

Washington
Metropolitan Area
Transit Authority

NEW BLUE LINE CONNECTIONS



3/31/2014

A Major Capital Project of Momentum's Metro
2025 Program

In support of its new strategic plan, Metro has considered the engineering feasibility of a proposed new Metrorail line in Rosslyn. Visit Metro's blog, PlanItMetro.com, to offer comments.

New Blue Line Connections

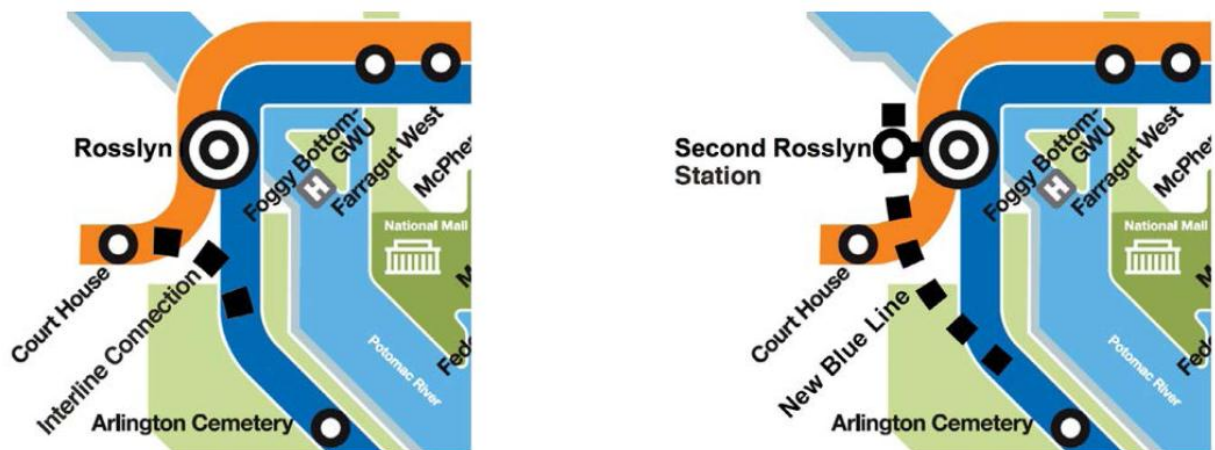
A MAJOR CAPITAL PROJECT OF MOMENTUM'S METRO 2025 PROGRAM

1. Background

1.1. Metro's Strategic Plan

In June 2013, the Metro Board adopted its new strategic plan, *Momentum*, which will guide Metro's decisions over the next eleven years and will ensure that the system will continue to support the region's competitiveness for decades to come. *Momentum* contains seven initiatives for year 2025. Within the *Metro 2025* program is the initiative 'New Blue Line Connections', which has proposed one of two alternative Metrorail core lines (Figure 1).

FIGURE 1. ALTERNATIVES 1 AND 2 OF NEW BLUE LINE CONNECTIONS



1.2. Metrorail Operations

The Metrorail system has a constraint of twenty-six trains per hour along any line, due to the duration of track switches and of train dwells at platforms. With the start of the Silver Line in 2014, three lines will converge at Rosslyn Station: Silver at ten trains per hour, Orange at eleven and Blue at five. This section describes the evolution of the operations plans.

During the planning of the Silver Line (2000-2004), Metro recognized the forecast of high ridership demand of the Orange and Silver Lines and proposed a change in the Metrorail operations plan within the 2004 Final Environmental Impact Statement (EIS) (underline added):

Peak-period service frequencies on the Orange and Blue lines would be reduced from six-minute headways (ten trains per hour) to approximately seven minutes (eight to nine trains per hour), and half of the peak-period Blue Line trains would

be diverted from the Rosslyn tunnel to the Yellow Line to accommodate additional Orange Line service from Vienna. Supplemental Orange Line service would continue to operate from Vienna and West Falls Church. The four to five diverted Blue Line trains would continue to Greenbelt, while four to five Orange Line trains would be diverted to Largo and the eastern end of the Blue Line.

As a prelude to the Silver Line and the above operations plan, Metro prepared the Rush Plus operations plan. Acknowledging the impact of less frequent service due to seven minute headways, Metro restored the original six-minute headways (ten trains per hour). Another marked difference was that additional trains across the Yellow Line bridge between Franconia-Springfield to Greenbelt Stations would be designated Yellow, not Blue. Under Rush Plus, the Blue Line would have three less trains per hour (from ten to seven) while the Yellow Line would have three more trains per hour (from ten to thirteen).

With the start of the Silver Line operations in 2014, the Blue Line will have two further less trains per hour (from seven to five) What had been six-minute headway service in 2010 will become 12-minute headway service in 2014. However, it is noteworthy that Metro has not pursued the 14-minute headway of the Blue Line as conceived in the 2004 Final EIS.

Blue Line

With the start of Rush Plus operations in June 2012, those Blue Line customers - who travel inbound in the morning to Rosslyn, Foggy Bottom and Farragut West Stations - immediately endured longer waits for trains (three less trains) and crowded conditions in the rail cars and on platforms.

Metro has a standard of an average 120 Passengers Per Car (PPC) at a line's maximum load point (which is Rosslyn Station for the morning Blue Line from Franconia Springfield Station). If the PPC is consistently greater than 120, Metro knows that there is a warrant for an increase in capacity. In June 2013, the Blue Line at Rosslyn Station had the fourth highest average morning PPC of 82, compared to 91 PPC for the Orange Line at Courthouse Station, 88 PPC for the Red Line at DuPont Circle Station and 83 PPC for the Red Line at Gallery Place/Chinatown Station. Thus, many lines have crowded conditions.

In May 2013, there were 8,300 SmarTrip customers traveling inbound in the morning along the Virginia Blue Line, with 3,500 exiting at Farragut West Station; 2,200 at Foggy Bottom Station; 1,500 at Rosslyn Station and 1,100 transferring to the outbound Orange Line at Rosslyn Station. Customers using magnetic swipe cards along the same travel path and stations may number in the hundreds.

For mitigating the Blue Line's crowded cars and platforms, Metro intends, with the start of the Silver Line, to have the five Blue Line trains in the peak hour to be all eight-cars. Between years 2020 and 2025, subject to availability of funding, all Metrorail lines will have all eight-car trains.

As presented in the next section, Metro has also developed the new Blue Line Connections, hoping to address the Blue Line service in the long-term.

2. Alternatives

For the advancement of *Momentum's* Metro 2025 program and in the interest of the Blue Line customers impacted by Rush Plus and Silver Line operations plans, Metro has developed the two alternatives of the New Blue Line Connections to a conceptual engineering stage.

2.1. Alternative 1: Interline Connection in Rosslyn

The current junction of the Orange/Silver and Blue Lines south of the Rosslyn Station allows for train movements between Rosslyn Station in Virginia and Foggy Bottom Station in the District of Columbia. The interline connection would create a wye or triangular junction to allow all directional movements, adding the movement between Courthouse and Arlington Cemetery Stations, both in Virginia (Alternative 1 of Figure 1).

To gauge the feasibility of Alternative 1, Metro directed its consultant to develop its plan and profile (Appendix 1 in the form of two long roll drawings). For the reasons below, Metro has considered Alternative 1 not to be viable.

- The connection with the existing Orange Line, inbound of Courthouse Station, would require deep excavation to the Orange Line tunnels under Fairfax Drive. Yet, the original tunnels were mined in rock and are under earth's pressure from all sides; to expose the tunnels by the deep excavation requires methods to counter those earth forces. Once exposed, their concrete walls must be then cut for the installation of new track turn-outs, likely only during a short timeframe of nighttime hours.
- The above deep excavation would require property acquisition and likely demolition of buildings.
- The northern track of the interline connection (Blue Line inbound to Orange Line outbound) must cross over the existing Orange and Blue Lines. That alignment places the northern track under several multi-story buildings and close to, if not through, their foundations, underground parking and other sublevels.

2.2. Alternative 2: New Blue Line in Rosslyn

A new Blue Line would have its turnouts from the existing Blue Line, at a location to be determined south of Arlington Boulevard (Route 50) and have a second Rosslyn Station north of Wilson Boulevard and under N. Fort Myer Drive (Alternative 2 of Figure 1). North of the second Rosslyn Station would be a tail track that nearly reaches the Virginia bank of the Potomac River.

To gauge the feasibility of Alternative 2, Metro also directed its consultant to develop its plan and profile (Appendix 2 in the form of two long roll drawings). Metro considers Alternative 2 to be viable and engineering feasible for further analysis. The second Rosslyn station's platform is 160 feet below N. Fort Myer Drive and 55 feet below the existing Rosslyn Station platform; the two stations would be connected by one, two or three passageways with stairs, escalators and/or elevators. The new Blue Line, its second Rosslyn station and tail tracks would be mined in rock due to their depth.

With respect to operations, the existing Blue Line at the start of Silver Line will have five trains per hour. Consider the system-wide constraint of twenty-six trains per hour for any line. South of Pentagon Station,

the Blue Line will have five trains per hour and the Yellow Line fifteen trains per hour. The total is twenty trains per hour.

2.3 Recommendations

In comparing Alternative 1 and Alternative 2, the former is infeasible from an engineering perspective while the latter is feasible and offers Blue Line service improvements, albeit incremental ones. Alternative 2's new Blue Line in Rosslyn yields only six trains per hour – an improvement over today's service levels but a low service level increase relative to the major capital investment. The Blue Line customers who are impacted by Rush Plus and Silver Line operations would not benefit from the additional six trains, unless their morning destination station is Rosslyn.

Metro staff notes, however, that the incremental improvement in Alternative 2 is an interim step that leads to more robust and full-service level improvements in subsequent phases of new Metrorail lines. Alternative 2 sets the stage for extensions of the Blue Line into Georgetown and onto Union Station as part of a future Metrorail core configuration. In this context, the staff recommends further consideration of the Alternative 2 with the caveat that the major investment, in order to have maximum impact, should be considered alongside support for the future Metrorail core configuration.

2.4 Next Steps

Subject to availability of funding for full project delivery, Alternative 2 will, in some future year, have intensive engineering and architecture studies as part of formal project development in accord with the requirements of the Metro Compact, Federal statutes and regulations, and Arlington County ordinances and codes. The studies would involve Metro and consultant experts in geotechnical engineering, construction engineering, mining construction and station architecture and would address:

- Coordination with Federal Transit Administration and other Federal agencies, particularly for the new Blue line through the Federal lands south of Arlington Boulevard.
- Coordination with the Commonwealth of Virginia and Arlington County.
- Metrorail ridership forecasts.
- Metrorail operations plan, fleet requirements (likely at sixty additional cars), and yard expansion or creation.
- Normal and emergency vertical customer access to and from the deep second Rosslyn station. Metro is not determining, at this time, the location of the station entrance(s) and the passageways between the two Rosslyn stations. Metrorail ridership forecasts (based on travel patterns, land use and development) plus involvement of Arlington County and its Rosslyn stakeholders will determine the number, location and type (elevators and/or escalators) of the new entrance(s).
- Geology of Rosslyn via deep structural borings, supplementing past Metro borings.
- Construction method of tunnel-mining horizontally the Metrorail line.
- Construction method of excavating vertically the shafts for mining access, customer access via elevators and/or escalators, emergency stairs, and venting.
- Engineering analysis of the tunnel-mining under the existing Key Bridge Marriott, its underground levels and foundation. The top of tunnel is approximately 80 feet below ground level, generally adequate for mining without effect to structures or the surface.

- Analysis of the range of environmental effects.
- Estimates of capital and operating costs. For this consideration, Metro and its consultant confirmed the order-of-magnitude capital cost estimate of \$1 billion (2012 dollars) for this [Alternative 2 in the Momentum Metro 2025 program](#).

Appendix 1. Interline Connection in Rosslyn

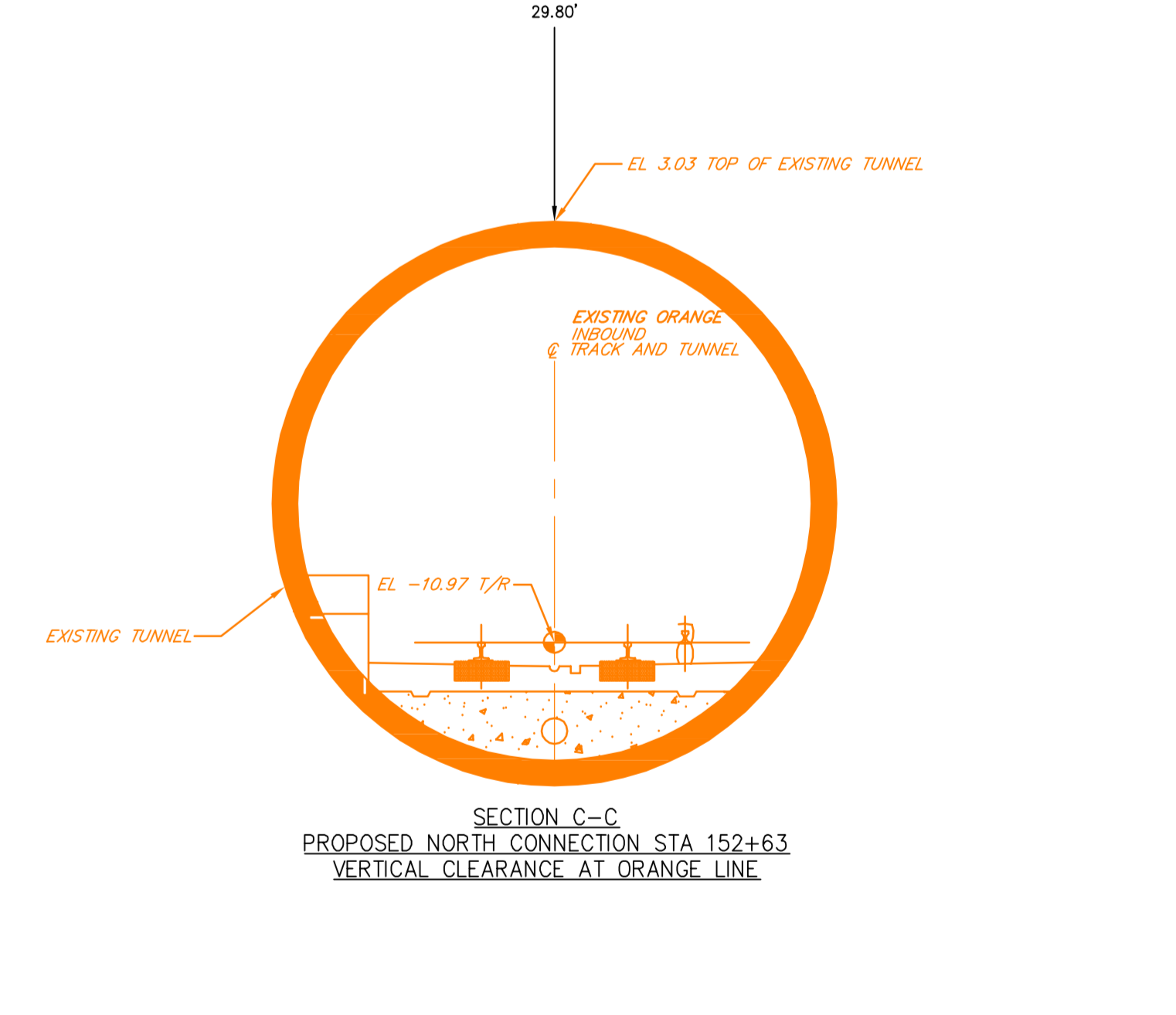
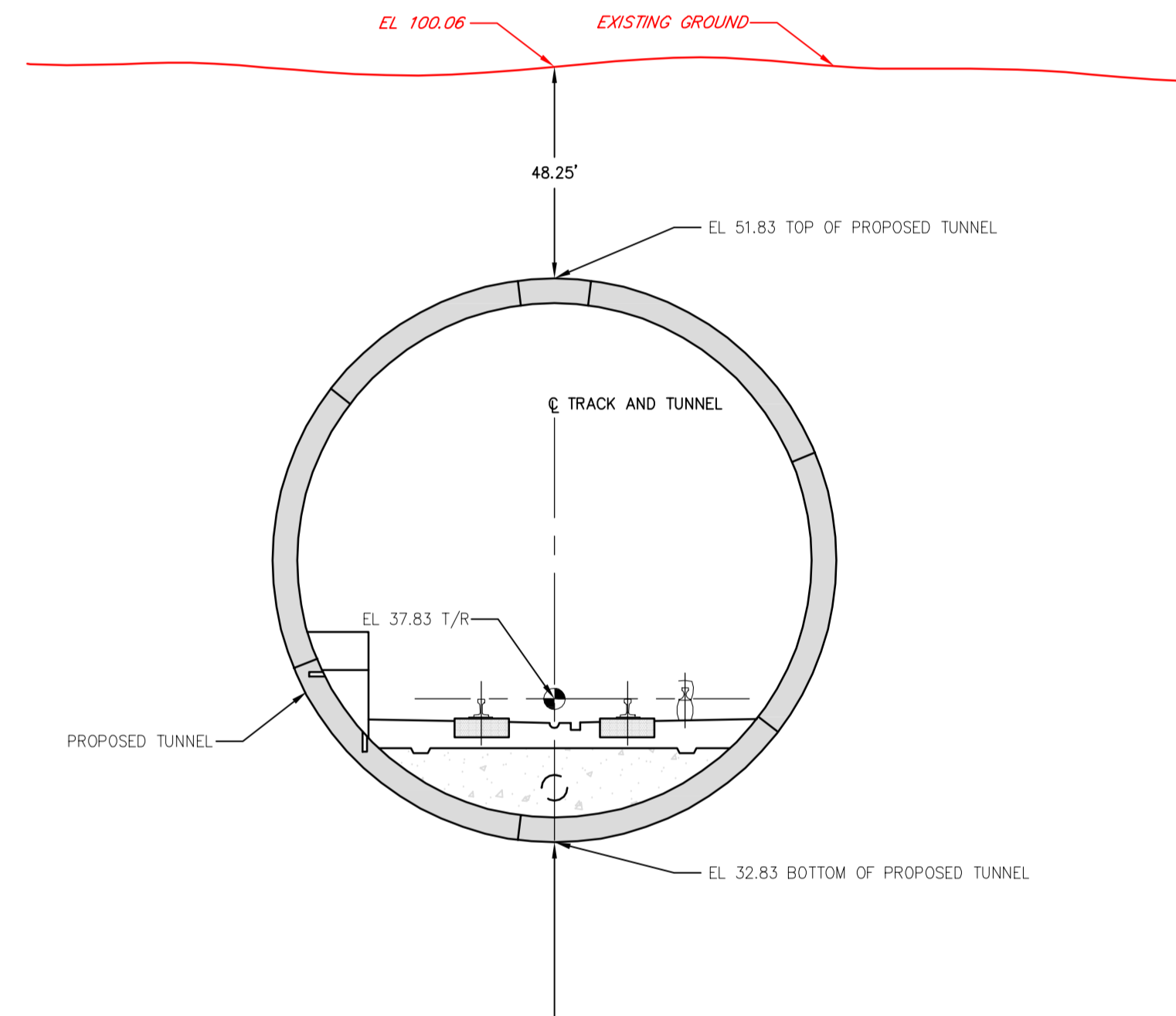
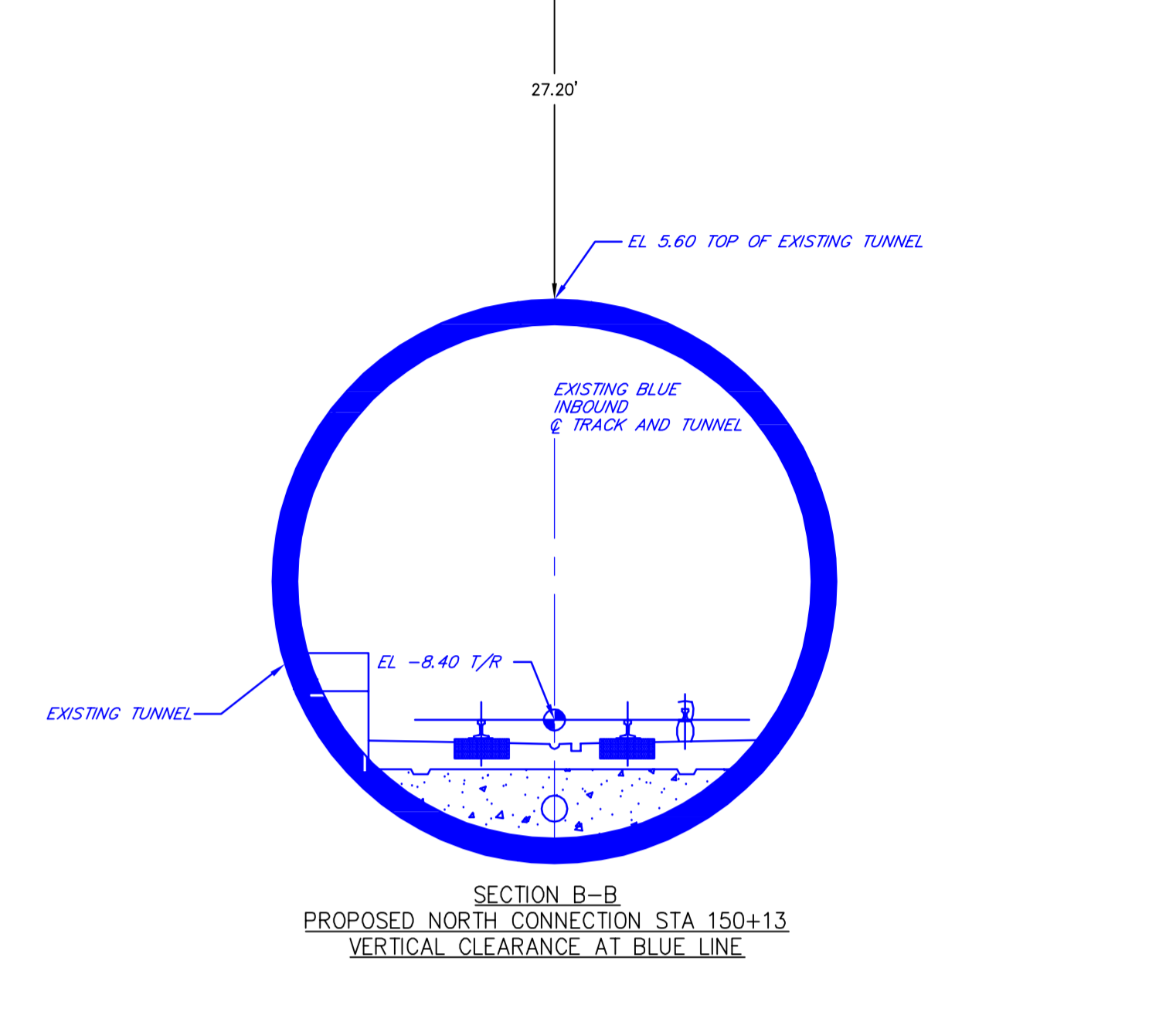
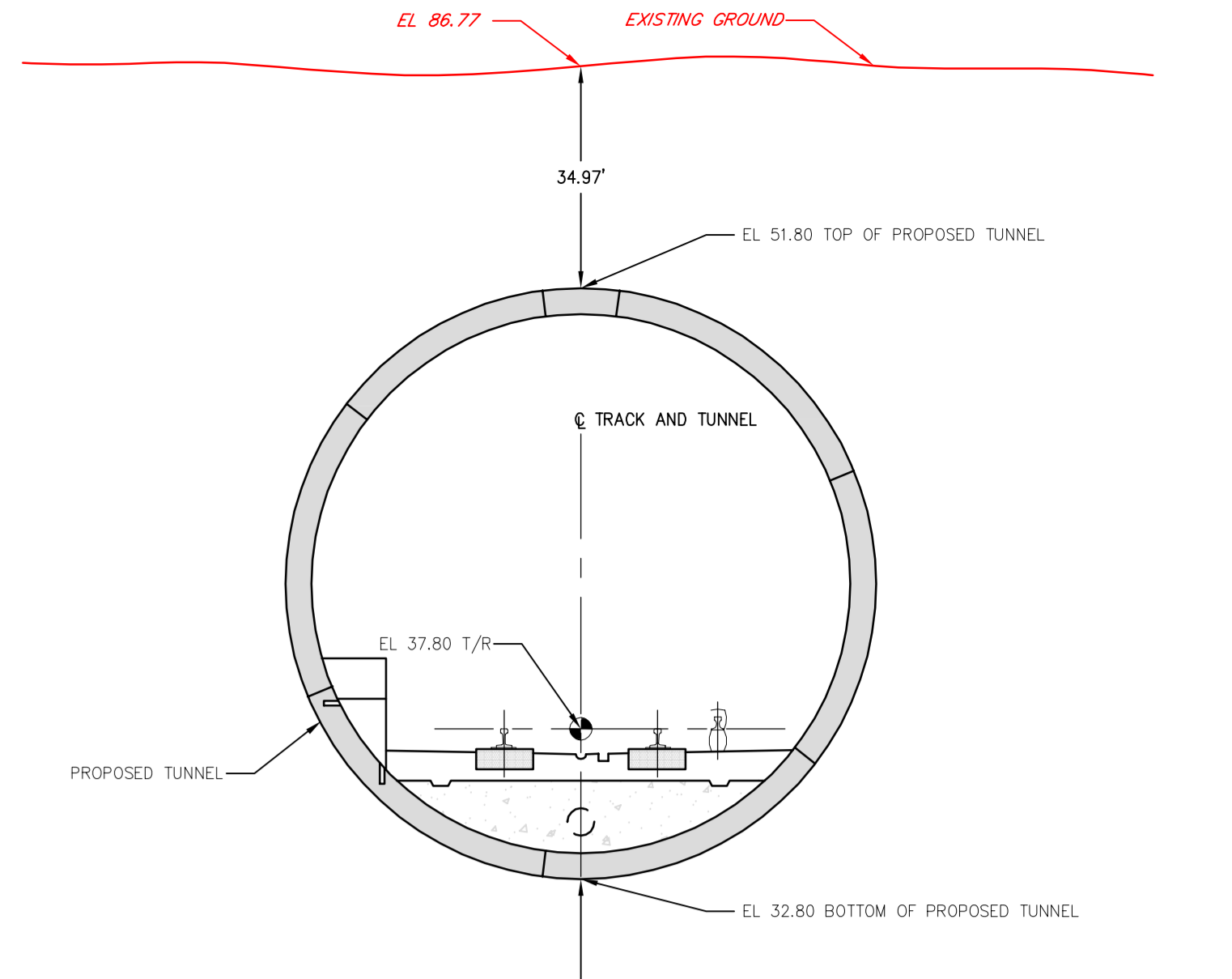
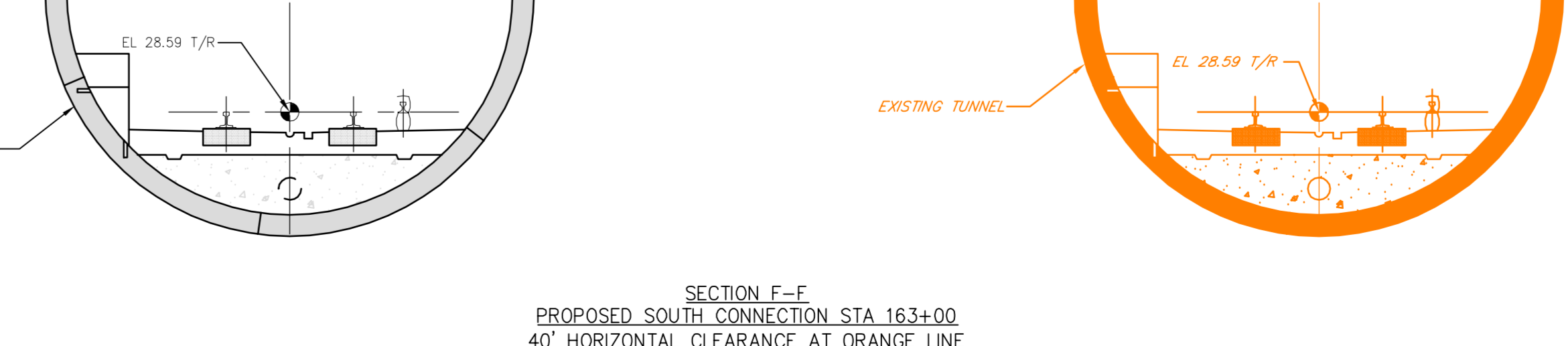
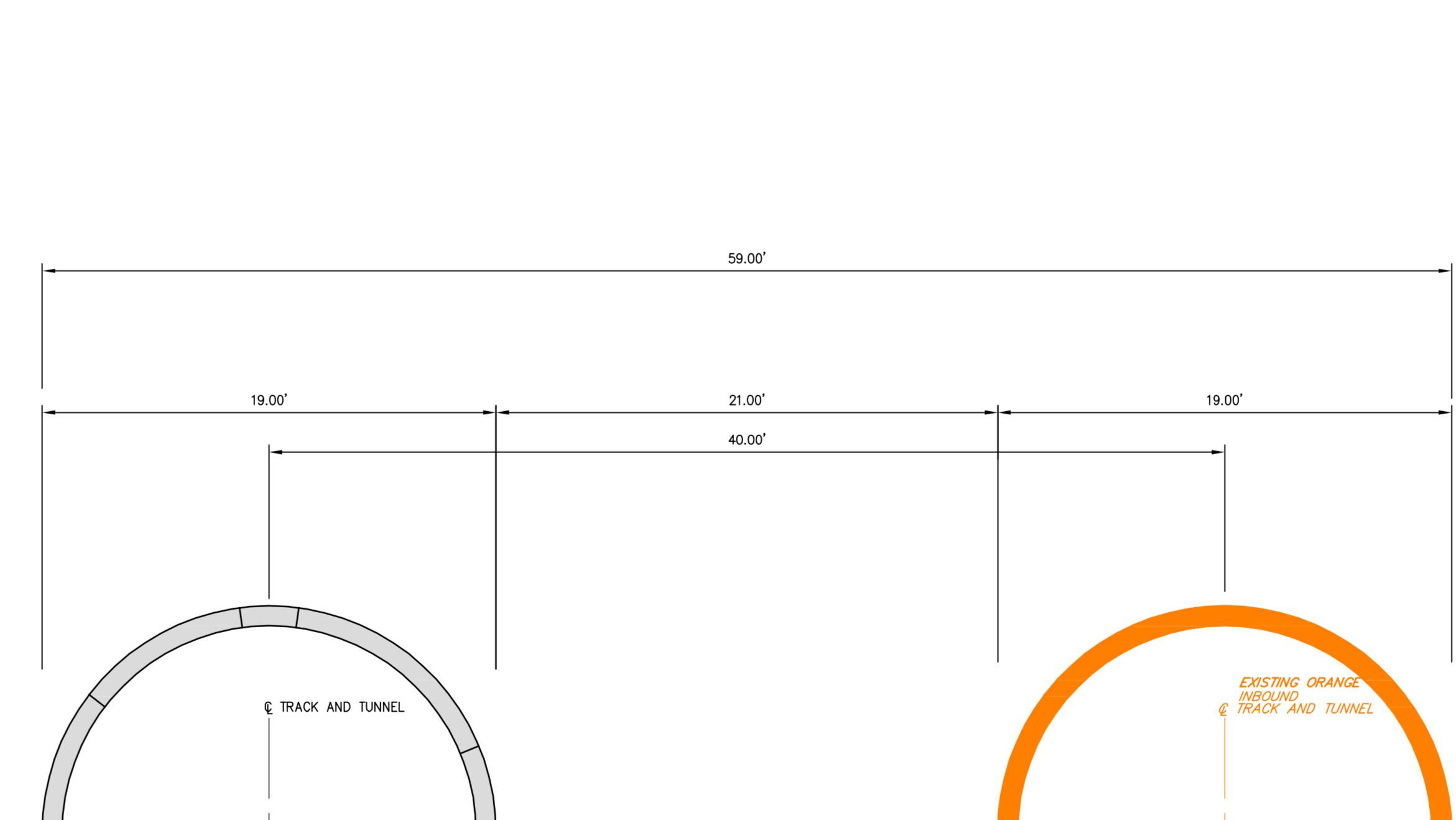
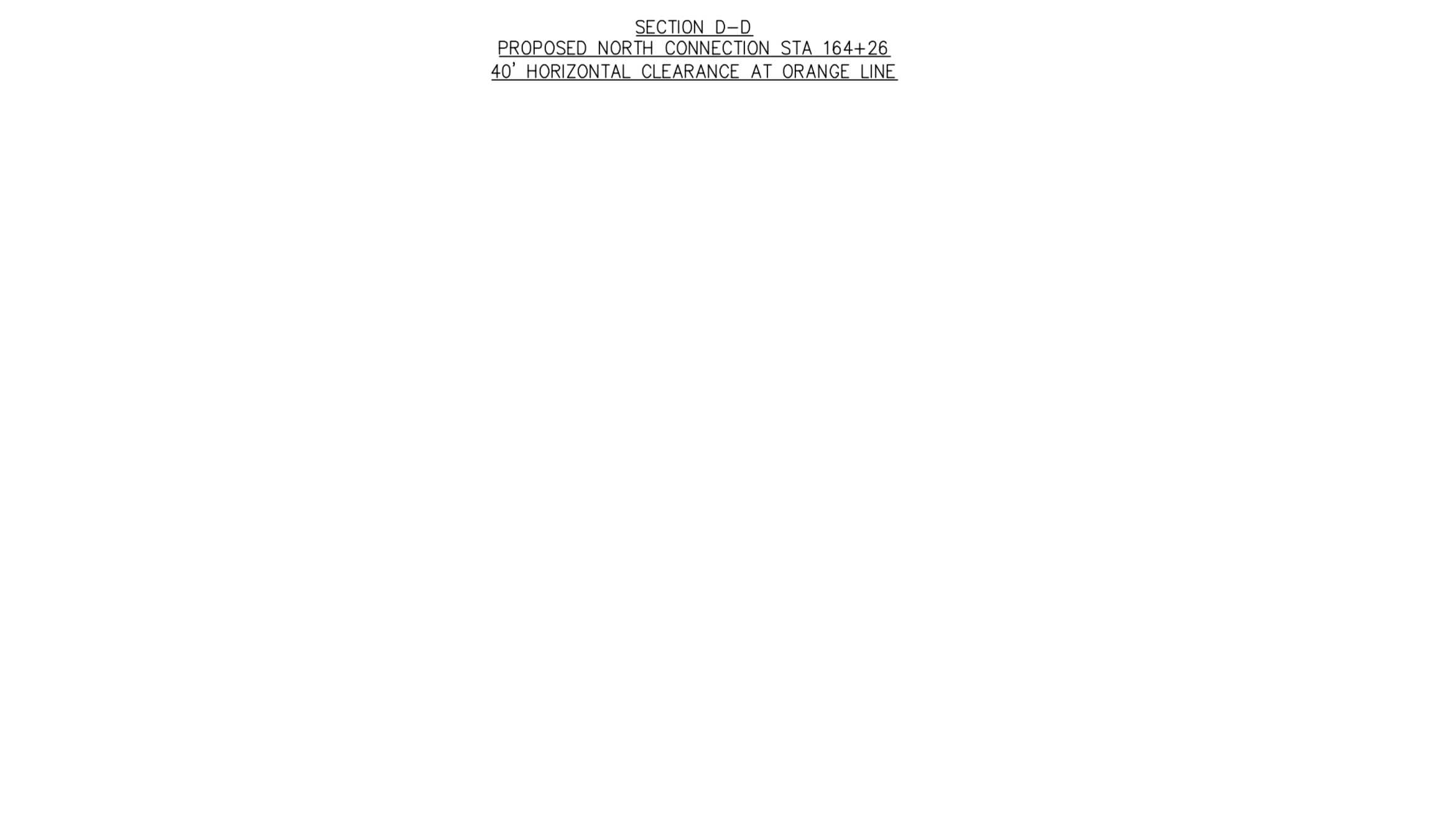
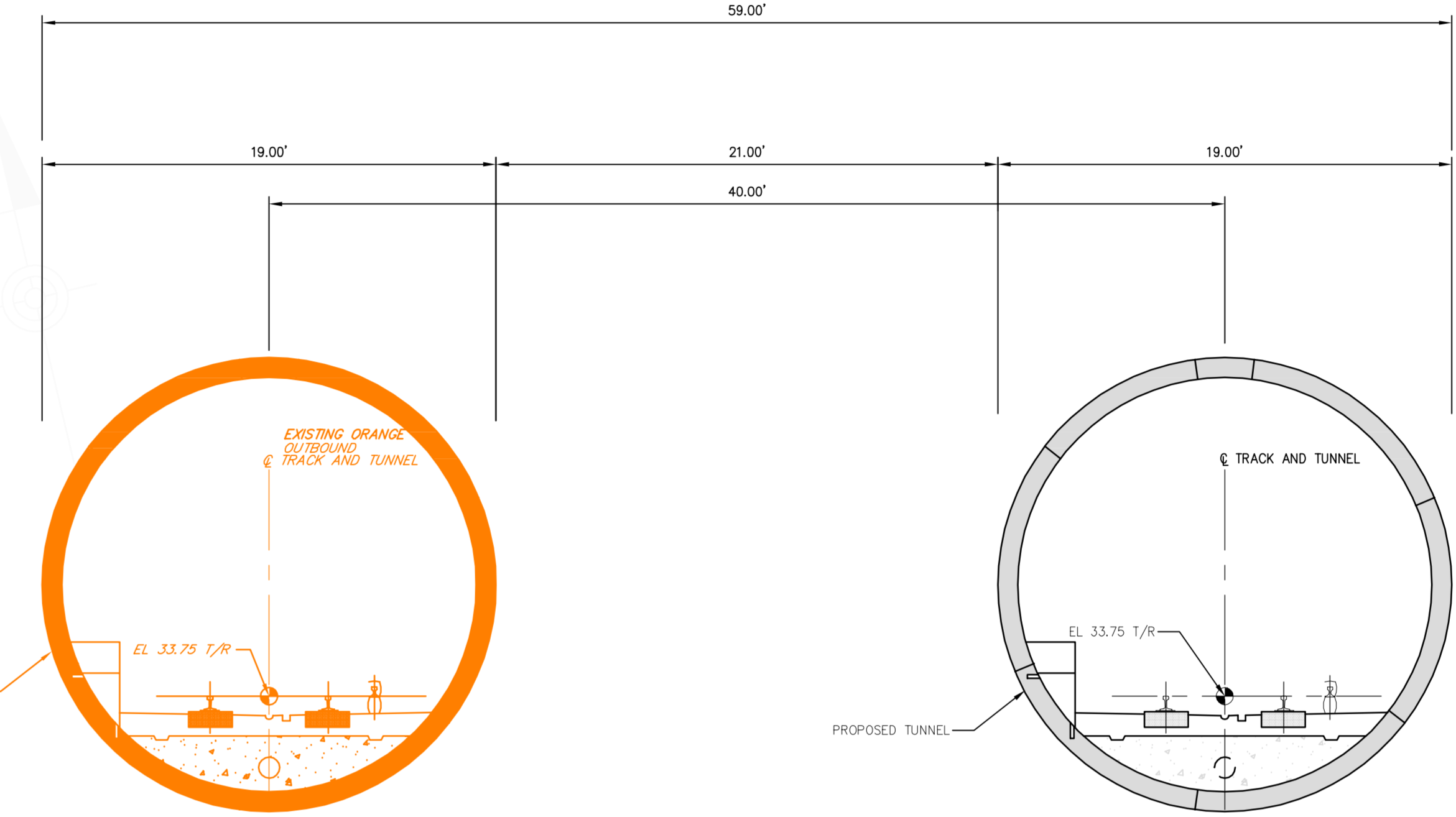
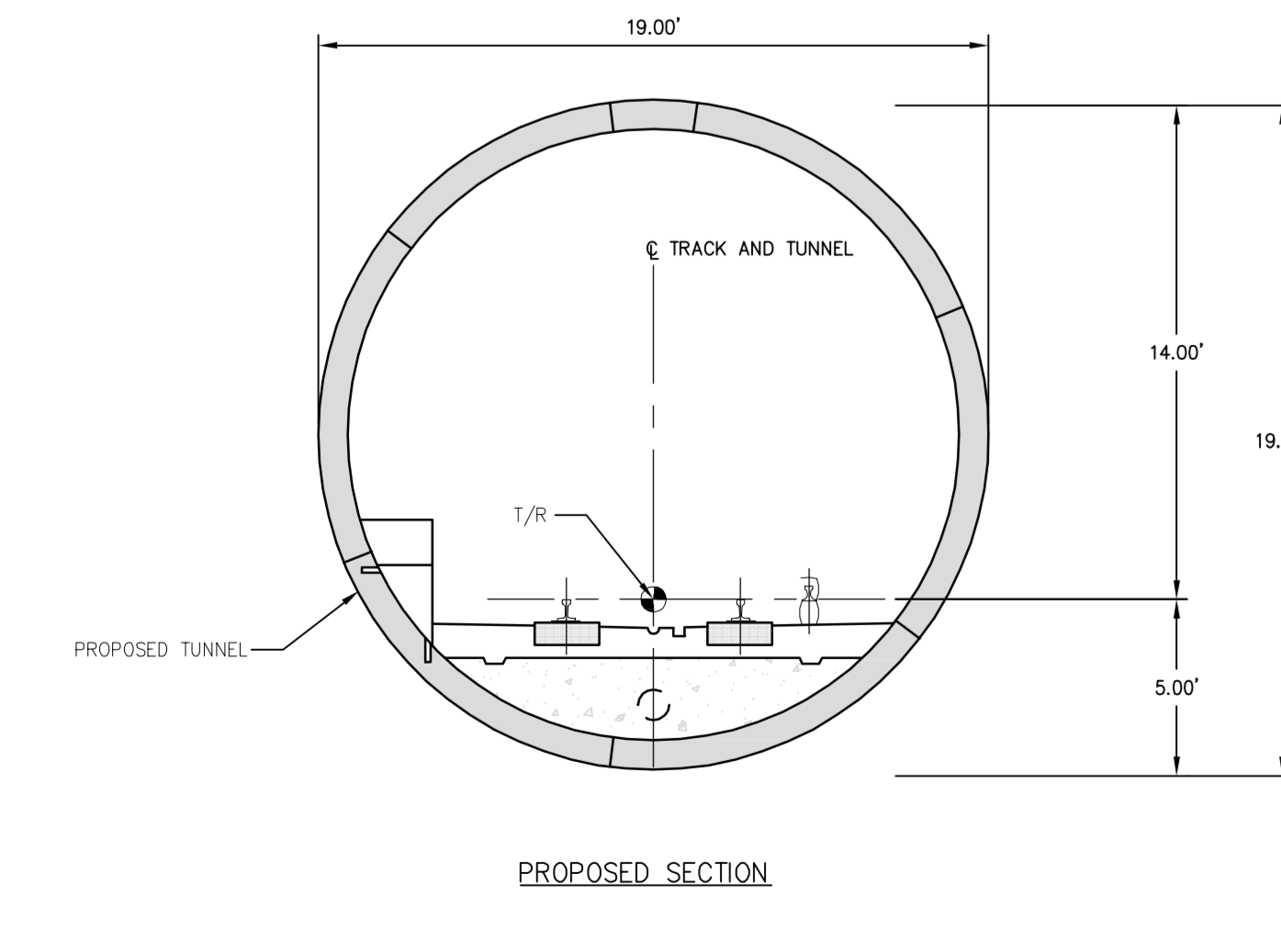
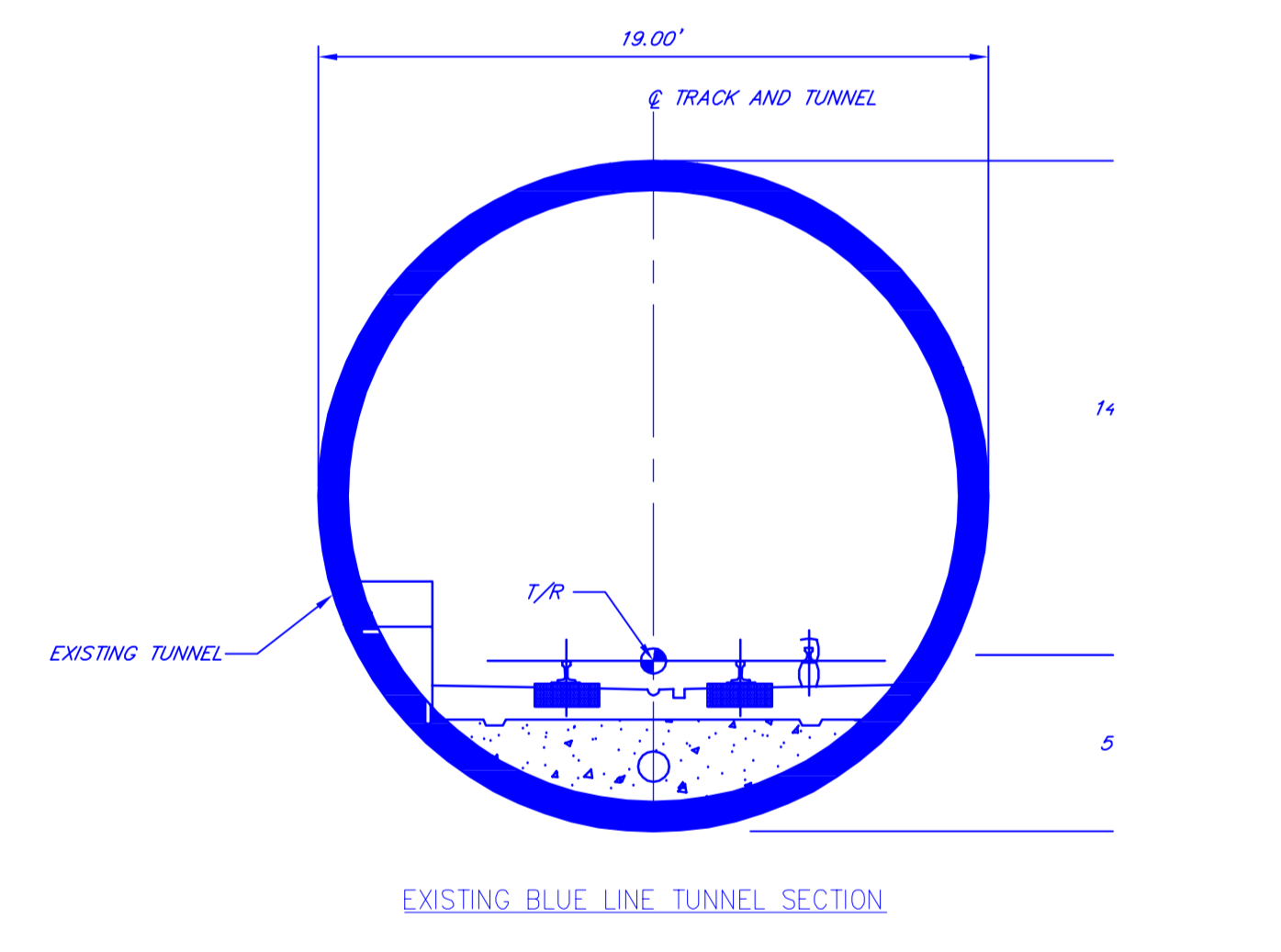
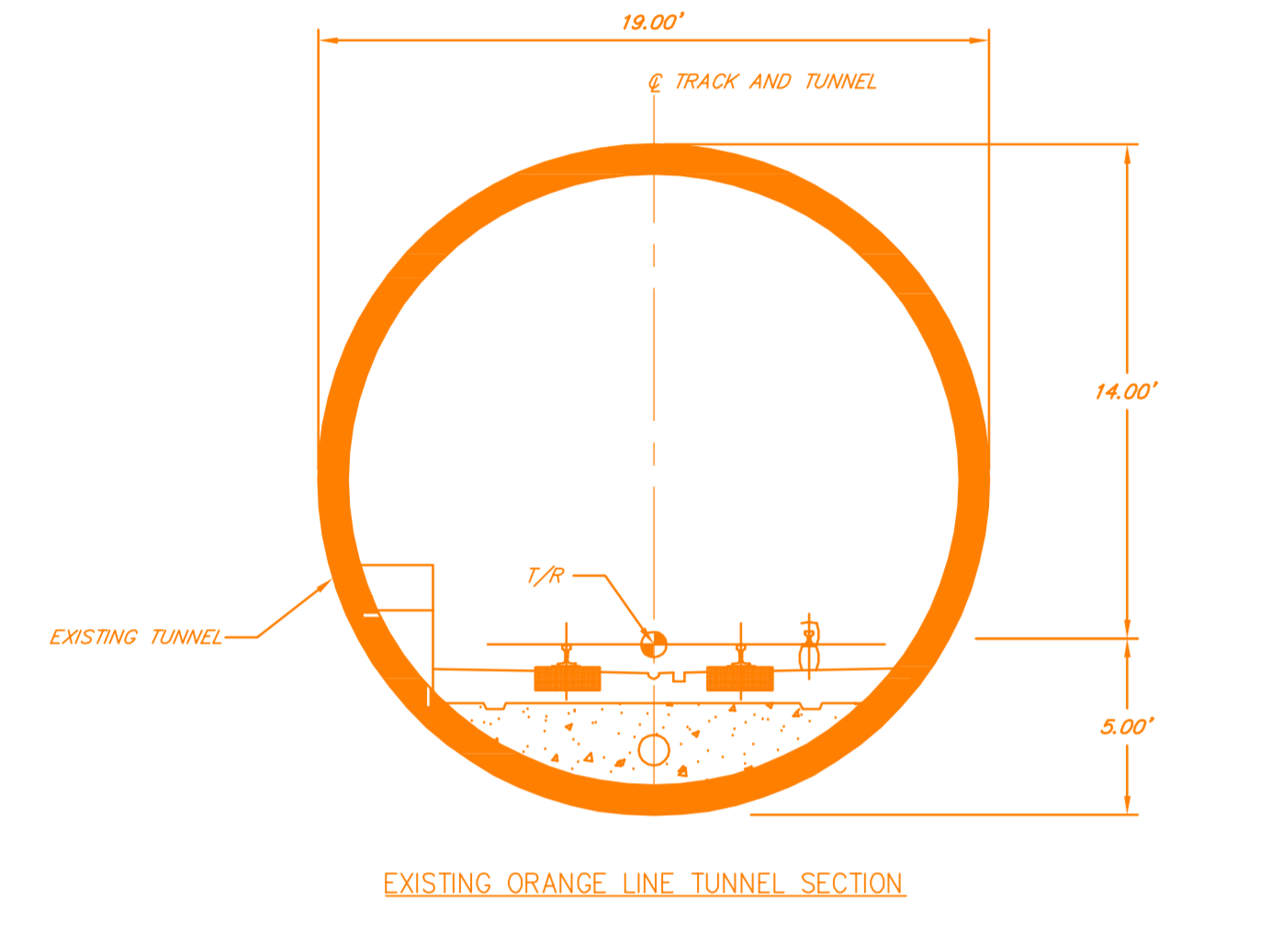
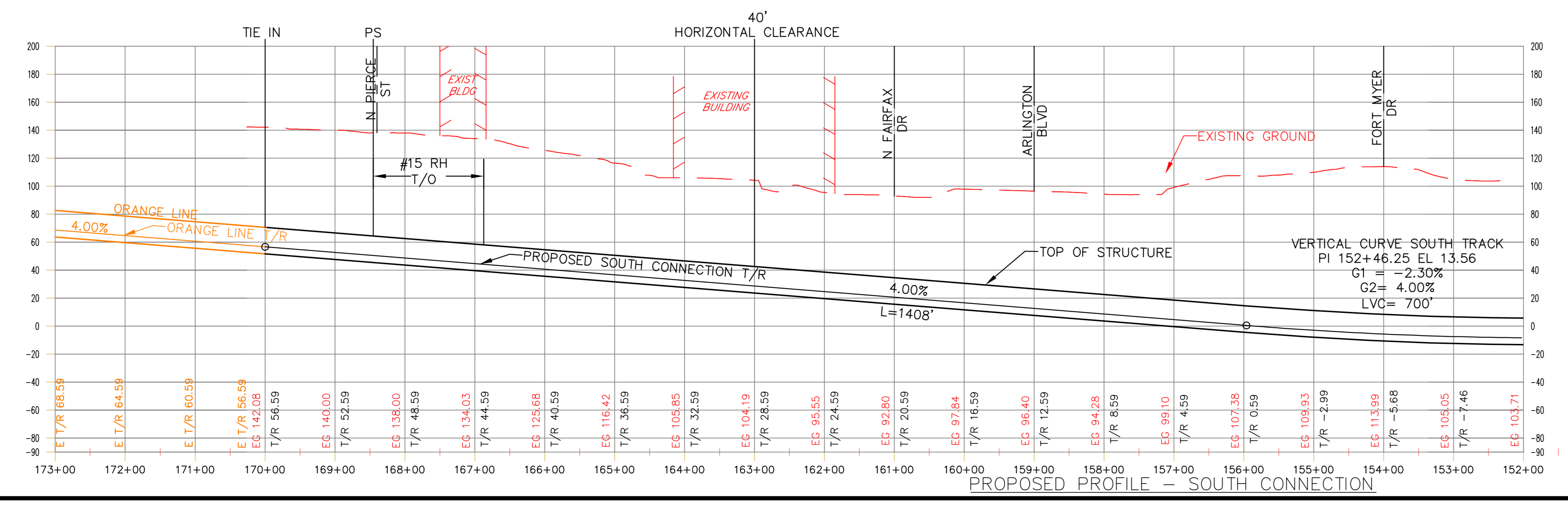
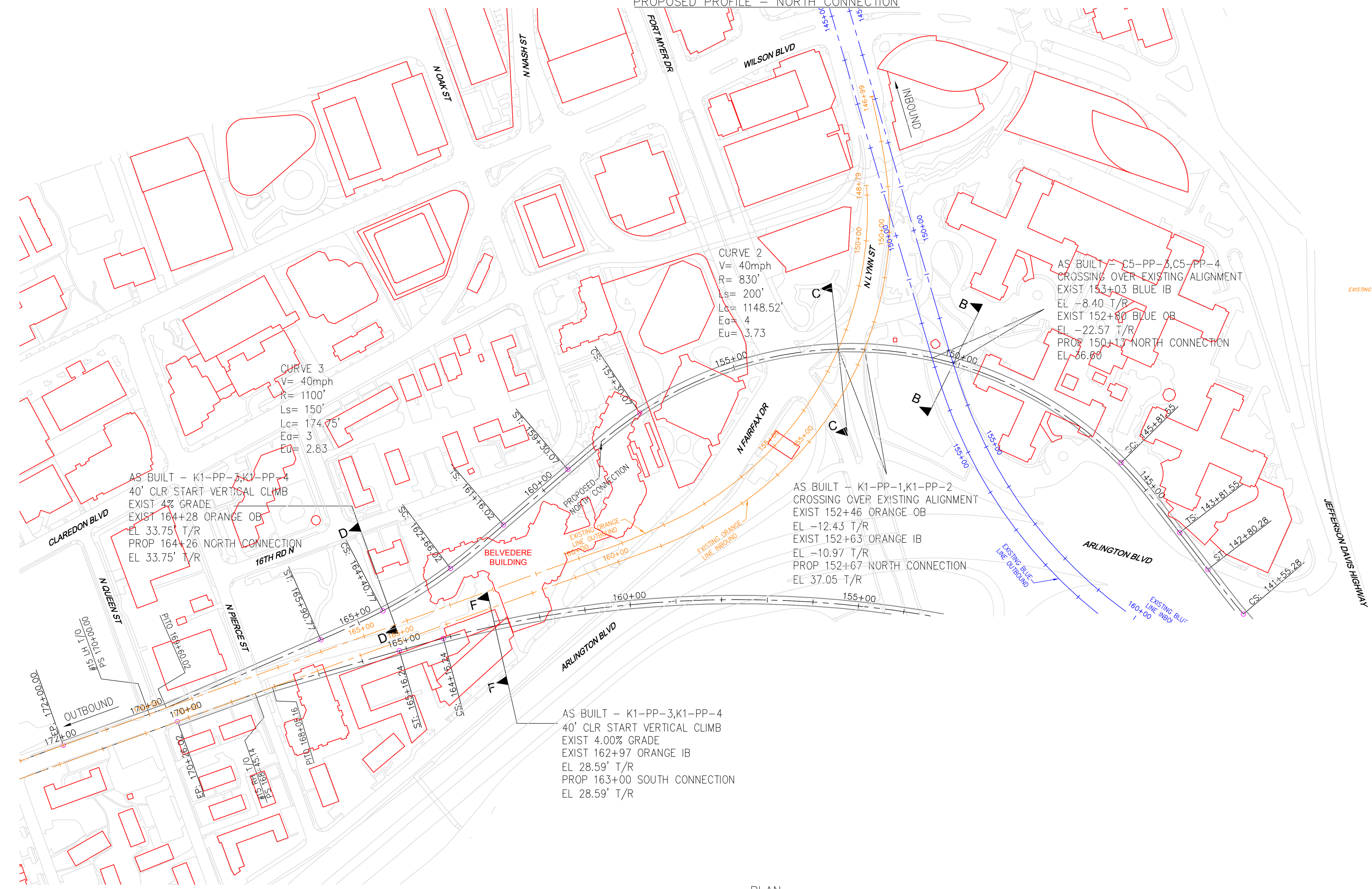
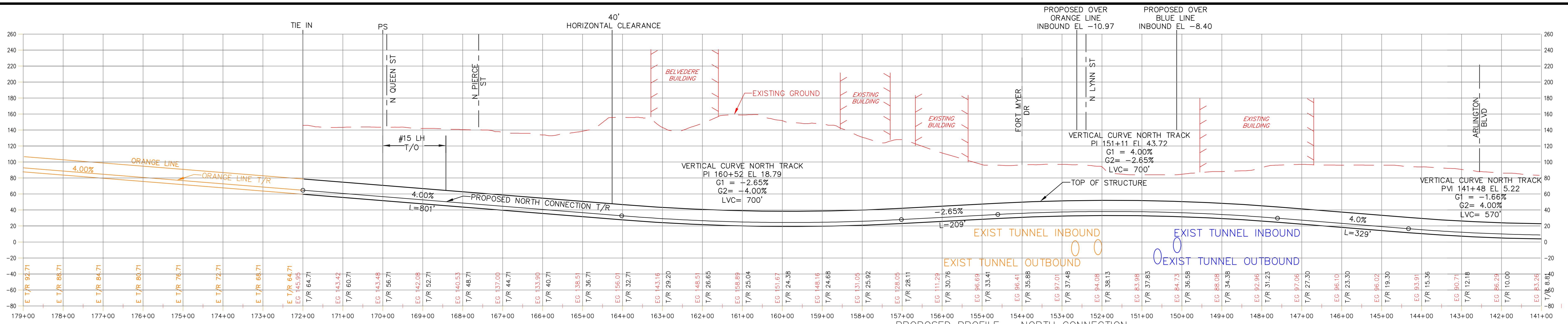
Appendix 2. New Blue Line in Rosslyn

To comment on this report, please visit Metro's blog, [PlanItMetro.com](#).

Appendix 1

Interline Connection in Rosslyn

(Plan, profiles and sections on one drawing)



APPENDIX 1 NOT VIABLE

PRELIMINARY
 OCTOBER 18, 2013

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

APPENDIX 1
 INTERLINE CONNECTION IN ROSSLYN
 PLAN, PROFILE AND SECTIONS

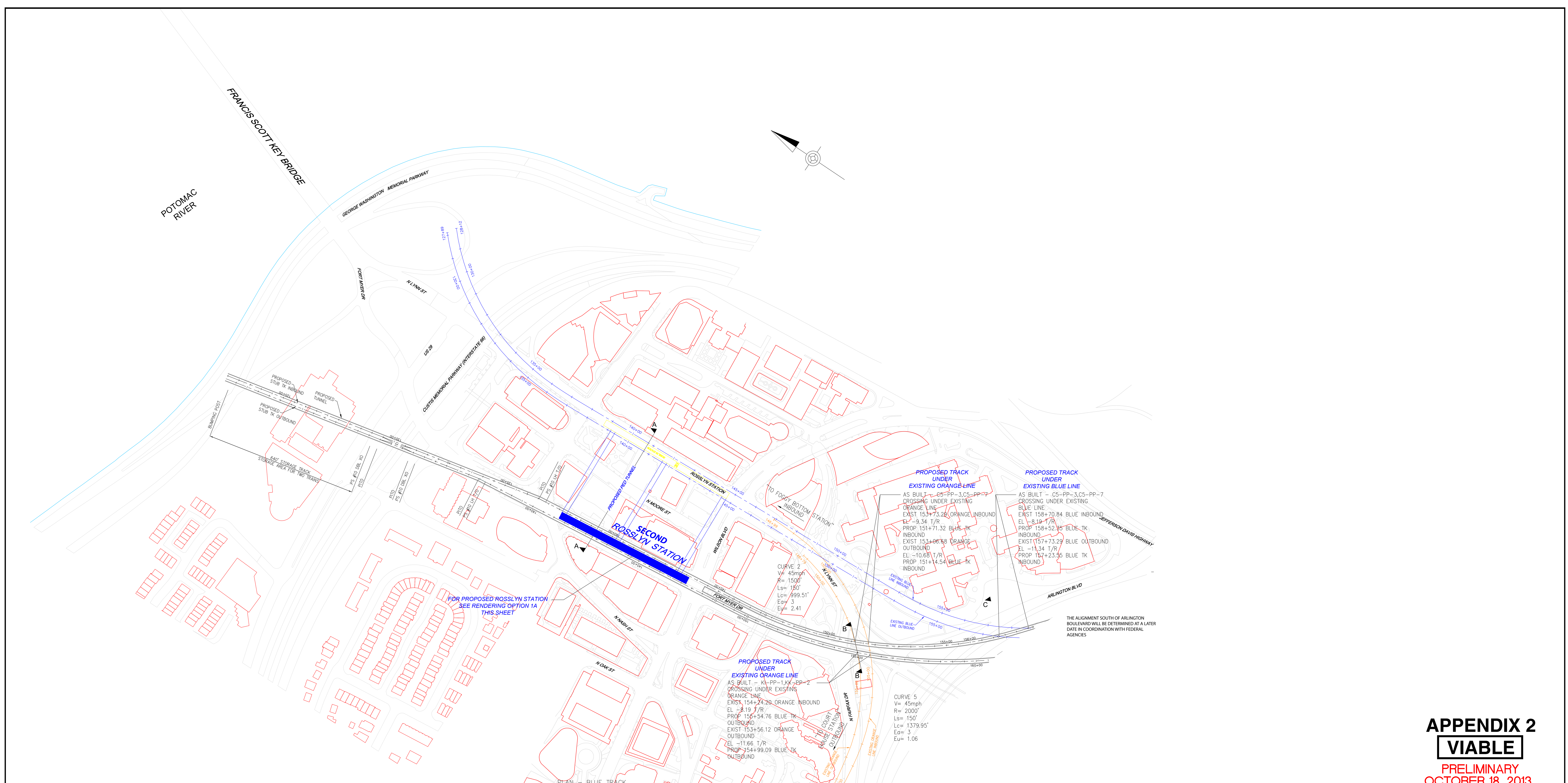
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 SHEET NO. 1 OF 1

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Appendix 2

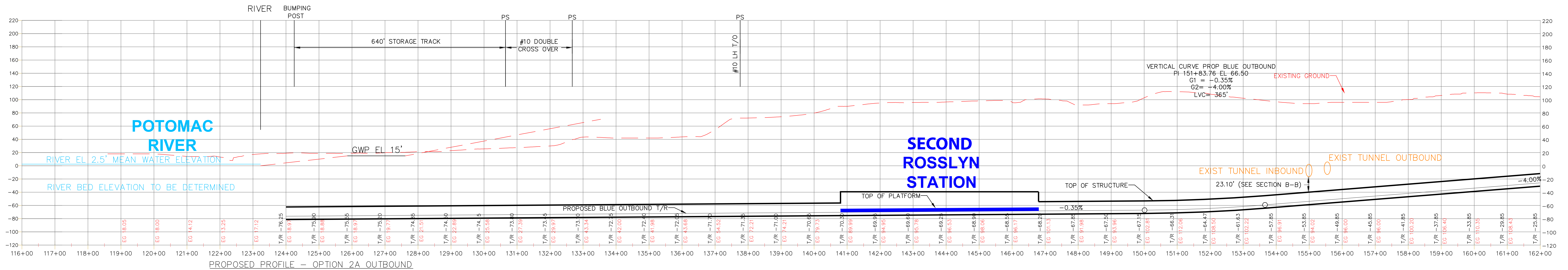
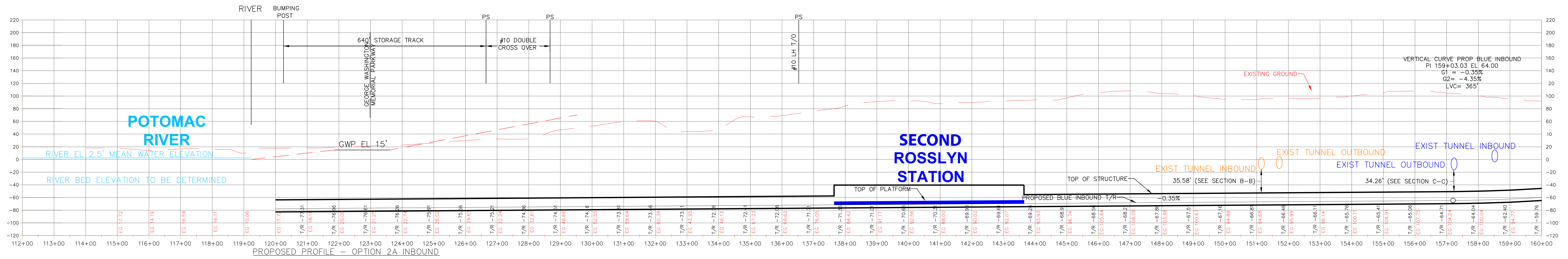
New Blue Line in Rosslyn

(Plan and profiles on two drawings)



APPENDIX 2
VIABLE
 PRELIMINARY
 OCTOBER 18, 2013

ASSUMPTIONS: EXISTING TOP OF RAIL ELEVATIONS BASED ON AS-BUILT DRAWINGS PROVIDED BY WMATA, AND AS IDENTIFIED HEREIN. EXISTING TUNNEL CROSS-SECTION ASSUMED BASED ON WMATA STANDARD DRAWING ST-5-002 25' ASSUMED SUFFICIENT COVER BETWEEN EXISTING AND PROPOSED TUNNEL STRUCTURES.	SCALES: PLANS: 1"=100' PROFILE: 1"=100' HORIZ. 1"=100' VERT. 1"=50'	WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY	
		APPENDIX 2 NEW BLUELINE IN ROSSLYN PLAN	
SUBMITTED _____ DATE _____	APPROVED _____ CHIEF ENGINEER	SCALE AS NOTED	DRAWING NO. _____ SHEET NO. 1 OF 2



APPENDIX 2 VIABLE

PRELIMINARY
OCTOBER 18, 2013

ASSUMPTIONS:
EXISTING TOP OF RAIL ELEVATIONS BASED ON AS-BUILT DRAWINGS PROVIDED BY WMATA, AND AS IDENTIFIED HEREIN.
EXISTING TUNNEL CROSS-SECTION ASSUMED BASED ON WMATA STANDARD DRAWING ST-S-002
25' ASSUMED SUFFICIENT COVER BETWEEN EXISTING AND PROPOSED TUNNEL STRUCTURES.

SCALE:
PLAN: 1"=100'
PROFILE: HORIZ. 1"=100'
VERT. 1"=50'

WASHINGTON METROPOLITAN AREA TRANSIT AUTHORITY

SUBMITTED _____ DATE _____ APPROVED _____ DATE _____
CHEF ENGINEER

APPENDIX 2
NEW BLUELINE IN ROSSLYN
PROFILE
SCALE AS NOTED DRAWING NO. SHEET NO. 2 OF 2