SOUNDTRANSIT

Additional Resiliency Effort

DRAFT White Paper

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HNTB

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EXECUTIVE SUMMARY

This screening-level white paper explores two concepts for deferring the Sound Transit 3 (ST3) planned second downtown tunnel south of Westlake Station from Sound Transit's capital program. The document includes an initial assessment of the feasibility of two alternative operating scenarios:

1. **Building a Westlake-to-Ballard Starter Line**
2. **Interlining the Ballard Link Extension (BLE) into the DSTT**

All observations in this white paper are based on conceptual design; subject to change pending additional study and analysis. This initial assessment does not account for all potential effects due to the environmental process, government or public relations, costs, right of way impacts, or engineering efforts and is meant to inform further lines of inquiry for analysis.

Initial Observations (Screening-Level)

Reliably Operating the Regional Spine without a Second Downtown Tunnel

Regardless of the scenario, the agency will need to make a baseline set of improvements in three areas to reliably operate the regional light rail spine extending to Tacoma, Everett, and Redmond:

- Downtown Seattle Transit Tunnel (DSTT)
- Tunnel between Westlake Station and the Maple Leaf portal near Northgate
- At-grade portions of the Rainier Valley

With the DSTT as a single point of failure for most of the Link system, these improvements (some of which have been already identified in the previous resiliency assessment) will increase the capacity and resiliency of normal operations, reduce response and recovery time from incidents, and reduce the magnitude and frequency of disruptions.

Scenario 1: Westlake-to-Ballard Starter Line

This conceptual scenario constructs a portion of the BLE project, including the northern section of the new downtown tunnel, and operates service only between Ballard and Westlake until the rest of the tunnel is built. In the interim, riders from the north would transfer between lines at the existing Westlake Station in the DSTT and a new Westlake Station. Benefits of this approach include accelerated service to Ballard and deferring the cost and risk of constructing the rest of the tunnel. However, this option does not increase capacity through downtown and introduces multiple downsides and challenges, including:

- Upgrades to existing Westlake Station to accommodate the additional transfers
- Additional impacts to Lower Queen Anne due to tunneling from the north (rather than from SODO)
- Construction of a double crossover north of the new Westlake Station for turn backs, a ventilation facility, and a TBM breakthrough/retrieval box south of Westlake to enable future completion of the tunnel

- New operations and maintenance facility (OMF) to support interim operations without a viable option to move trains via a connection to the DSTT due to elevation limitations

Additional design and constructability analysis are needed for the configuration of the new Westlake Station terminus, transfer facilities at the existing Westlake Station, north-portal construction approach, and a new OMF, including:

- Additional construction and property effects in downtown and Lower Queen Anne related to the staging and mucking and launch and retrieval of tunnel boring machines (TBMs), as well as construction of special trackwork to allow for train turn backs
- Locating and constructing an OMF in Interbay or Ballard, where available land is limited
- Reconfiguring existing Westlake Station to accommodate additional transfers

The extension of the second downtown tunnel would be needed when future ridership demands exceed the capacity of the DSTT and/or when there are necessary improvements to the DSTT that may require a long-term shut down of service. It is out of the scope of this document to weigh this approach against construction cost, disruption, and risk.

Scenario 2: Interlining BLE into the DSTT

This conceptual scenario interlines the BLE into the DSTT south of Westlake Station. Passengers could transfer between 1 Line, 2 Line, and 3 Line at the existing Symphony, Pioneer Square, and IDS Stations. The connection would be made via a grade-separated junction to operate the three lines through downtown at short headways without conflicts. A new northbound track would dive under from the DSTT to new BLE interline tracks under 3rd Ave, while the southbound BLE interline track would tie into the existing southbound DSTT at its current elevation. North of the junction, the connection arcs under Virginia Street and rejoins the planned BLE alignment near Westlake Ave, 7th Ave, and Lenora St. South-facing stub tunnels would be built under Westlake to provide for eventual completion of the southern section of the tunnel. Like Scenario 1, construction would advance from the north.

Challenges include a multi-block rebuild of the DSTT, long single-tracking/closures, major Symphony Station modifications, and significant downtown impacts and risk. It is out of the scope of this document to weigh this approach against construction cost, disruption, and risk.

The following elements need further evaluation:

- Rebuilding portions of the DSTT with cut-and-cover construction, which would impact service for an undetermined amount of time
- Options to stage construction to keep some service running in a single-track scenario for an undetermined amount of time
- Additional construction and property effects in downtown and Lower Queen Anne related to the launch of tunnel boring machines (TBMs) and on-going mucking and staging operations
- Difficult construction staging on 3rd Ave due to high bus volumes and overhead trolley wires

Additional study is also needed of the alignment, structural and geotechnical studies, building foundation surveys, an operating plan, as well as impacts to Link and KCM bus operations.

INTRODUCTION

Sound Transit is evaluating opportunities to reduce capital and operating costs across all Sound Transit (ST3) projects. The agency is considering cost savings options for the Ballard Link Extension (BLE) project to defer the southern portion of the second downtown tunnel. Meanwhile, recent service incidents have called attention to the need for additional resiliency and redundancy throughout the existing light rail network as the light rail system ages and expands.[1]

This white paper presents initial considerations for deferring southern portions of the planned second downtown tunnel. The document includes an initial assessment of the feasibility of two alternative operating scenarios:

1. Building a Westlake-to-Ballard Starter Line
2. Interlining the BLE into the Downtown Seattle Transit Tunnel (DSTT)

Considerations include the constraints of the DSTT, the purpose of the second tunnel in ST3, and a preliminary assessment of the technical and operational considerations of the two scenarios. The initial results of this assessment are based on high-level conceptual design and a preliminary analysis. This assessment does not account for all potential effects due to the environmental process, government or public relations, costs, right of way impacts, or engineering efforts and is meant to inform further lines of inquiry for feasibility.

Definitions

Prior to discussing the two operating scenarios, it is necessary to provide definitions and context for the existing system, as well as the baseline ST3 scenario with the second tunnel:

- **DSTT** is the segment of the existing 1 Line between the future 2 Line junction south of the International District-Chinatown (IDS) Station and Westlake Station
- **Existing northeast (NE) tunnel** is the segment of the existing 1 Line between Westlake Station and the Maple Leaf portal south of Northgate Station
- **Future second downtown tunnel** is the planned segment of the BLE project (future 1 Line) between a Massachusetts tunnel portal south of a new IDS Station and a new Westlake Station
- **Future northwest (NW) tunnel** is the planned segment of the BLE project (future 1 Line) between a new Westlake Station and a Republican tunnel portal west of a Seattle Center Station
- **Light rail spine** is the central alignment of the ST3 Link network which runs between Tacoma, Everett, and Redmond
- **Spine segmentation:** The ST3 plans to split the spine into segments and pairs each with a shorter extension to create three new lines: 1 Line (between Tacoma and Ballard), 2 Line (between Redmond and Mariner), and 3 Line (between West Seattle and Everett). *See* Figure 3 *in the Appendix for a graphic describing spine segmentation.*

[1] Sound Transit Link Light Rail Operating System Resiliency Assessment, February 2025

EXISTING SPINE CONSTRAINTS

Physical constraints of the existing spine, including the DSTT and Rainier Valley, have prevented the agency from fully equipping the tunnel to support high-capacity service without substantial impacts.[2] These constraints include:

1. **Insufficient ventilation zones in the NE tunnel:** Only one train can operate in each vent zone per agreement with the City of Seattle Authority Having Jurisdiction (AHJ), limiting allowable headways. An exception has already been granted between Capitol Hill and University of Washington, where the Montlake Mid-Point signal allows two trains, but requires a train to reverse out of the tunnel in a fire emergency.
2. **Limited crossovers:** Long distances between crossovers in the DSTT and north to Northgate Station make single tracking difficult and contribute to long recovery times.
3. **No pocket tracks:** A disabled train can block the tunnel, and trains cannot be stored near the busiest stations.
4. **Aging or limited signals:** The signaling system is nearing obsolescence, limiting ventilation zone options.
5. **Unpredictability of Rainier Valley service:** Minimum five-minute headways through at-grade section where traffic signals can override trains, increasing volatility of system.
6. **Overcrowded Westlake Station:** Platforms cannot accommodate ridership surges created by future transfer volumes.

Reliably Operating the Spine without a Second Tunnel

Regardless of the operating scenario (Ballard starter line or interlining Ballard while completing the spine to Tacoma and Everett), two-minute headways through the DSTT will be needed to meet projected ridership demand. To achieve these headways, the agency will need to make a baseline set of improvements to reliably operate the regional light rail spine extending to Tacoma, Everett, and Redmond and implement major changes in operating practices to manage merges and turn backs at tight headways.

With the DSTT as a single point of failure for most of the Link system, these improvements (some of which have been already identified in the previous resiliency assessment) will increase the capacity and resiliency of normal operations, reduce response and recovery time from incidents, and reduce the magnitude and frequency of disruptions.

More detail on the pros, cons, risks, and other implications are summarized in the table at the end of this document.

DSTT between IDS and Westlake Stations

- Possible station ventilation upgrades
- Passenger station improvements
- Possible additions of double crossovers in Pioneer Square and/or Symphony Stations

[2] Existing Westlake Station Modification Evaluation Memorandum, December 2020

- Address northbound passenger platform capacity problems at Westlake Station

NE tunnel between Westlake Station and Maple Leaf portal

- Combination of solutions to shorten the long Westlake-Capitol Hill, Capitol Hill-UW, and Roosevelt-Maple Leaf portal vent zones, including:
    - Add one or more new ventilation shafts
    - Fire hardening of the trains
    - Codify the exemption with the AHJs allowing for two trains to operate within a single vent zone if one vehicle can reverse out that is used in the tunnel between Capitol Hill and University of Washington Stations
- Add a pocket track between Westlake and Northgate
- Targeted station/mezzanine fan upgrades
- More refined signaling system or communications-based train control (CBTC)

Rainier Valley[3]

- Address schedule adherence and resiliency to reduce delays
- Improve incident recovery times in the Rainier Valley

BASELINE ST3 SCENARIO: SECOND DOWNTOWN TUNNEL

The proposed ST3 network is reliant on three Link lines passing through downtown Seattle and includes a second tunnel between International District-Chinatown Station (IDS) and Westlake Station. The project is planned to be built as part of the BLE project, which would also construct the connecting NW tunnel between Westlake and Seattle Center. The purpose of the ST3 planned second downtown tunnel as originally conceived was threefold:

1. **Provides additional transit capacity, redundancy, and resiliency through downtown** to accommodate future regional travel patterns, forecasted ridership, necessary frequencies, and enhanced safety and design standards[4]
2. **Facilitates spine segmentation**, which reduces the risk of operating one long light rail line along the "spine" of the system between Everett and Tacoma, especially with the unpredictability from the Rainier Valley and the future interline with the 2 Line
3. **Expands regional transit access to key regional destinations along the BLE alignment, including the Amazon Campus, South Lake Union and Seattle Center** with transfers between the 1 Line, 2 Line, and 3 Line between the new tunnel and DSTT

[3] This memo has yet to evaluate the improvements necessary for Rainier Valley
[4] A second transit tunnel through downtown was identified as a critical need in a 2002 Alternative Transportation Tunnels Downtown Seattle Study

ALTERNATIVE OPERATING SCENARIOS

This section summarizes the findings of a preliminary assessment of two alternative operating scenarios to construct the portion of the second downtown tunnel south of Westlake: 1) building a Westlake-to-Ballard Starter Line and 2) interlining BLE into the DSTT.

Scenario 1: Westlake-to-Ballard Starter Line

This conceptual scenario constructs a portion of the BLE project, including the northern section of the new downtown tunnel, and operates service only between Ballard and Westlake until the rest of the tunnel is built. In the interim, riders from the north would transfer between lines at the existing Westlake Station in the DSTT and a new Westlake Station. Benefits of this approach include accelerated service to Ballard and deferring the cost and risk of constructing the rest of the tunnel. However, this option does not increase capacity through downtown.

Construction and operations of the starter line would involve:

- Tunneling from the north from Lower Queen Anne (instead of the south from SODO, as planned with BLE)
- Adding a double crossover north of the new Westlake Station to accommodate train turn backs[5]
- Constructing a TBM breakthrough/retrieval box south of Westlake to enable future completion of the tunnel[6]
- New operations and maintenance facility (OMF) to support interim operations without a viable option to move trains via a connection to the DSTT due to elevation limitations

Additional design and constructability analysis are needed for the configuration of the new Westlake Station terminus, transfer facilities at the existing Westlake Station, north-portal construction approach, and a new OMF, including:

- Additional construction and property effects in downtown and Lower Queen Anne related to the staging and mucking and launch and retrieval of tunnel boring machines (TBMs), as well as construction of special trackwork to allow for train turn backs
- Locating and constructing an OMF in Interbay or Ballard, where available land is limited
- Reconfiguring existing Westlake Station to accommodate additional transfers

The pros, cons, risks, and other implications are summarized in in the Appendix.

[5] This crossover may be challenging to build given ground conditions and may require the acquisition of the existing Westlake Center and Monorail Station. If the crossover proves too challenging to build service levels on the BLE will be highly restricted until the southern half of the tunnel is built due to the distance from the Denny Station Crossover to Westlake Station.

[6] The buildings south of Pike Street on the current alignment present major obstacles that will require additional study to confirm feasibility. That will likely require a separate shaft and staging area for TBM launching (or retrieval) with a connection to the existing tunnel likely by SEM.

Necessary Additional Improvements to DSTT

- Reconfigure existing Westlake Station to accommodate transfers between the starter line and the 1 and 2 Lines in the DSTT[7]

Capacity Constraints and Future Tunnel Extension

Completion of the second downtown tunnel south of Westlake would likely be necessary in the case of:

- **High ridership:** When ridership in the DSTT is forecasted to require more than six-minute headways on each line, Sound Transit will need to find additional ways to increase capacity which likely would trigger construction of the southern portion of the second tunnel to add the necessary capacity.[8]
- **Necessary improvements to DSTT:** Building crossovers, ventilation shafts, pocket tracks and upgrading stations would be disruptive to service, possibly requiring single tracking for extended periods or a long-term service closure within the tunnel.

Additional Study Needed

This scenario still requires additional studies to determine feasibility:

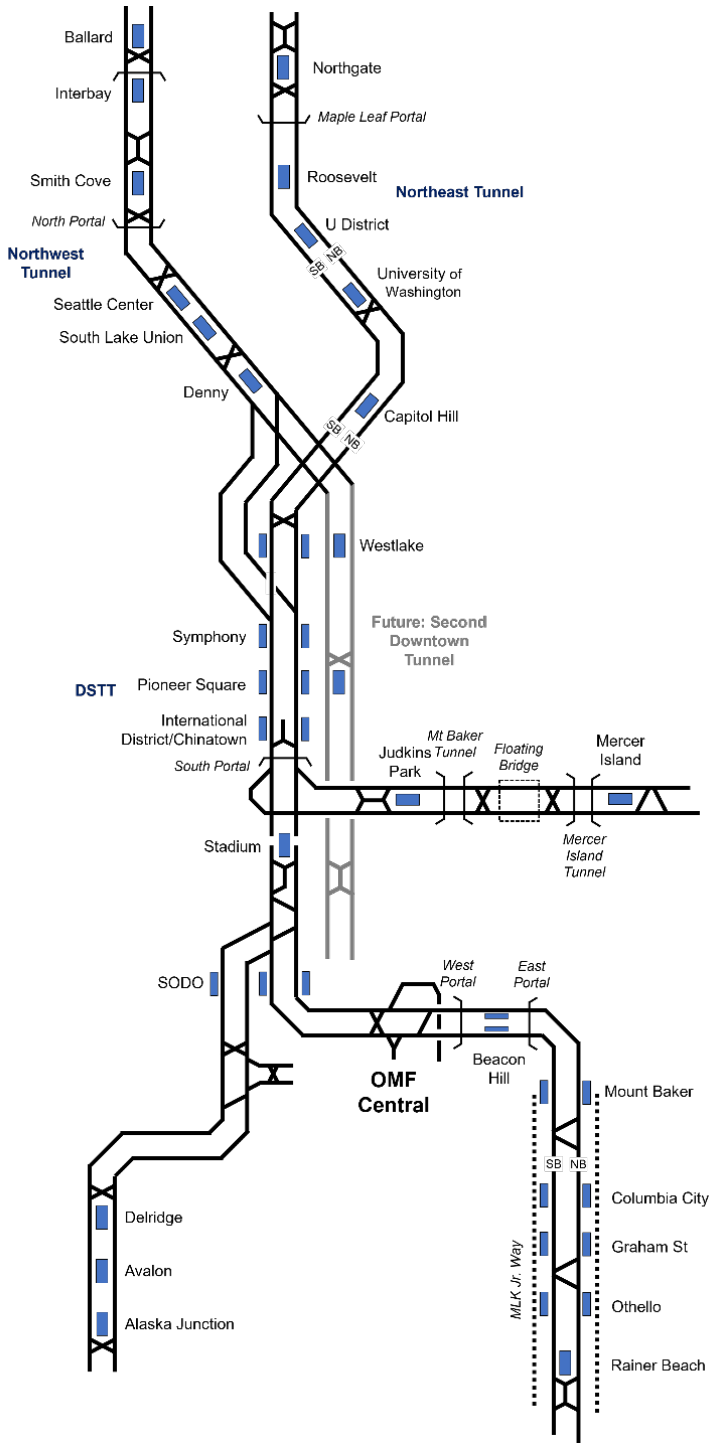
- Alternative configurations for the new BLE Westlake Station (both to turn trains back and allow for extensions south)
- Improvements needed to the existing Westlake Station to accommodate transfers.
- Staging of tunneling from the north portal on Lower Queen Anne
- Locating and developing a concept plan for an OMF in the Interbay area
- An understanding of the soil conditions to allow for mining the crossovers

[8] Current ridership projections would require at least five-minute headways on 1 Line to meet anticipated demand.
[8] Current ridership projections would require at least five-minute headways on 1 Line to meet anticipated demand.

Scenario 2: Interline BLE into Existing DSTT

This conceptual scenario interlines the BLE into the DSTT south of Westlake Station. Passengers can transfer between 1 Line, 2 Line, and 3 Line at the existing Symphony, Pioneer Square, and IDS Stations (see Figure 1).

Figure 1: Interline Scenario



To accommodate short headways in the DSTT with all three lines and avoid any opposing train conflicts, the connection requires a grade-separated junction between BLE and the DSTT. This connection would be located under and along 3rd Ave between Union and Pine Streets.

- North of Symphony Station, the existing northbound DSTT track would be reconstructed and shifted to the east to add a turnout to a new northbound BLE track, which would dive under the existing southbound DSTT track and continue north under 3rd Ave. The realigned northbound DSTT track would connect back to the DSTT alignment at Pine Street at the existing elevation. The new southbound BLE track would connect to the existing southbound DSTT track at the existing elevation.
- To construct this new junction, a slurry wall would be constructed between the existing northbound and southbound tubes on 3rd Ave from Symphony to the point where the existing DSTT tracks swing northeast towards Westlake Station. This wall would allow the existing southbound track to remain in service while the new northbound tracks are constructed.
- Single-track service could continue while the new junction is constructed, potentially using a cross-platform transfer at Symphony or Pioneer Square, like what was done at Pioneer Square Station for the 2 Line tie-in construction. After the northbound tracks are complete, single-track service would flip to the northbound tracks, and the southbound junction would be constructed.
- From 3rd Ave going north, the BLE connection tracks would turn northeast between Virginia St and Lenora St, and rejoin the proposed BLE alignment near the intersection of Westlake Ave, 7th Ave, and Lenora St. This would be south of the proposed Westlake and Denny station and associated crossovers thereby not impacting that design. A stub tunnel to the south on Westlake Ave would be constructed to allow the future construction of the deferred southern portion of the tunnel to along Westlake to SODO when warranted.

Construction and operations of the interline would likely involve:

- Tunneling from the north for the BLE starter line, extracting the tunnel boring machines (TBMs) on 3rd Ave north of Pine St
- Long-term closure of the northbound DSTT tube followed by a shorter-duration closure of the southbound DSTT tube. The possibility for single tracking during construction, instead of a full shutdown, is still under evaluation and subject to policy decisions.
- Major alterations of Symphony Station to address the added passenger transfers and additional ventilation needs
- Building stub out connections along Westlake Avenue to facilitate eventual connection to the southern section of a second tunnel
- Multiple, but potentially acceptable, track design deviations, particularly for length of vertical curves but potentially for lengths of horizontal alignment elements. Design approach to follow existing geometry of DSTT.
- Rebuilding of multiple blocks of the DSTT impacting 3rd Ave and Pine Street, including bus operations with overhead catenary on 3rd Ave
- Adding storage track to turn trains north of the Maple Leaf portal
- Adding a crossover in the DSTT

More detail on the pros, cons, risks, and other implications are summarized in Figure 6 in the Appendix.

Necessary Additional Improvements to DSTT

The short headways rely on the baseline necessary improvements to the DSTT, as well as:

- Improved platforms at Westlake Station (north and south)[9]
- Upgrades to ventilation at Symphony and Pioneer Square

Operational Considerations

Storage Track

Operating three rail lines at a combined two-minute headway will require an additional location to turn trains north of the Maple Leaf portal. The use of the existing pocket track at Northgate Station for midline turn backs precludes the ability to store out of service trains. Two additional storage locations were considered:

1. **Pocket track at Maple Leaf portal, south of the Northgate Station**: would require passenger service to end at Roosevelt with fewer bus connections and no crew facilities
4. **Sidings on the aerial guideway north of Northgate Station**: more difficult to construction, but would allow for longer turn times during revenue service and added operational flexibility of additional trains at the terminus

With both options, the existing pocket track would be used to turn the revenue trains and as additional storage to store out-of-service trains.

Crossover in DSTT

Without an existing crossover in the DSTT, the minimum single-tracking headway is over 26 minutes between the crossovers north of Westlake Station and south of Stadium Station. This headway is over three times headways today and 13 times the necessary combined two-minute headways. Two options for adding mid-platform crossovers in the DSTT were considered to reduce impacts to passengers during single-tracking:

- **Pioneer Square Station**
- **Symphony Station**

When trains use a mid-station crossover during single-tracking, one or more of the platforms must be closed to riders. Of the two options, a closure of Pioneer Square would be less impactful, since it has lower ridership and supports lower single-tracking headways with two stations north and south. When single-tracking between Symphony and Westlake during construction of the connection of BLE into the DSTT, this configuration would allow for a forced transfer at Symphony Station with eight-minute headways.[10] Comparatively, a crossover at Symphony would likely require traditional single-tracking with headways of 10- to 12-minutes.

[9] Improvements maybe unnecessary until the southern half of the new tunnel is built
[10] All headways will need to be confirmed through modeling

Additional Study Needed

If this alternative is considered further, more detailed studies of the following are needed to determine feasibility:

- Alignment and associated design deviations
- Evaluation of solutions, such as gap fillers and flip out edges, to the platform gap issue caused at Symphony or Pioneer Square due to addition of crossover, because diverging trains swing out and will strike the existing platform unless the fixed edge is cut back.
- Ground conditions and building foundations, including possibility that existing structures project beyond the ROW line below sidewalks
- Impacts to Symphony Station
- Mitigation of construction impacts on Link and KCM bus operations
- Staging of tunneling from the north portal on Lower Queen Anne

CONCLUSION

While both operating scenarios show conceptual viability at this point, there are a number of identified issues both technical and operational that need additional study to identify any fatal flaws. Both scenarios present credible paths to near-term benefits. The Starter Line can advance service to Ballard sooner, contingent on Westlake transfer capacity and an Interbay OMF. The Interline concept could streamline operations through downtown if AHJ, geotechnical, and property conditions support a grade separated junction on 3rd Ave. In all cases, a package of DSTT, NE tunnel, and Rainier Valley improvements are likely necessary for resiliency and capacity. Both options that delay the southern portion of the new downtown tunnel will require serious service disruptions to Link operations in both the DSTT and the tunnels north to Northgate. Thus, the sooner these disruptive improvements are made the less impactful to system riders and the region. These disruptive improvements, including the option interlining in the DSTT, should be completed prior to adding any extensions beyond Lynnwood and Federal Way.

Appendix: Reference Materials

Figure 2: Link Service Plan

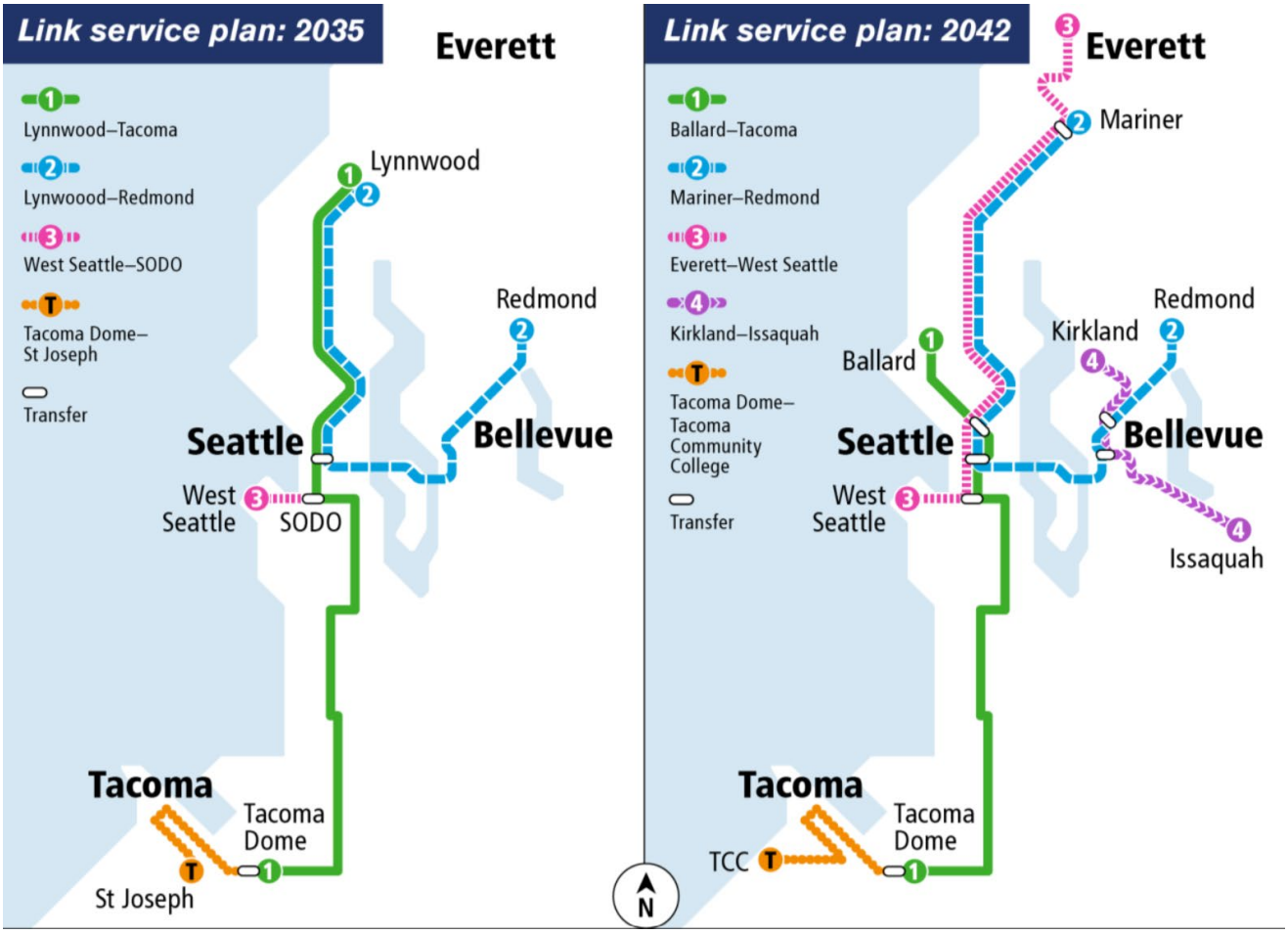
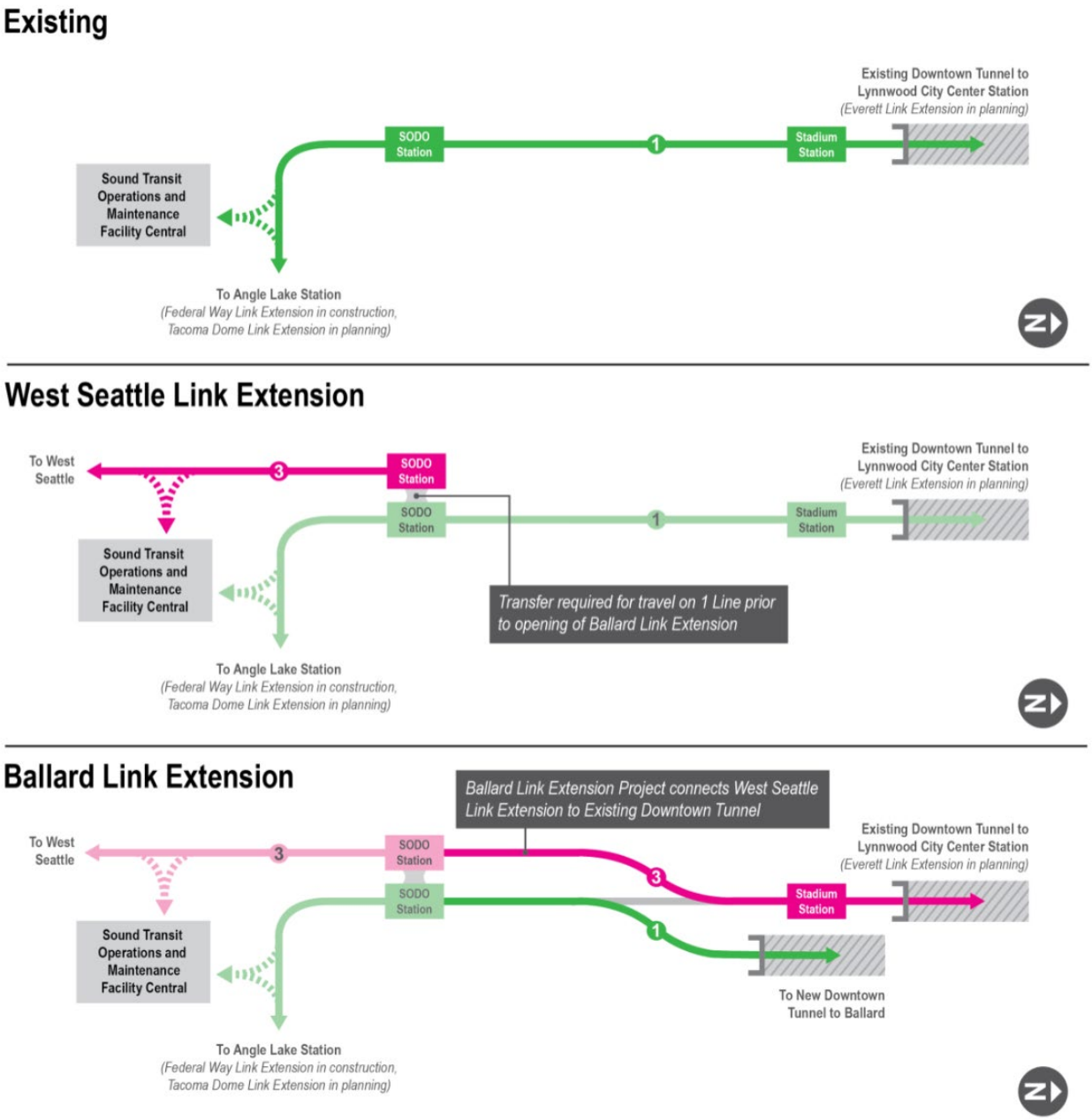


Figure 3: Spine Segmentation Graphic



Note: Graphic excludes junction of 2 and 3 Lines south of the existing downtown tunnel for simplicity

Figure 4: DSTT and NE Tunnel Necessary Improvements

Improvement	Pros	Cons/Risks	Implications
New Ventilation Shafts	• Splits long ventilation zones • Improve operations • Lower risk to operations • More trains per zone • Better emergency containment	• High cost • Property community impacts • Rebalancing fan plans • Deep shafts • Requires AHJ coordination and approvals	• Enables multiple shorter zones • May require new fan plants
Fire hardened trains and reverse out procedures	• Cuts single track distance • Improves recovery • Allows two trains in long zone • Low capital comparatively	• Station cannot be served in active direction • Potential platform clearance issues • Operator reverse driving, SCADA, and AHJ waivers needed • Requires intense AHJ coordination and approvals	• Provides operational flexibility • Limited to selected segments • May reduce needs for shafts but requires new procedures
Pocket Track North of Westlake	• Provides storage for gap or out of service trains • Enables recovery operations near downtown • Allows short turning WSLE trains at Westlake	• Limited length • Steep grade • Narrow track centers • Constrained by convention center • Major construction impacts and utility relocations • Complicated construction or extended full shutdown of DSTT	• Offers short turn facility near Westlake • Helps incident recovery but high cost and extremely disruptive
DSTT Crossovers and resiliency	• Allows short turns • Optimizes recovery • Reduces single track length	• Platform gap solution needed to accommodate train outswing when diverging through crossover	• Requires more evaluation vs more targeted works • Enhances long term reliability

trackwork at Pioneer and/or Symphony	• Improves resiliency for emergencies and events	• Station out of service when crossover in use	
DSTT Pocket Track between Pioneer and Symphony	• Allows short turns and storage • Optimize recovery and provides space for bad order train • Reduces single track length • Improves resiliency for emergencies and events	• High cost and complex • Deep shafts and property constraints • Long outages during construction • Construction risk	• Major disruption during downtown construction • Requires more evaluation vs more targeted works • Enhances long term reliability
Targeted station and mezzanine fan upgrades	• Supports shorter headways • Improves smoke control response • Less expensive than new shafts	• Work occurs in active stations • Potential disruption • Requires AHJ acceptance	• Complements other improvements for shorter headways and FLS compliance
CBTC/Refined signaling	• Improves reliability • Staged improvements and upgrades • Reduces headways	• Does not provide turnback capability on its own • May still require shafts for sidings • Integration risks	• Supports multi-line operations and shorter headways but still need other improvements for storage and turn backs
SR-520 Ventilation shaft and crossovers	• Converts UW-Capitol Hill zone into shorter zones • Reduces bottlenecks • Improves emergency containment • Could possibly mine pocket tracks and crossovers with more limited disruption (soil conditions permitting)	• New shaft site needed • Property and community impacts • Significant cost and schedule • AHJ Obstacles • Track curvature limits the feasibility of this option • Subsurface conditions could prevent mining from being a realistic option – needs additional study	• Major capacity improvement • Heavy capital and risk but balanced with crossovers and pocket track improvements

Figure 5: Assessment of Scenario 1 Pros, Cons, and Challenges

Pros	Cons	Challenges
• Accelerated service to Ballard • Defers the cost and risk of constructing the rest of the 2nd downtown tunnel	• Upgrades to existing Westlake Station to accommodate the additional transfers • Additional impacts to Lower Queen Anne due to tunneling from the north (rather than from SODO)	• Construction of a double crossover north of the new Westlake Station for turn backs, a ventilation facility, and a TBM breakthrough/retrieval box south of Westlake to enable future completion of the tunnel • Locating new OMF north of new Westlake Station to support interim operations without a viable option to move trains via a connection to the DSTT due to elevation limitations • Minimizing effects to existing DSTT service • Tunnel construction from the north portal in Lower Queen Anne confined residential neighborhood

Figure 6: Assessment of Scenario 2 Pros, Cons, and Challenges

Pros	Cons	Challenges
• Allows one-seat ride from BLE into downtown Seattle • Allows spine segmentation (1 Line from Ballard to Tacoma Dome, 3 Line from West Seattle to Everett) • BLE segment from Symphony to Ballard can be built without needing a new OMF • Allows transfers to be distributed across several stations • Relieves pressure on Westlake Station • Allows construction of new BLE tunnel from just south of Westlake and Denny Station to SODO with minimal disruption to existing service • Provides future operations flexibility (storage for gap or disabled trains, ability to switch which lines connect from south to north	• Single-tracking required during construction • If single tracking does not work, then the entire DSTT may be shut down during the construction period • Disruption to 3rd Ave buses and adjacent properties • Requires acquisition and demolition of up to two buildings in the northwest quadrant of the block bounded by Pike, Pine, 3rd and 4th • Requires tunnel construction staging, mucking and materials storage from the north portal in a confined residential neighborhood. • Requires two tight radius (500 feet) curves • Requires potentially acceptable design deviations • May impact major high rise towers depending on further alignment studies and review of existing building foundations	• Construct cut-and-cover boxes adjacent to active tracks • Proximity to adjacent development • Ventilation requirements uncertain at this time • Alignment from 3rd Ave to Westlake Ave to avoid large building foundations • Tunnel construction from the north portal in Lower Queen Anne confined residential neighborhood • Design and constructability assessments needed to minimize impacts to existing Link and KCM operations on both 3rd Ave and Pine Street

Figure 7: Ballard Stacked Wye Via 3rd Ave

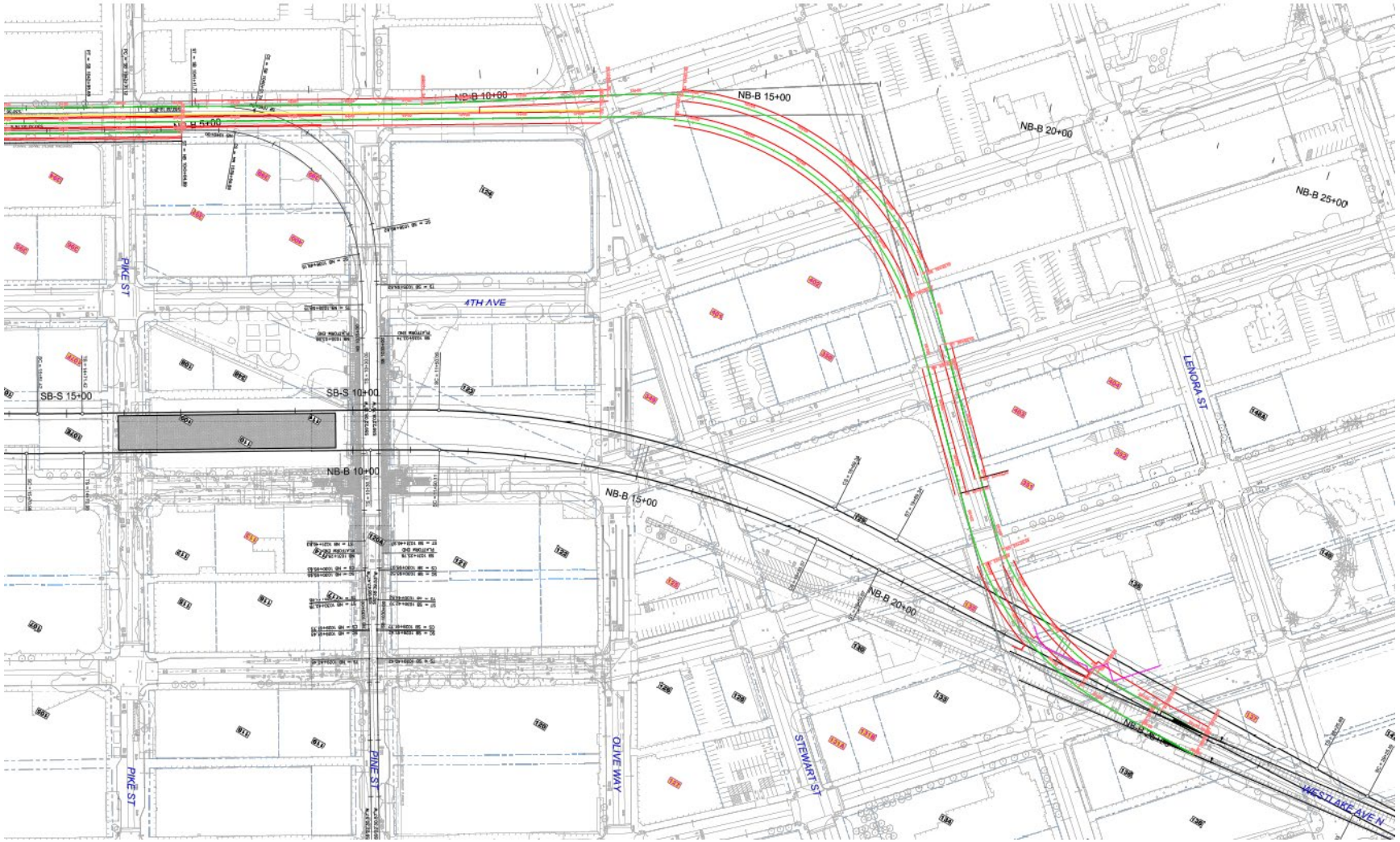
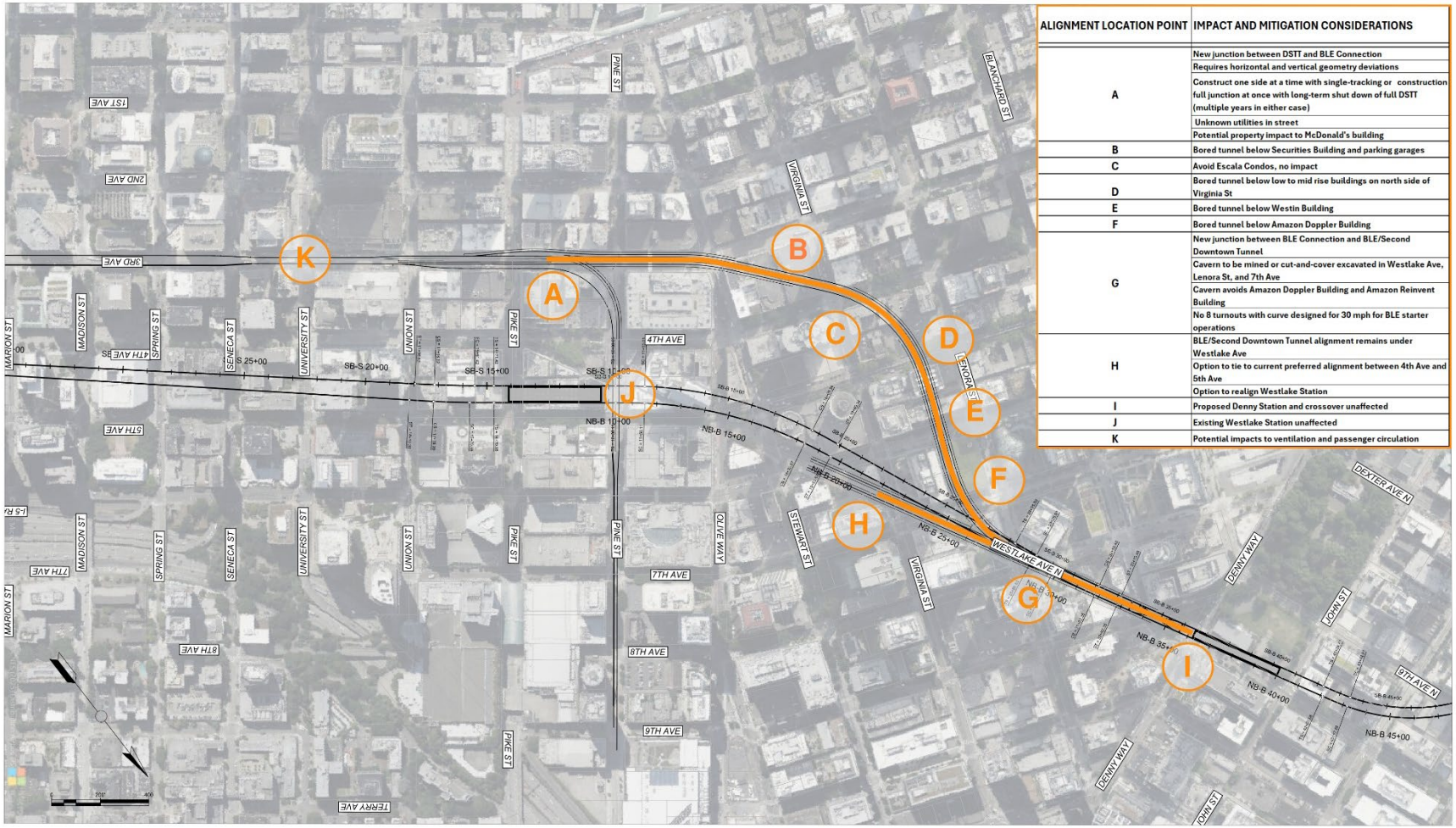


Figure 8: Scenario 2 Impacts and Mitigation Considerations



ALIGNMENT LOCATION POINT	IMPACT AND MITIGATION CONSIDERATIONS
A	New junction between DSTT and BLE Connection
	Requires horizontal and vertical geometry deviations
	Construct one side at a time with single-tracking or construction full junction at once with long-term shut down of full DSTT (multiple years in either case)
	Unknown utilities in street
	Potential property impact to McDonald's building
B	Bored tunnel below Securities Building and parking garages
C	Avoid Escala Condos, no impact
D	Bored tunnel below low to mid rise buildings on north side of Virginia St
E	Bored tunnel below Westin Building
F	Bored tunnel below Amazon Doppler Building
G	New junction between BLE Connection and BLE/Second Downtown Tunnel
	Cavern to be mined or cut-and-cover excavated in Westlake Ave, Lenora St, and 7th Ave
	Cavern avoids Amazon Doppler Building and Amazon Reinvent Building
	No 8 turnouts with curve designed for 30 mph for BLE starter operations
H	BLE/Second Downtown Tunnel alignment remains under Westlake Ave
	Option to tie to current preferred alignment between 4th Ave and 5th Ave
	Option to realign Westlake Station
I	Proposed Denny Station and crossover unaffected
J	Existing Westlake Station unaffected
K	Potential impacts to ventilation and passenger circulation

Figure 9: 3rd and Pike Exhibit A

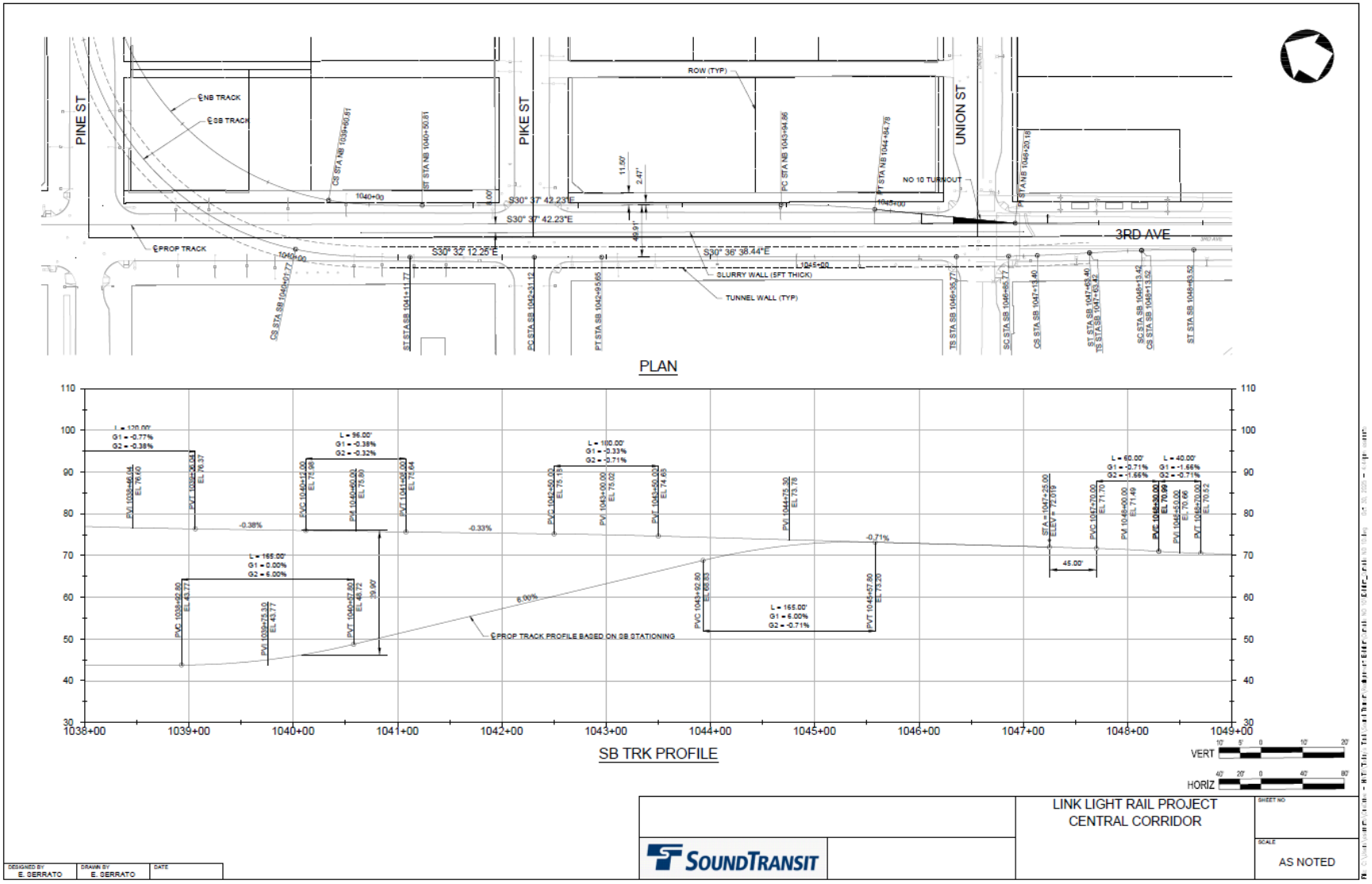


Figure 10: 3rd and Pike Exhibit B

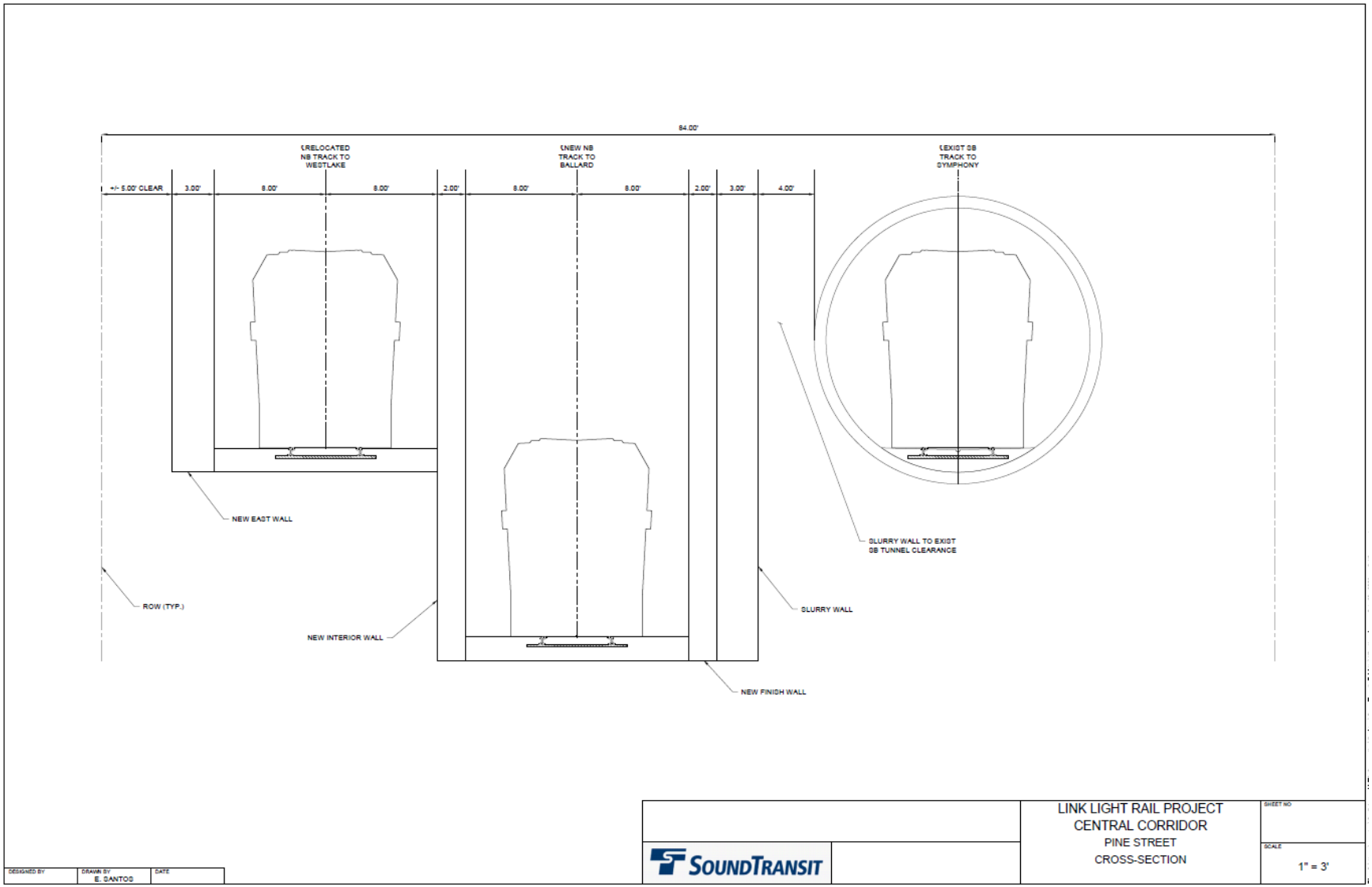


Figure 11: No 10 Crossover at Symphony

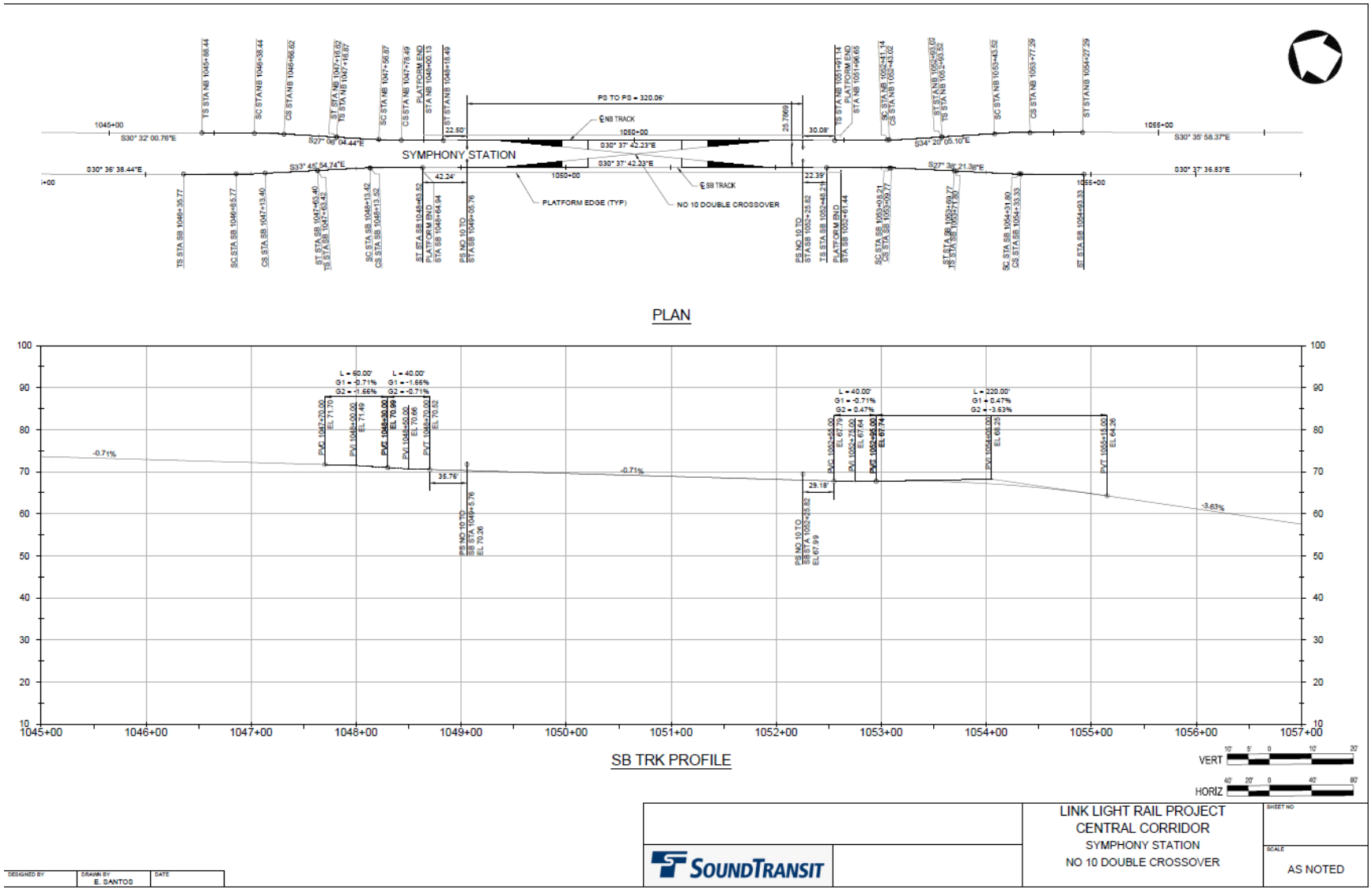


Figure 12: No 6 Crossover at Symphony

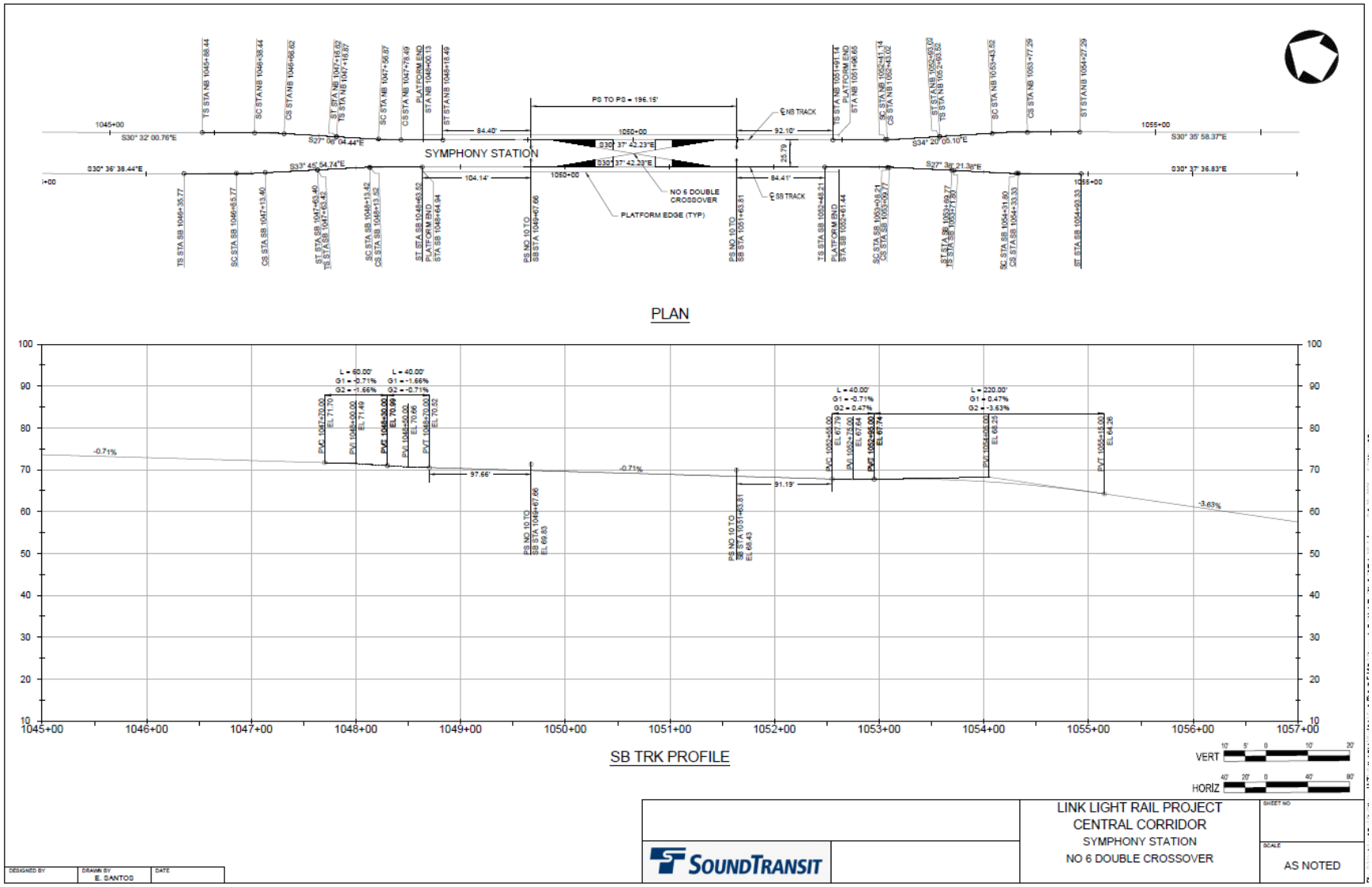


Figure 13: Pocket Track Symphony/Pioneer