

# Evaluating Quieter Pavement in Washington State: WSDOT and the OBSI Method

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# Why Quieter Pavement?

- Supplement and/or replace noise walls
  - Additional noise mitigation
  - Areas where “mitigation” not warranted but traffic noise is a concern
  - Where noise walls won’t work (views, slopes)
- Prevent “need” for traffic noise mitigation
  - Reduce traffic noise levels below impact
- Public and legislative interest

# Known Challenges to QP in WA

- Used frequently in 1980's/early 1990's but stopped because of rutting failure
- Studded tires and tire chains
- Frequent freeze/thaw cycles in temperate climate
- Frequent precipitation
- Low summer temperatures
  - ADOT spec 85°F surface
  - WSDOT only 70°F surface



Source: WSDOT

# What Pavements Evaluated?

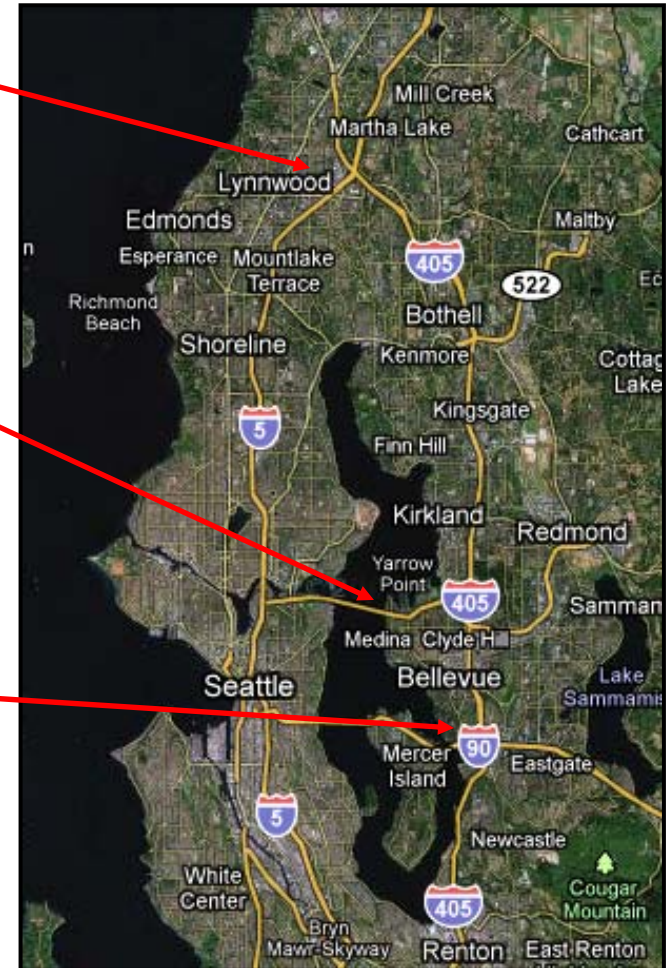
- Open-graded friction course with asphalt rubber binder (OGFC-AR)
  - 9.0-9.4% asphalt
  - 20-23.5% crumb rubber
- Open-graded friction course with styrene butadiene styrene modified binder (OGFC-SBS)
  - 8.3-8.7% asphalt
  - 0.3% fiber content
- Diamond Ground Concrete
  - With and w/o dowel bar retrofits



Source: WSDOT

# QP Test Locations

- I-5 in Lynnwood
  - 120,000 AADT; 3 GP, 1 HOV (1+)
  - Night install, asphalt overlay
- SR 520 near Medina
  - 100,000+ AADT; 5 GP, 1 HOV (2+)
  - Day install, asphalt overlay
- I-405 in Bellevue
  - 100,000+ AADT; 4 GP 1 HOV (1,+)
  - Day install, concrete overaly



Source: Google Maps

# How is QP Evaluated?

## *Structural Performance*

- Bi-Annual Measurements
  - Friction
    - locked-wheel friction tester (ASTM E-274)
  - Ride
    - IRI using pavement condition van
  - Rutting/wear
    - Transverse profile measurements



Source: WSDOT

# How is QP Evaluated?

## *Acoustic Performance*

- Goals: min. audible (3 dBA) lower than HMA
- Methods:
  - Tire/Pavement Noise: **Onboard Sound Intensity**
  - “General” Traffic Noise: Wayside Measurements
  - User Noise/Experience: Interior Sound Level Measurements



Source: WSDOT



# Why OBSI?

- Wanted to measure noise at the source for objective and precise comparison of standard HMA to QP
  - Remove/reduce effect of topography, other traffic, weather and ambient/background noise
- Wanted to measure sound quantity and quality (freq)
- Method that could be performed by acoustic group in-house (with training)
- Limited maintenance and upkeep
- Safe for measurement team



Source: King 5



# OBSI vs. CPX

- Other option: CPX (close proximity method) trailer
- Similar results between methods, but...
- Cost: OBSI vs. CPX
  - Less expensive
  - Mostly off the shelf components
- Equipment: OBSI vs. CPX
  - More portable: “rodeos,” bring into office, no storage restrictions
  - Better maneuverability: heavy traffic test sections with frequent lane changes, <“rubber-necking”

CPX Trailer



Source: Danish Road Institute

# OBSI at WSDOT after 3.5 years

## *The Good*

- Equipment durability
  - Monthly measurements using OBSI for all test sections
  - Over 70 tests in 3.5 years with only 1 “incident” with road debris
- Measurement at the source
  - Objective eliminates effects of traffic, wind, ambient sources
- Precise results
  - Consistent results to other practitioners on same pavement
- Frequency distribution
- Standardized procedure
- Data quality indicators
- Equipment can also be used for other measurements
  - Underwater noise
  - Construction source location: sound power

# OBSI at WSDOT after 3.5 years

## *The Bad*

- Cost
  - Initial equipment ~\$60,000
  - Annual maintenance costs ~\$6,000
- Risk for damage with equipment so close to the ground
- Won't give you all the answers
  - Doesn't explain causation
- At-the-source measurements need to be translated to the public, unlike wayside noise measurements
  - *What does this mean the sound level is at my house?*
  - *Over 100 dB!? I need a noise wall at my house.*

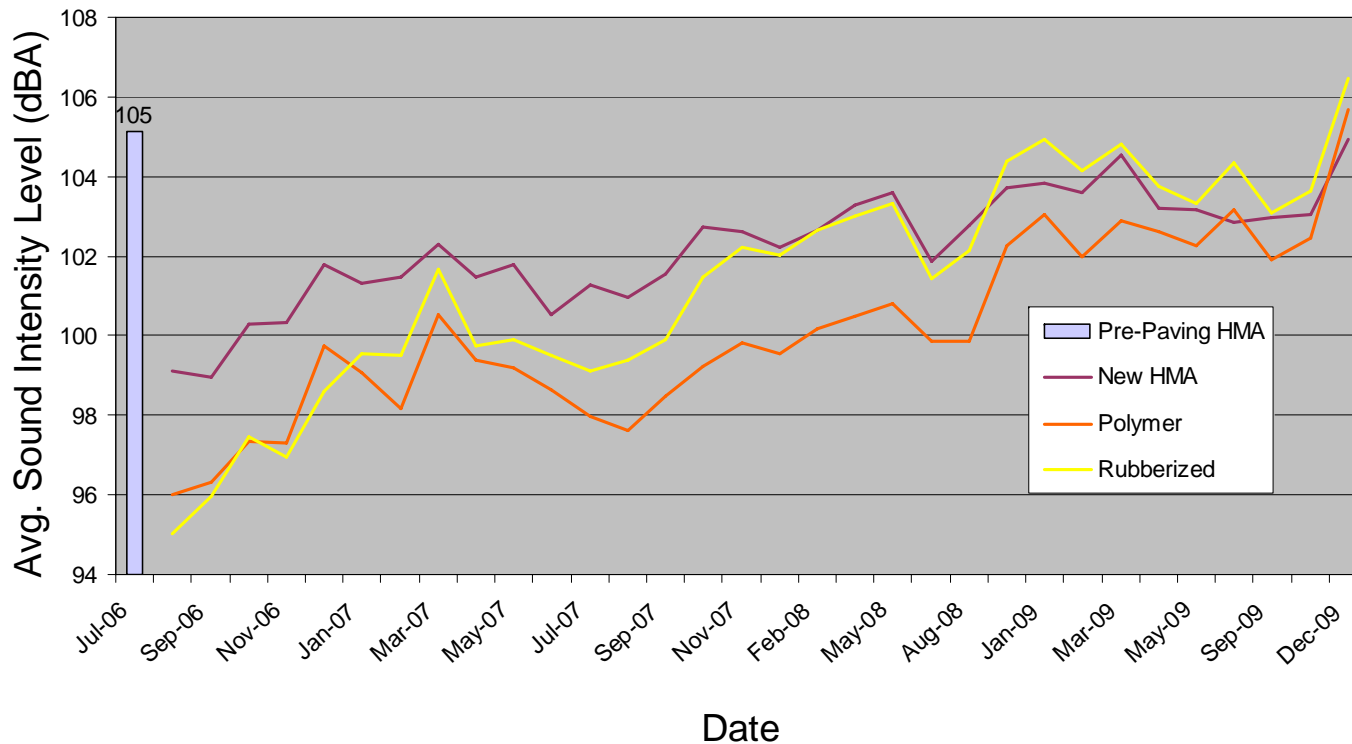
# Conclusions: OBSI at WSDOT

- OBSI provides objective, precise, and reliable method for determining acoustic performance of pavements
- Can be managed by state DOT acoustic program
  - Steep learning curve
  - Substantial initial investment
- *or* Some risk can be eliminated using consultants

# Overall – OBSI Works for WSDOT

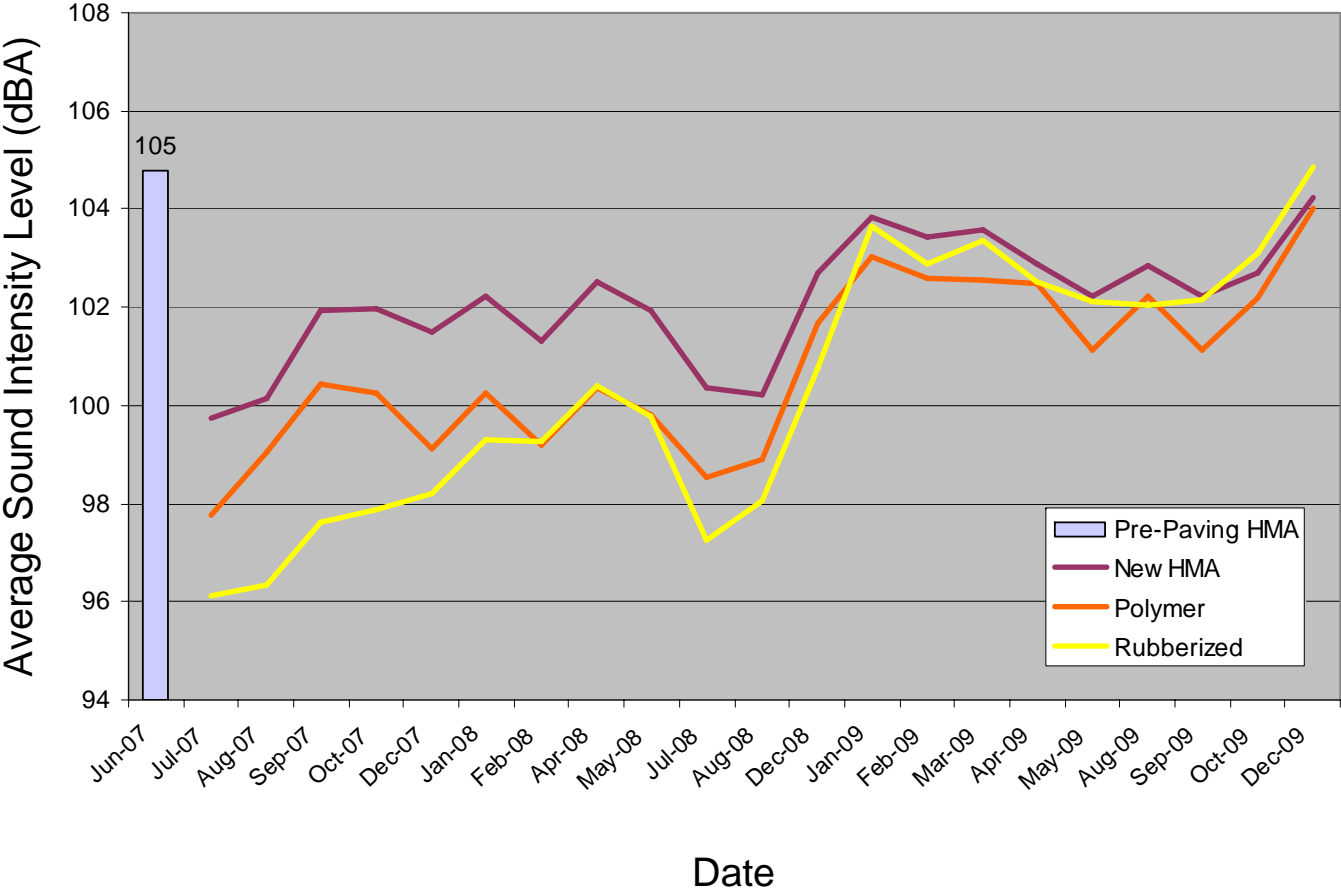
- OBSI has given WSDOT clear evidence that quieter pavements are not performing acoustically in Washington.

**Tire/Pavement Noise: Sound Intensity**  
I-5 Lynnwood, WA



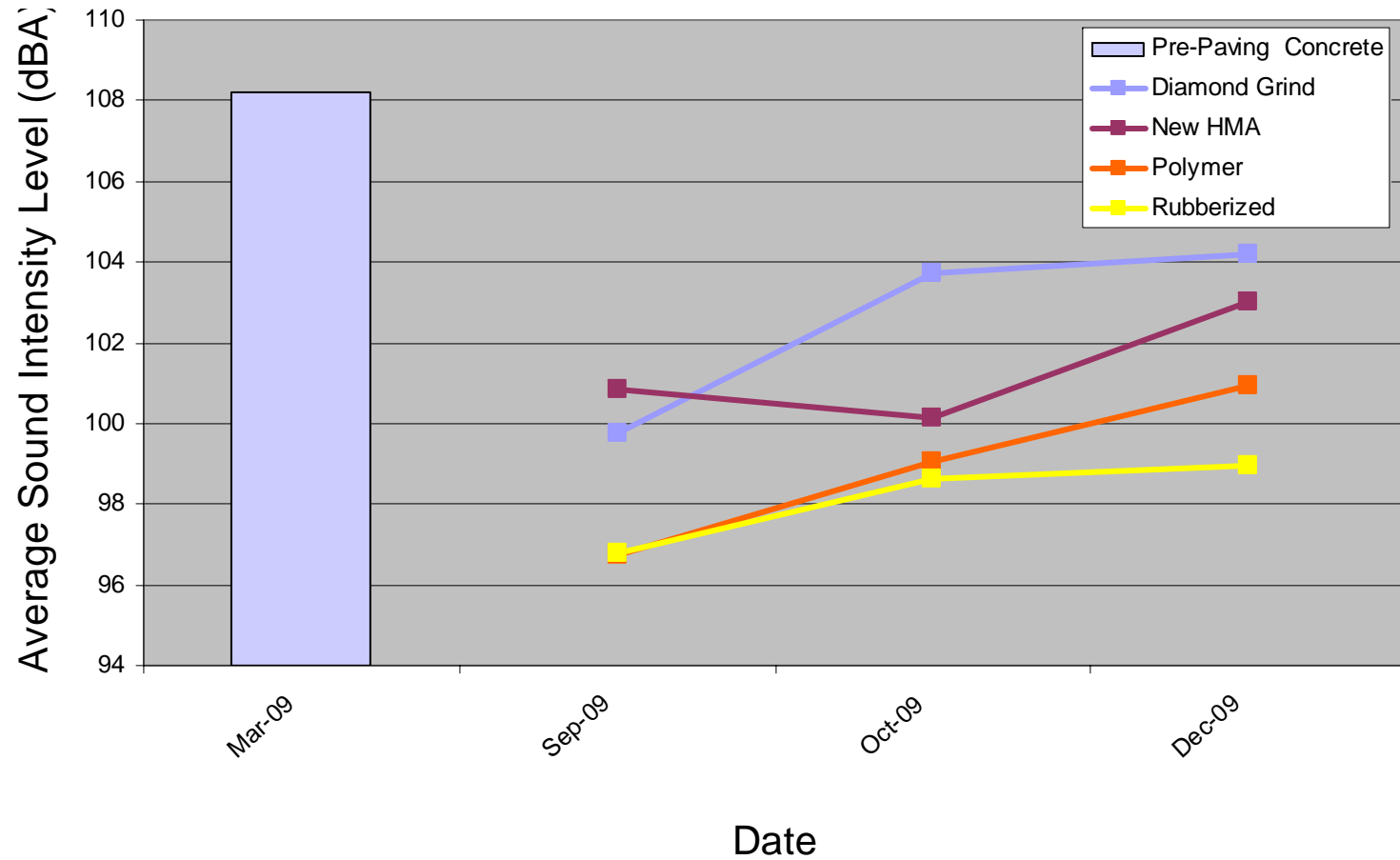
# Tire/Pavement Noise: Sound Intensity

SR 520 vicinity of Medina, WA



# Tire/Pavement Noise: Sound Intensity

I-405 Bellevue, WA



# Questions?

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