Peak Use Shoulder Lanes and the WSDOT I-90 Eastgate to SR 900 Project

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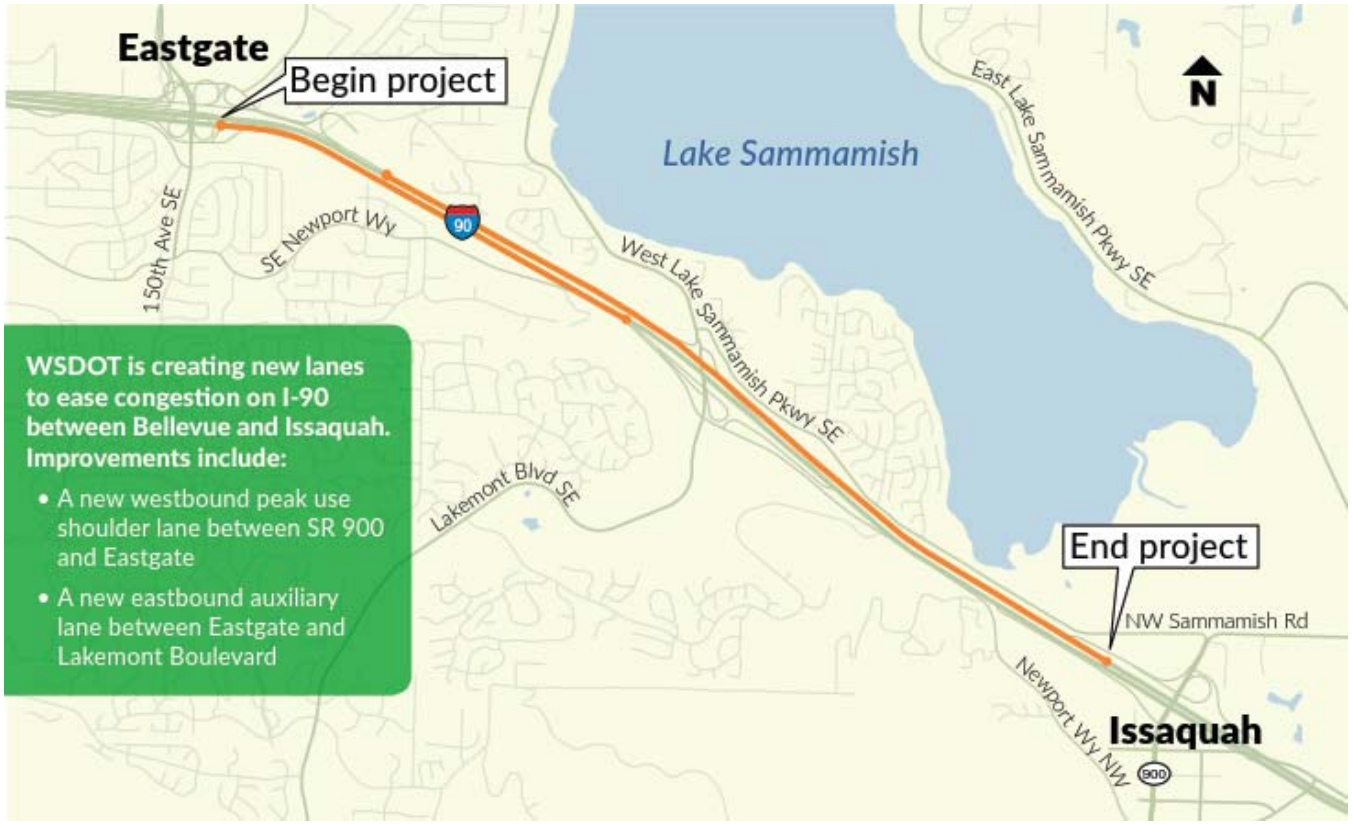
Presentation Outline

- Purpose of Study
- Summary of WSDOT I-90 Peak Use Shoulder Lanes Project
- WSDOT/FHWA Guidance on Peak Shoulder Lane Use
- Study Methodology
- Modeling Results
- Future Study Topics
- Questions/Discussion

Purpose of Study

- Describe WSDOT's latest Peak Use Shoulder Lanes Project and WSDOT's Operational Approach
- Conduct Supplemental Traffic Noise Modeling to evaluate change in noise levels resulting from Peak Hour Lane Use

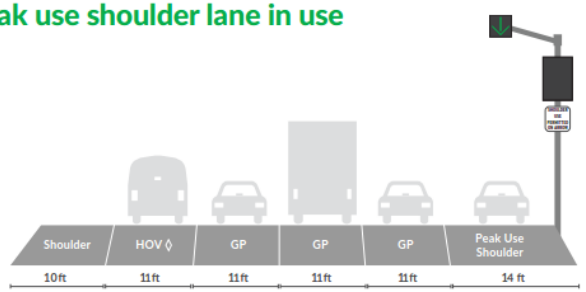
Summary of WSDOT I-90 Peak Use Shoulder Lanes Project



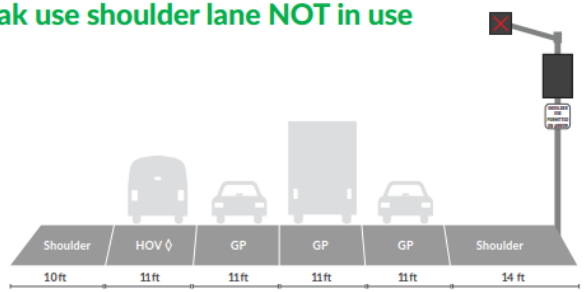
Summary of WSDOT I-90 Peak Use Shoulder Lanes Project

Westbound cross-section

Peak use shoulder lane in use



Peak use shoulder lane NOT in use

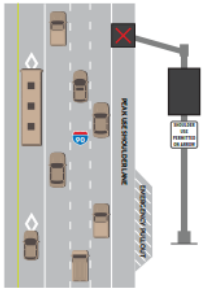


Lane controls

A green arrow will indicate when the lane is open to traffic.

A red X will indicate the lane is closed.

Yellow arrows will indicate when drivers should start to merge out of the lane or use extra caution because of an incident ahead.



An additional sign mounted on the side of the signpost may display information about traffic conditions, such as:

- Shoulder Open
- Shoulder Closed
- Shoulder Blocked
- Shoulder Work Ahead
- Incident in Shoulder Ahead
- Slow Traffic Ahead

Summary of WSDOT I-90 Peak Use Shoulder Lanes Project

- Project Location: 10 miles east of Seattle between Bellevue and Issaquah, WA
- Purpose: Congestion relief during AM and PM commutes
- Type I Project

- Project Improvements include:
  - New WB Peak Use Shoulder Lane between SR 900 and Eastgate
  - New EB Auxiliary Lane between Eastgate and Lakemont Boulevard

- Type I Study Results:
  - Existing and future noise levels over noise abatement criteria at various locations up to 400 feet from I-90
  - 9 Noise Barriers or Barrier systems evaluated, 5 Noise Barriers Proposed
  - Proposed Barriers are located mostly along I-90 shoulder shielding homes located at lower terrain than I-90 (terrain slopes south to north)

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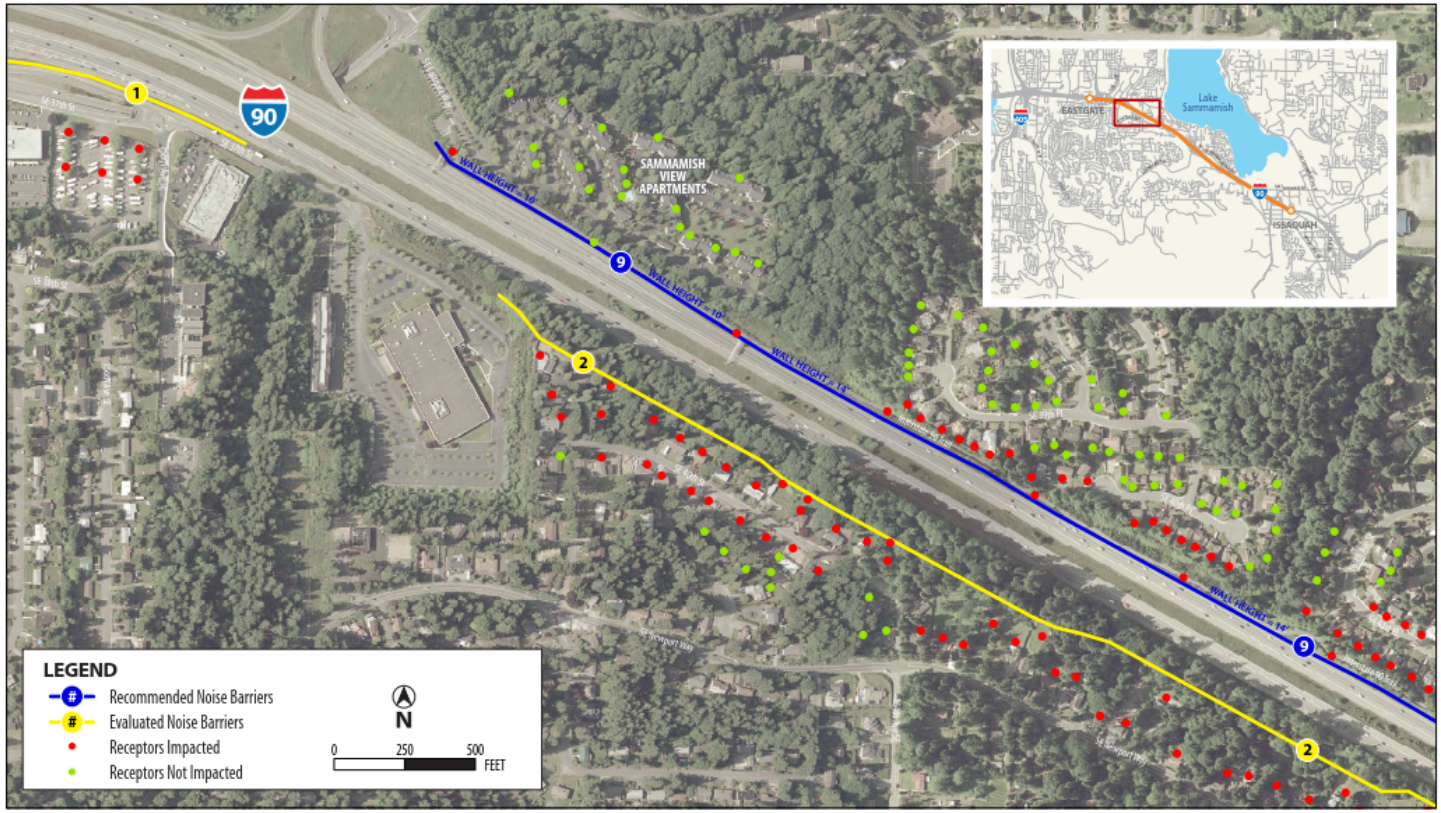
Summary of WSDOT I-90 Peak Use Shoulder Lanes Project



WSDOT/FHWA Guidance on Peak Use Shoulder Lanes

— WSDOT Guidance follows FHWA Guidance:

- FHWA 2016 Guidance Use of Freeway Shoulders for Travel
- Provides guidance on when noise studies are needed
- Scenarios
  - Transit bus-only use of shoulders
  - Static shoulder use for most vehicles during predetermined hours of operation and open to the all vehicles except heavy trucks (Inside Shoulder Use, Type 3 project)
  - Dynamic shoulder use for most vehicles based on need and real-time traffic conditions and open to all vehicles except heavy trucks (posted speeds 35mph or less, Type 3 project)
  - 24-hour Bus Access Transit (BAT) lane – Arterial Roadways

— WSDOT I-90 Peak Use Shoulder Lanes Project:

- Static shoulder use Westbound from 6 am – 9 am, Eastbound Auxiliary from 3 pm – 7 pm
- With the exception of buses, vehicles over 10,000 gross weight prohibited from PSL

Goals of Supplemental Modeling

— Evaluate change in noise levels resulting from Operation of the Peak Use Lane based on:

- Peak Use Lane Operation Strategies
  - Vehicle Mix
  - Percentage of Traffic
  - Speed Controls
- Receptor location
  - Distance from roadway
  - Terrain

Modeling Methodology and Inputs

- FHWA TNM 2.5 model
- Straight 4-lane/direction divided roadway
- Receptors:
  - *Distances: 50, 75, 100, 150, 200, 250, 300-ft from edge of shoulder*
  - *Ground Elevations: at roadway grade, 10-ft above, 10-ft below*

- Two conditions:
  - *Baseline (No Build)*
  - *Peak Use Lane (Build)*
- Peak Use Lane Assumptions:
  - *Outside shoulder*
  - *Heavy trucks restricted from use*
  - *Used by 30% of total non-heavy truck vehicles*
  - *Same vehicle travel speeds as GP lanes*

Vehicle Mix and Speed		
Vehicle	% Volume	Speed (mph)
Auto	95	60
Medium Truck	1	60
Heavy Truck	3	60
Bus	1	60
Motorcycle	0	0

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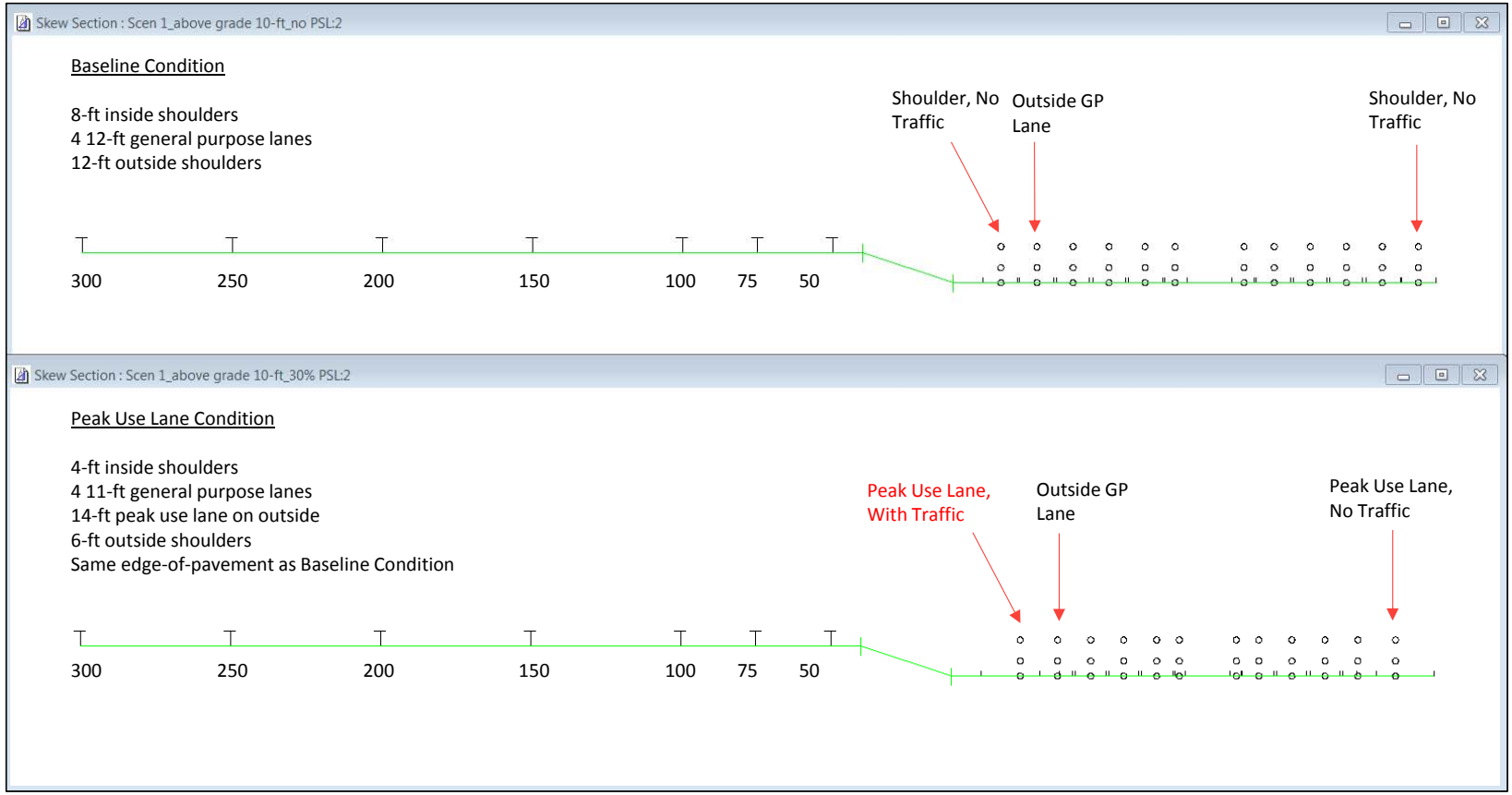
Example Cross-Sections



Supplemental Modeling Results

- Peak use lane resulted in minor changes in noise levels (+/- 1 dB)
- Reduction of noise levels at almost all receptor locations
- Larger change in noise levels at receptors above roadway grade
- Potential Reasons:
  - *Peak use lane shifted near lane vehicles 5-ft closer to receptors*
  - *GP lanes with heavy trucks shifted 5 – 8-ft away from receptors*
  - *No dramatic changes in shielding or line-of-sight*
- Other Operational Strategies:
  - *Bus on Shoulder: lower overall vehicle % using peak use lane*
  - *Restricted Speeds: likely similar results for peak use lane speeds w/in 5-10 mph of GP lanes*

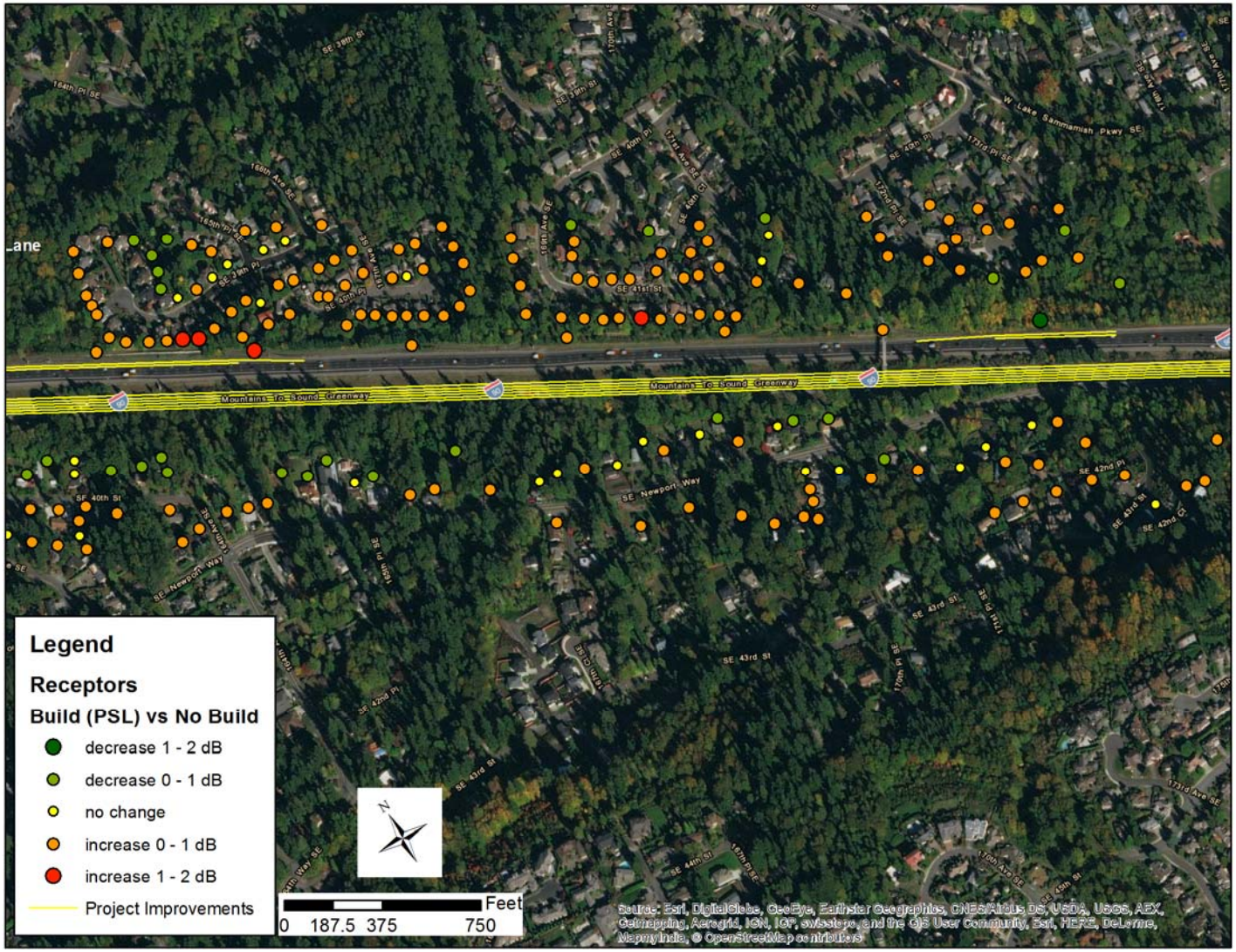
Distance from Edge of Pavement (ft)	Change in Noise Level due to Outside Peak Use Lane (dB)		
	Receptor At Grade	Receptor 10-ft Below Grade	Receptor 10-ft Above Grade
50	0.2	-0.2	-0.2
75	0.2	-0.2	-1.0
100	0.1	-0.1	-1.1
150	-0.3	-0.3	-0.8
200	-0.5	-0.4	-0.8
250	-0.4	0.1	-0.8
300	-0.4	-0.1	-0.8
Minimum	*-0.5*	*-0.4*	*-1.1*
Average	*-0.2*	*-0.2*	*-0.8*
Maximum	*0.2*	*0.1*	*-0.2*

Assumptions: 30% of total non-heavy truck volume in peak use lane
Peak use lane vehicles travel at same speed as GP lanes
Heavy trucks restricted from peak use lane

Comparison of Supplemental Modeling Results to I-90 PSL Study Results

- I-90 Build (Peak Shoulder Lane) vs. No Build
- Build PSL includes:
  - *Outside peak use lane in WB direction, nearest to receptors downhill from roadway*
  - *20 – 23% traffic in peak use lane, no heavy trucks*
  - *Same vehicle speeds as general purpose lanes*

I-90 Build (PSL) vs No Build Change in Noise Levels (dB)	
Minimum:	-1.3
Average:	0.2
Maximum:	1.4


Legend
Receptors
Build (PSL) vs No Build
decrease 1 - 2 dB
decrease 0 - 1 dB
no change
increase 0 - 1 dB
increase 1 - 2 dB
Project Improvements
Feet
0 187.5 375 750
Mountains-To-Sound Greenway
SE Newport Way
SE 43rd St
SE 42nd Pl
SE 40th St
W Lake Sammamish Pkwy SE
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community, Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors

Comparison of Supplemental Modeling Results to I-90 PSL Study Results

- I-90 PSL Project
  - *Change in noise levels due to peak use lane generally +/- 1 dB*
  - *Change in noise levels not clearly related to receptor elevation relative to the roadway*
- Supplemental modeling
  - *Change in noise levels due to peak use lane generally +/- 1 dB*
  - *Peak Use Lane decreased noise levels at most receptor locations*
- Conclusions
  - *Change in noise level of +/- 1 dB can be expected for peak use lane with 20 – 30% vehicle traffic and heavy trucks restricted*
  - *Results vary depending on specific roadway-receptor geometry*

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Future Study Topics

- Compare Noise Levels:
  - *Pre- and Post-Project along recent WSDOT PSL Projects*
  - *PSL projects on Highways and local roadways*
  - *Pavement types (concrete and asphalt)*
  - *Supporting facilities: Guardrails versus jersey barriers*
- Compare State DOT guidance

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Thank You.

Comments/Questions?

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