

# **Exit 64 East Hood River Interchange Study**

## **Final Report**

Includes Study of Local Traffic  
Circulation and Button Junction

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# EXIT 64 East Hood River Interchange Study Final Report

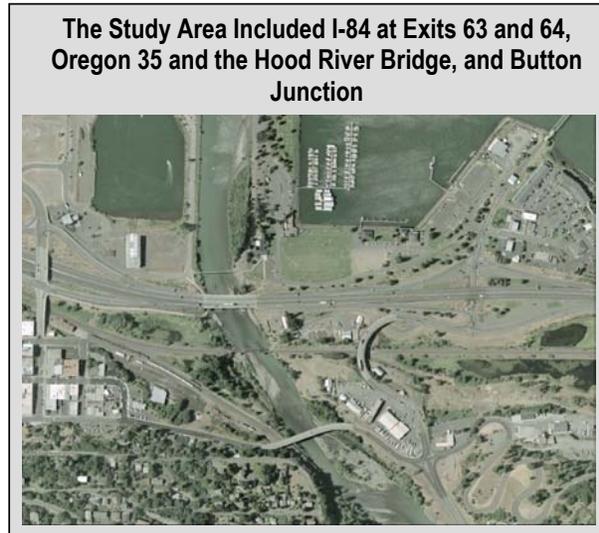
## 1. *What is the Purpose of this Report?*

This report is to summarize the process and outcomes of the Exit 64 East Hood River Interchange Study. It documents the reasons the study was conducted, the current and future traffic conditions that predicated the need to study solutions, design solutions that were developed and studied, and the recommended solutions to carry forward into eventual implementation.

This report summarizes the design options at the East Hood River interchange (EXIT 64), the intersection of Oregon Highway (OR) 35 and the Historic Columbia River Highway (HCRH), referred to as “Button Junction” and local traffic circulation options between downtown Hood River and the Hood River Bridge and Marina area. While this study reviewed possible options for Button Junction and local traffic circulation options, more analysis needs to be done before recommendations can be suggested. This Report only recommends a design option for EXIT 64, the East Hood River Interchange.

## 2. *Why was this Study Needed?*

Over the past ten years, the need for improvements at the East Hood River interchange has been well-documented. The Oregon Highway (OR) 35 Corridor



Strategy and the Hood River Transportation System Plan both call for improvements at this interchange. The SR-35 Columbia River Crossing Study, conducted in response to local business and resident concerns about the safety and service life of the existing Hood River Bridge, recommended a set of short-term improvements (within 3-5 years of the DEIS which was completed in 2004). These studies identified the need to respond to agency and public concerns regarding traffic safety and congestion

at the interchange.

The EXIT 64 East Hood River Interchange Study was conducted to identify the specific issues needing resolution, develop and evaluate alternative design solutions, and recommend one design solution to carry forward into implementation.

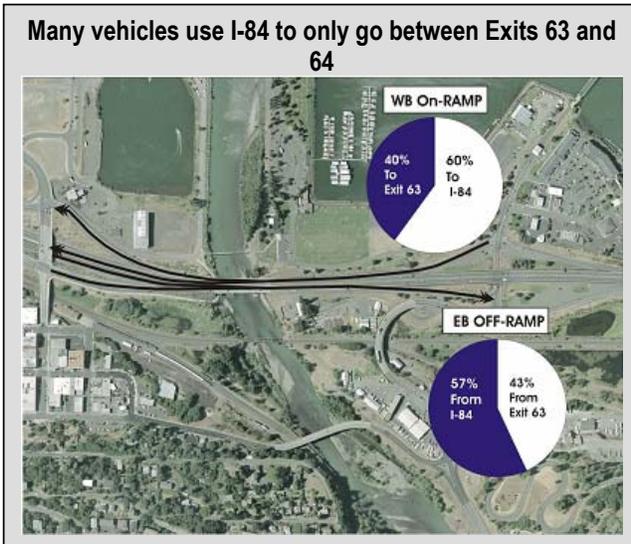
Also included was a study of improvement options at the intersection of OR 35 and the Historic Columbia River Highway (known as "Button Junction"), and local traffic circulation options between downtown Hood River and the Hood River Bridge and Marina area.

This study developed, analyzed, and recommended solutions for the East Hood River interchange. This study also examined intersection improvement options at the OR 35 and the Historic Columbia River Highway (known as "Button Junction"), and local traffic circulation options between downtown Hood River and the Hood River Bridge and Marina area.

### 3. Why is this Project Needed?

Traffic levels in the interchange area are expected to grow by over 50 percent between now and 2025 and will increase traffic delay, raising concerns about traffic congestion and safety.

There is a traffic bottleneck northbound into the Hood River Bridge toll booth that creates queues extending through the Marina Way intersection and into the I-84 ramp intersections. The close proximity of the westbound ramps with the Marina Drive four-way stop intersection and the Hood River Bridge toll booth often results in queues extending through the ramp intersection which will be exacerbated in the future. As delays increase for the eastbound and westbound



I-84 off-ramps at Exit 64, traffic queues will also increase. The result tends to be longer traffic queues, sometimes extending onto the I-84 mainline. When queues extend near and onto the I-84 mainline, the risk of rear-end collisions increase as well as the potential increase in driver risk-taking due to frustration with traffic backups and delays.

Summertime traffic volumes are highest and often result in traffic queuing at the interchange. Other instances where traffic queues occur are during the winter

season when traffic will divert from US 26 onto OR 35 and through East Hood River due to weather or incidents; and during local festivals occurring at the Expo Center or in the bridge area, which tend to attract higher-than-average traffic levels to the study area.

The impaired sight distance at the ramp intersections caused by the placement of the piers supporting the I-84 overpass, and the confusing traffic movements caused by the offset nature of the eastbound off-ramp and the eastbound on-ramp intersection with OR 35/Hood River Bridge access road, result in traffic safety concerns that need to be addressed.

#### **4. *What are the Project's Goals and Objectives?***

When considering alternatives, the East Hood River interchange project should:

- be phaseable and implementable without closing I-84, its ramps, or OR 35/Hood River Bridge access road to traffic;
- not interfere with and preferably be complementary to the programmed 2007 replacement of the I-84 overpass over the OR 35/Hood River Bridge access road;
- provide for longer-term capacity and safety improvements at the interchange;
- be constructable within the \$2.25 million overall project budget; and
- not create significant environmental impacts.

#### **5. *Why Can't the Interchange be Improved Without Reconstructing the I-84 Overpass?***

The I-84 overpass is on the list of replacement projects adopted by the Oregon Transportation Commission in 2003. While the existing interchange can be improved, it would be difficult to perform these improvements without fixing some of the existing issues with the roadway underneath I-84. For example, the sight distance issues caused by the current bridge piers would continue to be a problem. It is possible to improve the roadway for a through lane in each direction plus a left-turn lane, but the needed through lane capacity and turn lanes would not be feasible, and there would be no room for bicycles or pedestrians.

## 6. How was the Study Conducted?

This study follows the SR 35 Draft EIS work. An initial brainstorming workshop was held in January 2005 with a variety of stakeholders (see Appendix A) and a range of short-term and long-term options were developed for the East Hood River interchange, for Button Junction, and for local traffic circulation between central Hood River and the Hood River Bridge area. A variety of input from committees and stakeholders led to an initial narrowing of options and the eventual selection of the preferred interchange improvement option, as well as options for future consideration at Button Junction and between central Hood River and the Hood River Bridge area.

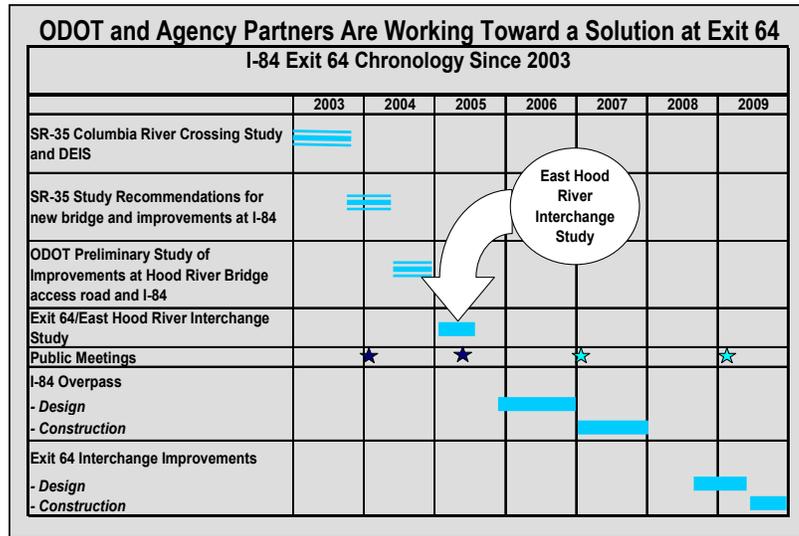
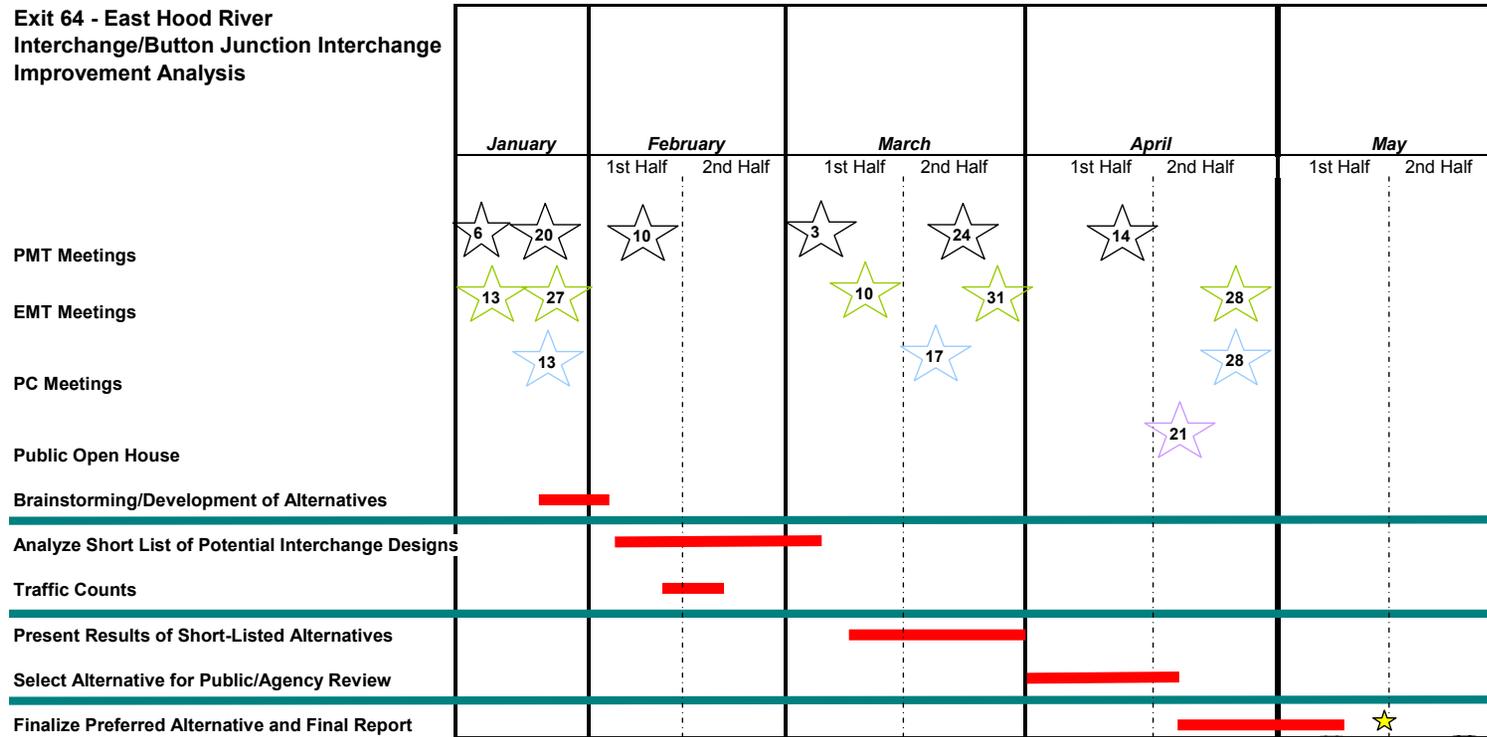


Figure 1 shows the project schedule and events.

Three committees were formed to provide advice and oversight during the process. Members of these committees were selected based on their agency roles and interest in the project. Many of these committee members were also involved in prior studies which included this interchange, including the OR 35 Corridor Strategy and the SR 35/Columbia River Crossing DEIS.

**Figure 1. Study Chronology**

**Exit 64 - East Hood River Interchange/Button Junction Interchange Improvement Analysis**



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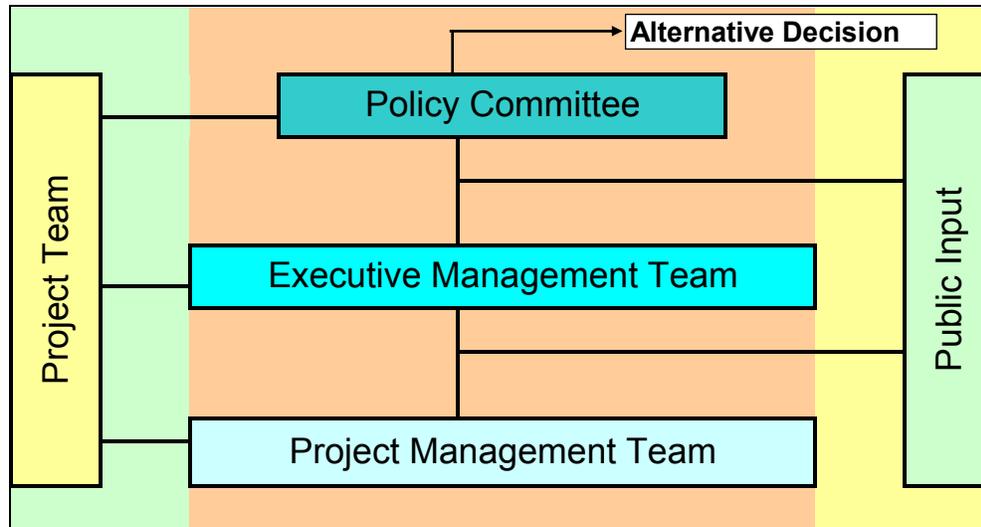
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The committees all met in Hood River. Table 1 shows the committees, their role and function, and the agencies represented. Figure 2 shows the committee hierarchy.

**Table 1. Exit 64 East Hood River Interchange Study Committees**

	<b>Project Management Team</b>	<b>Executive Management Team</b>	<b>Policy Committee</b>
<b>Committee Function</b>	A technical working group made up of staff-level representatives. This committee provided technical review and recommendations to the Executive Management Team.	A management-level committee comprised of agency staff. This committee provided review comments and recommendations concerning the analysis and design process.	Elected and appointed officials who made the final design decisions concerning the interchange
<b>Membership</b>	Hood River County Port of Hood River City of Hood River Columbia River Gorge National Scenic Area Commission (CRGNSAC) Historic Columbia River Highway Advisory Committee (HCRHAC) Federal Highway Administration (FHWA), ODOT Consultant staff	Hood River County Port of Hood River City of Hood River CRGNSAC HCRHAC FHWA ODOT	Hood River County Commission Port of Hood River Director and Commission City of Hood River CRGNSAC Director FHWA Division Administrator ODOT Region Manager

**Figure 2. Committee Hierarchy**



**7. How were the Public and Interested Stakeholders Involved?**

Besides ODOT, the City of Hood River, Hood River County, and the Port of Hood River, a variety of stakeholders were identified and invited to participate in this study. These stakeholders included the Columbia Gorge Commission, Washington State Department of Transportation, Southwest Washington Regional Transportation Council, members of the Historic Columbia River Highway Advisory Committee, and others.

The study was initiated with a design brainstorming charrette held in Hood River on January 26, 2005. All interested stakeholders were invited to participate (an attendance list is included in Appendix A). Participants were given background information on the project, including current and future traffic volumes, design and environmental constraints, and project objectives (see Page 3 for project goals and objectives). They were divided into three groups and asked to develop a range of interchange options (both short-term and long-term) for improving local traffic circulation between central Hood River and the Hood River Bridge area, and options for Button Junction.

The range of options that resulted from this workshop is included in Appendix A.

Options for Button Junction were presented to the Historic Columbia River Highway Advisory Committee (HCRHAC) on April 7, 2005. Two options were presented: a roundabout centered on the existing intersection, and a signal/intersection improvement alternative. There was much discussion on the impact of the roundabout on the planned interpretive site on the southeast quadrant of

the intersection, and whether or not the roundabout could be moved northward to alleviate those impacts. It was evident from the analysis that moving the roundabout northward would impact the businesses located on the northwest and northeast quadrants of the intersection.

Other discussion centered around the ability of each option to handle “significant traffic events,” such as the closure of US-26 off of Mount Hood and redirecting traffic north on OR 35 to I-84.

While the HCRHAC generally liked the aesthetics of the roundabout option, they were concerned about the impacts on the interpretive site, the inflexibility to cater to significant traffic events, and the design change to several hundred feet of the historic highway. The general consensus was to support the signal/intersection improvement option over the roundabout option, but to carry both options forward until more analysis could be performed.

A public meeting was held April 21, 2005, at the Waucoma Center in Hood River. Displays of the design options, from the early range of alternatives through the recommended alternative, were presented along with traffic simulations and cost estimates. Project consultant and ODOT staff were available, along with staff from the Port of Hood River and City of Hood River, to answer questions about this study as well as the I-84 Corridor Strategy, the Port’s upcoming Toll Booth Automated Toll Collection project and the Port’s proposed bridge crossing design study over the Hood River adjacent to I-84.

## **8. What are the Current and Future Traffic Conditions?**

### **Traffic Operations**

Traffic counts were collected in February and March 2005 at various locations in the study area (see Figure 3 through Figure 6). ODOT traffic analysis procedures call for the “30<sup>th</sup> Highest Hour volume” (30<sup>th</sup> HV) to be used for analysis of intersections and road segments. The 30<sup>th</sup> HV represent the traffic levels at the 30<sup>th</sup> highest traffic volume hour of the year. Using ODOT’s seasonal factors table, the late winter counts needed to be adjusted upward by 60 percent to account for the 30<sup>th</sup> highest hour traffic time, which typically occurs during the summer.

After determining the existing traffic volumes, traffic was then forecast for the Year 2025. After discussions with the ODOT traffic staff, it was decided that the forecasting procedure would use ODOT’s future volumes table and ODOT’s methodology describing how to use the future traffic volumes. This involved compiling counts in the area over the past 20 years and examining past growth trends. For the locations studied, traffic has grown at an average rate of 2.6 percent per year. This rate is consistent with the growth rate assumed for the Hood River Transportation System Plan.

More detail on the seasonal adjustment and traffic growth methodologies are contained in the Appendix.

Current and future traffic volumes were input into a Synchro traffic simulation model for the area to determine traffic congestion levels or level-of-service. Level-of-service (LOS) is a grade given to an intersection or roadway segment based on congestion or delay. LOS A indicates free-moving traffic with no delays, and LOS F indicates near-gridlock conditions with extreme delays. Local plans call for LOS D as the desired goal.

ODOT bases its level-of-service determination on the ratio of volume to capacity (V/C). The higher the v/c ratio, the more congested the intersection or roadway segment. V/C ratios over 1.00 indicate traffic volumes that exceed the estimated capacity of the intersection or segment, which in turn results in traffic queues of several vehicles on each leg of an intersection. ODOT's mobility standard is a peak hour v/c ratio of 0.65 for the I-84 ramp intersections, 0.70 for the Historic Columbia River Highway intersection with OR 35, and 0.80 for the Hood River Bridge access road/Marina Way intersection.

Level-of-Service and Volume/Capacity Ratios are shown. ODOT uses a volume/capacity ratio for measuring level-of-service while the city and county use a letter grade for existing and future "no improvement" levels-of-service in Table 2. All intersections analyzed are currently unsignalized; the volume/capacity ratio shown is for the "worst case" of the traffic movements at that intersection.

**Table 2. Current and Future Levels of Service**

Location	Existing		2025 No-Build			Build LOS Standard <sup>1</sup>
	AM	PM	AM	PM	No-Build LOS Standard <sup>2</sup>	
I-84 westbound off-ramps to OR 35	E(0.55)	F (1.66)	F (2.40)	F (5.61)	0.70	0.65
I-84 eastbound off-ramp to OR 35	E(0.78)	F (3.46)	F (2.14)	F (6.97)	0.70	0.65
Hood River Bridge access road at Marina Way	E(1.21)	F (2.41)	F (2.24)	F (2.56)	0.85	D/ 0.80
HCRH at OR 35	F(1.46)	D (0.93)	F (2.79)	F (2.26)	0.70	D/ 0.70
OR 35 at I-84 EB on-ramp	E(0.71)	F (2.03)	F (2.40)	F (3.31)	0.70	0.65

Level-of-service expressed as X(Y) where X is the letter grade using Highway Capacity Manual calculations, and Y is the volume-to-capacity ratio.

<sup>1</sup> Hood River Transportation System Plan (LOS classification); ODOT Highway Design Manual, Table 10-1 (V/C ratio).

<sup>2</sup> 1999 Oregon Highway Plan, Table 6.

This analysis indicates that even under existing conditions, most of the intersections studied will experience significant summer-time delays. This in turn creates traffic queues which may intrude on adjacent intersections. In the case of the I-84 off ramps, situations are created where vehicles will back up near or onto the I-84 mainline. Not only are extreme delays considered frustrating to travelers, they also pose a safety hazard. When traffic backs up onto or near the I-84 mainline, the risk of rear-end collisions increases. Additionally, human factor studies have shown that as drivers experience lengthy delays attempting to turn onto a roadway, they are more willing to perform these turns using unsafe gaps in traffic, which leads to a higher incidence of angle and rear-end collisions.

The close proximity of the I-84 ramp intersections, the Hood River Bridge/Marina Way intersection, and the Hood River Bridge toll booth, combined with the off-set nature of the eastbound ramps to and from I-84, all serve to reduce roadway capacity and increase congestion in the area. During peak hours, northbound traffic queues will extend from the toll booth through the Marina Way intersection and near or through the I-84 westbound ramp intersection.

In order to determine if a traffic signal is necessary and justified at an intersection, a study of how the intersection meets one or more of the criteria established in the "Manual on Uniform Traffic Control Devices (MUTCD)" is necessary. The MUTCD establishes eight criteria for justifying traffic signals called "warrants." The warrant study typically uses existing traffic conditions, but in cases where the warrants are not met today, future-year traffic projections are used to determine if they will be satisfied in the future. Warrants are based on delay (finding gaps in traffic to enter or cross a roadway), traffic volumes, collision history, and the presence of pedestrians.

The off-ramp intersections and the Hood River Bridge/Marina Way intersection all meet traffic signal Warrant 3 (Peak Hour volumes). The intersection of HCRH with OR 35 also meets at least three of the traffic signal warrants under current conditions: Warrant 2 (Four-Hour volumes), Warrant 3 (Peak Hour volumes), and Warrant 8 (Roadway network: installing a signal fits the overall roadway network and meets one of the other warrants).

Another factor for traffic operations is extreme traffic events which occur infrequently but have occurred in the past and are expected to occur in the future. These include:

- Weather or incidents on US 26 westbound off of Mount Hood, which result in significant numbers of vehicles diverting north on OR 35 to use I-84 to travel back to the Portland area. Most of these events occur during the winter; anecdotal evidence indicates that these occur 1-3 times per winter. The result tends to be long traffic delays and queues at the HCRH/OR 35 intersection and the I-84 ramp intersections.
- Local festivals occurring at the Expo Center or in the area near the Hood River/White Salmon Bridge tend to attract higher-than-average traffic

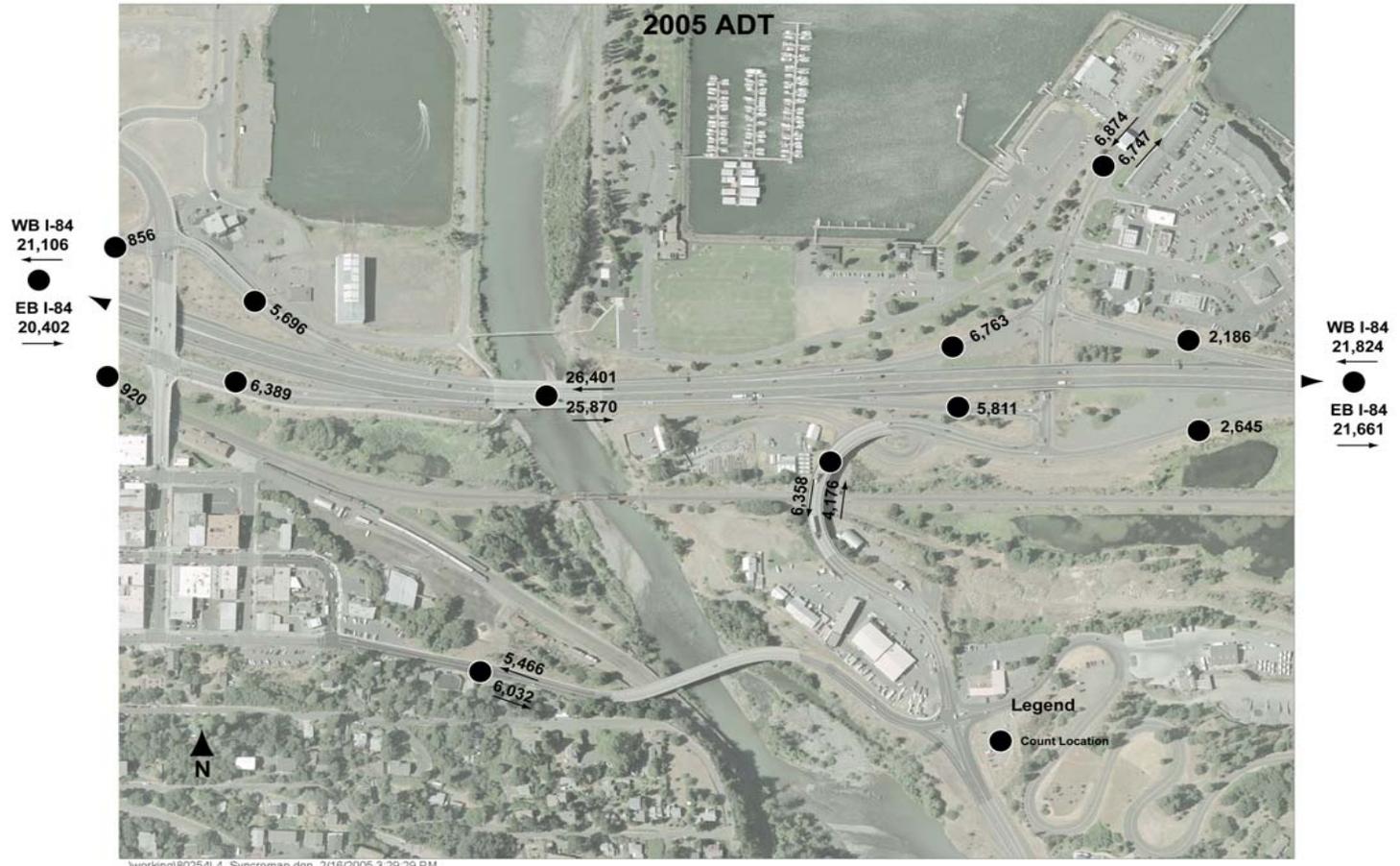
levels to the study area. These tend to occur during the summer. The result tends to be longer traffic queues, sometimes extending onto the I-84 mainline, at the I-84 eastbound off-ramp to OR 35 and the Hood River Bridge. Also, these events tend to create a bottleneck northbound into the Hood River Bridge toll booth, which then creates queues that extend through the Marina Way intersection and into the I-84 ramp intersections.

### **Local Traffic Using I-84**

Another concern expressed in past studies has been the amount of traffic using I-84 to travel between the 2<sup>nd</sup> Street interchange and the East Hood River interchange (Exits 63 and 64), known as “local traffic.” Traffic traveling between adjacent interchanges is inconsistent with the function of an Interstate highway. The amount of this traffic is considered significantly high; what is also significant is that as the on-off traffic levels increase due to growth in Hood River, the number of local trips using I-84 will also increase, which diminishes the ability of a vehicle already on I-84 to exit, and also inhibits vehicles that enter onto I-84 to travel beyond Hood River. This in turn increases the risk of rear-end collisions and negatively impacts traffic operations on I-84.

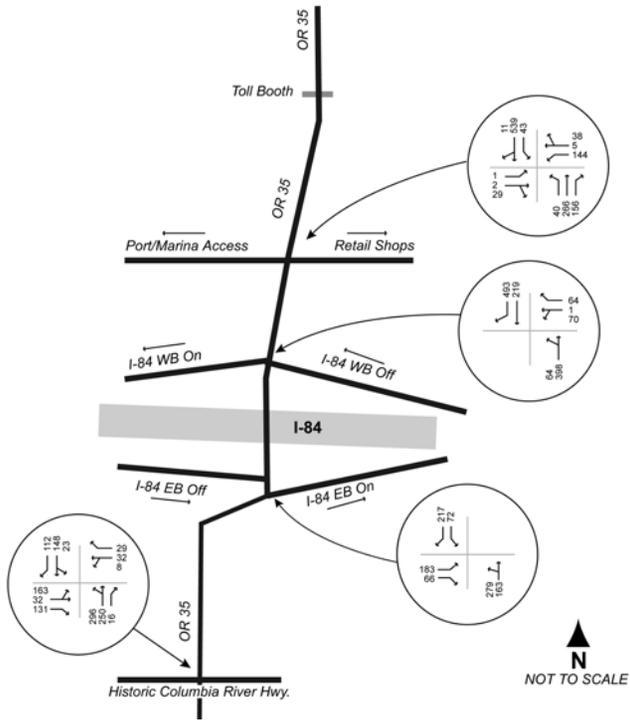
A license plate survey was conducted in March 2005, to identify the extent of local trip-making on I-84 between the 2<sup>nd</sup> Street interchange and the East Hood River interchange. The survey methodology was to record license plate numbers at the eastbound on-ramp to I-84 from the 2<sup>nd</sup> Street interchange and the eastbound off-ramp to the East Hood River interchange, and on the westbound on-ramp from the East Hood River interchange and the westbound off-ramp to the 2<sup>nd</sup> Street interchange. If the eastbound license plate numbers matched, the trip was considered a local trip. The same was true for the westbound license plate numbers.

Figure 3. Existing Traffic Volumes



**Figure 4. AM and PM Peak Hour Turning Movement Counts**

**Exit 64 Interchange Reconfiguration Analysis:  
2005 AM Peak Hour Traffic Counts**



**Exit 64 Interchange Reconfiguration Analysis:  
2005 PM Peak Hour Traffic Counts**

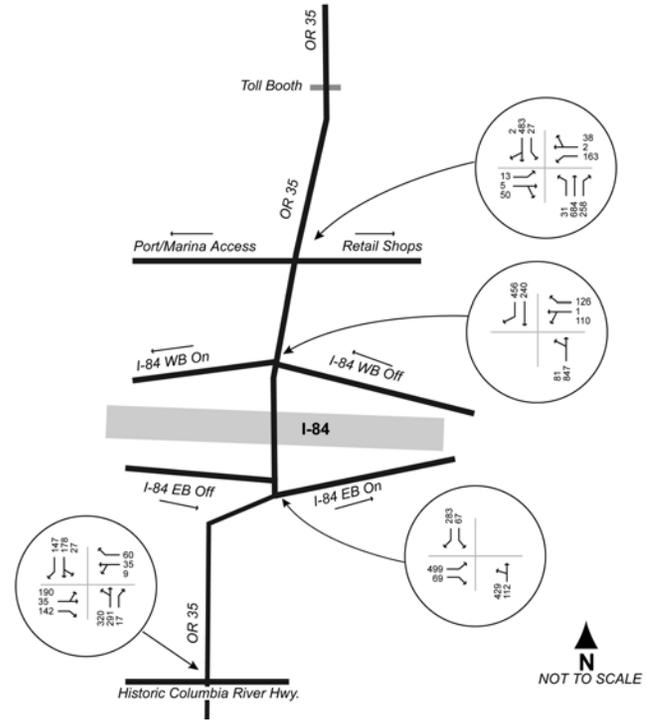
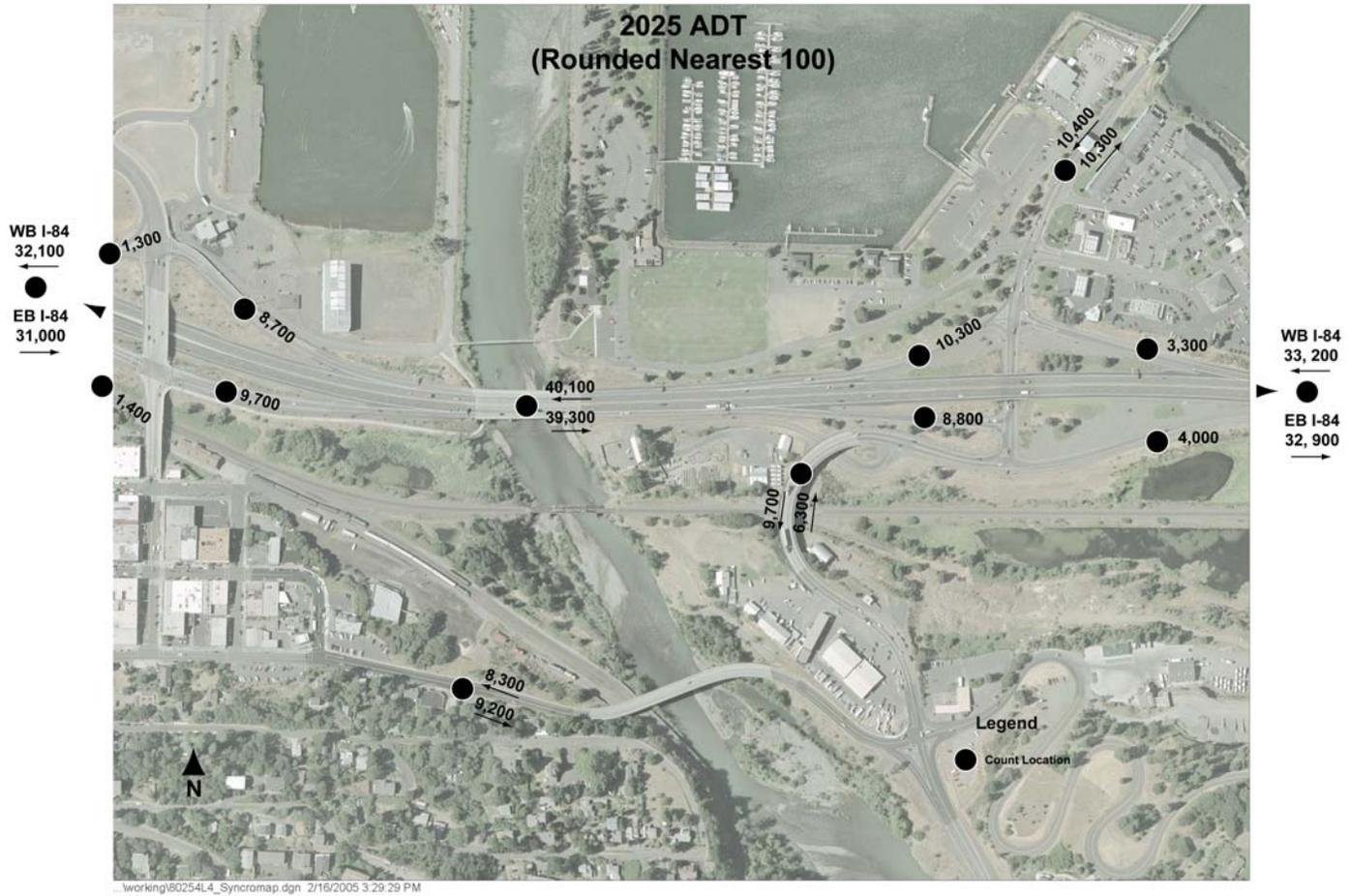
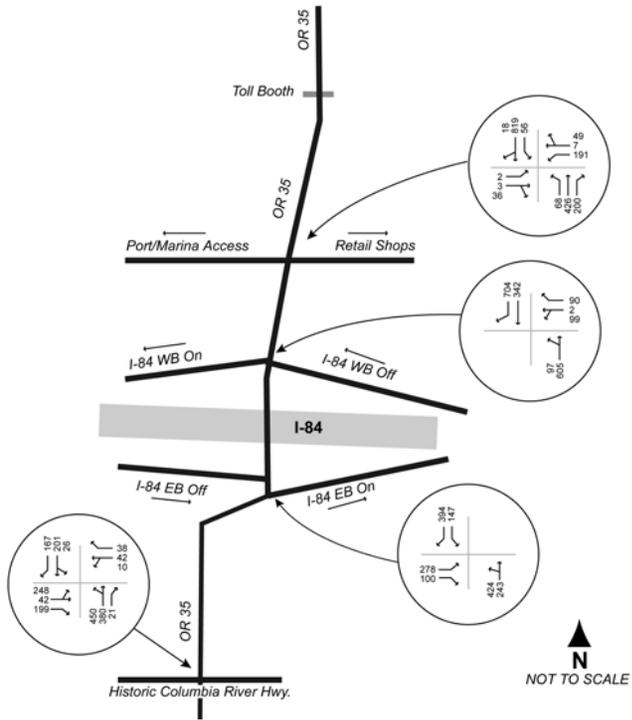


Figure 5. Future Year 2025 Traffic Volumes

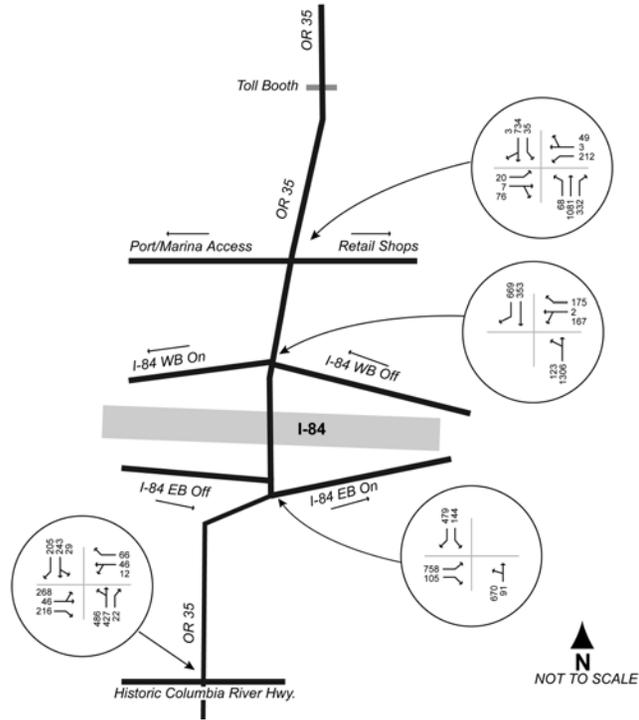


**Figure 6. Year 2025 Turning Movement Counts**

**Exit 64 Interchange Reconfiguration Analysis:  
2025 AM Peak Hour Traffic Counts**

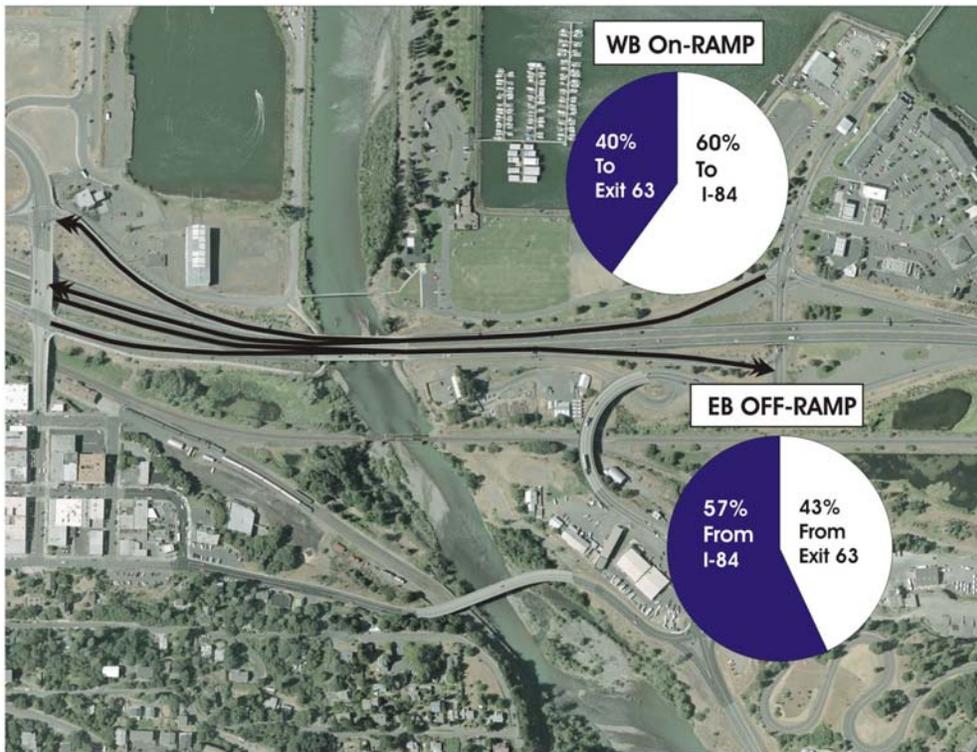


**Exit 64 Interchange Reconfiguration Analysis:  
2025 PM Peak Hour Traffic Counts**



The result was that approximately 40 percent of the trips exiting to the East Hood River interchange eastbound entered I-84 from the 2<sup>nd</sup> Street interchange, and a similar percent entering I-84 westbound from the East Hood River interchange exited immediately at the 2<sup>nd</sup> Street interchange (see Figure 7). For the year 2025, this is equivalent to approximately 350 vehicles eastbound between Exits 63 and 64, and 320 vehicles westbound between Exits 64 and 63. This “weaving” has the effect of reducing this section of I-84 to speeds to 40-47 mph during the PM peak in 2025 (the posted speed limit is 65 mph).

**Figure 7. Results of License Plate Survey**



### **Safety**

Discussions with ODOT and a review of data from the SR-35 DEIS and local transportation system plans indicate that there are no high-accident locations in the study area. The all-way stop at the HCRH/OR 35 intersection apparently is a response to a past high-severity collision condition that formerly existed and has since been alleviated at that intersection.

Although there are no high-rate collision locations, there are areas of collision risk that need to be factored into the analysis. These are:

- As delays increase for the eastbound and westbound I-84 off-ramps at OR 35, traffic queues will also increase. Anecdotal evidence indicates eastbound queues extend to the I-84 mainline at times under current conditions. Under 2025 conditions, both off-ramps are expected to experience frequent queues which extend near or onto the I-84 mainline in each direction during peak hours. This increases not only the risk of rear-end collisions but also collision severity due to the difference in speeds between vehicles on the mainline (65 mph) and off-ramp vehicles (slowing or stopped).
- As delays on the off-ramps increase, studies of driver response nationally have shown that drivers become increasingly frustrated with delay situations and take more risks. This frustration leads to an increase in rear-end and angle collision rates at high congestion levels (LOS F or V/C > 1.00).
- As volumes increase on I-84 and as traffic using Exits 63 and 64 increases, the risk of sideswipe and rear-end collisions will increase due to the short weaving section between the two interchanges, combined with the higher-than-usual amount of traffic traveling directly between the two interchanges.

## **9. How are the Improvement Options to be Evaluated?**

There are several factors affecting how to improve current and future traffic mobility deficiencies in the study area:

- Does the improvement significantly reduce the current and future potential for queues extending onto the I-84 mainline?
- Does the improvement not only reduce queuing on the I-84 ramps, but also alleviate the highly congested situation on the Hood River Bridge access road between I-84 and the toll booth?
- Will the improvement serve to encourage more local trip-making on I-84, or will it provide for an alternative that reduces the local trip-making?
- Can the East Hood River interchange improvement be accomplished within the \$2.25 million budget?
- Does the East Hood River interchange improvement accommodate the I-84 overpass replacement project?
- Are there any right-of-way or potential environmental impacts to address?

Based on the current and future traffic conditions, the following “purpose” statements were developed to guide the study process.

### **East Hood River Interchange (Exit 64)**

The purpose of the East Hood River Interchange Project is to alleviate current and future traffic congestion at the interchange with the Hood River Bridge

access road, and to improve safety by reducing the potential for traffic queues to extend onto the I-84 mainline.

This project is needed due to traffic congestion at the eastbound and westbound off-ramp intersections with OR 35/Hood River Bridge access road; the close proximity of the westbound ramps with the Marina Drive four-way stop intersection, which often results in queues extending through the westbound ramp intersection; confusing traffic movements caused by the offset nature of the eastbound on- and off-ramp intersection with OR 35/Hood River Bridge access road, and impaired sight distance at the ramp intersections.

When considering alternatives, the East Hood River interchange project should be phaseable and implementable without closing I-84, its ramps, or OR 35/Hood River Bridge access road to traffic; not interfere with, and preferably complement, the programmed 2007 replacement of the I-84 overpass over OR 35/Hood River Bridge access road; provide for longer-term capacity and safety at the interchange; be constructed within the \$2.25 million overall project budget; and be implementable without significant environmental impacts.

### **Button Junction**

The purpose of a future project at Button Junction would be to alleviate current and future traffic congestion associated with traffic growth exceeding the capacity of the intersection. The improvements are needed to reduce delay at the intersection and provide a promising alternative for trips between central Hood River and the Hood River Bridge area, helping to reduce the local trip-making on I-84 between Exits 63 and 64.

The project should be compatible with the Columbia Gorge National Scenic Area, the Historic Columbia River Highway, and the interpretive site being constructed in the southeast quadrant of the intersection. The project should strive to protect and preserve the HCRH as much as possible and minimize impacts on adjacent uses.

### **Local Traffic Circulation**

The purpose of local traffic circulation options is to reduce the amount of local trip-making on I-84 between Exits 63 and 64. Alternatives should be compatible with design standards on I-84 and also with local comprehensive and master plans. Local traffic circulation options should not adversely affect Button Junction or the I-84 ramp intersections.

## **10. *Developing and Studying the Solutions at the East Hood River Interchange***

The design brainstorming workshop in January 2005 produced 16 short- and long-term interchange improvement concepts (see Appendix). The committees all agreed that since one of the project objectives was to stay within the \$2.25

million budget, most of the long-term concepts from the workshop were eliminated.

An evaluation process was conducted for the remaining eight concepts. A workshop was held with the Project Management Team to evaluate the alternatives based on several criteria established at that workshop. Table 4 summarizes the outcome of that workshop. The list was narrowed to three alternatives:

- Tight diamond
- Full signalization with no realignment of ramps
- Roundabout at the eastbound ramps (south roundabout) and modified roundabout at the westbound ramps and Marina Way intersections (north roundabout).

The three options are shown in Figure 8 and Figure 9. Through the analysis, it was determined that combining elements of the tight diamond with the full signalization alternatives would provide the optimum benefits. It also became clear that the eastbound off-ramp should align directly with the eastbound on-ramp. The current offset nature of this intersection will result in adverse traffic operations between the eastbound off-ramp, and traffic traveling south to turn east on the on-ramp adding to delay.

The resultant levels of service from the traffic analysis are shown in Table 3 below. In both the tight diamond and roundabout cases, the improvement scenarios provide significant improvements over no-action and for the most part the level-of-service is within ODOT standards.

In reviewing the resultant levels-of-service, neither the signalization nor the roundabout alternative will fully satisfy the ODOT mobility standard at the I-84 ramps. However, in both cases, the resultant LOS is a significant improvement over no-build. It is likely impossible to improve the LOS in the signalization option without significantly modifying the intersection spacing and ramp configurations at the interchange.

**Table 3. Future Levels of Service (2025)**

Location	No-Action		Signals and Compressed Diamond <sup>3</sup>		Roundabout <sup>4</sup> (Single-lane/two-lane)	
	AM	PM	AM	PM	AM	PM
I-84 westbound off-ramps to OR 35	F (2.40)	F (5.61)	A (0.57)	A (0.60)	1.27/0.72	2.80/0.85
I-84 eastbound off-ramp to OR 35	F (2.14)	F (6.97)	B (0.54)	C (0.78)	0.82/two-lane not modeled	1.11/0.67
Hood River Bridge access road at Marina Way	F (2.24)	F (2.56)	B (0.58)	B (0.76)	Included in westbound ramps	Included in westbound ramps
OR 35 at I-84 EB on-ramp	F (2.40)	F (3.31)	No longer offset	No longer offset	Included in eastbound ramps	Included in eastbound ramps

The roundabout alternative was eliminated as further analysis concluded that two lanes are needed on both roundabouts to avoid ramp queuing and delays for traffic turning from Marina Way onto the Hood River Bridge access road. The two-lane roundabout would require right-of-way that would likely impact the businesses on the northeast quadrant of the interchange, and some of the Port property on the northwest quadrant of the interchange. Additionally, the north roundabout would require several decisions by the driver in a short distance, as it has 4-5 approaching legs and 5 departing legs, which is unusual. Based on these issues, the roundabout option was discarded from further consideration.

Based on this analysis and consideration of all factors, the Policy Committee decided to designate the compressed diamond with full signalization as the preferred alternative. That alternative is shown in Figure 10.

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<sup>3</sup> In some instances at the I-84 ramp intersections, the LOS for a scenario may be better but the v/c ratio is worse than another scenario. LOS is based on delay, while v/c is based on how much capacity is used during a given hour. In these counterintuitive instances, the anomaly is due to the close intersection spacing and the signal coordination system assumed at the interchange.

<sup>4</sup> Roundabout LOS is expressed in V/C ratio and in this table is for the highest V/C ratio of all approaches to the roundabout. ODOT's standard is a maximum V/C of 0.85.

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**Table 4. Evaluation Matrix for Alternatives Analysis**

DESIGN OPTION	EVALUATION CRITERIA														
	Should fit within the current right-of-way	Must be able to accommodate year 2025 traffic volumes, including removing queuing onto I-84	Must eliminate the current sight distance problem underneath the I-84 overpass	Should improve the spacing between the westbound ramps and Marina Way	Should improve the eastbound ramp configuration	Should not impact wetlands	Must not impact the I-84 bridge over the Hood River	Must work with the OTIA III replacement of the existing bridge carrying I-84 through the interchange	Must fit with the future alignment of the Columbia River Crossing	Should minimize disruption to traffic on the freeway	Must accommodate bicycle and pedestrian traffic	Must Accommodate Toll Booth automated toll collection	Must fit Freight Mobility Criteria	Must not impede freight mobility during and after construction	Should be within the \$7 million dollars allocated in the 2006-2009 STIP for the bridge and interchange projects
Ranking System	H, M, L	Y/N	H, M, L	H, M, L	H, M, L	H, M, L	Y/N	Y/N	H, M, L	H, M, L	Y/N	H, M, L	H, M, L	H, M, L	H, M, L
Example	H	Y	H	M	H	H	Y	Y/N	M	M	N	M	M	M	L
Idea 1: Roundabout/Oval-About	L to M	Y*	M to H	L to M	M	H	Y	Y	H	M to H	*	M to H	L to M	L to M	H
Idea 8: I-84 Signal and Bridge Ovalabout	M	Y*	M to H	M	M	H	Y	Y	H	H	*	M to H	M	M	H
Idea 9: Dogbone Roundabouts/Bridge Roundabout															
Idea 10: Tight Diamond***	H	Y	**	H	H	H	Y	Y	H	H	*	M to H	M to H	M to H	H
Idea 11: Total Signalization****	H	Y	**	L to M	H	H	Y	Y	H	H	*	H	M to H	M to H	H
Idea 12: Dogbone Roundabouts/Coordinated Couplet															

**Ranking of Low, Medium and High.** A low ranking equates to a concept unable to meet a specific criteria, either outright or only by substantially altering either the concept or the criteria. A medium ranking equates to a concept meeting a specific criteria by either altering the concept a little or altering the criteria a little. A high ranking equates to a concept meeting a criteria outright, or by making insignificant to minor changes in the concept or the criteria.

 Indicates a Long Term Solution. Eliminate as Short Term Solution

- \* To be determined by traffic analysis and simulation
- \*\* Need to work with the OTIA III Bridge Replacement Team (Replacement of the Existing Bridge Carrying I-84 Through the Interchange)
- \*\*\* This Option assumes Two Through lanes from South of Eastbound Ramps until the Toll Booth & Eastbound On-Ramp Re-aligned
- \*\*\*\* This Option assumes two through lanes from South of Eastbound Ramps until the Toll Booth

Figure 8. Tight Diamond and Signalization Alternative

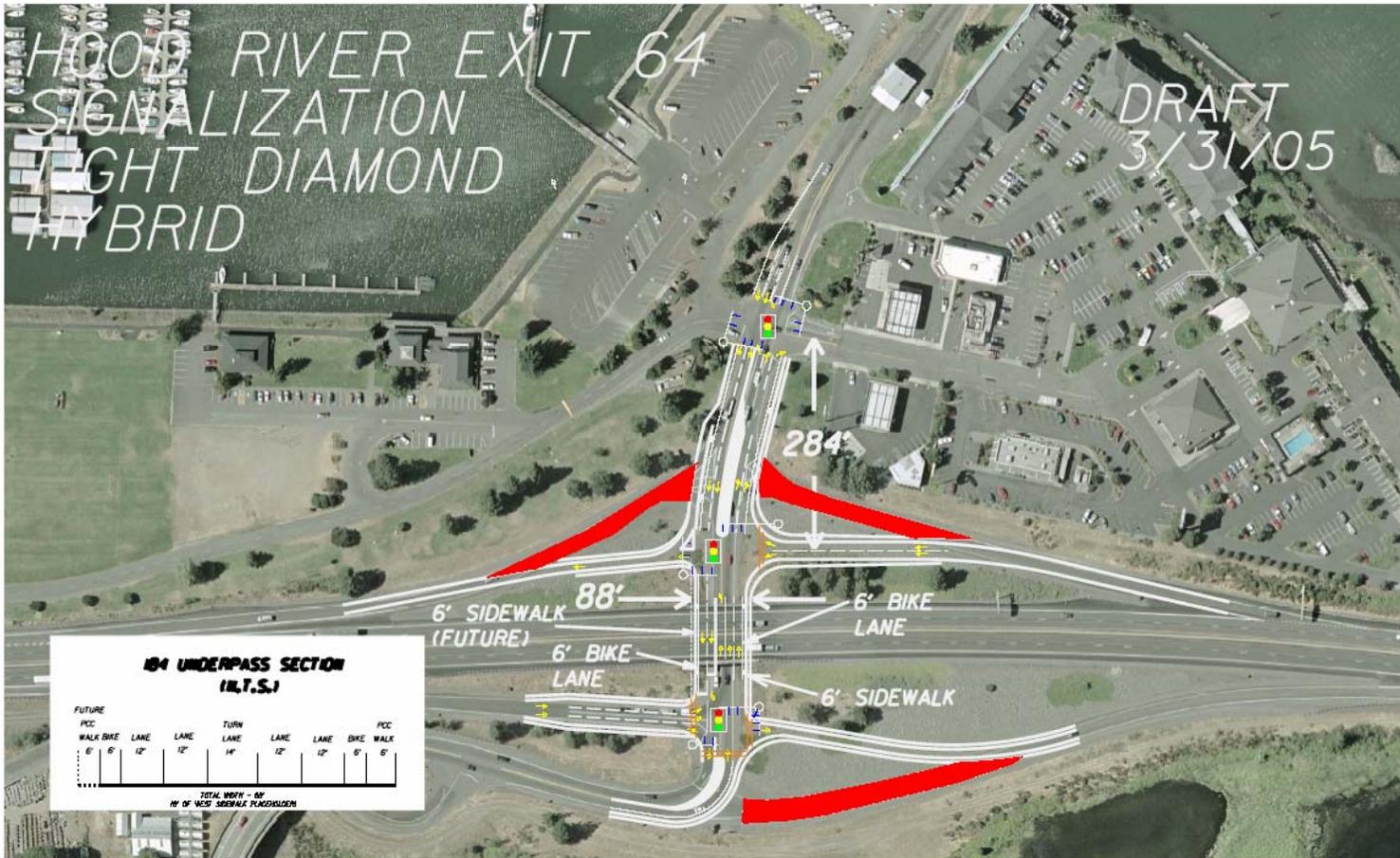


Figure 9. Roundabout and Signalization Options

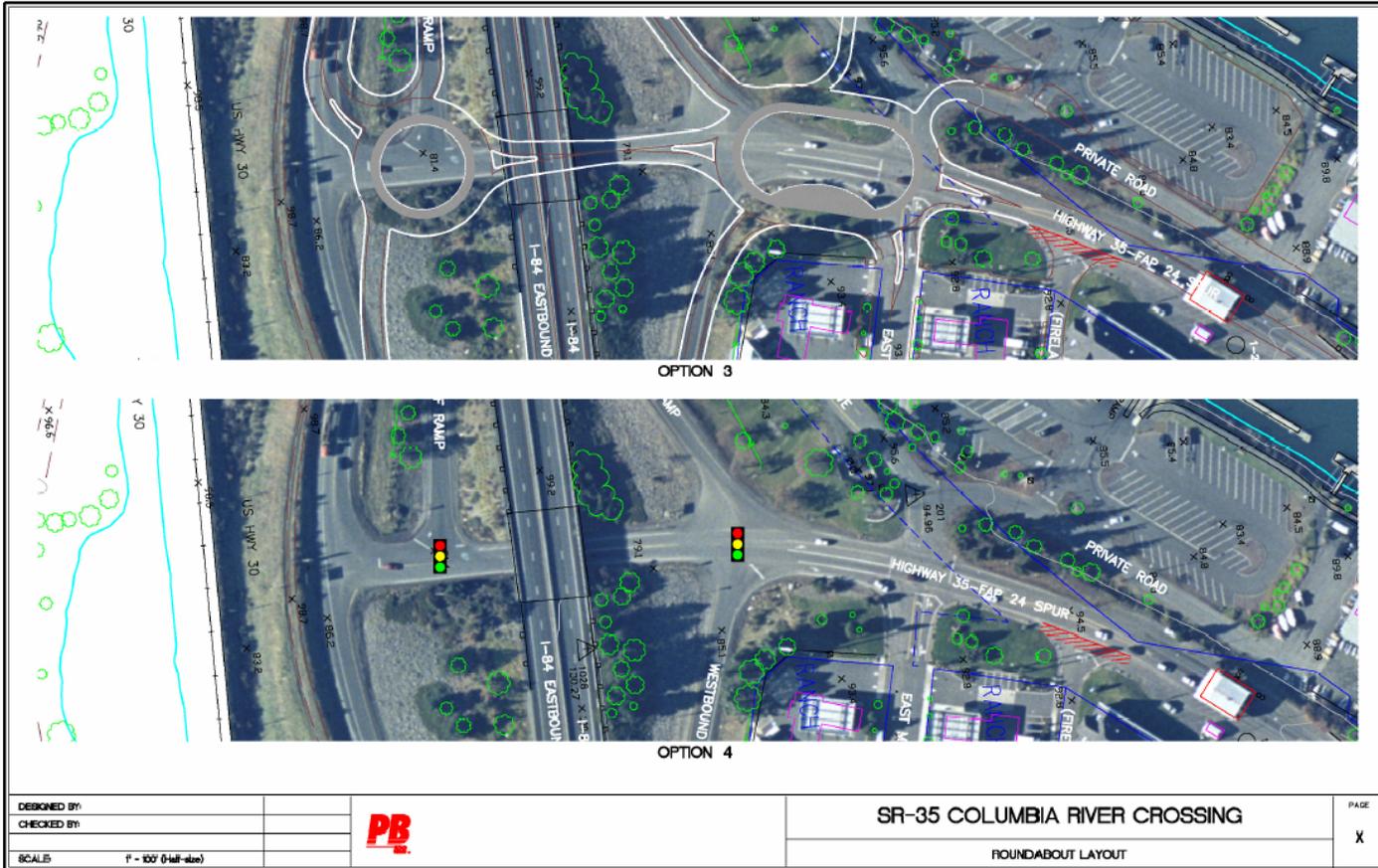
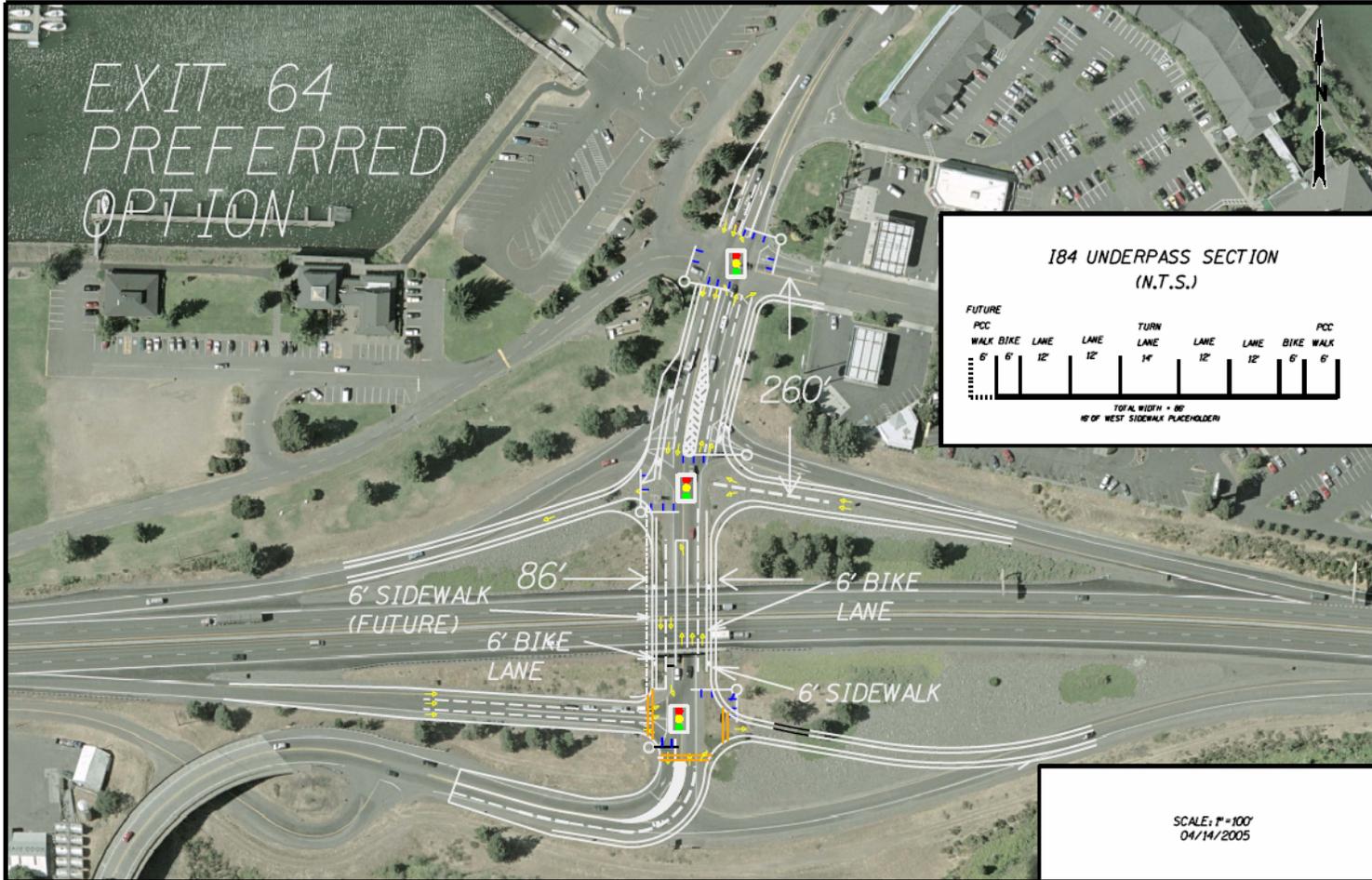


Figure 10. Preferred East Hood River Interchange Design Concept



## **11. How Much Would This Project Cost?**

The cost estimates for this project were developed by first establishing current unit costs per construction item, taken from recent construction bids (called “bid tabs”). Geometric quantities by type of design item were estimated and the cost estimated using the unit costs developed earlier.

Items that are not quantifiable, or lump sum items, were estimated based on common assumptions such as 8% of overall budget reserved for mobilization, or 9% reserved for design engineering. The main components of the cost estimates included pavement, structures (bridges and walls), earthwork, drainage, and traffic signals, as well as contractor mobilization and traffic control during construction.

In addition to these estimated construction costs, the following contingency and other items were marked up on a percentage basis: landscaping, environmental impact mitigation, project scope contingencies, contractor mobilization, construction contingency, design engineering and construction management, and right-of-way acquisition.

The cost estimate in 2005 dollars for the project is \$2.5 million. When inflation is taken into account, this equates to a 2009 cost of \$2.8 million. This project will be combined with the I-84 overpass replacement project to try and achieve enough cost savings to complete this project within the \$2.25 million budget.

Cost estimate details are found in the appendix.

## **12. Are There Any Design Exceptions Needed?**

Design exceptions are instances where conditions may constrain the ability to improve the interchange to desired ODOT standards. Because of existing constraints at the interchange, there are several design exceptions that will be needed for the improvement:

- Shoulders on the Hood River Bridge access road and OR 35 through the interchange area are proposed as 6 feet instead of the standard 10-foot width. This is to minimize the overall pavement width (which minimizes the width of roadway that pedestrians need to cross), which also accommodates the proposed I-84 overpass span widths to be built with the bridge reconstruction project scheduled in 2007.
- Intersection spacing: the intersections of the eastbound ramps (off- and on-ramps, which are currently offset), westbound ramps, and Marina Way are spaced less than 300 feet apart, less than ODOT’s desired standard of 520 feet (for a 35 mph design speed roadway). The proposed improvement increases the intersection separation as well as removes the offset of the eastbound ramp intersections, but still does not meet

standard. Due to the existing land uses, environmental and topographical constraints, and roadway layouts, correcting this situation to meet standard would be impractical, expensive, and may have significant environmental impacts on adjacent wetlands and habitat.

- Interchange spacing: the 2<sup>nd</sup> Street and East Hood River interchanges are a half-mile apart, less than ODOT's and FHWA's standard of a mile spacing in urban areas. While alternatives were investigated that would alleviate this situation, they are very expensive and would likely result in lower levels-of-service at the ramp intersections than the proposed alternative.
- Level-of-service: at the I-84 ramps and at Button Junction, the resultant levels-of-service under the selected improvement scenarios will not meet ODOT's mobility standard in at least one peak period in 2025. The improvements necessary to bring these intersections into compliance would require significant modification to each of these intersections, which will likely have significant cost, property, and environmental impacts.
- The taper rate for the left and right turns at the eastbound off ramp are designed at 40:1 matching the design speed of the off ramp. The standard taper rate for right turn lanes is 10:1.
- Trap lanes: this is an instance where vehicles are traveling in a lane and may become "trapped" as the lane ends or becomes a turn lane. An instance where this occurs is northbound approaching Marina Way, where there are two northbound traffic lanes approaching the intersection. The proposed improvement results in the right traffic lane becoming a right-turn-only lane until some future point in time where it could be extended to become a second lane at the toll booth. The second trap lane is southbound where the left of two southbound travel lanes through the interchange becomes a left-turn-only lane onto the eastbound on-ramp. This second lane must drop as there is only one southbound travel lane on OR 35 traveling uphill toward Button Junction, and there are no plans for a second travel lane. In both of these instances, proper advance warning and lane control ("Right lane must turn right") signs will alleviate the situation.
- Stopping sight distance at the eastbound off ramp to exit 64. Assuming a design speed of 60 miles per hour, the required distance from the ramp divergence from the Interstate to the storage lanes on the ramp is 570 feet. The preferred alternative design results in 500 feet of stopping sight distance, creating a disparity of 70 feet.

Both ODOT and the American Association of State Highway and Transportation Officials (AASHTO) call out the same figure of 570 feet for stopping sight distance at a design speed of 60 miles per hour. In order to meet this standard, the ramp beginning would need to be pushed 70 feet west of its current location. This becomes difficult due to the proximity of the I-84 bridge to the west of the exit 64 off ramp, and the existing condition of the East Hood River interchange.

During the final design of the interchange improvement, consideration should be made to widen asymmetrically to the east. This would allow some additional stopping distance on the eastbound off-ramp, although it is unlikely it will allow an additional 70 feet to be gained.

The existing condition, although technically within the design standard of 570 feet, is substandard in terms of storage performance and contributes to traffic queues backing up onto I-84.

This alteration of the plan would necessitate FHWA approval before the design could achieve acceptance. The alternative would add storage, eliminating the impact of peak hour traffic queuing on the interstate.

### **13. *What About Long-Term Improvements to the Interchange?***

During the analysis process, the general consensus of the committees and the project team was that the interchange would benefit by eventual conversion to a single point urban interchange (SPUI). The concept of a SPUI is to bring all the ramp ends together at a single point intersection with a roadway, instead of two intersections for a typical diamond interchange.

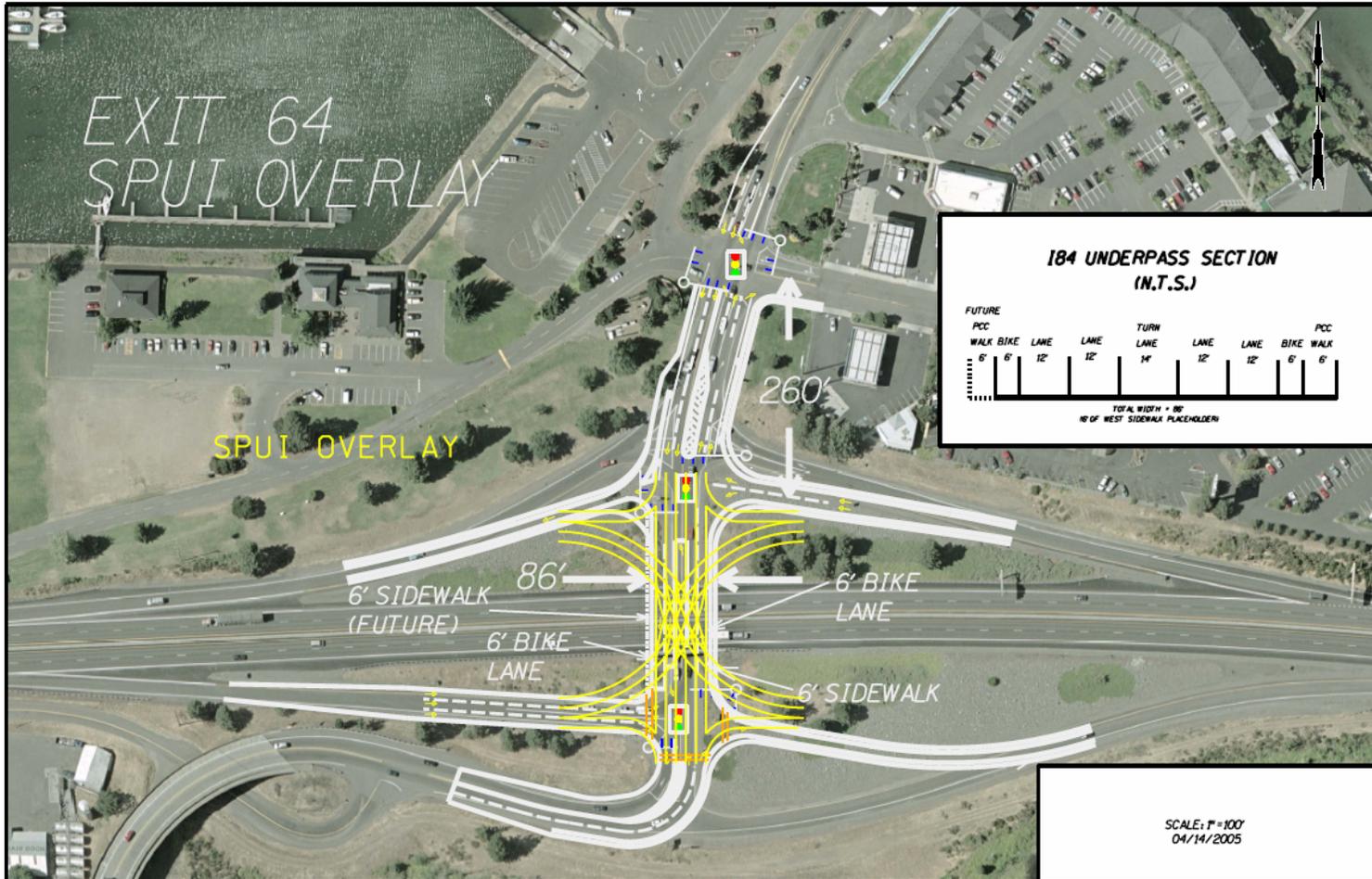
By converting the interchange to a SPUI, some physical improvements can be realized:

- There will only need to be two signalized intersections between I-84 and the Hood River Bridge instead of three;
- The two signalized intersections will be spaced further apart than the three signalized intersections in the preferred interchange alternative;
- The design of the off-ramps would allow for a longer deceleration length before widening into the turn lanes, thus reducing the amount of deviation needed.

Figure 11 shows the SPUI concept overlaid on the preferred interchange alternative. While the interchange improvement concept would appear to be close to accommodating a future conversion to a single point urban interchange, it is likely not sufficient to accommodate the required turning radii and clear zones needed for the single-point intersection underneath I-84. It is recommended that the SPUI design template be overlaid on the interchange improvement design during final design to ensure future conversion can occur without replacement of the I-84 overpass.

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Figure 11. SPUI Overlaid on Preferred Alternative



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## 14. What are the Options at Button Junction?

Based on traffic counts taken in early 2005, the intersection currently meets three of the eight warrants used to justify traffic signal installations. The intersection is currently an all-way stop, so a traffic signal would be the next logical step for increased traffic control. The intersection is currently operating at LOS F, with the northbound left turns and the westbound through and left turns experiencing the highest delays during peak hours.

With no improvements, the entire intersection of the Historic Columbia River Highway and OR 35, or Button Junction, would continue to operate at a level-of-service of "F" by 2025 during both AM and PM peak hours. Extreme delays would be experienced in the PM peak for northbound traffic from OR 35 either heading to I-84, the Hood River Bridge, or Hood River city center, and for traffic from the Hood River city center turning north toward I-84 and the Hood River Bridge. During typical AM peak hours in 2025, delays would be experienced by southbound traffic heading toward Mount Hood, the Hood River city center, or east on the HCRH, and by northbound traffic heading to the Hood River city center.

Table 5 below summarizes current and 2025 no-build peak levels-of-service.

**Table 5. Current and Future No-Build Levels-of-Service at Button Junction**

Location	Existing		2025 No-Action		Mobility Standard
	AM	PM	AM	PM	
HCRH at Oregon 35	F(1.46)	D (0.93)	F (2.79)	F (2.26)	D (0.70)

Two improvement options were considered:

- Construct a single-lane roundabout (Figure 12)
- Signalize and add turning lanes (Figure 13).

Conversion to a roundabout would provide an overall improvement over the no-build condition in 2025; however, it would still operate over the capacity standard (the roundabout must operate at no more than a 0.85 volume-to-capacity ratio). During the PM peak period, the southwest quadrant of the roundabout would operate over the capacity of a single-lane roundabout. Adding a second lane for right turns to the southwest, northwest, and northeast quadrants improves the situation somewhat, but the roundabout will still operate above capacity.

Other issues with the roundabout include intrusion into the planned interpretive site on the southeast quadrant and intrusion into the businesses north of the intersection. The Historic Columbia River Highway Advisory Committee felt that while the roundabout provided the best aesthetics for the intersection (with an

ability to landscape the center of the roundabout), the impacts to the interpretive site and to the Historic Highway itself caused concern.

The signalization option would also provide some widening to add a separate left turn lane eastbound (instead of a shared through-left), a separate westbound left turn lane, and a separate northbound left turn lane. The intersection would operate at LOS D (volume-to-capacity ratio of 0.85) during 2025 peak hours, with the volume/capacity ratio still exceeding ODOT mobility standards but a significant improvement over 2025 no-build conditions.

Seasonal traffic variations and the ability to accommodate unusually large traffic events, such as when weather or incidents may affect traffic on US 26 and send more traffic north on OR 35 to I-84, were also qualitatively assessed, as these were issues to the local community as well as the HCRH Advisory Committee. The signalization option offered better flexibility than the roundabout option as the signal can be manually operated, or remotely retimed, to accommodate the traffic event while the roundabout does not offer a similar flexibility.

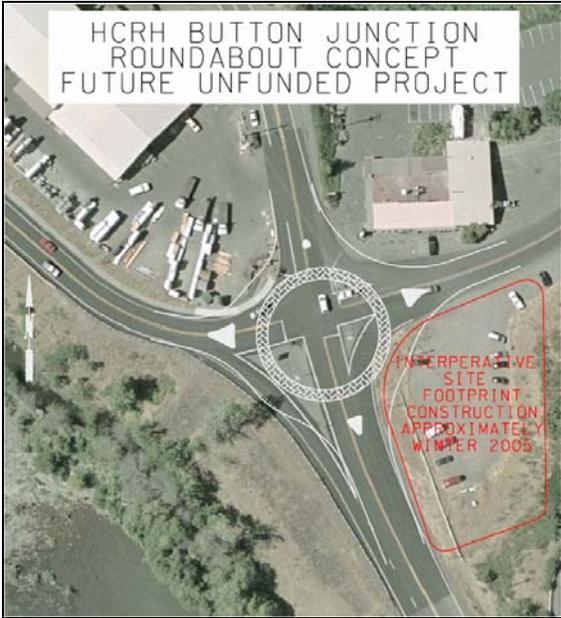
Given this analysis, the signalization option is preferred over the roundabout option. However, the Executive Management Team and the Policy Committee believe that both options have merit and should be carried forward into the future project development process when funding is programmed for an improvement at this intersection.

### **Oregon Historic Preservation Review**

Because the Historic Columbia River Highway is on the National Register of Historic Places (NRHP), any improvements at this location require a review of the Oregon State Historic Preservation Office.

Figure 12 and Figure 13 below show the dimensions of the two alternatives being carried forward as well as overlaying the planned interpretive site. While there will be an impact on the Historic Highway under either alternative, the roundabout option will result in a slightly higher impact as the original pavement will need to be removed within the roundabout for its construction, while for the signalization alternative, the original pavement may remain but additional pavement will be needed to provide the necessary widening for turn lanes.

**Figure 12. Roundabout Option at Button Junction**



**Figure 13. Signal and Intersection Improvements at Button Junction**



## **15. What Local Circulation Options Were Considered?**

An issue of concern identified by ODOT is that trips that travel only between the 2<sup>nd</sup> Street and East Hood River interchanges are using I-84. These “local trips” are inconsistent with the function of an Interstate highway, which is to carry regional and interstate trips over long distances, not between adjacent interchanges. These local trips are traveling between the Hood River city center, the Expo Center area, the Hood River Bridge, and the Marina Way area and use I-84 to do so.

The reason this is an issue, besides the inconsistency with the function of an Interstate highway, is that as the number of these trips increases, it also limits the ability of longer trips already on I-84 to exit at either interchange. This is called “friction” and results in lower travel speeds for vehicles trying to exit, and an increased risk of rear-end collisions with through vehicles on I-84.

During the study, four alternatives to reduce the local trip-making on I-84 were proposed:

1. Construct a local bridge crossing over the Hood River between the Expo Center area on the west bank of the river, and the Marina Way/Museum area on the east bank of the river (Figure 14);
2. Construct a grade separation between the on- and off-ramps between the two exits (called “braided ramps”) that would prevent trips only traveling between the two interchanges (Figure 15);

**Reconfigure the two interchanges into something called a “split diamond”. Westbound vehicles desiring to exit at Exit 63 would exit at Exit 64, travel through a signalized intersection using the westbound off-ramp, and then use the existing westbound on-ramp to travel to Exit 63. A barrier would be placed between the westbound I-84 through lanes and the auxiliary lane that exists between the current on- and off-ramps, so that traffic would not be allowed to weave left onto I-84 or weave right from I-84 (**

3. [Figure 16](#));
4. Improve the Button Junction intersection to reduce delays and encourage local trips to use it (see discussion above).



Figure 14. Local Bridge Crossing Option (Preferred)



Figure 15. Braided Ramps Option



Figure 16. Split Diamond Option



During the analysis, the following was found:

- The braided ramp option would force all trips between the Hood River city center and Expo Center area traveling to the Marina area to use Button Junction, as no other route exists other than to travel three miles out of direction to use Exit 62. This would add over 600 peak hour trips to the Button Junction intersection which would cause it to fail, even with improvements (see the Button Junction discussion above);
- Providing a local bridge connection between the east and west banks of the Hood River would reduce the local trip making and increase 2025 PM peak speeds on I-84 in the weaving area by at least 2 mph to 42-49 mph, reducing the collision risk and improving I-84 traffic operations;
- A local bridge crossing would cost in the \$4-6 million range, while the braided ramps are estimated to cost \$35-45 million;
- The barrier option would require widening of the I-84 bridge over Hood River which may cost more than \$4 million to build.

The Executive Management Team and the Policy committee recommended moving forward with the local bridge option as it provides the best option for relieving the local trip-making on I-84 and is a lower priced option than the braided ramp option.

## **16. What are the Next Steps?**

The intent of the East Hood River interchange alternatives is to select an improvement alternative that can be advanced into design and eventual construction, which is scheduled for 2009, and to guide the roadway needs underneath the I-84 overpass. The I-84 overpass replacement is scheduled for 2007.

Based on the committee reviews, the Executive Management Team and the Policy Committee selected the preferred interchange plan shown in Figure 14 as the interchange concept to advance into design. The committees felt that although the cost estimate was above the \$2.25 million budgeted in the Statewide Transportation Improvement Program (STIP), there may be ways to reduce costs during the design stage.

The committees also recommended that ODOT consider combining the interchange project and the I-84 bridge replacement project into one composite project. This should result in an overall savings on contractor mobilization (would only need to mobilize once rather than twice), traffic control (construction occurs once rather than twice), and economic impacts (due to construction delays and detours).

By combining the projects and accelerating the construction schedule, some reduction of the interchange improvement budget may be realized due to less impact from inflation, as well as the benefits of combining two projects into one.

The project team has also developed improvement options at Button Junction (OR 35 with the Historic Columbia River Highway) and local traffic options between the Hood River city center and the Hood River Bridge/Marina area. Neither the Button Junction nor the local traffic options between central Hood River and east Hood River have construction funding as of yet. The intent of this study is to develop options that can be advanced into the local planning process and to eventually seek funding for these improvements. Separate design studies will be performed for each of these projects similar to the Exit 64 study when funding becomes available for construction.

# APPENDICES

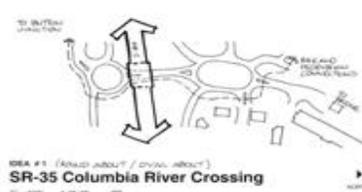
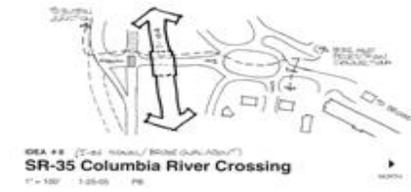
## A. Design Workshop Participants

Name	Agency
Dan Bacon	ODOT
Bill Barnhart	ODOT Dist. 2C
Anne Debbaut	HRC-Planning
June Carlson	ODOT
Art Carroll	Historic Highway Ad. Com.
Mike Doke	Port of Hood River
Jennifer Donnelly	City of Hood River Planning Dept.
Simon Eng	ODOT Regional Traffic
Chuck Green	Parsons Brinckerhoff
David Harlan	Port of Hood River
Steve Harry	ODOT
Mark Johnson	ODOT Preliminary Design
Linda Jones	White Salmon
Jeanette Kloos	ODOT
Mark Lago	City of Hood River
Brian Litt	Columbia River Gorge Commission
Shazia Malik	Parsons Brinckerhoff
David Myers	Parsons Brinckerhoff
Bill Pattison	Historic Col R14 Highway
Nathaniel Price	FHWA
Michael Ray	ODOT
Dale Robins	RTC
Linda Shames	Port of Hood River
Don Wiley	HR County
Eric Walker	HRC-Planning

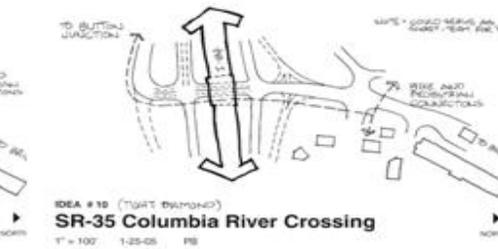
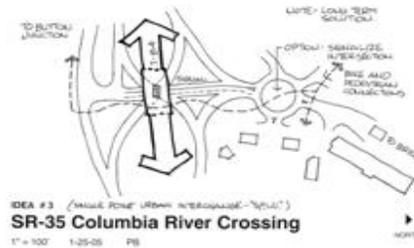
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## B.

### Exit 64 East Hood River Interchange Study – Alternatives from Design Workshop



- Advisory Committee Factors for Keeping or Eliminating Alternatives:
- Roundabout at Marina/Bridge Access Road/I-84 Ramps may be confusing to drivers
  - Need to have two lanes each way between I-84 and Marina Way for future traffic
  - Minimize right-of-way impacts
  - Need to line up Eastbound off-ramp and Eastbound on-ramp
  - Alternatives must stay within \$225 million project budget
  - Alternatives should be compatible with future new Columbia River Bridge, and the toll booth improvement project



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## C. Cost Estimates

<b>Hood River Exit 64 Interchange</b>				By: DEM
<b>Financially Constrained Estimate</b>				4/14/2005
	<u>Quantity</u>	<u>Unit</u>	<u>Unit Price</u>	<u>Total</u>
ACP Paving (includes base)	33895	SF	\$5.00	\$169,475
ACP 2 1/2" Overlay	48718	SF	\$1.25	\$60,898
PCC Sidewalk (includes base)	5411	SF	\$3.00	\$16,233
Storm Drainage (based on impervious area)	39306	SF	\$0.75	\$29,480
Earthwork (Cut)	1,137	CY	\$7.00	\$7,957
Earthwork (Fill)	0	CY	\$14.00	\$0
MSE Wall	2000	SF	\$50.00	\$100,000
Signing	1	LS	\$6,000	\$6,000
Striping	950	LF	\$3.00	\$2,850
Traffic Signal	3	EA	\$170,000.00	\$510,000
Illumination	950	LF	\$45.00	\$42,750
Traffic Control	1	LS	\$90,250	\$90,250
Clearing and Grubbing	1.896534	ACRE	\$1,800.00	\$3,414
Relocation of Utilities	665	LF	\$20.00	\$13,300
Landscaping	500	LF	\$60.00	\$30,000
Environmental Impact Mitigation	1	LS	\$120,250	\$120,250
			<b>Subtotal 1</b>	<b><u>\$1,202,855</u></b>
Project Scope Contingencies (20%)			\$240,571	<b><u>\$1,443,427</u></b>
			<b>Subtotal 2</b>	
Mobilization (8%)			\$115,474	<b><u>\$1,558,901</u></b>
			<b>Subtotal 3</b>	
Construction Contingency (5%)			\$77,945	
Construction Engineering (9%)			\$140,301	
			<b>Subtotal 4</b>	<b><u>\$1,777,147</u></b>
Design Engineering and Administration (15%)			\$266,572	
			<b>Subtotal 5</b>	<b><u>\$2,043,719</u></b>
Right-of-Way Acquisition			\$20,000	
<b>*Total Estimated Cost</b>	<b>2005 \$\$\$</b>			<b><u>\$2,063,719</u></b>
<b>*Total Estimated Cost</b>	<b>2009 \$\$\$</b>			<b><u>\$2,322,734</u></b>

**\*Note:** ROW Acquisition estimated at approximately \$5 per square foot (Subtotal 5). Signing, Traffic Control and Environmental Impact Mitigation estimated at approximately 0.5%, 7% and 10%, respectively, of construction cost (Subtotal 1).

<b>Total Ideal Project Estimate</b>	<b>2005 \$\$\$</b>	<b><u>\$2,496,639</u></b>
<b>Total Ideal Project Estimate</b>	<b>2009 \$\$\$</b>	<b><u>\$2,809,990</u></b>

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## D. Traffic Counts, Seasonal Adjustments, and Forecast Methodologies

**NOTE:** A separate traffic appendix will be issued which will contain all of the traffic counts and traffic projections, including Synchro files.

**To:** Project Team  
**From:** Shazia Malik  
**Date:** February 24, 2005  
**Subject:** Growth Rate Calculation (Exit 64 – East Hood River Interchange Study)

The following memo describes the methodology that was used to calculate the growth rate for the Exit 64 – East Hood River Interchange study area.

ODOT traffic analysis procedures call for 30<sup>th</sup> HV to be used for operations analysis of intersections and street segments. The raw count data will be adjusted to determine 30<sup>th</sup> HV at each study location using the following analysis methodology:

1. Selection of ATR locations that have similar traffic characteristics:
  - a. It was found that there is no Automatic Traffic Recorder (ATR) in the vicinity of analysis intersections.

2. Development of 30<sup>th</sup> HV will be based on ODOT's seasonal factors table<sup>5</sup>:

The table includes biweekly seasonal factors gathered at all ATR locations. Seasonal factors are available for the 1<sup>st</sup> and 15<sup>th</sup> of each month. Since our counts are scheduled for February, 2005, and could be on dates between the 1<sup>st</sup> and the 15<sup>th</sup> and between the 15<sup>th</sup> and the 30<sup>th</sup>, interpolation will be used to derive new seasonal counts for the analysis.

- a. For this purpose, the Rowena (33-001) ATR site will be used for any I-84 mainline and ramp volumes in the study area. This ATR will be used because it is the closest recorder to the study area with a similar functional classification and traffic characteristics. Two other ATR sites, Mt. Hood (14-003) and Bridal Veil (26-012) are also representative of the study area and the average of their seasonal factors will be applied to all other study area locations.
  - b. The peak month for the study area intersections is July. This is based on five years of historical data (1999-2003)<sup>2</sup> obtained from ODOT web site for ATR locations identified above.
3. Using ODOT's seasonal factors table, the 30<sup>th</sup> HV seasonal factor will be calculated using the following formula:

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<sup>5</sup> <http://www.odot.state.or.us/tddtpau/papers/analysis/2003SeasonalFactors.pdf>

<sup>2</sup> [http://www.oregon.gov/ODOT/TD/TDATA/tsm/tvt.shtml/shtml#Traffic\\_Volume\\_Tables](http://www.oregon.gov/ODOT/TD/TDATA/tsm/tvt.shtml/shtml#Traffic_Volume_Tables)

30 HV Seasonal factor = (Count period seasonal factor ÷ Peak period seasonal factor)

e.g., 30 HV Seasonal factor = {(February 2 seasonal factor obtained from interpolation between February 1 and February 15 for the appropriate ATR station) ÷ (lowest value in ATR station row)}

For the ATR locations identified above, the lowest adjustment factor in the seasonal factors table is for July, 15.

4. Raw intersection turning movement volumes and bi-directional tube counts will be converted to the 30<sup>th</sup> HV by multiplying the seasonal factor and the raw counts. This will account for any traffic seasonal variations between the peak travel month (July) and count dates (February) for the study area.
5. The roadway system will be balanced to a single peak hour exactly between intersections that have no accesses between them (e.g. interchange ramp terminals). Intersections with accesses/other non-counted intersections between them need to be consistent on the facility (e.g. reasonable differences for land uses).
6. Finally, peak 15-minute flows will be estimated using the applicable peak hour factor (PHF) and will be the basis for traffic operations analysis.

$PHF = \{(30 \text{ HV}) / (4 * \text{Max. 15-min Volume during the peak hour})\}$

For any comments and/or questions, please contact:

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**To:** Exit 64 Project Team  
**From:** Shazia Malik  
**Date:** February 24, 2005  
**Subject:** Growth Rate Calculation (Exit 64 – East Hood River Interchange Study)

The following memo describes the methodology that was used to calculate the growth rate for the Exit 64 – East Hood River Interchange study area.

After discussions with the ODOT traffic staff, it was decided that the analysis procedure would use ODOT's future volumes table<sup>6</sup> and ODOT's methodology describing how to use the future traffic volumes<sup>7</sup>. Following steps were taken to calculate the growth rate that could be used to obtain 2025 future year traffic volumes for the Hood River study area:

1. The Future Volumes Table uses data from the Transportation Volume Tables (TVT) maintained by the Transportation System Monitoring Unit<sup>3</sup>. Based on the TVT counts that are collected over 20 years, Future Volumes Table estimates future traffic by highway mile-points. Future Volumes Table assumes a linear growth function.
2. For the Hood river study area, TVT data for Highway 100 (Route no I-84/ Historic Columbia River Highway) and Highway 2 (Route no I-84/ Columbia River Highway) were used between mile-points (MPs) 48.93 to 51.27 and 61.86 to 64.24, respectively.
  - MP 48.93 and MP 51.27 refer to two locations on Highway 100; just east of Columbia River Highway (I-84) and east of Mt. Hood Highway (OR 35), respectively.
  - Similarly the two MPs on Highway 2, i.e. 61.86 and 64.24 refer to locations just west of West Hood River Interchange and just west of Hood River Bridge Interchange, respectively.

These mile-points were used because they were closest to the study area.

3. Future Volumes Table also provides the r-squared value with each traffic volume entry. This helps in measuring the correlation between the historical data points and the generated trend. A value of 1.0 would mean a perfect relationship, indicating that the historical data matched the regressed trend line perfectly in a straight line. For our purpose, mile-points with r-squared values greater than 0.75 were chosen for estimating growth rates. The result is shown Table 1.

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6 [http://egov.oregon.gov/ODOT/TD/TP/TADR.shtml#Future\\_Traffic\\_Volumes](http://egov.oregon.gov/ODOT/TD/TP/TADR.shtml#Future_Traffic_Volumes)

7 <http://www.oregon.gov/ODOT/TD/TP/docs/TADR/UseFVT.pdf>

3 [http://www.oregon.gov/ODOT/TD/TDATA/tsm/tvt.shtml#Traffic\\_Volume\\_Tables](http://www.oregon.gov/ODOT/TD/TDATA/tsm/tvt.shtml#Traffic_Volume_Tables)

**Table 1: Estimated Growth Rate**

Highway No.	MP	Description	Growth Rate/Year
100	48.93	0.05 mile east of Columbia River Highway (I-84)	2.7
100	49.19	West city limits of Hood River	2.7
100	50.89	0.01 mile east of Front Street	3.2*
100	51.05	East city limits of Hood River, 0.18 mile west of OR 35	2.9
2	61.86	0.20 mile west of West Hood River Interchange	2.5
2	62.85	West city limits of Hood River, 1.07 mile west of 2nd Street	2.6
2	64.24	0.20 mile west of Hood River Bridge Interchange	2.6
<b>Average Growth Rate per Year (%) =</b>			<b>2.6</b>

\*Not included in calculation

In Table 1, MP 50.89 showed a very high growth rate per than all other locations and was not thus included in calculating the average for the study area.

4. The linear growth rate per year was calculated using the following formula:  
 (Future Year – Base Year) Growth Factor = (Future Year Volume/ Base Year Volume)  
 Yearly Growth Factor = ((Future Year Volume/ Base Year Volume) – 1) / (Future Year – Base Year)  
 Growth rate/Year = {((Future Year Volume/ Base Year Volume) – 1) / (Future Year – Base Year)} \* 100
5. Growth rate of 2.6% per year was assumed to adequately represent the Hood River Bridge Interchange study area.
6. ODOT traffic staff confirmed that the growth rate of about 2.6% was comparable to the growth rate estimates used in the current Hood River County Transportation System Plan.

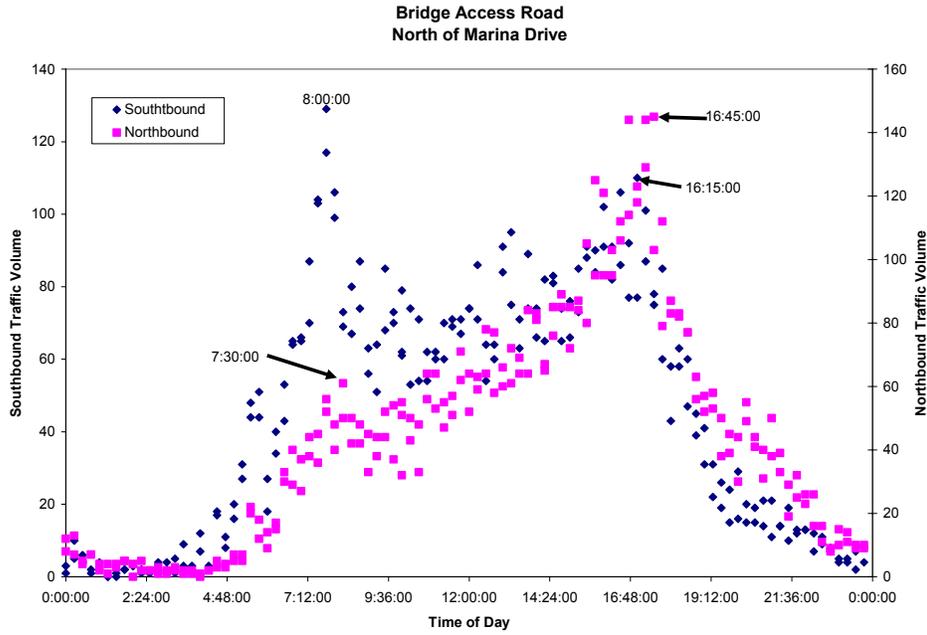
For any comments and/or questions, please contact:

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# Exit 64 – East Hood River Interchange Improvement Alternatives Study

## Traffic Analysis Summary:

1. Determination of the Peak Hour: Example below shows how raw data plots helped determine the peak hour for the EXIT -64 study area.



Peak Hour Chosen: AM Peak 7:25 – 8:25, PM Peak 4:35 – 5:35

2. Based on ODOT's Seasonal Factors Table, raw counts taken in February (2005) were adjusted by a factor of 1.6.
3. Peak season for the study area was determined from the ADT historic data for locations closer to the study area available from ODOT's transportation data web site. Peak season was determined to be July.
4. Counts were converted to flow rates by adjusting for the Peak Hour Factors by approach.
5. Weekend and weekday traffic counts were analyzed. Weekday is the heaviest traveled day of the week for the study area. Thus, build and no-build traffic analysis for 2005 and 2025 were carried out using weekday counts.
6. For 2025 future year traffic volumes, a growth factor of 2.6% per year was applied to the base year (2005) traffic data.

# Traffic Signal Warrant Analysis of OR 35/Historic Columbia River Highway Intersection for 2005 Conditions

All warrants standards are from the Manual on Uniform Traffic Control Devices (MUTCD) —Millennium Edition

## 1. Warrant 1, Eight-Hour Vehicular Volume

The Minimum Vehicular Volume, Condition A is used to compare available volume data at the subject intersection and is based on the 2-day, 24-hour directional count that was not taken at the exact studied intersection location, but rather at on OR 35 just south of the freeway and on Oak east of 2<sup>nd</sup> St and then adjusted using best engineering judgment to reflect conditions at the study intersection.

This warrant is not met.

## 2. Warrant 2. Four-Hour Vehicular Volume

Based on the available two hour turning movement counts at the exact location and the 24-hour directional counts described in Warrant 1 and evaluated using Figure 4C-1, which shows that for an average four hour volume of approximately 550 vehicles per hour, as observed on OR 35, a side street volume of about 250 vph is necessary to satisfy the warrant. The observed average four hour volume on the side street is over 350 vph.

Warrant 2 is met

## 3. Warrant 3. Peak Hour

Part B of the warrant uses Figure 4C-3, which shows that for a single hour volume of approximately 550 vehicles per hour, as observed on OR 35, a side street volume of about 400 vph is necessary to satisfy the warrant. The observed single hour volume on the side street is about 450 vph.

Warrant 3 is met

## 4. Warrant 4. Pedestrian Volume

There are very few pedestrians crossing at the subject intersection location

Warrant 4 is not met

## 5. Warrant 5. School Crossing

N/A

## 6. Warrant 6. Coordinated Signal System

Signalizing the subject intersection may help traffic flow, even though it is more than 1000 ft away from the I-84 EB ramp, however the majority of the movements are to and from the north so there is no significant platooning occurring.

Warrant 6 is not met.

**7. Warrant 7. Crash Experience**  
No data available

**8. Warrant 8. Roadway Network**

Both Historic Columbia River Highway and OR 35 are major routes, and the intersection has a total existing entering volumes of a little over 1000 vehicles per hour during a typical weekday PM peak hour according to the turning movement count. The 5-year projected traffic volume should meet Warrant 2, 3 since the existing volume already meets the warrant.

Warrant 8 is met

Warrant 2. Four Hour Vehicular Volume										
			Northbound		Southbound	Northbound + Southbound	Eastbound (Minor Street High Volume Approach)			
12>02/01/05	14:00:00	82		12>02/01/05	14:00:00	52				
12>02/01/05	14:15:00	98		12>02/01/05	14:15:00	45				
12>02/01/05	14:30:00	79		12>02/01/05	14:30:00	60				Meet Standard?
12>02/01/05	14:45:00	92	351	12>02/01/05	14:45:00	52	209	560	301	Yes
12>02/01/05	15:00:00	94		12>02/01/05	15:00:00	49				
12>02/01/05	15:15:00	83		12>02/01/05	15:15:00	56				
12>02/01/05	15:30:00	71		12>02/01/05	15:30:00	64				
12>02/01/05	15:45:00	93	341	12>02/01/05	15:45:00	45	214	555	354	Yes
12>02/01/05	16:00:00	102		12>02/01/05	16:00:00	62				
12>02/01/05	16:15:00	84		12>02/01/05	16:15:00	60				
12>02/01/05	16:30:00	79		12>02/01/05	16:30:00	60				
12>02/01/05	16:45:00	99	364	12>02/01/05	16:45:00	46	228	592	375	Yes
12>02/01/05	17:00:00	109		12>02/01/05	17:00:00	62				
12>02/01/05	17:15:00	111		12>02/01/05	17:15:00	50				
12>02/01/05	17:30:00	69		12>02/01/05	17:30:00	45				
12>02/01/05	17:45:00	61	350	12>02/01/05	17:45:00	40	197	547	430	Yes
Note : WB traffic volume from directional count is no good to be used here after comparing the data to actual turning movement counts.										
Warrant 3. Peak Hour										
From the Peak Hour turning movement count data:										
The PM peak hour is from 4:35--5:35 NB plus SB are about 530 vehicle per hour										
EB has about 450 vehicles per hour, considering 1lane & 1lane situation (Reference existing condition picture)										
The peak hour warrant is met										

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## E. Committee Meetings

Chronology of Committee meetings for the East Hood River Interchange Study.

<b>Committee</b>	<b>Date</b>	<b>Discussion Items</b>	<b>Action Items</b>
Project Management Team	January 6, 2005	<ul style="list-style-type: none"> <li>• Kickoff</li> <li>• Background</li> <li>• Committee roles</li> </ul>	<ul style="list-style-type: none"> <li>• Date for workshop</li> </ul>
Executive Management Team/ Policy Committee (joint meeting)	January 13, 2005	<ul style="list-style-type: none"> <li>• Kickoff</li> <li>• Background</li> <li>• Committee roles</li> <li>• Ideas for Workshop</li> </ul>	<ul style="list-style-type: none"> <li>• Agreement on study schedule</li> </ul>
Project Management Team/Stakeholders	January 20, 2005	<ul style="list-style-type: none"> <li>• Range of design options for consideration</li> </ul>	<ul style="list-style-type: none"> <li>• None</li> </ul>
Executive Management Team	January 27, 2005	<ul style="list-style-type: none"> <li>• Review of range of options</li> <li>• Review of purpose and need</li> </ul>	<ul style="list-style-type: none"> <li>• Screening criteria for narrowing alternatives</li> <li>• Purpose and need statement</li> <li>• Project objectives</li> </ul>
Project Management Team	February 10, 2005	<ul style="list-style-type: none"> <li>• Initial narrowing of alternatives</li> <li>• Evaluation Criteria</li> <li>• Review of preliminary traffic information</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluation criteria</li> <li>• Additional traffic information (license plate survey)</li> </ul>
Project Management Team	March 3, 2005	<ul style="list-style-type: none"> <li>• Narrowing of alternatives for open house</li> <li>• Comment on designs</li> <li>• Comment on traffic analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Narrowing of options (recommendation to EMT)</li> </ul>
Executive Management Team	March 10, 2005	<ul style="list-style-type: none"> <li>• Narrowing of alternatives</li> <li>• Comment on designs</li> <li>• Comment on traffic analysis</li> </ul>	<ul style="list-style-type: none"> <li>• Narrowing of options (recommendation to PC)</li> </ul>
Policy Committee	March 17, 2005	<ul style="list-style-type: none"> <li>• Narrowing of alternatives</li> <li>• Comment on designs</li> <li>• Comment on traffic</li> </ul>	<ul style="list-style-type: none"> <li>• Narrowing of options (decision)</li> </ul>

Project Management Team	March 24, 2005	<ul style="list-style-type: none"> <li>• Preparation for Public Open House</li> <li>• Discussion of refined designs</li> </ul>	<ul style="list-style-type: none"> <li>• Information for public open house (recommendation)</li> </ul>
Executive Management Team	March 31, 2005	<ul style="list-style-type: none"> <li>• Preparation for Public Open House</li> <li>• Discussion of refined designs</li> </ul>	<ul style="list-style-type: none"> <li>• Information for public open house (recommendation)</li> </ul>
Project Management Team	April 14, 2005	<ul style="list-style-type: none"> <li>• Rehearsal for Public Open House</li> <li>• Summary of HCRHAC comments</li> </ul>	<ul style="list-style-type: none"> <li>• Approval of graphics and displays for open house</li> </ul>
Executive Management Team/ Policy Committee (joint meeting)	April 28, 2005	<ul style="list-style-type: none"> <li>• Decision on Exit 64, Button Junction, Local circulation options</li> <li>• Expectations for final report</li> </ul>	<ul style="list-style-type: none"> <li>• Decision on Exit 64, Button Junction, Local circulation options</li> </ul>

## F. Public Workshop Comments

### Public Comments I-84 Exit 64 – East Hood River Interchange Open House April 21, 2005

**Jim Denton**  
Hood River, OR

**Likes:** Does not believe any improvement can be made until the toll booths for the Port's Columbia River Bridge are changed.

**Dislikes:** Prefers 4-way stop to stoplights.

**Other Alternatives Preferred:** Toll in one direction only (SB) over the Columbia River Bridge or have two toll booths, one at north end of bridge for NB traffic.

**Local Traffic Options:** If stoplights are added to Exit 64 and OR 35 interchange, the ramp barrier idea might work.

**Button Junction:** Not needed at present traffic flows.

**Additional Comments:**

1. Convincing the Port to have a toll solely on the SB traffic would give greatest improvement for least money.
2. Add 3-way stop at end of Exit 64 off-ramp (EB) and Hwy 35.
3. Spend no other funds until Columbia River Bridge is replaced.

**Jim Dummer**  
The Dalles, OR

**Likes:** Traffic lights, widening of lanes, no blind spots

**Dislikes:** Impacts on businesses. Begin project after Labor Day and run through Winter.

**Button Junction:** Traffic light is a must as long as all other lights are in place.

**Brad Nicport**  
Hood River, OR

**Likes:** Traffic lights

**Local Traffic Options:** Questions if people will really use it

**Button Junction:** Doesn't think improvements necessary

**Other comments:** Major construction really hurt local businesses in and around the Exit 64 area. Please no construction during peak business months. Memorial Day through Labor Day.

**Randy Anderson**

**Likes:** Looks like least expensive and viable solution to the problem

**Dislikes:** Possibility of electric or mechanical failure. Stop and go creates more air pollution.

**Other Alternatives:** Likes roundabouts but computer simulation shows that room is not available and too many inlet, exits.

**Local Traffic Options:** Could be improved.

**Button Junction:** Glad there will finally be improvements.

**Tom Stevenson**  
**Hood River, OR**

**Likes:** Good potential throughput in 2025

**Dislikes:** Initially won't need traffic signal. Save money and install when needed.

**Local Traffic Options:** Local traffic bridge over Hood River. Greatly reduces local traffic at Button Junction and Exit 64 east off ramp. May be able to reduce 2025 improvement costs if bridge is in place.

**Button Junction:** Round about is interesting.

**Jim Schlemmer**

**Likes:** Improves safety issues. Likes one-way exits.

**Dislikes:** ODOT should control the bridges whether on Port property or not

**Other Alternatives:** Move the gas station

**Local Traffic Options:** Poor alternative to have road to around gas station – move station.

**Button Junction:** Light is fine. Circle radius will be difficult for trucks.

**Brian Carlstrom**  
**Hood River, OR**

**Likes:** Traffic lights

**Local Traffic Options:** Would like a bike bridge attached to the I-84 overpass at about MP 62.5 (to connect west end of port property near the Hook to the area near the skatepark).

**Button Junction:** I like the present 4-way stop and don't like the idea of the light.

When light is green, traffic will be going too fast past his house and businesses at 100-108 Hwy 35.



## I-84 Interchange at East Hood River Proposed Design Improvements Public Meeting

The Oregon Department of Transportation (ODOT) invites you to attend a public meeting to review proposed improvements to the **I-84 interchange at East Hood River (Exit 64)**. The interchange is also known as the Hood River Bridge and Oregon 35 interchange. Improvements to this interchange were identified during the recently completed SR-35 Columbia River Crossing Draft Environmental Impact Statement process. ODOT has programmed funding for interchange improvements that would coincide with a scheduled replacement of the I-84 overpass at this interchange.

Representatives from ODOT and the consultant team analyzing design options will be available to discuss the options being considered as well as address any new ideas suggested from the public.

**Thursday, April 21, 2005  
4:00 pm - 7:00 pm  
Waucoma Center  
907 Wasco Avenue  
Hood River, Oregon**

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