DRAFT COMPONENTS STEP A SCREENING REPORT

March 15, 2006

Columbia River CROSSING

Table of Contents

List of Figures

List of Tables

ACRONYMS

AA	Alternatives Analysis
ADA	Americans with Disabilities Act
AGT	Automated Guideway Transit
BNSF	Burlington Northern Santa Fe Railroad
BRT	Bus Rapid Transit
CRC	Columbia River Crossing
CRD	Columbia River Datum
EIS	Environmental Impact Statement
FAA	Federal Aviation Administration
FHWA	Federal Highways Administration
FTA	Federal Transit Administration
HOV	High Occupancy Vehicle
NB	Northbound
NEPA	National Environmental Policy Act
ODOT	Oregon Department of Transportation
PDX	Portland International Airport
PRT	Personal Rapid Transit
RTC	Regional Transportation Council
RC	River Crossing
SB	Southbound
SOV	Single Occupant Vehicle
TR	Transit
TSM/TDM	Traffic System Management/Traffic Demand Management
WSDOT	Washington State Department of Transportation

1. Overview of Evaluation Process

In 1998, in response to evidence of growing congestion in the Portland-Vancouver I-5 corridor, leaders in the region came together to study the problem and potential solutions. This effort continues today as the Columbia River Crossing (CRC) Project Team works to identify and refine appropriate solutions to improve mobility and livability in the I-5 corridor. This current effort builds upon previous studies and will narrow potential transportation solutions to those that best meet the Purpose and Need Statement and Vision and Values Statement identified for the corridor.

The screening and evaluation of potential transportation improvements is part of the I-5 CRC Alternatives Analysis (AA) and the Environmental Impact Statement process. There are several steps to screening and evaluation. This *Components Step A Screening Report* describes how a broad range of potential transportation improvements (also known as "components") was initially evaluated and screened, and presents the results of that screening. Those components that passed this initial screening will undergo a second round (Step B) of evaluation and screening. Components advanced from the second round will then be packaged into multi-modal alternatives. These alternatives will then be further evaluated and screened, resulting in a short list of the most promising alternatives that will be advanced into the I-5 CRC Draft Environmental Impact Statement (DEIS). The AA and DEIS will be published in late 2007, and will provide analysis and findings to help the public and agencies to understand the consequences, characteristics and other considerations associated with these alternatives. This will also help inform recommendations and decisions regarding a preferred alternative.

1.1 What is a Component?

A "component" is a potential transportation improvement proposed to address one or more of the identified needs in the I-5 Bridge Influence Area. An example of a component is a newly constructed highway bridge, or light rail transit. For analysis purposes, all of the transportation components were grouped into eight categories relating to distinct transportation modes or strategies. These categories are:

1. Transit (buses, light rail, other)
2. River Crossings (different bridge or tunnel configurations and locations)
3. Roadways North (treatments to I-5 and other roadways north of the Columbia River, including interchanges)
4. Roadways South (treatments to I-5 and other roadways south of the Columbia River, including interchanges)
5. Freight (rail and truck facility improvements)
6. Transportation System/Demand Management (TSM/TDM—options to reduce auto travel during congested periods, strategies to optimize transportation facility operations)

7. Bicycles (bike lanes, bridge crossings, separate paths and routes)
8. Pedestrians (sidewalks, bridge crossings, separate paths and routes)

Some components are defined with respect to location, application, or operating characteristics (e.g., high bridge west of the existing I-5 bridges), whereas others are defined more generally and thus could be implemented in a wide range of locations or with different features (e.g., Highway On-Ramp Metering). Each component is also unique. Thus, each of several different bridge ideas, for example, is a separate component.

The final list of transportation components to be assessed was developed from two primary sources: 1) recommendations in the 2002 I-5 Transportation and Trade Partnership Final Strategic Plan, and 2) suggestions from the public and affected agencies received during the current NEPA scoping process.

Section 2 of this report describes the component screening process in more detail.

2. Evaluation Steps and Step A Measures

In February 2006, the CRC Task Force adopted a six-step evaluation framework that defines a formal process for screening the large number of transportation components and subsequently, a limited set of multi-modal alternative packages. In general, the framework establishes screening criteria and performance measures to evaluate the effectiveness of the transportation components in addressing:

- The project Purpose and Need,
- Problems identified in the project's Problem Definition, and
- Values identified in the Task Force's Vision and Values Statement.

Component screening is the first stage in the complete evaluation framework (see **Figure 2-1** at the end of this section) and is itself a two-step process.

In Step A, transportation components were screened against up to six pass/fail questions derived directly from the Problem Definition. To determine if each component offers an improvement, they were compared to the No Build condition, which includes transportation improvements adopted in the regional transportation plans, but no additional improvements at the Columbia River crossing.

In Step A, only the transit and river crossing components were screened. Components in the Pedestrian, Bike, Freight, Roadways, and TDM/TSM categories were not evaluated because their performance would critically depend upon how they were integrated with promising transit and/or river crossing improvements. As mentioned earlier, components in these categories (e.g., Ramp Queue Jump Lanes) could be implemented in a wide variety of ways. These components will be paired with complementary transit and river crossing components during alternatives packaging. **Table 2-1** shows the six Step A questions and what questions pertain to the transit and river crossing components.

Table 2-1. Component Categories and Relevant Step A Questions

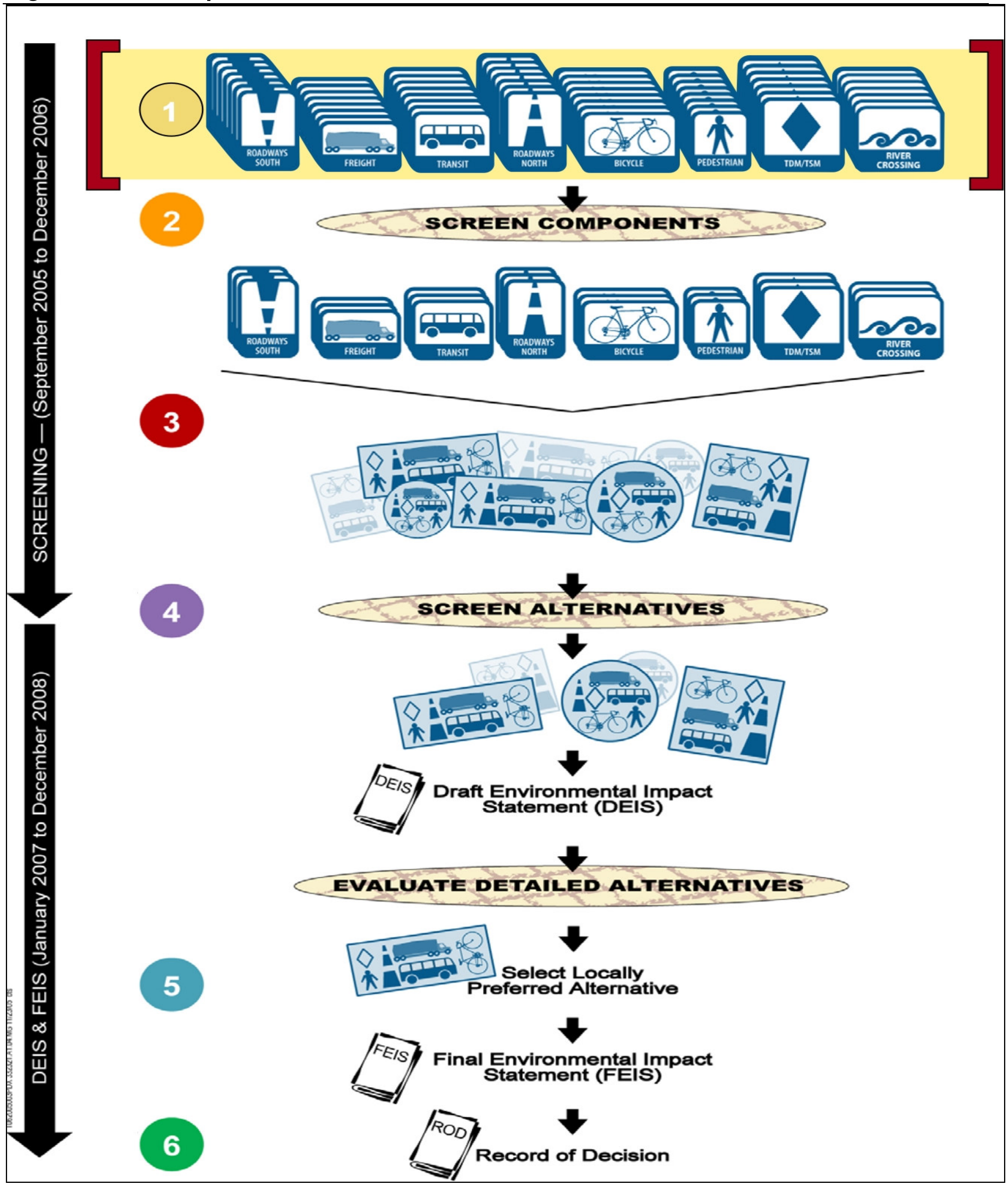
Question: Does the Component	Transit Components	River Crossing Components
1. Increase vehicular capacity or decrease vehicular demand within the bridge influence area?	♦	♦
2. Improve transit performance within the bridge influence area?	♦	♦
3. Improve freight mobility within the bridge influence area?		♦
4. Improve safety and decrease vulnerability to incidents within the bridge influence area?	♦	♦
5. Improve bicycle and pedestrian mobility within the bridge influence area?		♦
6. Reduce seismic risk of the I-5 Columbia River crossing?		♦

Note: Components were only screened against questions indicated by ♦

Importantly, each transit and river crossing component was screened independently during Step A screening. No consideration was given to how the component performs relative to other components in the same category, or how it could potentially be paired with components in other categories. In Step A, a component is eliminated from further consideration if it fails (characterized as a fatal flaw) any of the questions that pertain to that component.

After Step A, the remaining components will go through a second round of screening where consideration is given to how the component performs relative to other components in the same category. The Next Steps section at the end of this report briefly describes the Step B screening process.

Figure 2-1. Six Step Evaluation Framework



3. Step A Context and Considerations

This section describes the transportation deficiencies and issues that project staff considered and assessed in developing answers to the Step A questions.

Note to reader - *key points appear in italicized text.*

3.1 Question 1: Does the Component Increase Vehicular Capacity or Decrease Vehicular Demand Within the Bridge Influence Area?

3.1.1 Travel Markets Using the I-5 Bridge Influence Area

Interstate 5 is one of two major highways in the Vancouver-Portland area that provide interstate connectivity and mobility. I-5 directly connects the central cities of Vancouver and Portland. Interstate 205 (I-205), the other major highway, is a 37-mile long freeway that extends from its connection with I-5 at Salmon Creek to its terminus at I-5 near Tualatin. It provides a more suburban access and bypass function and serves travel demand between east Clark County, east Multnomah County, and Clackamas County.

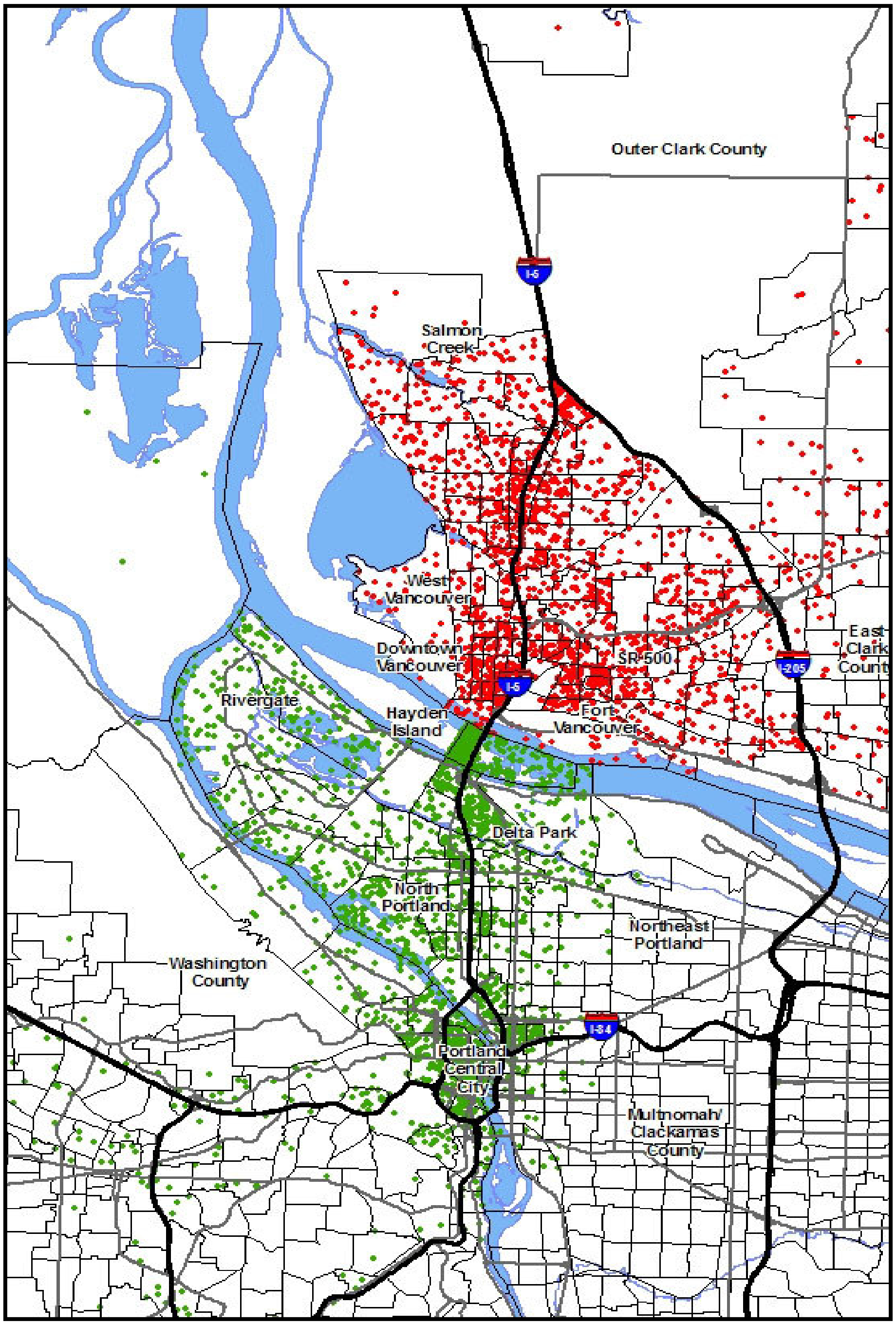
Travel demand across I-5 Interstate Bridge has steadily increased over the years. Recent traffic counts indicate that over 130,000 vehicles per day cross the bridge. By the year 2020, about 175,000 vehicles are estimated to use the crossing each day.

Current and future land uses on both sides of the Columbia River play a significant role in attracting traffic to the I-5 corridor. As an example, **Figure 3-1** shows the origins and destinations for person-trips expected to use I-5 Interstate Bridge in the year 2020. This figure highlights the locations of trips originating south of the Columbia River and the destinations of trips north of the Columbia River during a four-hour afternoon/evening commute period.

It is evident that most trips using the I-5 Interstate Bridge, today and into the future, have origins and/or destinations within or near the I-5 corridor itself, making the I-5 crossing the most direct means to accommodate these trips.

An analysis of potential transit markets and transit's role in reducing vehicular demand is discussed in section 3.2.3, which pertains to Question #2.

Figure 3-1. OR Origins and WA Destinations in PM Peak Period (2020)



3.1.2 Origin and Destination Travel Patterns within the I-5 Bridge Influence Area

Surveys of vehicle license plates were conducted at the I-5 on- and off-ramps within the Bridge Influence Area in October 2005. The surveys were conducted using video cameras to determine origin and destination patterns of traffic traveling within the Bridge Influence Area. License plate information was collected for vehicles traveling in the peak directions (i.e., southbound during a two-hour morning peak period and northbound during a two-hour afternoon/evening peak period). Almost 30,000 license plates were recorded and a database was created to match vehicles entering and exiting the I-5 ramps, and identify vehicles that remained on the I-5 mainline (i.e. trips that travel through the Bridge Influence Area).

Figures 3-2 and 3-3 graphically depict the results of the Bridge Influence Area origins and destinations for trips traveling southbound and northbound, respectively, across the Interstate Bridge.

Figure 3-2. Southbound I-5 Vehicle-Trip Patterns in the Bridge Influence Area, for Trips Across the Interstate Bridge (2005)

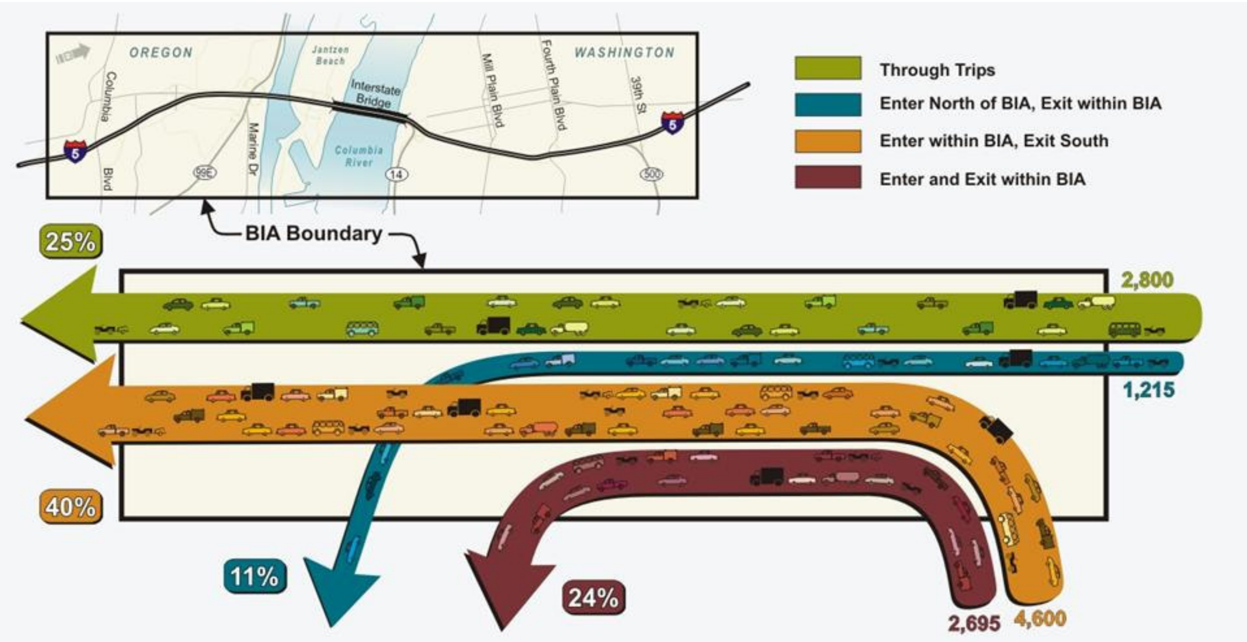
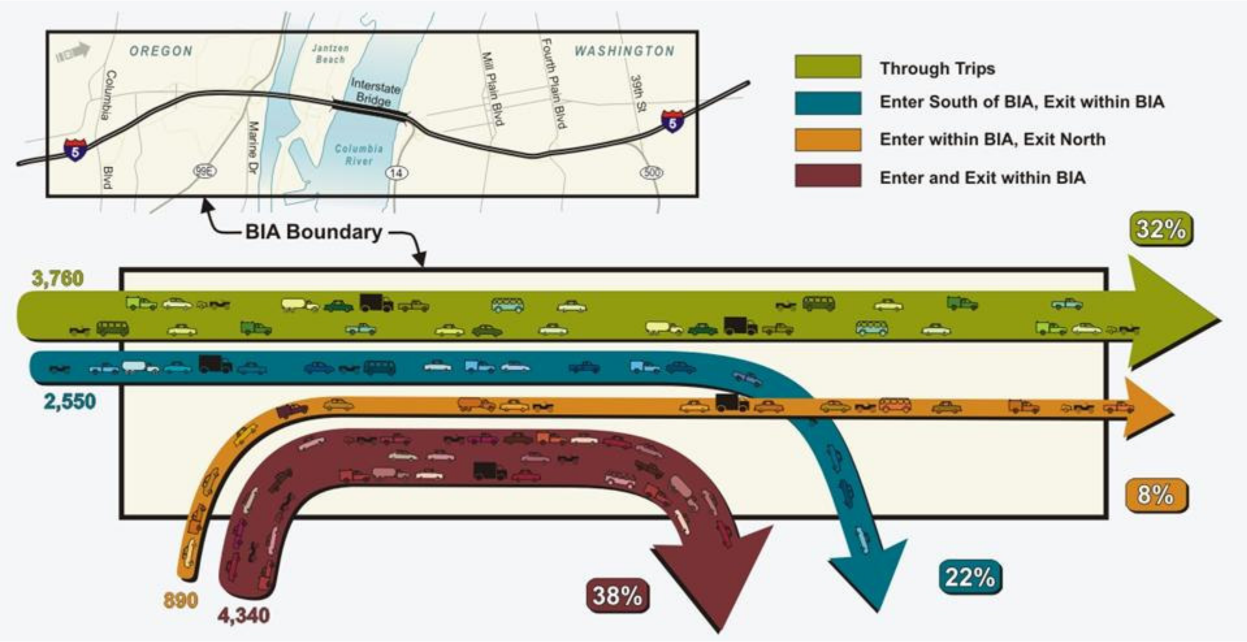


Figure 3-3. Northbound I-5 Vehicle-Trip Patterns in the Bridge Influence Area, for Trips Across the Interstate Bridge (2005)



According to the surveys, of all morning peak period southbound traffic traveling on I-5 across the Interstate Bridge and within the Bridge Influence Area:

- 25% of traffic travels through the Bridge Influence Area along I-5 from north of SR 500 to south of Columbia Boulevard,
- 51% of traffic enters the Bridge Influence Area from I-5 north of SR 500 and exits at an off-ramp within the Bridge Influence Area, or enters the Bridge Influence Area via an on-ramp and exits the Bridge Influence Area via I-5 south of Columbia Boulevard, and
- 24% of traffic enters and exits the Bridge Influence Area via on- and off-ramps within the Bridge Influence Area.

Of all afternoon/evening peak period northbound traffic traveling on I-5 across the Interstate Bridge and within the Bridge Influence Area:

- 32% of traffic travels through the Bridge Influence Area along I-5 from south of Columbia Boulevard to north of SR 500,
- 30% of traffic enters the Bridge Influence Area from I-5 south of Columbia Boulevard and exits at an off-ramp within the Bridge Influence Area, or enters the Bridge Influence Area via an on-ramp and exits the Bridge Influence Area via I-5 north of SR 500, and
- 38% of traffic enters and exits the Bridge Influence Area via on- and off-ramps within the Bridge Influence Area.

The comprehensive origin-destination survey found that 68% to 75% of all peak period and peak direction traffic traveling on I-5 across the Interstate Bridge and within the Bridge Influence

Area enter and/or exit I-5 via a ramp within the Bridge Influence Area. In other words, a substantial amount of traffic on this segment of I-5 directly accesses arterial roadways within the Bridge Influence Area.

In fact, 24% to 38% of the traffic traveling on the I-5 bridge uses both an on-ramp and an off-ramp within the Bridge Influence Area.

3.1.3 Traffic Demands and Capacities, and Duration of Congestion

Traffic counts were conducted in October 2005 on an hour-by-hour basis along I-5 at all of its ramps between the Pioneer Street interchange in Ridgefield, Washington to just south of the I-84 interchange in Portland, Oregon. At the same times, observations were conducted on vehicular queuing along the freeway and at on-ramps to compare the observed traffic counts with actual traffic demands.

Figure 3-4 illustrates 2005 traffic demands and the actual traffic served along northbound I-5 at the Interstate Bridge over the course of a typical weekday. As shown in the curve labeled "demand", the actual traffic demand currently exceeds the bridge's traffic-carrying capacity during part of the day. This results in fewer vehicles being served, as shown in the curve labeled "service", and congestion for about 4 hours with some trips being made later in the evening.

Figure 3-4. Northbound I-5 at Interstate Bridge Traffic Volume Profile (2005)

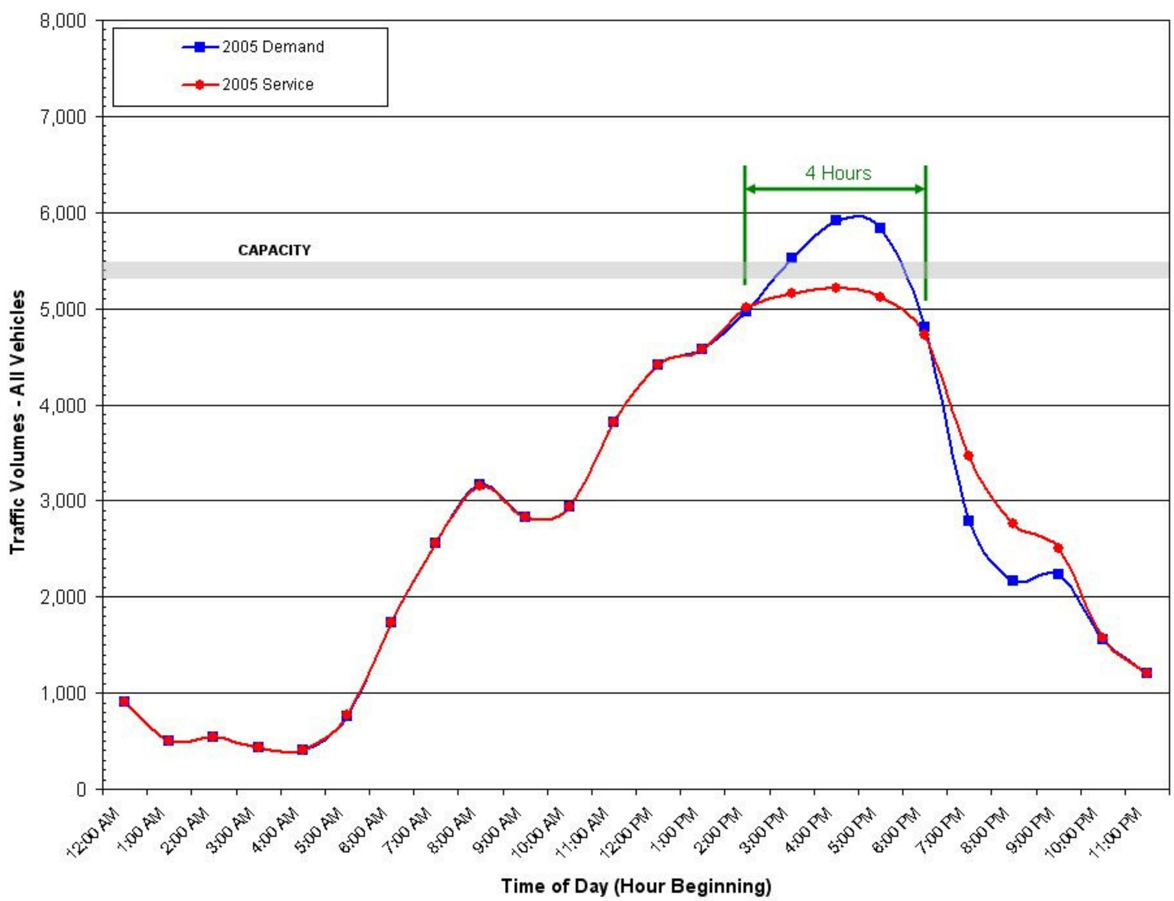
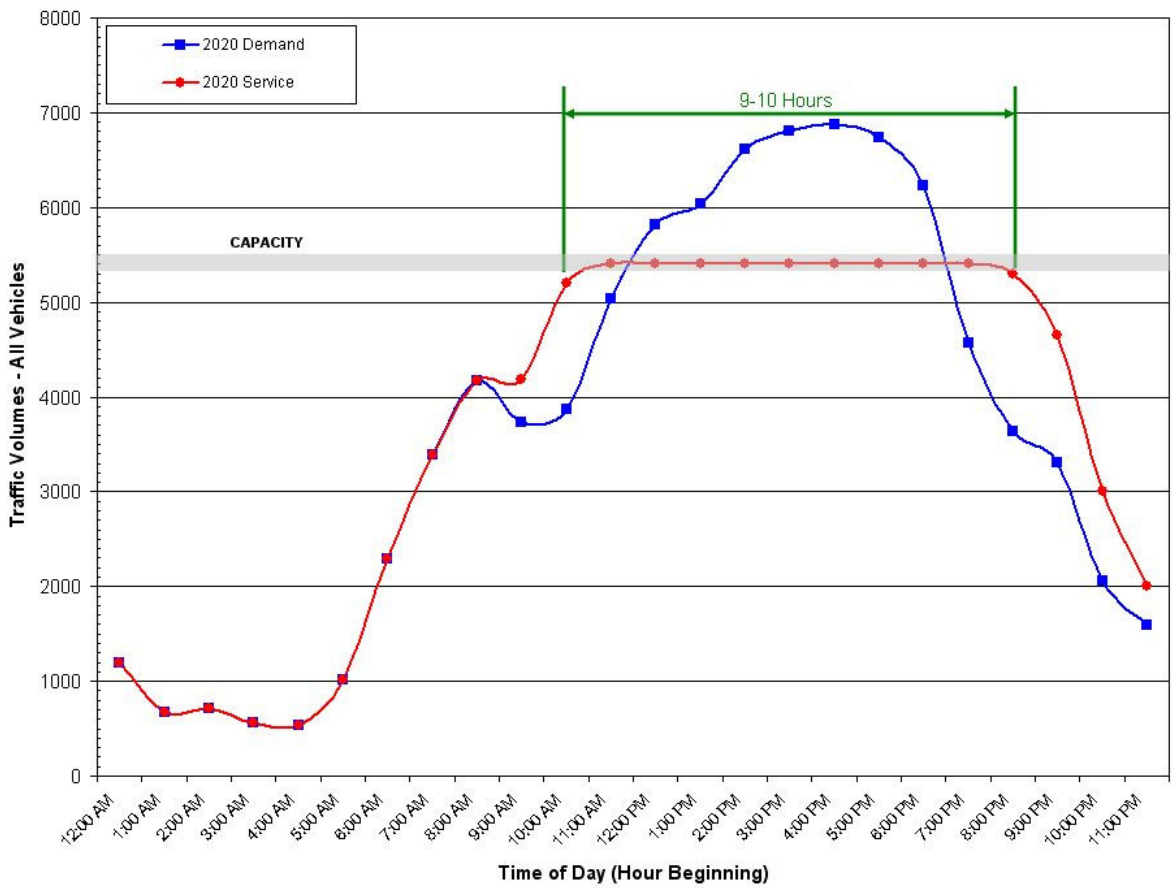


***Figure 3-5** shows and estimate of future hour-by-hour traffic levels along northbound I-5 at the Interstate Bridge. This assumes no highway capacity improvements are made within the Bridge Influence Area, no other corridor improvements are provided, and traffic demands increase to predicted 2020 levels. As shown in Figure 3-5, by year 2020 the duration of northbound congestion would be expected to increase to 9 to 10 hours from 4 hours under 2005 conditions. Similarly, the duration of southbound congestion would be expected to double over 2005 conditions by the year 2020.*

Figure 3-5. Northbound I-5 at Interstate Bridge Traffic Volume Profile (2020)



3.1.4 Attributes of Components Satisfying Question #1

It is evident that most existing vehicle-trips using I-5 within the Bridge Influence Area have a trip origin and/or trip destination along or near the I-5 corridor within the metropolitan region. The I-5 Bridge Influence Area, which includes eight interchanges with key arterial roadways and highways, is expected to continue to serve high travel demands due to existing and expected land uses served by these roadways and highways.

Due to the projected travel demands along I-5 and within the Bridge Influence Area, as long as no highway capacity improvements are made or other corridor improvements are provided, the duration of congestion along I-5 will significantly increase, creating congested conditions throughout much of the weekday and on weekends.

In order for a component to satisfy Question #1, the component must either:

- *Maintain future traffic demands such that they can be accommodated on I-5 within the Bridge Influence Area at acceptable congestion levels, or*
- *Increase the traffic-carrying capacity of I-5 within the Bridge Influence Area to accommodate forecast traffic levels at acceptable congestion levels.*

An analysis of potential transit markets and transit's role in reducing vehicular demand is discussed in the next section.

3.2 Question 2: Does the Component Improve Transit Performance Within the Bridge Influence Area?

3.2.1 Current Transit Problems

Bi-state transit service in the I-5 corridor currently includes one local bus route between downtown Portland and downtown Vancouver, and commuter-oriented peak period express routes from Clark County park-and-rides and transit centers to downtown Portland. Transit connections between Clark County and North and Northeast Portland are limited. Bi-state transit service in the I-5 corridor is constrained by limited roadway capacity and is subject to the same congestion as other vehicles, negatively affecting transit operations (i.e., travel speed) and reliability (i.e., delays caused by accidents and congestion).

Between 1998 and 2005, local bus travel times between the Vancouver Transit Center and Hayden Island increased 50 percent during the peak period. Local buses crossing the I-5 bridge in the southbound direction currently take up to three times longer during parts of the morning peak period compared to off peak periods. On average, local bus travel times are between 10 percent and 60 percent longer when traveling in the peak period direction.

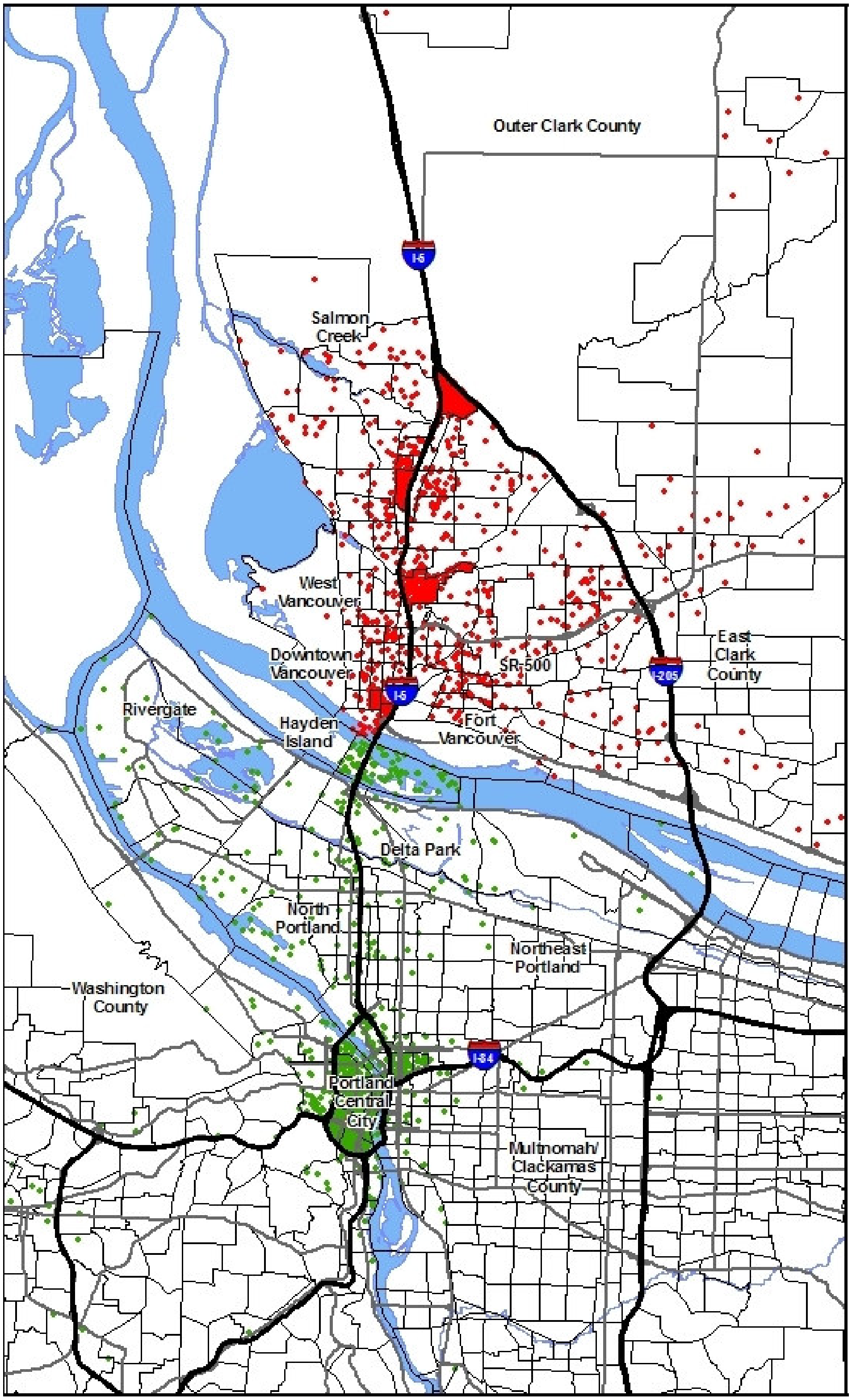
Commuter buses also experience congestion and incident-related delays. Commuter buses traveling southbound (i.e. in the peak direction) during the morning peak period have travel times between 45 percent and 115 percent longer than buses traveling northbound. Commuter buses traveling northbound during the afternoon peak period have the advantage of using the northbound High Occupancy Vehicle lane, however, these buses still experience travel times between 35 percent and 60 percent longer than commuter buses traveling southbound.

3.2.2 2020 Origins and Destinations of Transit Riders

The current transit problems within the I-5 corridor impact transit riders from both Tri-Met and C-TRAN. In order to determine whether a transit component would improve transit performance within the Bridge Influence Area, the existing and future market for public transit services should be well understood.

Figure 3-6 shows the projected origins and destinations of transit riders in the year 2020 under no-build conditions, as determined by work completed by the I-5 Partnership Study. With little exception, the majority of transit riders have origins and destinations tightly clustered around the I-5 corridor. Particularly evident is the significance of downtown Portland as an important origin point for the typical PM transit trip, and the significance of transit destinations immediately adjacent to I-5 in Clark County.

Figure 3-6. Year 2020: OR Origins and WA Destinations in PM Peak Period – Transit Only



It is expected that the transit riders of the future will have origins and destinations within and/or near the I-5 corridor itself, making I-5 the most direct means of accommodating future transit trips.

3.2.3 Projected Transit Problems

Transit travel times from downtown Portland to downtown Vancouver in the afternoon peak period are projected to double by the year 2020 if no improvements are made to the I-5 bridge or bi-state transit service. In the year 2000, this transit trip took an average of 27 minutes to complete, and in 2020 it is expected to take 55 minutes. A major cause of the increased travel times is expected growth in trips (by all modes) that use the I-5 bridge.

Previous analysis also highlighted the importance of operating transit in exclusive or semi-exclusive lanes or guideways. *In the I-5 Partnership study, the only alternatives that reduced I-5 corridor transit travel times between 2000 and 2020 were alternatives that either a) included light rail operating in exclusive ROW, or b) included buses operating in HOV (i.e., managed) lanes.*

3.2.4 2020 Transit Market Analysis

Transit riders comprise only a segment of the future market, as future transit services should also appeal to current SOV and HOV drivers who have similar origin and destination points. **Figure 3-1**, shown previously, depicts the specific origins and destinations for all modes in the year 2020 PM peak period. As illustrated in the figure, the future travel market for all modes is highly complimentary and shares the same geography as the future transit riders.

To better understand the projected growth in I-5 bridge demand, and which markets transit services should serve in the future, a more detailed analysis of 2020 person trips during the afternoon peak period was completed[1]. Person trips are defined as the sum of one-way, afternoon, 4-hour peak period trips made by all persons for all purposes in single occupancy vehicles (SOV), high occupancy vehicles (HOV), and transit. Potential transit markets are defined as geographic concentrations of person trips, from either Oregon or Washington, that use I-5 to travel between the states. Year 2020 data developed for the I-5 Partnership Study was analyzed, and assumes that no I-5 bridge improvements would be built. **Figure 3-7** shows the results of this analysis.

For trips expected to use the I-5 bridge during the afternoon 4-hour peak travel period in 2020:

1. Sixty-six percent (66%) of all person trips will be traveling northbound on I-5 from the Portland metropolitan area to Clark County. The remaining 34% will be traveling southbound from Clark County to the Portland metropolitan area.

2. *Over 80% of all northbound person trips will originate in five "I-5 corridor" districts: Hayden Island, Delta Park, Rivergate, North Portland, and Portland Central City. These*

[1] 2020 morning peak period trips were not analyzed as this travel model is not as thoroughly calibrated as the afternoon peak period model, due to incomplete freight and transit data.

five districts will account for approximately 25,200 trips in the 4-hour PM peak travel period.

3. In comparison, trips from the west of this corridor (e.g., Washington County, West Portland) and to the east (generally east of NE 33rd Avenue) will collectively account for less than 20% of the northbound afternoon trips that cross the I-5 bridge.

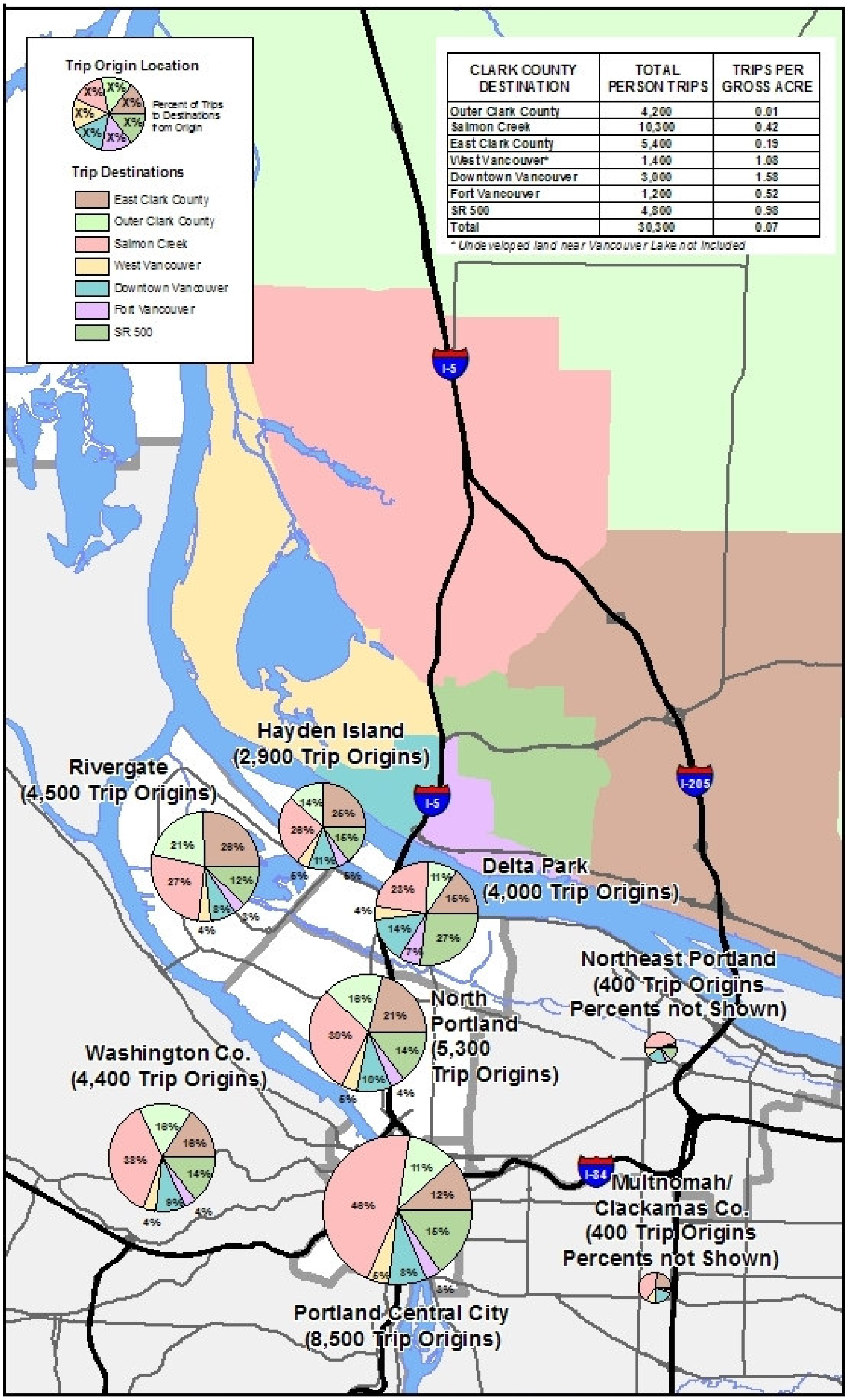
4. The Portland Central City, which includes downtown Portland, the Lloyd District, and Central Eastside Industrial District, will be the largest generator of person trips to Clark County (approximately 8,500 person trips). The Salmon Creek district will be the primary destination for these trips (3,900 trips).

5. North Portland will be the next largest trip producer to Clark County (5,300 trips), followed by Rivergate with 4,500 trips, Delta Park with 4,000 trips, and Hayden Island with 2,900 trips to Clark County.

6. The Bridge Influence Area will be a significant trip origin for trips to Clark County. Of the 30,264 total person trips from the Portland metropolitan area to Clark County, approximately 6,900 (23%) of the trips will originate in either Hayden Island or Delta Park. Both of these districts are within the Bridge Influence Area.

7. The Salmon Creek district will be the primary destination for seven of the eight Portland sub-markets. Roughly one-third of all northbound trips that will use the I-5 bridge during the afternoon peak period will be bound for the Salmon Creek district.

Figure 3-7. 2020 Person-Trips to Clark County Using I-5 Bridge in 4-HR PM Peak Period



CLARK COUNTY DESTINATION	TOTAL PERSON TRIPS	TRIPS PER GROSS ACRE
Outer Clark County	4,200	0.01
Salmon Creek	10,300	0.42
East Clark County	5,400	0.19
West Vancouver*	1,400	1.08
Downtown Vancouver	3,000	1.58
Fort Vancouver	1,200	0.52
SR 500	4,800	0.98
Total	30,300	0.07

** Undeveloped land near Vancouver Lake not Included*

3.2.5 Attributes of Components Satisfying Question #2

Transit and river crossing components that serve multiple I-5 corridor travel markets will attract greater transit ridership. Conversely, components that serve fewer markets due to out-of-direction alignments, unique transit operating characteristics and/or station spacing that would not match projected ridership patterns will attract less transit ridership, and have less of an impact on vehicular demand.

Transit components that operate in an exclusive or managed right-of-way will improve transit travel times and reliability because the risk of delay and accidents would decrease. Alternatively, adding significant new general purpose capacity could also reduce congestion levels, and improve transit travel times and reliability if congestion were sufficiently reduced. Conversely, components that subject transit to the same congested and unpredictable traffic conditions as SOVs do not improve transit operations.

In order for a component to satisfy Question #2, the component must:

- *Be able to serve a significant portion of the I-5 corridor transit markets, and*
- *Provide an exclusive or managed transit right-of-way to improve operations and reliability, or*
- *Provide enough highway capacity to reduce general congestion levels significantly, thereby improving transit performance.*

3.3 Question 3: Does the Component Improve Freight Mobility Within the Bridge Influence Area?

3.3.1 Freight Mobility

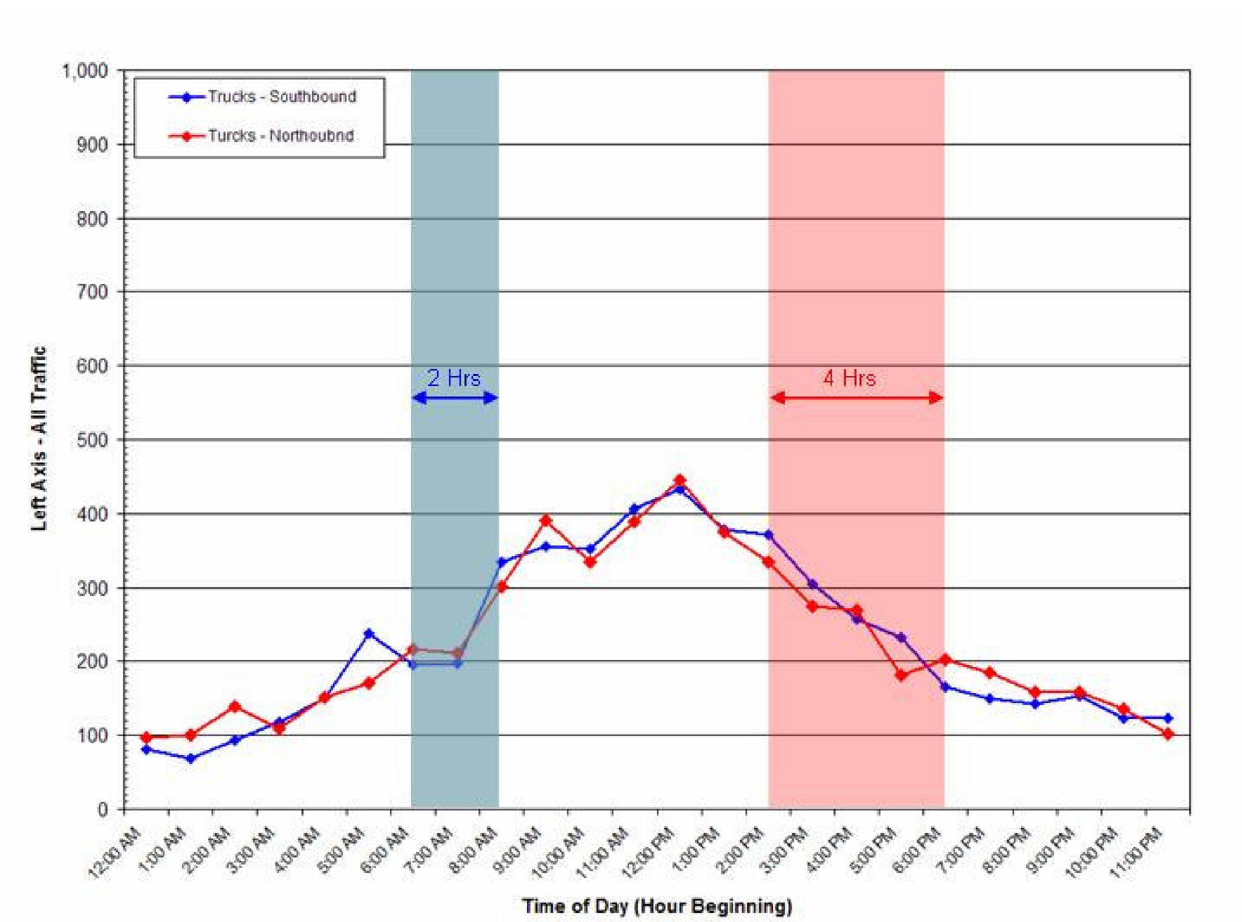
I-5 is the primary freight corridor for goods moving into and out of the Vancouver-Portland region and the Pacific Northwest. Access to significant industrial and commercial districts, including the Ports of Vancouver and Portland, and connections to marine, rail and air freight facilities, is adversely affected by congestion in the I-5 Bridge Influence Area.

Sixty-seven percent (67%) of all freight in the region travels by truck, and this is expected to grow to 73% by 2030. The increasing use of trucks is a reflection of the growing, diversifying and more demanding regional economy, which is leading to shipping practices becoming more tailored to the region's needs. There will continue to be a significant movement of bulk commodities in the region – which rely on non-truck modes – but their growth will occur at a slower rate than the smaller shipments of higher value products such as machinery, electronic components, prepared meat and seafood products, and mail and express traffic (principally moved by truck), which will represent a larger segment of the region's future economy. A corresponding phenomenon is that smaller shipments (under 1,000 pounds) have been, and will continue to be, the highest area of freight growth traffic.

Recent forecasts indicate that truck traffic in the region will double, and the logistics requirements for freight delivery time will become increasingly "just-in-time" – placing even more pressure on travel time reliability.

*Traffic congestion is increasingly spreading into the off-peak periods (including weekends) used by freight carriers, as shown in **Figure 3-8.** Declining freight carrier access slows delivery times and increases shipping costs, diminishing the attractiveness of I-5 and the uses served by I-5, and negatively affecting the region's economy.*

Figure 3-8. Northbound and Southbound I-5 Truck Volumes (2005)



3.3.2 Attributes of Components Satisfying Question #3

In order for a component to satisfy Question #3, the component must either:

- *Maintain future traffic demands such that they can be accommodated on I-5 within the Bridge Influence Area at acceptable congestion levels so freight is not further affected, or*
- *Increase the traffic-carrying capacity of I-5 within the Bridge Influence Area to accommodate forecast traffic levels at acceptable congestion levels, thereby improving freight mobility.*

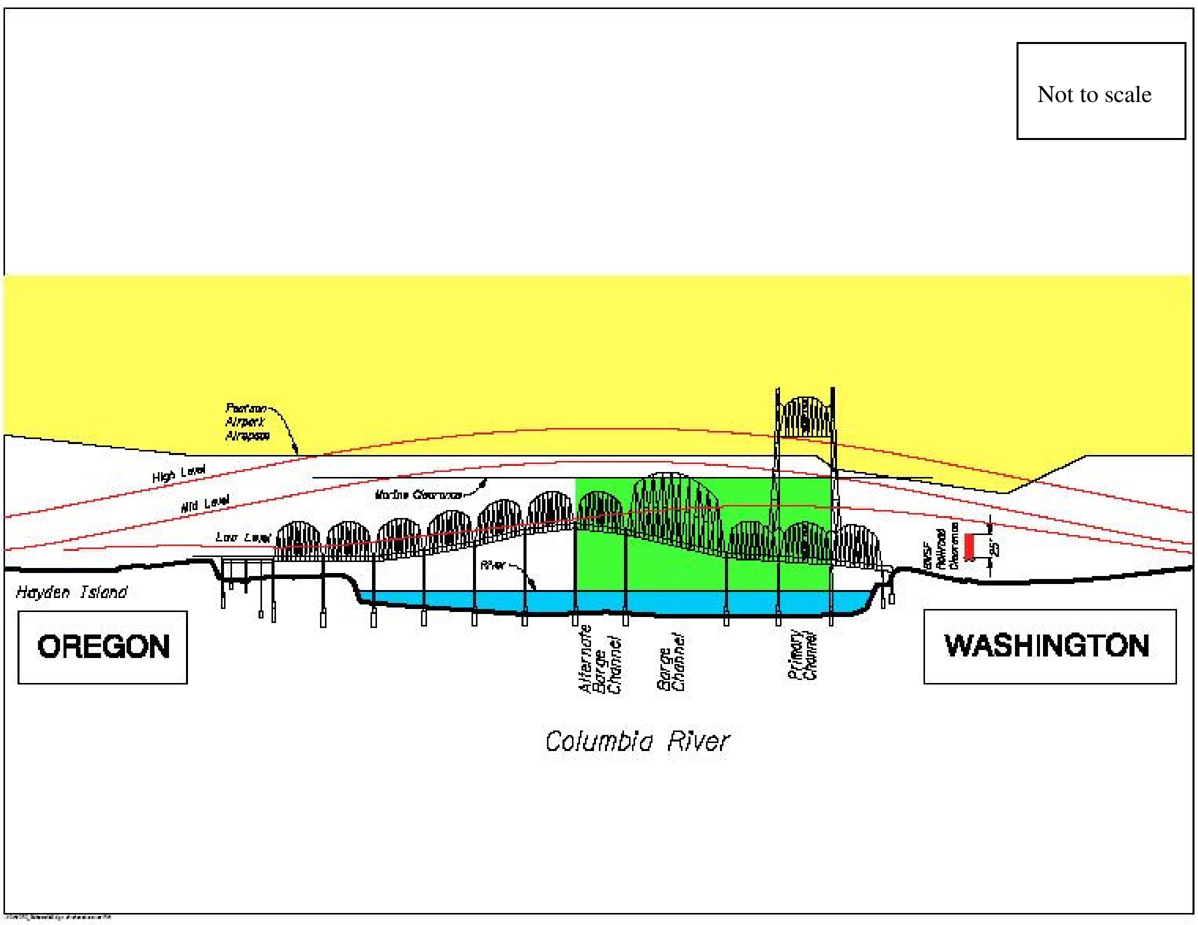
3.4 Question 4: Does the Component Improve Safety and Decrease Vulnerability to Incidents Within the Bridge Influence Area?

3.4.1 Safety and Incidents Related to Aviation

Two airports have influence on the airspace in the vicinity of the I-5 river crossing. Historic Pearson Airfield is located about one-half mile immediately east of I-5, while Portland International Airport (PDX) is located about three miles to the east of the project. For both airports, airspace requirements defined by the FAA must be considered to assess their impact on the vertical locations of the river crossing components (e.g. bridge towers).

The Pearson airspace has the most significant influence on the project because of its proximity to the existing I-5 bridge. FAA requirements state that airspace needs to be clear of obstructions for the safe operation of aircraft. This airspace was superimposed on an aerial map and the components were evaluated for penetration into the airspace. It should be noted that the existing I-5 bridge lift towers penetrate the Pearson airspace surface. ***Figure 3-9*** *shows how various bridge levels would relate to the Pearson airspace.*

Figure 3-9. Relationship of Bridge Levels to Pearson Airpark Airspace



PDX has two runways with approaches/departures bearing over the existing I-5 bridge. Currently PDX is proposing an expansion that would extend the north runway both to the west and to the east. As it exists, the north runway approaches/departs directly over the end of Pearson Airfield and the south runway tracks down the south shore of the Columbia River. In general, most potential river crossings do not encroach into the PDX airspace, with the exception of a high-level type structure.

3.4.2 Attributes of Components Satisfying Question #4 for Aviation

River crossings that are proposed upstream (east) of the existing bridge are closer to Pearson Airpark and thus must meet more restrictive standards to avoid impacting airspace requirements. Regarding the vertical location of a new bridge, a high or mid level bridge is also more likely to impact airspace requirements than a low level bridge (these different bridge heights are described further in the next section).

In order for a component to satisfy Question #4, the component:

- *Must not create a significant new encroachment into the Pearson Airport airspace, and*
- *Must not encroach into the PDX airspace.*

3.4.3 Safety and Incidents Related to Marine Navigation

Columbia River navigation clearances are controlled by the U.S. Coast Guard. This agency, which is the permitting authority for new bridge crossings, will base the permitting decision largely on whether marine navigation safety is improved or degraded by the project. The ability of a vessel to safely travel through the bridge area will be determined by the location of any new bridge piers. While this must be considered for all the bridge components, it is especially critical for any options that would retain the existing bridges while adding a new bridge. The Coast Guard has expressed a preference to reduce the number of obstacles to navigation in the river, which could only be achieved by construction of a replacement bridge. However, it may be possible to permit a supplemental bridge if it can be demonstrated that the placement of the piers for the new bridge will not further impede marine traffic.

Vertical clearances under a new bridge (and the existing bridges, if they are retained) will be another critical factor that the Coast Guard will consider in its permitting decision. Clearance requirements are dictated by the vessels that will pass under the bridge(s).

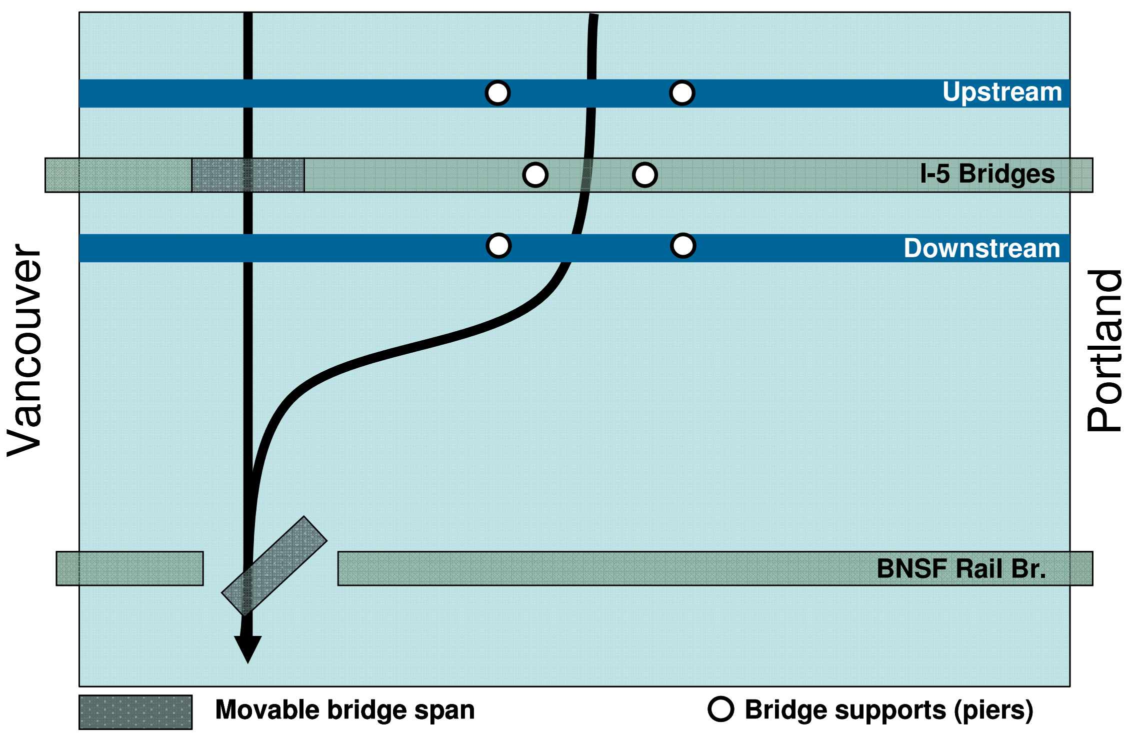
To understand the characteristics of existing river traffic, a boat survey was completed in 2005 identifying the existing vessel traffic using the river upstream of I-5. The survey found that most vessels using the river do not require a bridge opening to pass beneath I-5 except during higher water levels on the river. Additionally, the survey concluded that a clearance height of approximately 65 feet would accommodate all but six of the vessels identified in the survey, and a clearance height of approximately 110 feet would accommodate all known vessels using the river upstream of I-5.

Varying elevations and alignments of the river crossing options were evaluated as they relate to impacts on vessel navigation. Clearances defined as Low, Medium and High provide different clearance zones that would provide varying vessel passage percentages with the goal of minimizing or eliminating bridge openings. The river crossings were laid out using a clearance height of approximately 65 feet for a low level bridge, and approximately 110 feet of clearance for a mid-level bridge. These clearances should be provided over at least one of the existing navigational channels[2]. A high-level bridge would have a clearance of approximately 129 feet and would match the clearance of the existing I-205 bridge.

3.4.4 Attributes of Components Satisfying Question #4 for Marine Navigation

The horizontal location of a new bridge, either by itself or in tandem with the existing bridge, would affect vessel navigation operation and safety. Components that keep the existing bridges make it more difficult for navigational operations on the river. This is because vessels traveling on the river will need to navigate through another set of piers. In addition, the operators of river barges have stated that it is very difficult to navigate through the large channel opening of the I-5 bridge and then make an "S" curve to access the opening of the BNSF Railroad bridge downstream. Components that keep the existing bridges and that are located closer to the downstream railroad bridge have the greatest potential to create navigational problems on the river. ***Figure 3-10*** *shows the relationship of upstream and downstream new bridge locations as they might affect marine navigation.*

Figure 3-10. Marine Navigation Considerations



---

[2] Bridge elevations and clearances may be evaluated and discussed further with the Coast Guard throughout the project as more data is collected.

In order for a component to satisfy Question #4, the component:

- *Must maintain or improve navigational safety in the vicinity of the I-5 corridor crossings.*

3.4.5 Number of Vehicular Collisions and Collision Rates

An extensive review of motor vehicle collisions reported within and slightly beyond the I-5 Bridge Influence Area was conducted to assess collision frequencies, types and severities; and to assess collision relationships to existing non-standard highway geometrics, bridge span lifts, and time of day.

Collision data was obtained from both the Washington and the Oregon departments of transportation for the 5-year period from January 1, 2000 to December 31, 2004 (collision data for the calendar year 2005 was not available at the time of this analysis).

During the 5-year period, 2,204 collisions were reported on mainline I-5 and its ramps. There is no data available for collisions that were not reported.

There was an average rate of 1.21 reported collisions per day.

The standard transportation engineering method of reporting collision rates is in collisions per million vehicle-miles traveled. The average collision rate for "urban city interstate freeways" in Oregon is 0.60 collisions per million vehicle-miles traveled. The Washington State Department of Transportation does not calculate the average collision rate for urbanized interstate freeways within the state.

The collision rate experienced on I-5, within the Oregon segment of the Bridge Influence Area, was 1.34 collisions per million vehicle-miles traveled. This is 2.26 times greater than the average rate experienced on similar facilities in Oregon. The collision rate experienced within the Washington segment was 1.23 collisions per million vehicle-miles traveled.

3.4.6 Vehicular Collisions by Type and Severity

The number, type and severity of collisions reported during the 5-year period were compiled and plotted by direction (northbound and southbound) in 0.1-mile increments on maps of I-5.

Four collision types were reported: rear-end, side-swipe, fixed object, and other. Three severity types were reported: property damage only, injury, and fatality.

Figure 3-11 shows the number and type of collisions reported within I-5 Bridge Influence Area in Washington. **Figure 3-12** shows the number and type of collisions reported within I-5 Bridge Influence Area in Oregon.

Figure 3-11. Crash History by Crash Type for Mainline Highway and Ramps–January 2000-December 2004 (Washington)

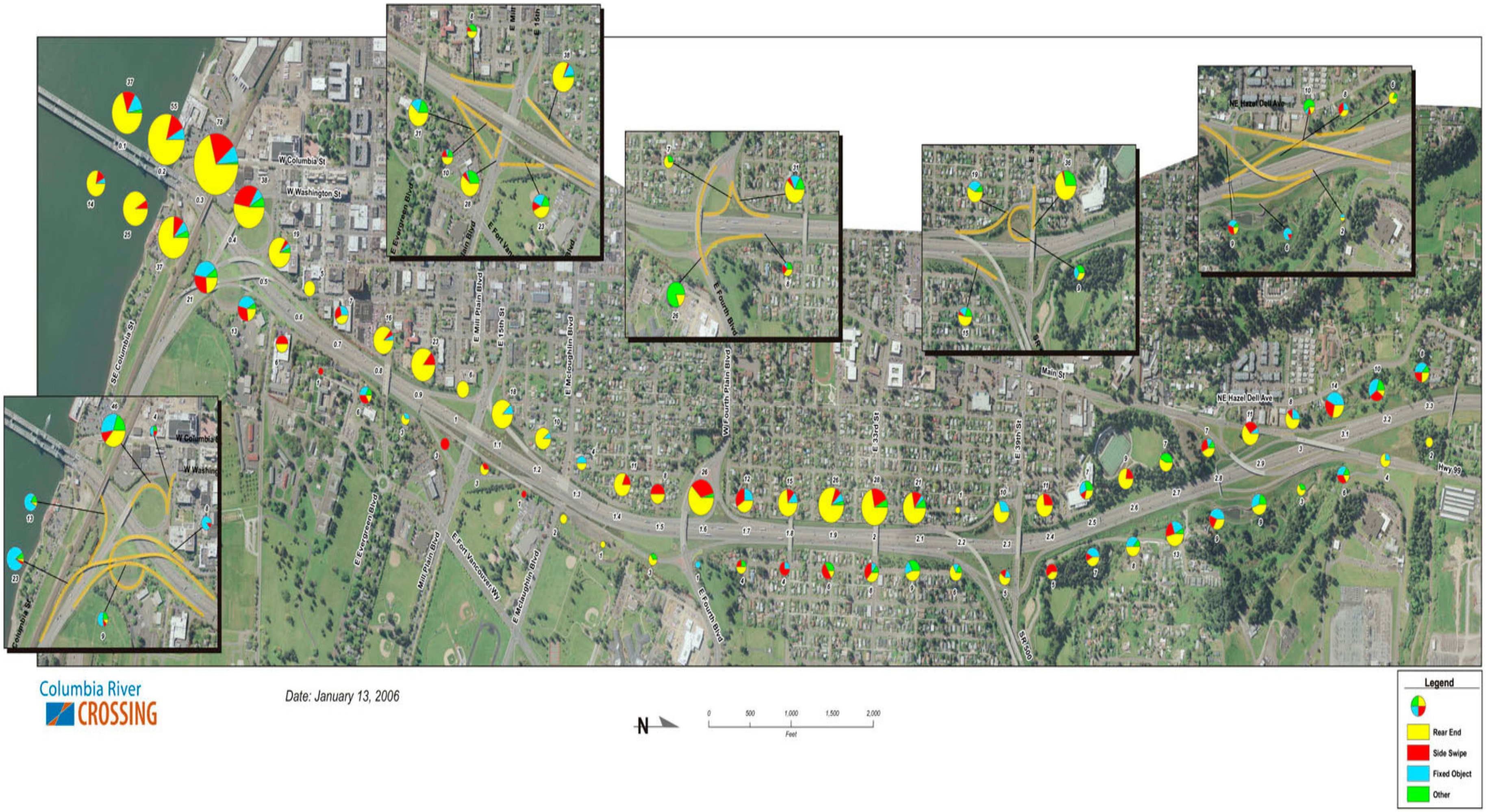
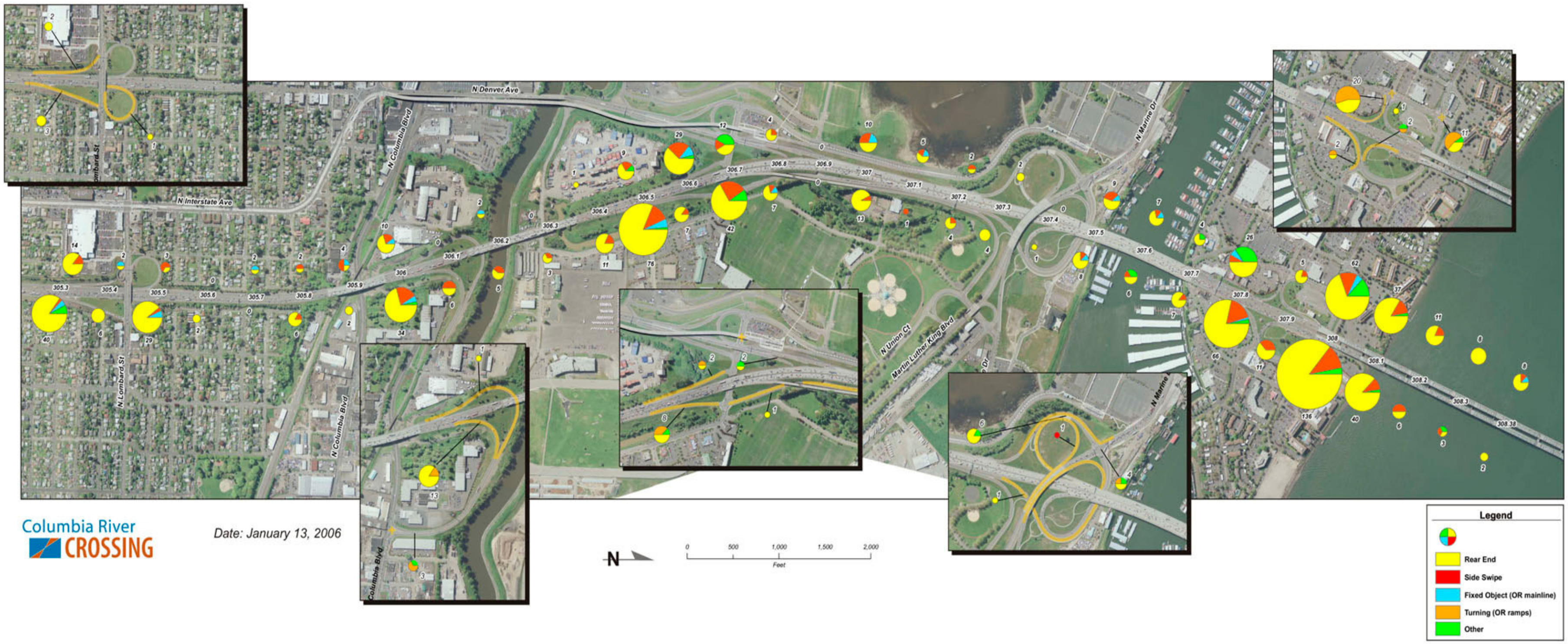


Figure 3-12. Crash History by Crash Type for Mainline Highway and Ramps–January 2000–December 2004 (Oregon)



A substantial portion of the reported collisions occurred near the approaches to the Interstate Bridge. Other notable collision locations included southbound I-5 at SR 14, at SR 500 and between Mill Plain Boulevard and SR 14 in Washington. In the northbound direction, high collision locations were at Hayden Island Drive, at Victory Boulevard, and at Lombard Street in Oregon.

For the period analyzed, the total number of southbound collisions that occurred in Washington was about twice that reported in the northbound direction. Sixty-nine percent (69%) of these collisions were rear-ends and 18% were side-swipes.

The total number of northbound collisions that occurred in Oregon was about twice that reported in the southbound direction. Eighty percent (80%) of these collisions were rear-ends and 14% were side-swipes.

3.4.7 Relationship of Vehicular Collisions to Highway Geometrics

A review was conducted to determine geometric elements of I-5 that do not meet current design standards. While I-5 within the Bridge Influence Area was originally constructed to generally meet design standards applicable at the time, design standards have evolved over the years, reflecting continued research in areas such as vehicle operating characteristics, driver expectations, traffic volumes, and physical highway elements.

The Federal Highway Administration has designated 12 geometric controlling criteria that have a primary importance for safety. These criteria are: design speed, grades, lane width, stopping sight distance, shoulder width, cross-slopes, bridge width, superelevation, horizontal alignment, horizontal clearance, vertical alignment, and vertical clearance.

The Washington and Oregon departments of transportation have developed geometric design standards related to each of the above controlling criteria. Their current design standards were compared to I-5 existing geometrics within the Bridge Influence Area. Particular emphasis was placed on the following elements, each related to one or more of the above criteria:

- Ramp-to-highway acceleration lane length
- Highway-to-ramp deceleration lane length
- Highway weaving area lane length
- Highway horizontal alignment
- Highway vertical alignment
- Highway shoulder width

It is evident that non-standard geometric features exist throughout the I-5 Bridge Influence Area, including short ramp merges/acceleration lanes, short ramp diverges/deceleration lanes, short weaving areas, vertical curves (crest and sag curves) limiting sight distance, and narrow shoulders.

The greatest concentration of existing non-standard geometric features is located along the Interstate Bridge and along its approaches. Within this area, there are multiple existing non-standard features.

Many ramps within the extent of the I-5 Bridge Influence Area do not provide standard acceleration or deceleration lane lengths and some weaving areas are also non-standard. Non-standard shoulder widths are prevalent in many areas of the I-5 Bridge Influence Area.

Based upon a comparison of the non-standard geometric features and reported collisions, there is a strong correlation between the presence of non-standard design features and the frequency and type of collisions.

For example, non-standard acceleration and deceleration lanes at several on- and off-ramps contribute to a high number of rear-end and side-swipe collisions along northbound I-5, particularly at Hayden Island Drive, Downtown Vancouver Exit, and at SR 14. Along southbound I-5, non-standard acceleration and deceleration lanes contribute to a high number of rear-end and side-swipe collisions at Fourth Plain Boulevard, SR 14, Hayden Island Drive, and at Victory Boulevard.

Existing non-standard weaving areas contribute to a high number of rear-end and side-swipe collisions along I-5, primarily in the southbound direction between SR 500 and Fourth Plain Boulevard, between Mill Plain Boulevard and SR 14, between Hayden Island Drive and Marine Drive, and between Marine Drive and Victory Boulevard.

The distance between the on- and off-ramps next to the Interstate Bridge and the bridge itself are substantially below standard; the bridge's vertical alignment results in non-standard crest and vertical curves (resulting in limited sight distance); and the bridge's shoulders are well below standard. All of these elements contribute to the high number of reported collisions near or at the Interstate Bridge.

3.4.8 Vehicular Collisions During Bridge Lifts and Traffic Stops

The I-5 northbound and southbound bridges include lift spans. Lifting of the spans or stopping of traffic for maintenance (even when the span is not lifted) is allowed on weekdays between 9:00 a.m. and 2:30 p.m. and overnight between 6:00 p.m. and 6:30 a.m., and is allowed any time during weekends.

An analysis was conducted to determine if the potential for a collision increases during bridge lifts and/or traffic stops. Logs obtained from the Oregon Department of Transportation's Maintenance Unit, which maintains and operates the bridge, include information on bridge lift/traffic stop dates, times and duration.

Using the 5-year collision database, a comparison was made between collisions that were reported to have occurred within a one-hour window of logged bridge lifts/traffic stops on weekdays between 9:00 a.m. and 2:30 p.m. The analysis only considered collisions that would involve vehicles approaching the bridge (i.e., northbound traffic approaching the bridge and southbound traffic approaching the bridge) as bridge lifts/traffic stops directly impact approaching traffic and may not have an effect on departing traffic.

Based on the analysis, it was determined that there is at least a 3 times higher likelihood of a northbound collision when a bridge lift/traffic stop occurs than when it does not. There is over a 4 times higher likelihood of a southbound collision when bridge lift/traffic stop occurs than when it does not.

It was also shown that collisions occurring during bridge lifts/traffic stops generally result in a higher amount of rear-end collisions and greater injury frequency than those collisions that occur during non-lift/non-stop periods.

3.4.9 Vehicular Collisions by Time of Day

The number and type of collisions reported in the I-5 Bridge Influence Area during the 5-year period were sorted on an hour-by-hour basis and by direction. **Figure 3-13** shows the number of collisions, by hour, that was reported along southbound I-5. **Figure 3-14** shows the number of collisions, by hour, that was reported along northbound I-5.

Figure 3-13. Southbound I-5 Crashes by Time of Day from Hwy 99/Main Street to Lombard Street (2000-2004)

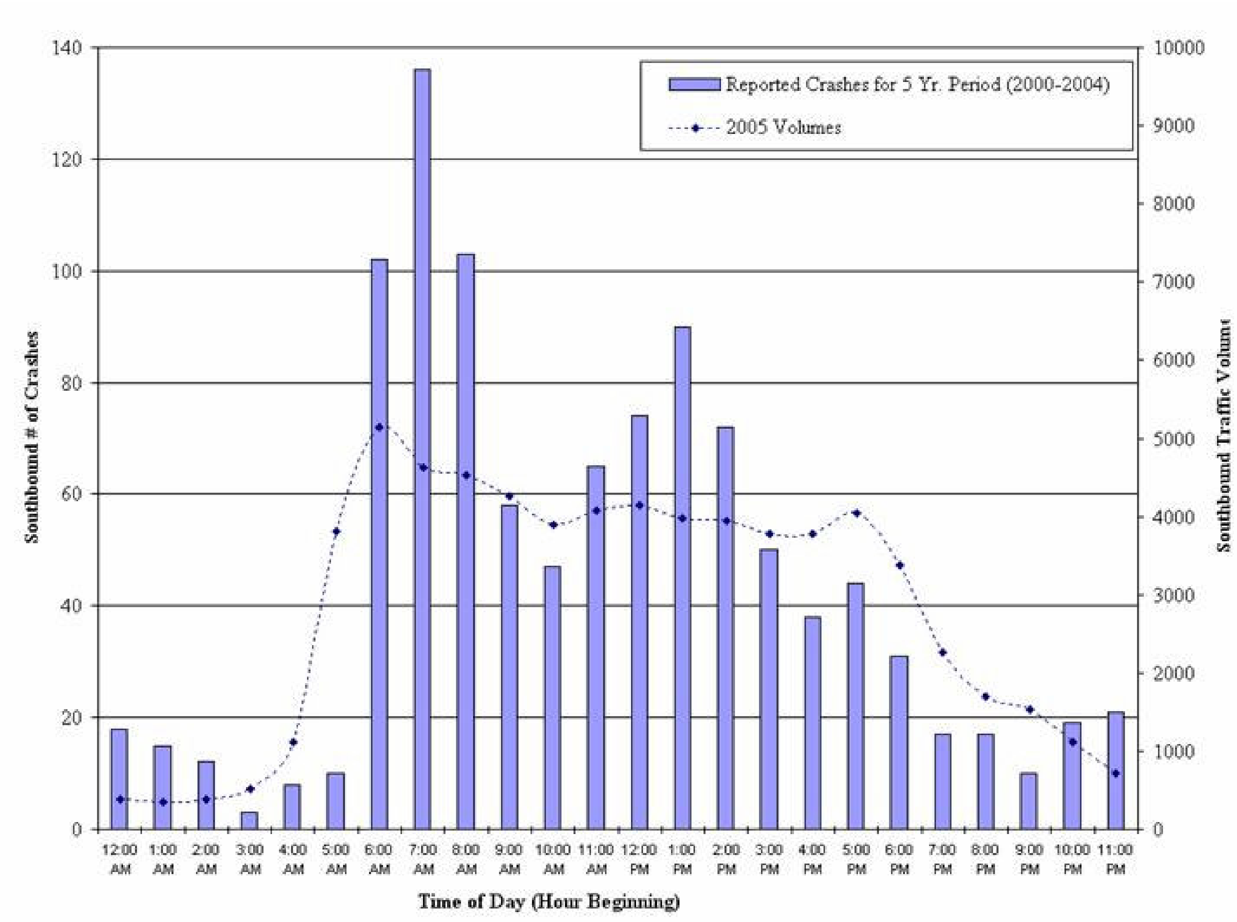
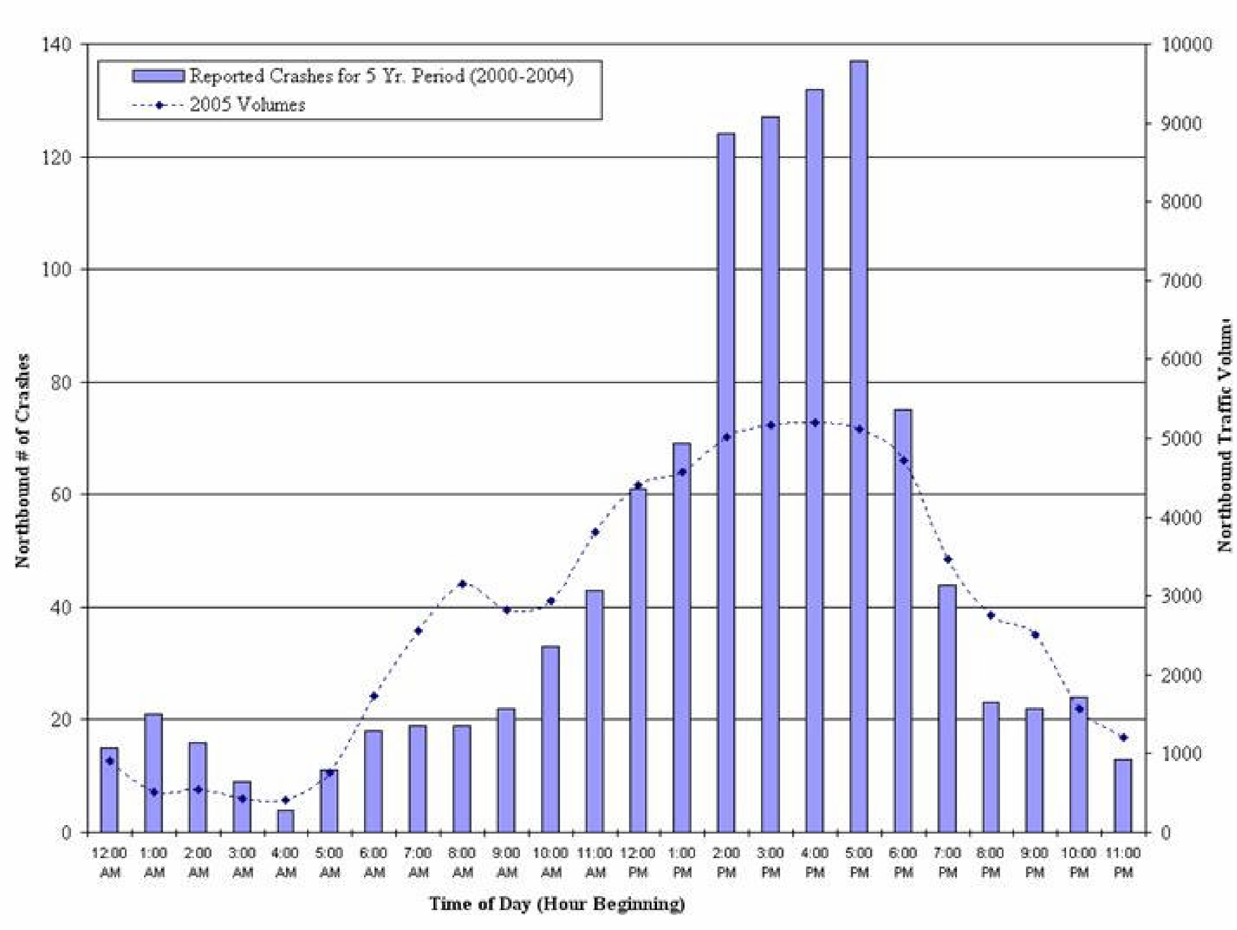


Figure 3-14. Northbound I-5 Crashes by Time of Day from Lombard Street to Hwy 99/Main Street (2000-2004)



Curves depicting existing traffic counts on the Interstate Bridge were added to **Figures 3-13 and 3-14** to determine if a correlation exists between collision frequency and traffic volumes.

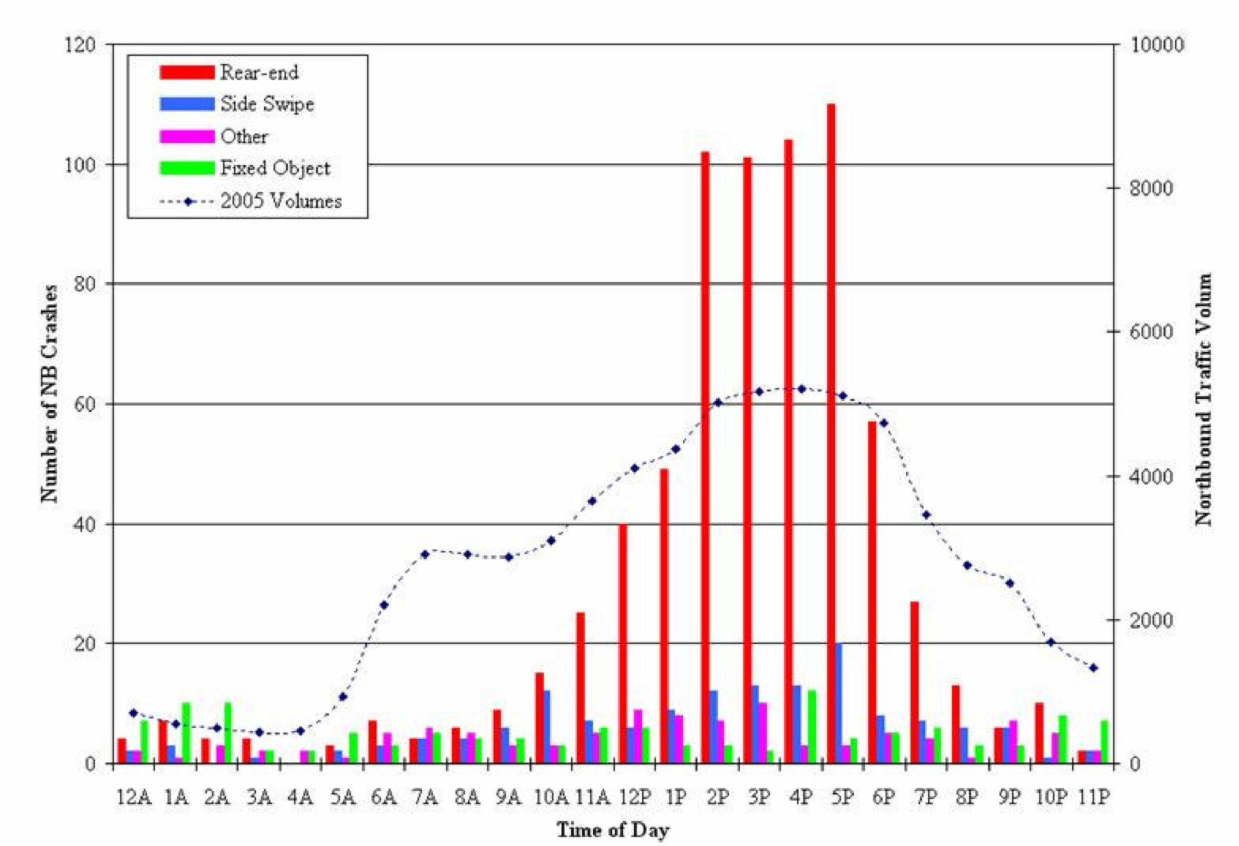
As shown in **Figure 3-13**, during periods when traffic is uncongested along southbound I-5, the number of reported collisions is generally proportional to prevailing traffic volumes (except during late night periods when the number of fixed-object and alcohol-related collisions increase). However, during periods when traffic volumes approach near-congestion or operate at congested levels, collisions increase significantly.

Figure 3-14 confirms the same results for northbound I-5. During periods approaching or at congestion, the frequency of collisions is substantially higher than during uncongested periods.

The frequency of collisions is generally proportional to prevailing traffic volumes, except during near or at-capacity conditions, when the frequency of collisions is about twice the proportion of congested traffic levels.

Figure 3-15 compares reported northbound I-5 collision types to time-of-day and to existing traffic volumes. During near or at-congested periods, the number of rear-end collisions increases substantially. As noted previously, rear-end collisions are the most prevalent along I-5 Bridge Influence Area, and the higher proportion that results during congestion periods could be attributed to existing non-standard design features as well vehicular queuing during peak conditions.

Figure 3-15. Northbound I-5 Crashes by Type and Time of Day from Lombard Street to Main Street/Hwy 99 (2000-2004)



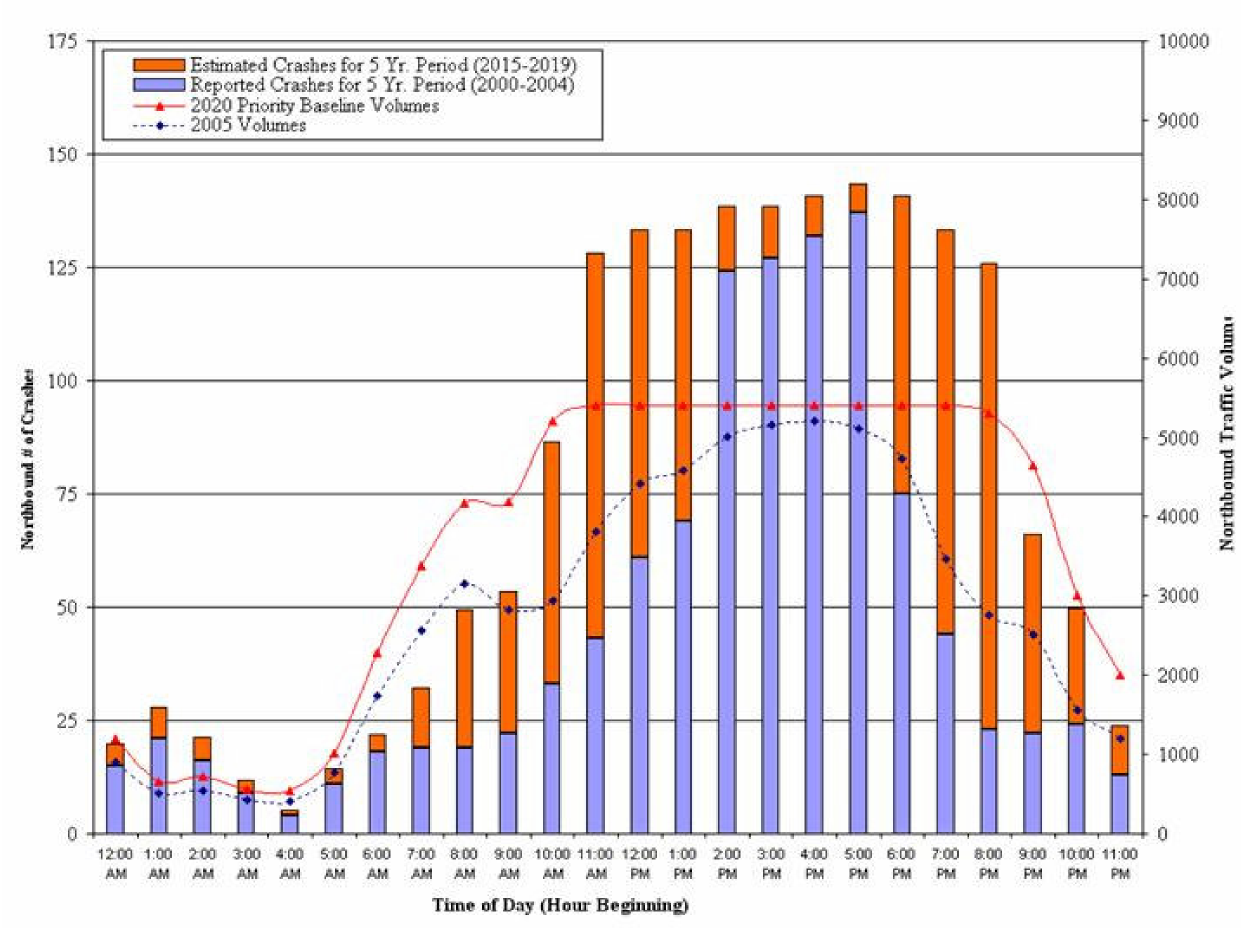
3.4.10 Attributes of Components Satisfying Question #4 for Vehicular Traffic

It is evident that the existence of non-standard geometric design features, the presence and duration of congested traffic conditions, and the occurrence of bridge lifts/traffic stops all contribute to the high number of vehicular collisions and the high collision rate in the I-5 Bridge Influence Area.

As long as the existing non-standard design features remain, the numbers of collisions are likely to substantially increase as traffic demands rise and the duration of congestion extends to more hours of the day.

Figure 3-16 shows predicted future collisions along northbound I-5 assuming no improvements are made within the Bridge Influence Area (i.e., existing non-standard geometric features remain and no traffic capacity is added) and traffic demands increase to predicted 2020 levels. As shown in **Figure 3-16**, by 2020 the duration of northbound congestion would be expected to increase to 9 hours from 4 hours under 2005 conditions. It is predicted that the increase in traffic levels and extension of congestion would increase the potential for collisions by 70% over existing conditions. Similar results would be expected in the southbound direction of I-5 within the Bridge Influence Area.

Figure 3-16. Northbound I-5 Crashes and Traffic Volumes at Interstate Bridge



In addition, as long as the existing non-standard features remain, traffic levels increase, and bridge lifts/traffic stops continue at their current rate or increase in the future to further maintain the bridge, the number of collisions are likely to substantially increase.

In order for a component to satisfy Question #4, the component must either:

- *Reduce future I-5 traffic demands compared to today's levels (this scenario would not require that existing non-standard geometric features be improve), or*

- *Redesign I-5 within the Bridge Influence Area to meet current design and safety standards.*

3.5 Question 5: Does the Component Improve Bicycle and Pedestrian Mobility Within the Bridge Influence Area?

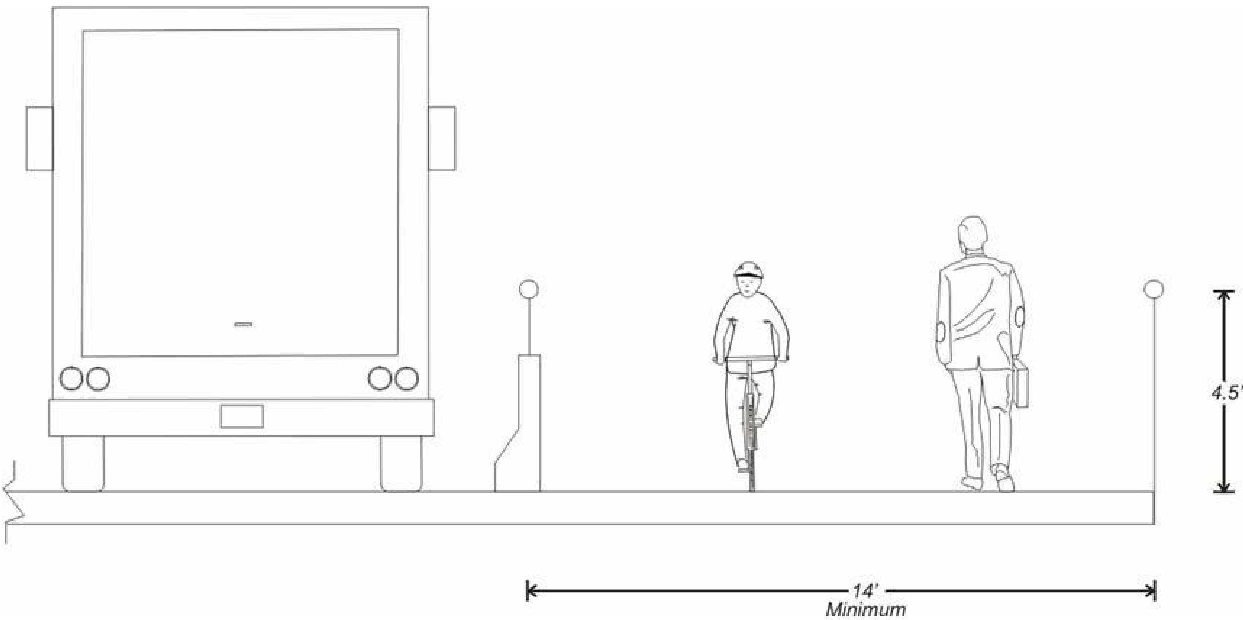
3.5.1 Bicycle and Pedestrian Mobility

Several elements of the existing bicycle and pedestrian network within the I-5 Bridge Influence Area do not enable safe and efficient mobility for bicyclists, pedestrians and disabled persons.

For example, although sidewalks are present on the Interstate Bridge (there is one on the west side of the southbound bridge and one on the east side of the northbound bridge), the sidewalks do not meet the minimum standards for shared use. The existing sidewalks vary in width from 3 to 6 feet and the minimum standard width for a shared pathway is 14 feet (per WSDOT and ODOT), as shown in ***Figures 3-17 and 3-18****. Provision of standard width pathways enable safe passage for bicyclists, pedestrians and disabled persons traveling in the same direction and in opposite directions.*

Figure 3-17. Photograph of Existing Non-Standard Multi-Use Pathway

Figure 3-18. Minimum Standard Multi-Use Pathway on a Bridge Structure



In addition, the existing sidewalks are located within 1 foot of the traffic lanes on the bridge, creating uncomfortable conditions for sidewalk users, and the existing railings separating users from traffic do not meet current design and safety standards.

Most of the connecting approaches to the Interstate Bridge sidewalks also do not meet multi-modal design, or Americans with Disabilities Act, standards.

Many of the connecting walkways and bikeways within the I-5 Bridge Influence Area, including along and adjacent to roadways in downtown Vancouver, on Hayden Island and near Marine Drive, do not enable safe and convenient bicycle, pedestrian and disabled person mobility for person trips approaching the river crossing. The routing is circuitous, confusing and consists of many impediments.

3.5.2 Attributes of Components Satisfying Question #5

In order for a component to satisfy Question #5, the component must either:

- *Improve the existing sidewalks across the Interstate Bridge, as well as other key bicycle, pedestrian and disabled person connections, to meet or exceed current shared use design standards, as well as provisions in accordance with the Americans with Disabilities Act, or*
- *Provide, as an element of a new river crossing, a new shared use pathway designed to meet or exceed applicable standards, to serve bicyclists, pedestrians and disabled persons.*

- *In addition, the component must improve bicycle, pedestrian and disabled person connections within the Bridge Influence Area to provide more direct routing and reduce or eliminate route impediments.*

3.6 Question 6: Does the Component Reduce Seismic Risk of the Columbia River Crossing?

3.6.1 Seismic Deficiencies

Both the Washington and Oregon departments of transportation acknowledge that the existing I-5 bridges do not meet today's seismic design standards and would be vulnerable in a major seismic event. A 1995 analysis of the lift span portion of the bridges revealed that items such as the timber piling in the foundations and steel braces in the lift span towers were insufficient to resist potential seismic forces.

3.6.2 Attributes of Components Satisfying Question #6

WSDOT and ODOT have agreed that all new structures that comprise the I-5 river crossing should be designed to the latest nationally accepted bridge design specifications. The existing I-5 bridges, if left in service and paired with a supplemental I-5 bridge, would also be seismically retrofitted if this is determined to be feasible in the design phase of this project. Meeting these specifications will reduce the risk of collapse during a seismic event, as they incorporate industry best practices for structure design and state-of-the-art design analysis procedures (based on national research and actual lessons learned from seismic events such as the Loma Prieta and Northridge earthquakes in California).

In order for a component to satisfy Question #6, the component must:

- *Provide a new river crossing within the Bridge Influence Area that is designed to the latest nationally accepted bridge design specifications, and/or*
- *Seismically retrofit the existing I-5 bridges if they are to remain in service, recognizing that the feasibility of a retrofit has not yet been determined.*

3.7 Other Considerations

In addition to the aforementioned issues, project staff was asked to consider and note factors that would likely jeopardize the overall feasibility of a component. Factors that could negatively impact a component's feasibility include: fundamental constructability problems, transit system integration problems, untested technology or facility designs, and consistency with currently adopted regional and statewide plans.