on the technical memos prepared under this study. As part of the meetings with PANYNJ and subsequent work on the project, the following items have been identified and need to be considered for all future planning and design efforts:

- The proposed rail station should be located between terminals 1 and 8 and be positioned in an east-west direction. Options that would be oriented in a north-south direction should be eliminated at this time as there will be a greater conflict with the proposed CTA plan.
- The PANYNJ would prefer a second station between terminals 4 and 5 to accommodate needed passenger volumes on AirTrain and to reduce walking distances to the terminals.
- Rail alignments will enter the CTA via bored tunnels below existing infrastructure and taxiways. However, the main station area would require a cut and cover type construction. This will have a significant impact on all surface features and will require detailed design analysis and staging plans to configure what’s required. Consideration of bored tunnels only should be part of future studies.
- Construction within and around the CTA will impact numerous infrastructure components including, but not limited to, the JFK Expressway, roadway ramps and interchanges, the AirTrain viaduct, and various utilities.
- Inter-terminal connectivity will be critical to the overall network and function of the rail station.
- Some features such as ventilation plants, emergency egress, etc., will be required for the rail tunnels and terminal station and will affect other proposed elements at the ground surface.
- The PANYNJ noted that some facilities/structures in the CTA have piles extending 60 feet below the surface and prefer that the tunnels and station be set below 60 feet to avoid interference with these piles. The location of the piles and depths of a working track alignment are deferred to future studies and conceptual engineering in coordination with the master planning effort.
- Tunneling underneath taxiways/runways during and after construction will need to consider substrate settlement.
- Security implications of having tunnels constructed below on-airport operations as well as in the terminal area will also require further analysis.

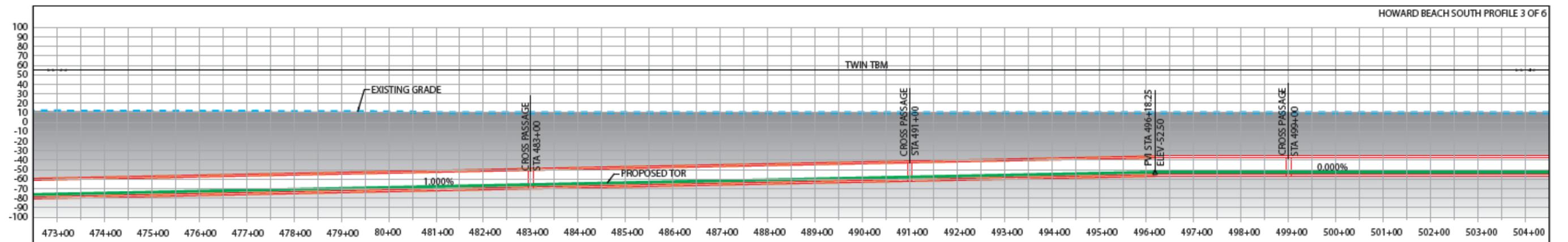
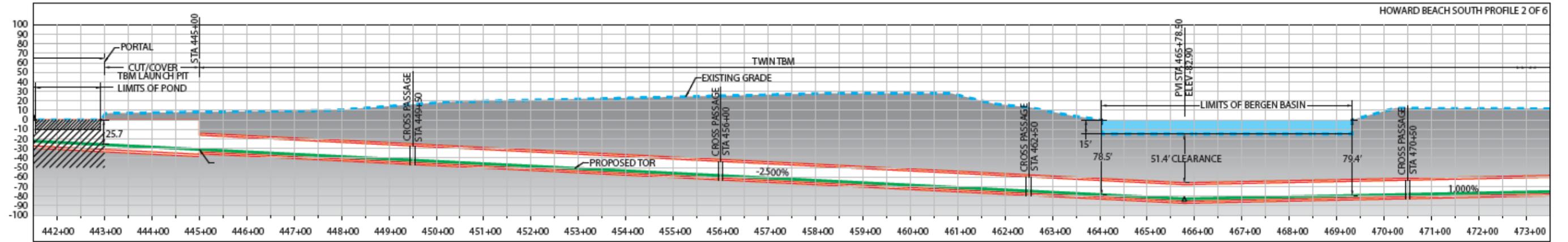
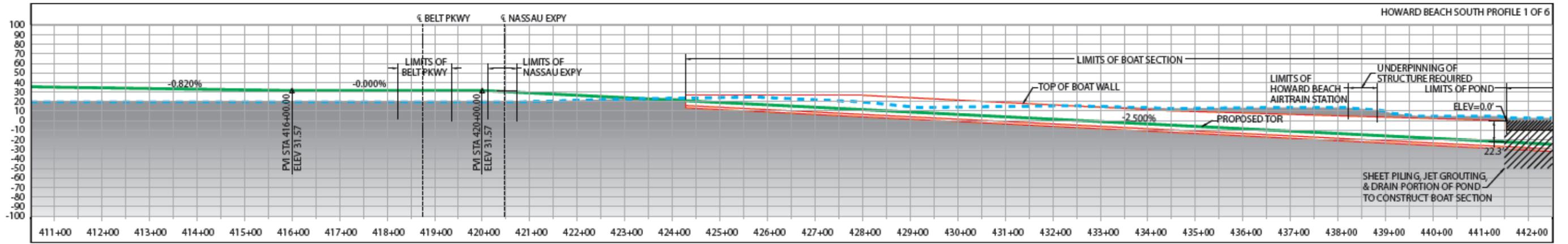
Continued coordination between the PANYNJ’s project and future efforts by the LIRR/MTA needs to be coordinated closely so that the needs of each project are clearly identified and accounted for in the master planning effort.

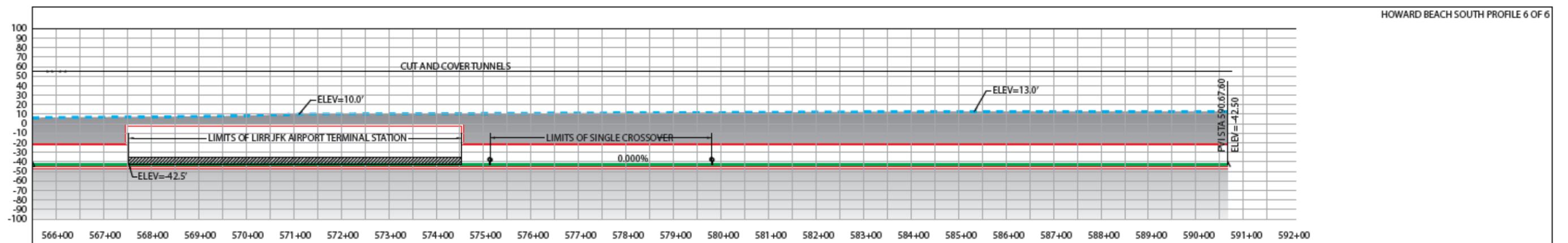
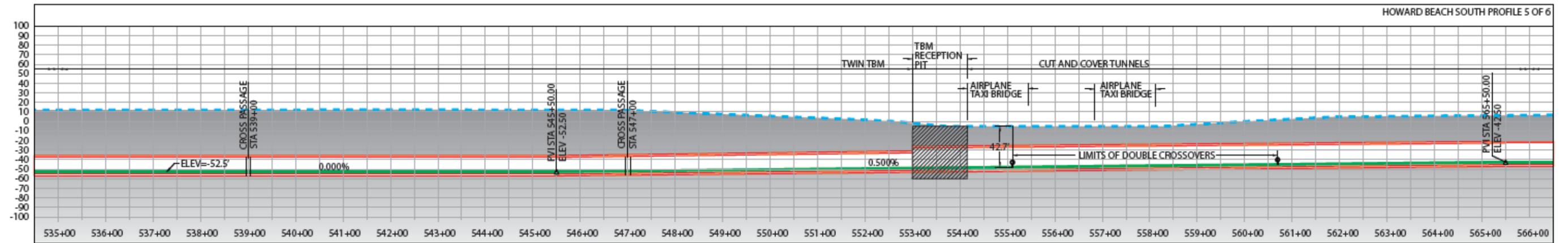
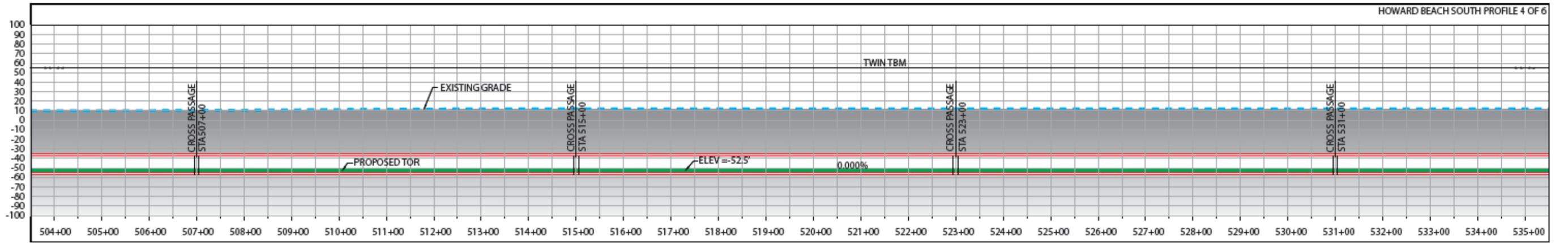
### 8.2 FURTHER ANALYSIS

The next step on the project is to prepare Technical Memo #4, which will address community impacts for both the North and South of Howard Beach alignments. In addition, the memo will provide a recommended strategy going forward and select alignments for further study. The final approved contents on Technical Memo’s 2, 3 and 4 will be combined in the Final Report along with other supporting documentation that may be required.



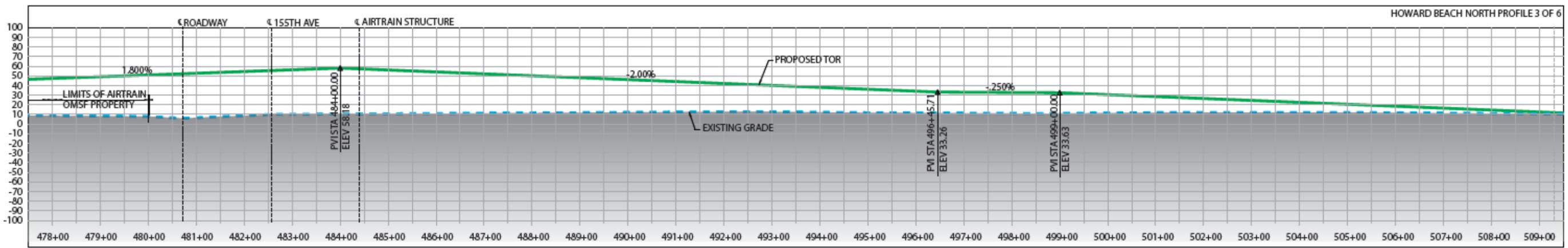
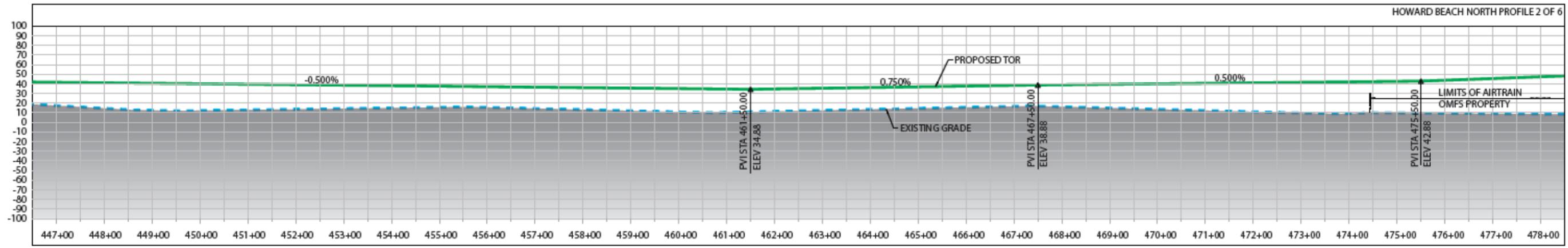
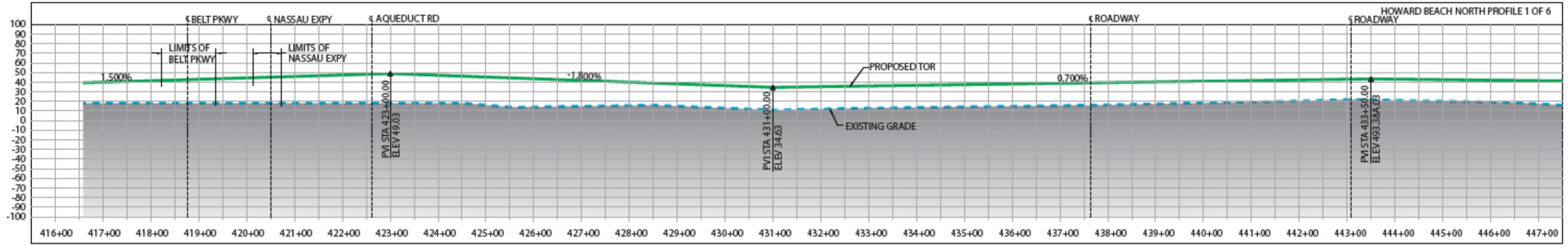
## **APPENDIX A: SOUTH OF HOWARD BEACH ALIGNMENT PROFILES**

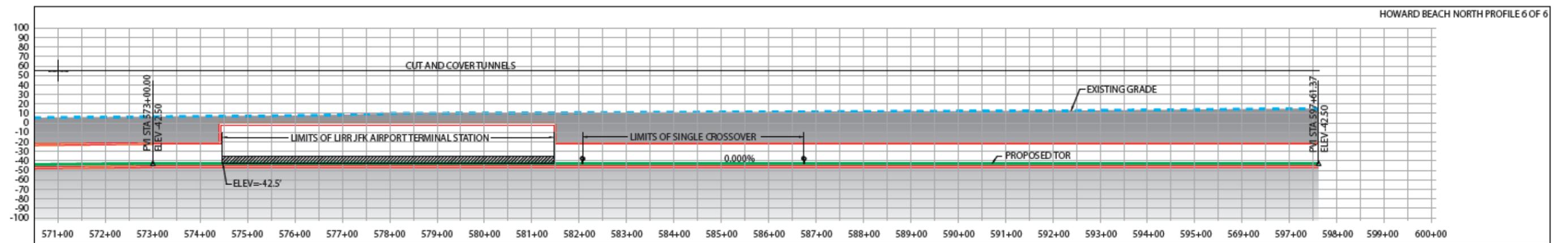
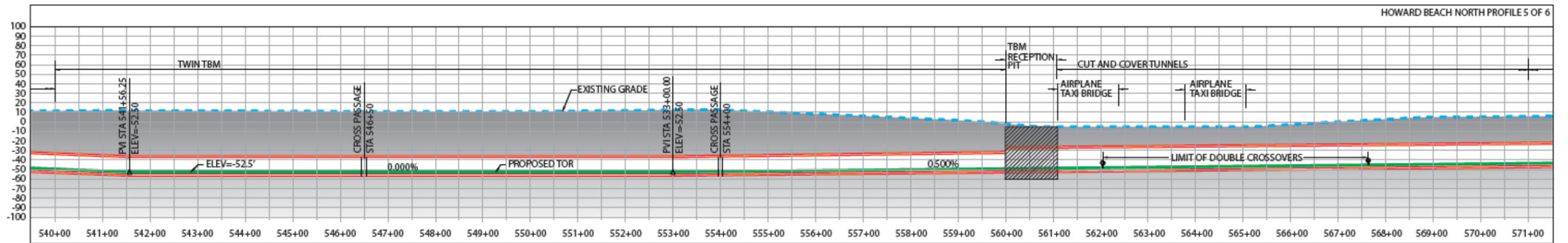
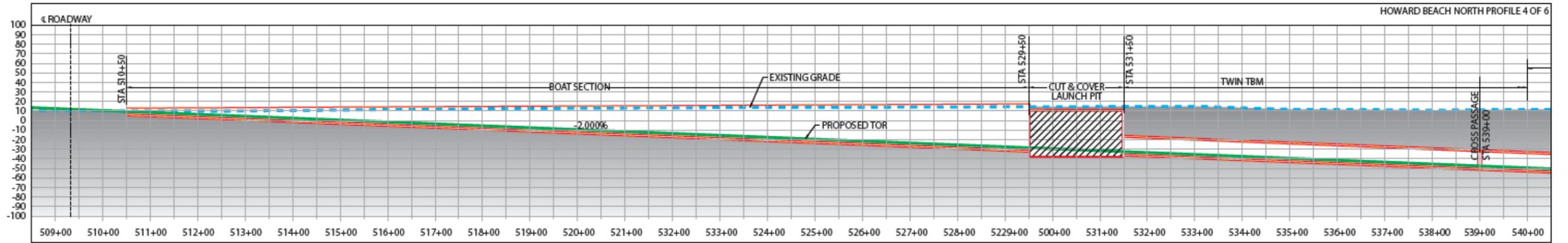






## **APPENDIX B: NORTH OF HOWARD BEACH ALIGNMENT PROFILES**

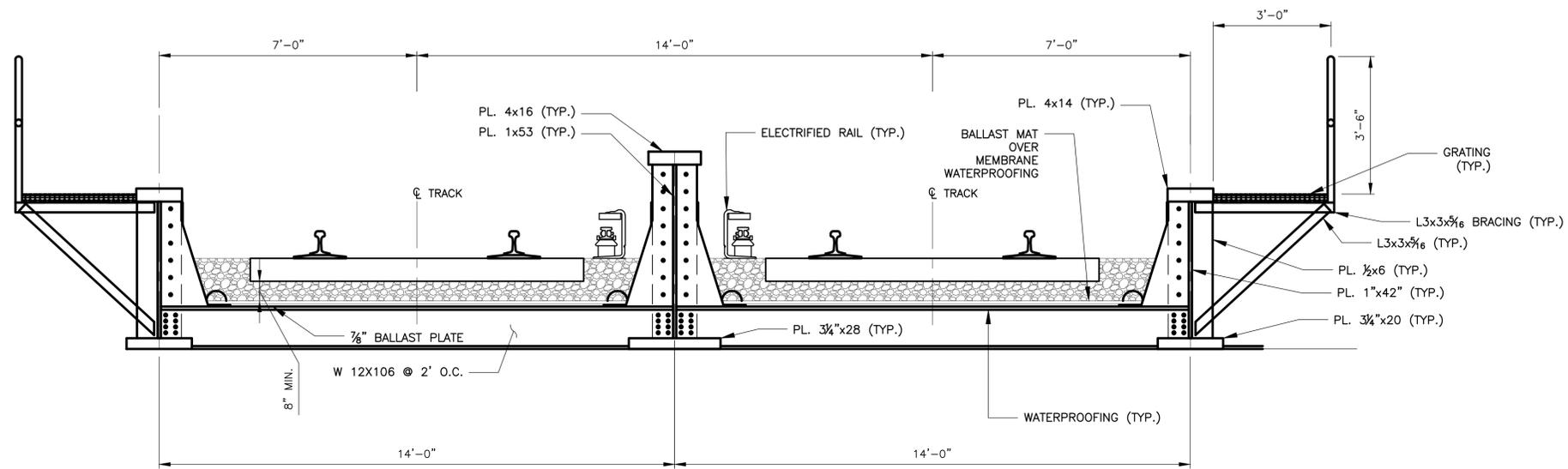




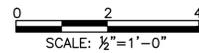


## **APPENDIX C: STRUCTURAL DRAWINGS**

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TYPICAL BRIDGE SECTION



**KSE**

**KS ENGINEERS, P.C.**  
 Surveyors • Construction Managers  
 494 Broadway, 4th Floor, New York, N.Y. 10012  
 Phone: (973) 623-2999, Fax: (973) 623-2911

IT IS A VIOLATION OF THE PROFESSIONAL LICENSE LAW FOR ANY PERSON TO ALTER THIS DOCUMENT IN ANY WAY UNLESS THAT PERSON IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL. THE LICENSED PROFESSIONAL SHALL AFFIX TO THIS DOCUMENT THE SEAL AND THE NOTATION "ALTERED BY", FOLLOWED BY THE AUTHORIZED SIGNATURE AND THE DATE OF THE ALTERATION.

REV. NO.	DRAWN BY	CHK BY	DESCRIPTION	DATE

DESIGNED BY: L.S.  
 DATE: 12/15/17  
 DRAWN BY: V.S.  
 DATE: 12/15/17  
 CHECKED BY: K.E.  
 DATE: 12/15/17  
 APPROVED BY: G.A.  
 DATE: 12/15/17

PE:



PROJECT: RESTORATION OF THE ROCKAWAY BEACH BRANCH

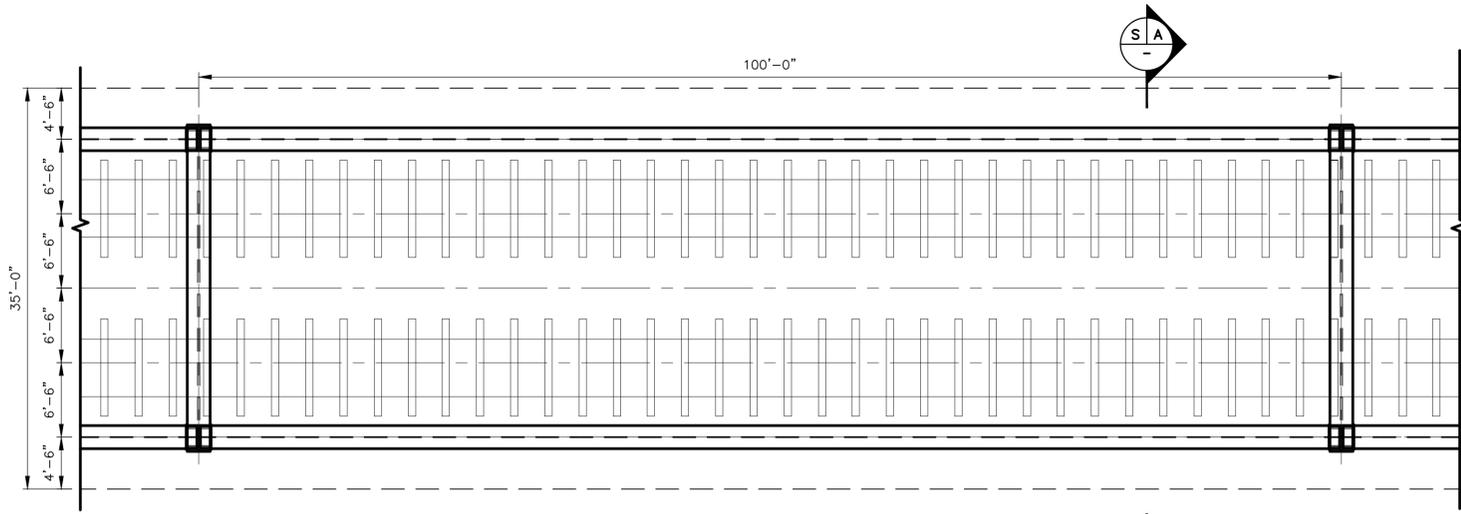
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 DATE:  
 REVISION NUMBER: -

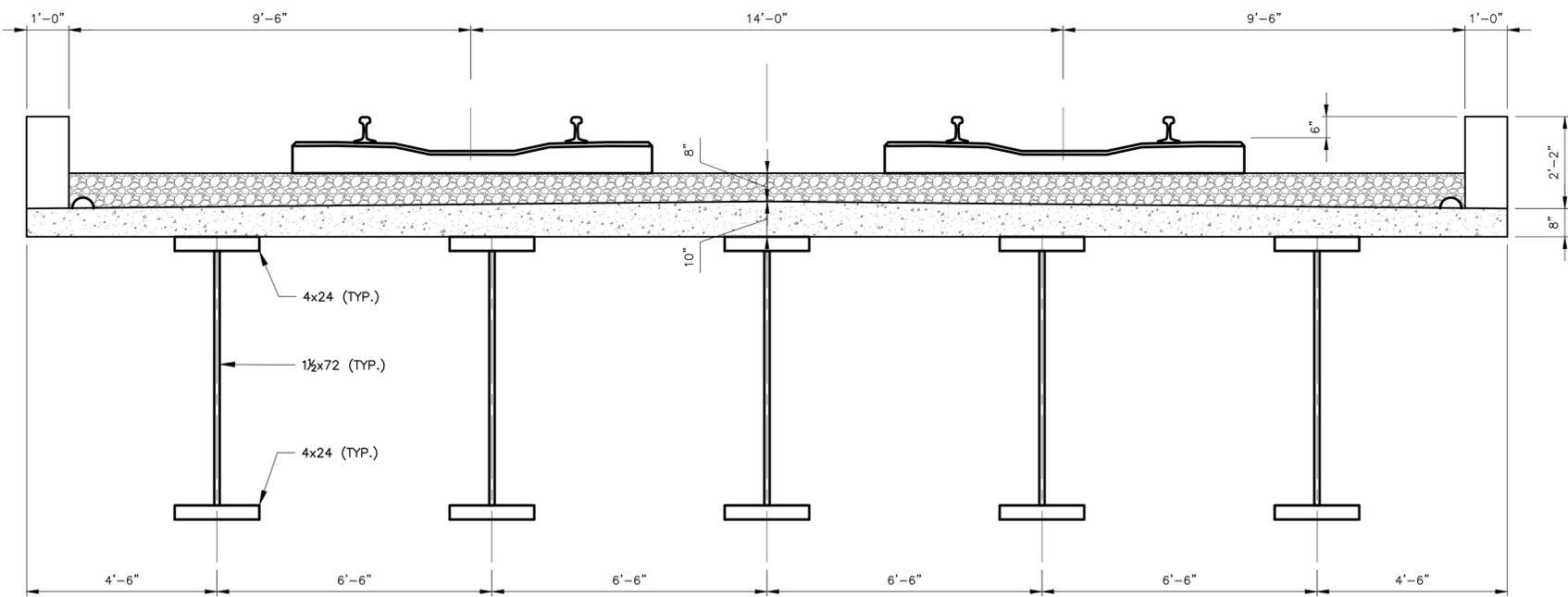
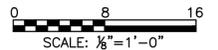
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 ISSUE: -  
 SHEET NO:



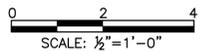
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VIADUCT (PLAN)  
(100 FEET SPAN LENGTH)



SECTION - DECK GIRDER OPTION (OPTION 2)



**KSE**

KS ENGINEERS, P.C.  
Surveyors • Construction Managers  
494 Broadway Street, 4th Floor, New York, N.Y. 10012  
Phone: (973) 623-2999, Fax: (973) 623-2911

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REV. NO.	DRAWN BY	CHK BY	DESCRIPTION	DATE

DESIGNED BY: L.S.  
DATE: 12/15/17  
DRAWN BY: V.S.  
DATE: 12/15/17  
CHECKED BY: K.E.  
DATE: 12/15/17  
APPROVED BY: G.A.  
DATE: 12/15/17

PE:



PROJECT: RESTORATION OF THE ROCKAWAY BEACH BRANCH  
DRAWING TITLE: VIADUCT DECK GIRDER OPTION-2

SCALE:  
DRAWING NUMBER: S-2  
DATE:  
REVISION NUMBER:

CONTRACT NUMBER: XXXX  
ISSUE:  
SHEET NO:



## **APPENDIX D: HYBRID VIADUCT RENDERINGS**



**LEGEND:**

- PROPOSED TRACK - HYBRID WESTBOUND
- PROPOSED TRACK - HYBRID EASTBOUND
- PROPOSED TRACK - HYBRID INBOUND
- PROPOSED TRACK - HYBRID OUTBOUND

**SYSTRA**

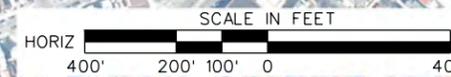
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520 8th Avenue, Suite 2100  
New York, NY 10018

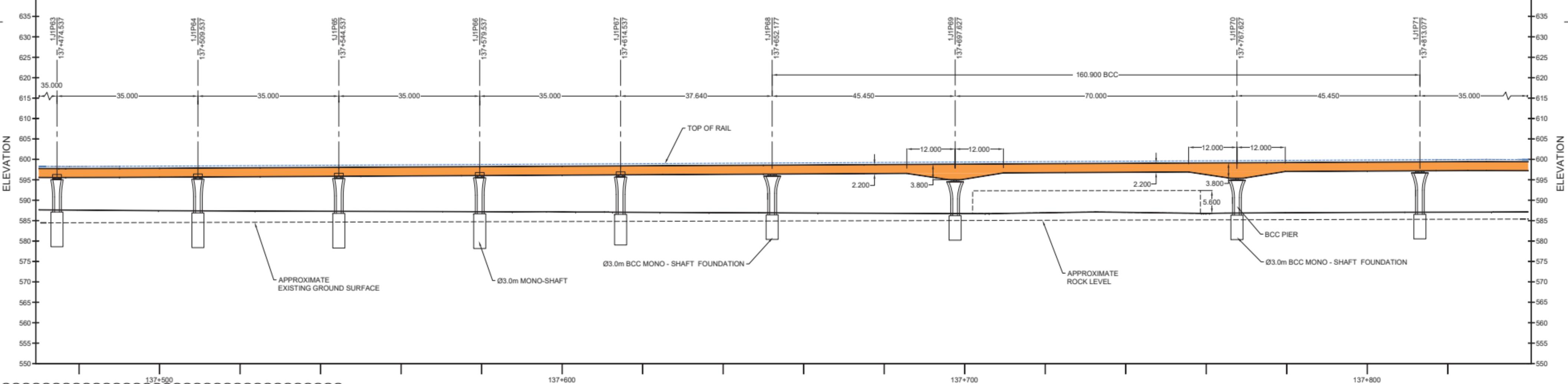
CONCEPTUAL  
NOT FOR  
CONSTRUCTION

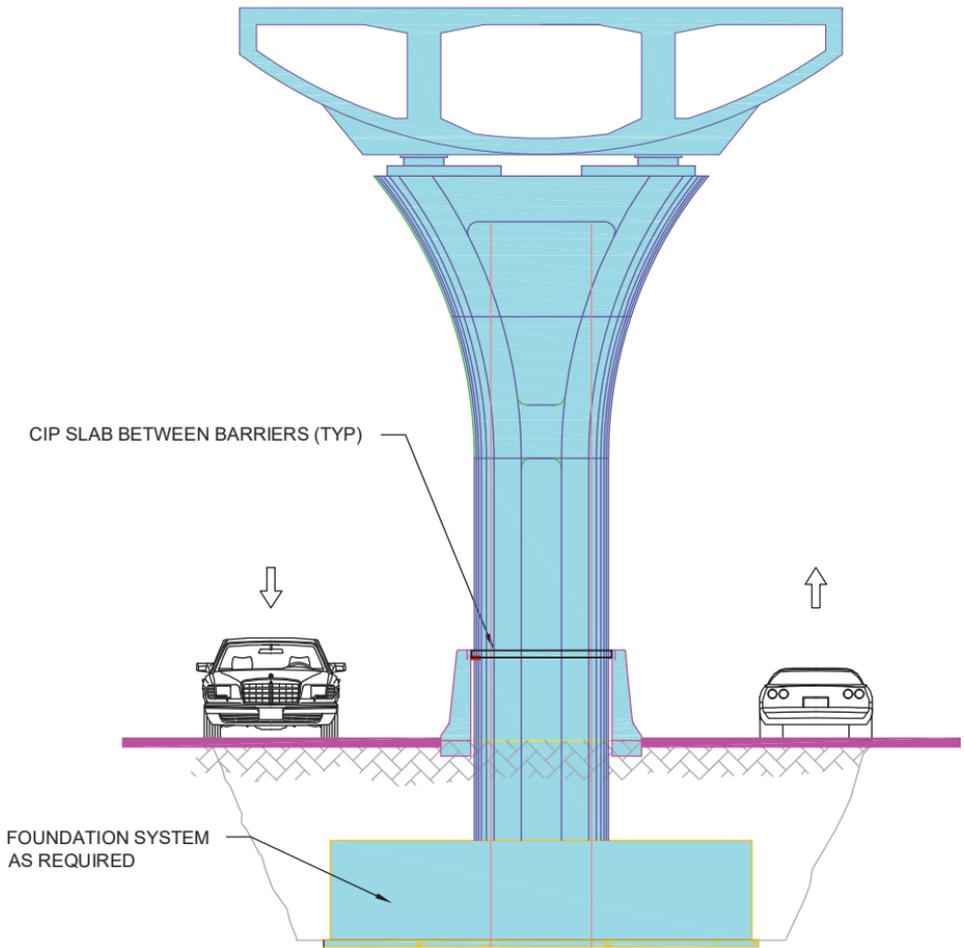
LONG ISLAND RAIL ROAD  
ROCKAWAY BEACH BRANCH /JFK AIRPORT ONE-SEAT RAIL STUDY  
HYBRID ALIGNMENT LAYOUT  
EXHIBIT 3

SCALE: AS NOTED

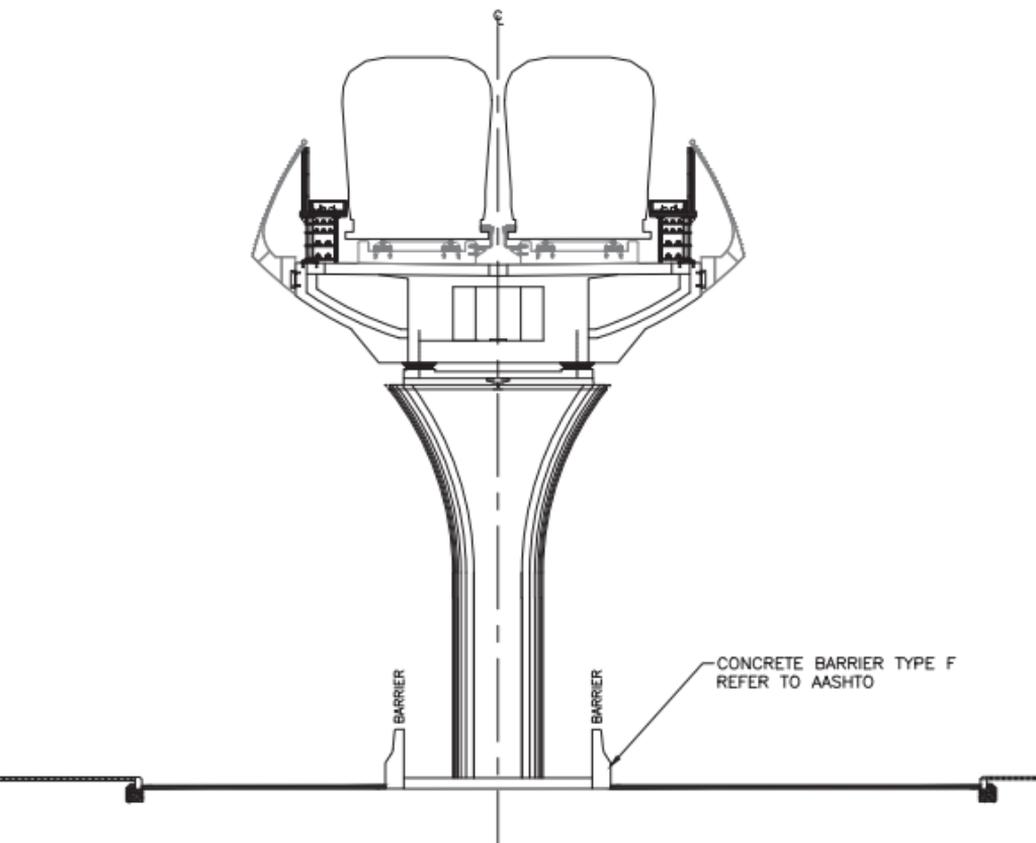
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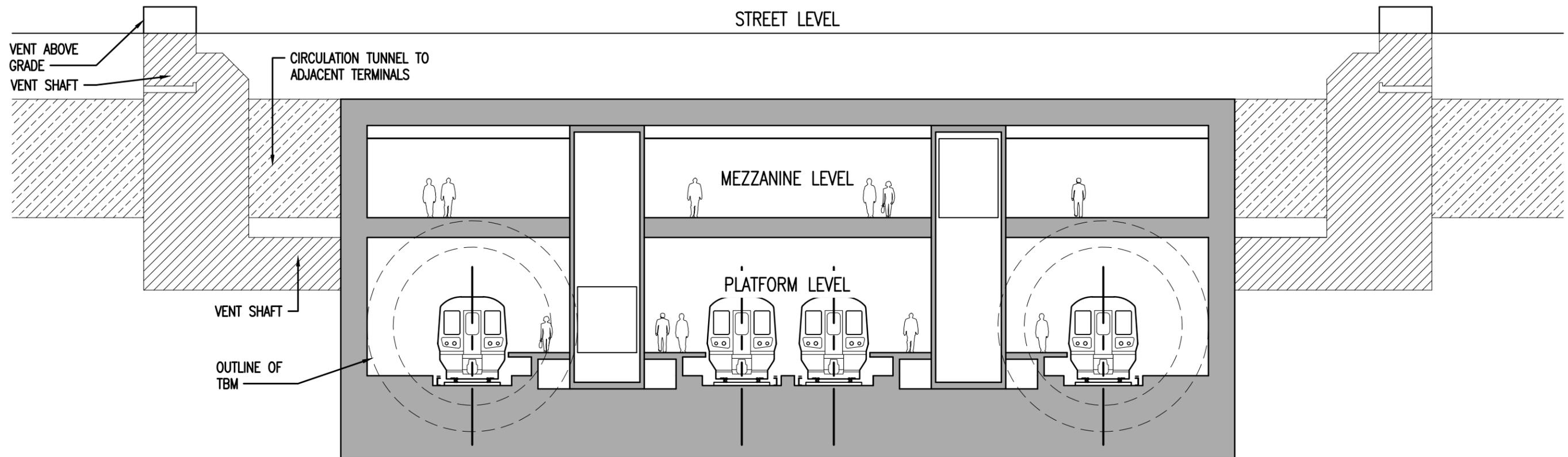
# TRANSVERSE ELEVATION



**B** | CROSS SECTION



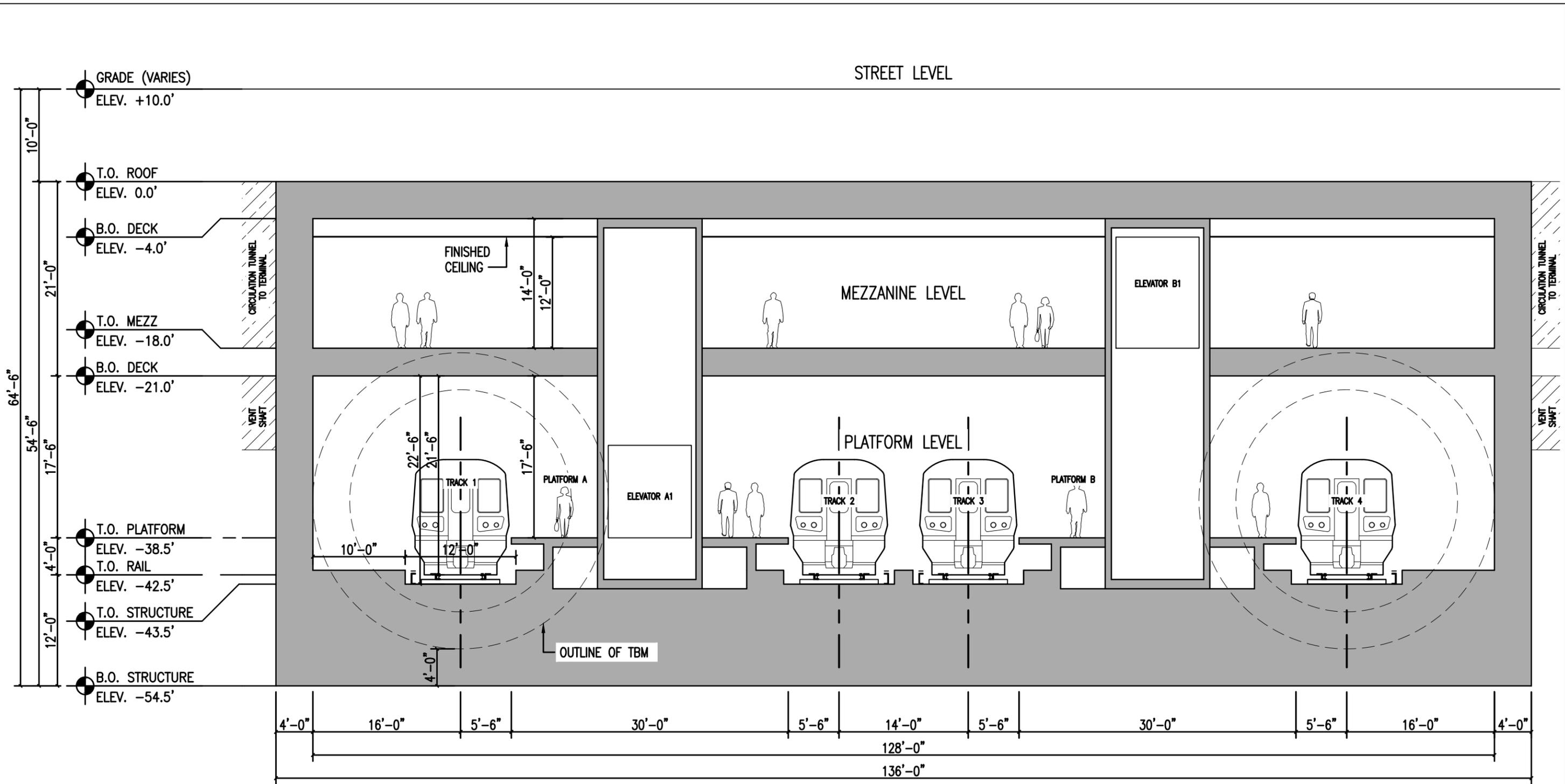
## **APPENDIX E: ARCHITECTURAL/ STATION DRAWINGS**



**LONG ISLAND RAIL ROAD  
RESTORATION OF THE ROCKAWAY BEACH BRANCH**

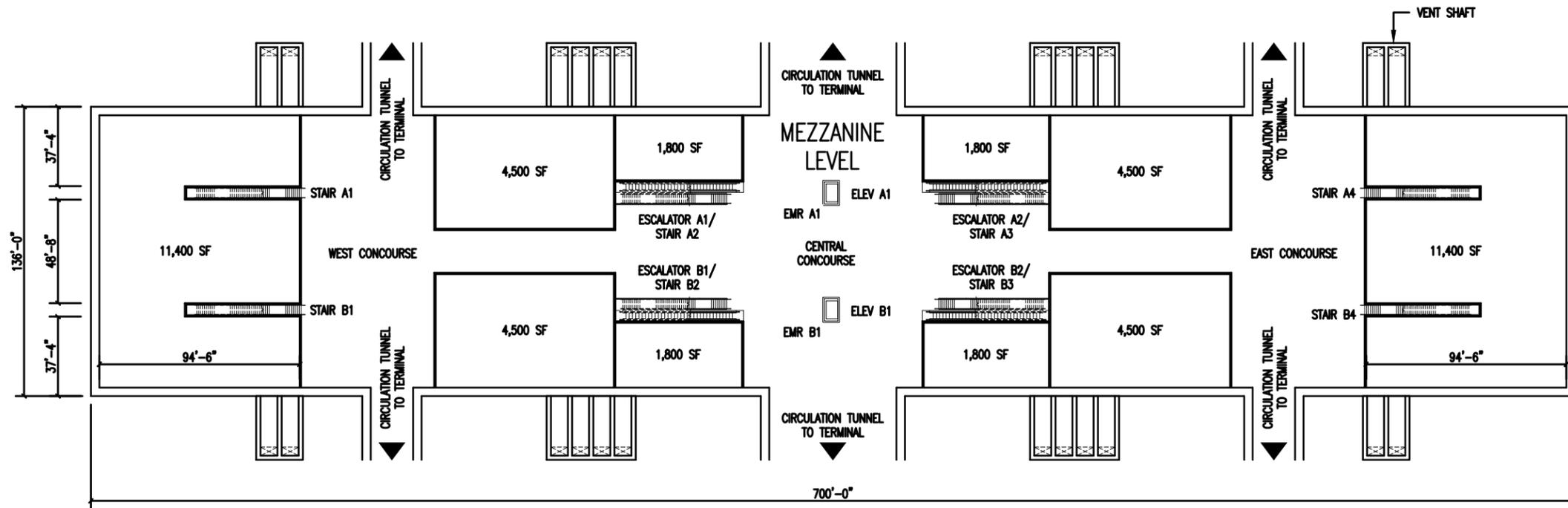
LONG ISLAND RAIL ROAD STATION STUDY

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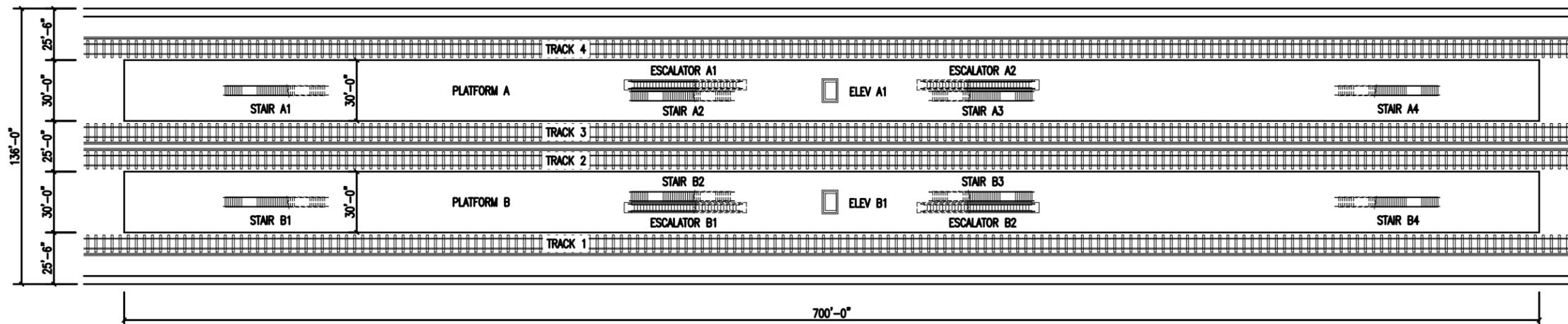


**LONG ISLAND RAIL ROAD  
RESTORATION OF THE ROCKAWAY BEACH BRANCH**  
LONG ISLAND RAIL ROAD STATION STUDY

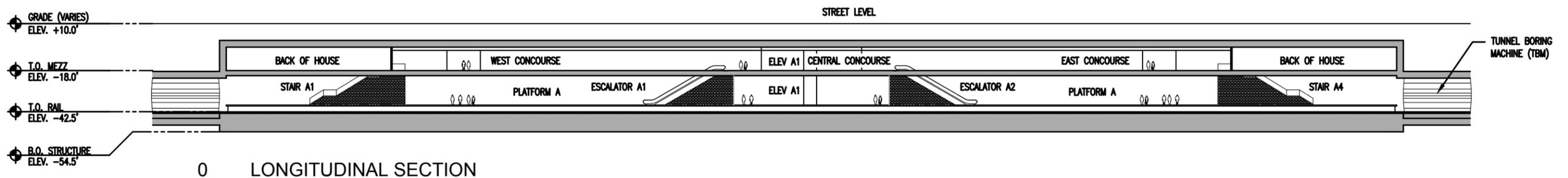
DRAWING NAME <b>TERMINAL STATION - SECTION</b>	
DATE 11/20/17	DRAWING NO.
SCALE AS SHOWN	<b>A-SEC</b>



2 MEZZANINE LEVEL



1 PLATFORM LEVEL



**LONG ISLAND RAIL ROAD  
RESTORATION OF THE ROCKAWAY BEACH BRANCH**  
LONG ISLAND RAIL ROAD STATION STUDY

DRAWING NAME		<b>A-100</b>
<b>TERMINAL ST - PLANS</b>		
DATE	DRAWING NO.	
11/20/17		
SCALE		
1/64"=1'-0"		



## **APPENDIX F: COST ESTIMATE**

**ASSUMPTIONS/CLARIFICATION/EXCEPTIONS:**

1. Direct Costs are in 2016 dollars.
2. Estimate is based on internal meetings regarding scope & constructability, various reports and white papers, and schematic alignment layouts.
3. For LIRR alternative, estimate includes new retaining walls, excavation and allowance for repairs to existing inactive WB tunnel below LIRR Mainline in White Pot Junction.
4. For LIRR alternative, estimate includes new turnouts for connection between LIRR Mainline and Rockaway Branch (RBB) track running along Mainline ROW.
5. Estimate includes clearing and grubbing along abandoned portions of ROW.
6. Estimate includes removal of existing track, ties and existing high tension poles where required.
7. Estimate includes providing geogrid stabilization mattresses on approximately 25% of embankment slopes.
8. Estimate includes ballast retaining curbs along approximately 25% of the trackway between White Pot Junction and Liberty Ave.
9. Estimate includes 8-ft high security fence & access gates along the ROW between White Pot Junction and Liberty Ave.
10. Estimate includes ballasted track on grade sections and Phase 1 aerial structures and Direct Fixation (DF) track in tunnels, Phase 2 aerial structures and boat sections.
11. Estimate includes cleaning of viaduct where required prior to demolition.
12. For LIRR alternative, estimate includes cleaning and painting along with misc repairs to four (4) undergrade (UG) bridge structures along the LIRR Mainline.
13. For LIRR alternative, estimate includes replacement of eleven (11) UG bridge structures between White Pot Junction and Pitkin Ave.
14. For NYCT alternative, estimate includes replacement of nine (9) UG bridge structures between White Pot Junction and Atlantic Ave.
15. For BOTH alternatives, estimate includes full replacement of viaduct between 97th Ave and Rockaway Blvd.
16. For LIRR alternative, estimate includes cantilever structural modification of retained embankment between Rockaway Blvd and Pitkin Ave.
17. Estimates include requisite allowances for signals, traction power and communications.
18. For NYCT alternative, estimate includes two (2) Tunnel Ventilation Plants for new tunnels between Rego Park Station and Portal north of Fleet St.
19. Estimate includes allowances for environmental issues regarding lead abatement, hazardous/contaminated soils and other fugitive environmental conditions.
20. Contingency of 30% is included commensurate with preliminary schematics of project.
21. Soft costs for Agency Costs, Project Mangement and Engineering Review & Inspection as shown and per direction from LIRR.
22. Soft costs for Professional Services (Design advancement, CM, Risk Assessments, Specialists, Public Outreach as shown and per direction from LIRR.
23. Soft costs for Agency Service Support Costs (Utility Companies, etc.) assumed at 5% of cost.
24. Force accounts costs as shown for each work category.
25. No costs for real estate acquisitions or rolling stock whatsoever are included.
26. Indirect costs included at 18% of direct cost; overhead and profit at 21% of direct cost.
27. Insurance and bond costs included at 7% per direction of LIRR
28. For simplicity, absent a schedule of program implementation, 10 years of escalation at 4.25% per annum is included across the board.
29. No costs are included for Portal Access to Air Terminals from Terminal Station.

## JFK 1-Seat Ride Options Summary Cost Breakdown

NORTH ALT - PH 2	LIRR OPTION
<b>Cost Categories:</b>	
bridge replacements	\$ -
retained cuts	\$ 578,649,938
viaducts	\$ 943,975,751
tunnels	\$ 3,927,115,698
site work	\$ 225,231,626
stations	\$ 1,434,268,125
trackwork	\$ 78,424,734
systems	\$ 456,792,918
force accounts	\$ 1,246,312,989
soft costs	\$ 3,823,031,865
<b>TOTALS</b>	<b>\$ 12,713,803,645</b>

Notes:

1- Values shown include all cost estimate mark-ups (i.e. General Conditions, OH&P, Insurance & Bonding, Contingency, Escalation).

2- Site Work Category includes; Retaining Walls, Sound Walls, Embankments & ROW Vegetation Removal.







## JFK 1-Seat Ride Options Summary Cost Breakdown

SOUTH ALT - PH 2	LIRR OPTION
<b>Cost Categories:</b>	
bridge replacements	\$ 43,001,065
retained cuts	\$ 438,477,308
viaducts	\$ -
tunnels	\$ 4,756,830,278
site work	\$ 345,682,788
stations	\$ 1,434,268,125
trackwork	\$ 83,373,601
systems	\$ 456,158,652
force accounts	\$ 1,233,528,673
soft costs	\$ 3,780,267,811
<b>TOTALS</b>	<b>\$ 12,571,588,300</b>

Notes:

1- Values shown include all cost estimate mark-ups (i.e. General Conditions, OH&P, Insurance & Bonding, Contingency, Escalation).

2- Site Work Category includes; Retaining Walls, Sound Walls, Embankments & ROW Vegetation Removal.





