APPENDIX "C"

I-5 Columbia River Crossing
Bridge Influence Area (BIA) Cost Estimating Qualitative Concept Assessment

This documents summarizes the Cost Estimating Qualitative Concept Assessment of the 8 BIA Concepts. The assessment includes major risk factors associated with the I-5 Columbia crossing cost estimates, concept-specific comments related to cost estimating and functional design, and review comments on Bridge Concepts 1, 4, 6 and 7.

Major risk factors associated with I-5 Columbia Crossing Cost Estimates

River Crossings

- Environmental mitigation
- Bridge foundations
- Movable spans and vertical clearance
- Seismic retrofit
- Material costs
  Example: recent spikes on steel prices
- Utility crossings
- Pier protection
  Not just fenders, but perhaps reshaping the river bottom so that large vessels are physically unable to float into any of the piers

Highway Elements

- Project phasing and temporary protection and direction of traffic
  Some of these concepts are extremely complex, requiring multiple shifts of traffic. It will not be known how this staging will be done until more complete design is done.
- Material costs
  Steel for rebar and fuel for equipment are just two of the more visible examples.
- Drainage and water quality
  There will be a major increase in impervious surfaces and major systems will be required to handle runoff volumes and to treat this runoff for water quality.

- Utility relocation
  There is no evidence that the utility network that must exist for this densely developed area has been adequately researched.

- Visual aspects and aesthetics
  This could be a real wild card as the project is developed with the neighboring residents, businesses and numerous other interested stakeholders.

- Toll plaza design and operation
  This is not common in Oregon so more is unknown than known.

Neighborhood Impacts

- Negative impacts for alignments, ramps, structures
  This includes mitigation measures for relocations, environmental impacts, disruption of residential neighborhoods and business clusters. This has a high potential for becoming highly political. On the Lombard-Delta Park project, the neighborhood is pushing to be made whole for all of the impacts of I-5 dating clear back to when it was constructed in the early 60's.

- Noise impact
  Traffic volumes are high, the area is highly developed, and space is very limited. These factors indicate complex and expensive noise mitigation.

- Access requirements
  Multiple roadways in the concepts make it very difficult to provide access "right at the front door." There will be a real challenge to balance the need for access against providing through traffic capacity. In some cases communities may want more ramps, while in others they may not.

- Security
  Significant security safeguards will have to be addressed, such as bridges on an Interstate Highway, crossing a major body of water, worldwide trade, and the glidepath to an International Airport.

Project Development

- Political requirements
  This project is already highly political. Political negotiations pose a high risk of extending the project schedule and increasing project cost. In the Bay Area, voters changed the bridge type, causing redesign.

- Regulatory requirements
  Probably near the top of this list is avoiding or mitigating impacts to the Fort Vancouver property. It will be very difficult, if not impossible, to avoid this impact all together.

- Appropriate contingency percentages
  How realistic a cost estimate is at any given point is heavily dependent upon the

percentage that is added in the form of contingencies to address the unknowns at that time. For a project of this magnitude, being off only a few percentage points will produce a huge swing in the projected cost.

- Design cost
  For many of the reasons stated above, the effort required to ultimately design this project can only be estimated right now and not very accurately because of all of the unknowns, not the least of which is project phasing. There seems to be a different philosophy regarding building highway capacity between ODOT and WSDOT. This could be very problematic, unless resolved. Will there be two sets of design standards?

Concept-Specific Comments Related to Cost Estimating and Functional Design

Concept 1

LRT is shown as the bottom level of a four-level stack at Marine Drive Interchange. Then it quickly has to gain elevation to go over the Portland Harbor Bridge. We don't know how feasible this elevation gradient is, but it looks to be a big cost item with extensive walls and a system to handle drainage from the light rail to the Columbia River.

The vertical grades for southbound I-5 look they may be difficult to achieve in the vicinity of Marine Drive.

A lot of curvature in the ramps and roadways will make this concept hard for the unfamiliar drivers to negotiate.

With all concepts, the southbound I-5-to-eastbound SR 500 ramp requires a very long (expensive) structure.

The ramps connect into Mill Plain Blvd. west of I-5 in such a manner as to encourage wrong-way movements onto the off-ramp.

This concept, along with most of the others looks to encroach on the Fort Vancouver property.

For any case where HOV lanes are to be placed in the center of the through lanes, a flyover structure is probably required. These structures are a big ticket cost item.

Construction staging is probably one of the highest risks associated with cost estimates at this level of planning. One really can't quantify how much this phasing will cost until more detailed design is done. However, the staging for this concept appears to be more straightforward than the other concepts.

Design build may be the most efficient way to get the staging to work.

Concept 4

It's not known how the new double-deck bridge could be built without first removing the existing northbound structure. This does not seem feasible from a traffic maintenance perspective.

On Hayden Island, a single point diamond interchange with Hayden Island Drive pulled to the south may be a better concept, causing less disruption to the adjacent businesses. It would also eliminate the two ramp structures over Hayden Island Drive.

It is not clear what happens to the CD road at Mill Plain Blvd.

In order for northbound traffic to exit to SR 500, they would have to enter the CD road at the SR 14 interchange. Because this is so far in advance of SR 500, it would cause a signing challenge and be something out of the ordinary for drivers.

Because the northbound CD road serves multiple interchanges, very quick decisions would be required at the north shore of the Columbia River.

The SR 500 Interchange is a mix of system interchange and service interchange. This mixture is not good and should be avoided if possible.

To really evaluate any of these concepts, a signing plan should be developed. If the signing cannot be made to work, the design is not good.

Concept 6

The arterial requires very expensive flyover structures south of Marine Drive and at the SR 14 Interchange.

The SR 14 Interchange is very complex and very expensive.

Concept 6 appears to have the biggest footprint.

Concept 7

This concept requires extensive walls.

It looks to be a little more friendly to the westside Hayden Island businesses, but eliminates a number of the eastside businesses.

Will the Hayden Island LRT station be elevated and therefore, more expensive?

Since the new northbound bridge must go under the railroad, its elevation must be fairly low, requiring more frequent openings.

All of these concepts include a downtown Vancouver LRT station. If a park-and-ride lot must also be provided, that will be expensive because of the land cost.

Once traffic has entered the northbound CD road, there is no way to reenter I-5. The CD road ends in a "must exit" situation at SR 500.

Northbound HOV traffic cannot get to the CD road to be able to exit at Mill Plain Blvd. or SR 500.

Other concepts

It appears that an concept that should be studied is one where the existing Columbia River bridges are used for arterial traffic and perhaps LRT with two new I-5 structures on either side of the existing structures. These new bridges would each carry one direction of I-5 traffic and would be high enough that they would not open at all or only infrequently.

Review Comments on Bridge Concepts 1, 4, 6 and 7

The information provided for the review is incomplete. The descriptions for Concepts 1, 2, 3, 6, 7 and 8 described in the memorandums do not match the color line drawings of Bridge Concepts 1, 4, 6 and 7. Table C-1 provides a status of the various cost elements for all the concepts considered to date. The table identifies what data was available and what gaps appear to exist in the existing cost evaluations.

With out concept drawings of the bridge alternates, it is very difficult to evaluate the unit costs of the bridges. The unit cost items will be evaluated when the concept drawings are provided.

Final estimates are in 2001 dollars. An inflation factor should be applied to each unit cost item to update estimates to 2004 dollars.

Final estimates should include major maintenance (upgrades) and seismic retrofit for all bridges impacted by the proposed improvements. If the existing river bridges are included in the alternates, the cost of seismic retrofit and upgrades for both structures, and the movable spans, should be included the final estimates.

The final estimates should include transition structures from the double-deck river crossing to the at-grade roadway section at the south and north approaches. It is unclear if these structures are included. Extensive ramps configuration to facilitate free flow of traffic in both directions would be required from the double-deck crossing to SR 14 and SR 14 to the main crossing.

Bicycle and pedestrian lanes should be included to the new bridge width. They are not included in the bridge estimates.

Major maintenance cost for movable span alternates and existing movable spans should be included in the final estimates. These costs should be considered when comparing movable span alternate to fixed span alternate.

Due to vertical constraints imposed by Pearson Airpark, and required vertical clearance for maritime activities on the Columbia River, a single level bridge would tend to fair better than a two-level structure when overhead constraints and under clearance are both required.

Comments on each Bridge Concept:

Bridge Concept 1:

Combine existing bridges for NB traffic and construct new double-deck bridge for SB traffic (top level) and LRT (bottom level)

A single level combined use (traffic and LRT) structure for the main crossing should be considered with this concept.

A fixed span alternate should be considered in addition to the lift span for the double-deck structure. The lift span alternate should include major maintenance cost of the lift span and the cost of operating the lift span.

Bridge Concept 4:

Replace existing bridges with new double-deck bridge, NB (top level) and SB (bottom level) and construct new LRT structure

Removal of existing bridge crossings and construction of the new double-deck bridge at the same location of the two existing bridges may not be feasible. If feasible, the cost associated with stage construction of the new double-deck bridge should be included in the final estimate. The current estimate does not include this cost.

604,000 SF of deck area for the new LRT structure seems high based on the approximate width of the structure carrying two tracks.

460,00 SF of deck area for the double-deck structure seems low if the deck area is based on two levels. Deck area for the new double-deck structure should be higher than the deck area of the two existing bridges. The existing bridges have the approximate deck area of 500,175 SF.

A single level structure should be considered for the freeway crossing, and for comparison with the double-deck alternative.

Bridge Concept 6:

Maintain existing bridges for NB and SB, and construct new double-deck bridge for NB and SB traffic ramp (top level) and LRT (bottom level)

Final estimate for this alternate was not available for review.

A single level bridge for traffic and LRT should be considered as an alternate, and for comparison with the double-deck concept. With the double-deck alternate, LRT will not occupy the entire lower level, leaving an area on each side of the two LRT tracks unused. Combining LRT and traffic lanes to single level will reduce the combined widths required for traffic and LRT.

Bridge Concept 7:

Maintain existing bridges for SB and NB (HOV and reversible lanes only) and construct new two-lane arterial and LRT bridge, and new NB bridge for freeway traffic

A fixed span alternate should be considered and for comparison with the movable span alternate.

Costs to upgrade existing NB river crossing to accommodate HOV and reversible lanes should be included in the final estimate.