“The Why’s, Where’s and Nuances of Roundabout Intersections”

A Washington State and Broader perspective







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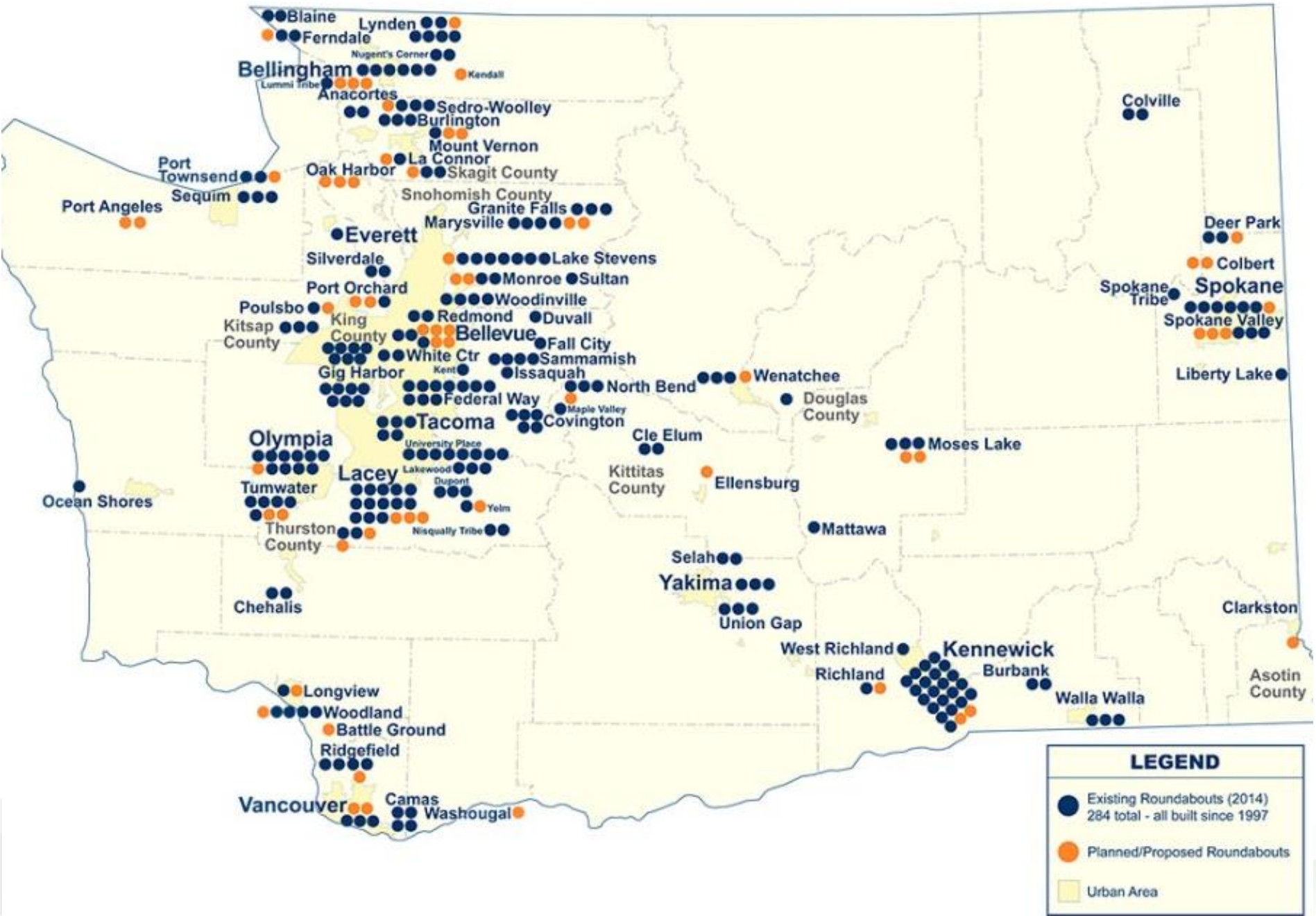
TO TRAFFIC
IN CIRCLE
YIELD

Roundabouts in Washington State



Short Tutorial on Intersections

What does a intersection represent on the system to you?

Context

- Is this a brand new roadway intersection or existing stop or traffic signal controlled intersection?

- If a location has an identified need for safety and mobility, we want to be practical and build what will do the job, not come up with something that spends more money with little additional benefit

Intersections (cont.)

- What do we want from an intersection?
  - Least amount of delay for ourselves, everyone?
  - Relative comfort level of the what the rules are?
  - Non motorized (pedestrian and bicycle) priority or equal preference to this issue in urban areas
  - Best balance of motorized and non-motorized uses?
  - Understanding Freight needs

Roundabout Efficiency

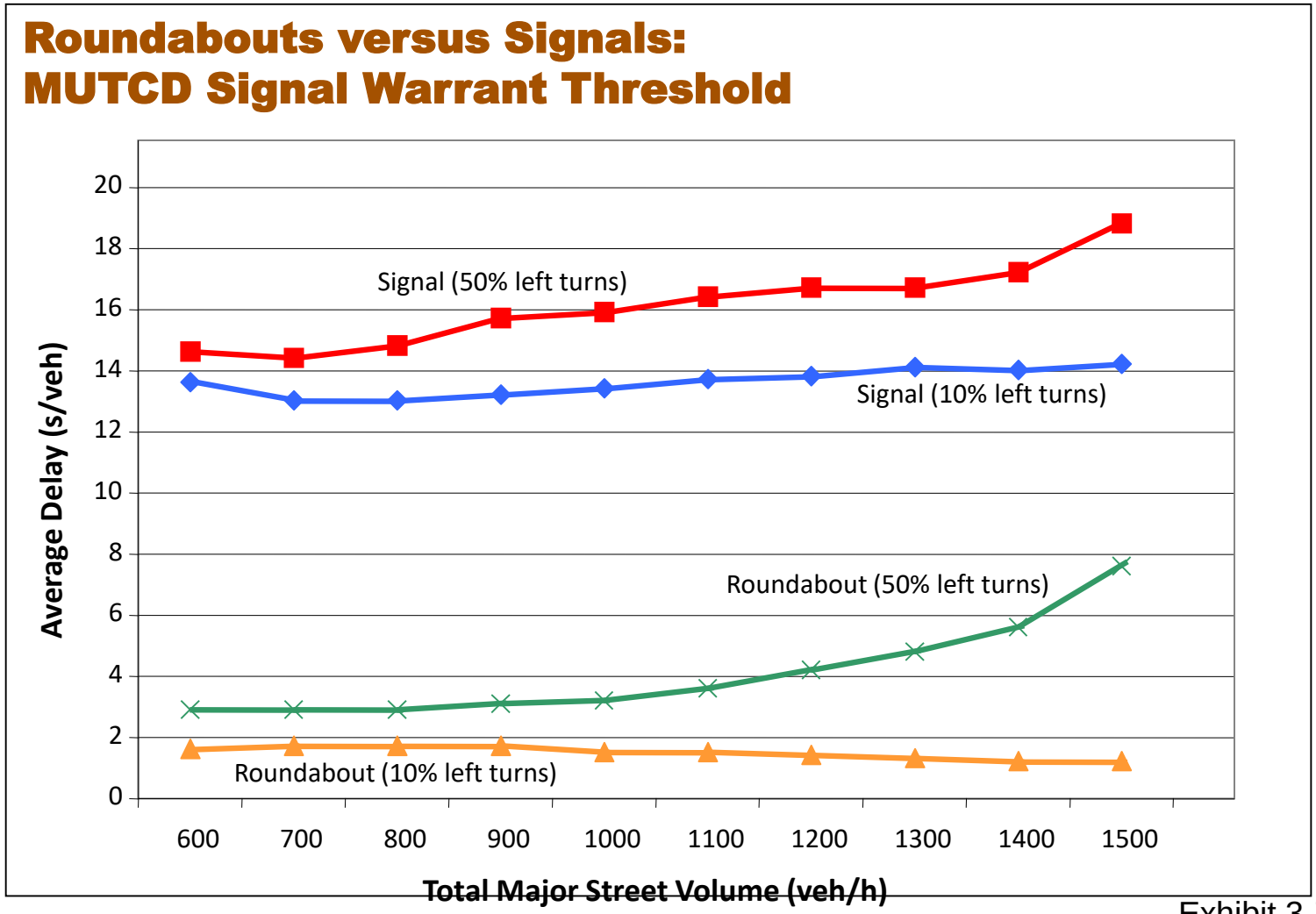


Exhibit 3-7, p. 63

Based on MUTCD Warrant 3 (2000 ed.)/Warrant 11 (1988 ed.)

Evolving Policy

Chapter 1300 Intersection Control Type

1300.01 General

It is WSDOT practice to analyze potential intersection solutions at all intersection improvement locations in accordance with E 1082 – *Business Practices for Moving Washington* and E 1090 – *Moving Washington Forward: Practical Solutions*. The objective is to provide the optimum solution within available limited resources. The analysis may be done for individual intersections, or on a corridor basis. This chapter provides guidance on preliminary intersection analysis and selection of control type. Intersection design is completed using Chapter 1310 for the geometrics of intersections, Chapter 1320 for roundabouts, and Chapter 1330 for traffic signals. Use the aforementioned chapters in conjunction with chapters 1106, 1230, 1430, 1510, and 1520 to assist with dimensioning design elements.

Motorized traffic and driver characteristics, bicycle and pedestrian needs, physical features, and economics are considered in selecting traffic control that facilitates efficient multimodal traffic flow through intersections. Signs, signals, channelization, and physical geometric layout are the major tools used to establish intersection control.

Typically, potential project locations with safety performance needs will have been identified

Intersection Control Evaluation or Analysis will contain:

- Safety evaluation using tools we have developed that compare safety tradeoffs.
- A mobility or volume analysis to see if a scenario is chosen, how will it function from a delay per car standpoint as well as 24 hour operational at the intersection
- A benefit/cost calculation
- A sustainability analysis (Maintenance/emissions)
- Driver workload
- Human Factors (Can we incorporate design elements to increase chances of drivers understanding what they need to do (Signing/Striping/Roadside elements)

Policy Procedure Details

1300.05(1) Intersection Control Analysis (ICA)

Use the following steps when screening intersection control alternatives for selection, or to support the need for modifications to existing intersection control:

- **Determine the right of way requirements and feasibility.** Discuss the right of way requirements and the feasibility of acquiring that right of way in the analysis. Include sketches or plan sheets with sufficient detail to identify topography (including utilities), environmental constraints, drainage, buildings, and other fixed objects. An economic evaluation will be useful if additional right of way is needed. Include the right of way costs in the benefit/cost analysis.

- **Check signal warrants.** Evaluate existing peak period counts to determine the need for additional count data. If these counts do not meet a warrant, obtaining 12- or 24-hour count information is likely unnecessary. In some cases, the project may alter traffic patterns at an existing signal enough that it may no longer meet a warrant. See the MUTCD for a list of the traffic signal warrants and information on how to apply them.

  For new intersections, project hourly volumes, and movements using established methodology; see Chapter 320.

  If signal warrants are met, evaluate multi-way stop, roundabout, and signal. If warrants are not met, evaluate yield, two-way stop, multi-way stop, and roundabout. Please note, the evaluation of a roundabout option is always required by resolution of the Multimodal Safety Executive Committee (MSEC). This evaluation requirement is based on the measured performance benefits of roundabouts.

Understanding options with other types of intersections

State statutes (RCW 46.61.085) require WSDOT approval for the design and location of all conventional traffic signals and for some types of beacons located on city streets forming parts of state highways. The Traffic Signal Permit (DOT Form 242-014 EF) is the formal record of the department's approval of the installation and type of signal. For traffic signal permit guidance, see Chapter 1330.

1300.03(7) Alternative Intersections

A number of alternative intersections have been developed to reduce the delay to through traffic, the number of conflict points, and the number of signal phases for signalized intersections.

Alternative intersections work mainly by rerouting U and left turns, and/or separating movements. Alternative intersections include:

- Median U-turn
- Jug handle
- Bowtie
- Restricted crossing U-turn
- Continuous flow intersection
- Continuous green tee (T)
- Split intersection
- Quadrant roadway intersection
- Single quadrant interchange
- Echelon
- Center turn overpass

Can we organize the pavement better?

Detailed Design Guidance

Chapter 1320 Roundabouts

1320.01 General

Modern roundabouts are near-circular intersections at grade. They are an effective intersection type with fewer conflict points and lower speeds, and they provide for easier decision making than conventional intersections. They also require less maintenance than traffic signals. Well-designed roundabouts have been found to reduce crashes (especially fatal and severe injury collisions), traffic delays, fuel consumption, and air pollution. They also have a traffic-calming effect by reducing vehicle speeds using geometric design rather than relying solely on traffic control devices.

Roundabout design is an iterative process. A well-designed roundabout achieves a balance of safety and efficiency. Good design is a process of creating the smooth curvature, channelization, and deflection required to

Exhibit 1300-1: Intersection Design Areas

Human Factors	
➢ Driving habits	➢ Conformance to natural paths of movement
➢ Driver workload	➢ Pedestrian use and habits
➢ Driver expectancy	➢ Bicycle traffic use and habits
➢ Driver error	➢ Visual recognition of roadway cues
➢ Perception-reaction time	➢ Demand for alternative mode choices
Traffic Considerations	
➢ Design users, modal priority, and intersection design vehicle	➢ Vehicle speeds
➢ Design and actual capacities	➢ Transit involvement
➢ Design-hour turning movements	➢ Crash experience
➢ Size and operating characteristics of vehicle	➢ Bicycle movements
➢ Variety of movements (diverging/merging/weaving/crossing)	➢ Pedestrian movements

Safety

Total Collisions in WSDOT Study of Nine Round-abouts by Type of Collision

Before and After Installation of Roundabouts

Type of collision	Collisions Before Installation	Collisions After Installation	Percent Change
Fatal and disabling	5	1[2]	-80%
Evident injury[1]	15	4	-73%

Source: WSDOT Traffic Office

1. Defines an evident injury
2. Disabling Injury coded and interpretation in coding

Reaching Balance

Policy Example -Deer Park (US 395) Study

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US 395 Study

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US 395 - Deer Park Intersection Improvement Study

Sidenote about Trucks

Case Study #1

City Arterial Application

Yelm Highway – Thurston County, WA

Changes for Yelm Highway

CHRISTIAN HILL; Staff writer

The long-awaited project aimed at relieving the last urban bottleneck on Yelm Highway is scheduled to begin in April now that Thurston County has secured final funding.

County officials announced last week that the state Transportation Improvement Board had awarded $3.9 million for the widening project between Rich Road and Henderson Boulevard. The estimated cost is $10 million, making it one of the largest road projects undertaken by the county in recent years.

Once completed, the 11/4-mile stretch will have two travel lanes in each direction, roundabouts at Boulevard Road and Brassfield Street, center medians, sidewalks and bike lanes.

The project is welcome news for drivers caught in long lines of traffic during the morning and evening rush hours. The new center median will restrict left turns to and from driveways and side streets to prevent crashes. Drivers will be able to make U-turns at the two roundabouts and at the Rich Road and Henderson Boulevard intersections.

Yelm Highway Roundabouts

Previous Signal at Boulevard Road

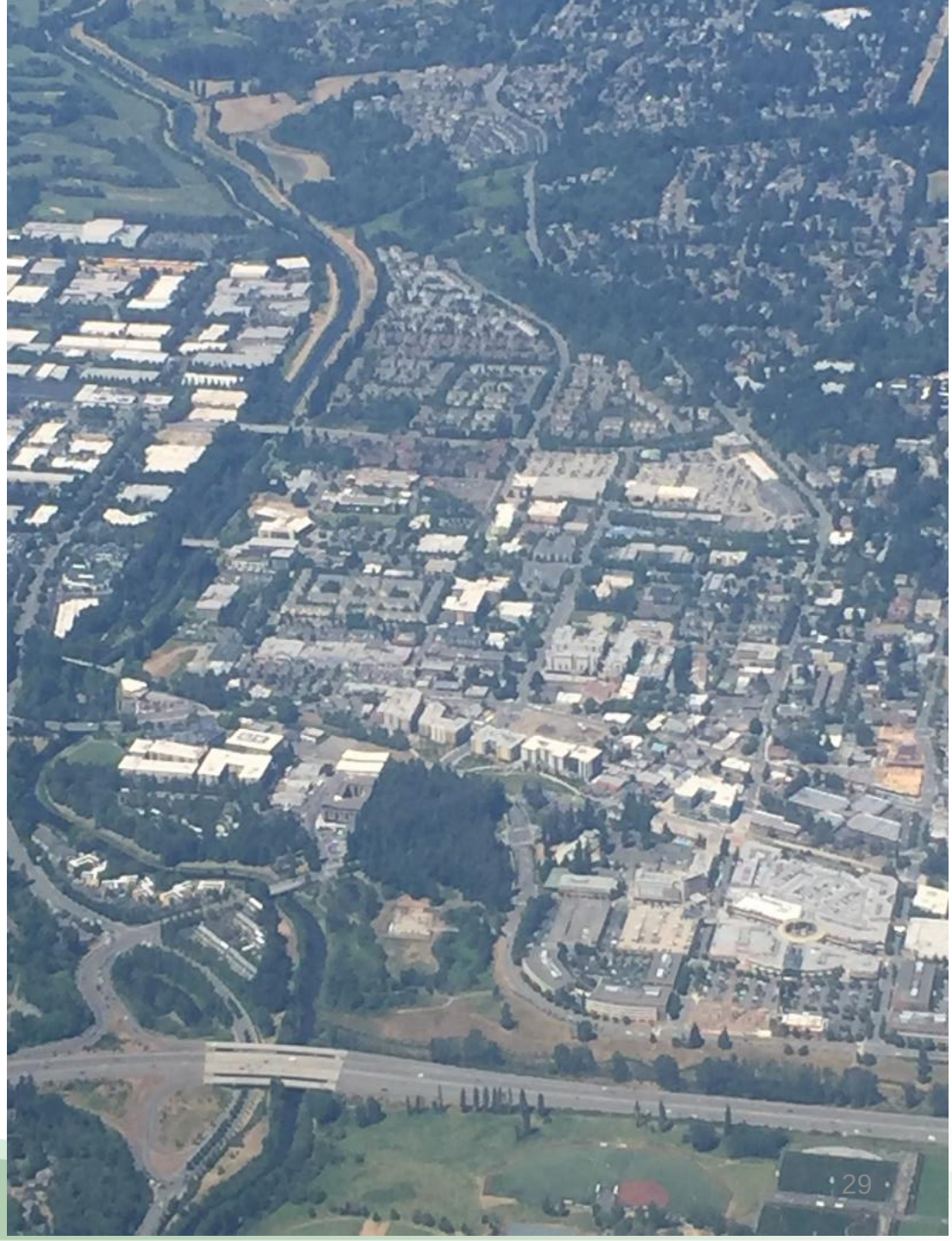
Case Study # 2

Ramp Terminals in Union Gap, WA (I-82 near Yakima)

Compact Roundabouts

- Slater Rd – Bellingham Area
- Cashmere WA
- Kelso
- Redmond WA
- Burien

Redmond




YIELD

Kelso


WSDOT I-5
SLATER RD

Community Aesthetics

National Perspective

A Trail Roundabout

Questions/Comments?

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Need and Purpose – To reduce injuries and fatalities

This (I-2) Safety Improvement - Collision Prevention Project built a single lane roundabout on SR 243 in western Grant County at MP 13.94 - the intersection with Road 24 SW in Mattawa.

Why is WSDOT improving this intersection?

The SR 243 and Road 24 SW intersection handles an average of 5,800 vehicles per day and was experiencing a large number of crashes. During the five years from Jan. 1, 2007 to Jan. 1, 2012 there were twenty one collisions involving forty three vehicles. Nine of those crashes resulted in two fatalities and twenty two serious injuries. The 12 other wrecks were property damage only.

This roundabout is anticipated to decrease the frequency and severity of accidents at the intersection.

Case Study #3

Mattawa, WA

Changing public perception at Mattawa

The majority of the people who gave comments in January told WSDOT engineers they remain unconvinced a roundabout would work with the 60 mph speed limit and large number of trucks utilizing the intersection. Officials say everyone did support improving the intersection to reduce accidents and most attendees reportedly said a roundabout was “better than nothing.”

"The first meeting gave us the opportunity to share our ideas for a roundabout, which appears to be the most efficient and cost-effective solution," stated Bob Romine, WSDOT project engineer. "We got a lot of great feedback, but we felt everyone deserved another opportunity to learn more about roundabouts and to see the other alternatives we looked at."

About 5,800 vehicles pass through the intersection of SR 243 and Road 24 Southwest each day,

Mattawa - BEFORE
Mainline – SR 243

Mattawa – BEFORE
Entrance to Town (Road 24)

Mattawa – BEFORE
(Minor Street Stop Control)

Mainline (SR 243) Freight Needs

Mattawa - AFTER


YIELD
Rd 24 SW

Answers/Thoughts on Intersections

- Access point for vehicles and non motorized movements
- Delay, reduction of your travel time
- Crossing opportunities for pedestrians
- Integrated bicycle design elements
- Added value as an entrance to community
- Represents a transition to a higher speed facility (ramp terminal to freeway)

Context Sensitive/Robust entrance to a University?