

Experiences with CDOT's Quiet Pavement Research Program

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FHWA Noise Policy

- For federal funding on highway projects:
 - 23 CFR 772 applies
 - Noise impact analysis required
- Noise abatement options:
 - Noise barriers (walls)
 - Traffic management
 - Alignment changes
 - Buffer zones
 - Insulation

FHWA Policy

- To use quieter pavement for noise abatement:
 - Special FHWA approval required
 - Must conduct a Quiet Pavement Pilot Program (QPPP)
 - Agency must commit to the noise abatement level
 - Arizona did it!
- Alternative:
 - Conduct Quiet Pavement Research (QPR)

Quieter Pavement Research

■ Research objectives:

- Determine noise benefits for specific pavements
- Determine noise behavior as pavements age
- Provide data for use in traffic noise modeling and validation
 - Noise = f (pavement type, texture, age, time, traffic, location)

CDOT Data Collection Plan

■ Measurement methods

- Source (by the tire)
- Wayside (by the road)

■ Sites

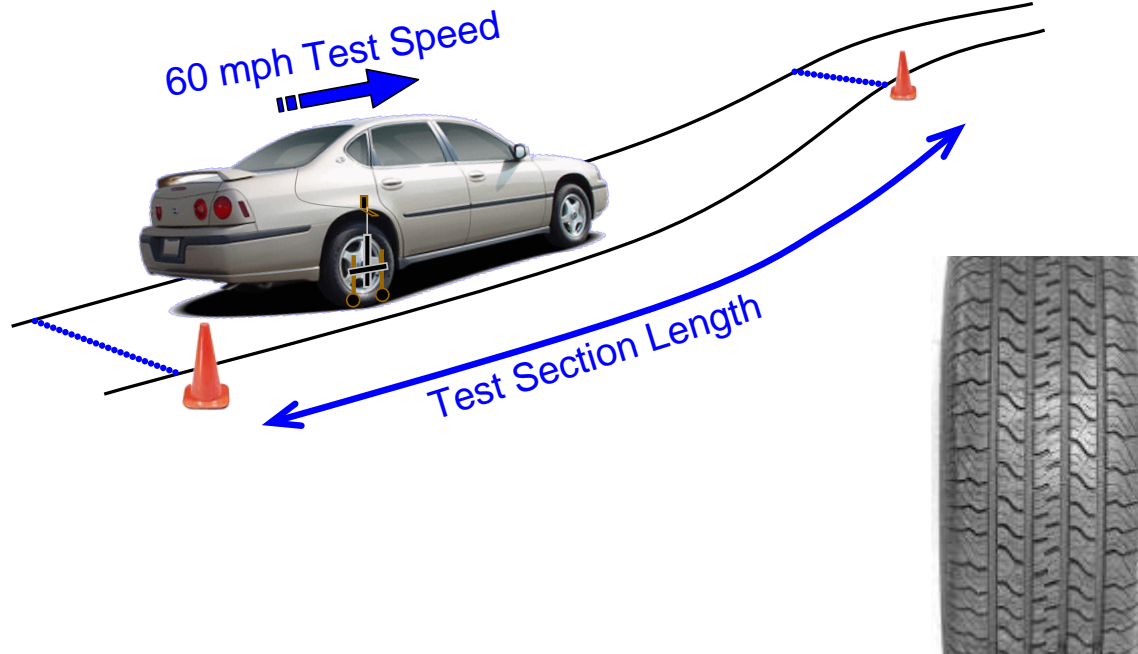
- Initially: 30
- Finally: 34 (+1 in 2007, +3 in 2009)

■ Measurement times

- 4 periods: 2006, 2007, 2009, 2011

Source Measurement Method

- Close proximity to the source
 - On-board sound intensity (OBSI) method

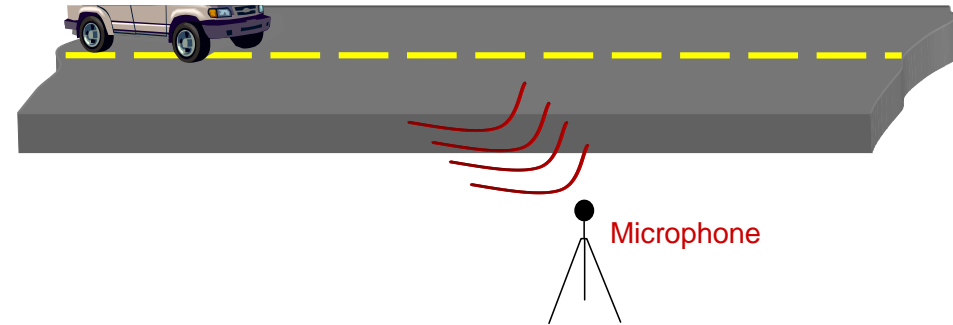


Wayside Measurement Method

■ Wayside (roadside)

■ Isolated pass-by:

- Applies when traffic is light
- Pass-by noise from individual vehicles can be isolated



■ Time averaged pass-by:

- Applies when traffic is dense



Measurement Methods

■ Source (OBSI)

- Representative of how much noise is generated at the tire-pavement interface
- Mobile measurement method

■ Wayside (pass-by)

- Representative of what listeners experience
- Fixed measurement locations
- Evaluates traffic noise in categories: car, light truck, heavy truck

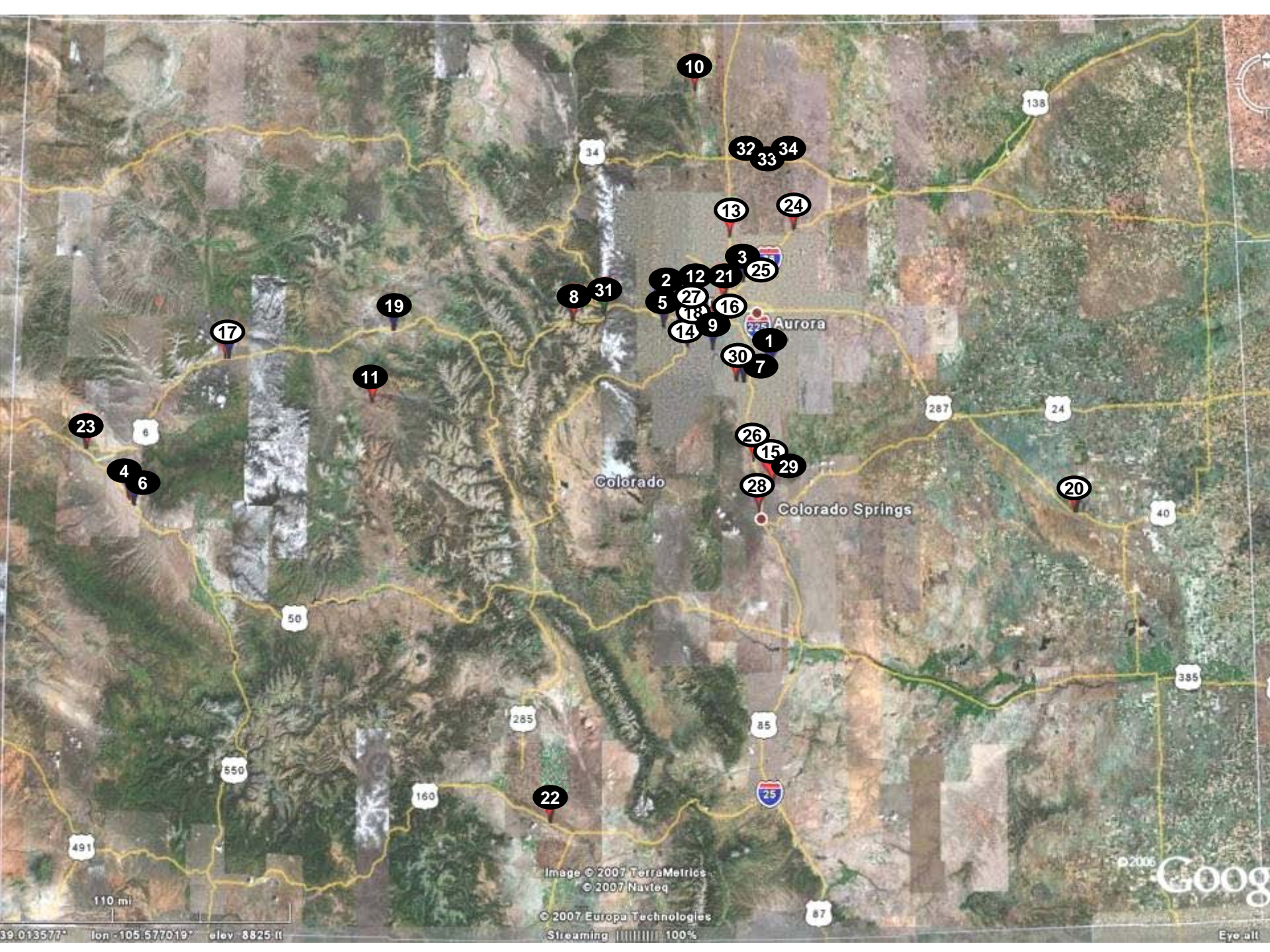
■ Good correlation between the two methods

■ Test sites

- Initially: 30 (in 2006)
- Finally: 34 (+1 in 2007, +3 in 2009)

■ Pavements

- SMA
- HMA
- Nova Chip
- PCC (various textures)
- Crumb rubber modified asphalt



10

32 33 34

13 24

2 12 21 25

8 31 5 27 18 16 9 30 1 7

19

11

23

4 6

17

26 15 29

28

20

50

285

85

25

22

160

550

491

385

87

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Streaming 100%

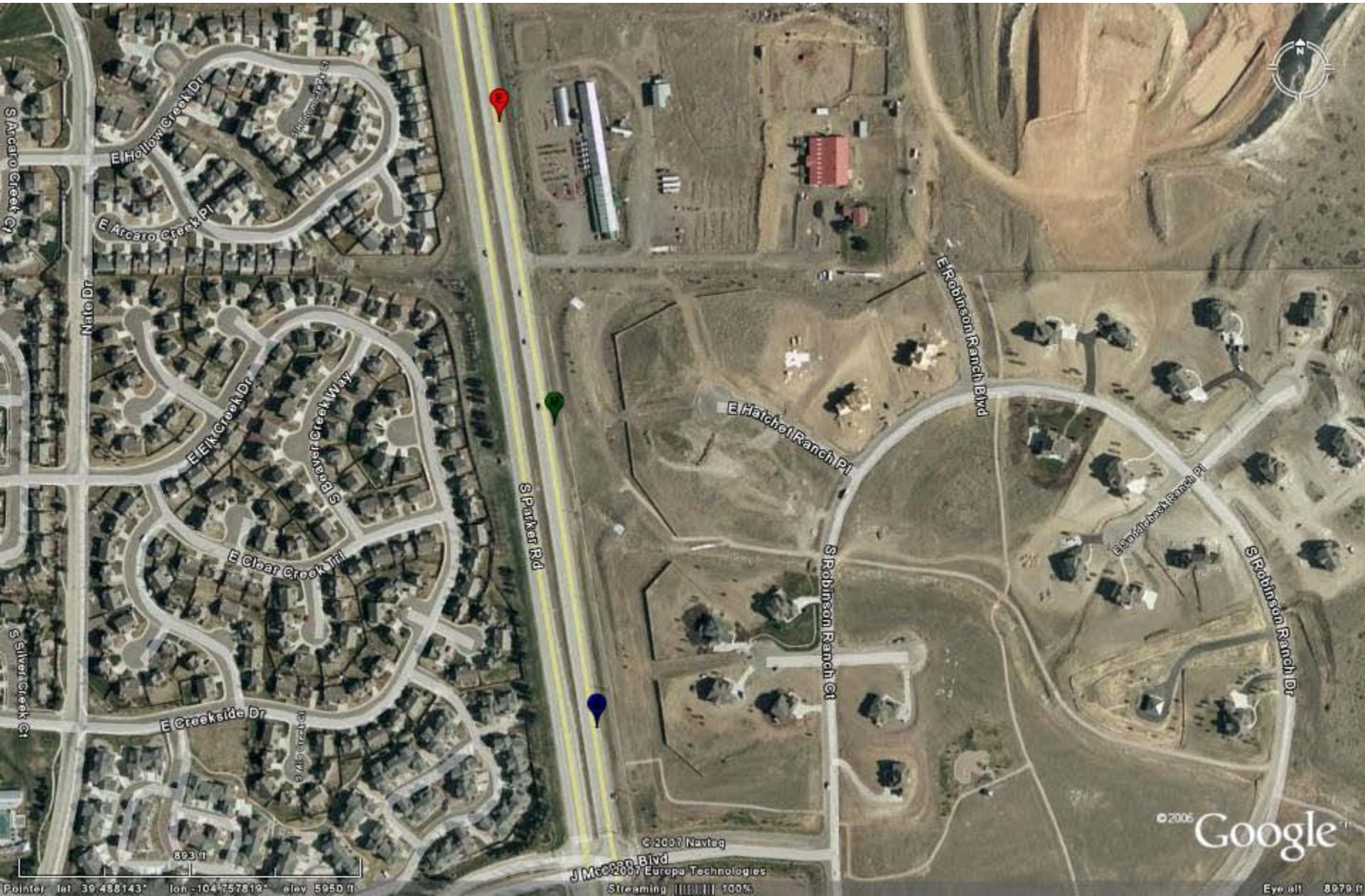
© 2006
Google

110 mi

39.013577° lon -105.577019° elev 8825 ft

Eye alt







Site 28 - Concrete

Site 29 - Asphalt



70

Site 8

Shield icon

Blue pin

1441 ft

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Streaming 100%

© 2006 Google™

Pointer lat: 39.698902° lon: -105.863457° elev: 10507 ft

Eye alt: 14022 ft

Managing Changes from 2006 - 2011

■ Test procedure changes

■ Test tire

- Goodyear Aquatred III
- ASTM F 2493 SRTT



■ Microphone fixture

- Single probe
- Dual probe

■ Test method standardized



■ Environmental changes

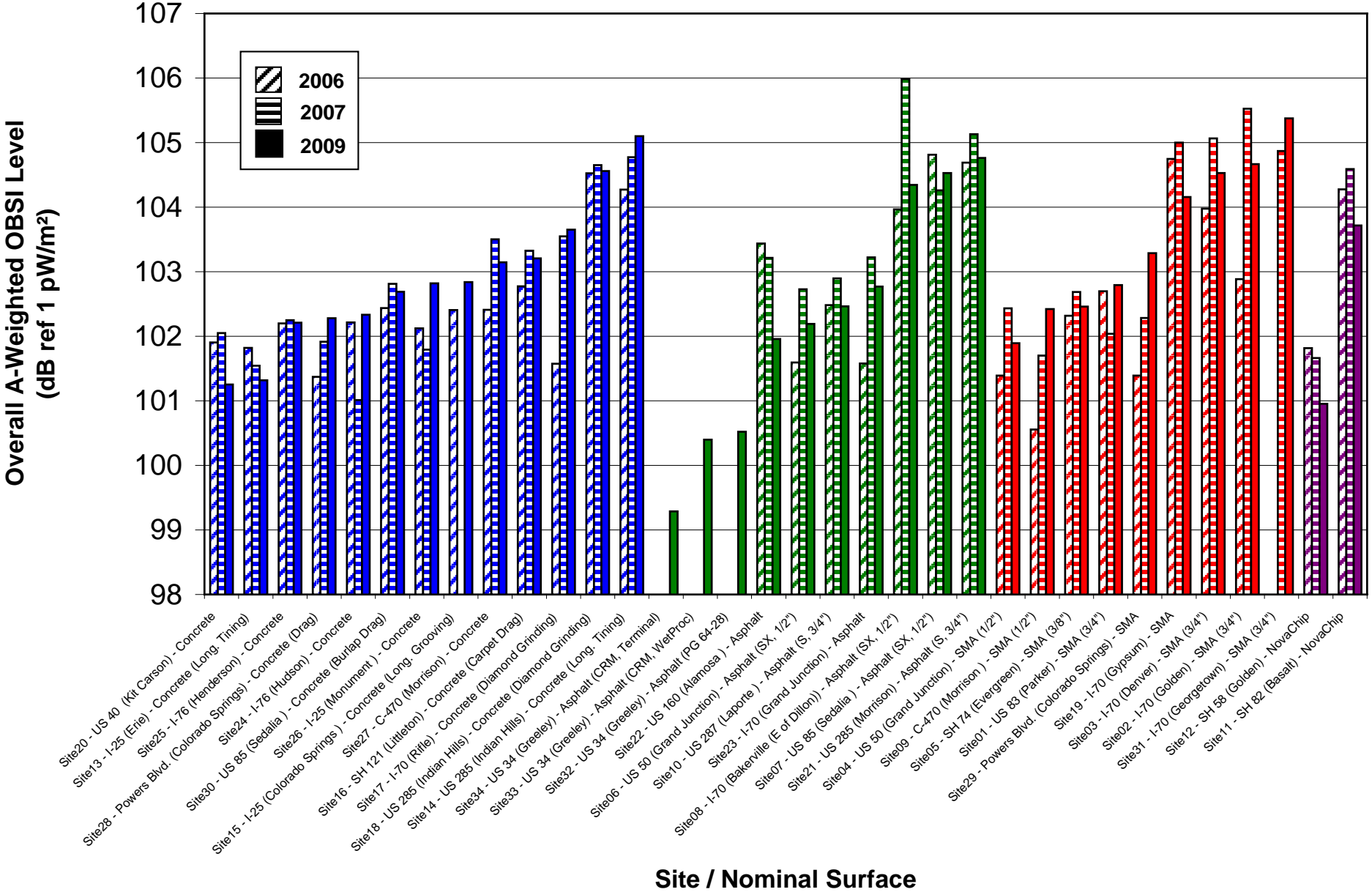
- Year-to-year temperature differences
- Pavement rehabilitation

Key Findings

- Results up through 2009 published
- Database of pavement types and tire-pavement noise
 - Useful for ranking
 - Identifying trends
- Correlation of wayside and source measurements
- Tire-pavement noise by vehicle type

OBSI Results

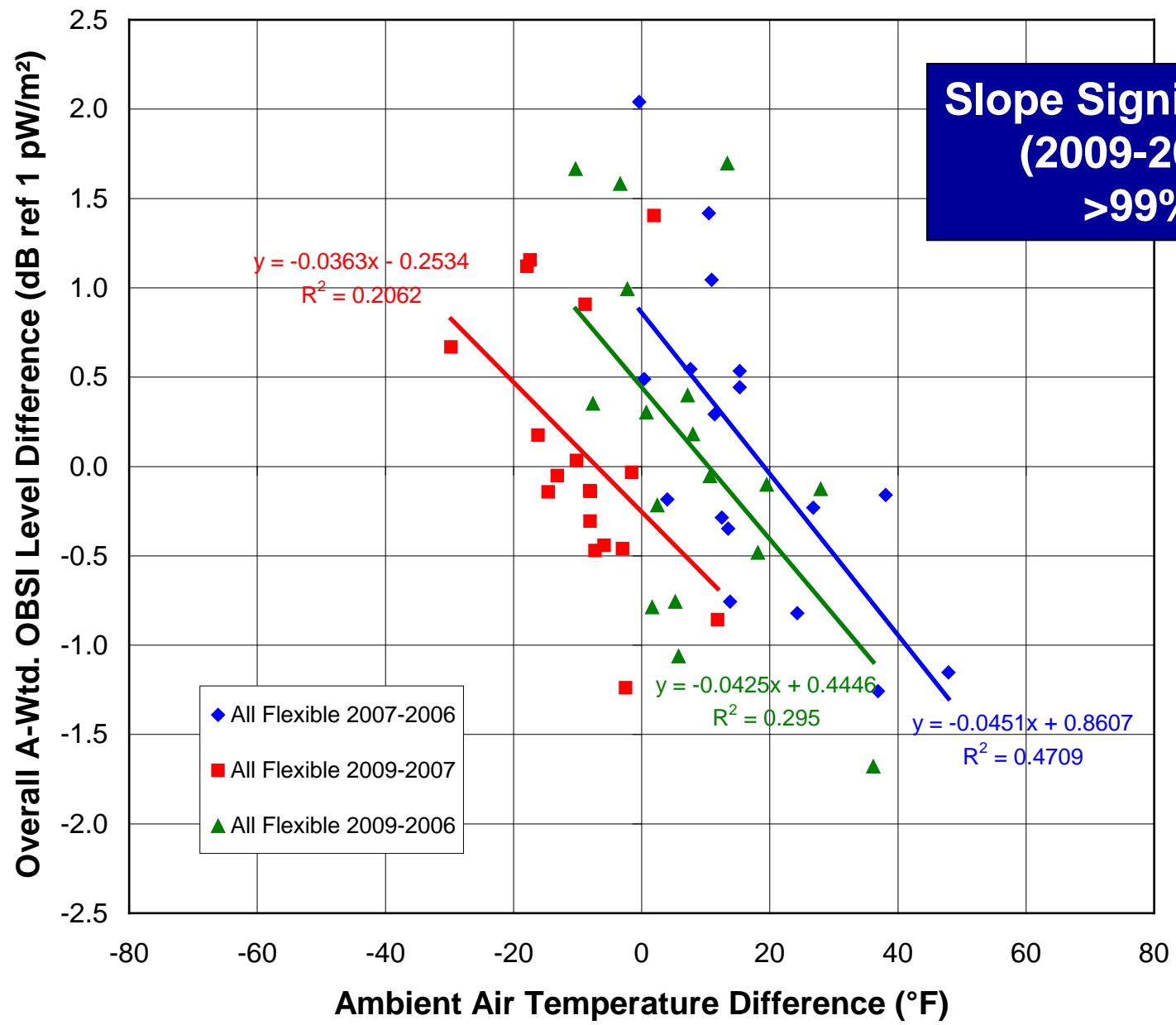
2009 Findings



Effect of Temperature on Noise

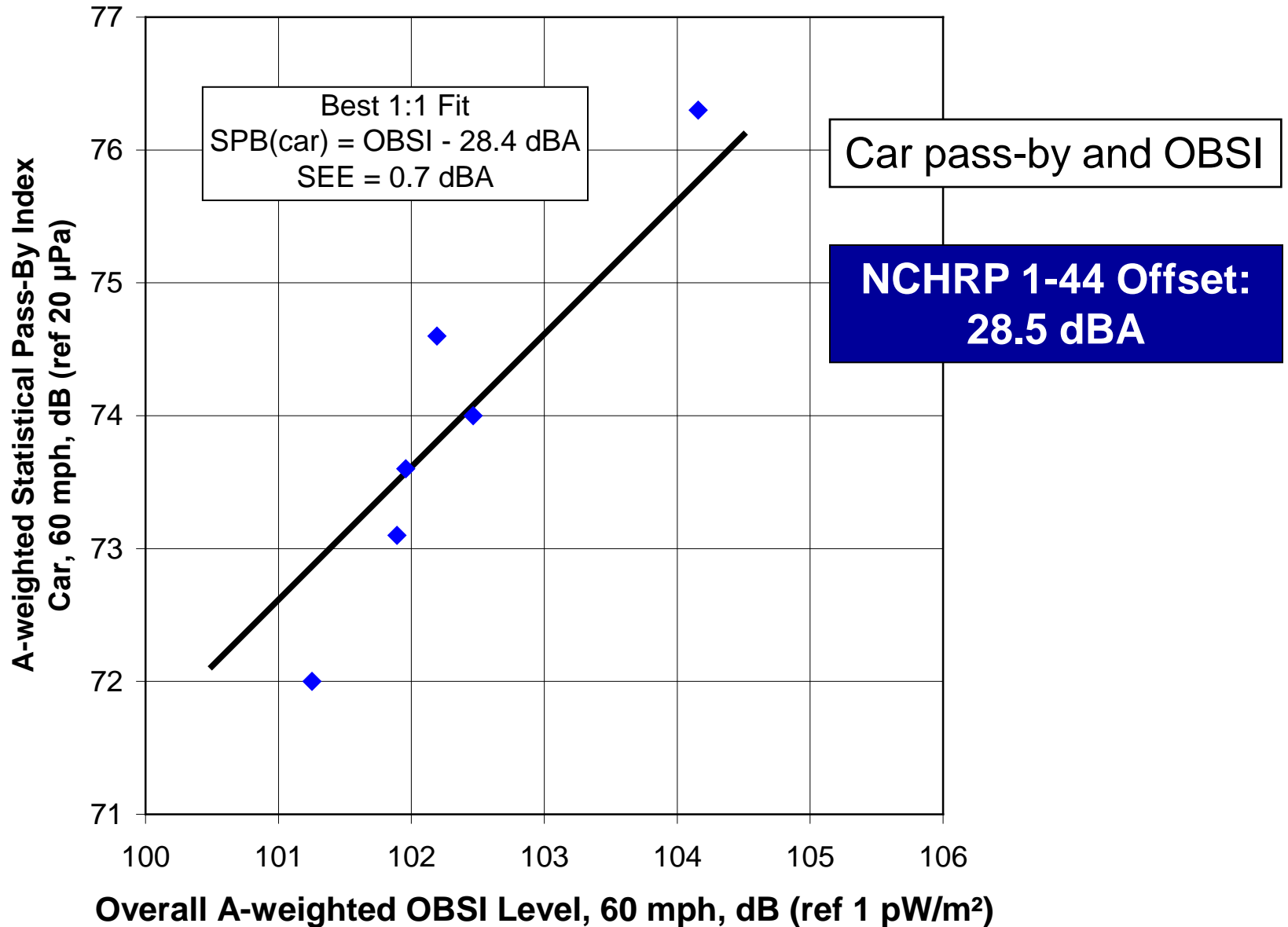
Hot-Mix Asphalt Pavements

2009 Findings



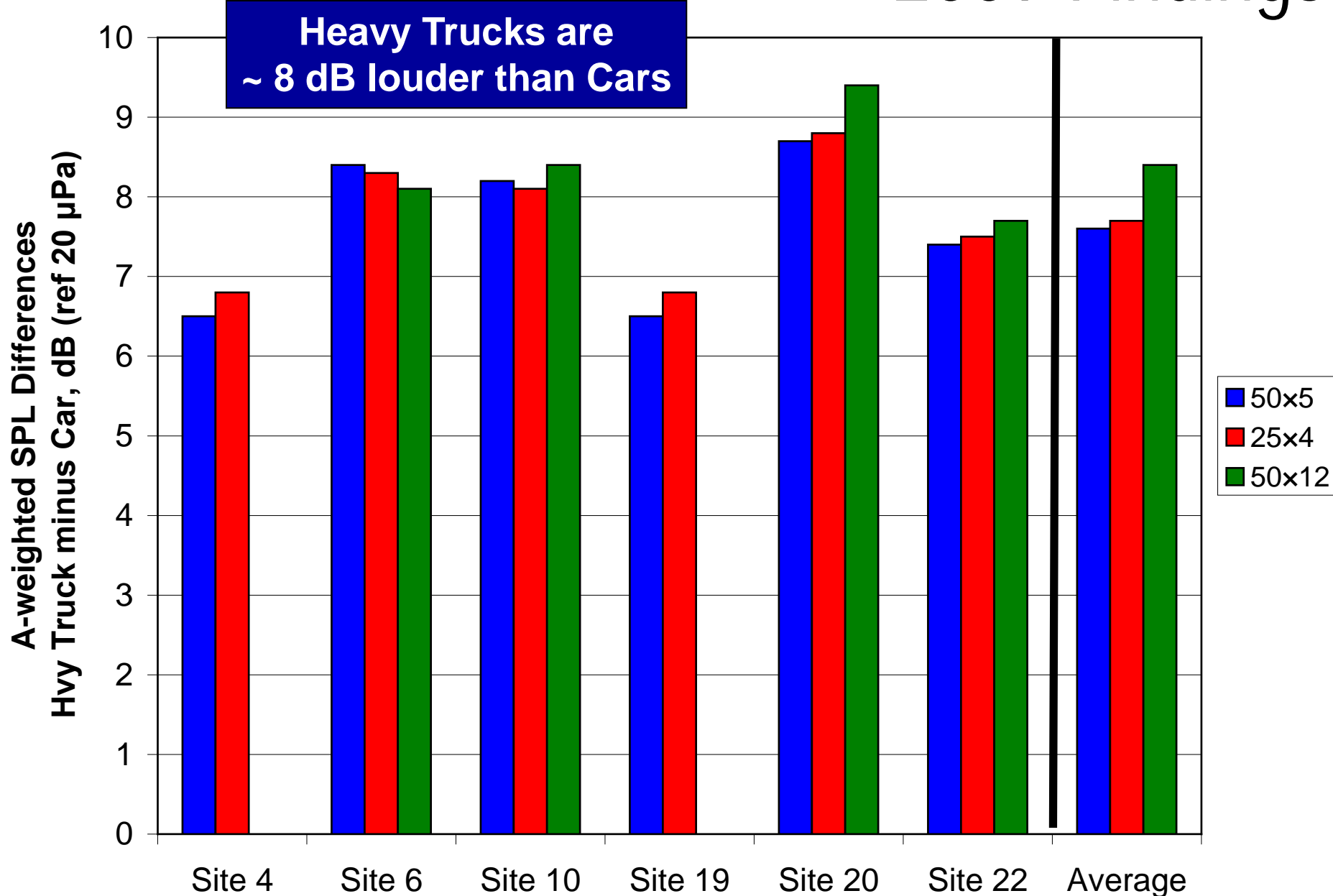
Wayside vs. Source (OBSI)

2009 Findings



Pass-by Noise by Vehicle Type

2009 Findings



What have we learned?

- Colorado has both quieter and louder pavements among all pavement types.
- Correlations exist between source and wayside measurements.
- Most pavements have increasing sound levels as they age
 - 0.1 dBA per year on the average
 - Some changing up to 0.7 dBA per year
- Noise levels are a function of temperature
 - Higher temperatures result in lower noise levels
 - More sensitive for flexible pavements

