# 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

**Report Date:** 2007-DEC 7

Washington State Department of Transportation/Oregon Department of Transportation

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**Cost Lead:** Roger Kitchin, CH2MHill, Columbia River Crossing

Columbia River CROSSING

**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 |



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## 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

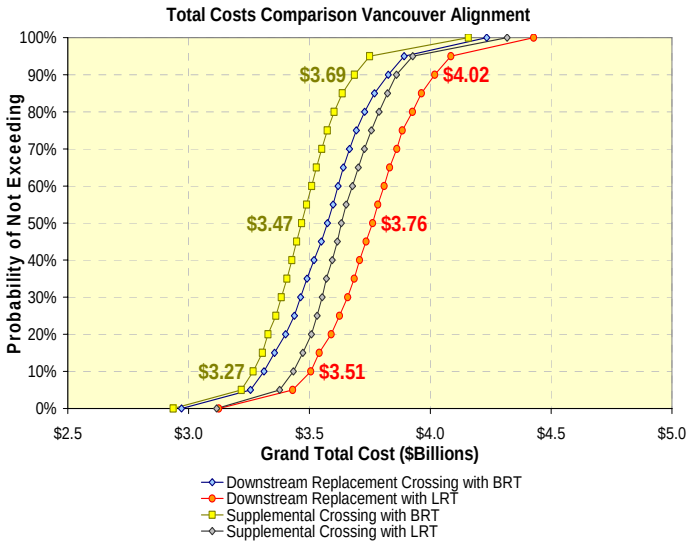
*October 2007*

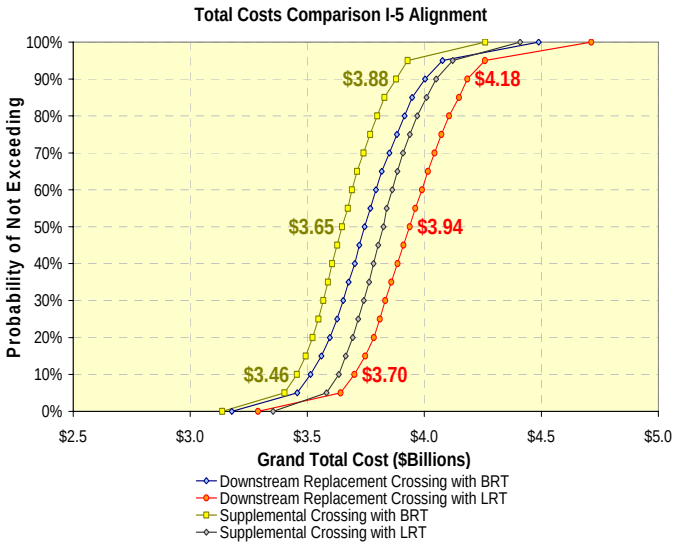
## Project Description:

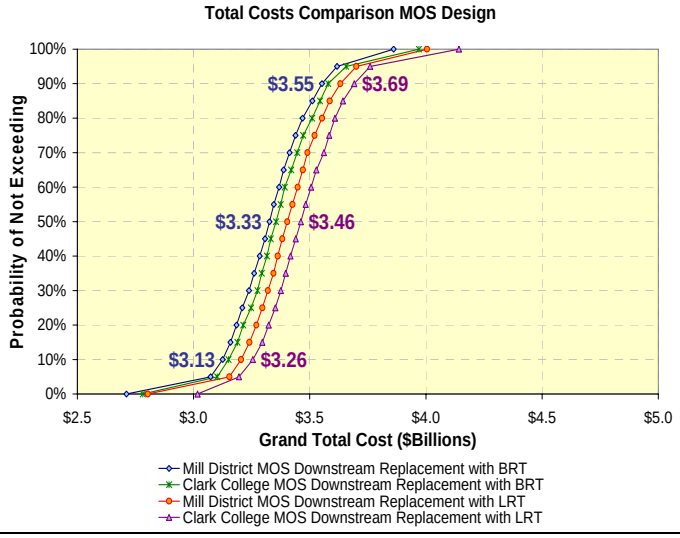
The Columbia River Crossing project is a bridge, transit and highway improvement project for I-5 between Vancouver and Portland. It is co-sponsored by the Oregon Department of Transportation and the Washington State Department of Transportation, and is working to address the congestion, mobility and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

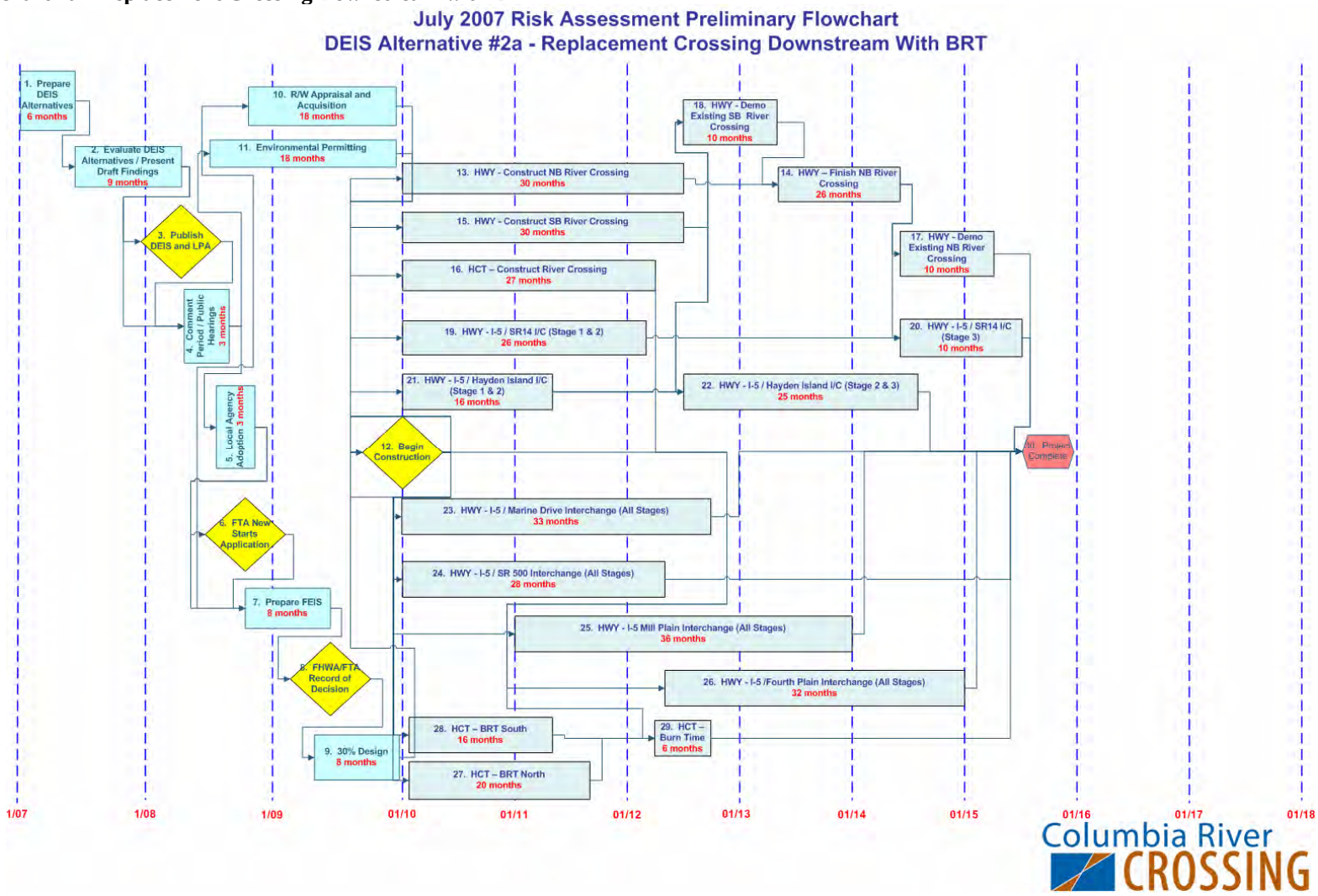


**Figure 2: Flowchart 2b - Replacement Crossing Upstream with BRT**

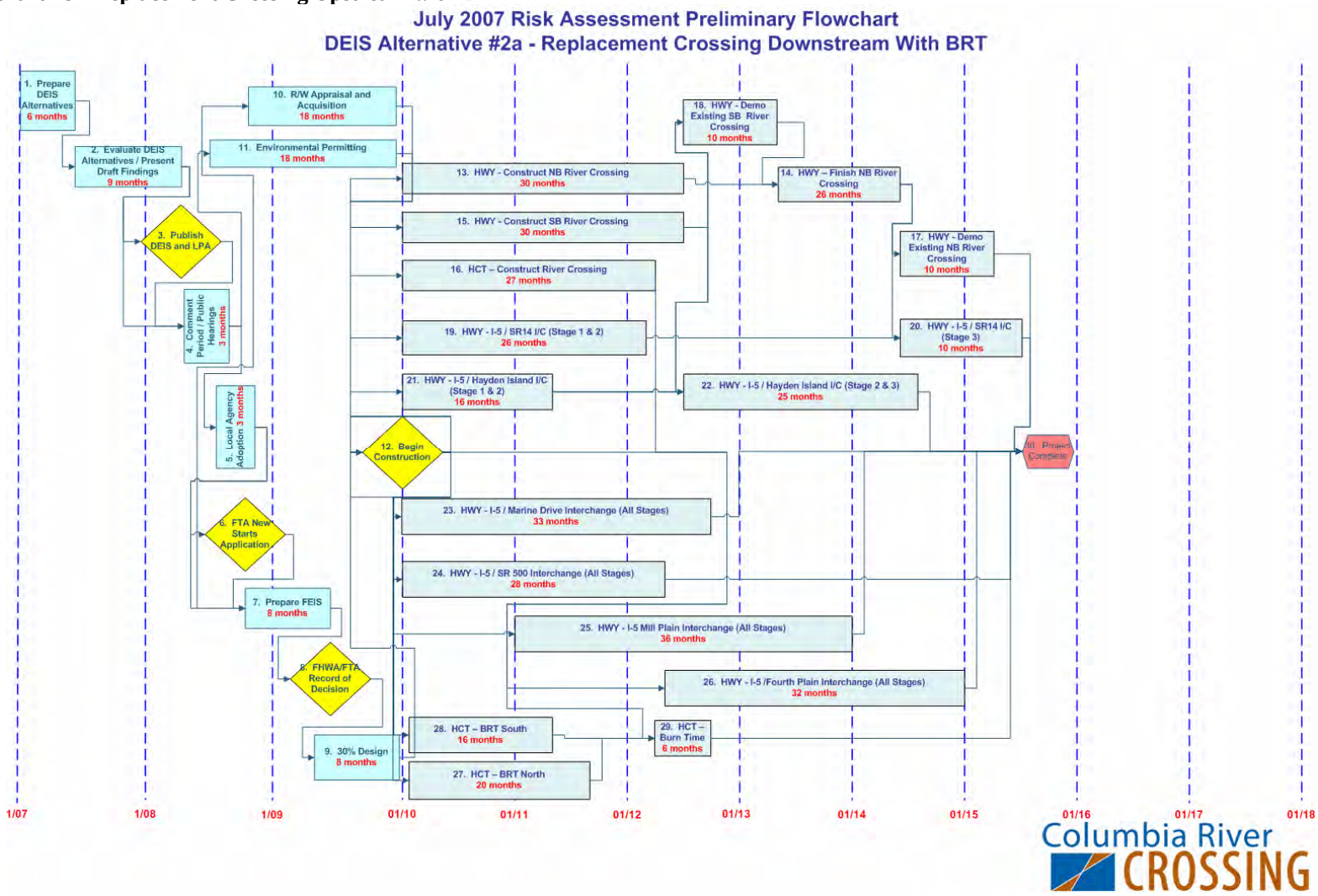


**Figure 3: Flowchart 3a - Replacement Crossing Downstream with LRT**

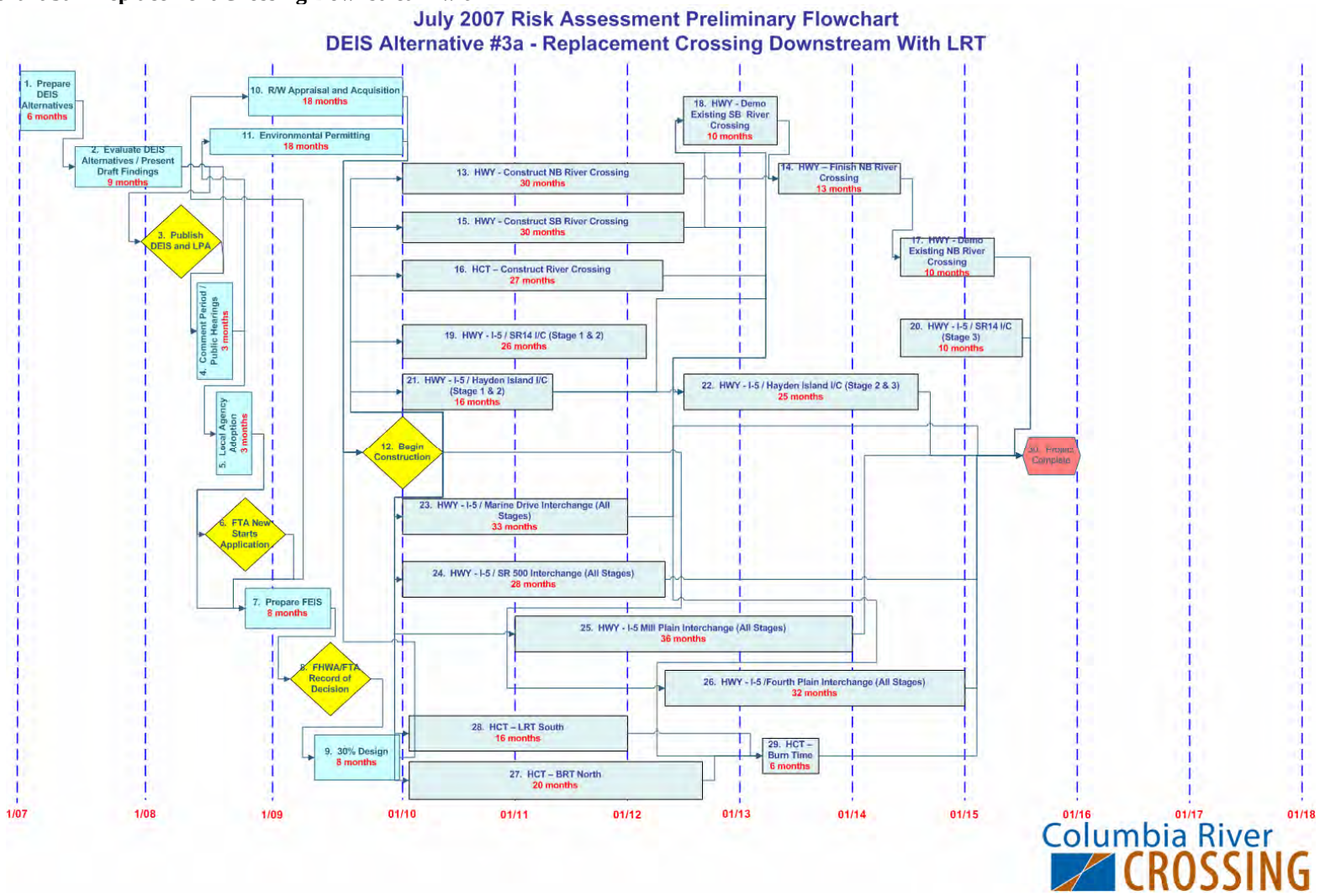


**Figure 4: Flowchart 3b - Replacement Crossing Upstream with LRT**

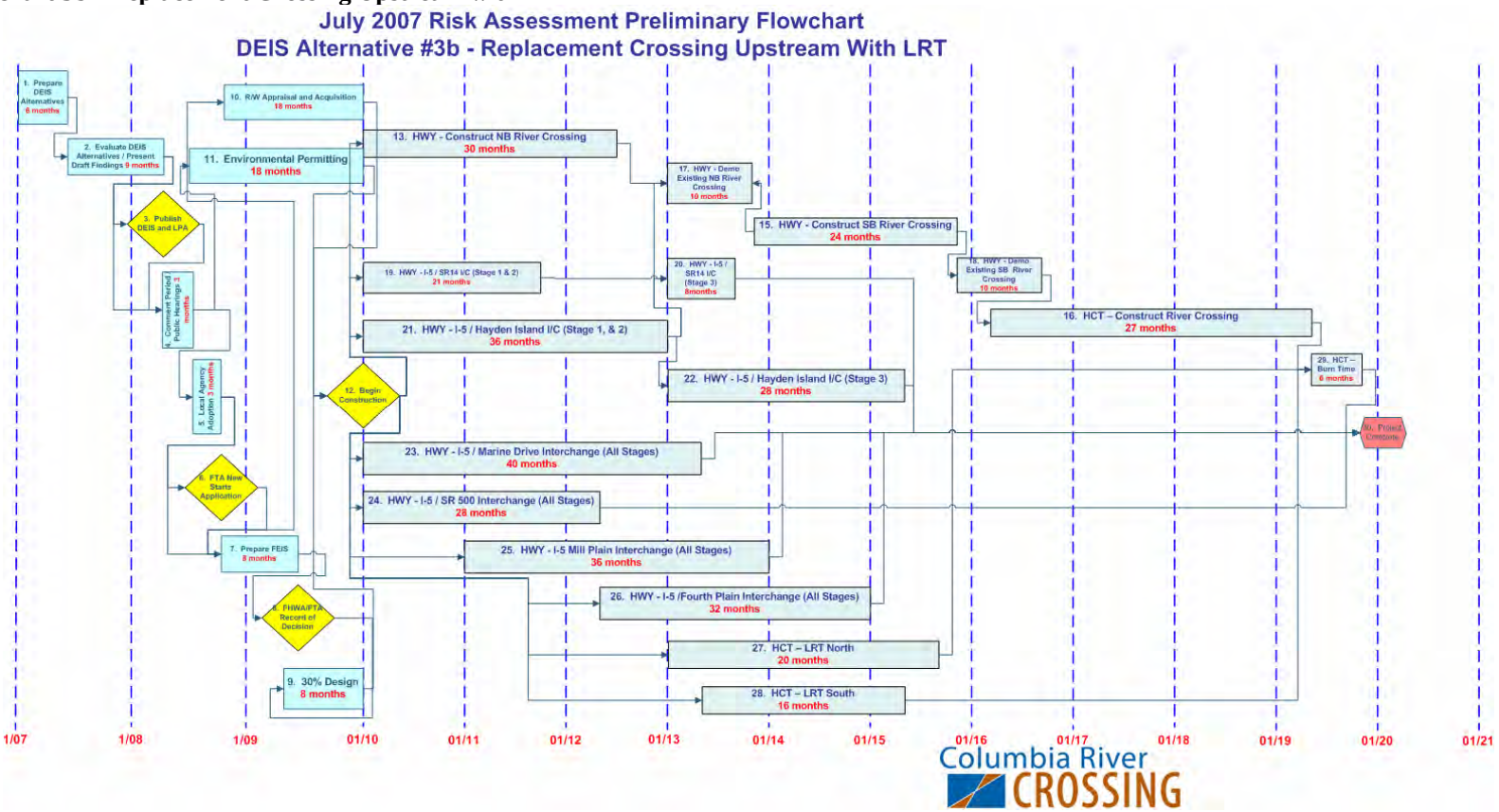


**Figure 5: Flowchart 4 - Supplemental Crossing with BRT**

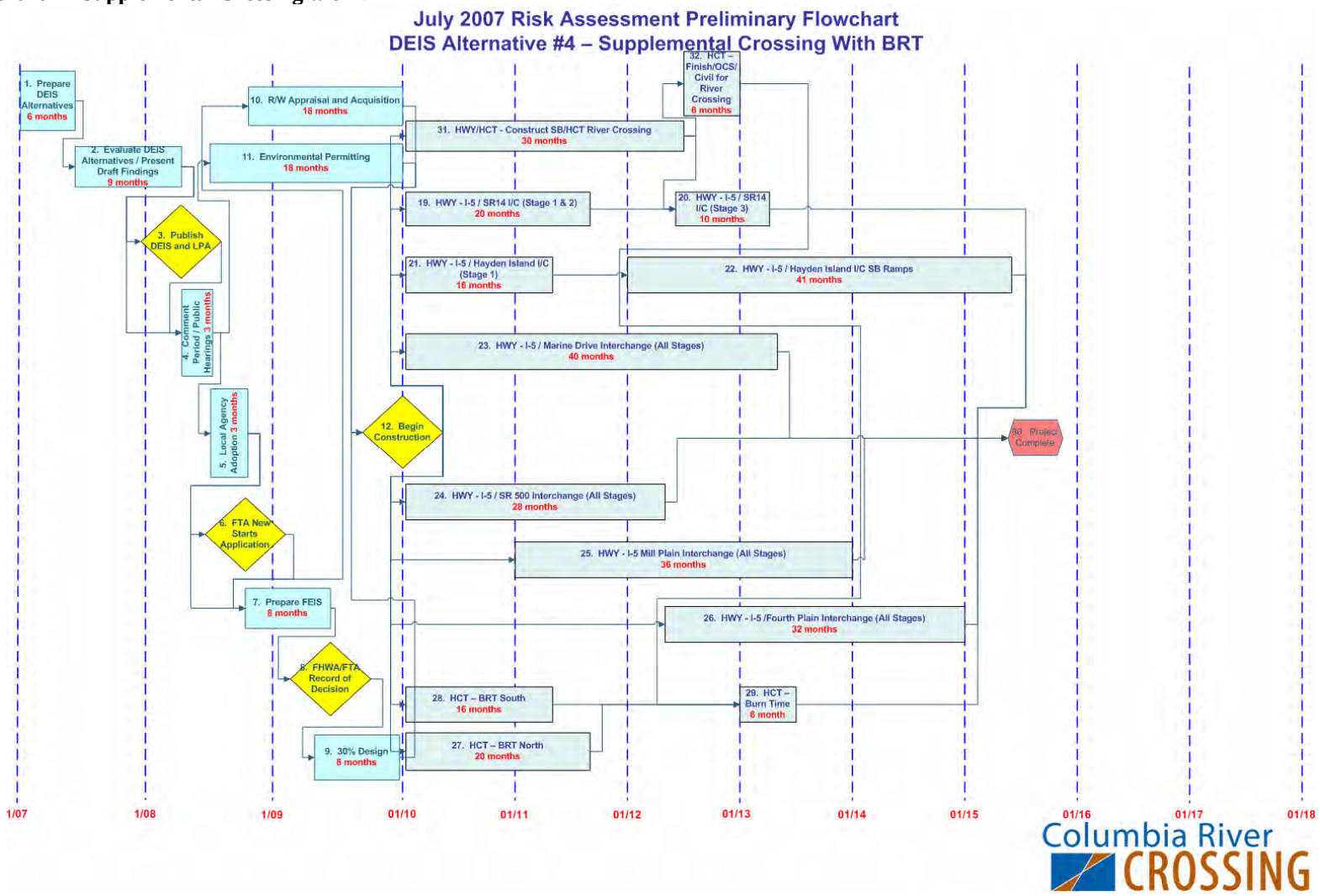


**Figure 6: Flowchart 5 - Supplemental Crossing with LRT**

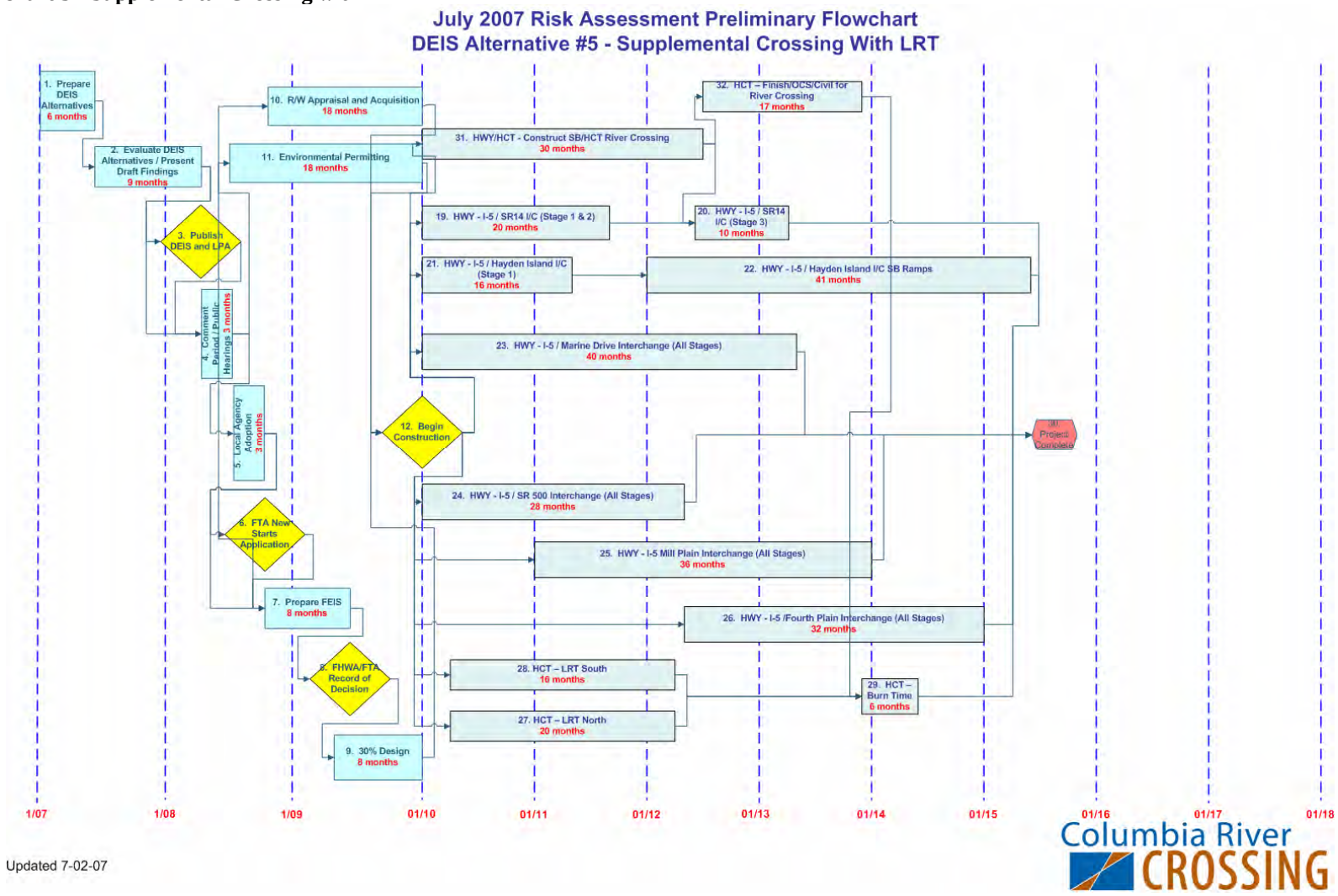


**Figure 7: Flowchart 2a - Replacement Crossing Downstream with BRT Mill District MOS**

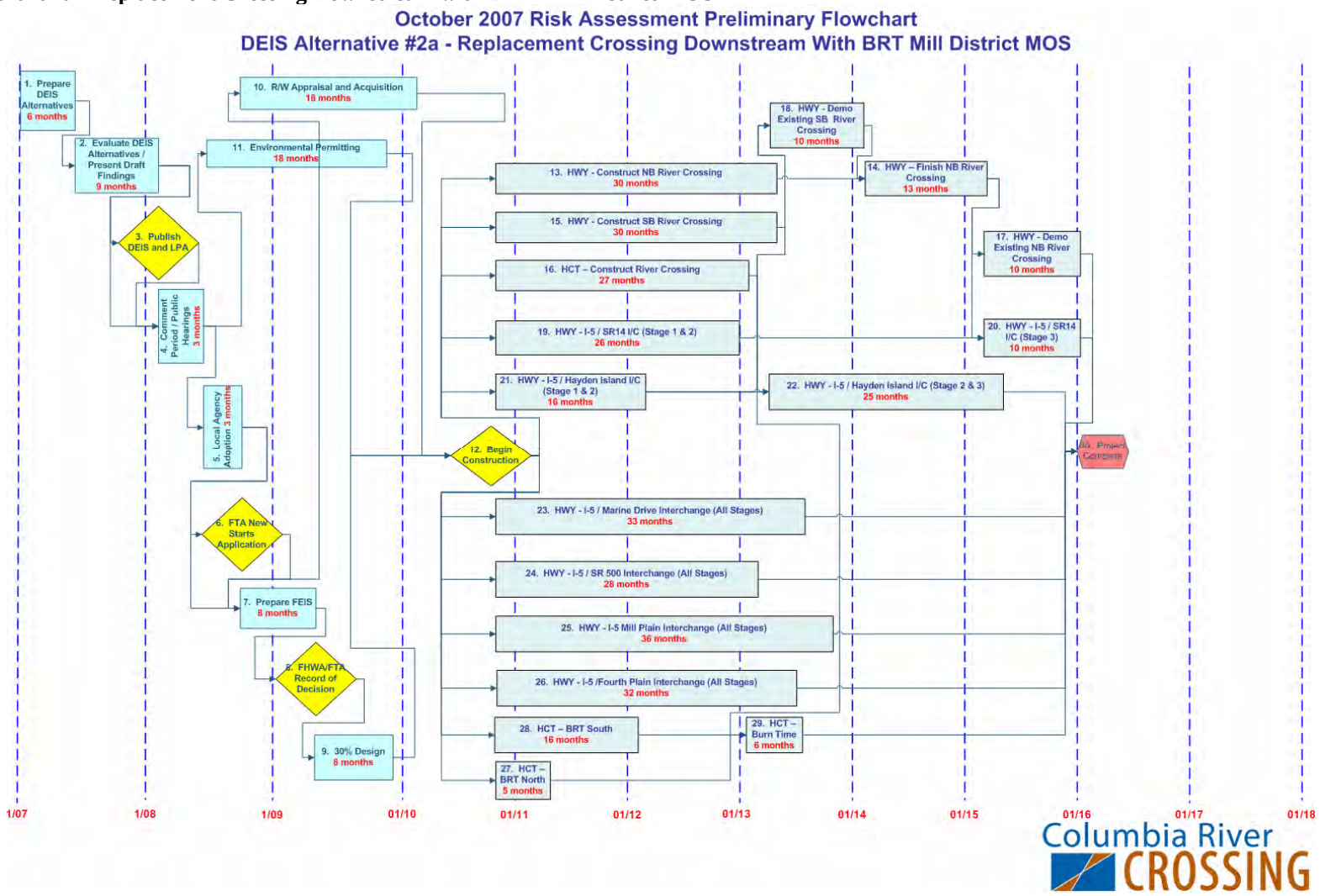


**Figure 8: Flowchart 2a - Replacement Crossing Downstream with BRT Clark College MOS**

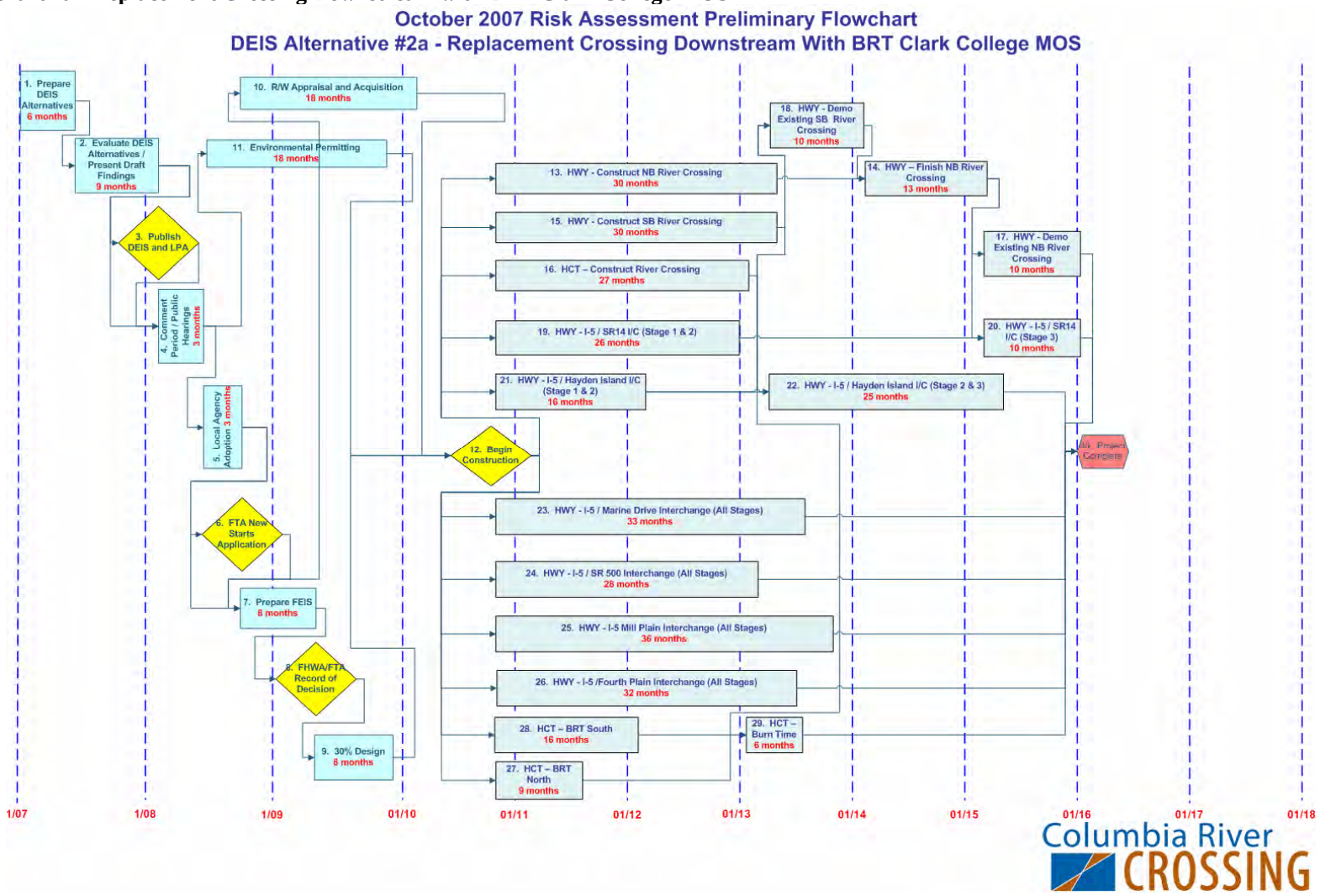


**Figure 9: Flowchart 3a - Replacement Crossing Downstream with LRT Mill District MOS**

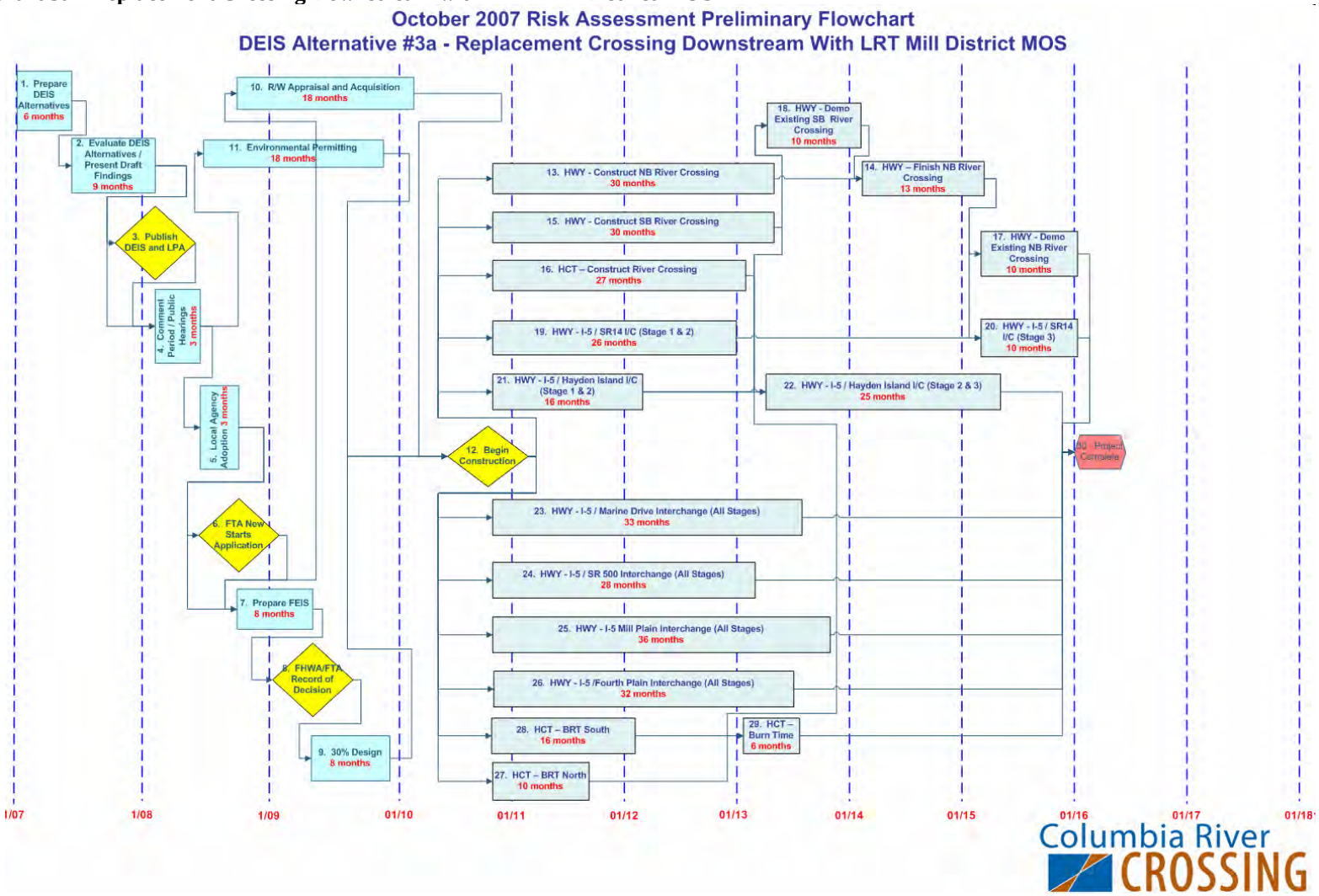
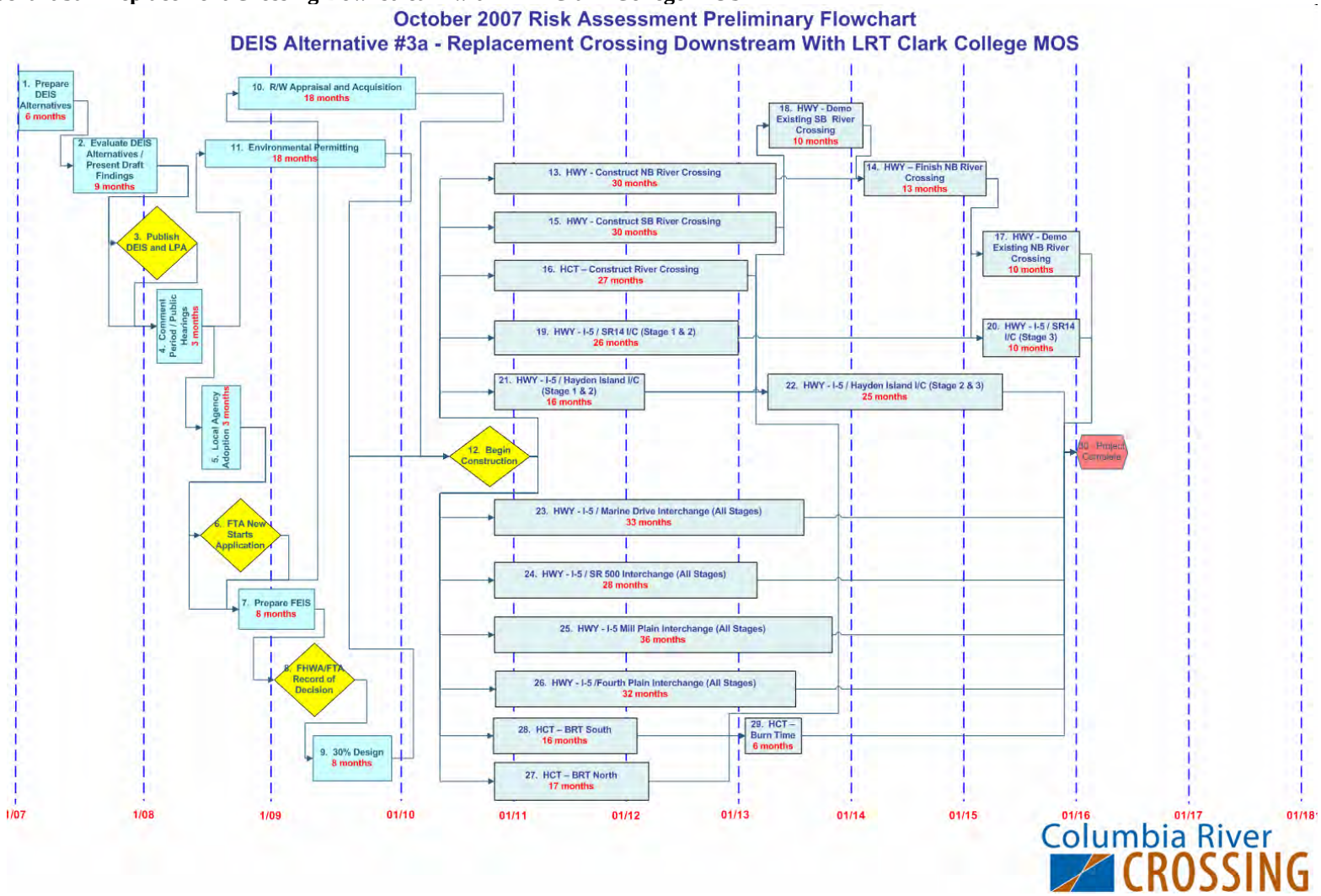


**Figure 10: Flowchart 3a - Replacement Crossing Downstream with LRT Clark College MOS**



## 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
2. North Highway Approach
    - I-5 Main Line
    - Collector/Distributor Roads
    - SR-14 Interchange
    - Evergreen Boulevard Bridge
    - Mill Plain Boulevard Interchange
    - 4th Plain Boulevard Interchange
    - 29th Street and 33rd Street Bridges
    - SR-500 Interchange
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 are will exceed **$3.99 billion**. The 80% confidence interval range between a 90% probability of exceeding and a 10% likelihood of exceeding is between $3.44billion 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**

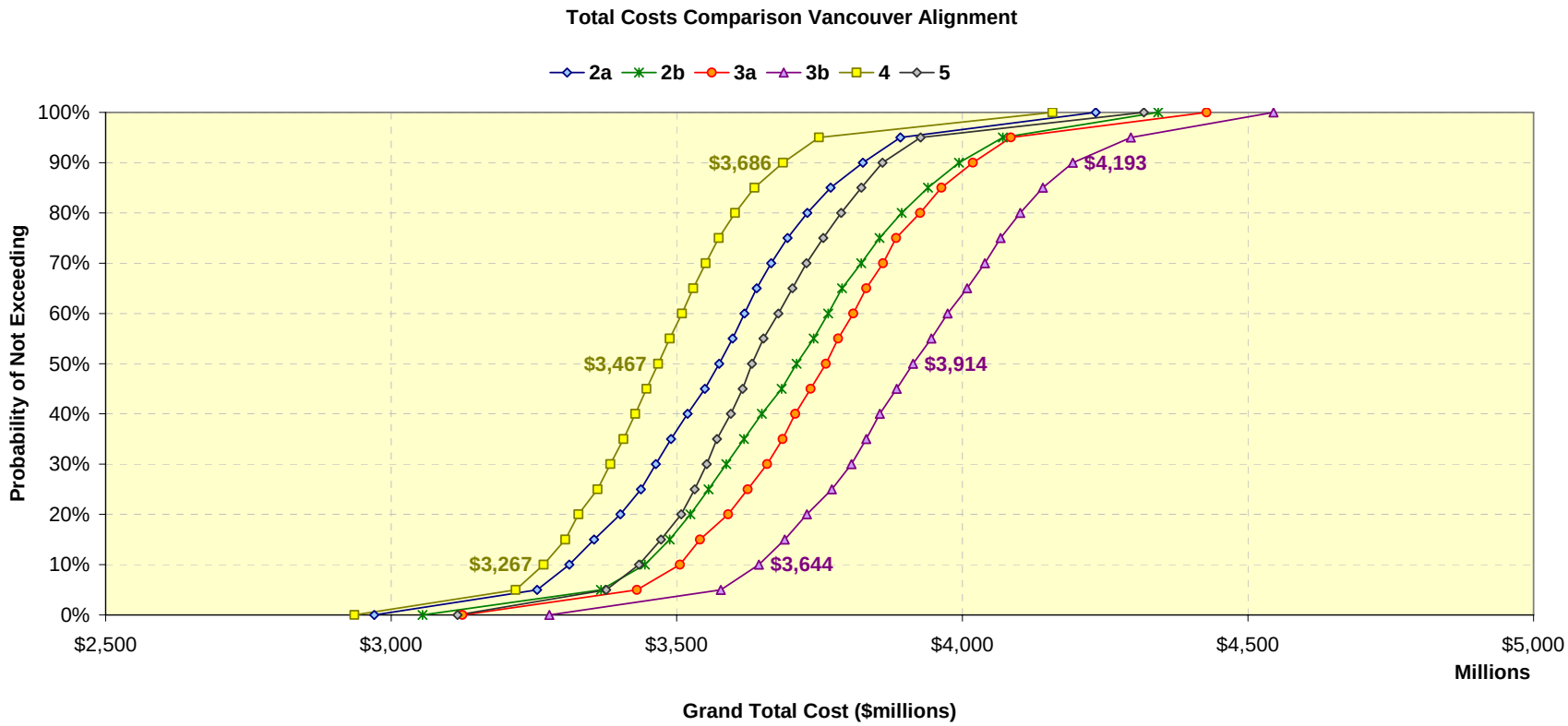


**Table 10: Vancouver Alignment Project Costs Summary Table**

| 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**

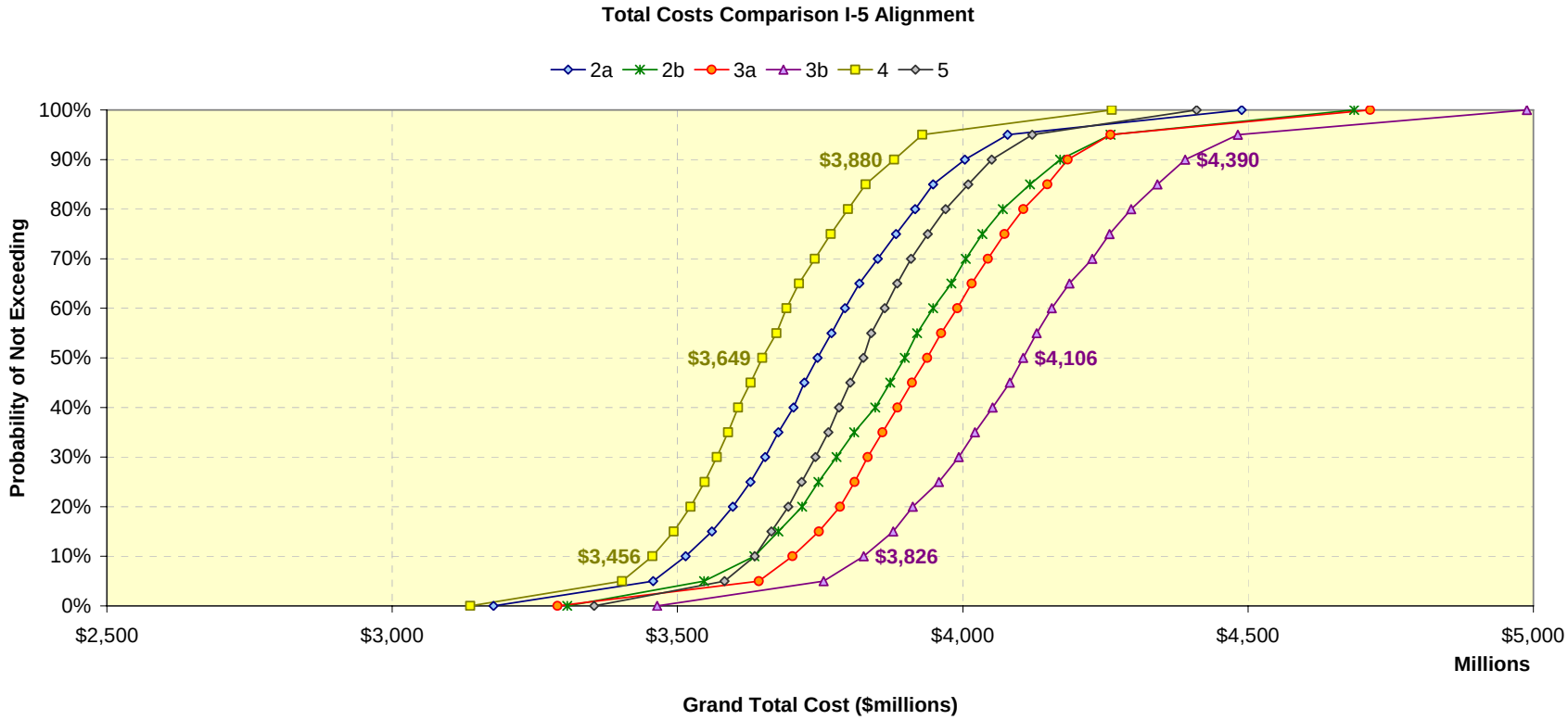


**Table 11: I-5 Alignment Project Costs Summary Table**

| 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**

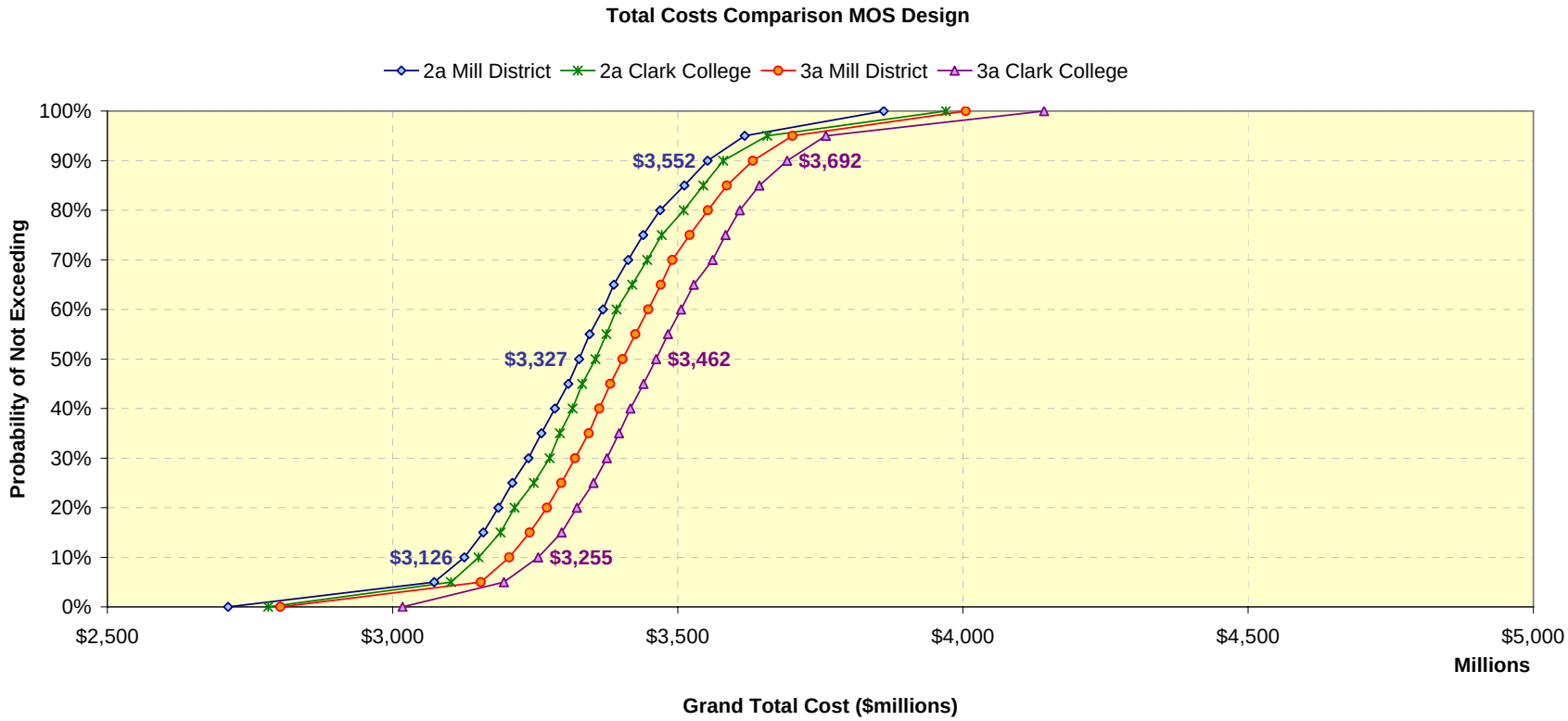


**Table 12: MOS Design Project Costs Summary Table**

| 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**

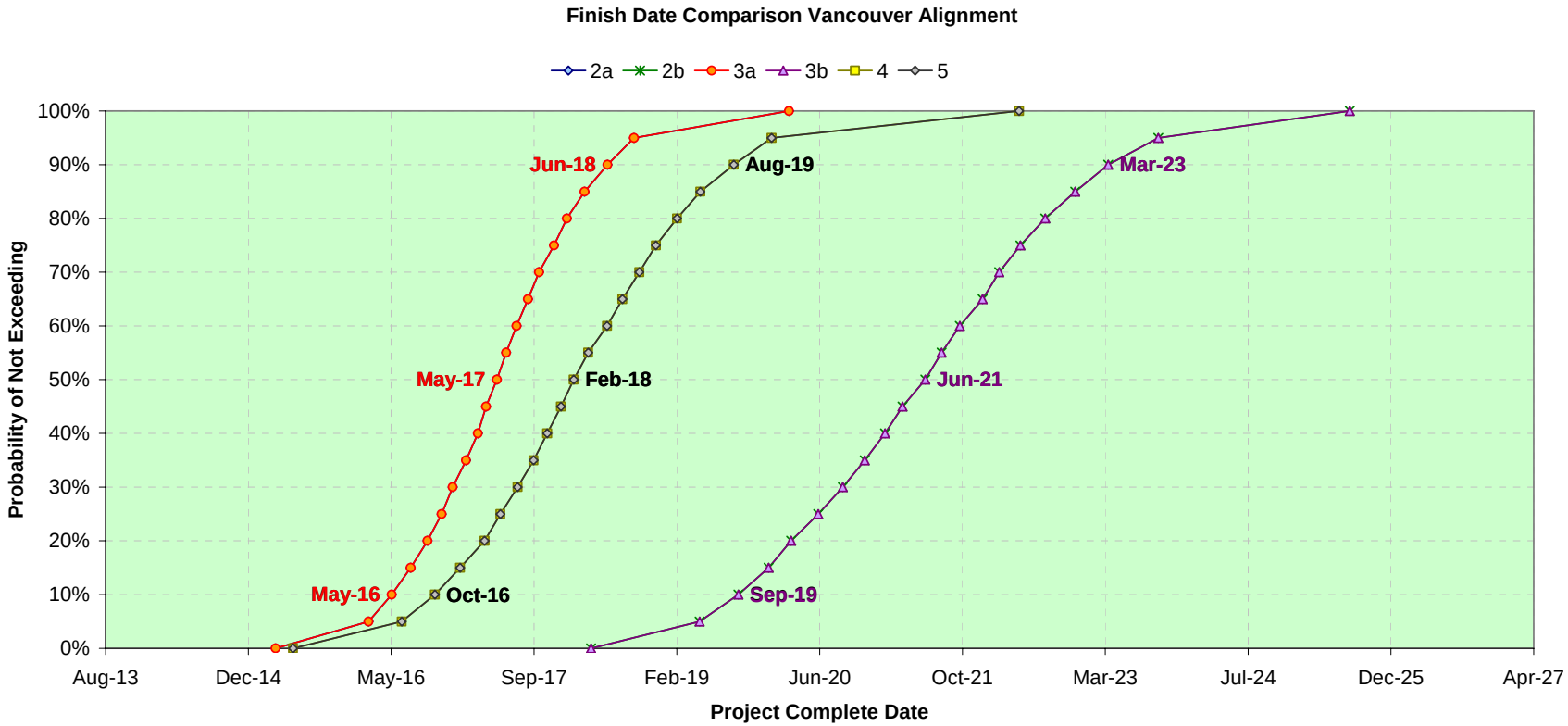


**Table 13: Vancouver Alignment Project End Date Summary Table**

| 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**

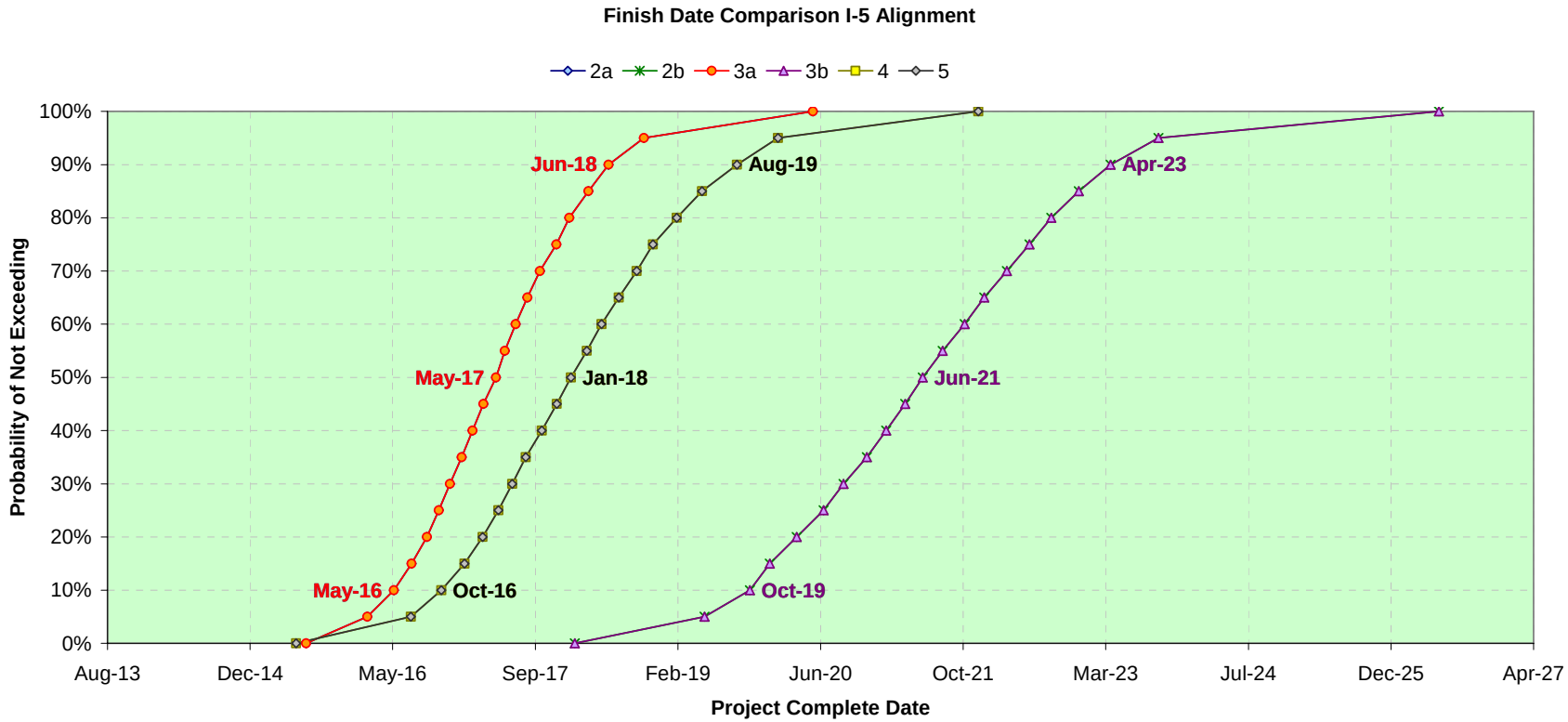


**Table 14: I-5 Project End Date Summary Table**

| 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**

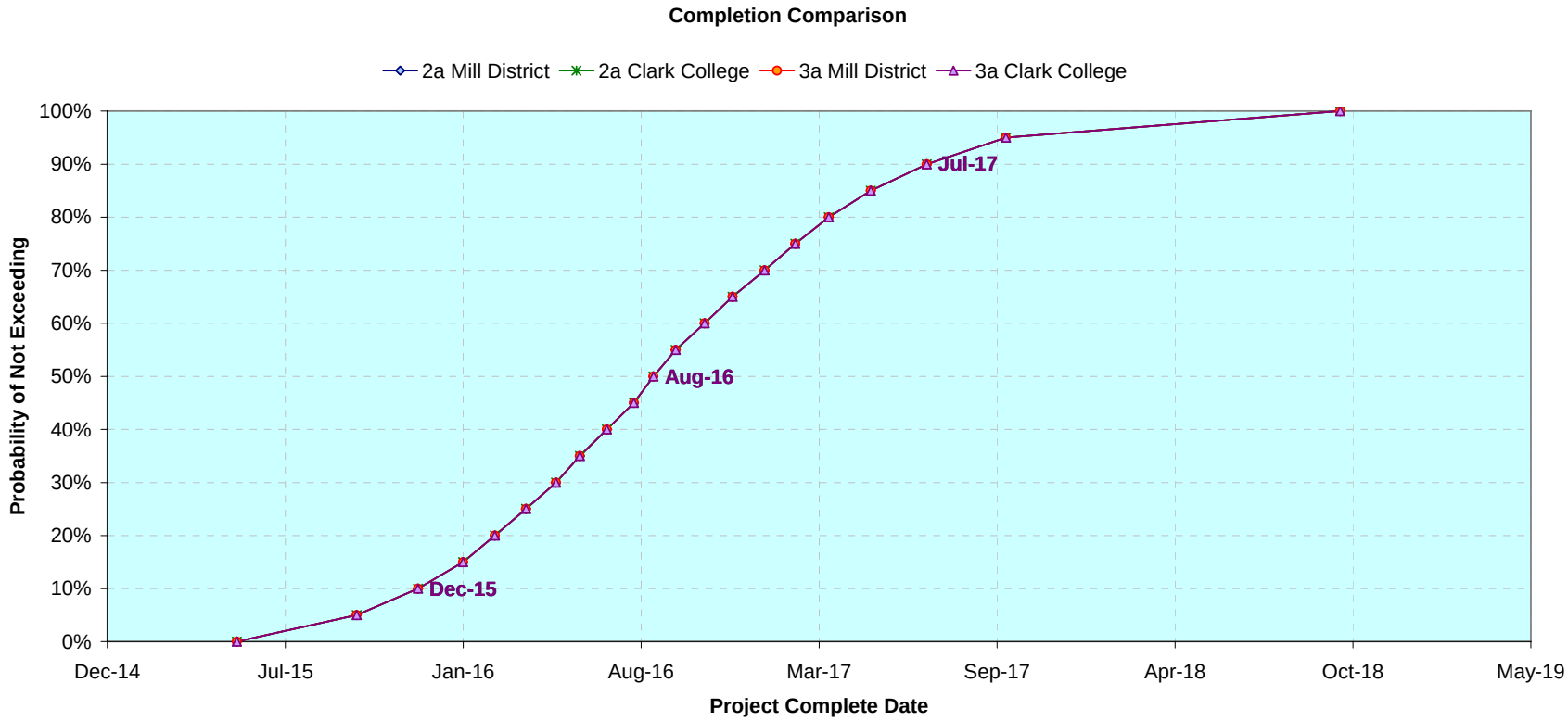


**Table 15: MOS Design Project End Date Summary Table**

| 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**

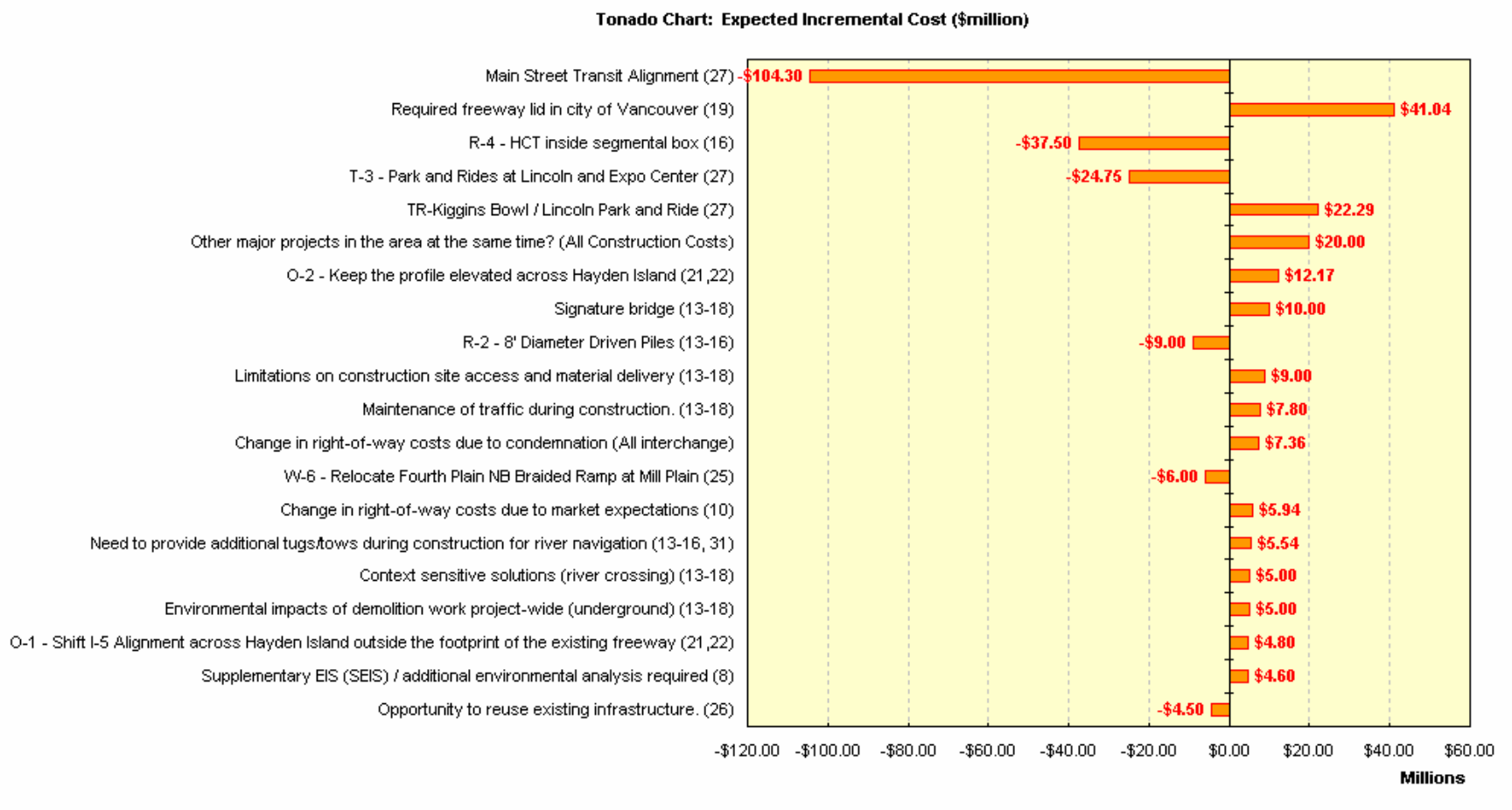


Figure 18 below is a graphical representation of the expected value the major events that might create a project cost risk or opportunity for an upstream replacement crossing with BRT for the Vancouver Alignment. The I-5 alignment has some minor differences. There is no $104 million opportunity for the 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**

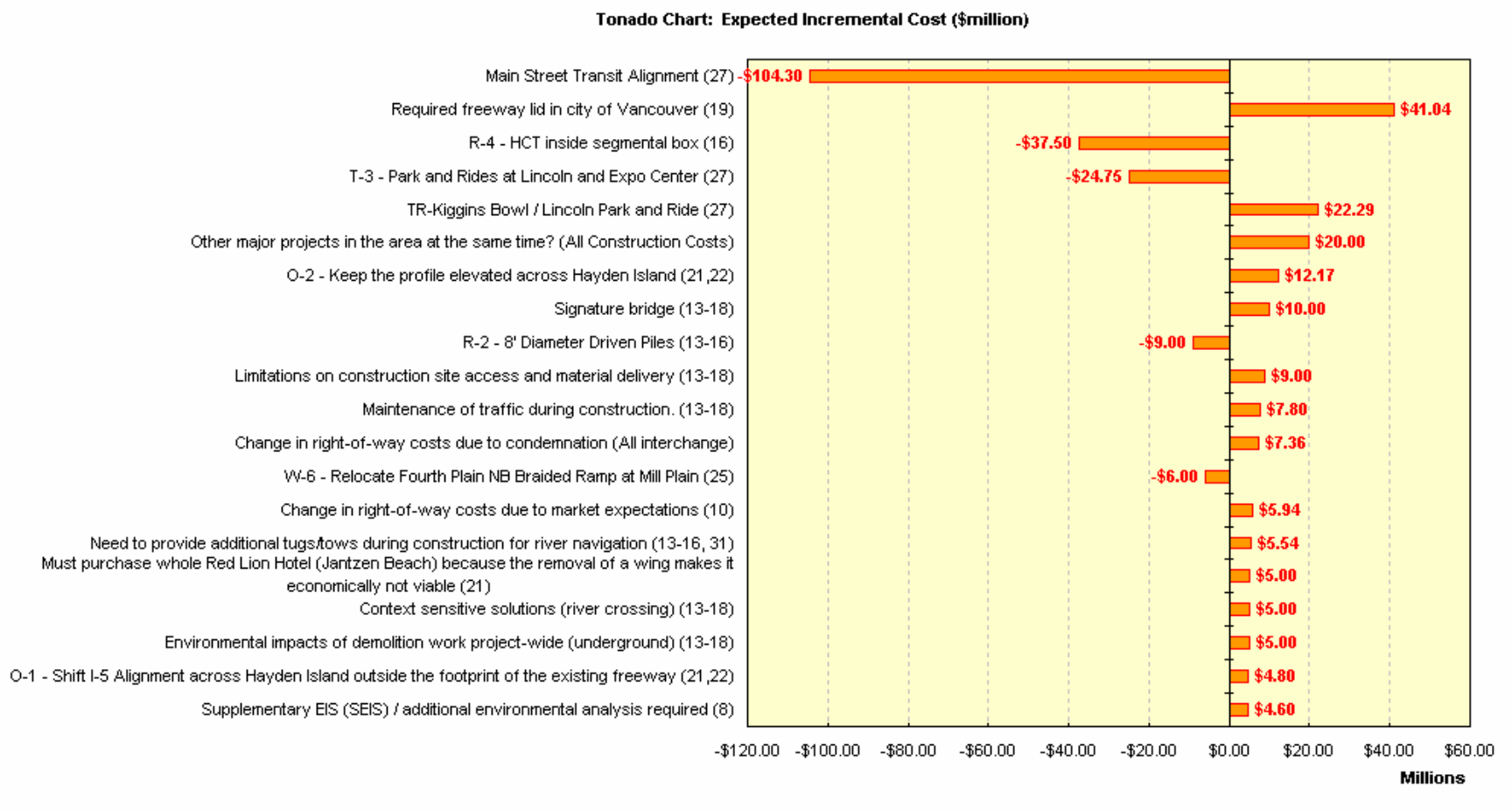


Figure 19 below is a graphical representation of the expected value the major events that might create a project cost risk or opportunity for a downstream replacement crossing with LRT for the Vancouver Alignment. The I-5 alignment has some minor differences. There is no $104 million opportunity for 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**

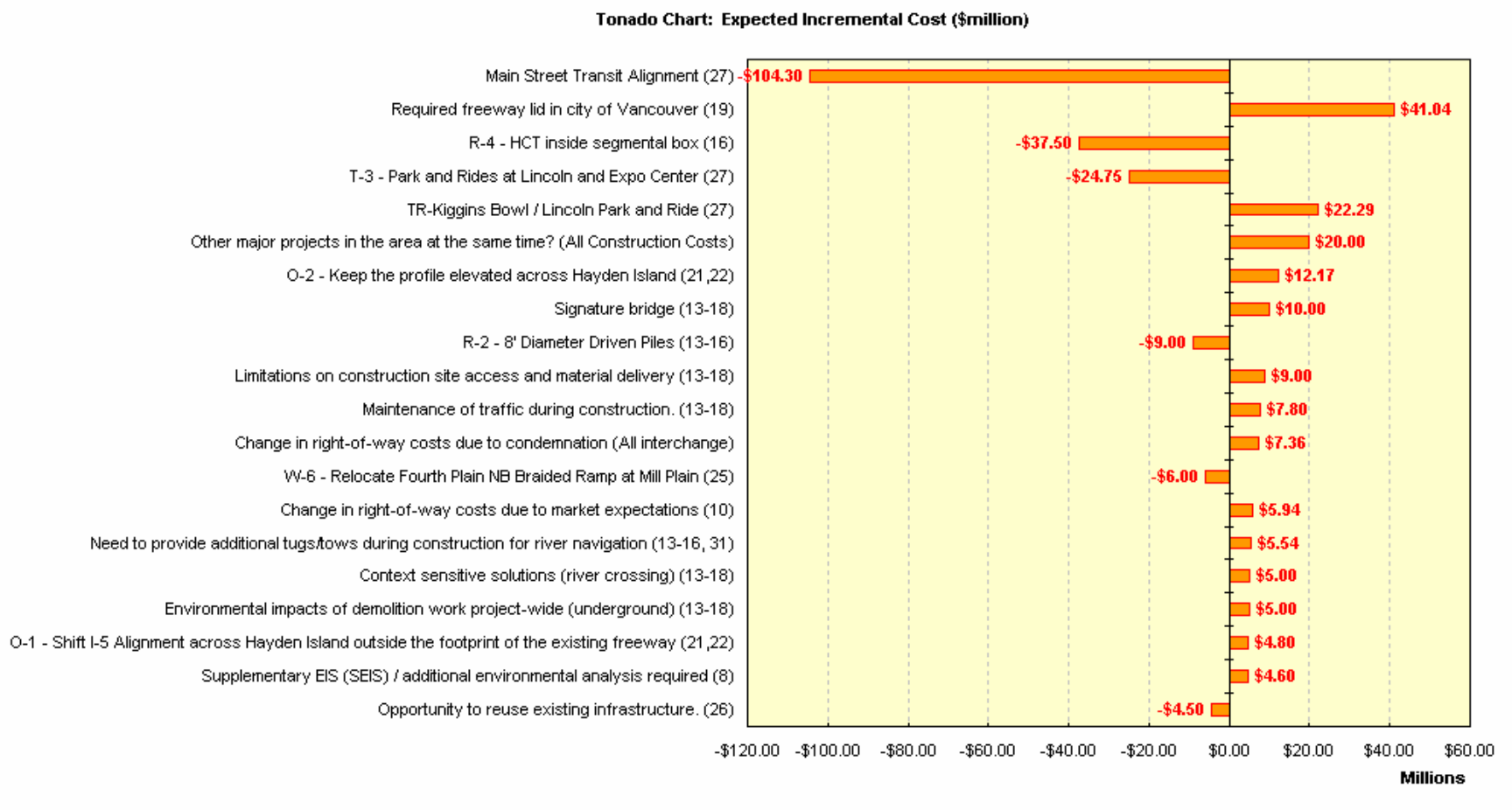


Figure 20 below is a graphical representation of the expected value the major events that might create a project cost risk or opportunity for an upstream replacement crossing with LRT for the Vancouver Alignment. The I-5 alignment has some minor differences. There is no $104 million opportunity for the 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**

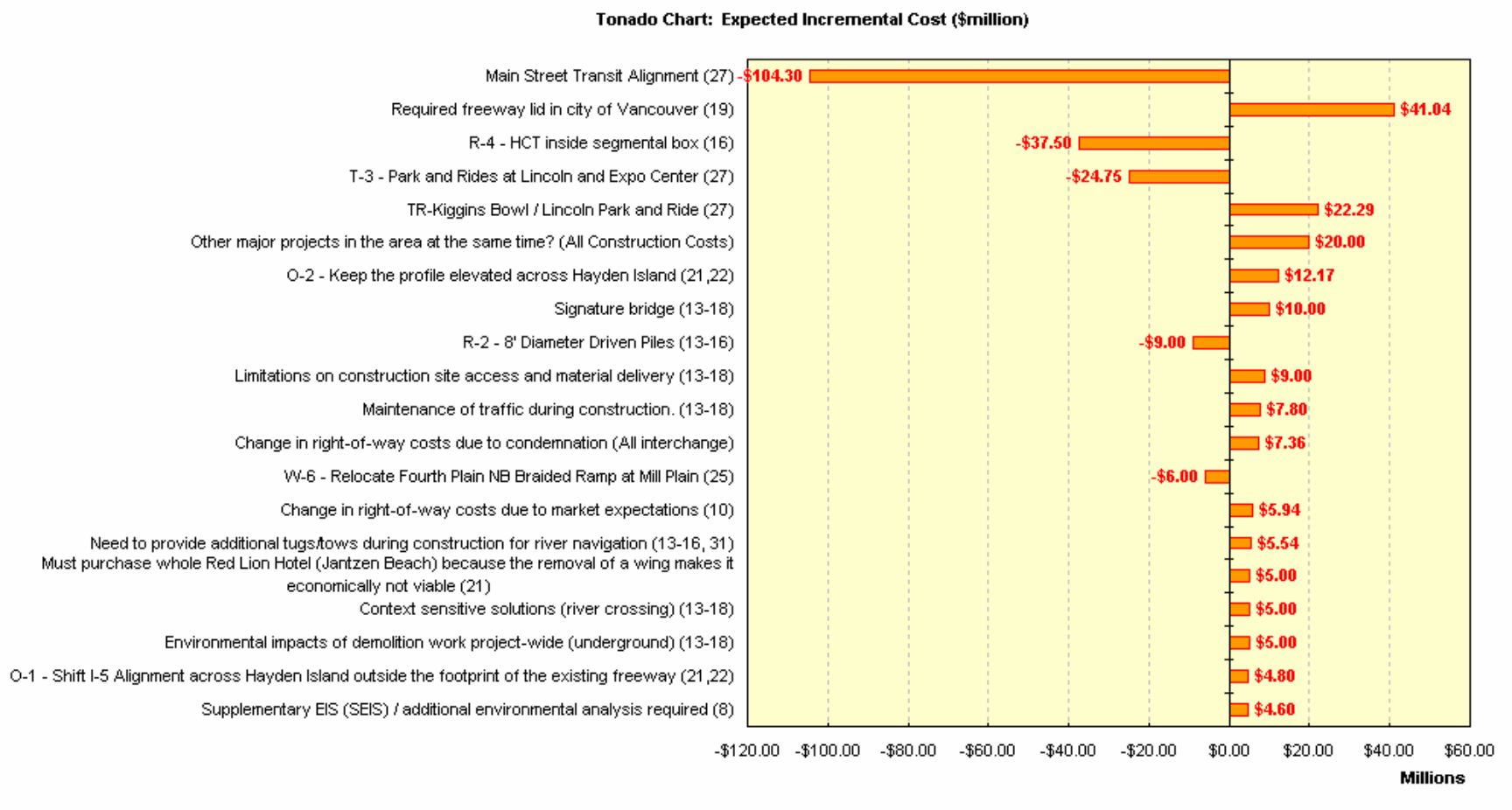


Figure 21 below is a graphical representation of the expected value the major events that might create a project cost risk or opportunity for supplemental crossing with BRT for the Vancouver alignment. The I-5 alignment has some minor differences. There is a $104 million opportunity for the I-5 and not 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**

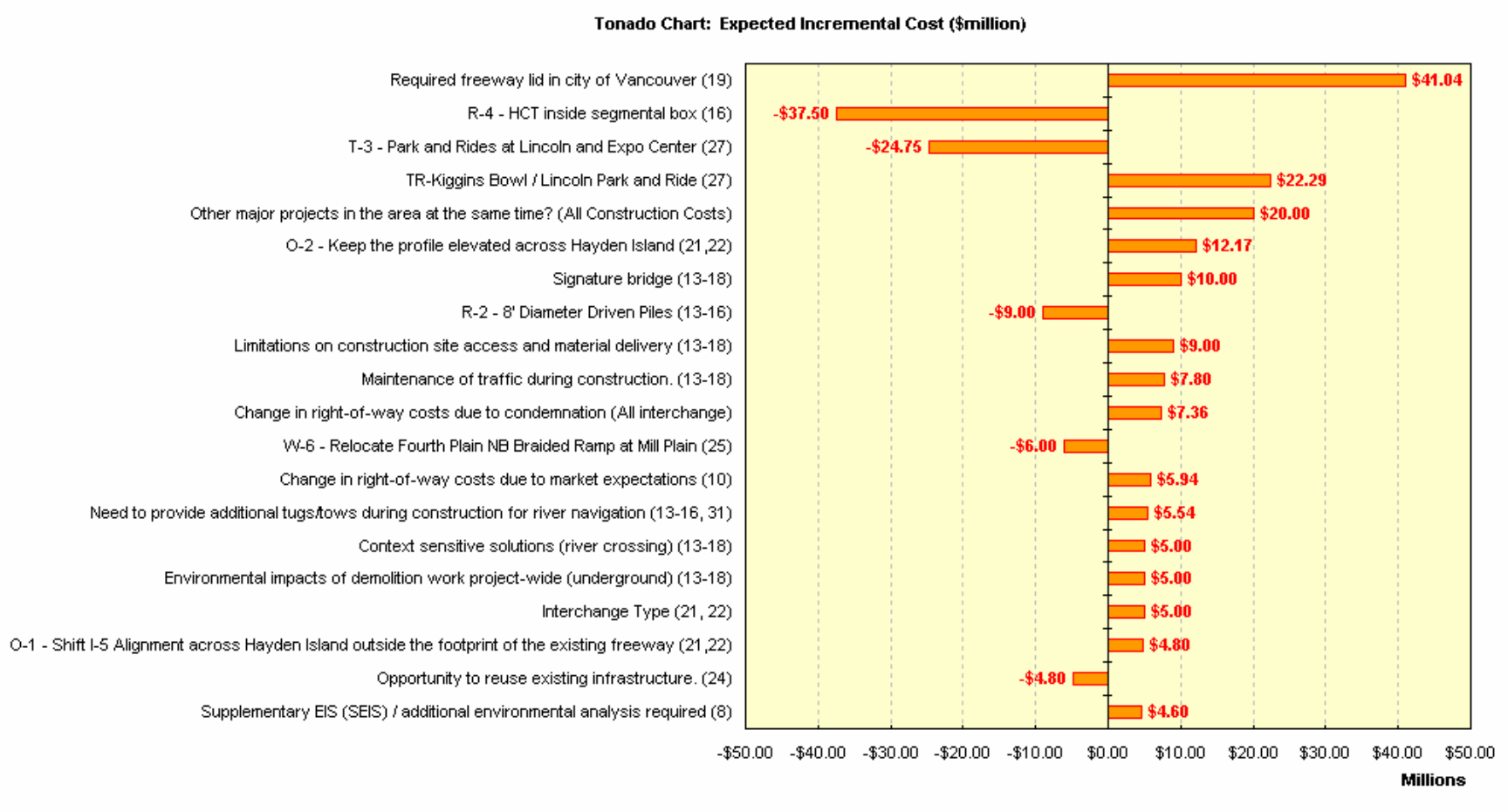


Figure 22 below is a graphical representation of the expected value the major events that might create a project cost risk or opportunity for supplemental crossing with LRT for the Vancouver alignment. The I-5 alignment has some minor differences. There is a $104 million opportunity for the I-5 and not 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**

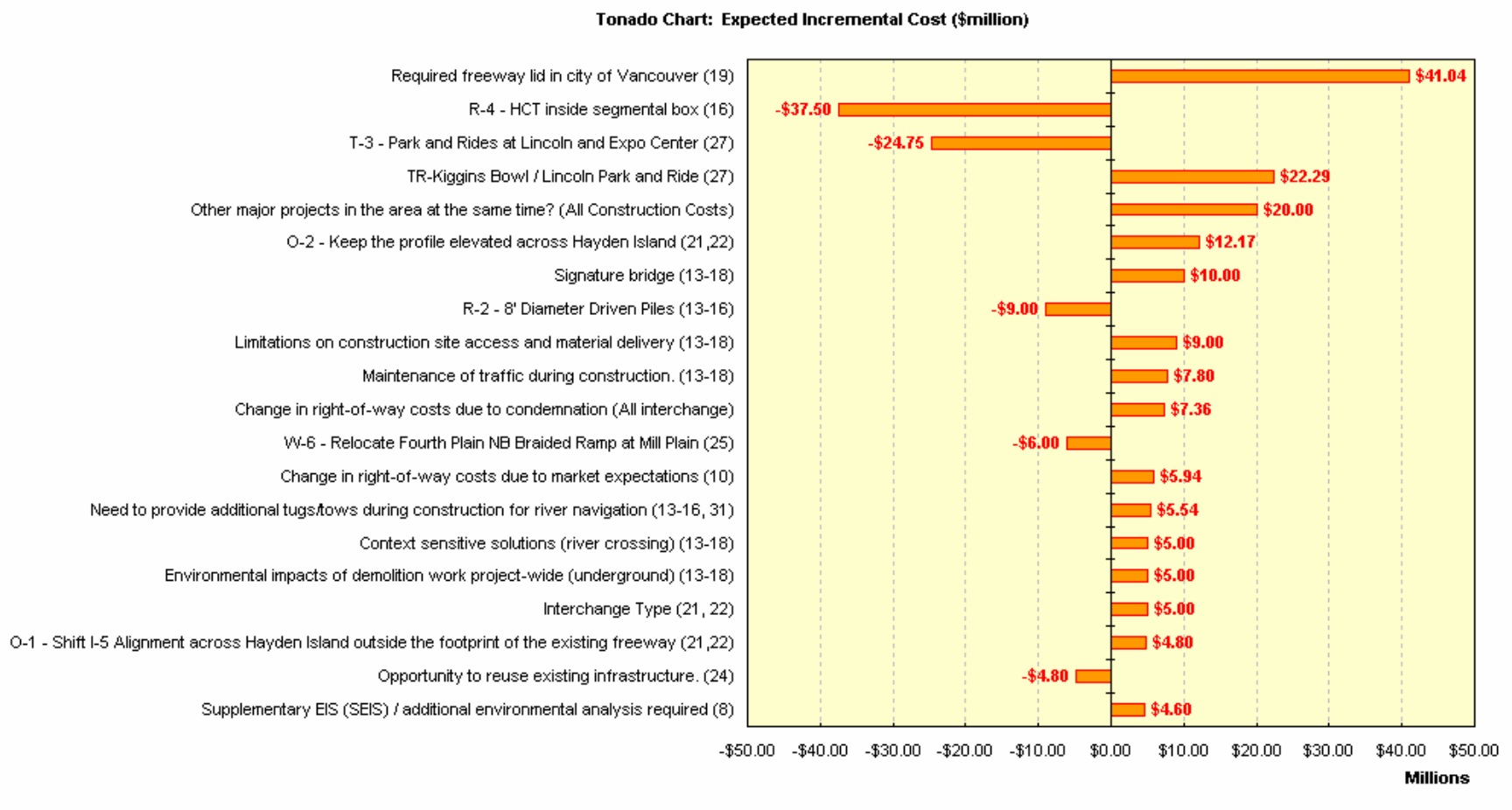


Figure 23 below is a graphical representation of the expected value the major events that might create a project cost risk or opportunity for the downstream replacement crossing with BRT for the MOS Design Alternative for both the Mill District Alignment and the Clark College Alignment.[7]

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**

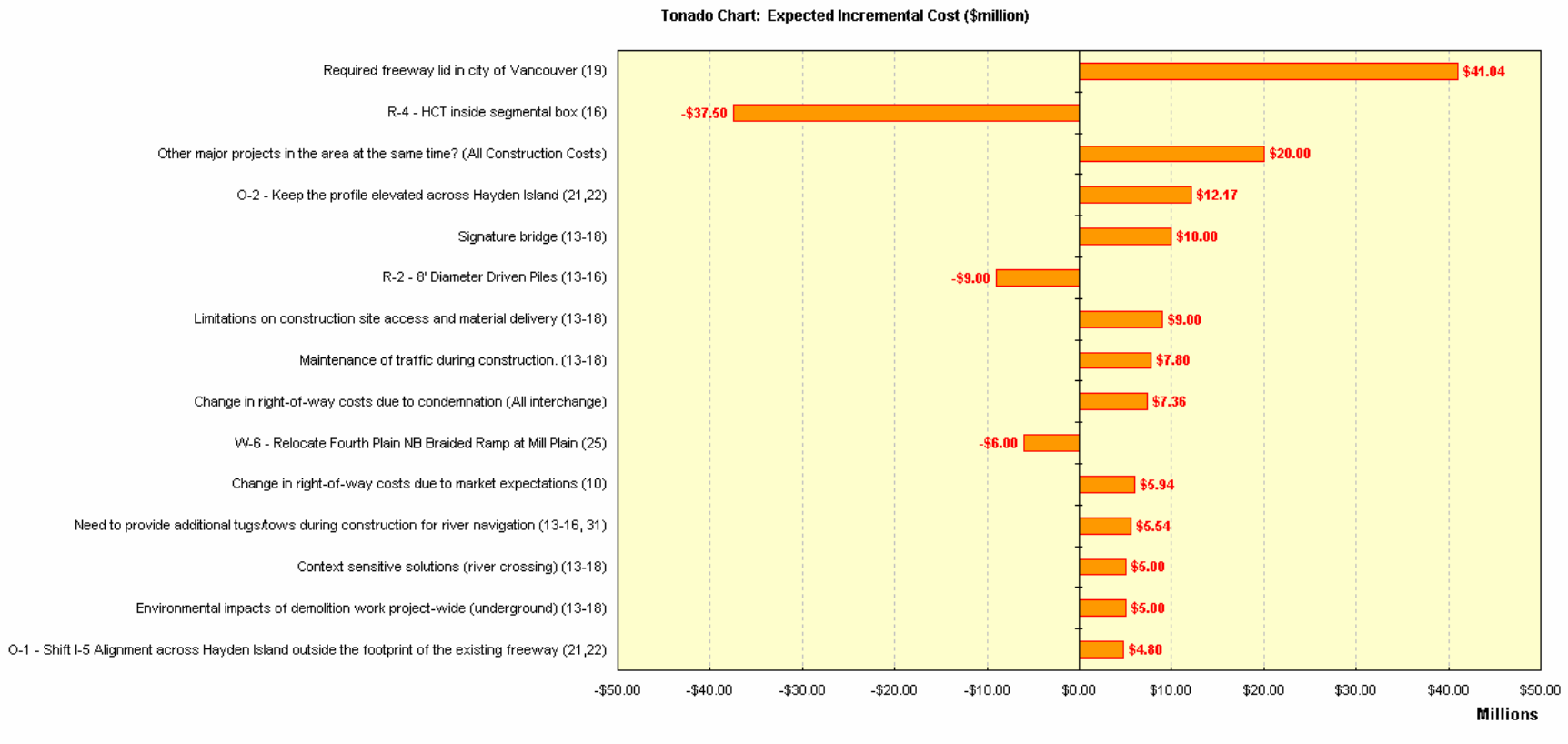
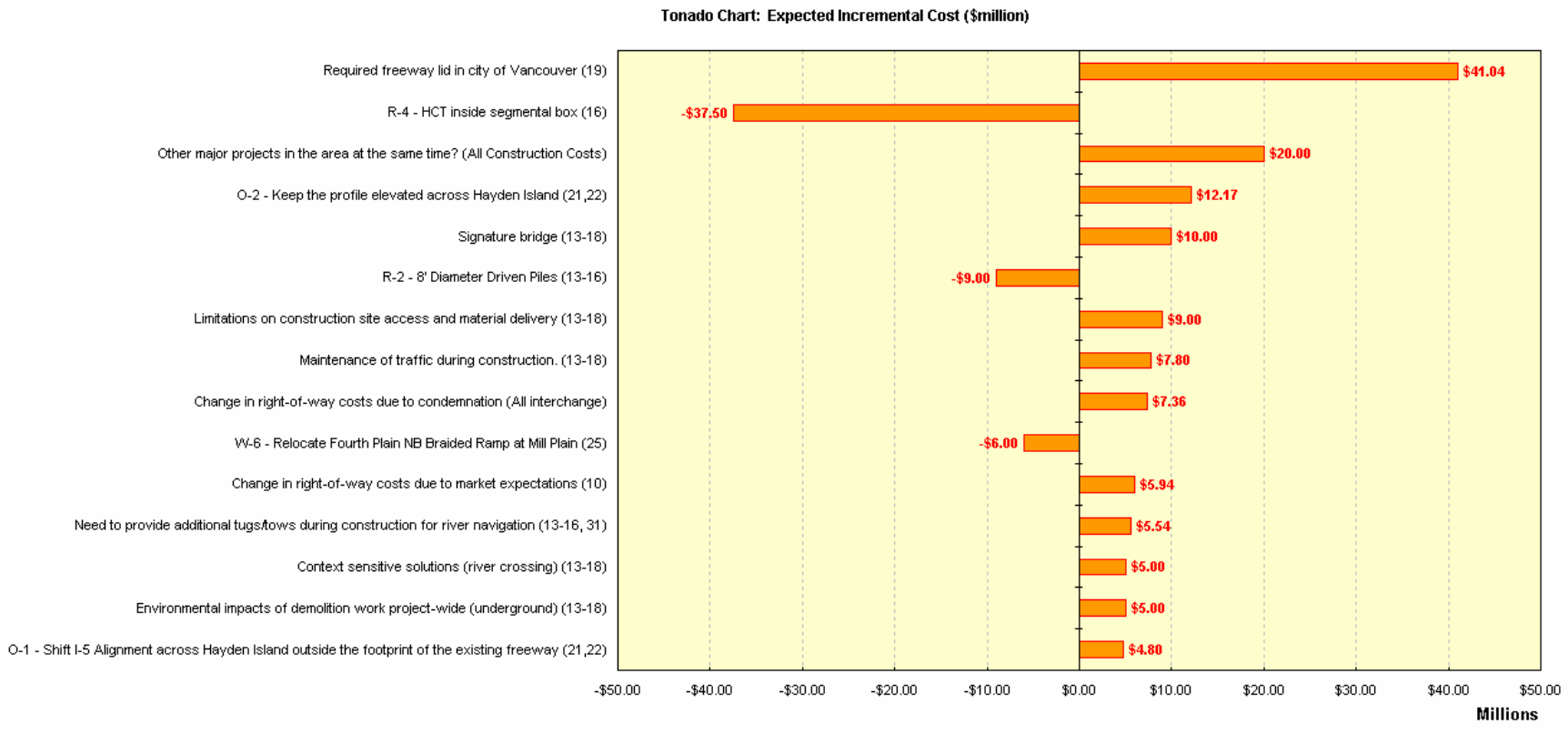


Figure 24 below is a graphical representation of the expected value the major events that might create a project cost risk or opportunity for the downstream replacement crossing with LRT for the MOS Design Alternative for both the Mill District Alignment and the Clark College Alignment.[8]

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**

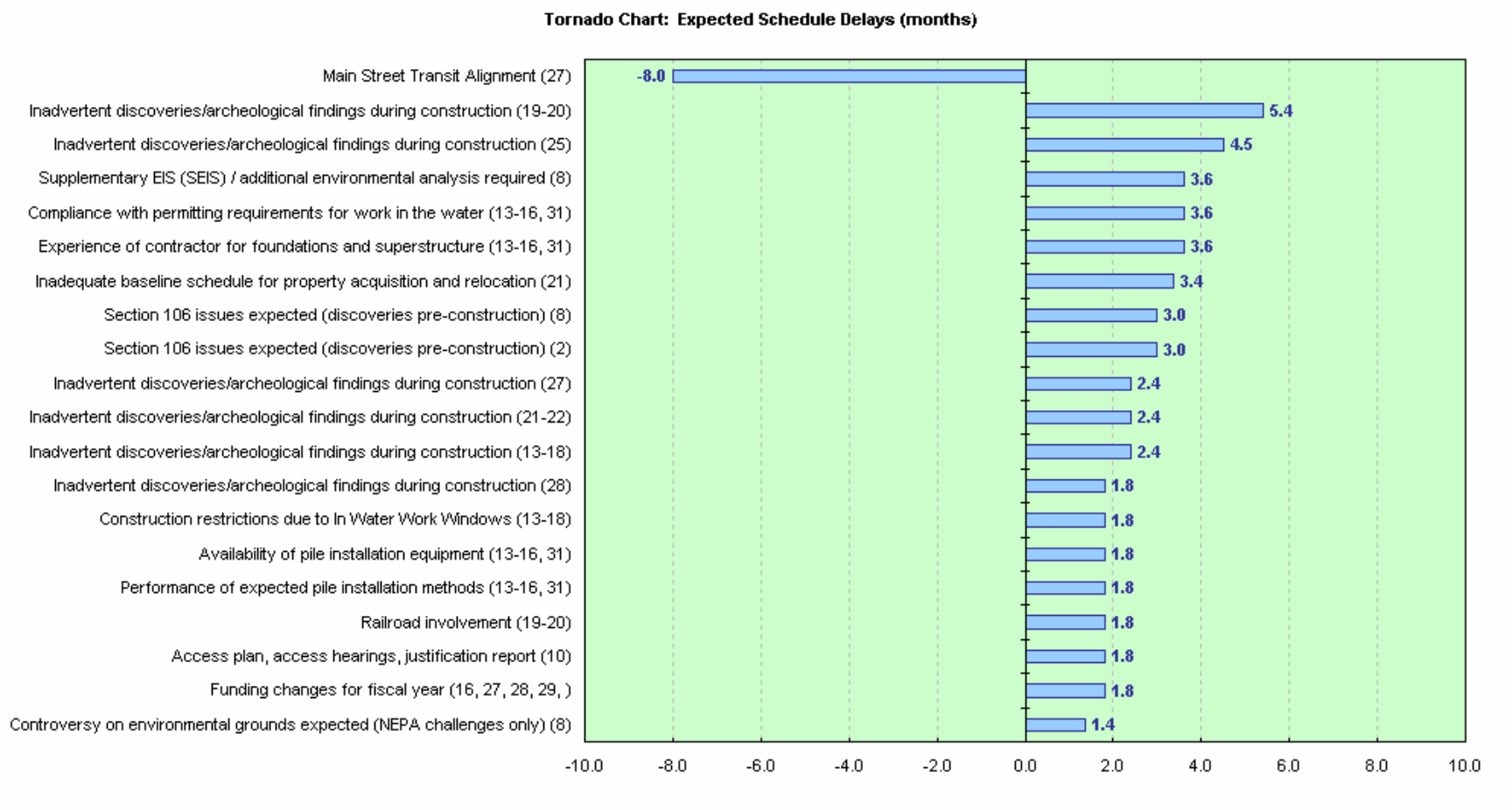


Figure 26 below is a graphical representation of the expected delay that may occur due to event risks forecasted by risk panel. Excluding the risks exclusive to either the Vancouver or I-5 Alignment (the Vancouver Transit Alignment Risk applicable to only the Vancouver Alignment), the top 5 risks expected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

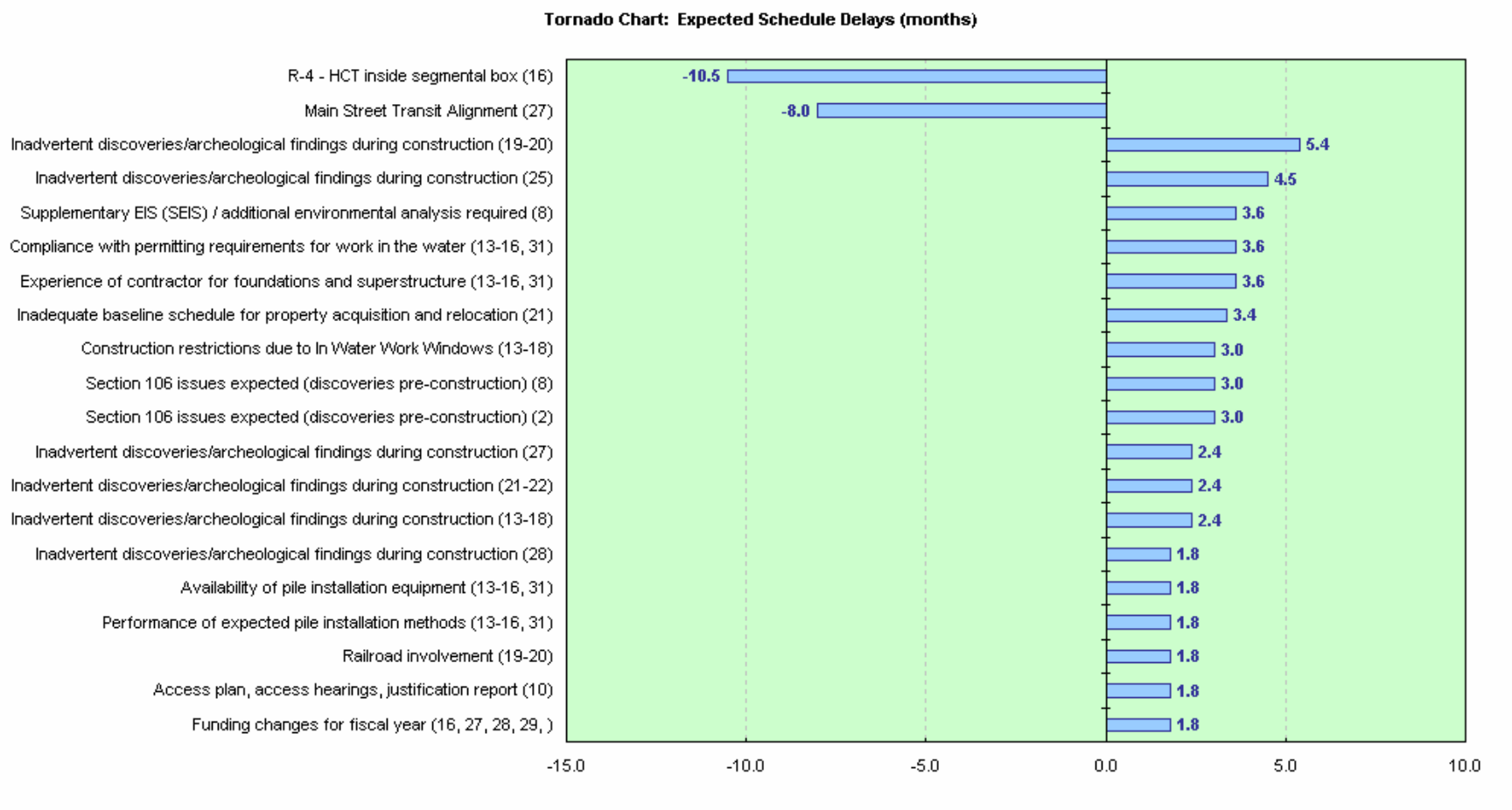


Figure 27 below is a graphical representation of the expected delay that may occur due to event risks forecasted by risk panel. Excluding the risks exclusive to either the Vancouver or I-5 Alignment (the Vancouver Transit Alignment Risk applicable to only the Vancouver Alignment), the top 5 risks expected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

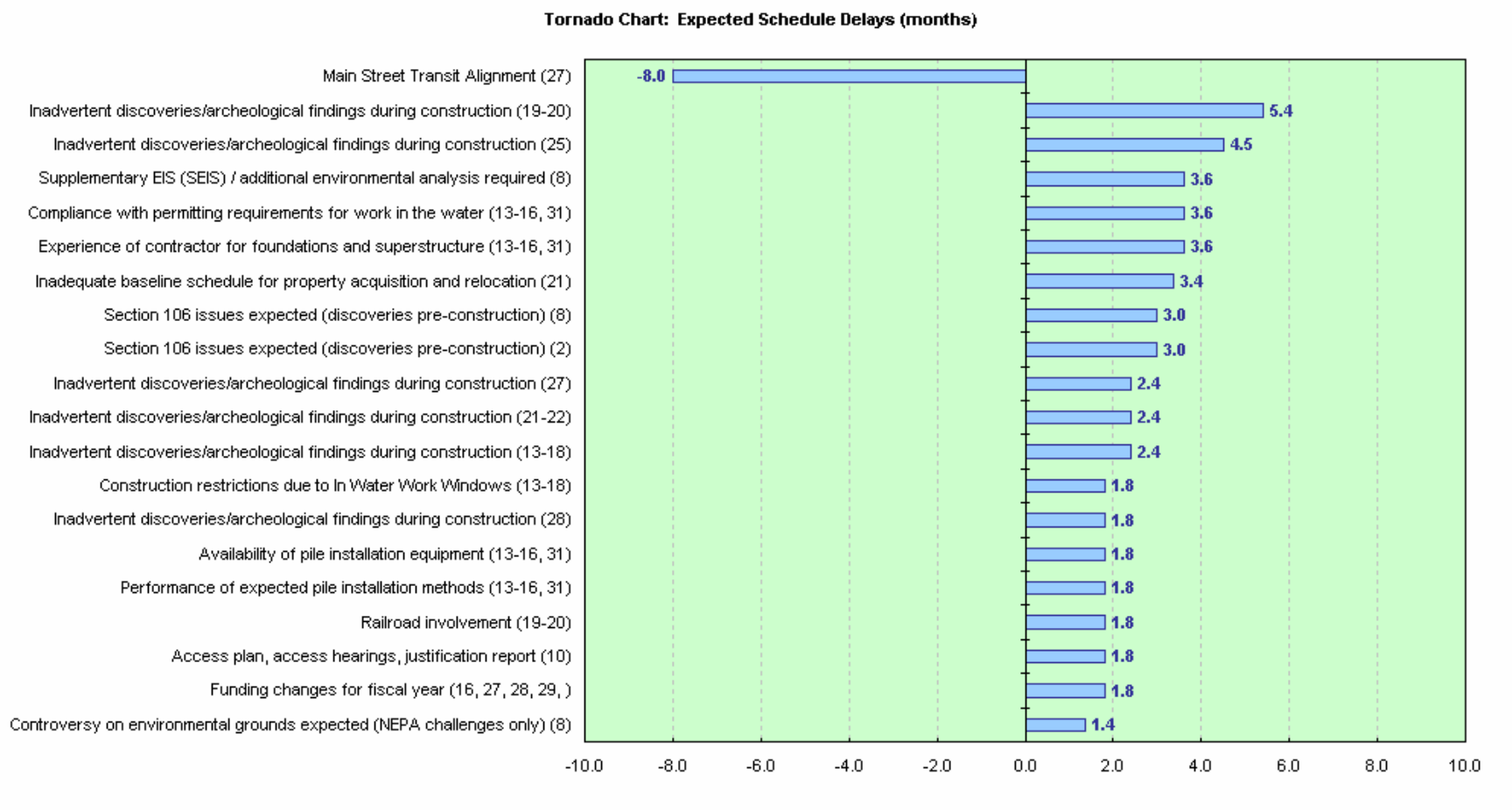


Figure 28 below is a graphical representation of the expected delay that may occur due to event risks forecasted by risk panel. Excluding the risks exclusive to either the Vancouver or I-5 Alignment (the Vancouver Transit Alignment Risk applicable to only the Vancouver Alignment), the top 5 risks expected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

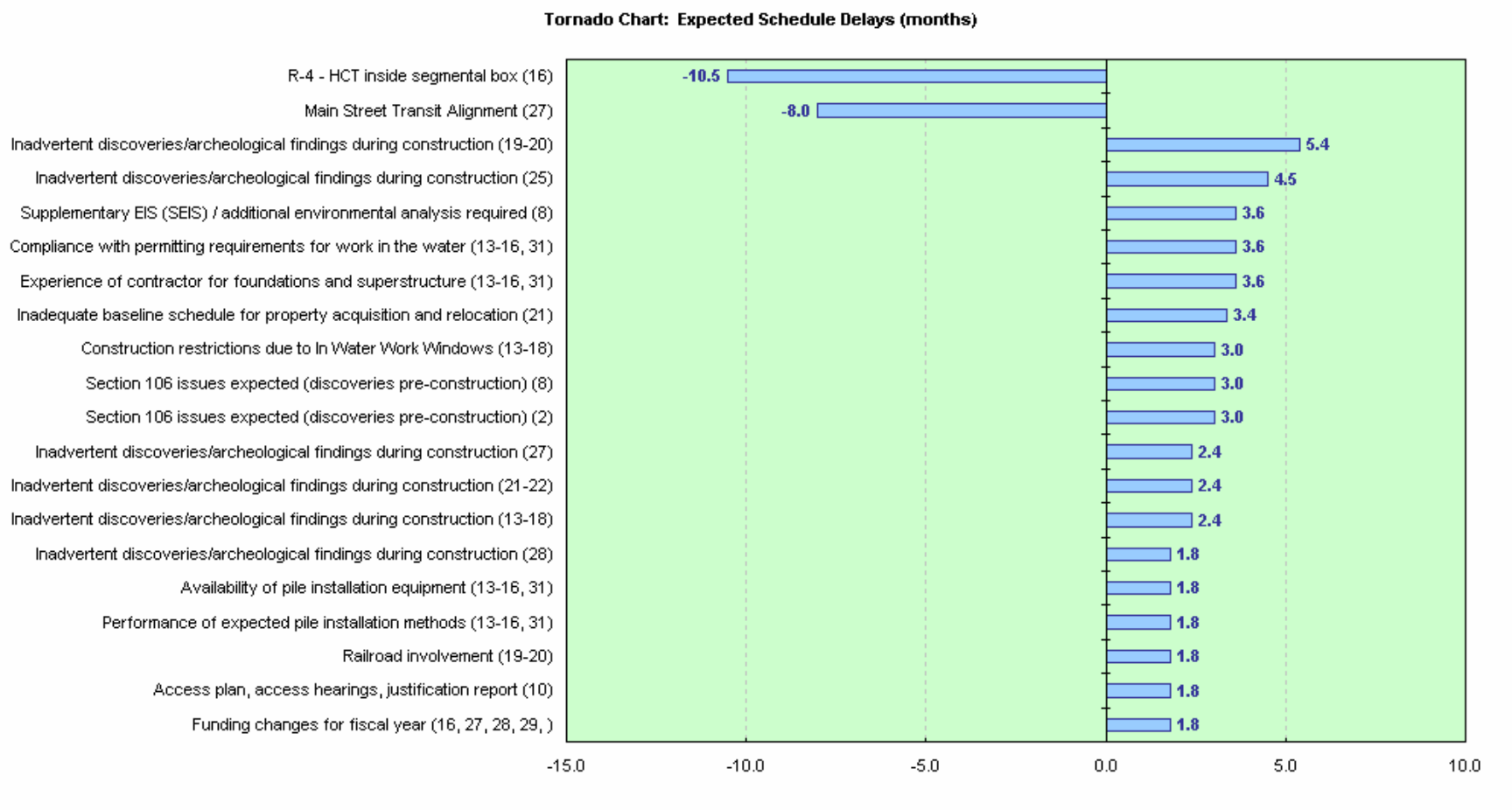


Figure 29 below is a graphical representation of the expected delay that may occur due to event risks forecasted by risk panel. Excluding the risks exclusive to either the Vancouver or I-5 Alignment (the Vancouver Transit Alignment Risk of an 8 month expected delay not depicted applicable to only the 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**

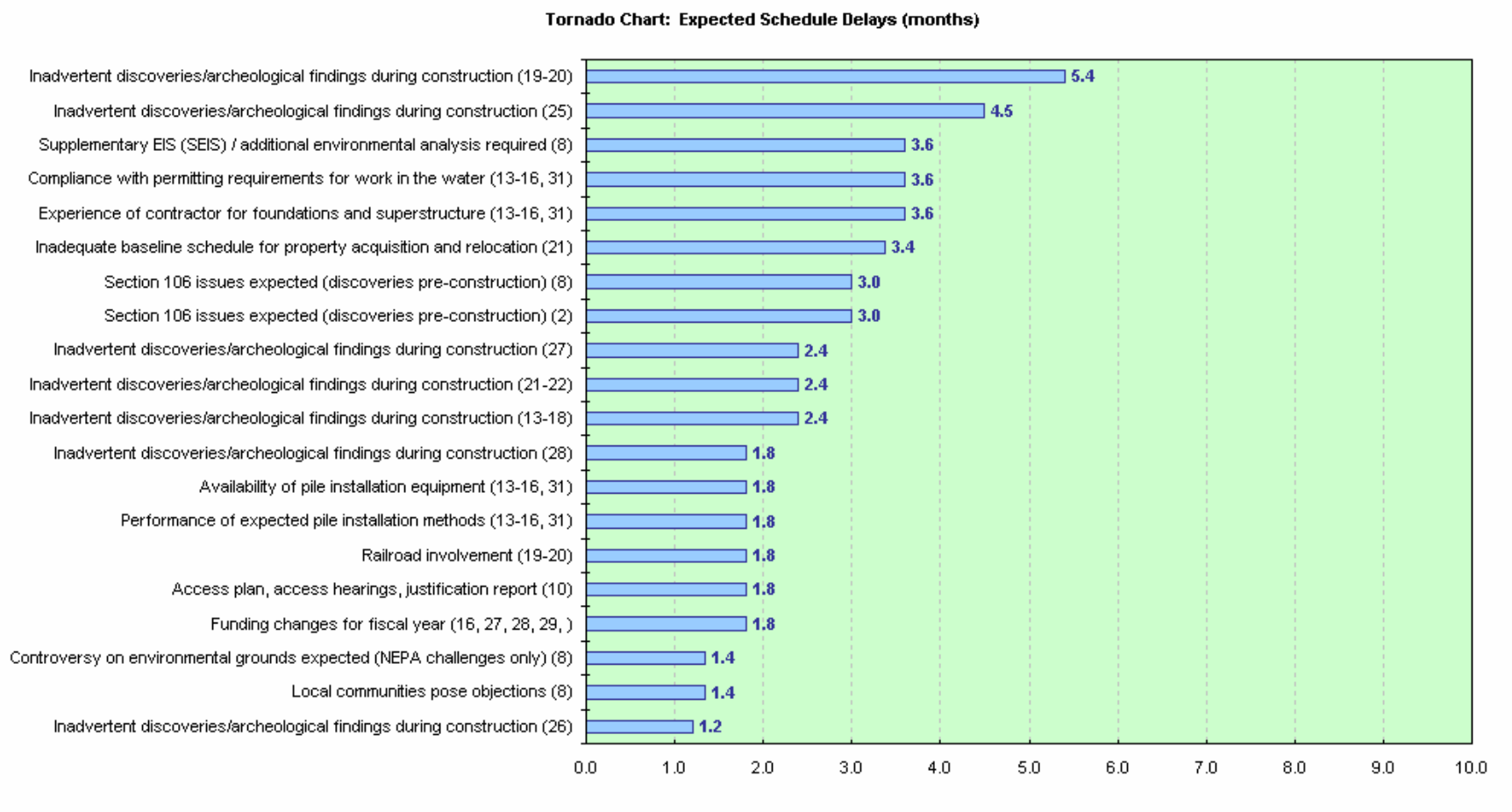


Figure 30 below is a graphical representation of the expected delay that may occur due to event risks forecasted by risk panel. Excluding the risks exclusive to either the Vancouver or I-5 Alignment (the Vancouver Transit Alignment Risk of an 8 month expected delay not depicted applicable to only the 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**

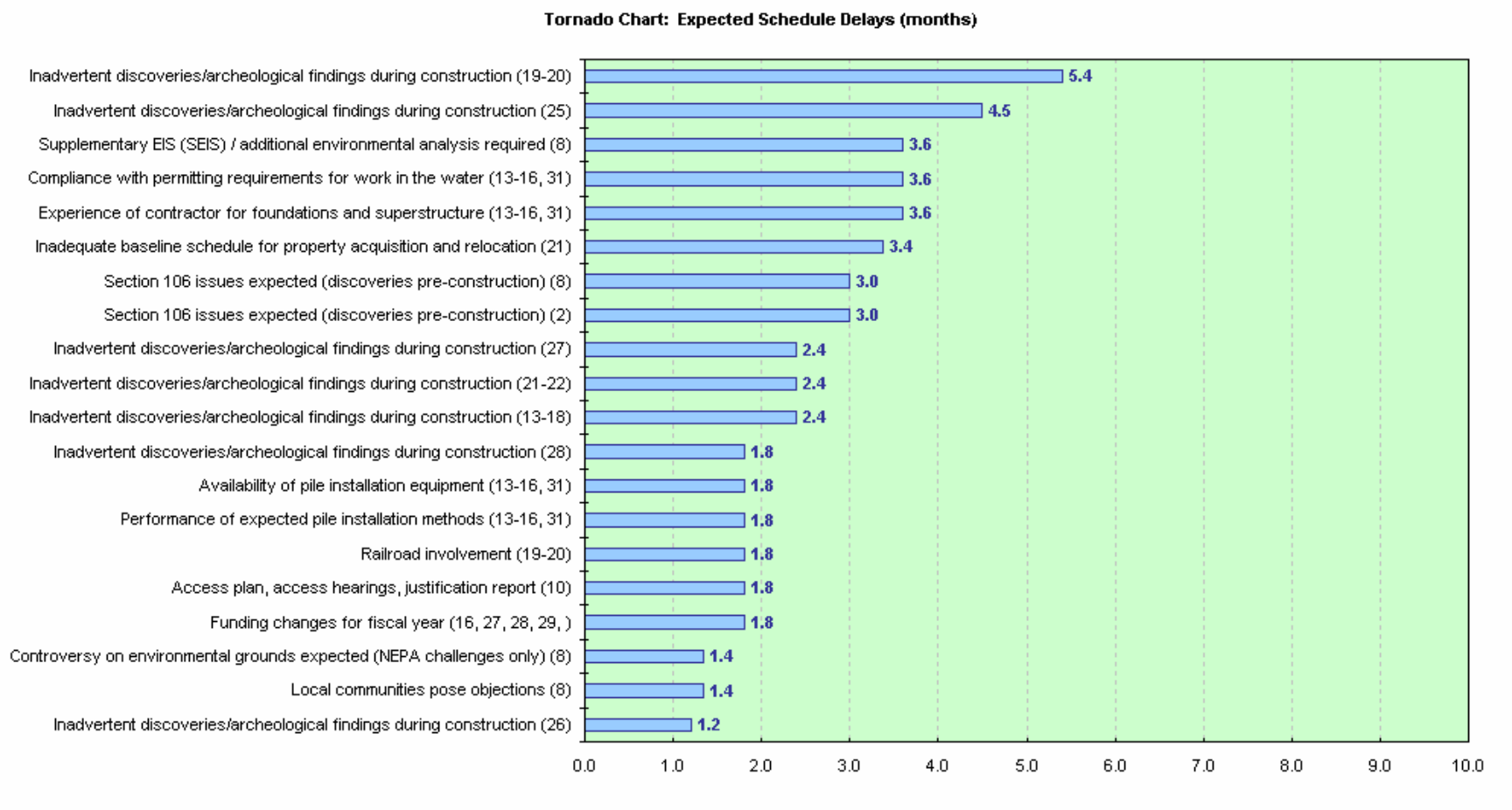


Figure 31 below is a graphical representation of the expected delay that may occur due to event risks forecasted by risk panel. The top 5 risks expected to impact MOS downstream replacement crossings with BRT are:[15]

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**

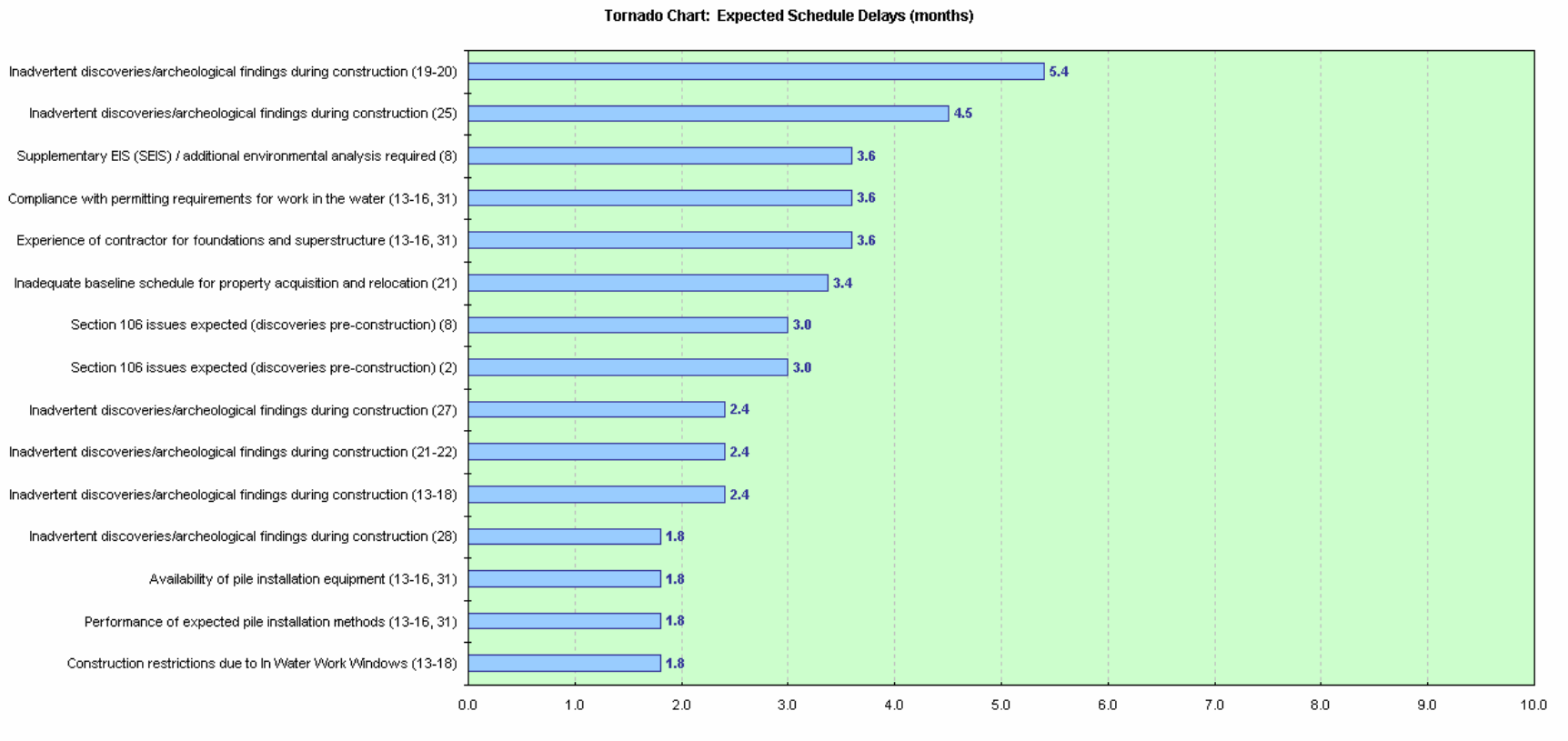
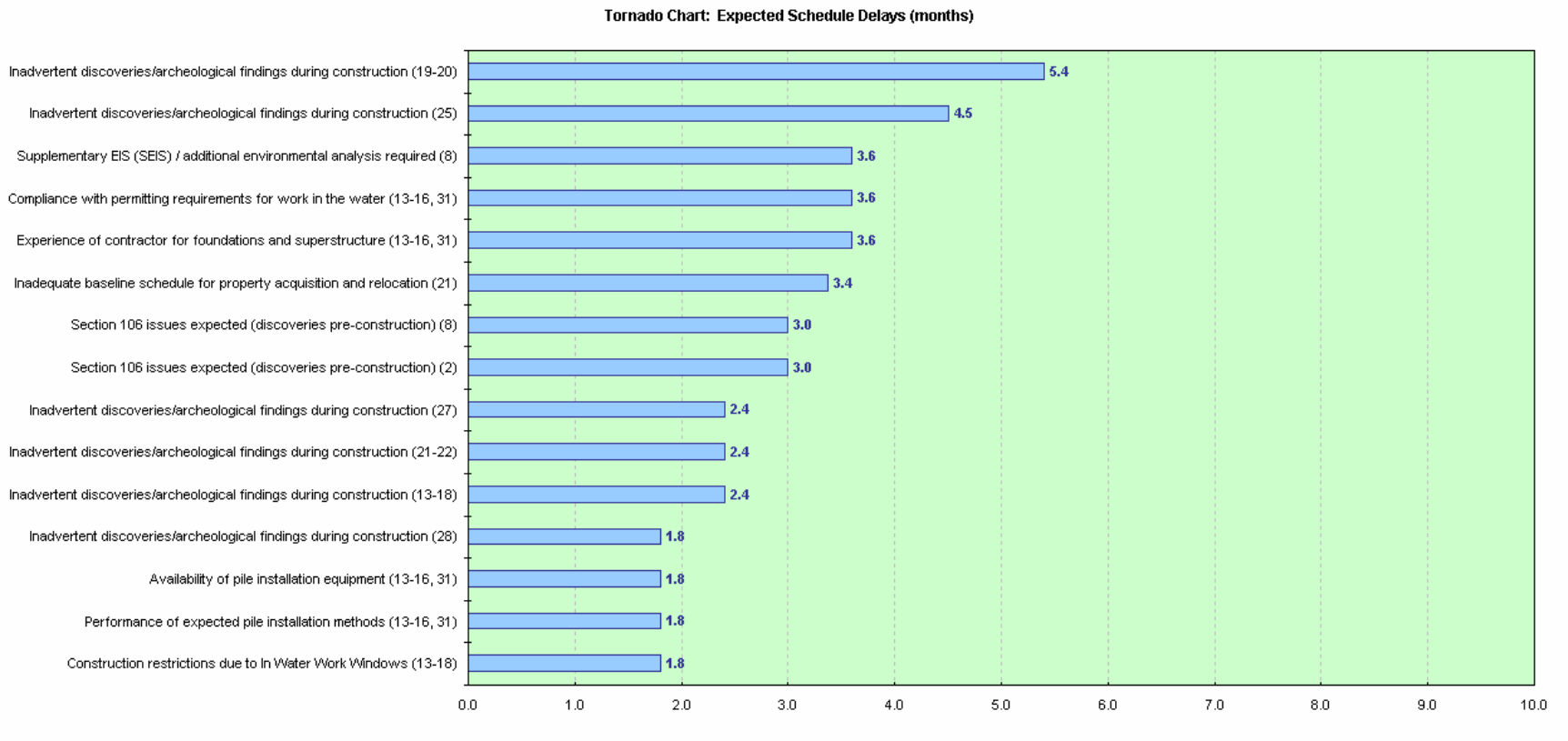


Figure 32 below is a graphical representation of the expected delay that may occur due to event risks forecasted by risk panel. The top 5 risks expected to impact MOS downstream replacement crossings with LRT are:[16]

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**

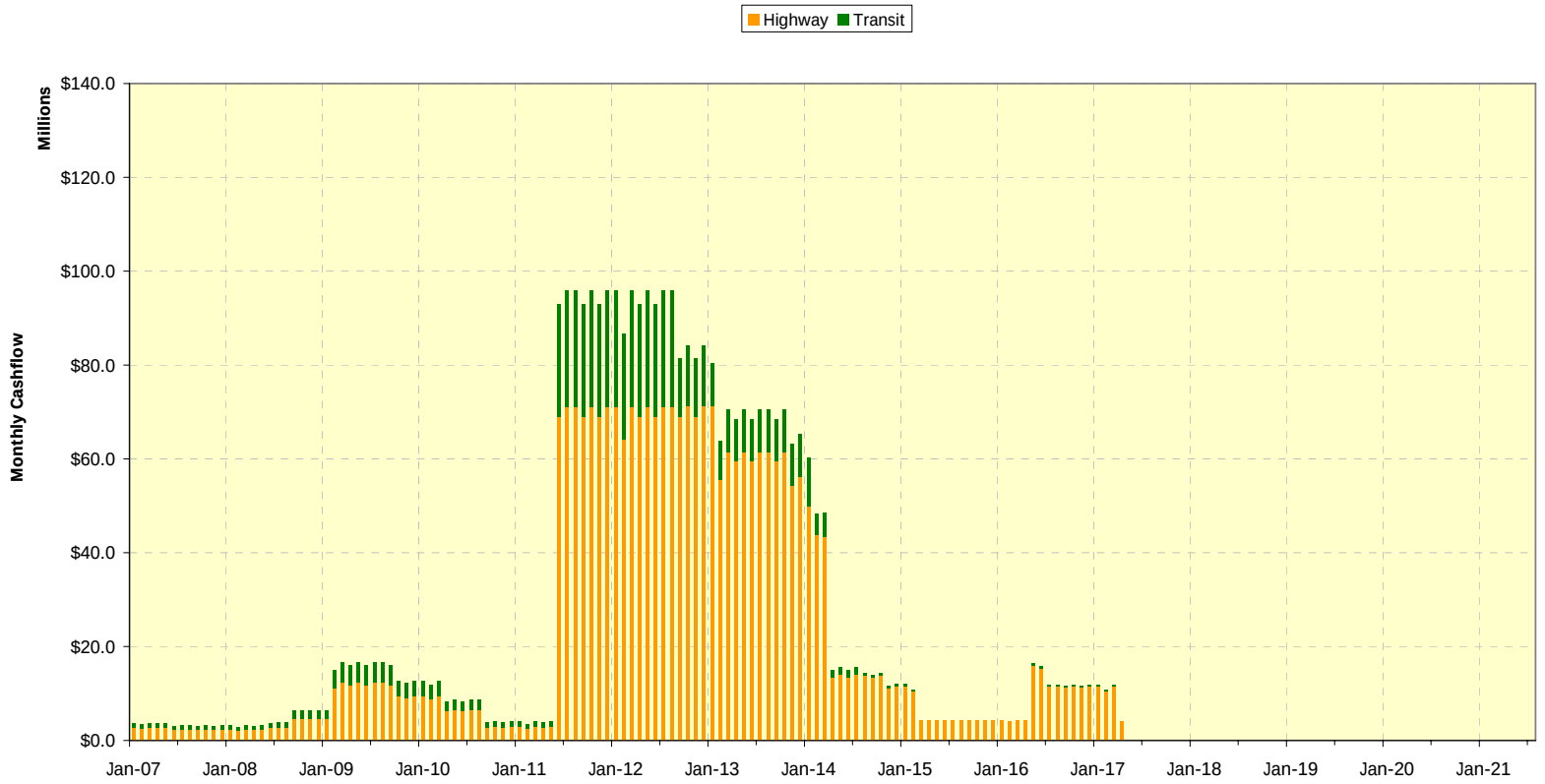


**Figure 34: Downstream Replacement Crossing with BRT Cash flow, I-5 Alignment**

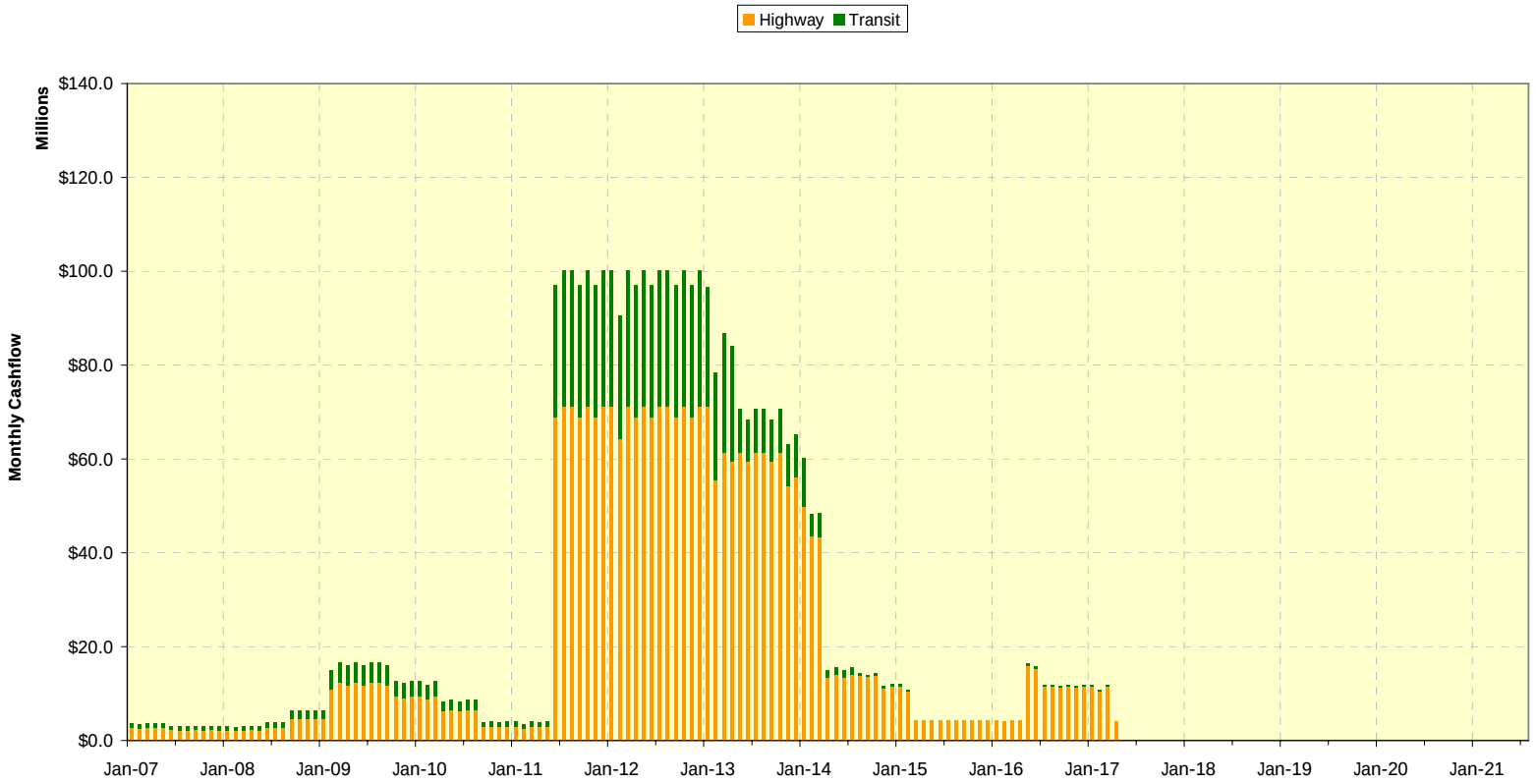


**Figure 35: Upstream Replacement Crossing with BRT Cash flow, Vancouver Alignment**

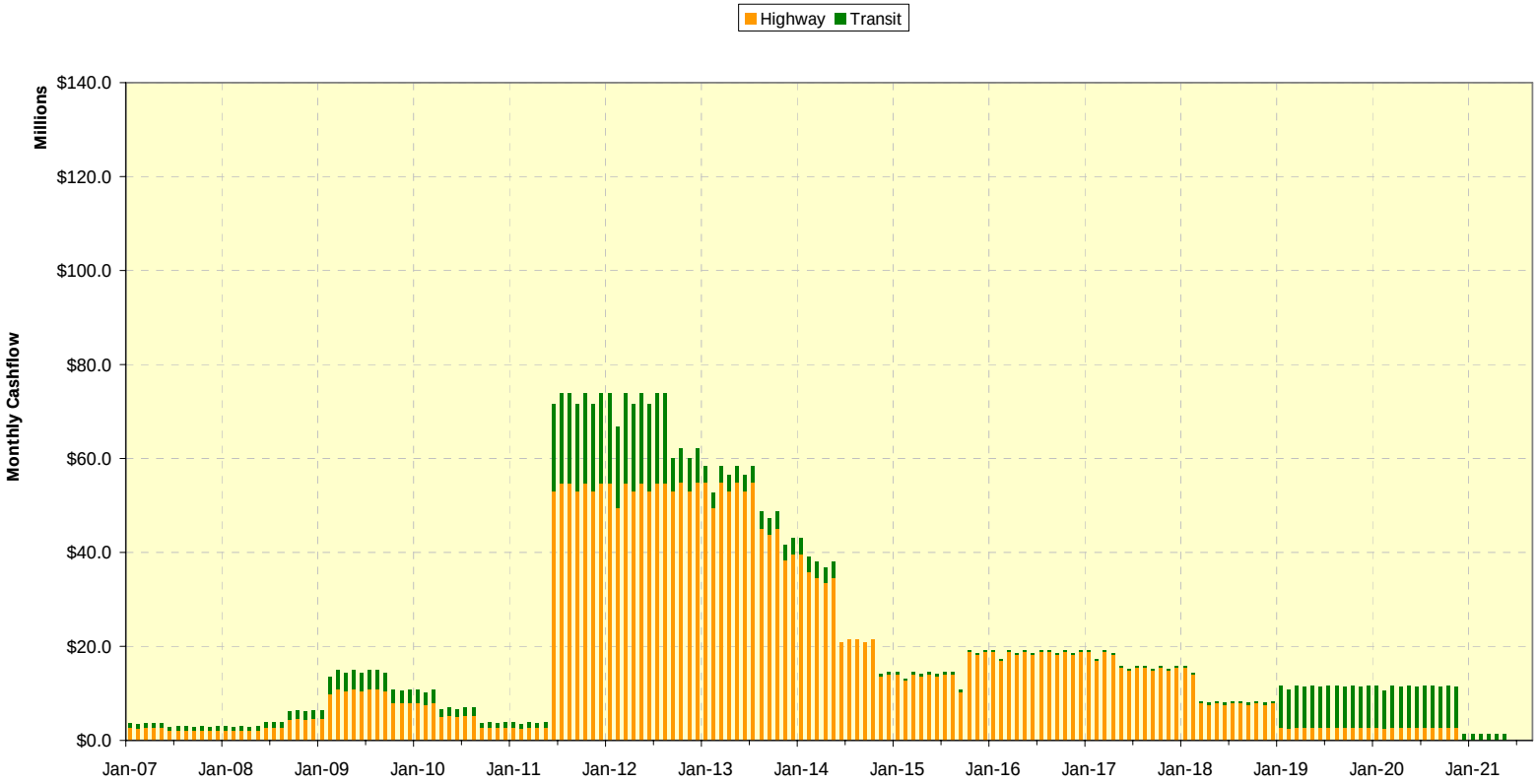


**Figure 36: Upstream Replacement Crossing with BRT Cashflow, I-5 Alignment**

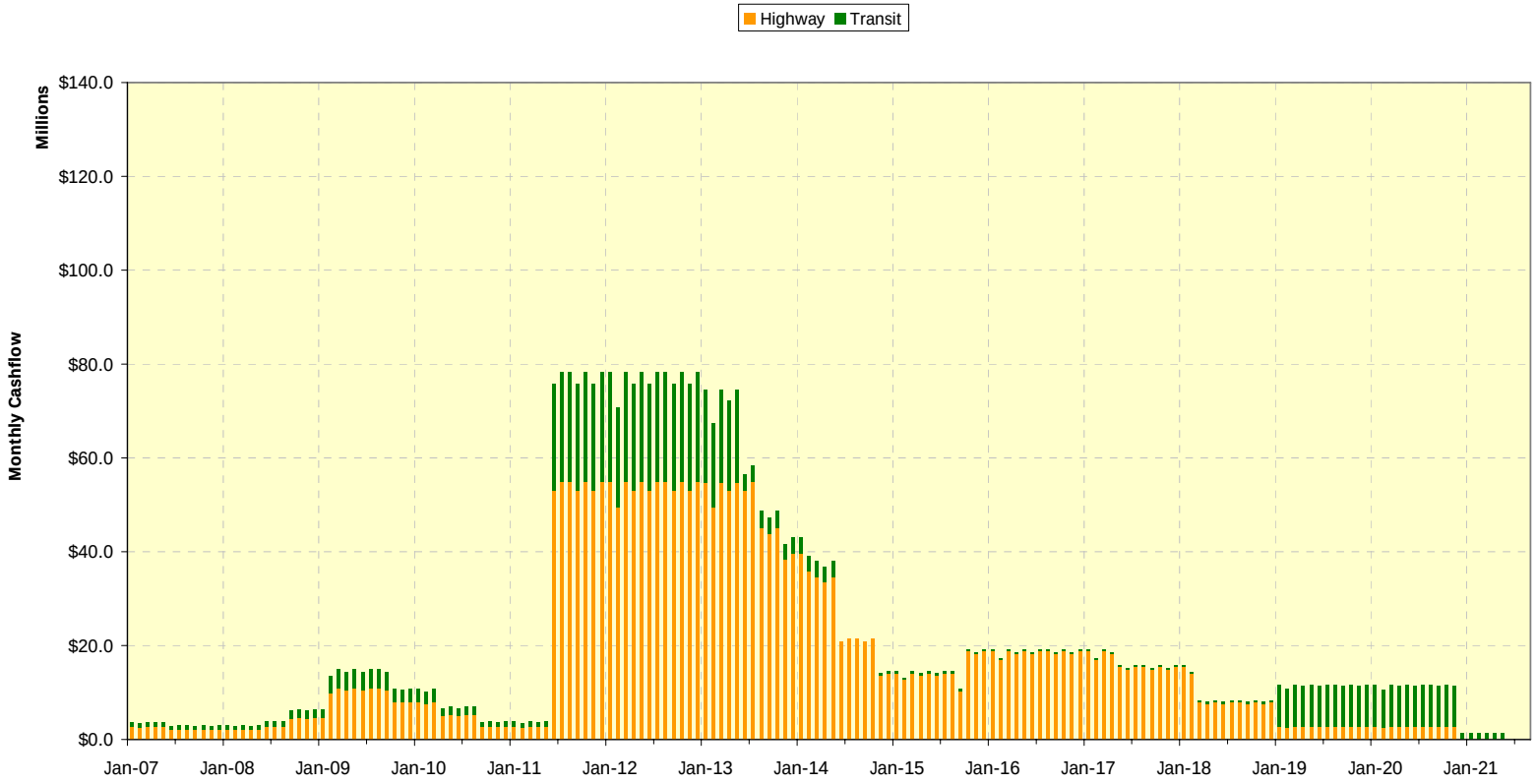


**Figure 37: Downstream Replacement Crossing with LRT Cashflow, Vancouver Alignment**

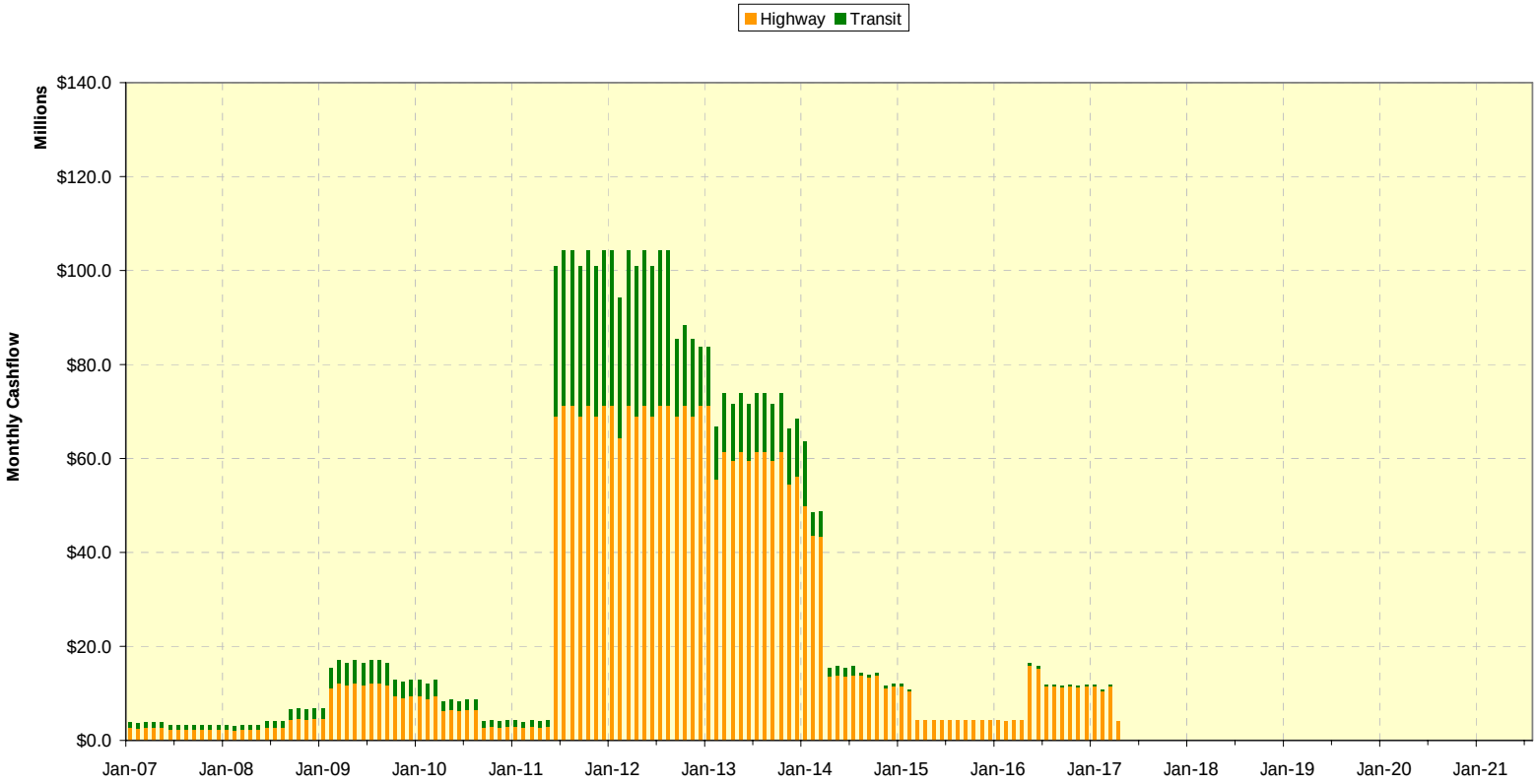


**Figure 38: Downstream Replacement Crossing with LRT Cashflow, I-5 Alignment**

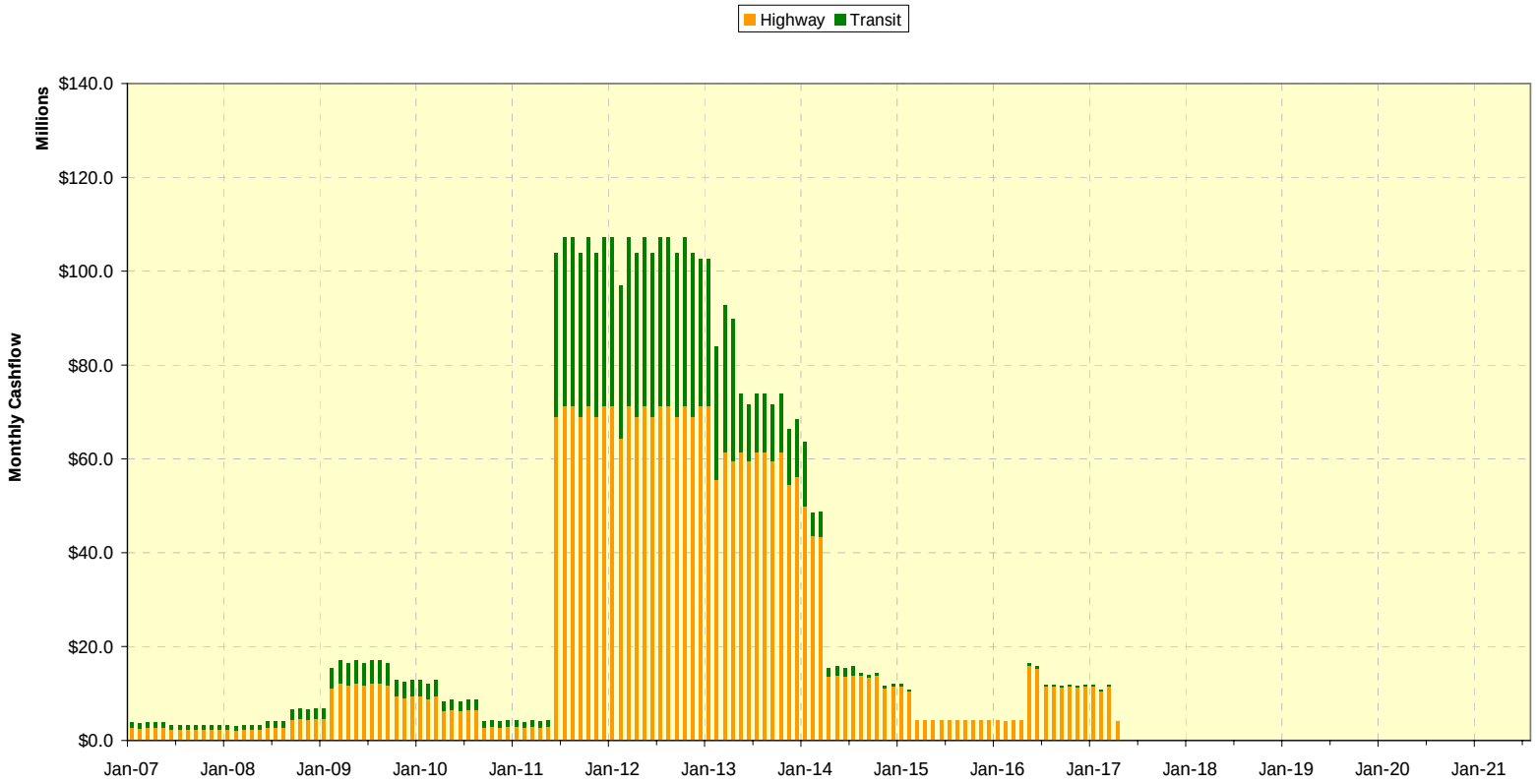


**Figure 39: Upstream Replacement Crossing with LRT Cashflow, Vancouver Alignment**

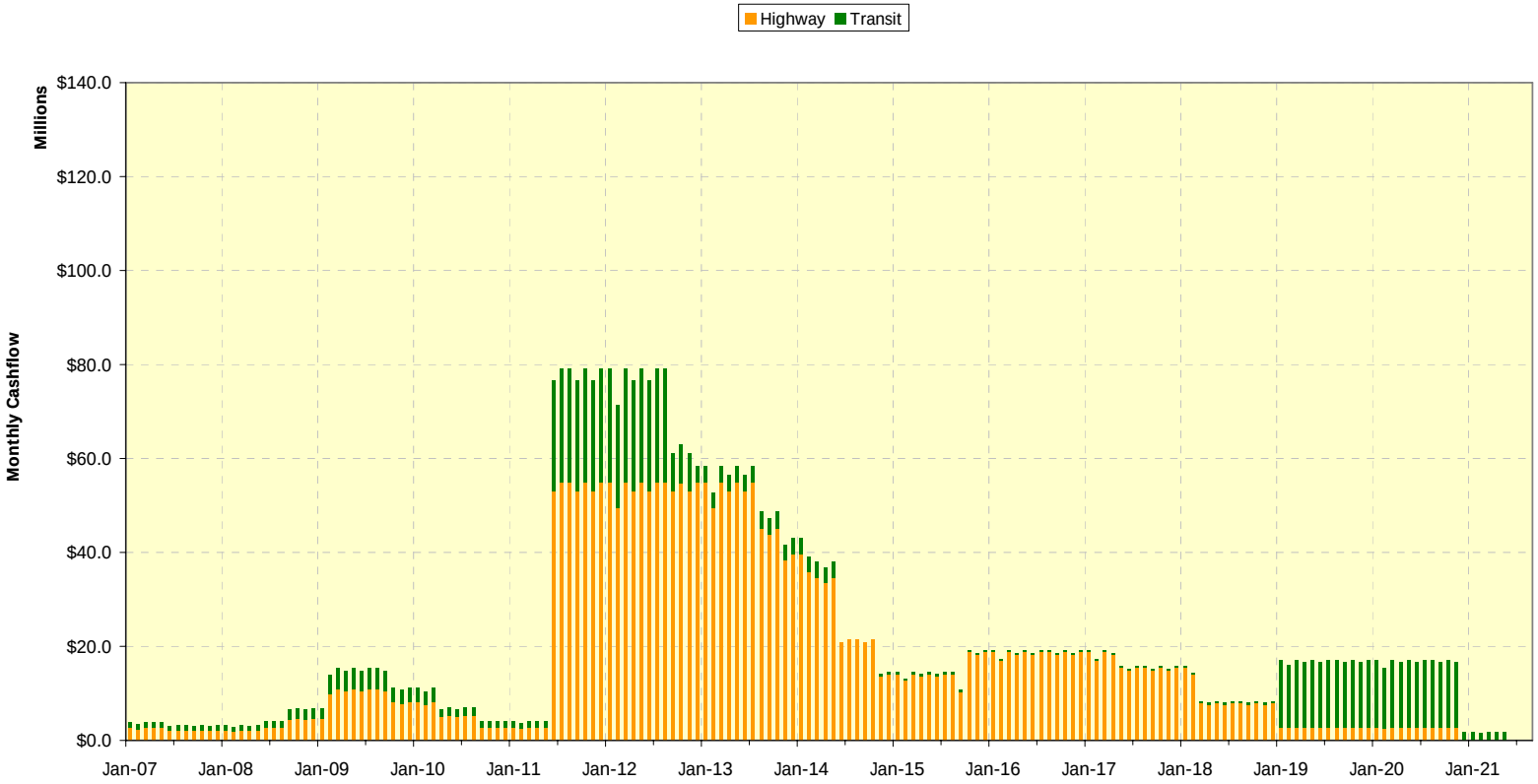


**Figure 40: Upstream Replacement Crossing with LRT Cashflow, I-5 Alignment**

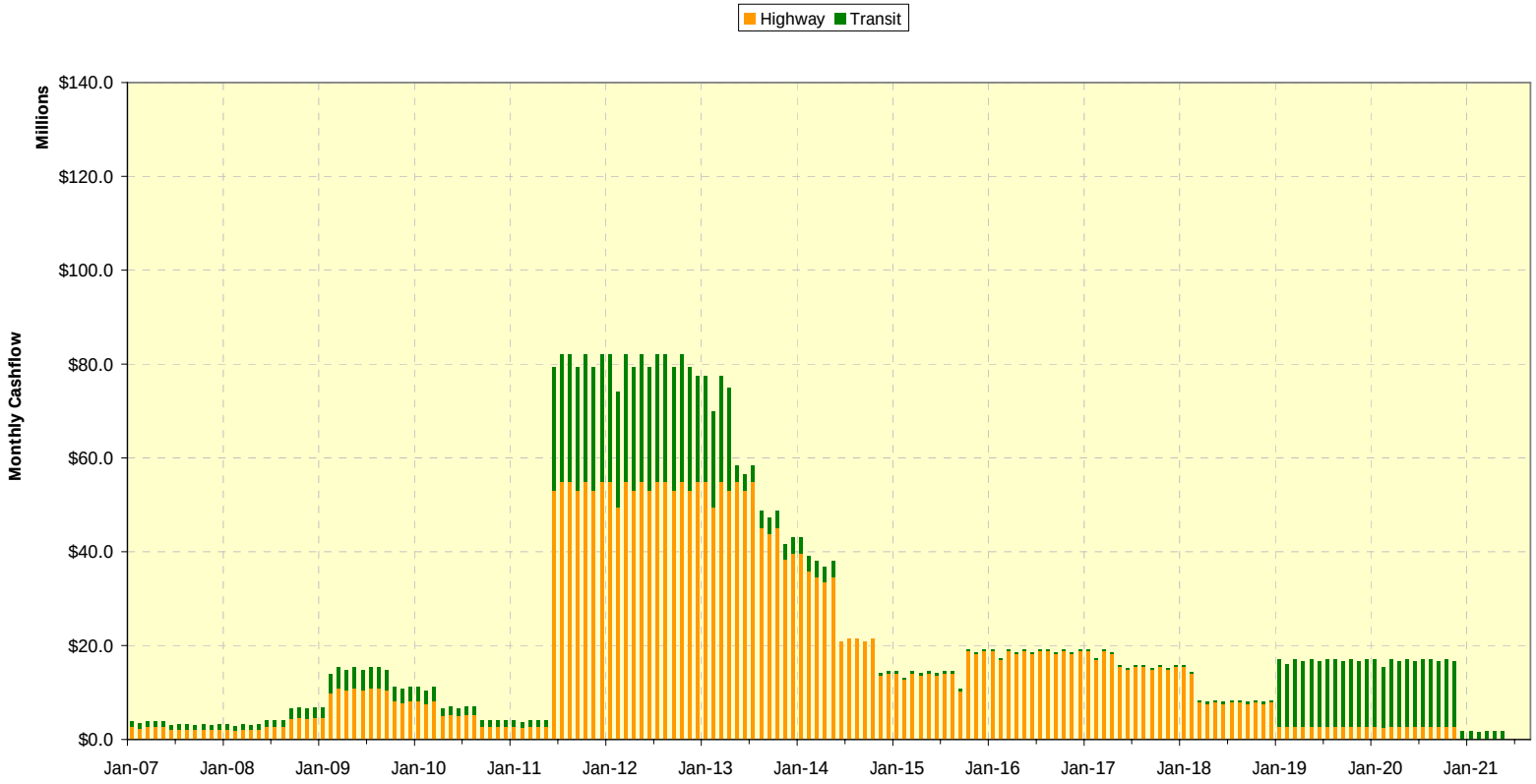


**Figure 41: Supplemental Crossing with BRT Cashflow, Vancouver Alignment**

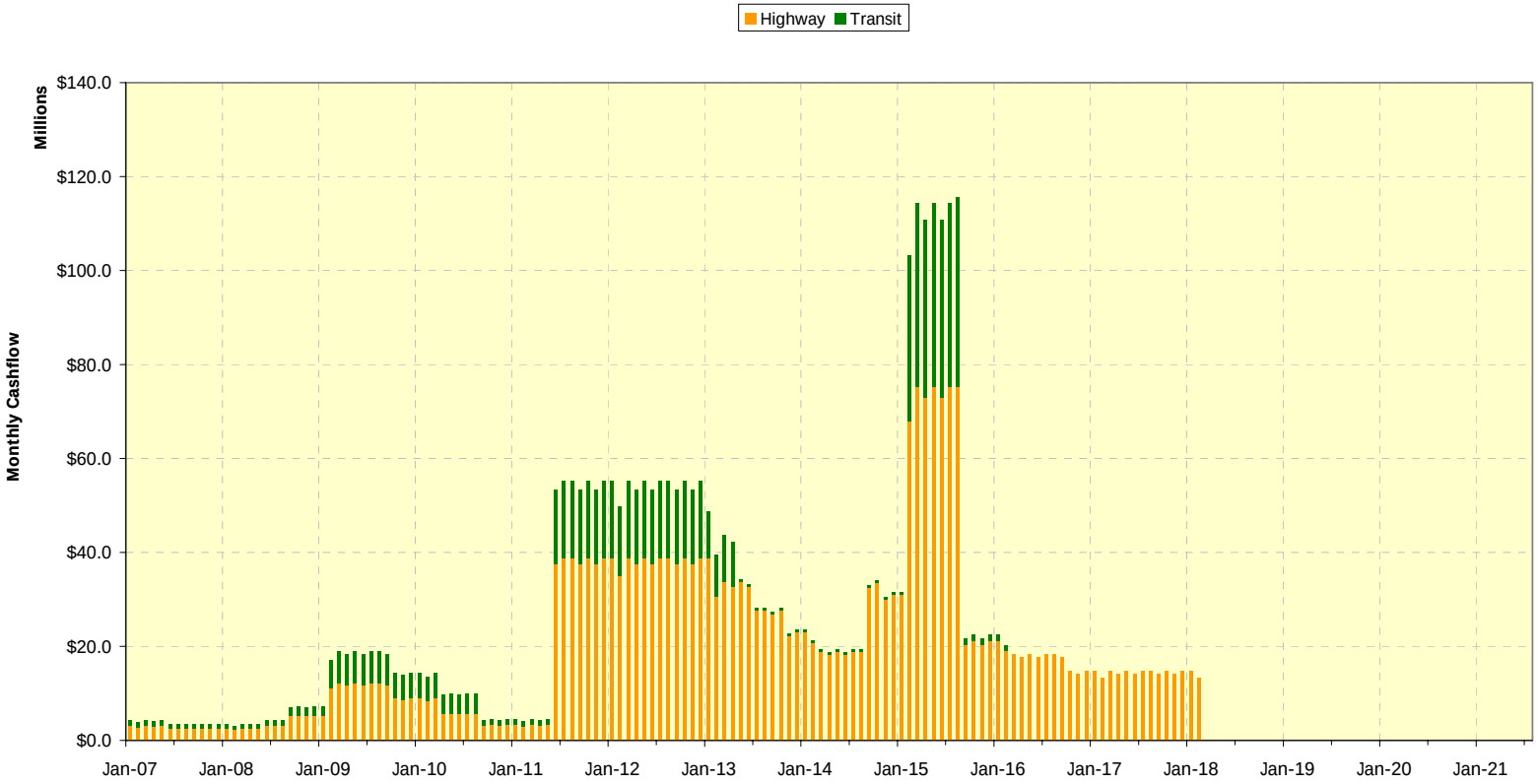


**Figure 42: Supplemental Crossing with BRT Cashflow, I-5 Alignment**

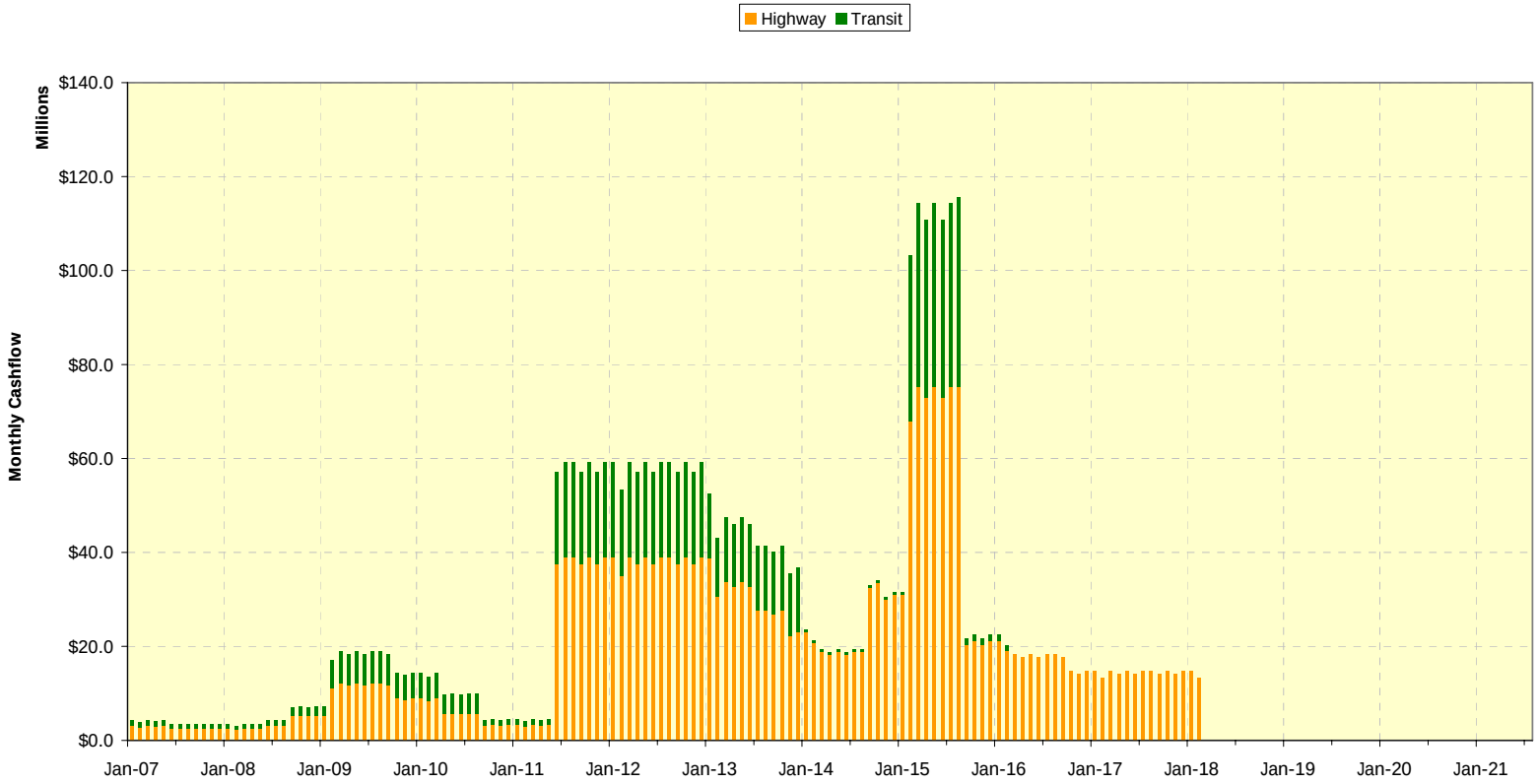


**Figure 43: Supplemental Crossing with LRT Cashflow, Vancouver Alignment**

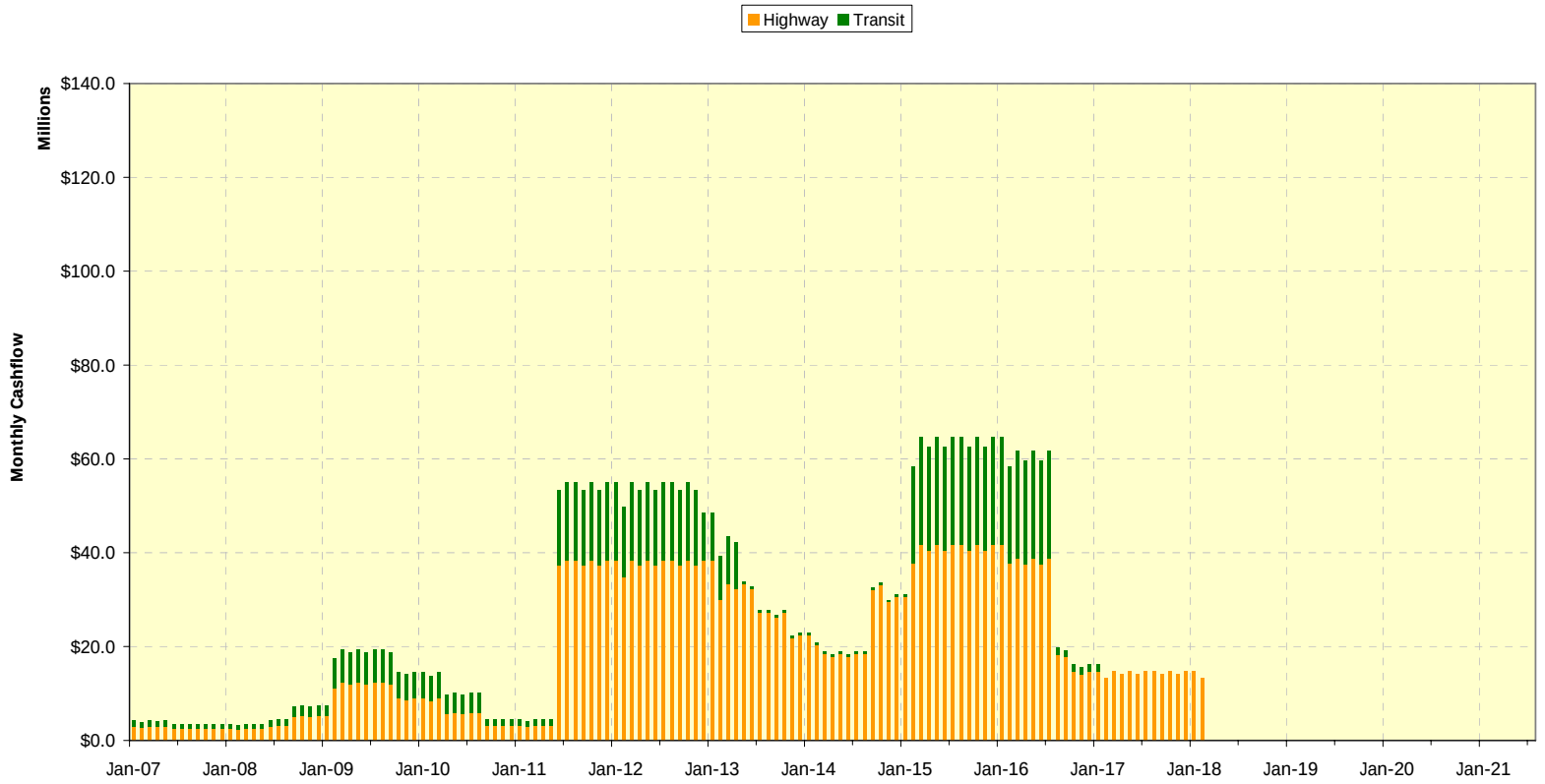


**Figure 44: Supplemental Crossing with LRT Cashflow, I-5 Alignment**

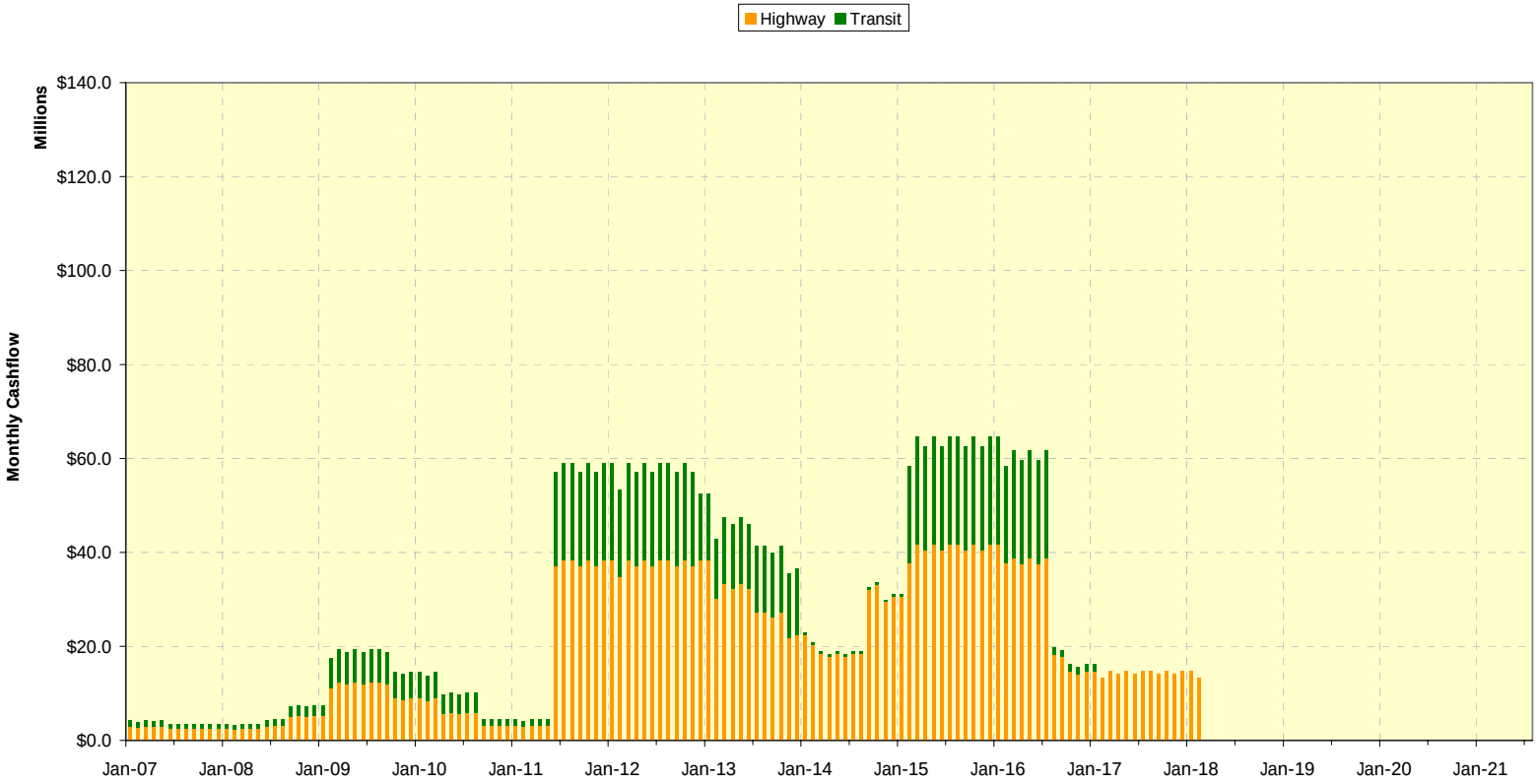


**Figure 45: Downstream Replacement Crossing with BRT Mill District Cashflow, MOS Design**

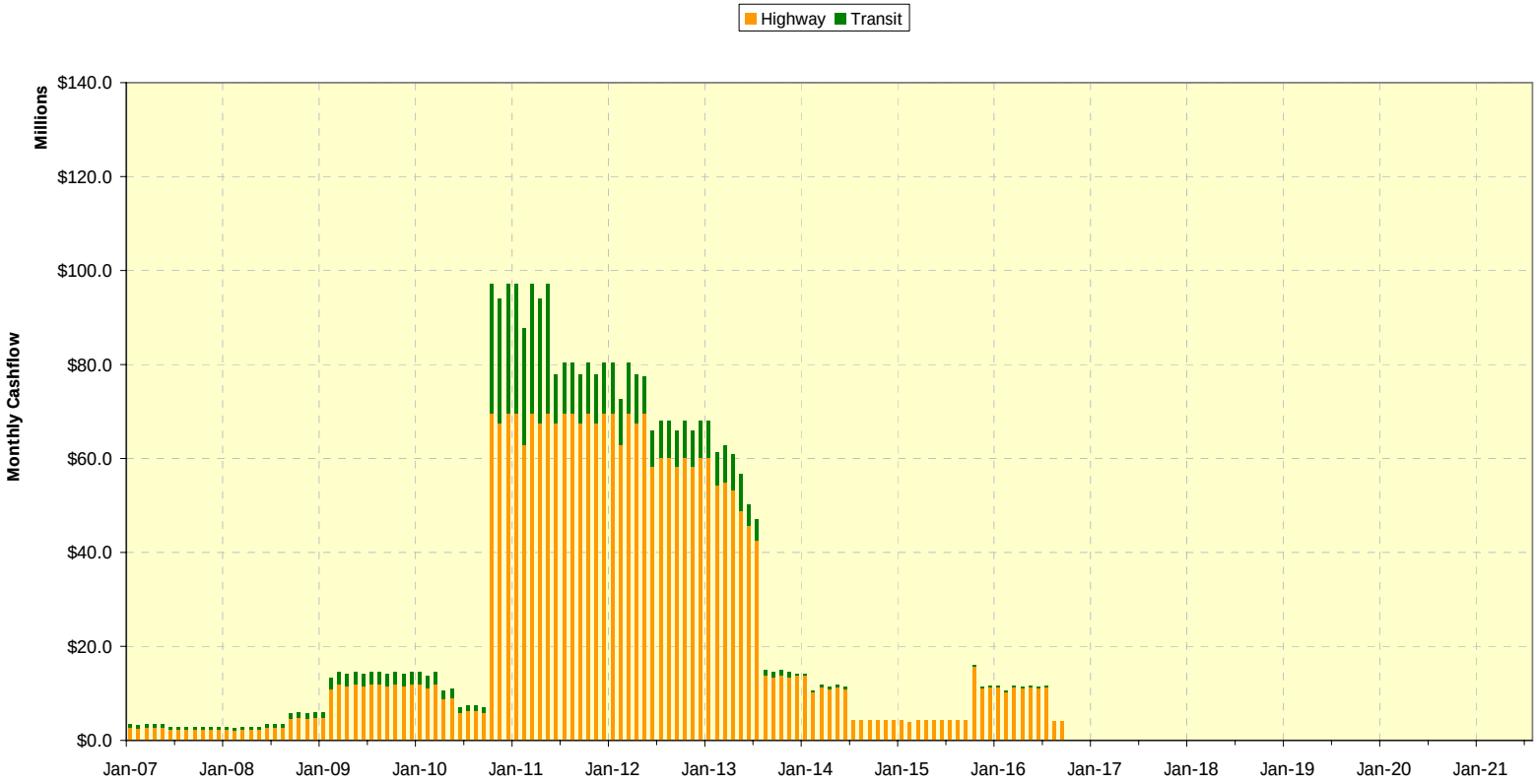


**Figure 46: Downstream Replacement Crossing with BRT Clark College Cashflow, MOS Design**

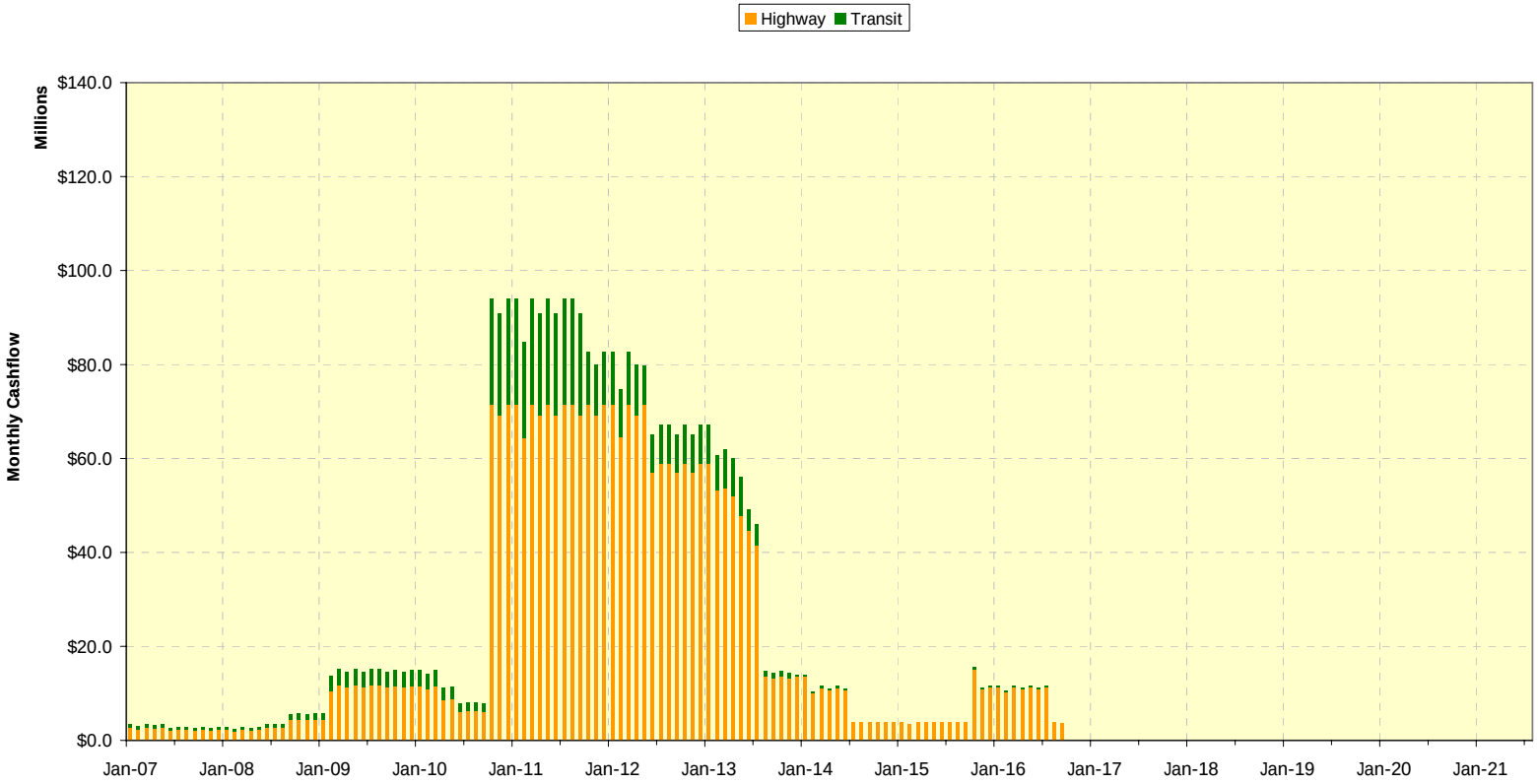


**Figure 47: Downstream Replacement Crossing with LRT Mill District Cashflow, MOS Design**

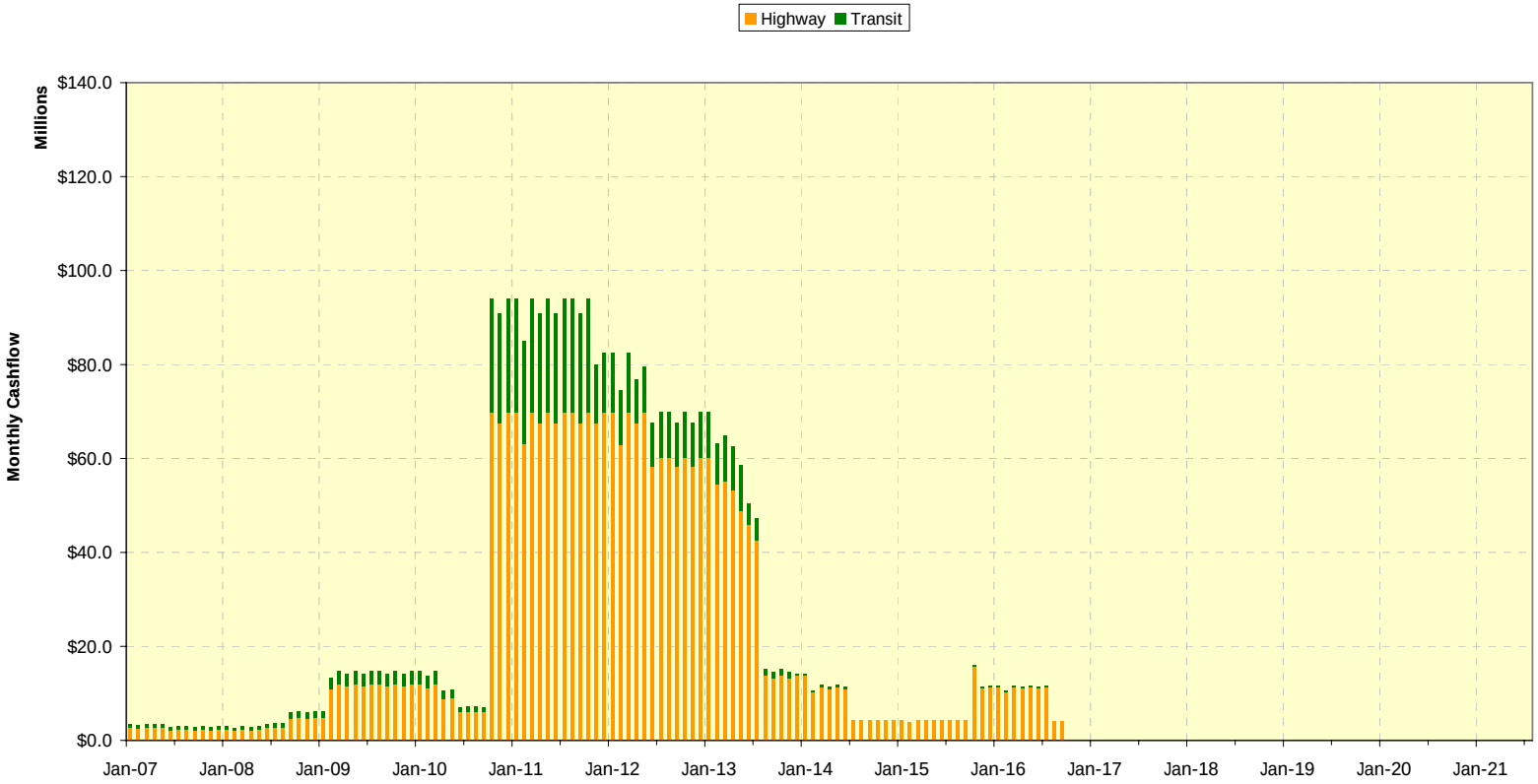
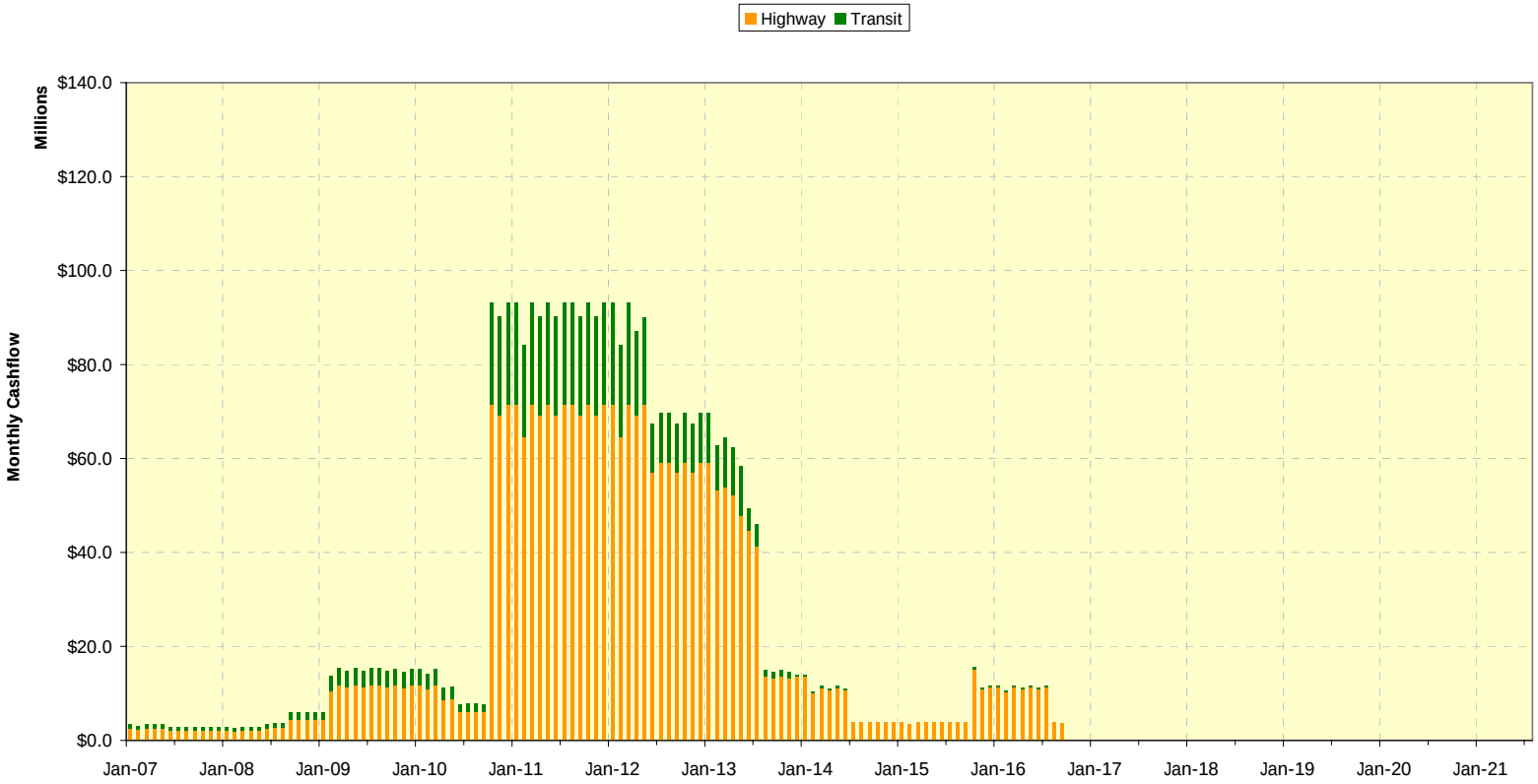


**Figure 48: Downstream Replacement Crossing with LRT Clark College Cashflow, MOS Design**



# 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 Dirctor | 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 Delay[17]**

| 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 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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 alterantives | 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 assuemes 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 assuemes Modified Existing | Variation to the Alternative (Inadvertent discovery) | | Cost & Schedule | 0% | | Probably not a significant difference. | | | | | | |

| # | Activity | Identification | | | | | | | | | | | | Quantitative Analysis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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 | | 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 | | | | | | |

| # | Activity | Identification | | | | | | | | | | | | Quantitative Analysis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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). | IJRs, 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 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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 | | | | | | | | | | | | Quantitative Analysis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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 expediation 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 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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 expediation 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: wil 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 expediation 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: wil 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 expediation 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: wil 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 expediation 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: wil 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 expediation 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 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | Prob. | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | | 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: wil 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 expediation 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: wil 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 expediation 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: wil 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 expediation 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: wil 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 expediation 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: wil 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 expediation 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 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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). | Took previous costs and allocated costs proportioally 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 | 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 proportioally 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 |
| 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). | Took previous costs and allocated costs proportioally based on the amount of structures being demolished. Protect surrounding area from dust and debris | 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). | Took previous costs and allocated costs proportioally based on the amount of structures being demolished. Protect surrounding area from dust and debris | 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). | Took previous costs and allocated costs proportioally 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 |
| 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). | Took previous costs and allocated costs proportioally 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 |
| 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). | Took previous costs and allocated costs proportioally 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 |
| 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 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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) | | May vary from $5-10 M for EJ issues with 0 to three month range | 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. | | May be captured elsewhere. May be time only, all costs would be due to schedule | 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) | Only to activity 19 as evergreen bridge will be built first, morelikely to go up than down given the pedestrian bridge over SR 14. | 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. | | Predatory Fish, and getting materials not accounted for in staging. | 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. | Key driver to project. Should be lower probability than 75% since the project is currently on schedule. | 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. | | Works closely with local stakeholders currently | 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 feeback 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. | Low risk, with only one more major decision to be made. Will present them prefered alternative at the end of the year. | 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. | 50% that it is about 10% of ROW Costs from last CVEP | Cost | 50% | trigen | $13,000,000 | $10,000,000 | $20,000,000 | | | | |

| # | Activity | Identification | | | | | | | | | | | Type | Quantitative Analysis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | | 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 adaquate 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 railraod 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 railraod 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 (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 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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 memoradum 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 | 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 | 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 signiture 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 | | | | 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 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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% | trigen | $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 agencie 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 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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. | 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% | | | | | | | | |

| # | Activity | Identification | | | | | | | | | | | | Quantitative Analysis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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 diamter 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 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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. | 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 | | 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 | 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 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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 | | | 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 53: I-5 Alignment Risk Register**

| # | Activity | Identification | | | | | | | | SMART Column | Additional Panelists' Comments | | Type | Quantitative Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | Prob. | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | | | | | | 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 alterantives | 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 assuemes 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 assuemes Modified Existing | Variation to the Alternative (Inadvertent discovery) | | Cost & Schedule | 0% | | Probably not a significant difference. | | | | | | |

| # | Activity | Identification | | | | | | | | SMART Column | Additional Panelists' Comments | | Type | Quantitative Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | | | | | Prob. | 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 | | | | | | | | SMART Column | Additional Panelists' Comments | | Type | Quantitative Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | | | | | Prob. | 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. | May need to redo the main street interchange improvements only | 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. | 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 | 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. | 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). | IJRs, 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 | | | | | | | | SMART Column | Additional Panelists' Comments | | Type | Quantitative Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | Prob. | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | | | | | | 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 | | | | | | | | SMART Column | Additional Panelists' Comments | | Type | Quantitative Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | | | | | Prob. | 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 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). | 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 expediation 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 | | | | | | | | SMART Column | Additional Panelists' Comments | | Type | Quantitative Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| # | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | | | | | Prob. | 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 expediation 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: wil 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 expediation 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: wil 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 expediation 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: wil 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 expediation 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: wil 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 expediation 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 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| # | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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: wil 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 expediation 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: wil 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 expediation 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: wil 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 expediation 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: wil 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 expediation 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: wil 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 expediation 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 | | | | | | | | SMART Column | Additional Panelists' Comments | | Type | Prob. | Quantitative Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | | | | | | 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). | Took previous costs and allocated costs proportioally 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 | 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 proportioally 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 |
| 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). | Took previous costs and allocated costs proportioally based on the amount of structures being demolished. Protect surrounding area from dust and debris | 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). | Took previous costs and allocated costs proportioally based on the amount of structures being demolished. Protect surrounding area from dust and debris | 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). | Took previous costs and allocated costs proportioally 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 |
| 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). | Took previous costs and allocated costs proportioally 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 |
| 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). | Took previous costs and allocated costs proportioally 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 |
| 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 | | | | | | | | SMART Column | Additional Panelists' Comments | | Type | Quantitative Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| # | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | | | | | Prob. | 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) | | May vary from $5-10 M for EJ issues with 0 to three month range | 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. | | May be captured elsewhere. May be time only, all costs would be due to schedule | 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) | Only to activity 19 as evergreen bridge will be built first, morelikely to go up than down given the pedestrian bridge over SR 14. | 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. | | Predatory Fish, and getting materials not accounted for in staging. | 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. | Key driver to project. Should be lower probability than 75% since the project is currently on schedule. | 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. | | Works closely with local stakeholders currently | 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 feeback 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. | Low risk, with only one more major decision to be made. Will present them prefered alternative at the end of the year. | 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. | 50% that it is about 10% of ROW Costs from last CVEP | Cost | 50% | trigen | $13,000,000 | $10,000,000 | $20,000,000 | | | | |

| # | Activity | Identification | | | | | | | | SMART Column | Additional Panelists' Comments | | Type | Quantitative Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | | | | | 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% | | | | | 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 adaquate 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 railraod 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 railraod 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 | | | | | | | | SMART Column | Additional Panelists' Comments | | Type | Quantitative Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | | | | | Prob. | 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 memoradum 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 | 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 | 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 signiture 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 | | | | 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 | | | | | | | | SMART Column | Additional Panelists' Comments | | Type | Quantitative Analysis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | | | | | Prob. | 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% | trigen | $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 agencie 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 | | | | | | | | SMART Column | Additional Panelists' Comments | | Type | Quantitative Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | | | | | Prob. | 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 | | | | | | | | SMART Column | Additional Panelists' Comments | | Type | Quantitative Analysis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | | | | | Prob. | 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. | Maybe lower percent to 30% | 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. | 30% for 2 and 3 | 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. | 40% for 4 and 5 | 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. | 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 diamter 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 | 1 | 1 | | R-3 - No Seismic Retrofit of Substructure, Superstructure Retrofit only | VE Recommendation | | | | | | | | | | | | |

| # | Activity | Identification | | | | | | | | SMART Column | Additional Panelists' Comments | | Type | Quantitative Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | | | | | Prob. | 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. | 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 | | 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 | 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 | | | | | | | | SMART Column | Additional Panelists' Comments | | Type | Quantitative Analysis | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| | | Alt 2a | Alt 2b | Alt 3a | Alt 3b | Alt 4 | Alt 5 | Functional Assignment | Threat / Opportunity Events | | | | | Prob. | 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**

| | | Identification | | | | | | | | | | Quantitative Analysis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| # | Activity | 2a - Mill District | 2a - Clark College | 3a - Mill District | 3a - Clark College | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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 alterantives | 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 assuemes 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 assuemes 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 | | |

| | Activity | Identification | | | | | | | | | Type | Quantitative Analysis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| # | | 2a - Mill District | 2a - Clark College | 3a - Mill District | 3a - Clark College | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | | Prob. | 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% | | | | | | | | |

| | Activity | Identification | | | | | | | | | Type | Quantitative Analysis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| # | | 2a - Mill District | 2a - Clark College | 3a - Mill District | 3a - Clark College | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | | Prob. | 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). | IJRs, 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% | trigen | $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% | trigen | $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% | trigen | $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% | trigen | $2,500,000 | $2,000,000 | $3,000,000 | | | | |

| | Activity | Identification | | | | | | | | | | Quantitative Analysis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| # | | 2a - Mill District | 2a - Clark College | 3a - Mill District | 3a - Clark College | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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 | | |

| | Activity | Identification | | | | | | | | | Type | Quantitative Analysis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| # | | 2a - Mill District | 2a - Clark College | 3a - Mill District | 3a - Clark College | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | | Prob. | 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). | 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 | 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 | 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 | 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 expediation 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 |
| 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. | Depends on the size of the site, the expediation 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 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| # | | 2a - Mill District | 2a - Clark College | 3a - Mill District | 3a - Clark College | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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: wil 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 expediation 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: wil 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 expediation 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: wil 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 expediation 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: wil 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 expediation 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: wil 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 expediation 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 |

| | Activity | Identification | | | | | | | | | | Quantitative Analysis | | | | | | | | |
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| | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| # | | 2a - Mill District | 2a - Clark College | 3a - Mill District | 3a - Clark College | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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: wil 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 expediation 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: wil 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 expediation 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: wil 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 expediation 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: wil 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 expediation 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 proportioally 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 proportioally 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 |

| | Activity | Identification | | | | | | | | | | Quantitative Analysis | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| # | | 2a - Mill District | 2a - Clark College | 3a - Mill District | 3a - Clark College | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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. Assume the SB bridge is in the base (lead paint). | Took previous costs and allocated costs proportioally based on the amount of structures being demolished. Protect surrounding area from dust and debris | 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. Assume the SB bridge is in the base (lead paint). | Took previous costs and allocated costs proportioally based on the amount of structures being demolished. Protect surrounding area from dust and debris | 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. Assume the SB bridge is in the base (lead paint). | Took previous costs and allocated costs proportioally 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 |
| 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. Assume the SB bridge is in the base (lead paint). | Took previous costs and allocated costs proportioally 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 |
| 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. Assume the SB bridge is in the base (lead paint). | Took previous costs and allocated costs proportioally 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 |
| 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. Assume the SB bridge is in the base (lead paint). | | 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. Assume the SB bridge is in the base (lead paint). | | 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) | | May vary from $5-10 M for EJ issues with 0 to three month range | 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. | | May be captured elsewhere. May be time only, all costs would be due to schedule | Cost & Schedule | 20% | | | | | uniform | | 3.0 | 6.0 |

| | Activity | Identification | | | | | | | | | | Quantitative Analysis | | | | | | | | |
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| | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| # | | 2a - Mill District | 2a - Clark College | 3a - Mill District | 3a - Clark College | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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) | Only to activity 19 as evergreen bridge will be built first, morelikely to go up than down given the pedestrian bridge over SR 14. | 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. | | Predatory Fish, and getting materials not accounted for in staging. | 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. | Key driver to project. Should be lower probability than 75% since the project is currently on schedule. | 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. | | Works closely with local stakeholders currently | 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 feeback 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. | Low risk, with only one more major decision to be made. Will present them prefered alternative at the end of the year. | 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. | 50% that it is about 10% of ROW Costs from last CVEP | 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 | Thinks there is adaquate time in the schedule for this right away plan | Schedule | 75% | | | | | uniform | | 3.0 | 6.0 |

| | Activity | Identification | | | | | | | | | Type | Quantitative Analysis | | | | | | | | |
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| | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| # | | 2a - Mill District | 2a - Clark College | 3a - Mill District | 3a - Clark College | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | | Prob. | 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 railraod 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 railraod 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. | So small no range really needed. | 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 | | | | | | | | |
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| | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| # | | 2a - Mill District | 2a - Clark College | 3a - Mill District | 3a - Clark College | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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 memoradum be developed. | | Cost & Schedule | | | | | | | | | |
| 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 signiture 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 agencie 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 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| # | | 2a - Mill District | 2a - Clark College | 3a - Mill District | 3a - Clark College | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| # | | 2a - Mill District | 2a - Clark College | 3a - Mill District | 3a - Clark College | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| # | | 2a - Mill District | 2a - Clark College | 3a - Mill District | 3a - Clark College | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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 diamter 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 | uniform | | -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 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | Cost Impact ($) | | | | Schedule Impact (Months) | | | |
| # | | 2a - Mill District | 2a - Clark College | 3a - Mill District | 3a - Clark College | Functional Assignment | Threat / Opportunity Events | SMART Column | Additional Panelists' Comments | | Type | Prob. | 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/tows 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.

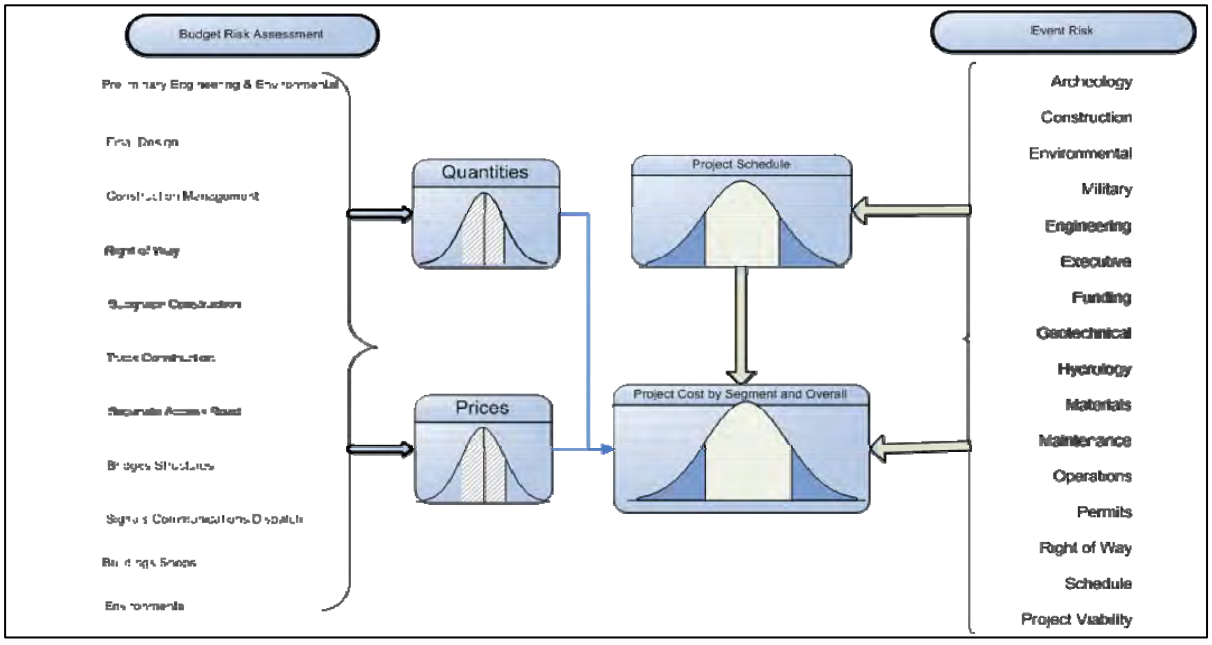


Figure H-1 – Illustration of the Risk Assessment Process

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.

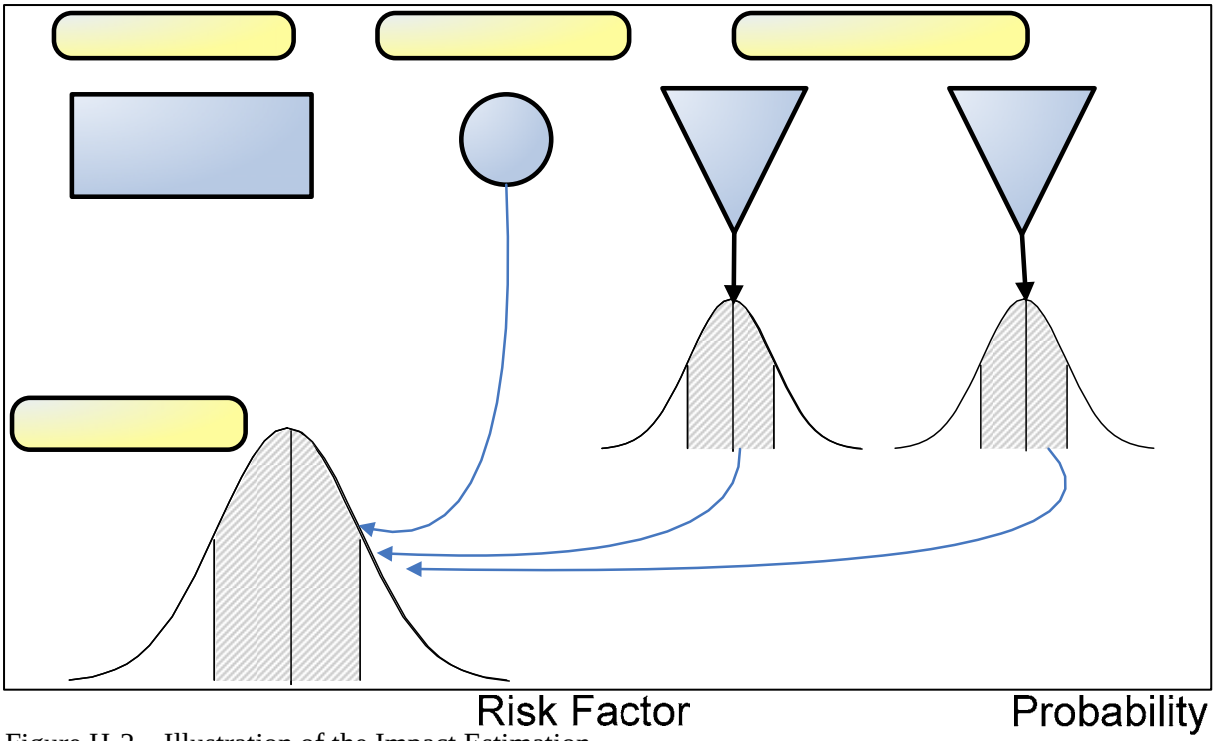


Figure H-2 – Illustration of the Impact Estimation

**Delay of NEPA Process** **33%**

I
In



**Overall Effect of the**

## 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

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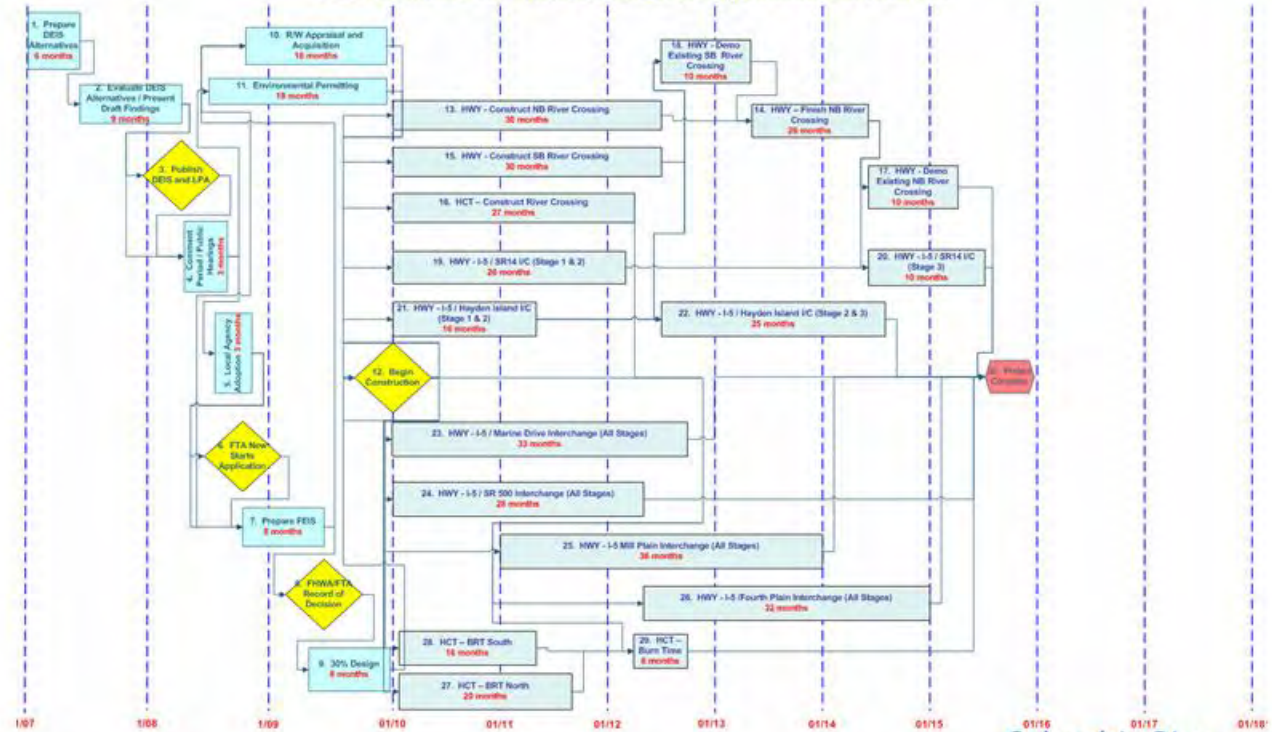
I-5 COLUMBIA RIVER CROSSING PROJECT

# Project Flowchart 2a, Downstream Replacement w/ BRT

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




Columbia River CROSSING

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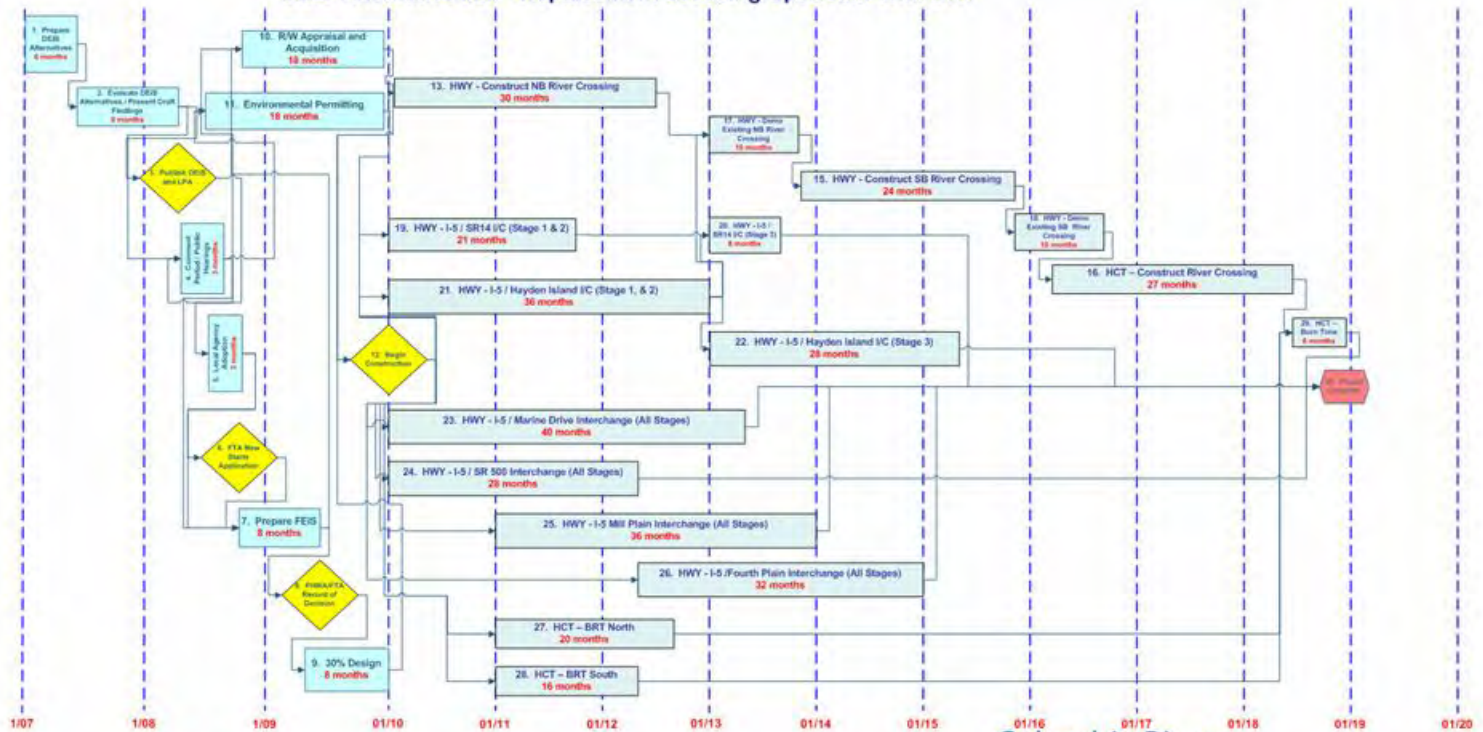
## I-5 COLUMBIA RIVER CROSSING PROJECT

# Project Flowchart 2b, Upstream Replacement w/ BRT

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




Columbia River CROSSING

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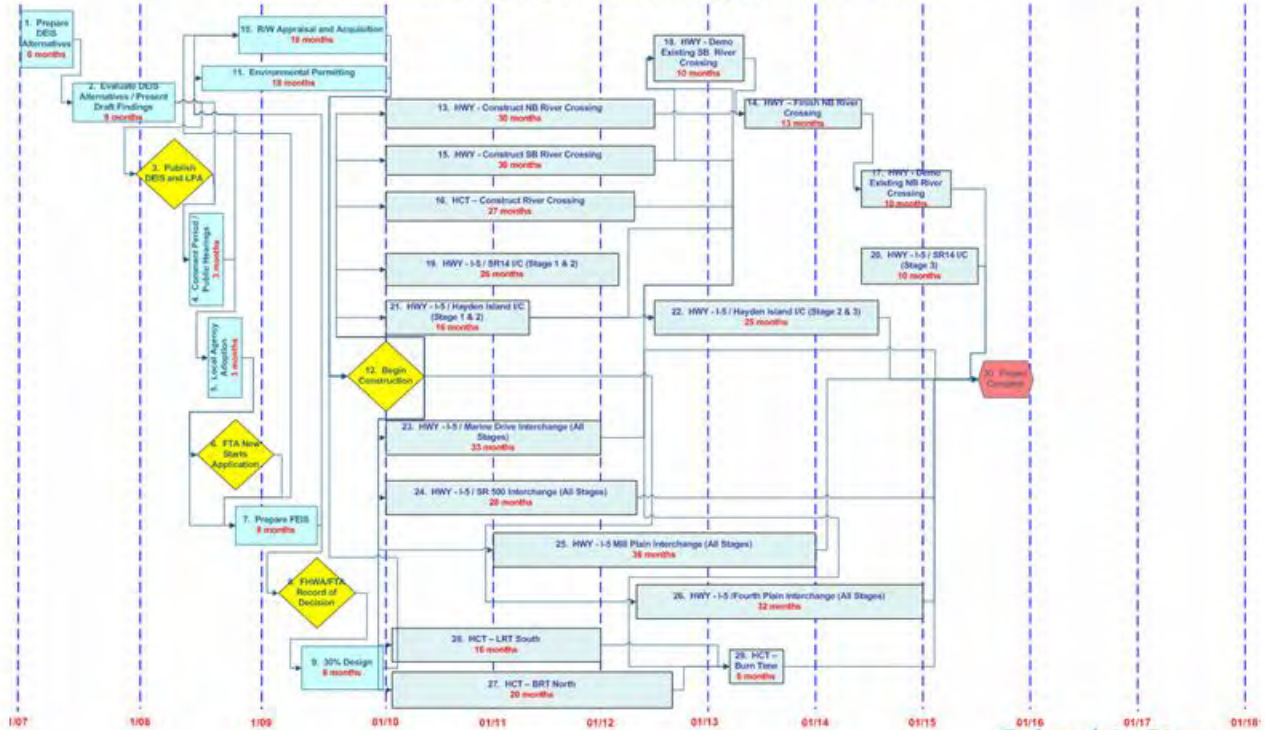
I-5 COLUMBIA RIVER CROSSING PROJECT

# Project Flowchart 3a, Downstream Replacement w/ LRT

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




Columbia River CROSSING

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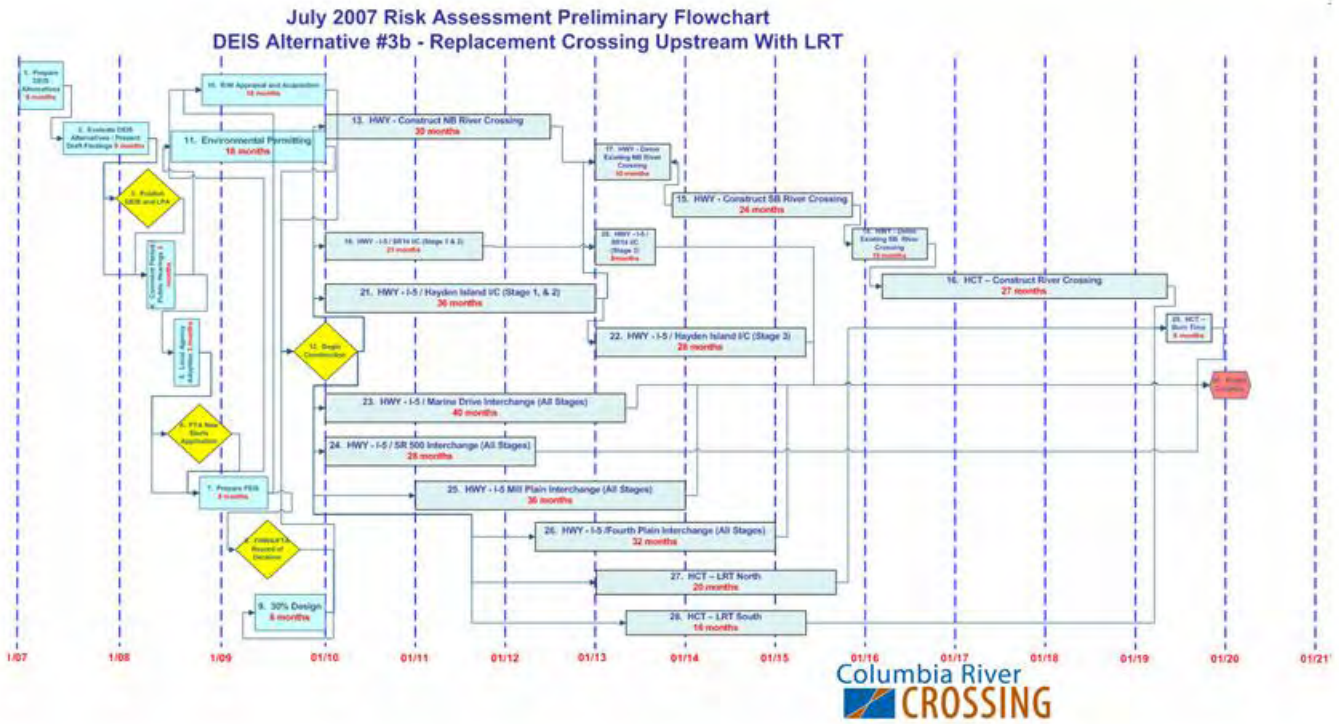
I-5 COLUMBIA RIVER CROSSING PROJECT

# Project Flowchart 3b, Upstream Replacement w/ LRT

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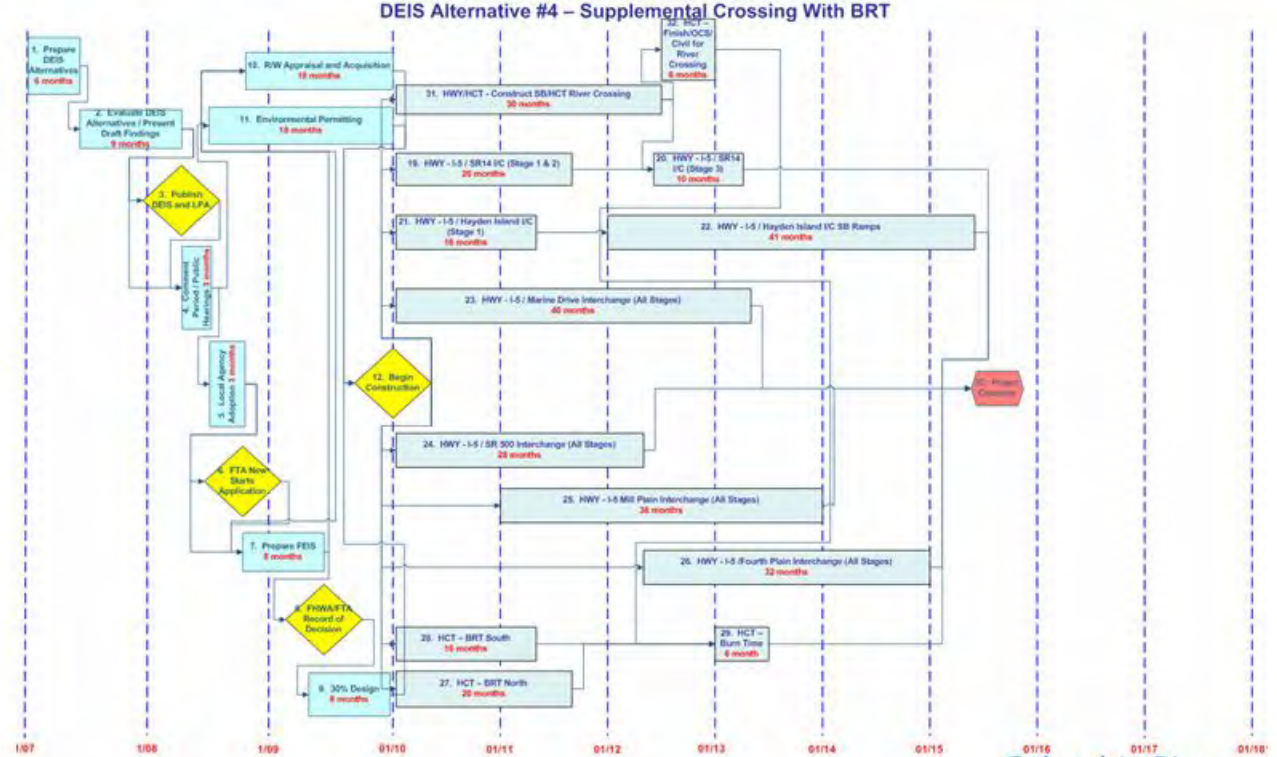
I-5 COLUMBIA RIVER CROSSING PROJECT

# Project Flowchart 4, Supplemental Crossing w/ BRT

July 2007 Risk Assessment Preliminary Flowchart
DEIS Alternative #4 – Supplemental Crossing With BRT




Columbia River CROSSING

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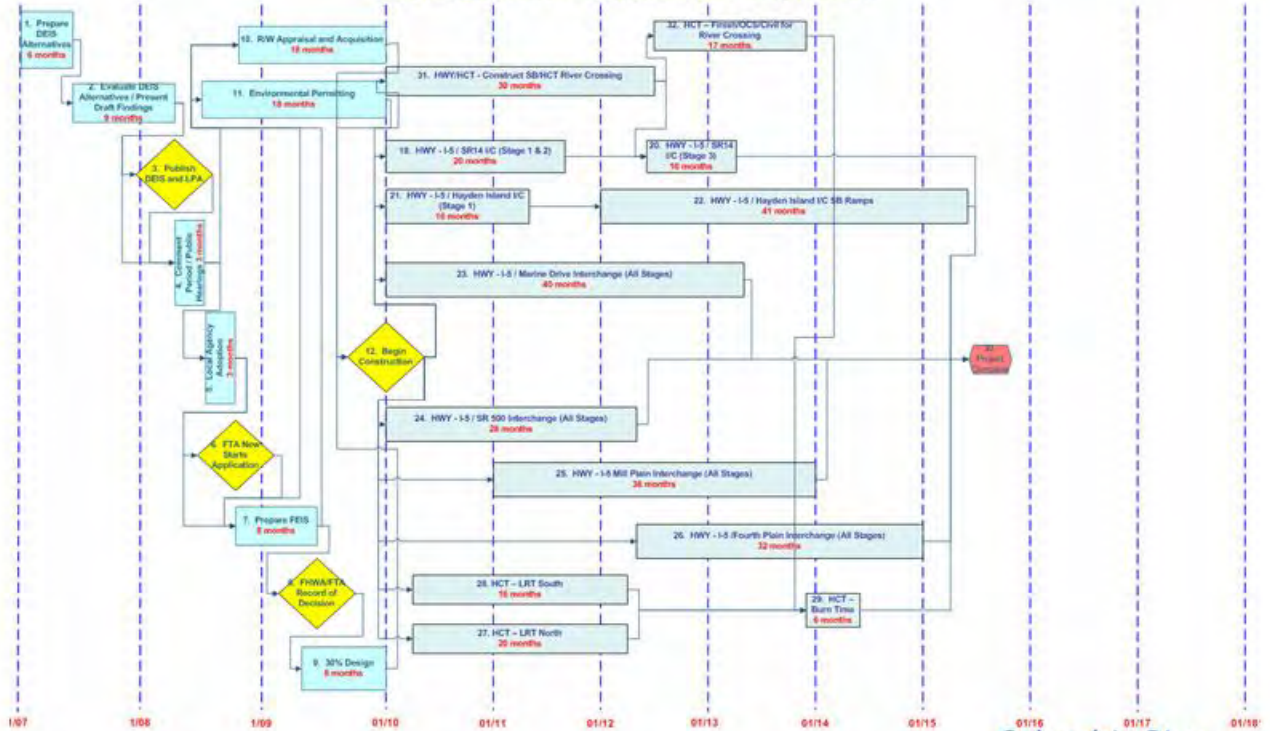
## I-5 COLUMBIA RIVER CROSSING PROJECT

# Project Flowchart 5, Supplemental Crossing w/ LRT

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




Columbia River CROSSING

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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.

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# 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% |

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I-5 COLUMBIA RIVER CROSSING PROJECT

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



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## I-5 COLUMBIA RIVER CROSSING PROJECT

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


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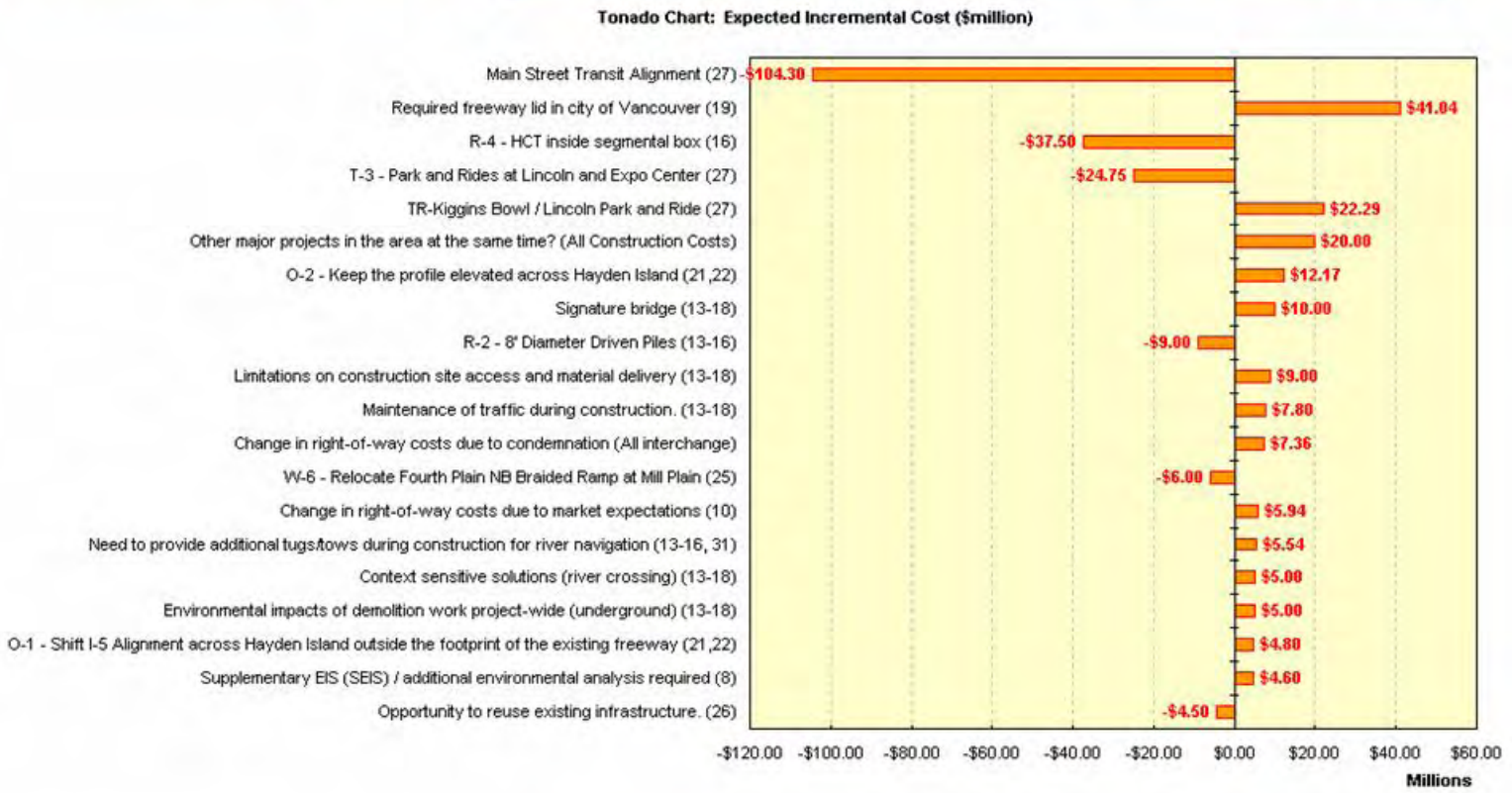
I-5 COLUMBIA RIVER CROSSING PROJECT

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




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**.

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I-5 COLUMBIA RIVER CROSSING PROJECT

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



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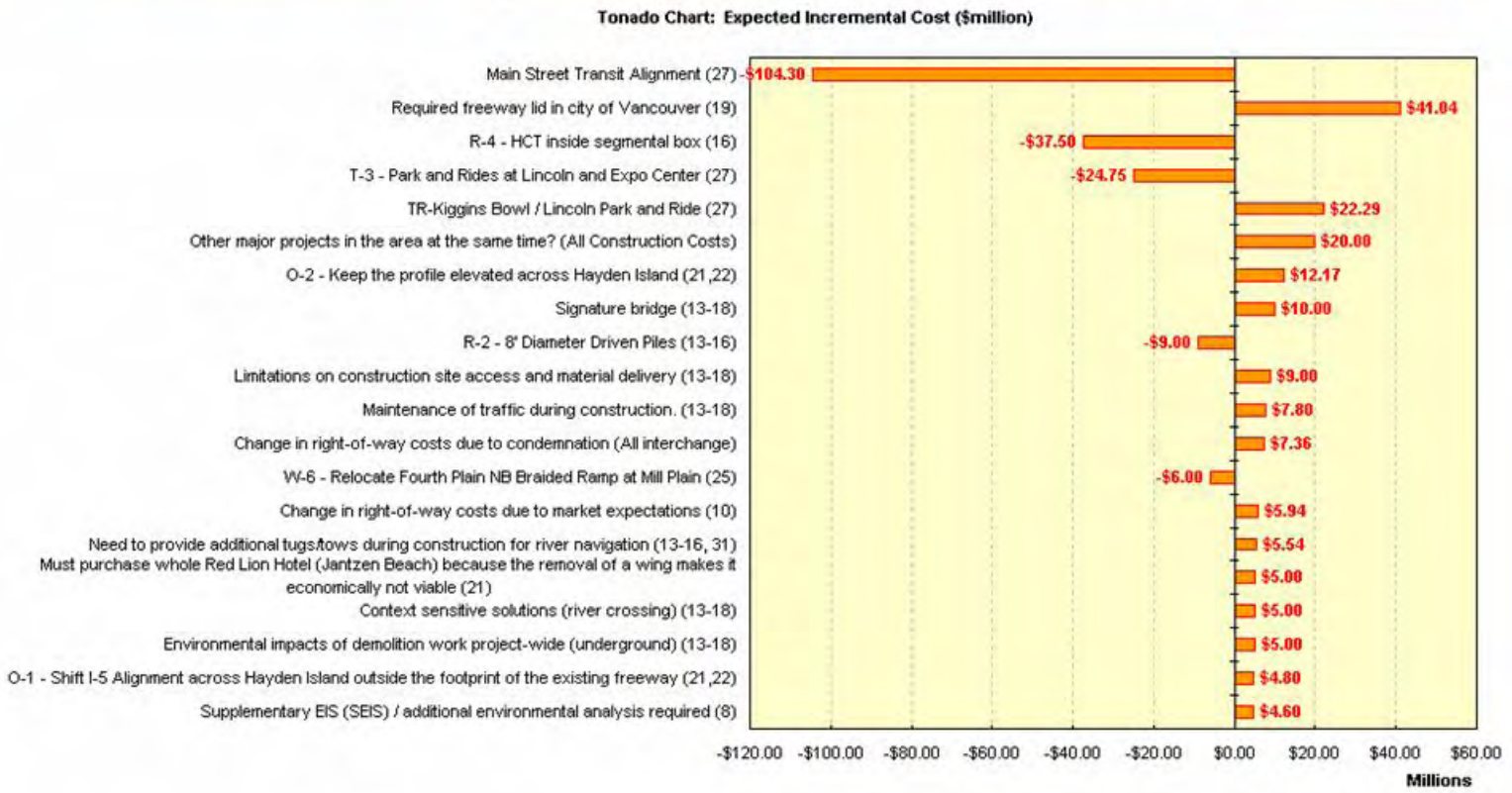
I-5 COLUMBIA RIVER CROSSING PROJECT

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




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**.

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I-5 COLUMBIA RIVER CROSSING PROJECT

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



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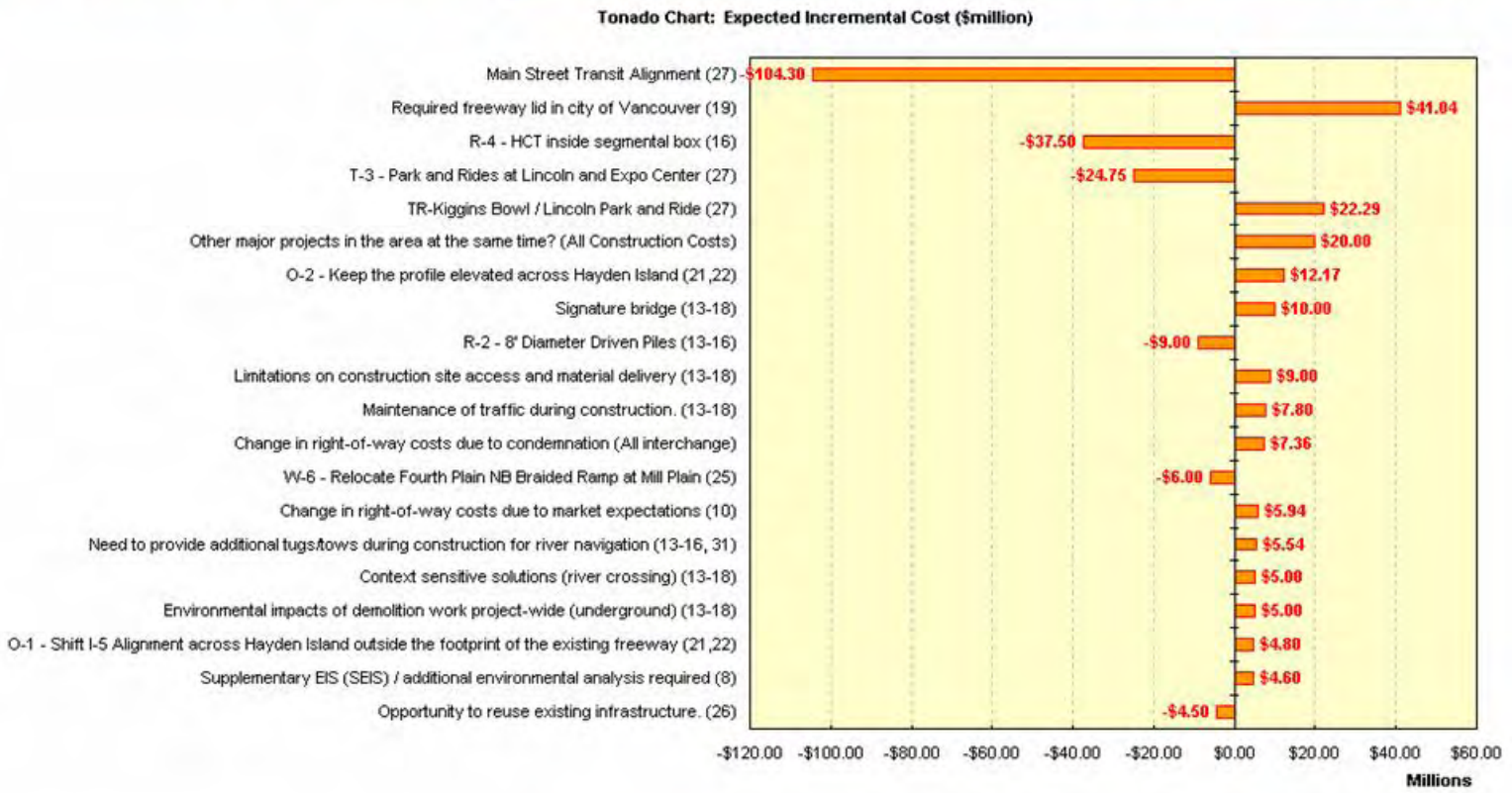
I-5 COLUMBIA RIVER CROSSING PROJECT

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




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**.

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I-5 COLUMBIA RIVER CROSSING PROJECT

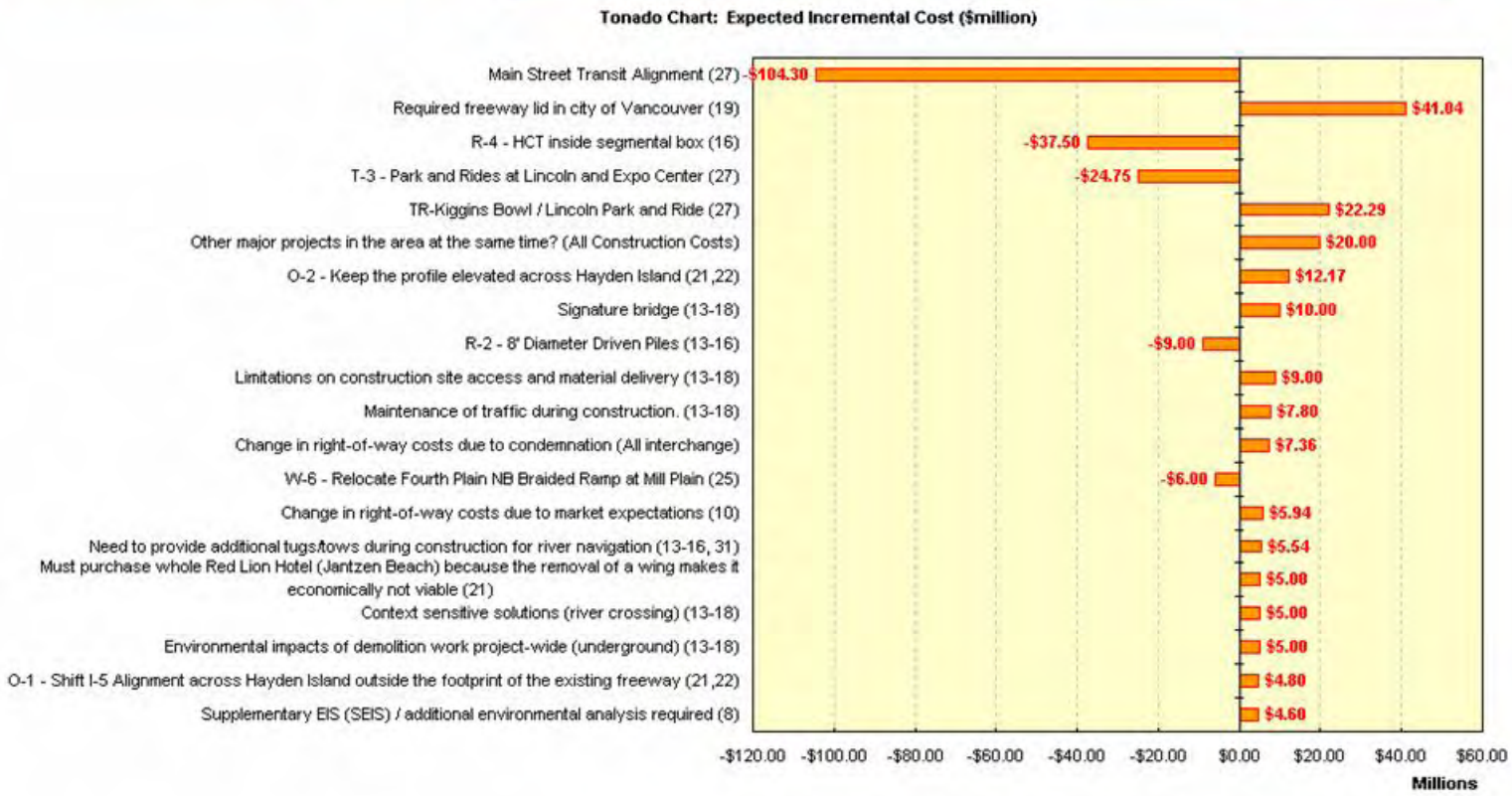
# Total Project Costs Summary 3b, Upstream Replacement w/ LRT



19

I-5 COLUMBIA RIVER CROSSING PROJECT

# Identification of Key Cost Risks 3b, Upstream 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 Vancouver Alignment **Alternative 3b**.

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I-5 COLUMBIA RIVER CROSSING PROJECT

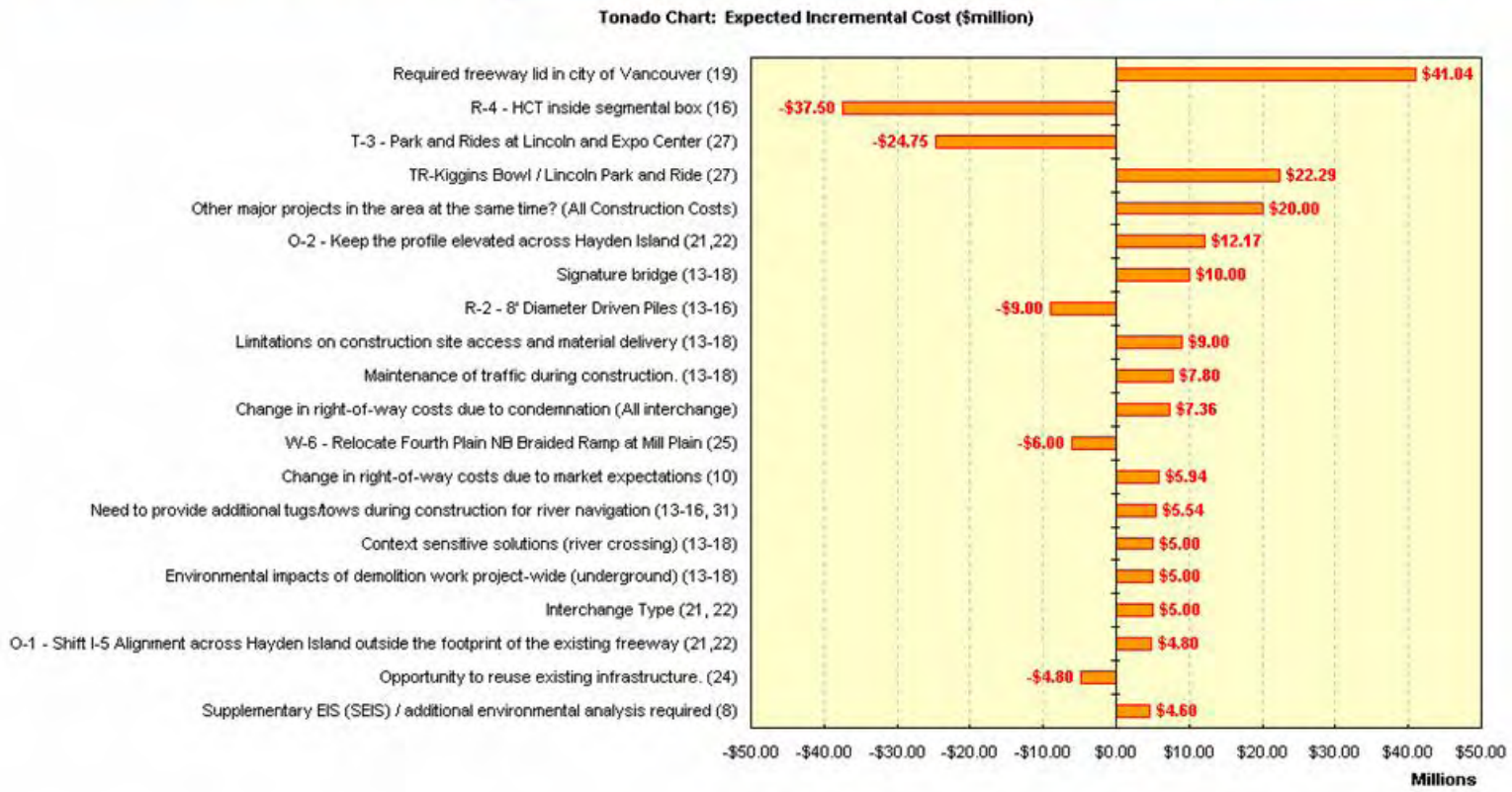
# Total Project Costs Summary 4, Supplemental Crossing w/ BRT



21

I-5 COLUMBIA RIVER CROSSING PROJECT

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




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**.

22

I-5 COLUMBIA RIVER CROSSING PROJECT

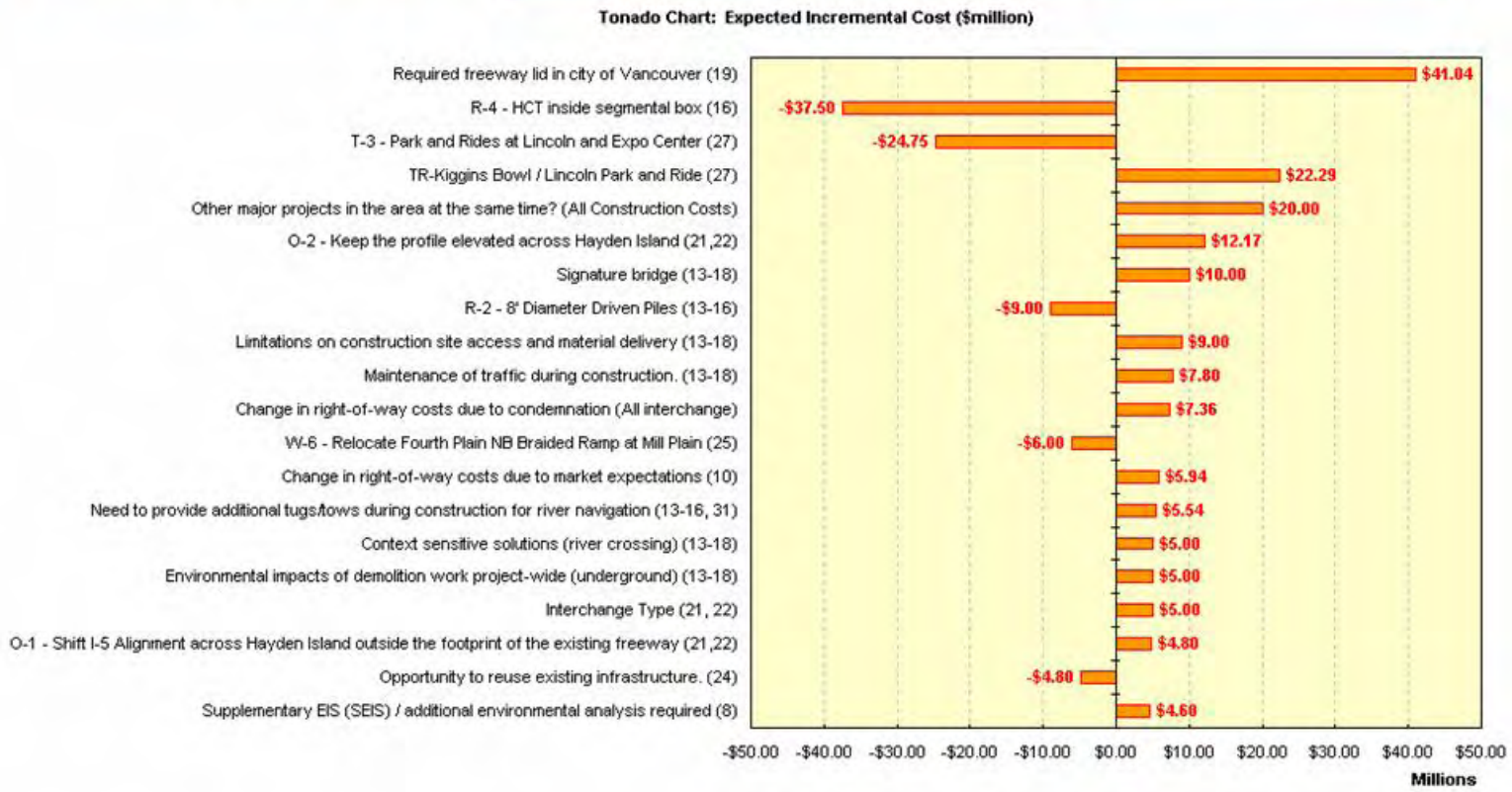
# Total Project Costs Summary 5, Supplemental Crossing w/ LRT



23

I-5 COLUMBIA RIVER CROSSING PROJECT

# Identification of Key Cost Risks 5, Supplemental Crossing 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 Vancouver Alignment **Alternative 5**.

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# Total Costs Comparison



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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 |

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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 |

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## 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 |

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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 |

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## 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 |

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I-5 COLUMBIA RIVER CROSSING PROJECT

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



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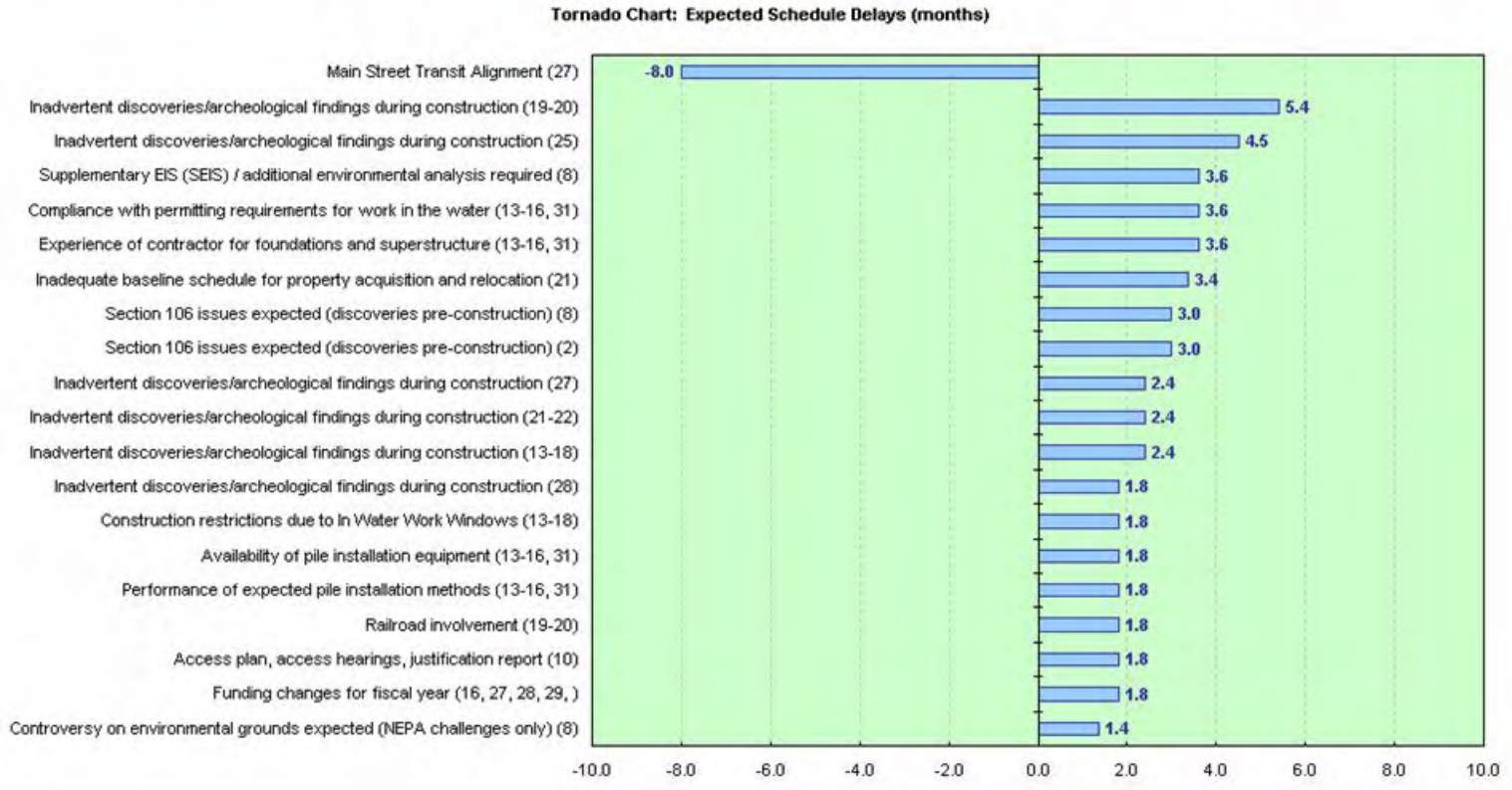
## I-5 COLUMBIA RIVER CROSSING PROJECT

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




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**.

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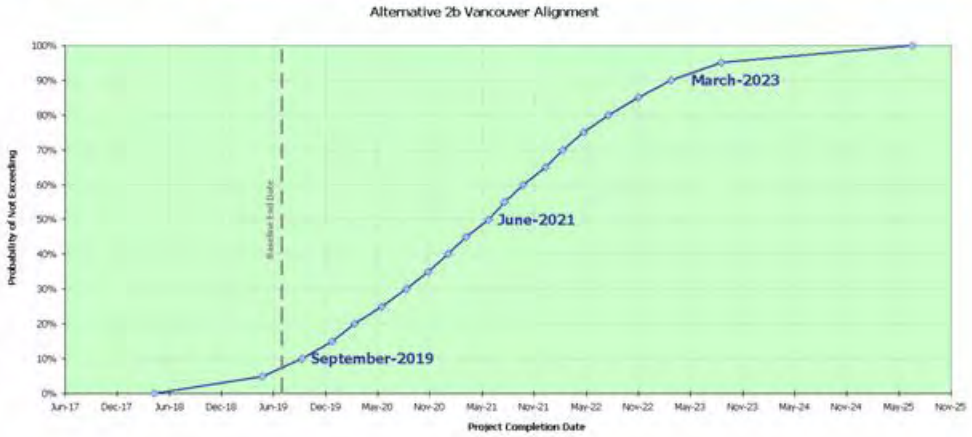
I-5 COLUMBIA RIVER CROSSING PROJECT

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

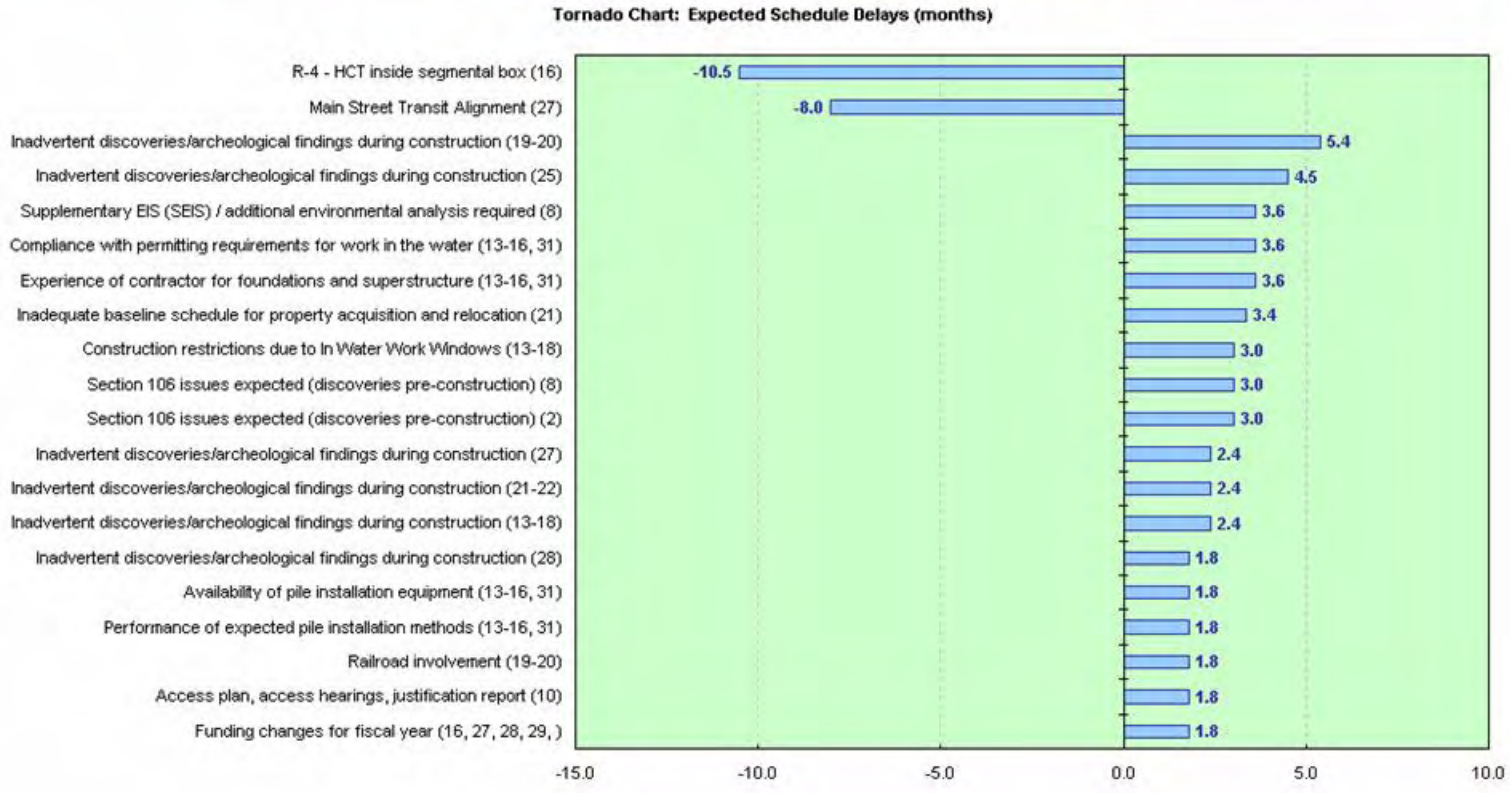




33

## I-5 COLUMBIA RIVER CROSSING PROJECT

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




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**.

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I-5 COLUMBIA RIVER CROSSING PROJECT

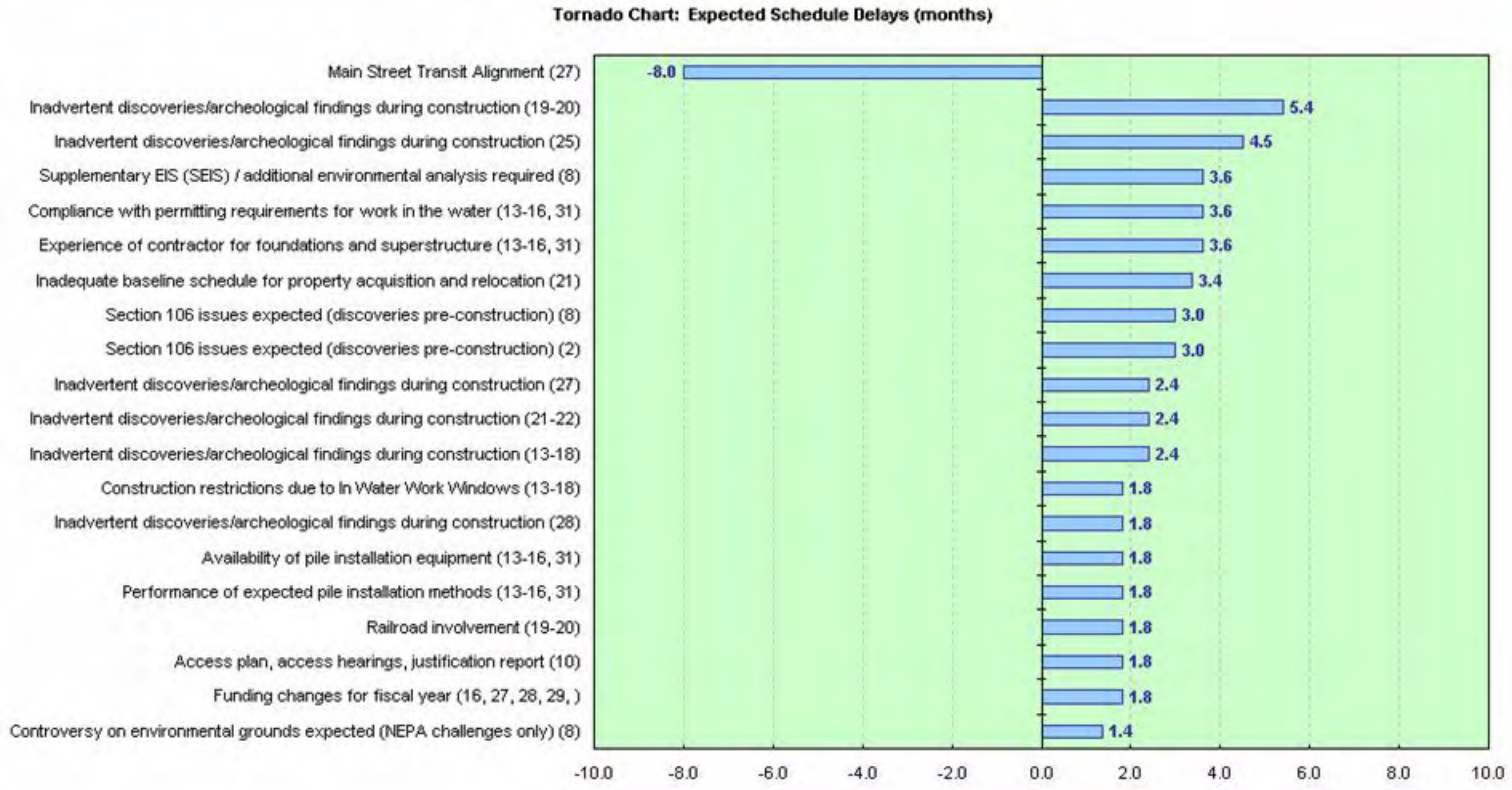
# Project End Dates Summary 3a, Downstream Replacement w/ LRT



35

## I-5 COLUMBIA RIVER CROSSING PROJECT

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




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**.

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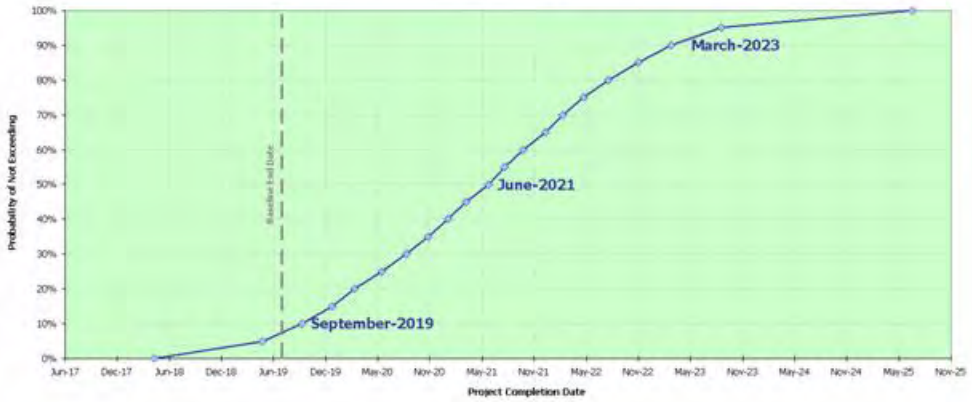
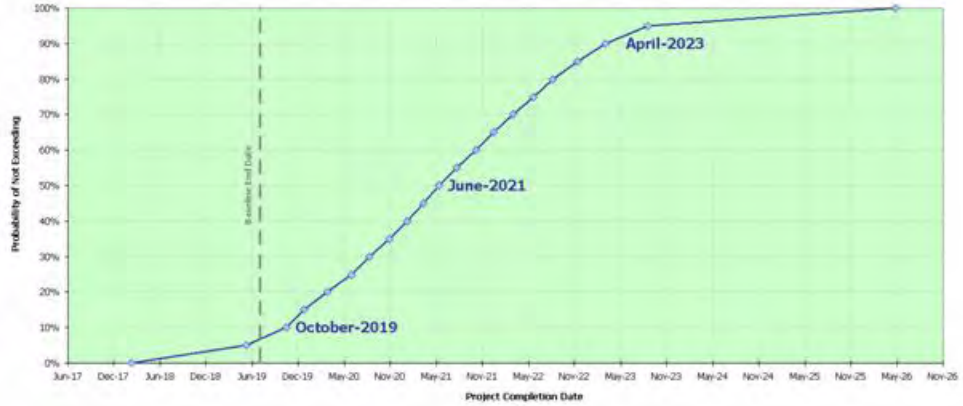
I-5 COLUMBIA RIVER CROSSING PROJECT

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

Alternative 3b Vancouver Alignment



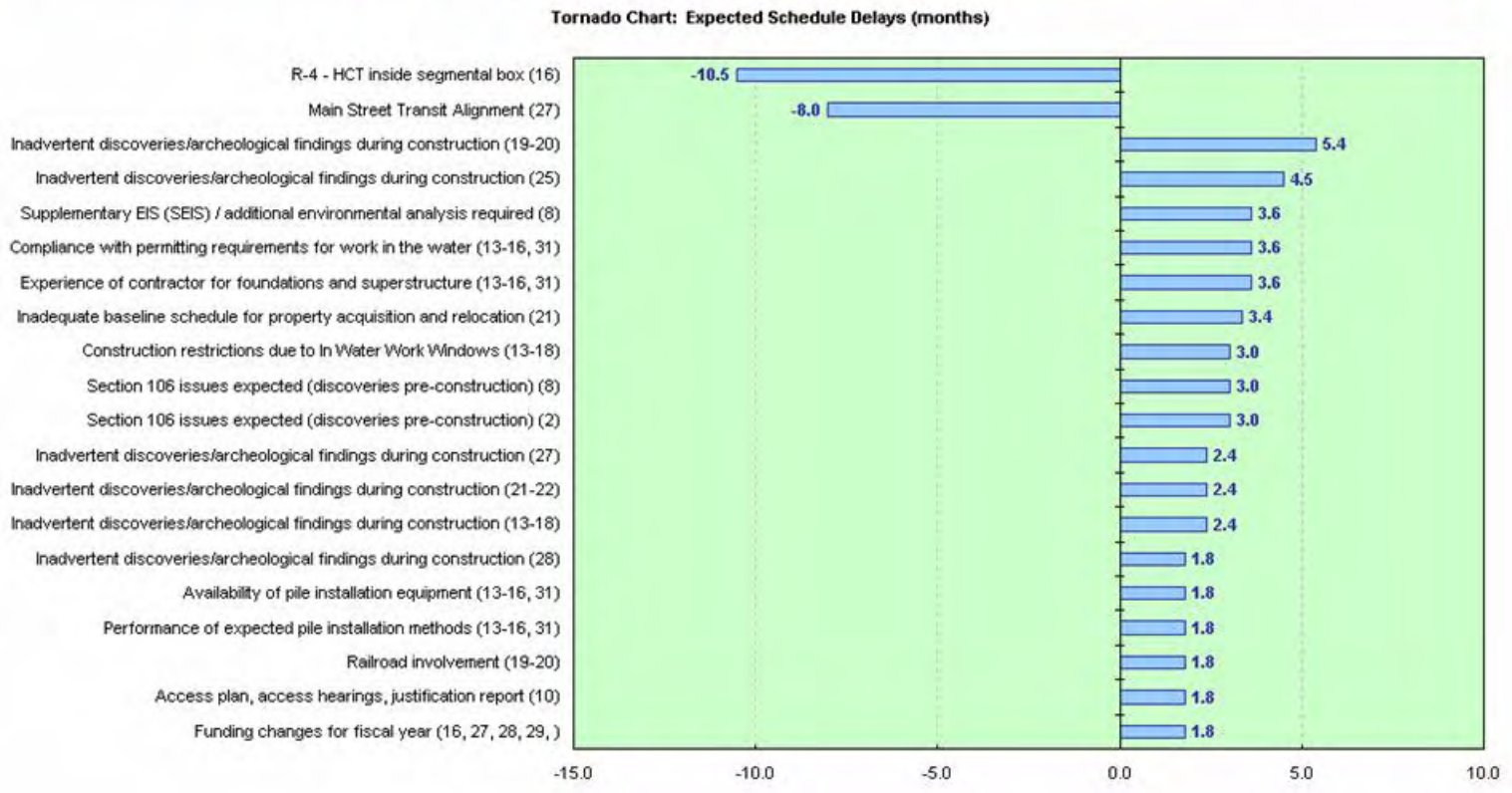

Alternative 3b I-5 Alignment




37

## I-5 COLUMBIA RIVER CROSSING PROJECT

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




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**.

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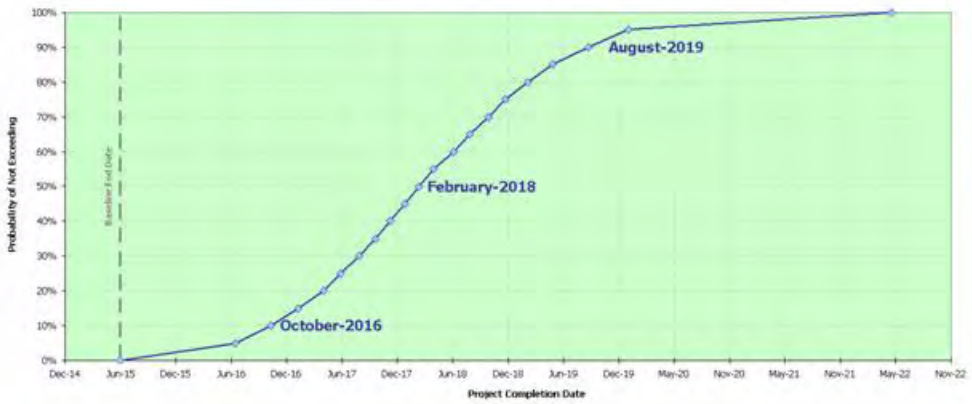
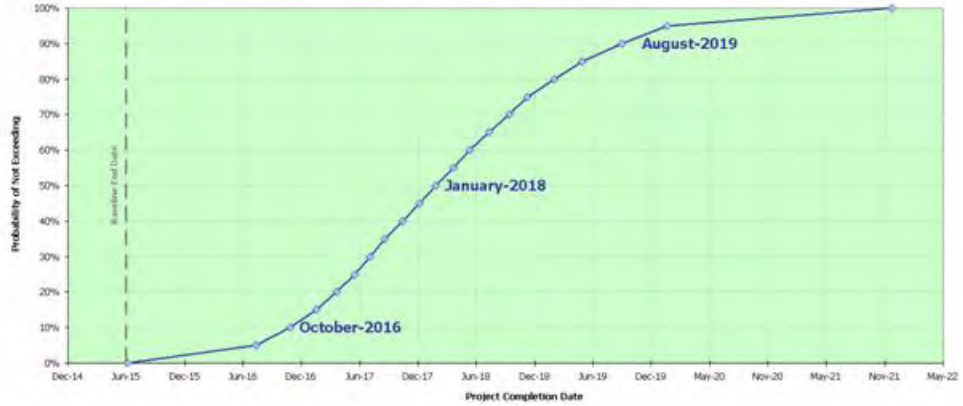
I-5 COLUMBIA RIVER CROSSING PROJECT

# Project End Dates Summary 4, Supplemental Crossing w/ BRT

Alternative 4 Vancouver Alignment




Alternative 4 I-5 Alignment

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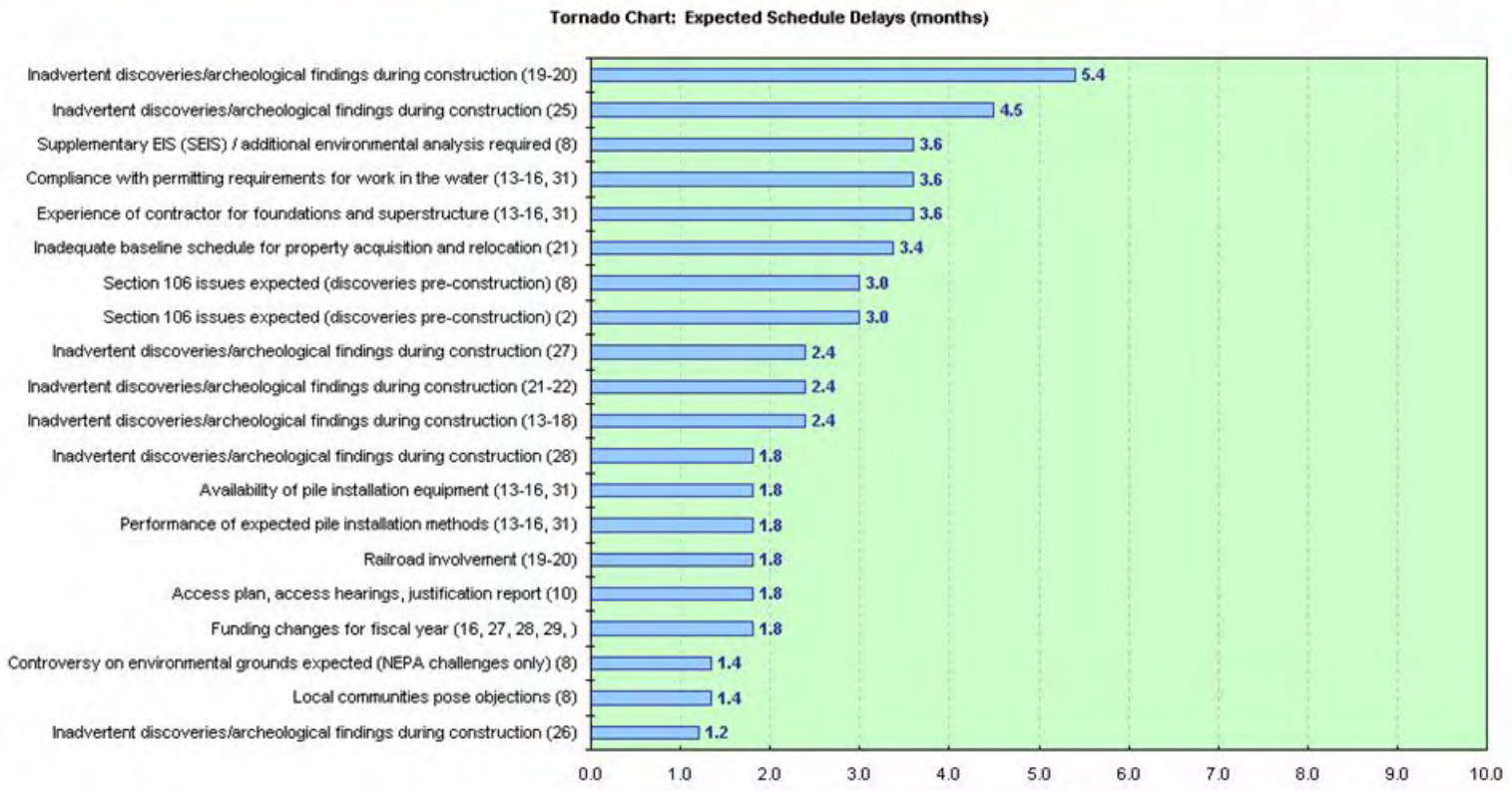
## I-5 COLUMBIA RIVER CROSSING PROJECT

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




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**.

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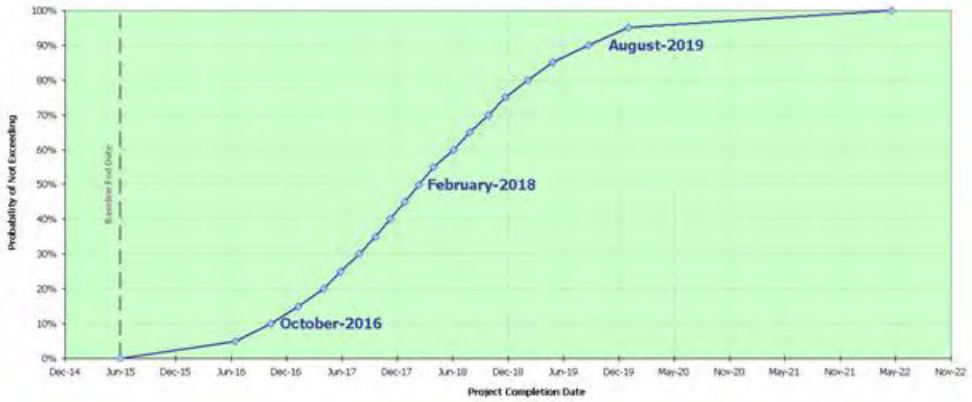
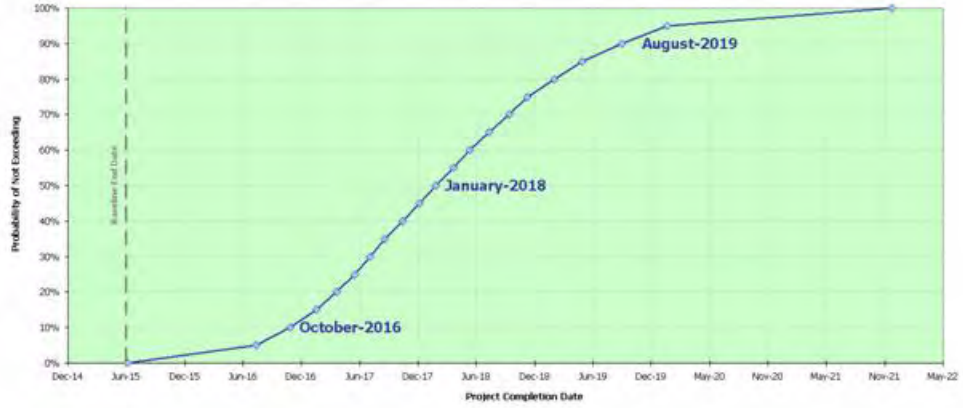
I-5 COLUMBIA RIVER CROSSING PROJECT

# Project End Dates Summary 5, Supplemental Crossing w/ LRT

Alternative 5 Vancouver Alignment




Alternative 5 I-5 Alignment

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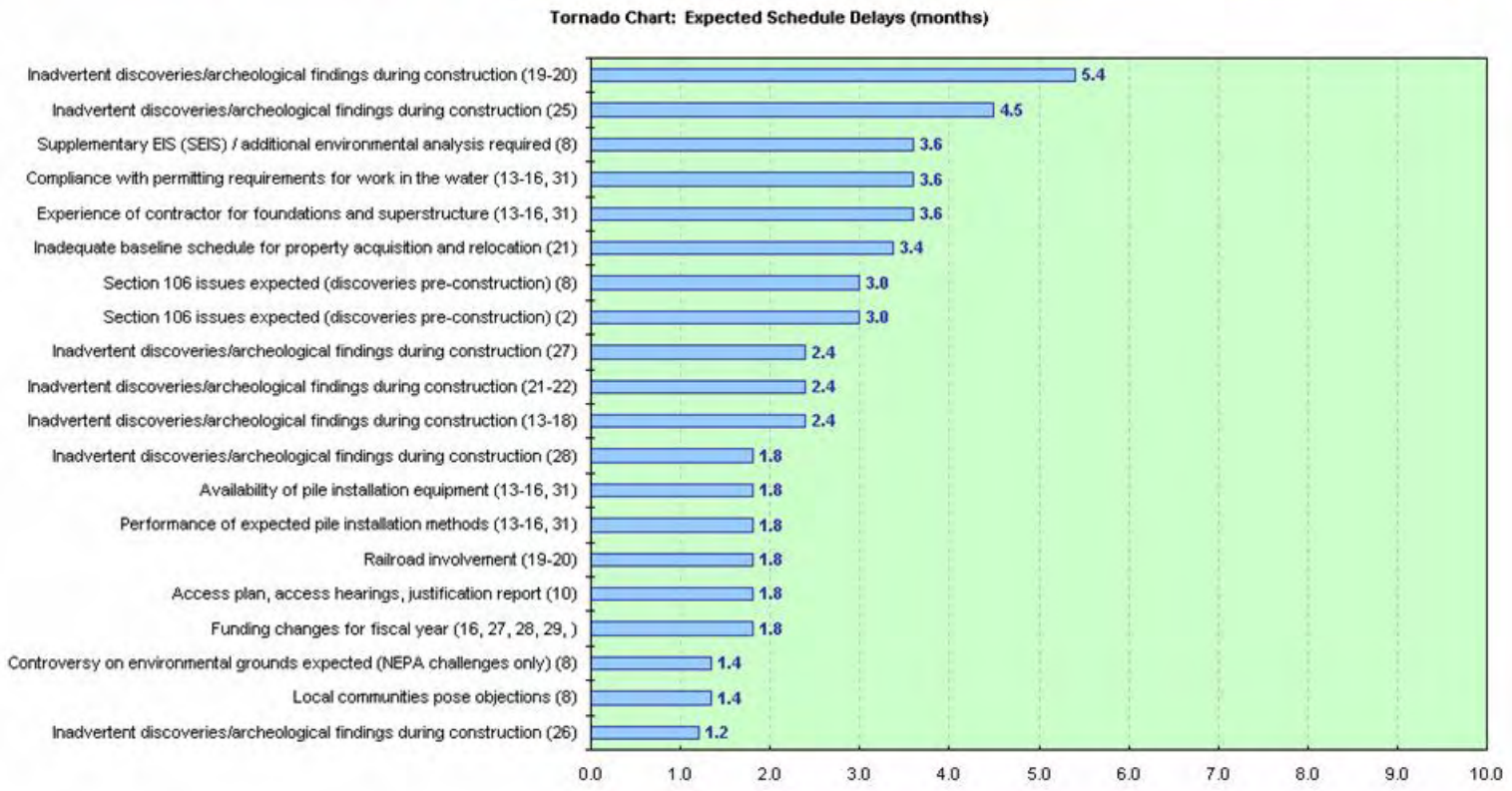
## I-5 COLUMBIA RIVER CROSSING PROJECT

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




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**.

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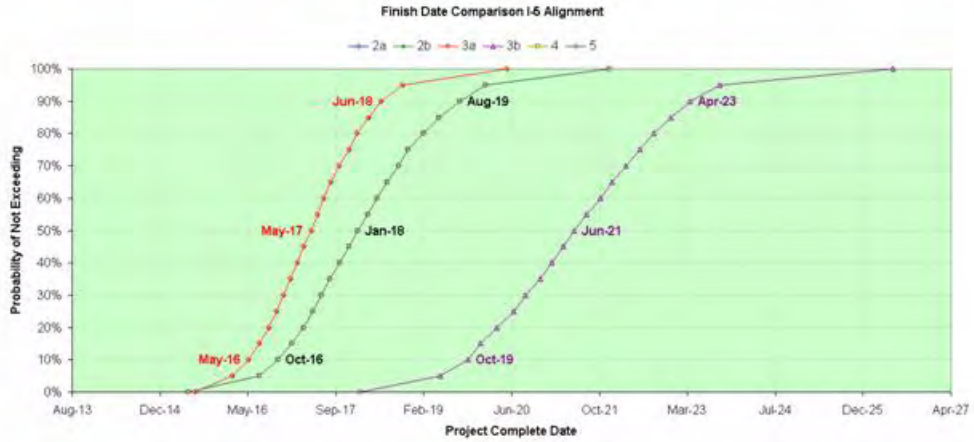
## I-5 COLUMBIA RIVER CROSSING PROJECT

# 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.

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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.

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I-5 COLUMBIA RIVER CROSSING PROJECT

# 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.

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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.

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## 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

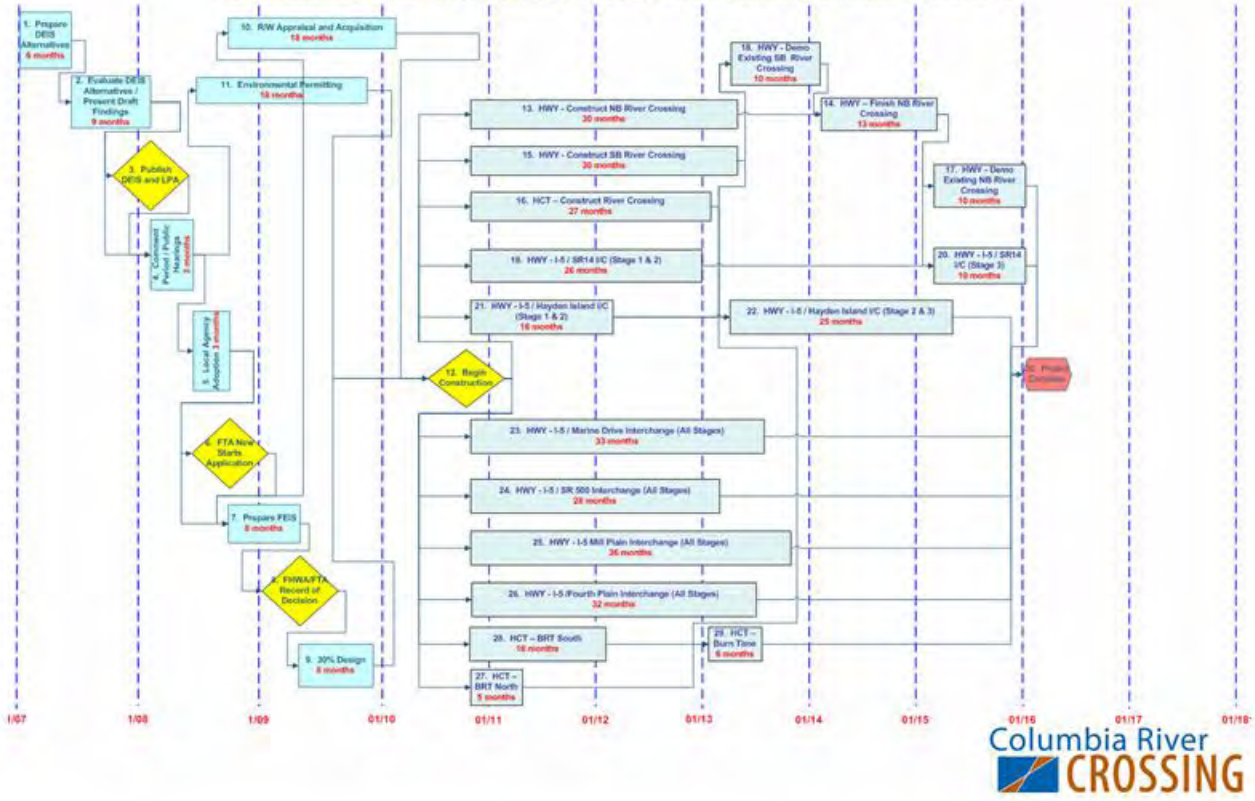
# Introduction

- **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*

**October 2007 Risk Assessment Preliminary Flowchart**
**DEIS Alternative #2a - Replacement Crossing Downstream With LRT Mill District MOS**




Columbia River CROSSING

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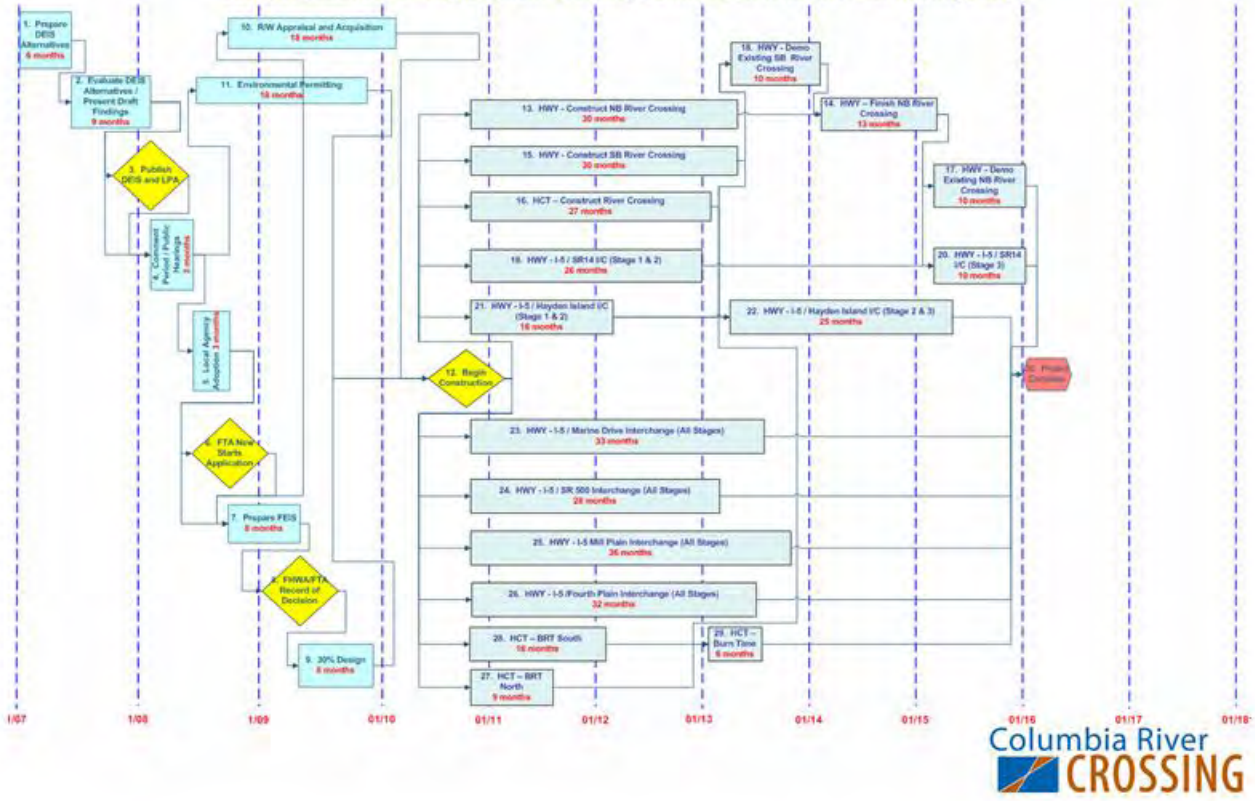
## I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

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

**October 2007 Risk Assessment Preliminary Flowchart**
**DEIS Alternative #2a - Replacement Crossing Downstream With LRT Clark College MOS**




Columbia River CROSSING

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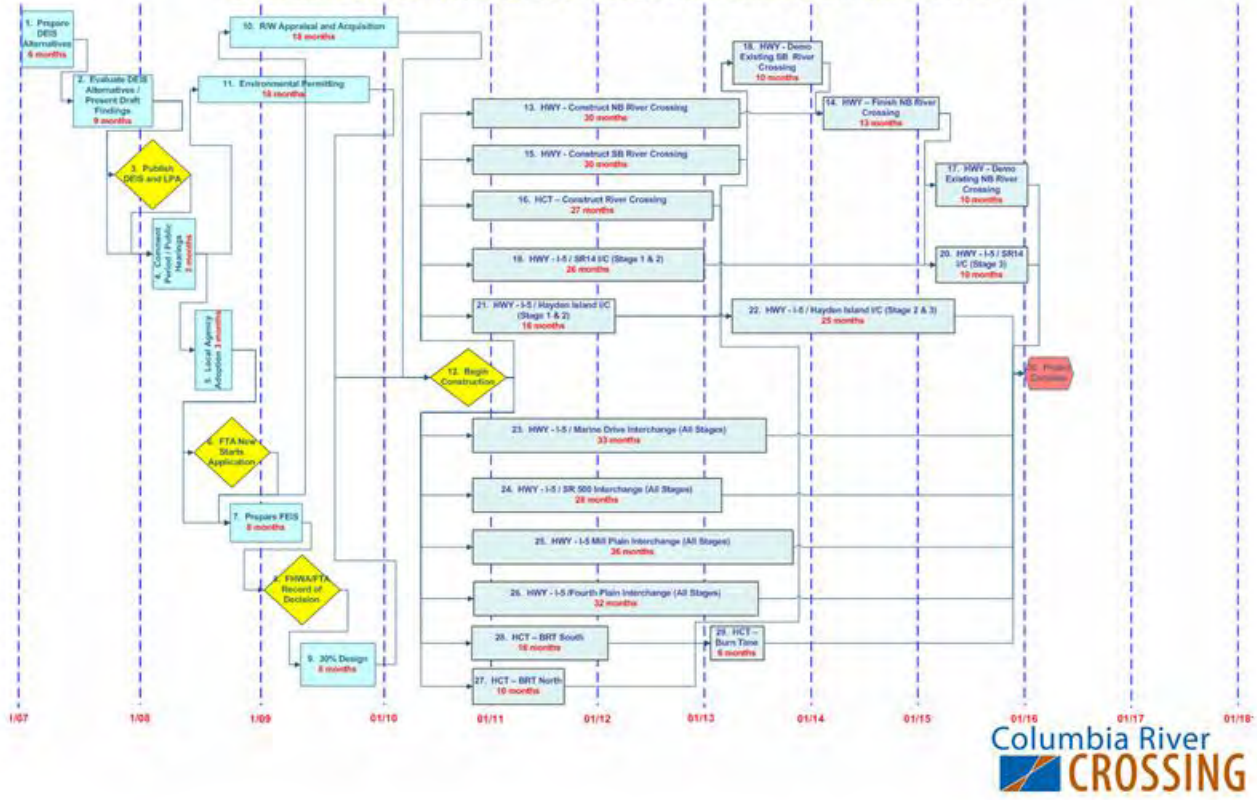
## I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

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

**October 2007 Risk Assessment Preliminary Flowchart**
**DEIS Alternative #3a - Replacement Crossing Downstream With LRT Mill District MOS**




Columbia River CROSSING

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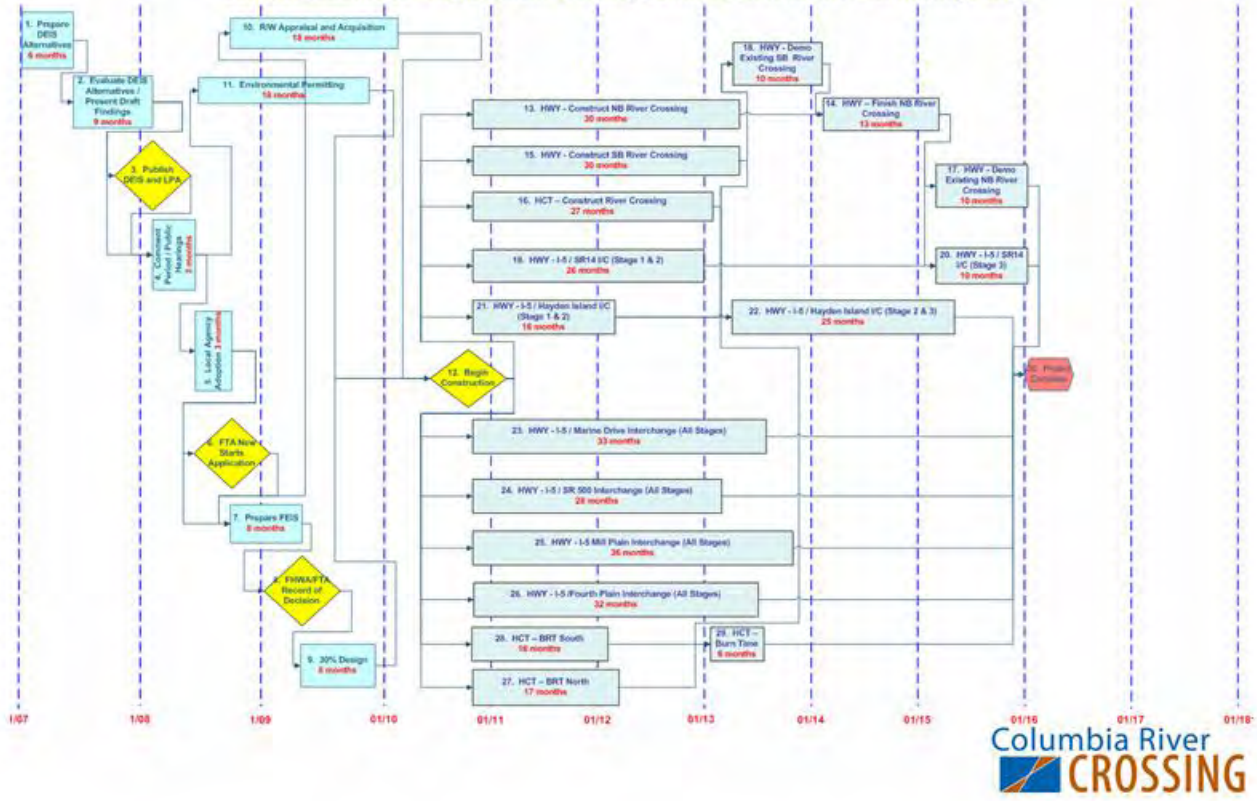
## I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

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

**October 2007 Risk Assessment Preliminary Flowchart**
**DEIS Alternative #3a - Replacement Crossing Downstream With LRT Clark College MOS**




Columbia River CROSSING

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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.

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# 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% |

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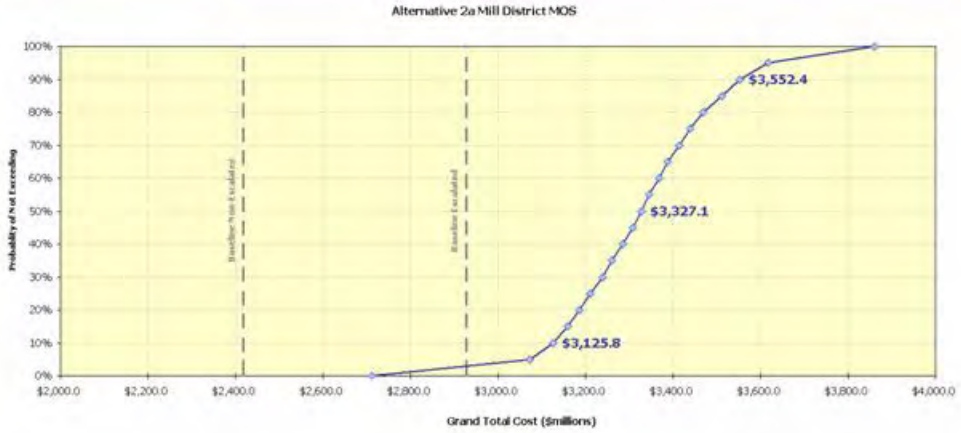
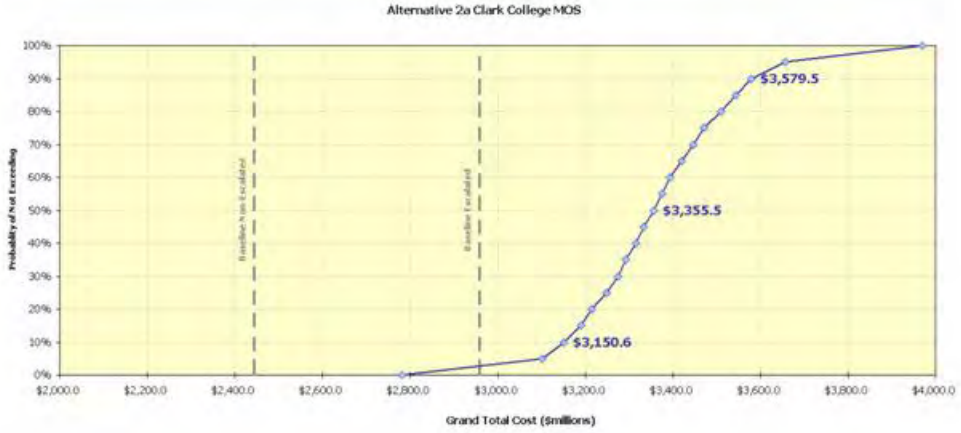
## I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

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

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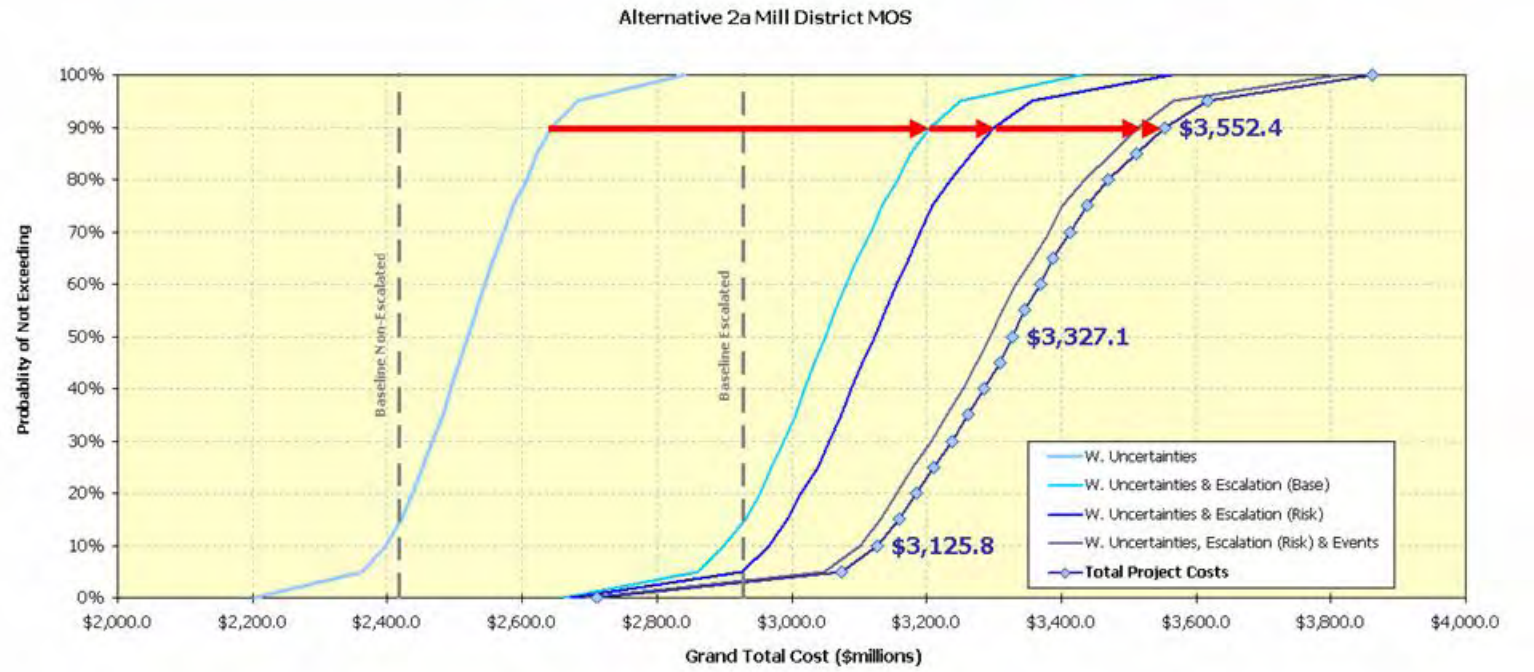
## I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

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

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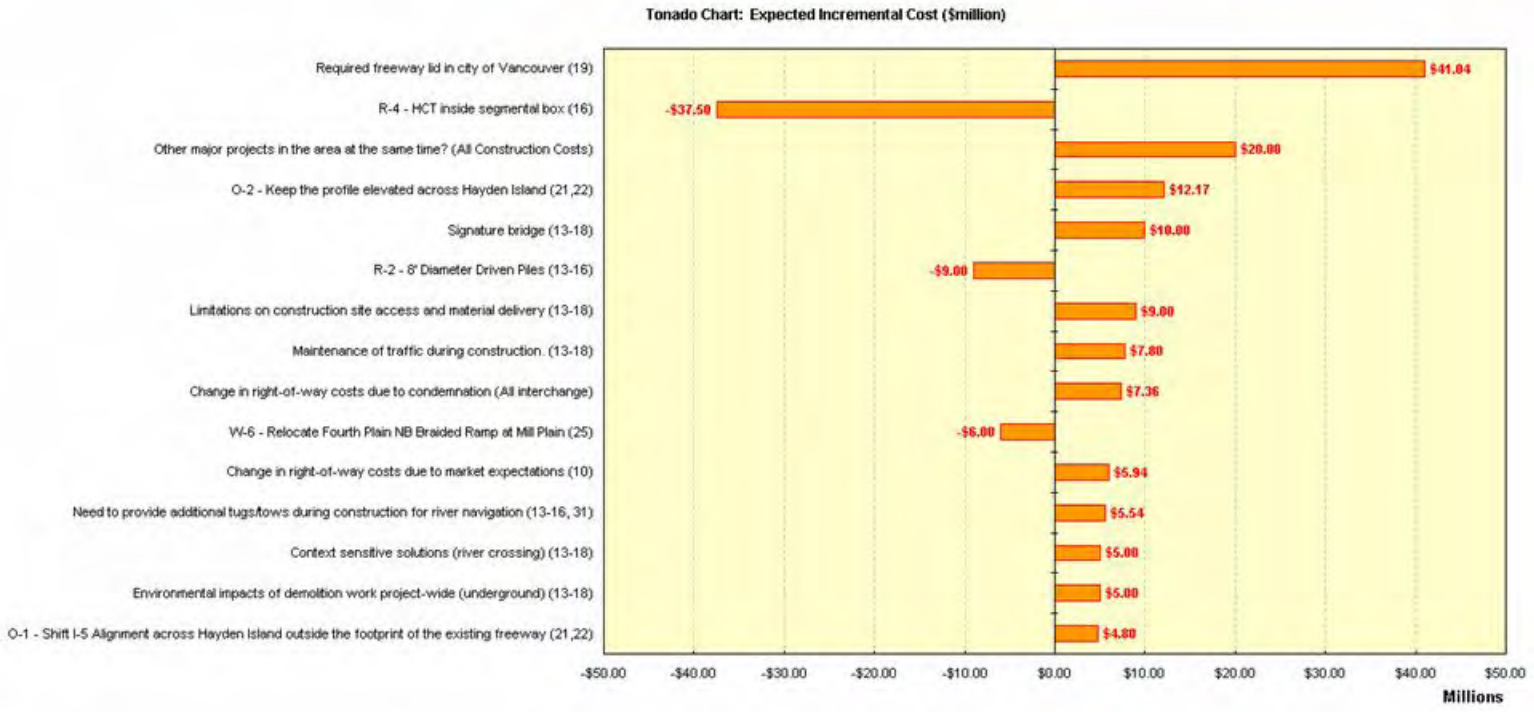
## I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

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




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**.

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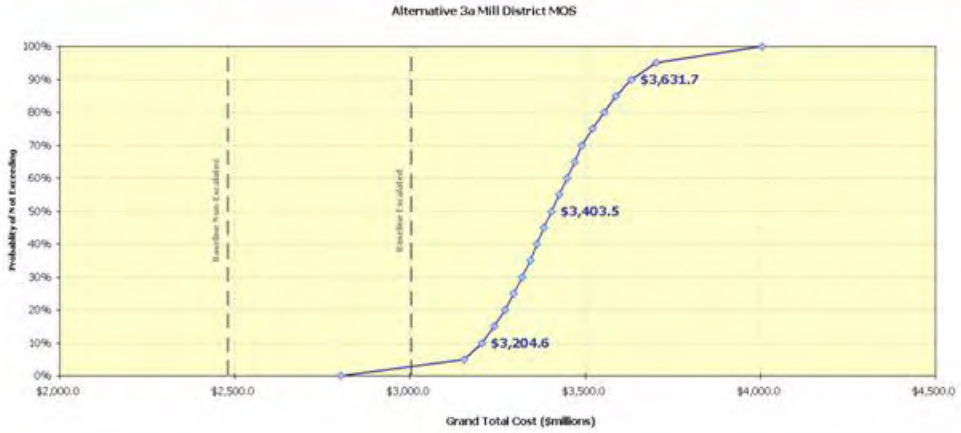
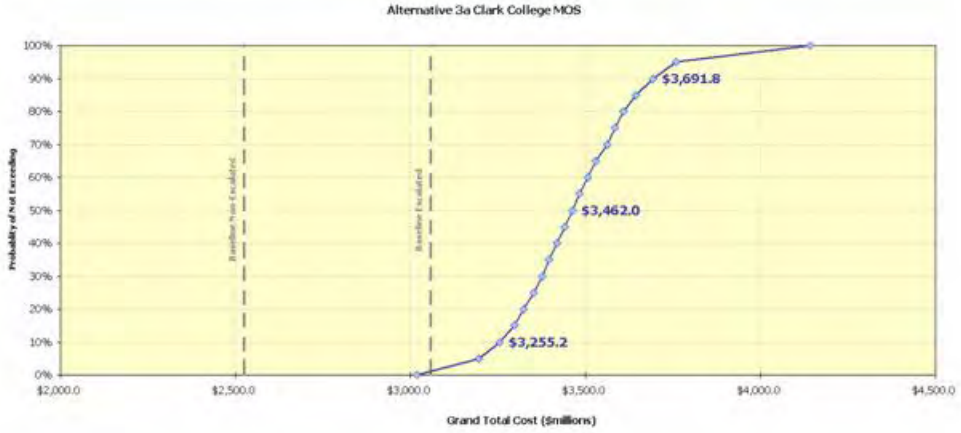
## I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

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

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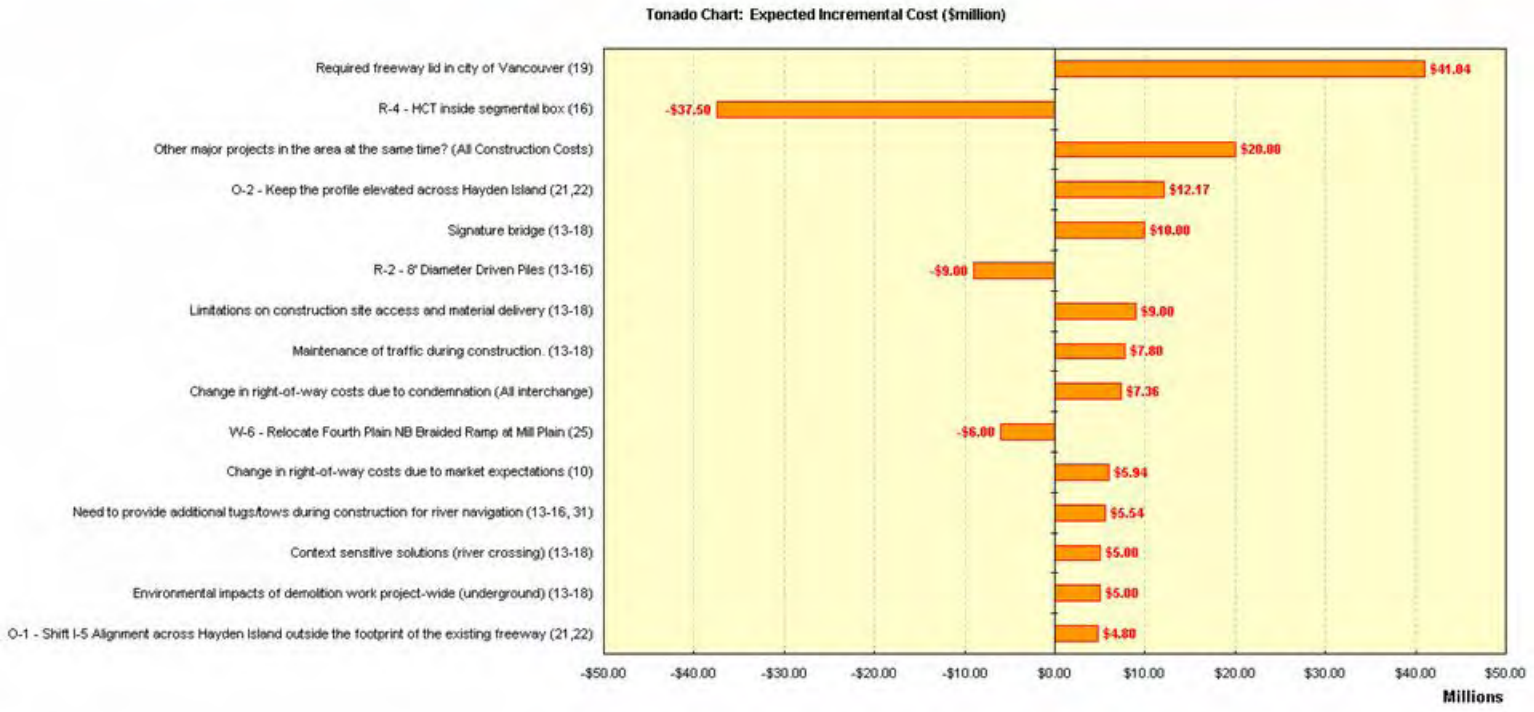
## I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

# *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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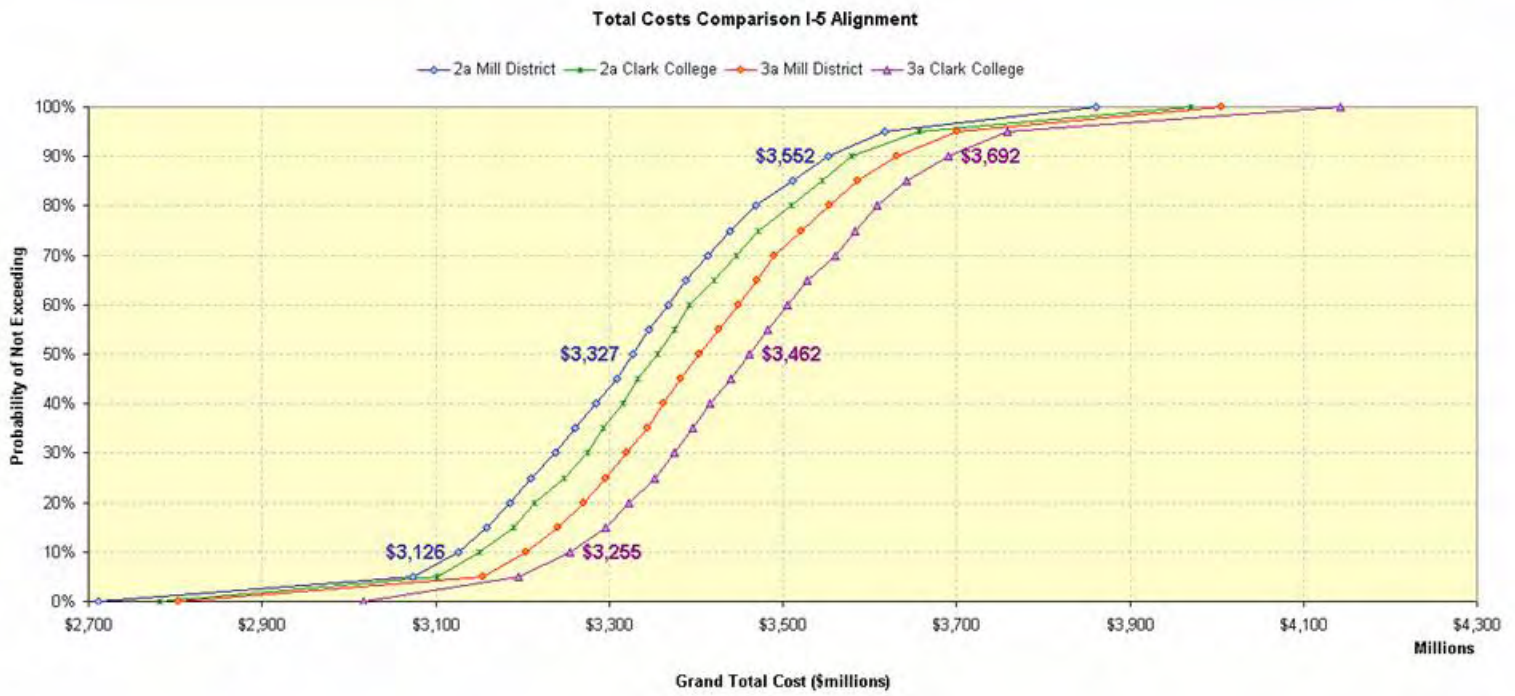
## I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

# *Total Costs Comparison*

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## 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 |

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## 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 |

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## 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 |

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## 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 |

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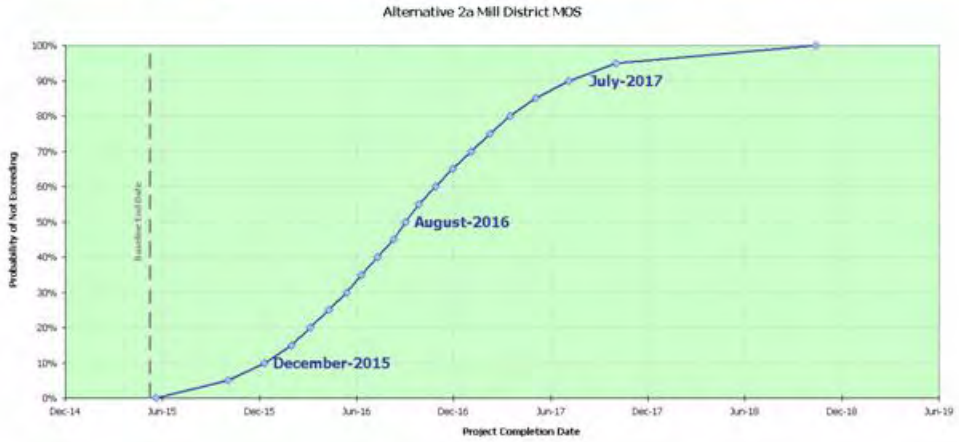
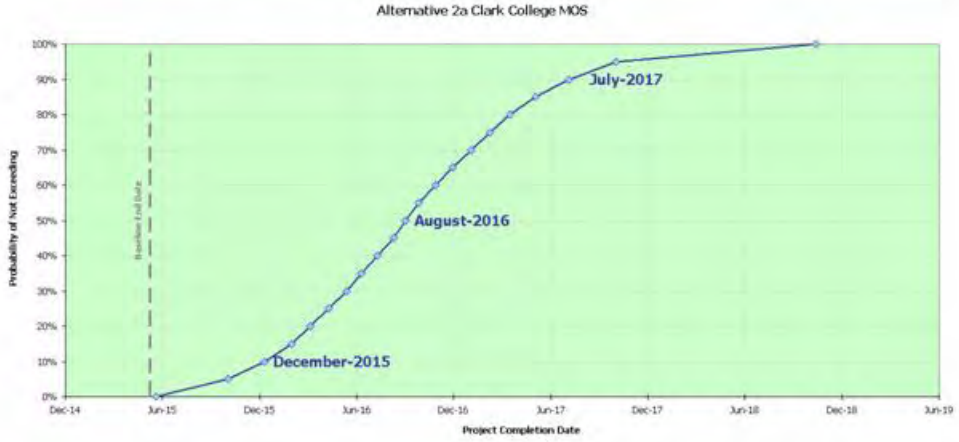
## I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

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

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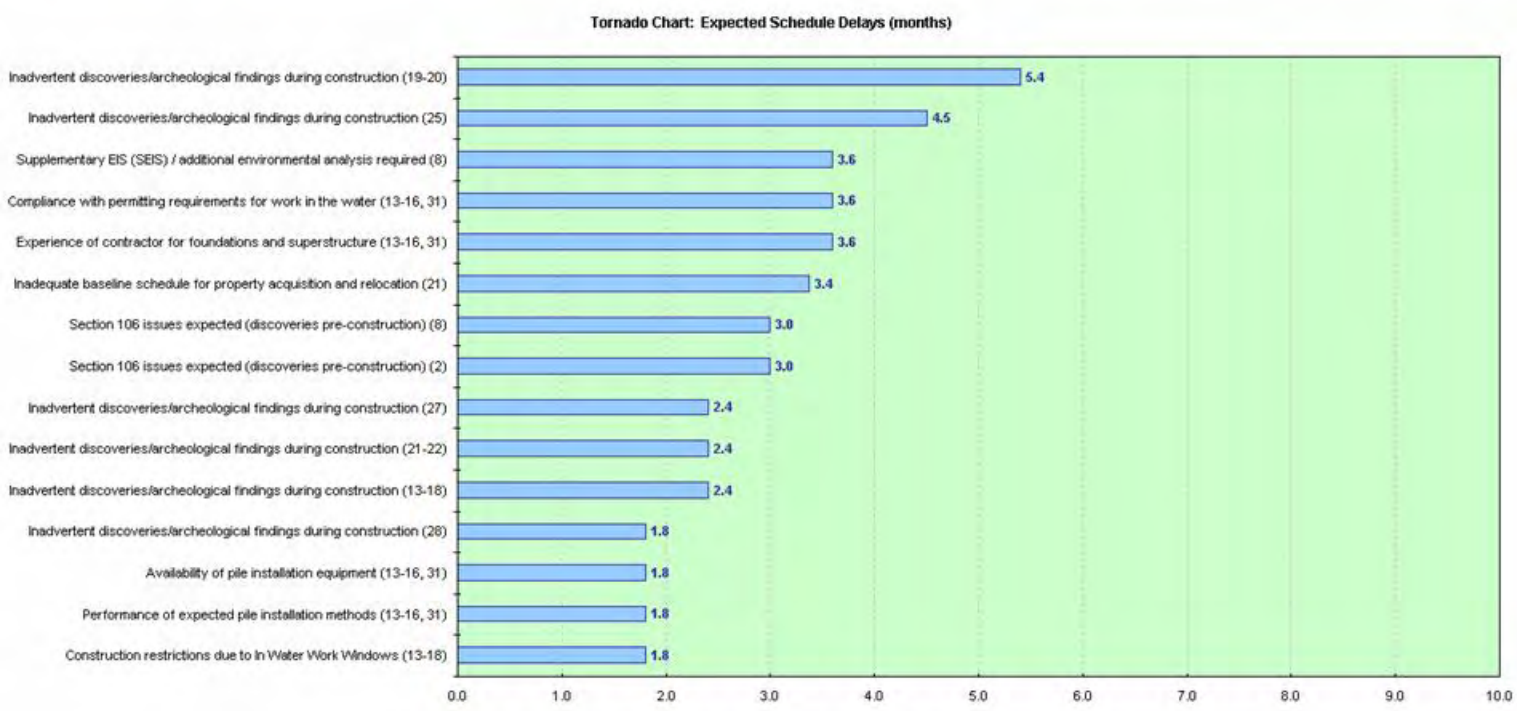
## I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

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




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**.

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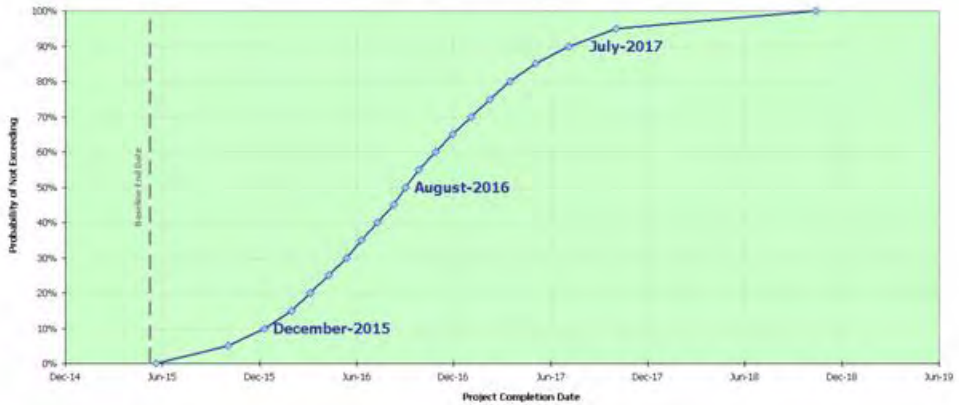
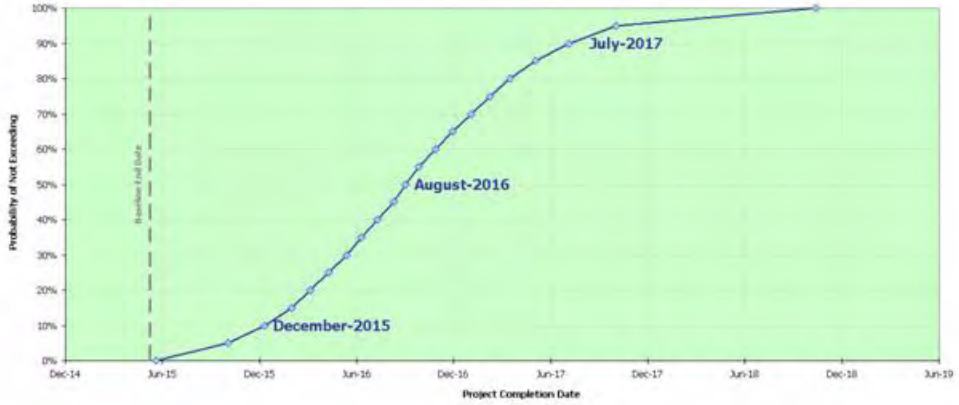
## I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

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

Alternative 3a Mill District MOS




Alternative 3a Clark College MOS

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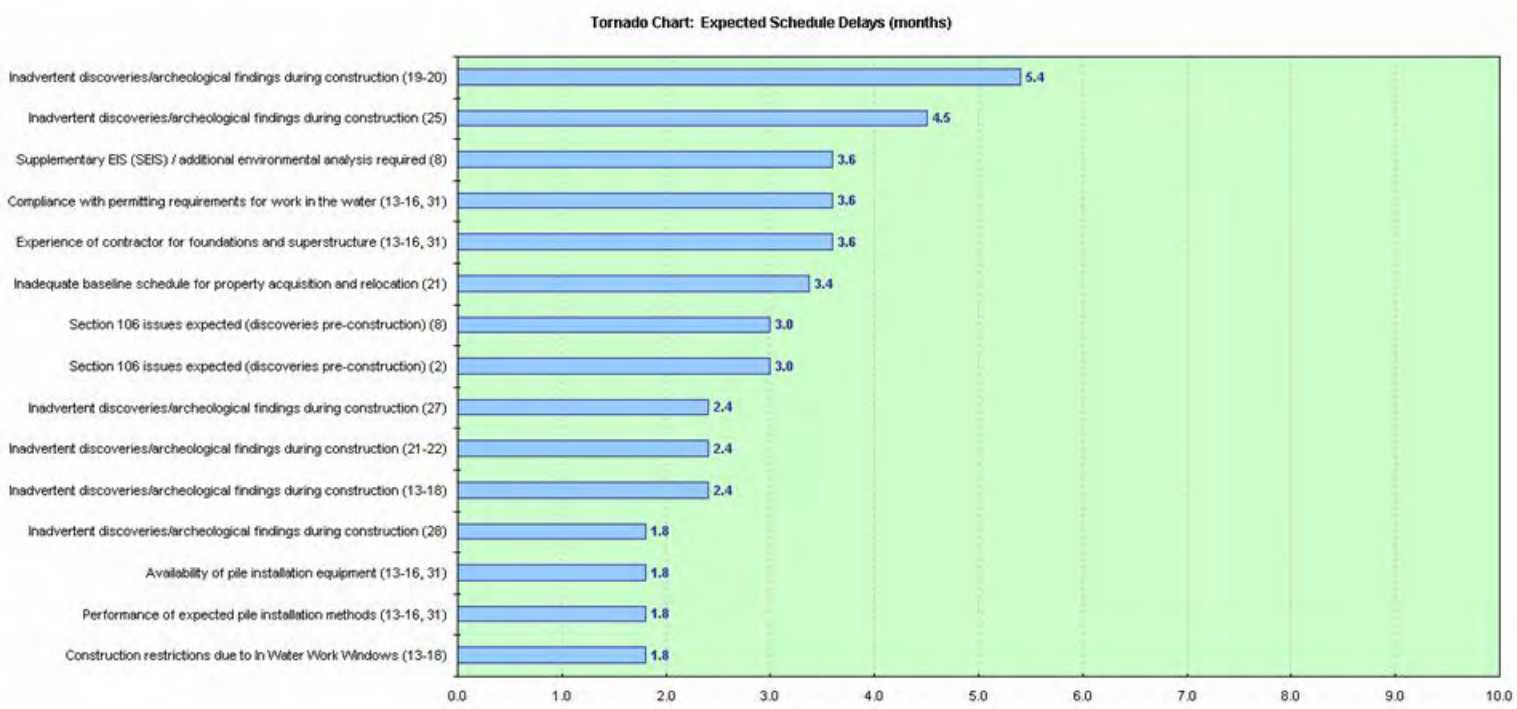
## I-5 COLUMBIA RIVER CROSSING PROJECT MOS ALTERNATIVES

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




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**.

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## 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.

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## 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.

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