

City of Bellevue

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

**TM13 - B7-Revised Optimization**

215382/TM13

Final | June 2011

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Job number 215382-00

**ARUP**



# Document Verification

# ARUP

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**Issue Document Verification with Document**





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## Appendices

### Appendix A

#### Minutes of B7-Revised Optimization Workshop

# 1 Executive Summary

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This technical memorandum summarizes the early work by the project team in preparing preliminary concepts and solutions for issues related to the B7-Revised alignment and the A-2 Station and park-and-ride design.

The options and alternatives presented in this memorandum were presented to a workshop of City staff on January 13, 2011 with the objective of determining the key constraints to be applied to the alignment and station design.

The conclusions from this technical memorandum and the direction provided by City staff provide input to the development of the alignment and South Bellevue station and park-and-ride.

## **City of Bellevue staff direction for development of the 1% alignment and A-2 Station concept design**

- Do not pursue a split park-and-ride with two stations – one at South Bellevue and one at 118<sup>th</sup> Avenue SE.
- Do not pursue a park and ride station at SE 34<sup>th</sup> Street due to traffic impacts on the residential streets in Enatai.
- Develop the A-2 Station alternative with the proposed Transit Center on the top-level of the park-and-ride facility. This reduces vertical circulation, costs and other dis-benefits associated with a ground floor Transit Center.
- Noise on 113<sup>th</sup> will be a significant concern for the community as this is a climbing grade. Investigate alternative means for bus access to the Transit Center.
- Determine whether a trail will be on west or east of light rail alignment through BNSF corridor. Maintain this profile for the full length of the BNSF corridor.
- Pursue alternatives that avoid acquisition of the ‘Public Storage’ facility at 1111 118<sup>th</sup> Avenue SE, and the Greenbaum Store.
- Use a portal in the Sheraton site to avoid an at-grade crossing at NE 2<sup>nd</sup> Street and 112<sup>th</sup> Avenue SE.
- Do not consider an at-grade crossing of Main Street

## 2 Background

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### 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 project scope of work requires the project team to develop an alternative alignment based on Bellevue City Council direction to modify the East Link DEIS B7 alignment and C9T alignments by the following:

- Near the Bellevue Way/I-90 Interchange, add the SBSALA “A-2” station and park and ride, and adjust B7 light rail line as needed to meet station requirements and provide connectivity from park-and-ride
- On the BNSF ROW, based on independent legal analysis of rail banking status, locate tracks to minimize costs (not necessary to accommodate planned regional trail).
- Exiting the BNSF corridor and travelling north on 118th Avenue SE, locate guideway to minimize property impacts and right-of-way acquisition costs.
- Eliminate 118th Station (as in DEIS B7 alignment)
- At existing Red Lion site, add East Main Station (no park and ride)
- On 114th Avenue NE, transition from elevated to at-grade adjacent to the Hilton Hotel and travel north under Main St. to connect to a NE 2nd Street portal compatible with the C9T tunnel alternative

As part of this process, the project team was tasked with holding a workshop with City and project team staff to optimize the B7-Revised alignment, and subsequently to produce this technical memo describing the results of the B7-Revised Optimization.

## 2.3 Technical memo objectives

The objectives of this technical memo are to:

- Describe the alternatives considered in developing the Bellevue B7-Revised alignment.
- Document the direction received from City of Bellevue staff.
- Describe agreed optimized B7-Revised alignment to progress to 1% concept design

## 2.4 Key meetings and background documents

The following meetings (overleaf) relate to the issues discussed in this technical memo.

Date	Agency/Stakeholder	Attendees
December 16, 2010	City of Bellevue kick-off meeting  City of Bellevue	<p>City Of Bellevue: Maher Welaye (Project Manager), Michael Paine (Environmental Planning Manager), Judith Clark (Transportation Analyst), Franz Loewenherz (Senior Transportation Planner), Carl Wilson (Development Review Professional), Fred Liang (Traffic Signal Engineer), Tresa Berg (Public Involvement Manager), Michael Kattermann (Senior Planner), and Maria Koengeter (Senior Planner Resource lead/Liaison)</p> <p>Consultant Team: Richard Prust (Deputy Project Manager), David Hunt (Engineering Lead), William Baumgardner (Planning Lead), Kittie Ford (Environmental Lead), Chris Hoffman (Public Outreach Lead), Bill Maddex (Cost Lead), Faith Roland (Real Estate), Nicholas Taylor (Project Management/Controls), Ron West (Cambridge Systematics), Corey Wong (Transit Planner), and Colm Tully (Cost Estimator).</p>
January 6, 2011	Sound Transit kick-off meeting  Sound Transit City of Bellevue	<p>Sound Transit: Don Billen (East Link Project Manager), Sue Comis (Segments B and C Project Manager), James Irish (Environmental), Michael Williams (Overview), Brant Lyerla (Traffic Analysis, Transit Integration, Ridership), Katie Kuciemba (Easy Corridor Community Outreach Lead), Wit Ekman (East Link Project Control), and Stephen Mak (Segment B PE Lead).</p> <p>City of Bellevue: Goran Sparrman (Transportation Director), Dave Berg (Transportation Deputy Director), Maher Welaye (City of Bellevue PM), Bernard Van de Kamp (Transportation Regional Projects Manager), and Judith Clark (Transportation Analyst).</p> <p>Consultant team: Richard Prust (Deputy Arup PM), Nicholas Taylor (Project Controls), and Yushuang Zhou (Ridership Forecasting Task Leader)</p>
January 13, 2011	B7-Revised optimization workshop  City of Bellevue	Refer to workshop minutes (Appendix A).

Table 1 - Relevant meetings

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

<b>Document</b>	<b>Referred to in Technical Memo as:</b>	<b>Relevance to Technical Memo:</b>
Central Puget Sound Regional Transit Authority, Washington State Department of Transportation, and Federal Transit Administration, et al (December 2008). <i>East Link Project: Draft Environmental Impact Statement</i> . Seattle, WA: Sound Transit.	DEIS	Provides station program details for South Bellevue Station, used to design A-2 Station
Central Puget Sound Regional Transit Authority, Washington State Department of Transportation, and Federal Transit Administration, et al (October 2010). <i>East Link Project: Supplemental Draft Environmental Impact Statement</i> . Seattle, WA: Sound Transit.	SDEIS	Provides station program details for South Bellevue Station, used to design A-2 Station
City of Bellevue (December 2010). <i>City of Bellevue, Washington Comprehensive Plan</i> . Bellevue, WA: City of Bellevue	City of Bellevue Comprehensive Plan	Describes land use plans around A-2 Station area
City of Bellevue (October 2010). <i>Bellevue City Code – Chapter 20 Bellevue Land Use Code</i> . Bellevue, WA: City of Bellevue	Bellevue City Codes	Details height restrictions around A-2 Station
KPFF (July 2010). <i>South Bellevue Station: Alternative Location Analysis</i> . Bellevue, WA: City of Bellevue Transportation Department.	SBSALA	Presents A-2 Station concept to assess and optimize

Table 2 - Relevant documents and reports

### 3 Sound Transit methodology and data

The project team has been directed by Bellevue City Council to prepare an “apples-to-apples” comparison of the Sound Transit Draft Environmental Impact Statement (DEIS) and Supplemental Draft Environmental Impact Statement (SDEIS) B7 alignment with the B7-Revised alignment. Such a comparison requires consistency of three elements – base data and information, key assumptions, and methodology. The significant aspects of each element are summarized and discussed in this section.

#### 3.1 Base data and information

B7-Revised	B7/C9T	“Apples-to-Apples”	Comment
Not applicable to the B7-Revised optimization study.			

Table 3 - Comparison with Sound Transit DEIS and SDEIS base data and information

#### 3.2 Key assumptions

B7-Revised	B7/C9T	“Apples-to-Apples”	Comment
Sound transit alignment design criteria	Same	Yes	

Table 4 - Comparison with Sound Transit DEIS and SDEIS key assumptions

#### 3.3 Methodology

B7-Revised	B7/C9T	“Apples-to-Apples”	Comment
Not applicable to the B7-Revised optimization study.			

Table 5 - Comparison with Sound Transit DEIS and SDEIS methodology

## 4 Alignment optimization

The B7-Revised alignment is bounded by several key constraints, including:

- Bellevue City Council direction, specifically as to the location of the proposed South Bellevue station and park-and-ride, use of the BNSF alignment, and connection to the C9T alignment.
- Natural features, including the Mercer Slough, Sturtevant Creek.
- Man-made features, including I90, I405, Bellevue Way, Main Street, 2<sup>nd</sup> Street, and the Hilton, Red Lion and Sheraton hotel sites.
- Sound Transit light rail design criteria

In addition, there are undocumented elements of preference and importance to stakeholders. A purpose of the B7-Revised Optimization workshop was to bring these to light through discussion of multiple options. These strong preferences are documented in the following sections of this technical memorandum as City staff direction.

### 4.1 South Bellevue: Option 1

#### 4.1.1 Description

Option 1 re-aligns the B7-Revised alignment locally at the South Bellevue station platform to allow the train platform to be moved west from the A-2 Station reference location.



Figure 1 Option 1 – A-2 Station Approach

### 4.1.2 Key features

- Re-alignment of B7 to suit A-2 Station arrangement
- Horizontal curve at beginning of span across I-90 moved west, increasing span length from the B7 alignment span (+30')
- Horizontal curve at A-2 Station eliminated to meet station track requirements
- Vertically similar to B7 – alignment rises over I-90 west-bound lanes & I-90 EB on-ramp and enters station at 0.5%
- Locating platform after on-ramp reduces overall alignment height
- Aerial structure through Mercer Slough to shared BNSF corridor
- Reduced intrusion into Mercer Slough (closer to I-90 WB lanes)

### 4.1.3 Issues and constraints

- Span length across I-90 greater than in Alignment B7

## 4.2 South Bellevue: Option 2

### 4.2.1 Description

Option 2 investigates solutions which seek to minimize the cost of the light rail structure across westbound I-90 by reducing the span.



Figure 2 Option 2

## 4.2.2 Key features

- Horizontally optimized version of Option 1
- Horizontal curve added after crossing I-90, allowing the platform to be moved further to the north and minimizing the walking bridge length
- Vertically similar to Option 1 – clearances over I-90 lanes and on-ramps, span length across I-90 similar to B7 alignment
- Aerial structure through Mercer Slough to shared BNSF corridor
- Similar to horizontal alignment of B7 through Mercer Slough

## 4.2.3 Issues and constraints

- Horizontal alignment more restricted than in Option 1 to allow adequate tangent lengths at Station 2

## 4.3 South Bellevue: Option 3

### 4.3.1 Description

Option 3 re-aligns the B7-Revised alignment locally to take advantage of running at-grade (or in a low elevated section) along SE 34<sup>th</sup> Street. This option corresponds with the A-2 Station option 4.



Figure 3 Option 3 – A-2 Station and Scheme 4 Approach

### 4.3.2 Key features

- Proposed span across I-90 WB lanes after crossing Lake Washington

- Alignment follows 34<sup>th</sup> street on aerial structure
- Provides optimized location for A-2 Station (minimizes walking bridge length over Options 1 and 2) and for possibility of alternate option over current 34<sup>th</sup> street location

### 4.3.3 Issues and constraints

- Increased height of aerial structure required for adequate clearance over I-90 WB lanes
- Span length much greater than B7 and Options 1-2 (+100-130', 430'). May require a change in structure type (steel)

## 4.4 South Bellevue: Option 4

### 4.4.1 Overview

Figure 4 illustrates conceptually the direction provided to the project team for the alignment in the vicinity of the Red Lion site at Main Street and 112<sup>th</sup> Avenue. There are a number of viable station locations and alignments between 114<sup>th</sup> Avenue SE from south of the Bellevue Hilton site to the proposed C9T portal location at NE 2nd Street and 112<sup>th</sup> Avenue NE, including a station located on the Sheraton site.

Constraints governing the station location include the salmon-bearing Sturtevant Creek to the south, and the Main Street I-405 bridge structure.

The project team outlined at-grade alternatives along 112<sup>th</sup> Avenue NE, as well as the potential for locating a station at the Sheraton site rather than the Red Lion site.



Figure 4 East Main Station and alignment

## 4.5 Mercer Slough crossing

### 4.5.1 Environmental issues

Alignment optimization by moving the light rail alignment away from the I90 transportation corridor north into the Mercer Slough was considered by the project team and then rejected.

Mercer Slough is both a highly valued local resource, and a Category 1 (the highest level of protection) wetland. For B7, the Federal Highway Agency agreed with Sound Transit's determination that there was a de minimis effect for the B7 elevated alignment across the Mercer Slough. There was no constructive use, due to the proximity of I-90. Locating the alignment further from I-90 would likely change this determination.

Shadow cast on wetland from the structure will be a consideration, as are all structures over aquatic resources. The lower the structure; the greater the shading effect. OTAK in a August 2010 memorandum to the City of Bellevue considered that the DEIS B7 elevated structure was at a high enough elevation, that there was no adverse impact.

### 4.5.2 Geotechnical issues

As an approximate characterization, the Mercer Slough is 60' peat and 60' soft clay. The existing I-90 foundations are 4 x 12" diameter driven piles, 120' deep.

The foundation solution that was developed for the Link light rail crossing of the Duwamish waterway (which has very similar ground conditions), was 8' and 10' diameter drilled shafts. The Duwamish crossing, like I-90, is located adjacent to the Seattle Fault.

During analysis of the large diameter drilled shafts for the Duwamish crossing it was evident that during the design earthquake there was no lateral support from 60' to 80' below the surface. As a result, ground modification was required in the form of a 50' diameter matrix of stone columns creating a stable earth mass.

In addition to issue related to earthquake design, at the Mercer Slough crossing WSDOT has experienced movement of the I-90 structures as a result of seasonal movements of the peat towards Lake Washington, thought to be related to fluctuations in the lake level.

It is likely that the solution of large diameter drilled shafts and ground improvement will be appropriate for B7 revised. The solution has environmental impacts during construction related to the pier construction, and has potential permanent impacts related to drainage which will be further investigated. Wider spans would minimize the number of piers needed, but equally there will be a trade-off between span length and foundation cost. Pier spacing will be considered in subsequent work by the project team developing from the 1% alignment.

## 4.6 BNSF corridor

The BNSF corridor is defined by the alignment description and there is some scope for optimization of the alignment to reduce the extent of earthworks and structures. Future development of the alignment will investigate retaining structure options, and local optimizations to the alignment.

## 4.7 114<sup>th</sup> Avenue SE: Wilburton to Red Lion

Future development of the alignment will investigate mitigations required along 114<sup>th</sup> Avenue SE, which include consideration of Sturtevant Creek adjacent to, and south of, the Bellevue Hilton site.

## 5 Station optimization

### 5.1 Background

During the summer of 2010, the Bellevue City Council commissioned several consultant studies of the B7 alignment. One of these consultant studies included feasibility analysis of alternative station and park-and-ride locations to the existing South Bellevue park-and-ride facility.

The consultant's report identified a number of potential station options. The preferred option was the A-2 Station configuration located to the west of Bellevue Way, just north of the I-90 interchange.

The B7-Revised project team was tasked with further developing the design and transportation analysis which was identified as required by the previous consultant.

#### 5.1.1 A-2 Station challenges

Section 6 of the A-2 Station study (SBSALA, 2010) describes the issues of feasibility associated with construction and operation of the proposed A-2 Station. Both Sound Transit and the project team independently reviewed these challenges. The project team identified the following aspects of the A-2 Station design which could be optimized within the direction provided for the B7-Revised alignment.

Issues to be addressed with A-2 Station	
<b>Covered Transit Center at Level 1</b>	<ul style="list-style-type: none"> <li>▪ Unpleasant waiting experience</li> <li>▪ Inconvenient rail-to-bus transfer</li> <li>▪ High elevator loads during peaks</li> <li>▪ Park and ride walk across bus paths</li> <li>▪ Covered transit center requires two levels to remove stalled buses – removing potential parking capacity above the transit center</li> </ul>
<b>Pedestrian Bridge Configuration</b>	<ul style="list-style-type: none"> <li>▪ Crosses I-90 ramp at higher elevation</li> <li>▪ Increases walk distance to/from the east end of the platform</li> </ul>
<b>Configuration of road to north of park and ride lot</b>	<ul style="list-style-type: none"> <li>▪ Traffic circle configuration requires additional land that could be part of the parking structure</li> </ul>
<b>Height of Station Platform</b>	<ul style="list-style-type: none"> <li>▪ Pedestrian bridge configuration drives a higher station platform</li> </ul>
<b>Costs</b>	<ul style="list-style-type: none"> <li>▪ High construction cost</li> </ul>

Table 6 Issues to be addressed through optimization of A-2 Station

## 5.2 A-2 Station program requirements

The South Bellevue Station Alternative Location Analysis assumed the same program elements as for the existing South Bellevue Park & Ride. These program elements are extracted in Table 7. The program requirements will be reviewed and confirmed in the Station Concept Report (Technical Memorandum 03).

A-2 Station program requirement	
<b>Parking Spaces</b>	<b>1,400</b>
<b>Kiss and Ride / Waiting Zones</b>	
<b>Transit Facilities</b>	
Arrival/departure bus bays	2
Layover bus bays	5
Trips/hour:	26 trips (9 routes)
<b>Paratransit Facilities</b>	
Van access bay:	1
Layover bus bays	5
<b>Bike lockers</b>	<b>45</b>

Table 7 A-2 Station program requirements (SBSALA, 2010)

## 5.3 A-2 Station costs

The South Bellevue Station Alternative Location Analysis assessed the total cost of the A-2 Station at \$166 million. Significant components of that cost included the parking garage structure, station, Bellevue Way access bridge and ROW take as summarized below.

A-2 Station element	Construction Cost (\$m)
Parking Garage	\$37.4
Aerial Station (includes \$10 million add-on for side platform configuration, and assumes mezzanine for ticketing, etc.)	\$43.0
Roadway Bridge	\$10.1
ROW Take (13 parcels)	\$13.2

Table 8 A-2 Station - Significant Cost Components

In comparison, the Sound Transit B7 DEIS cost for 118<sup>th</sup> Station is \$115 million, while that for South Bellevue Station (B2M) is \$129 million.

Opportunities to reduce A-2 Station costs by modifying station configuration are explored in the subsequent sections. An update of the A-2 Station cost estimate will be presented in technical memo TM05 which examines the A-2 Station cost.

## 5.4 Option 1 – Optimized A-2

### 5.4.1 Description

This option has minor modifications to the original A-2 Station concept presented in the South Bellevue Station Alternative Location Analysis. Option 1 does not provide access to the transit or parking facilities from 113<sup>th</sup> Avenue SE.

Option 1 includes another difference from the earlier A-2 Station concept, in that the station is ‘center loaded’ from the pedestrian bridge. In other respects, this design option represents the baseline reference for the design team from which to assess further optimizations.

Option 1 is illustrated in

Figure 5, Figure 6, and Figure 7. Key features, opportunities, and constraints are highlighted in this section.

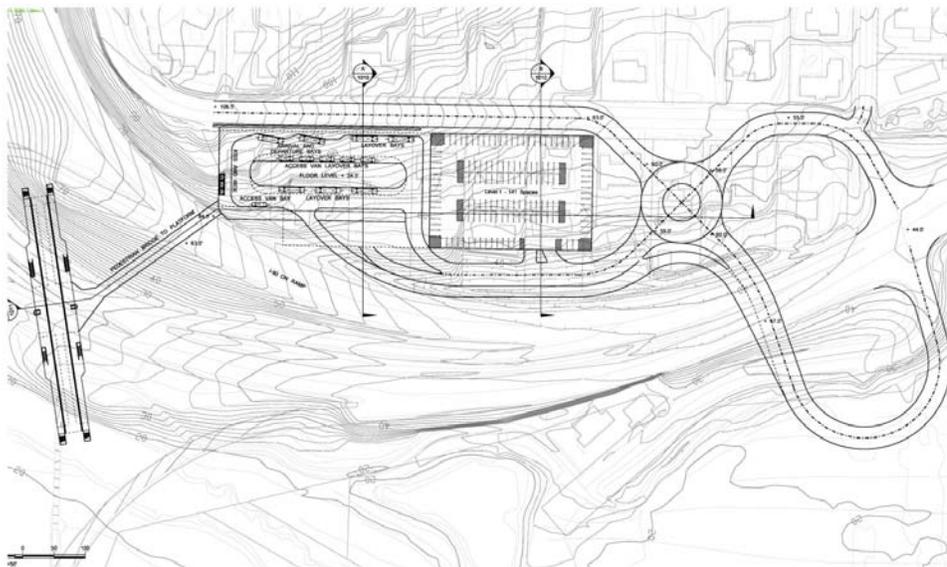


Figure 5 Option 1 – Basement level 1 showing transit facility

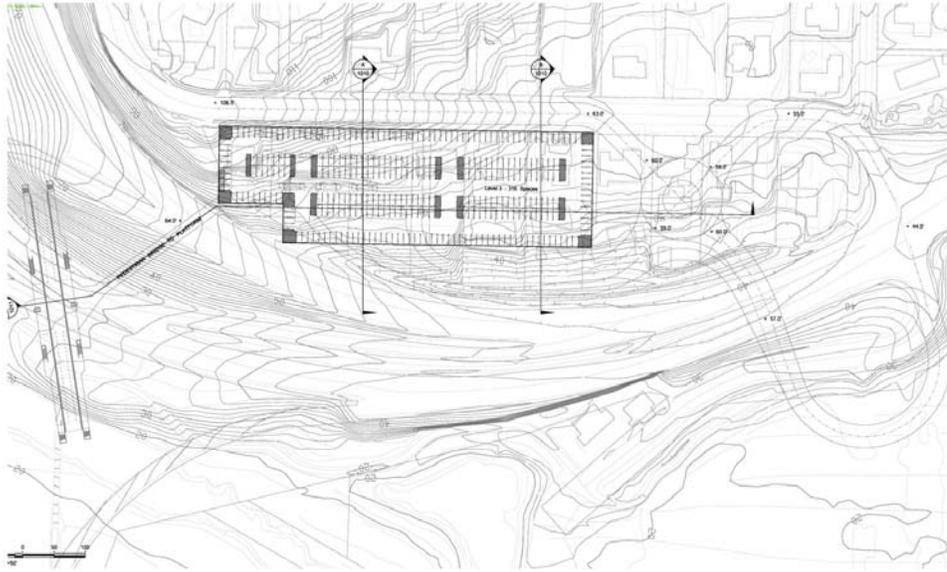


Figure 6 Option 1 – Parking levels

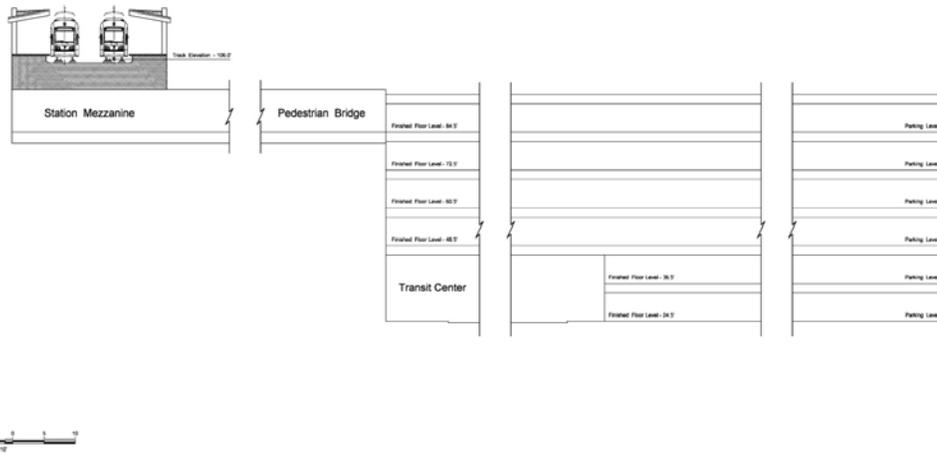


Figure 7 Option 1 –Profile view

### 5.4.2 Key Features:

- Number of levels: 6
- Transit Center Location: Level 1
- Transit Center Access: Level 1
- Kiss & Ride Location: Level 1
- Levels of Parking: 2 partial floors, 4 full floors
- Parking Access: Level 1 (entry/exit) and Level 3 (exit only)
- Station Platform Configuration: Side

### 5.4.3 Opportunities

- Provides full station functionality within envelope
- Keeps traffic off of 113<sup>th</sup> and away from residents (although could provide access to parking off 113<sup>th</sup>)
- Bridge angled to cross I-90 EB on-ramp at lower elevation

### 5.4.4 Constraints

- Transit center on Level 1 requires double height space to remove disabled vehicles and mechanical ventilation (ST concern)
- Dark and uninviting transit center
- Patrons must walk across bus lanes to transfer or get to parking
- Pedestrian bridge at Level 6 requires transit riders to use elevators
- Elevators must handle transit and P&R users
- Roundabout reduces usable area for parking
- Side platform requires double the vertical circulation elements that a center platform would (4 stairwells, 2 escalators, 2 elevators)

## 5.5 Option 2: Transit center on top floor of facility

### 5.5.1 Description

Major challenges with the reference A-2 Station concept include the uninviting waiting environment, inconvenient transfers, and the need to provide sufficient vertical circulation elements to reach the transit facility, which is 6 floors below the station access bridge.

Option 2 presents a refinement of Option 1 with the transit facility on the top level of the park-and-ride garage, with access for public transit vehicles provided off 113<sup>th</sup> Avenue SE.

Option 2 is illustrated in Figure 8, Figure 9, and Figure 10. Key features, opportunities, and constraints are highlighted in this section.

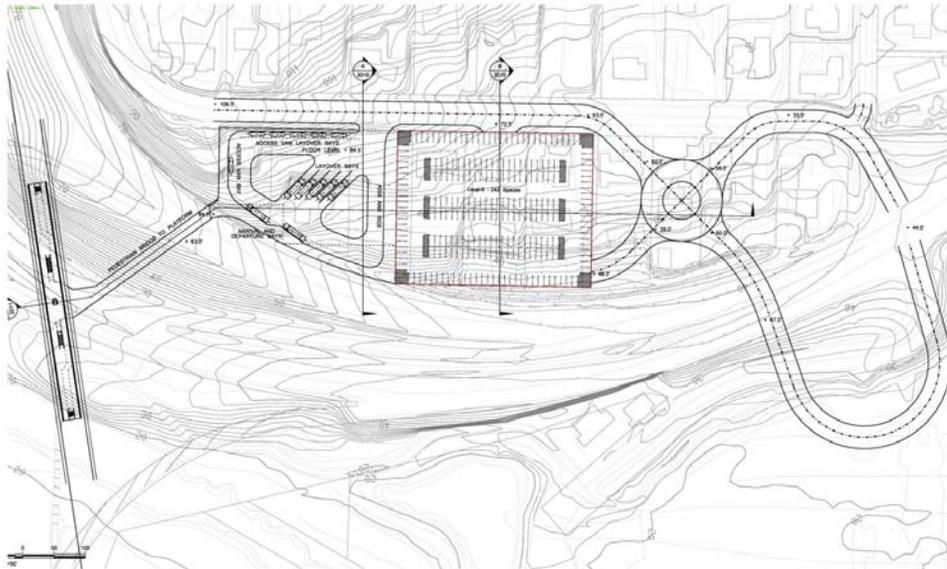


Figure 8 Option 2 – Level 6 showing transit facility

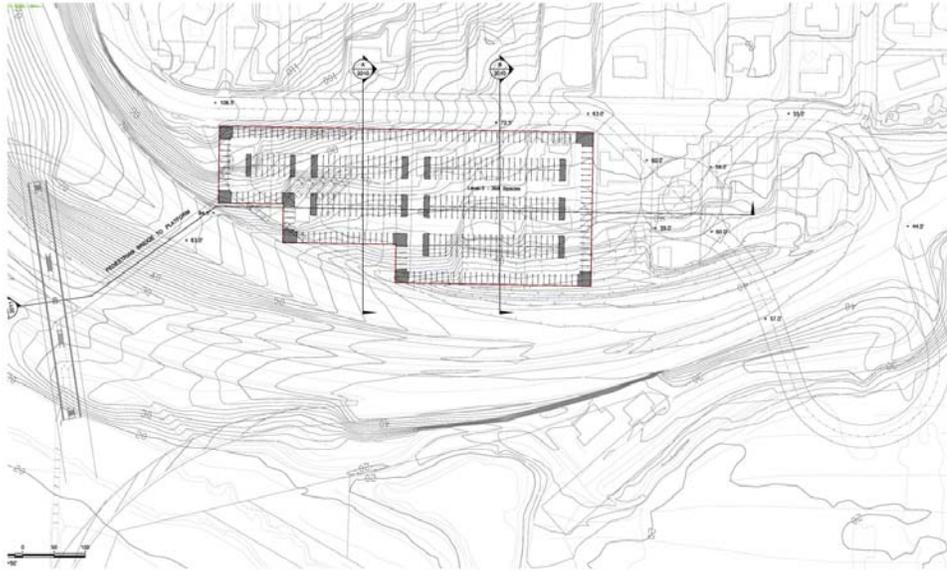


Figure 9 Option 2 – Parking levels

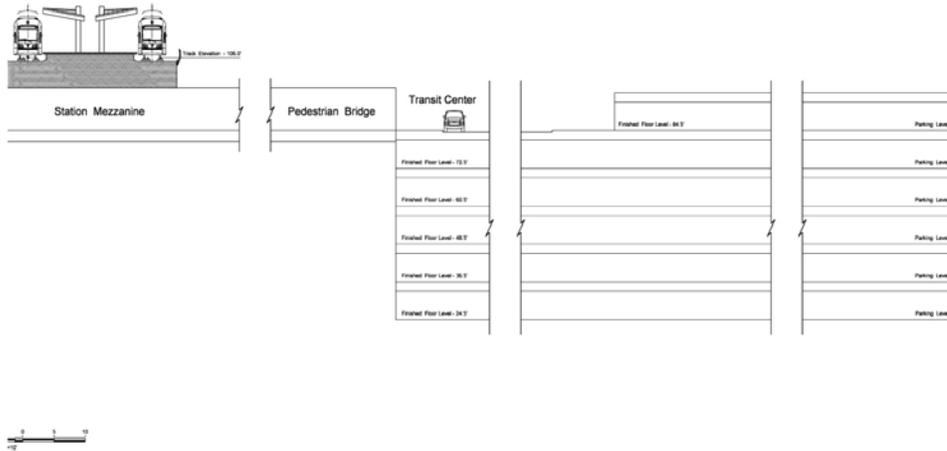


Figure 10 Option 2 – Profile view

### 5.5.2 Key Features:

- Number of levels: 6
- Transit Center location: Level 6
- Transit Center access: 113<sup>th</sup> Avenue SE
- Kiss & Ride location: Level 6 along the north drop-off curb
- Levels of parking: 5 full floor and 1 partial floor (Level 6)
- Parking Access: Level 5 from 113<sup>th</sup> and Level 3 from roundabout
- Station Platform Configuration: Center

### 5.5.3 Opportunities

- Shorter rail-bus interface for more efficient transfers
- Open air transit center provides more pleasant waiting environment
- Patrons do not need to cross bus paths
- Center platform reduces vertical circulation elements
- Ramps on east side eliminated to provide more room for parking
- Bridge angled to cross I-90 EB on-ramp at lower elevation

### 5.5.4 Constraints

- Center platform may require slight alignment shift
- Roundabout reduces usable area for parking
- Bus operations on 113<sup>th</sup> may disturb residents
- Additional Park & Ride traffic on 113<sup>th</sup> Avenue SE
- Wayfinding system needed to show open parking spaces

## 5.6 Option 3: Optimized parking facility

The roundabout shown in the reference A-2 Station concept presents challenges to public transit and private vehicle movement. This road configuration also occupies land that could be used for the parking structure. Option 3 refines Option 2 to show a re-configured access road network to the north of the park-and-ride facility.

Option 3 is illustrated in Figure 11, Figure 12, and Figure 13. Key features, opportunities, and constraints are highlighted in this section.

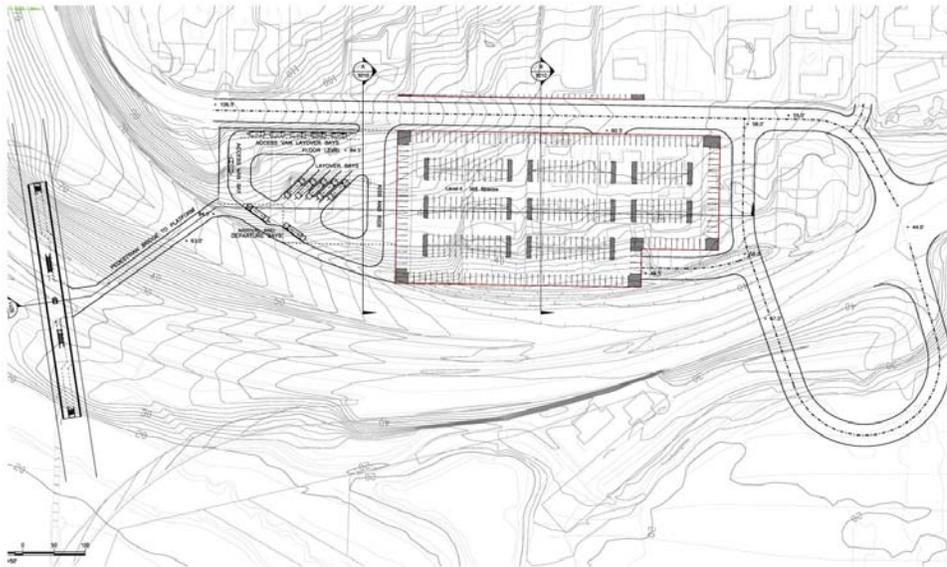


Figure 11 Option 3 –Top level 1 showing transit facility

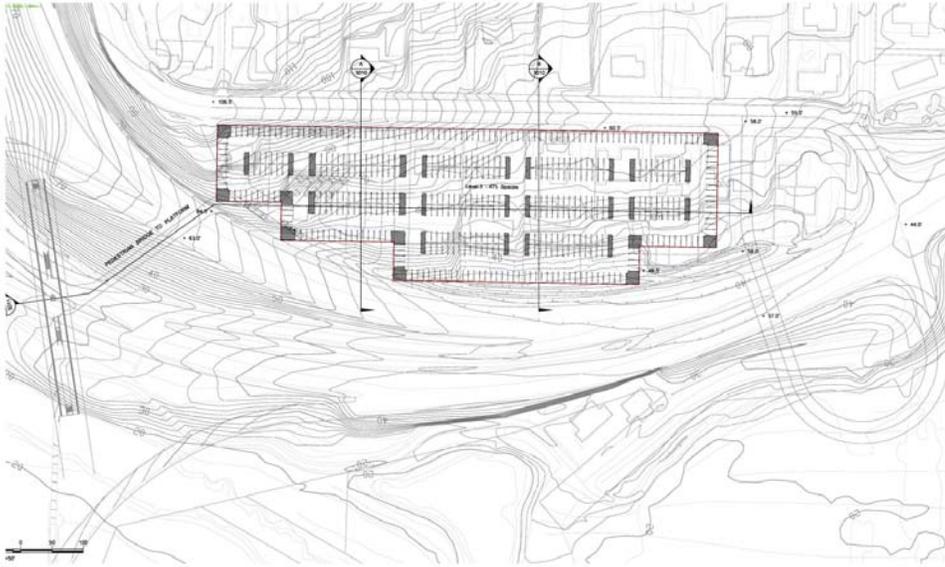


Figure 12 Option 3 – Parking level

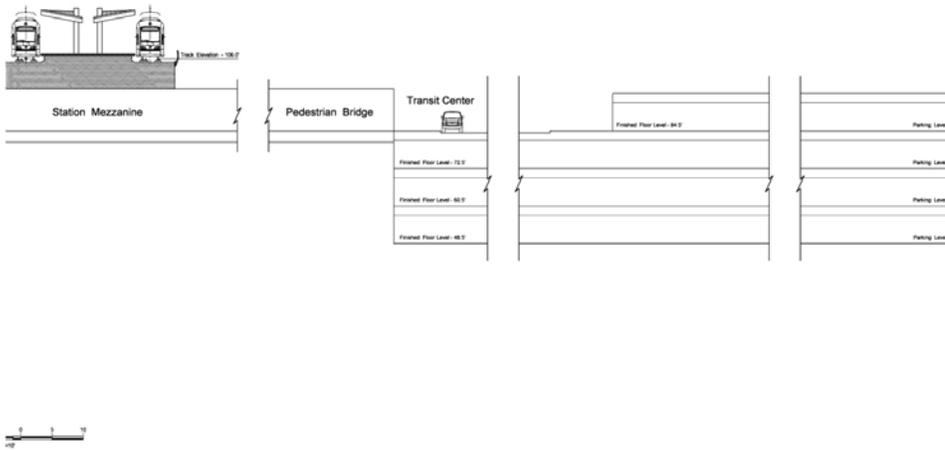


Figure 13 Option 3 – Profile view

### 5.6.1 Key Features:

- Number of levels: 4
- Transit Center location: Level 4
- Transit Center access: 113<sup>th</sup> Avenue
- Kiss & Ride: North drop-off curb
- Levels of parking: 3 full floors and 1 partial floor
- Parking access: Level 2 from 113<sup>th</sup> and Level 1 from T-junction
- Station platform configuration: Center

### 5.6.2 Opportunities

- “T”-junction instead of roundabout reduces wasted area (adding nearly 200 feet of length in north direction for parking)
- Parking structure only 4 levels, significantly reducing cut and costs
- No ramps on east side which allows more room for parking
- Provides similar benefits as Option 2

### 5.6.3 Constraints

- Center platform potentially requires slight shift in alignment
- Bus operations on 113<sup>th</sup> may disturb residents
- Additional Park & Ride traffic on 113<sup>th</sup> Avenue SE

## 5.7 Option 4: SE 34<sup>th</sup> Street and 112<sup>th</sup> Avenue SE station and park-and-ride

### 5.7.1 Description

As part of the optimization process, station cost savings could potentially be realized by moving the station platform west, where an at-grade, or substantially lower elevated platform, would be feasible.

Option 4 investigates the impacts of a station location at SE34th Street and 112<sup>th</sup> Avenue SE. This option is illustrated in Figure 14.



Figure 14 Option 4 – Footprint

### 5.7.2 Key Features

- New station aligned along SE 34th Street
- Transit center and parking lot directly north of station, centered on 112<sup>th</sup> Avenue SE
- Transit center at Level 1, with four levels of parking on top

### 5.7.3 Opportunities

- Reduces walking distance for P&R users
- Enhanced bus connections from the rail station

### 5.7.4 Constraints

- Increased neighborhood traffic including bus circulation
- Parking lot would need to adhere to height limitations which could require additional cut and costs
- Alignment must “leave” central reserve of I-90 earlier
- Potentially longer bridge spans over I-90

## 5.8 Option 5: Split park-and-ride facility

### 5.8.1 Description

While recognizing City Council direction to eliminate 118<sup>th</sup> Station, the project team felt there was merit in exploring options to reduce parking requirements at A-2.

This option assumed the A-2 Station configuration with a reduced number of parking stalls (750 compared to 1,400). This would reduce the cost of the A-2 parking facility by both reducing the size of the parking structure required, and minimizing excavation requirements.

To compensate for the lost parking stalls, the 118<sup>th</sup> Station would be retained with a 750 stall parking structure. The proposed station at East Main would be eliminated.

This option is illustrated in Figure 14.

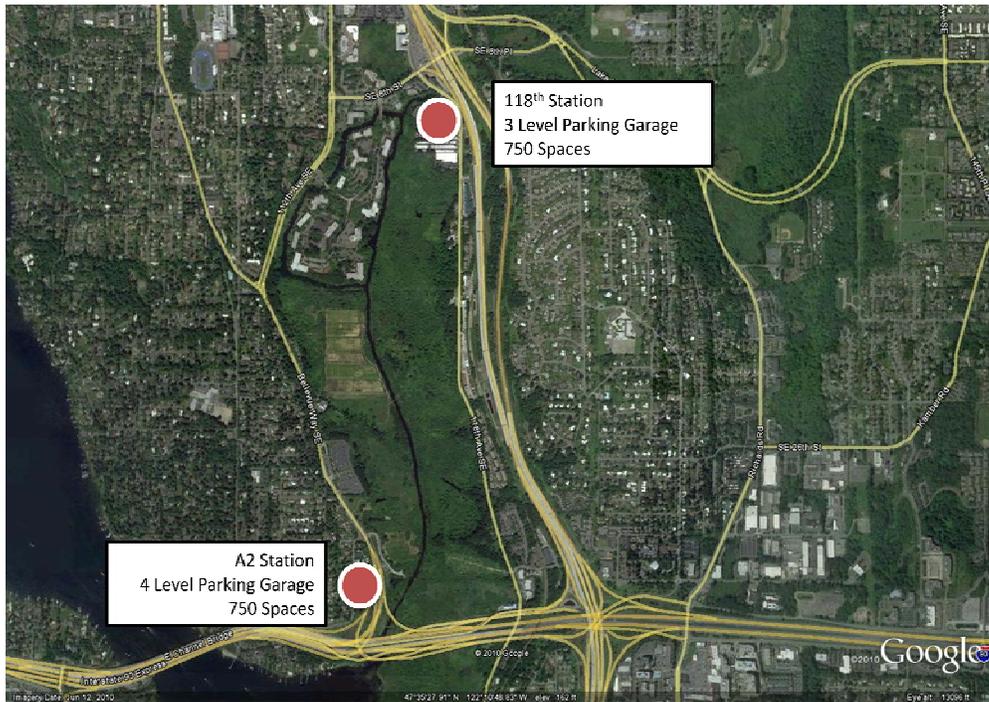


Figure 15 Configuration of split B7-revised park-and-ride configuration

### 5.8.2 Key Features:

- A2 and 118<sup>th</sup> Station included in B7-Revised Alignment
- Both stations act as park-and-ride with 700-750 spaces each
- East Main Station is removed

### 5.8.3 Opportunities:

- Reduced traffic impacts around A-2 Station

### 5.8.4 Constraints:

- Poorer walk/bike access to 118<sup>th</sup> compared to East Main (which is only 15% auto) – potential for decreased ridership
- Limited transit oriented development (TOD) opportunities around both South Bellevue station and 118<sup>th</sup> Station
- Potentially increased construction cost as a result of developing two sites and two elevated stations.
- Full taking of Greenbaum furniture store

## 6 Conclusions

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The options outlined in Sections 4 and 5 of this technical memorandum were presented to a workshop of senior City of Bellevue staff. The objective of this workshop was to confirm the project alignment constraints and seek direction on less-defined alignment drivers. Key conclusions follow:

- Proceed with development of the A-2 Station on the basis of a Transit Center at the top of the park-and-ride facility, to avoid vertical circulation costs and other dis-benefits associated with the ground floor Transit Center.
- Do not to pursue a split park-and-ride with two stations – one at South Bellevue and one at 118<sup>th</sup> Avenue SE.
- Noise on 113<sup>th</sup> will be a significant concern for the community as this is a climbing grade. Investigate alternative means for bus access to the Transit Center. From a neighbourhood perspective there should be no access off 113<sup>th</sup> Avenue SE.
- Determine whether trail will be on west or east of light rail alignment through BNSF corridor. Maintain this profile for the full length of the BNSF corridor.
- Pursue alternatives that avoid acquisition of the ‘Public Storage’ facility at 1111 118<sup>th</sup> Avenue SE.
- Use a portal in the Sheraton site to avoid an at-grade crossing at NE 2<sup>nd</sup> and 112<sup>th</sup> Avenue SE.
- Do not consider an at-grade crossing of Main Street

## **Appendix A**

### **Minutes of B7-Revised Optimization Workshop**



# Minutes



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<b>Project title</b>	B7-Revised Concept Study	<b>Job number</b>
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<b>Meeting name and number</b>	B7- Revised Optimization Workshop	<b>File reference</b>
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<b>Location</b>	City of Bellevue - Rm 1E-118	<b>Time and date</b> 8.00 am January 13, 2011 to 12.00am
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<b>Purpose of meeting</b>	Optimize B7-Revised alignment and stations	<b>Page 1 of 9</b>
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**Attendance**

**City Of Bellevue:**  
Maher Welaye – Project Manager  
Tresa Berg – Public Involvement Manager  
Bernard Van de Kamp – Transportation Regional Projects Manager  
Dave Berg – Transportation Deputy Director  
Judith Clark – Transportation Analyst  
Carol Helland – DSD Land Use Director  
Michael Kattermann – Senior Planner  
Maria Koengeter – Senior Planner (Resource lead/Liaison)  
Franz Loewenherz – Senior Transportation Planner  
Carl Wilson – Development Review Professional

**Arup Team:**  
Richard Prust – Arup / Deputy Project Manager  
David Cotton – Kleinfelder / Geotechnics  
Kittie Ford – Herrera / Environmental Lead  
David Hunt – Arup / Engineering Lead  
Faith Roland – Roland Resources / Real Estate  
Nicholas Taylor – Arup / Project Management/Controls  
Corey Wong – Arup / Station Planning  
Yushuang Zhou – Cambridge Systematics

**Apologies**

**Circulation** Those attending

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<b>Prepared by</b>	Nicholas Taylor
<b>Date of circulation</b>	January 25, 2011
<b>Date of next meeting</b>	See meeting schedule

<b>Project title</b>	<b>Job number</b>	<b>Date of Meeting</b>
B7-Revised Concept Study	215382-00	January 13, 2011

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**Action**

**1. Establish ground rules**

REP gave a short project update, noting that since mid-December the project team has been collecting existing information from the City and from publicly available data sources. The team met with Sound Transit on 6<sup>th</sup> January and are now receiving project information from Sound Transit. The Sound Transit meeting also kicked-off the ridership and traffic planning discussion. Significantly, Sound Transit have asked that their consultant (CH2MHill) run the models – and while this may impact how the project team are able to use the results, it shouldn't affect the schedule.

REP explained that the purpose of the current B7-Revised Optimization workshop was for the Arup team to share their preliminary work on the alignment, look at possible alternatives, and hone in on a preferred alignment with direction from City staff.

By the “Tipping Point” in April 2011, the project team will have completed a reasonable amount of the alignment work and station work, and will be able present information for the Council to take a view on whether B7-Revised is significantly better, on par, or worse when compared to B7.

MW added that there is an open house scheduled for 25 January 2011 which the team has been working on during the week. Also ongoing with City staff is a discussion of rail banking working towards a council update on 4 February 2011.

**2. Alignment Alternates**

**2.1 Discussion of general alignment issues/constraints**

**2.2 Station A-2 and approaches (I-90 corridor)**

See attached presentation by David Hunt (Engineering Lead), noting:

*Option 1 Q&A*

- Preserves HOV access (no change to I-90)
- Same speed as B7 (it is already a reduced line speed)
- Optimization of the alignment might be possible through having a steeper station grade. This might be a deviation to request (if

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**Action**

cost saving is significant). An LRT station on a grade would not be unusual for a LRT system.

*Option 2 Q&A*

- This option brings the station further north, approximately 50 ft closer to the station/park-and-ride.

*Option 3 Q&A*

Similar long-span crossing can be seen on the link light rail system at Seatac Airport / SR-518. Suggestion raised that team could request costs for that structure from Sound Transit.

Noted that there is a significant retaining structure separating I-90 from the Enatai properties to the north. Query whether the proposed option is feasible.

Noted that the abutment for the I-90 crossing to Mercer Island is just to the east of 108<sup>th</sup> Avenue SE. Question raised whether this is a fatal flaw with this option.

## 2.3 Mercer Slough

*Environmental issues*

KF described some of the significant aquatic and wetland issues with crossing the Mercer Slough which is both a highly valued local resource, and a category 1 (the highest level of protection) wetland.

The further away the alignment is from the existing I-90 transportation corridor, the higher the level of environmental scrutiny will be.

For B7, the Federal Highway Agency agreed with Sound Transit's determination that there was a de minimis effect for the B7 elevated alignment across the Mercer Slough. There was no constructive use, due to the proximity of I-90.

The further away from I-90 that the revised alignment is placed, the greater chance of tipping into a higher Section 4(f) category.

FR noted that there were also state and county bond fund issues (besides the environmental impacts).

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OTAK disagreed with the Sound Transit assessment in a few areas, notably that since the construction impacts last longer than 1 year, they should be considered as permanent impacts.

Essentially “closer is better from both a Federal and City perspective” for the location of the B7-Revised alignment. Though it is not impossible to justify an alternative de minimis solution. KF noted that there are already significant Section 4(f) issues with B2M.

Shadow cast on wetland from the structure will be a consideration, as are all structures over aquatic resources. The lower the structure, the greater the shading effect. OTAK felt the B7 elevated structure was high enough that there was no impact.

An observation was made that the proposed South Bellevue station was likely high enough to create a “visual blight”. The project team noted that station visualizations are included in the project scope, in part to address this issue.

*Geotechnical issues*

DC described some of the geotechnical issues and an outline solution for crossing the Mercer Slough. He explained that between 1978 and 1982 he was part of the design team for the WSDOT I-90 improvements in specifically the area under consideration. DC has had conversations recently with WSDOT, and noted WSDOT’s Tom Badger had given a presentation to the City (and Sound Transit) on the geotechnical issues in the I-90 corridor.

The Mercer Slough is approximately 60’ peat and 60’ soft clay.

The existing I-90 foundations are 4 x 12” diameter piles, 120’ deep. DC likened this to a foundation of spaghetti-like slender sticks ie very long and slender structural elements.

The WSDOT annual review of critical structures found that the I-90 piers were ‘walking off’ the foundations. The peat below was moving (flowing) en mass, pulsing with groundwater variation. This was moving the piers.

The solution that was developed for the Link light rail crossing of the Duwamish waterway (which has very similar ground

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conditions), was 8' and 10' diameter drilled shafts.

The Duwamish crossing, like I-90, is located adjacent to the Seattle Fault. Sound Transit established the following specific seismic design criteria for the fault (as none existed previously):

Maximum Probable: Functional

Maximum Credible: No collapse

During analysis of the large diameter drilled shafts it was evident that during the design earthquake there was no lateral support from 60' to 80' below the surface. As a result, ground modification was required in the form of a 50' diameter matrix of stone columns creating a stable earth mass.

This solution has a temporary environmental impact increase at each pier location. Wider spans could minimize the number of piers needed.

There will be a trade-off between span length and foundation cost. Typically spans are 100' for simple foundations and 300' across the Duwamish.

DH asked whether there was a step in foundation cost with increased pier height. DC noted that there is a height limit for the alignment, as at a certain point the site period translates to resonance and amplifies seismic motion.

Understanding the Sound Transit foundation assumption is very important. The geotechnical design described by DC might be an additional cost to what Sound Transit has costed in the B7 cost estimate.

DC (Kleinfelder)

Possible impact to Sound Transit structures is a significant issue. The City noted that WSDOT was very concerned over recent proposals to add rip-rap close to the I-90.

There was a short discussion about restoration of the disturbed area after construction of the stone columns. DC explained that the foundations could be constructed either 'constrained' or 'unconstrained' referring to whether the peat could flow out of the boring or whether it had to be controlled. If constrained it would add significantly to the cost of the foundations. KF noted it should be assumed that the construction would have to be constrained.

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## Action

Also noted was the possible need for a temporary haul road to construct the foundation. DH did not believe a permanent roadway would be required for emergency access.

Noted that additional parapet structure might be needed to mitigate derailment on the elevated guideway during a seismic event.

## 2.4 BNSF corridor

### Presentations of possible optimizations and discussion

See attached presentation.

#### *Discussion*

FR requested a copy of the whole WSDOT agreement with the Port of Seattle regards the Wilburton Crossing. It was noted that the whole agreement is available on the Port of Seattle website.

#### *I-405*

Discussion about extent to which I-405 masterplan build-out has been completed adjacent to BNSF corridor. This will be discussed with WSDOT.

#### *Shared corridor*

To provide for heavy rail means a deeper formation and heavier structures to accommodate both light and heavy rail. The team will investigate the feasibility of the heavy rail connection at the I-90/I-405 interchange, but will not complete a detailed design.

#### *Trail*

Discussion about whether removing the trail allowed for a fair comparison with B7.

ST (unwritten) policy is that they don't share track. City staff discussed the issues that may arise if the project team does not

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include a trail in the BNSF corridor. Sound Transit policy is not to share right of way.

Weaving of the alignment (ie trail on both left and right of tracks) makes it complicated to share rail and trail. The team needs to decide overall whether it is better overall for the trail to be on the west or east of the tracks and apply that section along the full length of the BNSF corridor in order to share the corridor as required by rail banking.

City staff noted that the team is between a “rock and a hard place” ie rail banking legal requirements to make provision for a trail versus Council direction. This is a very clear risk to the “apples-to-apples” comparison.

Sound Transit’s assumption is that the whole storage facility on 118<sup>th</sup> Avenue SE needs to be acquired. City staff suggested the team look at ways in which that acquisition can be avoided.

**3. 10.15am Alignment Alternates continued**

**3.1 BNSF corridor to East main and station**

The team will be looking at options which include having the station on the Sheraton site rather than the Red Lion site. YZ noted there was unlikely to be any real preference in ridership between either site.

A portal in the Sheraton site would minimize/avoid an at-grade crossing of Main Street.

City staff directed the project team to avoid an at-grade crossing at NE 2<sup>nd</sup> and 112<sup>th</sup> Avenue SE.

It was noted that there was a salmon-bearing stream parallel to 114<sup>th</sup> Avenue SE at the Hilton site. The stream daylight west of 11<sup>th</sup> Avenue SE and is salmon bearing to the piped culvert where it crossed under I-405.

There was a short discussion about possible ways to address this. Project team to investigate possible environmental mitigation approaches and implications. Noting that this was an issue of widening of an existing infrastructure corridor.

KF (Herrera)

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**Action**

Noted that Sound Transit chose to have B7 elevated in this section in part to avoid issues with the salmon bearing stream.

**4. 10.45am Station Alternatives**

**4.1 Discussion of general station issues/constraints**

**4.2 A2 – Optimization alternatives**

See attached presentation by Corey Wong (Station Planner).

*Station options Q&A*

No signal is permitted on Bellevue Way due to queuing issue concerns from WSDOT.

Team should document operational cost impact.

CW (Arup)

Noted that KPFF were tasked with achieving minimal visual intrusion in developing options for the South Bellevue station.

Noise on 113<sup>th</sup> will be a significant concern for the community as this is a climbing grade. City staff directed the project team to investigate alternative means for bus access. From a neighbourhood perspective there should be no access off 113<sup>th</sup> Avenue SE.

CW (Arup)

The City has no desire for a park-and-ride facility in downtown Bellevue ie at Main Street.

There was a discussion as to the opportunities to use the existing park-and-ride facility on Bellevue Way with the transit penalties mitigated by a moving walkway/personal rapid transit (PRT). Though possible that the saving in park-and-ride cost might offset additional inter-facility costs, it was unlikely that the transit penalties could be overcome. Project teams directed to assume that existing South Bellevue park-and-ride will be abandoned.

City staff directed that the project team proceed with the transit center at the top of the transit center, to avoid vertical movement costs associated with the ground floor transit center.

Project team directed not to pursue a split park-and-ride with two stations – one at South Bellevue and one at 118<sup>th</sup> Avenue SE. Council has been very clear in direction that there is to be no 118<sup>th</sup> Avenue SE station.

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**Action**

**4.3 Other Alternatives**

See presentations of other station alternatives

**5. Next actions**

City staff direction as minuted in above notes.