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I-5 Columbia River Crossing Partnership:
Traffic and Tolling Analysis

I-5 Bridge/Highway Alternatives

Working Paper 2.8

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Date

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~~OVERVIEW~~OVERVIEW

The purpose of Working Paper 2.8 is to describe each bridge/highway concept identified ~~and/~~or examined ~~from~~between January 2001 ~~to~~and June 2002 while developing the Portland/Vancouver I-5 Transportation and Trade Partnership Strategic Plan including the level of detail it was defined and evaluated, and the current status of each~~the~~ concept.

The I-5 Partnership considered the~~an~~ I-5 corridor extending from the I-205 junction in Clark County to the I-84 junction in Portland. In developing the strategic plan, it became evident that the greatest need and challenges for providing capacity increases and freeway access occurred within ~~a segment of~~ the I-5 ~~corridor within~~corridor ~~within the~~ Columbia River Crossing Bridge Influence Area (BIA). The four~~4 mile~~4 ~~mile segment~~-mile segment depicted in **Figure 1.1** extends from SR 500 in Vancouver to Columbia B~~oulevard~~lvd. ~~.~~ in Portland. This paper focuses primarily on options/concepts developed within the BIA.

Throughout the paper, as occurred during the I-5 Partnership, the terms "options packages," "options," "improvement options," and "concepts" are used interchangeably to refer to various ideas that emerged in solution to existing or forecast deficiencies within the I-5 corridor. The word "alternative" is typically reserved for use in the formal environmental documentation phase. Within this paper, "alternative" refers to options/concepts that will be evaluated in an Environmental Impact Statement (EIS).

Figure 1~~1~~-1: I-5 Corridor and BIA.

Background

In January 2001, the governors of Oregon and Washington initiated the Portland/Vancouver I-5 Transportation and Trade Partnership (I-5 Partnership) for the purpose of ~~defining potential~~defining potential improvement options within the I-5 corridor. Results from the partnership project were presented to the public and Governor's Task Force for initial consideration and feedback. The process began in earnest in February 2001 with ODOT and WSDOT sponsoring a design workshop at WSDOT. The workshop was attended by over 50 planners, engineers, and other technical experts in the fields of land use and transportation. The attendees represented~~ing~~ ODOT, WSDOT, Metro, RTC, City of Portland, City of Vancouver, Port of Portland, Port of Vancouver, Clark County, Multnomah County, Tri-Met, C-Tran, and the consultant team.

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By April 2001~~, subsequent~~., subsequent screening and consolidation of concepts resulted in the development of eight corridor option packages. They ~~-~~consisted~~ing~~ of year 2000 existing and year 2020 No Build, Baseline, and five Build concepts. The Baseline and build option packages involved a combination of highway and transit improvements that were modeled by Metro to generate initial performance measures and ridership levels from which to operationally evaluate the options. Of the five Build options, one involved a new western arterial corridor parallel to I-5. The other four packages generally followed the existing ~~were centered around~~ I-5 corridor and differed principally in the number of through lanes provided ~~throughout the I-5 corridor~~ (3 versus 4) and the type of transit investment (express bus versus light rail).

From April through December 2001, the project team completed a planning level evaluation of transportation performance, land use and environmental impacts, and concept level cost estimates associated with the eight corridor-long option packages. Recognizing the special nature of integrating new roadway and transit capacity across the Columbia River ~~and integrating~~ as well as interchange access within the I-5 corridor, the project team also evaluated an initial range of I-5 Columbia River Crossing concepts including:

- New four-lane supplemental bridge (based on three through lanes in corridor);
- New six-lane supplemental bridge (based on four through lanes in corridor);
- New 10-lane replacement bridge (based on four through lanes in corridor);
- New four-lane supplemental tunnel (based on four through lanes in corridor); and
- All of the above concepts considered integration of transit and HOV.~~(?)~~

The transportation performance of each concept was evaluated at a~~the~~ macro level utilizing the freeway queuing (FREQ) traffic operation model. This evaluation revealed several high level findings:

- Any increase in mainline capacity requires modifications to the existing interchanges and connectors if overall system benefits are to be realized.
- Major capacity improvements will allow the corridor to serve a larger number of trips, but~~,~~ over time, will not significantly improve the level of congestion that is experienced in the corridor ~~today~~under current conditions. Improvements result in a shift of traffic from other routes. And, in cases where designs alleviate the I-5 Columbia River crossing bottleneck, other existing bottlenecks on both sides of the river, some currently masked by the I-5 Bridges, are expected to emerge.
- Travel demands in the corridor include both ~~he corridor configuration to serve~~ longer distance through trips as well as ~~along with~~ shorter distance intra- and interstate trips. The mix of trip lengths and purposes will continue to be a key design consideration. ~~(because….?)~~
- Design criteria required to accommodate the six-lane supplemental bridge and four-lane tunnel options results in an alignment that bypasses the segment of I-5 between Columbia

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Boulevard and SR 500. The resulting section only benefits longer distance through trips and creates an imbalance in traffic flow that overloads the existing mainline where trips enter and leave the freeway. Resulting interchange-related queues would then hinder access to the six-lane supplemental bridge and four-lane tunnel during peak periods, diminishing their benefit.

By late January 2002, the Governor's Task Force completed their review of the project information and issued draft recommendations stipulating that the future of the I-5 corridor should be designed around:

- Three mainline through-lanes in each direction on I-5 in Vancouver and Portland, including southbound through Delta Park;
- A phased light rail loop in Clark County in the vicinity of the I-5, SR500/4th Plain and I-205 corridors;
- An additional span or a replacement bridge for the I-5 crossing of the Columbia River, with two light rail tracks and up to two additional lanes in each direction for weaving and merging; and
- Interchange improvements and additional merging lanes where needed between SR500 in Vancouver and Columbia Boulevard in Portland, to balance traffic flow and accommodate the increased bridge capacity. These improvements include a full interchange at Columbia Boulevard.

In addition to the Task Force's adopted draft recommendations, it recognized the importance of integrating new roadway and transit capacity across the Columbia River and the potential impacts that would occur from major interchange modifications in this area. The Task Force, therefore, asked the project team to conduct additional and more detailed analysis within ~~a segment of the I-5 corridor known as the I-5 Columbia River Crossing Bridge Influence Area~~the (BIA), extending between SR 500 in Vancouver to Columbia Boulevard in Portland, to better understand these implications. In shaping the BIA analysis and development of river crossing concepts, the Task Force recommendations were significant in that they specified the extent of capacity increases that would be considered within the BIA. Up to this point, the transportation evaluation had revealed that accommodating four through lanes (the most tested) along I-5 would provide the highest transportation benefits. However, the Task Force did not feel the associated environmental impacts and costs warranted the investment in four through lanes.

The BIA analyses occurred from February 2002 through May 2002 with the project team completing parallel evaluations of transportation performance, costs, property impacts, environmental concerns, and implementation issues.

Design Context

The design context for the BIA involved an understanding of operational and design constraints and public involvement feedback.

The Task Force recognized that the greatest need and challenges for providing capacity increases occurred within the BIA. The BIA is characterized by close interchange spacing with eight interchanges in approximately four miles, substandard merging, diverging, and weaving segments for

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traffic maneuvering, and the heaviest concentration of traffic within the larger project corridor. Regional model forecasts used for the I-5 Partnership revealed that 80 percent of I-5 automobile trips crossing the Columbia River in the 2020 PM peak period are expected to begin or end within the BIA. The remaining 20 percent of PM peak period trips are expected to be through trips, i.e., trips beginning and ending outside of the BIA. The AM peak period is estimated to experience a similar 70/30 split of BIA versus through trips. ~~(Resolve 80/20 vs. similar 70/30)~~ .

An early task of the conceptual design team involved compiling a set of known constraints that shape the design envelope for the I-5 corridor. **Appendix A** includes a summary of design constraints focused on aviation, navigation, and railroad clearance requirements, and Section 4(f) park and historical considerations.

Throughout the I-5 Partnership, an extensive public involvement process also shaped the design envelope. Key public involvement comments and findings are summarized in several I-5 Partnership resources including the *Bridge Influence Area Summary* (April 19, 2002) *Appendices B and C* and the *I-5 Partnership Strategic Plan* (June 2002). Working Paper 2.8 does not explicitly address the public involvement process.

Organization of BIA Discussion

The remainder of Working Paper 2.8 addresses the range of BIA concepts identified to date pertaining to the bridge and interchange decisions. The paper is organized in the subsequent sections to address the following specific information needs identified by the project management team:

1. Description of each bridge/highway alternative examined during the I-5 Partnership, the level of detail it was defined and evaluated, and the current status of the alternative;
2. Alternatives that were discussed during the I-5 Partnership that required study, or more study, but whose study was deferred to a subsequent EIS or pre-EIS phase;
3. Reasonable alternatives that were not discussed during the I-5 Partnership, but may require study in this pre-EIS phase;
4. The association of freeway and interchange improvements with each of the bridge concepts;
5. Alternatives that were not carried forward during the I-5 Partnership and why; and
6. Contractor's preliminary judgments regarding which freeway/bridge alternatives and design options constitute a reasonable range of alternatives for the I-5 DEIS.

1. DESCRIPTION OF I-5 BIA CONCEPTS STUDIED

This section provides a description of each BIA bridge/highway concept examined during the I-5 Partnership including the level of detail at which it was defined and evaluated and the current status of the concept. The discussion leads with a look at Columbia River crossing concepts followed by a review of Portland and Vancouver interchange concepts.

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~~1.1.~~ 1.1 Columbia River Bridge Crossing Concepts

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The I-5 Partnership BIA design process was organized around a series of three meetings each with Portland and Vancouver communities. Ideas, concerns, and impacts identified by the neighborhood representatives, concerned property owners, and business representatives were incorporated into designs to the extent practicable as they were developed, revised and finalized.

The objective of the design process was to develop designs in the BIA to:

- Provide for an LRT connection to Vancouver;
- Accommodate 2020 traffic volumes as efficiently and effectively as possible;
- Transition from up to five lanes in each direction crossing the Columbia River to three through lanes north and south of the BIA;
- Reduce the number of traffic conflict points where on and off movements and lane changes occur on the mainline;
- Design the freeway and adjoining collector/distributor roadways to minimize potential displacements of homes and businesses and to minimize where additional right-of-way needs encroach on private property;
- Provide for efficient freight movement;
- Avoid or minimize possible impacts to cultural and historic resources and environmental impacts including: noise, air quality and wetlands; and
- Provide for adequate connectivity between major land uses in the corridor.

Providing additional capacity within the I-5 corridor BIA begins with a decision of how to cross the Columbia River. Crossing options can either replace the existing bridges or can supplement one or both of them with an additional bridge or tunnel. A crossing for light-rail transit can be provided independently or on a joint-use bridge (autos and LRT).

During the I-5 Partnership BIA analysis, eight Columbia River Crossing capacity concepts were developed representing a range of possible combinations of new and existing bridges crossing the Columbia River. The eight bridge crossings were broadly categorized as follows:

Table 1-1. I-5 BIA Columbia River Crossing Concepts

Category 1	Category 2	Category 3
River crossings that provide five freeway lanes in each direction (Concepts 1,2,3,4)	A freeway and river crossing system that provides three mainline freeway lanes in each direction, plus a four lane collector-distributor bridge/roadway west of the freeway (Concepts 5,6)	Four through freeway lanes in each direction plus a two-lane arterial system connecting Hayden Island to Marine Drive and downtown Vancouver (Concepts 7,8)

Source: I-5 Partnership BIA Draft Summary April 19, 2002.

The eight concepts involve a series of critical high-level design details as follows:

- Types of bridges to be constructed—supplemental vs. replacement;

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- Mode use of bridges—joint use (LRT-highway) vs. separate bridges;
- Bridge alignments east and west of existing bridges; and
- Use of bridges for freeway vs. arterial travel.

Figure 1-21 schematically depicts the eight BIA Columbia River crossing concepts.

The project team recognized that reasonable design and operational conclusions could be drawn for all eight concepts by considering one concept from each category. For Category 1, two concepts

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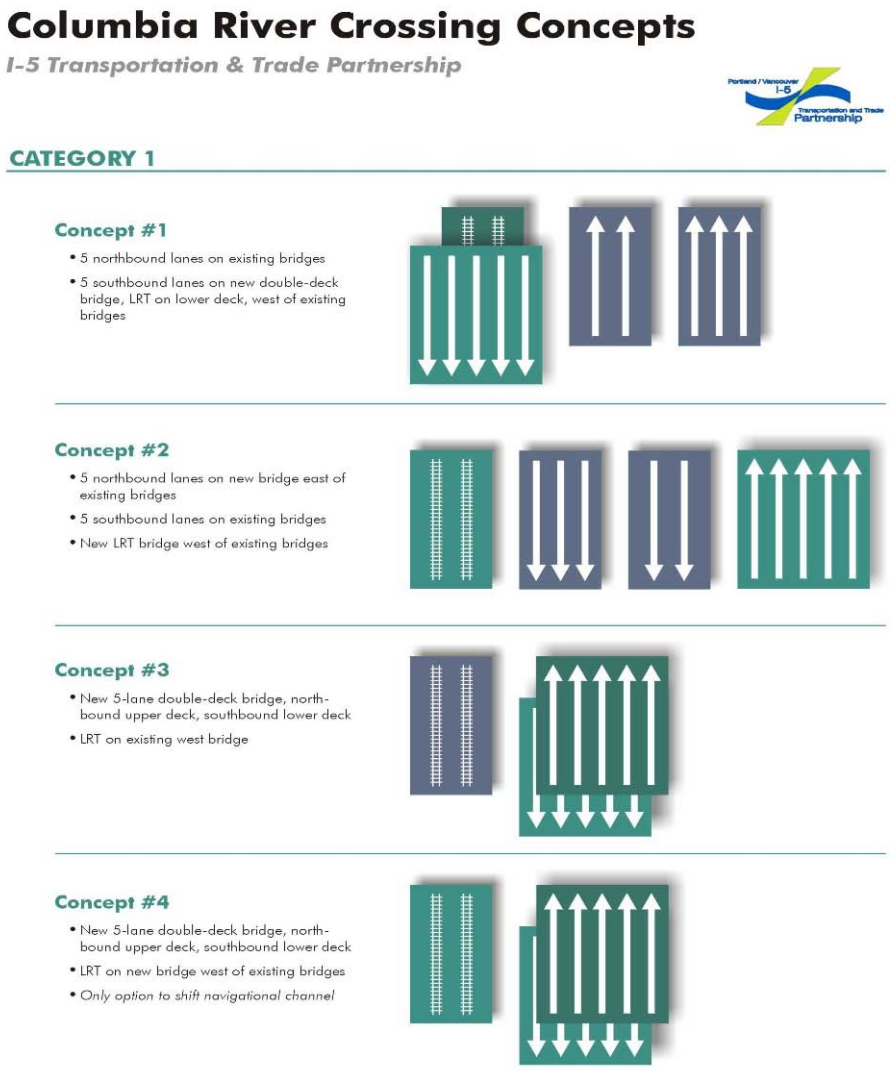

Figure 1-~~1~~2. Columbia River Crossing Concepts.
Source: I-5 Partnership BIA Draft Summary, April 19, 2002.

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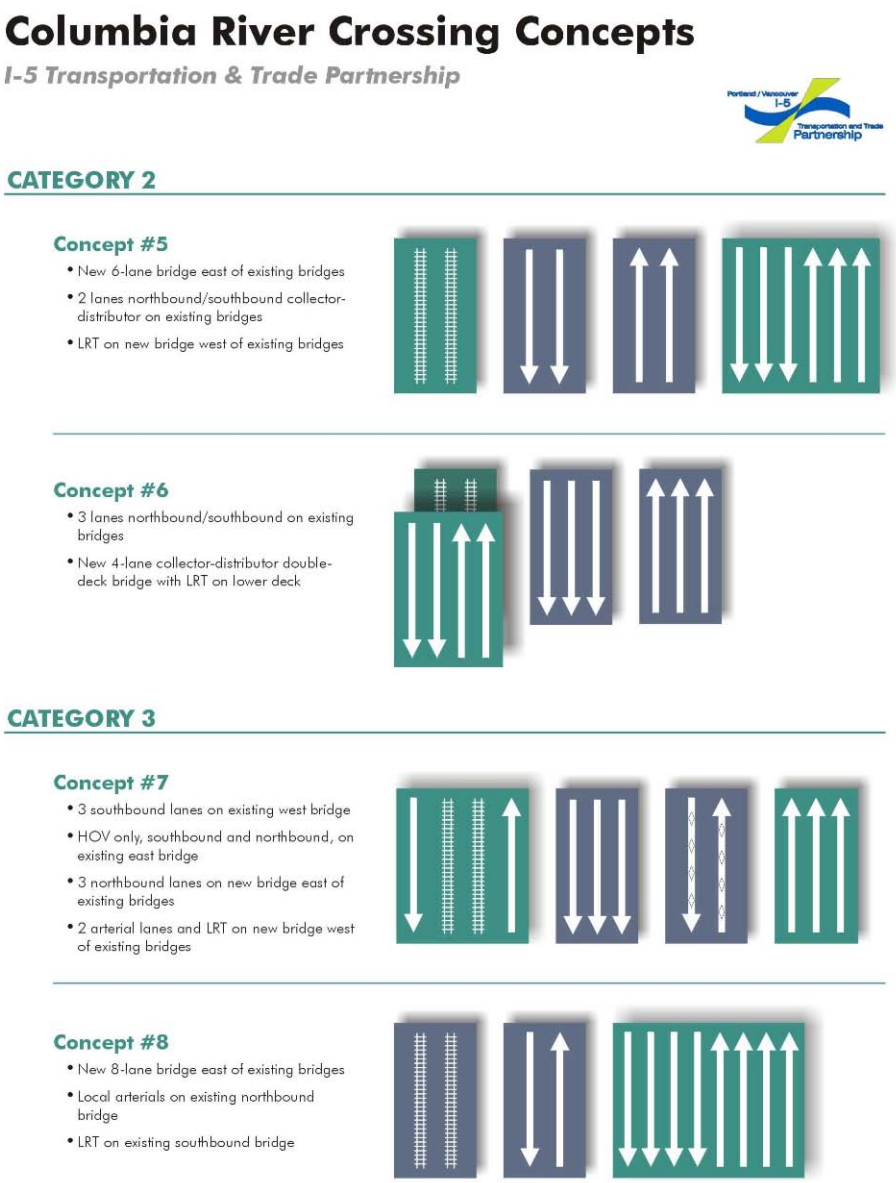

Figure 1-~~12~~ (continued). ~~cont.~~Columbia River Crossing Concepts.
Source: I-5 Partnership BIA Draft Summary, April 19, 2002.

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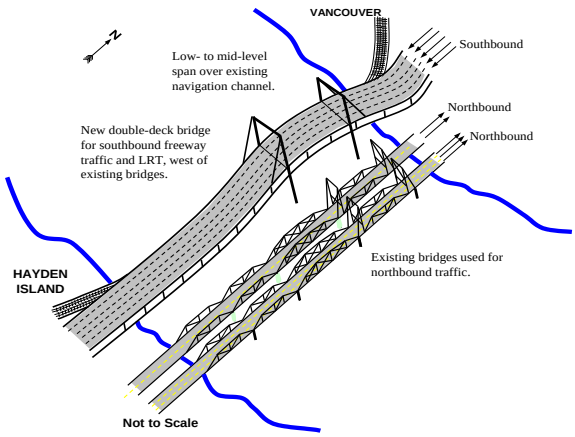
were evaluated because Concept 1 retained the existing I-5 bridges and Concept 4 removed them. Concept 4 provided an option to eliminate the lift span and improve navigation opportunities through use of a high-level bridge.

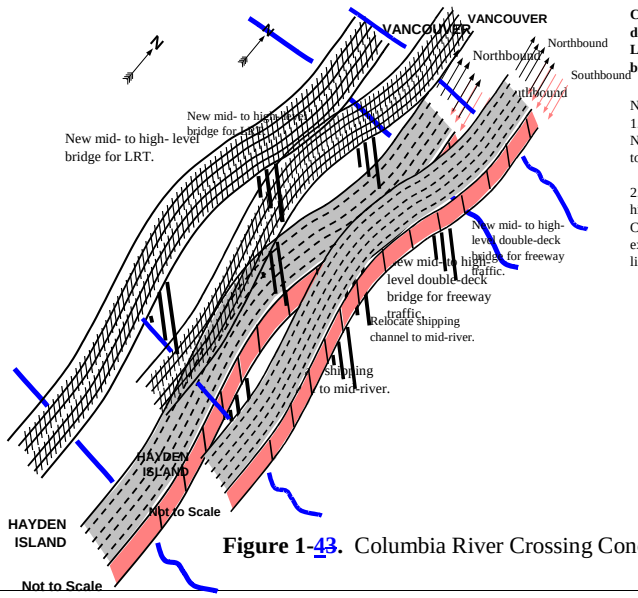
Concepts 1, 4, 6, and 7 were selected for detailed design and evaluation. Analysis of these concepts provides insight into issues of supplemental and replacement bridges; joint use (LRT-highway) and separate bridges; alignments east and west of existing bridges; freeway lanes and arterial lanes across the Columbia River; and, a comparison between high-level, fixed span bridges to low-level movable span bridges**. Figures 1-32** through **1-65** depict the key details of each crossing concept.



Concept 1: Five-lane southbound supplemental bridge for freeway traffic with LRT

Notes:
1. Southbound traffic on new five-lane bridge, LRT on lower deck west of existing bridges.
2. Low- to mid-level bridge, with lift span over existing navigation channel.
3. Northbound traffic would be split between the two existing bridges.

Figure 1-32. Columbia River Crossing Concept 1.



Concept 4: Ten lanes on double-deck bridge, with LRT on separate new bridge.

Notes:
1. Mid- to high-level bridges. Navigation channel relocated to center of river.
2. Potential fixed spans for highway and LRT (with Coast Guard reduction of existing lift requirements), or lift spans.

Figure 1-43. Columbia River Crossing Concept 4.

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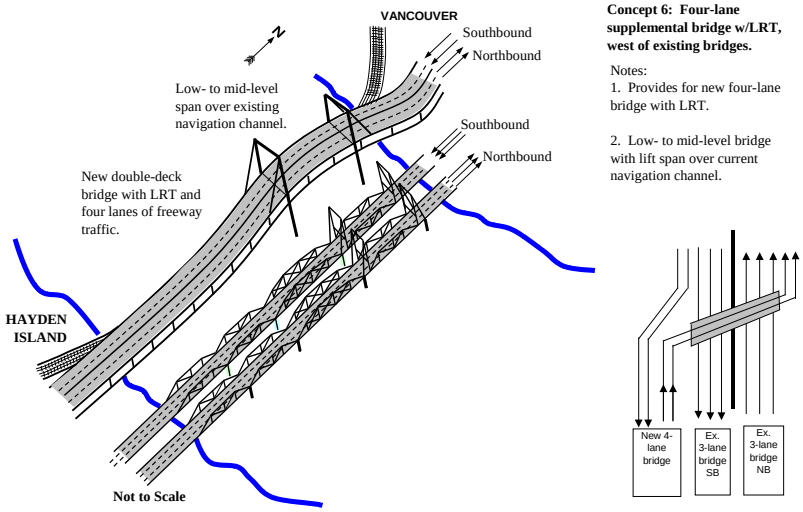
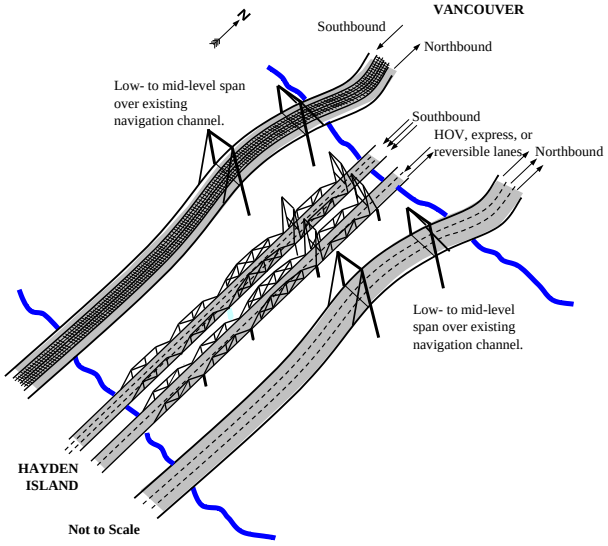


Concept 6: Four-lane supplemental bridge w/LRT, west of existing bridges.

Notes:
1. Provides for new four-lane bridge with LRT.

2. Low- to mid-level bridge with lift span over current navigation channel.

Figure 1-~~5~~4. Columbia River Crossing Concept 6.



Concept 7: LRT bridge with two-lane arterial, plus new three-lane supplemental bridge for freeway traffic.

Notes:
1. Provides for new four-lane bridge with LRT.

2. Low- to mid-level bridges with lift spans over current navigation channel.

Figure 1-~~6~~5. Columbia River Crossing Concept 7.

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Additional information describing each of the concepts, along with detailed findings regarding transportation performance, costs, property impacts, environmental concerns, and implementation issues for each concept can be found in the *Draft BIA Summary* dated April 19, 2002. This document provides detailed justification for recommending to the Task Force that certain concepts be discontinued for further consideration.

~~1.2.~~ 1.2 Design Level for Columbia River Bridge Crossing Concepts

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The four selected Columbia River crossing concepts were developed at a concept level principally depicting right-of-way (ROW), access locations, and lane configurations. Within areas of particularly restrictive ROW or where impacts to sensitive resources were likely, typical roadway and ramp sections and plan level profiles were developed to aid design refinement and planning level cost development. Designs were overlaid on aerial photos, which were ortho-rectified across the Columbia River. Designs were also applied to geographic information system (GIS) analysis for evaluation of environmental and property impacts.

It should be noted that design work and cost estimating for Concept 6 was stopped when it was recognized that it performed the worst in terms of traffic flow among the four concepts. For the other three concepts, designs were developed sufficiently to determine their feasibility and estimated costs.

Current Status of Columbia River Bridge Crossing Concepts

The *I-5 Partnership Strategic Plan* presents the Task Force's final recommendations for the I-5 corridor. The Task Force did not adopt the four specific river-crossing concepts, but rather made broad recommendations that encompassed many of the concepts that were studied. Within the plan, recommendations were made for investments that would meet the needs for highways, transit and heavy rail, and recommendations for managing the transportation and land use systems to protect investment in the corridor.

In reviewing the project materials regarding transportation performance, costs, property impacts, environmental concerns, and implementation issues for each concept, the Task Force recommended further evaluation of several concept elements as follows:

- In the EIS, the following BIA elements should be studied:
  a) Eight- or ten-lane freeway concepts;
  b) Replacement or Supplemental Bridge;
  c) Joint use or non-joint use Freeway/LRT Bridge;
  d) Eight-lane freeway with joint LRT/2-lane arterial; and
  e) HOV throughout the I-5 Corridor.
- Evaluate whether or not a six-lane freeway plus two two-lane arterials, one in the vicinity of the I-5 corridor and one in the vicinity of the railroad bridge, is a viable alternative for consideration in the EIS.

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The Task Force recommendations effectively reduced the list of eight Columbia River crossing concepts to six by eliminating Concepts 5 and 6 from further consideration due to their configuration around a collector-distributor river crossing system.

It is worth noting that the Task Force's recommendations do not constitute establishment of specific "alternatives" and do not give any specific status to specific concepts. Rather, they establish a framework that shapes the refinement of concepts in the future. Thus, the "status" of Columbia River crossing concepts 1, 2, 3, 4, 7, and 8 is that they all generally meet the criteria established by the Task Force and that further analyses are needed to refine and screen the concepts as part of developing a set of DEIS alternatives.

2. DEFERRED CONCEPTS

This section focuses on identifying alternatives that were discussed in the Strategic Plan phase that required study, or more study, but whose study was deferred to the pre-EIS or EIS phase.

As noted above, the BIA analyses started with the development of eight potential river crossing concepts, organized in three general categories. Four representative concepts were selected for analysis, with the understanding that the results of the studies would be used to evaluate and refine those four concepts as well as the four that were not considered at that time.

The BIA analyses focused on Concepts 1, 4, 6, and 7. From those analyses, Concepts 1, 4, and 7 showed promise. On the other hand, Concept 6 was fundamentally flawed and should not be carried forward for further study. By implication, the other Category 2 (collector-distributor) bridge concept, Concept 5, also should not be carried forward for further study.

Therefore, the three remaining concepts that were deferred (Concepts 2, 3, and 8) should be further evaluated as part of a process leading to identification of DEIS alternatives. In addition, the final report recommended consideration of a six-lane freeway bridge plus two two-lane arterials (one in vicinity of RR bridge).

The I-5 Partnership included an interactive process of sharing design concepts with the public, seeking their comments, and refining the concepts based on comments to the degree practicable. Some comments were captured and deferred for future consideration. Key public comments regarding the various Columbia River Crossing concepts are summarized in the *Bridge Influence Area Summary* (April 19, 2002) *Appendices B and C*. ~~Any recurring themse~~themes ~~from public comments?~~

3. POSSIBLE CONCEPTS TO BE EVALUATED FOR TOLLING

This section identifies reasonable alternatives that were not discussed in the Strategic Plan phase, but may require study in this current Tolling phase. Answers to the following two questions help frame the response:

- First, are there alternatives that would be reasonable to consider in the EIS that for some reason were not considered in the Strategic Plan?

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- Second, does the introduction of tolling as an element of design and operation affect the range of alternatives to be considered?

~~4.1.~~ 3.1 Alternatives that ~~Should~~should be Added?

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With regard to the **first question**, the BIA concepts that were considered in the I-5 Transportation and Trade Partnership study were based on prior analyses and conclusions from the previous phase of work. The Task Force concluded that the river crossing should include LRT as well as three through freeway lanes plus two auxiliary/arterial lanes in each direction. The decisions about transit mode (LRT) and through freeway capacity (three lanes in each direction) were based on a comparison of potential transportation benefits, costs, and impacts. Thus, it was reasonable to limit the BIA concepts to those consistent with the Task Force recommendations.

On the other hand, the number of additional lanes needed across the river to balance on- and off-movements as well as local traffic should be treated as a conclusion resulting from the analyses, rather than as an assumption. It may be that more than two additional lanes in each direction are needed to accommodate interchange-to-interchange movements as well as local traffic. For example, the analyses of concepts indicated that the northbound and southbound freeway segments crossing the river might need to include six lanes (three through lanes plus three auxiliary lanes) to accommodate the weaving between the Hayden Island and SR 14 interchanges.

~~Options to tunnel under the river were considered in prior phases of study, but were not directly addressed in the BIA analyses. However, traffic operations with a tunnel for through traffic can be reasonably inferred to be similar to Concept 6, which would use collector-distributor lanes to segregate through traffic from vehicles entering and exiting at the interchanges. Of the concepts considered, Concept 6 was predicted to perform the worst, with little improvement compared to the 2020 Baseline concept. The collector-distributor lanes were predicted to experience significant congestion, while the through lanes would be relatively underutilized. With a tunnel concept, the existing bridges and interchanges would essentially serve the collector-distributor function, and would be severely congested without major improvements. Thus a tunnel concept would require major investments to improve the surface facilities as well as the investment in the tunnel crossing.~~

~~4.1.~~ 3.2 The Impact of Tolling on Alternatives

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With regard to the **second question**, the introduction of tolling complicates the selection of what alternatives should be carried forward for further evaluation. If tolling is required to fully fund the improvements, alternatives that maximize revenues will need to be considered. If tolling is intended for partial cost recovery, then other options may be viable. Fundamentally, the general concepts recommended by the Task Force in the Final Strategic Plan provide a range of options that fit fairly well with the concepts that were evaluated within the BIA.

Issues such as potential trip diversion created by full or partial tolling and the impacts of siting toll collection facilities can also shape the alternatives. Results from this I-5 Columbia River Crossing Partnership: Traffic and Tolling Analysis will help answer many of the questions relating to the introduction of tolling that will shape the recommended alternatives that are carried forward for further evaluation in the environmental process. Therefore, it is too early in the study to know how the alternatives will be impacted by tolling.

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4. FREEWAY AND INTERCHANGE IMPROVEMENTS

The four Columbia River crossing concepts shown previously in Section 1.1 depict only the bridge configurations at the Columbia River. Critical to each concept is the integrated interchange system that balances freeway on- and off- movements moving to and away from the Columbia River crossing. This section identifies and discusses the association of freeway and interchange improvements with a new Columbia River crossing.

~~4.1.~~ 4.1 Existing Freeway ~~Access~~Access, ~~the~~ the Problem

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The close proximity of the eight interchanges is a significant contributing cause of the congestion at the river. Existing I-5 Columbia River bridges limit the traffic flow across the river, and thus, limit the pressure on the interchanges. Adding capacity across the river will expose the limitations of the interchanges. Therefore, bridge and interchange improvements must go hand-in-hand. ~~Much of the congestion experienced today along I-5 is a function of freeway access.~~

Within the I-5 BIA, access generally occurs in one of three ways: (1) on-ramp lanes either merge directly onto the freeway (merge section); (2) on-ramps create their own additional lane along the freeway (for example, Columbia Boulevard on southbound I-5)~~;or~~; or, (3) on-ramps connect to adjacent downstream off-ramps linked by an auxiliary lane (weave section). Weave sections require motorists entering and leaving the freeway to weave across one freeway lane to complete their maneuvers.

Freeway access creates friction along the freeway as mainline and entering motorists make decisions in seeking to accommodate each other in the given space and under prevailing mainline speeds. The friction is exacerbated under high volumes and speed differentials and particularly if the merge and weave sections are too short in length to allow smooth maneuvering at prevailing speeds. The BIA is characterized by eight closely spaced interchanges within four miles containing substandard merge and weave sections—principally due to section lengths.

~~4.2.~~ 4.2 Interchange Collector-Distributor (C-D) System- a Promising Choice

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Where a collector-distributor (C-D) system did not perform well as a means of separating and managing traffic crossing the Columbia River, a directional C-D system parallel to I-5 proved particularly effective in managing interchange on- and off-ramp movements on both sides of the river.

An interchange C-D system provides two primary benefits. First, it creates a parallel, lower functioning facility more safely suited to the transition of traffic movements between the freeway and state highway or arterial system. Second, it provides flexibility to reduce the number of direct access points to the freeway- providing opportunity for smoother, more predictable and reliable freeway level traffic flow.

Close inspection of Figure 4-1 reveals that the ramp lanes supplement a three-through lane corridor as recommended by the Task force. Similar sketch level concepts are depicted in **Appendix C** for the ramp sections between Fourth Plain and Mill Plain, Mill Plain and SR 14, and at Hayden Island.

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River crossing concepts, depending on lane configurations, will benefit from customized use of C-D ramp designs.

Figure 4-1 depicts at a sketch level how a C-D ramp system might connect between SR 500 and 4th Plain in Vancouver.

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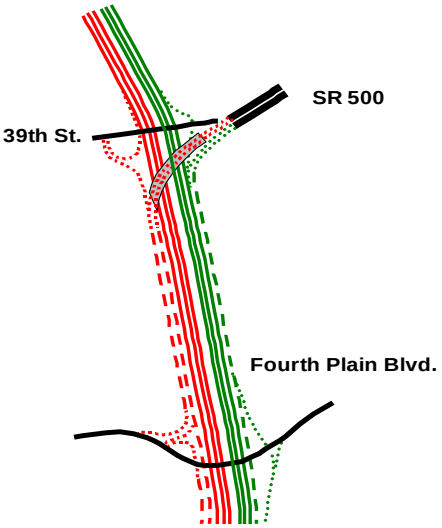

Figure 4-1: Existing Lane Configuration.

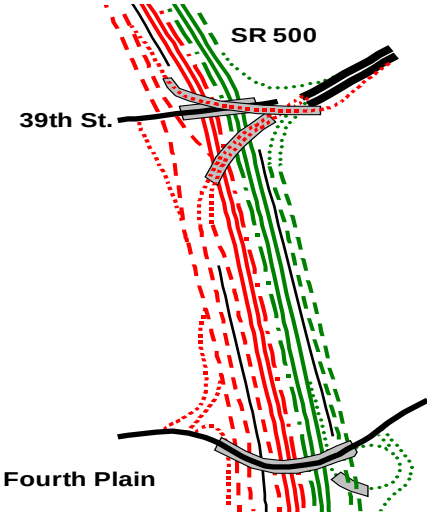

Figure 4-1: C-D Interchange Configuration.

5. ALTERNATIVES NOT CARRIED FORWARD

This section identifies the alternatives that were identified during the I-5 Partnership that were not carried forward into evaluation during the I-5 Partnership and were not suggested to be carried forward into a future EIS and the justification behind these decisions.

The I-5 Partnership began with a charge to identify the "universe" of potential options to address identified transportation issues in the I-5 corridor. Studies indicated that options that provided capacity in another corridor did not address the fundamental traffic patterns and demands within the existing corridor and were therefore not recommended for further consideration. For example, a western bypass linking Washington County, Oregon with Clark County, Washington did not address congestion in the I-5 corridor and was therefore not carried forward.

Second, corridor-wide capacity improvements, those based on four or more through lanes, were ruled out because the Task Force concluded that the transportation benefits did not justify the costs and impacts.

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~~As discussed in Section 3, s~~Specialty options such as a tunnel under the river were considered in prior phases of study, but were not directly addressed in the BIA analyses. The tunnel option, because of geometric design constraints required to transition under the river, began ~~began~~ south of Marine Drive in Portland ~~Columbia Boulevard in Portland~~ and extend to Mill Plain ~~ed past SR 500~~ in Vancouver. The tunnel would miss the Marine Drive, Hayden Island, SR 14, and Mill Plain interchanges, resulting in ~~There was~~ insufficient through traffic to make the option a cost-effective concept.

Traffic operations with a tunnel for through traffic can be reasonably inferred to be similar to Concept 6, which would use collector-distributor lanes to segregate through traffic from vehicles entering and exiting at the interchanges. Of the concepts considered, Concept 6 was predicted to perform the worst, with little improvement compared to the 2020 Baseline concept. The C-D lanes were predicted to experience significant congestion, while the through lanes would be relatively underutilized. With a tunnel concept, the existing bridges and interchanges would essentially serve the collector-distributor function, and would be severely congested without major improvements. Thus a tunnel concept would require major investments to improve the surface facilities as well as the investment in the tunnel crossing.

Within the BIA, the following concepts do not show promise for addressing the Corridor's problems and should not be considered in an EIS:

a) Collector-Distributor bridge concepts;

b) Arterial-only bridge concepts; and

c) Tunnel concepts.

6. REASONABLE RANGE OF ALTERNATIVES FOR AN I-5 DEIS

For this working paper and at this stage of development of the I-5 Columbia River Crossing ~~Partnership :~~Partnership: Traffic and Tolling Analysis study, it is too early to narrow the range of reasonable alternatives for an I-5 DEIS. This is because the impacts of implementing tolling have yet to be studied sufficiently to understand their potential impacts on the concepts that have been studied to date. ~~T~~

6.1 Options that should be considered for Tolling

The Task Force, in the Final Strategic Plan, made specific recommendations for accommodating vehicles and transit within the Bridge Influence Area. The recommendations provide a viable range of options for evaluating the impacts of tolling. Subsequent working papers and technical memoranda~~ums~~ will evaluate tolling scenarios and better define their impact on the various alternatives.

The following range of options should be considered for the tolling analysis:

1. Toll five lanes in one direction on I-5 similar to concepts 1 and 4. Toll collection facilities can be located in either Washington or Oregon, and can cover either northbound or southbound traffic.

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2. Toll five lanes in one direction on I-5 ~~and toll existing lanes~~ similar to above, and toll I-205 in one direction. Toll collection facilities on I-205 will be directionally compatible with those on I-5. Toll collection facilities can be located ~~sited~~ in either Washington or Oregon, and can cover either northbound or southbound traffic.

3. Toll four lanes in one direction on I-5. Arterial crossings would not be tolled. Toll collection facilities can be located in either Washington or Oregon, and can cover either northbound or southbound traffic.

4. Toll three lanes in one direction on I-5. Arterial crossings would not be tolled. Toll collection facilities can be located in either Washington or Oregon, and can cover either northbound or southbound traffic.

Findings and recommendations from the tolling analysis will be summarized in a final report that will aid decision and policy makers to further narrow the alternatives.

6.2 Other Considerations for Narrowing Alternatives

In addition to the impacts of tolling scenarios, other key design issues and accompanying policy decisions limit the ability to make more than general recommendations for deciding what alternatives should be evaluated in the EIS process without further development of design concepts, and assessment of costs and impacts. For example, within the recommendations of the Task Force, there are numerous variations that are impacted by whether to use the old bridges or replace them, impacts on navigation, integration of transit/LRT, and placement of new structures.

Within the BIA, following are examples of design options that impact the potential number of alternatives to be carried forward. Previous work on the I-5 Transportation and Trade Partnership project did not evaluate the options in great enough detail to warrant a recommendation from the Task Force.

- ~~6.1~~ Keep or replace the existing I-5 bridges;
- ~~6.2~~ Integrate LRT/HCT on a joint new bridge or on a separate bridge;
- ~~6.3~~ Place the new I-5 bridge east or west of the existing bridges; and
- ~~6.4~~ Use of bridges for freeway or arterial.

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~~6.1.~~ Keep or Replace Existing I-5 Bridges

Whether to keep or replace the existing I-5 bridges ~~This~~ is perhaps the fundamental issue that will most shape the alternatives to be carried forward. A new mid- to high-span I-5 replacement bridge (Concept 4) combined with replacement of the railroad bridge provides the only opportunity to relocate the existing Columbia River shipping channel to the middle of the river. Such a scenario would eliminate the need for bridge lifts on I-5 and the need for out of direction barge navigation. Any ongoing use of one or both of the existing I-5 bridges involves continued bridge lifts and the increased costs associated with equipping a new supplemental crossing with a lift span.

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A decision toward replacement bridges also impacts the need for seismic upgrades of the existing bridges and their long-term maintenance and operation of the lift spans. Bridge replacement also has the potential to maximize use of existing freeway right-of-way, thereby minimizing property impacts in Vancouver and on Hayden Island.

~~6.2~~ Integrate LRT/HCT on a Joint New Bridge or on a Separate Bridge

The Final Strategic Plan recommends a light rail loop system both within Clark County and between Washington and Oregon, in the I-5 and I-205 corridors. The decision to integrate LRT with highways on a single or separate bridge will influence the alternatives. Incorporating LRT also complicates access modifications to the existing interchanges servicing I-5 and adds funding issues. Constructing LRT on a separate alignment will also need to be evaluated.

~~6.3~~ Place New Bridge East or West of Existing I-5 Bridges

Any option that results in a new interstate bridge will require continued use of the existing I-5 bridges during construction. Therefore, the new bridge will need to be constructed upstream or downstream from the existing bridges. Each option creates unique ROW impacts and design issues on Hayden Island and the adjacent interchanges in Oregon and Washington.

~~6.4~~ Use the Bridges for Freeway or Arterial

Concepts 7 and 8 include options for arterials on new or existing bridges. In the Final Strategic Plan, the Task Force included recommendations to evaluate whether or not a six-lane freeway plus two two-lane arterials, one in the vicinity of the I-5 corridor and one in the vicinity of the railroad bridge, is a viable alternative for consideration in the EIS.

SUMMARY

The purpose of this working paper is to describe each bridge/highway concept identified ~~and/~~or examined between ~~from~~ January 2001 and ~~to~~ June 2002 while developing the Portland/Vancouver I-5 Transportation and Trade Partnership Strategic Plan, including the level of detail it was defined and evaluated, and the current status of each~~the~~ concept. ~~In addition~~In addition, the Contractor was asked to provide preliminary judgements regarding which freeway/bridge alternatives and design options constitute a reasonable range of alternatives for the EIS. Following are the key findings:

- A wide range of concepts for solving I-5 corridor transportation problems were generated, evaluated, and narrowed within a process that included substantial guidance from a Task Force and involvement by the public.
- The I-5 Transportation and Trade Partnership Task Force made specific recommendations for what should be included within the BIA between SR 500 in Washington and Columbia Boulevard in Oregon. The Final Strategic Plan included broad guidelines for highway and transit options within the Bridge Influence Area.
- The range of alternatives were constrained by the Task Force by their decision to place a limit of five lanes in each direction across the Columbia River and three through lanes in each direction in Vancouver and Portland.

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- Analysis of tolling scenarios was not included in the evaluation of concepts that were developed in more detail as part of the I-5 Transportation and Trade Partnership project.
- Development of tolling scenarios might impact alternatives that will be evaluated in further detail in the EIS. Findings of the tolling analysis that might shape these alternatives will not be accomplished until later in this study.
- Other design and policy issues will influence recommendation of alternatives to be evaluated in the EIS. Further engineering design and evaluation of impacts will be required to aid in the decision process. They include:
  - Adding travel lanes, beyond Task Force recommendations, to improve safety and reduce pinchpoints;
  - Whether to use or replace the existing I-5 bridges;
  - Whether to realign the navigation channel;
  - How LRT/HCT will be integrated into the project; and,
  - Whether new bridges will be placed east or west of the existing.

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APPENDIX A
I-5 TRADE CORRIDOR DESIGN CONSTRAINTS

Aviation Clearance

Pearson Airpark is a general aviation airport located in Vancouver south of the Fort Vancouver National Historical Site and east of Interstate 5 (I-5). Pearson Airpark contains one east-west runway approximately 3,200 feet in length; the runway centerline extended to the west is in approximate alignment with the north end of the most northerly I-5 truss span. The west end of the runway is approximately 2,500 feet from the I-5 centerline. In accordance with FAA Part 77.25 Civil Airport Imaginary Surfaces, the clearance (lower boundary of the useable airspace) for this runway extends from ground level 200 feet from the end of the runway at an upward slope of 20:1. Objections penetrating this surface into the runway airspace can be considered an obstruction to air navigation; the existing I-5 lift towers presently constitute an obstruction of the air space. Due to the obstruction of the I-5 lift towers, aircraft operations to the west of the runway are effectively restricted to an area to the north of the towers.

Navigation Clearances

In reference to the previous Columbia River Crossing Study, the river navigation clearances are controlled by the Thirteenth Coast Guard District, Aids to Navigation and Waterway Management Branch, Seattle, Washington. That agency is the permitting authority for new bridge crossings. The agency has stated that the piers for all adjacent new structures must align with the piers on the existing I-5 Columbia River and Portland Harbor bridges and that existing vertical clearances beneath the spans must be maintained. For the same matter, it is assumed that the statement is applied to I-205 bridge and I-5 Columbia Slough bridge. The existing horizontal and vertical clearances for the related bridges are tabulated in the following table:

Bridge	Horizontal	Vertical
I-205	300’	144
I-5 Columbia Slough	94’	44’
I-5 Portland Harbor	215’	35’
I-5 Columbia River (Primary Shipping Channel)	263’	178’
I-5 Columbia River (Secondary Barge Channel)	511’	46’
NWA[1] Willamette	205’[2]	161’[2]
NWA Columbia Slough	94’[3]	44’[3]
NWA Portland Harbor	215’[4]	35’[4]
NWA Columbia River	263’[5]	178’[5]

[1]New west arterial road
[2]According to the Steel Bridge
[3]According to I-5 Columbia Slough Bridge
[4]According to I-5 Portland Harbor Bridge
[5]According to I-5 Columbia River Bridge

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Typical present marine traffic consists of 70 percent barge traffic, with vertical clearance requirements of 60 to 80 feet.

Railroad Clearances

Union Pacific Railroad (UPRR) and Burlington Northern (BN) are the affected railroad organizations in this project. Their clearance requirements are tabulated in the following table for tangent tracks. Horizontal clearances are measured from centerline of nearest track. Vertical clearances are measured from top of rail.

Company	Horizontal	Vertical
UPRR	18' (9' in special case)	23'
BN	10'	23.6'

Horizontal clearances are to be increased 1-1/2 inches per degree of curve on curved tracks.

Park and Historical Site Impact

The adjacent parks and historical sites of this project include Fort Vancouver National Park in Vancouver, Washington, and Delta Park and the historical building located southwest of I-5 and Columbia Boulevard in Portland Oregon. The intent of the Section 4(f) of the U.S. Department of Transportation Act statute and the policy of the Department of Transportation is to avoid public parks, recreation areas, refuges, and historic sites. In order to demonstrate that there is no feasible and prudent alternative to the use of Section 4(f) land, the evaluation must address location alternatives and design shifts that avoid the section 4(f) land. Supporting information must demonstrate that such alternatives result in unique problems. Unique problems are present when there are truly unusual factors or when the costs or community disruption are extraordinary.

When making a finding that an alternative is not feasible and prudent, it is not necessary to show that any single factor presents unique problems. Adverse factors such as environmental impacts, safety and geometric problems, decreased traffic service, increase costs, and any other factors may be considered collectively.

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