City of Bellevue

East Link Light Rail B7/C9T to NE 2nd Portal (B7 – Revised) Alternative

TM12 - Shared Track with Freight Rail

215382/TM12

Final | June 2011

Arup North America Ltd
403 Columbia Street
Suite 220
Seattle
WA 98104
United States of America
arup.com

Job number 215382-00

ARUP

Document Verification

ARUP

Job title		East Link Light Rail B7/C9T to NE 2nd Portal (B7 – Revised) Alternative		Job number 215382-00
Document title		TM12 - Shared Track with Freight Rail		**File reference**
Document ref		215382/TM12		
Revision	**Date**	**Filename**	Technical Memo Template v2.docx	
Draft 1	02/07/11	**Description**	First draft	
			Prepared by	Checked by	Approved by
		Name	Nathan Will	David Hunt	Richard Prust
		Signature			
Review Draft 2	03/31/11	**Filename**	Technical Memo 12 Shared Track (Review Draft 2).docx	
		Description	Issued for review by City of Bellevue	
			Prepared by	Checked by	Approved by
		Name	Nathan Will	David Hunt	Richard Prust
		Signature			
Final Draft	05/03/11	**Filename**	Technical Memo 12 Shared Track (Final Draft).docx	
		Description	Revised to address comments from City of Bellevue and Sound Transit.	
			Prepared by	Checked by	Approved by
		Name	Nathan Will	Richard Prust	Richard Prust
		Signature			
Final	06/24/11	**Filename**	TM12 - Shared Track (Final).docx	
		Description	Revision status revised. No changes.	
			Prepared by	Checked by	Approved by
		Name	Nathan Will	Richard Prust	Richard Prust
		Signature			

Issue Document Verification with Document ✓

Contents

1 Executive summary

The issues associated with shared track operation of Light Rail Vehicles (LRVs) and freight rail fall into two broad categories, regulatory and technical.

The regulatory framework is dictated by the Joint Policy Statements by the Federal Railroad Administration (FRA) and the Federal Transit Administration (FTA), which were finalized in 2000. The FRA considers this a statutory guideline and administers the waiver process for allowing what they consider non-compliant vehicles (such as LRVs) to operate on the general railroad network that it oversees. This creates a high "burden of proof" on the applicant to prove that the two vehicles types can operate safely. To do this, the FRA heavily favors implementing time windows, or temporal separation, for each system to operate in, instead of comingled operation. This is the model used on the existing systems in the US. Therefore, there is a regulatory path to allow joint use however, it is an onerous process for the applicant.

The technical considerations to be considered cover all aspects of the system:

- The track, bedding, structures, and associated civil works need to be designed for the higher wheel loads of freight traffic.
- The alignments and superelevations need to be designed to the more onerous of freight and LRV standards.
- The vertical clearances for LRV and freight are different (freight generally requires 23.5 feet); therefore, additional systems, including the need for a special pantograph assembly on the vehicles, may be required.
- Differing signaling systems need to be integrated.
- Annual operations and maintenance costs are higher because of increased wear on the joint track segment.

These technical considerations are manageable; however, with no identified freight operator to negotiate with, implementation would have a degree of risk.

Shared Track with Freight Rail

- The regulatory framework imposed by the FRA heavily favors time separation of transit operations and freight operations.
- Multiple technical considerations that can add capital costs and annual O&M costs for the joint segment need to be considered when looking at the cost savings of shared track.
- Temporal separation of operations will impose significant operational and maintenance restrictions on both Sound Transit and a future freight operator.
- The terms of the Rail Bank agreement must be fully understood, and a determination made whether time separated operations can be imposed on the section of track.

2 Background

2.1 Project description

The East Link project is an extension to Sound Transit's Link light rail system that will provide light rail service across Lake Washington, linking Seattle, Bellevue, and Redmond (Overlake).

For the segment of East Link between the Lake Washington crossing and downtown Bellevue, Sound Transit has developed the B7 alternative to a conceptual engineering level of design (approximately five percent design) as part of the Draft Environmental Impact Statement (DEIS) for the project which was issued in December 2008.

A Supplemental Draft EIS, which analyzes new alternatives developed since the DEIS, was published in November 2010. That supplemental document includes updated conceptual engineering for the Sound Transit B7 alternative and a C9T alternative that could connect B7 to a station at the Bellevue Transit Center. A Final EIS is expected in the summer of 2011.

At the September 13, 2010, Bellevue City Council Study Session, the council discussed the need for design variations and for additional analysis of revised East Link B7 and C9T alternatives. The objectives of the additional analysis would be to improve performance, to reduce impacts, and to reduce costs, as compared with the Sound Transit B7 and C9T alternatives. As a result of that discussion the council initiated the development of a modified B7 alternative ("B7-Revised"). The council directed City staff to develop an "apples-to-apples" comparison of the Sound Transit B7 and C9T alternatives with a B7-Revised alternative. ARUP were commissioned by the City to develop the B7-Revised alternative.

The B7-Revised alternative begins at the transition from East Link Segment A to Segment B at the east shore of Lake Washington and connects with a new elevated station (A-2 Station) over south Bellevue Way/I-90 ramps. The alignment continues east from the station along the north side of I-90 and turns north into the BNSF corridor with an at-grade profile. The alignment transitions to elevated as it leaves the BNSF corridor, crosses over SE 8th Street, and transitions back to at-grade prior to a new station (East Main Station) just south of Main Street on the current Red Lion Hotel site. The alignment crosses under Main Street and turns west on the current Sheraton Hotel site before entering a tunnel portal at NE 2nd Street. The B7-Revised alternative is approximately three miles long with a combination of at-grade, elevated, and open-cut sections.

2.2 Technical memo scope

The old freight rail tracks within the BNSF corridor have been abandoned and the corridor now falls under a rail banking agreement which requires that the ROW be maintained such that heavy rail could be reactivated if a future railroad company

identified a need for it. The City of Bellevue has requested a review of the issues related to allowing future railroad operations on Sound Transit tracks.

This memo provides an overview of the issues related to the operation of Light Rail Vehicles (LRVs) in a joint operation with freight rail on shared track for approximately 5300 feet. It describes the current technical, operational, and regulatory issues that must be addressed if Sound Transit is to operate LRV jointly with freight rail over a segment of track.

This memo does not address the legal issues associated with rail banking or the future requirements for freight operations in the corridor.

2.3 Technical memo objectives

The objective of this Technical Memo is to identify the key hurdles to implementing a joint LRV operation with a freight railroad and to identify whether there are any fatal flaws in this approach. These are:

- Regulatory framework
- Technical considerations
- Operational considerations

2.4 Background documents

Relevant documents and reports used to support the analysis included the following:

- *TCRP Report 43: Supplementing and Updating TCRP Report 52: Joint Operation of Light Rail Transit or Diesel Multiple Unit Vehicles with Railroads (2001)*
- *Joint Statement of Policy Concerning Shared Use of the Tracks of the General Railroad System by Conventional Railroads and Light Rail Transit Systems, Federal Register, Vol. 65, No. 132, p. 42,526, issued by the FRA and FTA (2000)*
- *Statement of Agency Policy Concerning Jurisdiction Over the Safety of Railroad Passenger Operations and Waivers Related to Shared Use of the Tracks of the General Railroad System by Light Rail and Conventional Equipment, Federal Register, Vol. 65, No. 132, p. 42,529, issued by the FRA (2000)*

3 Regulatory considerations

Many of the technical and operational considerations of comingling light rail and freight rail service on the same track, while difficult, can be managed. However, one of the largest hurdles to overcome regarding joint use of the track is navigating the federal regulatory requirements.

3.1 FRA and FTA joint policy statement

In 2000, both the Federal Rail Administration (FRA) and the Federal Transit Administration (FTA) issued policy statements concerning the use of general purpose tracks meeting FRA requirements, such as freight rail, by LRV. The statements are coordinated and use much of the same language. Because of the differences in mandates and authority, the FTA considers this statement to be predominantly a policy statement, whereas the FRA statement has evolved into a technical and legal guideline for the implementation of Joint Use Rail, and the final version of the FRA policy statement describes its statutory jurisdiction over railroad passenger operations.

Several items from the joint policy statements need to be considered:

- The assertion of FRA safety jurisdiction over the general railroad system.
- The identification of major incompatibilities when mixing rail vehicle types on the same track at the same time.
- The acceptance of temporal separation of the transit and freight movements as the safest means to physically segregate the differing types of rolling stock.
- The introduction of the FRA waiver process to regulate exceptions when shared track will be permitted; the waiver process includes additional safety measures that are required to reduce risk.
- The introduction of the concept of a “Steep Burden of Proof” by the FRA on petitions for waivers for simultaneous track sharing, as opposed to temporal separation. This requires the applicant to prove that the safety of comingled operation is as safe as temporal segregation. To our knowledge, this has not been proven.

The FRA clearly favors time separation as a means for separating the different vehicle types because this is the operational framework for which waivers have been granted on the existing joint-use tracks in the country.

In summary, the FRA regulates the joint use track, but granting waivers comes down to two main points:

- There are significant concerns about operating two incompatible types of equipment on the same track; therefore, the FRA may grant a waiver for simultaneous track sharing, but only if the petitioner can demonstrate a “steep burden of proof” that alternative safety measures will reduce the risk of collision.

- The FRA will likely grant waivers that rail transit carriers need to operate by if the systems are time-base separated.

While the waiver process is onerous, there is a federal mechanism to allow joint use of freight rail tracks.

3.2 Current joint use operations

Within the United States, four systems have been identified that operate LRVs (considered non-compliant vehicles by the FRA) on general railroad infrastructures:

- San Diego
- Baltimore
- New Jersey Transit Gold Line
- Austin Capital Metro[1]

These systems all utilize operation time separation of the light rail vehicles and the freight trains, with an operational buffer time, to gain waivers for the FRA.

The following are some overseas examples:

- Sunderland Direct, UK – A light rail line is shared with heavy rail passenger services.
- Saarbrücken, Germany – The regulatory climate is similar to that of the US. The operational arrangement is not known.
- Japan – A local light rail operates with locomotive-hauled freights under common management.

[1] The Austin Capitol Metro system operates Diesel Multiple Units (DMU's) which are different than light rail; however, the FRA still does not consider them to be compliant with freight trains and temporal separation is required.

4 Technical considerations

There are several technical considerations to be considered when running LRVs and freight trains on the same track. These need to be considered over the life of the railways, from design and construction through to operations and maintenance of the vehicles, track, and associated civil works. The primary differences are that freight trains will have a heavier wheel load, take longer to stop, and have a larger operational envelope.

Many of these technical considerations would need to be negotiated and agreed on by the impacted freight rail operator. With no known operator in the future, the ability to foresee what they will or will not agree to is difficult; therefore, the technical considerations present a significant risk to the implementation of joint-use track. This configuration is also not in conformance with the Sound Transit Design Criteria Manual.

4.1 Track and civil works

4.1.1 Track cross section

The track and associated civil works, which include structures and track bed, would need to be designed for the heavier loading of freight cars. The track ties and ballast may have to be constructed to higher FRA standards if the freight trains are expected to carry heavier load than the LRT cross section can handle over time.

4.1.2 Running clearances

For an LRV system, the critical dimension in determining vertical clearance is the elevation of wire for the overhead catenary system (OCS) system, generally 15 feet above top of rail. The running clearances for freight are significantly greater because of the length of the vehicles and the possibility of needing vertical clearance for double-stack flatbed cars, of up to 23.5 feet. Thus the vertical clearance envelope would likely be greater than required for an LRV system+.

The horizontal clearances may or may not be an issued depending on the specific type of rolling stock utilized on the freight line. If the standard freight running clearance of 9-feet is recognized, then the Center OCS Poles (ST standard) that support the traction power wire may need to be switched to a configuration that has two poles located on either side of the tracks. This will support the OCS wire by lateral wires strung between the poles.

4.1.3 Alignments

On any dedicated track system, the alignment is designed for the specific physical properties of the vehicles that utilize them. LRVs can operate on much sharper curves because of shorter body lengths, and LRVs can operate on much steeper grades because the vehicles are lighter than freight trains. Vertically, freight is

typically limited to a 1% grade, whereas LRVs can operate on a grade up to 6%—or even steeper in special cases.

The impacts on superelevation, or the amount the rail pitches around curves, are more complex because of the long-term wear on the track. Through urban areas, freight is generally limited to a speed of 50 mph, and the speed limit depends on the geometry of the track. The correct superelevation must be implemented for the operating speed of the freight trains to limit unbalanced wear on the outer track to within FRA standards. A superelevation appropriate for freight could result in slower operating speeds for the LRVs because of passenger comfort criteria.

4.1.4 Future turn-outs

The construction of the turn-outs in the future will be complex and have a possibility of shutting down service on the light rail line for a duration of time (might vary from a weekend to several weeks) while the safety zone is established.

4.2 Line side infrastructure

There are two primary systems that could be impacted, the signaling system and the traction power OCS.

4.2.1 Signaling

Sound Transit and the freight operator will likely utilize different signaling and communication systems, and these systems could be very different. The two systems would likely have to be integrated. Even with temporal segregation of the LRV and freight trains, such integration would be complex.

4.2.2 Traction power and OCS

The impacts on the traction power system would need to be studied in detail because in many systems the rails provide an electrical return path for the LRV's traction motor. Therefore, careful design and insulation would be required between the traction power and signaling systems.

The main impact will be on the OCS system. Typically, the OCS wire that supplies power is set just above the LRV. Because of the potential requirement for a higher clearance, this section of the LRV system will need to have the wires set above the freight clearance envelope. A higher clearance requirement for a segment would require an LRV design that could vary the pantograph height to meet theses clearances.

Alternatively, this segment of the freight track could have an imposed height restriction as part of its operating guidelines. This alternative would likely be resisted by any potential freight operators.

4.3 Light rail vehicle impacts

LRVs are classified by the FRA as noncompliant vehicles to operate on the General Railroad infrastructure because of the FRA's crash worthiness requirements. A waiver would be required for any proposed joint-use line.

For this LRV expansion line, a modified vehicle might be required, that is, one that can adjust the pantograph[2] height to account for the height variance of the contact wire. For example, the San Diego Metro uses the S70 vehicle from Siemens, which can vary the height of the pantograph up to 23 feet.[3] The ability of the existing Sound Transit fleet to meet this requirement of the pantograph system has not been researched, but the requirement for modified vehicles could result in separate fleets and limited flexibility.

4.4 Operations and maintenance

The operations and maintenance (O&M) requirements that would result from joint use of the freight rail track would be varied and could require extensive and constant interoperability with the freight operator.

4.4.1 Operations facility

The LRV operational control center might need to be upgraded to have connections to the freight operator's control center. Sound Transit might be required to hire specific and dedicated dispatchers who would be certified on the general railroad network.

4.4.2 Maintenance

Heavier freight vehicles and mixed traffic would result in increased maintenance costs for the track bed and tracks.

Varied traffic speeds could result in over and under application of superelevation, which would increase rail wear.

Sound Transit operates a 20 hour per day system. The remaining four hours are used for maintenance and relocating train sets. The use of the tracks by a freight operator during this period could impact these operations.

[2] The pantograph is the assembly on the top of the LRV that contacts the overhead power line to run the electric motors. This assembly generally operates within a specific range.
[3] http://www.mobility.siemens.com/shared/data/pdf/sts_usa_internet/san_diego_s70.pdf

5 Conclusions

This Technical Memo highlights the Regulatory Framework imposed by the FRA and the FTA to applicants wishing to operate Light Rail Vehicles jointly with freight rail.

Several of the technical and operational considerations have been discussed, including potential areas of increased capital costs. These considerations are a high level analysis and are therefore not exhaustive.

While feasible from a technical standpoint, the implementation of light rail infrastructure that can also accommodate freight rail in the future would add additional expense to the capital cost of the project. It would also increase the future cost of establishing freight rail in the corridor and may require changes to the Sound Transit fleet.

Temporal segregation of operations on the line would likely be required which would impact Sound Transit operations, whether on passenger operations during the day or maintenance work during night closures. This would also impose operational restrictions on the future freight operator.

A governance structure will need to be established between Sound Transit and the freight operator to ensure one entity has overall responsibility for the operations and maintenance of this section of track.

The lack of a known freight rail operator in this segment adds to the uncertainty because many of these technical and operational solutions would require extensive negotiations with the freight operator.

Decisions made now regarding the build out of the infrastructure for light rail will likely increase the cost to, and impose restrictions on the future freight operator. The ability to impose these constraints must be reviewed in the light of the rail banking agreement.

6 Next steps

There are several key items that need to be understood to further address this issue:

- The terms of the Rail Bank Agreement (not in this scope of work)
- Whether time separation of operations would be acceptable to Sound Transit or the potential freight rail operators, as this is likely to be the only viable option to have a joint used track.
- Review of clearance requirements for the LRV catenary and impacts to Sound Transit infrastructure and future freight operations.