

INTERSTATE 5 - COLUMBIA RIVER CROSSING

Cost Risk Assessment

Risk Assessment by HDR | HLB Decision Economics Inc.

CRA Workshop Held July, 24 2007

Draft CRA Report

Route: Interstate 5

Official Project Title: Interstate 5 - Columbia River Crossing

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TO: Readers of the CRC Technical Reports
FROM: CRC Project Team
SUBJECT: Differences between CRC DEIS and Technical Reports

The I-5 Columbia River Crossing (CRC) Draft Environmental Impact Statement (DEIS) presents information summarized from numerous technical documents. Most of these documents are discipline-specific technical reports (e.g., archeology, noise and vibration, navigation, etc.). These reports include a detailed explanation of the data gathering and analytical methods used by each discipline team. The methodologies were reviewed by federal, state and local agencies before analysis began. The technical reports are longer and more detailed than the DEIS and should be referred to for information beyond that which is presented in the DEIS. For example, findings summarized in the DEIS are supported by analysis in the technical reports and their appendices.

The DEIS organizes the range of alternatives differently than the technical reports. Although the information contained in the DEIS was derived from the analyses documented in the technical reports, this information is organized differently in the DEIS than in the reports. The following explains these differences. The following details the significant differences between how alternatives are described, terminology, and how impacts are organized in the DEIS and in most technical reports so that readers of the DEIS can understand where to look for information in the technical reports. Some technical reports do not exhibit all these differences from the DEIS.

Difference #1: Description of Alternatives

The first difference readers of the technical reports are likely to discover is that the full alternatives are packaged differently than in the DEIS. The primary difference is that the DEIS includes all four transit terminus options (Kiggins Bowl, Lincoln, Clark College Minimum Operable Segment (MOS), and Mill Plain MOS) with each build alternative. In contrast, the alternatives in the technical reports assume a single transit terminus:

- Alternatives 2 and 3 both include the Kiggins Bowl terminus
- Alternatives 4 and 5 both include the Lincoln terminus

In the technical reports, the Clark College MOS and Mill Plain MOS are evaluated and discussed from the standpoint of how they would differ from the full-length Kiggins Bowl and Lincoln terminus options.

Difference #2: Terminology

Several elements of the project alternatives are described using different terms in the DEIS than in the technical reports. The following table shows the major differences in terminology.

DEIS terms	Technical report terms
Kiggins Bowl terminus	I-5 alignment
Lincoln terminus	Vancouver alignment
Efficient transit operations	Standard transit operations
Increased transit operations	Enhanced transit operations

Difference #3: Analysis of Alternatives

The most significant difference between most of the technical reports and the DEIS is how each structures its discussion of impacts of the alternatives. Both the reports and the DEIS introduce long-term effects of the full alternatives first. However, the technical reports then discuss “segment-level options,” “other project elements,” and “system-level choices.” The technical reports used segment-level analyses to focus on specific and consistent geographic regions. This enabled a robust analysis of the choices on Hayden Island, in downtown Vancouver, etc. The system-level analysis allowed for a comparative evaluation of major project components (replacement versus supplemental bridge, light rail versus bus rapid transit, etc). The key findings of these analyses are summarized in the DEIS; they are simply organized in only two general areas: impacts by each full alternative, and impacts of the individual “components” that comprise the alternatives (e.g. transit mode).

Difference #4: Updates

The draft technical reports were largely completed in late 2007. Some data in these reports have been updated since then and are reflected in the DEIS. However, not all changes have been incorporated into the technical reports. The DEIS reflects more recent public and agency input than is included in the technical reports. Some of the options and potential mitigation measures developed after the technical reports were drafted are included in the DEIS, but not in the technical reports. For example, Chapter 5 of the DEIS (Section 4(f) evaluation) includes a range of potential “minimization measures” that are being considered to reduce impacts to historic and public park and recreation resources. These are generally not included in the technical reports. Also, impacts related to the stacked transit/highway bridge (STHB) design for the replacement river crossing are not discussed in the individual technical reports, but are consolidated into a single technical memorandum.

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Columbia River CROSSING

October 2007

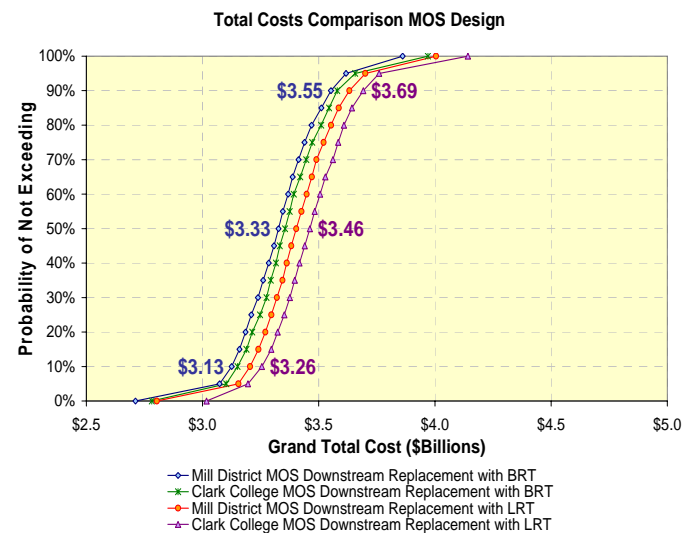
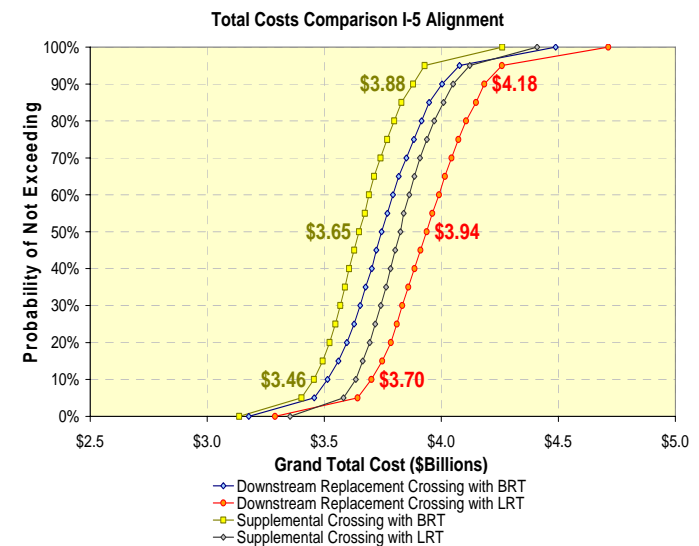
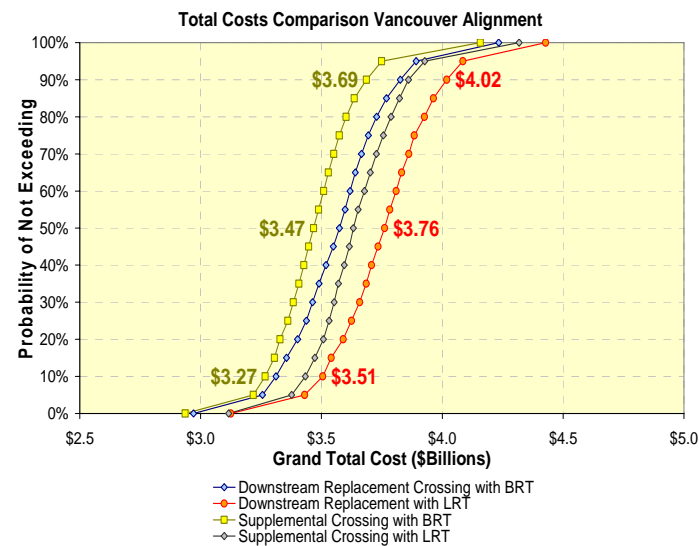


Project Description:

The Columbia River Crossing project is a bridge, transit and highway improvement project for I-5 between Vancouver and Portland. It is co-sponsored by the Oregon Department of Transportation and the Washington State Department of Transportation, and is working to address the congestion, mobility and safety problems on I-5 between State Route 500 in Vancouver and Columbia Boulevard in Portland.

Project Benefits:

- Reduced delays in travel time between Portland and Vancouver
- Improved transit options between Portland and Vancouver
- Improved accessibility to the I-5 corridor in the vicinity of the Columbia River Bridge
- Increased bridge durability and reduced susceptibility to earthquakes



Project Risks:

- HCT inside river crossing bridge;
- Park and Rides;
- Other major projects in the area at the same time;
- Elevated profile across Hayden Island;
- Inadvertent discoveries of archeological findings during construction;
- Supplementary EIS (SEIS) / additional environmental analysis required;
- Compliance with permitting requirements for work in the water; and
- Experience of contractor for foundations and superstructure

Level of Project Design:
Low
Medium
High

Total Project Costs: \$3.1 - \$4.2 Billion

Total Project Schedule: 2010 - 2017

CHAPTER 1: INTRODUCTION

The Columbia River Crossing (CRC) project is a bridge, transit and highway improvement project for I-5 between Vancouver and Portland. It is co-sponsored by the Oregon Department of Transportation (ODOT) and the Washington State Department of Transportation (WSDOT), and is working to address the congestion, mobility and safety problems on I-5 between State Route 500 in Vancouver and Columbia Boulevard in Portland.

The alternatives that are being studied in the Draft Environmental Impact Statement by the CRC project are:

- Replacement bridge with bus rapid transit
- Replacement bridge with light rail
- Supplemental bridge with bus rapid transit
- Supplemental bridge with light rail
- No build

A process called “Cost Risk Assessment” (CRA) is applied to each of the alternatives and scenarios to obtain a better understanding of projected costs and completion dates. A Cost Risk Assessment process begins with a definition of risks. **Risks** are defined according to the *associated project function, type of threat, and any other key descriptor information*. A Risk Assessment workshop was held to assess the applicability of each risk, and determine cost and schedule impacts. Cost and schedule impacts are defined on a probabilistic basis, which includes the probability that the risk occurs and the probability distribution of the impact if it occurs. The probability distribution of a risk impact is defined by a functional form (e.g. uniform, trigonometric, normal, etc.) and associated parameters (e.g. low, median, high, mean, standard deviation, etc.). In this report, low and high values are defined at a 90% likelihood of exceeding and a 10% likelihood of exceeding. These represent an 80% confidence interval. Results are shown graphically and communicate the probabilities on an s-curve.

CHAPTER 2: PROJECT ALTERNATIVES, SCENARIOS, BASELINE SCHEDULES AND COSTS

2.1 DESIGN ALTERNATIVES

The design alternatives for the CRC Project can be separated into three categories:

- Vancouver Alignment Designs: Transit implemented north of the Columbia River along Main Street rather than using the I-5 corridor.
- I-5 Alignment Designs: Transit implemented north of the Columbia River along the I-5 corridor rather than using Main Street.
- Minimal Operable Segment (MOS) designs: Transit segments north of the Columbia River are shortened to either Mill District or Clark College rather than extending the entire length to the Kiggins or Lincoln Park and Rides.

All design alternatives are assumed to have the same baseline uncertainties.

2.2 SCENARIO DESCRIPTIONS

This CRA considers six scenarios for the Vancouver Alignment designs, six scenarios for the I-5 alignment designs, and an additional four scenarios for the MOS designs. The scenario options used are in the table below.

Table 1: Columbia River Crossing Bridge Scenarios

		Vancouver Alignment	I-5 Alignment	Mill District MOS	Clark College MOS
2a	Downstream Replacement Crossing with BRT	X	X	X	X
2b	Upstream Replacement Crossing with BRT	X	X		
3a	Downstream Replacement Crossing with LRT	X	X	X	X
3b	Upstream Replacement Crossing with LRT	X	X		
4	Supplemental Crossing with BRT	X	X		
5	Supplemental Crossing with LRT	X	X		

Each of the 16 different scenarios can be varied in four different ways: crossing option, crossing location, transit mode, and transit alignment. The two different crossing options being compared are replacing both the northbound and southbound spans of the bridge or retrofitting the current bridge to hold one direction of traffic and building a supplemental bridge for the other. The crossing location will either be upstream or downstream from the current bridge. The two different transit mode options are Bus Rapid Transit (BRT) and Light Rail Transit (LRT). The transit alignment can either be full length, terminating at Lincoln or Kiggins Park and Riders, or a minimum operable segment (MOS) that would terminate at Mill District or Clark College.

2.3 PROJECT BASELINE SCHEDULE AND FLOW CHARTS

Tables 2 through 4 are the baseline start and end dates for all project alternatives. These schedules do not include any risks or contingencies and reflect the same information provided in the flow charts. The main differences in the baseline schedules come from the duration of the activities involved in construction over the river and the Marine Drive, Hayden Island, and SR-14 interchanges among the Vancouver and I-5 Alignments. The MOS Design alternatives only deviate from each other in the northbound transit river crossing construction.

The flowcharts for the project are provided in Figures 1 through 10 on the next pages:

- Each activity is represented by a square shaded box; the milestones and decision points (design approval, right of way certification, etc.) are represented by yellow diamonds;
- The arrows connecting the activities represent dependency on the previous activity to either start or complete the activity in question.
- The activities are identified with a sequential number, ranging from 1 (Prepare DEIS Alternatives) to 32 (HCT - Finish/OCS/Civil for River Crossing);

Table 2: Vancouver Alignments Baseline Schedules

ID	FLOWCHART ACTIVITY	2a		2b		3a		3b		4		5	
		Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
1	Prepare DEIS Alternatives	11/1/06	5/3/07	11/1/06	5/3/07	11/1/06	5/3/07	11/1/06	5/3/07	11/1/06	5/3/07	11/1/06	5/3/07
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	2/1/08	5/3/07	2/1/08	5/3/07	2/1/08	5/3/07	2/1/08	5/3/07	2/1/08	5/3/07	2/1/08
3	Publish DEIS and LPA	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08
4	Comment Period / Public Hearings	2/1/08	5/3/08	2/1/08	5/3/08	2/1/08	5/3/08	2/1/08	5/3/08	2/1/08	5/3/08	2/1/08	5/3/08
5	Local Agency Adoption	5/3/08	8/2/08	5/3/08	8/2/08	5/3/08	8/2/08	5/3/08	8/2/08	5/3/08	8/2/08	5/3/08	8/2/08
6	FTA New Starts Application	8/1/08	8/1/08	8/1/08	8/1/08	8/1/08	8/1/08	8/1/08	8/1/08	8/1/08	8/1/08	8/1/08	8/1/08
7	Prepare FEIS	8/1/08	4/2/09	8/1/08	4/2/09	8/1/08	4/2/09	8/1/08	4/2/09	8/1/08	4/2/09	8/1/08	4/2/09
8	FHWA/FTA Record of Decision	4/1/09	4/1/09	4/1/09	4/1/09	4/1/09	4/1/09	4/1/09	4/1/09	4/1/09	4/1/09	4/1/09	4/1/09
9	30% Design	4/1/09	12/1/09	4/1/09	12/1/09	4/1/09	12/1/09	4/1/09	12/1/09	4/1/09	12/1/09	4/1/09	12/1/09
10	R/W Appraisal and Acquisition	8/1/08	1/2/10	8/1/08	1/2/10	8/1/08	1/2/10	8/1/08	1/2/10	8/1/08	1/2/10	8/1/08	1/2/10
11	Environmental Permitting	5/3/08	11/3/09	5/3/08	11/3/09	5/3/08	11/3/09	5/3/08	11/3/09	5/3/08	11/3/09	5/3/08	11/3/09
12	Begin Construction	1/1/10	1/1/10	1/1/10	1/1/10	1/1/10	1/1/10	1/1/10	1/1/10	1/1/10	1/1/10	1/1/10	1/1/10
13	HWY - Construct NB River Crossing	1/1/10	7/4/12	1/4/10	7/7/12	1/1/10	7/4/12	1/4/10	7/7/12				
14	HWY - Finish NB River Crossing	5/5/13	6/5/14	1/0/00	1/0/00	5/5/13	6/5/14	1/0/00					
15	HWY - Construct SB River Crossing	1/1/10	7/4/12	11/13/13	11/15/15	1/1/10	7/4/12	11/13/13	11/15/15				
16	HCT – Construct River Crossing	1/1/10	4/3/12	9/21/16	12/23/18	1/1/10	4/3/12	9/21/16	12/23/18				
17	HWY - Demo Existing NB River Crossing	5/31/14	4/1/15	1/8/13	11/9/13	5/31/14	4/1/15	1/8/13	11/9/13				
18	HWY - Demo Existing SB River Crossing	7/4/12	5/5/13	11/18/15	9/18/16	7/4/12	5/5/13	11/18/15	9/18/16				
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	1/1/10	3/4/12	1/4/10	10/6/11	1/1/10	3/4/12	1/4/10	10/6/11	1/4/10	9/6/11	1/4/10	9/6/11
20	HWY - I-5 / SR14 I/C (Stage 3)	5/31/14	4/1/15	1/7/13	9/8/13	5/31/14	4/1/15	1/7/13	9/8/13	7/9/12	5/10/13	7/9/12	5/10/13
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	1/1/10	5/4/11	1/4/10	1/6/13	1/1/10	5/4/11	1/4/10	1/6/13	1/4/10	5/7/11	1/4/10	5/7/11
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	7/4/12	8/5/14	1/7/13	5/11/15	7/4/12	8/5/14	1/7/13	5/11/15	5/9/11	10/10/14	5/9/11	10/10/14
23	HWY - I-5 / Marine Drive Interchange (All Stages)	1/1/10	10/3/12	1/4/10	5/8/13	1/1/10	10/3/12	1/4/10	5/8/13	1/20/12	5/24/15	1/20/12	5/24/15
24	HWY - I-5 / SR 500 Interchange (All Stages)	1/1/10	5/4/12	1/4/10	5/7/12	1/1/10	5/4/12	1/4/10	5/7/12	1/4/10	5/7/12	1/4/10	5/7/12
25	HWY - I-5 Mill Plain Interchange (All Stages)	1/1/10	1/3/13	1/4/10	1/6/13	1/1/10	1/3/13	1/4/10	1/6/13	1/4/10	1/6/13	1/4/10	1/6/13
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	1/1/10	9/3/12	1/4/10	9/6/12	1/1/10	9/3/12	1/4/10	9/6/12	1/4/10	9/6/12	1/4/10	9/6/12
27	HCT – BRT North	1/1/10	9/3/11	1/4/10	9/6/11	1/1/10	9/3/11	1/4/10	9/6/11	1/4/10	9/6/11	1/4/10	9/6/11
28	HCT – BRT South	1/1/10	5/4/11	1/4/10	5/7/11	1/1/10	5/4/11	1/4/10	5/7/11	1/4/10	5/7/11	1/4/10	5/7/11
29	HCT – Burn Time	4/3/12	10/3/12	12/26/18	6/27/19	4/3/12	10/3/12	12/26/18	6/27/19	1/8/13	7/10/13	12/9/13	6/10/14
30	Project Complete	4/1/15	4/1/15	7/1/19	7/1/19	4/1/15	4/1/15	7/1/19	7/1/19	6/1/15	6/1/15	6/1/15	6/1/15
31	HWY/HCT - Construct SB/HCT River Crossing									1/4/10	7/7/12	1/4/10	7/7/12
32	HCT - Finish/OCS/Civil for River Crossing									7/9/12	1/8/13	7/9/12	12/9/13

Table 3: I-5 Alignment Baseline Schedules

ID	FLOWCHART ACTIVITY	2a		2b		3a		3b		4		5	
		Start	End	Start	End	Start	End	Start	End	Start	End	Start	End
1	Prepare DEIS Alternatives	11/1/06	5/3/07	11/1/06	5/3/07	11/1/06	5/3/07	11/1/06	5/3/07	11/1/06	5/3/07	11/1/06	5/3/07
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	2/1/08	5/3/07	2/1/08	5/3/07	2/1/08	5/3/07	2/1/08	5/3/07	2/1/08	5/3/07	2/1/08
3	Publish DEIS and LPA	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08
4	Comment Period / Public Hearings	2/1/08	5/3/08	2/1/08	5/3/08	2/1/08	5/3/08	2/1/08	5/3/08	2/1/08	5/3/08	2/1/08	5/3/08
5	Local Agency Adoption	5/3/08	8/2/08	5/3/08	8/2/08	5/3/08	8/2/08	5/3/08	8/2/08	5/3/08	8/2/08	5/3/08	8/2/08
6	FTA New Starts Application	8/1/08	8/1/08	8/1/08	8/1/08	8/1/08	8/1/08	8/1/08	8/1/08	8/1/08	8/1/08	8/1/08	8/1/08
7	Prepare FEIS	8/1/08	4/2/09	8/1/08	4/2/09	8/1/08	4/2/09	8/1/08	4/2/09	8/1/08	4/2/09	8/1/08	4/2/09
8	FHWA/FTA Record of Decision	4/1/09	4/1/09	4/1/09	4/1/09	4/1/09	4/1/09	4/1/09	4/1/09	4/1/09	4/1/09	4/1/09	4/1/09
9	30% Design	4/1/09	12/1/09	4/1/09	12/1/09	4/1/09	12/1/09	4/1/09	12/1/09	4/1/09	12/1/09	4/1/09	12/1/09
10	R/W Appraisal and Acquisition	8/1/08	1/2/10	8/1/08	1/2/10	8/1/08	1/2/10	8/1/08	1/2/10	8/1/08	1/2/10	8/1/08	1/2/10
11	Environmental Permitting	5/3/08	11/3/09	5/3/08	11/3/09	5/3/08	11/3/09	5/3/08	11/3/09	5/3/08	11/3/09	5/3/08	11/3/09
12	Begin Construction	1/1/10	1/1/10	1/1/10	1/1/10	1/1/10	1/1/10	1/1/10	1/1/10	1/1/10	1/1/10	1/1/10	1/1/10
13	HWY - Construct NB River Crossing	1/1/10	7/4/12	1/4/10	7/7/12	1/1/10	7/4/12	1/4/10	7/7/12				
14	HWY - Finish NB River Crossing	5/5/13	6/5/14	1/0/00	1/0/00	5/5/13	6/5/14	1/0/00					
15	HWY - Construct SB River Crossing	1/1/10	7/4/12	11/13/13	11/15/15	1/1/10	7/4/12	11/13/13	11/15/15				
16	HCT – Construct River Crossing	1/1/10	4/3/12	9/21/16	12/23/18	1/1/10	4/3/12	9/21/16	12/23/18				
17	HWY - Demo Existing NB River Crossing	5/31/14	4/1/15	1/8/13	11/9/13	5/31/14	4/1/15	1/8/13	11/9/13				
18	HWY - Demo Existing SB River Crossing	7/4/12	5/5/13	11/18/15	9/18/16	7/4/12	5/5/13	11/18/15	9/18/16				
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	1/1/10	3/4/12	1/4/10	10/6/11	1/1/10	3/4/12	1/4/10	10/6/11	1/4/10	9/6/11	1/4/10	9/6/11
20	HWY - I-5 / SR14 I/C (Stage 3)	5/31/14	4/1/15	1/7/13	9/8/13	5/31/14	4/1/15	1/7/13	9/8/13	7/9/12	5/10/13	7/9/12	5/10/13
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	1/1/10	5/4/11	1/4/10	1/6/13	1/1/10	5/4/11	1/4/10	1/6/13	1/4/10	5/7/11	1/4/10	5/7/11
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	7/4/12	8/5/14	1/7/13	5/11/15	7/4/12	8/5/14	1/7/13	5/11/15	5/9/11	10/10/14	5/9/11	10/10/14
23	HWY - I-5 / Marine Drive Interchange (All Stages)	1/1/10	10/3/12	1/4/10	5/8/13	1/1/10	10/3/12	1/4/10	5/8/13	1/20/12	5/24/15	1/20/12	5/24/15
24	HWY - I-5 / SR 500 Interchange (All Stages)	1/1/10	5/4/12	1/4/10	5/7/12	1/1/10	5/4/12	1/4/10	5/7/12	1/4/10	5/7/12	1/4/10	5/7/12
25	HWY - I-5 Mill Plain Interchange (All Stages)	1/1/10	1/3/13	1/4/10	1/6/13	1/1/10	1/3/13	1/4/10	1/6/13	1/4/10	1/6/13	1/4/10	1/6/13
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	1/1/10	9/3/12	1/4/10	9/6/12	1/1/10	9/3/12	1/4/10	9/6/12	1/4/10	9/6/12	1/4/10	9/6/12
27	HCT – BRT North	1/1/10	9/3/11	1/4/10	9/6/11	1/1/10	9/3/11	1/4/10	9/6/11	1/4/10	9/6/11	1/4/10	9/6/11
28	HCT – BRT South	1/1/10	5/4/11	1/4/10	5/7/11	1/1/10	5/4/11	1/4/10	5/7/11	1/4/10	5/7/11	1/4/10	5/7/11
29	HCT – Burn Time	4/3/12	10/3/12	12/26/18	6/27/19	4/3/12	10/3/12	12/26/18	6/27/19	1/8/13	7/10/13	12/9/13	6/10/14
30	Project Complete	4/1/15	4/1/15	7/1/19	7/1/19	4/1/15	4/1/15	7/1/19	7/1/19	6/1/15	6/1/15	6/1/15	6/1/15
31	HWY/HCT - Construct SB/HCT River Crossing									1/4/10	7/7/12	1/4/10	7/7/12
32	HCT - Finish/OCS/Civil for River Crossing									7/9/12	1/8/13	7/9/12	12/9/13

Table 4: MOS Design Baseline Schedules

ID	FLOWCHART ACTIVITY	2a MD		2a CC		3a MD		3a CC	
		Start	End	Start	End	Start	End	Start	End
1	Prepare DEIS Alternatives	11/1/06	5/3/07	11/1/06	5/3/07	11/1/06	5/3/07	11/1/06	5/3/07
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	2/1/08	5/3/07	2/1/08	5/3/07	2/1/08	5/3/07	2/1/08
3	Publish DEIS and LPA	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08	2/1/08
4	Comment Period / Public Hearings	2/1/08	5/3/08	2/1/08	5/3/08	2/1/08	5/3/08	2/1/08	5/3/08
5	Local Agency Adoption	5/3/08	8/2/08	5/3/08	8/2/08	5/3/08	8/2/08	5/3/08	8/2/08
6	FTA New Starts Application	8/2/08	8/2/08	8/2/08	8/2/08	8/2/08	8/2/08	8/2/08	8/2/08
7	Prepare FEIS	8/2/08	4/3/09	8/2/08	4/3/09	8/2/08	4/3/09	8/2/08	4/3/09
8	FHWA/FTA Record of Decision	4/3/09	4/3/09	4/3/09	4/3/09	4/3/09	4/3/09	4/3/09	4/3/09
9	30% Design	4/3/09	12/3/09	4/3/09	12/3/09	4/3/09	12/3/09	4/3/09	12/3/09
10	R/W Appraisal and Acquisition	8/2/08	2/2/10	8/2/08	2/2/10	8/2/08	2/2/10	8/2/08	2/2/10
11	Environmental Permitting	5/3/08	11/3/09	5/3/08	11/3/09	5/3/08	11/3/09	5/3/08	11/3/09
12	Begin Construction	2/2/10	2/2/10	2/2/10	2/2/10	2/2/10	2/2/10	2/2/10	2/2/10
13	HWY - Construct NB River Crossing	2/2/10	8/5/12	2/2/10	8/5/12	2/2/10	8/5/12	2/2/10	8/5/12
14	HWY - Finish NB River Crossing	6/6/13	7/8/14	6/6/13	7/8/14	6/6/13	7/8/14	6/6/13	7/8/14
15	HWY - Construct SB River Crossing	2/2/10	8/5/12	2/2/10	8/5/12	2/2/10	8/5/12	2/2/10	8/5/12
16	HCT – Construct River Crossing	2/2/10	5/6/12	2/2/10	5/6/12	2/2/10	5/6/12	2/2/10	5/6/12
17	HWY - Demo Existing NB River Crossing	7/8/14	5/9/15	7/8/14	5/9/15	7/8/14	5/9/15	7/8/14	5/9/15
18	HWY - Demo Existing SB River Crossing	8/5/12	6/6/13	8/5/12	6/6/13	8/5/12	6/6/13	8/5/12	6/6/13
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	2/2/10	4/5/12	2/2/10	4/5/12	2/2/10	4/5/12	2/2/10	4/5/12
20	HWY - I-5 / SR14 I/C (Stage 3)	7/8/14	5/9/15	7/8/14	5/9/15	7/8/14	5/9/15	7/8/14	5/9/15
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	2/2/10	6/5/11	2/2/10	6/5/11	2/2/10	6/5/11	2/2/10	6/5/11
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	8/5/12	9/7/14	8/5/12	9/7/14	8/5/12	9/7/14	8/5/12	9/7/14
23	HWY - I-5 / Marine Drive Interchange (All Stages)	2/2/10	11/5/12	2/2/10	11/5/12	2/2/10	11/5/12	2/2/10	11/5/12
24	HWY - I-5 / SR 500 Interchange (All Stages)	2/2/10	6/5/12	2/2/10	6/5/12	2/2/10	6/5/12	2/2/10	6/5/12
25	HWY - I-5 Mill Plain Interchange (All Stages)	2/2/10	2/4/13	2/2/10	2/4/13	2/2/10	2/4/13	2/2/10	2/4/13
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	2/2/10	10/5/12	2/2/10	10/5/12	2/2/10	10/5/12	2/2/10	10/5/12
27	HCT – BRT North	2/2/10	7/5/10	2/2/10	11/4/10	2/2/10	12/4/10	2/2/10	7/6/11
28	HCT – BRT South	2/2/10	6/5/11	2/2/10	6/5/11	2/2/10	6/5/11	2/2/10	6/5/11
29	HCT – Burn Time	5/6/12	11/5/12	5/6/12	11/5/12	5/6/12	11/5/12	5/6/12	11/5/12
30	Project Complete	5/9/15	5/9/15	5/9/15	5/9/15	5/9/15	5/9/15	5/9/15	5/9/15

Figure 1: Flowchart 2a - Replacement Crossing Downstream with BRT

July 2007 Risk Assessment Preliminary Flowchart
 DEIS Alternative #2a - Replacement Crossing Downstream With BRT

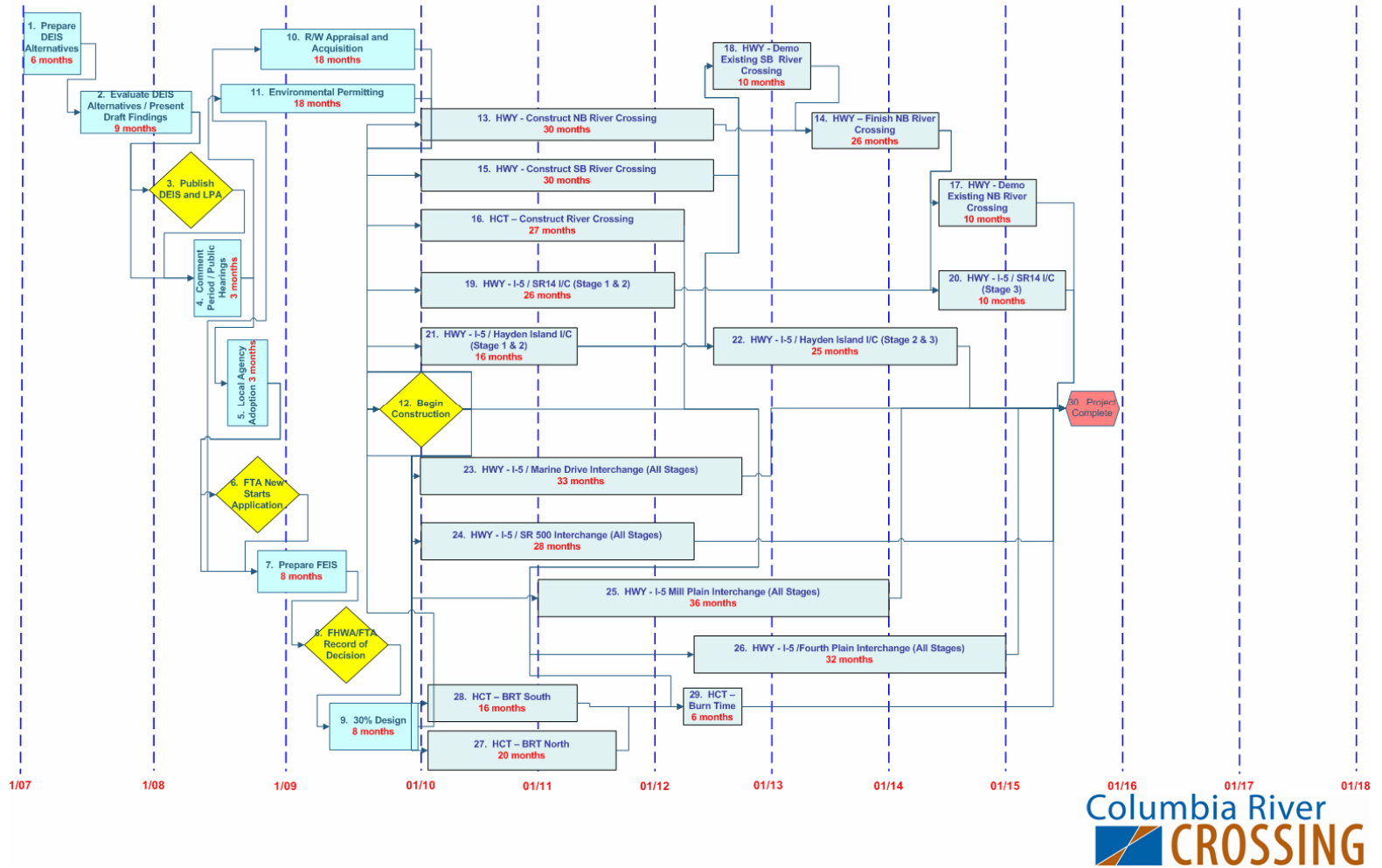


Figure 2: Flowchart 2b - Replacement Crossing Upstream with BRT

July 2007 Risk Assessment Preliminary Flowchart
 DEIS Alternative #2a - Replacement Crossing Downstream With BRT

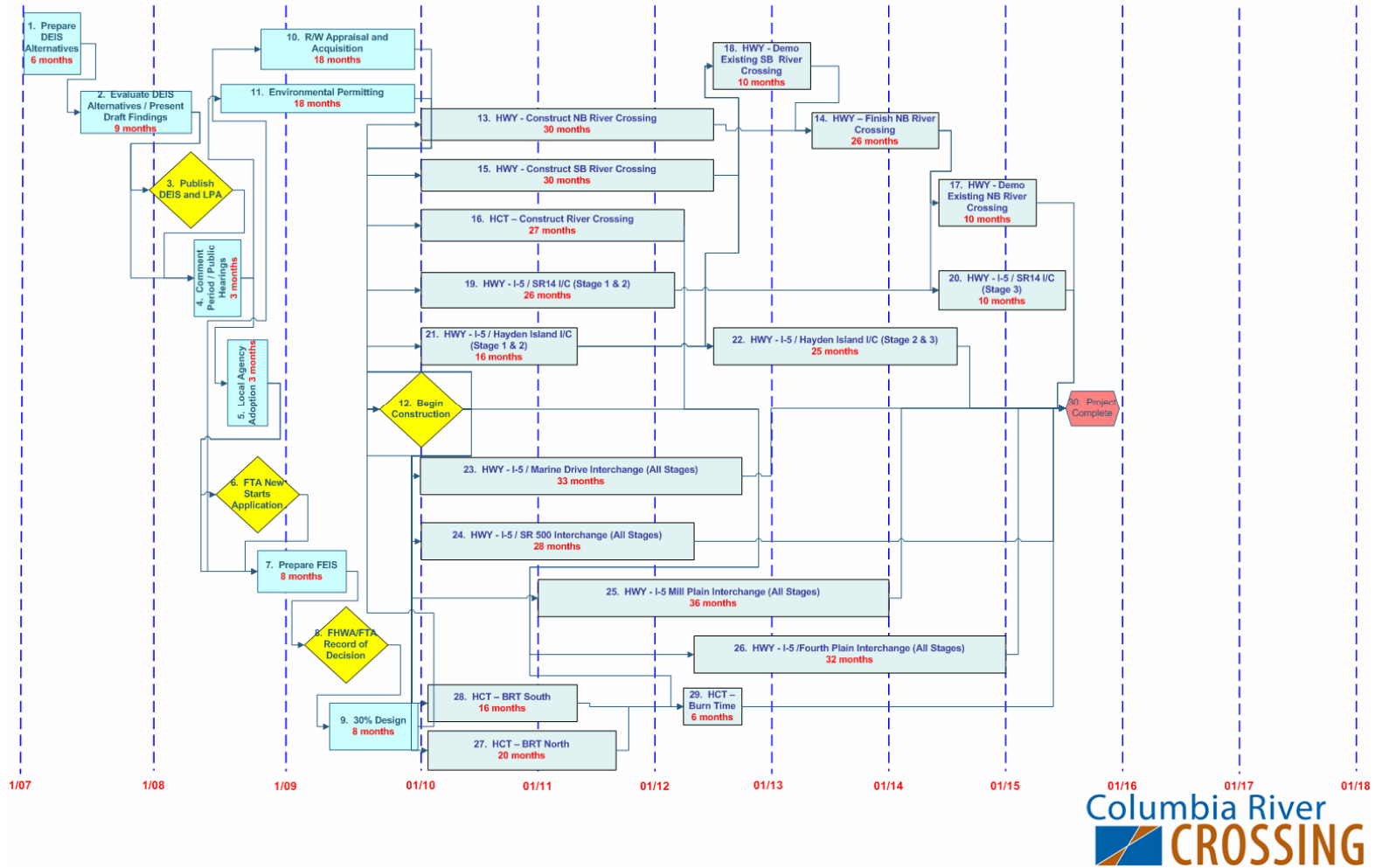


Figure 3: Flowchart 3a - Replacement Crossing Downstream with LRT

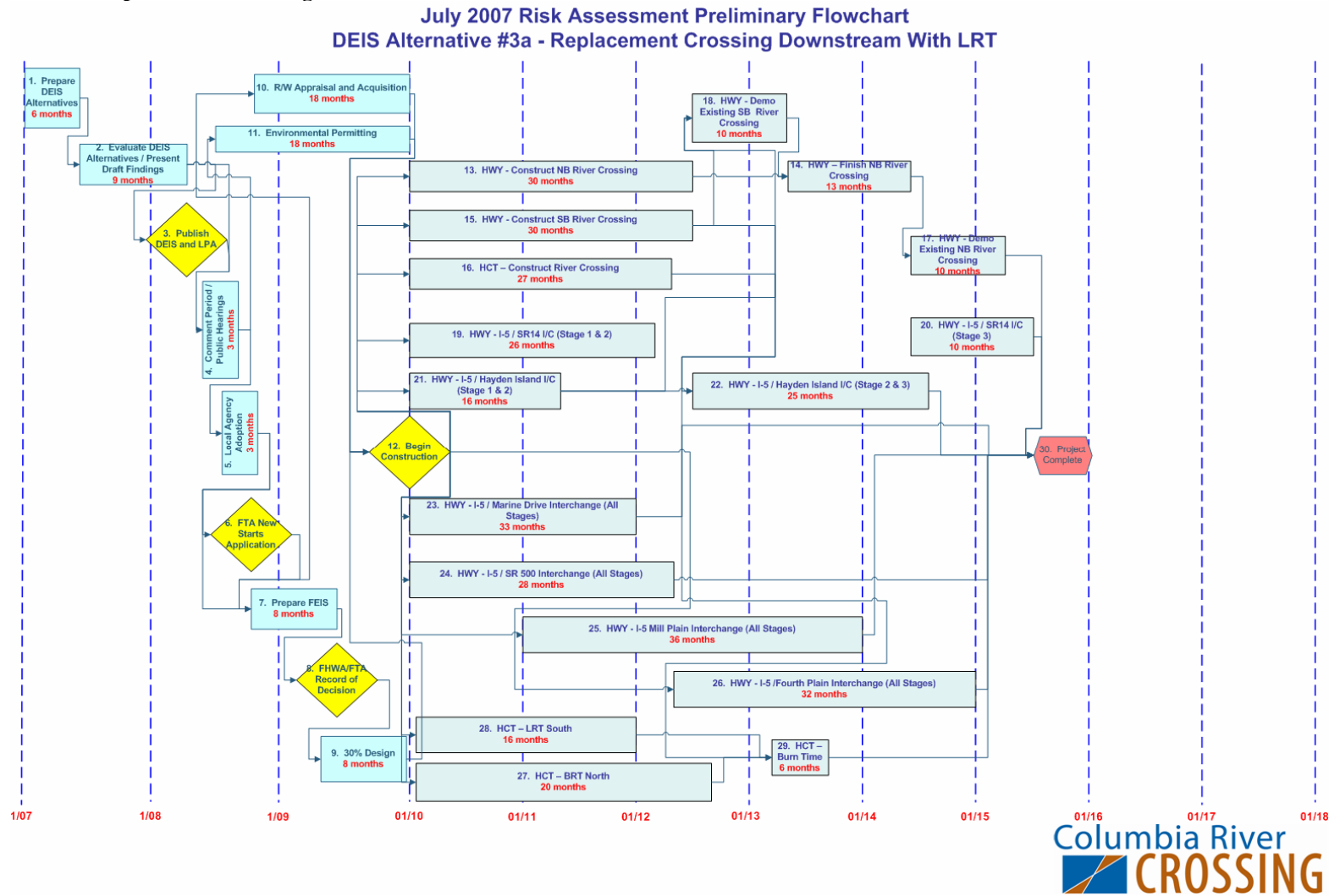


Figure 4: Flowchart 3b - Replacement Crossing Upstream with LRT

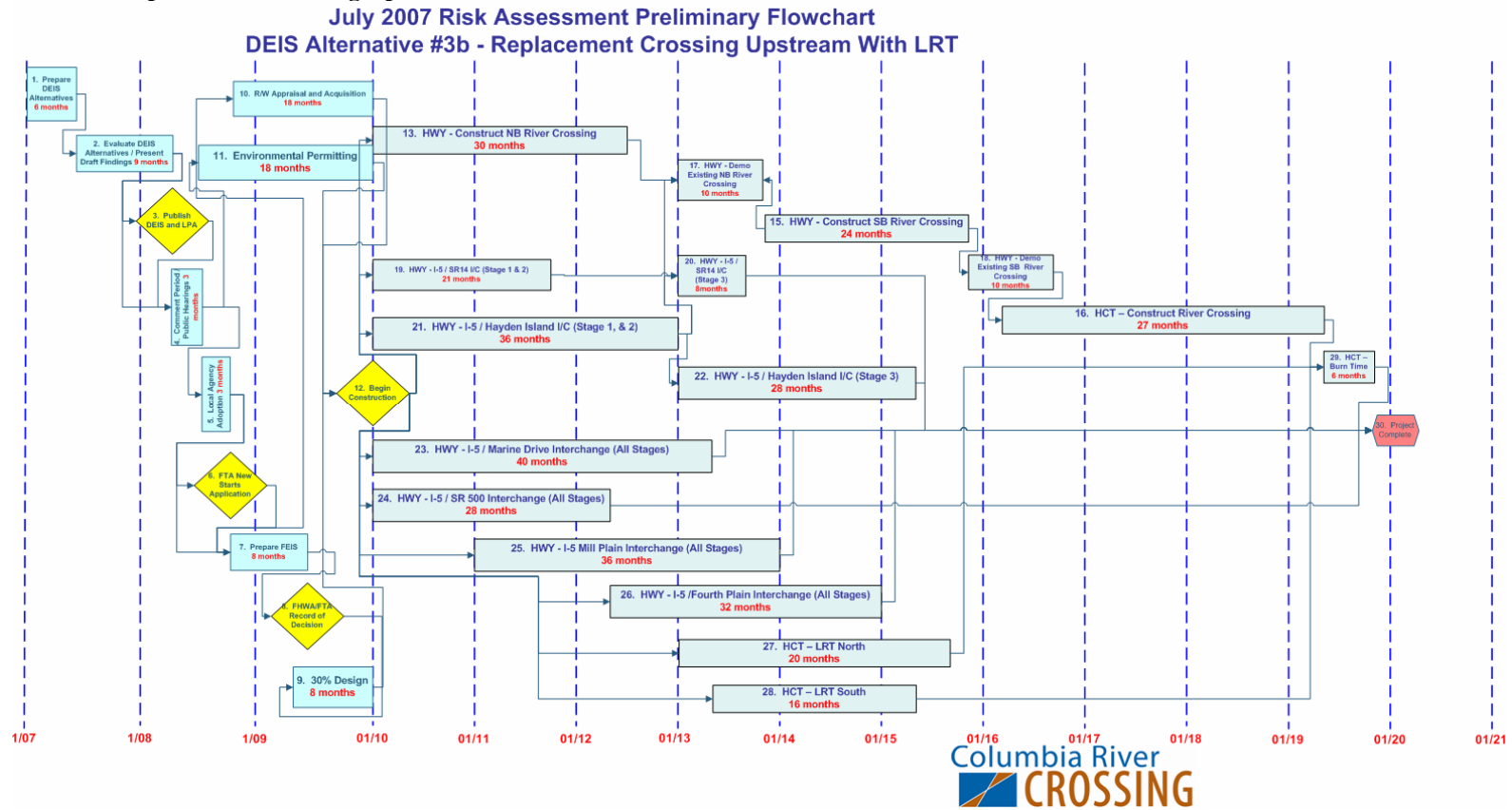


Figure 5: Flowchart 4 - Supplemental Crossing with BRT

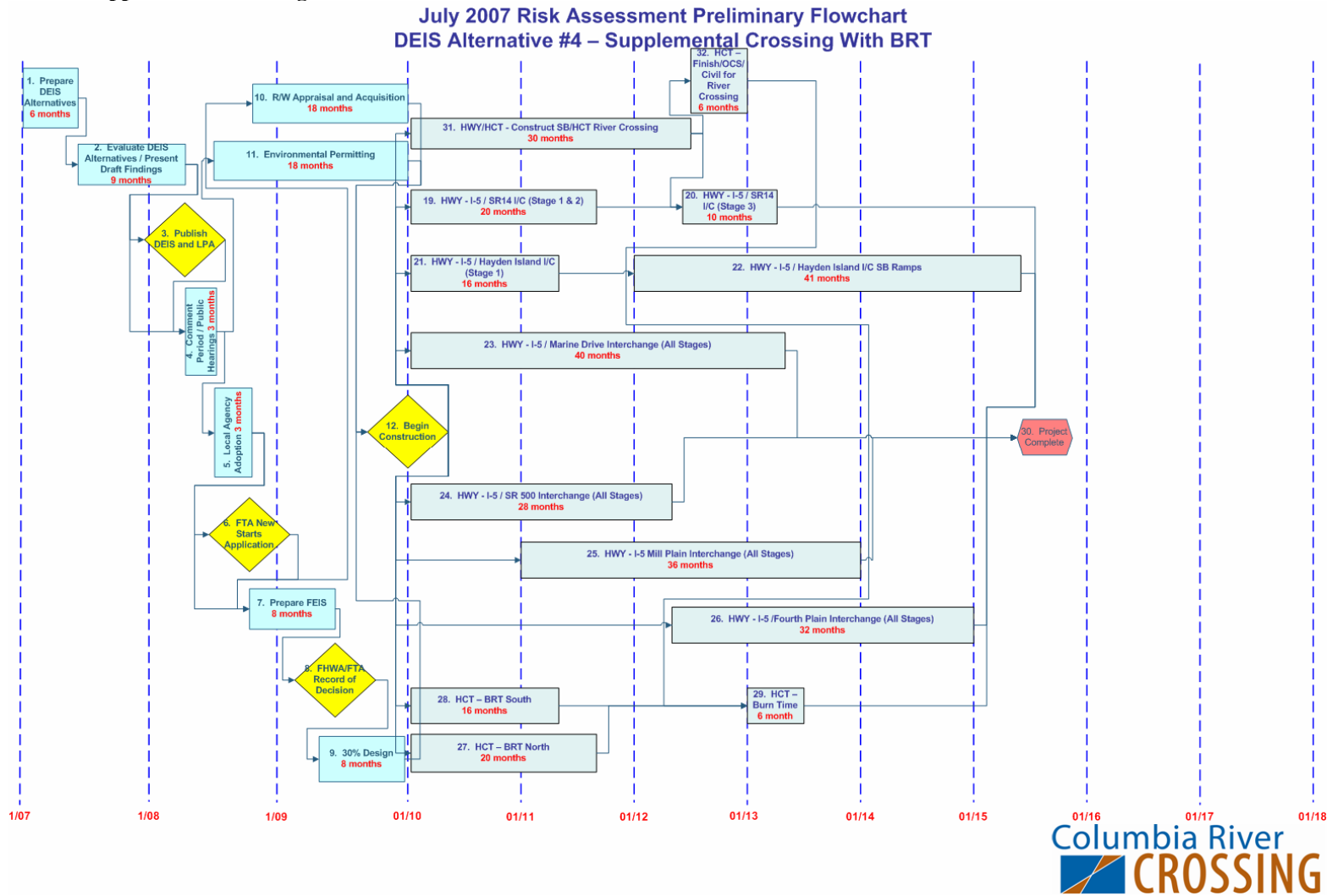


Figure 6: Flowchart 5 - Supplemental Crossing with LRT

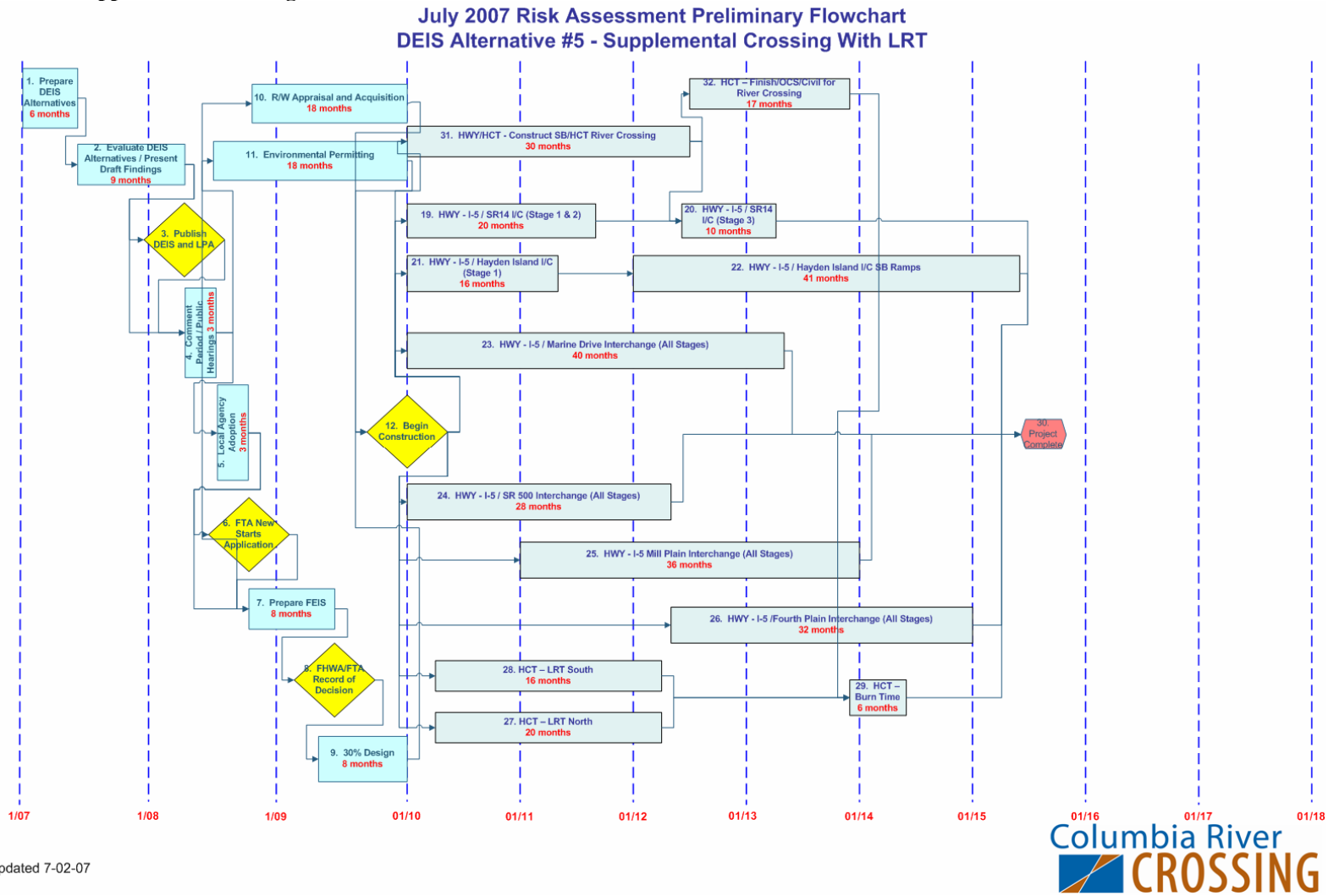


Figure 7: Flowchart 2a - Replacement Crossing Downstream with BRT Mill District MOS

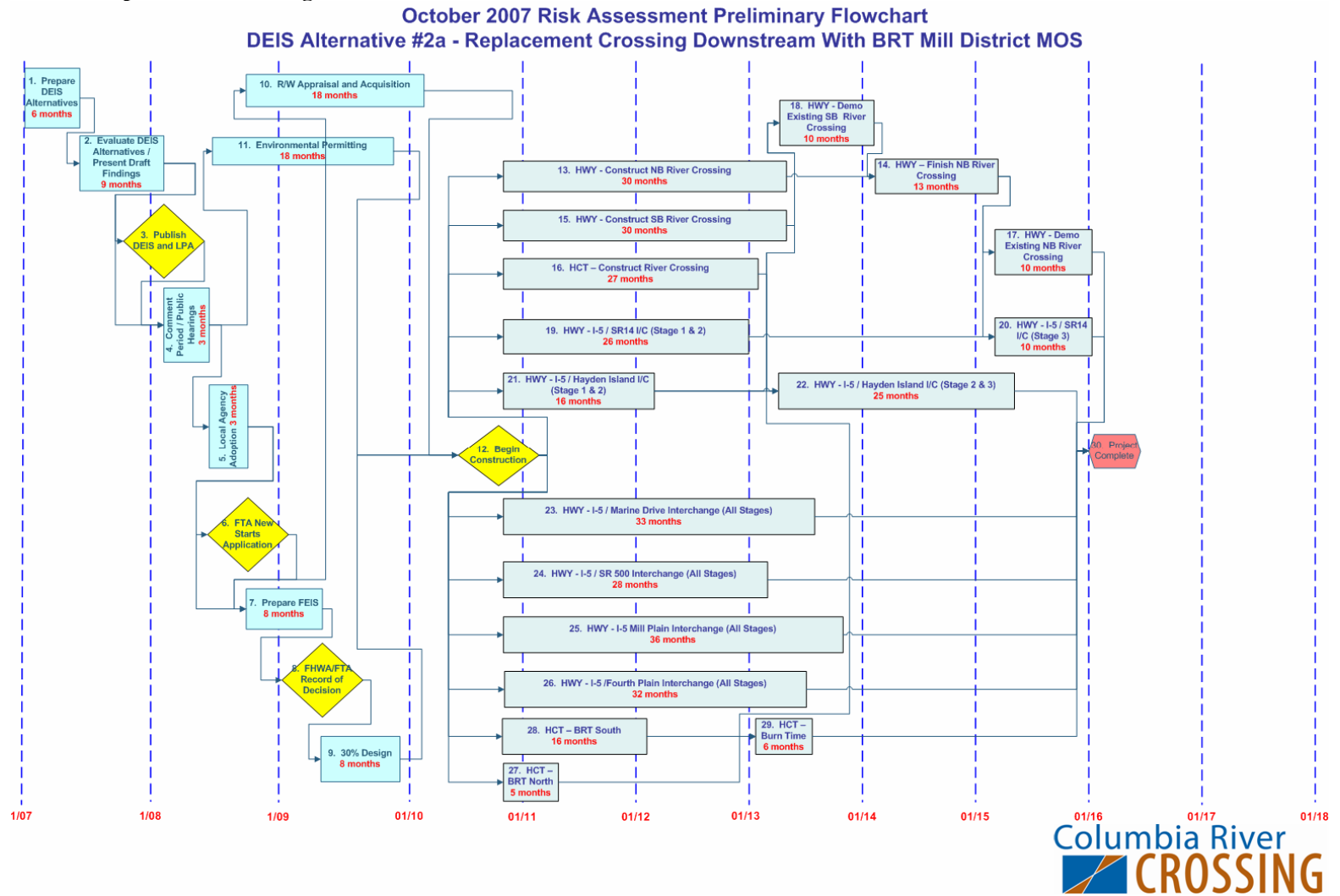


Figure 8: Flowchart 2a - Replacement Crossing Downstream with BRT Clark College MOS

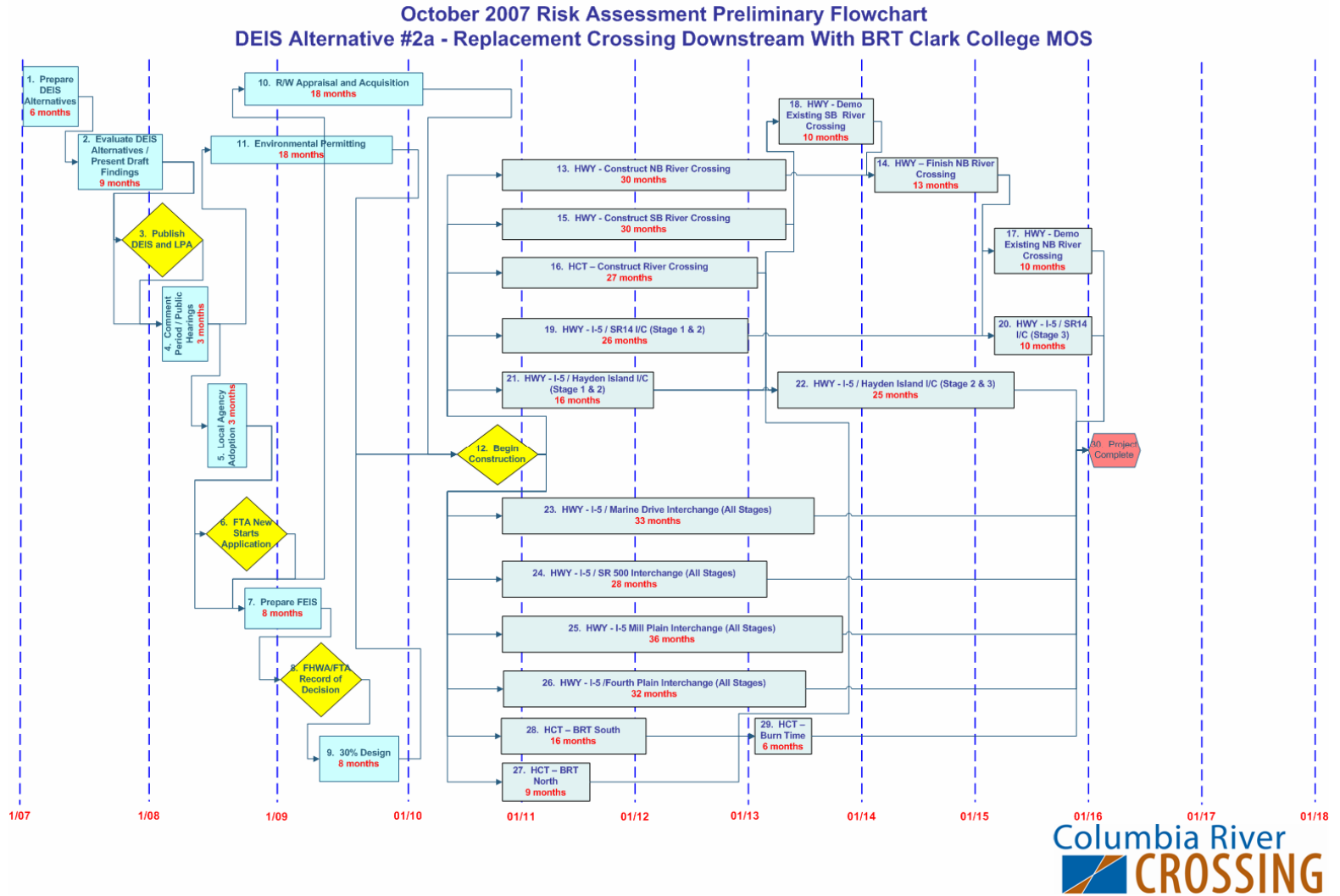


Figure 9: Flowchart 3a - Replacement Crossing Downstream with LRT Mill District MOS

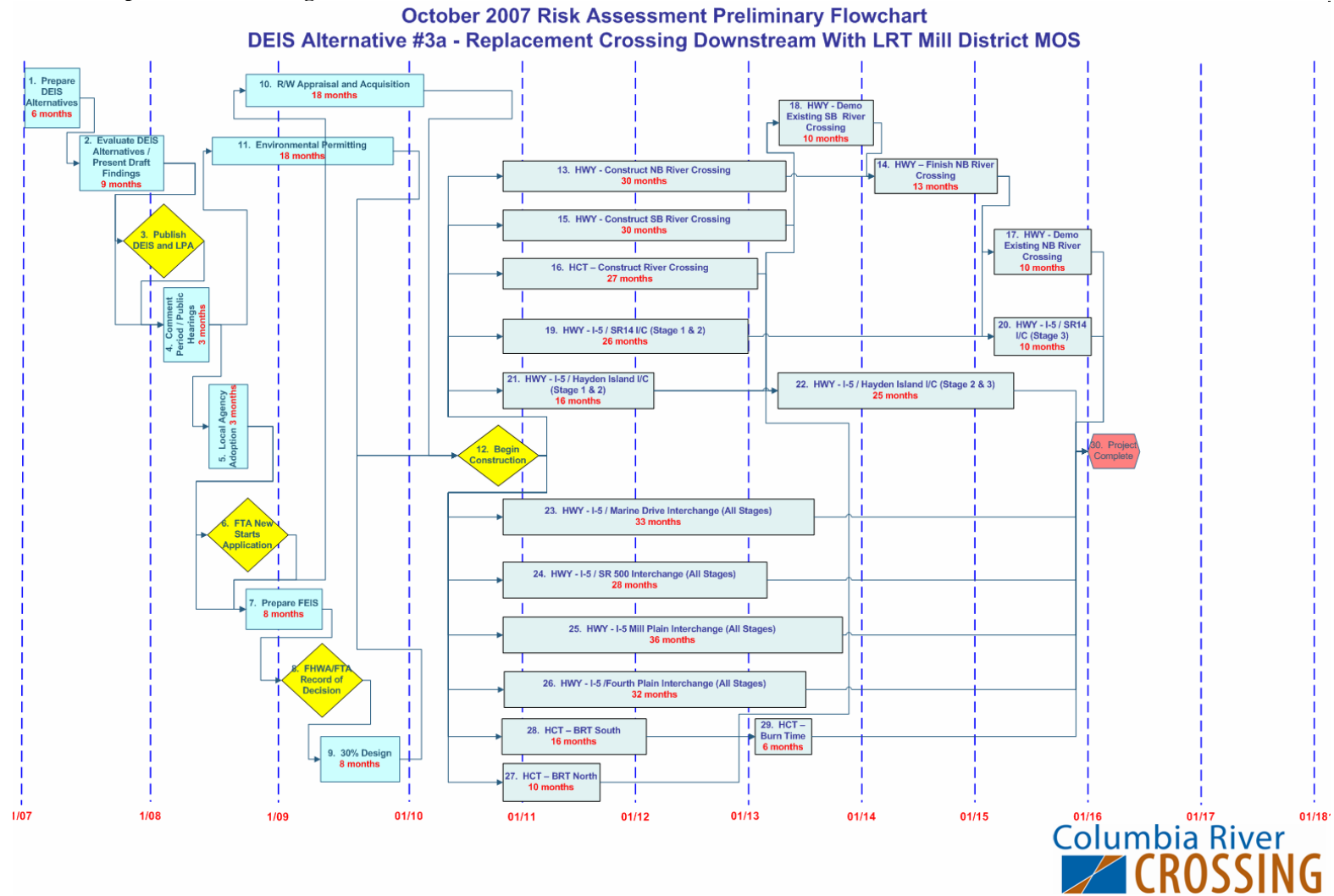
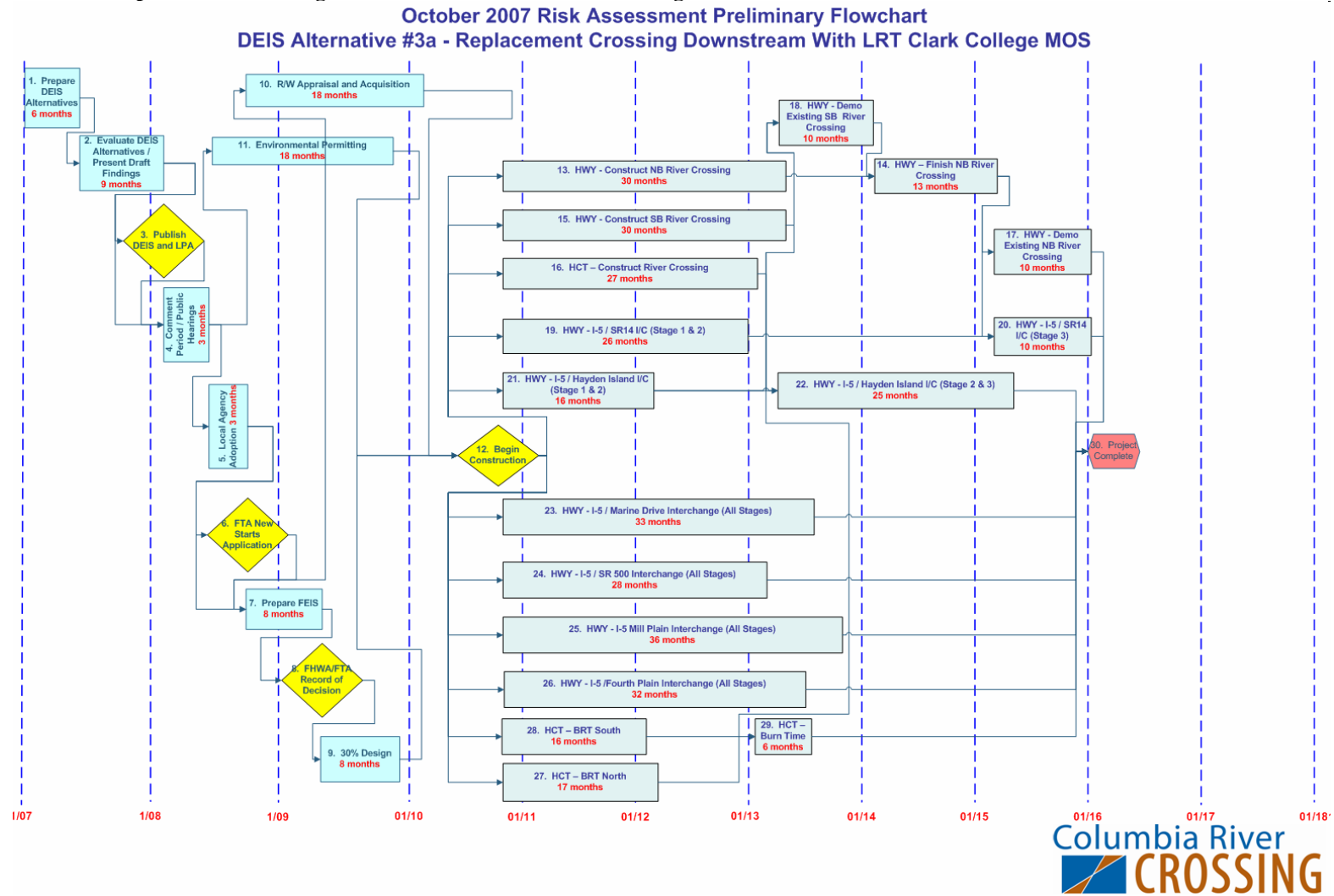


Figure 10: Flowchart 3a - Replacement Crossing Downstream with LRT Clark College MOS



2.4 BASE COSTS

A base cost estimate (that did not have any risk or uncertainty included in it) was provided for the workshop. During the subsequent analysis and review of preliminary results, the cost estimates were revised for the baseline costs.

The Base Estimate package provided by the project design team included the following components:

- Pavement
- Earthwork
- Bridges
- Walls
- Guideway
- Tracks
- Stations
- Sitework
- Systems
- Non-Distributed Costs
- Professional Services
- Support Facilities and Vehicles
- Right of Way

Additional support documentation in the package included full item by item breakdown of the base cost estimates. Additional project scope related information was provided by the project team and specialty groups as required. The overall state of development of the project design elements was estimated to be about 10 percent complete.

The base cost estimate focused on several major facets of construction outlined in the following list:

1. South Highway Approach
 - I-5 Main Line
 - Collector/Distributor Roads
 - Victory Boulevard Interchange
 - Marine Drive Interchange
 - Hayden Island Interchange
 - Mill Plain Boulevard Interchange
 - 4th Plain Boulevard Interchange
 - 29th Street and 33rd Street Bridges
 - SR-500 Interchange
2. North Highway Approach
 - I-5 Main Line
 - Collector/Distributor Roads
 - SR-14 Interchange
 - Evergreen Boulevard Bridge
3. Columbia River Bridges
4. Transit
 - Beginning of Project to State Line
 - State Line to Clark College
 - Clark College to End of the Project
 - State Line to End of the Project

Tables 5 and 6 summarize the base costs and the base costs with uncertainties of the different project alternatives. Additional information on the project base costs including detailed costs for each project activity can be found in Appendix D.

Table 5: Base Costs Summary Table

Base Costs		Preliminary Engineering	Right-of-Way	Construction	Total
Vancouver Alignment	Downstream Replacement with BRT	\$194,331,235	\$117,776,596	\$2,311,861,467	\$2,623,969,298
	Upstream Replacement with BRT	\$192,032,585	\$93,153,600	\$2,371,800,413	\$2,656,986,598
	Downstream Replacement with LRT	\$206,620,763	\$117,776,596	\$2,442,726,314	\$2,767,123,673
	Upstream Replacement with LRT	\$204,374,200	\$93,153,600	\$2,503,219,918	\$2,800,747,719
	Supplemental with BRT	\$218,577,377	\$143,728,900	\$2,084,392,691	\$2,446,698,968
	Supplemental with LRT	\$224,779,001	\$144,857,180	\$2,194,471,885	\$2,564,108,066
I-5 Alignment	Downstream Replacement with BRT	\$194,331,235	\$117,776,596	\$2,311,861,467	\$2,623,969,298
	Upstream Replacement with BRT	\$192,032,585	\$93,153,600	\$2,371,800,413	\$2,656,986,598
	Downstream Replacement with LRT	\$206,620,763	\$117,776,596	\$2,442,726,314	\$2,767,123,673
	Upstream Replacement with LRT	\$204,374,200	\$93,153,600	\$2,503,219,918	\$2,800,747,719
	Supplemental with BRT	\$218,577,377	\$143,728,900	\$2,084,392,691	\$2,446,698,968
	Supplemental with LRT	\$224,779,001	\$144,857,180	\$2,194,471,885	\$2,564,108,066
MOS Design	Downstream Replacement with BRT Mill District	\$177,830,635	\$105,117,196	\$2,134,707,942	\$2,417,655,773
	Downstream Replacement with BRT Clark College	\$173,553,884	\$114,855,196	\$2,155,851,354	\$2,444,260,434
	Downstream Replacement with LRT Mill District	\$183,390,757	\$102,953,196	\$2,193,863,659	\$2,480,207,612
	Downstream Replacement with LRT Clark College	\$180,657,244	\$112,691,196	\$2,231,491,377	\$2,524,839,817

Table 6: Base Costs with Uncertainties Summary Table

Base Cost Uncertainties		Preliminary Engineering	Right-of-Way	Construction	Total
Vancouver Alignment	Downstream Replacement with BRT	\$202,716,780	\$122,235,218	\$2,414,812,310	\$2,739,764,308
	Upstream Replacement with BRT	\$200,318,942	\$96,984,336	\$2,476,924,918	\$2,774,228,197
	Downstream Replacement with LRT	\$215,536,611	\$122,235,218	\$2,551,419,134	\$2,889,190,963
	Upstream Replacement with LRT	\$213,193,108	\$96,984,336	\$2,614,107,355	\$2,924,284,799
	Supplemental with BRT	\$228,009,162	\$143,728,900	\$2,135,233,409	\$2,506,971,471
	Supplemental with LRT	\$234,478,392	\$144,857,180	\$2,248,355,921	\$2,627,691,493
I-5 Alignment	Downstream Replacement with BRT	\$202,716,780	\$122,235,218	\$2,414,812,310	\$2,739,764,308
	Upstream Replacement with BRT	\$200,318,942	\$96,984,336	\$2,476,924,918	\$2,774,228,197
	Downstream Replacement with LRT	\$215,536,611	\$122,235,218	\$2,551,419,134	\$2,889,190,963
	Upstream Replacement with LRT	\$213,193,108	\$96,984,336	\$2,614,107,355	\$2,924,284,799
	Supplemental with BRT	\$228,009,162	\$143,728,900	\$2,135,233,409	\$2,506,971,471
	Supplemental with LRT	\$234,478,392	\$144,857,180	\$2,248,355,921	\$2,627,691,493
MOS Design	Downstream Replacement with BRT Mill District	\$185,504,166	\$109,029,555	\$2,228,091,511	\$2,522,625,232
	Downstream Replacement with BRT Clark College	\$181,042,870	\$119,187,757	\$2,250,256,659	\$2,550,487,287
	Downstream Replacement with LRT Mill District	\$191,304,212	\$106,772,177	\$2,289,842,481	\$2,587,918,870
	Downstream Replacement with LRT Clark College	\$188,452,746	\$116,930,379	\$2,329,253,988	\$2,634,637,114

CHAPTER 3: PROJECT WORKSHOP NOTES AND KEY ASSUMPTIONS

3.1 PROJECT SPECIFIC ASSUMPTIONS

The following assumptions were made in the estimation of project costs and/or project schedule:

1. **Escalation factors** were developed separately for different project components. All construction costs are based on the values estimated in HDR's June 14th 2006 technical report for WSDOT, "Risk Analysis of Cost Escalation Factors for Highway Construction Materials". For Preliminary Engineering and Right-of-Way activities, annually constant escalation rates were used based on the values provided by the WSDOT Strategic Planning & Programming - Systems Analysis & Program Development Office. Tables 7 and 8 present escalation factors for estimating future preliminary engineering, right of way, and construction costs.

Table 7: Construction Cost Escalation

Year	Median	Lower 10% Limit	Upper 10% Limit
2006	5.2%	2.8%	8.5%
2007	5.2%	2.8%	8.5%
2008	5.2%	2.8%	8.5%
2009	4.9%	2.2%	8.6%
2010	4.5%	1.6%	8.6%
2011	4.2%	1.0%	8.7%
2012	3.9%	0.4%	8.8%
2013	3.5%	-0.2%	8.8%
2014	3.2%	-0.8%	8.9%
2015	2.8%	-1.4%	8.9%
2016	2.5%	-2.0%	9.0%
2017	2.5%	-2.0%	9.0%
2018	2.5%	-2.0%	9.0%
2019	2.5%	-2.0%	9.0%
2020	2.5%	-2.0%	9.0%
2021	2.5%	-2.0%	9.0%

Table 8: Preliminary Engineering and ROW Escalation

	Median	Lower 10% Limit	Upper 10% Limit
PE	2.80%	2.00%	3.60%
ROW	6.80%	4.00%	9.60%

2. Base Cost Uncertainties have been developed by the cost team for the CRC project. These uncertainties reflect the range of expected deviation from the base cost estimates. Base cost uncertainties are determined for each of the cost categories. Table 9 presents the ranges of values. Many of the categories have a positive skew indicating that there is a high likelihood that base costs will increase.

Table 9: Base Cost Uncertainties

Description	Low	Most Likely	High
Pavement	-10.00%	0.00%	15.00%
Earthwork	-10.00%	0.00%	20.00%
Bridges	-15.00%	0.00%	20.00%
Walls	-10.00%	0.00%	20.00%
Other	-10.00%	0.00%	10.00%
Guideway	-5.00%	0.00%	20.00%
Tracks	-10.00%	0.00%	15.00%
Stations	-10.00%	0.00%	20.00%
Sitework	-5.00%	0.00%	20.00%
Systems	-5.00%	0.00%	20.00%
Non-Distributed Construction Costs	-5.00%	0.00%	15.00%
Non-Distributed Construction Costs (Bridge)	-5.00%	0.00%	15.00%
Professional Services	-5.00%	0.00%	15.00%
Support Facilities and Vehicles	-5.00%	0.00%	15.00%
Right-of-Way	-5.00%	0.00%	15.00%
Right-of-Way (Bridge)	-5.00%	0.00%	10.00%

3. **The Cost Impact of Schedule Delays** are the costs added on to total project costs for each month of delay. The project team estimates that this annual cost is approximately 1% of total construction costs.

3.2 RISKS

A number of event risks were discussed during the July 2007 workshop. They are summarized in the risk registers provided in Appendix E, at the end of this report. Risk Registers for the Vancouver Alignment, I-5 Alignment, and MOS Design are all included. Categories of risks reviewed during the Risk Assessment Process (RAP) Session include river crossing, highway, transit, construction, environmental, right-of-way, design, external, technical/structural, and traffic risks.

CHAPTER 4: MODEL RESULTS

4.1 COST DISTRIBUTIONS

Vancouver Alignment

Results for Vancouver Alignment scenarios are shown in Figure 11 and Table 10. Figure 11 shows the probability distribution of project costs for all Vancouver Alignment alternatives. The costs are the lowest for the Supplemental Crossing with BRT alternative and highest for the Upstream Replacement Crossing with LRT. In the table below the contingency for the Vancouver Alignment alternatives is presented. This is the percent contingency that would need to be added to the base cost to demonstrate the level of risk in the alternative at the upper end of the 80% confidence interval. By this measure the Supplemental Crossing with BRT has the highest level of risk.

	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Contingency	45.8%	50.3%	45.2%	49.7%	50.7%	50.5%

For the 2a Downstream Replacement Crossing with BRT alternative on the Vancouver Alignment there is only a 10% probability that construction costs will exceed **\$3.83 billion**. The 80% confidence interval range between a 90% probability of exceeding and a 10% likelihood of exceeding is between \$3.31 billion and \$3.83 billion. The base cost of \$2.64 billion is far below this range.

The 2b Upstream Replacement Crossing with BRT alternative on the Vancouver Alignment has higher costs than the similar downstream crossing. There is 10% probability that construction costs will exceed **\$3.99 billion**. The 80% confidence interval range between a 90% probability of exceeding and a 10% likelihood of exceeding is between \$3.44 billion and \$3.99 billion. The base cost of \$2.66 billion is far below this range.

The 3a Downstream Replacement Crossing with LRT alternative on the Vancouver Alignment has higher costs than the similar alternative featuring BRT. The difference in transit type produces a 10% probability that construction will exceed **\$4.02 billion**. The 80% confidence interval range between a 90% probability of exceeding and a 10% likelihood of exceeding is between \$3.51 billion and \$4.02 billion. The base cost of \$2.77 billion is far below this range.

The 3b Upstream Replacement Crossing with LRT alternative on the Vancouver Alignment has higher costs than the similar alternative featuring BRT as well as higher than the similar downstream crossing. The difference in transit type and crossing location produces a 10% probability that construction will exceed **\$4.19 billion**. The 80% confidence interval range between a 90% probability of exceeding and a 10% likelihood of exceeding is between \$3.64 billion and \$4.19 billion. The base cost of \$2.8 billion is far below this range.

The 4 Supplemental Crossing with BRT alternative on the Vancouver Alignment has lower costs than either of the other two BRT alternatives on the Vancouver Alignment. The use of only a supplemental bridge span produces a 10% probability that construction will exceed **\$3.69 billion**. The 80% confidence interval range between a 90% probability of exceeding and a 10% likelihood of exceeding is between \$3.27 billion and \$3.69 billion. The base cost of \$2.45 billion is far below this range.

The 5 Supplemental Crossing with LRT alternative on the Vancouver Alignment has lower costs than the other two LRT alternatives on the Vancouver Alignment, but they are higher than the costs for the Supplemental Crossing with BRT. The Supplemental Crossing with LRT is only 10% will exceed costs of **\$3.86 billion**. The 80% confidence interval range between a 90% probability of exceeding and a 10% likelihood of exceeding is between \$3.43 billion and \$3.86 billion. The base cost of \$2.56 billion is far below this range.

Figure 11: Total Project Costs Vancouver Alignment

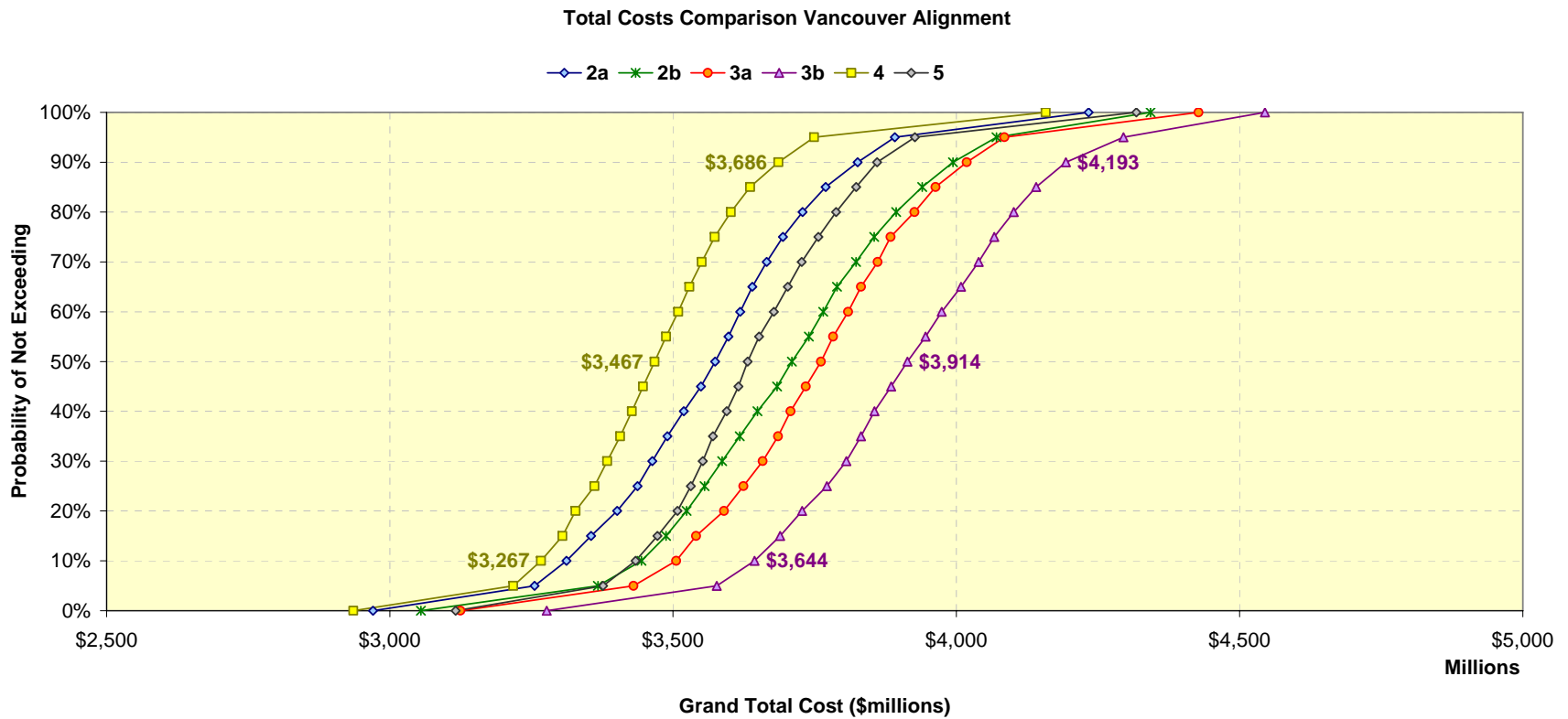


Table 10: Vancouver Alignment Project Costs Summary Table

Mean Expected Outcomes (\$millions)	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Baseline Costs	\$2,624.0	\$2,657.0	\$2,767.1	\$2,800.7	\$2,446.7	\$2,564.1
Baseline Escalated Costs	\$3,166.4	\$3,292.8	\$3,337.1	\$3,480.5	\$2,998.0	\$3,154.1
Mean Expected Outcomes	\$3,560.6	\$3,698.5	\$3,748.3	\$3,906.8	\$3,462.1	\$3,630.0
10 % Probability of Exceeding	\$3,825.9	\$3,994.1	\$4,018.4	\$4,193.5	\$3,686.1	\$3,860.2
40% Probability of Exceeding	\$3,618.6	\$3,765.1	\$3,808.9	\$3,974.1	\$3,509.0	\$3,678.0
50% Probability of Exceeding	\$3,574.2	\$3,709.8	\$3,761.2	\$3,913.8	\$3,467.4	\$3,631.7
90% Probability of Exceeding	\$3,311.8	\$3,444.1	\$3,505.6	\$3,643.9	\$3,267.0	\$3,433.6

I-5 Alignment

Results for I-5 Alignment scenarios are shown in Figure 12 and Table 11. Figure 12 shows the probability distribution of project costs for all I-5 Alignment alternatives. The costs are the lowest for the Supplemental Crossing with BRT alternative and highest for the Upstream Replacement Crossing with LRT. In the table below the contingency for the I-5 Alignment alternatives is presented. This is the percent contingency that would need to be added to the base cost to demonstrate the level of risk in the alternative at the upper end of the 80% confidence interval. By this measure the Supplemental Crossing with BRT has the highest level of risk.

	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Contingency	52.6%	57.0%	51.2%	56.7%	58.6%	58.0%

For the 2a Downstream Replacement Crossing with BRT alternative on the I-5 Alignment there is only a 10% probability that construction costs will exceed **\$4.00 billion**. With base costs of \$2.62 billion, the probability distribution of likely project costs range from a 90% probability of exceeding \$3.51 billion to a 10% likelihood of exceeding \$4.00 billion. The median expected outcome is \$3.75 billion.

The 2b Upstream Replacement Crossing with BRT alternative on the I-5 Alignment has higher costs than the similar downstream crossing. There is 10% probability that construction costs are likely to exceed **\$4.17 billion**. The 2b alternative has a base cost of \$2.66 billion. There is an 80% probability the project costs will be between \$3.63 billion and \$4.17 billion with a median value of \$3.90 billion.

The 3a Downstream Replacement Crossing with LRT alternative on the I-5 Alignment has higher costs than the similar alternative featuring BRT. The difference in transit type produces a 10% probability that construction will exceed **\$4.18 billion**. This alternative has base costs of \$2.77 billion. There is an 80% probability project costs will be between \$3.70 billion and \$4.18 billion.

The 3b Upstream Replacement Crossing with LRT alternative on the I-5 Alignment has higher costs than the similar alternative featuring BRT as well as higher than the similar downstream crossing. The difference in transit type and crossing location produces a 10% probability that construction will exceed **\$4.40 billion**. This alternative has base costs of \$2.8 billion. There is an 80% probability the project costs will be between \$3.83 billion and \$4.40 billion with the median at \$4.11 billion.

The 4 Supplemental Crossing with BRT alternative on the I-5 Alignment has lower costs than either of the other two BRT alternatives on the I-5 Alignment. The use of only a supplemental bridge span produces a 10% probability that construction will exceed **\$3.88 billion**. There is a \$2.45 billion base cost for this alternative. Project Costs have an 80% probability of being between \$3.46 billion and \$3.88 billion with the median project costs expected to be \$3.65 billion.

The 5 Supplemental Crossing with LRT alternative on the I-5 Alignment has lower costs than the other two LRT alternatives on the I-5 Alignment, but they are higher than the costs for the Supplemental Crossing with BRT. The Supplemental Crossing with LRT is only 10% likely to exceed costs of **\$4.05 billion**. The base costs for this project are \$2.56 billion. There is an 80% likelihood project costs will fall between \$3.64 billion and \$4.05 billion with the median expected value being \$3.83 billion.

Figure 12: Total Project Costs I-5 Alignment

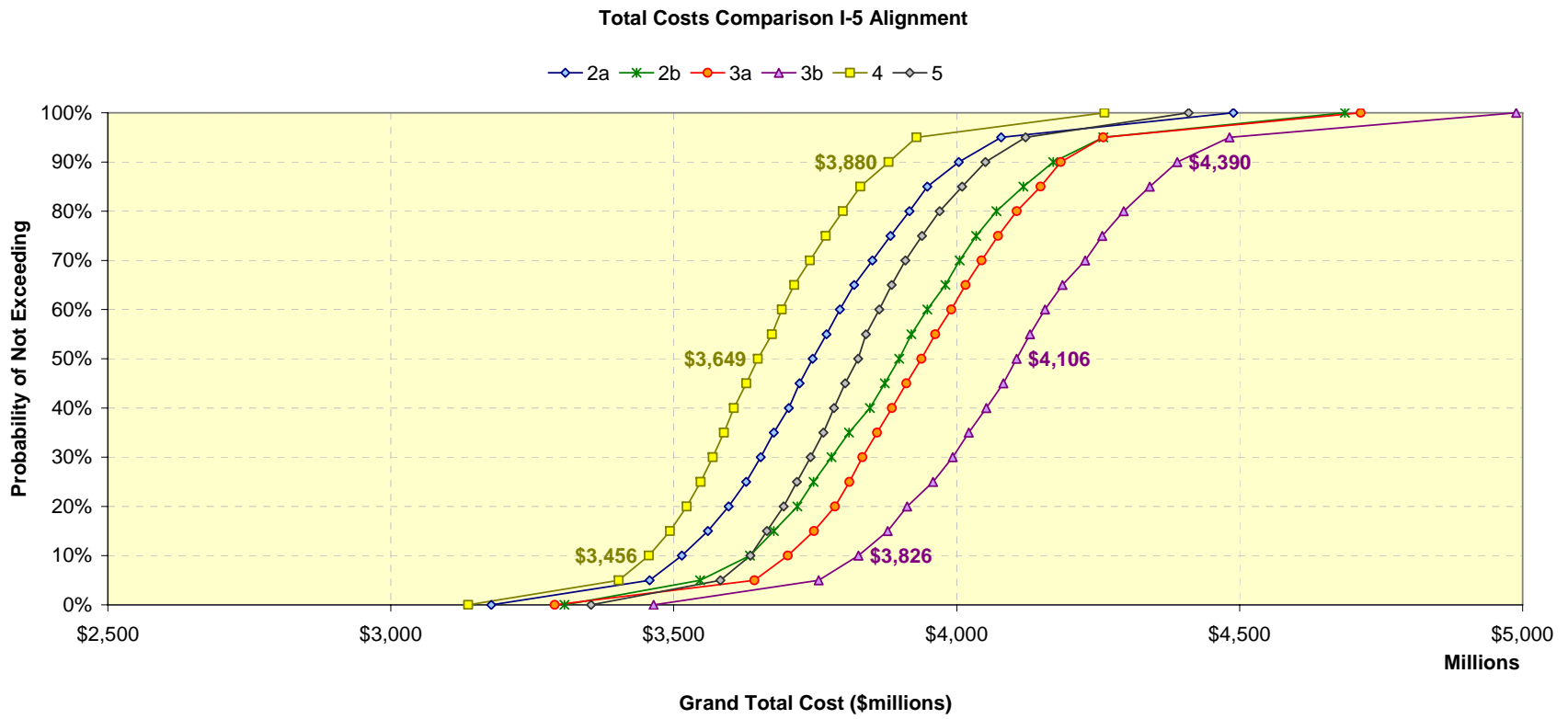


Table 11: I-5 Alignment Project Costs Summary Table

Mean Expected Outcomes (\$millions)	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Base Costs	\$2,624.0	\$2,657.0	\$2,767.1	\$2,800.7	\$2,446.7	\$2,564.1
Baseline Escalated Costs	\$3,166.4	\$3,292.8	\$3,337.1	\$3,480.5	\$2,998.0	\$3,154.1
Mean Expected Outcomes	\$3,753.5	\$3,891.4	\$3,941.6	\$4,100.1	\$3,657.1	\$3,824.9
10 % Probability of Exceeding	\$4,003.8	\$4,170.5	\$4,183.6	\$4,389.7	\$3,879.7	\$4,050.8
40 % Probability of Exceeding	\$3,793.5	\$3,947.9	\$3,990.5	\$4,156.1	\$3,691.0	\$3,863.4
50% Probability of Exceeding	\$3,745.3	\$3,898.3	\$3,937.5	\$4,105.8	\$3,648.7	\$3,825.9
90% Probability of Exceeding	\$3,514.4	\$3,634.7	\$3,701.7	\$3,826.0	\$3,455.9	\$3,635.3

MOS Design

Results for MOS Design scenarios are shown in Figure 13 and Table 12. Figure 13 shows the probability distribution of project costs for all MOS Design alternatives. The costs are the lowest for the Mill District BRT alternative and highest for the Clark College LRT alternative. In the table below the contingency for the MOS Design alternatives is presented. This is the percent contingency that would need to be added to the base cost to demonstrate the level of risk in the alternative at the upper end of the 80% confidence interval. By this measure the Mill District BRT has the highest level of risk.

	2a: Downstream Replacement w/ BRT Mill District MOS	2a: Downstream Replacement w/ BRT Clark College MOS	3a: Downstream Replacement w/ LRT Mill District MOS	3a: Downstream Replacement w/ LRT Clark College MOS
Contingency	46.9%	46.4%	46.4%	46.2%

The 2a Downstream Replacement Crossing with BRT MOS alternative on the Mill District Alignment has lower costs than either of the two full segment Downstream Replacement Crossings with BRT. The use of only the minimal operable segment on the Mill District Alignment produces a 10% probability that construction will exceed **\$3.55 billion**. There is a \$2.42 billion base cost for this alternative. Project Costs have an 80% probability of being between \$3.13 billion and \$3.55 billion with the median project costs expected to be \$3.33 billion.

The 2a Downstream Replacement Crossing with BRT MOS alternative on the Clark College Alignment has lower costs than either of the two full segment Downstream Replacement Crossings with BRT but not quite as low as the Mill District Alignment. The use of only the minimal operable segment on the Clark College Alignment produces a 10% probability that construction will exceed **\$3.58 billion**. There is a \$2.44 billion base cost for this alternative. Project Costs have an 80% probability of being between \$3.15 billion and \$3.58 billion with the median project costs expected to be \$3.36 billion.

The 3a Downstream Replacement Crossing with LRT MOS alternative on the Mill District Alignment has lower costs than either of the two full segment Downstream Replacement Crossings with LRT. The use of only the minimal operable segment on the Mill District Alignment produces a 10% probability that construction will exceed **\$3.63 billion**. There is a \$2.48 billion base cost for this alternative. Project Costs have an 80% probability of being between \$3.20 billion and \$3.63 billion with the median project costs expected to be \$3.40 billion.

The 3a Downstream Replacement Crossing with LRT MOS alternative on the Clark College Alignment has lower costs than either of the two full segment Downstream Replacement Crossings with LRT but not quite as low as the Mill District Alignment. The use of only the minimal operable segment on the Clark College Alignment produces a 10% probability that construction will exceed **\$3.69 billion**. There is a \$2.52 billion base cost for this alternative. Project Costs have an 80% probability of being between \$3.26 billion and \$3.69 billion with the median project costs expected to be \$3.46 billion.

Figure 13: Total Project Costs MOS Design

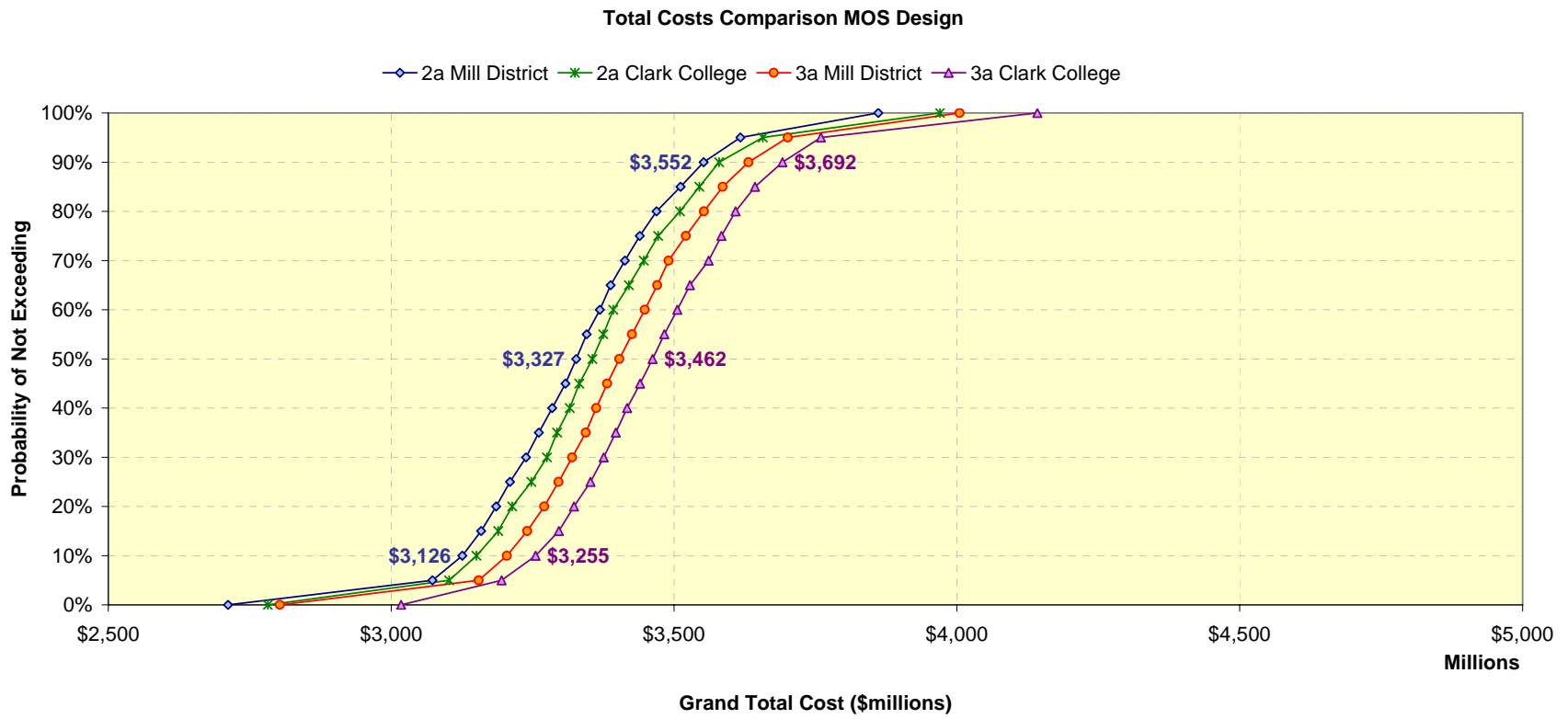


Table 12: MOS Design Project Costs Summary Table

Mean Expected Outcomes (\$millions)	2a: Downstream Replacement w/ BRT Mill District MOS	2a: Downstream Replacement w/ BRT Clark College MOS	3a: Downstream Replacement w/ LRT Mill District MOS	3a: Downstream Replacement w/ LRT Clark College MOS
Base Costs	\$2,417.7	\$2,444.3	\$2,480.2	\$2,524.8
Baseline Escalated Costs	\$2,927.5	\$2,958.8	\$3,003.6	\$3,057.0
Mean Expected Outcomes	\$3,333.0	\$3,367.5	\$3,413.4	\$3,472.0
10 % Probability of Exceeding	\$3,552.4	\$3,579.5	\$3,631.7	\$3,691.8
40 % Probability of Exceeding	\$3,368.9	\$3,392.8	\$3,448.3	\$3,506.1
50% Probability of Exceeding	\$3,327.1	\$3,355.5	\$3,403.5	\$3,462.0
90% Probability of Exceeding	\$3,125.8	\$3,150.6	\$3,204.6	\$3,255.2

4.2 SCHEDULE DISTRIBUTIONS

All project schedules are contingent on a November 1, 2006 start for the initial project activities. The complete baseline and risk adjusted schedules are provided in Appendix D. At the current level of design there is no difference in the schedule for constructing the BRT transit option and the LRT transit option.

Vancouver Alignment

In the Vancouver Alignment the shortest project schedules are for the two downstream replacement bridge options. This is true with an expected baseline end date of April 2015, and a 90% chance of completion by June of 2018. The downstream replacement options have an 80% likelihood of being completed between May of 2016 and June of 2018, with a median end date of May 2017.

The next shortest schedules belong to the two supplemental crossing project options. The expected baseline end date for these alternatives is June of 2015, with 90% likelihood that risk events will not delay the project past August of 2018. The supplemental crossing options have an 80% likelihood of being completed between October 2016 and August 2019 with a median end date of February 2018.

The project schedule for the upstream replacement bridges on the Vancouver Alignment is the longest for any of this alignment. The expected baseline end date for these alternatives is July of 2019, with 90% likelihood that risk events will not delay the project past March of 2023. The upstream replacement crossing options have an 80% likelihood of being

completed between September 2019 and March 2023 with a median end date of June 2021.

Figure 14: Expected Dates of Completion Vancouver Alignment

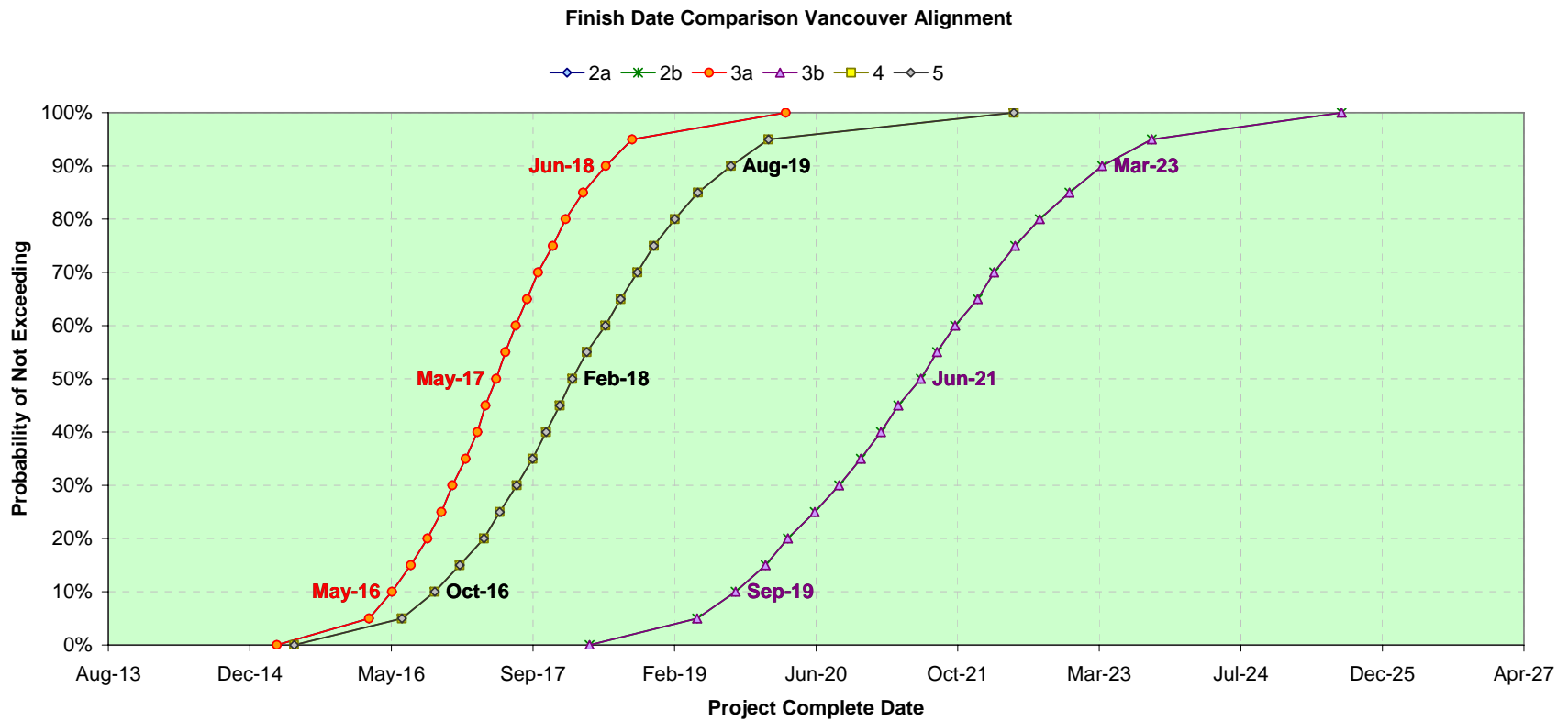


Table 13: Vancouver Alignment Project End Date Summary Table

Project End Dates	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Baseline Project End Date	4/1/2015	7/1/2019	4/1/2015	7/1/2019	6/1/2015	6/1/2015
Mean Expected End Date	4/29/2017	5/25/2021	4/29/2017	5/25/2021	2/1/2018	2/1/2018
10 % Probability of Exceeding	6/6/2018	3/25/2023	6/6/2018	3/25/2023	8/22/2019	8/22/2019
40% Probability of Exceeding	7/23/2017	10/21/2021	7/23/2017	10/21/2021	6/5/2018	6/5/2018
50% Probability of Exceeding	5/15/2017	6/23/2021	5/15/2017	6/23/2021	2/8/2018	2/8/2018
90% Probability of Exceeding	5/11/2016	9/8/2019	5/11/2016	9/8/2019	10/10/2016	10/10/2016

I-5 Alignment

In the I-5 Alignment the shortest project schedules are for the two downstream replacement bridge options. This is true with an expected baseline end date of April 2015, and a 90% chance of completion by June of 2018. The downstream replacement options have an 80% likelihood of being completed between May of 2016 and June of 2018, with a median end date of May 2017.

The next shortest schedules belong to the two supplemental crossing project options. The expected baseline end date for these alternatives is June of 2015, with 90% likelihood that risk events will not delay the project past August of 2018. The supplemental crossing options have an 80% likelihood of being completed between October 2016 and August 2019 with a median end date of January 2018.

The project schedule for the upstream replacement bridges on the I-5 Alignment is the longest for any of this alignment. The expected baseline end date for these alternatives is July of 2019, with 90% likelihood that risk events will not delay the project past April of 2023. The upstream replacement crossing options have an 80% likelihood of being completed between October 2019 and April 2023 with a median end date of June 2021.

Figure 15: Expected Dates of Completion I-5 Alignment

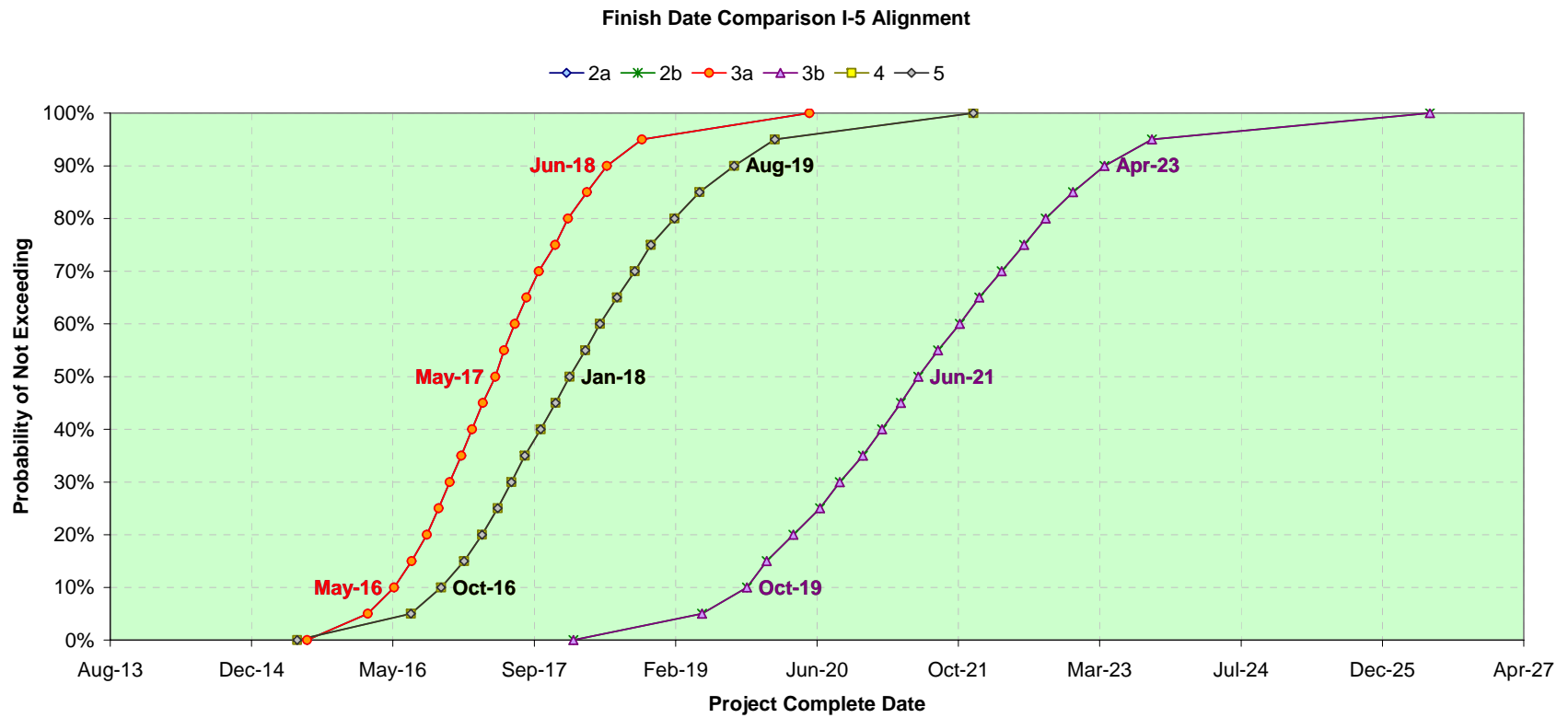


Table 14: I-5 Project End Date Summary Table

Project End Dates	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Baseline Project End Date	4/1/2015	7/1/2019	4/1/2015	7/1/2019	6/1/2015	6/1/2015
Mean Expected End Date	4/29/2017	5/25/2021	4/29/2017	5/25/2021	2/1/2018	2/1/2018
10 % Probability of Exceeding	6/5/2018	4/1/2023	6/5/2018	4/1/2023	8/29/2019	8/29/2019
40 % Probability of Exceeding	7/15/2017	11/4/2021	7/15/2017	11/4/2021	5/12/2018	5/12/2018
50% Probability of Exceeding	5/6/2017	6/10/2021	5/6/2017	6/10/2021	1/24/2018	1/24/2018
90% Probability of Exceeding	5/14/2016	10/14/2019	5/14/2016	10/14/2019	10/27/2016	10/27/2016

MOS Design

The MOS design alternatives do not feature differences in project schedule whether they go to Mill District or Clark College. Combine this with the lack of schedule difference between BRT and LRT alternatives and all four MOS alternatives have the same likely schedule. The expected baseline end date for these alternatives is May of 2015, with 90% likelihood that risk events will not delay the project past July of 2017. The upstream replacement crossing options have an 80% likelihood of being completed between December 2015 and July 2017 with a median end date of August 2016.

Figure 16: Expected Dates of Completion MOS Design

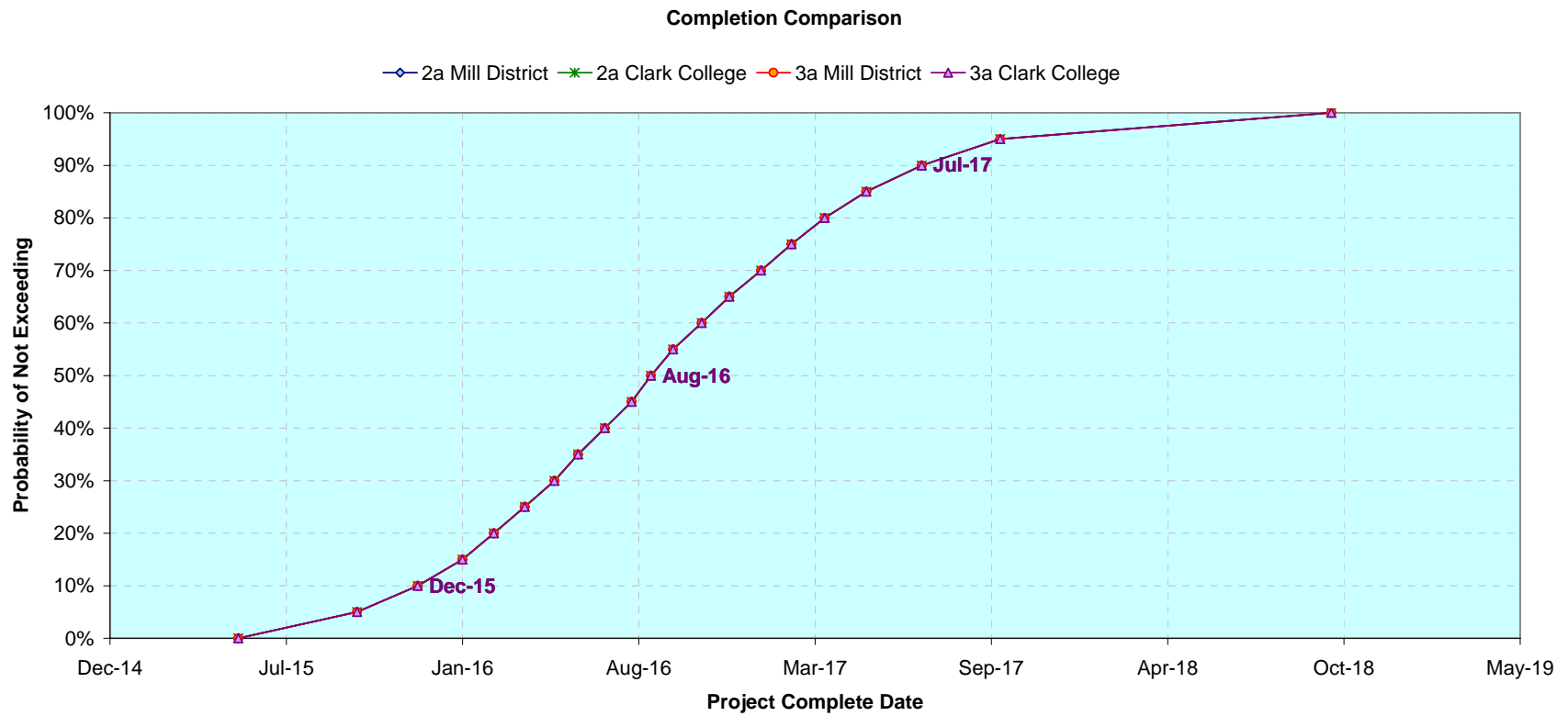


Table 15: MOS Design Project End Date Summary Table

Project End Dates	2a: Downstream Replacement w/ BRT Mill District MOS	2a: Downstream Replacement w/ BRT Clark College MOS	3a: Downstream Replacement w/ LRT Mill District MOS	3a: Downstream Replacement w/ LRT Clark College MOS
Baseline Project End Date	5/9/2015	5/9/2015	5/9/2015	5/9/2015
Mean Expected End Date	9/6/2016	9/6/2016	9/6/2016	9/6/2016
10 % Probability of Exceeding	7/4/2017	7/4/2017	7/4/2017	7/4/2017
40 % Probability of Exceeding	10/28/2016	10/28/2016	10/28/2016	10/28/2016
50% Probability of Exceeding	8/31/2016	8/31/2016	8/31/2016	8/31/2016
90% Probability of Exceeding	12/11/2015	12/11/2015	12/11/2015	12/11/2015

4.3 IDENTIFICATION OF KEY RISKS AND OPPORTUNITIES AND TORNADO DIAGRAMS

The tornado charts in the following pages are used to identify the key risks for each project alternative. This tornado chart shows the expected value of the cost or schedule impact for each event risk. The expected impact is calculated as the product of the probability of occurrence and the cost or delay estimate provided by the panelists.

Key Cost Risks and Opportunities

Figure 17 below is a graphical representation of the expected value the major events that might create a project cost risk or opportunity for a downstream replacement crossing with BRT for the Vancouver Alignment. The I-5 alignment has some minor differences. There is no \$104 million opportunity for the I-5, and the TR-Kiggins Bowl / Lincoln Park and Ride event has an expected value of \$69 million rather than \$22 million. The top 5 risks applicable to both of the Vancouver Alignment and the I-5 Alignment for downstream replacement crossing with BRT are:¹

1. Required freeway lid in city of Vancouver (19);
2. R-4 - HCT inside segmental box (16);
3. T-3 - Park and Rides at Lincoln and Expo Center (27);
4. Other major projects in the area at the same time (Construction); and
5. O-2 - Keep the profile elevated across Hayden Island (21-22).

¹ The number in parenthesis following each risk is the activity number the risk is applied to.

Figure 17: Key Cost Risks Downstream Replacement Crossing with BRT

Tornado Chart: Expected Incremental Cost (\$million)

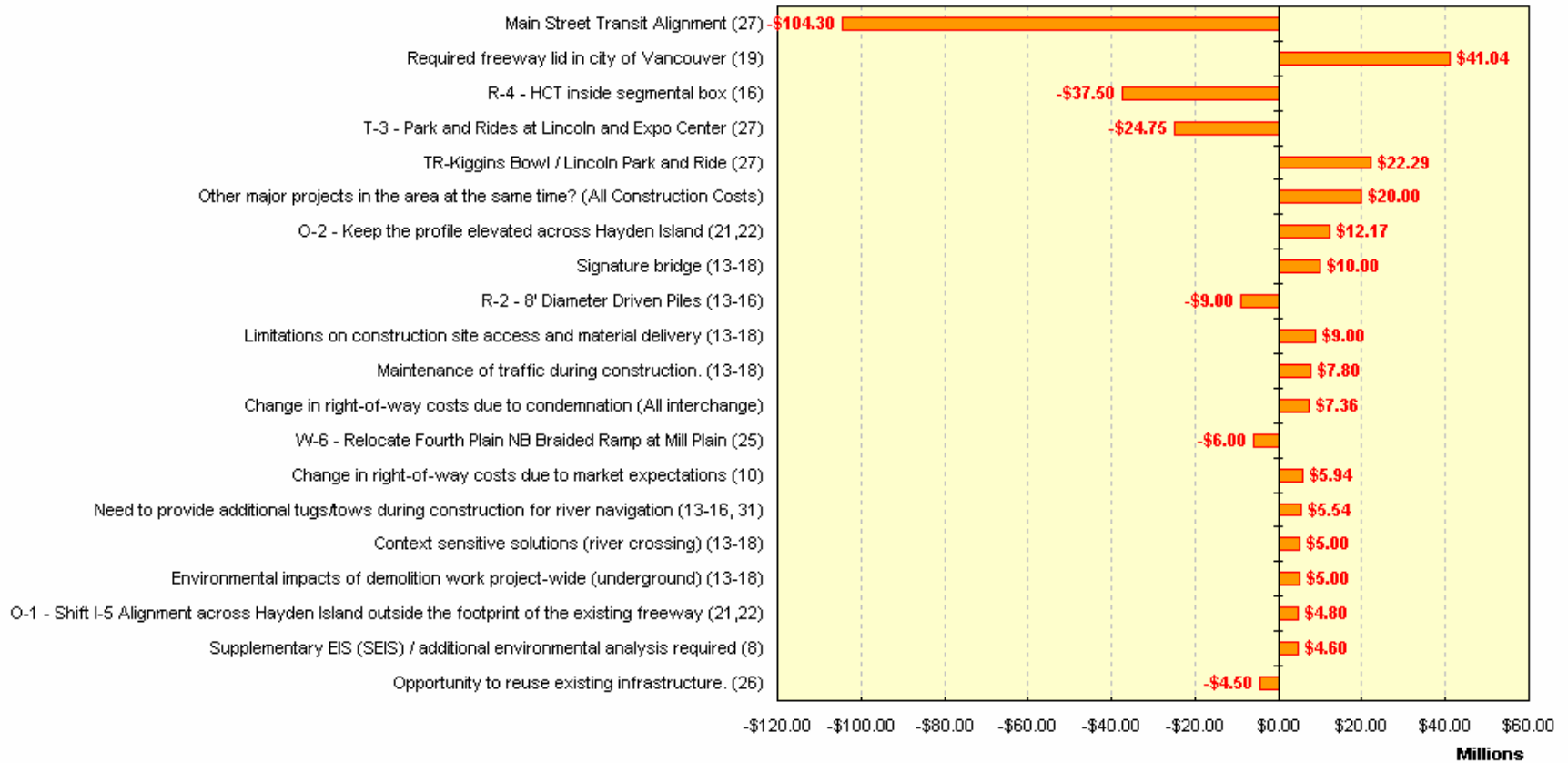


Figure 18 below is a graphical representation of the expected value the major events that might create a project cost risk or opportunity for an upstream replacement crossing with BRT for the Vancouver Alignment. The I-5 alignment has some minor differences. There is no \$104 million opportunity for the I-5, and the TR-Kiggins Bowl / Lincoln Park and Ride event has an expected value of \$69 million rather than \$22 million. The top 5 risks applicable to both of the Vancouver Alignment and the I-5 Alignment for upstream replacement crossing with BRT are:²

1. Required freeway lid in city of Vancouver (19);
2. R-4 - HCT inside segmental box (16);
3. T-3 - Park and Rides at Lincoln and Expo Center (27);
4. Other major projects in the area at the same time (Construction); and
5. O-2 - Keep the profile elevated across Hayden Island (21-22).

² The number in parenthesis following each risk is the activity number the risk is applied to.

Figure 18: Key Cost Risks Upstream Replacement Crossing with BRT

Tornado Chart: Expected Incremental Cost (\$million)

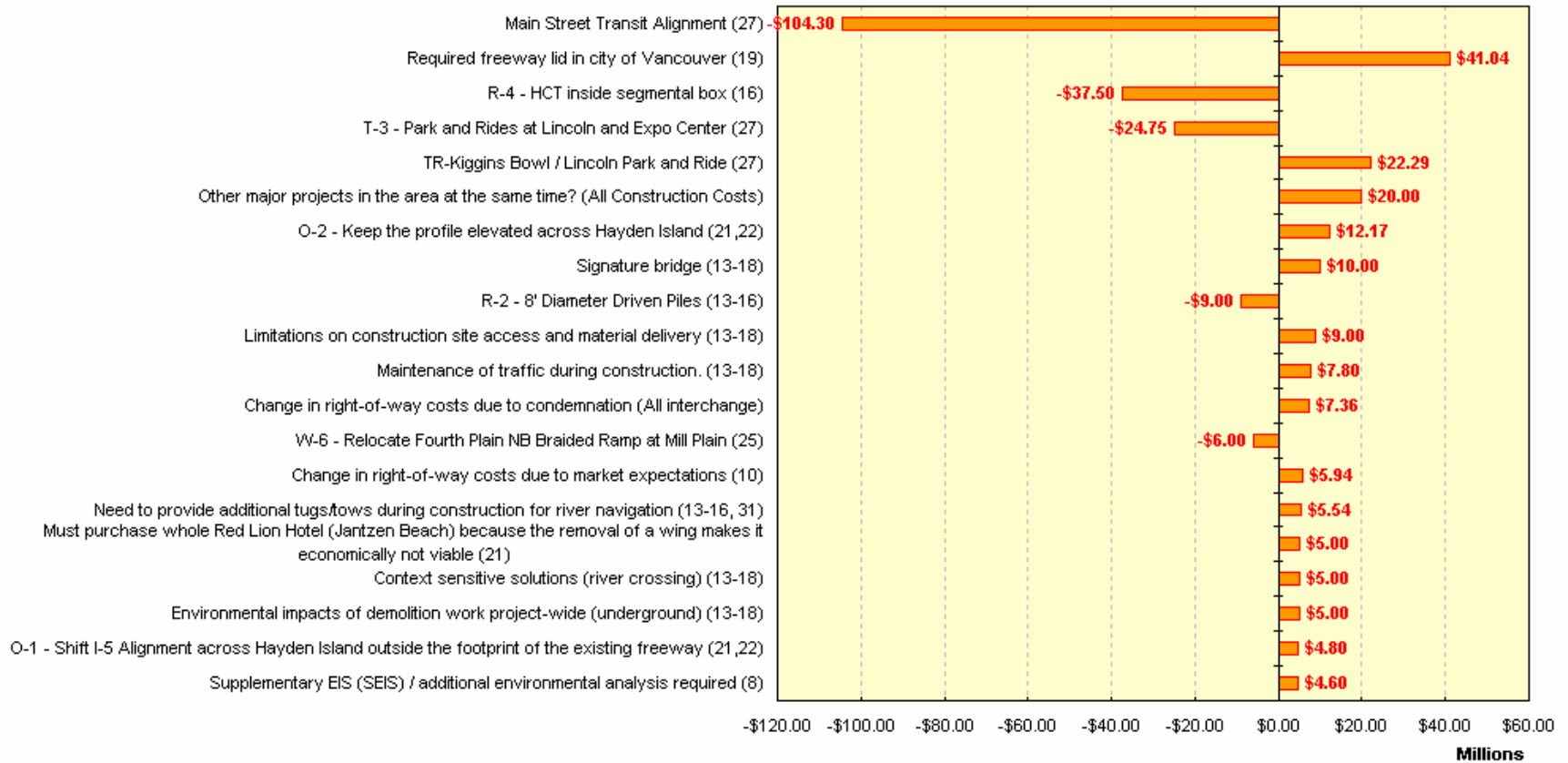


Figure 19 below is a graphical representation of the expected value the major events that might create a project cost risk or opportunity for a downstream replacement crossing with LRT for the Vancouver Alignment. The I-5 alignment has some minor differences. There is no \$104 million opportunity for the I-5, and the TR-Kiggins Bowl / Lincoln Park and Ride event has an expected value of \$69 million rather than \$22 million. The top 5 risks applicable to both of the Vancouver Alignment and the I-5 Alignment for downstream replacement crossing with LRT are:³

1. Required freeway lid in city of Vancouver (19);
2. R-4 - HCT inside segmental box (16);
3. T-3 - Park and Rides at Lincoln and Expo Center (27);
4. Other major projects in the area at the same time (Construction); and
5. O-2 - Keep the profile elevated across Hayden Island (21-22).

³ The number in parenthesis following each risk is the activity number the risk is applied to.

Figure 19: Key Cost Risks Downstream Replacement Crossing with LRT

Tornado Chart: Expected Incremental Cost (\$million)

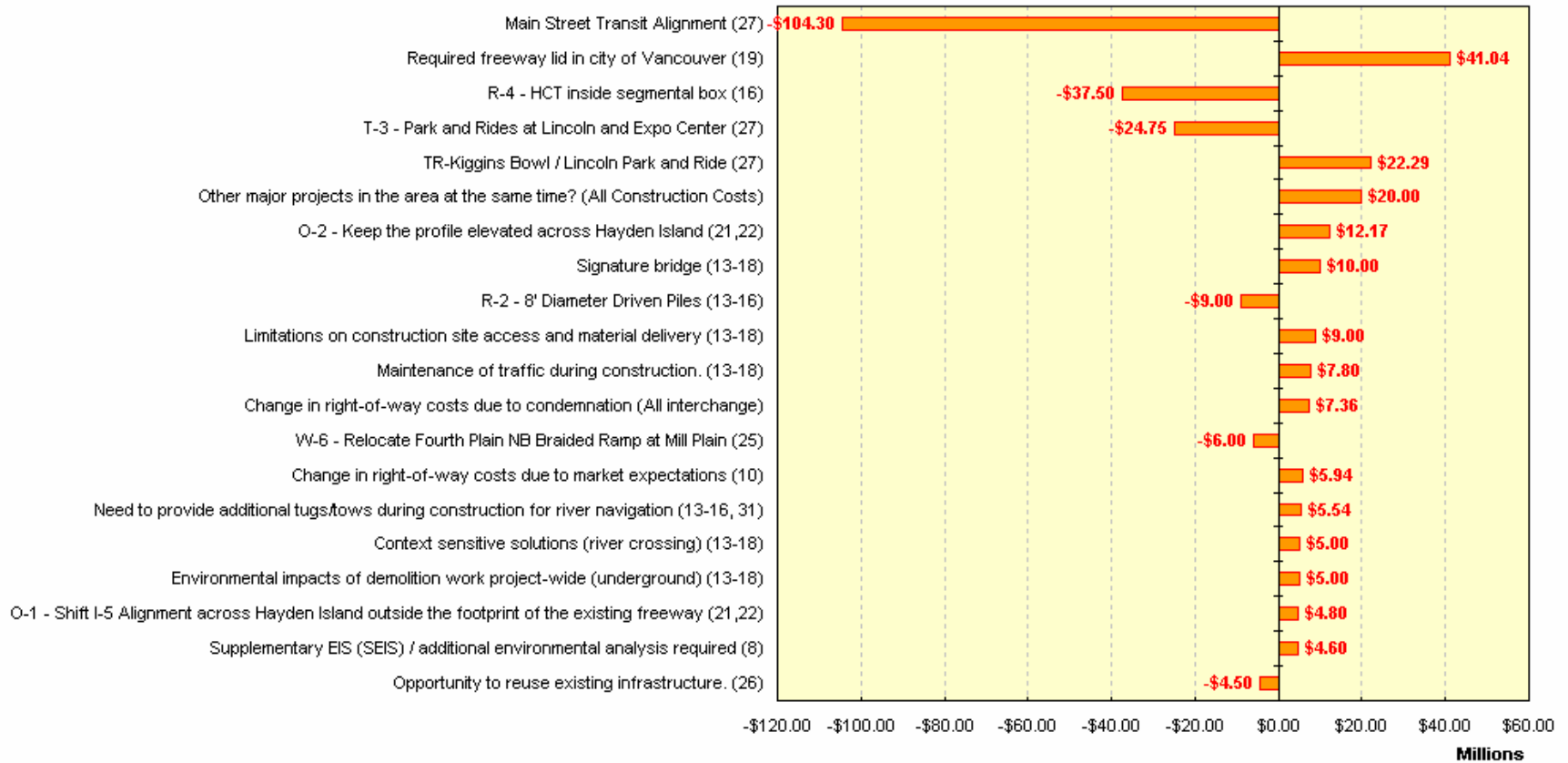


Figure 20 below is a graphical representation of the expected value the major events that might create a project cost risk or opportunity for an upstream replacement crossing with LRT for the Vancouver Alignment. The I-5 alignment has some minor differences. There is no \$104 million opportunity for the I-5, and the TR-Kiggins Bowl / Lincoln Park and Ride event has an expected value of \$69 million rather than \$22 million. The top 5 risks applicable to both of the Vancouver Alignment and the I-5 Alignment for upstream replacement crossing with LRT are:⁴

1. Required freeway lid in city of Vancouver (19);
2. R-4 - HCT inside segmental box (16);
3. T-3 - Park and Rides at Lincoln and Expo Center (27);
4. Other major projects in the area at the same time (Construction); and
5. O-2 - Keep the profile elevated across Hayden Island (21-22).

⁴ The number in parenthesis following each risk is the activity number the risk is applied to.

Figure 20: Key Cost Risks Upstream Replacement Crossing with LRT

Tornado Chart: Expected Incremental Cost (\$million)

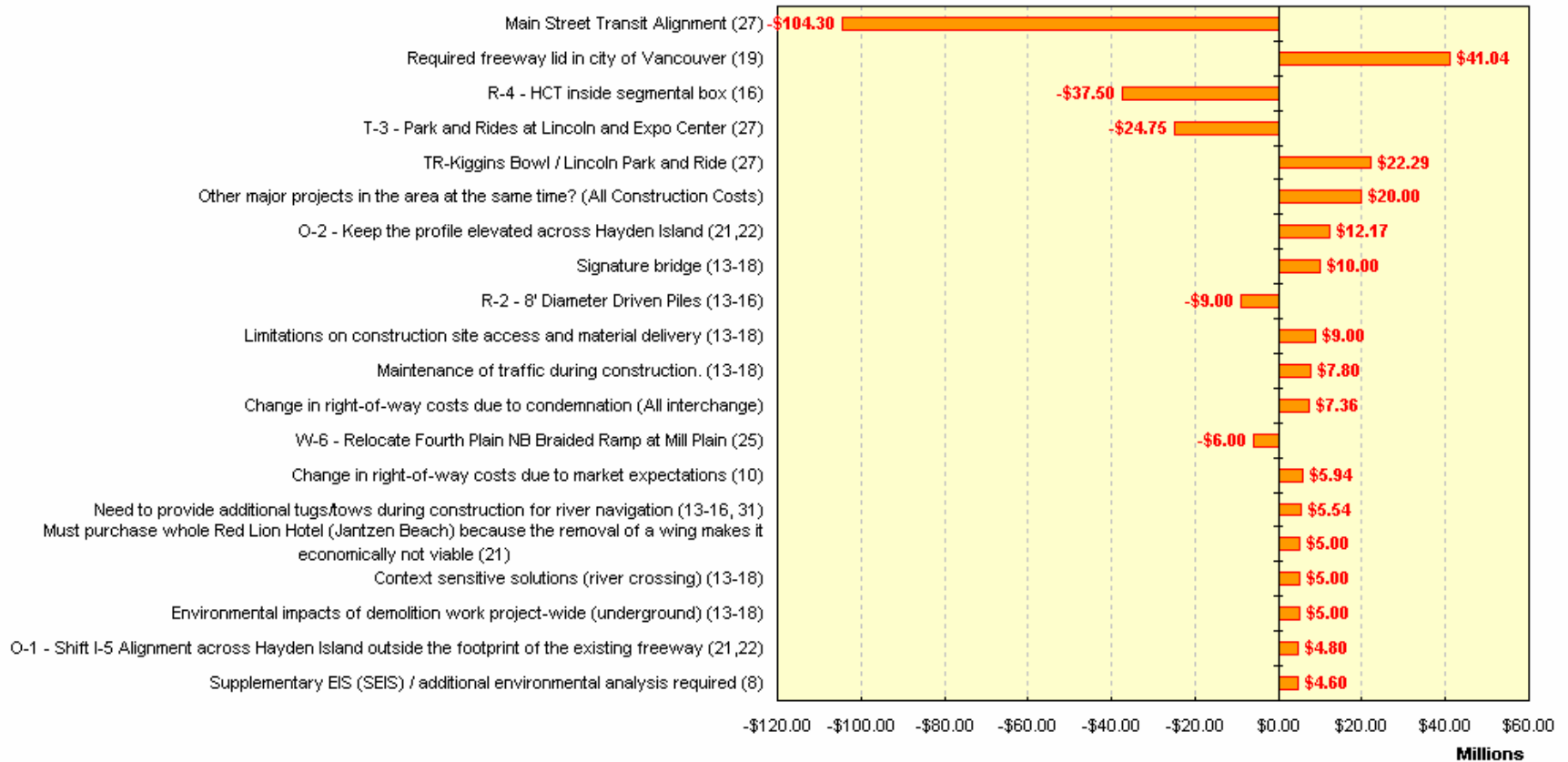


Figure 21 below is a graphical representation of the expected value the major events that might create a project cost risk or opportunity for supplemental crossing with BRT for the Vancouver alignment. The I-5 alignment has some minor differences. There is a \$104 million opportunity for the I-5 and not the Vancouver alignment, and the TR-Kiggins Bowl / Lincoln Park and Ride event has an expected value of \$69 million rather than \$22 million. The top 5 risks applicable to both of the Vancouver alignment and the I-5 Alignment for upstream replacement crossing with LRT are:⁵

1. Required freeway lid in city of Vancouver (19);
2. R-4 - HCT inside segmental box (16);
3. T-3 - Park and Rides at Lincoln and Expo Center (27);
4. Other major projects in the area at the same time (Construction); and
5. O-2 - Keep the profile elevated across Hayden Island (21-22).

⁵ The number in parenthesis following each risk is the activity number the risk is applied to.

Figure 21: Key Cost Risks Supplemental Crossing with BRT

Tornado Chart: Expected Incremental Cost (\$million)

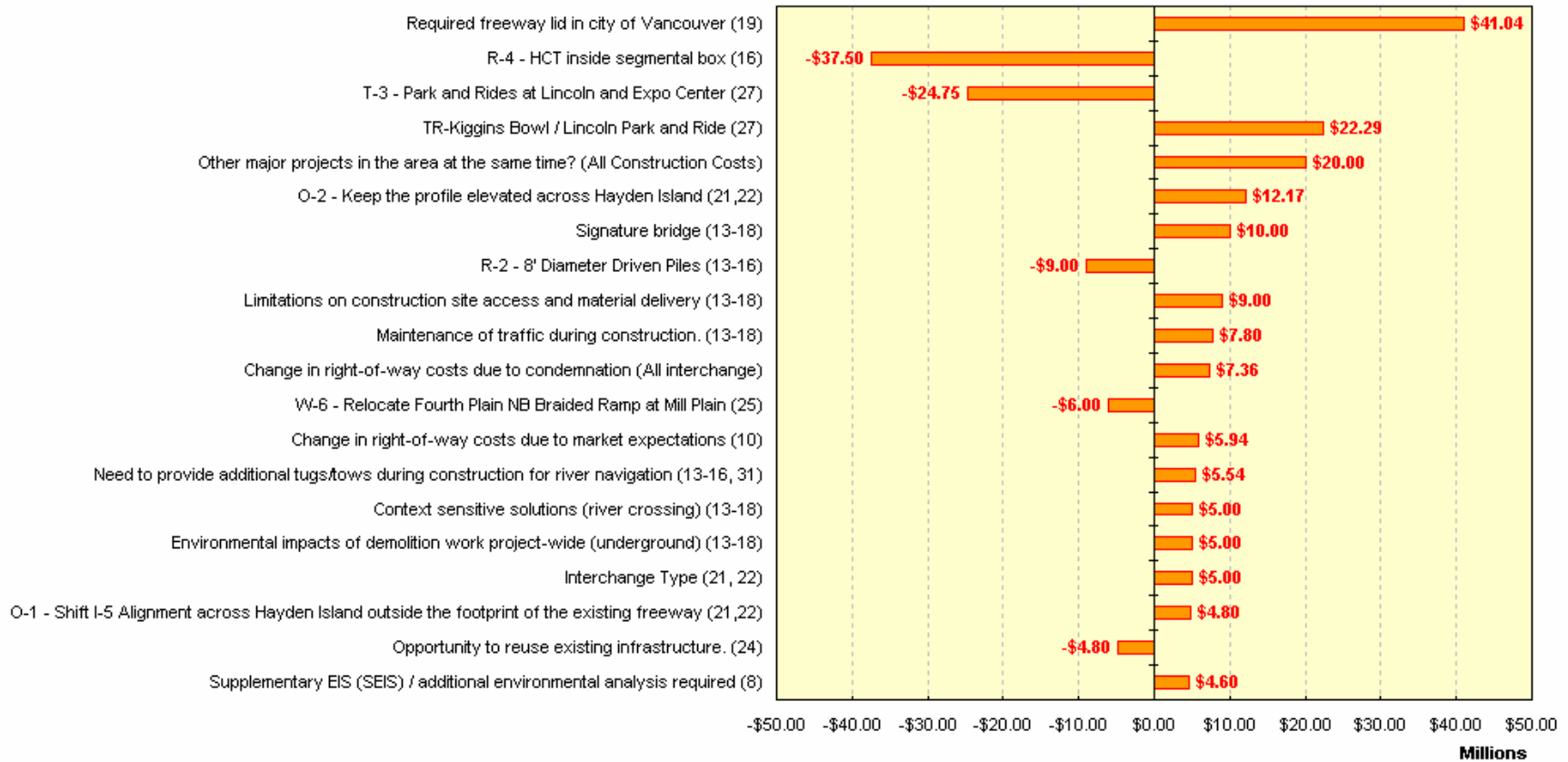


Figure 22 below is a graphical representation of the expected value the major events that might create a project cost risk or opportunity for supplemental crossing with LRT for the Vancouver alignment. The I-5 alignment has some minor differences. There is a \$104 million opportunity for the I-5 and not the Vancouver alignment, and the TR-Kiggins Bowl / Lincoln Park and Ride event has an expected value of \$69 million rather than \$22 million. The top 5 risks applicable to both of the Vancouver alignment and the I-5 Alignment for upstream replacement crossing with LRT are:⁶

1. Required freeway lid in city of Vancouver (19);
2. R-4 - HCT inside segmental box (16);
3. T-3 - Park and Rides at Lincoln and Expo Center (27);
4. Other major projects in the area at the same time (Construction); and
5. O-2 - Keep the profile elevated across Hayden Island (21-22).

⁶ The number in parenthesis following each risk is the activity number the risk is applied to.

Figure 22: Key Cost Risks Supplemental Crossing with LRT

Tornado Chart: Expected Incremental Cost (\$million)

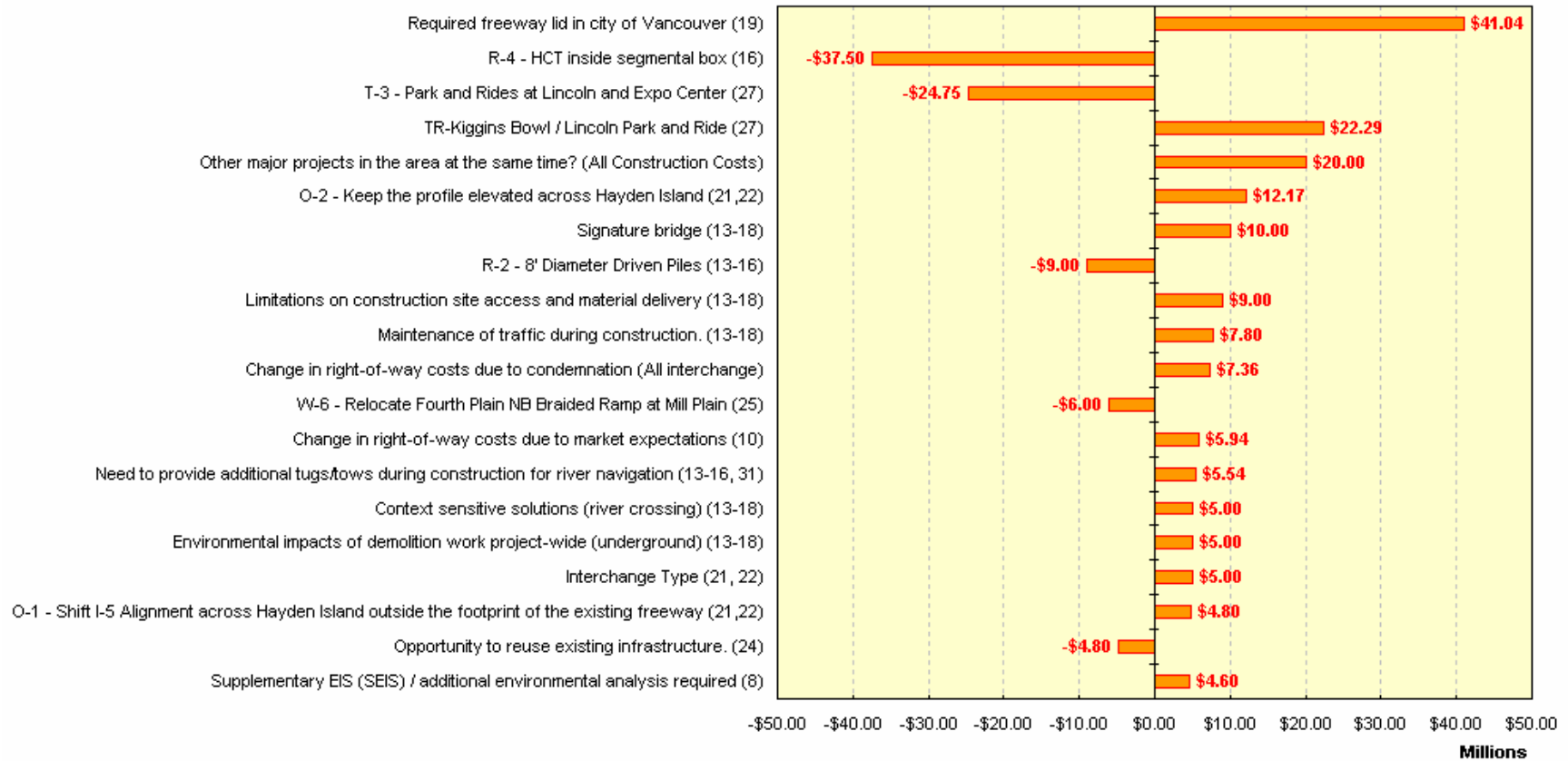


Figure 23 below is a graphical representation of the expected value the major events that might create a project cost risk or opportunity for the downstream replacement crossing with BRT for the MOS Design Alternative for both the Mill District Alignment and the Clark College Alignment.⁷

1. Required freeway lid in city of Vancouver (19);
2. R-4 – HCT inside segmental box (16);
3. Other major projects in the area at the same time (Construction);
4. O-2 – Keep the profile elevated across Hayden Island (21-22); and
5. Signature Bridge (13-18)

⁷ The number in parenthesis following each risk is the activity number the risk is applied to.

Figure 23: Key Cost Risks Downstream Replacement Crossing with BRT MOS

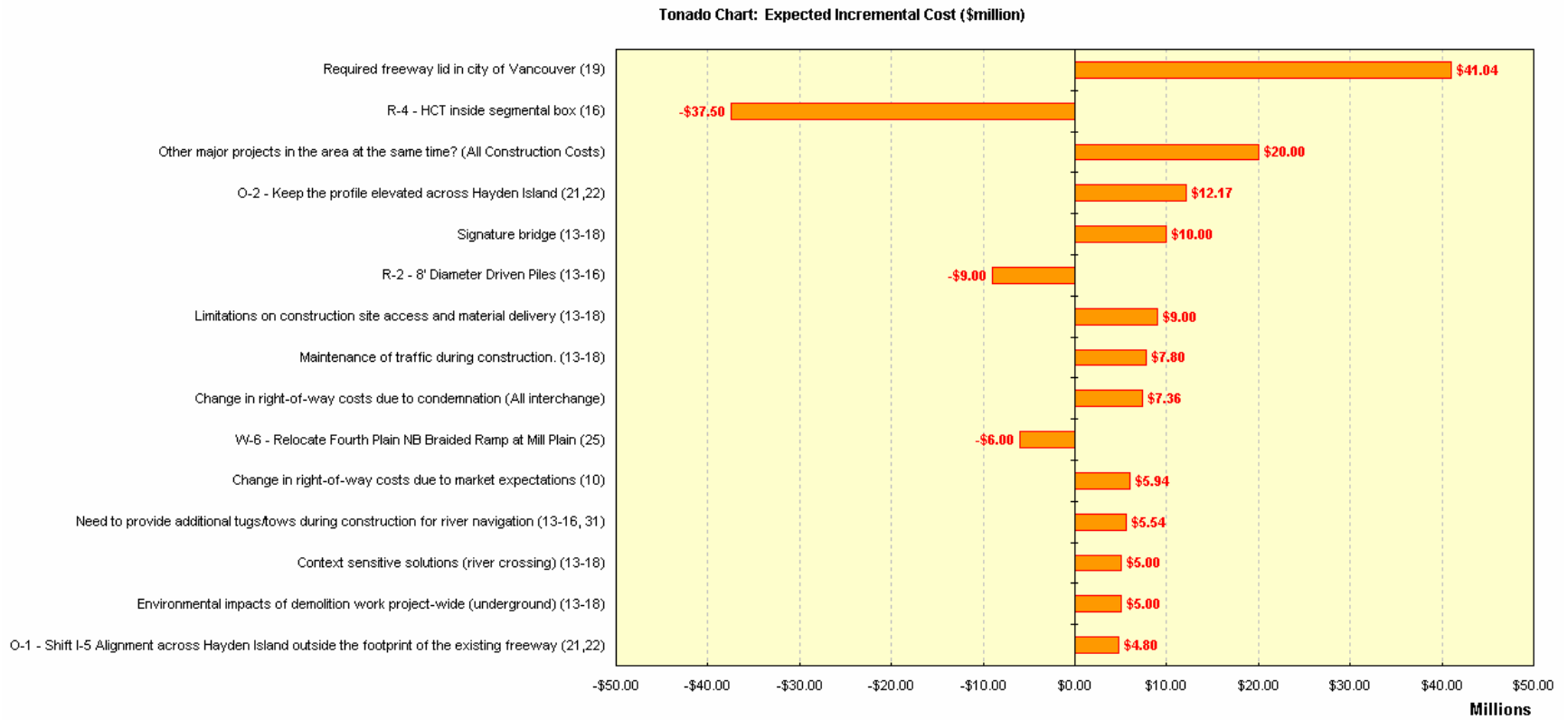
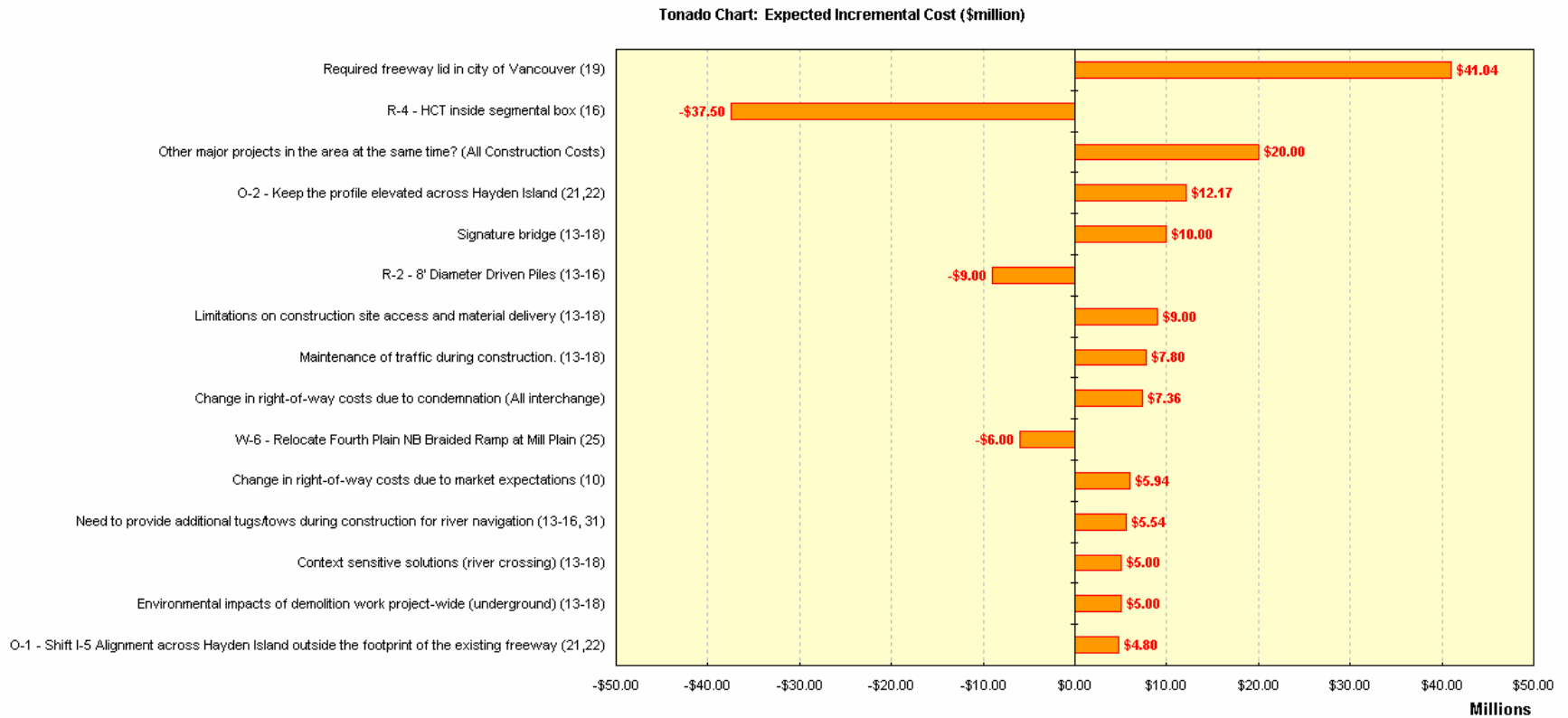


Figure 24 below is a graphical representation of the expected value the major events that might create a project cost risk or opportunity for the downstream replacement crossing with LRT for the MOS Design Alternative for both the Mill District Alignment and the Clark College Alignment.⁸

1. Required freeway lid in city of Vancouver (19);
2. R-4 – HCT inside segmental box (16);
3. Other major projects in the area at the same time (Construction);
4. O-2 – Keep the profile elevated across Hayden Island (21-22); and
5. Signature Bridge (13-18)

⁸ The number in parenthesis following each risk is the activity number the risk is applied to.

Figure 24: Key Cost Risks Downstream Replacement Crossing with LRT MOS



Key Schedule Risks and Opportunities

Figure 25 below is a graphical representation of the expected delay that may occur due to event risks forecasted by risk panel. Excluding the risks exclusive to either the Vancouver or I-5 Alignment (the Vancouver Transit Alignment Risk applicable to only the Vancouver Alignment), the top 5 risks expected to impact downstream replacement crossings with BRT are:⁹

1. Inadvertent discoveries of archeological findings during construction (19-20);
2. Inadvertent discoveries of archeological findings during construction (25);
3. Supplementary EIS (SEIS)/ additional environmental analysis required (8);
4. Compliance with permitting requirements for work in the water (13-16, 31); and
5. Experience of contractor for foundations and superstructure (13-16, 31).

⁹ The number in parenthesis following each risk is the activity number the risk is applied to.

Figure 25: Key Schedule Risks Downstream Replacement Crossing with BRT

Tornado Chart: Expected Schedule Delays (months)

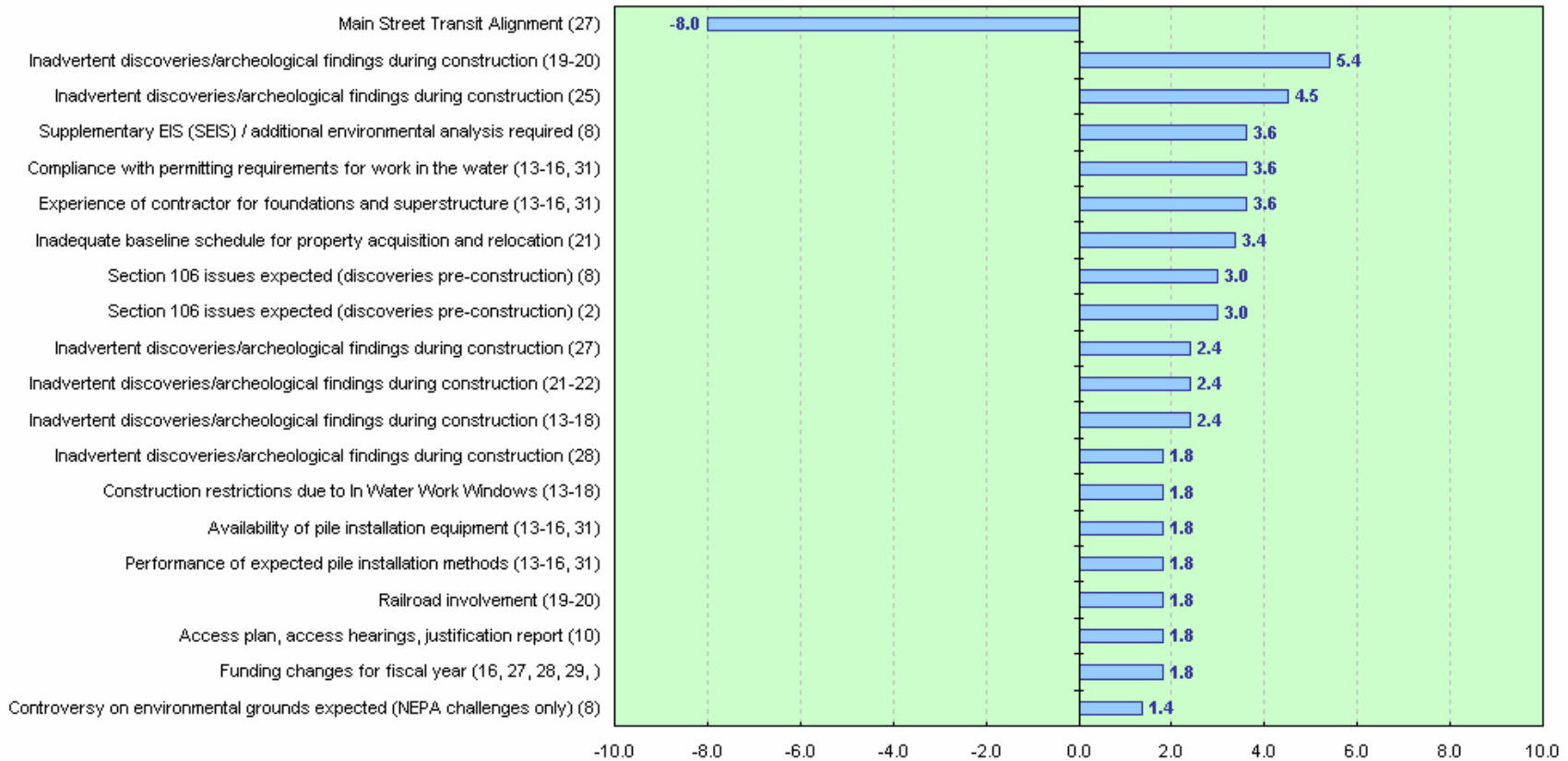


Figure 26 below is a graphical representation of the expected delay that may occur due to event risks forecasted by risk panel. Excluding the risks exclusive to either the Vancouver or I-5 Alignment (the Vancouver Transit Alignment Risk applicable to only the Vancouver Alignment), the top 5 risks expected to impact upstream replacement crossings with BRT are:¹⁰

1. R-4 – HCT inside segmental box (16);
2. Inadvertent discoveries of archeological findings during construction (19-20);
3. Inadvertent discoveries of archeological findings during construction (25);
4. Supplementary EIS (SEIS)/ additional environmental analysis required (8); and
5. Compliance with permitting requirements for work in the water (13-16, 31).

¹⁰ The number in parenthesis following each risk is the activity number the risk is applied to.

Figure 26: Key Schedule Risks Upstream Replacement Crossing with BRT

Tornado Chart: Expected Schedule Delays (months)

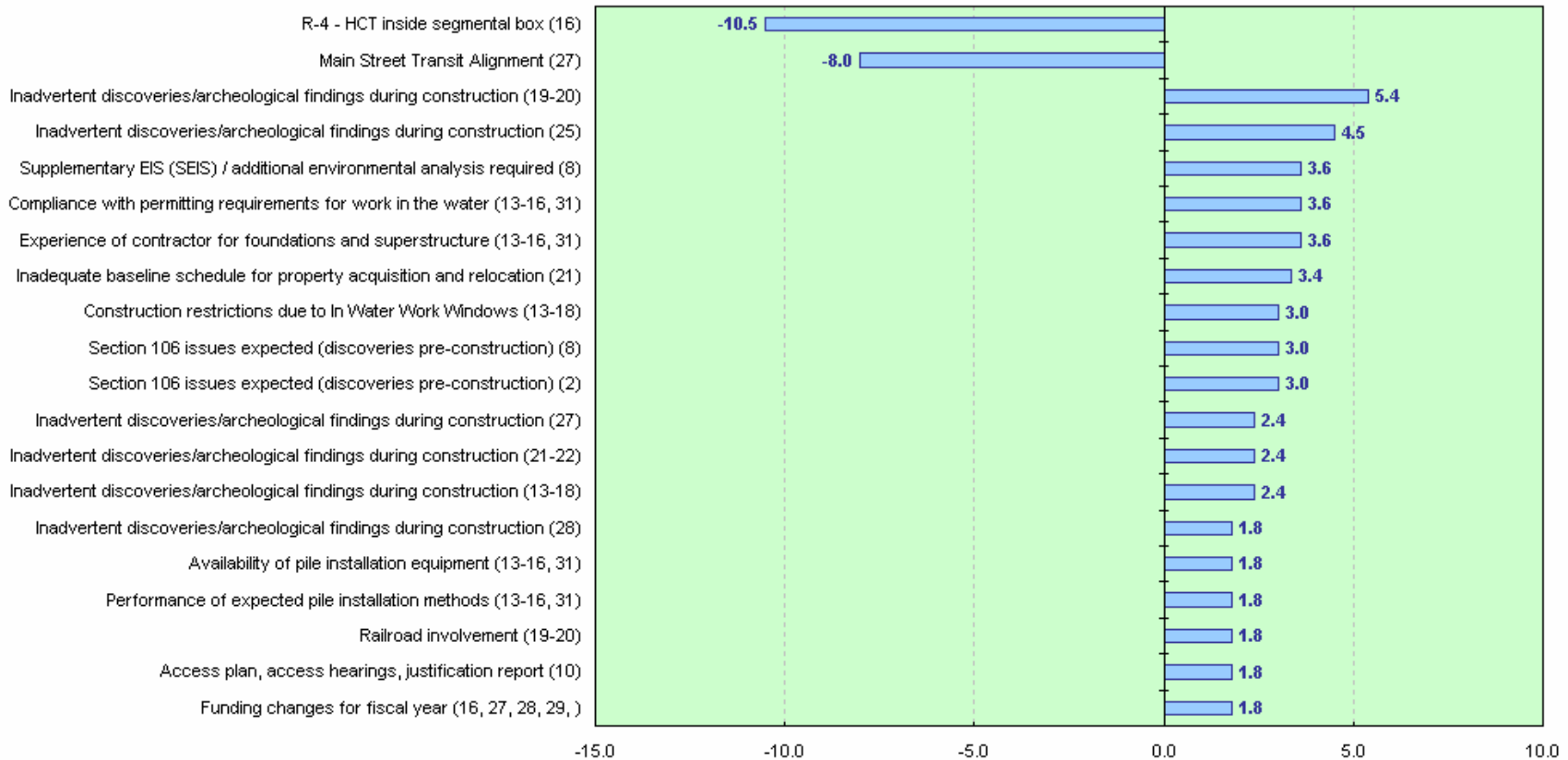


Figure 27 below is a graphical representation of the expected delay that may occur due to event risks forecasted by risk panel. Excluding the risks exclusive to either the Vancouver or I-5 Alignment (the Vancouver Transit Alignment Risk applicable to only the Vancouver Alignment), the top 5 risks expected to impact downstream replacement crossings with LRT are:¹¹

1. Inadvertent discoveries of archeological findings during construction (19-20);
2. Inadvertent discoveries of archeological findings during construction (25);
3. Supplementary EIS (SEIS)/ additional environmental analysis required (8);
4. Compliance with permitting requirements for work in the water (13-16, 31); and
5. Experience of contractor for foundations and superstructure (13-16, 31).

¹¹ The number in parenthesis following each risk is the activity number the risk is applied to.

Figure 27: Key Schedule Risks Downstream Replacement Crossing with LRT

Tornado Chart: Expected Schedule Delays (months)

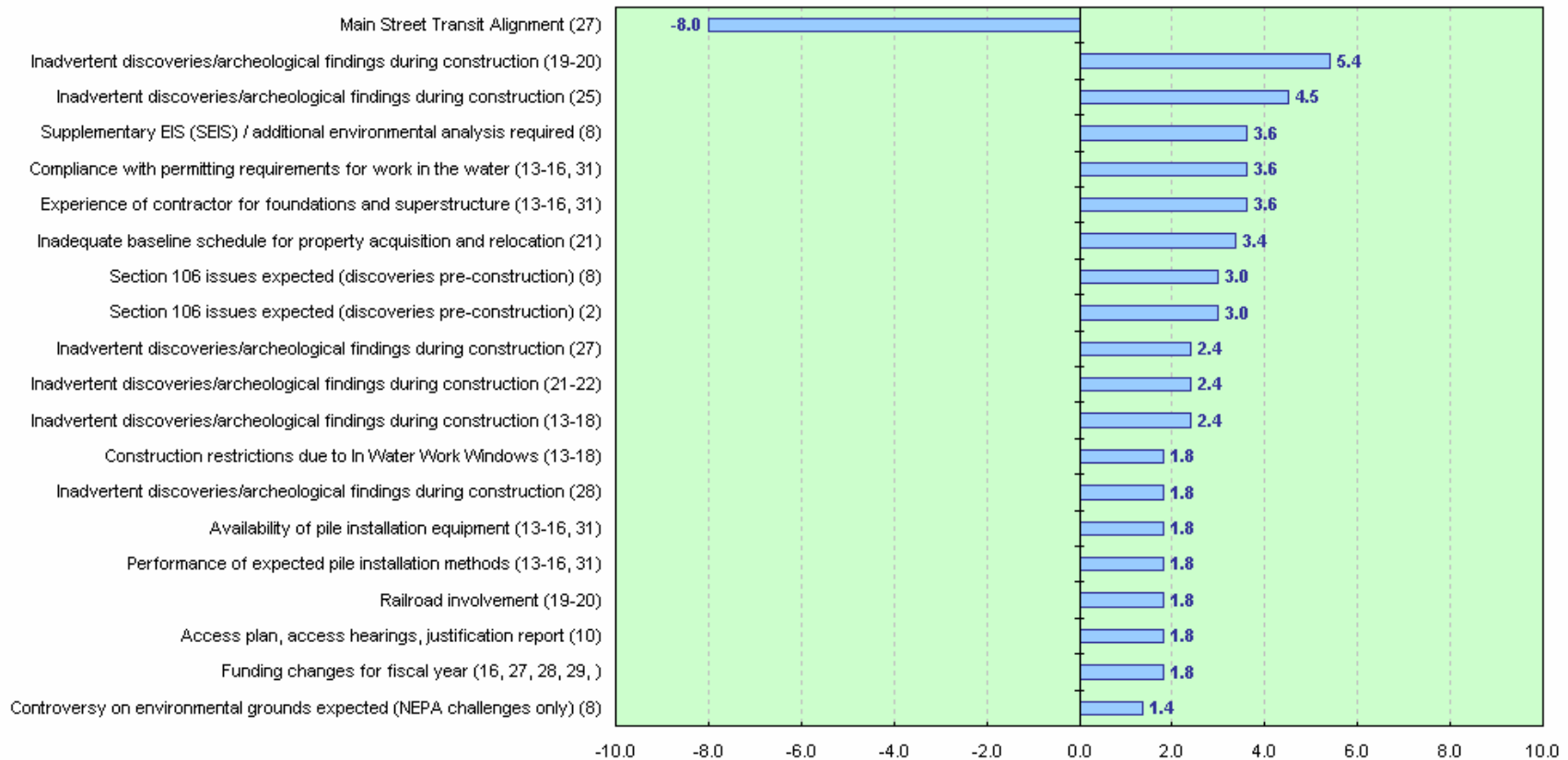


Figure 28 below is a graphical representation of the expected delay that may occur due to event risks forecasted by risk panel. Excluding the risks exclusive to either the Vancouver or I-5 Alignment (the Vancouver Transit Alignment Risk applicable to only the Vancouver Alignment), the top 5 risks expected to impact upstream replacement crossings with LRT are:¹²

1. R-4 – HCT inside segmental box (16);
2. Inadvertent discoveries of archeological findings during construction (19-20);
3. Inadvertent discoveries of archeological findings during construction (25);
4. Supplementary EIS (SEIS)/ additional environmental analysis required (8); and
5. Compliance with permitting requirements for work in the water (13-16, 31).

¹² The number in parenthesis following each risk is the activity number the risk is applied to.

Figure 28: Key Schedule Risks Upstream Replacement Crossing with LRT

Tornado Chart: Expected Schedule Delays (months)

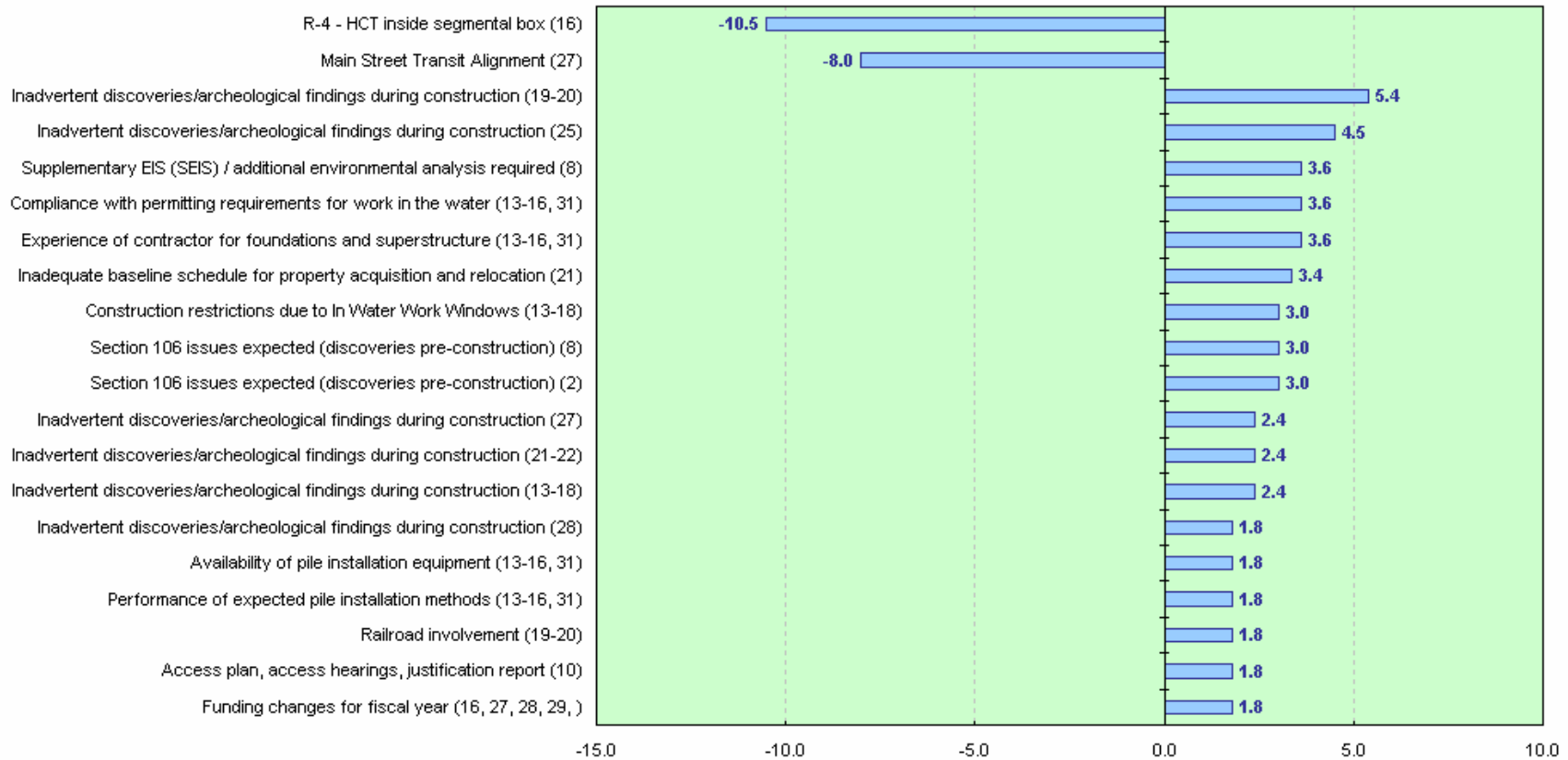


Figure 29 below is a graphical representation of the expected delay that may occur due to event risks forecasted by risk panel. Excluding the risks exclusive to either the Vancouver or I-5 Alignment (the Vancouver Transit Alignment Risk of an 8 month expected delay not depicted applicable to only the I-5 Alignment), the top 5 risks expected to impact supplemental crossing with BRT are:¹³

1. Inadvertent discoveries of archeological findings during construction (19-20);
2. Inadvertent discoveries of archeological findings during construction (25);
3. Supplementary EIS (SEIS)/ additional environmental analysis required (8);
4. Compliance with permitting requirements for work in the water (13-16, 31); and
5. Experience of contractor for foundations and superstructure (13-16, 31).

¹³ The number in parenthesis following each risk is the activity number the risk is applied to.

Figure 29: Key Schedule Risks Supplemental Crossing with BRT

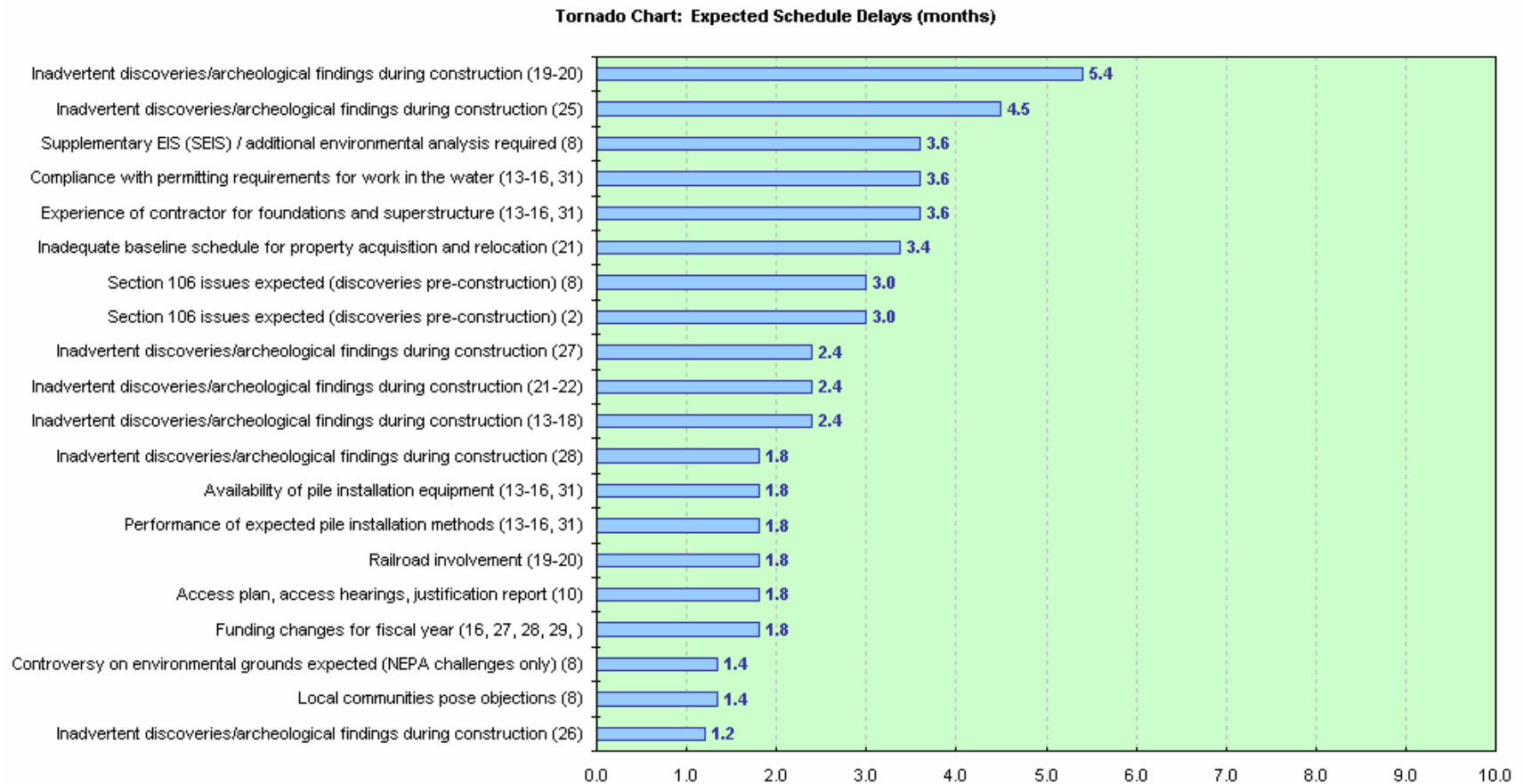


Figure 30 below is a graphical representation of the expected delay that may occur due to event risks forecasted by risk panel. Excluding the risks exclusive to either the Vancouver or I-5 Alignment (the Vancouver Transit Alignment Risk of an 8 month expected delay not depicted applicable to only the I-5 Alignment), the top 5 risks expected to impact supplemental crossing with LRT are:¹⁴

1. Inadvertent discoveries of archeological findings during construction (19-20);
2. Inadvertent discoveries of archeological findings during construction (25);
3. Supplementary EIS (SEIS)/ additional environmental analysis required (8);
4. Compliance with permitting requirements for work in the water (13-16, 31); and
5. Experience of contractor for foundations and superstructure (13-16, 31).

¹⁴ The number in parenthesis following each risk is the activity number the risk is applied to.

Figure 30: Key Schedule Risks Supplemental Crossing with LRT

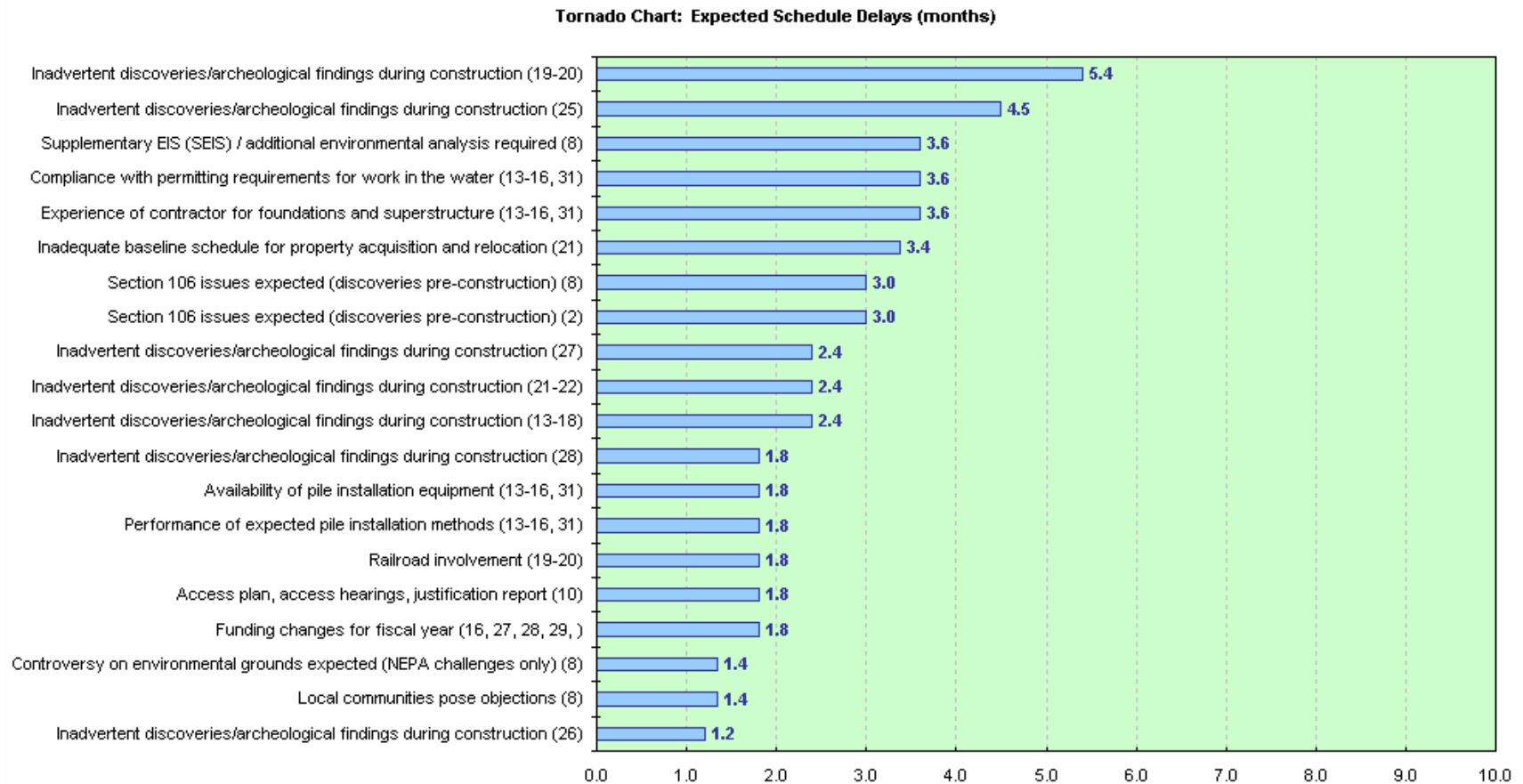


Figure 31 below is a graphical representation of the expected delay that may occur due to event risks forecasted by risk panel. The top 5 risks expected to impact MOS downstream replacement crossings with BRT are:¹⁵

1. Inadvertent discoveries of archeological findings during construction (19-20);
2. Inadvertent discoveries of archeological findings during construction (25);
3. Supplementary EIS (SEIS)/ additional environmental analysis required (8);
4. Compliance with permitting requirements for work in the water (13-16, 31); and
5. Experience of contractor for foundations and superstructure (13-16, 31).

¹⁵ The number in parenthesis following each risk is the activity number the risk is applied to.

Figure 31: Key Schedule Risks Downstream Replacement Crossing with BRT MOS

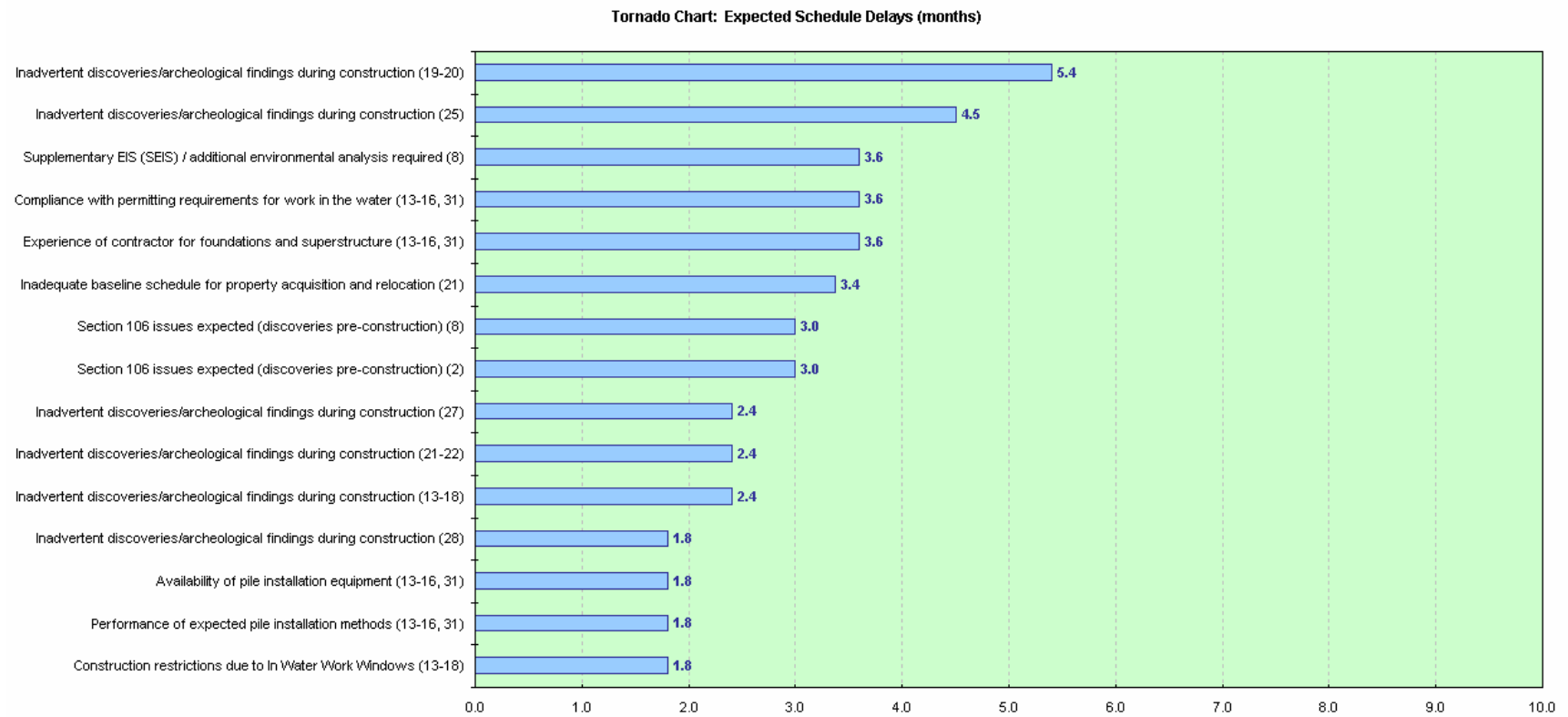
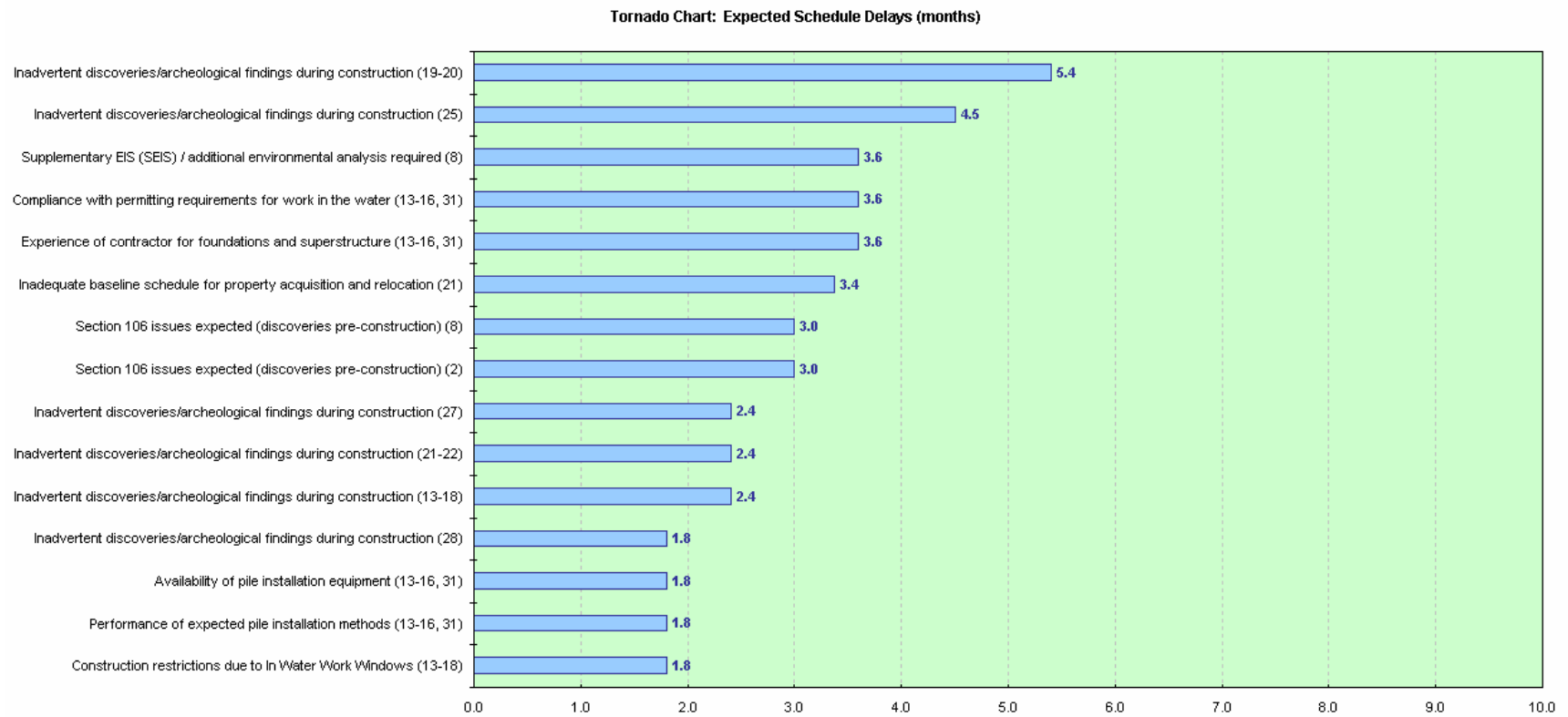


Figure 32 below is a graphical representation of the expected delay that may occur due to event risks forecasted by risk panel. The top 5 risks expected to impact MOS downstream replacement crossings with LRT are:¹⁶

1. Inadvertent discoveries of archeological findings during construction (19-20);
2. Inadvertent discoveries of archeological findings during construction (25);
3. Supplementary EIS (SEIS)/ additional environmental analysis required (8);
4. Compliance with permitting requirements for work in the water (13-16, 31); and
5. Experience of contractor for foundations and superstructure (13-16, 31).

¹⁶ The number in parenthesis following each risk is the activity number the risk is applied to.

Figure 32: Key Schedule Risks Downstream Replacement Crossing with LRT MOS



4.4 CASH FLOW RESULTS

The simulated cash flows associated with the workshop assumptions and cost and schedule outcomes are shown on the next pages. The cash flow results depict the highway and transit costs as they are expected to occur by month. These results are only estimations as all activity costs are distributed evenly throughout the duration of an activity, estimates reflect the mean expected value of the project expressed as a percentage of an activity based on highway and transit base cost percentages.

Figure 33: Downstream Replacement Crossing with BRT Cash flow, Vancouver Alignment

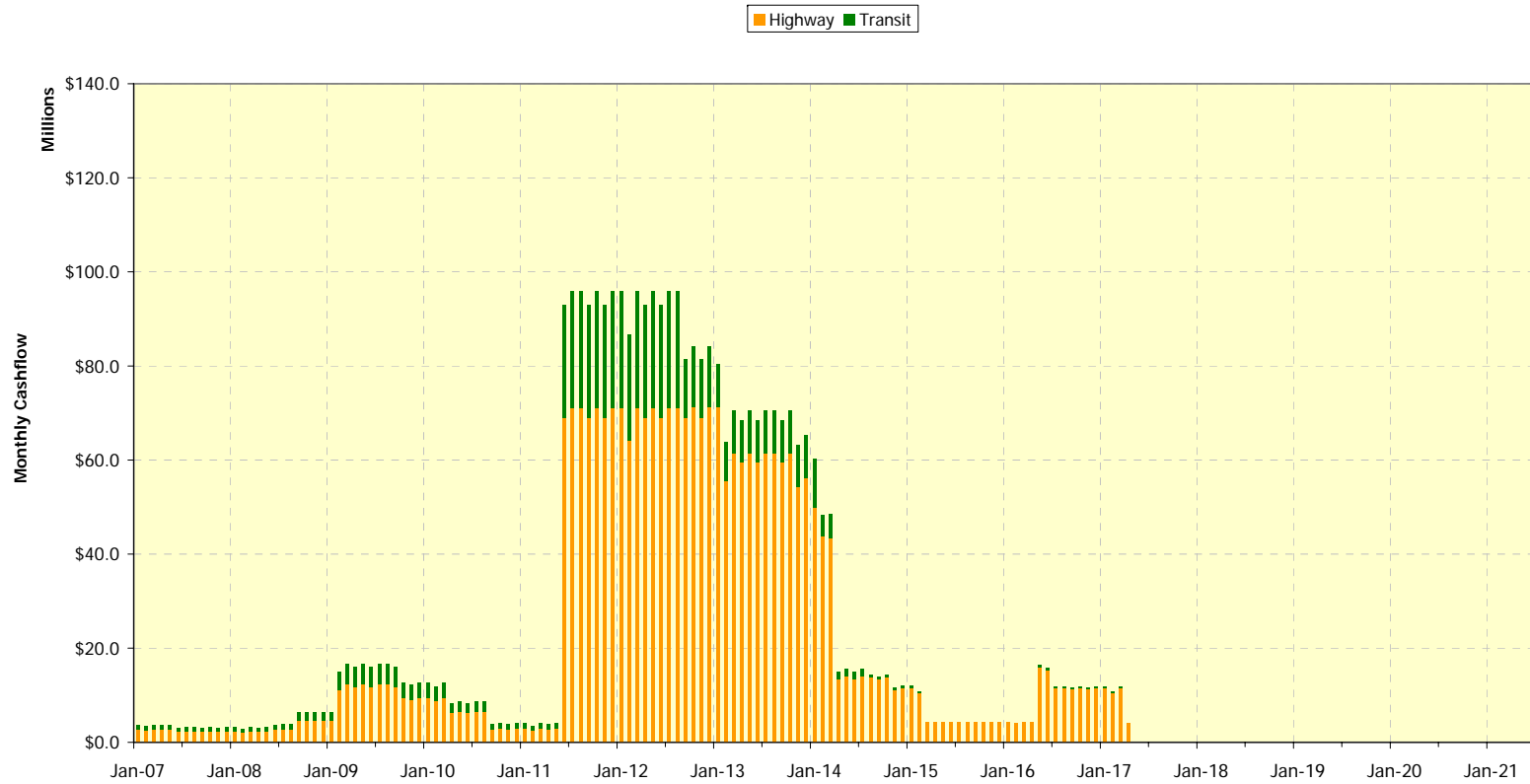


Figure 34: Downstream Replacement Crossing with BRT Cash flow, I-5 Alignment

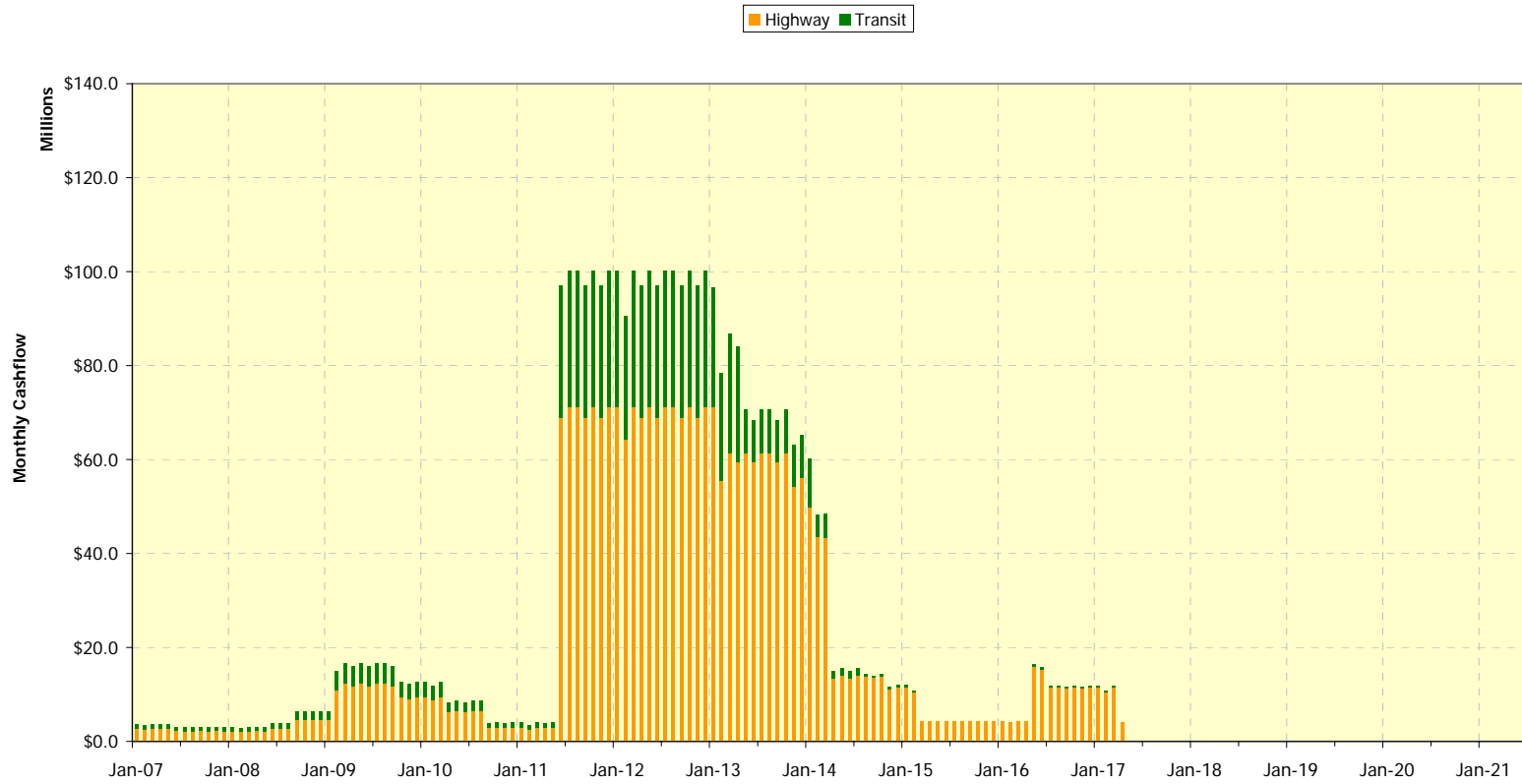


Figure 35: Upstream Replacement Crossing with BRT Cash flow, Vancouver Alignment

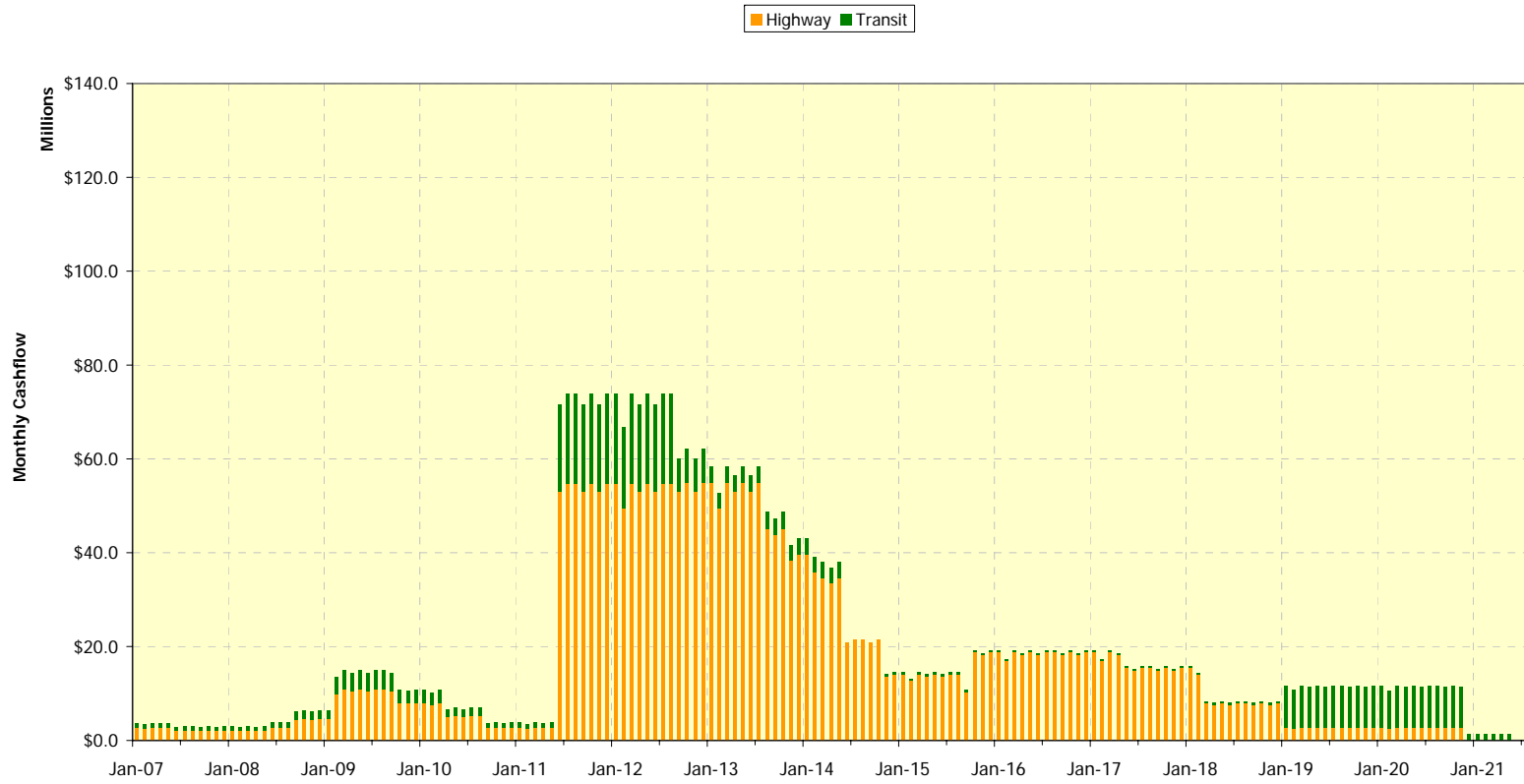


Figure 36: Upstream Replacement Crossing with BRT Cashflow, I-5 Alignment

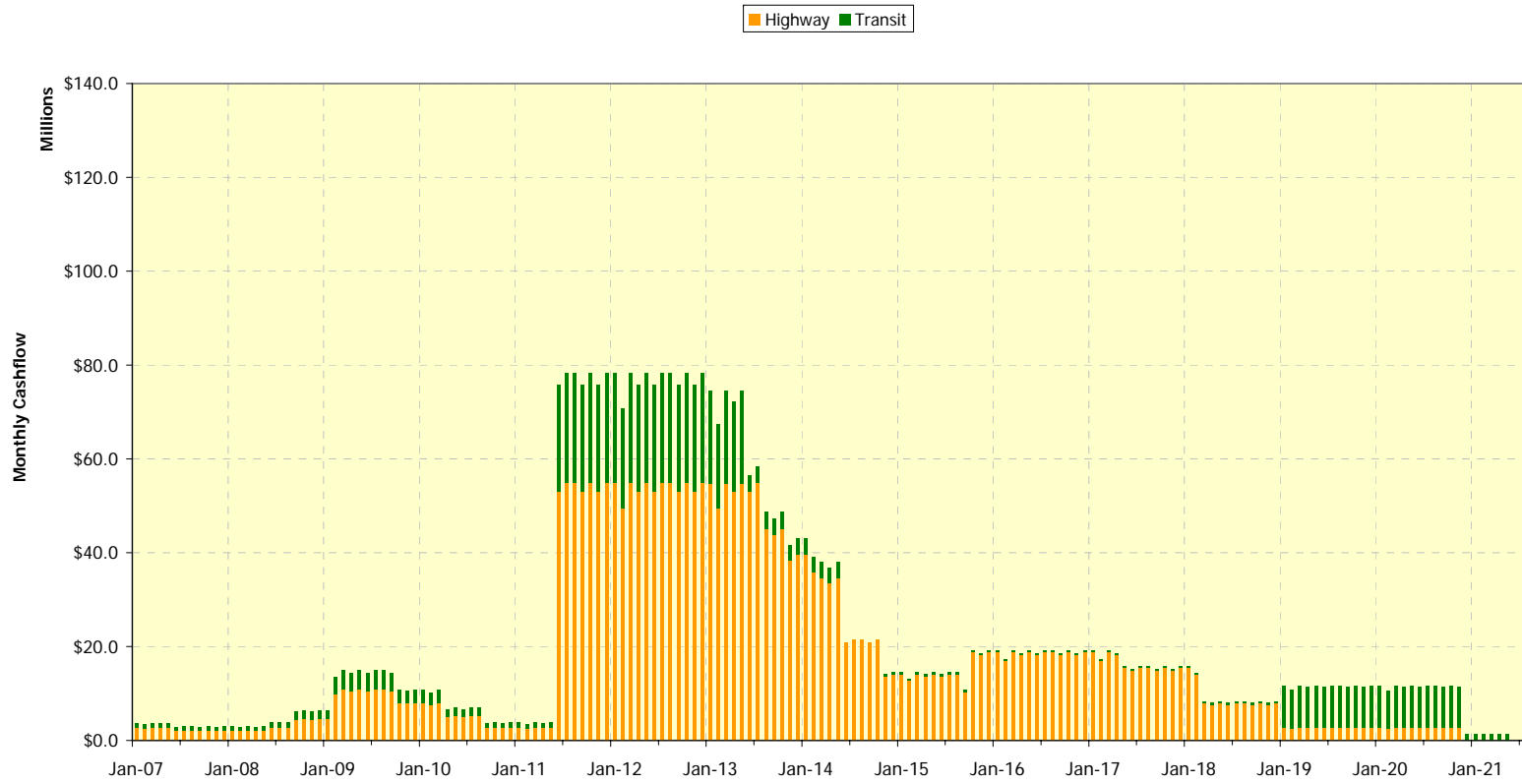


Figure 37: Downstream Replacement Crossing with LRT Cashflow, Vancouver Alignment

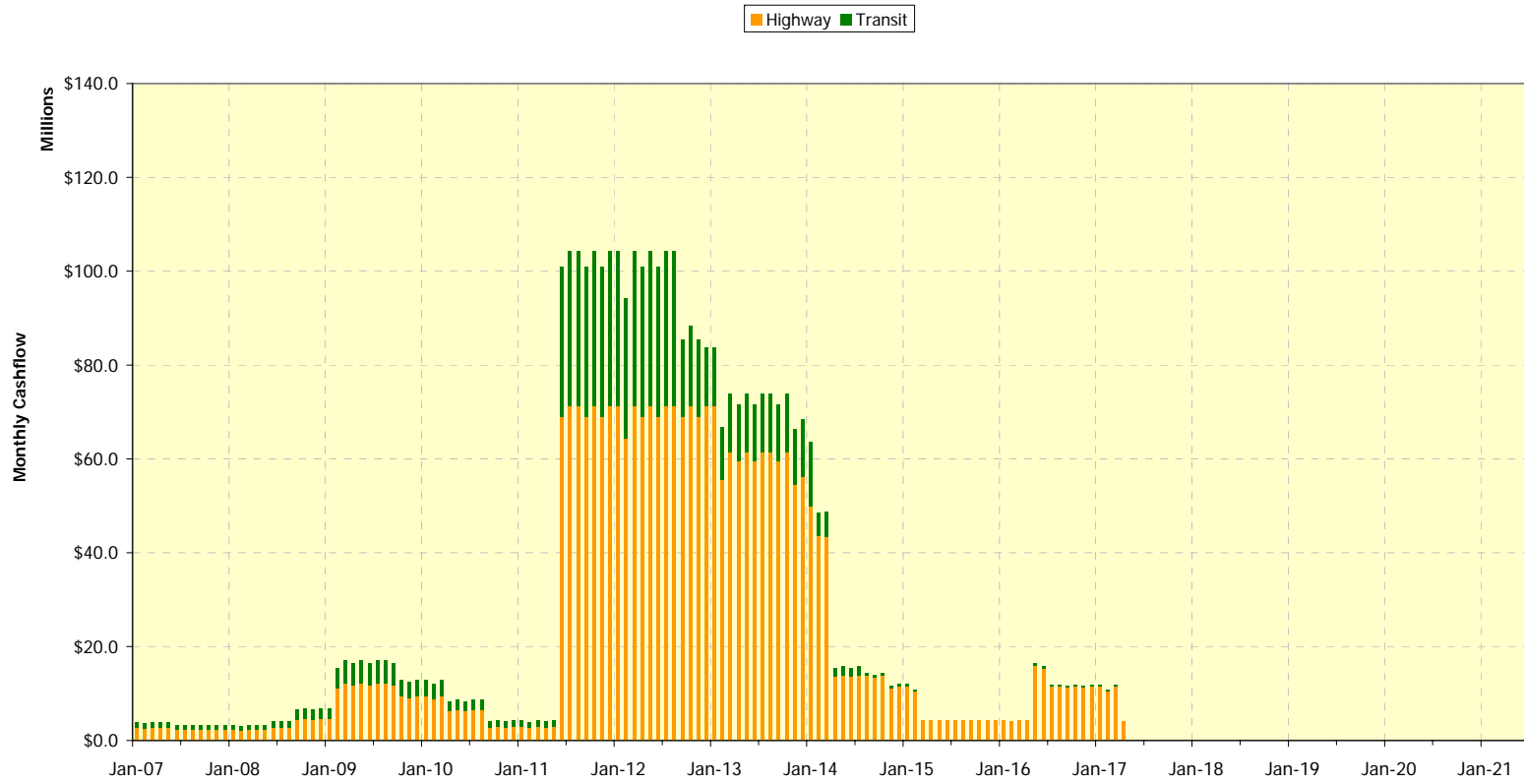


Figure 38: Downstream Replacement Crossing with LRT Cashflow, I-5 Alignment

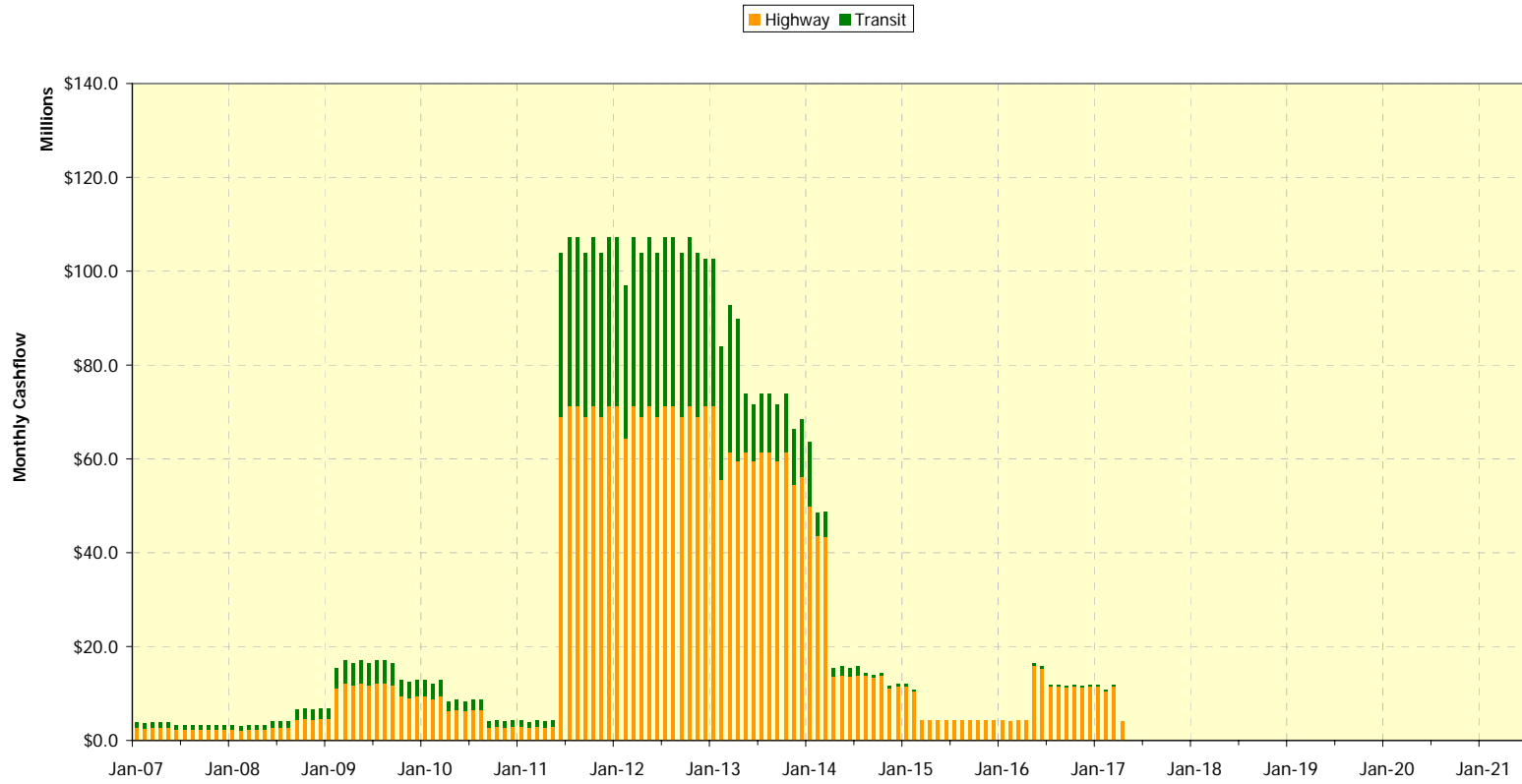


Figure 39: Upstream Replacement Crossing with LRT Cashflow, Vancouver Alignment

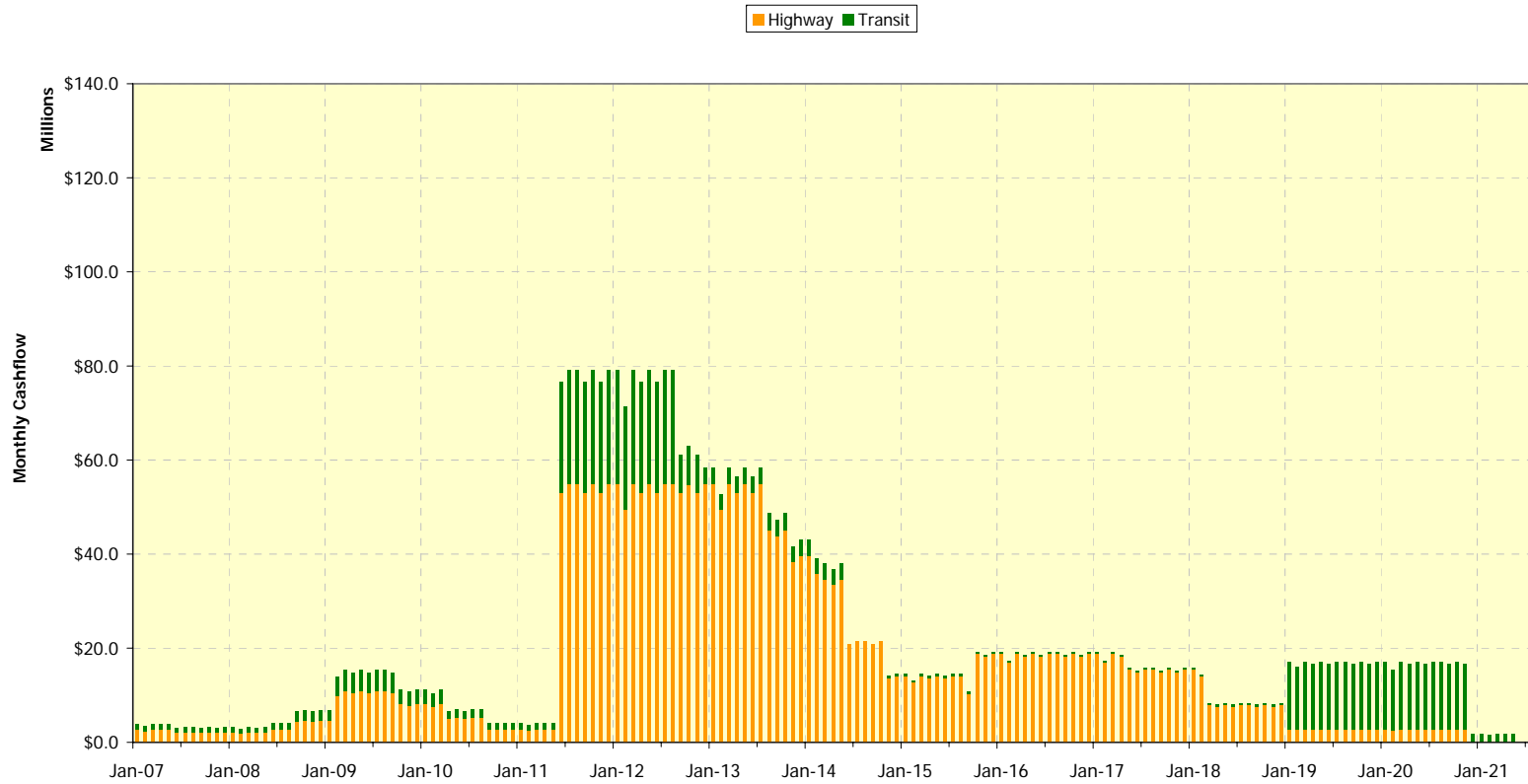


Figure 40: Upstream Replacement Crossing with LRT Cashflow, I-5 Alignment

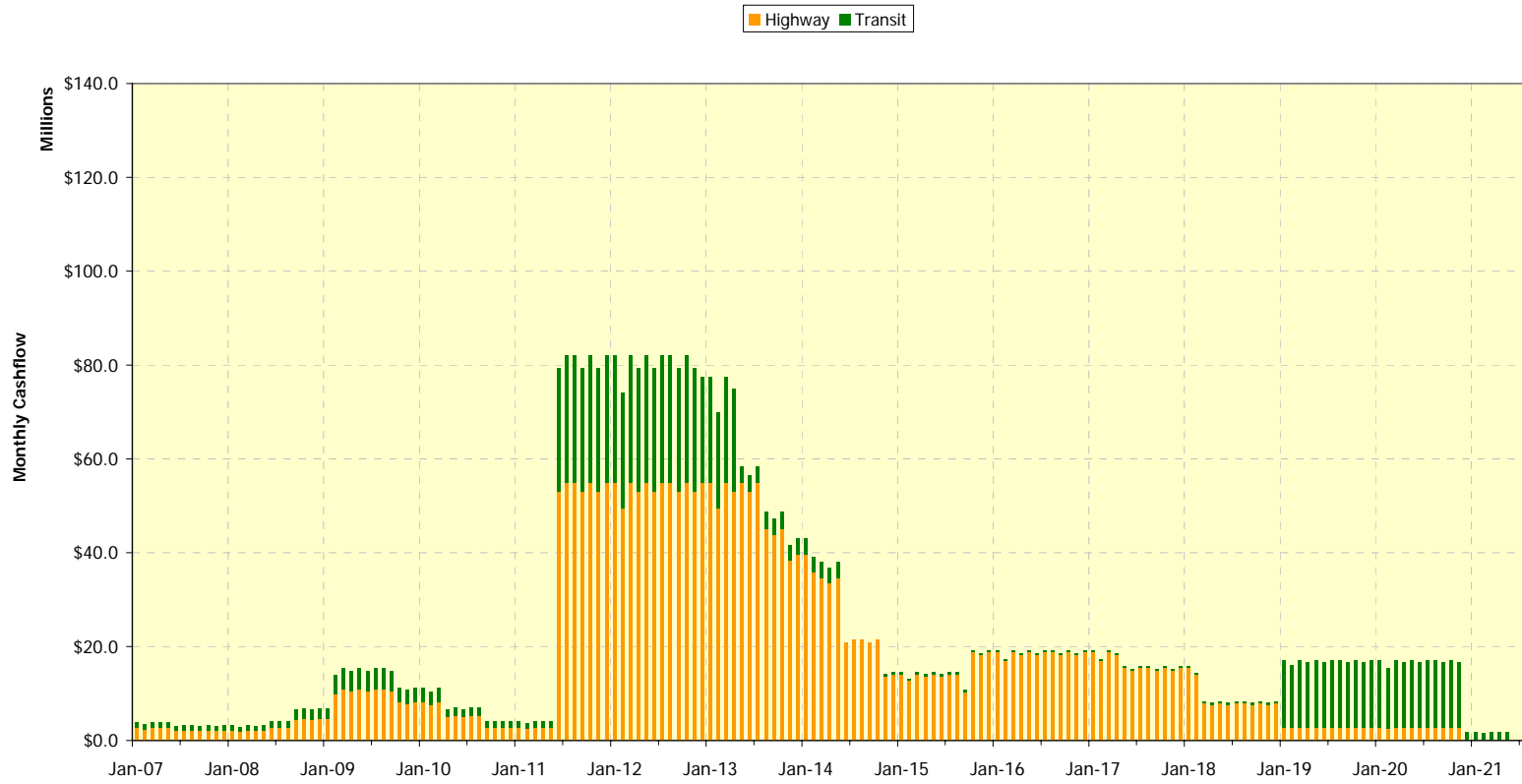


Figure 41: Supplemental Crossing with BRT Cashflow, Vancouver Alignment

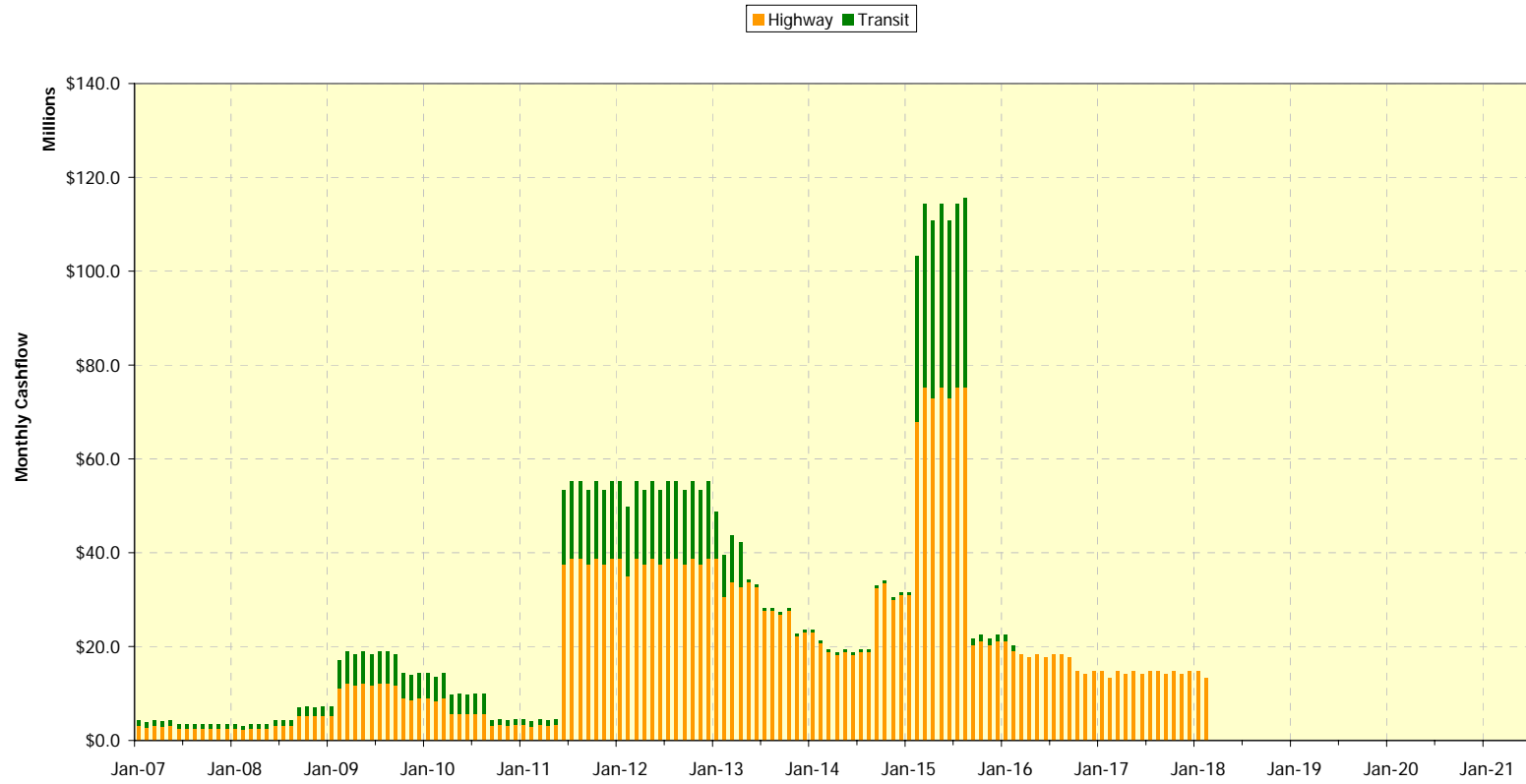


Figure 42: Supplemental Crossing with BRT Cashflow, I-5 Alignment

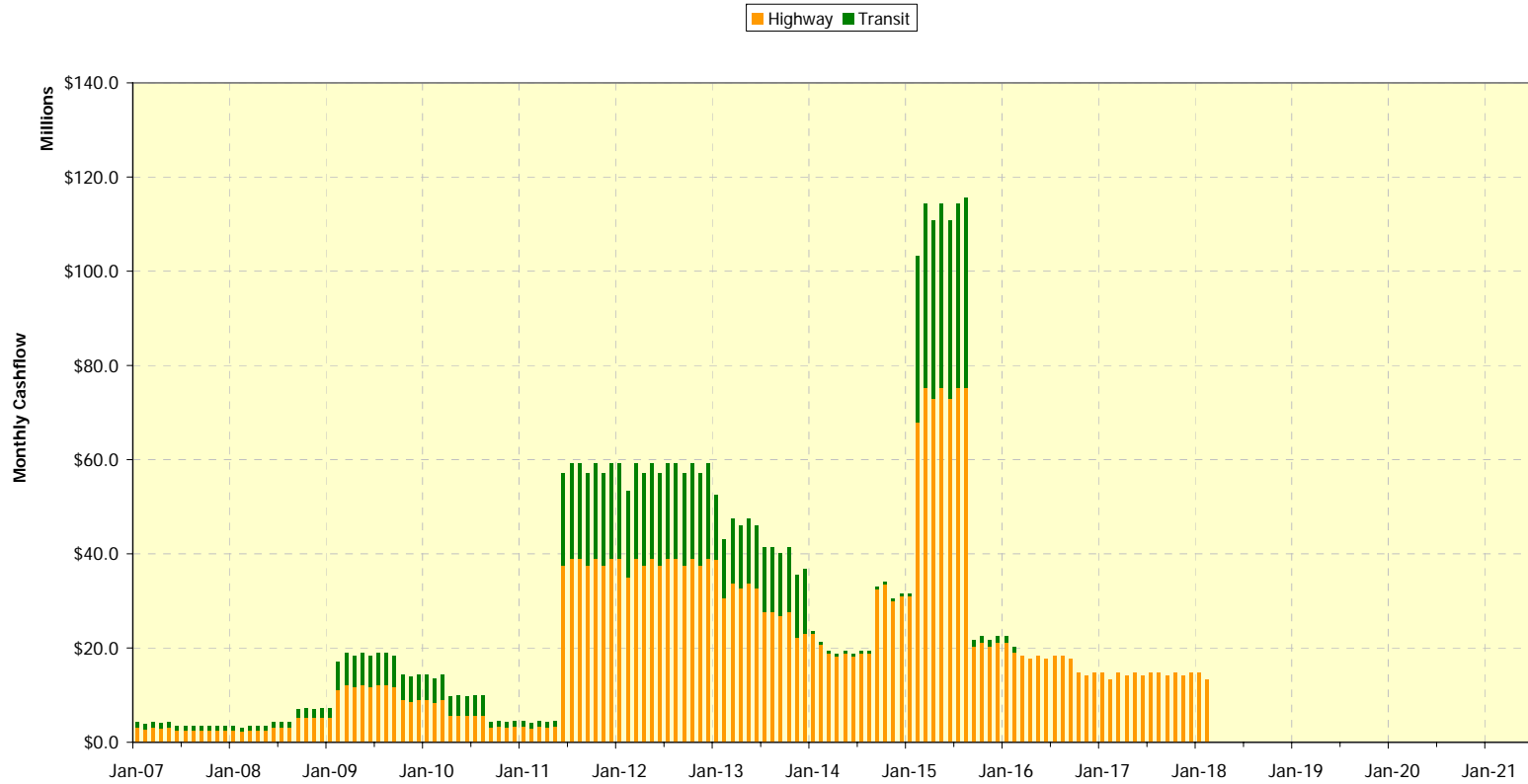


Figure 43: Supplemental Crossing with LRT Cashflow, Vancouver Alignment

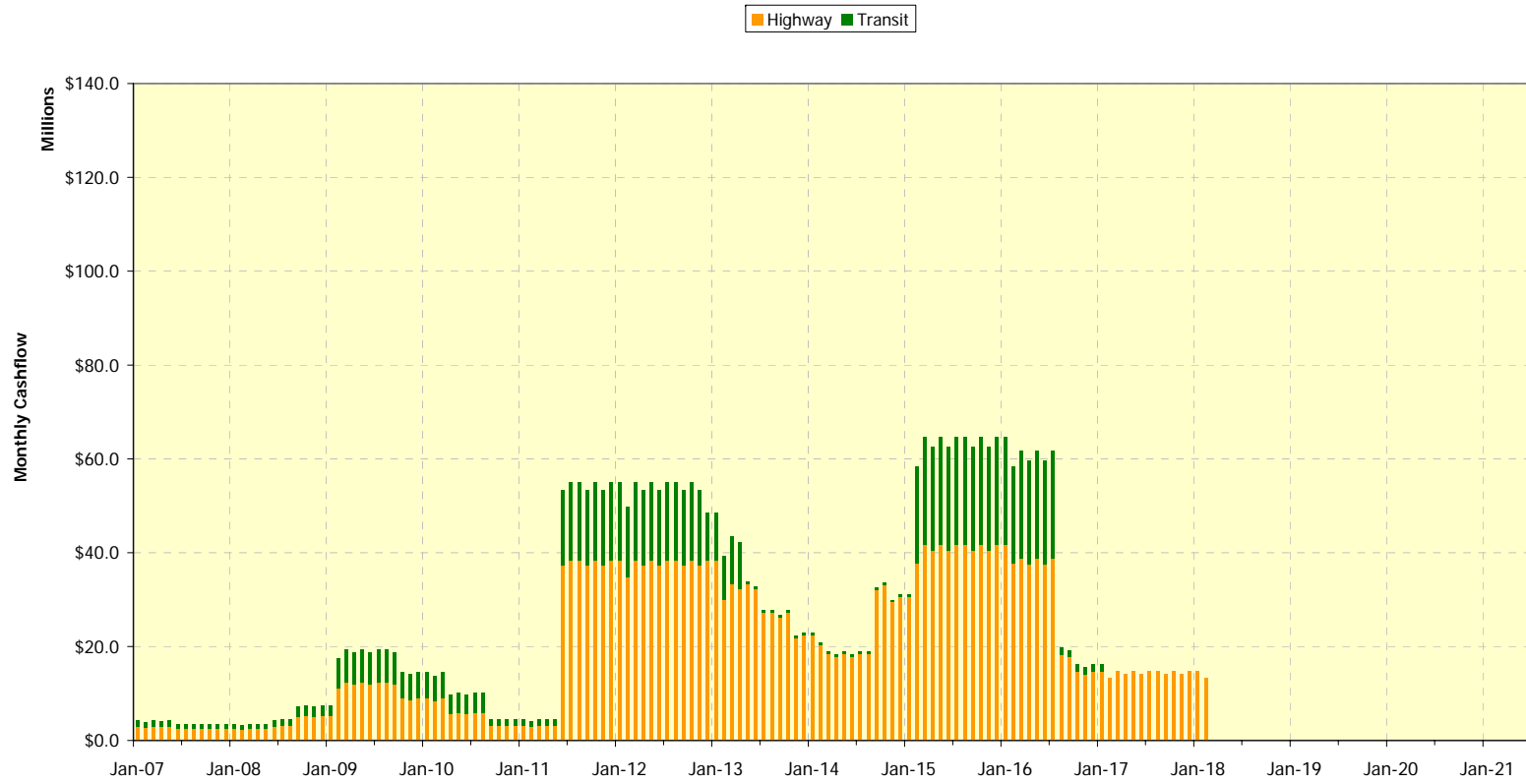


Figure 44: Supplemental Crossing with LRT Cashflow, I-5 Alignment

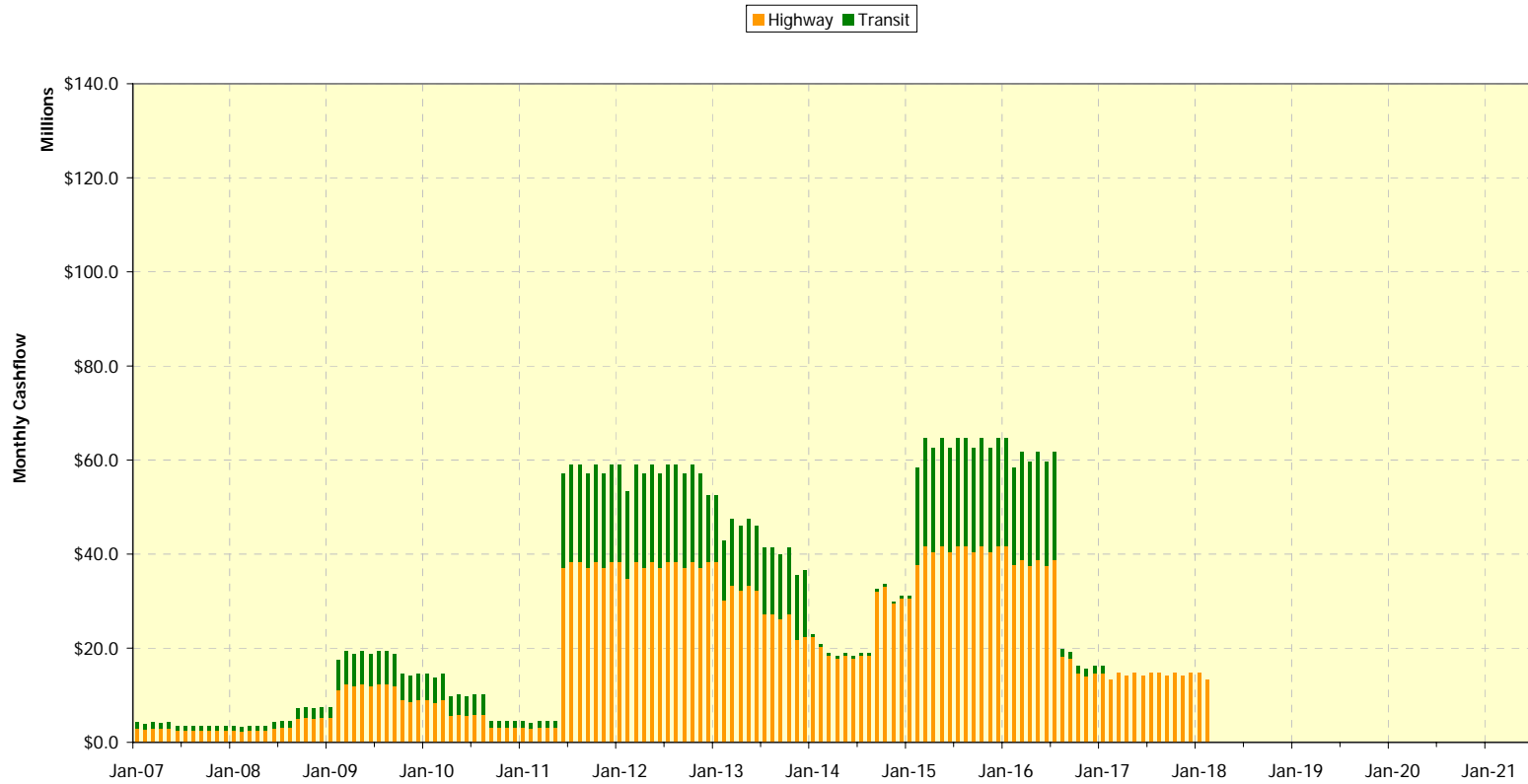


Figure 45: Downstream Replacement Crossing with BRT Mill District Cashflow, MOS Design

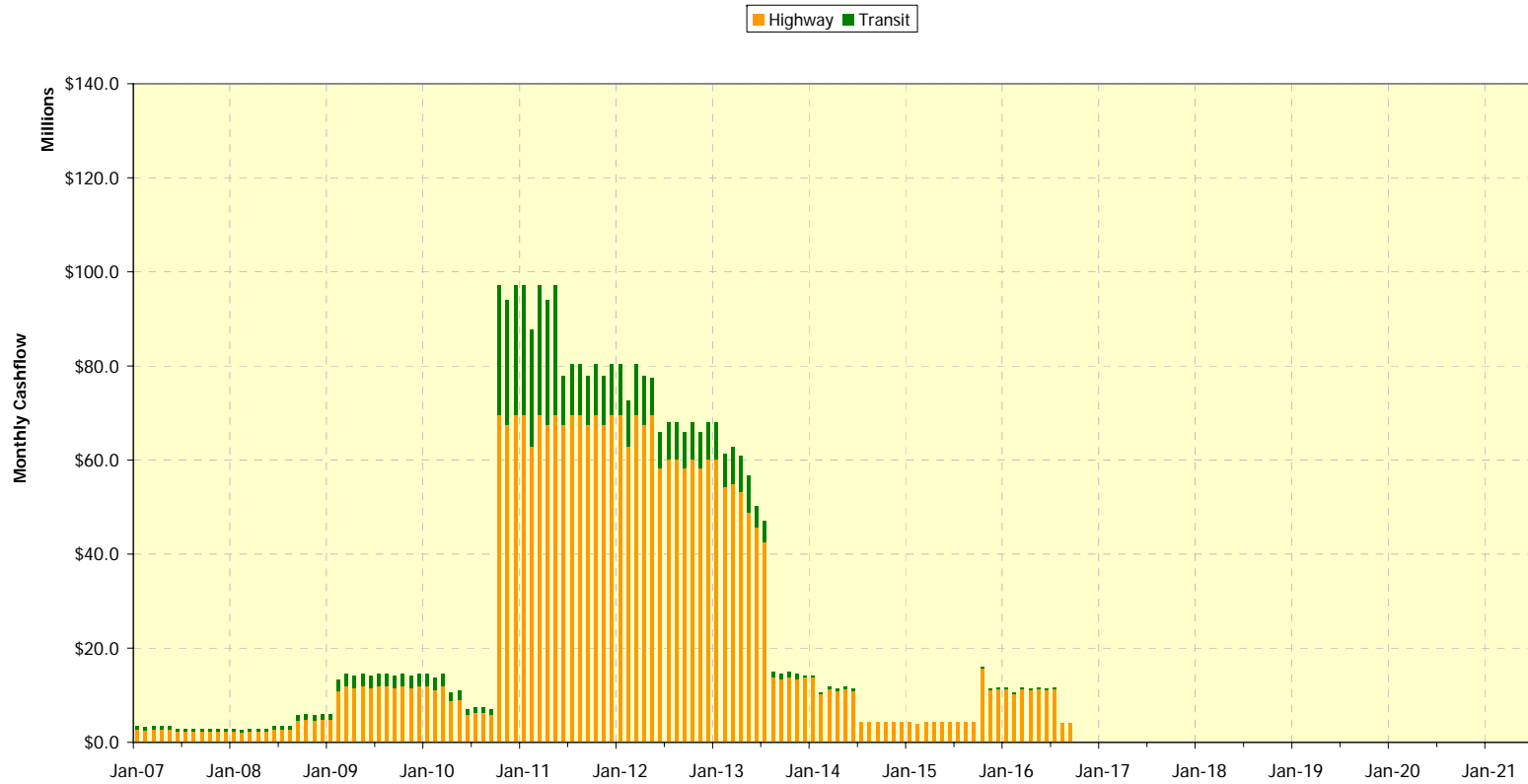


Figure 46: Downstream Replacement Crossing with BRT Clark College Cashflow, MOS Design

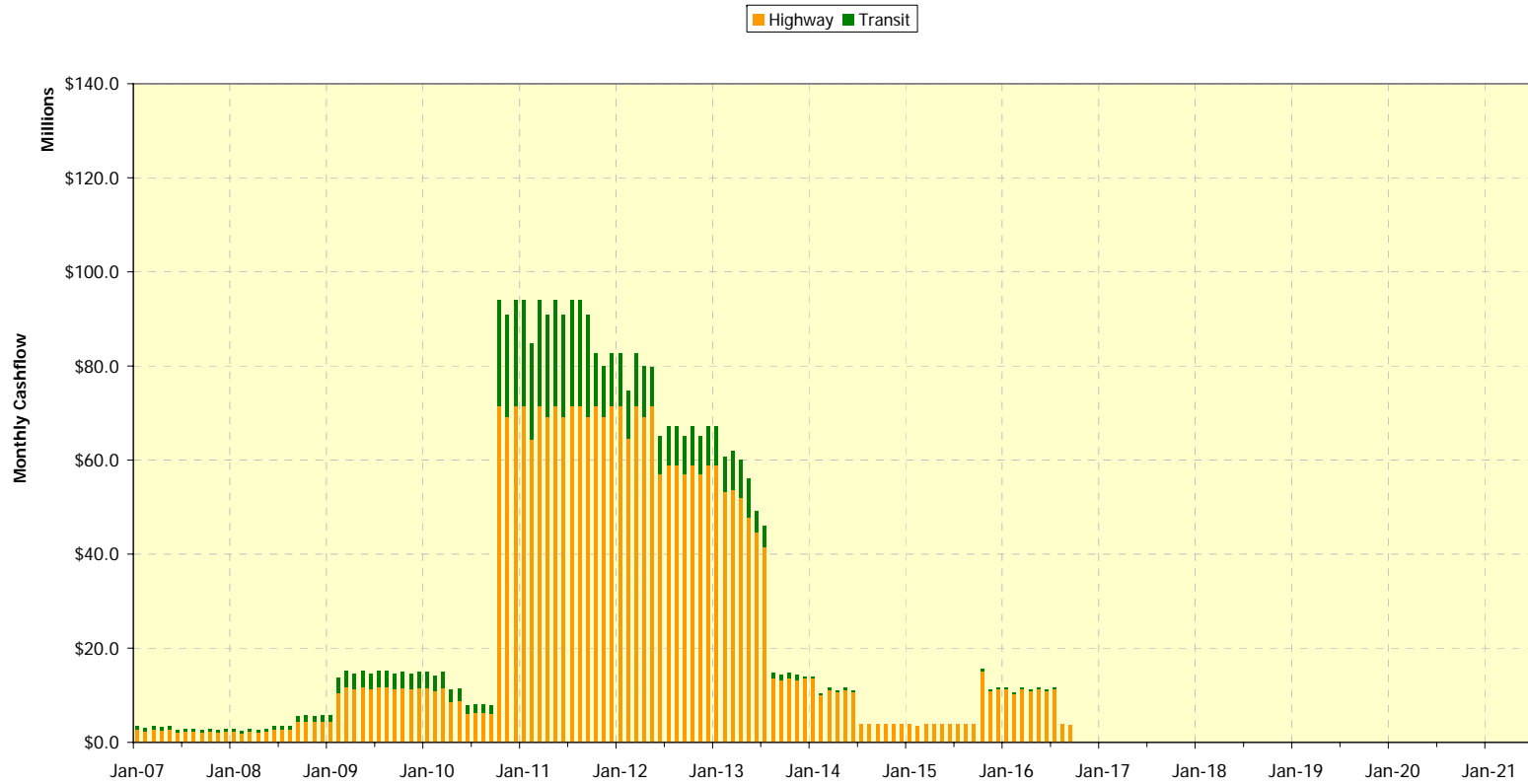


Figure 47: Downstream Replacement Crossing with LRT Mill District Cashflow, MOS Design

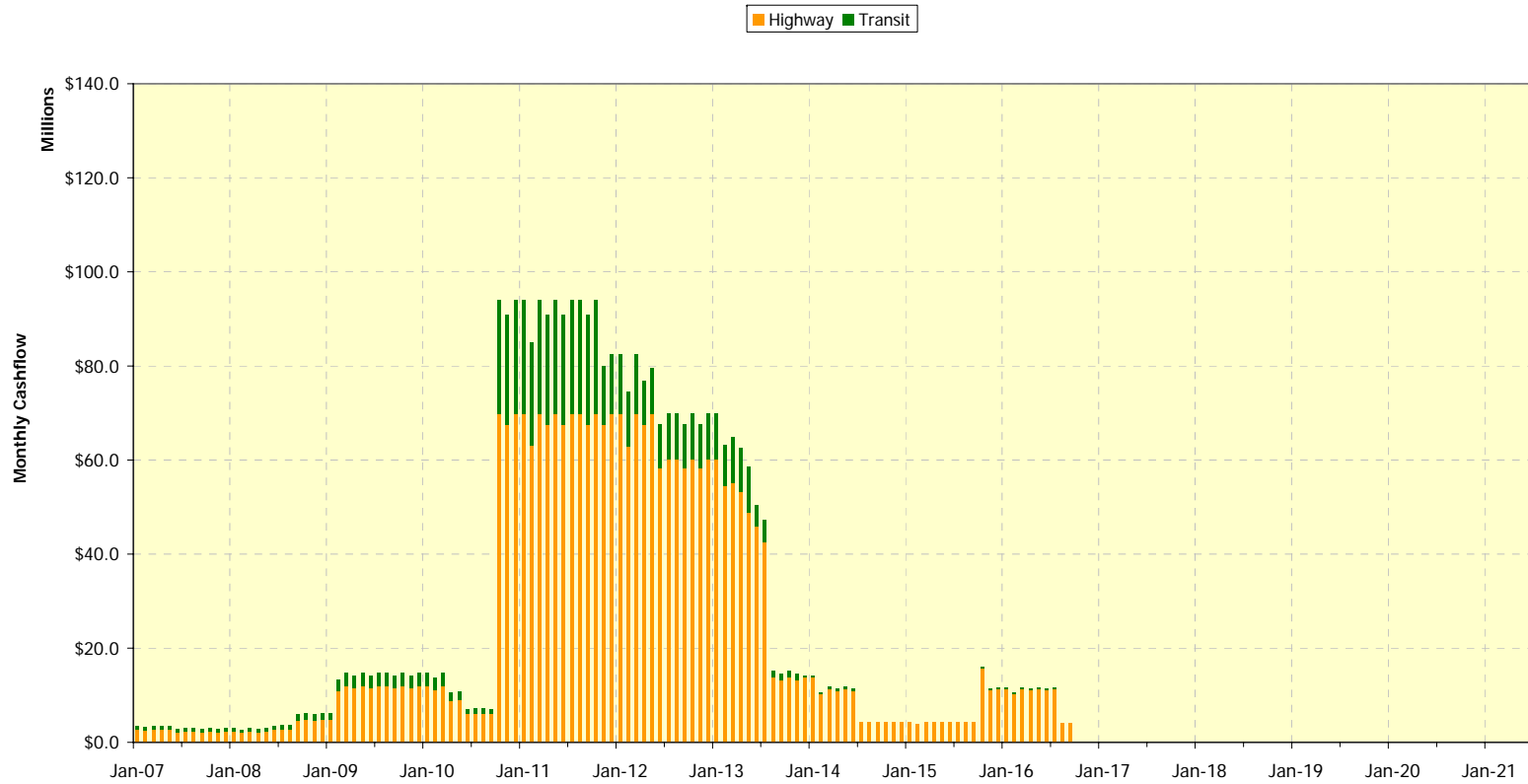
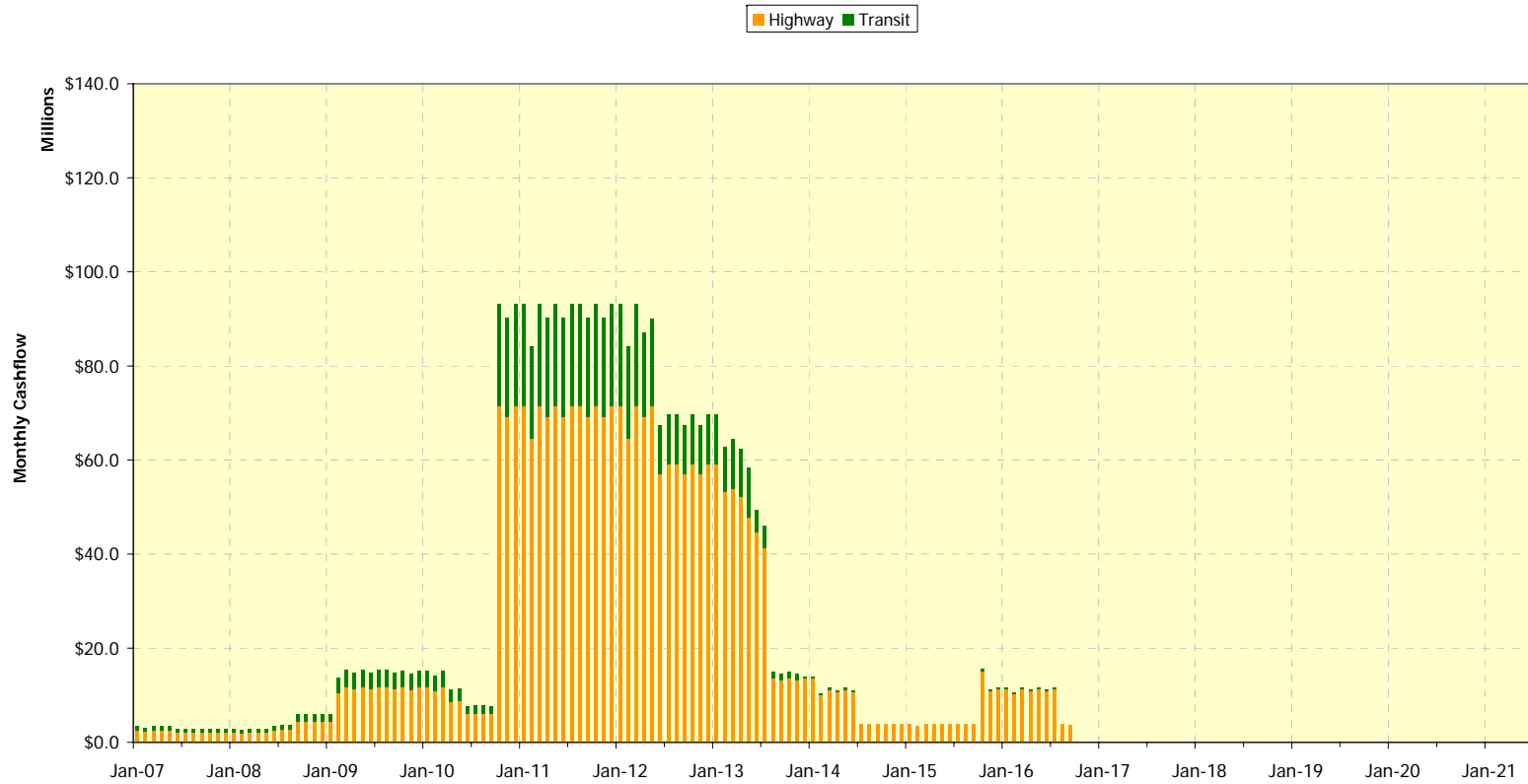


Figure 48: Downstream Replacement Crossing with LRT Clark College Cashflow, MOS Design



APPENDICES

Appendix A: Workshop Participants/Workshop Expenditures

Appendix B: Summary of Base Cost Validation and Base Schedule Duration

Appendix C: Risk Register

Appendix D: Cost Risk Assessment Process - Overview & Modeling Approach

Appendix E: Preliminary Results Presentation with Updated Base Costs

Appendix F: Preliminary Results Presentation Minimal Operable Segment

APPENDIX A: WORKSHOP PARTICIPANTS/WORKSHOP EXPENDITURES

#	Name	WSDOT Org /Consultant	Responsibility	Telephone	Email Address
1	Frank Green	CRC	Project Engineer	360-816-8855	greenf@columbiarivercrossing.org
2	Khalid Bekka	HDR	Risk Lead	240-485-2605	khalid.bekka@hdrinc.com
3	Lynn Rust	CRC	Assistant Deputy Project Director	360-816-2177	RustL@columbiarivercrossing.org
4	Roger Kitchin	CRC	Cost Lead	360-816-2157	KitchinR@columbiarivercrossing.org
5	Patrick Murray	HDR	Risk Modeler	240-485-2613	pmurray@hdrinc.com
6					
7					

APPENDIX B: SUMMARY OF BASE COSTS, BASE SCHEDULE DURATION, RISK ADJUSTED COSTS AND RISK ADJUSTED SCHEDULE

Base Costs

The following tables detail the baseline costs for the activities in all project alternatives:

Table 16: Vancouver Alignment Base Costs

ID	FLOWCHART ACTIVITY	Downstream Replacement with BRT	Upstream Replacement with BRT	Downstream Replacement with LRT	Upstream Replacement with LRT	Supplemental with BRT	Supplemental with LRT
1	Prepare DEIS Alternatives	\$21,199,771	\$20,949,009	\$22,540,447	\$22,295,367	\$23,844,805	\$24,521,346
2	Evaluate DEIS Alternatives / Present Draft Findings	\$31,799,657	\$31,423,514	\$33,810,670	\$33,443,051	\$35,767,207	\$36,782,018
3	Publish DEIS and LPA	\$0	\$0	\$0	\$0	\$0	\$0
4	Comment Period / Public Hearings	\$10,599,886	\$10,474,505	\$11,270,223	\$11,147,684	\$11,922,402	\$12,260,673
5	Local Agency Adoption	\$10,599,886	\$10,474,505	\$11,270,223	\$11,147,684	\$11,922,402	\$12,260,673
6	FTA New Starts Application	\$0	\$0	\$0	\$0	\$0	\$0
7	Prepare FEIS	\$28,266,361	\$27,932,012	\$30,053,929	\$29,727,156	\$31,793,073	\$32,695,127
8	FHWA/FTA Record of Decision	\$0	\$0	\$0	\$0	\$0	\$0
9	30% Design	\$28,266,361	\$27,932,012	\$30,053,929	\$29,727,156	\$31,793,073	\$32,695,127
10	R/W Appraisal and Acquisition	\$117,776,596	\$93,153,600	\$117,776,596	\$93,153,600	\$143,728,900	\$144,857,180
11	Environmental Permitting	\$63,599,313	\$62,847,028	\$67,621,340	\$66,886,102	\$71,534,414	\$73,564,037
12	Begin Construction	\$0	\$0	\$0	\$0	\$0	\$0
13	HWY - Construct NB River Crossing	\$404,256,198	\$415,055,568	\$404,256,198	\$415,055,568	\$0	\$0
14	HWY - Finish NB River Crossing	\$0	\$0	\$0	\$0	\$0	\$0
15	HWY - Construct SB River Crossing	\$297,242,848	\$293,090,109	\$297,242,848	\$293,090,109	\$0	\$0
16	HCT - Construct River Crossing	\$183,729,042	\$184,801,101	\$258,588,136	\$260,072,491	\$0	\$0
17	HWY - Demo Existing NB River Crossing	\$51,328,670	\$52,192,927	\$51,328,670	\$52,192,927	\$0	\$0
18	HWY - Demo Existing SB River Crossing	\$51,328,670	\$52,192,927	\$51,328,670	\$52,192,927	\$0	\$0
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	\$90,507,813	\$136,227,508	\$90,507,813	\$136,227,508	\$63,617,926	\$63,617,926
20	HWY - I-5 / SR14 I/C (Stage 3)	\$28,103,865	\$20,070,444	\$28,103,865	\$20,070,444	\$18,599,103	\$18,599,103
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	\$141,657,091	\$180,257,912	\$141,657,091	\$180,257,912	\$125,152,853	\$125,152,853
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	\$66,908,368	\$56,836,567	\$66,908,368	\$56,836,567	\$85,863,982	\$85,863,982
23	HWY - I-5 / Marine Drive Interchange (All Stages)	\$402,224,425	\$365,090,157	\$402,224,425	\$365,090,157	\$422,831,913	\$422,831,913
24	HWY - I-5 / SR 500 Interchange (All Stages)	\$113,924,777	\$119,092,467	\$113,924,777	\$119,092,467	\$101,310,686	\$101,310,686
25	HWY - I-5 Mill Plain Interchange (All Stages)	\$71,415,684	\$80,937,899	\$71,415,684	\$80,937,899	\$76,446,605	\$76,446,605
26	HWY - I-5 / Fourth Plain Interchange (All Stages)	\$124,828,529	\$130,734,461	\$124,828,529	\$130,734,461	\$105,083,736	\$105,083,736
27	HCT - BRT North	\$231,782,050	\$232,225,280	\$273,825,048	\$274,344,211	\$160,807,973	\$164,904,957
28	HCT - BRT South	\$47,710,375	\$48,064,959	\$60,332,455	\$60,747,785	\$87,491,704	\$85,514,250
29	HCT - Burn Time	\$4,913,063	\$4,930,126	\$6,253,739	\$6,276,484	\$5,264,558	\$5,941,098
30	Project Complete	\$0	\$0	\$0	\$0	\$0	\$0
31	HWY/HCT - Construct SB/HCT River Crossing	\$0	\$0	\$0	\$0	\$423,232,999	\$406,576,788
32	HCT - Finish/OCS/Civil for River Crossing	\$0	\$0	\$0	\$0	\$408,688,653	\$532,627,988
GRAND TOTAL PROJECT COST		\$2,623,969,298	\$2,656,986,598	\$2,767,123,673	\$2,800,747,719	\$2,446,698,968	\$2,564,108,066

Table 17: I-5 Alignment Base Costs

ID	FLOWCHART ACTIVITY	Downstream Replacement with BRT	Upstream Replacement with BRT	Downstream Replacement with LRT	Upstream Replacement with LRT	Supplemental with BRT	Supplemental with LRT
1	Prepare DEIS Alternatives	\$21,199,771	\$20,949,009	\$22,540,447	\$22,295,367	\$23,844,805	\$24,521,346
2	Evaluate DEIS Alternatives / Present Draft Findings	\$31,799,657	\$31,423,514	\$33,810,670	\$33,443,051	\$35,767,207	\$36,782,018
3	Publish DEIS and LPA	\$0	\$0	\$0	\$0	\$0	\$0
4	Comment Period / Public Hearings	\$10,599,886	\$10,474,505	\$11,270,223	\$11,147,684	\$11,922,402	\$12,260,673
5	Local Agency Adoption	\$10,599,886	\$10,474,505	\$11,270,223	\$11,147,684	\$11,922,402	\$12,260,673
6	FTA New Starts Application	\$0	\$0	\$0	\$0	\$0	\$0
7	Prepare FEIS	\$28,266,361	\$27,932,012	\$30,053,929	\$29,727,156	\$31,793,073	\$32,695,127
8	FHWA/FTA Record of Decision	\$0	\$0	\$0	\$0	\$0	\$0
9	30% Design	\$28,266,361	\$27,932,012	\$30,053,929	\$29,727,156	\$31,793,073	\$32,695,127
10	R/W Appraisal and Acquisition	\$117,776,596	\$93,153,600	\$117,776,596	\$93,153,600	\$143,728,900	\$144,857,180
11	Environmental Permitting	\$63,599,313	\$62,847,028	\$67,621,340	\$66,886,102	\$71,534,414	\$73,564,037
12	Begin Construction	\$0	\$0	\$0	\$0	\$0	\$0
13	HWY - Construct NB River Crossing	\$404,256,198	\$415,055,568	\$404,256,198	\$415,055,568	\$0	\$0
14	HWY - Finish NB River Crossing	\$0	\$0	\$0	\$0	\$0	\$0
15	HWY - Construct SB River Crossing	\$297,242,848	\$293,090,109	\$297,242,848	\$293,090,109	\$0	\$0
16	HCT - Construct River Crossing	\$183,729,042	\$184,801,101	\$258,588,136	\$260,072,491	\$0	\$0
17	HWY - Demo Existing NB River Crossing	\$51,328,670	\$52,192,927	\$51,328,670	\$52,192,927	\$0	\$0
18	HWY - Demo Existing SB River Crossing	\$51,328,670	\$52,192,927	\$51,328,670	\$52,192,927	\$0	\$0
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	\$90,507,813	\$136,227,508	\$90,507,813	\$136,227,508	\$63,617,926	\$63,617,926
20	HWY - I-5 / SR14 I/C (Stage 3)	\$28,103,865	\$20,070,444	\$28,103,865	\$20,070,444	\$18,599,103	\$18,599,103
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	\$141,657,091	\$180,257,912	\$141,657,091	\$180,257,912	\$125,152,853	\$125,152,853
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	\$66,908,368	\$56,836,567	\$66,908,368	\$56,836,567	\$85,863,982	\$85,863,982
23	HWY - I-5 / Marine Drive Interchange (All Stages)	\$402,224,425	\$365,090,157	\$402,224,425	\$365,090,157	\$422,831,913	\$422,831,913
24	HWY - I-5 / SR 500 Interchange (All Stages)	\$113,924,777	\$119,092,467	\$113,924,777	\$119,092,467	\$101,310,686	\$101,310,686
25	HWY - I-5 Mill Plain Interchange (All Stages)	\$71,415,684	\$80,937,899	\$71,415,684	\$80,937,899	\$76,446,605	\$76,446,605
26	HWY - I-5 / Fourth Plain Interchange (All Stages)	\$124,828,529	\$130,734,461	\$124,828,529	\$130,734,461	\$105,083,736	\$105,083,736
27	HCT - BRT North	\$231,782,050	\$232,225,280	\$273,825,048	\$274,344,211	\$160,807,973	\$164,904,957
28	HCT - BRT South	\$47,710,375	\$48,064,959	\$60,332,455	\$60,747,785	\$87,491,704	\$85,514,250
29	HCT - Burn Time	\$4,913,063	\$4,930,126	\$6,253,739	\$6,276,484	\$5,264,558	\$5,941,098
30	Project Complete	\$0	\$0	\$0	\$0	\$0	\$0
31	HWY/HCT - Construct SB/HCT River Crossing	\$0	\$0	\$0	\$0	\$423,232,999	\$406,576,788
32	HCT - Finish/OCS/Civil for River Crossing	\$0	\$0	\$0	\$0	\$408,688,653	\$532,627,988
GRAND TOTAL PROJECT COST		\$2,623,969,298	\$2,656,986,598	\$2,767,123,673	\$2,800,747,719	\$2,446,698,968	\$2,564,108,066

Table 18: MOS Design Base Costs

ID	FLOWCHART ACTIVITY	Downstream Replacement with BRT Mill District	Downstream Replacement with BRT Clark College	Downstream Replacement with LRT Mill District	Downstream Replacement with LRT Clark College
1	Prepare DEIS Alternatives	\$19,399,706	\$18,933,151	\$20,006,264	\$19,708,063
2	Evaluate DEIS Alternatives / Present Draft Findings	\$29,099,558	\$28,399,727	\$30,009,397	\$29,562,095
3	Publish DEIS and LPA	\$0	\$0	\$0	\$0
4	Comment Period / Public Hearings	\$9,699,853	\$9,466,576	\$10,003,132	\$9,854,032
5	Local Agency Adoption	\$9,699,853	\$9,466,576	\$10,003,132	\$9,854,032
6	FTA New Starts Application	\$0	\$0	\$0	\$0
7	Prepare FEIS	\$25,866,274	\$25,244,201	\$26,675,019	\$26,277,417
8	FHWA/FTA Record of Decision	\$0	\$0	\$0	\$0
9	30% Design	\$25,866,274	\$25,244,201	\$26,675,019	\$26,277,417
10	R/W Appraisal and Acquisition	\$105,117,196	\$114,855,196	\$102,953,196	\$112,691,196
11	Environmental Permitting	\$58,199,117	\$56,799,453	\$60,018,793	\$59,124,189
12	Begin Construction	\$0	\$0	\$0	\$0
13	HWY - Construct NB River Crossing	\$404,256,198	\$407,644,965	\$404,256,198	\$407,644,965
14	HWY - Finish NB River Crossing	\$0	\$0	\$0	\$0
15	HWY - Construct SB River Crossing	\$297,242,848	\$286,859,582	\$297,242,848	\$286,859,582
16	HCT – Construct River Crossing	\$157,685,483	\$169,302,882	\$204,329,829	\$226,378,529
17	HWY - Demo Existing NB River Crossing	\$51,328,670	\$52,458,259	\$51,328,670	\$52,458,259
18	HWY - Demo Existing SB River Crossing	\$51,328,670	\$52,458,259	\$51,328,670	\$52,458,259
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	\$90,314,884	\$85,238,897	\$90,289,917	\$85,238,897
20	HWY - I-5 / SR14 I/C (Stage 3)	\$28,029,661	\$25,870,081	\$28,020,059	\$25,870,081
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	\$141,657,091	\$188,184,853	\$141,657,091	\$188,184,853
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	\$66,908,368	\$58,318,126	\$66,908,368	\$58,318,126
23	HWY - I-5 / Marine Drive Interchange (All Stages)	\$402,224,425	\$374,249,524	\$402,224,425	\$374,249,524
24	HWY - I-5 / SR 500 Interchange (All Stages)	\$112,189,830	\$114,037,627	\$112,162,943	\$114,037,627
25	HWY - I-5 Mill Plain Interchange (All Stages)	\$71,148,552	\$73,886,406	\$71,113,983	\$73,886,406
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	\$123,512,162	\$126,702,846	\$123,481,434	\$126,702,846
27	HCT – BRT North	\$95,937,505	\$98,811,824	\$106,600,688	\$113,375,301
28	HCT – BRT South	\$37,808,690	\$38,549,397	\$39,176,297	\$41,775,384
29	HCT – Burn Time	\$3,134,905	\$3,277,826	\$3,742,238	\$4,052,738
30	Project Complete	\$0	\$0	\$0	\$0
31	HWY/HCT - Construct SB/HCT River Crossing	\$0	\$0	\$0	\$0
32	HCT - Finish/OCS/Civil for River Crossing	\$0	\$0	\$0	\$0
	GRAND TOTAL PROJECT COST	\$2,417,655,773	\$2,444,260,434	\$2,480,207,612	\$2,524,839,817

Base Costs with Uncertainties

The following tables detail the baseline costs with uncertainties for the activities in all project alternatives:

Table 19: Vancouver Alignment Base Costs with Uncertainties

ID	FLOWCHART ACTIVITY	Downstream Replacement with BRT	Upstream Replacement with BRT	Downstream Replacement with LRT	Upstream Replacement with LRT	Supplemental with BRT	Supplemental with LRT
1	Prepare DEIS Alternatives	\$22,114,558	\$21,852,975	\$23,513,085	\$23,257,430	\$24,873,727	\$25,579,461
2	Evaluate DEIS Alternatives / Present Draft Findings	\$33,171,837	\$32,779,463	\$35,269,627	\$34,886,145	\$37,310,590	\$38,369,191
3	Publish DEIS and LPA	\$0	\$0	\$0	\$0	\$0	\$0
4	Comment Period / Public Hearings	\$11,057,279	\$10,926,488	\$11,756,542	\$11,628,715	\$12,436,863	\$12,789,730
5	Local Agency Adoption	\$11,057,279	\$10,926,488	\$11,756,542	\$11,628,715	\$12,436,863	\$12,789,730
6	FTA New Starts Application	\$0	\$0	\$0	\$0	\$0	\$0
7	Prepare FEIS	\$29,486,077	\$29,137,301	\$31,350,780	\$31,009,907	\$33,164,969	\$34,105,948
8	FHWA/FTA Record of Decision	\$0	\$0	\$0	\$0	\$0	\$0
9	30% Design	\$29,486,077	\$29,137,301	\$31,350,780	\$31,009,907	\$33,164,969	\$34,105,948
10	R/W Appraisal and Acquisition	\$122,235,218	\$96,984,336	\$122,235,218	\$96,984,336	\$143,728,900	\$144,857,180
11	Environmental Permitting	\$66,343,674	\$65,558,926	\$70,539,254	\$69,772,290	\$74,621,180	\$76,738,383
12	Begin Construction	\$0	\$0	\$0	\$0	\$0	\$0
13	HWY - Construct NB River Crossing	\$428,977,961	\$440,419,627	\$428,977,961	\$440,419,627	\$0	\$0
14	HWY - Finish NB River Crossing	\$0	\$0	\$0	\$0	\$0	\$0
15	HWY - Construct SB River Crossing	\$315,048,036	\$310,863,626	\$315,048,036	\$310,863,626	\$0	\$0
16	HCT - Construct River Crossing	\$193,790,268	\$194,914,073	\$271,944,802	\$273,495,714	\$0	\$0
17	HWY - Demo Existing NB River Crossing	\$54,177,367	\$55,078,918	\$54,177,367	\$55,078,918	\$0	\$0
18	HWY - Demo Existing SB River Crossing	\$54,177,367	\$55,078,918	\$54,177,367	\$55,078,918	\$0	\$0
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	\$93,093,122	\$139,731,151	\$93,093,122	\$139,731,151	\$64,469,574	\$64,469,574
20	HWY - I-5 / SR14 I/C (Stage 3)	\$29,124,669	\$20,737,294	\$29,124,669	\$20,737,294	\$19,078,990	\$19,078,990
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	\$145,571,483	\$185,521,807	\$145,571,483	\$185,521,807	\$127,250,696	\$127,250,696
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	\$69,522,453	\$59,032,416	\$69,522,453	\$59,032,416	\$89,118,476	\$89,118,476
23	HWY - I-5 / Marine Drive Interchange (All Stages)	\$412,433,842	\$374,355,582	\$412,433,842	\$374,355,582	\$428,160,549	\$428,160,549
24	HWY - I-5 / SR 500 Interchange (All Stages)	\$117,141,331	\$122,522,722	\$117,141,331	\$122,522,722	\$102,584,121	\$102,584,121
25	HWY - I-5 Mill Plain Interchange (All Stages)	\$73,882,130	\$83,796,304	\$73,882,130	\$83,796,304	\$78,381,437	\$78,381,437
26	HWY - I-5 / Fourth Plain Interchange (All Stages)	\$128,669,753	\$134,819,913	\$128,669,753	\$134,819,913	\$106,539,091	\$106,539,091
27	HCT - BRT North	\$244,261,007	\$244,723,363	\$288,188,542	\$288,730,108	\$164,946,962	\$169,322,316
28	HCT - BRT South	\$49,816,454	\$50,186,338	\$62,942,682	\$63,375,934	\$90,802,895	\$89,048,137
29	HCT - Burn Time	\$5,125,065	\$5,142,865	\$6,523,592	\$6,547,319	\$5,491,727	\$6,197,461
30	Project Complete	\$0	\$0	\$0	\$0	\$0	\$0
31	HWY/HCT - Construct SB/HCT River Crossing	\$0	\$0	\$0	\$0	\$447,864,353	\$430,489,413
32	HCT - Finish/OCS/Civil for River Crossing	\$0	\$0	\$0	\$0	\$410,544,536	\$537,715,658
GRAND TOTAL PROJECT COST		\$2,739,764,308	\$2,774,228,197	\$2,889,190,963	\$2,924,284,799	\$2,506,971,471	\$2,627,691,493

Table 20: I-5 Alignment Base Costs with Uncertainties

ID	FLOWCHART ACTIVITY	Downstream Replacement with BRT	Upstream Replacement with BRT	Downstream Replacement with LRT	Upstream Replacement with LRT	Supplemental with BRT	Supplemental with LRT
1	Prepare DEIS Alternatives	\$22,114,558	\$21,852,975	\$23,513,085	\$23,257,430	\$24,873,727	\$25,579,461
2	Evaluate DEIS Alternatives / Present Draft Findings	\$33,171,837	\$32,779,463	\$35,269,627	\$34,886,145	\$37,310,590	\$38,369,191
3	Publish DEIS and LPA	\$0	\$0	\$0	\$0	\$0	\$0
4	Comment Period / Public Hearings	\$11,057,279	\$10,926,488	\$11,756,542	\$11,628,715	\$12,436,863	\$12,789,730
5	Local Agency Adoption	\$11,057,279	\$10,926,488	\$11,756,542	\$11,628,715	\$12,436,863	\$12,789,730
6	FTA New Starts Application	\$0	\$0	\$0	\$0	\$0	\$0
7	Prepare FEIS	\$29,486,077	\$29,137,301	\$31,350,780	\$31,009,907	\$33,164,969	\$34,105,948
8	FHWA/FTA Record of Decision	\$0	\$0	\$0	\$0	\$0	\$0
9	30% Design	\$29,486,077	\$29,137,301	\$31,350,780	\$31,009,907	\$33,164,969	\$34,105,948
10	R/W Appraisal and Acquisition	\$122,235,218	\$96,984,336	\$122,235,218	\$96,984,336	\$143,728,900	\$144,857,180
11	Environmental Permitting	\$66,343,674	\$65,558,926	\$70,539,254	\$69,772,290	\$74,621,180	\$76,738,383
12	Begin Construction	\$0	\$0	\$0	\$0	\$0	\$0
13	HWY - Construct NB River Crossing	\$428,977,961	\$440,419,627	\$428,977,961	\$440,419,627	\$0	\$0
14	HWY - Finish NB River Crossing	\$0	\$0	\$0	\$0	\$0	\$0
15	HWY - Construct SB River Crossing	\$315,048,036	\$310,863,626	\$315,048,036	\$310,863,626	\$0	\$0
16	HCT - Construct River Crossing	\$193,790,268	\$194,914,073	\$271,944,802	\$273,495,714	\$0	\$0
17	HWY - Demo Existing NB River Crossing	\$54,177,367	\$55,078,918	\$54,177,367	\$55,078,918	\$0	\$0
18	HWY - Demo Existing SB River Crossing	\$54,177,367	\$55,078,918	\$54,177,367	\$55,078,918	\$0	\$0
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	\$93,093,122	\$139,731,151	\$93,093,122	\$139,731,151	\$64,469,574	\$64,469,574
20	HWY - I-5 / SR14 I/C (Stage 3)	\$29,124,669	\$20,737,294	\$29,124,669	\$20,737,294	\$19,078,990	\$19,078,990
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	\$145,571,483	\$185,521,807	\$145,571,483	\$185,521,807	\$127,250,696	\$127,250,696
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	\$69,522,453	\$59,032,416	\$69,522,453	\$59,032,416	\$89,118,476	\$89,118,476
23	HWY - I-5 / Marine Drive Interchange (All Stages)	\$412,433,842	\$374,355,582	\$412,433,842	\$374,355,582	\$428,160,549	\$428,160,549
24	HWY - I-5 / SR 500 Interchange (All Stages)	\$117,141,331	\$122,522,722	\$117,141,331	\$122,522,722	\$102,584,121	\$102,584,121
25	HWY - I-5 Mill Plain Interchange (All Stages)	\$73,882,130	\$83,796,304	\$73,882,130	\$83,796,304	\$78,381,437	\$78,381,437
26	HWY - I-5 / Fourth Plain Interchange (All Stages)	\$128,669,753	\$134,819,913	\$128,669,753	\$134,819,913	\$106,539,091	\$106,539,091
27	HCT - BRT North	\$244,261,007	\$244,723,363	\$288,188,542	\$288,730,108	\$164,946,962	\$169,322,316
28	HCT - BRT South	\$49,816,454	\$50,186,338	\$62,942,682	\$63,375,934	\$90,802,895	\$89,048,137
29	HCT - Burn Time	\$5,125,065	\$5,142,865	\$6,523,592	\$6,547,319	\$5,491,727	\$6,197,461
30	Project Complete	\$0	\$0	\$0	\$0	\$0	\$0
31	HWY/HCT - Construct SB/HCT River Crossing	\$0	\$0	\$0	\$0	\$447,864,353	\$430,489,413
32	HCT - Finish/OCS/Civil for River Crossing	\$0	\$0	\$0	\$0	\$410,544,536	\$537,715,658
	GRAND TOTAL PROJECT COST	\$2,739,764,308	\$2,774,228,197	\$2,889,190,963	\$2,924,284,799	\$2,506,971,471	\$2,627,691,493

Table 21: MOS Design Base Costs with Uncertainties

ID	FLOWCHART ACTIVITY	Downstream Replacement with BRT Mill District	Downstream Replacement with BRT Clark College	Downstream Replacement with LRT Mill District	Downstream Replacement with LRT Clark College
1	Prepare DEIS Alternatives	\$20,236,818	\$19,750,131	\$20,869,550	\$20,558,481
2	Evaluate DEIS Alternatives / Present Draft Findings	\$30,355,227	\$29,625,197	\$31,304,326	\$30,837,722
3	Publish DEIS and LPA	\$0	\$0	\$0	\$0
4	Comment Period / Public Hearings	\$10,118,409	\$9,875,066	\$10,434,775	\$10,279,241
5	Local Agency Adoption	\$10,118,409	\$9,875,066	\$10,434,775	\$10,279,241
6	FTA New Starts Application	\$0	\$0	\$0	\$0
7	Prepare FEIS	\$26,982,424	\$26,333,508	\$27,826,067	\$27,411,309
8	FHWA/FTA Record of Decision	\$0	\$0	\$0	\$0
9	30% Design	\$26,982,424	\$26,333,508	\$27,826,067	\$27,411,309
10	R/W Appraisal and Acquisition	\$109,029,555	\$119,187,757	\$106,772,177	\$116,930,379
11	Environmental Permitting	\$60,710,454	\$59,250,394	\$62,608,651	\$61,675,444
12	Begin Construction	\$0	\$0	\$0	\$0
13	HWY - Construct NB River Crossing	\$428,977,961	\$432,512,956	\$428,977,961	\$432,512,956
14	HWY - Finish NB River Crossing	\$0	\$0	\$0	\$0
15	HWY - Construct SB River Crossing	\$315,048,036	\$304,216,724	\$315,048,036	\$304,216,724
16	HCT – Construct River Crossing	\$166,404,346	\$178,717,497	\$215,147,041	\$238,354,873
17	HWY - Demo Existing NB River Crossing	\$54,177,367	\$55,355,699	\$54,177,367	\$55,355,699
18	HWY - Demo Existing SB River Crossing	\$54,177,367	\$55,355,699	\$54,177,367	\$55,355,699
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	\$92,891,868	\$87,621,487	\$92,865,824	\$87,621,487
20	HWY - I-5 / SR14 I/C (Stage 3)	\$29,047,264	\$26,805,220	\$29,037,247	\$26,805,220
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	\$145,571,483	\$193,633,696	\$145,571,483	\$193,633,696
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	\$69,522,453	\$60,566,486	\$69,522,453	\$60,566,486
23	HWY - I-5 / Marine Drive Interchange (All Stages)	\$412,433,842	\$383,720,110	\$412,433,842	\$383,720,110
24	HWY - I-5 / SR 500 Interchange (All Stages)	\$115,369,911	\$117,288,229	\$115,341,863	\$117,288,229
25	HWY - I-5 Mill Plain Interchange (All Stages)	\$73,603,471	\$76,443,845	\$73,567,410	\$76,443,845
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	\$127,313,029	\$130,614,419	\$127,280,975	\$130,614,419
27	HCT – BRT North	\$100,795,377	\$103,725,100	\$111,916,173	\$118,951,969
28	HCT – BRT South	\$39,487,557	\$40,260,226	\$40,873,720	\$43,584,960
29	HCT – Burn Time	\$3,270,179	\$3,419,267	\$3,903,719	\$4,227,617
30	Project Complete	\$0	\$0	\$0	\$0
31	HWY/HCT - Construct SB/HCT River Crossing	\$0	\$0	\$0	\$0
32	HCT - Finish/OCS/Civil for River Crossing	\$0	\$0	\$0	\$0
	GRAND TOTAL PROJECT COST	\$2,522,625,232	\$2,550,487,287	\$2,587,918,870	\$2,634,637,114

Baseline Schedules

The following tables detail the baseline schedules for all projects:

Table 22: Baseline Schedule Downstream Replacement Crossing with BRT

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	2/1/08	9.00
3	Publish DEIS and LPA	2/1/08	2/1/08	0.00
4	Comment Period / Public Hearings	2/1/08	5/3/08	3.00
5	Local Agency Adoption	5/3/08	8/2/08	3.00
6	FTA New Starts Application	8/1/08	8/1/08	0.00
7	Prepare FEIS	8/1/08	4/2/09	8.00
8	FHWA/FTA Record of Decision	4/1/09	4/1/09	0.00
9	30% Design	4/1/09	12/1/09	8.00
10	R/W Appraisal and Acquisition	8/1/08	1/2/10	17.00
11	Environmental Permitting	5/3/08	11/3/09	18.00
12	Begin Construction	1/1/10	1/1/10	0.00
13	HWY - Construct NB River Crossing	1/1/10	7/4/12	30.00
14	HWY - Finish NB River Crossing	5/5/13	6/5/14	13.00
15	HWY - Construct SB River Crossing	1/1/10	7/4/12	30.00
16	HCT - Construct River Crossing	1/1/10	4/3/12	27.00
17	HWY - Demo Existing NB River Crossing	5/31/14	4/1/15	10.00
18	HWY - Demo Existing SB River Crossing	7/4/12	5/5/13	10.00
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	1/1/10	3/4/12	26.00
20	HWY - I-5 / SR14 I/C (Stage 3)	5/31/14	4/1/15	10.00
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	1/1/10	5/4/11	16.00
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	7/4/12	8/5/14	25.00
23	HWY - I-5 / Marine Drive Interchange (All Stages)	1/1/10	10/3/12	33.00
24	HWY - I-5 / SR 500 Interchange (All Stages)	1/1/10	5/4/12	28.00
25	HWY - I-5 Mill Plain Interchange (All Stages)	1/1/10	1/3/13	36.00
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	1/1/10	9/3/12	32.00
27	HCT - BRT North	1/1/10	9/3/11	20.00
28	HCT - BRT South	1/1/10	5/4/11	16.00
29	HCT - Burn Time	4/3/12	10/3/12	6.00
30	Project Complete	4/1/15	4/1/15	0.00

Table 23: Baseline Schedule Upstream Replacement Crossing with BRT

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	2/1/08	9.00
3	Publish DEIS and LPA	2/1/08	2/1/08	0.00
4	Comment Period / Public Hearings	2/1/08	5/3/08	3.00
5	Local Agency Adoption	5/3/08	8/2/08	3.00
6	FTA New Starts Application	8/1/08	8/1/08	0.00
7	Prepare FEIS	8/1/08	4/2/09	8.00
8	FHWA/FTA Record of Decision	4/1/09	4/1/09	0.00
9	30% Design	4/1/09	12/1/09	8.00
10	R/W Appraisal and Acquisition	8/1/08	1/2/10	17.00
11	Environmental Permitting	5/3/08	11/3/09	18.00
12	Begin Construction	1/1/10	1/1/10	0.00
13	HWY - Construct NB River Crossing	1/4/10	7/7/12	30.00
15	HWY - Construct SB River Crossing	11/13/13	11/15/15	24.00
16	HCT – Construct River Crossing	9/21/16	12/23/18	27.00
17	HWY - Demo Existing NB River Crossing	1/8/13	11/9/13	10.00
18	HWY - Demo Existing SB River Crossing	11/18/15	9/18/16	10.00
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	1/4/10	10/6/11	21.00
20	HWY - I-5 / SR14 I/C (Stage 3)	1/7/13	9/8/13	8.00
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	1/4/10	1/6/13	36.00
22	HWY - I-5 / Hayden Island I/C (Stage 3)	1/7/13	5/11/15	28.00
23	HWY - I-5 / Marine Drive Interchange (All Stages)	1/4/10	5/8/13	40.00
24	HWY - I-5 / SR 500 Interchange (All Stages)	1/4/10	5/7/12	28.00
25	HWY - I-5 Mill Plain Interchange (All Stages)	1/4/10	1/6/13	36.00
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	1/4/10	9/6/12	32.00
27	HCT – BRT North	1/4/10	9/6/11	20.00
28	HCT – BRT South	1/4/10	5/7/11	16.00
29	HCT – Burn Time	12/26/18	6/27/19	6.00
30	Project Complete	7/1/19	7/1/19	0.00

Table 24: Baseline Schedule Downstream Replacement Crossing with LRT

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	2/1/08	9.00
3	Publish DEIS and LPA	2/1/08	2/1/08	0.00
4	Comment Period / Public Hearings	2/1/08	5/3/08	3.00
5	Local Agency Adoption	5/3/08	8/2/08	3.00
6	FTA New Starts Application	8/1/08	8/1/08	0.00
7	Prepare FEIS	8/1/08	4/2/09	8.00
8	FHWA/FTA Record of Decision	4/1/09	4/1/09	0.00
9	30% Design	4/1/09	12/1/09	8.00
10	R/W Appraisal and Acquisition	8/1/08	1/2/10	17.00
11	Environmental Permitting	5/3/08	11/3/09	18.00
12	Begin Construction	1/1/10	1/1/10	0.00
13	HWY - Construct NB River Crossing	1/1/10	7/4/12	30.00
14	HWY - Finish NB River Crossing	5/5/13	6/5/14	13.00
15	HWY - Construct SB River Crossing	1/1/10	7/4/12	30.00
16	HCT – Construct River Crossing	1/1/10	4/3/12	27.00
17	HWY - Demo Existing NB River Crossing	5/31/14	4/1/15	10.00
18	HWY - Demo Existing SB River Crossing	7/4/12	5/5/13	10.00
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	1/1/10	3/4/12	26.00
20	HWY - I-5 / SR14 I/C (Stage 3)	5/31/14	4/1/15	10.00
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	1/1/10	5/4/11	16.00
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	7/4/12	8/5/14	25.00
23	HWY - I-5 / Marine Drive Interchange (All Stages)	1/1/10	10/3/12	33.00
24	HWY - I-5 / SR 500 Interchange (All Stages)	1/1/10	5/4/12	28.00
25	HWY - I-5 Mill Plain Interchange (All Stages)	1/1/10	1/3/13	36.00
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	1/1/10	9/3/12	32.00
27	HCT – BRT North	1/1/10	9/3/11	20.00
28	HCT – BRT South	1/1/10	5/4/11	16.00
29	HCT – Burn Time	4/3/12	10/3/12	6.00
30	Project Complete	4/1/15	4/1/15	0.00

Table 25: Baseline Schedule Upstream Replacement Crossing with LRT

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	2/1/08	9.00
3	Publish DEIS and LPA	2/1/08	2/1/08	0.00
4	Comment Period / Public Hearings	2/1/08	5/3/08	3.00
5	Local Agency Adoption	5/3/08	8/2/08	3.00
6	FTA New Starts Application	8/1/08	8/1/08	0.00
7	Prepare FEIS	8/1/08	4/2/09	8.00
8	FHWA/FTA Record of Decision	4/1/09	4/1/09	0.00
9	30% Design	4/1/09	12/1/09	8.00
10	R/W Appraisal and Acquisition	8/1/08	1/2/10	17.00
11	Environmental Permitting	5/3/08	11/3/09	18.00
12	Begin Construction	1/1/10	1/1/10	0.00
13	HWY - Construct NB River Crossing	1/4/10	7/7/12	30.00
15	HWY - Construct SB River Crossing	11/13/13	11/15/15	24.00
16	HCT – Construct River Crossing	9/21/16	12/23/18	27.00
17	HWY - Demo Existing NB River Crossing	1/8/13	11/9/13	10.00
18	HWY - Demo Existing SB River Crossing	11/18/15	9/18/16	10.00
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	1/4/10	10/6/11	21.00
20	HWY - I-5 / SR14 I/C (Stage 3)	1/7/13	9/8/13	8.00
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	1/4/10	1/6/13	36.00
22	HWY - I-5 / Hayden Island I/C (Stage 3)	1/7/13	5/11/15	28.00
23	HWY - I-5 / Marine Drive Interchange (All Stages)	1/4/10	5/8/13	40.00
24	HWY - I-5 / SR 500 Interchange (All Stages)	1/4/10	5/7/12	28.00
25	HWY - I-5 Mill Plain Interchange (All Stages)	1/4/10	1/6/13	36.00
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	1/4/10	9/6/12	32.00
27	HCT – BRT North	1/4/10	9/6/11	20.00
28	HCT – BRT South	1/4/10	5/7/11	16.00
29	HCT – Burn Time	12/26/18	6/27/19	6.00
30	Project Complete	7/1/19	7/1/19	0.00

Table 26: Baseline Schedule Supplemental Crossing with BRT

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	2/1/08	9.00
3	Publish DEIS and LPA	2/1/08	2/1/08	0.00
4	Comment Period / Public Hearings	2/1/08	5/3/08	3.00
5	Local Agency Adoption	5/3/08	8/2/08	3.00
6	FTA New Starts Application	8/1/08	8/1/08	0.00
7	Prepare FEIS	8/1/08	4/2/09	8.00
8	FHWA/FTA Record of Decision	4/1/09	4/1/09	0.00
9	30% Design	4/1/09	12/1/09	8.00
10	R/W Appraisal and Acquisition	8/1/08	1/2/10	17.00
11	Environmental Permitting	5/3/08	11/3/09	18.00
12	Begin Construction	1/1/10	1/1/10	0.00
31	HWY/HCT - Construct SB/HCT River Crossing	1/4/10	7/7/12	30.00
32	HCT - Finish/OCS/Civil for River Crossing	7/9/12	1/8/13	6.00
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	1/4/10	9/6/11	20.00
20	HWY - I-5 / SR14 I/C (Stage 3)	7/9/12	5/10/13	10.00
21	HWY - I-5 / Hayden Island I/C (Stage 1)	1/4/10	5/7/11	16.00
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	5/9/11	10/10/14	41.00
23	HWY - I-5 / Marine Drive Interchange (All Stages)	1/20/12	5/24/15	40.00
24	HWY - I-5 / SR 500 Interchange (All Stages)	1/4/10	5/7/12	28.00
25	HWY - I-5 Mill Plain Interchange (All Stages)	1/4/10	1/6/13	36.00
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	1/4/10	9/6/12	32.00
27	HCT – BRT North	1/4/10	9/6/11	20.00
28	HCT – BRT South	1/4/10	5/7/11	16.00
29	HCT – Burn Time	1/8/13	7/10/13	6.00
30	Project Complete	6/1/15	6/1/15	0.00

Table 27: Baseline Schedule Supplemental Crossing with LRT

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	2/1/08	9.00
3	Publish DEIS and LPA	2/1/08	2/1/08	0.00
4	Comment Period / Public Hearings	2/1/08	5/3/08	3.00
5	Local Agency Adoption	5/3/08	8/2/08	3.00
6	FTA New Starts Application	8/1/08	8/1/08	0.00
7	Prepare FEIS	8/1/08	4/2/09	8.00
8	FHWA/FTA Record of Decision	4/1/09	4/1/09	0.00
9	30% Design	4/1/09	12/1/09	8.00
10	R/W Appraisal and Acquisition	8/1/08	1/2/10	17.00
11	Environmental Permitting	5/3/08	11/3/09	18.00
12	Begin Construction	1/1/10	1/1/10	0.00
31	HWY/HCT - Construct SB/HCT River Crossing	1/4/10	7/7/12	30.00
32	HCT - Finish/OCS/Civil for River Crossing	7/9/12	12/9/13	17.00
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	1/4/10	9/6/11	20.00
20	HWY - I-5 / SR14 I/C (Stage 3)	7/9/12	5/10/13	10.00
21	HWY - I-5 / Hayden Island I/C (Stage 1)	1/4/10	5/7/11	16.00
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	5/9/11	10/10/14	41.00
23	HWY - I-5 / Marine Drive Interchange (All Stages)	1/20/12	5/24/15	40.00
24	HWY - I-5 / SR 500 Interchange (All Stages)	1/4/10	5/7/12	28.00
25	HWY - I-5 Mill Plain Interchange (All Stages)	1/4/10	1/6/13	36.00
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	1/4/10	9/6/12	32.00
27	HCT – BRT North	1/4/10	9/6/11	20.00
28	HCT – BRT South	1/4/10	5/7/11	16.00
29	HCT – Burn Time	12/9/13	6/10/14	6.00
30	Project Complete	6/1/15	6/1/15	0.00

Table 28: Baseline Schedule MOS Downstream Replacement Crossing with BRT, Mill District

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	2/1/08	9.00
3	Publish DEIS and LPA	2/1/08	2/1/08	0.00
4	Comment Period / Public Hearings	2/1/08	5/3/08	3.00
5	Local Agency Adoption	5/3/08	8/2/08	3.00
6	FTA New Starts Application	8/2/08	8/2/08	0.00
7	Prepare FEIS	8/2/08	4/3/09	8.00
8	FHWA/FTA Record of Decision	4/3/09	4/3/09	0.00
9	30% Design	4/3/09	12/3/09	8.00
10	R/W Appraisal and Acquisition	8/2/08	2/2/10	18.00
11	Environmental Permitting	5/3/08	11/3/09	18.00
12	Begin Construction	2/2/10	2/2/10	0.00
13	HWY - Construct NB River Crossing	2/2/10	8/5/12	30.00
14	HWY - Finish NB River Crossing	6/6/13	7/8/14	13.00
15	HWY - Construct SB River Crossing	2/2/10	8/5/12	30.00
16	HCT – Construct River Crossing	2/2/10	5/6/12	27.00
17	HWY - Demo Existing NB River Crossing	7/8/14	5/9/15	10.00
18	HWY - Demo Existing SB River Crossing	8/5/12	6/6/13	10.00
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	2/2/10	4/5/12	26.00
20	HWY - I-5 / SR14 I/C (Stage 3)	7/8/14	5/9/15	10.00
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	2/2/10	6/5/11	16.00
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	8/5/12	9/7/14	25.00
23	HWY - I-5 / Marine Drive Interchange (All Stages)	2/2/10	11/5/12	33.00
24	HWY - I-5 / SR 500 Interchange (All Stages)	2/2/10	6/5/12	28.00
25	HWY - I-5 Mill Plain Interchange (All Stages)	2/2/10	2/4/13	36.00
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	2/2/10	10/5/12	32.00
27	HCT – BRT North	2/2/10	7/5/10	5.00
28	HCT – BRT South	2/2/10	6/5/11	16.00
29	HCT – Burn Time	5/6/12	11/5/12	6.00
30	Project Complete	5/9/15	5/9/15	0.00

Table 29: Baseline Schedule MOS Downstream Replacement Crossing with BRT, Clark College

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	2/1/08	9.00
3	Publish DEIS and LPA	2/1/08	2/1/08	0.00
4	Comment Period / Public Hearings	2/1/08	5/3/08	3.00
5	Local Agency Adoption	5/3/08	8/2/08	3.00
6	FTA New Starts Application	8/2/08	8/2/08	0.00
7	Prepare FEIS	8/2/08	4/3/09	8.00
8	FHWA/FTA Record of Decision	4/3/09	4/3/09	0.00
9	30% Design	4/3/09	12/3/09	8.00
10	R/W Appraisal and Acquisition	8/2/08	2/2/10	18.00
11	Environmental Permitting	5/3/08	11/3/09	18.00
12	Begin Construction	2/2/10	2/2/10	0.00
13	HWY - Construct NB River Crossing	2/2/10	8/5/12	30.00
14	HWY - Finish NB River Crossing	6/6/13	7/8/14	13.00
15	HWY - Construct SB River Crossing	2/2/10	8/5/12	30.00
16	HCT – Construct River Crossing	2/2/10	5/6/12	27.00
17	HWY - Demo Existing NB River Crossing	7/8/14	5/9/15	10.00
18	HWY - Demo Existing SB River Crossing	8/5/12	6/6/13	10.00
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	2/2/10	4/5/12	26.00
20	HWY - I-5 / SR14 I/C (Stage 3)	7/8/14	5/9/15	10.00
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	2/2/10	6/5/11	16.00
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	8/5/12	9/7/14	25.00
23	HWY - I-5 / Marine Drive Interchange (All Stages)	2/2/10	11/5/12	33.00
24	HWY - I-5 / SR 500 Interchange (All Stages)	2/2/10	6/5/12	28.00
25	HWY - I-5 Mill Plain Interchange (All Stages)	2/2/10	2/4/13	36.00
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	2/2/10	10/5/12	32.00
27	HCT – BRT North	2/2/10	11/4/10	9.00
28	HCT – BRT South	2/2/10	6/5/11	16.00
29	HCT – Burn Time	5/6/12	11/5/12	6.00
30	Project Complete	5/9/15	5/9/15	0.00

Table 30: Baseline Schedule MOS Downstream Replacement Crossing with LRT, Mill District

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	2/1/08	9.00
3	Publish DEIS and LPA	2/1/08	2/1/08	0.00
4	Comment Period / Public Hearings	2/1/08	5/3/08	3.00
5	Local Agency Adoption	5/3/08	8/2/08	3.00
6	FTA New Starts Application	8/2/08	8/2/08	0.00
7	Prepare FEIS	8/2/08	4/3/09	8.00
8	FHWA/FTA Record of Decision	4/3/09	4/3/09	0.00
9	30% Design	4/3/09	12/3/09	8.00
10	R/W Appraisal and Acquisition	8/2/08	2/2/10	18.00
11	Environmental Permitting	5/3/08	11/3/09	18.00
12	Begin Construction	2/2/10	2/2/10	0.00
13	HWY - Construct NB River Crossing	2/2/10	8/5/12	30.00
14	HWY - Finish NB River Crossing	6/6/13	7/8/14	13.00
15	HWY - Construct SB River Crossing	2/2/10	8/5/12	30.00
16	HCT – Construct River Crossing	2/2/10	5/6/12	27.00
17	HWY - Demo Existing NB River Crossing	7/8/14	5/9/15	10.00
18	HWY - Demo Existing SB River Crossing	8/5/12	6/6/13	10.00
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	2/2/10	4/5/12	26.00
20	HWY - I-5 / SR14 I/C (Stage 3)	7/8/14	5/9/15	10.00
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	2/2/10	6/5/11	16.00
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	8/5/12	9/7/14	25.00
23	HWY - I-5 / Marine Drive Interchange (All Stages)	2/2/10	11/5/12	33.00
24	HWY - I-5 / SR 500 Interchange (All Stages)	2/2/10	6/5/12	28.00
25	HWY - I-5 Mill Plain Interchange (All Stages)	2/2/10	2/4/13	36.00
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	2/2/10	10/5/12	32.00
27	HCT – LRT North	2/2/10	12/4/10	10.00
28	HCT – LRT South	2/2/10	6/5/11	16.00
29	HCT – Burn Time	5/6/12	11/5/12	6.00
30	Project Complete	5/9/15	5/9/15	0.00

Table 31: Baseline Schedule Downstream Replacement Crossing with LRT, Clark College

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	2/1/08	9.00
3	Publish DEIS and LPA	2/1/08	2/1/08	0.00
4	Comment Period / Public Hearings	2/1/08	5/3/08	3.00
5	Local Agency Adoption	5/3/08	8/2/08	3.00
6	FTA New Starts Application	8/2/08	8/2/08	0.00
7	Prepare FEIS	8/2/08	4/3/09	8.00
8	FHWA/FTA Record of Decision	4/3/09	4/3/09	0.00
9	30% Design	4/3/09	12/3/09	8.00
10	R/W Appraisal and Acquisition	8/2/08	2/2/10	18.00
11	Environmental Permitting	5/3/08	11/3/09	18.00
12	Begin Construction	2/2/10	2/2/10	0.00
13	HWY - Construct NB River Crossing	2/2/10	8/5/12	30.00
14	HWY - Finish NB River Crossing	6/6/13	7/8/14	13.00
15	HWY - Construct SB River Crossing	2/2/10	8/5/12	30.00
16	HCT – Construct River Crossing	2/2/10	5/6/12	27.00
17	HWY - Demo Existing NB River Crossing	7/8/14	5/9/15	10.00
18	HWY - Demo Existing SB River Crossing	8/5/12	6/6/13	10.00
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	2/2/10	4/5/12	26.00
20	HWY - I-5 / SR14 I/C (Stage 3)	7/8/14	5/9/15	10.00
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	2/2/10	6/5/11	16.00
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	8/5/12	9/7/14	25.00
23	HWY - I-5 / Marine Drive Interchange (All Stages)	2/2/10	11/5/12	33.00
24	HWY - I-5 / SR 500 Interchange (All Stages)	2/2/10	6/5/12	28.00
25	HWY - I-5 Mill Plain Interchange (All Stages)	2/2/10	2/4/13	36.00
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	2/2/10	10/5/12	32.00
27	HCT – LRT North	2/2/10	7/6/11	17.00
28	HCT – LRT South	2/2/10	6/5/11	16.00
29	HCT – Burn Time	5/6/12	11/5/12	6.00
30	Project Complete	5/9/15	5/9/15	0.00

Risk Adjusted Costs

The following tables detail the risk adjusted costs for all projects. All values are the mean expected risk adjusted values. The risk adjusted costs do not include the cost impact of schedule delay. The cost impact of schedule delay for each alternative is detailed in the table below. The mean expected risk adjusted total cost for an alternative can be calculated if the values below are added to the sum of the risk adjusted costs for an alternative.

Table 32: Cost Impact of Schedule Delay¹⁷

Design / Alignment	Bridge Alternative	Cost Impact of Schedule Delay
Vancouver Alignment	Downstream Replacement with BRT	\$53,493,970
	Upstream Replacement with BRT	\$53,209,104
	Downstream Replacement with LRT	\$56,522,041
	Upstream Replacement with LRT	\$56,157,377
	Supplemental with BRT	\$62,238,919
	Supplemental with LRT	\$65,525,829
I-5 Alignment	Downstream Replacement with BRT	\$53,493,970
	Upstream Replacement with BRT	\$53,209,104
	Downstream Replacement with LRT	\$56,522,041
	Upstream Replacement with LRT	\$56,157,377
	Supplemental with BRT	\$62,238,919
	Supplemental with LRT	\$65,525,829
MOS Design	Downstream Replacement with BRT Mill District	\$31,690,855
	Downstream Replacement with BRT Clark College	\$32,004,740
	Downstream Replacement with LRT Mill District	\$32,569,052
	Downstream Replacement with LRT Clark College	\$33,127,655

¹⁷ Escalated to the risk adjusted project midpoint

Table 33: Risk Adjusted Costs Vancouver Alignment

ID	FLOWCHART ACTIVITY	Downstream Replacement with BRT	Upstream Replacement with BRT	Downstream Replacement with LRT	Upstream Replacement with LRT	Supplemental with BRT	Supplemental with LRT
1	Prepare DEIS Alternatives	\$22,164,809	\$21,902,632	\$23,566,514	\$23,310,278	\$24,930,248	\$25,637,586
2	Evaluate DEIS Alternatives / Present Draft Findings	\$36,493,514	\$36,092,102	\$38,639,626	\$38,247,310	\$40,727,601	\$41,810,586
3	Publish DEIS and LPA	\$0	\$0	\$0	\$0	\$0	\$0
4	Comment Period / Public Hearings	\$11,506,189	\$11,370,088	\$12,233,841	\$12,100,824	\$12,941,782	\$13,308,975
5	Local Agency Adoption	\$13,192,250	\$13,054,845	\$13,926,872	\$13,792,581	\$14,641,594	\$15,012,304
6	FTA New Starts Application	\$0	\$0	\$0	\$0	\$0	\$0
7	Prepare FEIS	\$31,451,745	\$31,079,717	\$33,440,756	\$33,077,159	\$35,375,887	\$36,379,596
8	FHWA/FTA Record of Decision	\$11,185,322	\$11,185,322	\$11,185,322	\$11,185,322	\$11,185,322	\$11,185,322
9	30% Design	\$32,887,501	\$32,498,491	\$34,967,310	\$34,587,115	\$36,990,779	\$38,040,306
10	R/W Appraisal and Acquisition	\$159,013,674	\$128,693,750	\$159,013,674	\$128,693,750	\$184,822,152	\$186,176,931
11	Environmental Permitting	\$73,983,209	\$73,145,957	\$78,459,501	\$77,641,221	\$82,814,534	\$85,073,390
12	Begin Construction	\$0	\$0	\$0	\$0	\$0	\$0
13	HWY - Construct NB River Crossing	\$562,030,955	\$579,546,997	\$562,030,955	\$579,546,997	\$0	\$0
14	HWY - Finish NB River Crossing	\$6,036,533	\$0	\$6,036,533	\$0	\$0	\$0
15	HWY - Construct SB River Crossing	\$416,271,791	\$443,686,479	\$416,271,791	\$443,686,479	\$0	\$0
16	HCT - Construct River Crossing	\$211,256,272	\$256,243,119	\$310,969,624	\$376,016,653	\$0	\$0
17	HWY - Demo Existing NB River Crossing	\$79,693,968	\$79,838,059	\$79,693,968	\$79,838,059	\$0	\$0
18	HWY - Demo Existing SB River Crossing	\$77,371,367	\$86,649,038	\$77,371,367	\$86,649,038	\$0	\$0
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	\$193,222,071	\$247,955,455	\$193,222,071	\$247,955,455	\$151,230,271	\$151,170,978
20	HWY - I-5 / SR14 I/C (Stage 3)	\$49,331,950	\$35,410,214	\$49,331,950	\$35,410,214	\$35,158,801	\$35,127,212
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	\$197,170,117	\$267,280,170	\$197,170,117	\$267,280,170	\$172,687,236	\$172,640,020
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	\$116,595,688	\$98,036,201	\$116,595,688	\$98,036,201	\$152,741,181	\$152,612,855
23	HWY - I-5 / Marine Drive Interchange (All Stages)	\$538,437,172	\$494,143,372	\$538,437,172	\$494,143,372	\$600,824,426	\$600,695,766
24	HWY - I-5 / SR 500 Interchange (All Stages)	\$152,522,006	\$159,256,218	\$152,522,006	\$159,256,218	\$132,856,036	\$132,772,619
25	HWY - I-5 Mill Plain Interchange (All Stages)	\$97,809,048	\$110,410,950	\$97,809,048	\$110,410,950	\$104,062,233	\$103,953,567
26	HWY - I-5 / Fourth Plain Interchange (All Stages)	\$161,460,143	\$169,186,661	\$161,460,143	\$169,186,661	\$133,591,073	\$133,495,251
27	HCT - BRT North	\$180,877,218	\$181,494,165	\$234,722,791	\$235,453,649	\$214,639,112	\$219,076,658
28	HCT - BRT South	\$67,959,115	\$68,440,143	\$83,664,581	\$84,231,145	\$119,747,297	\$116,683,334
29	HCT - Burn Time	\$7,184,382	\$8,661,818	\$9,027,579	\$10,887,644	\$7,995,945	\$9,045,426
30	Project Complete	\$0	\$0	\$0	\$0	\$0	\$0
31	HWY/HCT - Construct SB/HCT River Crossing	\$0	\$0	\$0	\$0	\$579,541,741	\$556,965,213
32	HCT - Finish/OCS/Civil for River Crossing	\$0	\$0	\$0	\$0	\$550,336,766	\$727,617,827
	Risk Adjusted Project Costs	\$3,507,108,008	\$3,645,261,963	\$3,691,770,801	\$3,850,624,466	\$3,399,842,014	\$3,564,481,721

Table 34: Risk Adjusted Project Costs I-5 Alignment

ID	FLOWCHART ACTIVITY	Downstream Replacement with BRT	Upstream Replacement with BRT	Downstream Replacement with LRT	Upstream Replacement with LRT	Supplemental with BRT	Supplemental with LRT
1	Prepare DEIS Alternatives	\$22,164,809	\$21,902,632	\$23,566,514	\$23,310,278	\$24,930,248	\$25,637,586
2	Evaluate DEIS Alternatives / Present Draft Findings	\$36,493,514	\$36,092,102	\$38,639,626	\$38,247,310	\$40,727,601	\$41,810,586
3	Publish DEIS and LPA	\$0	\$0	\$0	\$0	\$0	\$0
4	Comment Period / Public Hearings	\$11,506,189	\$11,370,088	\$12,233,841	\$12,100,824	\$12,941,782	\$13,308,975
5	Local Agency Adoption	\$13,192,250	\$13,054,845	\$13,926,872	\$13,792,581	\$14,641,594	\$15,012,304
6	FTA New Starts Application	\$0	\$0	\$0	\$0	\$0	\$0
7	Prepare FEIS	\$31,451,745	\$31,079,717	\$33,440,756	\$33,077,159	\$35,375,887	\$36,379,596
8	FHWA/FTA Record of Decision	\$11,185,322	\$11,185,322	\$11,185,322	\$11,185,322	\$11,185,322	\$11,185,322
9	30% Design	\$32,887,501	\$32,498,491	\$34,967,310	\$34,587,115	\$36,990,779	\$38,040,306
10	R/W Appraisal and Acquisition	\$159,013,674	\$128,693,750	\$159,013,674	\$128,693,750	\$184,822,152	\$186,176,931
11	Environmental Permitting	\$73,983,209	\$73,145,957	\$78,459,501	\$77,641,221	\$82,814,534	\$85,073,390
12	Begin Construction	\$0	\$0	\$0	\$0	\$0	\$0
13	HWY - Construct NB River Crossing	\$562,030,955	\$579,546,997	\$562,030,955	\$579,546,997	\$0	\$0
14	HWY - Finish NB River Crossing	\$6,036,533	\$0	\$6,036,533	\$0	\$0	\$0
15	HWY - Construct SB River Crossing	\$416,271,791	\$443,686,479	\$416,271,791	\$443,686,479	\$0	\$0
16	HCT - Construct River Crossing	\$211,256,272	\$256,243,119	\$310,969,624	\$376,016,653	\$0	\$0
17	HWY - Demo Existing NB River Crossing	\$79,693,968	\$79,838,059	\$79,693,968	\$79,838,059	\$0	\$0
18	HWY - Demo Existing SB River Crossing	\$77,371,367	\$86,649,038	\$77,371,367	\$86,649,038	\$0	\$0
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	\$193,222,071	\$247,955,455	\$193,222,071	\$247,955,455	\$151,230,271	\$151,170,978
20	HWY - I-5 / SR14 I/C (Stage 3)	\$49,331,950	\$35,410,214	\$49,331,950	\$35,410,214	\$35,158,801	\$35,127,212
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	\$197,170,117	\$267,280,170	\$197,170,117	\$267,280,170	\$172,687,236	\$172,640,020
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	\$116,595,688	\$98,036,201	\$116,595,688	\$98,036,201	\$152,741,181	\$152,612,855
23	HWY - I-5 / Marine Drive Interchange (All Stages)	\$538,437,172	\$494,143,372	\$538,437,172	\$494,143,372	\$600,824,426	\$600,695,766
24	HWY - I-5 / SR 500 Interchange (All Stages)	\$152,522,006	\$159,256,218	\$152,522,006	\$159,256,218	\$132,856,036	\$132,772,619
25	HWY - I-5 Mill Plain Interchange (All Stages)	\$97,809,048	\$110,410,950	\$97,809,048	\$110,410,950	\$104,062,233	\$103,953,567
26	HWY - I-5 / Fourth Plain Interchange (All Stages)	\$161,460,143	\$169,186,661	\$161,460,143	\$169,186,661	\$133,591,073	\$133,495,251
27	HCT - BRT North	\$373,746,950	\$374,407,316	\$428,041,316	\$428,813,800	\$409,649,845	\$414,009,639
28	HCT - BRT South	\$67,959,115	\$68,440,143	\$83,664,581	\$84,231,145	\$119,747,297	\$116,683,334
29	HCT - Burn Time	\$7,184,382	\$8,661,818	\$9,027,579	\$10,887,644	\$7,995,945	\$9,045,426
30	Project Complete	\$0	\$0	\$0	\$0	\$0	\$0
31	HWY/HCT - Construct SB/HCT River Crossing	\$0	\$0	\$0	\$0	\$579,541,741	\$556,965,213
32	HCT - Finish/OCS/Civil for River Crossing	\$0	\$0	\$0	\$0	\$550,336,766	\$727,617,827
	Risk Adjusted Project Costs	\$3,699,977,741	\$3,838,175,114	\$3,885,089,326	\$4,043,984,616	\$3,594,852,747	\$3,759,414,703

Table 35: Risk Adjusted Project Costs MOS Design

ID	FLOWCHART ACTIVITY	Downstream Replacement with BRT Mill District	Downstream Replacement with BRT Clark College	Downstream Replacement with LRT Mill District	Downstream Replacement with LRT Clark College
1	Prepare DEIS Alternatives	\$20,282,803	\$19,795,010	\$20,916,973	\$20,605,197
2	Evaluate DEIS Alternatives / Present Draft Findings	\$33,612,026	\$32,865,180	\$34,582,986	\$34,105,635
3	Publish DEIS and LPA	\$0	\$0	\$0	\$0
4	Comment Period / Public Hearings	\$10,529,202	\$10,275,979	\$10,858,412	\$10,696,563
5	Local Agency Adoption	\$12,205,905	\$11,950,257	\$12,538,268	\$12,374,869
6	FTA New Starts Application	\$0	\$0	\$0	\$0
7	Prepare FEIS	\$28,785,543	\$28,093,263	\$29,685,563	\$29,243,088
8	FHWA/FTA Record of Decision	\$0	\$0	\$0	\$0
9	30% Design	\$29,326,312	\$28,621,027	\$30,243,240	\$29,792,453
10	R/W Appraisal and Acquisition	\$143,570,451	\$155,803,110	\$140,852,082	\$153,084,741
11	Environmental Permitting	\$67,973,091	\$66,415,343	\$69,998,289	\$69,002,645
12	Begin Construction	\$0	\$0	\$0	\$0
13	HWY - Construct NB River Crossing	\$551,108,628	\$555,518,737	\$551,078,852	\$555,472,532
14	HWY - Finish NB River Crossing	\$6,037,066	\$6,026,003	\$6,023,275	\$6,004,604
15	HWY - Construct SB River Crossing	\$408,204,638	\$394,594,875	\$408,174,862	\$394,548,670
16	HCT - Construct River Crossing	\$172,870,548	\$188,229,112	\$233,771,923	\$262,701,357
17	HWY - Demo Existing NB River Crossing	\$78,679,278	\$80,269,457	\$78,668,541	\$80,252,796
18	HWY - Demo Existing SB River Crossing	\$76,314,997	\$77,857,392	\$76,304,583	\$77,841,233
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	\$189,170,366	\$182,563,409	\$189,112,109	\$182,523,513
20	HWY - I-5 / SR14 I/C (Stage 3)	\$48,573,323	\$45,518,907	\$48,548,966	\$45,502,226
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	\$192,795,923	\$251,969,635	\$192,780,331	\$251,945,442
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	\$115,573,628	\$103,612,820	\$115,547,255	\$103,571,896
23	HWY - I-5 / Marine Drive Interchange (All Stages)	\$527,919,955	\$491,881,869	\$527,887,205	\$491,831,050
24	HWY - I-5 / SR 500 Interchange (All Stages)	\$147,356,463	\$149,724,675	\$147,293,906	\$149,681,834
25	HWY - I-5 Mill Plain Interchange (All Stages)	\$95,784,388	\$99,348,048	\$95,702,746	\$99,292,138
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	\$156,665,855	\$160,776,157	\$156,593,979	\$160,726,934
27	HCT - BRT North	\$128,840,703	\$133,768,500	\$143,394,169	\$154,050,684
28	HCT - BRT South	\$54,396,184	\$55,096,672	\$54,773,618	\$58,054,235
29	HCT - Burn Time	\$4,716,679	\$4,905,386	\$5,536,338	\$5,948,971
30	Project Complete	\$0	\$0	\$0	\$0
31	HWY/HCT - Construct SB/HCT River Crossing	\$0	\$0	\$0	\$0
32	HCT - Finish/OCS/Civil for River Crossing	\$0	\$0	\$0	\$0
	Risk Adjusted Project Costs	\$3,301,293,955	\$3,335,480,822	\$3,380,868,473	\$3,438,855,307

Risk Adjusted Schedules

The following tables detail the risk adjusted schedules for all projects. All values are the mean expected risk adjusted values.

Table 36: Risk Adjusted Schedule Vancouver Alignment Downstream Replacement Crossing with BRT

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	5/3/08	12.00
3	Publish DEIS and LPA	5/3/08	5/3/08	0.00
4	Comment Period / Public Hearings	5/3/08	8/2/08	3.00
5	Local Agency Adoption	8/2/08	1/13/09	5.40
6	FTA New Starts Application	1/13/09	1/13/09	0.00
7	Prepare FEIS	1/13/09	9/13/09	8.00
8	FHWA/FTA Record of Decision	9/13/09	8/28/10	11.45
9	30% Design	8/28/10	5/13/11	8.45
10	R/W Appraisal and Acquisition	1/13/09	8/8/10	18.80
11	Environmental Permitting	8/2/08	3/1/10	18.90
12	Begin Construction	5/13/11	5/13/11	0.00
13	HWY - Construct NB River Crossing	5/13/11	3/26/14	34.36
14	HWY - Finish NB River Crossing	2/7/15	5/1/16	14.89
15	HWY - Construct SB River Crossing	5/13/11	3/26/14	34.36
16	HCT - Construct River Crossing	5/13/11	1/1/14	31.63
17	HWY - Demo Existing NB River Crossing	5/1/16	3/16/17	10.45
18	HWY - Demo Existing SB River Crossing	3/26/14	2/7/15	10.45
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	5/13/11	12/23/13	31.31
20	HWY - I-5 / SR14 I/C (Stage 3)	5/1/16	4/29/17	12.04
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	5/13/11	1/30/13	20.60
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	3/26/14	6/24/16	26.92
23	HWY - I-5 / Marine Drive Interchange (All Stages)	5/13/11	3/25/14	34.35
24	HWY - I-5 / SR 500 Interchange (All Stages)	5/13/11	10/10/13	28.90
25	HWY - I-5 Mill Plain Interchange (All Stages)	5/13/11	10/4/14	40.65
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	5/13/11	2/23/14	33.35
27	HCT - BRT North	5/13/11	8/27/12	15.48
28	HCT - BRT South	5/13/11	12/2/12	18.66
29	HCT - Burn Time	1/1/14	7/8/14	6.16
30	Project Complete	4/29/17	4/29/17	0.00

Table 37: Risk Adjusted Schedule Vancouver Alignment Upstream Replacement Crossing with BRT

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	5/3/08	12.00
3	Publish DEIS and LPA	5/3/08	5/3/08	0.00
4	Comment Period / Public Hearings	5/3/08	8/2/08	3.00
5	Local Agency Adoption	8/2/08	1/13/09	5.40
6	FTA New Starts Application	1/13/09	1/13/09	0.00
7	Prepare FEIS	1/13/09	9/13/09	8.00
8	FHWA/FTA Record of Decision	9/13/09	8/28/10	11.45
9	30% Design	8/28/10	5/13/11	8.45
10	R/W Appraisal and Acquisition	1/13/09	8/8/10	18.80
11	Environmental Permitting	8/2/08	3/1/10	18.90
12	Begin Construction	5/13/11	5/13/11	0.00
13	HWY - Construct NB River Crossing	5/16/11	5/8/14	35.68
14	HWY - Finish NB River Crossing	1/0/00	1/0/00	0.00
15	HWY - Construct SB River Crossing	9/18/15	2/4/18	28.54
16	HCT – Construct River Crossing	1/1/19	11/11/20	22.31
17	HWY - Demo Existing NB River Crossing	10/24/14	9/14/15	10.65
18	HWY - Demo Existing SB River Crossing	2/7/18	12/29/18	10.65
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	5/16/11	7/27/13	26.32
20	HWY - I-5 / SR14 I/C (Stage 3)	10/23/14	8/26/15	10.03
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	5/16/11	10/23/14	41.15
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	10/23/14	4/6/17	29.38
23	HWY - I-5 / Marine Drive Interchange (All Stages)	5/16/11	10/28/14	41.35
24	HWY - I-5 / SR 500 Interchange (All Stages)	5/16/11	10/13/13	28.90
25	HWY - I-5 Mill Plain Interchange (All Stages)	5/16/11	10/8/14	40.65
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	5/16/11	2/26/14	33.35
27	HCT – BRT North	5/16/11	8/30/12	15.48
28	HCT – BRT South	5/16/11	12/7/12	18.66
29	HCT – Burn Time	11/14/20	5/25/21	6.16
30	Project Complete	5/25/21	5/25/21	0.00

Table 38: Risk Adjusted Schedule Vancouver Alignment Downstream Replacement Crossing with LRT

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	5/3/08	12.00
3	Publish DEIS and LPA	5/3/08	5/3/08	0.00
4	Comment Period / Public Hearings	5/3/08	8/2/08	3.00
5	Local Agency Adoption	8/2/08	1/13/09	5.40
6	FTA New Starts Application	1/13/09	1/13/09	0.00
7	Prepare FEIS	1/13/09	9/13/09	8.00
8	FHWA/FTA Record of Decision	9/13/09	8/28/10	11.45
9	30% Design	8/28/10	5/13/11	8.45
10	R/W Appraisal and Acquisition	1/13/09	8/8/10	18.80
11	Environmental Permitting	8/2/08	3/1/10	18.90
12	Begin Construction	5/13/11	5/13/11	0.00
13	HWY - Construct NB River Crossing	5/13/11	3/26/14	34.36
14	HWY - Finish NB River Crossing	2/7/15	5/1/16	14.89
15	HWY - Construct SB River Crossing	5/13/11	3/26/14	34.36
16	HCT – Construct River Crossing	5/13/11	1/1/14	31.63
17	HWY - Demo Existing NB River Crossing	5/1/16	3/16/17	10.45
18	HWY - Demo Existing SB River Crossing	3/26/14	2/7/15	10.45
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	5/13/11	12/23/13	31.31
20	HWY - I-5 / SR14 I/C (Stage 3)	5/1/16	4/29/17	12.04
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	5/13/11	1/30/13	20.60
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	3/26/14	6/24/16	26.92
23	HWY - I-5 / Marine Drive Interchange (All Stages)	5/13/11	3/25/14	34.35
24	HWY - I-5 / SR 500 Interchange (All Stages)	5/13/11	10/10/13	28.90
25	HWY - I-5 Mill Plain Interchange (All Stages)	5/13/11	10/4/14	40.65
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	5/13/11	2/23/14	33.35
27	HCT – BRT North	5/13/11	8/10/12	14.92
28	HCT – BRT South	5/13/11	11/18/12	18.22
29	HCT – Burn Time	1/1/14	7/8/14	6.16
30	Project Complete	4/29/17	4/29/17	0.00

Table 39: Risk Adjusted Schedule Vancouver Alignment Upstream Replacement Crossing with LRT

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	5/3/08	12.00
3	Publish DEIS and LPA	5/3/08	5/3/08	0.00
4	Comment Period / Public Hearings	5/3/08	8/2/08	3.00
5	Local Agency Adoption	8/2/08	1/13/09	5.40
6	FTA New Starts Application	1/13/09	1/13/09	0.00
7	Prepare FEIS	1/13/09	9/13/09	8.00
8	FHWA/FTA Record of Decision	9/13/09	8/28/10	11.45
9	30% Design	8/28/10	5/13/11	8.45
10	R/W Appraisal and Acquisition	1/13/09	8/8/10	18.80
11	Environmental Permitting	8/2/08	3/1/10	18.90
12	Begin Construction	5/13/11	5/13/11	0.00
13	HWY - Construct NB River Crossing	5/16/11	5/8/14	35.68
14	HWY - Finish NB River Crossing	1/0/00	1/0/00	0.00
15	HWY - Construct SB River Crossing	9/18/15	2/4/18	28.54
16	HCT – Construct River Crossing	1/1/19	11/11/20	22.31
17	HWY - Demo Existing NB River Crossing	10/24/14	9/14/15	10.65
18	HWY - Demo Existing SB River Crossing	2/7/18	12/29/18	10.65
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	5/16/11	7/27/13	26.32
20	HWY - I-5 / SR14 I/C (Stage 3)	10/23/14	8/26/15	10.03
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	5/16/11	10/23/14	41.15
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	10/23/14	4/6/17	29.38
23	HWY - I-5 / Marine Drive Interchange (All Stages)	5/16/11	10/28/14	41.35
24	HWY - I-5 / SR 500 Interchange (All Stages)	5/16/11	10/13/13	28.90
25	HWY - I-5 Mill Plain Interchange (All Stages)	5/16/11	10/8/14	40.65
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	5/16/11	2/26/14	33.35
27	HCT – BRT North	5/16/11	8/13/12	14.92
28	HCT – BRT South	5/16/11	11/23/12	18.22
29	HCT – Burn Time	11/14/20	5/25/21	6.16
30	Project Complete	5/25/21	5/25/21	0.00

Table 40: Risk Adjusted Schedule Vancouver Alignment Supplemental Crossing with BRT

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	5/3/08	12.00
3	Publish DEIS and LPA	5/3/08	5/3/08	0.00
4	Comment Period / Public Hearings	5/3/08	8/2/08	3.00
5	Local Agency Adoption	8/2/08	1/13/09	5.40
6	FTA New Starts Application	1/13/09	1/13/09	0.00
7	Prepare FEIS	1/13/09	9/13/09	8.00
8	FHWA/FTA Record of Decision	9/13/09	8/28/10	11.45
9	30% Design	8/28/10	5/13/11	8.45
10	R/W Appraisal and Acquisition	1/13/09	8/8/10	18.80
11	Environmental Permitting	8/2/08	3/1/10	18.90
12	Begin Construction	5/13/11	5/13/11	0.00
31	HWY/HCT - Construct SB/HCT River Crossing	5/16/11	1/30/15	44.38
32	HCT - Finish/OCS/Civil for River Crossing	1/30/15	8/1/15	6.00
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	5/16/11	6/13/13	24.90
20	HWY - I-5 / SR14 I/C (Stage 3)	1/30/15	2/14/16	12.45
21	HWY - I-5 / Hayden Island I/C (Stage 1)	5/16/11	1/25/13	20.26
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	1/25/13	9/5/16	43.27
23	HWY - I-5 / Marine Drive Interchange (All Stages)	8/12/14	2/1/18	41.35
24	HWY - I-5 / SR 500 Interchange (All Stages)	5/16/11	10/13/13	28.90
25	HWY - I-5 Mill Plain Interchange (All Stages)	5/16/11	10/8/14	40.65
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	5/16/11	2/26/14	33.35
27	HCT – BRT North	5/16/11	4/30/13	23.46
28	HCT – BRT South	5/16/11	12/6/12	18.64
29	HCT – Burn Time	8/1/15	2/5/16	6.15
30	Project Complete	2/1/18	2/1/18	0.00

Table 41: Risk Adjusted Schedule Vancouver Alignment Supplemental Crossing with LRT

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	5/3/08	12.00
3	Publish DEIS and LPA	5/3/08	5/3/08	0.00
4	Comment Period / Public Hearings	5/3/08	8/2/08	3.00
5	Local Agency Adoption	8/2/08	1/13/09	5.40
6	FTA New Starts Application	1/13/09	1/13/09	0.00
7	Prepare FEIS	1/13/09	9/13/09	8.00
8	FHWA/FTA Record of Decision	9/13/09	8/28/10	11.45
9	30% Design	8/28/10	5/13/11	8.45
10	R/W Appraisal and Acquisition	1/13/09	8/8/10	18.80
11	Environmental Permitting	8/2/08	3/1/10	18.90
12	Begin Construction	5/13/11	5/13/11	0.00
31	HWY/HCT - Construct SB/HCT River Crossing	5/16/11	1/30/15	44.38
32	HCT - Finish/OCS/Civil for River Crossing	1/30/15	7/2/16	17.00
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	5/16/11	6/13/13	24.90
20	HWY - I-5 / SR14 I/C (Stage 3)	1/30/15	2/14/16	12.45
21	HWY - I-5 / Hayden Island I/C (Stage 1)	5/16/11	1/25/13	20.26
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	1/25/13	9/5/16	43.27
23	HWY - I-5 / Marine Drive Interchange (All Stages)	8/12/14	2/1/18	41.35
24	HWY - I-5 / SR 500 Interchange (All Stages)	5/16/11	10/13/13	28.90
25	HWY - I-5 Mill Plain Interchange (All Stages)	5/16/11	10/8/14	40.65
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	5/16/11	2/26/14	33.35
27	HCT – BRT North	5/16/11	4/13/13	22.90
28	HCT – BRT South	5/16/11	11/23/12	18.20
29	HCT – Burn Time	7/2/16	1/5/17	6.15
30	Project Complete	2/1/18	2/1/18	0.00

Table 42: Risk Adjusted Schedule I-5 Alignment Downstream Replacement Crossing with BRT

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	5/3/08	12.00
3	Publish DEIS and LPA	5/3/08	5/3/08	0.00
4	Comment Period / Public Hearings	5/3/08	8/2/08	3.00
5	Local Agency Adoption	8/2/08	1/13/09	5.40
6	FTA New Starts Application	1/13/09	1/13/09	0.00
7	Prepare FEIS	1/13/09	9/13/09	8.00
8	FHWA/FTA Record of Decision	9/13/09	8/28/10	11.45
9	30% Design	8/28/10	5/13/11	8.45
10	R/W Appraisal and Acquisition	1/13/09	8/8/10	18.80
11	Environmental Permitting	8/2/08	3/1/10	18.90
12	Begin Construction	5/13/11	5/13/11	0.00
13	HWY - Construct NB River Crossing	5/13/11	3/26/14	34.36
14	HWY - Finish NB River Crossing	2/7/15	5/1/16	14.89
15	HWY - Construct SB River Crossing	5/13/11	3/26/14	34.36
16	HCT – Construct River Crossing	5/13/11	1/1/14	31.63
17	HWY - Demo Existing NB River Crossing	5/1/16	3/16/17	10.45
18	HWY - Demo Existing SB River Crossing	3/26/14	2/7/15	10.45
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	5/13/11	12/23/13	31.31
20	HWY - I-5 / SR14 I/C (Stage 3)	5/1/16	4/29/17	12.04
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	5/13/11	1/30/13	20.60
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	3/26/14	6/24/16	26.92
23	HWY - I-5 / Marine Drive Interchange (All Stages)	5/13/11	3/25/14	34.35
24	HWY - I-5 / SR 500 Interchange (All Stages)	5/13/11	10/10/13	28.90
25	HWY - I-5 Mill Plain Interchange (All Stages)	5/13/11	10/4/14	40.65
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	5/13/11	2/23/14	33.35
27	HCT – BRT North	5/13/11	4/28/13	23.48
28	HCT – BRT South	5/13/11	12/2/12	18.66
29	HCT – Burn Time	1/1/14	7/8/14	6.16
30	Project Complete	4/29/17	4/29/17	0.00

Table 43: Risk Adjusted Schedule I-5 Alignment Upstream Replacement Crossing with BRT

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	5/3/08	12.00
3	Publish DEIS and LPA	5/3/08	5/3/08	0.00
4	Comment Period / Public Hearings	5/3/08	8/2/08	3.00
5	Local Agency Adoption	8/2/08	1/13/09	5.40
6	FTA New Starts Application	1/13/09	1/13/09	0.00
7	Prepare FEIS	1/13/09	9/13/09	8.00
8	FHWA/FTA Record of Decision	9/13/09	8/28/10	11.45
9	30% Design	8/28/10	5/13/11	8.45
10	R/W Appraisal and Acquisition	1/13/09	8/8/10	18.80
11	Environmental Permitting	8/2/08	3/1/10	18.90
12	Begin Construction	5/13/11	5/13/11	0.00
13	HWY - Construct NB River Crossing	5/16/11	5/8/14	35.68
14	HWY - Finish NB River Crossing	1/0/00	1/0/00	0.00
15	HWY - Construct SB River Crossing	9/18/15	2/4/18	28.54
16	HCT – Construct River Crossing	1/1/19	11/11/20	22.31
17	HWY - Demo Existing NB River Crossing	10/24/14	9/14/15	10.65
18	HWY - Demo Existing SB River Crossing	2/7/18	12/29/18	10.65
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	5/16/11	7/27/13	26.32
20	HWY - I-5 / SR14 I/C (Stage 3)	10/23/14	8/26/15	10.03
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	5/16/11	10/23/14	41.15
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	10/23/14	4/6/17	29.38
23	HWY - I-5 / Marine Drive Interchange (All Stages)	5/16/11	10/28/14	41.35
24	HWY - I-5 / SR 500 Interchange (All Stages)	5/16/11	10/13/13	28.90
25	HWY - I-5 Mill Plain Interchange (All Stages)	5/16/11	10/8/14	40.65
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	5/16/11	2/26/14	33.35
27	HCT – BRT North	5/16/11	5/1/13	23.48
28	HCT – BRT South	5/16/11	12/7/12	18.66
29	HCT – Burn Time	11/14/20	5/25/21	6.16
30	Project Complete	5/25/21	5/25/21	0.00

Table 44: Risk Adjusted Schedule I-5 Alignment Downstream Replacement Crossing with LRT

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	5/3/08	12.00
3	Publish DEIS and LPA	5/3/08	5/3/08	0.00
4	Comment Period / Public Hearings	5/3/08	8/2/08	3.00
5	Local Agency Adoption	8/2/08	1/13/09	5.40
6	FTA New Starts Application	1/13/09	1/13/09	0.00
7	Prepare FEIS	1/13/09	9/13/09	8.00
8	FHWA/FTA Record of Decision	9/13/09	8/28/10	11.45
9	30% Design	8/28/10	5/13/11	8.45
10	R/W Appraisal and Acquisition	1/13/09	8/8/10	18.80
11	Environmental Permitting	8/2/08	3/1/10	18.90
12	Begin Construction	5/13/11	5/13/11	0.00
13	HWY - Construct NB River Crossing	5/13/11	3/26/14	34.36
14	HWY - Finish NB River Crossing	2/7/15	5/1/16	14.89
15	HWY - Construct SB River Crossing	5/13/11	3/26/14	34.36
16	HCT – Construct River Crossing	5/13/11	1/1/14	31.63
17	HWY - Demo Existing NB River Crossing	5/1/16	3/16/17	10.45
18	HWY - Demo Existing SB River Crossing	3/26/14	2/7/15	10.45
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	5/13/11	12/23/13	31.31
20	HWY - I-5 / SR14 I/C (Stage 3)	5/1/16	4/29/17	12.04
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	5/13/11	1/30/13	20.60
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	3/26/14	6/24/16	26.92
23	HWY - I-5 / Marine Drive Interchange (All Stages)	5/13/11	3/25/14	34.35
24	HWY - I-5 / SR 500 Interchange (All Stages)	5/13/11	10/10/13	28.90
25	HWY - I-5 Mill Plain Interchange (All Stages)	5/13/11	10/4/14	40.65
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	5/13/11	2/23/14	33.35
27	HCT – BRT North	5/13/11	4/11/13	22.92
28	HCT – BRT South	5/13/11	11/18/12	18.22
29	HCT – Burn Time	1/1/14	7/8/14	6.16
30	Project Complete	4/29/17	4/29/17	0.00

Table 45: Risk Adjusted Schedule I-5 Alignment Upstream Replacement Crossing with LRT

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	5/3/08	12.00
3	Publish DEIS and LPA	5/3/08	5/3/08	0.00
4	Comment Period / Public Hearings	5/3/08	8/2/08	3.00
5	Local Agency Adoption	8/2/08	1/13/09	5.40
6	FTA New Starts Application	1/13/09	1/13/09	0.00
7	Prepare FEIS	1/13/09	9/13/09	8.00
8	FHWA/FTA Record of Decision	9/13/09	8/28/10	11.45
9	30% Design	8/28/10	5/13/11	8.45
10	R/W Appraisal and Acquisition	1/13/09	8/8/10	18.80
11	Environmental Permitting	8/2/08	3/1/10	18.90
12	Begin Construction	5/13/11	5/13/11	0.00
13	HWY - Construct NB River Crossing	5/16/11	5/8/14	35.68
14	HWY - Finish NB River Crossing	1/0/00	1/0/00	0.00
15	HWY - Construct SB River Crossing	9/18/15	2/4/18	28.54
16	HCT – Construct River Crossing	1/1/19	11/11/20	22.31
17	HWY - Demo Existing NB River Crossing	10/24/14	9/14/15	10.65
18	HWY - Demo Existing SB River Crossing	2/7/18	12/29/18	10.65
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	5/16/11	7/27/13	26.32
20	HWY - I-5 / SR14 I/C (Stage 3)	10/23/14	8/26/15	10.03
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	5/16/11	10/23/14	41.15
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	10/23/14	4/6/17	29.38
23	HWY - I-5 / Marine Drive Interchange (All Stages)	5/16/11	10/28/14	41.35
24	HWY - I-5 / SR 500 Interchange (All Stages)	5/16/11	10/13/13	28.90
25	HWY - I-5 Mill Plain Interchange (All Stages)	5/16/11	10/8/14	40.65
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	5/16/11	2/26/14	33.35
27	HCT – BRT North	5/16/11	4/14/13	22.92
28	HCT – BRT South	5/16/11	11/23/12	18.22
29	HCT – Burn Time	11/14/20	5/25/21	6.16
30	Project Complete	5/25/21	5/25/21	0.00

Table 46: Risk Adjusted Schedule I-5 Alignment Supplemental Crossing with BRT

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	5/3/08	12.00
3	Publish DEIS and LPA	5/3/08	5/3/08	0.00
4	Comment Period / Public Hearings	5/3/08	8/2/08	3.00
5	Local Agency Adoption	8/2/08	1/13/09	5.40
6	FTA New Starts Application	1/13/09	1/13/09	0.00
7	Prepare FEIS	1/13/09	9/13/09	8.00
8	FHWA/FTA Record of Decision	9/13/09	8/28/10	11.45
9	30% Design	8/28/10	5/13/11	8.45
10	R/W Appraisal and Acquisition	1/13/09	8/8/10	18.80
11	Environmental Permitting	8/2/08	3/1/10	18.90
12	Begin Construction	5/13/11	5/13/11	0.00
31	HWY/HCT - Construct SB/HCT River Crossing	5/16/11	1/30/15	44.38
32	HCT - Finish/OCS/Civil for River Crossing	1/30/15	8/1/15	6.00
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	5/16/11	6/13/13	24.90
20	HWY - I-5 / SR14 I/C (Stage 3)	1/30/15	2/14/16	12.45
21	HWY - I-5 / Hayden Island I/C (Stage 1)	5/16/11	1/25/13	20.26
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	1/25/13	9/5/16	43.27
23	HWY - I-5 / Marine Drive Interchange (All Stages)	8/12/14	2/1/18	41.35
24	HWY - I-5 / SR 500 Interchange (All Stages)	5/16/11	10/13/13	28.90
25	HWY - I-5 Mill Plain Interchange (All Stages)	5/16/11	10/8/14	40.65
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	5/16/11	2/26/14	33.35
27	HCT – BRT North	5/16/11	12/30/13	31.46
28	HCT – BRT South	5/16/11	12/6/12	18.64
29	HCT – Burn Time	8/1/15	2/5/16	6.15
30	Project Complete	2/1/18	2/1/18	0.00

Table 47: Risk Adjusted Schedule I-5 Alignment Supplemental Crossing with LRT

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	5/3/08	12.00
3	Publish DEIS and LPA	5/3/08	5/3/08	0.00
4	Comment Period / Public Hearings	5/3/08	8/2/08	3.00
5	Local Agency Adoption	8/2/08	1/13/09	5.40
6	FTA New Starts Application	1/13/09	1/13/09	0.00
7	Prepare FEIS	1/13/09	9/13/09	8.00
8	FHWA/FTA Record of Decision	9/13/09	8/28/10	11.45
9	30% Design	8/28/10	5/13/11	8.45
10	R/W Appraisal and Acquisition	1/13/09	8/8/10	18.80
11	Environmental Permitting	8/2/08	3/1/10	18.90
12	Begin Construction	5/13/11	5/13/11	0.00
31	HWY/HCT - Construct SB/HCT River Crossing	5/16/11	1/30/15	44.38
32	HCT - Finish/OCS/Civil for River Crossing	1/30/15	7/2/16	17.00
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	5/16/11	6/13/13	24.90
20	HWY - I-5 / SR14 I/C (Stage 3)	1/30/15	2/14/16	12.45
21	HWY - I-5 / Hayden Island I/C (Stage 1)	5/16/11	1/25/13	20.26
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	1/25/13	9/5/16	43.27
23	HWY - I-5 / Marine Drive Interchange (All Stages)	8/12/14	2/1/18	41.35
24	HWY - I-5 / SR 500 Interchange (All Stages)	5/16/11	10/13/13	28.90
25	HWY - I-5 Mill Plain Interchange (All Stages)	5/16/11	10/8/14	40.65
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	5/16/11	2/26/14	33.35
27	HCT – BRT North	5/16/11	12/13/13	30.90
28	HCT – BRT South	5/16/11	11/23/12	18.20
29	HCT – Burn Time	7/2/16	1/5/17	6.15
30	Project Complete	2/1/18	2/1/18	0.00

Table 48: Risk Adjusted Schedule MOS Design Downstream Replacement Crossing with BRT, Mill District

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	5/3/08	12.00
3	Publish DEIS and LPA	5/3/08	5/3/08	0.00
4	Comment Period / Public Hearings	5/3/08	8/2/08	3.00
5	Local Agency Adoption	8/2/08	1/14/09	5.40
6	FTA New Starts Application	1/14/09	1/14/09	0.00
7	Prepare FEIS	1/14/09	9/15/09	8.00
8	FHWA/FTA Record of Decision	9/15/09	9/15/09	0.00
9	30% Design	9/15/09	5/30/10	8.45
10	R/W Appraisal and Acquisition	1/14/09	9/10/10	19.80
11	Environmental Permitting	8/2/08	3/1/10	18.90
12	Begin Construction	9/10/10	9/10/10	0.00
13	HWY - Construct NB River Crossing	9/10/10	7/24/13	34.36
14	HWY - Finish NB River Crossing	6/7/14	9/4/15	14.89
15	HWY - Construct SB River Crossing	9/10/10	7/24/13	34.36
16	HCT – Construct River Crossing	9/10/10	5/7/13	31.82
17	HWY - Demo Existing NB River Crossing	9/4/15	7/19/16	10.45
18	HWY - Demo Existing SB River Crossing	7/24/13	6/7/14	10.45
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	9/10/10	4/22/13	31.31
20	HWY - I-5 / SR14 I/C (Stage 3)	9/4/15	9/6/16	12.04
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	9/10/10	5/30/12	20.60
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	7/24/13	10/23/15	26.92
23	HWY - I-5 / Marine Drive Interchange (All Stages)	9/10/10	7/23/13	34.35
24	HWY - I-5 / SR 500 Interchange (All Stages)	9/10/10	2/7/13	28.90
25	HWY - I-5 Mill Plain Interchange (All Stages)	9/10/10	1/31/14	40.65
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	9/10/10	6/23/13	33.35
27	HCT – BRT North	9/10/10	5/6/11	7.80
28	HCT – BRT South	9/10/10	4/14/12	19.10
29	HCT – Burn Time	5/7/13	11/12/13	6.20
30	Project Complete	9/6/16	9/6/16	0.00

Table 49: Risk Adjusted Schedule MOS Design Downstream Replacement Crossing with BRT, Clark College

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	5/3/08	12.00
3	Publish DEIS and LPA	5/3/08	5/3/08	0.00
4	Comment Period / Public Hearings	5/3/08	8/2/08	3.00
5	Local Agency Adoption	8/2/08	1/14/09	5.40
6	FTA New Starts Application	1/14/09	1/14/09	0.00
7	Prepare FEIS	1/14/09	9/15/09	8.00
8	FHWA/FTA Record of Decision	9/15/09	9/15/09	0.00
9	30% Design	9/15/09	5/30/10	8.45
10	R/W Appraisal and Acquisition	1/14/09	9/10/10	19.80
11	Environmental Permitting	8/2/08	3/1/10	18.90
12	Begin Construction	9/10/10	9/10/10	0.00
13	HWY - Construct NB River Crossing	9/10/10	7/24/13	34.36
14	HWY - Finish NB River Crossing	6/7/14	9/4/15	14.89
15	HWY - Construct SB River Crossing	9/10/10	7/24/13	34.36
16	HCT – Construct River Crossing	9/10/10	5/5/13	31.76
17	HWY - Demo Existing NB River Crossing	9/4/15	7/19/16	10.45
18	HWY - Demo Existing SB River Crossing	7/24/13	6/7/14	10.45
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	9/10/10	4/22/13	31.31
20	HWY - I-5 / SR14 I/C (Stage 3)	9/4/15	9/6/16	12.04
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	9/10/10	5/30/12	20.60
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	7/24/13	10/23/15	26.92
23	HWY - I-5 / Marine Drive Interchange (All Stages)	9/10/10	7/23/13	34.35
24	HWY - I-5 / SR 500 Interchange (All Stages)	9/10/10	2/7/13	28.90
25	HWY - I-5 Mill Plain Interchange (All Stages)	9/10/10	1/31/14	40.65
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	9/10/10	6/23/13	33.35
27	HCT – BRT North	9/10/10	9/12/11	12.04
28	HCT – BRT South	9/10/10	4/9/12	18.94
29	HCT – Burn Time	5/5/13	11/10/13	6.19
30	Project Complete	9/6/16	9/6/16	0.00

Table 50: Risk Adjusted Schedule MOS Design Downstream Replacement Crossing with LRT, Mill District

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	5/3/08	12.00
3	Publish DEIS and LPA	5/3/08	5/3/08	0.00
4	Comment Period / Public Hearings	5/3/08	8/2/08	3.00
5	Local Agency Adoption	8/2/08	1/14/09	5.40
6	FTA New Starts Application	1/14/09	1/14/09	0.00
7	Prepare FEIS	1/14/09	9/15/09	8.00
8	FHWA/FTA Record of Decision	9/15/09	9/15/09	0.00
9	30% Design	9/15/09	5/30/10	8.45
10	R/W Appraisal and Acquisition	1/14/09	9/10/10	19.80
11	Environmental Permitting	8/2/08	3/1/10	18.90
12	Begin Construction	9/10/10	9/10/10	0.00
13	HWY - Construct NB River Crossing	9/10/10	7/24/13	34.36
14	HWY - Finish NB River Crossing	6/7/14	9/4/15	14.89
15	HWY - Construct SB River Crossing	9/10/10	7/24/13	34.36
16	HCT – Construct River Crossing	9/10/10	5/5/13	31.75
17	HWY - Demo Existing NB River Crossing	9/4/15	7/19/16	10.45
18	HWY - Demo Existing SB River Crossing	7/24/13	6/7/14	10.45
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	9/10/10	4/22/13	31.31
20	HWY - I-5 / SR14 I/C (Stage 3)	9/4/15	9/6/16	12.04
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	9/10/10	5/30/12	20.60
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	7/24/13	10/23/15	26.92
23	HWY - I-5 / Marine Drive Interchange (All Stages)	9/10/10	7/23/13	34.35
24	HWY - I-5 / SR 500 Interchange (All Stages)	9/10/10	2/7/13	28.90
25	HWY - I-5 Mill Plain Interchange (All Stages)	9/10/10	1/31/14	40.65
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	9/10/10	6/23/13	33.35
27	HCT – BRT North	9/10/10	10/2/11	12.71
28	HCT – BRT South	9/10/10	3/20/12	18.29
29	HCT – Burn Time	5/5/13	11/9/13	6.18
30	Project Complete	9/6/16	9/6/16	0.00

Table 51: Risk Adjusted Schedule MOS Design Downstream Replacement Crossing with LRT, Clark College

ID	FLOWCHART ACTIVITY	Start	End	Duration
1	Prepare DEIS Alternatives	11/1/06	5/3/07	6.00
2	Evaluate DEIS Alternatives / Present Draft Findings	5/3/07	5/3/08	12.00
3	Publish DEIS and LPA	5/3/08	5/3/08	0.00
4	Comment Period / Public Hearings	5/3/08	8/2/08	3.00
5	Local Agency Adoption	8/2/08	1/14/09	5.40
6	FTA New Starts Application	1/14/09	1/14/09	0.00
7	Prepare FEIS	1/14/09	9/15/09	8.00
8	FHWA/FTA Record of Decision	9/15/09	9/15/09	0.00
9	30% Design	9/15/09	5/30/10	8.45
10	R/W Appraisal and Acquisition	1/14/09	9/10/10	19.80
11	Environmental Permitting	8/2/08	3/1/10	18.90
12	Begin Construction	9/10/10	9/10/10	0.00
13	HWY - Construct NB River Crossing	9/10/10	7/24/13	34.36
14	HWY - Finish NB River Crossing	6/7/14	9/4/15	14.89
15	HWY - Construct SB River Crossing	9/10/10	7/24/13	34.36
16	HCT – Construct River Crossing	9/10/10	5/2/13	31.66
17	HWY - Demo Existing NB River Crossing	9/4/15	7/19/16	10.45
18	HWY - Demo Existing SB River Crossing	7/24/13	6/7/14	10.45
19	HWY - I-5 / SR14 I/C (Stage 1 & 2)	9/10/10	4/22/13	31.31
20	HWY - I-5 / SR14 I/C (Stage 3)	9/4/15	9/6/16	12.04
21	HWY - I-5 / Hayden Island I/C (Stage 1 & 2)	9/10/10	5/30/12	20.60
22	HWY - I-5 / Hayden Island I/C (Stage 2 & 3)	7/24/13	10/23/15	26.92
23	HWY - I-5 / Marine Drive Interchange (All Stages)	9/10/10	7/23/13	34.35
24	HWY - I-5 / SR 500 Interchange (All Stages)	9/10/10	2/7/13	28.90
25	HWY - I-5 Mill Plain Interchange (All Stages)	9/10/10	1/31/14	40.65
26	HWY - I-5 /Fourth Plain Interchange (All Stages)	9/10/10	6/23/13	33.35
27	HCT – BRT North	9/10/10	5/7/12	19.86
28	HCT – BRT South	9/10/10	3/19/12	18.24
29	HCT – Burn Time	5/2/13	11/6/13	6.16
30	Project Complete	9/6/16	9/6/16	0.00

APPENDIX C: RISK REGISTER

The risk register used during the risk workshop is presented in the table below. There are three different versions of the risk register provided: the Vancouver Alignment Risk Register, the I-5 Alignment Risk Register and the MOS Design Risk Register.

Note that all the risk items discussed during the session, active or inactive, are provided in the table. Inactive risk items have been grayed out.

Table 52: Vancouver Alignment Risk Register

#	Activity	Identification										Quantitative Analysis													
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)			Schedule Impact (Months)								
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)				
1	13-15	1		1				River Crossing	Upstream Alignment	Baseline assumes Downstream	Variation to the Alternative	added two alternatives	Cost & Schedule	0%											
2						1	1	Construction	Technical / Structure	Seismic Retrofit of Existing Structures			Cost & Schedule			\$0									
3						1	1	Transit	Technical / Structure	BNSF Railroad Bridge Moveable Span Relocataion	Best guess.		Cost & Schedule			\$250,000,000					0.9				
4	23	1	1	1	1	1	1	Highway	Interchange Type	Baseline assumes SPUI w/ Flyover for Marine Drive EB to I-5 NB	Variation to the Alternative - Exist, Exist w/ Flyover for Marine Drive EB to I-5 NB, SPUI, DDI, Full System Interchange	Thinks might be lower probability. Design change may raise or lower the costs on the Interchange construction. Rebuild Exist or replace with new.	Cost	10%	uniform		-\$100,000,000	\$100,000,000			0.0				
5						1	1	Highway	Interchange Type	Baseline assumes SPUI w/ Flyover for Marine Drive EB to I-5 NB	Variation to the Alternative - Exist, Exist w/ Flyover for Marine Drive EB to I-5 NB, SPUI, DDI, Full System Interchange (Replacing MD bridge only would be -\$135 million and full i/c would be approx +20% or +\$80 million)	covered above	Cost & Schedule	0%											
6	21-22	1		1				Highway	Interchange Type	Baseline Assumes Split SPUI	Variation to the Alternative - Folded Diamond, SPUI	Confident this isn't an issue	Cost & Schedule												
7	21, 22					1	1	Highway	Interchange Type	Baseline Assumes Split SPUI	Variation to the Alternative - Folded Diamond, SPUI (Assume 50%)	May need to add arterial since there is no connection between hayden island and marine drive. No arterial in 2 and 3. No range	Cost	10%	No Dist.	\$50,000,000									
8	19-20	1		1				Highway	Interchange Type	Baseline assumes Tunnel for I-5 SB to SR14 EB	Variation to the Alternative - Left Loop Ramp for I-5 NB to SR14 EB, Flyover for I-5 SB to SR14 EB (Inadvertent discovery)	Doesn't think water table is an issue with a tunnel or other tunneling risks due to short tunnel. Limited contamination and geotech issues.	Cost	0%		Probably not a significant difference.					0.0				
9						1	1	Highway	Interchange Type	Baseline assumes Modified Existing	Variation to the Alternative (Inadvertent discovery)		Cost & Schedule	0%		Probably not a significant difference.									

#	Activity	Identification							Quantitative Analysis															
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)				Schedule Impact (Months)						
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)			
10	25	1	1	1	1	1	1	Highway	Interchange Type	Baseline assumes SPUI	Variation to the Alternative - Exist, Tight Diamond, DDI (Could be -\$8 million if only exist bridge widened by 4 lanes)	Might be shorter if they change the interchange type from single point to tight diamond. Or even less if they widen bridge instead.	Cost	20%	uniform		-\$4,000,000	-\$2,000,000			0.0			
11	26	1	1	1	1	1	1	Highway	Interchange Type	Baseline assumes Modified Folded Diamond	Variation to the Alternative - Exist (Assume 20% reduction)	Very likely change in design to change interchange type to be more simplified.	Cost	80%	uniform		-\$5,000,000	-\$2,000,000			0.0			
12							1	1	Highway	Interchange Type	Baseline assumes Modified Folded Diamond	Variation to the Alternative - Exist (Assume 20% reduction)	rolled into above	Cost & Schedule	0%		-\$20,000,000							
13	24	1	1	1	1	1	1	Highway	Interchange Type	Baseline assumes Tunnel for I-5 SB to SR500 EB	Variation to the Alternative - Flyover for I-5 SB to SR500 EB (120,000 SF @ \$250 minus tunnels and earthwork plus tax and mark-ups)	Potential tunnel to bridge change.	Cost	5%	uniform		\$20,000,000	\$30,000,000	uniform		0.0		6.0	
14							1	1	Highway	Interchange Type	Baseline assumes Tunnel for I-5 SB to SR14 EB	Variation to the Alternative - Flyover for I-5 SB to SR14 EB (120,000 SF @ \$250 minus tunnels and earthwork plus tax and mark-ups)		Cost & Schedule	0%		\$20,000,000	\$30,000,000						
15	27	1	1	1	1			Transit	Vancouver Transit Alignment	Baseline assumes I-5.	VE Team sees this as an opportunity.	Originally chose one alignment for all, through evaluation the I-5 alignment has a very long bridge. At main st. there are much fewer structures. Design changes minimize ROW issues. Difference is in the structure.	Cost & Schedule		trigen	-\$100,000,000	-\$120,000,000	-\$90,000,000	trigen	-8.0	-10.0	-6.0		
16							1	1	Transit	Vancouver Transit Alignment	Baseline assumes I-5.	VE Team sees this as an opportunity.		Cost & Schedule			-\$100,000,000							
17	27 and 28	1	1				1	Construction	Utility Relocation BRT		Lower probability and impacts than CON1. VE believes probability is higher than 20% Very little utility relocation in OR as HCT is elevated.	Risk is that you would relocate the utilities and build the guideway "LRT Ready"	Cost & Schedule	20%	trigen	\$6,500,000	\$5,000,000	\$10,000,000	uniform		4.0	6.0		
18	27 and 28			1	1			Construction	Utility Relocation LRT		Lower probability and impacts than CON1. VE believes probability is higher than 20% Very little utility relocation in OR as HCT is elevated.		Cost & Schedule	10%	uniform		\$0	\$3,500,000						
19	27	1		1			1	Construction	Utility Relocation BRT		Lower probability and impacts than CON1. VE believes probability is higher than 20% (Assumes full relocation)		Cost & Schedule	0%		\$5,000,000								

#	Activity	Identification											Quantitative Analysis									
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)				Schedule Impact (Months)				
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
20	27	1	1	1	1	1	1	Transit	TR-Kiggins Bowl / Lincoln Park and Ride	Mitigation needs associated with the potential traffic increases.	Not a big issue. Captured in general facility costs? Partly. VE team believes this is a big issue with high probability.	May need to redo the main street interchange improvements only	Cost		trigen	\$21,000,000	\$18,000,000	\$27,000,000				
21	27	1	1	1	1	1	1	Transit	TR-Kiggins Bowl / Lincoln Park and Ride	Mitigation needs associated with the potential traffic increases.	Not a big issue. Captured in general facility costs? Partly. VE team believes this is a big issue with high probability.	Structure at Lincoln and baseline assumes surface lot 2000 spaces by 20000 per space by 1.6 for markups (only for I-5 alignment)	Cost		trigen	\$64,000,000	\$60,000,000	\$80,000,000				
22	27	1		1				Transit	TR-Clark College Park and Ride	Mitigation needs associated with the potential traffic increases.	Not a big issue. Captured in general facility costs? Partly. VE team believes this is a big issue with high probability.		Cost	0%								
23						1	1	Transit	TR-Clark College Park and Ride	Mitigation needs associated with the potential traffic increases.	Not a big issue. Captured in general facility costs? Partly. VE team believes this is a big issue with high probability.		Cost	0%								
24	28	1	1	1	1	1	1	Transit	Implement VE recommendation to relocate Park and Ride lots	Opportunity that can reduce project cost.	Mitigation may be required in areas where Park and Ride lots are expanded.		Cost									
25	27	1	1	1	1	1	1	Transit	Implement VE recommendation to relocate Park and Ride lots	Opportunity that can reduce project cost.	Mitigation may be required in areas where Park and Ride lots are expanded.		Cost									
26	9	1	1	1	1	1	1	Design	Need for design exceptions / deviations	Schedule impact only. Both states involved in the deviations approval.	Early coordination required to mitigate this action.	Deviations may occur on Marine to Hayden, 14 to Mill Plain, concurrences with differences in ramp speed. Apply to interchanges only	Schedule	10%					uniform		3.0	6.0
27	8	1	1	1	1	1	1	Design	Delays in design approvals by FHWA and FTA.	But early engagement of / coordination with FHWA: limited impact (1 to 3 months).	LIRs, TS&Ls may be required on major structures. A dedicated FHWA representative will be assigned to the project.	Used VE recommendations	Cost & Schedule	30%					uniform		1.0	3.0
28	8	1	1	1	1	1	1	Design	Multiple federal leads for the environmental documents	FHWA and FTA are co-signators. No agreement is in place that either has a leadership role.	This would require additional coordination. Limited impact of 1 to 3 months.	Used VE recommendations	Schedule	25%					uniform		1.0	3.0
29	23	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000				
30	21-22	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000				

#	Activity	Identification							Quantitative Analysis													
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)				Schedule Impact (Months)				
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
31	13-18	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	water	Cost	50%	trigen	\$10,000,000	\$5,000,000	\$15,000,000				
32	19-20	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000				
33	25	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000				
34	26	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000				
35	24	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000				
36	28	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000				
37	27	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000				
38	8	1	1	1	1	1	1	Environmental	Supplementary EIS (SEIS) / additional environmental analysis required	Highly likely for this type of project. Would delay ROD. Cost impact = consultant fee to complete SEIS.	Risk of supplemental EIS post-ROD also exists.	average of \$1.2 a month over the last year	Cost & Schedule	40%	uniform	\$5,000,000	\$18,000,000	\$18,000,000	uniform		6.0	12.0
39	8	1	1	1	1	1	1	Environmental	Controversy on environmental grounds expected (NEPA challenges only)	Cost impacts would include legal costs.		Previous litigation for ROW cost used as a base for this estimate	Cost & Schedule	30%	trigen	\$5,000,000	\$4,000,000	\$7,500,000	uniform		3.0	6.0

#	Activity	Identification							Quantitative Analysis													
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)			Schedule Impact (Months)					
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
40	8	1	1	1	1	1	1	Environmental	404 consultation is required	Additional unforeseeable work/mitigation	Army Corps of Engineering Permitting	Not a lot of information on this	Cost & Schedule	15%	trigen	\$5,000,000	\$3,000,000	\$6,000,000			3.0	6.0
41	11	1	1	1	1	1	1	Environmental	Formal Section 7 consultation is required	Key cost issue is stormwater treatment mitigation.	Cost for stormwater treatment should be put in the base. This is a given, not a risk. There is an additional risk that the services cannot deliver in accordance with the baseline schedule.	Not a lot of information on this	Cost & Schedule	60%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	no distribution	3.0		
42	23	1	1	1	1	1	1	Environmental	Post Section 7 consultation	Fish passage, fish windows: work in water possible from November through February (4 months).	Baseline cost and schedule does not account for work restrictions. Foundation platforms and access facilities. Window could change as the project progresses. Communication and coordination needs to begin early in the project. There is an opportunity to get a larger window (baseline needs to reflect actual window).	Have the environmental agencies on board already, there is a lot of communication with them already creating a lower probability (Dealing with Oregon Slough)	Schedule	10%					uniform		4.0	8.0
43	21-22	1	1	1	1	1	1	Environmental	Post Section 7 consultation	Fish passage, fish windows: work in water possible from November through February (4 months).	Baseline cost and schedule does not account for work restrictions. Foundation platforms and access facilities. Window could change as the project progresses. Communication and coordination needs to begin early in the project. There is an opportunity to get a larger window (baseline needs to reflect actual window).	Have the environmental agencies on board already, there is a lot of communication with them already creating a lower probability (Dealing with Oregon Slough)	Schedule	10%					uniform		4.0	8.0
44	13-18	1	1	1	1	1	1	Environmental	Post Section 7 consultation	Fish passage, fish windows: work in water possible from November through February (4 months).	Baseline cost and schedule does not account for work restrictions. Foundation platforms and access facilities. Window could change as the project progresses. Communication and coordination needs to begin early in the project. There is an opportunity to get a larger window (baseline needs to reflect actual window).	Have the environmental agencies on board already, there is a lot of communication with them already creating a lower probability (Dealing with the Columbia River)	Schedule	10%					uniform		6.0	10.0
45	2	1	1	1	1	1	1	Environmental	Section 106 issues expected (discoveries pre-construction)	Mitigation associated with historical and archeological findings pre-construction. Is there anything beyond what is in the base? e.g., a stakeholder may request additional investigations/mitigation.	Applicable to geotech investigations as well. The survey would reduce this probability considerably.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	50%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0

#	Activity	Identification							Quantitative Analysis													
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)			Schedule Impact (Months)					
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
46	8	1	1	1	1	1	1	Environmental	Section 106 issues expected (discoveries pre-construction)	Mitigation associated with historical and archeological findings pre-construction. Is there anything beyond what is in the base? e.g., a stakeholder may request additional investigations/mitigation.	Applicable to geotech investigations as well. The survey would reduce this probability considerably.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	50%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
47	23	1	1	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	10%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
48	21-22	1	1	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	40%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
49	13-18	1	1	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	40%	trigen	\$10,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
50	19-20	1	1	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	90%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0

#	Activity	Identification							Quantitative Analysis													
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)			Schedule Impact (Months)					
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
51	25	1	1	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	75%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
52	26	1	1	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	20%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
53	24	1	1	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	10%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
54	28	1	1	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	30%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
55	27	1	1	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	40%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0

#	Activity	Identification							Quantitative Analysis												
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)				Schedule Impact (Months)			
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)
56	23	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Cost & Schedule	10%	trigen	\$1,000,000	\$500,000	\$1,500,000	uniform		0.0	3.0
57	21-22	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Cost & Schedule	10%	uniform		\$3,000,000	\$5,000,000	uniform		0.0	3.0
58	13-18	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Cost & Schedule	25%	uniform		\$7,000,000	\$10,000,000	uniform		0.0	3.0
59	19-20	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Cost & Schedule	10%	uniform		\$1,000,000	\$2,000,000	uniform		0.0	3.0
60	25	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Cost & Schedule	10%	trigen	\$1,000,000	\$500,000	\$1,500,000	uniform		0.0	3.0
61	26	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Cost & Schedule	10%	trigen	\$1,000,000	\$500,000	\$1,500,000	uniform		0.0	3.0
62	24	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Cost & Schedule	10%	trigen	\$1,000,000	\$500,000	\$1,500,000	uniform		0.0	3.0
63	28	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Cost & Schedule	0%								
64	27	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Cost & Schedule	0%								

#	Activity	Identification							Quantitative Analysis												
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)				Schedule Impact (Months)			
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)
65	8	1	1	1	1	1	1	Environmental	Negative community impacts expected (environmental justice issues)	Potential lawsuit on EJ issues; various pressures from communities (e.g., pressure for Community Investment Fund = compensation for impacted communities)		Cost & Schedule	10%	trigen	\$10,000,000	\$5,000,000	\$10,000,000	uniform		0.0	3.0
66	11	1	1	1	1	1	1	Environmental	Environmental regulations change	Water quality and endangered species list. Schedule impact larger if change occurs later.		Cost & Schedule	20%				uniform		3.0	6.0	
67	19	1	1	1	1	1	1	External	Required freeway lid in city of Vancouver	About 50% probability will be added to project. Required by City of Vancouver as part of re-development (new condos, library, ect.)	Add cost into baseline. (Assume 4 to 5 x Evergreen Bridge plus mar-ups)	Cost	70%	trigen	\$60,000,000	\$40,000,000	\$80,000,000				
68	13-18	1	1	1	1	1	1	Environmental	Limitations on construction site access and material delivery	Limitations on time barges can stay on site (predator fishes hiding below barges to attack outgoing smolts. Would add to delivery/construction costs.		Cost	60%	trigen	\$15,000,000	\$10,000,000	\$20,000,000				
69	8	1	1	1	1	1	1	External	Local communities pose objections	Risk: objections before ROD. Likely that one community will hold up decision and stop or slow down project. For example: opposition to tolling; selection of transit mode.	Some community risks accounted for under environmental. Cost impacts captured under environmental.	Schedule	15%				uniform		6.0	12.0	
70	16, 27, 28, 29,	1	1	1	1	1	1	External	Funding changes for fiscal year	Likelihood of New Starts funding? Risk = likelihood of funding shortages being an issue. Schedule impact only (missing "a cycle").	Note: Initially, probability of 80% and impact between 12 and 48 months. But, even with no FTA approval, can go all the way to ROD 11/08. Removed 9 months from range. Changed to discrete distribution after discussion with transit SMEs.	Schedule	15%				trigen	12.0	6.0	18.0	
71	5	1	1	1	1	1	1	External	Stakeholders request late changes	Requests very likely. Cost impacts accounted for in other risks. Limited schedule impacts.		Schedule	20%				trigen	6.0	4.0	8.0	
72	5	1	1	1	1	1	1	Organizational	Internal "red tape" causes delay getting approvals, decisions	Issue: getting feedback from 39-member Task Force (inc. local agencies, neighborhood organizations, etc.). Is Task Force an opportunity for taking decisions earlier? Overall: minimal impact on schedule; a "wash."	Continued work with task force will lower risks.	Schedule	20%				no distribution	3.0			
73	All interchange	1	1	1	1	1	1	Right of Way	Change in right-of-way costs due to condemnation	About 10% of properties go to condemnation.	Add potential of condemnation to baseline.	Cost	50%	trigen	\$13,000,000	\$10,000,000	\$20,000,000				

#	Activity	Identification							Quantitative Analysis													
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)				Schedule Impact (Months)				
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
74	10	1	1	1	1	1	1	Right of Way	Access plan, access hearings, justification report	Baseline schedule does not provide enough time. Needs to be completed before ROD. Note: no acquisition before the ROD.	Revise baseline schedule.		Schedule	20%					trigen	9.0	6.0	12.0
75	21	1	1	1	1	1	1	Right of Way	Inadequate baseline schedule for property acquisition and relocation	Base duration (about 1.5 year) is too short. Minimum 24 months for commercial properties relocation.	Hayden Island	Thinks there is adequate time in the schedule for this right away plan	Schedule	75%					uniform		3.0	6.0
76	21		1		1			Right of Way	Must purchase whole Red Lion Hotel (Jantzen Beach) because the removal of a wing makes it economically not viable				Cost	25%	trigen	\$20,000,000	\$15,000,000	\$25,000,000				
77	19, 20	1		1				Right of Way	Must purchase whole Red Lion At The Quay Hotel because the removal of a piece of the structure makes it economically not viable				Cost	25%	trigen	\$10,000,000	\$8,000,000	\$15,000,000				
78	10	1	1	1	1	1	1	Right of Way	Change in right-of-way costs due to market expectations	How will market expectations of project development impact property prices? Research indicates premiums of 4 to 6% (residential) and 6 to 8% (commercial). About 60% commercial; 40% residential.	Allow 6% for ROW purchase only.		Cost	80%	trigen	\$7,000,000	\$5,000,000	\$10,000,000				
79	19-20	1	1	1	1	1	1	Right of Way	Railroad involvement	Crossing of railroad properties. Schedule issue: getting the railroad to agree (railroad will want to review all NEPA and engineering documents). Early coordination needed / planned for documents review. Additional risks: no construction above tracks during fourth quarter.			Schedule	30%					uniform		4.0	8.0
80							1	Right of Way	Railroad involvement	Crossing of railroad properties. Schedule issue: getting the railroad to agree (railroad will want to review all NEPA and engineering documents). Early coordination needed / planned for documents review. Additional risks: no construction above tracks during fourth quarter.			Schedule	0%								
81	10	1	1	1	1	1	1	Right of Way	Cost increase due to condemnation litigation (legal fees only)	Factoring in % of properties sent to condemnation litigation (10%), cost impact = 3% to 5% of base costs.	Allow 4% for total ROW costs.	So small no range really needed.	Cost	10%	no distribution	\$5,000,000						

#	Activity	Identification											Quantitative Analysis									
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)			Schedule Impact (Months)					
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
82	10	1	1	1	1	1	1	Right of Way	Underestimation of number of parcels to be acquired for final alignment / alternative	Impact is 10% additional parcels / cost (10% of base costs). No schedule impact.	Allow 10% for total ROW costs.	Cost	25%	uniform	\$13,000,000	\$10,000,000	\$20,000,000					
83						1	1	Right of Way	Underestimation of number of parcels to be acquired for final alignment / alternative	Impact is 10% additional parcels / cost (10% of base costs). No schedule impact.	Allow 10% for total ROW costs.	Cost	0%		\$14,000,000							
84	13-18	1		1		1	1	Technical / Structure	Structural design incomplete or in error (existing structures over Columbia river)	Delays associated with agreement on bridge upgrade / retrofit design. Cost overrun likely as well.	Potential mitigation is retrofit memorandum be developed.	Cost & Schedule										
85	13-18	1	1	1	1	1	1	Technical / Structure	Inaccurate assumptions on technical issues in planning stage	Coast guard hearings and issues with barges => changing location of railroad bridge / realignment possible? Considered in evaluation of alternatives? Dealbreaker if realignment required? No.	FAA requirements?? FAA review should be added to baseline schedule.		0%									
86	13-18	1	1	1	1	1	1	Technical / Structure	Context sensitive solutions (river crossing)		VE team assumption is that this is only amenities		Cost	50%	uniform		\$5,000,000	\$15,000,000				
87	13-18	1	1	1	1	1	1	Technical / Structure	Signature bridge	Added costs for structure type (20% premium over segmental box estimate)	Conflicts with airspace restrictions limits this possibility.		Cost	10%	uniform		\$50,000,000	\$150,000,000				
88	13-18	1		1				Technical / Structure	Structural design incomplete (new structures)	Issue: foundation type: limited information now.	Opportunity for cost reductions through more geotech investigations, inwater work strategies, addressing fish issues, wider spans/less foundation work, etc.		Cost									
89	13-18					1	1	Technical / Structure	Structural design incomplete (new structures)	Issue: foundation type: limited information now.	Opportunity for cost reductions through more geotech investigations, inwater work strategies, addressing fish issues, wider spans/less foundation work, etc.		Cost	0%								
90	28	1		1				Transit	Maintenance and storage facility for BRT	Costs are included in Baseline Estimate	See VE recommendations.		Cost									
91						1	1	Transit	Maintenance and storage facility for BRT	Costs are included in Baseline Estimate	See VE recommendations.		Cost	0%								
92	27	1		1				Transit	Maintenance and storage facility for BRT	Costs are included in Baseline Estimate	See VE recommendations.		Cost									
93						1	1	Transit	Maintenance and storage facility for BRT	Costs are included in Baseline Estimate	See VE recommendations.		Cost	0%								

#	Activity	Identification										Quantitative Analysis													
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)				Schedule Impact (Months)							
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)				
94	28	1	1			1		Transit	Cost of complete street rebuild along the high-capacity transit corridor	Is this included in the baseline cost estimates? Yes. But some risk around it. Also, could be on two separate streets.	No couplets on BRT South	Assumed we have double tracks then there are additional	Cost	0%		\$0									
95	27	1	1	1	1	1	1	Transit	Cost of complete street rebuild along the high-capacity transit corridor	Is this included in the baseline cost estimates? Yes. But some risk around it. Also, could be on two separate streets.	Assume 4,000 ft @ \$2,500 for road recon & streetscape plus tax and mark-up.	Rebuild over and above guideway costs	Cost	10%	irigen	\$20,000,000	\$10,000,000	\$30,000,000							
96	All Construction Costs	1	1	1	1	1	1	Project	Other major projects in the area at the same time?	Construction activities and conflicts with other companies. Maintenance of traffic and constructibility.	Working with other agency to coordinate construction impacts.	Strong interest expressed from contractors low probability, potential to not get bonding if spread too thin high costs?	Cost & Schedule	20%	uniform		\$50,000,000	\$150,000,000							
97		1	1	1	1	1	1	Project	Market conditions	Funding, labor, and materials. Contractor availability		Covered above and in escalation	Cost	0%											
98	5	1	1	1	1	1	1	Project	Third Parties, i.e., local agencies	Permit conditions from local agencies and requirements for added emergency services.	Purchasing equipment as project mitigation.		Cost	20%	uniform		\$5,000,000	\$10,000,000							
99	5	1	1	1	1	1	1	Project	Interagency agreements/MOAs and MOUs	Agreements must be in place prior to funding obligations	All agencies such as FAA, FTA, Coast Guard, cities, counties, etc.		Schedule	30%						uniform		1.0	3.0		
100		1	1	1	1	1	1	Project	Delivery methods	What contracting laws? Which statutes apply? How many contract packages?	Design-bid-build? Design-build? Other?	To early to quantify this risk	Cost & Schedule												
101	23	1	1	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	40%	no distribution	\$9,000,000									
102	21-22	1	1	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	50%	uniform		\$5,000,000	\$10,000,000							
103						1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	0%		\$10,000,000									
104	13-18	1	1	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	change 40% to 60%	Cost & Schedule	60%	no distribution	\$13,000,000									
105						1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	0%		\$3,000,000									

#	Activity	Identification										Quantitative Analysis													
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)				Schedule Impact (Months)							
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)				
106	19-20	1	1	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	Cost & Schedule	60%	uniform		\$5,000,000	\$10,000,000								
107						1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	Cost & Schedule	0%		\$10,000,000										
108	25	1	1	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	Cost & Schedule	30%	no distribution	\$1,000,000										
109						1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	Cost & Schedule	0%		\$2,000,000										
110	26	1	1	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	Cost & Schedule	30%	no distribution	\$3,000,000										
111						1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	Cost & Schedule	0%		\$1,000,000										
112	24	1	1	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	Cost & Schedule	40%	no distribution	\$2,000,000										
113						1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	Cost & Schedule	0%		\$3,000,000										
114						1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	Cost & Schedule	0%		\$2,000,000										
115		1	1	1	1			Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	Bridge over Union not removed for Alts 2 & 3.	Cost & Schedule	0%		\$0										
116						1	1	Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	Bridge over Union not removed for Alts 4 & 5.	Cost & Schedule	0%		\$0										
117		1		1		1	1	Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.		Cost & Schedule	0%												
118						1	1	Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.		Cost & Schedule	0%												

#	Activity	Identification										Quantitative Analysis														
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)				Schedule Impact (Months)								
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)					
119		1		1				Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	See line 6.	Cost & Schedule	0%													
120						1	1	Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	See line 7.	Cost & Schedule	0%													
121	26	1	1	1	1	1	1	Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	For 4P bridge over I-5 only.	Maybe lower percent to 30%	Cost & Schedule	30%	no distribution	-\$15,000,000										
122						1	1	Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	For 4P bridge over I-5 only.		Cost & Schedule	0%		-\$15,000,000										
123	24	1	1	1	1			Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	For 500W to 5S ramp only.	30% for 2 and 3	Cost & Schedule	30%	no distribution	-\$12,000,000										
124	24					1	1	Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	For 500W to 5S ramp only.	40% for 4 and 5	Cost & Schedule	40%	no distribution	-\$12,000,000										
125	8	1	1	1	1	1	1	Traffic	Changes in regional traffic models and/or design year.	MPO changes the regional model or delays to project revises design year.	Baseline should be updated to include impact results of 2035 traffic model. Changes to land use can impact model.	Effects the record of decision need to go to the 2035 year in projections, changes in land use of the models	Schedule	10%						uniform			6.0	12.0		
126		1	1	1	1	1	1	Right of Way	Opportunity to purchase available property.	Thunderbird Hotel is an example.	Property around the river is needed for construction staging as well as for the project.	VE recommendation, already captured, and not going to save time for now. Becomes an issue if the property gets purchased	Cost	0%												
127		1	1	1	1	1	1		T-1 - LRT To Downtown Vancouver w/ Branded Bus	VE Recommendation	Included in base cost estimate															
128		1	1	1	1	1	1		T-2 - LRT on Main Street w/ Branded Bus	VE Recommendation	Included in base cost estimate															
129	27	1	1	1	1	1	1		T-3 - Park and Rides at Lincoln and Expo Center	VE Recommendation	From VE Team: -\$7 million at Ross and -\$40 million at Clark.			90%	uniform		-\$50,000,000		-\$5,000,000							
130		1	1	1	1	1	1		R-1 - 2 Cell Trapezoidal Segmental Box	VE Recommendation		Not at this level yet to impact this project.														
131	13-16	1	1	1	1	1	1		R-2 - 8' Diameter Driven Piles	VE Recommendation	From VE Team.	Currently 42 diameter pile based on WSDOT projections on the number of competition between contractors, but 8' piles could work and have less to drill in.		30%	uniform		-\$40,000,000		-\$20,000,000		uniform			-3.0	-2.0	

#	Activity	Identification								Quantitative Analysis																			
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)				Schedule Impact (Months)											
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)								
132		1	1	1	1	1	1		R-3 - No Seismic Retrofit of Substructure, Superstructure Retrofit only	VE Recommendation																			
133	16	1		1		1	1		R-4 - HCT inside segmental box	VE Recommendation	From VE Team.		50%	uniform			-\$100,000,000	-\$50,000,000											
134	16		1		1				R-4 - HCT inside segmental box	VE Recommendation	From VE Team.		50%	uniform			-\$100,000,000	-\$50,000,000	uniform						-24.0	-18.0			
135		1	1	1	1	1	1		R-5 - Constructability	VE Recommendation	No cost impacts, schedule impacts captured in other risks (upstream v downstream)																		
136	19-20	1	1	1	1	1	1		W-1 - Main Street Extension to Columbia Blvd	VE Recommendation	From VE Team.		90%	uniform			\$3,000,000	\$5,000,000											
137	19-20	1	1	1	1	1	1		W-2 - Connect SR14 WB to Columbia with SR5 to C Street	VE Recommendation	From VE Team.		50%	uniform			\$1,000,000	\$15,000,000											
138		1	1	1	1	1	1		W-3 - Remove Ramp Meter from Mill Plain NB On Ramp	VE Recommendation	Negligible cost impact.		0%																
139		1	1	1	1	1	1		W-4 - Evaluate Tight Diamond at Mill Plain	VE Recommendation	Assessed elsewhere.		0%																
140	26	1	1	1	1	1	1		W-5 - Evaluate removing access at 4th Plain	VE Recommendation			1%	no distribution		-\$116,000,000													
141	25	1	1	1	1	1	1		W-6 - Relocate Fourth Plain NB Braided Ramp at Mill Plain	VE Recommendation			20%	uniform			-\$50,000,000	-\$10,000,000											

#	Activity	Identification										Quantitative Analysis									
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)			Schedule Impact (Months)				
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)
142		1	1	1	1	1	1		W-7 - Eliminate I-5 SB to SR500 EB Tunnel	VE Recommendation	Recommendation not accepted		0%								
143		1	1	1	1	1	1		W-8 - Construct SR500 Interchange First	VE Recommendation	No cost or schedule benefits		0%								
144		1	1	1	1	1	1		W-9 - Do not shift I-5 between 4th Plain and SR500 if HCT is on Main Street	VE Recommendation	Based on difference in mainline between Alts 2 & 3 and Alts 4 & 5.	This is included in the transit alignment costs									
145	21,22	1	1	1	1	1	1		O-1 - Shift I-5 Alignment across Hayden Island outside the footprint of the existing freeway	VE Recommendation	Double earthwork minus demolition of Safeway and Red Lion.	May be able to save time but not likely	70%	trigen	\$6,000,000	\$4,000,000	\$10,000,000				
146	21,22	1	1	1	1	1	1		O-2 - Keep the profile elevated across Hayden Island	VE Recommendation	85,000 SF bridge @ \$300 minus 20% for earthwork and pavement.		40%	trigen	\$33,000,000	\$20,000,000	\$40,000,000				
147		1	1	1	1	1	1		O-3 - Remove Ramp Meter from Marine Drive NB On Ramp	VE Recommendation	Negligible cost impact.		0%								
148		1	1	1	1	1	1		O-4 Combine O-1 through O-3, use existing slough bridge for connection between Marine Drive and Hayden Island	VE Recommendation			0%								
149	13-16, 31	1	1	1	1	1	1		Need to provide additional tugs/tows during construction for river navigation			Cost	50%	trigen	\$10,000,000	\$7,500,000	\$15,000,000				
150	13-16, 31	1	1	1	1	1	1		Experience of contractor for foundations and superstructure				40%					trigen	9.0	6.0	12.0
151	13-18	1		1					Construction restrictions due to In Water Work Windows				30%					trigen	6.0	3.0	9.0
152	13-18		1		1				Construction restrictions due to In Water Work Windows				30%					trigen	10.0	6.0	14.0
153	13-16, 31	1	1	1	1	1	1		Performance of expected pile installation methods				30%					trigen	6.0	3.0	9.0
154	13-16, 31	1	1	1	1	1	1		Availability of pile installation equipment				30%					trigen	6.0	3.0	9.0
155	13-16, 31	1	1	1	1	1	1		Compliance with permitting requirements for work in the water				30%					trigen	12.0	6.0	18.0

Table 53: I-5 Alignment Risk Register

#	Activity	Identification							Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Quantitative Analysis										
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Prob.						Cost Impact (\$)				Schedule Impact (Months)						
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)			
1	13-15	1		1				River Crossing	Upstream Alignment	Baseline assumes Downstream	Variation to the Alternative	added two alternatives	Cost & Schedule	0%										
2						1	1	Construction	Technical / Structure	Seismic Retrofit of Existing Structures			Cost & Schedule			\$0								
3						1	1	Transit	Technical / Structure	BNSF Railroad Bridge Moveable Span Relocation	Best guess.		Cost & Schedule		\$250,000,000						0.9			
4	23	1	1	1	1	1	1	Highway	Interchange Type	Baseline assumes SPUI w/ Flyover for Marine Drive EB to I-5 NB	Variation to the Alternative - Exist, Exist w/ Flyover for Marine Drive EB to I-5 NB, SPUI, DDI, Full System Interchange	Thinks might be lower probability. Design change may raise or lower the costs on the interchange construction. Rebuild Exist or replace with new.	Cost	10%	uniform		-\$100,000,000	\$100,000,000			0.0			
5						1	1	Highway	Interchange Type	Baseline assumes SPUI w/ Flyover for Marine Drive EB to I-5 NB	Variation to the Alternative - Exist, Exist w/ Flyover for Marine Drive EB to I-5 NB, SPUI, DDI, Full System Interchange (Replacing MD bridge only would be -\$135 million and full i/c would be approx +20% or +\$80 million)	covered above	Cost & Schedule	0%										
6	21-22	1		1				Highway	Interchange Type	Baseline Assumes Split SPUI	Variation to the Alternative - Folded Diamond, SPUI	Confident this isn't an issue	Cost & Schedule											
7	21, 22					1	1	Highway	Interchange Type	Baseline Assumes Split SPUI	Variation to the Alternative - Folded Diamond, SPUI (Assume 50%)	May need to add arterial since there is no connection between hayden island and marine drive. No arterial in 2 and 3. No range	Cost	10%	No Dist.	\$50,000,000								
8	19-20	1		1				Highway	Interchange Type	Baseline assumes Tunnel for I-5 SB to SR14 EB	Variation to the Alternative - Left Loop Ramp for I-5 NB to SR14 EB, Flyover for I-5 SB to SR14 EB (Inadvertent discovery)	Doesn't think water table is an issue with a tunnel or other tunneling risks due to short tunnel. Limited contamination and geotech issues.	Cost	0%		Probably not a significant difference.					0.0			
9						1	1	Highway	Interchange Type	Baseline assumes Modified Existing	Variation to the Alternative (Inadvertent discovery)		Cost & Schedule	0%		Probably not a significant difference.								

#	Activity	Identification							Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Quantitative Analysis									
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment					Prob.	Cost Impact (\$)				Schedule Impact (Months)				
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
10	25	1	1	1	1	1	1	Highway	Interchange Type	Baseline assumes SPUI	Variation to the Alternative - Exist, Tight Diamond, DDI (Could be -\$8 million if only exist bridge widened by 4 lanes)	Might be shorter if they change the interchange type from single point to tight diamond. Or even less if they widen bridge instead.	Cost	20%	uniform		-\$4,000,000	-\$2,000,000		0.0		
11	26	1	1	1	1	1	1	Highway	Interchange Type	Baseline assumes Modified Folded Diamond	Variation to the Alternative - Exist (Assume 20% reduction)	Very likely change in design to change interchange type to be more simplified.	Cost	80%	uniform		-\$5,000,000	-\$2,000,000		0.0		
12						1	1	Highway	Interchange Type	Baseline assumes Modified Folded Diamond	Variation to the Alternative - Exist (Assume 20% reduction)	rolled into above	Cost & Schedule	0%		-\$20,000,000						
13	24	1	1	1	1	1	1	Highway	Interchange Type	Baseline assumes Tunnel for I-5 SB to SR500 EB	Variation to the Alternative - Flyover for I-5 SB to SR500 EB (120,000 SF @ \$250 minus tunnels and earthwork plus tax and mark-ups)	Potential tunnel to bridge change.	Cost	5%	uniform		\$20,000,000	\$30,000,000	uniform	0.0	6.0	
14						1	1	Highway	Interchange Type	Baseline assumes Tunnel for I-5 SB to SR14 EB	Variation to the Alternative - Flyover for I-5 SB to SR14 EB (120,000 SF @ \$250 minus tunnels and earthwork plus tax and mark-ups)		Cost & Schedule	0%		\$20,000,000	\$30,000,000					
15	27	1	1	1	1			Transit	Vancouver Transit Alignment	Baseline assumes I-5.	VE Team sees this as an opportunity.	Originally chose one alignment for all, through evaluation the I-5 alignment has a very long bridge. At main st. there are much fewer structures. Design changes minimize ROW issues. Difference is in the structure.	Cost & Schedule	0%	trigen	-\$100,000,000	-\$120,000,000	-\$90,000,000	trigen	-8.0	-10.0	-6.0
15a	27					1	1	Transit	Vancouver Transit Alignment	Baseline assumes I-5.	VE Team sees this as an opportunity.	Originally chose one alignment for all, through evaluation the I-5 alignment has a very long bridge. At main st. there are much fewer structures. Design changes minimize ROW issues. Difference is in the structure.	Cost & Schedule	100%	trigen	\$100,000,000	\$90,000,000	\$120,000,000	trigen	8.0	6.0	10.0
16						1	1	Transit	Vancouver Transit Alignment	Baseline assumes I-5.	VE Team sees this as an opportunity.		Cost & Schedule			-\$100,000,000						
17	27 and 28	1	1			1		Construction	Utility Relocation BRT		Lower probability and impacts than CON1. VE believes probability is higher than 20% Very little utility relocation in OR as HCT is elevated.	Risk is that you would relocate the utilities and build the guideway "LRT Ready"	Cost & Schedule	20%	trigen	\$6,500,000	\$5,000,000	\$10,000,000	uniform	4.0	6.0	
18	27 and 28			1	1		1	Construction	Utility Relocation LRT		Lower probability and impacts than CON1. VE believes probability is higher than 20% Very little utility relocation in OR as HCT is elevated.		Cost & Schedule	10%	uniform		\$0	\$3,500,000				

#	Activity	Identification						Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Quantitative Analysis										
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5						Prob.	Cost Impact (\$)				Schedule Impact (Months)					
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)		
19	27	1		1		1	1	Construction	Utility Relocation BRT		Lower probability and impacts than CON1. VE believes probability is higher than 20% (Assumes full relocation)	Cost & Schedule	0%		\$5,000,000								
20	27	1	1	1	1	1	1	Transit	TR-Kiggins Bowl / Lincoln Park and Ride	Mitigation needs associated with the potential traffic increases.	Not a big issue. Captured in general facility costs? Partly. VE team believes this is a big issue with high probability.	Cost	0%	trigen	\$21,000,000	\$18,000,000	\$27,000,000						
21	27	1	1	1	1	1	1	Transit	TR-Kiggins Bowl / Lincoln Park and Ride	Mitigation needs associated with the potential traffic increases.	Not a big issue. Captured in general facility costs? Partly. VE team believes this is a big issue with high probability.	Cost	100%	trigen	\$64,000,000	\$60,000,000	\$80,000,000						
22	27	1		1				Transit	TR-Clark College Park and Ride	Mitigation needs associated with the potential traffic increases.	Not a big issue. Captured in general facility costs? Partly. VE team believes this is a big issue with high probability.	Cost	0%										
23						1	1	Transit	TR-Clark College Park and Ride	Mitigation needs associated with the potential traffic increases.	Not a big issue. Captured in general facility costs? Partly. VE team believes this is a big issue with high probability.	Cost	0%										
24	28	1	1	1	1	1	1	Transit	Implement VE recommendation to relocate Park and Ride lots	Opportunity that can reduce project cost.	Mitigation may be required in areas where Park and Ride lots are expanded.	Cost											
25	27	1	1	1	1	1	1	Transit	Implement VE recommendation to relocate Park and Ride lots	Opportunity that can reduce project cost.	Mitigation may be required in areas where Park and Ride lots are expanded.	Cost											
26	9	1	1	1	1	1	1	Design	Need for design exceptions / deviations	Schedule impact only. Both states involved in the deviations approval.	Early coordination required to mitigate this action.	Schedule	10%						uniform		3.0	6.0	
27	8	1	1	1	1	1	1	Design	Delays in design approvals by FHWA and FTA.	But early engagement of / coordination with FHWA: limited impact (1 to 3 months).	IJR, TS&Ls may be required on major structures. A dedicated FHWA representative will be assigned to the project.	Cost & Schedule	30%						uniform		1.0	3.0	
28	8	1	1	1	1	1	1	Design	Multiple federal leads for the environmental documents	FHWA and FTA are co-signators. No agreement is in place that either has a leadership role.	This would require additional coordination. Limited impact of 1 to 3 months.	Schedule	25%						uniform		1.0	3.0	
29	23	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000						
30	21-22	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000						

#	Activity	Identification						Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Quantitative Analysis									
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5						Prob.	Cost Impact (\$)				Schedule Impact (Months)				
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
31	13-18	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	water	Cost	50%	trigen	\$10,000,000	\$5,000,000	\$15,000,000				
32	19-20	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000				
33	25	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000				
34	26	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000				
35	24	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000				
36	28	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000				
37	27	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000				
38	8	1	1	1	1	1	1	Environmental	Supplementary EIS (SEIS) / additional environmental analysis required	Highly likely for this type of project. Would delay ROD. Cost impact = consultant fee to complete SEIS.	Risk of supplemental EIS post-ROD also exists.	average of \$1.2 a month over the last year	Cost & Schedule	40%	uniform	\$5,000,000	\$18,000,000		uniform		6.0	12.0
39	8	1	1	1	1	1	1	Environmental	Controversy on environmental grounds expected (NEPA challenges only)	Cost impacts would include legal costs.		Previous litigation for ROW cost used as a base for this estimate	Cost & Schedule	30%	trigen	\$5,000,000	\$4,000,000	\$7,500,000	uniform		3.0	6.0

#	Activity	Identification							Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Quantitative Analysis								
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Prob.						Cost Impact (\$)			Schedule Impact (Months)					
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
40	8	1	1	1	1	1	1	Environmental	404 consultation is required	Additional unforeseeable work/mitigation	Army Corps of Engineering Permitting	Cost & Schedule	15%	trigen	\$5,000,000	\$3,000,000	\$6,000,000			3.0	6.0	
41	11	1	1	1	1	1	1	Environmental	Formal Section 7 consultation is required	Key cost issue is stormwater treatment mitigation.	Cost for stormwater treatment should be put in the base. This is a given, not a risk. There is an additional risk that the services cannot deliver in accordance with the baseline schedule.	Cost & Schedule	60%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	No Dist.		3.0		
42	23	1	1	1	1	1	1	Environmental	Post Section 7 consultation	Fish passage, fish windows: work in water possible from November through February (4 months).	Baseline cost and schedule does not account for work restrictions. Foundation platforms and access facilities. Window could change as the project progresses. Communication and coordination needs to begin early in the project. There is an opportunity to get a larger window (baseline needs to reflect actual window).	Schedule	10%					uniform		4.0	8.0	
43	21-22	1	1	1	1	1	1	Environmental	Post Section 7 consultation	Fish passage, fish windows: work in water possible from November through February (4 months).	Baseline cost and schedule does not account for work restrictions. Foundation platforms and access facilities. Window could change as the project progresses. Communication and coordination needs to begin early in the project. There is an opportunity to get a larger window (baseline needs to reflect actual window).	Schedule	10%					uniform		4.0	8.0	
44	13-18	1	1	1	1	1	1	Environmental	Post Section 7 consultation	Fish passage, fish windows: work in water possible from November through February (4 months).	Baseline cost and schedule does not account for work restrictions. Foundation platforms and access facilities. Window could change as the project progresses. Communication and coordination needs to begin early in the project. There is an opportunity to get a larger window (baseline needs to reflect actual window).	Schedule	10%					uniform		6.0	10.0	
45	2	1	1	1	1	1	1	Environmental	Section 106 issues expected (discoveries pre-construction)	Mitigation associated with historical and archeological findings pre-construction. Is there anything beyond what is in the base? e.g., a stakeholder may request additional investigations/mitigation.	Applicable to geotech investigations as well. The survey would reduce this probability considerably.	Cost & Schedule	50%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0	

#	Activity	Identification						Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Quantitative Analysis									
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5						Prob.	Cost Impact (\$)				Schedule Impact (Months)				
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
46	8	1	1	1	1	1	1	Environmental	Section 106 issues expected (discoveries pre-construction)	Mitigation associated with historical and archeological findings pre-construction. Is there anything beyond what is in the base? e.g., a stakeholder may request additional investigations/mitigation.	Applicable to geotech investigations as well. The survey would reduce this probability considerably.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	50%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
47	23	1	1	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	10%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
48	21-22	1	1	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	40%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
49	13-18	1	1	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	40%	trigen	\$10,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
50	19-20	1	1	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	90%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0

#	Activity	Identification						Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Quantitative Analysis								
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5						Prob.	Cost Impact (\$)				Schedule Impact (Months)			
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)
51	25	1	1	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Cost & Schedule	75%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
52	26	1	1	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Cost & Schedule	20%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
53	24	1	1	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Cost & Schedule	10%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
54	28	1	1	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Cost & Schedule	30%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
55	27	1	1	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Cost & Schedule	40%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0

#	Activity	Identification							Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Quantitative Analysis							
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Prob.						Cost Impact (\$)				Schedule Impact (Months)			
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)
56	23	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Cost & Schedule	10%	trigen	\$1,000,000	\$500,000	\$1,500,000	uniform		0.0	3.0
57	21-22	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Cost & Schedule	10%	uniform		\$3,000,000	\$5,000,000	uniform		0.0	3.0
58	13-18	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Cost & Schedule	25%	uniform		\$7,000,000	\$10,000,000	uniform		0.0	3.0
59	19-20	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Cost & Schedule	10%	uniform		\$1,000,000	\$2,000,000	uniform		0.0	3.0
60	25	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Cost & Schedule	10%	trigen	\$1,000,000	\$500,000	\$1,500,000	uniform		0.0	3.0
61	26	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Cost & Schedule	10%	trigen	\$1,000,000	\$500,000	\$1,500,000	uniform		0.0	3.0
62	24	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Cost & Schedule	10%	trigen	\$1,000,000	\$500,000	\$1,500,000	uniform		0.0	3.0
63	28	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Cost & Schedule	0%								
64	27	1	1	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Cost & Schedule	0%								

#	Activity	Identification						Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Quantitative Analysis								
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5						Prob.	Cost Impact (\$)				Schedule Impact (Months)			
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)
65	8	1	1	1	1	1	1	Environmental	Negative community impacts expected (environmental justice issues)	Potential lawsuit on EJ issues: various pressures from communities (e.g., pressure for Community Investment Fund = compensation for impacted communities)		Cost & Schedule	10%	trigen	\$10,000,000	\$5,000,000	\$10,000,000	uniform		0.0	3.0
66	11	1	1	1	1	1	1	Environmental	Environmental regulations change	Water quality and endangered species list. Schedule impact larger if change occurs later.		Cost & Schedule	20%					uniform		3.0	6.0
67	19	1	1	1	1	1	1	External	Required freeway lid in city of Vancouver	About 50% probability will be added to project. Required by City of Vancouver as part of re-development (new condos, library, ect.)	Add cost into baseline. (Assume 4 to 5 x Evergreen Bridge plus mar-ups)	Cost	70%	trigen	\$50,000,000	\$40,000,000	\$80,000,000				
68	13-18	1	1	1	1	1	1	Environmental	Limitations on construction site access and material delivery	Limitations on time barges can stay on site (predator fishes hiding below barges to attack outgoing smolts. Would add to delivery/construction costs.		Cost	60%	trigen	\$15,000,000	\$10,000,000	\$20,000,000				
69	8	1	1	1	1	1	1	External	Local communities pose objections	Risk: objections before ROD. Likely that one community will hold up decision and stop or slow down project. For example: opposition to tolling; selection of transit mode.	Some community risks accounted for under environmental. Cost impacts captured under environmental.	Schedule	15%					uniform		6.0	12.0
70	16, 27, 28, 29,	1	1	1	1	1	1	External	Funding changes for fiscal year	Likelihood of New Starts funding? Risk = likelihood of funding shortages being an issue. Schedule impact only (missing "a cycle").	Note: Initially, probability of 80% and impact between 12 and 48 months. But, even with no FTA approval, can go all the way to ROD 11/08. Removed 9 months from range. Changed to discrete Dist. after discussion with transit SMEs.	Schedule	15%					trigen	12.0	6.0	18.0
71	5	1	1	1	1	1	1	External	Stakeholders request late changes	Requests very likely. Cost impacts accounted for in other risks. Limited schedule impacts.		Schedule	20%					trigen	6.0	4.0	8.0
72	5	1	1	1	1	1	1	Organizational	Internal "red tape" causes delay getting approvals, decisions	Issue: getting feedback from 39-member Task Force (inc. local agencies, neighborhood organizations, etc.). Is Task Force an opportunity for taking decisions earlier? Overall: minimal impact on schedule; a "wash."	Continued work with task force will lower risks.	Schedule	20%					No Dist.	3.0		
73	All interchange	1	1	1	1	1	1	Right of Way	Change in right-of-way costs due to condemnation	About 10% of properties go to condemnation.	Add potential of condemnation to baseline.	Cost	50%	trigen	\$13,000,000	\$10,000,000	\$20,000,000				

#	Activity	Identification							Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Quantitative Analysis									
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment					Cost Impact (\$)				Schedule Impact (Months)					
													Prob.	Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
74	10	1	1	1	1	1	1	Right of Way	Access plan, access hearings, justification report	Baseline schedule does not provide enough time. Needs to be completed before ROD. Note: no acquisition before the ROD.	Revise baseline schedule.	Schedule	20%					Irigen	9.0	6.0	12.0	
75	21	1	1	1	1	1	1	Right of Way	Inadequate baseline schedule for property acquisition and relocation	Base duration (about 1.5 year) is too short. Minimum 24 months for commercial properties relocation.	Hayden Island	Schedule	75%					uniform		3.0	6.0	
76	21		1		1			Right of Way	Must purchase whole Red Lion Hotel (Jantzen Beach) because the removal of a wing makes it economically not viable			Cost	25%	Irigen	\$20,000,000	\$15,000,000	\$25,000,000					
77	19, 20	1		1				Right of Way	Must purchase whole Red Lion At The Quay Hotel because the removal of a piece of the structure makes it economically not viable			Cost	25%	Irigen	\$10,000,000	\$8,000,000	\$15,000,000					
78	10	1	1	1	1	1	1	Right of Way	Change in right-of-way costs due to market expectations	How will market expectations of project development impact property prices? Research indicates premiums of 4 to 6% (residential) and 6 to 8% (commercial). About 60% commercial; 40% residential.	Allow 6% for ROW purchase only.	Cost	80%	Irigen	\$7,000,000	\$5,000,000	\$10,000,000					
79	19-20	1	1	1	1	1	1	Right of Way	Railroad involvement	Crossing of railroad properties. Schedule issue: getting the railroad to agree (railroad will want to review all NEPA and engineering documents). Early coordination needed / planned for documents review. Additional risks: no construction above tracks during fourth quarter.		Schedule	30%						uniform		4.0	8.0
80						1	1	Right of Way	Railroad involvement	Crossing of railroad properties. Schedule issue: getting the railroad to agree (railroad will want to review all NEPA and engineering documents). Early coordination needed / planned for documents review. Additional risks: no construction above tracks during fourth quarter.		Schedule	0%									

#	Activity	Identification							Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Quantitative Analysis									
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Prob.						Cost Impact (\$)			Schedule Impact (Months)						
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)		
81	10	1	1	1	1	1	1	Right of Way	Cost increase due to condemnation litigation (legal fees only)	Factoring in % of properties sent to condemnation (10%), cost impact = 3% to 5% of base costs.	Allow 4% for total ROW costs.	So small no range really needed.	Cost	10%	No Dist.	\$5,000,000							
82	10	1	1	1	1	1	1	Right of Way	Underestimation of number of parcels to be acquired for final alignment / alternative	Impact is 10% additional parcels / cost (10% of base costs). No schedule impact.	Allow 10% for total ROW costs.		Cost	25%	uniform	\$13,000,000	\$10,000,000	\$20,000,000					
83						1	1	Right of Way	Underestimation of number of parcels to be acquired for final alignment / alternative	Impact is 10% additional parcels / cost (10% of base costs). No schedule impact.	Allow 10% for total ROW costs.		Cost	0%		\$14,000,000							
84	13-18	1		1		1	1	Technical / Structure	Structural design incomplete or in error (existing structures over Columbia river)	Delays associated with agreement on bridge upgrade / retrofit design. Cost overrun likely as well.		Potential mitigation is retrofit memorandum be developed.	Cost & Schedule										
85	13-18	1	1	1	1	1	1	Technical / Structure	Inaccurate assumptions on technical issues in planning stage	Coast guard hearings and issues with barges => changing location of railroad bridge / realignment possible? Considered in evaluation of alternatives? Dealbreaker if realignment required? No	FAA requirements?? FAA review should be added to baseline schedule.	We have been meeting regularly with the Coast Guard and FAA	Cost	0%									
86	13-18	1	1	1	1	1	1	Technical / Structure	Context sensitive solutions (river crossing)			VE team assumption is that this is only amenities	Cost	50%	uniform		\$5,000,000	\$15,000,000					
87	13-18	1	1	1	1	1	1	Technical / Structure	Signature bridge	Added costs for structure type (20% premium over segmental box estimate)		Conflicts with airspace restrictions limits this possibility.	Cost	10%	uniform		\$50,000,000	\$150,000,000					
88	13-18	1		1				Technical / Structure	Structural design incomplete (new structures)	Issue: foundation type: limited information now.		Opportunity for cost reductions through more geotech investigations, inwater work strategies, addressing fish issues, wider spans/less foundation work, etc.	Cost										
89	13-18					1	1	Technical / Structure	Structural design incomplete (new structures)	Issue: foundation type: limited information now.		Opportunity for cost reductions through more geotech investigations, inwater work strategies, addressing fish issues, wider spans/less foundation work, etc.	Cost	0%									
90	28	1		1				Transit	Maintenance and storage facility for BRT	Costs are included in Baseline Estimate		See VE recommendations.	Cost										
91						1	1	Transit	Maintenance and storage facility for BRT	Costs are included in Baseline Estimate		See VE recommendations.	Cost	0%									
92	27	1		1				Transit	Maintenance and storage facility for BRT	Costs are included in Baseline Estimate		See VE recommendations.	Cost										

#	Activity	Identification							Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Quantitative Analysis											
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment					Prob.	Cost Impact (\$)				Schedule Impact (Months)						
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)			
93						1	1	Transit	Maintenance and storage facility for BRT	Costs are included in Baseline Estimate	See VE recommendations.	Cost	0%											
94	28	1	1			1		Transit	Cost of complete street rebuild along the high-capacity transit corridor	Is this included in the baseline cost estimates? Yes. But some risk around it. Also, could be on two separate streets.	No couplets on BRT South	Assumed we have double tracks then there are additional	Cost	0%		\$0								
95	27	1	1	1	1	1	1	Transit	Cost of complete street rebuild along the high-capacity transit corridor	Is this included in the baseline cost estimates? Yes. But some risk around it. Also, could be on two separate streets.	Assume 4,000 ft @ \$2,500 for road recon & streetscape plus tax and mark-up.	Rebuild over and above guideway costs	Cost	10%	Irigen	\$20,000,000	\$10,000,000	\$30,000,000						
96	All Construction Costs	1	1	1	1	1	1	Project	Other major projects in the area at the same time?	Construction activities and conflicts with other companies. Maintenance of traffic and constructibility.	Working with other agency to coordinate construction impacts.	Strong interest expressed from contractors low probability, potential to not get bonding if spread too thin high costs?	Cost & Schedule	20%	uniform		\$50,000,000	\$150,000,000						
97		1	1	1	1	1	1	Project	Market conditions	Funding, labor, and materials. Contractor availability		Covered above and in escalation	Cost	0%										
98	5	1	1	1	1	1	1	Project	Third Parties, i.e., local agencies	Permit conditions from local agencies and requirements for added emergency services.	Purchasing equipment as project mitigation.		Cost	20%	uniform		\$5,000,000	\$10,000,000						
99	5	1	1	1	1	1	1	Project	Interagency agreements/MOAs and MOUs	Agreements must be in place prior to funding obligations	All agencies such as FAA, FTA, Coast Guard, cities, counties, etc.		Schedule	30%					uniform		1.0	3.0		
100		1	1	1	1	1	1	Project	Delivery methods	What contracting laws? Which statutes apply? How many contract packages?	Design-bid-build? Design-build? Other?	To early to quantify this risk	Cost & Schedule											
101	23	1	1	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	40%	No Dist.	\$9,000,000								
102	21-22	1	1	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	50%	uniform		\$5,000,000	\$10,000,000						
103						1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	0%		\$10,000,000								
104	13-18	1	1	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	change 40% to 60%	Cost & Schedule	60%	No Dist.	\$13,000,000								
105						1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	0%		\$3,000,000								

#	Activity	Identification							Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Quantitative Analysis									
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Prob.						Cost Impact (\$)			Schedule Impact (Months)						
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)		
106	19-20	1	1	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	Cost & Schedule	60%	uniform		\$5,000,000	\$10,000,000						
107						1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	Cost & Schedule	0%		\$10,000,000								
108	25	1	1	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	Cost & Schedule	30%	No Dist.	\$1,000,000								
109						1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	Cost & Schedule	0%		\$2,000,000								
110	26	1	1	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	Cost & Schedule	30%	No Dist.	\$3,000,000								
111						1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	Cost & Schedule	0%		\$1,000,000								
112	24	1	1	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	Cost & Schedule	40%	No Dist.	\$2,000,000								
113						1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	Cost & Schedule	0%		\$3,000,000								
114						1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	Cost & Schedule	0%		\$2,000,000								
115		1	1	1	1			Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	Bridge over Union not removed for Alts 2 & 3.	Shouldn't apply to hayden, river crossing or sr 14	Cost & Schedule	0%	\$0								
116						1	1	Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	Bridge over Union not removed for Alts 4 & 5.	Shouldn't apply to hayden, river crossing or sr 14	Cost & Schedule	0%	\$0								
117		1		1		1	1	Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.			Cost & Schedule	0%									
118						1	1	Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.			Cost & Schedule	0%									
119		1		1				Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	See line 6.		Cost & Schedule	0%									

#	Activity	Identification							Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Quantitative Analysis												
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Functional Assignment					Prob.	Cost Impact (\$)				Schedule Impact (Months)							
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)				
120						1	1	Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	See line 7.	Cost & Schedule	0%												
121	26	1	1	1	1	1	1	Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	For 4P bridge over I-5 only.	Cost & Schedule	30%	No Dist.	-\$15,000,000										
122						1	1	Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	For 4P bridge over I-5 only.	Cost & Schedule	0%		-\$15,000,000										
123	24	1	1	1	1			Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	For 500W to 5S ramp only.	Cost & Schedule	30%	No Dist.	-\$12,000,000										
124	24					1	1	Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	For 500W to 5S ramp only.	Cost & Schedule	40%	No Dist.	-\$12,000,000										
125	8	1	1	1	1	1	1	Traffic	Changes in regional traffic models and/or design year.	MPO changes the regional model or delays to project revises design year.	Baseline should be updated to include impact results of 2035 traffic model. Changes to land use can impact model.	Schedule	10%						uniform		6.0	12.0			
126		1	1	1	1	1	1	Right of Way	Opportunity to purchase available property.	Thunderbird Hotel is an example.	Property around the river is needed for construction staging as well as for the project.	Cost	0%												
127		1	1	1	1	1	1		T-1 - LRT To Downtown Vancouver w/ Branded Bus	VE Recommendation	Included in base cost estimate														
128		1	1	1	1	1	1		T-2 - LRT on Main Street w/ Branded Bus	VE Recommendation	Included in base cost estimate														
129	27	1	1	1	1	1	1		T-3 - Park and Rides at Lincoln and Expo Center	VE Recommendation	From VE Team: -\$7 million at Ross and -\$40 million at Clark.		90%	uniform		-\$50,000,000		-\$5,000,000							
130		1	1	1	1	1	1		R-1 - 2 Cell Trapezoidal Segmental Box	VE Recommendation															
131	13-16	1	1	1	1	1	1		R-2 - 8' Diameter Driven Piles	VE Recommendation	From VE Team.		30%	uniform		-\$40,000,000		-\$20,000,000		uniform		-3.0	-2.0		
132		1	1	1	1	1	1		R-3 - No Seismic Retrofit of Substructure, Superstructure Retrofit only	VE Recommendation															

#	Activity	Identification							Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Quantitative Analysis								
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Prob.						Cost Impact (\$)				Schedule Impact (Months)				
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
133	16	1		1		1	1		R-4 - HCT inside segmental box	VE Recommendation	From VE Team.		50%	uniform			-\$100,000,000	-\$50,000,000				
134	16		1		1				R-4 - HCT inside segmental box	VE Recommendation	From VE Team.		50%	uniform			-\$100,000,000	-\$50,000,000	uniform		-24.0	-18.0
135		1	1	1	1	1	1		R-5 - Constructability	VE Recommendation	No cost impacts, schedule impacts captured in other risks (upstream v downstream)											
136	19-20	1	1	1	1	1	1		W-1 - Main Street Extension to Columbia Blvd	VE Recommendation	From VE Team.		90%	uniform			\$3,000,000	\$5,000,000				
137	19-20	1	1	1	1	1	1		W-2 - Connect SR14 WB to Columbia with SR5 to C Street	VE Recommendation	From VE Team.		50%	uniform			\$1,000,000	\$15,000,000				
138		1	1	1	1	1	1		W-3 - Remove Ramp Meter from Mill Plain NB On Ramp	VE Recommendation	Negligible cost impact.		0%									
139		1	1	1	1	1	1		W-4 - Evaluate Tight Diamond at Mill Plain	VE Recommendation	Assessed elsewhere.		0%									
140	26	1	1	1	1	1	1		W-5 - Evaluate removing access at 4th Plain	VE Recommendation			1%	No Dist.	-\$116,000,000							
141	25	1	1	1	1	1	1		W-6 - Relocate Fourth Plain NB Braided Ramp at Mill Plain	VE Recommendation			20%	uniform			-\$50,000,000	-\$10,000,000				
142		1	1	1	1	1	1		W-7 - Eliminate I-5 SB to SR500 EB Tunnel	VE Recommendation	Recommendation not accepted		0%									
143		1	1	1	1	1	1		W-8 - Construct SR500 Interchange First	VE Recommendation	No cost or schedule benefits		0%									
144		1	1	1	1	1	1		W-9 - Do not shift I-5 between 4th Plain and SR500 if HCT is on Main Street	VE Recommendation	Based on difference in mainline between Alts 2 & 3 and Alts 4 & 5.	This is included in the transit alignment costs										

#	Activity	Identification							Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Quantitative Analysis								
		Alt 2a	Alt 2b	Alt 3a	Alt 3b	Alt 4	Alt 5	Prob.						Cost Impact (\$)			Schedule Impact (Months)					
														Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
145	21,22	1	1	1	1	1	1		O-1 - Shift I-5 Alignment across Hayden Island outside the footprint of the existing freeway	VE Recommendation	Double earthwork minus demolition of Safeway and Red Lion.	May be able to save time but not likely	70%	trigen	\$6,000,000	\$4,000,000	\$10,000,000					
146	21,22	1	1	1	1	1	1		O-2 - Keep the profile elevated across Hayden Island	VE Recommendation	85,000 SF bridge @ \$300 minus 20% for earthwork and pavement.		40%	trigen	\$33,000,000	\$20,000,000	\$40,000,000					
147		1	1	1	1	1	1		O-3 - Remove Ramp Meter from Marine Drive NB On Ramp	VE Recommendation	Negligible cost impact.		0%									
148		1	1	1	1	1	1		O-4 Combine O-1 through O-3, use existing slough bridge for connection between Marine Drive and Hayden Island	VE Recommendation			0%									
149	13-16, 31	1	1	1	1	1	1		Need to provide additional tugs/tows during construction for river navigation				Cost	50%	trigen	\$10,000,000	\$7,500,000	\$15,000,000				
150	13-16, 31	1	1	1	1	1	1		Experience of contractor for foundations and superstructure					40%					trigen	9.0	6.0	12.0
151	13-18	1		1					Construction restrictions due to In Water Work Windows			Currently there is only a 4 month in water window to perform work, staging assumes no in water work limitations		30%					trigen	6.0	3.0	9.0
152	13-18		1		1				Construction restrictions due to In Water Work Windows			Currently there is only a 4 month in water window to perform work, staging assumes no in water work limitations		30%					trigen	10.0	6.0	14.0
153	13-16, 31	1	1	1	1	1	1		Performance of expected pile installation methods					30%					trigen	6.0	3.0	9.0
154	13-16, 31	1	1	1	1	1	1		Availability of pile installation equipment			With 8' driven piling, equipment availability is an issue		30%					trigen	6.0	3.0	9.0
155	13-16, 31	1	1	1	1	1	1		Compliance with permitting requirements for work in the water			Concerns about water quality compliance and vibration management		30%					trigen	12.0	6.0	18.0

Table 54: MOS Design Risk Register

#	Activity	Identification				Quantitative Analysis																	
		2a - Mill District	2a - Clark College	3a - Mill District	3a - Clark College	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)				Schedule Impact (Months)							
												Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)				
1	13-15	1	1	1	1	River Crossing	Upstream Alignment	Baseline assumes Downstream	Variation to the Alternative	added two alternatives	Cost & Schedule	0%											
2						Construction	Technical / Structure	Seismic Retrofit of Existing Structures			Cost & Schedule			\$0									
3						Transit	Technical / Structure	BNSF Railroad Bridge Moveable Span Relocataion	Best guess.		Cost & Schedule			\$250,000,000						0.9			
4	23	1	1	1	1	Highway	Interchange Type	Baseline assumes SPUI w/ Flyover for Marine Drive EB to I-5 NB	Variation to the Alternative - Exist, Exist w/ Flyover for Marine Drive EB to I-5 NB, SPUI, DDI, Full System Interchange	Thinks might be lower probability. Design change may raise or lower the costs on the Interchange construction. Rebuild Exist or replace with new.	Cost	10%	uniform		-\$100,000,000	\$100,000,000			0.0				
5						Highway	Interchange Type	Baseline assumes SPUI w/ Flyover for Marine Drive EB to I-5 NB	Variation to the Alternative - Exist, Exist w/ Flyover for Marine Drive EB to I-5 NB, SPUI, DDI, Full System Interchange (Replacing MD bridge only would be -\$135 million and full i/c would be approx +20% or +\$80 million)	covered above	Cost & Schedule	0%											
6	21-22	1	1	1	1	Highway	Interchange Type	Baseline Assumes Split SPUI	Variation to the Alternative - Folded Diamond, SPUI	Confident this isn't an issue	Cost & Schedule												
7	21, 22					Highway	Interchange Type	Baseline Assumes Split SPUI	Variation to the Alternative - Folded Diamond, SPUI (Assume 50%)	May need to add arterial since there is no connection between hayden island and marine drive. No arterial in 2 and 3. No range	Cost	10%	No Dist.	\$50,000,000									
8	19-20	1	1	1	1	Highway	Interchange Type	Baseline assumes Tunnel for I-5 SB to SR14 EB	Variation to the Alternative - Left Loop Ramp for I-5 NB to SR14 EB, Flyover for I-5 SB to SR14 EB (Inadvertent discovery)	Doesn't think water table is an issue with a tunnel or other tunneling risks due to short tunnel. Limited contamination and geotech issues.	Cost	0%		Probably not a significant difference.					0.0				
9						Highway	Interchange Type	Baseline assumes Modified Existing	Variation to the Alternative (Inadvertent discovery)		Cost & Schedule	0%		Probably not a significant difference.									
10	25	1	1	1	1	Highway	Interchange Type	Baseline assumes SPUI	Variation to the Alternative - Exist, Tight Diamond, DDI (Could be -\$8 million if only exist bridge widened by 4 lanes)	Might be shorter if they change the interchange type from single point to tight diamond. Or even less if they widen bridge instead.	Cost	20%	uniform		-\$4,000,000	-\$2,000,000			0.0				
11	26	1	1	1	1	Highway	Interchange Type	Baseline assumes Modified Folded Diamond	Variation to the Alternative - Exist (Assume 20% reduction)	Very likely change in design to change interchange type to be more simplified.	Cost	80%	uniform		-\$5,000,000	-\$2,000,000			0.0				

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												Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
12						Highway	Interchange Type	Baseline assumes Modified Folded Diamond	Variation to the Alternative - Exist (Assume 20% reduction)	rolled into above	Cost & Schedule	0%		-\$20,000,000						
13	24	1	1	1	1	Highway	Interchange Type	Baseline assumes Tunnel for I-5 SB to SR500 EB	Variation to the Alternative - Flyover for I-5 SB to SR500 EB (120,000 SF @ \$250 minus tunnels and earthwork plus tax and mark-ups)	Potential tunnel to bridge change.	Cost	5%	uniform		\$20,000,000	\$30,000,000	uniform		0.0	6.0
14						Highway	Interchange Type	Baseline assumes Tunnel for I-5 SB to SR14 EB	Variation to the Alternative - Flyover for I-5 SB to SR14 EB (120,000 SF @ \$250 minus tunnels and earthwork plus tax and mark-ups)		Cost & Schedule	0%		\$20,000,000	\$30,000,000					
15	27	1	1	1	1	Transit	Vancouver Transit Alignment	Baseline assumes I-5.	VE Team sees this as an opportunity.	Originally chose one alignment for all, through evaluation the I-5 alignment has a very long bridge. At main st. there are much fewer structures. Design changes minimize ROW issues. Difference is in the structure.	Cost & Schedule	0%								
15a	27	1	1	1	1	Transit	Vancouver Transit Alignment	Baseline assumes I-5.	VE Team sees this as an opportunity.	Originally chose one alignment for all, through evaluation the I-5 alignment has a very long bridge. At main st. there are much fewer structures. Design changes minimize ROW issues. Difference is in the structure.	Cost & Schedule	0%								
16						Transit	Vancouver Transit Alignment	Baseline assumes I-5.	VE Team sees this as an opportunity.		Cost & Schedule			-\$100,000,000						
17	27 and 28	1	1			Construction	Utility Relocation BRT		Lower probability and impacts than CON1. VE believes probability is higher than 20% Very little utility relocation in OR as HCT is elevated.	Risk is that you would relocate the utilities and build the guideway "LRT Ready"	Cost & Schedule	20%	trigen	\$6,500,000	\$5,000,000	\$10,000,000	uniform		4.0	6.0
18	27 and 28			1	1	Construction	Utility Relocation LRT		Lower probability and impacts than CON1. VE believes probability is higher than 20% Very little utility relocation in OR as HCT is elevated.		Cost & Schedule	10%	uniform	\$0	\$3,500,000					
19	27	1	1	1	1	Construction	Utility Relocation BRT		Lower probability and impacts than CON1. VE believes probability is higher than 20% (Assumes full relocation)		Cost & Schedule	0%		\$5,000,000						
20	27	1	1	1	1	Transit	TR-Kiggins Bowl / Lincoln Park and Ride	Mitigation needs associated with the potential traffic increases.	Not a big issue. Captured in general facility costs? Partly. VE team believes this is a big issue with high probability.	May need to redo the main street interchange improvements only	Cost	0%								

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												Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
21	27	1	1	1	1	Transit	TR-Kiggins Bowl / Lincoln Park and Ride	Mitigation needs associated with the potential traffic increases.	Not a big issue. Captured in general facility costs? Partly. VE team believes this is a big issue with high probability.	Structure at Lincoln and baseline assumes surface lot 2000 spaces by 20000 per space by 1.6 for markups (only for I-5 alignment)	Cost	0%								
22	27	1	1	1	1	Transit	TR-Clark College Park and Ride	Mitigation needs associated with the potential traffic increases.	Not a big issue. Captured in general facility costs? Partly. VE team believes this is a big issue with high probability.		Cost	0%								
23						Transit	TR-Clark College Park and Ride	Mitigation needs associated with the potential traffic increases.	Not a big issue. Captured in general facility costs? Partly. VE team believes this is a big issue with high probability.		Cost	0%								
24	28	1	1	1	1	Transit	Implement VE recommendation to relocate Park and Ride lots	Opportunity that can reduce project cost.	Mitigation may be required in areas where Park and Ride lots are expanded.		Cost									
25	27	1	1	1	1	Transit	Implement VE recommendation to relocate Park and Ride lots	Opportunity that can reduce project cost.	Mitigation may be required in areas where Park and Ride lots are expanded.		Cost									
26	9	1	1	1	1	Design	Need for design exceptions / deviations	Schedule impact only. Both states involved in the deviations approval.	Early coordination required to mitigate this action.	Deviations may occur on Marine to Hayden, 14 to Mill Plain, concurrences with differences in ramp speed. Apply to interchanges only	Schedule	10%					uniform		3.0	6.0
27	8	1	1	1	1	Design	Delays in design approvals by FHWA and FTA.	But early engagement of / coordination with FHWA: limited impact (1 to 3 months).	IJR, TS&Ls may be required on major structures. A dedicated FHWA representative will be assigned to the project.	Used VE recommendations	Cost & Schedule	30%					uniform		1.0	3.0
28	8	1	1	1	1	Design	Multiple federal leads for the environmental documents	FHWA and FTA are co-signators. No agreement is in place that either has a leadership role.	This would require additional coordination. Limited impact of 1 to 3 months.	Used VE recommendations	Schedule	25%					uniform		1.0	3.0
29	23	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	irigen	\$2,500,000	\$2,000,000	\$3,000,000				
30	21-22	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	irigen	\$2,500,000	\$2,000,000	\$3,000,000				
31	13-18	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	water	Cost	50%	irigen	\$10,000,000	\$5,000,000	\$15,000,000				
32	19-20	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	irigen	\$2,500,000	\$2,000,000	\$3,000,000				

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												Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
33	25	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000				
34	26	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000				
35	24	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000				
36	28	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000				
37	27	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (underground)	Risks associated with demolition work: contamination of soil conditions, ground water, disposal site, sediments. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert.	not water	Cost	50%	trigen	\$2,500,000	\$2,000,000	\$3,000,000				
38	8	1	1	1	1	Environmental	Supplementary EIS (SEIS) / additional environmental analysis required	Highly likely for this type of project. Would delay ROD. Cost impact = consultant fee to complete SEIS.	Risk of supplemental EIS post-ROD also exists.	average of \$1.2 a month over the last year	Cost & Schedule	40%	uniform	\$5,000,000	\$18,000,000		uniform		6.0	12.0
39	8	1	1	1	1	Environmental	Controversy on environmental grounds expected (NEPA challenges only)	Cost impacts would include legal costs.		Previous litigation for ROW cost used as a base for this estimate	Cost & Schedule	30%	trigen	\$5,000,000	\$4,000,000	\$7,500,000	uniform		3.0	6.0
40	8	1	1	1	1	Environmental	404 consultation is required	Additional unforeseeable work/mitigation	Army Corps of Engineering Permitting	Not a lot of information on this	Cost & Schedule	15%	trigen	\$5,000,000	\$3,000,000	\$6,000,000			3.0	6.0
41	11	1	1	1	1	Environmental	Formal Section 7 consultation is required	Key cost issue is stormwater treatment mitigation.	Cost for stormwater treatment should be put in the base. This is a given, not a risk. There is an additional risk that the services cannot deliver in accordance with the baseline schedule.	Not a lot of information on this	Cost & Schedule	60%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	No Dist.	3.0		

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		2a - Mill District	2a - Clark College	3a - Mill District	3a - Clark College	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)				Schedule Impact (Months)			
												Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)
42	23	1	1	1	1	Environmental	Post Section 7 consultation	Fish passage, fish windows: work in water possible from November through February (4 months).	Baseline cost and schedule does not account for work restrictions. Foundation platforms and access facilities. Window could change as the project progresses. Communication and coordination needs to begin early in the project. There is an opportunity to get a larger window (baseline needs to reflect actual window).	Schedule	10%					uniform		4.0	8.0
43	21-22	1	1	1	1	Environmental	Post Section 7 consultation	Fish passage, fish windows: work in water possible from November through February (4 months).	Baseline cost and schedule does not account for work restrictions. Foundation platforms and access facilities. Window could change as the project progresses. Communication and coordination needs to begin early in the project. There is an opportunity to get a larger window (baseline needs to reflect actual window).	Schedule	10%					uniform		4.0	8.0
44	13-18	1	1	1	1	Environmental	Post Section 7 consultation	Fish passage, fish windows: work in water possible from November through February (4 months).	Baseline cost and schedule does not account for work restrictions. Foundation platforms and access facilities. Window could change as the project progresses. Communication and coordination needs to begin early in the project. There is an opportunity to get a larger window (baseline needs to reflect actual window).	Schedule	10%					uniform		6.0	10.0
45	2	1	1	1	1	Environmental	Section 106 issues expected (discoveries pre-construction)	Mitigation associated with historical and archeological findings pre-construction. Is there anything beyond what is in the base? e.g., a stakeholder may request additional investigations/mitigation.	Applicable to geotech investigations as well. The survey would reduce this probability considerably.	Cost & Schedule	50%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
46	8	1	1	1	1	Environmental	Section 106 issues expected (discoveries pre-construction)	Mitigation associated with historical and archeological findings pre-construction. Is there anything beyond what is in the base? e.g., a stakeholder may request additional investigations/mitigation.	Applicable to geotech investigations as well. The survey would reduce this probability considerably.	Cost & Schedule	50%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0

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												Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
47	23	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	10%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
48	21-22	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	40%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
49	13-18	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	40%	trigen	\$10,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
50	19-20	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	90%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
51	25	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	75%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0

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												Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
52	26	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	20%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
53	24	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	10%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
54	28	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	30%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
55	27	1	1	1	1	Environmental	Inadvertent discoveries/archeological findings during construction	Very rich history. Very likely to find human remains (close to 100% is consensus). Consultation with the tribes underway. Impact of findings on project schedule uncertain: will depend on negotiations with the tribes. Archeological findings in wet areas likely as well.	Need to quantify the cost before adding the probability.	Depends on the size of the site, the expedition needed of the excavation and the need to bring in tribes.	Cost & Schedule	40%	trigen	\$5,000,000	\$3,000,000	\$7,000,000	trigen	6.0	3.0	9.0
56	23	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Took previous costs and allocated costs proportionally based on the amount of structures being demolished. Protect surrounding area from dust and debris	Cost & Schedule	10%	trigen	\$1,000,000	\$500,000	\$1,500,000	uniform		0.0	3.0
57	21-22	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. Assume the SB bridge is in the base (lead paint).	Took previous costs and allocated costs proportionally based on the amount of structures being demolished. Protect surrounding area from dust and debris	Cost & Schedule	10%	uniform	\$3,000,000	\$5,000,000		uniform		0.0	3.0

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												Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)
58	13-18	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. <i>Assume the SB bridge is in the base (lead paint).</i>	Cost & Schedule	25%	uniform		\$7,000,000	\$10,000,000	uniform		0.0	3.0
59	19-20	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. <i>Assume the SB bridge is in the base (lead paint).</i>	Cost & Schedule	10%	uniform		\$1,000,000	\$2,000,000	uniform		0.0	3.0
60	25	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. <i>Assume the SB bridge is in the base (lead paint).</i>	Cost & Schedule	10%	trigen	\$1,000,000	\$500,000	\$1,500,000	uniform		0.0	3.0
61	26	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. <i>Assume the SB bridge is in the base (lead paint).</i>	Cost & Schedule	10%	trigen	\$1,000,000	\$500,000	\$1,500,000	uniform		0.0	3.0
62	24	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. <i>Assume the SB bridge is in the base (lead paint).</i>	Cost & Schedule	10%	trigen	\$1,000,000	\$500,000	\$1,500,000	uniform		0.0	3.0
63	28	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. <i>Assume the SB bridge is in the base (lead paint).</i>	Cost & Schedule	0%								
64	27	1	1	1	1	Environmental	Environmental impacts of demolition work project-wide (above ground)	Risks associated with demolition work: above water (bridges), asbestos pipes, lead paint, lead in concrete, etc. Level of contamination unknown.	Demolition significant issue/impact. Conditions unknown. Need local expert. <i>Assume the SB bridge is in the base (lead paint).</i>	Cost & Schedule	0%								
65	8	1	1	1	1	Environmental	Negative community impacts expected (environmental justice issues)	Potential lawsuit on EJ issues; various pressures from communities (e.g., pressure for Community Investment Fund = compensation for impacted communities)		Cost & Schedule	10%	trigen	\$10,000,000	\$5,000,000	\$10,000,000	uniform		0.0	3.0
66	11	1	1	1	1	Environmental	Environmental regulations change	Water quality and endangered species list. Schedule impact larger if change occurs later.		Cost & Schedule	20%					uniform		3.0	6.0

#	Activity	Identification						Quantitative Analysis											
		2a - Mill District	2a - Clark College	3a - Mill District	3a - Clark College	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)			Schedule Impact (Months)				
												Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)
67	19	1	1	1	1	External	Required freeway lid in city of Vancouver	About 50% probability will be added to project. Required by City of Vancouver as part of re-development (new condos, library, ect.)	Add cost into baseline. (Assume 4 to 5 x Evergreen Bridge plus mar-ups)	Cost	70%	trigen	\$50,000,000	\$40,000,000	\$80,000,000				
68	13-18	1	1	1	1	Environmental	Limitations on construction site access and material delivery	Limitations on time barges can stay on site (predator fishes hiding below barges to attack outgoing smolts. Would add to delivery/construction costs.		Cost	60%	trigen	\$15,000,000	\$10,000,000	\$20,000,000				
69	8	1	1	1	1	External	Local communities pose objections	Risk: objections before ROD. Likely that one community will hold up decision and stop or slow down project. For example: opposition to tolling; selection of transit mode.	Some community risks accounted for under environmental. Cost impacts captured under environmental.	Schedule	15%					uniform		6.0	12.0
70	16, 27, 28, 29,	1	1	1	1	External	Funding changes for fiscal year	Likelihood of New Starts funding? Risk = likelihood of funding shortages being an issue. Schedule impact only (missing "a cycle").	Note: Initially, probability of 80% and impact between 12 and 48 months. But, even with no FTA approval, can go all the way to ROD 11/08. Removed 9 months from range. Changed to discrete distribution after discussion with transit SMEs.	Schedule	15%					trigen	12.0	6.0	18.0
71	5	1	1	1	1	External	Stakeholders request late changes	Requests very likely. Cost impacts accounted for in other risks. Limited schedule impacts.		Schedule	20%				trigen	6.0	4.0	8.0	
72	5	1	1	1	1	Organizational	Internal "red tape" causes delay getting approvals, decisions	Issue: getting feedback from 39-member Task Force (inc. local agencies, neighborhood organizations, etc.). Is Task Force an opportunity for taking decisions earlier? Overall: minimal impact on schedule: a "wash."	Continued work with task force will lower risks.	Schedule	20%				No Dist.	3.0			
73	All interchange	1	1	1	1	Right of Way	Change in right-of-way costs due to condemnation	About 10% of properties go to condemnation.	Add potential of condemnation to baseline.	Cost	50%	trigen	\$13,000,000	\$10,000,000	\$20,000,000				
74	10	1	1	1	1	Right of Way	Access plan, access hearings, justification report	Baseline schedule does not provide enough time. Needs to be completed before ROD. Note: no acquisition before the ROD.	Revise baseline schedule.	Schedule	20%				trigen	9.0	6.0	12.0	
75	21	1	1	1	1	Right of Way	Inadequate baseline schedule for property acquisition and relocation	Base duration (about 1.5 year) is too short. Minimum 24 months for commercial properties relocation.	Hayden Island	Schedule	75%				uniform		3.0	6.0	

#	Activity	Identification						Quantitative Analysis											
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												Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)
76	21					Right of Way	Must purchase whole Red Lion Hotel (Jantzen Beach) because the removal of a wing makes it economically not viable			Cost	25%	trigen	\$20,000,000	\$15,000,000	\$25,000,000				
77	19, 20	1	1	1	1	Right of Way	Must purchase whole Red Lion At The Quay Hotel because the removal of a piece of the structure makes it economically not viable			Cost	25%	trigen	\$10,000,000	\$8,000,000	\$15,000,000				
78	10	1	1	1	1	Right of Way	Change in right-of-way costs due to market expectations	How will market expectations of project development impact property prices? Research indicates premiums of 4 to 6% (residential) and 6 to 8% (commercial). About 60% commercial; 40% residential.	Allow 6% for ROW purchase only.	Cost	80%	trigen	\$7,000,000	\$5,000,000	\$10,000,000				
79	19-20	1	1	1	1	Right of Way	Railroad involvement	Crossing of railroad properties. Schedule issue: getting the railroad to agree (railroad will want to review all NEPA and engineering documents). Early coordination needed / planned for documents review. Additional risks: no construction above tracks during fourth quarter.		Schedule	30%					uniform		4.0	8.0
80						Right of Way	Railroad involvement	Crossing of railroad properties. Schedule issue: getting the railroad to agree (railroad will want to review all NEPA and engineering documents). Early coordination needed / planned for documents review. Additional risks: no construction above tracks during fourth quarter.		Schedule	0%								
81	10	1	1	1	1	Right of Way	Cost increase due to condemnation litigation (legal fees only)	Factoring in % of properties sent to condemnation (10%), cost impact = 3% to 5% of base costs.	Allow 4% for total ROW costs.	Cost	10%	No Dist.	\$5,000,000						
82	10	1	1	1	1	Right of Way	Underestimation of number of parcels to be acquired for final alignment / alternative	Impact is 10% additional parcels / cost (10% of base costs). No schedule impact.	Allow 10% for total ROW costs.	Cost	25%	uniform	\$13,000,000	\$10,000,000	\$20,000,000				
83						Right of Way	Underestimation of number of parcels to be acquired for final alignment / alternative	Impact is 10% additional parcels / cost (10% of base costs). No schedule impact.	Allow 10% for total ROW costs.	Cost	0%		\$14,000,000						

#	Activity	Identification						Quantitative Analysis											
		2a - Mill District	2a - Clark College	3a - Mill District	3a - Clark College	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)				Schedule Impact (Months)			
												Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)
84	13-18	1	1	1	1	Technical / Structure	Structural design incomplete or in error (existing structures over Columbia river)	Delays associated with agreement on bridge upgrade / retrofit design. Cost overrun likely as well.	Potential mitigation is retrofit memorandum be developed.										
85	13-18	1	1	1	1	Technical / Structure	Inaccurate assumptions on technical issues in planning stage	Coast guard hearings and issues with barges => changing location of railroad bridge / realignment possible? Considered in evaluation of alternatives? Dealbreaker if realignment required? No.	FAA requirements?? FAA review should be added to baseline schedule.	We have been meeting regularly with the Coast Guard and FAA	Cost	0%							
86	13-18	1	1	1	1	Technical / Structure	Context sensitive solutions (river crossing)		VE team assumption is that this is only amenities	Thinks \$25 M is high, but comes from the VE that they think the above and beyond amenities may amount to this much for such a large bridge	Cost	50%	uniform		\$5,000,000	\$15,000,000			
87	13-18	1	1	1	1	Technical / Structure	Signature bridge	Added costs for structure type (20% premium over segmental box estimate)	Conflicts with airspace restrictions limits this possibility.	Thinks \$150 M is high to switch to a signature bridge, because there are so many limitations due to airspace issues.	Cost	10%	uniform		\$50,000,000	\$150,000,000			
88	13-18	1	1	1	1	Technical / Structure	Structural design incomplete (new structures)	Issue: foundation type: limited information now.	Opportunity for cost reductions through more geotech investigations, inwater work strategies, addressing fish issues, wider spans/less foundation work, etc.		Cost								
89	13-18					Technical / Structure	Structural design incomplete (new structures)	Issue: foundation type: limited information now.	Opportunity for cost reductions through more geotech investigations, inwater work strategies, addressing fish issues, wider spans/less foundation work, etc.		Cost	0%							
90	28	1	1	1	1	Transit	Maintenance and storage facility for BRT	Costs are included in Baseline Estimate	See VE recommendations.		Cost								
91						Transit	Maintenance and storage facility for BRT	Costs are included in Baseline Estimate	See VE recommendations.		Cost	0%							
92	27	1	1	1	1	Transit	Maintenance and storage facility for BRT	Costs are included in Baseline Estimate	See VE recommendations.		Cost								
93						Transit	Maintenance and storage facility for BRT	Costs are included in Baseline Estimate	See VE recommendations.		Cost	0%							
94	28	1	1			Transit	Cost of complete street rebuild along the high-capacity transit corridor	Is this included in the baseline cost estimates? Yes. But some risk around it. Also, could be on two separate streets.	No couplets on BRT South	Assumed we have double tracks then there are additional	Cost	0%		\$0					
95	27	1	1	1	1	Transit	Cost of complete street rebuild along the high-capacity transit corridor	Is this included in the baseline cost estimates? Yes. But some risk around it. Also, could be on two separate streets.	Assume 4,000 ft @ \$2,500 for road recon & streetscape plus tax and mark-up.	Rebuild over and above guideway costs	Cost	10%	trigen	\$20,000,000	\$10,000,000	\$30,000,000			
96	All Construction Costs	1	1	1	1	Project	Other major projects in the area at the same time?	Construction activities and conflicts with other companies. Maintenance of traffic and constructibility.	Working with other agency to coordinate construction impacts.	Strong interest expressed from contractors low probability, potential to not get bonding if spread too thin high costs?	Cost & Schedule	20%	uniform		\$50,000,000	\$150,000,000			

#	Activity	Identification						Quantitative Analysis															
		2a - Mill District	2a - Clark College	3a - Mill District	3a - Clark College	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)				Schedule Impact (Months)							
												Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)				
97		1	1	1	1	Project	Market conditions	Funding, labor, and materials. Contractor availability		Covered above and in escalation	Cost	0%											
98	5	1	1	1	1	Project	Third Parties, i.e., local agencies	Permit conditions from local agencies and requirements for added emergency services.	Purchasing equipment as project mitigation.		Cost	20%	uniform		\$5,000,000	\$10,000,000							
99	5	1	1	1	1	Project	Interagency agreements/MOAs and MOUs	Agreements must be in place prior to funding obligations	All agencies such as FAA, FTA, Coast Guard, cities, counties, etc.		Schedule	30%					uniform		1.0	3.0			
100		1	1	1	1	Project	Delivery methods	What contracting laws? Which statutes apply? How many contract packages?	Design-bid-build? Design-build? Other?	To early to quantify this risk	Cost & Schedule												
101	23	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	40%	No Dist.	\$9,000,000									
102	21-22	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	50%	uniform		\$5,000,000	\$10,000,000							
103						Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	0%		\$10,000,000									
104	13-18	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.	change 40% to 60%	Cost & Schedule	60%	No Dist.	\$13,000,000									
105						Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	0%		\$3,000,000									
106	19-20	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	60%	uniform		\$5,000,000	\$10,000,000							
107						Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	0%		\$10,000,000									
108	25	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	30%	No Dist.	\$1,000,000									

#	Activity	Identification										Quantitative Analysis								
		2a - Mill District	2a - Clark College	3a - Mill District	3a - Clark College	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)				Schedule Impact (Months)				
												Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)	
109						Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	0%		\$2,000,000						
110	26	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	30%	No Dist.	\$3,000,000						
111						Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	0%		\$1,000,000						
112	24	1	1	1	1	Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	40%	No Dist.	\$2,000,000						
113						Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	0%		\$3,000,000						
114						Construction	Maintenance of traffic during construction.	Staging plans are conceptual at this time. Uncertainties about how traffic will be maintained.	Assume 50% increase from 8% to 12%.		Cost & Schedule	0%		\$2,000,000						
115		1	1	1	1	Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	Bridge over Union not removed for Alts 2 & 3.	Shouldn't apply to hayden, river crossing or sr 14	Cost & Schedule	0%		\$0						
116						Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	Bridge over Union not removed for Alts 4 & 5.	Shouldn't apply to hayden, river crossing or sr 14	Cost & Schedule	0%		\$0						
117		1	1	1	1	Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.			Cost & Schedule	0%								
118						Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.			Cost & Schedule	0%								
119		1	1	1	1	Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	See line 6.		Cost & Schedule	0%								
120						Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	See line 7.		Cost & Schedule	0%								
121	26	1	1	1	1	Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	For 4P bridge over I-5 only.	Maybe lower percent to 30%	Cost & Schedule	30%	No Dist.	-\$15,000,000						
122						Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	For 4P bridge over I-5 only.		Cost & Schedule	0%		-\$15,000,000						

#	Activity	Identification								Quantitative Analysis											
		2a - Mill District	2a - Clark College	3a - Mill District	3a - Clark College	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)				Schedule Impact (Months)					
												Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)		
123	24	1	1	1	1	Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	For 500W to 5S ramp only.	30% for 2 and 3	Cost & Schedule	30%	No Dist.	-\$12,000,000							
124	24					Construction	Opportunity to reuse existing infrastructure.	The assumption is that all structures will be replaced.	For 500W to 5S ramp only.	40% for 4 and 5	Cost & Schedule	40%	No Dist.	-\$12,000,000							
125	8	1	1	1	1	Traffic	Changes in regional traffic models and/or design year.	MPO changes the regional model or delays to project revises design year.	Baseline should be updated to include impact results of 2035 traffic model. Changes to land use can impact model.	Effects the record of decision need to go to the 2035 year in projections, changes in land use of the models	Schedule	10%					uniform		6.0	12.0	
126		1	1	1	1	Right of Way	Opportunity to purchase available property.	Thunderbird Hotel is an example.	Property around the river is needed for construction staging as well as for the project.	VE recommendation, already captured, and not going to save time for now. Becomes an issue if the property gets purchased.	Cost	0%									
127		1	1	1	1		T-1 - LRT To Downtown Vancouver w/ Branded Bus	VE Recommendation	Included in base cost estimate												
128		1	1	1	1		T-2 - LRT on Main Street w/ Branded Bus	VE Recommendation	Included in base cost estimate												
129	27	1	1	1	1		T-3 - Park and Rides at Lincoln and Expo Center	VE Recommendation	From VE Team; -\$7 million at Ross and -\$40 million at Clark.			0%									
130		1	1	1	1		R-1 - 2 Cell Trapezoidal Segmental Box	VE Recommendation		Not at this level yet to impact this project.											
131	13-16	1	1	1	1		R-2 - 8' Diameter Driven Piles	VE Recommendation	From VE Team.	Currently 42 diameter pile based on WSDOT projections on the number of competition between contractors, but 8' piles could work and have less to drill in.		30%	uniform		-\$40,000,000	-\$20,000,000	uniform		-3.0	-2.0	
132		1	1	1	1		R-3 - No Seismic Retrofit of Substructure, Superstructure Retrofit only	VE Recommendation													
133	16	1	1	1	1		R-4 - HCT inside segmental box	VE Recommendation	From VE Team.	Eliminates everything over the river for transit. Now transit will have to wait until south is done to start work. Should push back the burn time until after the bridge is done, adds 3-6 months for downstream, but eliminates duration for the upstream process. Maybe capture schedule at a later date		50%	uniform		-\$100,000,000	-\$50,000,000					
134	16						R-4 - HCT inside segmental box	VE Recommendation	From VE Team.	Eliminates everything over the river for transit. Now transit will have to wait until south is done to start work. Should push back the burn time until after the bridge is done, adds 3-6 months for downstream, but eliminates duration for the upstream process. Maybe capture schedule at a later date		50%	uniform		-\$100,000,000	-\$50,000,000				-24.0	-18.0
135		1	1	1	1		R-5 - Constructability	VE Recommendation	No cost impacts, schedule impacts captured in other risks (upstream v downstream)												

#	Activity	Identification						Quantitative Analysis											
		2a - Mill District	2a - Clark College	3a - Mill District	3a - Clark College	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)				Schedule Impact (Months)			
												Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)
136	19-20	1	1	1	1		W-1 - Main Street Extension to Columbia Blvd	VE Recommendation	From VE Team.		90%	uniform		\$3,000,000	\$5,000,000				
137	19-20	1	1	1	1		W-2 - Connect SR14 WB to Columbia with SR5 to C Street	VE Recommendation	From VE Team.		50%	uniform		\$1,000,000	\$15,000,000				
138		1	1	1	1		W-3 - Remove Ramp Meter from Mill Plain NB On Ramp	VE Recommendation	Negligible cost impact.		0%								
139		1	1	1	1		W-4 - Evaluate Tight Diamond at Mill Plain	VE Recommendation	Assessed elsewhere.		0%								
140	26	1	1	1	1		W-5 - Evaluate removing access at 4th Plain	VE Recommendation			1%	No Dist.	-\$116,000,000						
141	25	1	1	1	1		W-6 - Relocate Fourth Plain NB Braided Ramp at Mill Plain	VE Recommendation			20%	uniform	-\$50,000,000	-\$10,000,000					
142		1	1	1	1		W-7 - Eliminate I-5 SB to SR500 EB Tunnel	VE Recommendation	Recommendation not accepted		0%								
143		1	1	1	1		W-8 - Construct SR500 Interchange First	VE Recommendation	No cost or schedule benefits		0%								
144		1	1	1	1		W-9 - Do not shift I-5 between 4th Plain and SR500 if HCT is on Main Street	VE Recommendation	Based on difference in mainline between Alts 2 & 3 and Alts 4 & 5.	This is included in the transit alignment costs									
145	21,22	1	1	1	1		O-1 - Shift I-5 Alignment across Hayden Island outside the footprint of the existing freeway	VE Recommendation	Double earthwork minus demolition of Safeway and Red Lion.	May be able to save time but not likely	70%	trigen	\$6,000,000	\$4,000,000	\$10,000,000				
146	21,22	1	1	1	1		O-2 - Keep the profile elevated across Hayden Island	VE Recommendation	85,000 SF bridge @ \$300 minus 20% for earthwork and pavement.		40%	trigen	\$33,000,000	\$20,000,000	\$40,000,000				
147		1	1	1	1		O-3 - Remove Ramp Meter from Marine Drive NB On Ramp	VE Recommendation	Negligible cost impact.		0%								
148		1	1	1	1		O-4 Combine O-1 through O-3, use existing slough bridge for connection between Marine Drive and Hayden Island	VE Recommendation			0%								
149	13-16, 31	1	1	1	1		Need to provide additional tugs/lows during construction for river navigation			Cost	50%	trigen	\$10,000,000	\$7,500,000	\$15,000,000				

#	Activity	Identification							Quantitative Analysis										
		2a - Mill District	2a - Clark College	3a - Mill District	3a - Clark College	Functional Assignment	Threat / Opportunity Events	SMART Column	Additional Panelists' Comments	Type	Prob.	Cost Impact (\$)				Schedule Impact (Months)			
												Dist.	V1	V2 (L)	V3 (H)	Dist.	V1	V2 (L)	V3 (H)
150	13-16, 31	1	1	1	1		Experience of contractor for foundations and superstructure				40%					trigen	9.0	6.0	12.0
151	13-18	1	1	1	1		Construction restrictions due to In Water Work Windows		Currently there is only a 4 month in water window to perform work, staging assumes no in water work limitations		30%					trigen	6.0	3.0	9.0
152	13-18						Construction restrictions due to In Water Work Windows		Currently there is only a 4 month in water window to perform work, staging assumes no in water work limitations		30%					trigen	10.0	6.0	14.0
153	13-16, 31	1	1	1	1		Performance of expected pile installation methods				30%					trigen	6.0	3.0	9.0
154	13-16, 31	1	1	1	1		Availability of pile installation equipment		With 8' driven piling, equipment availability is an issue		30%					trigen	6.0	3.0	9.0
155	13-16, 31	1	1	1	1		Compliance with permitting requirements for work in the water		Concerns about water quality compliance and vibration management		30%					trigen	12.0	6.0	18.0

APPENDIX D: RISK ASSESSMENT PROCESS - OVERVIEW & MODELING APPROACH

The cost risk assessment approach can be categorized within six key steps:

1. Develop a flowchart of the project that dictates the baseline key activities and their schedule;
2. Assess the base costs, which are defined as those costs which can be reasonably expected;
3. Examine the risk surrounding base costs and develop ranges, when applied, to cost line items with substantial level of uncertainty;
4. Develop a risk register for the project;
5. Within a consensus-based process, assess the likelihood of the event risks and their potential impact on project cost and/or schedule by activity; and
6. Identify risk mitigation actions.

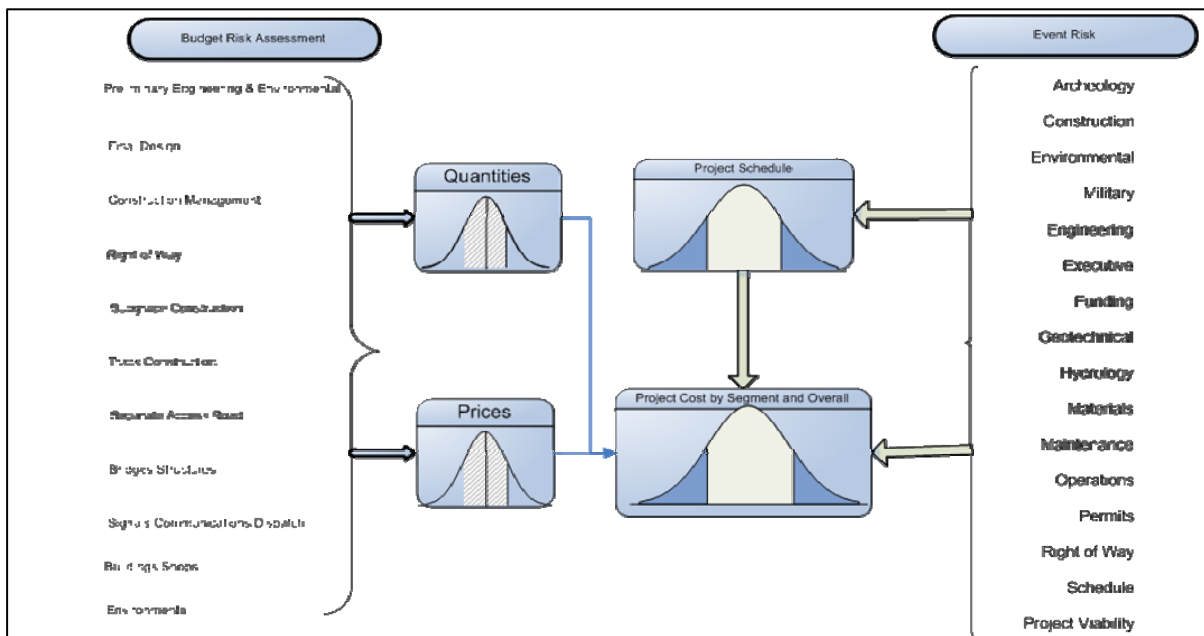


Figure H-1 – Illustration of the Risk Assessment Process

Figure H-2 portrays how a risk factor is assessed within the framework used in this workshop:

1. Identify a risk factor;
2. Determine a probability level of occurrence, which can also be entered as a range;
3. Determine the impact of the risk factor on cost and schedule if it occurs, which also can be entered as a range;
4. The model combines the probability with the impact to produce the overall impact of the project schedule and cost.

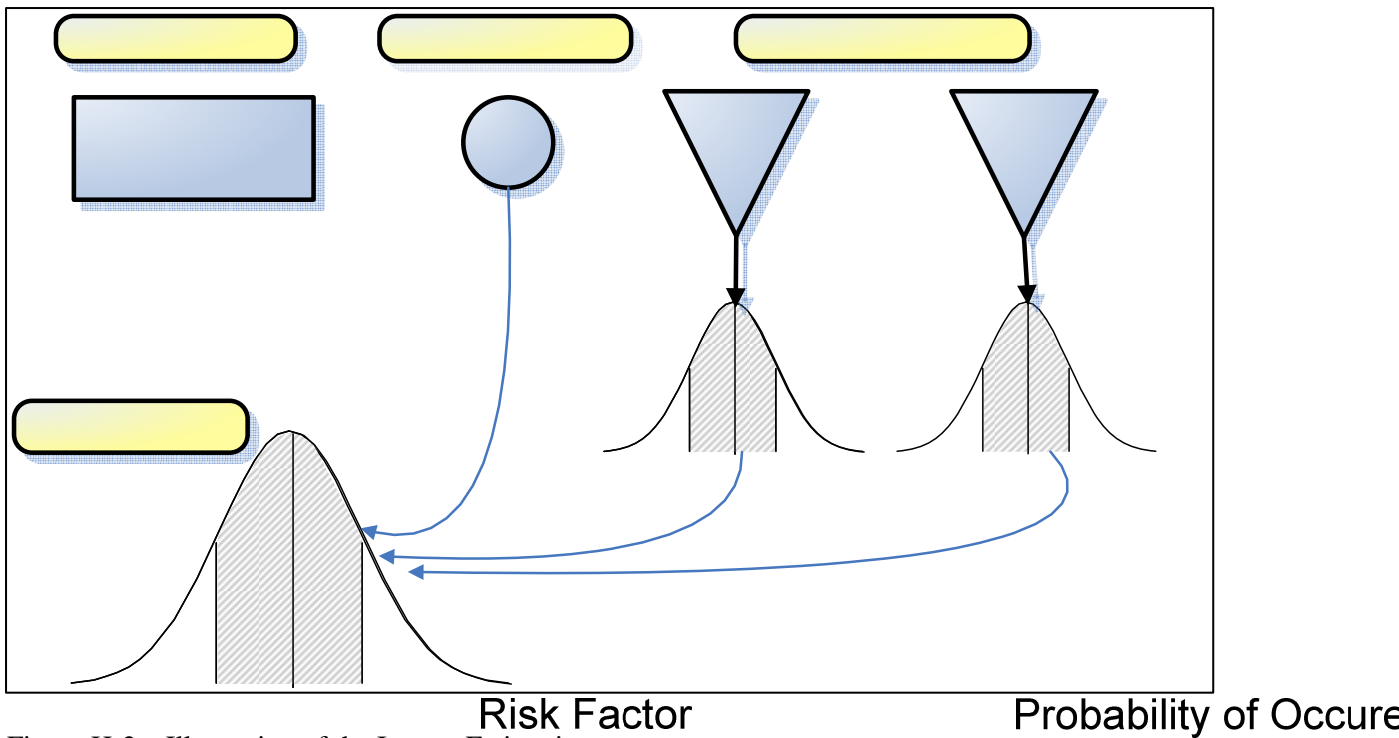


Figure H-2 – Illustration of the Impact Estimation

**Delay of NEPA
Process**

33%

APPENDIX E: PRELIMINARY RESULTS PRESENTATION WITH UPDATED BASE COSTS

The following pages contain the power point presentation of the final results for the full length alternatives.

Columbia River Crossing

COLUMBIA RIVER CROSSING PROJECT

Cost Risk Analysis

Summary of Assumptions & Preliminary Results

All results are preliminary and subject to revisions

Prepared by:

HDR | HLB Decision Economics Inc.
with Participation from the Project Team

October 5, 2007



Introduction

◆ Document Structure

- Flowcharts and Assumptions – slides 3-11
- Project Costs – slides 12-30
- Project Schedule – slides 31-45
- Project summary – slides 46-47

◆ Alternatives under review in this presentation:

- #2a: Replacement Crossing Downstream with BRT
- #2b: Replacement Crossing Upstream with BRT
- #3a: Replacement Crossing Downstream with LRT
- #3b: Replacement Crossing Upstream with LRT
- #4: Supplemental Crossing with BRT (updated base costs)
- #5: Supplemental Crossing with LRT (updated base costs)

◆ Project Design is approximately 10%.

Project Assumptions

◆ **Vancouver Alignment:**

- **Assumes with 100% probability that the Vancouver Transit Alignment will occur**
- **Assumes with 100% probability that the Kiggins Bowl/Lincoln Park and Ride will need to redo only the Vancouver Interchanges and not the structure**

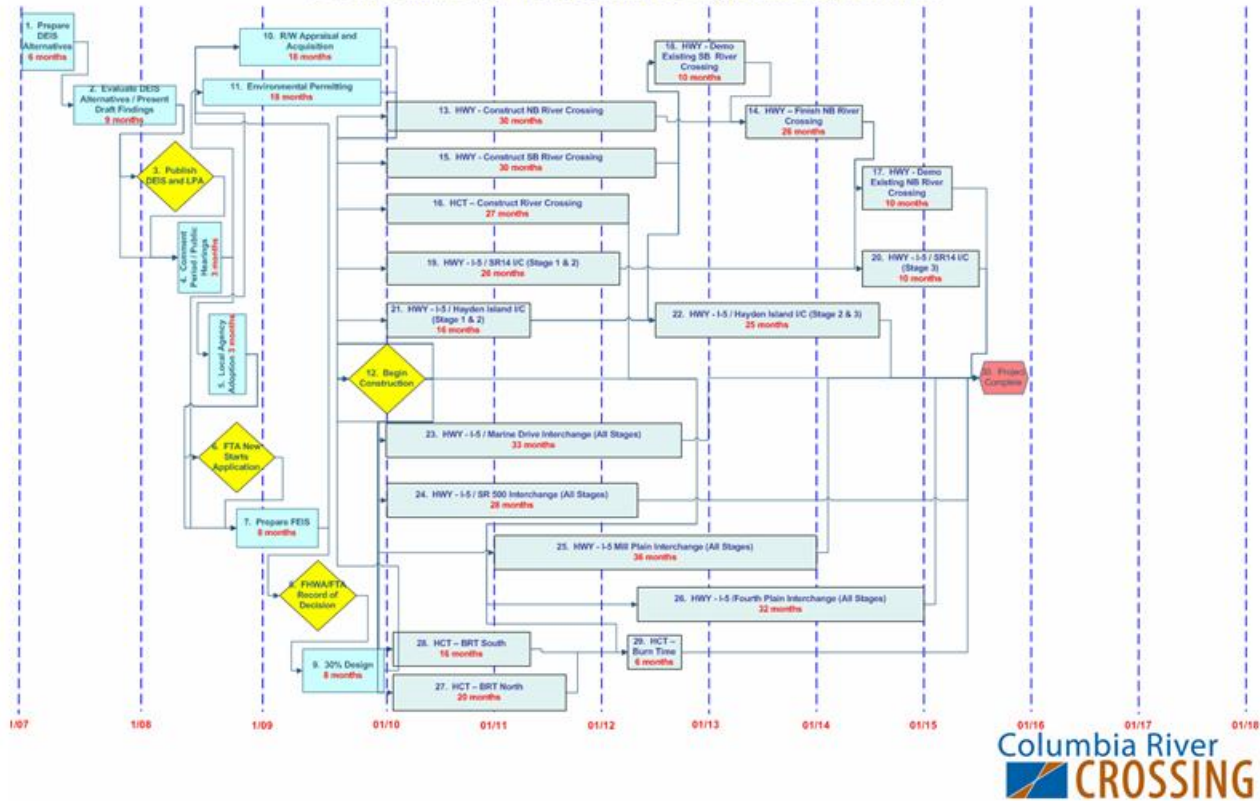
◆ **I-5 Alignment:**

- **Assumes with 100% probability that the Vancouver Transit Alignment will not occur**
- **Assumes with 100% probability that the Kiggins Bowl/Lincoln Park and Ride will need to redo the whole structure at Lincoln**

I-5 COLUMBIA RIVER CROSSING PROJECT

Project Flowchart 2a, Downstream Replacement w/ BRT

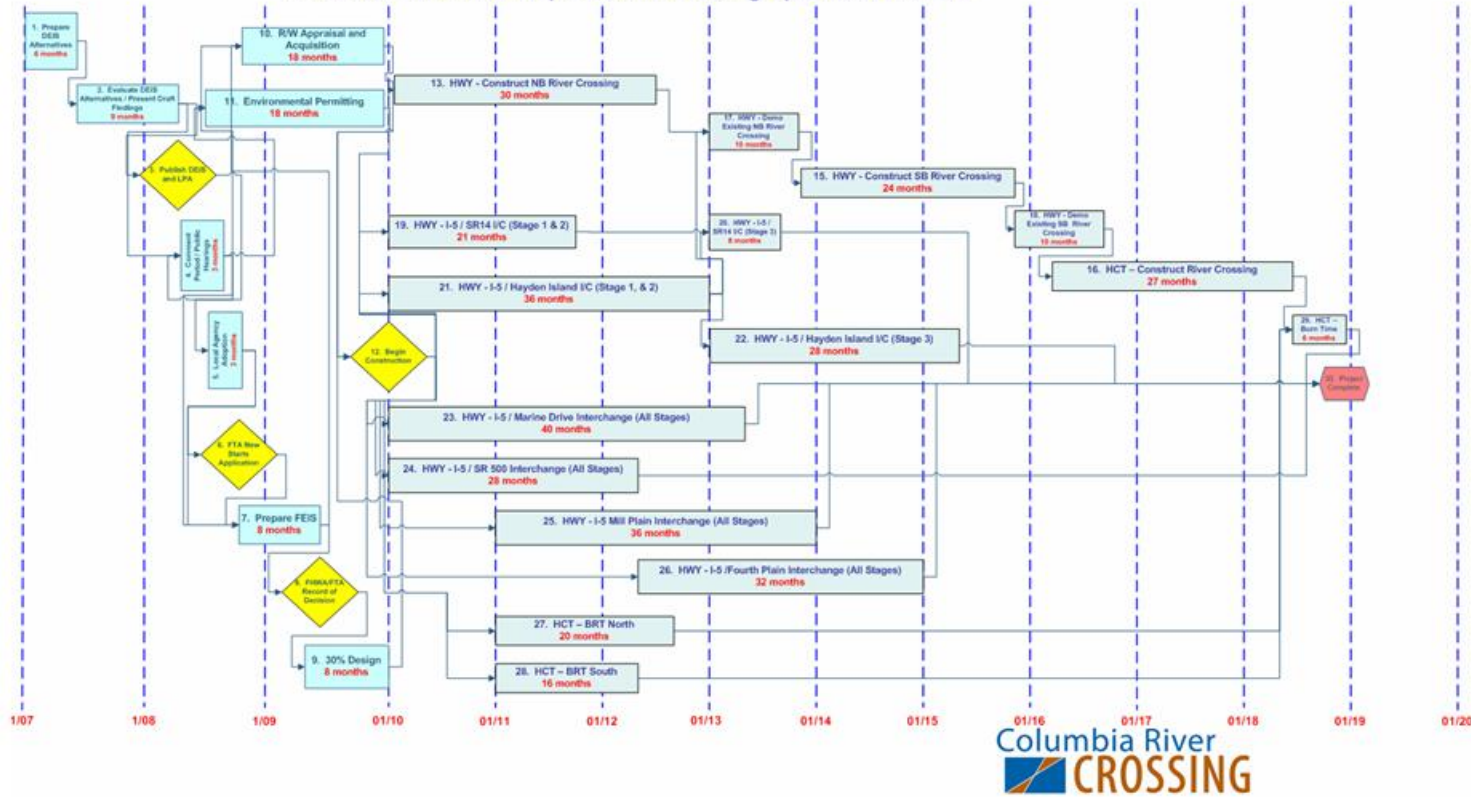
July 2007 Risk Assessment Preliminary Flowchart
DEIS Alternative #2a - Replacement Crossing Downstream With BRT



I-5 COLUMBIA RIVER CROSSING PROJECT

Project Flowchart 2b, Upstream Replacement w/ BRT

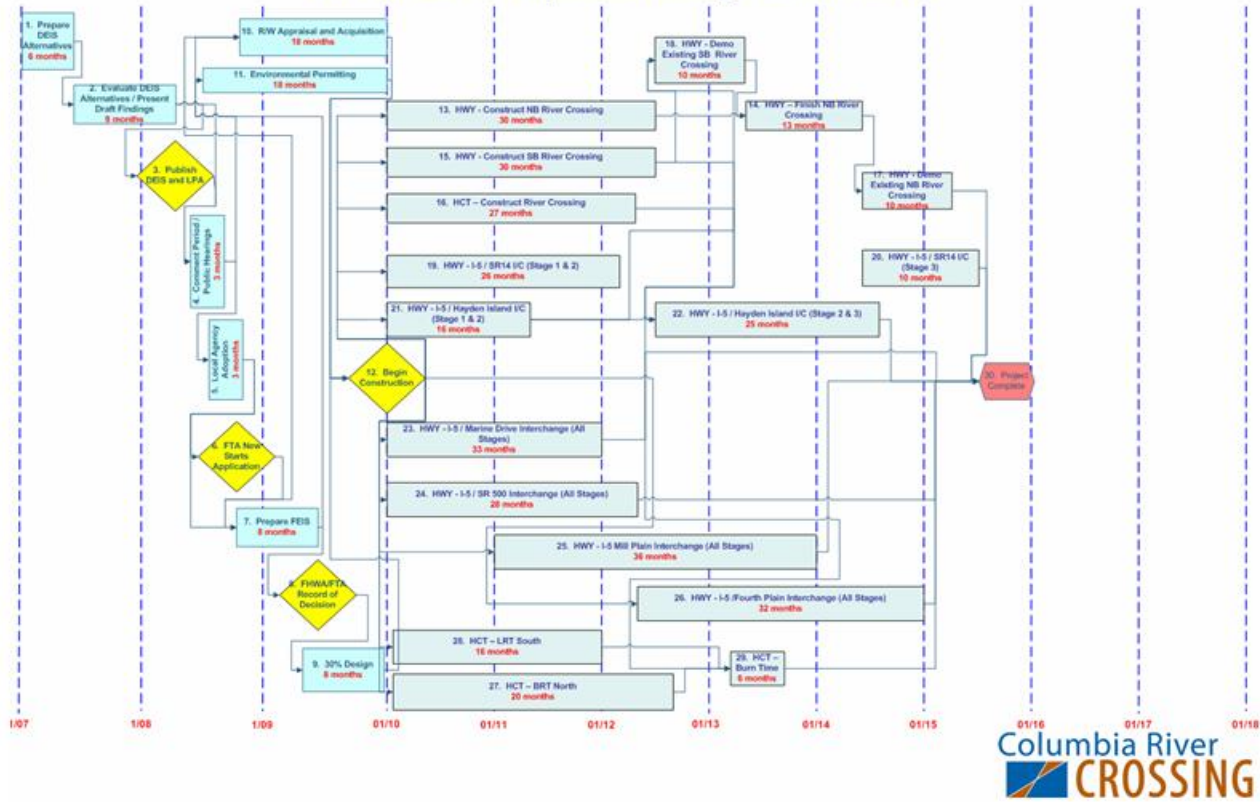
July 2007 Risk Assessment Preliminary Flowchart
DEIS Alternative #2b - Replacement Crossing Upstream With BRT



I-5 COLUMBIA RIVER CROSSING PROJECT

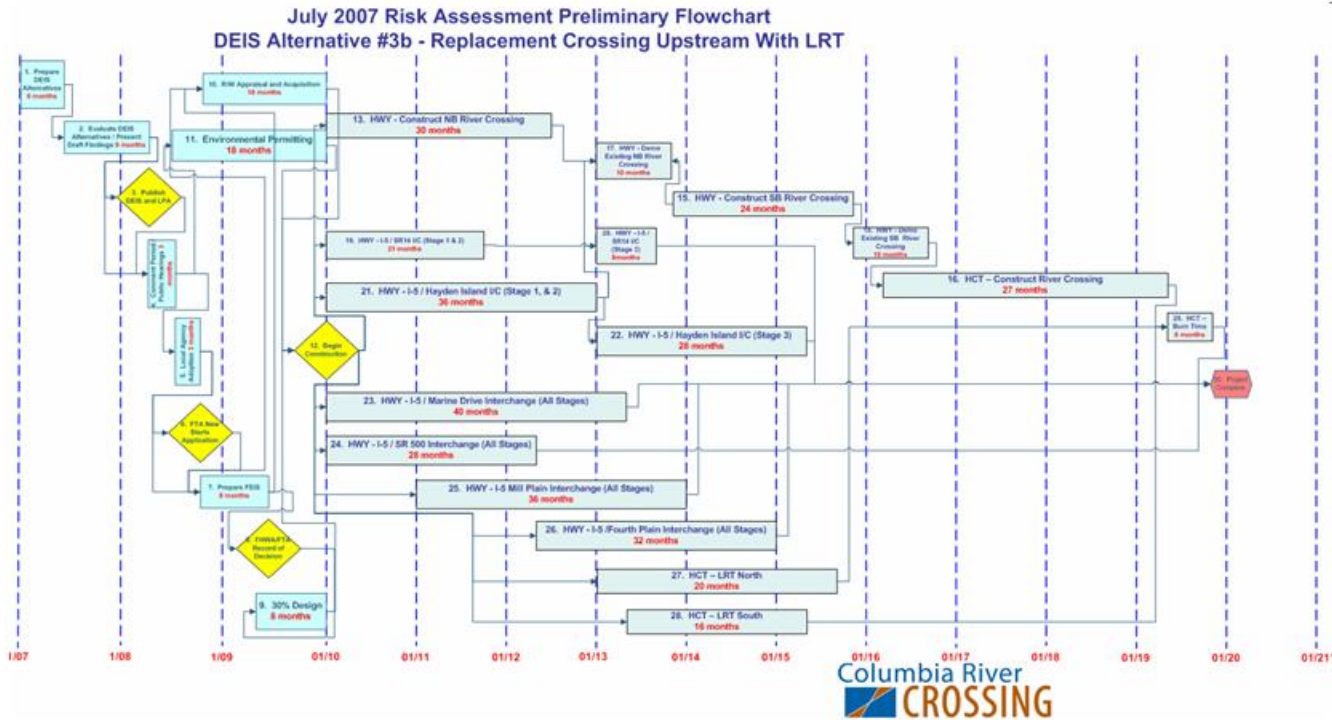
Project Flowchart 3a, Downstream Replacement w/ LRT

July 2007 Risk Assessment Preliminary Flowchart
DEIS Alternative #3a - Replacement Crossing Downstream With LRT



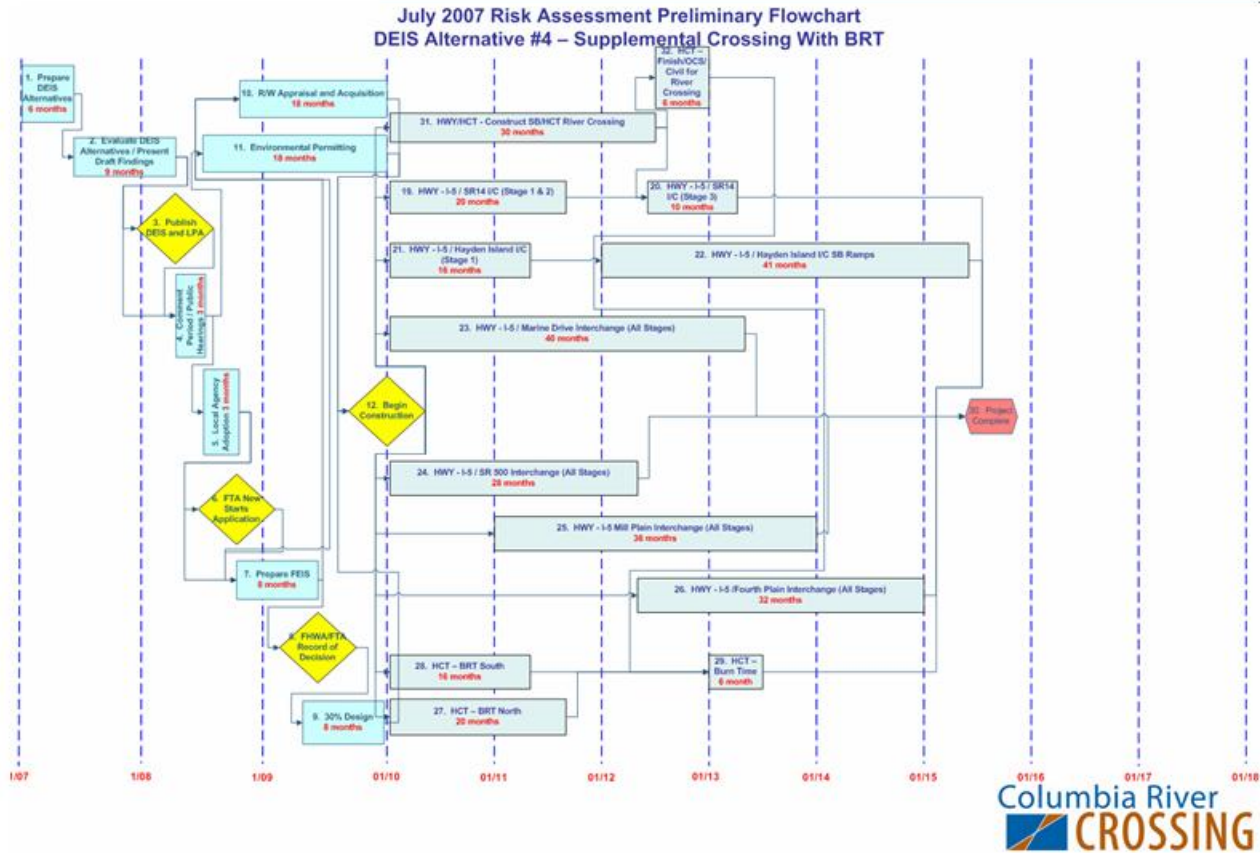
I-5 COLUMBIA RIVER CROSSING PROJECT

Project Flowchart 3b, Upstream Replacement w/ LRT



I-5 COLUMBIA RIVER CROSSING PROJECT

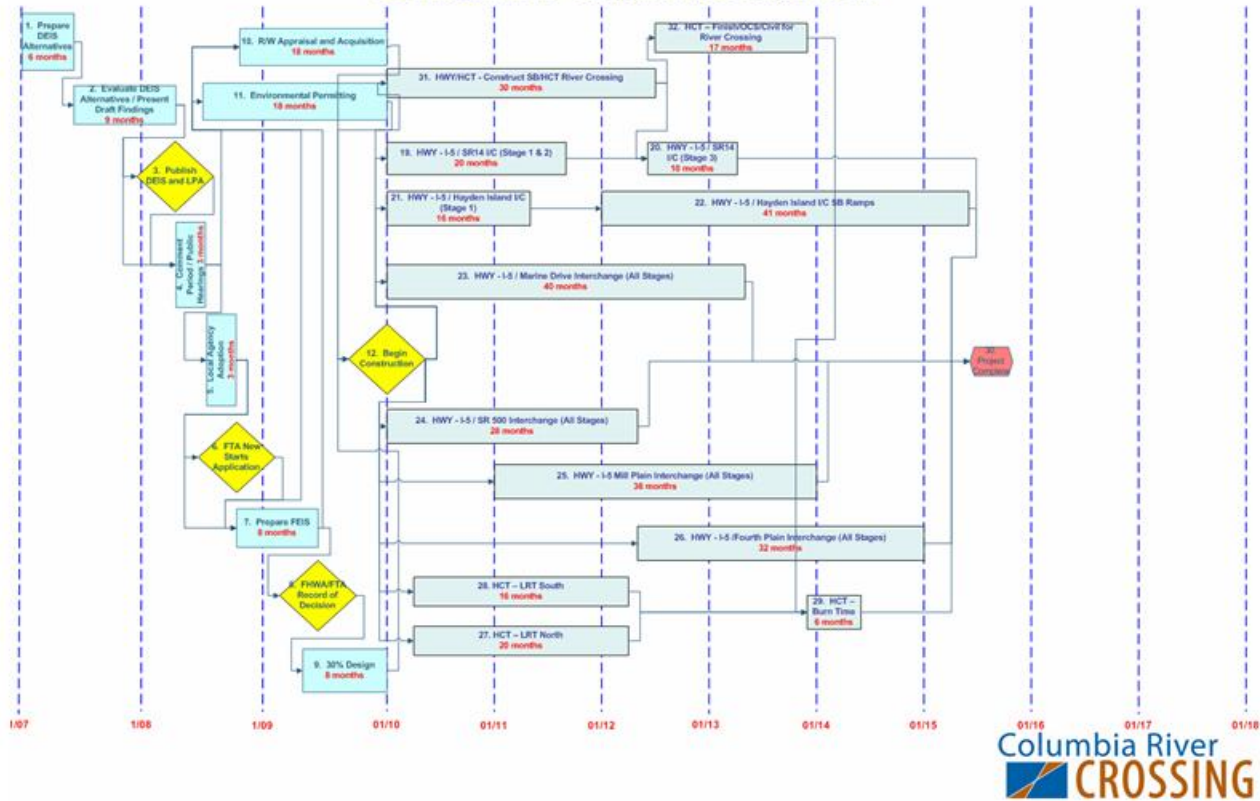
Project Flowchart 4, Supplemental Crossing w/ BRT



I-5 COLUMBIA RIVER CROSSING PROJECT

Project Flowchart 5, Supplemental Crossing w/ LRT

July 2007 Risk Assessment Preliminary Flowchart
DEIS Alternative #5 - Supplemental Crossing With LRT



I-5 COLUMBIA RIVER CROSSING PROJECT

Base Cost Estimate Uncertainties

Description	Low	High
Pavement	-10.00%	15.00%
Earthwork	-10.00%	20.00%
Bridges	-15.00%	20.00%
Walls	-10.00%	20.00%
Other	-10.00%	10.00%
Guideway	-5.00%	20.00%
Tracks	-10.00%	15.00%
Stations	-10.00%	20.00%
Sitework	-5.00%	20.00%
Systems	-5.00%	20.00%
Non-Distributed Construction Costs	-5.00%	15.00%
Non-Distributed Construction Costs (Bridge)	-5.00%	15.00%
Professional Services	-5.00%	15.00%
Support Facilities and Vehicles	-5.00%	15.00%
Right-of-Way	-5.00%	15.00%
Right-of-Way (Bridge)	-5.00%	10.00%

Values are percentage deviations around the baseline estimates with the low defined as the lower 10% value and the high defined as the upper 10% value. Applicable to all projects.

Escalation Factors

- ◆ **Construction costs were escalated with an annually adjusted rate from projections developed in a previous HDR study for WSDOT on construction escalation. The annual estimates are presented in the table below.**
- ◆ **Preliminary engineering and right-of-way costs are escalated with a flat rate indicated in the chart below.**

Year	Median	Lower 10% Limit	Upper 10% Limit
2006	5.20%	2.80%	8.50%
2007	5.20%	2.80%	8.50%
2008	5.20%	2.80%	8.50%
2009	4.90%	2.20%	8.60%
2010	4.50%	1.60%	8.60%
2011	4.20%	1.00%	8.70%
2012	3.90%	0.40%	8.80%
2013	3.50%	-0.20%	8.80%
2014	3.20%	-0.80%	8.90%
2015	2.80%	-1.40%	8.90%
2016	2.50%	-2.00%	9.00%
2017	2.50%	-2.00%	9.00%
2018	2.50%	-2.00%	9.00%
2019	2.50%	-2.00%	9.00%
2020	2.50%	-2.00%	9.00%
2021	2.50%	-2.00%	9.00%

	Median	Lower 10% Limit	Upper 10% Limit
Preliminary Engineering	2.00%	2.80%	3.60%
Right-of-Way	4.00%	6.80%	9.60%

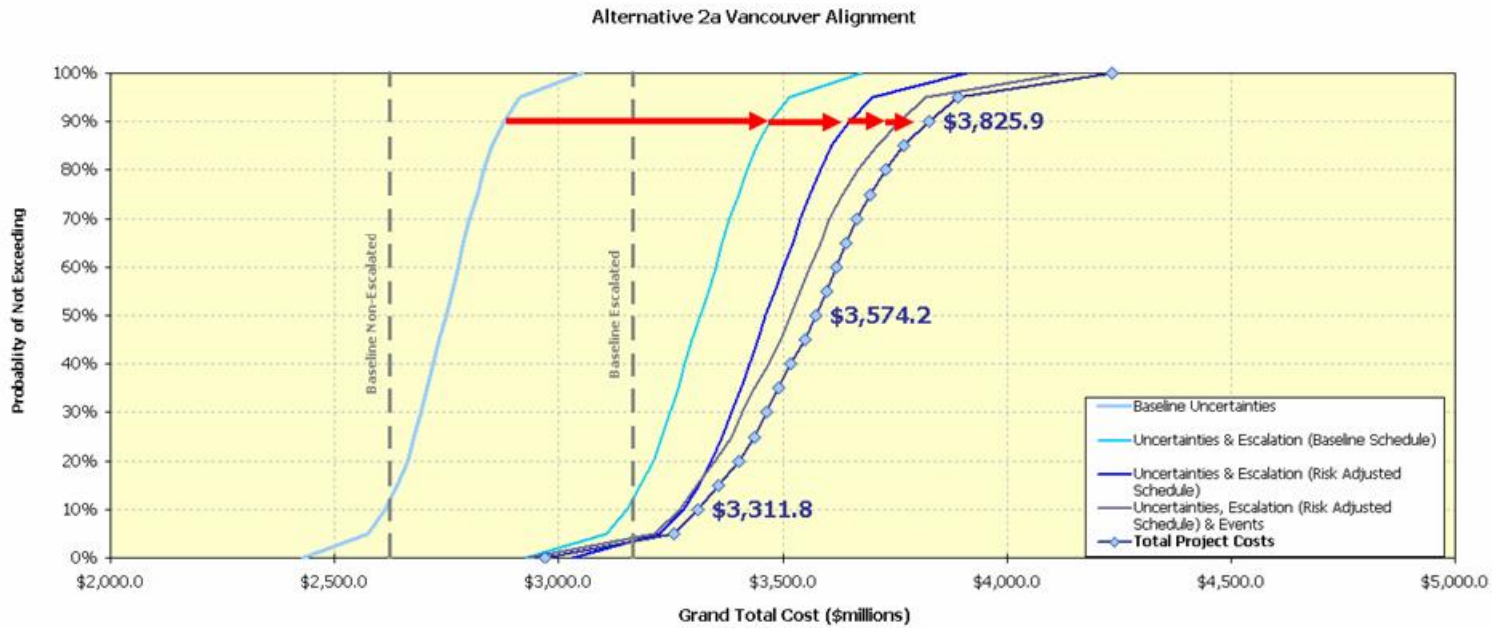
I-5 COLUMBIA RIVER CROSSING PROJECT

Total Project Costs Summary 2a, Downstream Replacement w/ BRT



I-5 COLUMBIA RIVER CROSSING PROJECT

Total Project Costs Decomposition 2a, Downstream Replacement w/ BRT

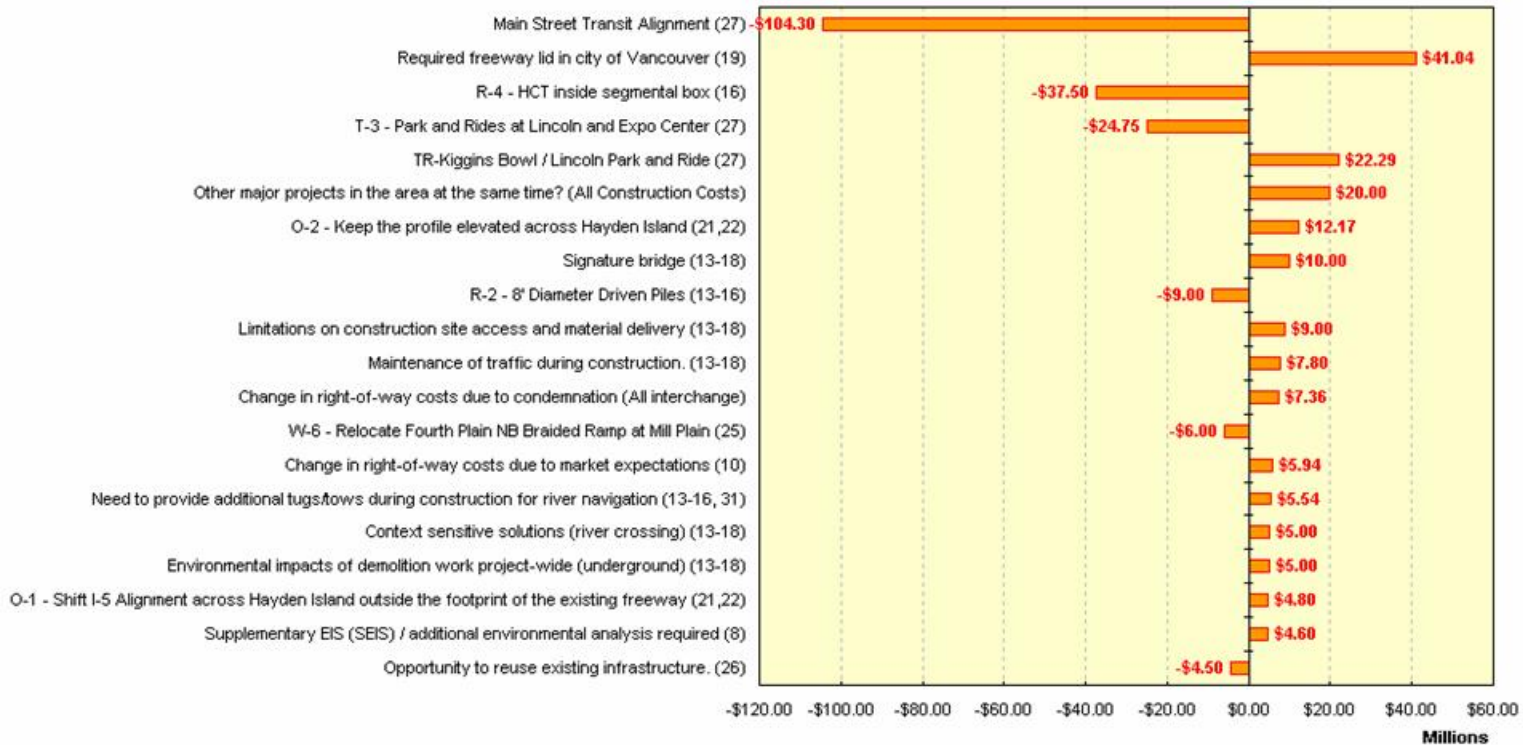


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I-5 COLUMBIA RIVER CROSSING PROJECT

Identification of Key Cost Risks 2a, Downstream Replacement w/ BRT

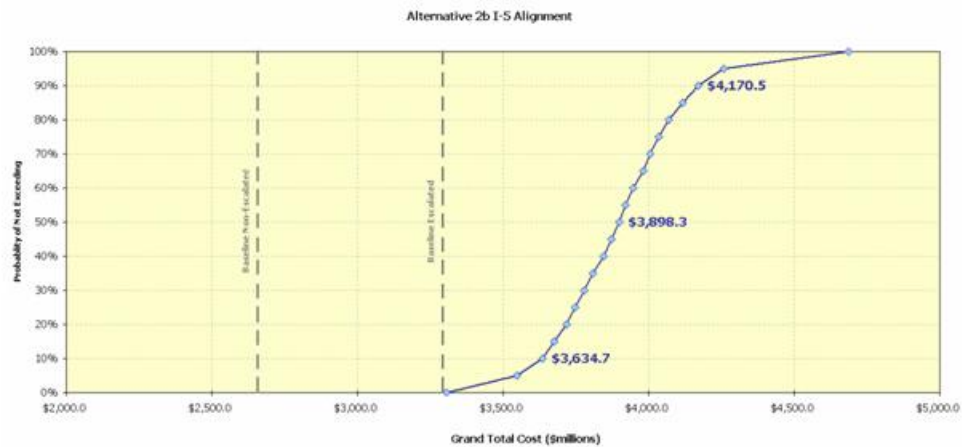
Tornado Chart: Expected Incremental Cost (\$million)



Note: This chart is based solely on the risk register: for each event risk, the expected cost impact is calculated as the product of the probability of occurrence times the cost estimate, both provided by the panelists. Derived for Vancouver Alignment **Alternative 2a**.

I-5 COLUMBIA RIVER CROSSING PROJECT

Total Project Costs Summary 2b, Upstream Replacement w/ BRT

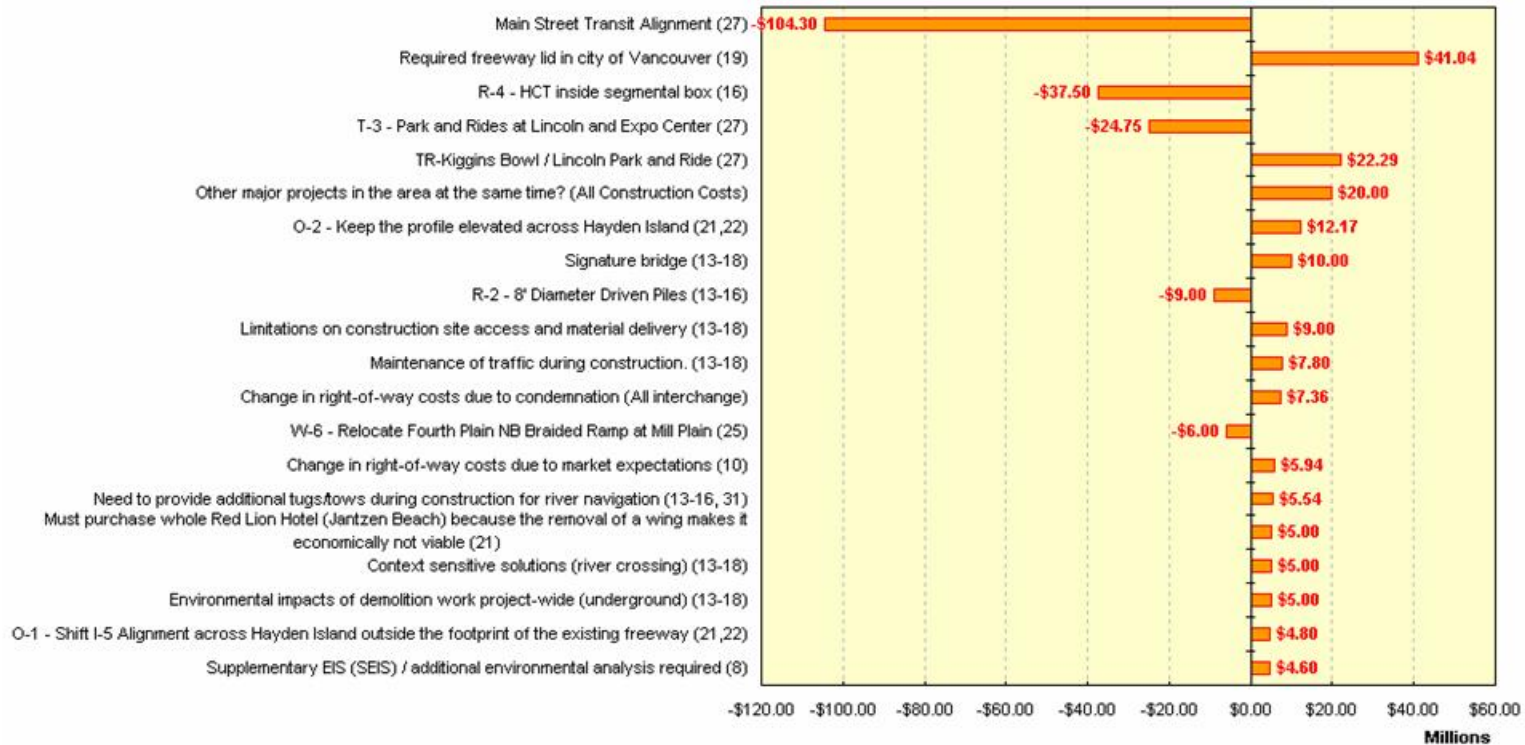


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I-5 COLUMBIA RIVER CROSSING PROJECT

Identification of Key Cost Risks 2b, Upstream Replacement w/ BRT

Tornado Chart: Expected Incremental Cost (\$million)



Note: This chart is based solely on the risk register: for each event risk, the expected cost impact is calculated as the product of the probability of occurrence times the cost estimate, both provided by the panelists. Derived for Vancouver Alignment **Alternative 2b**.

I-5 COLUMBIA RIVER CROSSING PROJECT

Total Project Costs Summary 3a, Downstream Replacement w/ LRT

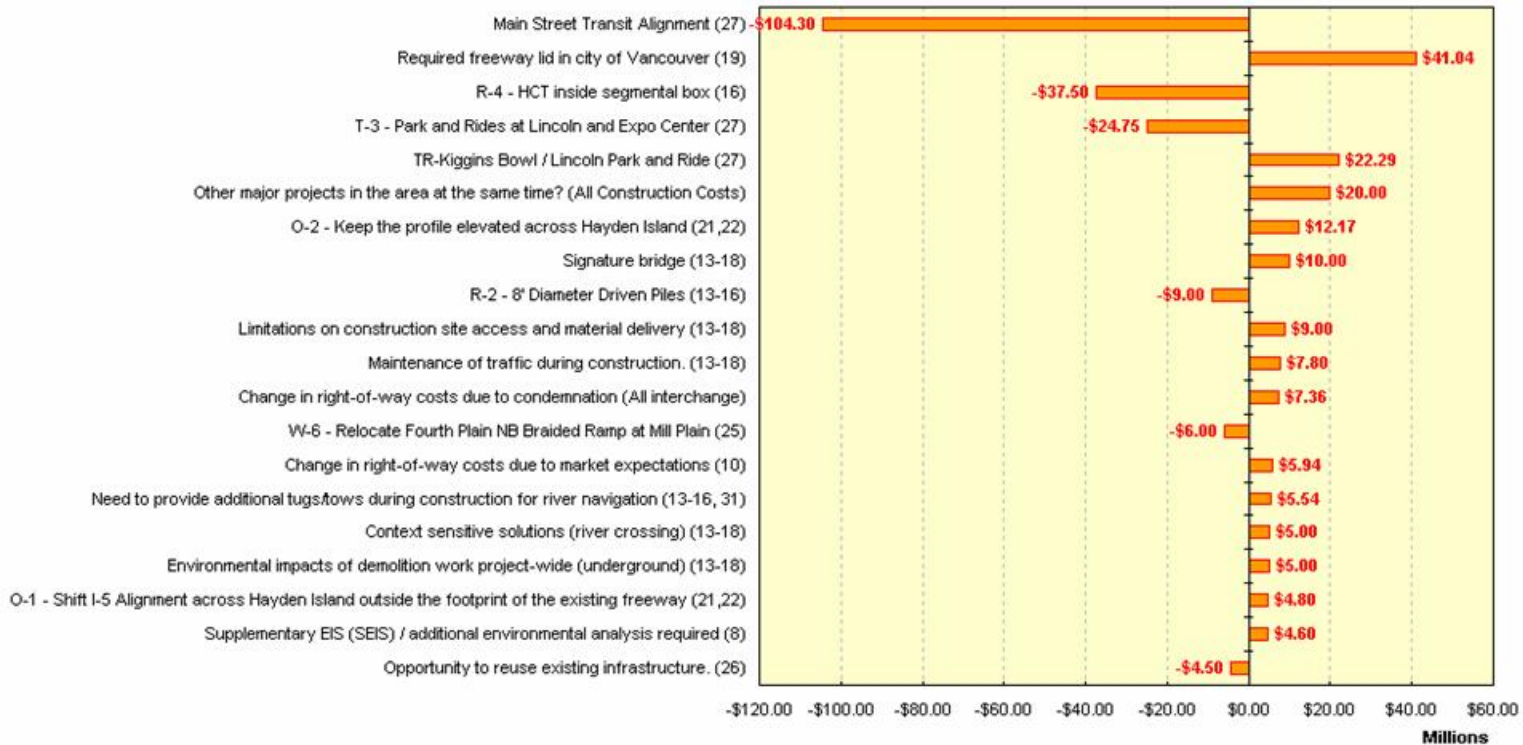


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I-5 COLUMBIA RIVER CROSSING PROJECT

Identification of Key Cost Risks 3a, Downstream Replacement w/ LRT

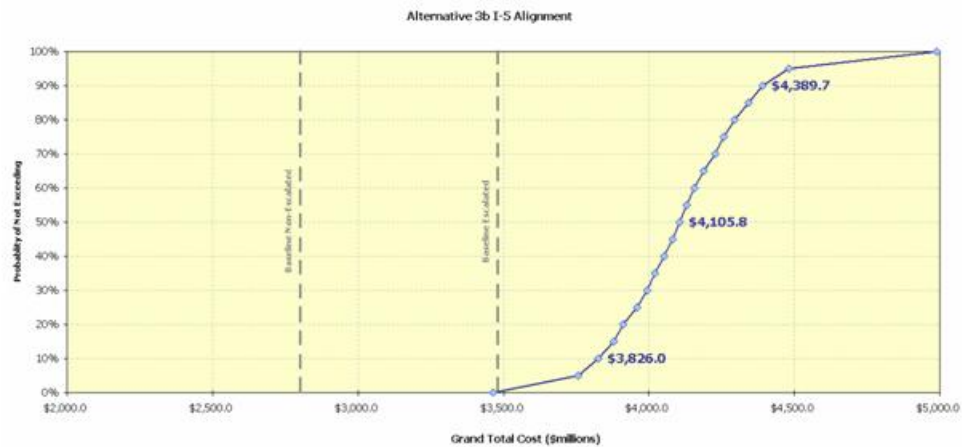
Tornado Chart: Expected Incremental Cost (\$million)



Note: This chart is based solely on the risk register: for each event risk, the expected cost impact is calculated as the product of the probability of occurrence times the cost estimate, both provided by the panelists. Derived for Vancouver Alignment **Alternative 3a**.

I-5 COLUMBIA RIVER CROSSING PROJECT

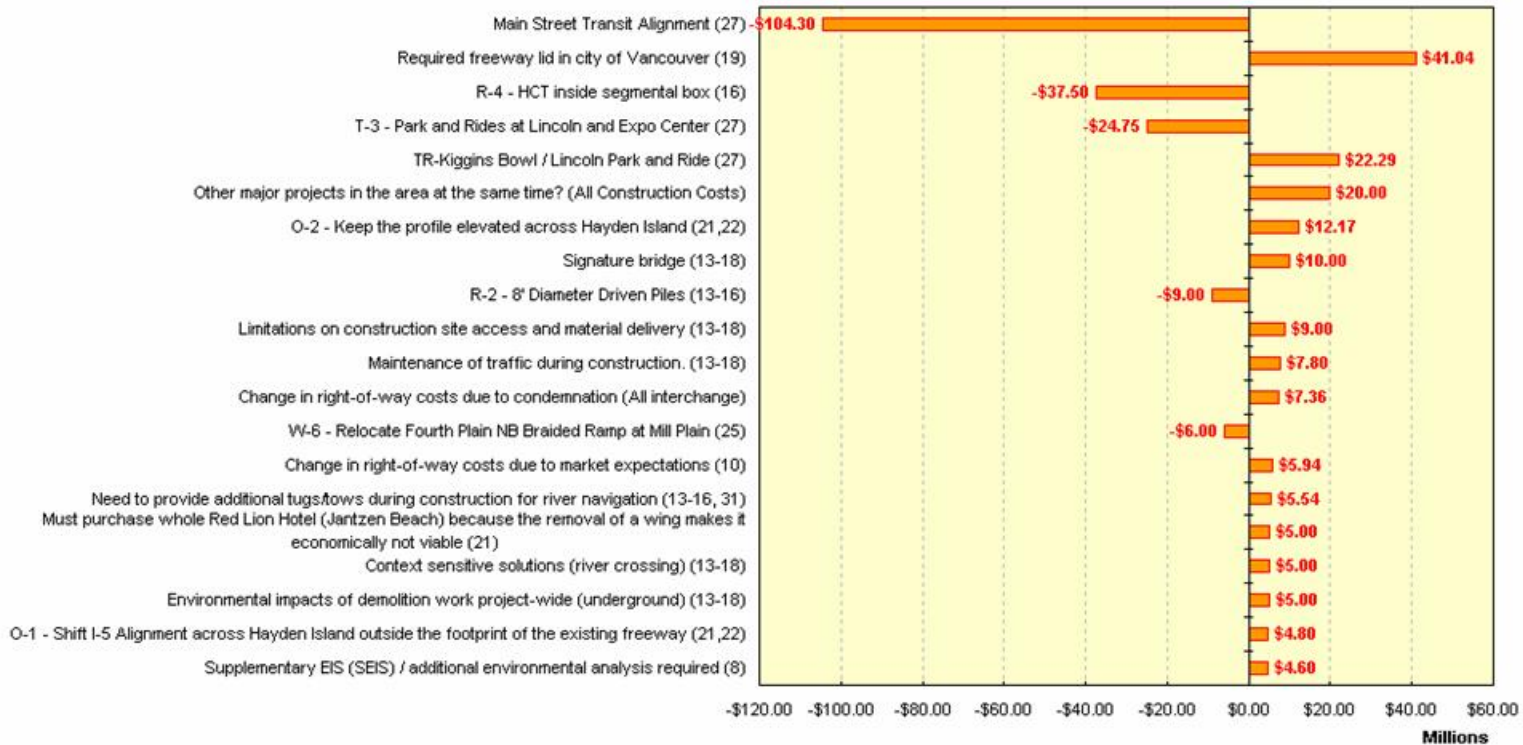
Total Project Costs Summary 3b, Upstream Replacement w/ LRT



I-5 COLUMBIA RIVER CROSSING PROJECT

Identification of Key Cost Risks 3b, Upstream Replacement w/ LRT

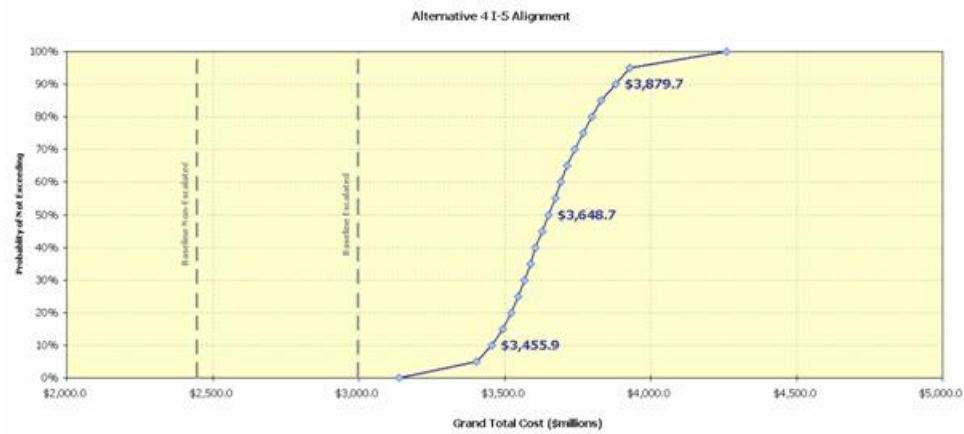
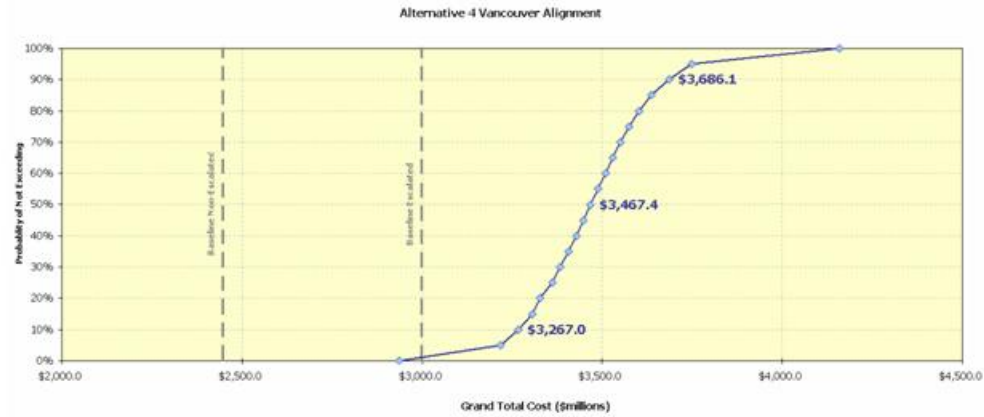
Tornado Chart: Expected Incremental Cost (\$million)



Note: This chart is based solely on the risk register: for each event risk, the expected cost impact is calculated as the product of the probability of occurrence times the cost estimate, both provided by the panelists. Derived for Vancouver Alignment **Alternative 3b**.

I-5 COLUMBIA RIVER CROSSING PROJECT

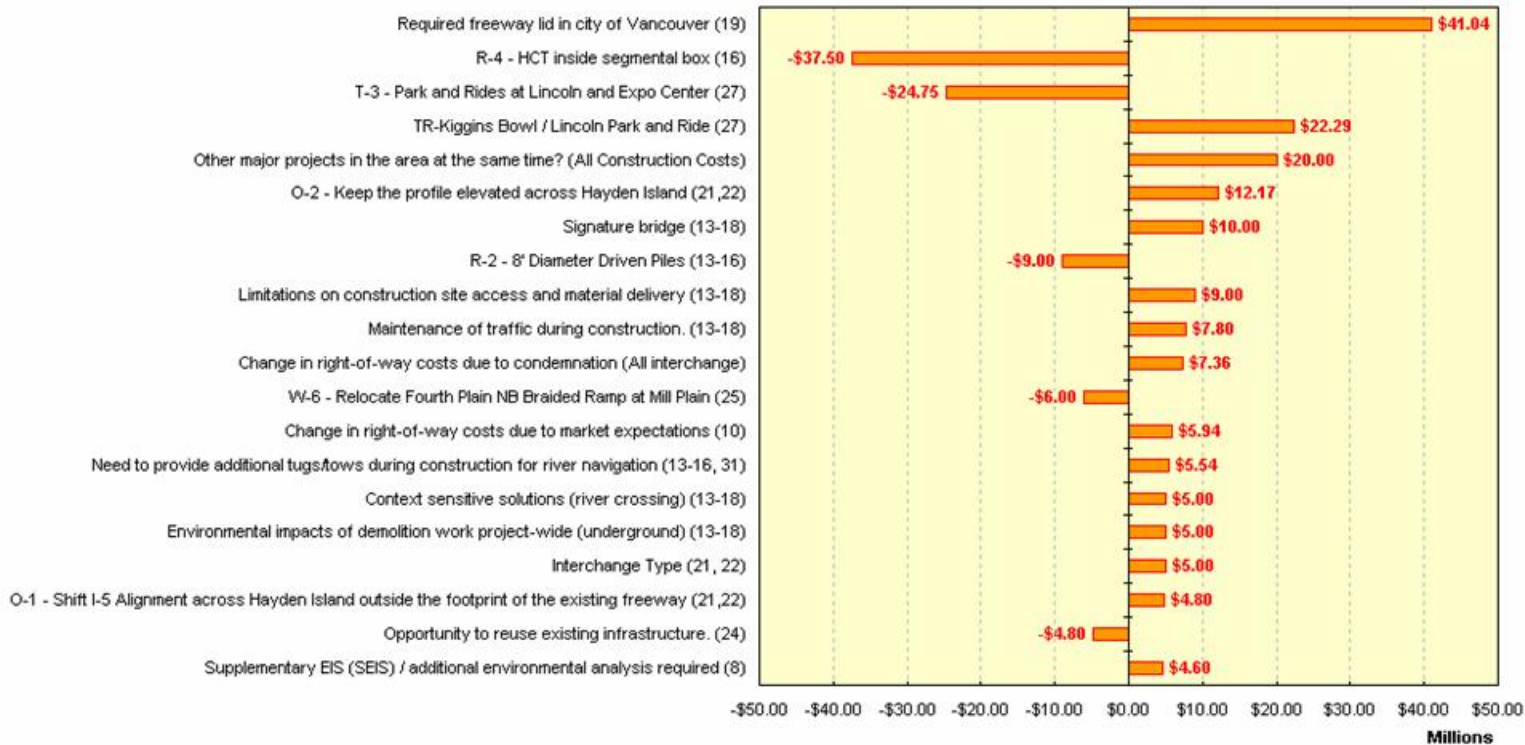
Total Project Costs Summary 4, Supplemental Crossing w/ BRT



I-5 COLUMBIA RIVER CROSSING PROJECT

Identification of Key Cost Risks 4, Supplemental Crossing w/ BRT

Tornado Chart: Expected Incremental Cost (\$million)



Note: This chart is based solely on the risk register: for each event risk, the expected cost impact is calculated as the product of the probability of occurrence times the cost estimate, both provided by the panelists. Derived for Vancouver Alignment **Alternative 4**.

I-5 COLUMBIA RIVER CROSSING PROJECT

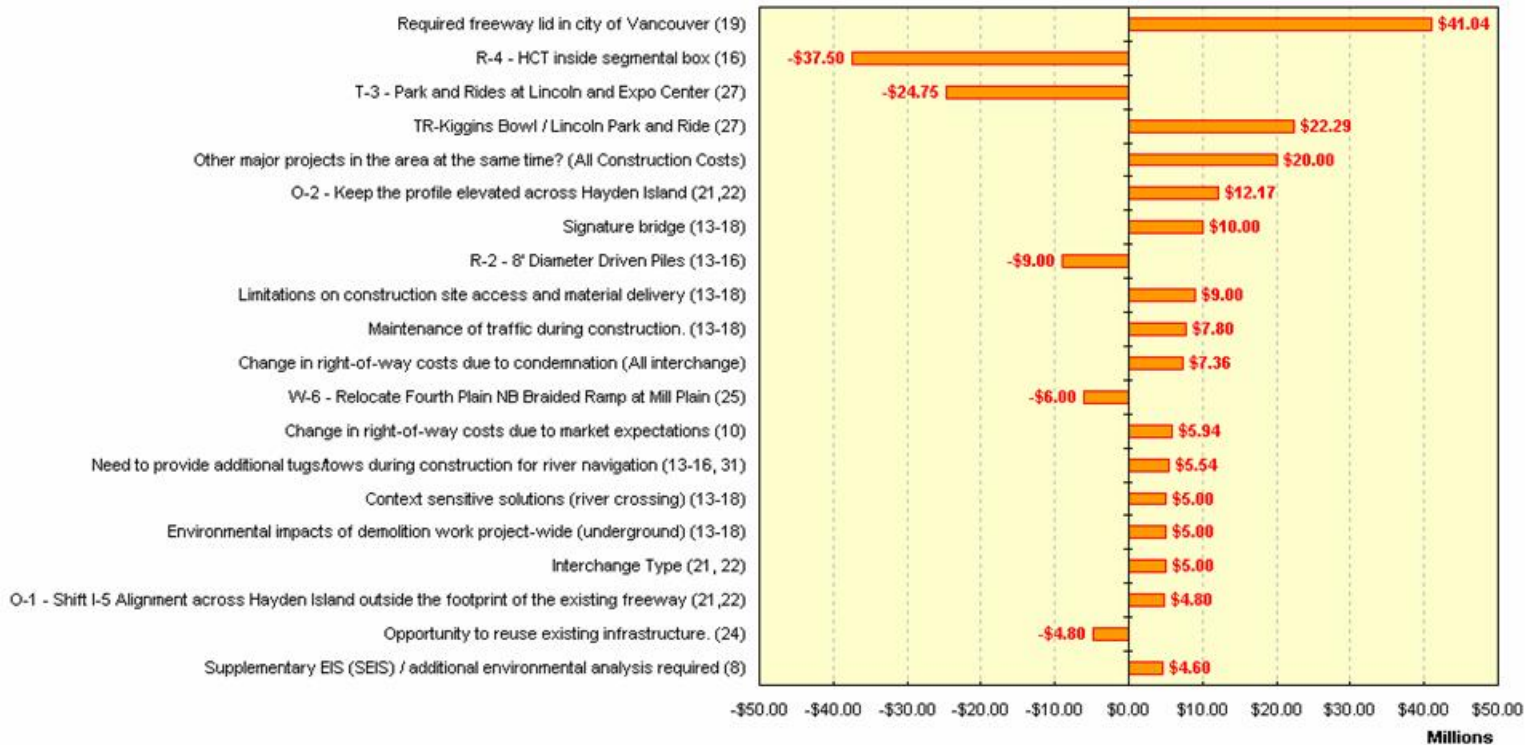
Total Project Costs Summary 5, Supplemental Crossing w/ LRT



I-5 COLUMBIA RIVER CROSSING PROJECT

Identification of Key Cost Risks 5, Supplemental Crossing w/ LRT

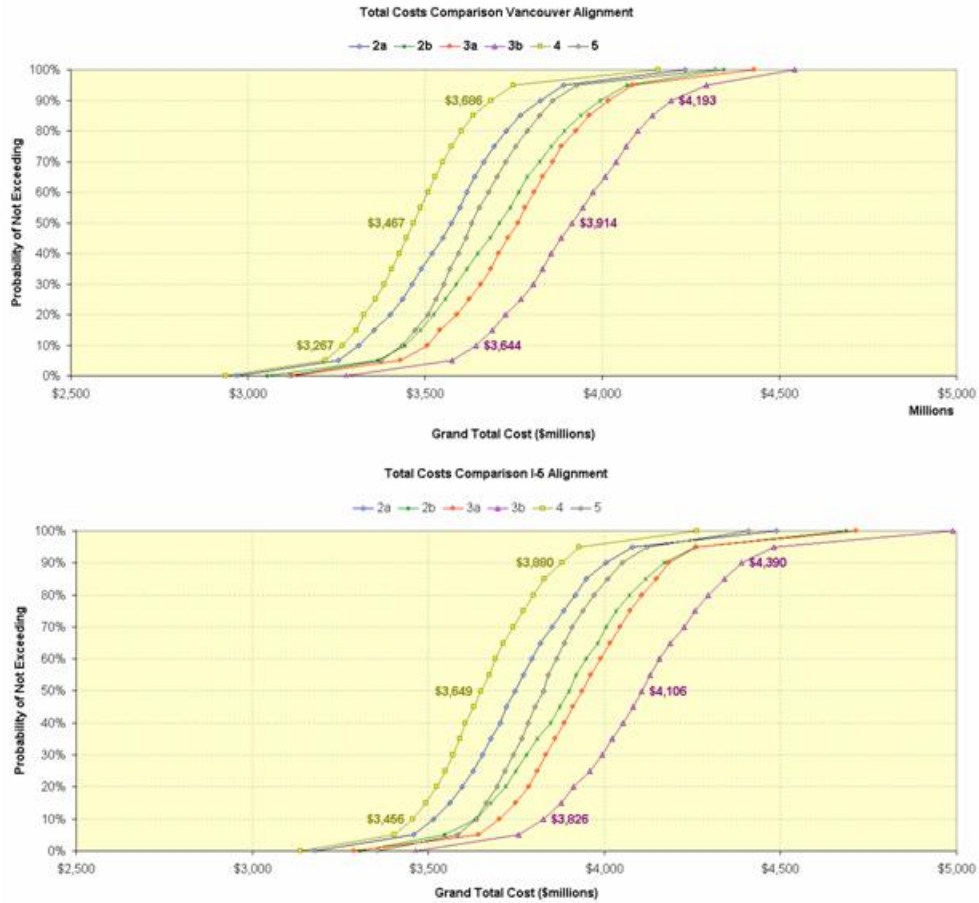
Tornado Chart: Expected Incremental Cost (\$million)



Note: This chart is based solely on the risk register: for each event risk, the expected cost impact is calculated as the product of the probability of occurrence times the cost estimate, both provided by the panelists. Derived for Vancouver Alignment **Alternative 5**.

I-5 COLUMBIA RIVER CROSSING PROJECT

Total Costs Comparison



I-5 COLUMBIA RIVER CROSSING PROJECT

Project Costs Summary Table, Vancouver Alignment

Mean Expected Outcomes (\$millions)	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Base Costs	\$2,624.0	\$2,657.0	\$2,767.1	\$2,800.7	\$2,446.7	\$2,564.1
Base Costs + Budget Uncertainty	\$2,739.8	\$2,774.2	\$2,889.2	\$2,924.3	\$2,507.0	\$2,627.7
Base Costs + Escalation (Base Schedule)	\$3,166.4	\$3,292.8	\$3,337.1	\$3,480.5	\$2,998.0	\$3,154.1
Base Costs + Budget Uncertainty + Escalation (Base Schedule)	\$3,306.2	\$3,439.0	\$3,484.4	\$3,634.9	\$3,070.4	\$3,230.8
Base Costs + Budget Uncertainty + Escalation (Risk Adjusted Schedule)	\$3,453.8	\$3,594.9	\$3,640.0	\$3,801.8	\$3,215.3	\$3,381.5
Base Costs + Budget Uncertainty + Escalation (Risk Adjusted Schedule) + Event Risks	\$3,507.1	\$3,645.3	\$3,691.8	\$3,850.6	\$3,399.8	\$3,564.5
Base Costs + Budget Uncertainty + Escalation (Risk Adjusted Schedule) + Event Risks + Project Delay Cost = Total Project Cost	\$3,560.6	\$3,698.5	\$3,748.3	\$3,906.8	\$3,462.1	\$3,630.0

Total Project Costs (\$millions)	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Mean Expected Outcomes	\$3,560.6	\$3,698.5	\$3,748.3	\$3,906.8	\$3,462.1	\$3,630.0
10 % Probability of Exceeding	\$3,825.9	\$3,994.1	\$4,018.4	\$4,193.5	\$3,686.1	\$3,860.2
40% Probability of Exceeding	\$3,618.6	\$3,765.1	\$3,808.9	\$3,974.1	\$3,509.0	\$3,678.0
50% Probability of Exceeding	\$3,574.2	\$3,709.8	\$3,761.2	\$3,913.8	\$3,467.4	\$3,631.7
90% Probability of Exceeding	\$3,311.8	\$3,444.1	\$3,505.6	\$3,643.9	\$3,267.0	\$3,433.6

I-5 COLUMBIA RIVER CROSSING PROJECT

Project Costs Summary Table, I-5 Alignment

Mean Expected Outcomes (\$millions)	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Base Costs	\$2,624.0	\$2,657.0	\$2,767.1	\$2,800.7	\$2,446.7	\$2,564.1
Base Costs + Budget Uncertainty	\$2,739.8	\$2,774.2	\$2,889.2	\$2,924.3	\$2,507.0	\$2,627.7
Base Costs + Escalation (Base Schedule)	\$3,166.4	\$3,292.8	\$3,337.1	\$3,480.5	\$2,998.0	\$3,154.1
Base Costs + Budget Uncertainty + Escalation (Base Schedule)	\$3,306.2	\$3,439.0	\$3,484.4	\$3,634.9	\$3,070.4	\$3,230.8
Base Costs + Budget Uncertainty + Escalation (Risk Adjusted Schedule)	\$3,457.0	\$3,598.0	\$3,643.7	\$3,805.5	\$3,217.3	\$3,383.6
Base Costs + Budget Uncertainty + Escalation (Risk Adjusted Schedule) + Event Risks	\$3,700.0	\$3,838.2	\$3,885.1	\$4,044.0	\$3,594.9	\$3,759.4
Base Costs + Budget Uncertainty + Escalation (Risk Adjusted Schedule) + Event Risks + Project Delay Cost = Total Project Cost	\$3,753.5	\$3,891.4	\$3,941.6	\$4,100.1	\$3,657.1	\$3,824.9

Total Project Costs (\$millions)	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Mean Expected Outcomes	\$3,753.5	\$3,891.4	\$3,941.6	\$4,100.1	\$3,657.1	\$3,824.9
10 % Probability of Exceeding	\$4,003.8	\$4,170.5	\$4,183.6	\$4,389.7	\$3,879.7	\$4,050.8
40 % Probability of Exceeding	\$3,793.5	\$3,947.9	\$3,990.5	\$4,156.1	\$3,691.0	\$3,863.4
50% Probability of Exceeding	\$3,745.3	\$3,898.3	\$3,937.5	\$4,105.8	\$3,648.7	\$3,825.9
90% Probability of Exceeding	\$3,514.4	\$3,634.7	\$3,701.7	\$3,826.0	\$3,455.9	\$3,635.3

I-5 COLUMBIA RIVER CROSSING PROJECT

Transit Costs Summary Table

Transit Costs Vancouver Alignment

Total Project Costs (\$millions)	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Mean Expected Outcomes	\$646.3	\$680.0	\$824.9	\$878.5	\$694.3	\$849.9
10 % Probability of Exceeding	\$749.7	\$798.6	\$940.8	\$1,016.9	\$805.2	\$975.7
40% Probability of Exceeding	\$692.2	\$726.7	\$879.3	\$935.8	\$769.6	\$935.2
50% Probability of Exceeding	\$676.3	\$706.8	\$862.0	\$911.0	\$759.9	\$924.6
90% Probability of Exceeding	\$602.6	\$614.2	\$783.1	\$808.3	\$718.8	\$879.1

Transit Costs I-5 Alignment

Total Project Costs (\$millions)	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Mean Expected Outcomes	\$868.8	\$897.6	\$1,054.9	\$1,104.2	\$954.0	\$1,117.8
10 % Probability of Exceeding	\$938.6	\$989.1	\$1,133.2	\$1,208.1	\$1,007.3	\$1,178.3
40 % Probability of Exceeding	\$883.0	\$922.2	\$1,068.8	\$1,132.5	\$964.4	\$1,130.5
50% Probability of Exceeding	\$867.8	\$901.7	\$1,054.9	\$1,108.8	\$955.2	\$1,119.3
90% Probability of Exceeding	\$793.4	\$804.5	\$971.0	\$998.7	\$907.2	\$1,067.5

I-5 COLUMBIA RIVER CROSSING PROJECT

Highway Costs Summary Table

Highway Costs Vancouver Alignment						
Total Project Costs (\$millions)	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Mean Expected Outcomes	\$2,680.0	\$2,801.1	\$2,679.1	\$2,799.9	\$2,523.5	\$2,528.2
10 % Probability of Exceeding	\$3,086.7	\$3,222.6	\$3,091.8	\$3,225.3	\$2,880.0	\$2,894.6
40% Probability of Exceeding	\$2,914.1	\$3,033.2	\$2,916.9	\$3,037.6	\$2,733.4	\$2,739.8
50% Probability of Exceeding	\$2,871.8	\$2,995.6	\$2,880.6	\$2,986.5	\$2,697.1	\$2,697.9
90% Probability of Exceeding	\$2,668.9	\$2,772.5	\$2,674.9	\$2,771.3	\$2,515.4	\$2,524.1

Highway Costs I-5 Alignment						
Total Project Costs (\$millions)	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Mean Expected Outcomes	\$2,867.5	\$2,982.6	\$2,869.5	\$2,984.7	\$2,691.9	\$2,696.0
10 % Probability of Exceeding	\$3,075.4	\$3,206.2	\$3,075.5	\$3,208.8	\$2,880.3	\$2,887.4
40 % Probability of Exceeding	\$2,904.7	\$3,021.8	\$2,912.0	\$3,028.5	\$2,719.6	\$2,723.6
50% Probability of Exceeding	\$2,863.5	\$2,977.9	\$2,868.9	\$2,982.3	\$2,686.0	\$2,690.5
90% Probability of Exceeding	\$2,668.6	\$2,770.0	\$2,670.7	\$2,775.8	\$2,518.7	\$2,536.4

I-5 COLUMBIA RIVER CROSSING PROJECT

River Crossing Costs Summary Table

River Crossing Costs Vancouver Alignment

Total Project Costs (\$millions)	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Mean Expected Outcomes	\$1,315.2	\$1,424.8	\$1,410.0	\$1,538.5	\$1,106.9	\$1,254.9
10 % Probability of Exceeding	\$1,487.8	\$1,639.2	\$1,591.3	\$1,745.1	\$1,269.3	\$1,436.1
40% Probability of Exceeding	\$1,390.1	\$1,495.3	\$1,492.8	\$1,625.9	\$1,173.4	\$1,336.4
50% Probability of Exceeding	\$1,364.8	\$1,463.5	\$1,464.9	\$1,594.4	\$1,151.9	\$1,310.4
90% Probability of Exceeding	\$1,240.5	\$1,322.9	\$1,349.8	\$1,440.0	\$1,034.0	\$1,193.6

River Crossing Costs I-5 Alignment

Total Project Costs (\$millions)	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Mean Expected Outcomes	\$1,365.9	\$1,465.8	\$1,467.2	\$1,587.2	\$1,149.2	\$1,306.7
10 % Probability of Exceeding	\$1,494.5	\$1,628.4	\$1,597.3	\$1,758.2	\$1,272.9	\$1,435.4
40 % Probability of Exceeding	\$1,384.8	\$1,501.2	\$1,484.5	\$1,622.9	\$1,167.4	\$1,328.4
50% Probability of Exceeding	\$1,358.0	\$1,468.8	\$1,460.7	\$1,588.2	\$1,142.8	\$1,306.6
90% Probability of Exceeding	\$1,240.9	\$1,313.1	\$1,342.9	\$1,443.5	\$1,025.4	\$1,193.2

I-5 COLUMBIA RIVER CROSSING PROJECT

Project End Dates Summary 2a, Downstream Replacement w/ BRT

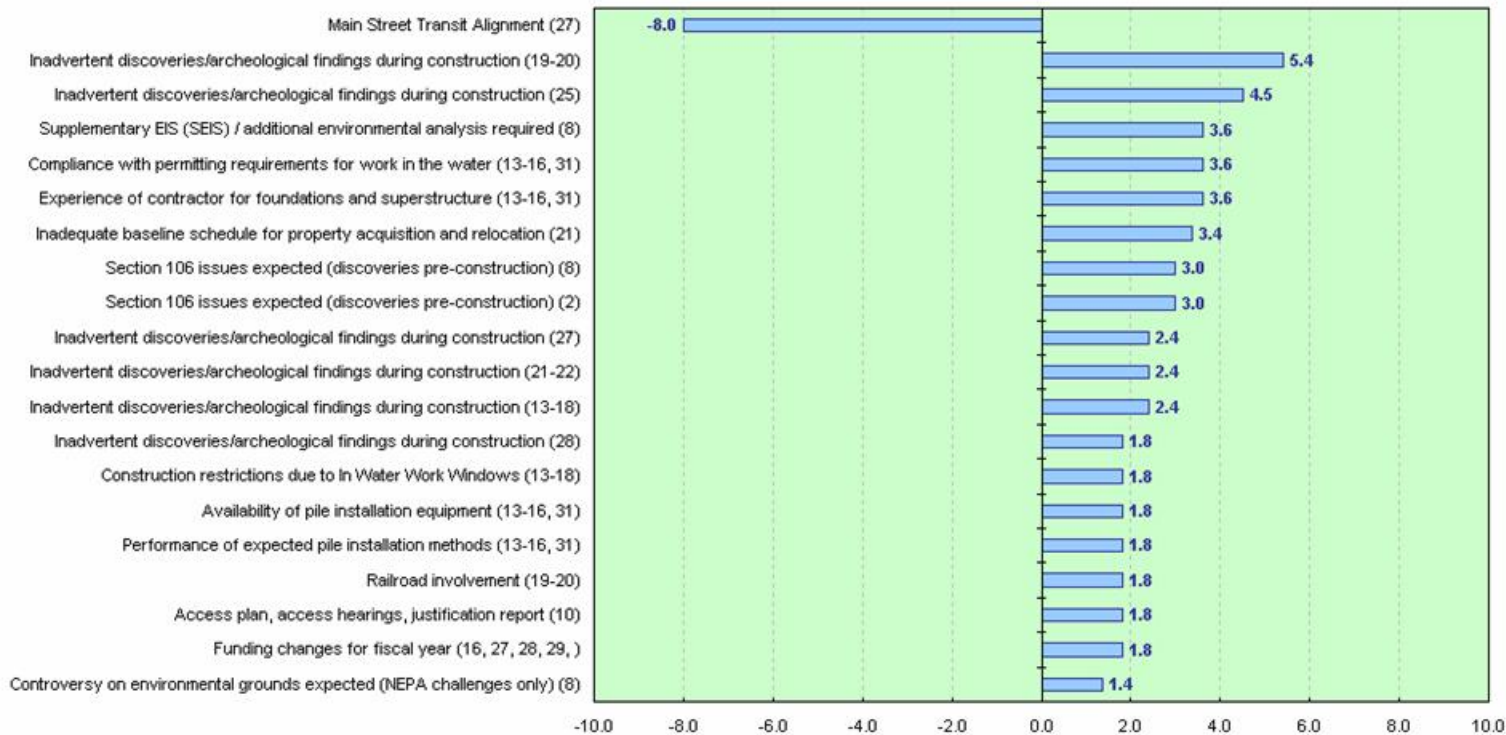


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I-5 COLUMBIA RIVER CROSSING PROJECT

Identification of Key Schedule Risks 2a, Downstream Replacement w/ BRT

Tornado Chart: Expected Schedule Delays (months)



Note: This chart is based solely on the risk register: for each event risk, the expected schedule delay is calculated as the product of the probability of occurrence times the delay estimate, both provided by the panelists. Derived for Vancouver Alignment **Alternative 2a**.

I-5 COLUMBIA RIVER CROSSING PROJECT

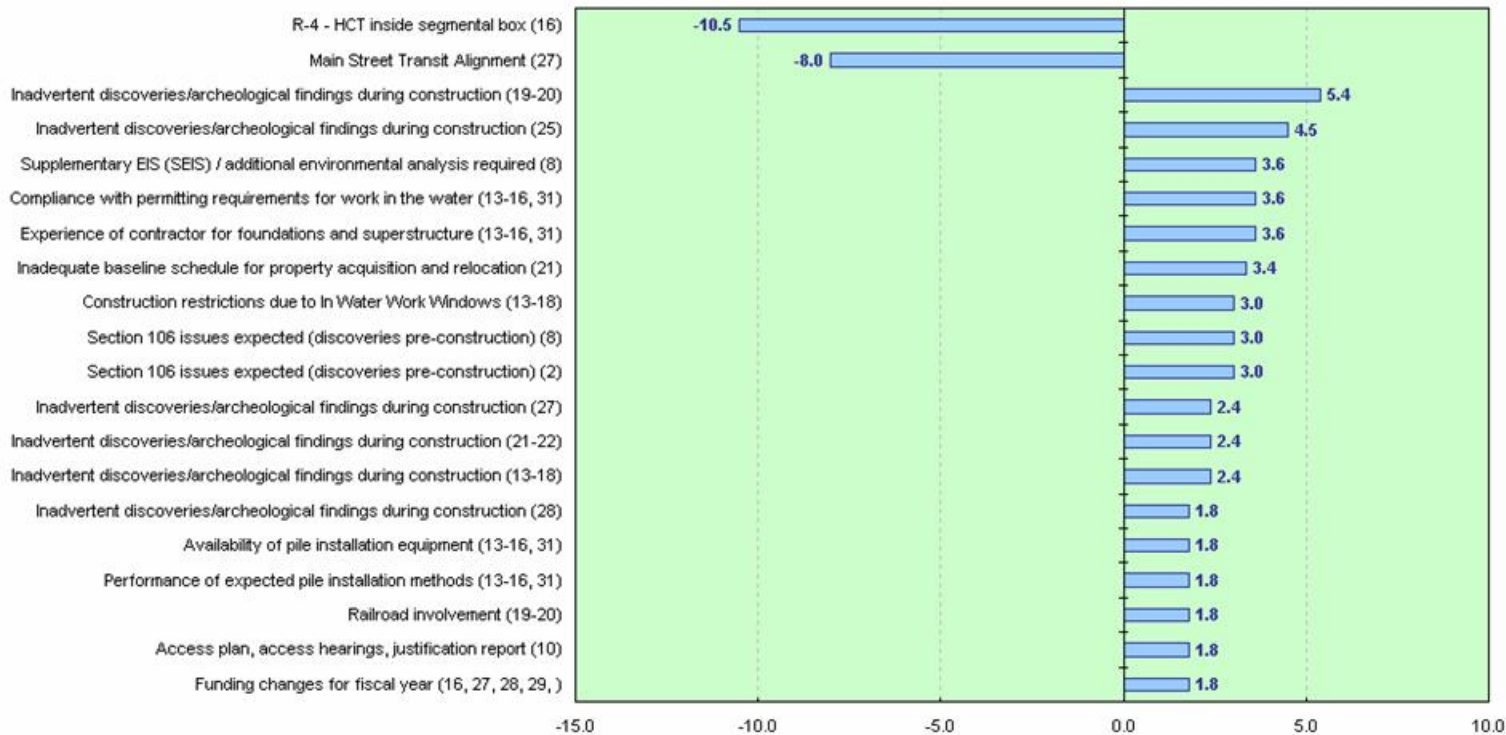
Project End Dates Summary 2b, Upstream Replacement w/ BRT



I-5 COLUMBIA RIVER CROSSING PROJECT

Identification of Key Schedule Risks 2b, Upstream Replacement w/ BRT

Tornado Chart: Expected Schedule Delays (months)



Note: This chart is based solely on the risk register: for each event risk, the expected schedule delay is calculated as the product of the probability of occurrence times the delay estimate, both provided by the panelists. Derived for Vancouver Alignment **Alternative 2b**.

I-5 COLUMBIA RIVER CROSSING PROJECT

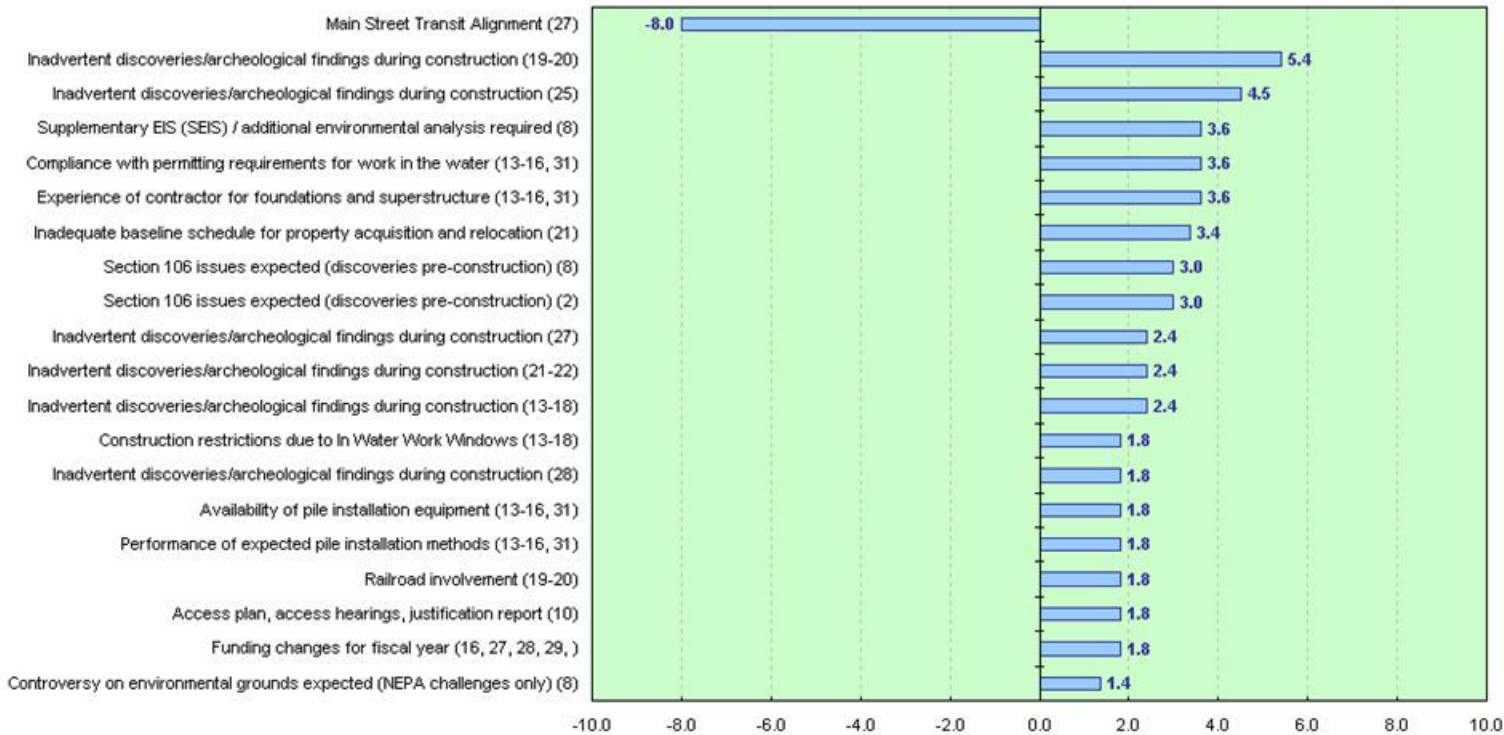
Project End Dates Summary 3a, Downstream Replacement w/ LRT



I-5 COLUMBIA RIVER CROSSING PROJECT

Identification of Key Schedule Risks 3a, Downstream Replacement w/ LRT

Tornado Chart: Expected Schedule Delays (months)



Note: This chart is based solely on the risk register: for each event risk, the expected schedule delay is calculated as the product of the probability of occurrence times the delay estimate, both provided by the panelists. Derived for Vancouver Alignment **Alternative 3a**.

I-5 COLUMBIA RIVER CROSSING PROJECT

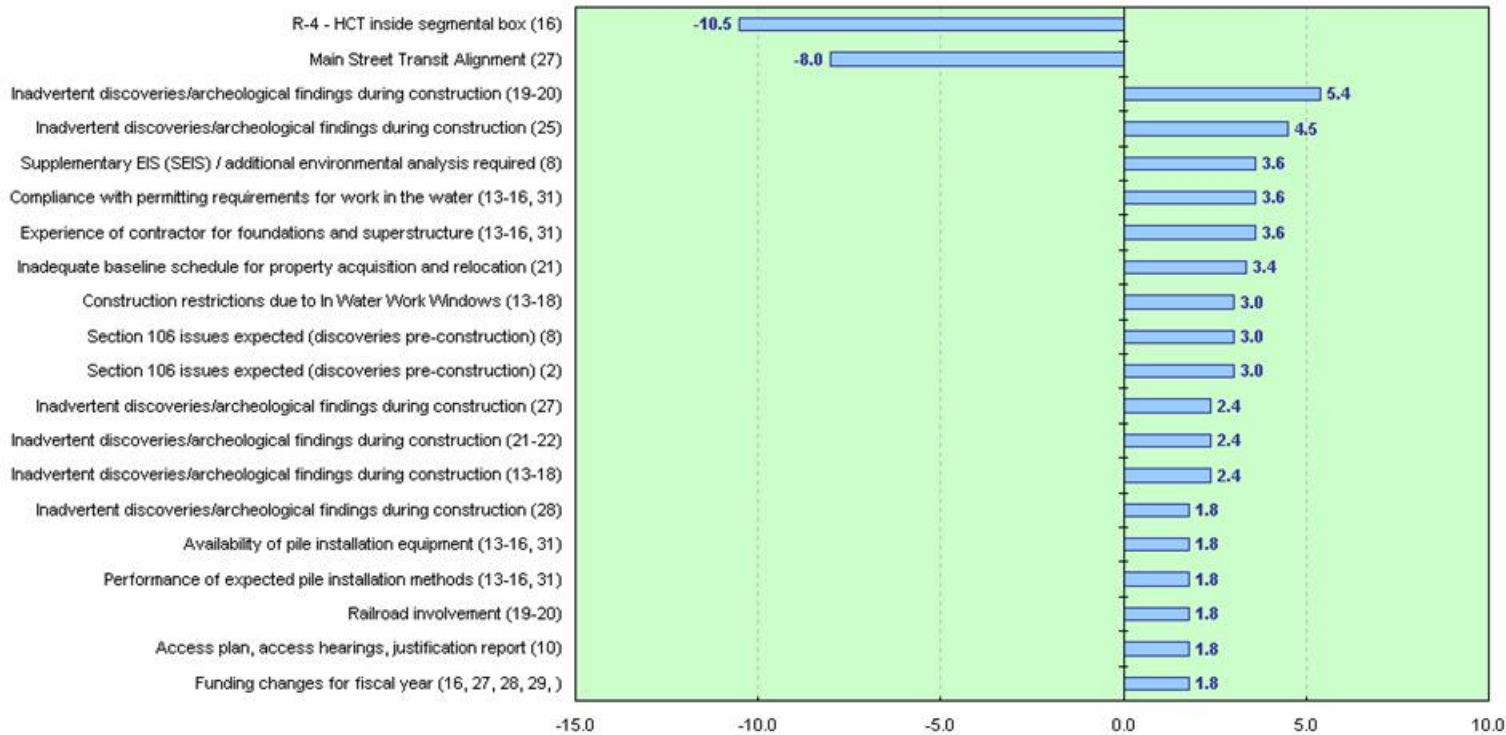
Project End Dates Summary 3b, Upstream Replacement w/ LRT



I-5 COLUMBIA RIVER CROSSING PROJECT

Identification of Key Schedule Risks 3b, Upstream Replacement w/ LRT

Tornado Chart: Expected Schedule Delays (months)



Note: This chart is based solely on the risk register: for each event risk, the expected schedule delay is calculated as the product of the probability of occurrence times the delay estimate, both provided by the panelists. Derived for Vancouver Alignment **Alternative 3b**.

I-5 COLUMBIA RIVER CROSSING PROJECT

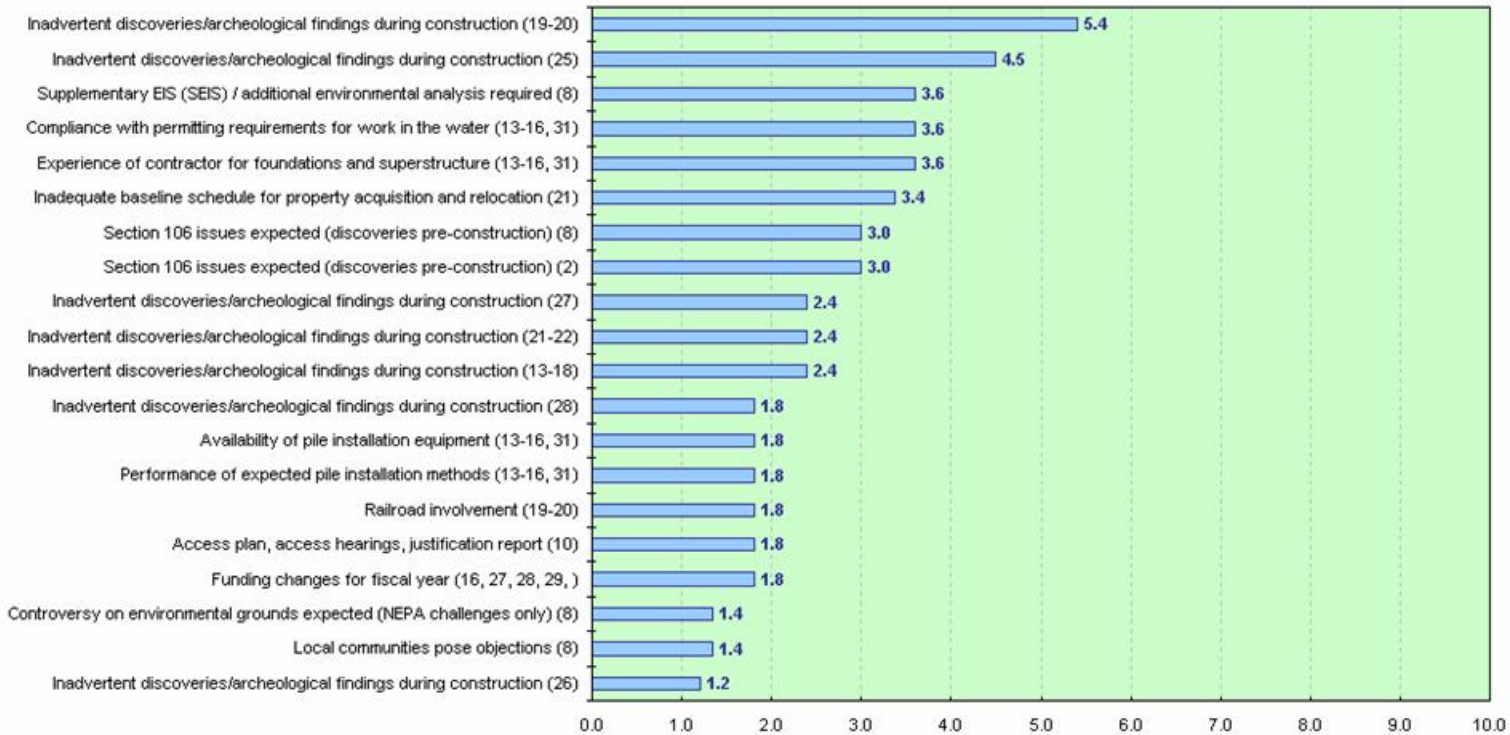
Project End Dates Summary 4, Supplemental Crossing w/ BRT



I-5 COLUMBIA RIVER CROSSING PROJECT

Identification of Key Schedule Risks 4, Supplemental Crossing w/ BRT

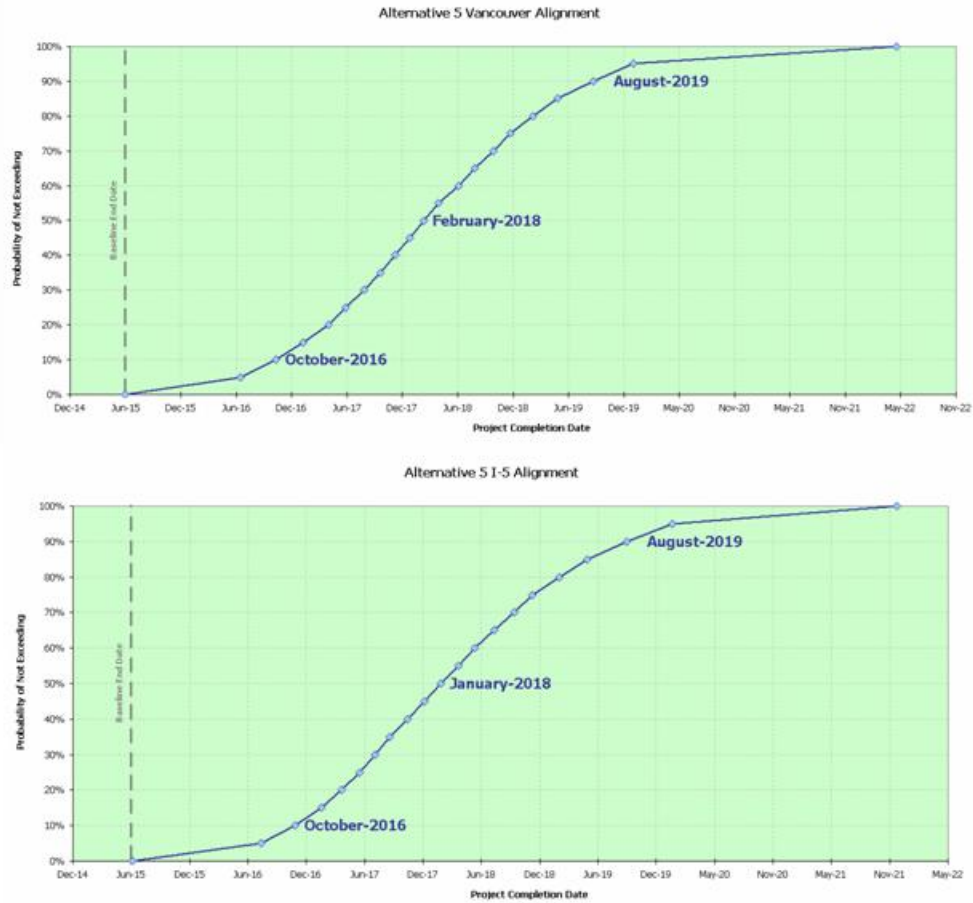
Tornado Chart: Expected Schedule Delays (months)



Note: This chart is based solely on the risk register: for each event risk, the expected schedule delay is calculated as the product of the probability of occurrence times the delay estimate, both provided by the panelists. Derived for Vancouver Alignment **Alternative 4**.

I-5 COLUMBIA RIVER CROSSING PROJECT

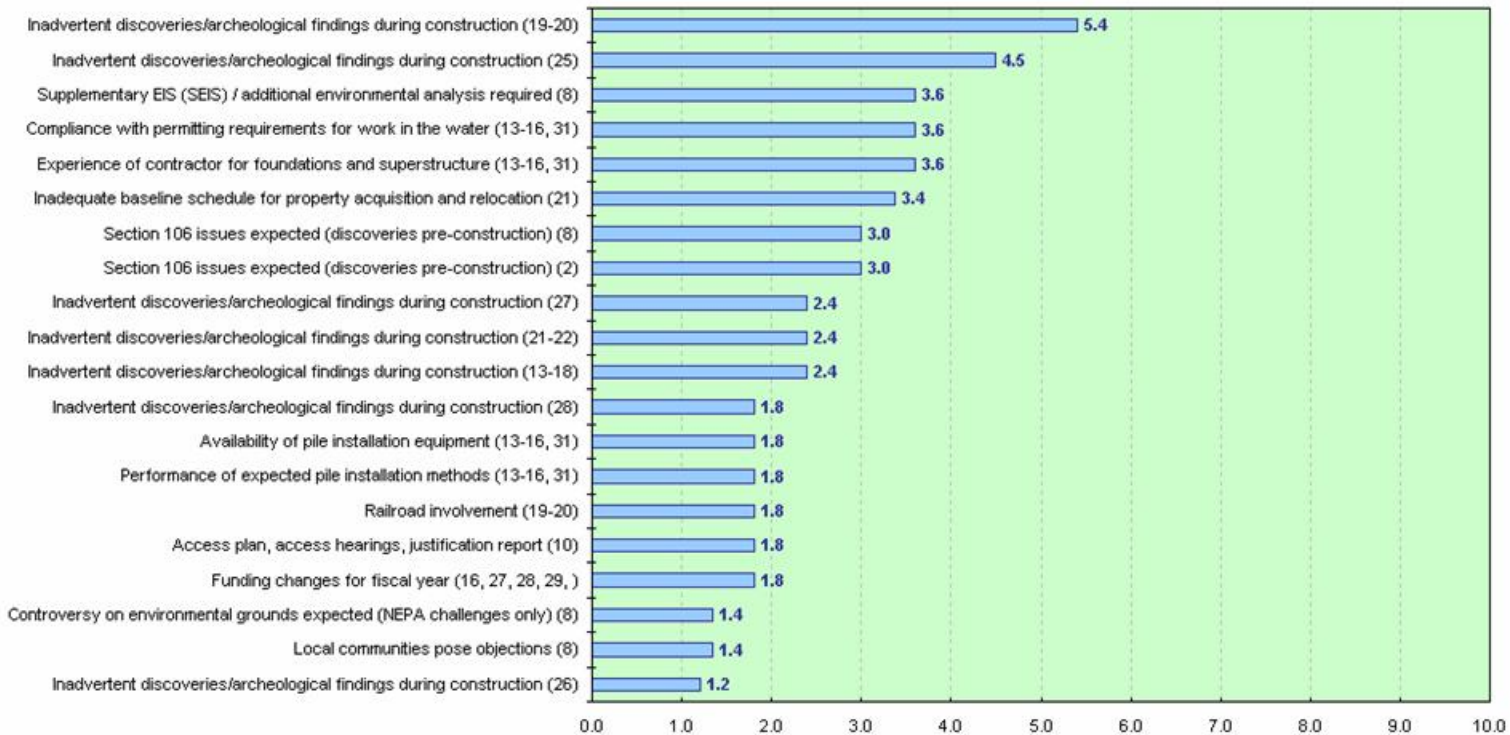
Project End Dates Summary 5, Supplemental Crossing w/ LRT



I-5 COLUMBIA RIVER CROSSING PROJECT

Identification of Key Schedule Risks 5, Supplemental Crossing w/ LRT

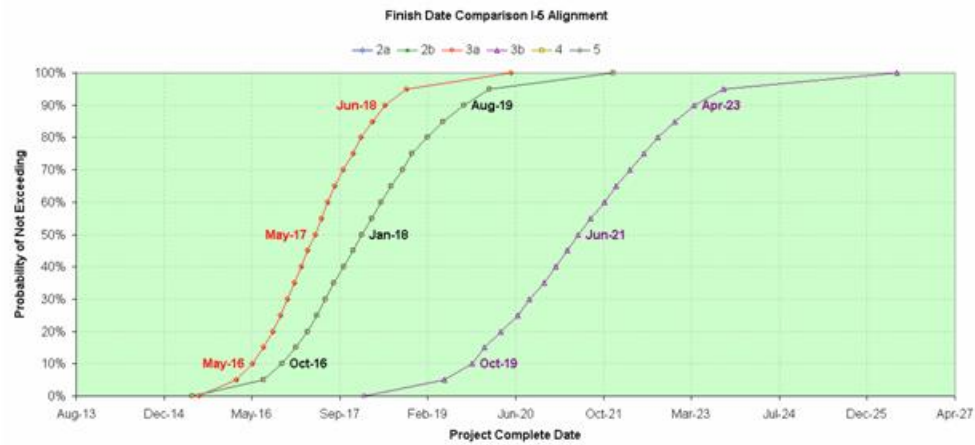
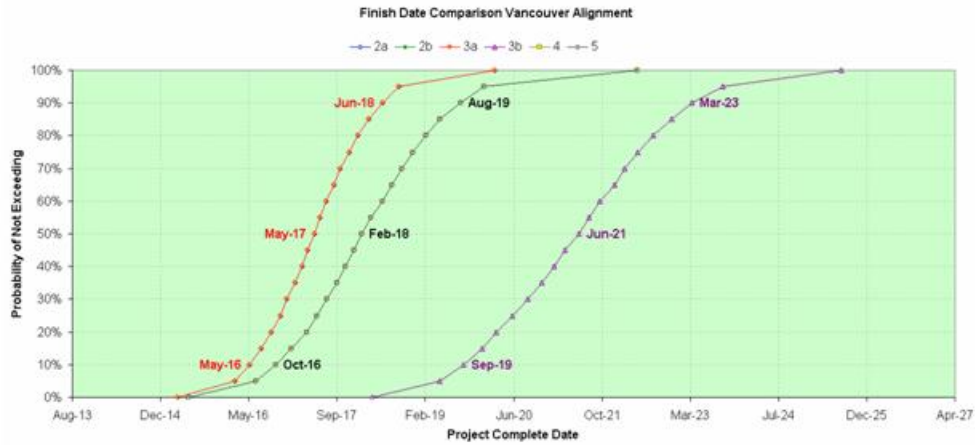
Tornado Chart: Expected Schedule Delays (months)



Note: This chart is based solely on the risk register: for each event risk, the expected schedule delay is calculated as the product of the probability of occurrence times the delay estimate, both provided by the panelists. Derived for Vancouver Alignment **Alternative 5**.

I-5 COLUMBIA RIVER CROSSING PROJECT

Finish Date Comparison



I-5 COLUMBIA RIVER CROSSING PROJECT

Project Schedule Summary Table, Vancouver Alignment

Project End Dates	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Baseline Project End Date	4/1/2015	7/1/2019	4/1/2015	7/1/2019	6/1/2015	6/1/2015
Mean Expected End Date	4/29/2017	5/25/2021	4/29/2017	5/25/2021	2/1/2018	2/1/2018
10 % Probability of Exceeding	6/6/2018	3/25/2023	6/6/2018	3/25/2023	8/22/2019	8/22/2019
40% Probability of Exceeding	7/23/2017	10/21/2021	7/23/2017	10/21/2021	6/5/2018	6/5/2018
50% Probability of Exceeding	5/15/2017	6/23/2021	5/15/2017	6/23/2021	2/8/2018	2/8/2018
90% Probability of Exceeding	5/11/2016	9/8/2019	5/11/2016	9/8/2019	10/10/2016	10/10/2016

Project Delay	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Mean Expected Delay	24.9	22.8	24.9	22.8	32.0	32.0
10 % Probability of Exceeding	38.1	44.7	38.1	44.7	50.6	50.6
40% Probability of Exceeding	27.7	27.6	27.7	27.6	36.1	36.1
50% Probability of Exceeding	25.4	23.7	25.4	23.7	32.2	32.2
90% Probability of Exceeding	13.3	2.2	13.3	2.2	16.3	16.3

Note: Project delays are expressed in months.

I-5 COLUMBIA RIVER CROSSING PROJECT

Project Schedule Summary Table, I-5 Alignment

Project End Dates	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Baseline Project End Date	4/1/2015	7/1/2019	4/1/2015	7/1/2019	6/1/2015	6/1/2015
Mean Expected End Date	4/29/2017	5/25/2021	4/29/2017	5/25/2021	2/1/2018	2/1/2018
10 % Probability of Exceeding	6/5/2018	4/1/2023	6/5/2018	4/1/2023	8/29/2019	8/29/2019
40 % Probability of Exceeding	7/15/2017	11/4/2021	7/15/2017	11/4/2021	5/12/2018	5/12/2018
50% Probability of Exceeding	5/6/2017	6/10/2021	5/6/2017	6/10/2021	1/24/2018	1/24/2018
90% Probability of Exceeding	5/14/2016	10/14/2019	5/14/2016	10/14/2019	10/27/2016	10/27/2016

Project Delay	2a: Downstream Replacement w/ BRT	2b: Upstream Replacement w/ BRT	3a: Downstream Replacement w/ LRT	3b: Upstream Replacement w/LRT	4: Supplemental Crossing w/ BRT	5: Supplemental Crossing w/ LRT
Mean Expected Delay	24.9	22.8	24.9	22.8	32.0	32.0
10 % Probability of Exceeding	38.1	44.9	38.1	44.9	50.8	50.8
40 % Probability of Exceeding	27.4	28.1	27.4	28.1	35.3	35.3
50% Probability of Exceeding	25.1	23.3	25.1	23.3	31.8	31.8
90% Probability of Exceeding	13.4	3.4	13.4	3.4	16.9	16.9

Note: Project delays are expressed in months.

Summary of Findings, Vancouver Alignment

- ◆ For Alternative 2a the 90% probability that costs will not exceeding is **\$3.83 billion** or 46% over the non-escalated base costs (\$2.62 billion). The 80% range of confidence for total costs is between \$3.31 billion and \$3.83 billion. The mean expected schedule delay for this project is 24.9 months.
- ◆ For Alternative 2b the 90% probability that costs will not exceeding is **\$3.99 billion** or 50% over the base costs (\$2.66 billion). The 80% range of confidence for total costs is between \$3.44 billion and \$3.99 billion. The mean expected schedule delay for this project is 22.8 months.
- ◆ For Alternative 3a the 90% probability that costs will not exceeding is **\$4.02 billion** or 45% over the base costs (\$2.76 billion). The 80% range of confidence for total costs is between \$3.51 billion and \$4.02 billion. The mean expected schedule delay for this project is 24.9 months.
- ◆ For Alternative 3b the 90% probability that costs will not exceeding is **\$4.19 billion** or 50% over the base costs (\$2.80 billion). The 80% range of confidence for total costs is between \$3.64 billion and \$4.19 billion. The mean expected schedule delay for this project is 22.8 months.
- ◆ For Alternative 4 the 90% probability that costs will not exceeding is **\$3.69 billion** or 51% over the base costs (\$2.45 billion). The 80% range of confidence for total costs is between \$3.27 billion and \$3.69 billion. The mean expected schedule delay for this project is 32.0 months.
- ◆ For Alternative 5 the 90% probability that costs will not exceeding is **\$3.86 billion** or 51% over the base costs (\$2.56 billion). The 80% range of confidence for total costs is between \$3.43 billion and \$3.86 billion. The mean expected schedule delay for this project is 32.0 months.

I-5 COLUMBIA RIVER CROSSING PROJECT

Summary of Findings, I-5 Alignment

- ◆ For Alternative 2a the 90% probability that costs will not exceeding is **\$4.00** billion or 53% over the non-escalated base costs (\$2.62 billion). The 80% range of confidence for total costs is between \$3.51 billion and \$4.00 billion. The mean expected schedule delay for this project is 24.9 months.
- ◆ For Alternative 2b the 90% probability that costs will not exceeding is **\$4.17** billion or 57% over the base costs (\$2.66 billion). The 80% range of confidence for total costs is between \$3.63 billion and \$4.17 billion. The mean expected schedule delay for this project is 22.8 months.
- ◆ For Alternative 3a the 90% probability that costs will not exceeding is **\$4.18** billion or 51% over the base costs (\$2.76 billion). The 80% range of confidence for total costs is between \$3.70 billion and \$4.18 billion. The mean expected schedule delay for this project is 24.9 months.
- ◆ For Alternative 3b the 90% probability that costs will not exceeding is **\$4.39** billion or 57% over the base costs (\$2.80 billion). The 80% range of confidence for total costs is between \$3.83 billion and \$4.39 billion. The mean expected schedule delay for this project is 22.8 months.
- ◆ For Alternative 4 the 90% probability that costs will not exceeding is **\$3.88** billion or 59% over the base costs (\$2.45 billion). The 80% range of confidence for total costs is between \$3.46 billion and \$3.88 billion. The mean expected schedule delay for this project is 32.0 months.
- ◆ For Alternative 5 the 90% probability that costs will not exceeding is **\$4.05** billion or 58% over the base costs (\$2.56 billion). The 80% range of confidence for total costs is between \$3.64 billion and \$4.05 billion. The mean expected schedule delay for this project is 32.0 months.

APPENDIX F: PRELIMINARY RESULTS PRESENTATION MINIMAL OPERABLE SEGMENT

The following pages contain the power point presentation of the final results for the minimal operable segment length alternatives.

Columbia River Crossing

COLUMBIA RIVER CROSSING PROJECT

Cost Risk Analysis

Summary of Assumptions & Preliminary Results MOS Alternatives

All results are preliminary and subject to revisions

Prepared by:

HDR | HLB Decision Economics Inc.
with Participation from the Project Team

October 9, 2007



Introduction

◆ Document Structure

- Flowcharts and Assumptions – slides 3-8
- Project Costs – slides 9-18
- Project Schedule – slides 19-23
- Project summary – slide 24

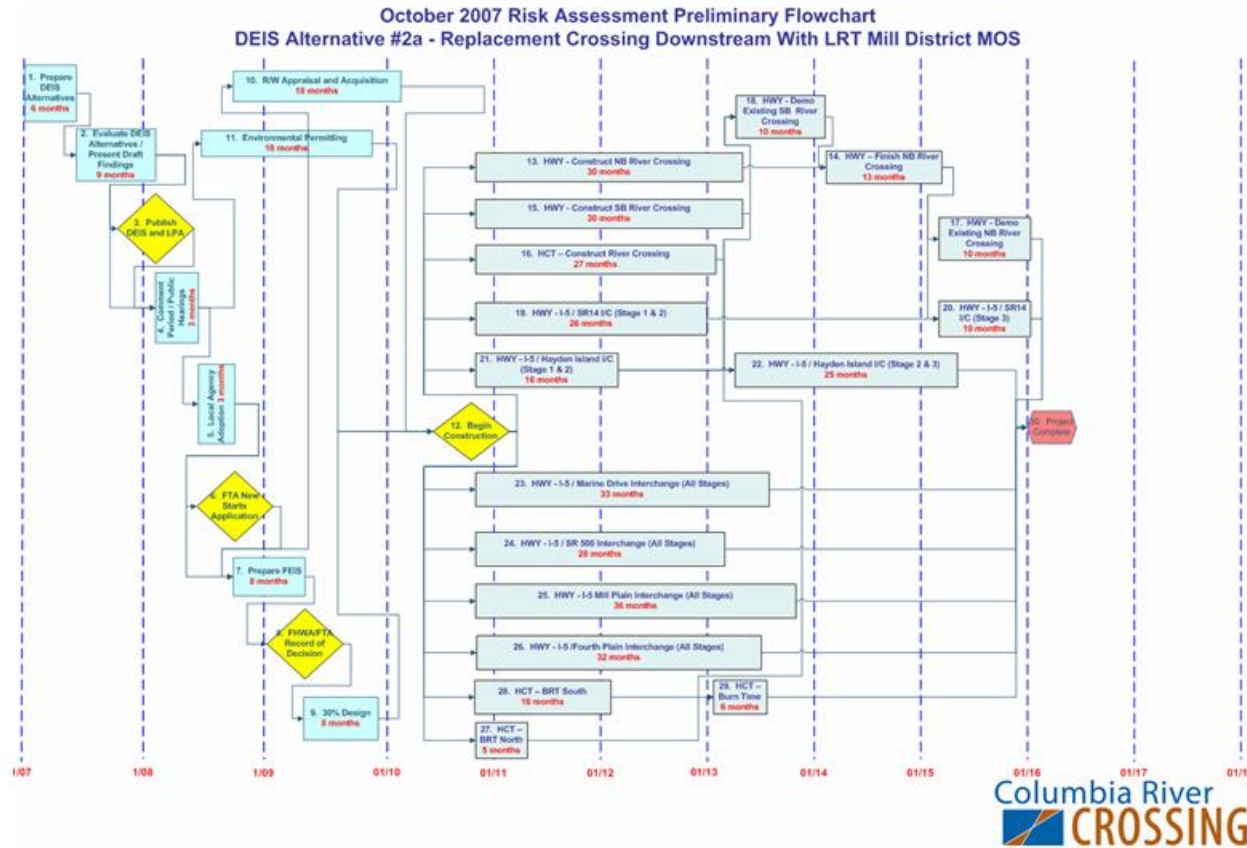
◆ Alternatives under review in this presentation:

- #2a: Replacement Crossing Downstream with BRT Mill District MOS
- #2a: Replacement Crossing Upstream with BRT Clark College MOS
- #3a: Replacement Crossing Downstream with LRT Mill District MOS
- #3a: Replacement Crossing Upstream with LRT Clark College MOS

◆ Project Design is approximately 10%.

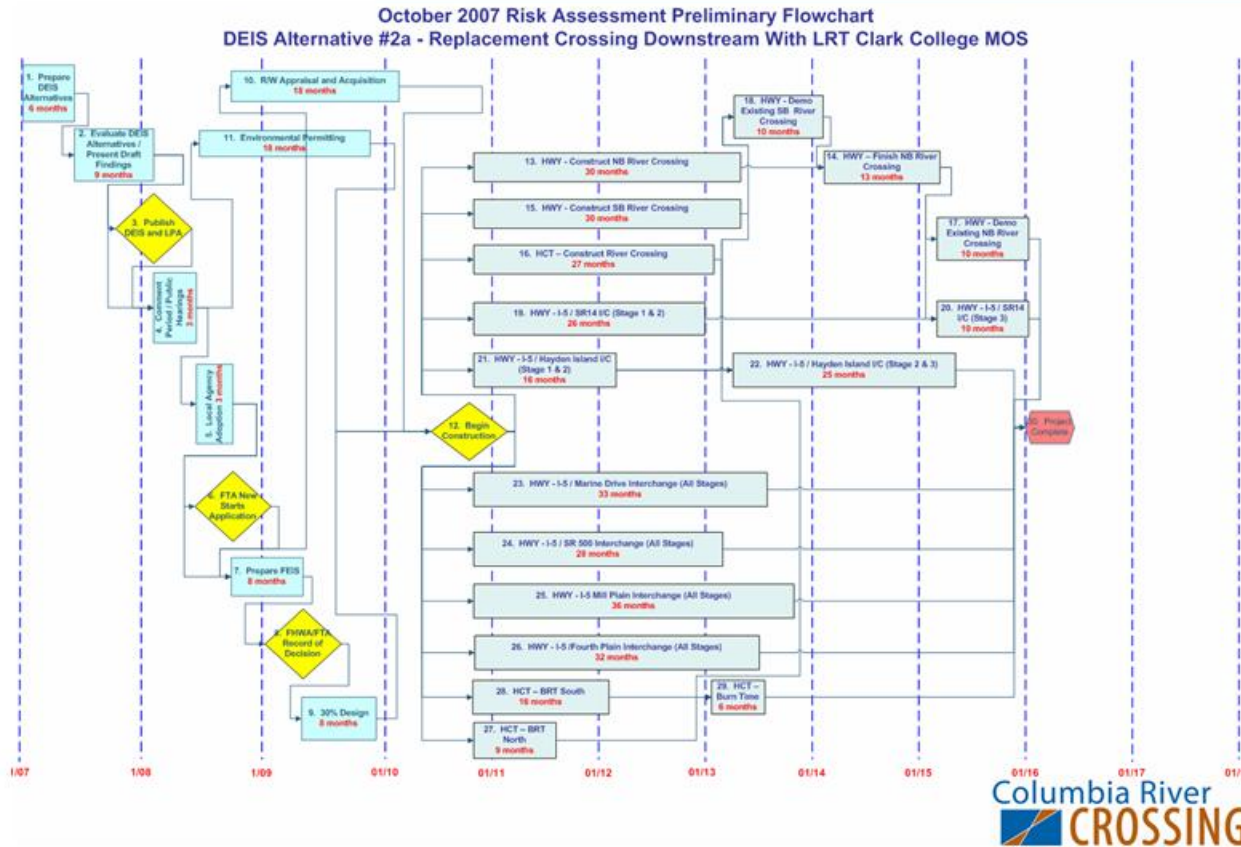
I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

Project Flowchart 2a, Downstream Replacement w/ BRT Mill District MOS



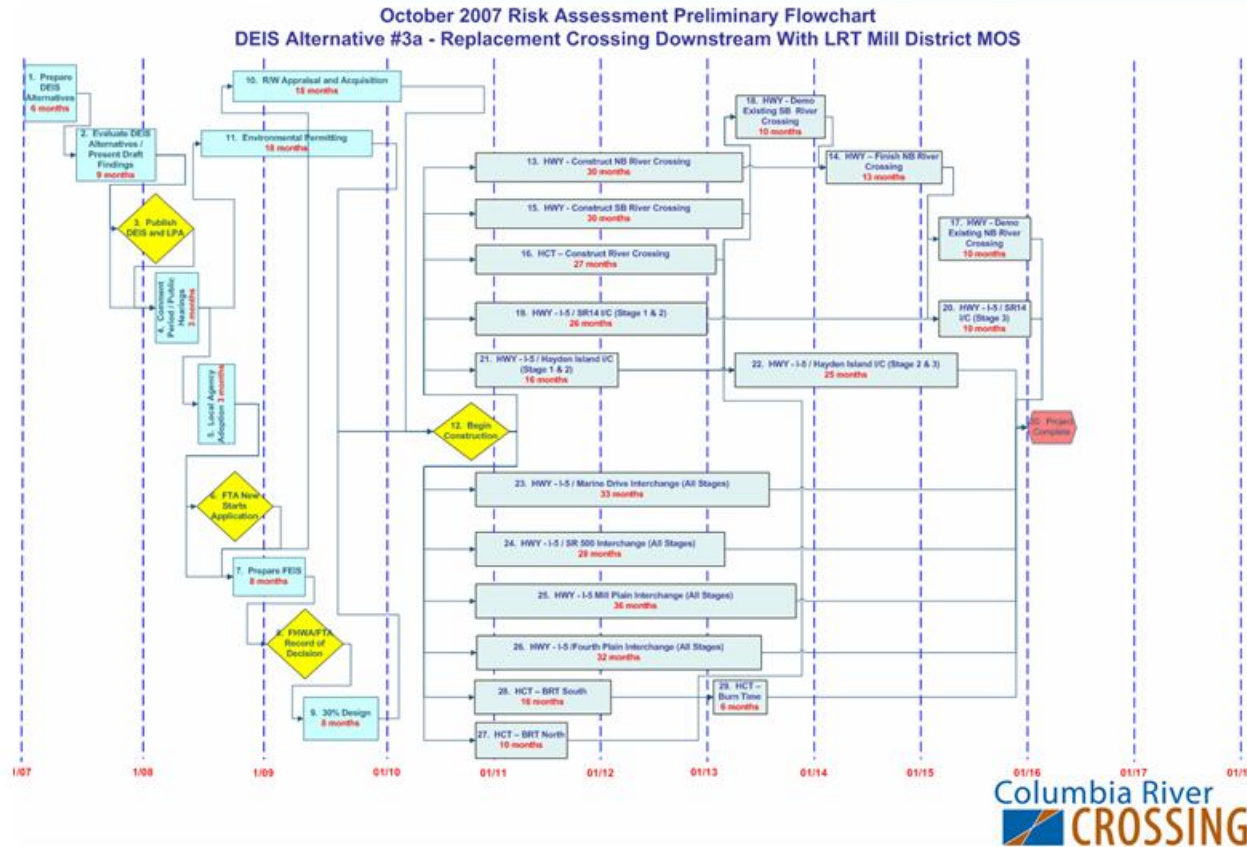
I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

Project Flowchart 2a, Downstream Replacement w/ BRT Clark College MOS



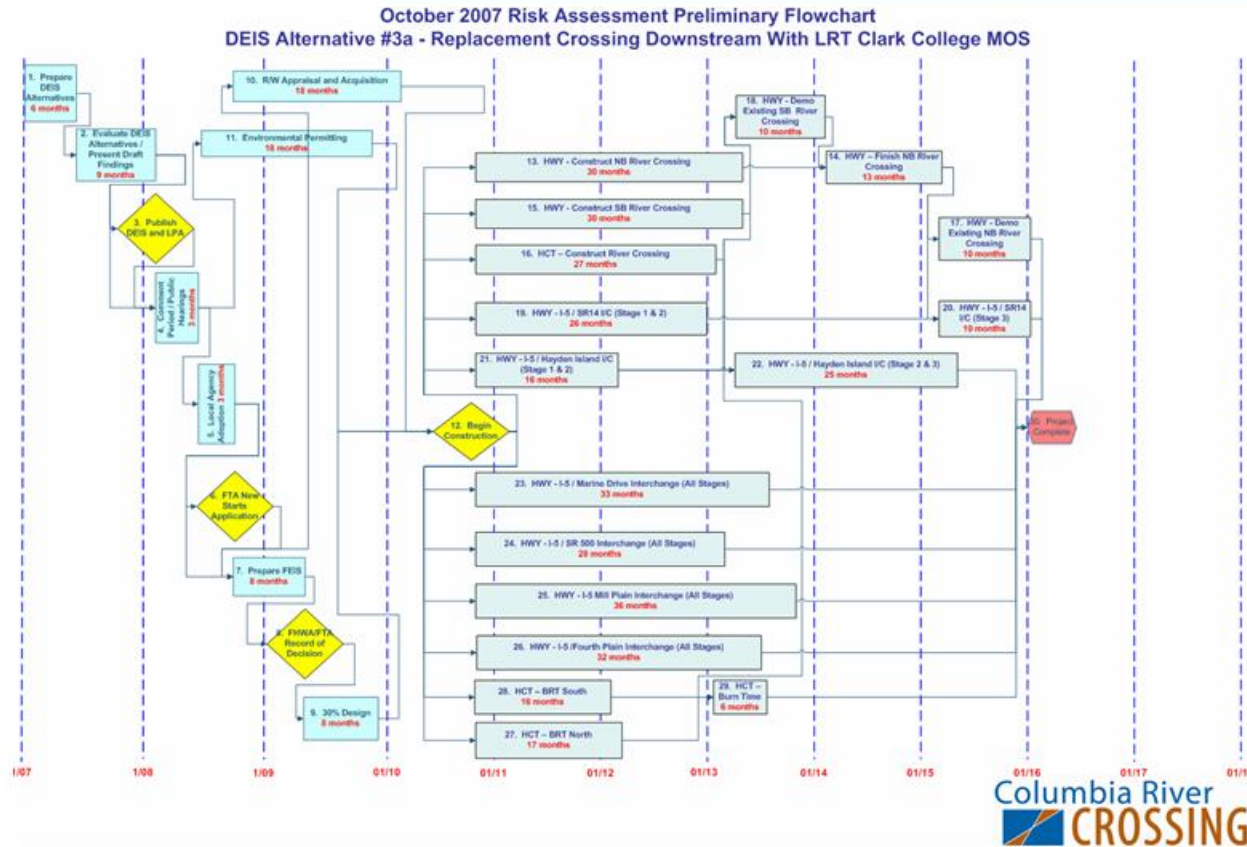
I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

Project Flowchart 3a, Downstream Replacement w/ LRT Mill District MOS



I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

Project Flowchart 3a, Downstream Replacement w/ LRT Clark College MOS



I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

Base Cost Estimate Uncertainties

Description	Low	High
Pavement	-10.00%	15.00%
Earthwork	-10.00%	20.00%
Bridges	-15.00%	20.00%
Walls	-10.00%	20.00%
Other	-10.00%	10.00%
Guideway	-5.00%	20.00%
Tracks	-10.00%	15.00%
Stations	-10.00%	20.00%
Sitework	-5.00%	20.00%
Systems	-5.00%	20.00%
Non-Distributed Construction Costs	-5.00%	15.00%
Non-Distributed Construction Costs (Bridge)	-5.00%	15.00%
Professional Services	-5.00%	15.00%
Support Facilities and Vehicles	-5.00%	15.00%
Right-of-Way	-5.00%	15.00%
Right-of-Way (Bridge)	-5.00%	10.00%

Values are percentage deviations around the baseline estimates with the low defined as the lower 10% value and the high defined as the upper 10% value. Applicable to all projects.

I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

Escalation Factors

- ◆ **Construction costs were escalated with an annually adjusted rate from projections developed in a previous HDR study for WSDOT on construction escalation. The annual estimates are presented in the table below.**

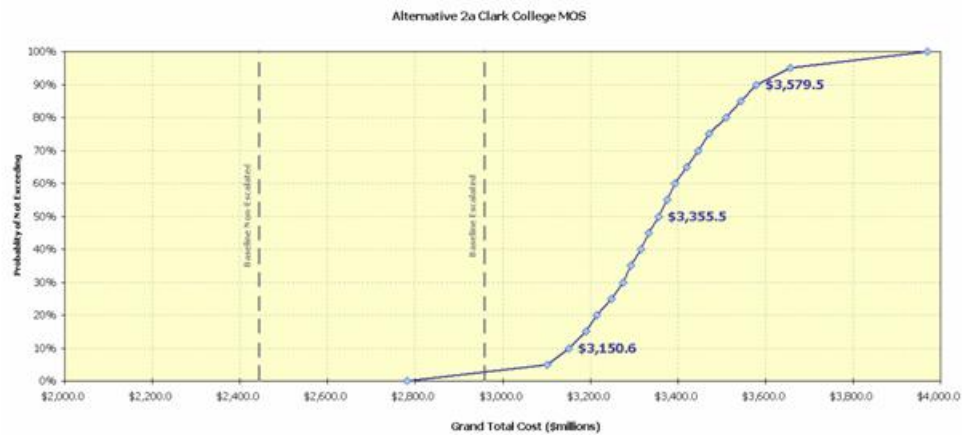
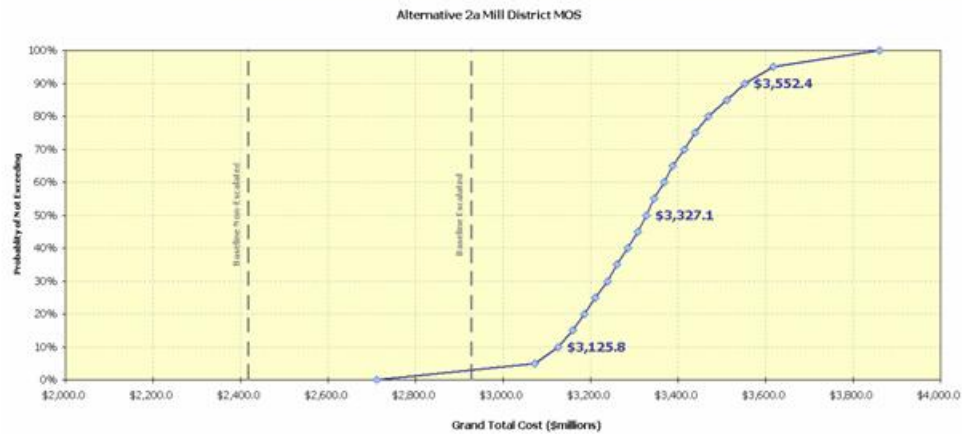
Year	Median	Lower 10% Limit	Upper 10% Limit
2006	5.20%	2.80%	8.50%
2007	5.20%	2.80%	8.50%
2008	5.20%	2.80%	8.50%
2009	4.90%	2.20%	8.60%
2010	4.50%	1.60%	8.60%
2011	4.20%	1.00%	8.70%
2012	3.90%	0.40%	8.80%
2013	3.50%	-0.20%	8.80%
2014	3.20%	-0.80%	8.90%
2015	2.80%	-1.40%	8.90%
2016	2.50%	-2.00%	9.00%
2017	2.50%	-2.00%	9.00%
2018	2.50%	-2.00%	9.00%
2019	2.50%	-2.00%	9.00%
2020	2.50%	-2.00%	9.00%
2021	2.50%	-2.00%	9.00%

- ◆ **Preliminary engineering and right-of-way costs are escalated with a flat rate indicated in the chart below.**

	Median	Lower 10% Limit	Upper 10% Limit
Preliminary Engineering	2.00%	2.80%	3.60%
Right-of-Way	4.00%	6.80%	9.60%

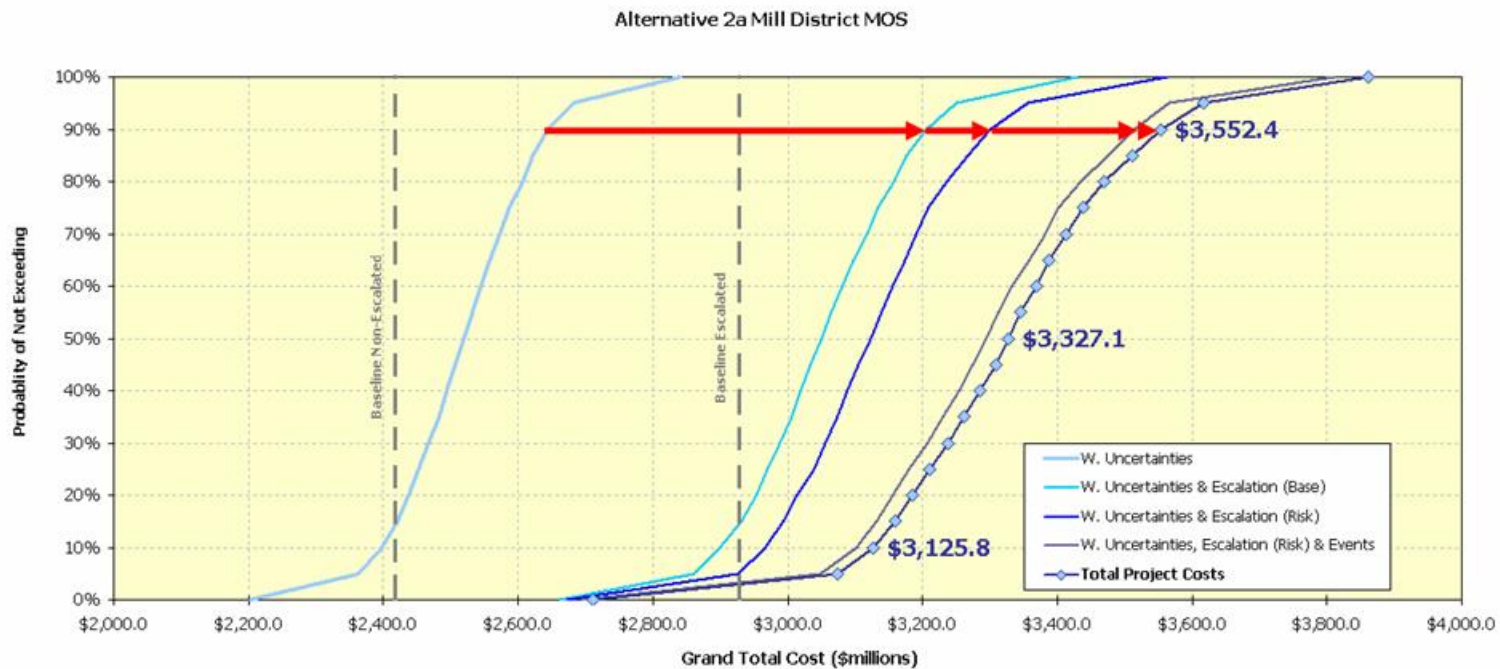
I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

Total Project Costs Summary 2a, Downstream Replacement w/ BRT



I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

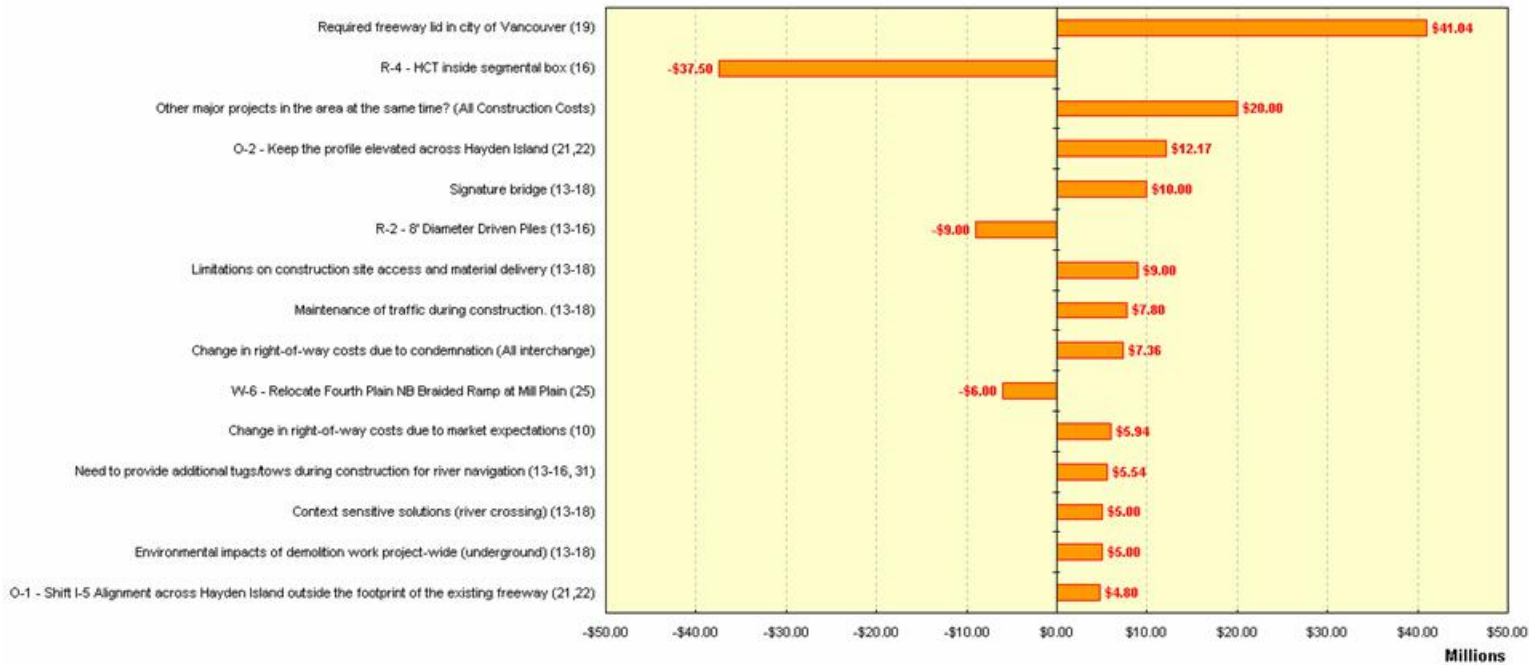
Total Project Costs Decomposition 2a Mill District, Downstream Replacement w/ BRT



I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

Identification of Key Cost Risks 2a, Downstream Replacement w/ BRT

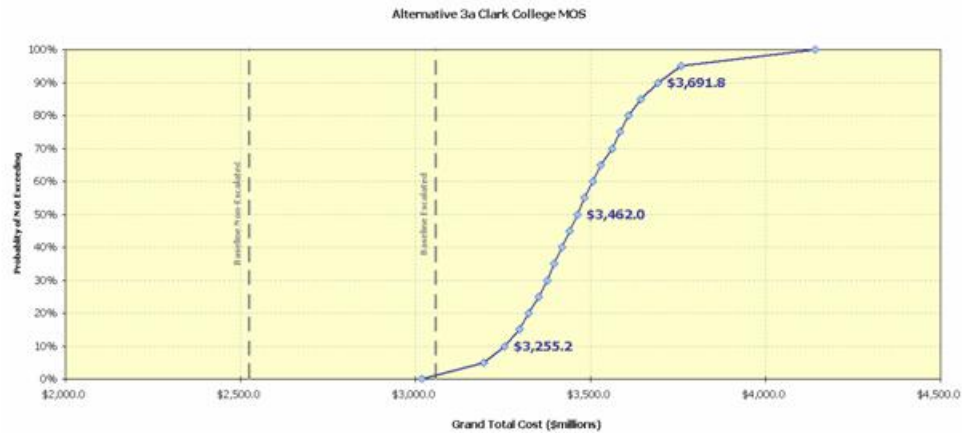
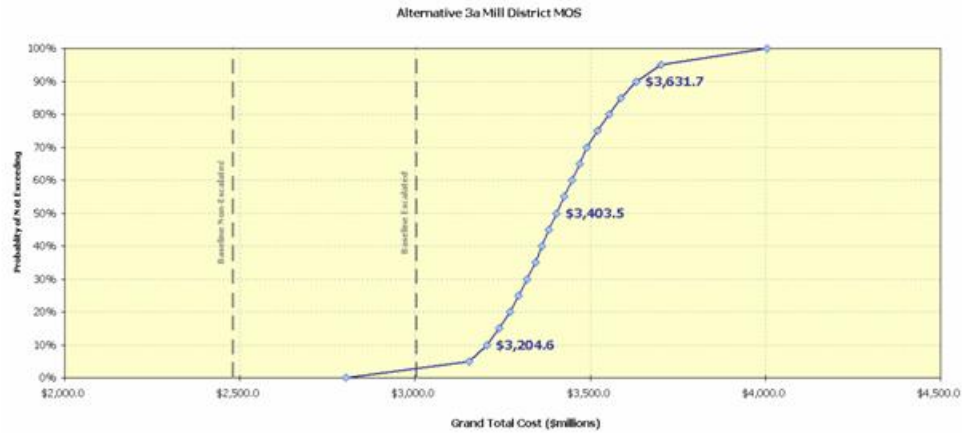
Tornado Chart: Expected Incremental Cost (\$million)



Note: This chart is based solely on the risk register: for each event risk, the expected cost impact is calculated as the product of the probability of occurrence times the cost estimate, both provided by the panelists. Derived for Main Street Alignment **Alternative 2a**.

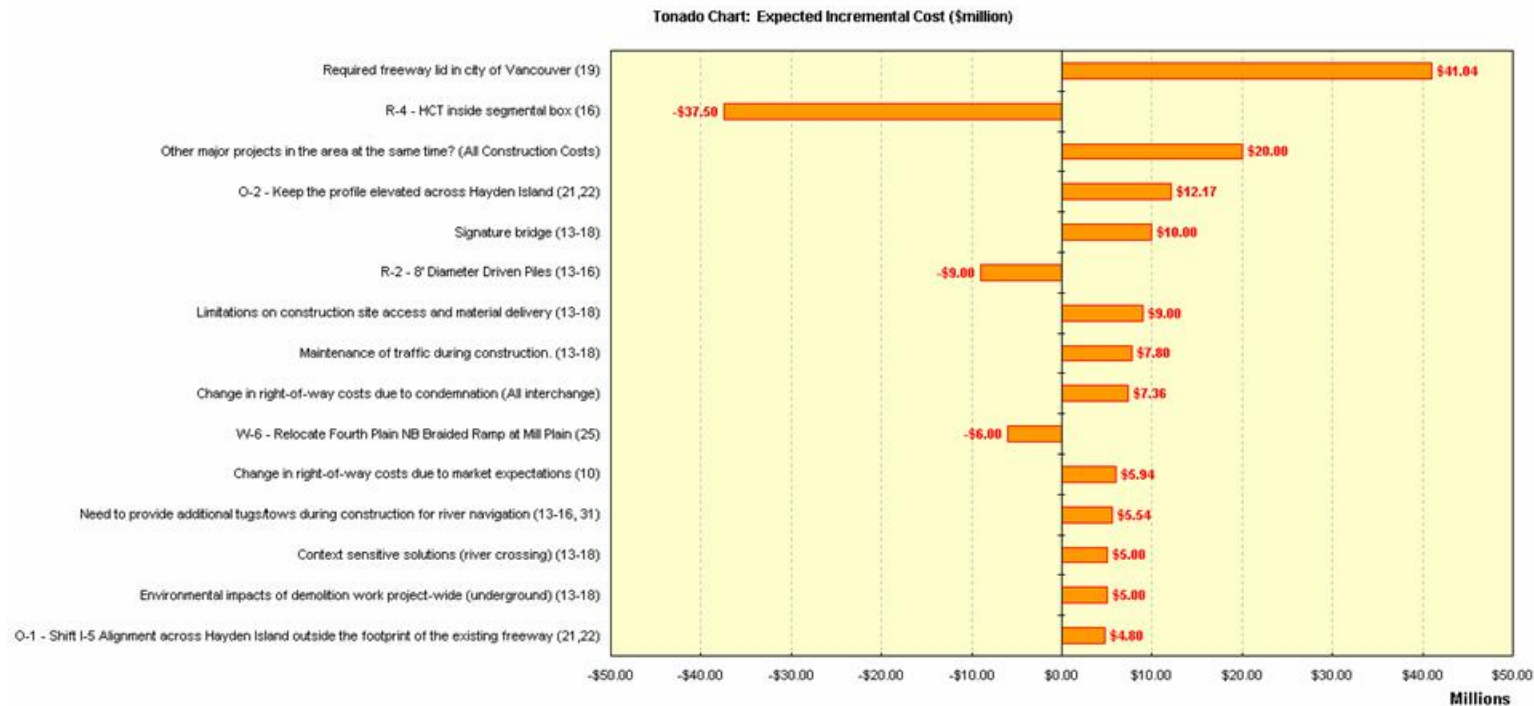
I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

Total Project Costs Summary 3a, Downstream Replacement w/ LRT



I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

Identification of Key Cost Risks 3a, Downstream Replacement w/ LRT

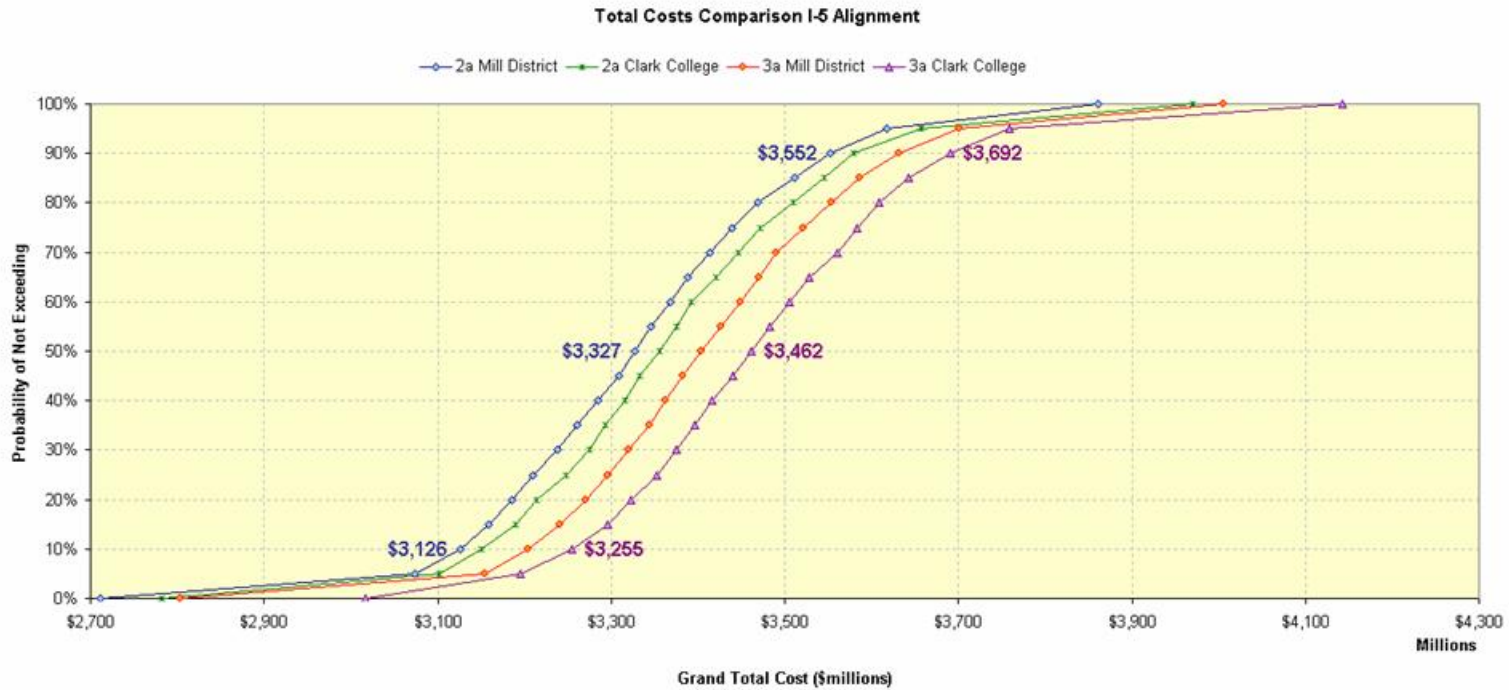


Note: This chart is based solely on the risk register: for each event risk, the expected cost impact is calculated as the product of the probability of occurrence times the cost estimate, both provided by the panelists. Derived for Main Street Alignment **Alternative 3a**.

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I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

Total Costs Comparison



I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

Project Costs Summary Table

Mean Expected Outcomes (\$millions)	2a: Downstream Replacement w/ BRT Mill District MOS	2a: Downstream Replacement w/ BRT Clark College MOS	3a: Downstream Replacement w/ LRT Mill District MOS	3a: Downstream Replacement w/ LRT Clark College MOS
Base Costs	\$2,417.7	\$2,444.3	\$2,480.2	\$2,524.8
Base Costs + Budget Uncertainty	\$2,522.6	\$2,550.5	\$2,587.9	\$2,634.6
Base Costs + Escalation (Base Schedule)	\$2,927.5	\$2,958.8	\$3,003.6	\$3,057.0
Base Costs + Budget Uncertainty + Escalation (Base Schedule)	\$3,054.7	\$3,087.5	\$3,134.1	\$3,190.0
Base Costs + Budget Uncertainty + Escalation (Risk Adjusted Schedule)	\$3,128.4	\$3,162.6	\$3,209.5	\$3,267.5
Base Costs + Budget Uncertainty + Escalation (Risk Adjusted Schedule) + Event Risks	\$3,301.3	\$3,335.5	\$3,380.9	\$3,438.9
Base Costs + Budget Uncertainty + Escalation (Risk Adjusted Schedule) + Event Risks + Project Delay Cost = Total Project Cost	\$3,333.0	\$3,367.5	\$3,413.4	\$3,472.0

Total Project Costs (\$millions)	2a: Downstream Replacement w/ BRT Mill District MOS	2a: Downstream Replacement w/ BRT Clark College MOS	3a: Downstream Replacement w/ LRT Mill District MOS	3a: Downstream Replacement w/ LRT Clark College MOS
Mean Expected Outcomes	\$3,333.0	\$3,367.5	\$3,413.4	\$3,472.0
10 % Probability of Exceeding	\$3,552.4	\$3,579.5	\$3,631.7	\$3,691.8
40 % Probability of Exceeding	\$3,368.9	\$3,392.8	\$3,448.3	\$3,506.1
50% Probability of Exceeding	\$3,327.1	\$3,355.5	\$3,403.5	\$3,462.0
90% Probability of Exceeding	\$3,125.8	\$3,150.6	\$3,204.6	\$3,255.2

I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

Transit Costs Summary Table

Transit Costs MOS Alternatives

Total Project Costs (\$millions)	2a: Downstream Replacement w/ BRT Mill District MOS	2a: Downstream Replacement w/ BRT Clark College MOS	3a: Downstream Replacement w/ LRT Mill District MOS	3a: Downstream Replacement w/ LRT Clark College MOS
Mean Expected Outcomes	\$520.0	\$554.0	\$600.3	\$657.2
10 % Probability of Exceeding	\$576.1	\$612.2	\$658.9	\$721.3
40 % Probability of Exceeding	\$534.9	\$572.1	\$615.8	\$674.9
50% Probability of Exceeding	\$522.1	\$557.2	\$602.7	\$661.4
90% Probability of Exceeding	\$465.9	\$497.2	\$538.9	\$596.1

I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

Highway Costs Summary Table

Highway Costs MOS Alternatives

Total Project Costs (\$millions)	2a: Downstream Replacement w/ BRT Mill District MOS	2a: Downstream Replacement w/ BRT Clark College MOS	3a: Downstream Replacement w/ LRT Mill District MOS	3a: Downstream Replacement w/ LRT Clark College MOS
Mean Expected Outcomes	\$2,688.6	\$2,688.0	\$2,687.8	\$2,687.3
10 % Probability of Exceeding	\$2,997.5	\$2,993.2	\$3,003.6	\$2,987.2
40 % Probability of Exceeding	\$2,834.7	\$2,833.7	\$2,836.9	\$2,836.8
50% Probability of Exceeding	\$2,796.8	\$2,797.2	\$2,800.7	\$2,795.8
90% Probability of Exceeding	\$2,620.1	\$2,612.3	\$2,626.0	\$2,616.7

I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

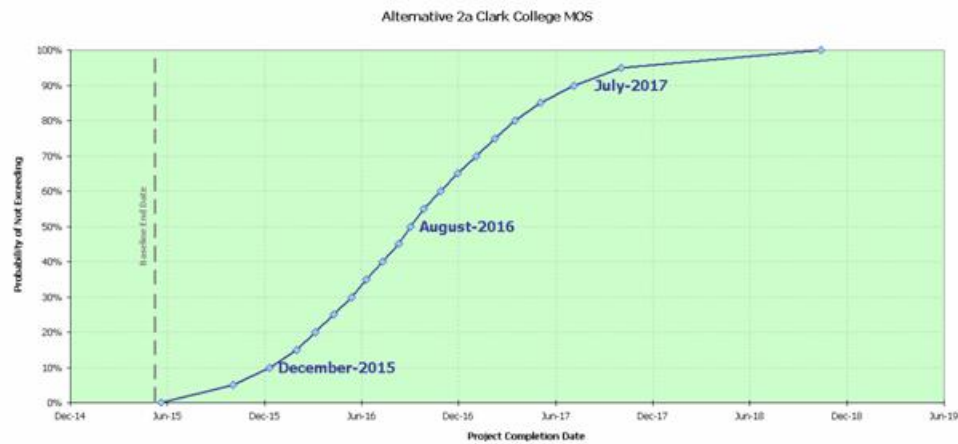
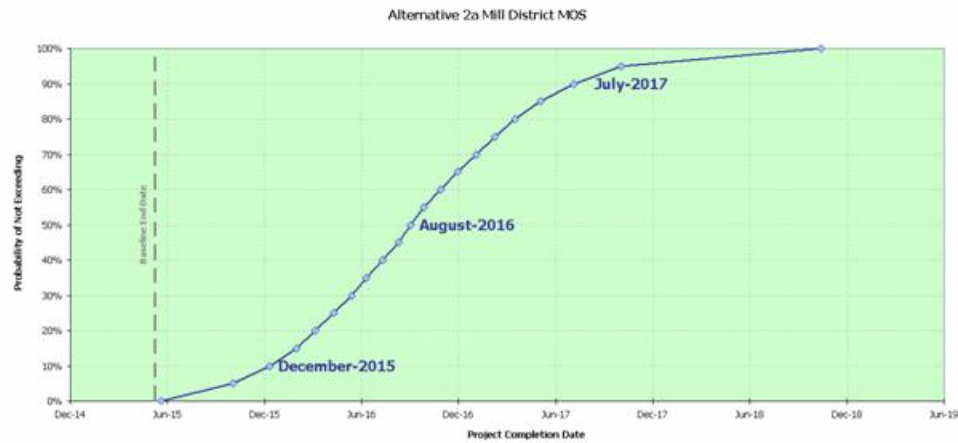
River Crossing Costs Summary Table

River Crossing Costs MOS Alternatives

Total Project Costs (\$millions)	2a: Downstream Replacement w/ BRT Mill District MOS	2a: Downstream Replacement w/ BRT Clark College MOS	3a: Downstream Replacement w/ LRT Mill District MOS	3a: Downstream Replacement w/ LRT Clark College MOS
Mean Expected Outcomes	\$1,286.2	\$1,295.4	\$1,345.6	\$1,368.1
10 % Probability of Exceeding	\$1,416.9	\$1,425.9	\$1,472.2	\$1,498.7
40 % Probability of Exceeding	\$1,322.7	\$1,323.2	\$1,383.0	\$1,406.2
50% Probability of Exceeding	\$1,297.2	\$1,304.4	\$1,358.7	\$1,382.0
90% Probability of Exceeding	\$1,181.7	\$1,195.5	\$1,248.6	\$1,260.9

I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

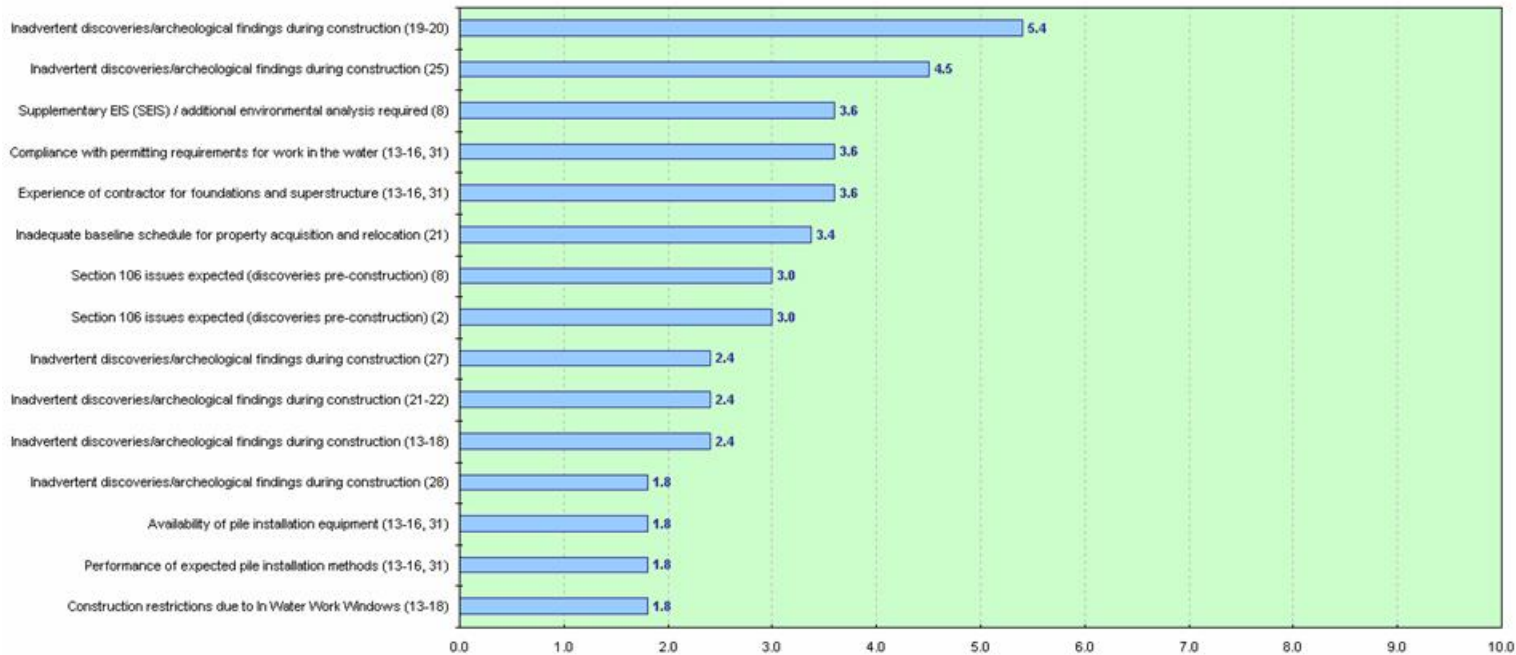
Project End Dates Summary 2a, Downstream Replacement w/ BRT



I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

Identification of Key Schedule Risks 2a, Downstream Replacement w/ BRT

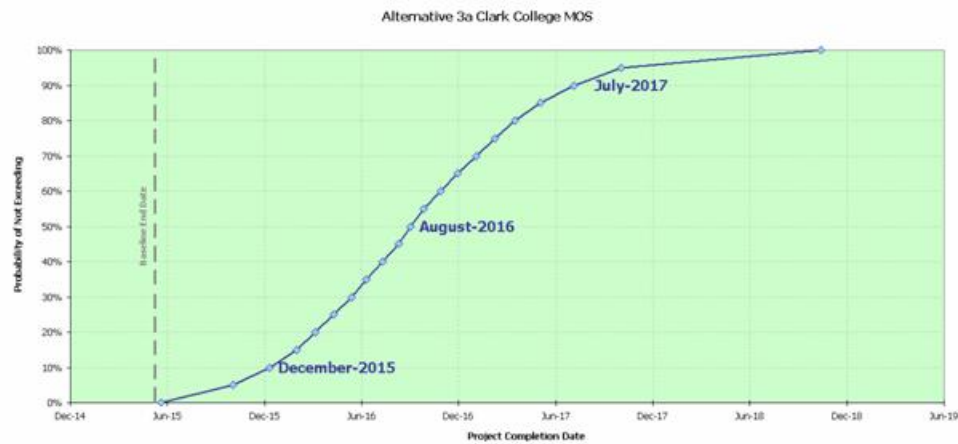
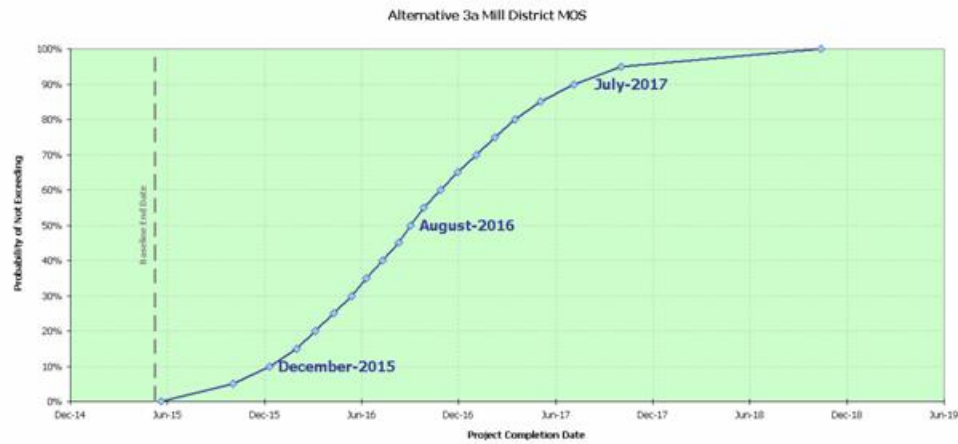
Tornado Chart: Expected Schedule Delays (months)



Note: This chart is based solely on the risk register: for each event risk, the expected schedule delay is calculated as the product of the probability of occurrence times the delay estimate, both provided by the panelists. Derived for Main Street Alignment **Alternative 2a**.

I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

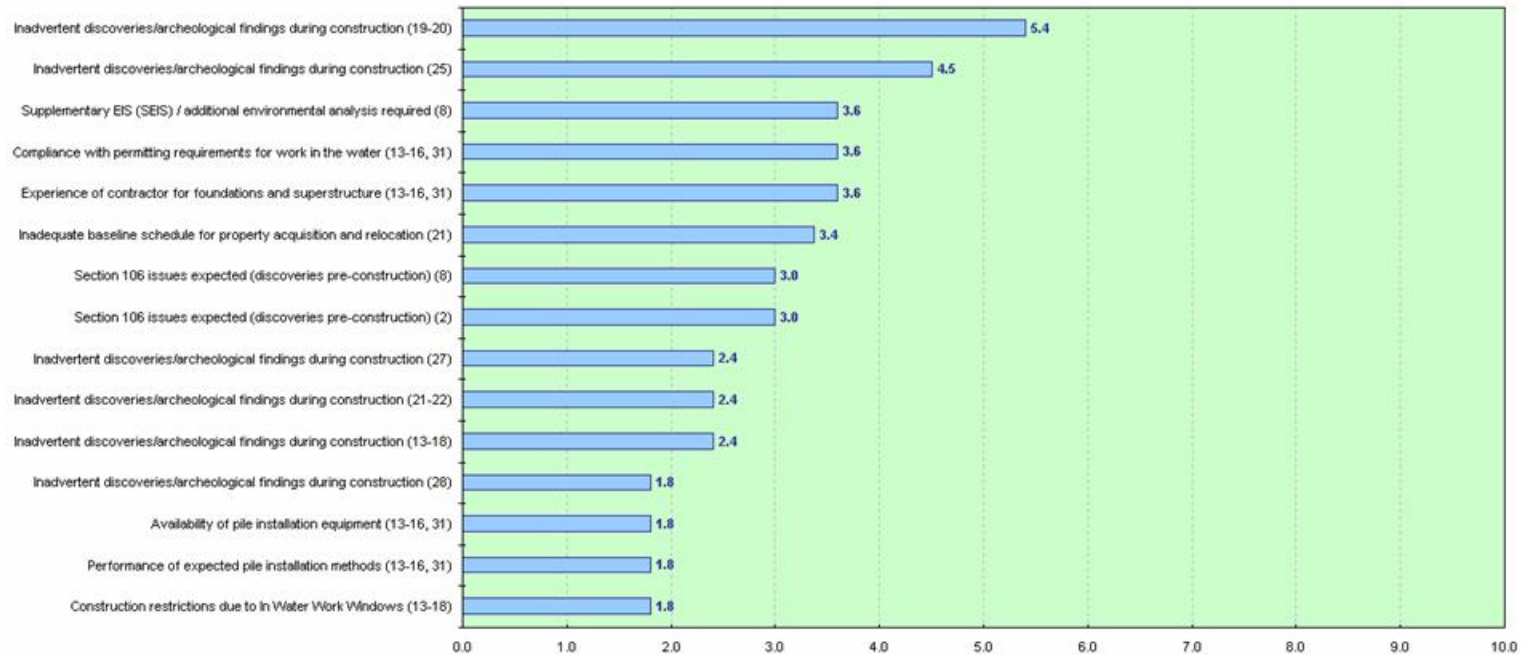
Project End Dates Summary 3a, Downstream Replacement w/ LRT



I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

Identification of Key Schedule Risks 3a, Downstream Replacement w/ LRT

Tornado Chart: Expected Schedule Delays (months)



Note: This chart is based solely on the risk register: for each event risk, the expected schedule delay is calculated as the product of the probability of occurrence times the delay estimate, both provided by the panelists. Derived for Main Street Alignment **Alternative 3a**.

I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

Project Schedule Summary Table, Main Street Alignment

Project End Dates	2a: Downstream Replacement w/ BRT Mill District MOS	2a: Downstream Replacement w/ BRT Clark College MOS	3a: Downstream Replacement w/ LRT Mill District MOS	3a: Downstream Replacement w/ LRT Clark College MOS
Baseline Project End Date	5/9/2015	5/9/2015	5/9/2015	5/9/2015
Mean Expected End Date	6/28/2015	6/28/2015	6/28/2015	6/28/2015
10 % Probability of Exceeding	7/4/2017	7/4/2017	7/4/2017	7/4/2017
40 % Probability of Exceeding	10/28/2016	10/28/2016	10/28/2016	10/28/2016
50% Probability of Exceeding	8/31/2016	8/31/2016	8/31/2016	8/31/2016
90% Probability of Exceeding	12/11/2015	12/11/2015	12/11/2015	12/11/2015

Project Delay	2a: Downstream Replacement w/ BRT Mill District MOS	2a: Downstream Replacement w/ BRT Clark College MOS	3a: Downstream Replacement w/ LRT Mill District MOS	3a: Downstream Replacement w/ LRT Clark College MOS
Mean Expected Delay	1.7	1.7	1.7	1.7
10 % Probability of Exceeding	25.8	25.8	25.8	25.8
40 % Probability of Exceeding	17.7	17.7	17.7	17.7
50% Probability of Exceeding	15.8	15.8	15.8	15.8
90% Probability of Exceeding	7.1	7.1	7.1	7.1

Note: Project delays are expressed in months.

I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

Summary of Findings

- ◆ For Alternative 2a Mill District the 90% probability that costs will not exceeding is **\$3.55** billion or 47% over the non-escalated base costs (\$2.42 billion). The 80% range of confidence for total costs is between \$3.13 billion and \$3.55 billion. The mean expected schedule delay for this project is 15.9 months.
- ◆ For Alternative 2a Clark College the 90% probability that costs will not exceeding is **\$3.58** billion or 46% over the base costs (\$2.44 billion). The 80% range of confidence for total costs is between \$3.15 billion and \$3.58 billion. The mean expected schedule delay for this project is 15.9 months.
- ◆ For Alternative 3a Mill District the 90% probability that costs will not exceeding is **\$3.63** billion or 46% over the base costs (\$2.48 billion). The 80% range of confidence for total costs is between \$3.20 billion and \$3.63 billion. The mean expected schedule delay for this project is 15.9 months.
- ◆ For Alternative 3a Clark College the 90% probability that costs will not exceeding is **\$3.69** billion or 46% over the base costs (\$2.52 billion). The 80% range of confidence for total costs is between \$3.26 billion and \$3.69 billion. The mean expected schedule delay for this project is 15.9 months.