

OR47 @ NW Purdin Road/NW Verboort Road

Improvements and Alternatives

EXECUTIVE SUMMARY

Background

OR47 Nehalem Highway (#102) is a 2 lane section of rural Oregon Highway that connects Banks, Oregon to Forest Grove. This highway is used by local daily commuters, farmers and is a vital route for the trucking industry. NW Verboort Road and NW Purdin Road intersect with OR47 at MP 88.05. This portion includes a comparatively straight horizontal alignment, with little or no vertical curvature, surrounded by wide open farm land allowing exceptional sight distance for motorists. The intersection underwent a safety construction project on October 5, 2005 to install new right and left turn bays on OR47 and right turn lanes on NW Purdin and Verboort. The intersection received new asphalt, new lane striping, and wider paved shoulders. On Verboort Rd. and Purdin Rd. ODOT installed rumble strips within the travel lanes approaching the intersection to alert motorists of the approaching 2-Way stop controlled intersection. The intersection yellow/red flashing beacon was installed June 11, 1987 and removed January 30, 2005 as part of the construction safety project. This corridor has a posted speed of 55 mph based upon the 85th percentile vehicle speed.

Traffic Engineering Investigation

The tragic fatality on September 14, 2007 at 3:30pm immediately prompted a comprehensive investigation into the safety of the intersection. ODOT began an analysis of the recent collision, site conditions, speed zone, sight distance, illumination, crash data, and intersection geometry. ODOT Traffic also interviewed two Oregon State Senior Troopers to collect further information on the intersection and highway characteristics. ODOT Traffic determined the intersection geometry was designed and constructed per the Oregon Highway Design Manual and requirements set by the American Association of State Highway Transportation Officials (AASHTO). The crash data shows evidence of a decline in the number of overall crashes since the intersection improvements constructed in 2005. However, the crash data reveals 30% of the crashes occur at night meeting the warrants for the installation of illumination. The site distance approaching the intersection is the optimal condition engineers hope to achieve. The wide open fields give motorists the opportunity to see vehicles entering the intersection from a minimum of 800' away. The Oregon State Police officers interviewed spoke of personal encounters while traveling on the highway. In several instances when traveling northbound or southbound on OR47, as the officers approach the intersection motorists waiting at the access road stop sign seem to pull forward possibly attempting to cross the highway to make a left turn and then immediately pause as if realizing that they could not safely cross or make the turn in time. The findings confirm that the majority of crashes involve movements from the county access roads and are caused by poor judgment of gap acceptance. The wide open fields actually seem to hinder the perception of accurately judging vehicle speeds. It appears drivers have a difficult time deciphering the speed of the oncoming vehicle due to the absence of physical objects in the surrounding area in which to compare.

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Intersection Improvements Study

The analysis also included long term intersection improvements, benefit costs, and crash reduction factors. The installation of a traffic signal was reviewed and found to meet two signal warrants, #2 (four-hour vehicular volume) & #3 (peak hour). The intersection would also meet the capacity guidelines for today and projected future 2019 conditions. The cost for a signal installation is estimated at \$1.5 million. This would include pole mounted signals, left turn channelization on Verboort & Purdin, and concrete islands with mountable curbs to increase the perception of an intersection. To perform a benefit to cost ratio analysis, crash reduction factors are applied from previous engineering research. At this time crash reductions do not exist to generate a complete B/C Ratio. Due to the lack of rural signal feature values, traffic engineering conducted a comprehensive study to research the benefits of a signal installation at a rural intersection. The result of the study produced factors that were applied to the B/C Ratio to further warrant funds for improvements.

The installation of a single-lane roundabout was also reviewed and found to meet the requirements for a balanced flow from all directions given the average daily traffic (ADT) volumes. The capacity analysis study determined a single-lane roundabout would also function today and for future projected 2019 conditions. The "footprint" of a roundabout fit very well within the existing right of way. A benefit to cost ratio was also performed with the current crash reduction factors applied for a rural intersection. See appendices for a complete explanation and analysis

Recent Improvements

The result of the investigation produced a list of potential improvements that were installed to better alert motorists of the Verboort/Purdin intersection. These improvements were installed by ODOT on October 30, 2007.

- Reduced the posted speed from 55 mph to 50 mph.
- Installed new intersection warning signs with amber flashing beacons in advance of the intersection on OR47.
- Installed "Cross Traffic Does Not Stop" under the existing oversized Stop signs on Verboort Road and Purdin Road.
- Installed raised pavement markers on OR47 right turn deceleration lanes NB and SB to better delineate the through lane from the right turn lane.

Traffic Engineering Conclusions / Recommendations

A traffic signal assigns right of way and reduces crashes involving turning vehicles. However, the signal does not reduce the number of overall crashes (or severity) and has been proven to increase rear end crashes. The severity may be even worse with the high amount of truck traffic at a rural intersection. Furthermore, crash reduction factors for rural applications do not exist simply because rural traffic signals do not benefit highway applications (see Portland State University research). Given the low Benefit to Cost ratio of 0.35, Region 1 cannot recommend safety funds for a signal installation.

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Continued Traffic Engineering Conclusions / Recommendations

A roundabout installation will assign right of way, reduce overall traffic speeds, provide traffic calming, and act as a gateway to Forest Grove. A roundabout will also reduce the number of crashes and all but eliminate Fatal and Injury "A" crashes.

The town hall meeting led by ODOT Region 1 Manager Jason Tell on October 18, 2007 generated criticism of roundabouts due to local experience with the county designed chicanes. The ODOT design would generate much less confusion. Crash reduction factors and the computed Benefit to Cost ratio of 1.05 allow the Region to support a roundabout with safety funds and is also supported by the Region 1 and State Traffic engineers.

The recent construction project in 2005 has proven to reduce the number of total crashes per year by 50% with a 100% reduction in rear end crashes. Since the goal of the channelization project was to reduce the number of rear end collisions it appears the project was successful. Of the total number of crashes, 30% occur at night meeting the warrants to install illumination at an estimated cost of \$48,000. At this time the data analysis does not show a significant need for improvement when compared to the top 15% SPIS sites in Region 1.

- Recommendation is to monitor the effect of the recent improvements
- Install Illumination consisting of 6 Luminaires estimated to cost \$50,000.

The executive meeting on January 2, 2008 reviewed these findings and approved the traffic engineering report. The attendees agreed with the recommendations to monitor the intersection and will include this site in our annual SPIS (safety priority index system) investigation.

Robert Hopewell
Oregon Department of Transportation
Region 1 Traffic Engineering

Traffic Engineering Recommendations

■ Existing Condition

- The recent channelization project in 2005 has proven to reduce the number of crashes per year by 50% and a 100% reduction in rear end crashes. Since the goal of the channelization project was to reduce the number of rear end collisions it appears the project was successful. Region 1 contains many more high risk intersections that produce fatal injuries every year in comparison to Hwy 47. The data analysis does not show a significant need for improvement when compared to the top 15% SPIS sites in Region 1.

- Recommendation is to monitor for future improvements

■ Traffic Signal

- A traffic signal assigns right of way and reduces crashes involving turning vehicles. However, the signal does not reduce the number of overall crashes (or severity) and has been proven to increase rear end crashes. The severity may be even worse with the high amount of truck traffic at a rural intersection. Furthermore, PSU does not provide crash reduction factors for rural applications. Given the low B/C ratio, Region 1 cannot recommend safety funds for a signal installation. Also, the engineering data does not support a signal installation as a benefit to the intersection.

■ Roundabout

- A roundabout installation will assign right of way, reduce overall traffic speeds, provide traffic calming and act as a gateway to Forest Grove. A roundabout will also reduce the number of crashes and all but eliminate Fatal and Injury "A" crashes. The town hall meeting generated criticism of roundabouts due to experience with the county designed chicanes. The proposed design does not include any "squiggles" but a simple design. Truck traffic will not have to make a complete stop, causing platoons or dangerous passing. Crash reduction factors and the computed B/C ratio allow the Region to support a roundabout with safety funds and is supported by the Region 1 and State Traffic engineers.

- Supported by the Region 1 Traffic Engineer.
- Supported by the State Traffic-Roadway Engineer

Intersection Character

- OR47 (Hwy#102) Nehalem Highway
- Intersection located 1 ¼ miles north of Forest Grove at MP 88.05
- Current posted speed is 50mph (10/30/07).
- Highway alignment is fairly straight with a slight horizontal curve.
- Grade is flat with no vertical curves.
- No obstructions to sight distance.
- Yellow / Red overhead intersection flashing beacon in service from June 11, 1987 – January 30, 2005.
- New left & right turn channelization on Hwy 47 installed October 5, 2005.

Construction Project 2005

OR 47: Nehalem Hwy At Verboort Rd. & Purdin Rd.
Sec. Key #11929

- Constructed from November 30, 2004 to October 5, 2005.
- The goal of this project was to reduce the dominant crash type, rear end collisions on Hwy 47.
- Project added NB and SB right deceleration lanes and left turn channelization.
- New striping features making the intersection more obvious to motorists.
- Oversized “Stop” and “Stop Ahead” signs with transverse rumble strips on Verboort Rd and Purdin Rd.
- Installed new asphalt (dense mix) wearing surface.
- Installed standard (wider) shoulders.

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Recent Improvements *Installed 10/30/2007*



- Reduced posted speed to 50 mph
- Installed larger “Stop” signs and “Cross traffic does not stop” signs on side streets.
- Installed raised pavement markers on highway to better delineate the right turn deceleration lanes and through lanes.
- Installed new intersection warning signs w/flashing beacons in both directions on OR47



Traffic Engineering Analysis, Research & Data

- Crash Data Analysis by direction prior to construction and post 2005 construction.
- Speed Zone Investigation.
- Illumination warrant analysis.
- Existing signing and striping review.
- Interviews with Oregon State Troopers.
- Traffic/truck volumes (traffic counts).
- Future forecast of existing and alternative design intersection performance.
- Potential future intersection improvements.
 - Grade separated intersection.
 - Signal warrant analysis / cost estimate
 - Benefit Cost Ratio
 - Additional channelization
 - Roundabout analysis / cost estimate
 - Benefit Cost Ratio
 - “Footprint” preliminary design

Long Term Future Intersection Improvements

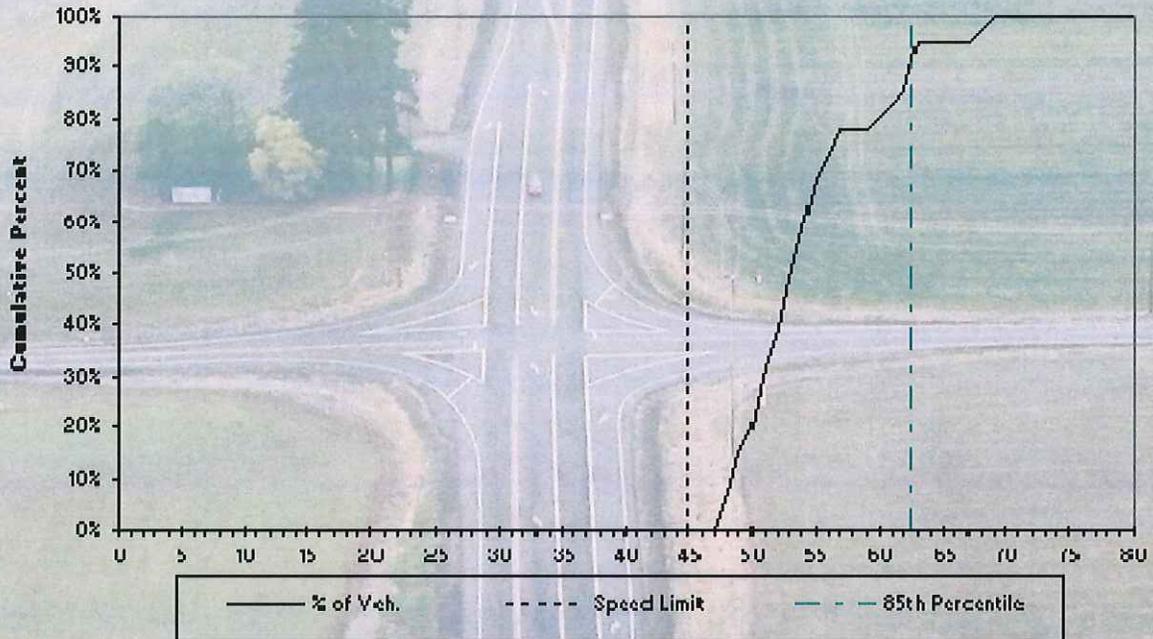
- **Grade Separated Intersection**
 - Not warranted at this time.
- **Traffic Signal Installation w/ Left Turn Channelization**
 - Signal warrant analysis.
 - Future year 2019 capacity analysis.
 - Benefit / Cost ratio
 - Crash reduction factor research for a signalized rural intersection.
- **Roundabout**
 - Site “footprint” and preliminary design
 - Future year 2019 capacity analysis.
 - Benefit / Cost ratio
 - Applied crash reduction factors from PSU.

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Speed Zone Investigation

Roadway: Hwy #102 Nehalem Highway (Hwy 47) Date: 10/5/2007

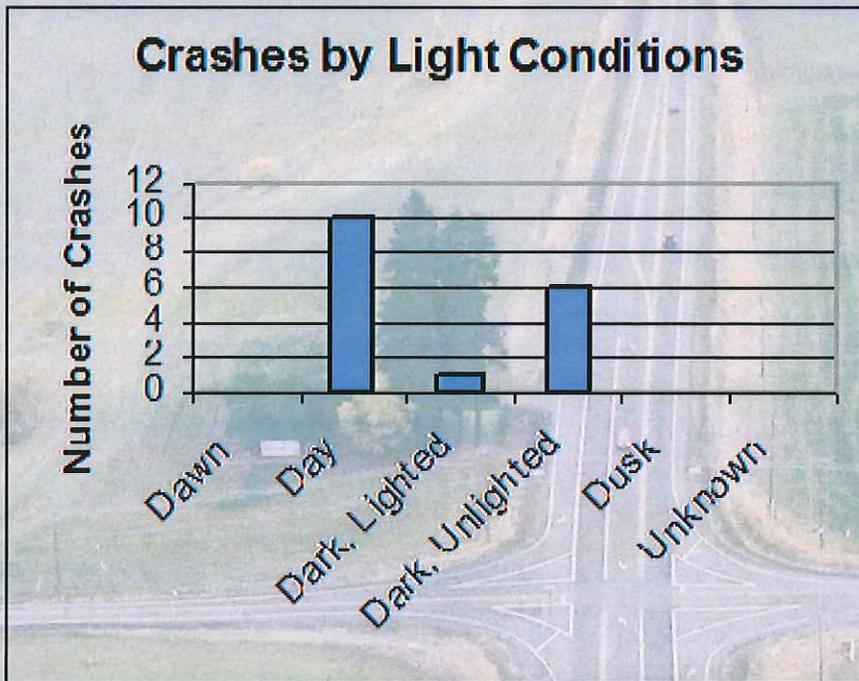
City: Forest Grove Time: 11:00 am - 12:00 pm
 County: Washington Weather: Partly Sunny / Cloudy
 Location: MP 88.05 Direction of Travel: NB and SB



	MPH SB	Averaged	MPH NB
# of Vehicles	17	41	24
85th % Speed	63	63	62
Face Limits	47 - 56	48 - 57	48 - 57
% In Pace	82%	79%	75%
Mean Speed	54.71	54.81	54.92
Median Speed	54	54	54
Std. Dev.	5.23	5.41	5.65
Max Speed	68	69	69
Posted Speed	45	45	45
% Exceeding Posted	100%	100%	100%

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Illumination Warrant Analysis



Ambient Light	Crashes	Percent
Dawn		
Day	10	59%
Dark, Lighted	1	6%
Dark, Unlighted	6	35%
Dusk		
Unknown		
Total	17	

ODOT Lighting Policy and Guidelines

- **Section 2.2.2 Spot Locations:**
 - A spot location may be considered for lighting when at least 30% of crashes occur at night.
 - **Intersection meets illumination warrants.**
 - Cost estimate: \$48,000 (\$8K/Luminaire x 6 Luminaires).