REVIEW DRAFT

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

I-5 and I-205 Deficiencies Analysis

Working Paper 12.34

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OVERVIEW

The purpose of this Working Paper is to identify existing operational and geometric deficiencies on I-5 and I-205 within the Bridge Influence Area (BIA). The BIA for I-5, as defined by the I-5 Partnership Strategic Plan, extends from Columbia Boulevard in Oregon to SR 500 in Washington.. For the purposes of this paper, ~~we~~the BIA ~~define a BIA and~~ on I-205 is defined~~,~~ from Sandy Boulevard in Oregon to SR 500 in Washington.

The analysis of deficiencies include:

- Description of Congestion and Level of Service
- Accident Analysis
- Summary of Interviews with ODOT and WSDOT Maintenance Superintendents to identify problem areas.
- Existing geometric deficiencies

CONGESTION AND LEVEL OF SERVICE

Working Paper 4.3, Travel and Traffic Characteristics and Trends, provides a detailed look at current and projected traffic volumes for both I-5 and I-205 within their BIAs. In 2003, typical Average Weekday (AWD) traffic on the six lane I-5 Interstate Bridge was 129,500, and on the eight-lane I-205 Glenn Jackson Bridge the AWD was 143,600.

In general, I-5 operates at capacity with directional peak hour volumes about 5,300 to 5,600 vehicles per hour (vph). Between 6 AM and 7 PM, hourly volumes along the Interstate Bridge are relatively consistent with a southbound AM peak of relatively short duration and a longer northbound PM peak. Volumes stay relatively high all day on I-5 with mid-day directional totals dropping about a 1,000 vph.

The I-205 Glenn Jackson Bridge accommodates nearly ~~up to~~ 3,000 vph more than the I-5 Interstate Bridge because of the extra two lanes, with AM and PM peak rates about 8,000 vph. I-205 displays more traditional peaking than I-5 with mid-day directional totals dropping by half. Morning and evening peaks occur ~~characteristics, particularly~~ between 6 AM and 10 AM, and between 3 PM and 7 PM respectively.

Existing travel demand, for both regional bi-state travel and local access, approaches or exceeds the capacity of the interchange areas along I-5 and I-205 within the BIAs. On I-5 during the weekday PM period, northbound bottlenecks occur primarily due to the I-5 Interstate Bridge and merging areas just upstream of the bridge. AM peak period southbound bottlenecks on I-5 occur at the I-5 Bridge, and at the Victory Boulevard on-ramp just downstream of the three-lane to two-lane transition. By 2020, these bottlenecks and the associated back-ups are projected to expand.

Comment [MSOffice1]: Does this mean I-205 accomodates 8300-8600 vph? Then say that.

Comment [MSOffice2]: Does this mean I-5's peaking pattern is not "traditional"? How?

Comment [MSOffice3]: Is the bottleneck caused by the on-ramp or the 3 lane to 2 lane merge?

On I-205, congestion occurs in the southbound direction in the vicinity of the SR 500 interchange area and in the vicinity of the Mill Plain Boulevard interchange area to SR 14 during the AM peak hour. Northbound congestion extends from the Glenn Jackson Bridge back alongto I-205.

Comment [MSOffice4]: The Jackson Bridge is ON I-205 – do you mean back to I-84?

Several sections along I-5 and I-205 experience travel speeds less than 30 mph during peak hours, with Volume Capacity ratios between 0.9 and 1.0+ during peak conditions. Several sections of weaving lanes on both I-5 and I-205 are operating at a failing Level of Service (LOS F). Ideally, the freeway would operate at LOS D or better. By year 2020, much of I-5 and I-205 areis projected to operate at LOS E or F during prolonged peak periods.

ACCIDENT ANALYSIS

The Oregon and Washington Departments of Transportation provided accident data for I-5 and I-205 within the Portland/Vancouver metro area. Accident data was evaluated along I-5 between the I-84 junction in Portland and the SR 500 junction in Vancouver, and along I-205 between Sandy Boulevard in Portland and the SR 500 junction in Vancouver. ODOT Region 1 provided the analysis/summary of accident data in this report for I-205 from Sandy Boulevard to the Columbia River.

Available accident data was summarized by travel direction for accident type and severity. Accident rates were calculated per million vehicle miles traveled and compared to statewide accident rates of similar facilities in Oregon and Washington, with accident statistics in Oregon being compared to Oregon averages, and Washington statistics being compared to Washington averages. The statewide averages are very different for Oregon and Washington, with 0.61 accidents per million vehicle miles on similar urban interstates in Oregon, compared to a rate of 1.41 on similar routes in Washington. In interviews, ODOT and WSDOT did not have a reason for the difference. (In this analysis it is assumed that the accident data should be compared to each state's respective average.)

Additionally, ODOT and WSDOT use safety-monitoring systems to identify safety needs and prioritize safety investments. A review of these systems was performed for the I-5 and I-205 segments identified above.

Washington State Accident Data

Accident data was summarized for the most recent available five years (1999 to 2003) from the Columbia River to SR 500. The following sections summarize the results for I-5 and I-205 in Washington.

Interstate 5 - Washington: Columbia River to SR 500

The following is a summary of requested accident information along I-5 from the Columbia River (M.P. 0.00) to SR 500 (M.P. 2.35). **Table 1** provides a summary of the accidents occurring on the mainline for the most recent available five-year period between 1999 and 2003.

Table 1: I-5 Mainline Accident Summary (1999-2003)- Washington Columbia River (M.P. 0.00) to SR 500 (M.P. 2.35)

Direction	Accident Type								
	Rear-end	SS	F.O.	Over.	Angle	Parked	Nonc.	Other	**Total**
Northbound	96	36	33	4	0	0	0	9	178
Southbound	361	68	42	1	0	0	1	11	484
Both Directions	457	104	75	5	0	0	1	20	662

Accident Severity				
Fatality	Disabling Injury	Evident Injury	Possible Injury	Property Damage Only
1	7	44	194	416

SS = Sideswipe F.O. = Fixed-Object Nonc. = Non-Collision Over. = Vehicle Overturned

Accident Type: As shown in Table 1, there were a total of 662 reported mainline accidents with 73% of accidents occurring in the southbound direction. The majority of accidents involved rear-end (69%) and sideswipe (16%) incidents indicative of congested freeway operations.

Time of Day: Today, southbound I-5 peaks during the morning while northbound I-5 peaks during the afternoon/evening. Approximately 35% (62 of 178) of the northbound accidents occurred during the 3:00-7:00 PM peak period while approximately 44% (213 of 484) of the southbound accidents occurred during the 6:00-10:00 AM peak period. Northbound volumes for the 3:00-7:00 PM period are about 7% higher than the southbound volumes for the 6:00-10:00 AM period. The higher rates of southbound accidents in Washington are indicative of vehicles rapidly reducing speed to queue for the bridge crossing. In Oregon, the higher percentages of accidents are northbound.

Accident Severity: Most mainline freeway accidents were of lower severity- involving property damage only and possible injury. One fatal accident occurred near SR 14 (M.P. 0.20) heading southbound and involved a driver traveling too fast for the conditions that struck the bridge rail.

Accident Rate: The calculated five-year (1999-2003) accident rate for this section of I-5 is 1.34 accidents per million vehicle miles traveled. The calculated four-year (1999-2002) accident rate is 1.35. This is slightly lower than the four-year (1999 to 2002) Washington statewide average accident rate of 1.41 accidents per million vehicle miles traveled on similar Washington urban interstates.

Freeway Ramps: A combined total of 420 accidents occurred on the ramps at the SR 14, Mill Plain Boulevard, Fourth Plain Boulevard, and SR 500 entrance/exit ramps. Of those, 135 occurred on northbound ramps, 194 occurred on southbound ramps, and the remaining 91 accidents occurred on the overpasses. Over half of the accidents occurring on the ramps involved rear-end incidents.

Accident Priority: The High Accident Location (HAL) and High Accident Corridor (HAC) programs by WSDOT are used to identify and correct unsafe locations. Ramps on interstate interchanges are frequently HALs. I-5 had five ramps qualify as HAL sites. The HAL locations are as follows:

- Southbound I-5 on-ramp from SR 14 – M.P. 0.00 to 0.35
- Northbound I-5 off-ramp to Fourth Plain Blvd – M.P. 0.12 to 0.66
- Southbound I-5 off-ramp to Fourth Plain Blvd – M.P. 0.11 to 0.22
- Along Mill Plain Blvd at I-5 overcrossing M.P. 0.02 to 0.09
- Northbound I-5 on-ramp from Mill Plain Blvd – M.P. 0.00 to 0.25

Interstate 205 - Washington: Columbia River to SR 500

The following is a summary of accident information along I-205 from the Columbia River (M.P. 26.59) to SR 500 (M.P. 30.90). **Table 2** provides a summary of the accidents occurring on the mainline for the most recent five years between 1999 and 2003.

Table 2: I-205 Mainline Accident Summary (1999-2003) - Washington Columbia River (M.P. 26.59) to SR 500 (M.P. 30.90)

Direction	Accident Type								
	Rear-end	SS	F.O.	Over.	Angle	Parked	Nonc.	Other	**Total**
Northbound	107	48	35	13	0	2	1	19	225
Southbound	70	34	33	11	1	1	3	23	176
Both Directions	177	82	68	24	1	3	4	42	401

Accident Severity				
Fatality	Disabling Injury	Evident Injury	Possible Injury	Property Damage Only
1	2	57	102	239

SS = Sideswipe F.O. = Fixed-Object Nonc. = Non-Collision Over. = Vehicle Overturned

Accident Type: As shown in Table 2, there were a total of 401 reported mainline accidents with 56% of the accidents occurring in northbound direction. The majority of accidents involved rear-end (44%) and sideswipe (20%) incidents. Most accidents involved motorists traveling too fast for the roadway conditions, again typical for congested freeway operations.

Time of Day: Today, southbound I-205 peaks during the morning while northbound I-205 peaks during the afternoon/evening. Approximately 48% (108 of 225) of the northbound accidents occurred during the 3:00-7:00 PM peak period while approximately 36% (63 of 176) of the southbound accidents occurred during the 6:00-10:00 AM peak period. The northbound four-hour volumes are about 10% higher than the southbound four-hour volumes.

Accident Severity: Most mainline freeway accidents were of lower severity- involving property damage only and possible injury. One fatal accident occurred in the last five years, which was

located at milepost 29.65 between Mill Plain Boulevard and SR 500. The driver was traveling northbound when the vehicle overturned in the median. The driver was exceeding the stated speed limit for this segment of freeway.

Crash Rates: The calculated five-year (1999-2003) accident rate for this section of I-205 is 0.50 accidents per million vehicle miles traveled. The four-year (1999-2002) accident rate of 0.51 is considerably lower than the four-year (1999 to 2002) Washington statewide average accident rate of 1.41 crashes per million vehicle miles traveled on similar Washington urban interstates.

Freeway Ramps: A combined total of 622 accidents occurred on the ramps at SR 14, Mill Plain Boulevard, and SR 500. Of those, 265 occurred on northbound ramps, 168 occurred on southbound ramps, and the remaining 189 accidents occurred on the overpass at Mill Plain Boulevard. Over half of the accidents occurring on the ramps were rear-end type and approximately 15% were fixed object accidents. One of the ramp accidents resulted in two fatalities.

Accident Priority: The HAL and HAC programs by WSDOT are used to identify and correct unsafe locations. Ramps on interstate interchanges are frequently HALs. I-205 had four sites qualify as HAL sites. The sites all occur at exit ramps, specifically at:

- Northbound I-205 off-ramp to westbound SR-14 – M.P. 0.00 to 0.47
- Southbound I-205 off-ramp to westbound SR-14 – M.P. 0.17 to 1.01
- Southbound I-205 on-ramp from westbound SR-500 – M.P. 0.00 to 0.24
- I-205 interchange with NE 83rd Street – M.P. 0.19 to 0.38

Oregon Accident Data

Accident data was evaluated for the most recent available five years (1998 to 2002) along I-5 between the Columbia River and I-84 junction and along I-205 between the Columbia River and Sandy Boulevard. The reason the I-5 accident data goes all the way to I-84 in Oregon is because the analysis was provided by ODOT and was not broken out to include the BIA area only. The following sections summarize the results.

Comment [MSOffice5]: This stretch of highway is considerably longer than the BIA. You need to explain why.

Interstate 5 - Oregon: I-84 Junction to Columbia River

The following is a summary of accident information along I-5 between the Columbia River (M.P. 308.38) and I-84 junction (M.P. 301.89). Table 3 summarizes the accidents occurring on the mainline for the most recent available five years between 1998 and 2002.

Accident Type: As shown in **Table 3**, there were a total of 1,775 reported accidents on I-5 between the I-84 junction and the Columbia River with 55% of the accidents occurring in the northbound direction. The majority of all accidents involved rear-end incidents (74%).

Time of Day: Today, southbound I-5 peaks during the morning while northbound I-5 peaks during the afternoon/evening. Approximately 52% (507 of 979) of the northbound accidents occurred during the 3:00-7:00 PM peak period while approximately 19% (147 of 796) of the southbound accidents occurred during the 6:00-10:00 AM peak period. Northbound volumes for the 3:00-7:00 PM period are about 7% higher than the southbound volumes for the 6:00-10:00 AM period. In

Washington, the higher percentages of accidents were southbound. In Oregon, the higher percentages are northbound. Again, this is due to the increase of rear-end and side-swipe accidents that are indicative of rapidly slowing vehicles queuing for the bridge crossing.

Accident Severity: The majority of the accidents on the mainline freeway involved property damage only and minor injury. Three of the six fatal accidents occurred between Marine Drive and Jantzen Beach (milepost 307.34 and 307.99).

Comment [MSOffice6]: In the BIA. So the others were outside the BIA?

Table 3: I-5 Mainline Accident Summary (1998-2002)
I-84 Junction (M.P. 301.89) to Columbia River (M.P. 308.38)

Direction	Accident Types								
	Rear-end	SS	F.O.	Turn	Angle	Misc.	Nonc.	Other	**Total**
Northbound	749	156	40	20	3	3	4	4	979
Southbound	567	137	48	27	1	4	3	9	796
Both Directions	1316	293	88	47	4	7	7	13	1775

Accident Severity				
Fatality	Injury A (Major)	Injury B (Intermediate)	Injury C (Minor)	Property Damage Only
6	29	148	488	1104

SS-O = Sideswipe Overtaking
F.O. = Fixed-Object
Nonc. = Non-Collision

Injury A = Major (bleeding, broken bones, etc.)
Injury B = Intermediate (bruises, swelling, etc.)
Injury C = Minor (complaints of pain)

Accident Rate: The calculated five-year accident rate for this section of I-5 is 1.23 accidents per million vehicle miles traveled. This is more than double the five-year (1998 to 2002) Oregon statewide average accident rate of 0.61 accidents per million vehicle miles traveled on similar urban interstates.

Accident Priority: The Safety Priority Index System (SPIS) is a method developed by ODOT for identifying hazardous locations on state highways based on accident data over a three-year period and is comprised of three components: accident frequency, accident rate, and accident severity. A location qualifies as a SPIS site if a minimum of three accidents or at least one fatal accident have occurred at the location in the last three years. SPIS sites are 0.1 miles long and must have a score of 45.07 to qualify in the top 10% statewide. There are 12 segments along I-5 between I-84 and the Columbia River that scored in the top 10% of SPIS sites. The high number of locations is to be expected due to the high number of accidents and the fatalities that occurred on this congested freeway segment in the last three-years.

Comment [MSOffice7]: Is there no way to separate out the BIA incidents?

Interstate 205 - Oregon: Sandy Boulevard to Columbia River

This section covers accident information on the East Portland Freeway (I-205) between Sandy Boulevard and the Columbia River for a five-year period (1998-2002). **Table 4** provides a summary of these accidents by type and severity.

Accident Type: As shown in Table 4, there were a total of 273 reported accidents on the mainline freeway with 51% of the accidents occurring in northbound direction. The majority of accidents involved rear-end (52%) and sideswipe (25%) incidents. Most of the accidents involved motorists traveling too fast for the roadway conditions or following too close to the vehicles in front- both indicative of congested traffic flow conditions.

Table 4: I-205 Mainline Accident Summary (1998-2002)
Sandy Boulevard (M.P. 23.38) to Columbia River (M.P. 26.60)

Direction	Accident Types								
	Rear-end	SS-O	F.O.	Turn	Angle	Misc.	Nonc.	Ped.	**Total**
Northbound	78	30	22	5	2	3	0	0	140
Southbound	63	39	24	4	1	0	1	1	133
Both Directions	141	69	46	9	3	3	1	1	273

Accident Severity				
Fatality	Injury A (Major)	Injury B (Intermediate)	Injury C (Minor)	Property Damage Only
1	6	33	77	156

SS-O = Sideswipe Overtaking
F.O. = Fixed-Object
Nonc. = Non-Collision

Injury A = Major (bleeding, broken bones, etc.)
Injury B = Intermediate (bruises, swelling, etc.)
Injury C = Minor (complaints of pain)

Time of Day: Time of day data was not available for review.

Accident Severity: The majority of the accidents on the mainline freeway involved property damage only and minor injury. The fatal accident occurred on the Glen Jackson Bridge at M.P. 25.98 and was a fixed-object accident that involved a vehicle traveling in the southbound direction. The 17-year-old male driver made an improper lane change, lost control of the vehicle and struck the bridge rail, and he ~~somehow fell or jumped off~~ was ejected from the moving vehicle and was killed as a result.

Accident Rate: The computed accident rate for this section of the I-205 freeway over a five-year study period (1998-2002) is 0.34 accidents per million vehicle miles traveled—less than one-half the 2002 Oregon statewide average accident rate of 0.61 accidents per million vehicle miles traveled on similar urban interstates.

Accident Priority: SPIS is a method developed by ODOT for identifying hazardous locations on state highways based on accident data over a three-year period and is comprised of three components: accident frequency, accident rate, and accident severity. A location qualifies as a SPIS site if a minimum of three accidents or at least one fatal accident have occurred at the location in the last three years. SPIS sites are 0.1 miles long and must have a score of 45.07 to qualify in the top 10% statewide. The highest 2003 SPIS value (2000-2002 crash data) in the I-205 section is 63.75, which is above the 2003 cutoff value of 45.07 for the top 10% SPIS sites. This highest SPIS value of

Comment [MSOffice8]: I am not sure you have to repeat all this explanatory information about SPIS here after having done so for I-5.

63.75 occurred at M.P. 24.92, which is located at the Airport Way ramp connections.

Trends – Washington and Oregon

The accident type and severity seen on both I-5 and I-205 are indicative of freeway operations. For example, during peak times, the close vehicle spacing and lane changing that occur under congested conditions at generally lower speeds tend to result in lower severity accidents. Higher severity accidents tend to occur during off-peak times when prevailing travel speeds are higher.

Although Oregon and Washington listed different average accident rates per million vehicle miles driven for urban interstates, data in both Washington and Oregon indicate that I-5 has more than double the accident rate than I-205. The probable reason for the higher accident rates on I-5 is due to the longer peak periods and geometric deficiencies such as lack of shoulders and closely spaced interchanges with substandard weaving sections.

INTERVIEWS WITH ODOT AND WSDOT MAINTENANCE REPRESENTATIVES

ODOT and WSDOT maintenance representatives were interviewed to determine their perspective of existing maintenance and operational deficiencies on I-5 and I-205 within the BIAs. Following is a synopsis of the interviews.

Washington State Department of Transportation

Candi Hein – Area 1 Superintendent (360) 905-2130

Mike Gartman – Area 1 Maintenance Manager

Interview Date: January 5, 2005 1 p.m. via conference call.

On January 4, 2005 Candi was ~~notified~~ contacted to explain the purpose of the phone interview. She responded that her jurisdiction covers both I-5 and I-205, but she had only been in her superintendent position a few months. She wanted to bring in one of her managers to assist in the conversation and the combined interview was held on January 5th.

Candi and Mike started the conversation by expressing the need for a new bridge on I-5. Traffic volumes have outgrown the system.

***I-205 Geometry*:** The on-ramp from SR-14 to I-205 southbound appears to have an inadequate super-elevation. With the ramp not sloped enough to the right, they have had numerous semi-trucks and large vehicles tip over. Mike said that some of the truck drivers have stated that they were going the posted speed and their loads still shifted and caused the truck and trailer to roll over. WSDOT has installed caution signs for the trucks but it is still a problem spot.

I-205 Deficiencies: The northbound and southbound off-ramps for Mill Plain continue to have traffic back up onto the mainline Interstate and rear-end accidents occur. There is also a problem with rear-end accidents on I-205 near the Padden Expressway due to the increasing volume of traffic. Mike said that when I-205 was first built there were never back-ups on the highway. Communities around

I-205 have dramatically grown, and the volume of traffic on the Interstate has outgrown the highway's capacity.

I-205 Drainage: The highway between SR 500 and the Padden Expressway has a problem with water bleeding up through the slabs. During the winter the bleeding water freezes on the surface and creates a potential accident problem with the slippery conditions.

I-205 General Maintenance Needs: The Mill Plain and SR-14 Interchanges are in need of a Preservation project. The pavement is in poor condition and some of the guardrail needs to be updated to today's standards.

I-5 Drainage: At the north end of the I-5 Bridge, there has been a drainage problem with the inlet, but it was recently repaired. They basically just modified the lid to allow more water in. The system itself appears adequate. There are some underground filters that maintenance does have to clear out a couple times a year.

I-5 and I-205 Transient Issues: On both sections of highway, but more on I-5, there are large landscaped areas where transients have chosen to build camps. Besides being a maintenance issue, the transients also walk along the highway posing a pedestrian safety concern.

Comment [MSOffice9]: No I-5 Geometry issues? Should explain if possible

Oregon Department of Transportation

Larry Olson – District 2B Maintenance Manager (503) 653-3086

Interview Date: January 10, 2005 10:30 a.m.

I-205 Traffic Accidents: The majority of accidents in the area are related to weather and speed. Larry did not know of specific design issues that cause accidents.

I-205 Interchange Issues: On Airport Way westbound to I-205 northbound, traffic back-ups create severe congestion on Airport Way. The problem is primarily during rush hour when traffic volumes are high.

I-205 Drainage: The drainage system works well. There is a treatment facility at Airport Way that was one of the first built in the area. Maintenance requirements for the facility have never been clarified.

There is a section on the northbound bridge between the Government Island and Washington where the super-elevation transitions and water does not adequately drain during heavy rains. There have been accidents due to this issue.

I-205 General Maintenance Needs: There is an upcoming project that will overlay the highway and replace most of the guardrail and signs from the I-205 bridge southward. I-205 will benefit from the improvements and should be in good shape after that. In the near future, there will need to be a Preservation project for the I-205 Bridge itself.

The bike trail on the bridge is starting to have some problems. The slabs hung between the two bridges appear to be shifting and the joints are starting to rise up above the pavement and this causes problems for bikes.

I-5 Geometry: There are a fair amount of traffic accidents on the I-5 Bridge. For southbound traffic, there is a crest vertical curve in the bridge (due to geometry to gain vertical clearance over river traffic) that causes a sight distance problem for motorists. It is common to travel southbound over the crest and quickly come upon vehicles slowed or stopped due to traffic congestion, resulting in rear-end accidents. To make the situation worse, there are no shoulders on the bridge, so there is nowhere for traffic to go to avoid an accident.

I-5 General Maintenance: There are not many metal guardrails within this section of highway. Most roadside rail is concrete barrier, which does not require much maintenance. The pavement is in good condition.

I-5 Traffic Issues: Traffic volumes appear to be the leading cause accidents in this area.

There is also a problem area where the southbound lanes merge to two lanes and then back out to three. However, there appears to be an upcoming project that will add an additional lane in this section.

During major events, southbound traffic from Jantzen Beach gets congested and requires additional ODOT/Police traffic control to get onto highway.

Accidents also occur when the Bridge is raised for river traffic. This is just a reality of having a lift-span on an Interstate Bridge.

I-5 Drainage: Maintenance has no drainage concerns. There are no water quality facilities to maintain.

I-5 Bridge Maintenance: During September through March large flocks of starlings (birds) nest on the bridge and their droppings cause corrosion. There are also peregrine falcons nesting on the bridge that limit the times of year when certain maintenance activities can occur. Annual maintenance activities are scheduled to miss the period when the falcons are present.

I-5 Landscaping: Most of the median landscaping has been removed and replaced with river rock. Maintenance under traffic is too difficult to support landscaping in the median.

I-5 and I-205 Transient Issues: Since the area under the bridge has been caged for maintenance storage, transients have not been a problem. They might sleep over, but will be gone in the morning.

EXISTING GEOMETRIC DEFICIENCIES

The existing I-5 Columbia River Bridges predate the Interstate System. The northbound bridge opened for traffic in 1917 and the companion southbound bridge opened for traffic in 1958. In contrast, the I-205 Glenn Jackson Bridge began operations in 1982 and more closely meets current Interstate standards. Overall, the I-5 Corridor has more design deficiencies than the I-205 Corridor.

Extensive analysis was conducted on geometric deficiencies on I-5 in 1999 as part of the original Trade Corridor Study. This information was published in a Technical Memorandum dated March 3, 1999 and is available for review. For the purpose of this working paper, key elements of the Technical Memorandum are summarized. Design information for I-205 is less detailed based on a field review and data from Washington State's Highway Log Planning Report for the sections in Washington.

For I-5, geometric deficiencies along the I-5 mainline and intersecting ramp terminals were identified by comparing the observed geometric data with the standards used by ODOT and WSDOT. In addition, requirements set forth by the American Association of State Highway and Transportation Officials (AASHTO) for urban freeways were reviewed. Some preferred standards applied in the assessment include:

- 12-foot travel lanes along the mainline.
- 10-foot inside shoulders along a freeway with 6 or more lanes.
- 10-12-foot outside shoulders along the mainline.
- A 2,000 foot weaving area where an on-ramp is followed by a freeway-to-freeway off-ramp connection.
- A general ramp terminal grade not exceeding +6% over an extended length.
- A minimum taper length of 800 feet for an on-ramp into the through traffic lane of a high-speed freeway (no auxiliary lane).

Existing deficiencies on I-205 were noted for between Sandy Boulevard in Oregon and SR-500 in Washington. The I-205 section included a clear-zone inventory.

Washington Deficiencies

I-5 Deficiencies

The deficiencies noted for the I-5 study area in Washington State are as follows:

- On the Columbia River Bridge, NB and SB directions have inside and outside shoulder widths of one foot or less due to the narrow bridge structure.

- The SB on-ramp from westbound SR-14 to SB I-5 has an insufficient taper length of 211 feet for merging with mainstream traffic due to the proximity of the bridge.

- Between Mill Plain Boulevard on-ramp to SB I-5 and the SB SR-14 off-ramp, the ramp spacing was measured at 666 feet.

I-205 Deficiencies

By the design year, the merging and weaving section of I-205 (specifically SR 14, Mill Plain Boulevard, and SR 500 interchange areas) are projected to operate at LOS F. The large

concentration of traffic entering and exiting the freeway at existing access locations affect the freeway's ability to convey traffic at LOS D or better.

Other I-205 geometric deficiencies of note within Washington are as follows:

- Both northbound (NB) and southbound (SB) lanes have 6-foot inside shoulders between Mill Plane Boulevard and SR-500.
- For NB travel at the end of the SR-14 eastbound to northbound overpass, there is a potential need for a barrier protecting the steep down slope.
- For SB travel between the SR-500 undercrossing and the SR-500 on-ramp, there is potential vegetation to be cleared from the clearzone.
- For SB travel at the end of the SR-14 overpass, there is a potential need for barrier to protect the steep down slope.

Oregon Deficiencies

I-5 Deficiencies

The following items were noted for I-5 in the Oregon portion of the BIA study area:

- NB I-5 on the Columbia Slough Bridge has an inside shoulder width of two feet and an outside shoulder width of 0.5 feet.
- The SB Victory Boulevard on-ramp has insufficient taper length for merging before the Columbia Slough Bridge begins.
- The NB Jantzen Beach/Hayden Island on-ramp has insufficient taper length of 158 feet for merging into mainstream traffic before the I-5 Columbia River Bridge.

I-205 Deficiencies

The following items were noted for I-205 in the Oregon portion of the study area:

- Both the NB and SB lanes have 4-foot outside shoulders between Columbia Boulevard and Airport Way.
- Both NB and SB lanes have 6- to 8-foot inside shoulders from M~~m~~arine Drive to Glenn Jackson Bridge.
- The interchange spacing between Columbia Boulevard and Airport Way is 0.97 miles. (Typically one mile minimum is recommended.)
- The weaving section distance for NB travel between the Sandy Boulevard on-ramp and the Airport Way off-ramp is approximately 1700 feet, which is less than the 2000-foot minimum.

- The weaving section distance for SB travel between the Columbia Boulevard westbound (WB) off-ramp and Columbia Boulevard eastbound (EB) off-ramp is approximately 800 feet, which is less than the 1000-foot minimum

- For NB travel lanes, at the end of Airport Way overpass, there is a potential need for a barrier protecting the steep down slope.

SUMMARY OF FINDINGS – WASHINGTON AND OREGON

Traffic congestion on I-5 and I-205 is bad and getting worse. Many sections of I-5 and I-205 within the study area currently exceed LOS D. By year 2020, projected growth in traffic will result in many sections of I-5 and I-205 operating at LOS F which exceeds the criteria of LOS D established for Interstate highways.

Increased congestion also has an impact on accidents. Analyses of accidents on I-5 shows that accident rates exceed or are nearly equal to those of similar urban interstate highways in Oregon and Washington. The majority of accidents are rear-end with sideswipes the next leading cause. Accident rates on I-5 are more than double those encountered on I-205. (In Washington, I-5 is 1.34 and I-205 is 0.50, and in Oregon, I-5 is 1.23 and I-205 is 0.34.) Accident rates on I-205 are below those experienced on urban interstate highways.

Interviews with maintenance personnel from both states have identified congestion and narrow shoulders as a problem. Several specific design and operational issues were also identified, but none were considered serious enough to warrant immediate attention.

Design deficiencies on I-5 were primarily related to narrow shoulders and the close spacing of existing interchanges that have resulted in substandard weaving sections. I-205 was constructed much later and more closely meets current interstate standards. Current design standards require wider shoulders on the median side than currently exist on I-205.

Comment [MSOffice10]: This "summary" idea is not mentioned above in the analysis