ILLINGWORTH & RODKIN

Acoustics · Air Quality

Minneapolis, MN| **July 24-26th, 2017**

Quieter Pavements: Acoustical Measurement and Performance

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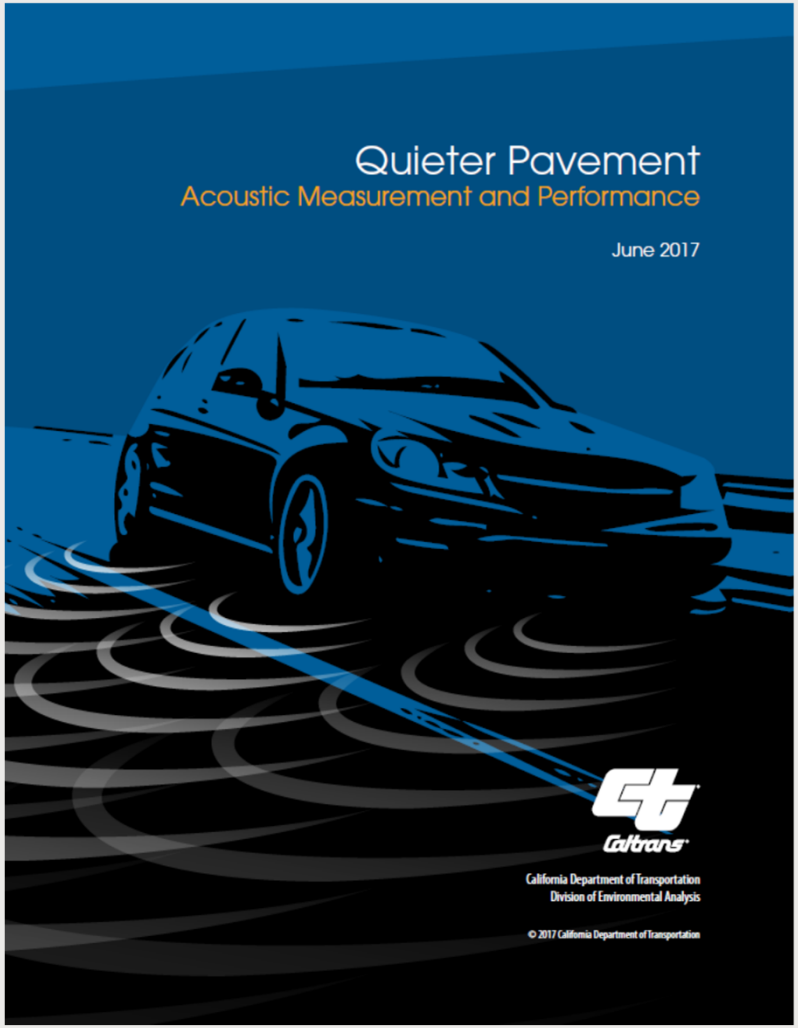
Quieter Pavement – Acoustic Measurement and Performance



Caltrans, in cooperation with ICF & I&R, has developed a quieter pavement document:

- Summarizes research from past 15+ years
- Indexes relative noise levels of ~700 pavements
- Provides best practices in acoustical design

Background

- Document includes:
  - Fundamentals of traffic noise & tire-pavement noise
  - Development of OBSI
  - Discussion and comparison of measurement methods
  - Summary of tire-pavement noise studies & results
  - Overview of past & current policy
  - Best practices in acoustical design
  - Future recommendations
  - Tire-pavement noise level database

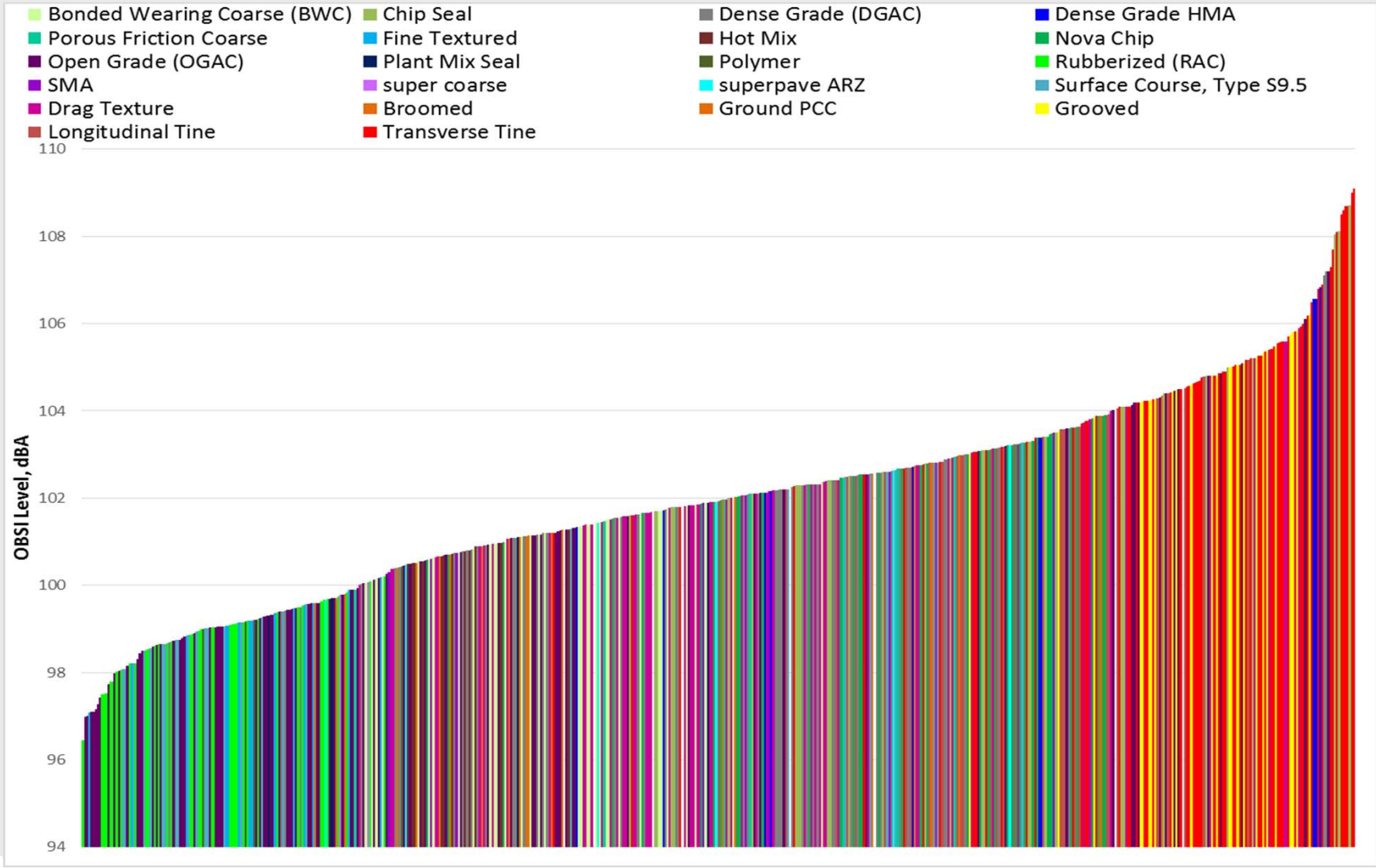
To be available on Caltrans website

Presentation Overview

- This presentation summarizes the following sections:
  - Overall tire-pavement levels
    - Highways
    - Low speed roads
    - By pavement category
  - Quieter flexible surfaces (AC)
  - Porous pavements
  - Rehabilitation of rigid pavement
  - Acoustical longevity

- There are many other topics described in the document!!

Tire-Pavement Noise Levels – SRTT (60 mph)



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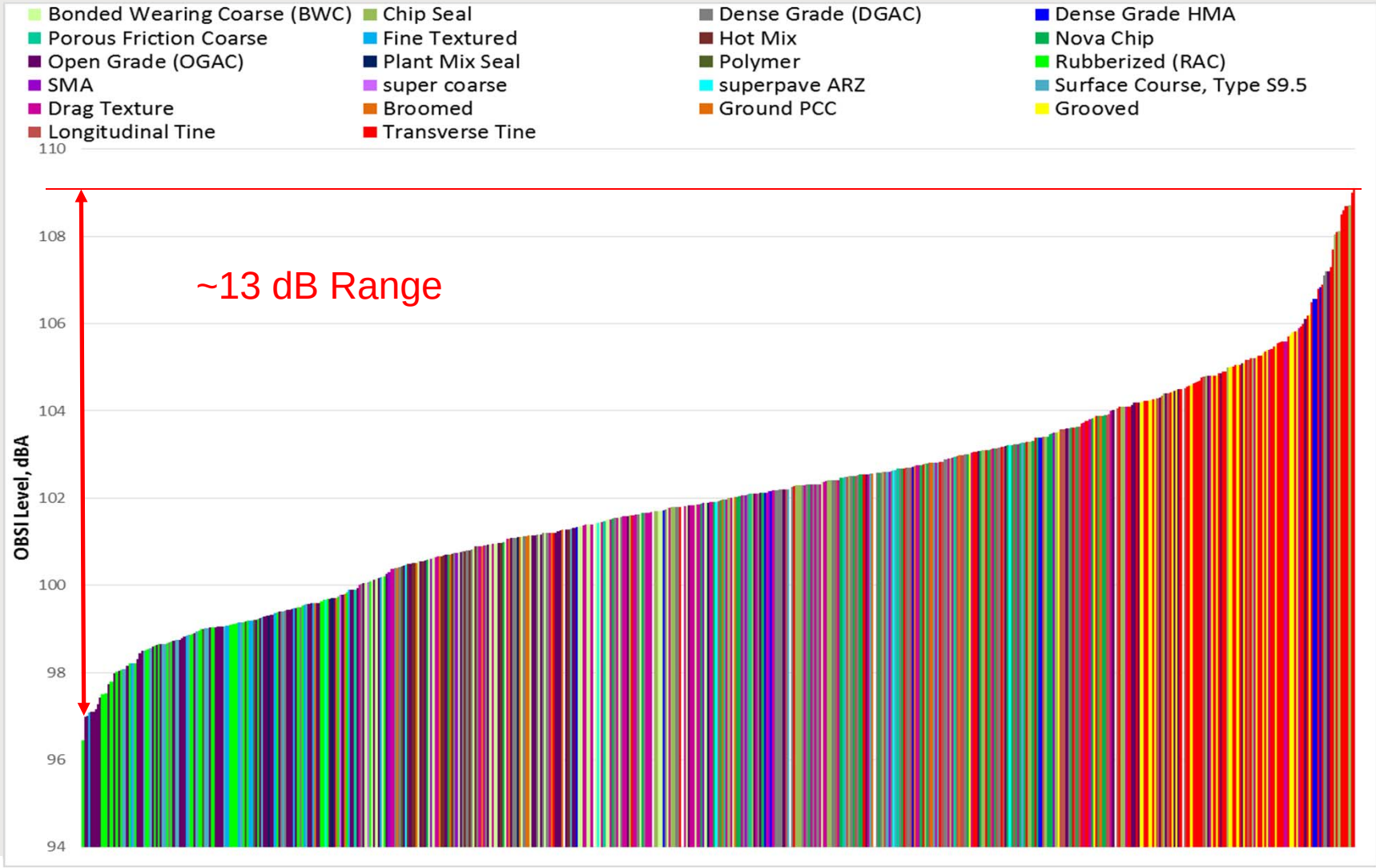
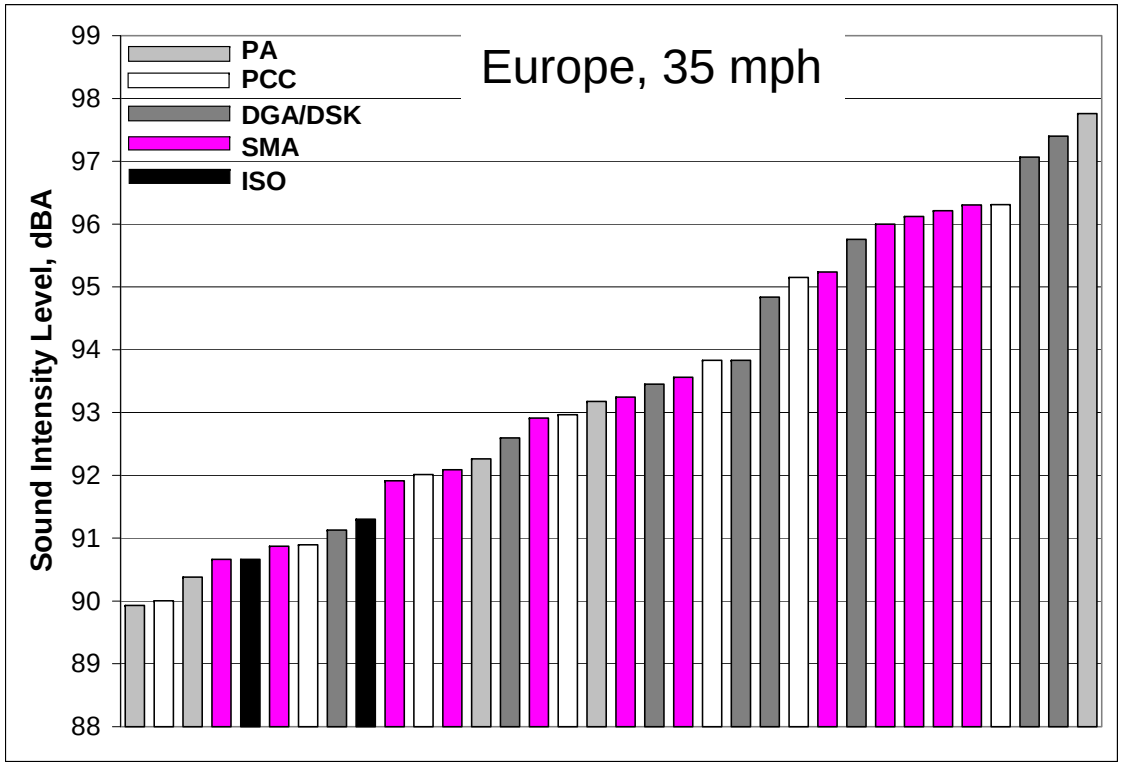
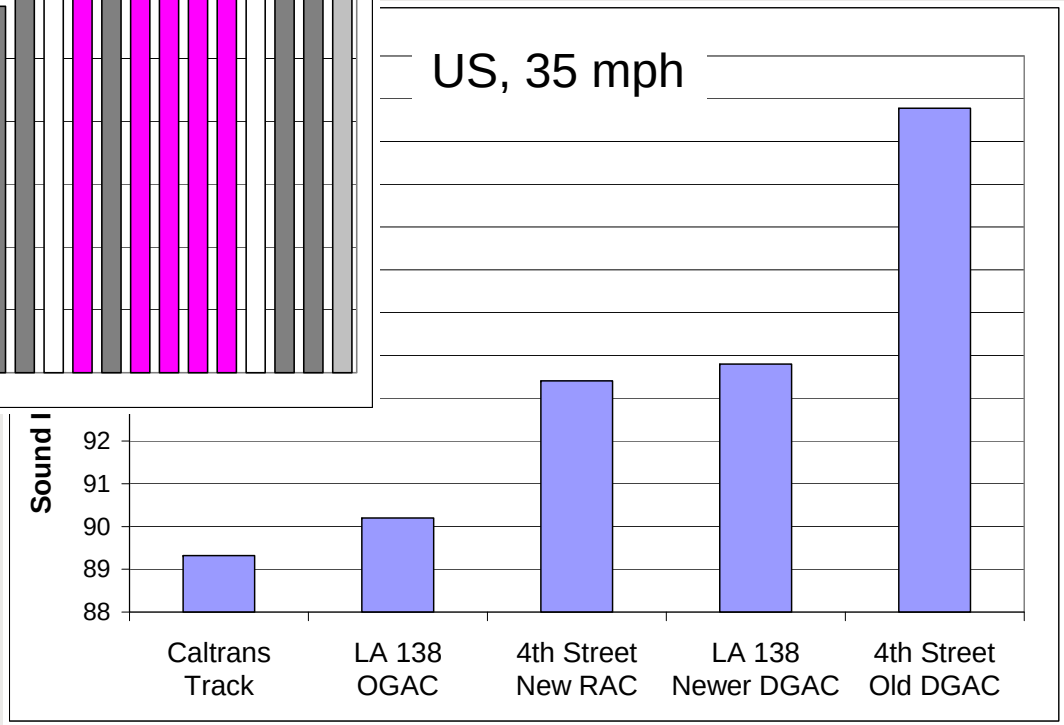


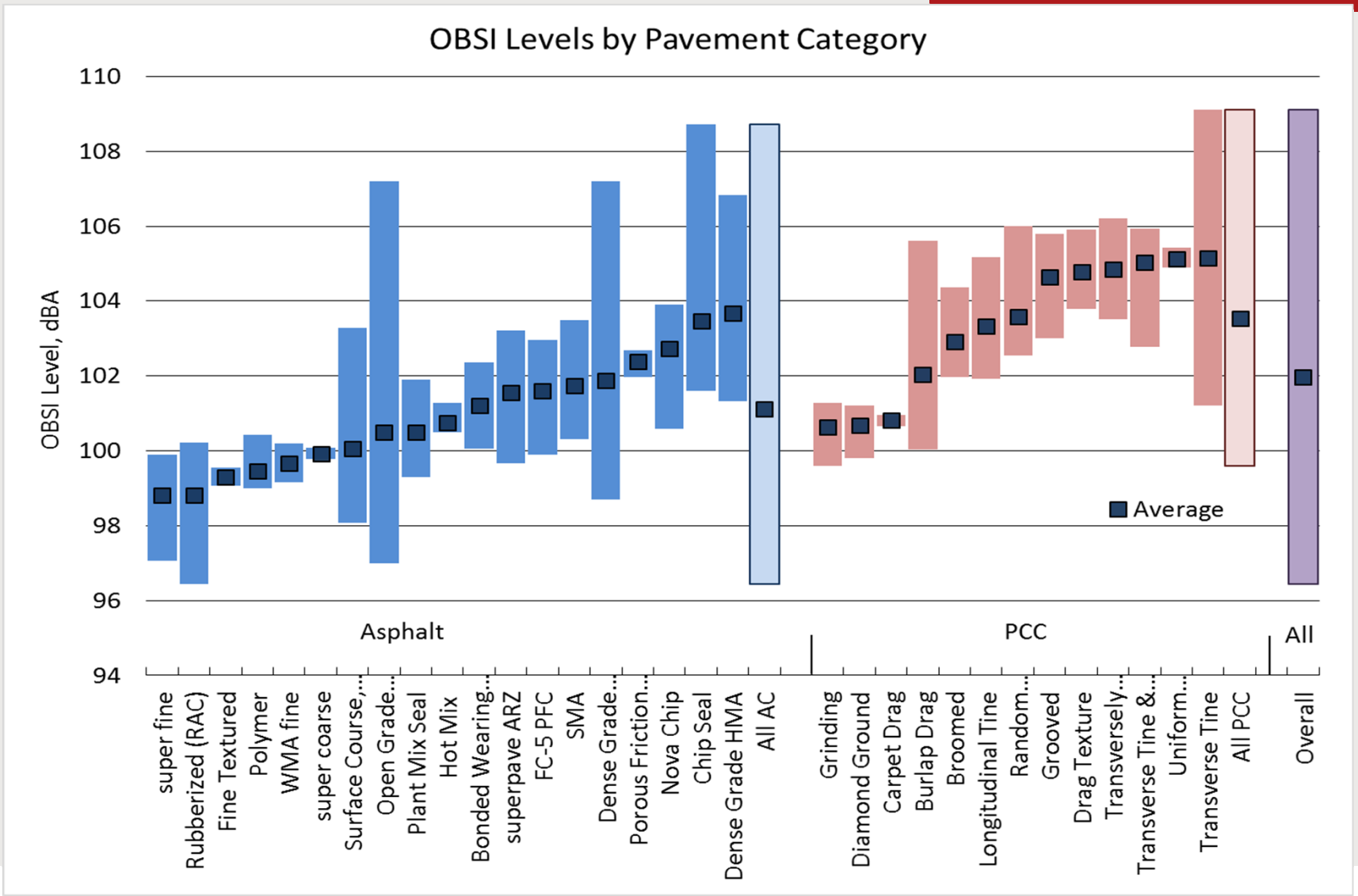
Low Speed Roads – OBSI Levels



~10 dB Range



Range of OBSI Level by Pavement Category



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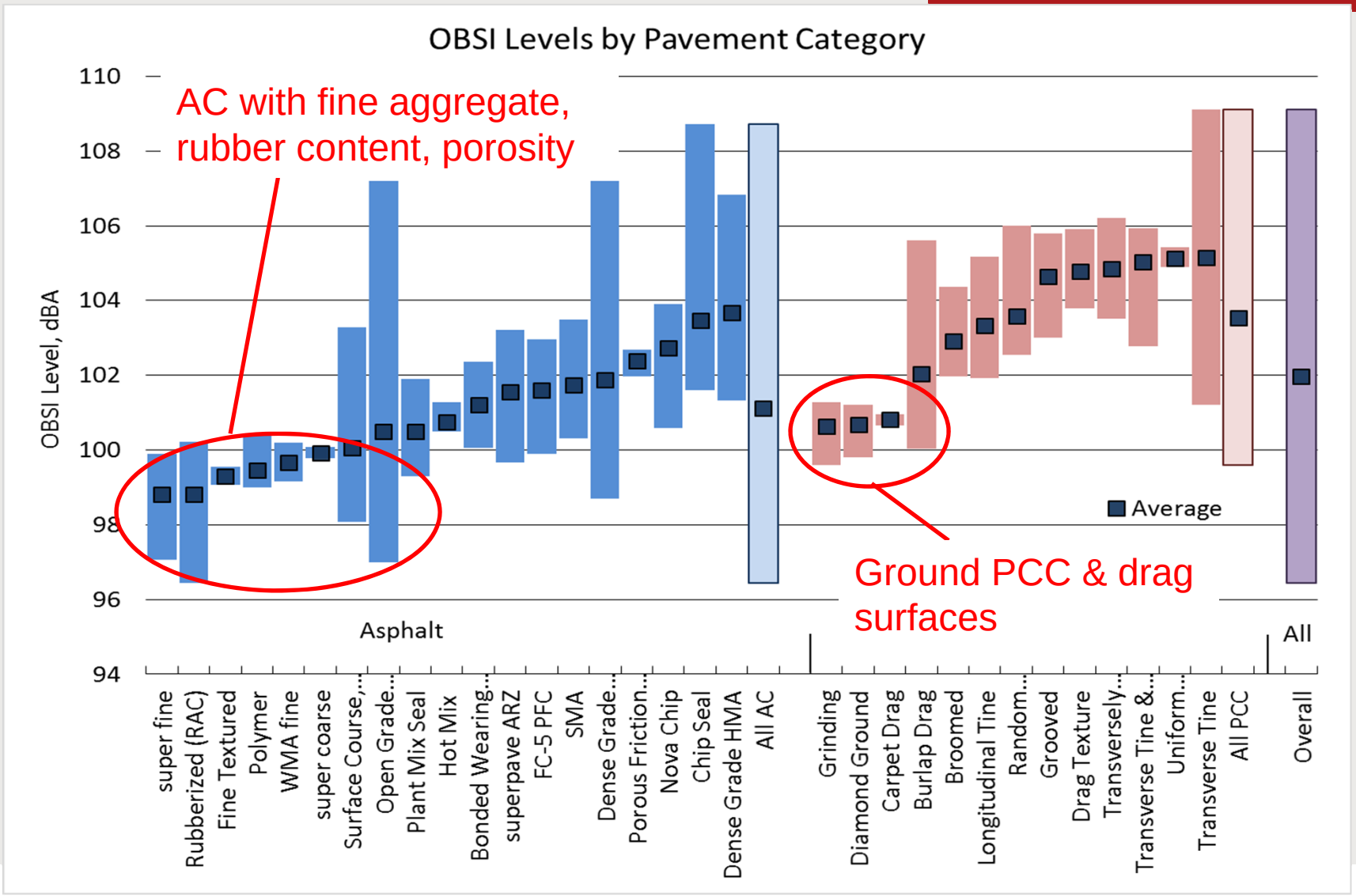

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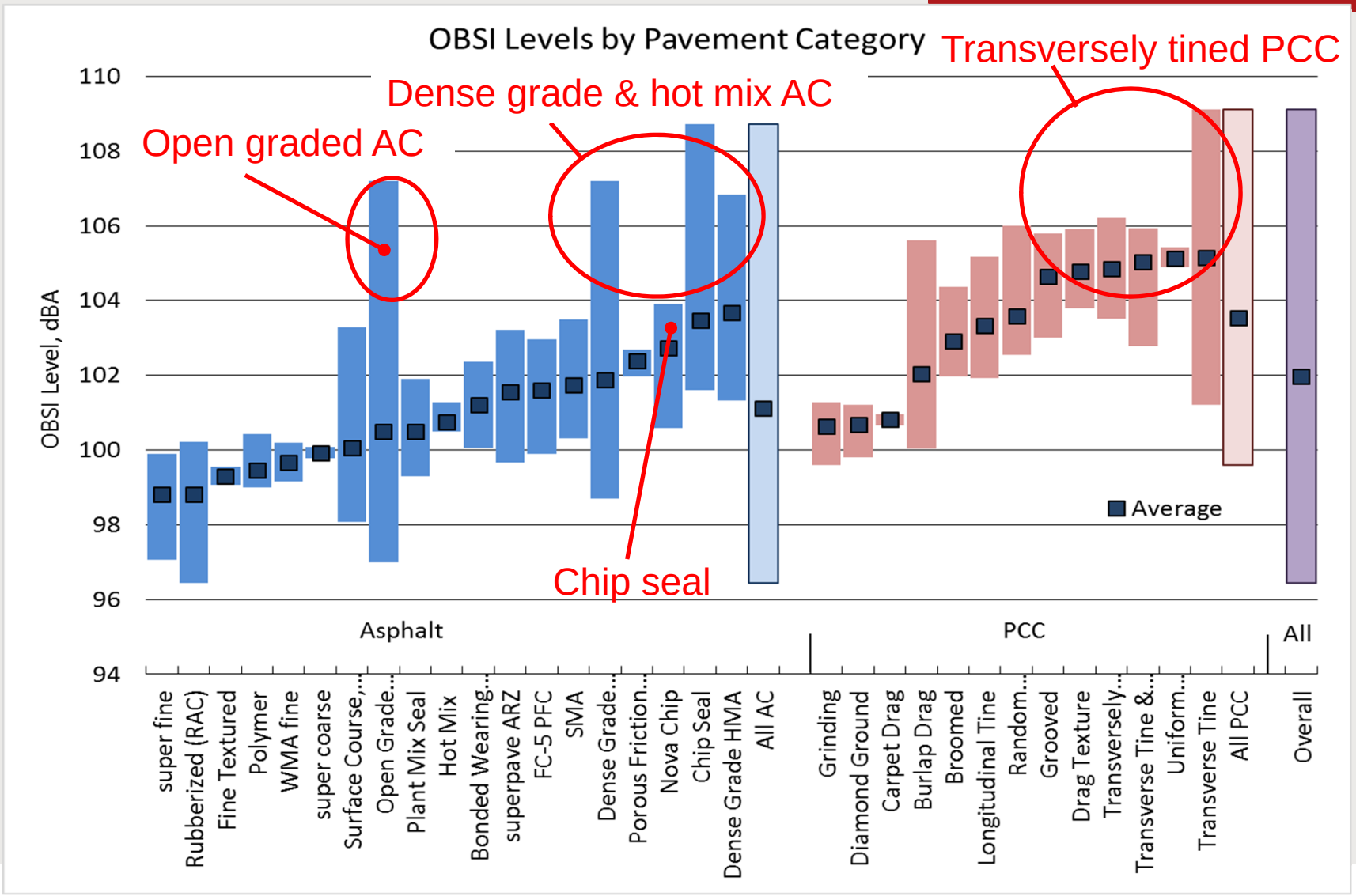


Quieter Flexible Pavements

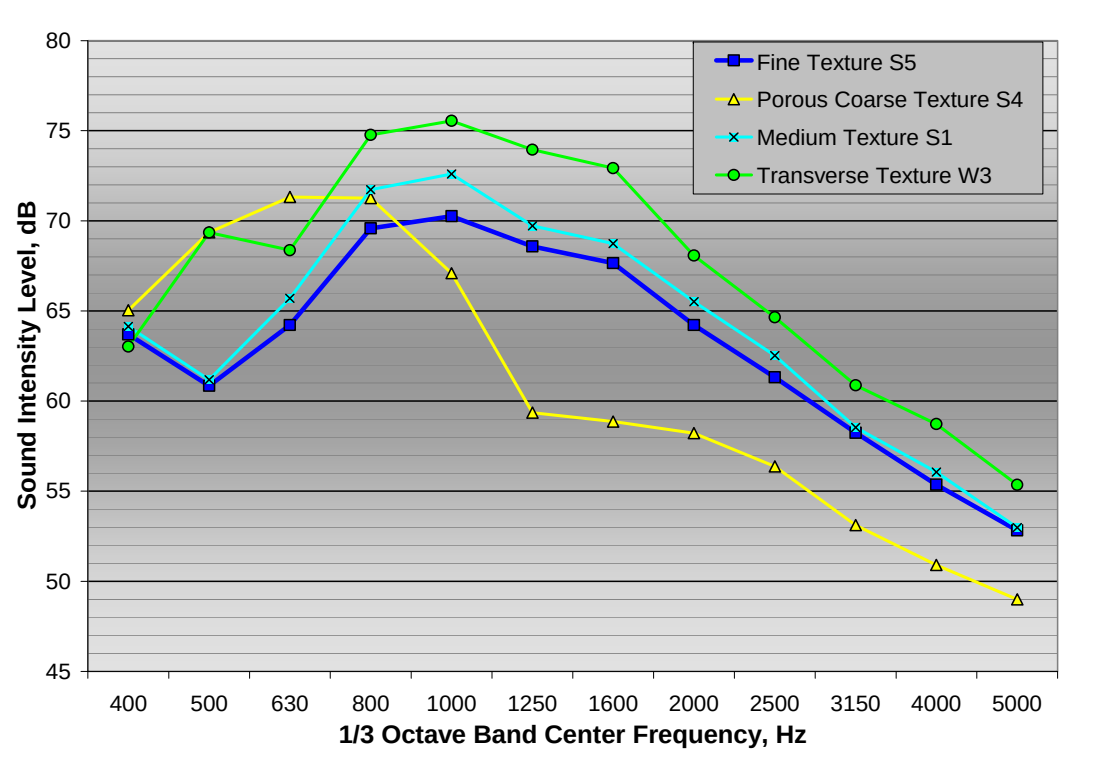
Rubber Content

Small Aggregate

Open Grade / Porous

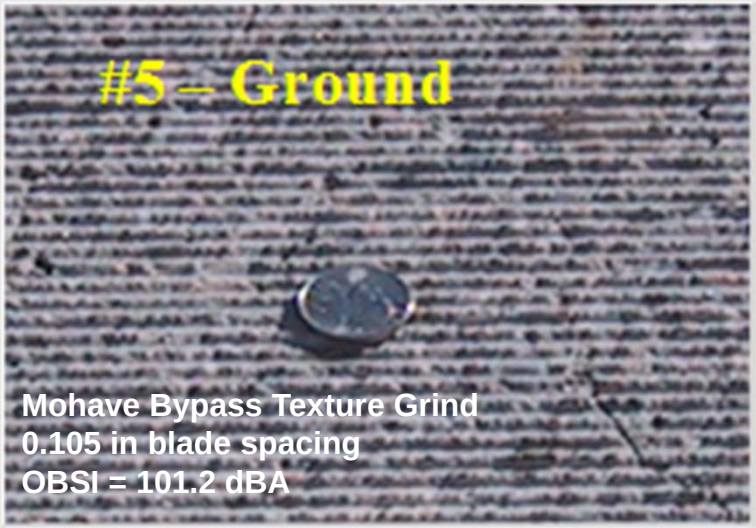
Porous AC Pavement

- Quietest pavements constructed with conventional materials



- Reduced mid & high frequencies
- Increased low frequencies (larger aggregate)
- Additional attenuation at wayside (propagation)
- Particularly effective for trucks

Rigid Pavement Rehabilitation - Grinding



Mohave Bypass Texture Grind
0.105 in blade spacing
OBSI = 101.2 dBA

Example of Arizona "Whisper" Grind

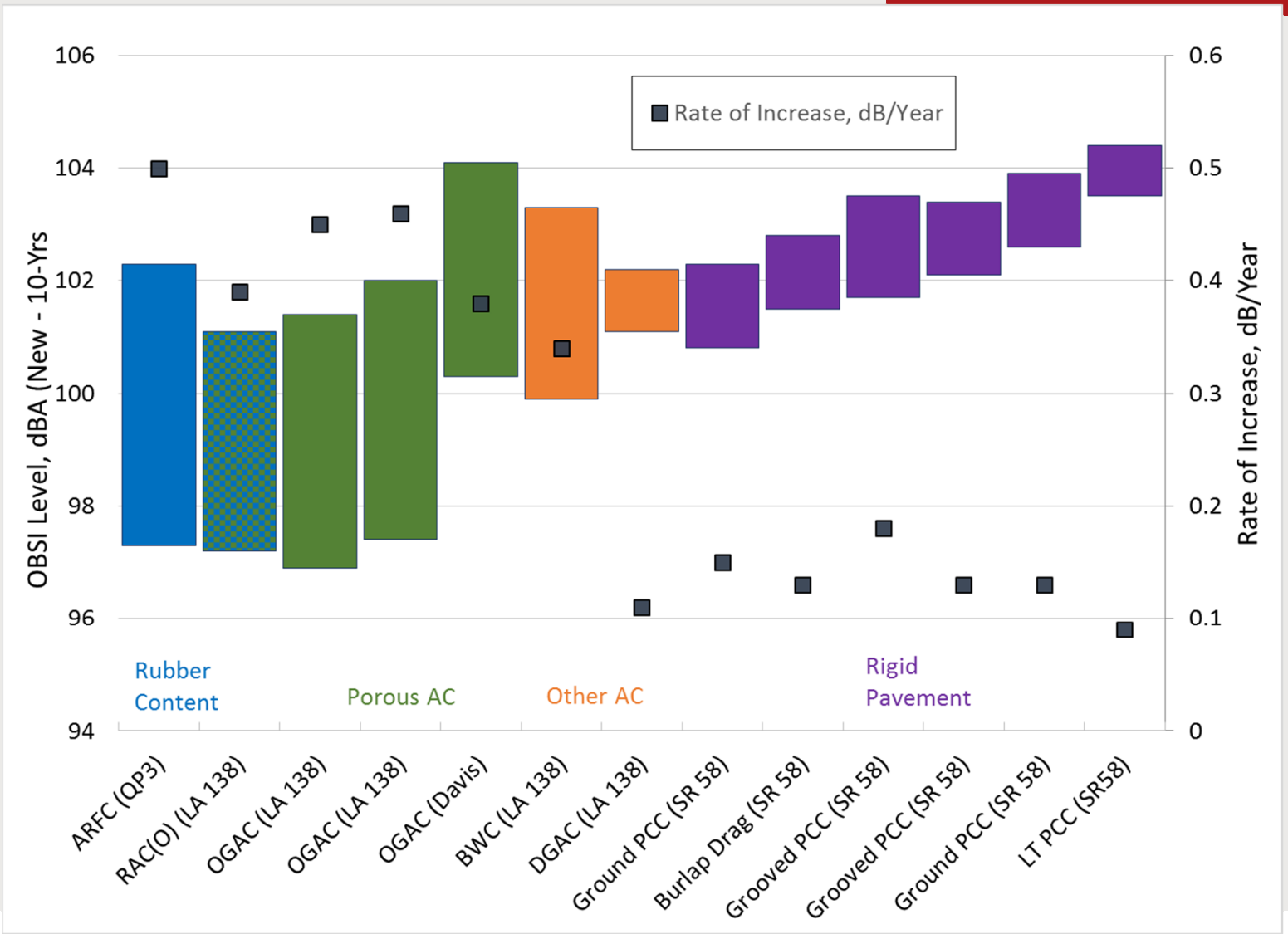
Next Generation Concrete Surface (NGCF)
OBSI ~ 99 dBA new

– Quietest surfaces use 0.120-inch blade spacing or less

Acoustical Longevity – Long Term Research

Project	Pavement Details	OBSI Level, dBA		10-Yr Rate of Increase, dB/Year	Mid-Project Year Traffic Loading
		New Pavement	10-yr Pavement		
ADOT QP3	ARFC (Rubberized)	97.3	102.3	0.50	Varies
Davis I-80 (6-lanes)	OGAC (Porous)	100.3	104.1	0.38	146,000 AADT, 7.6% Trucks (2006)
LA 138 (2-lanes)	DGAC	101.1	102.2	0.11	4,400 AADT, 14% Trucks (2007)
	OGAC 75 mm (Porous)	96.9	101.4	0.45	
	OGAC 30 mm (Porous)	97.4	102.0	0.46	
	RAC(O) (Porous, Rubberized)	97.2	101.1	0.39	
	BWC	99.9	103.3	0.34	
Mohave Bypass SR 58 (4-lanes)	LT PCC	103.5	104.4	0.09	17,000 AADT, 37% Trucks (2007)
	Ground PCC, S1	102.6	103.9	0.13	
	Ground PCC, S5	100.8	102.3	0.15	
	Burlap Drag PCC	101.5	102.8	0.13	
	Grooved PCC, S3	101.7	103.5	0.18	
	Grooved PCC, S4	102.1	103.4	0.13	

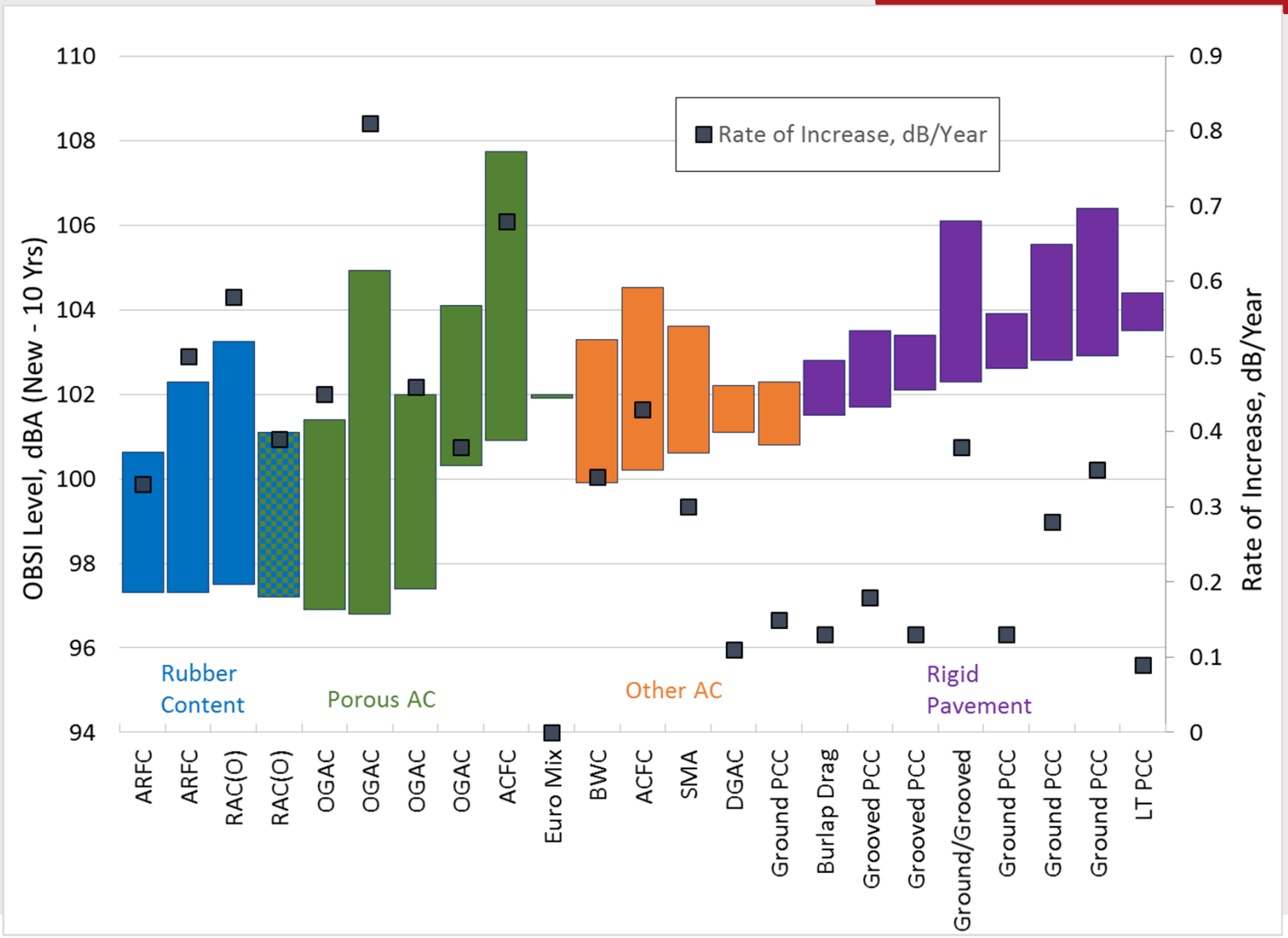
Acoustical Longevity – Long Term Research



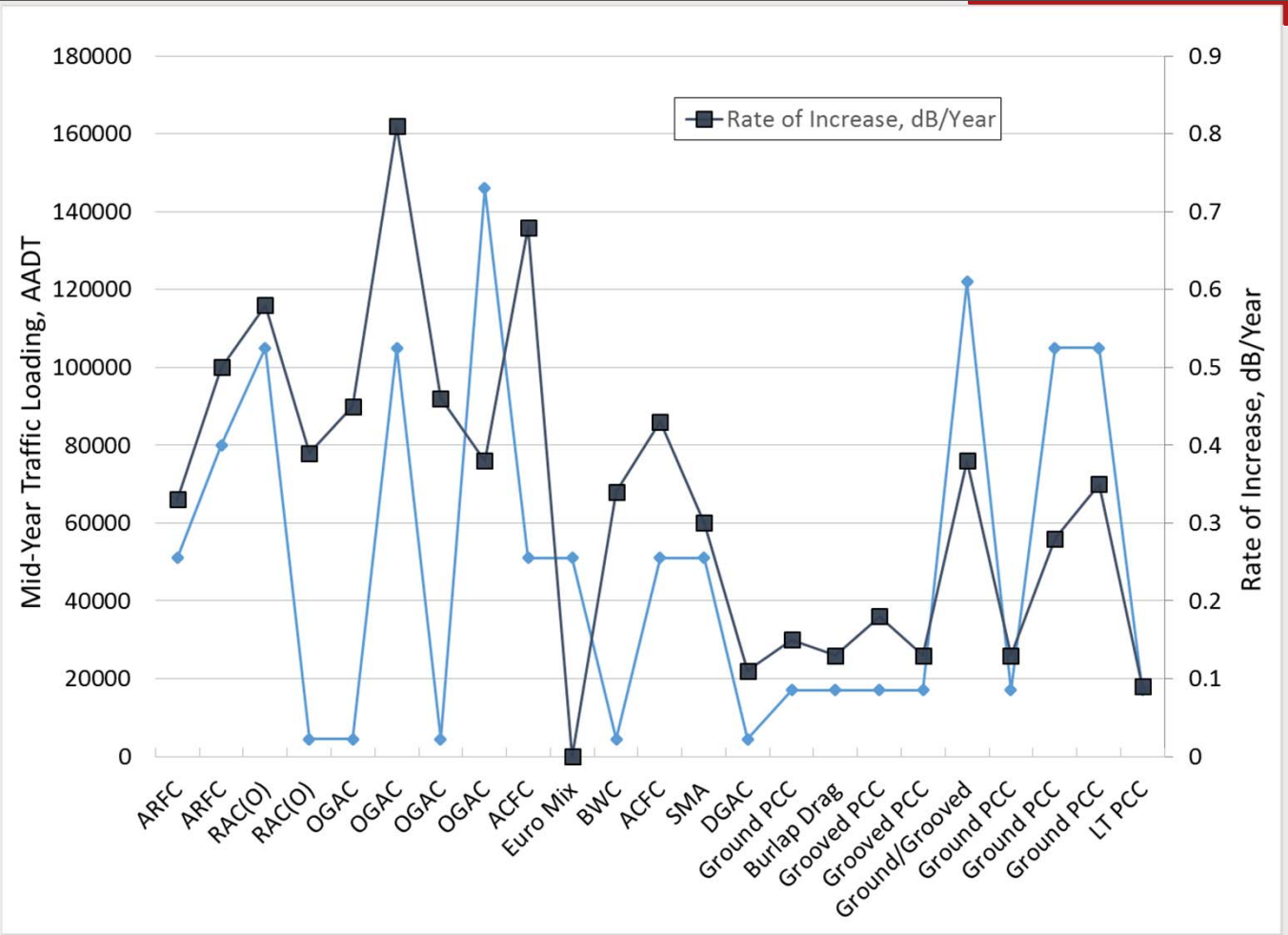
Acoustical Longevity – Smaller Studies

Project	Pavement Details	OBSI Level, dBA		Rate of Increase, dB/Year	Mid-Project Year Traffic Loading
		New Pavement	Aged Pavement		
SR 85, Saratoga, CA (6-lanes)	Ground and Grooved Long. Tined PCC	102.3	104.2 (5-Yr)	0.38	122,000 AADT, 0.57% Trucks (2007)
I-280, San Mateo County (6-lanes)	Diamond Ground PCC	102.8	105.0 (8-Yr)	0.28	105,000 AADT, 2.3% Trucks (2006)
	Texture Ground PCC	102.9	105.7 (8-Yr)	0.35	
	RAC(O) (Rubberized)	97.5	102.1 (8-Yr)	0.58	
	OGAC (Porous)	96.8	103.3 (8-Yr)	0.81	
I-10, Casa Grande, AZ (6-lanes)	AR-ACFC (Rubberized)	97.3	99.3 (6-Yr)	0.33	51,000 AADT (2007)
	ACFC	100.2	102.8 (6-Yr)	0.43	
	SMA	100.6	102.4 (6-Yr)	0.30	
	ACFC (Porous)	100.9	105.0 (6-Yr)	0.68	
	Euro Mix (Porous)	101.9	101.7 (6-Yr)	negligible	

Acoustical Longevity – Long Term and Smaller Studies

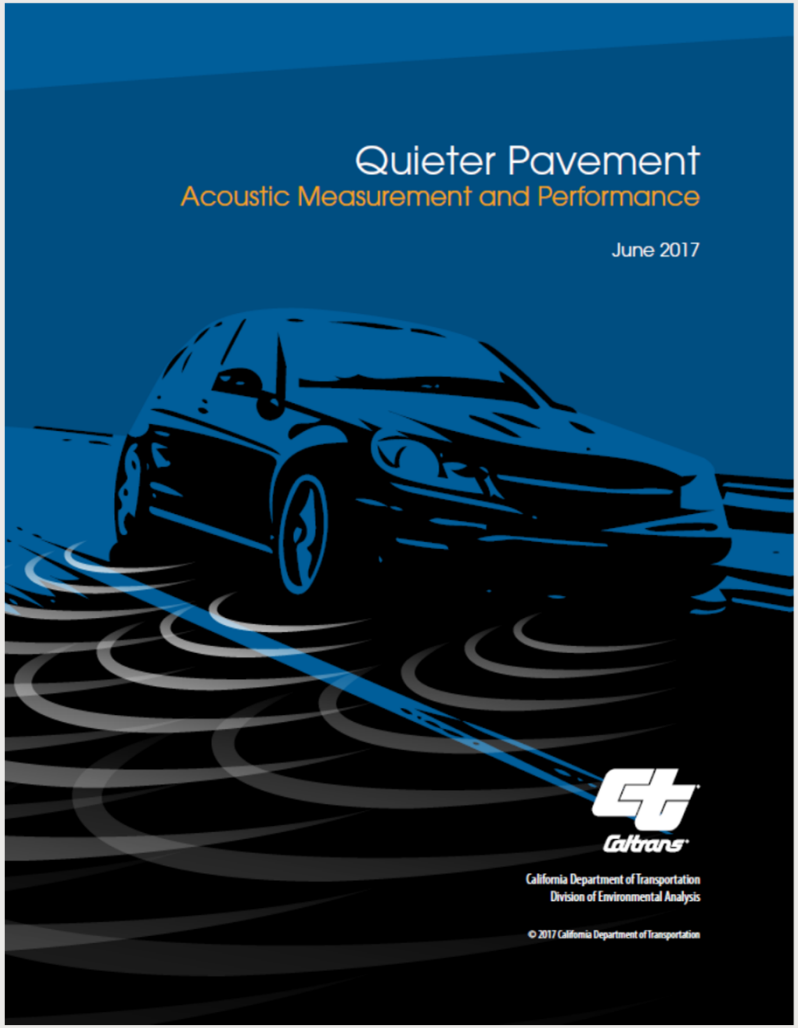


Acoustical Longevity & Vehicle Loading



Tire-Pavement Noise Level Database

- Approximately 700 pavements indexed for SRTT!
  - ~600 pavements @ 60 mph
  - ~80 pavements @ <60 mph
  - ~20 pavements @ >60 mph
- Database includes the following Information:
  - OBSI sound levels (overall, 1/3rd octave)
  - Pavement details (type, age, specifics)
  - Section location
  - Measurement details (time/date, vehicle, speed, tire, ...)
  - Meteorology information



Thank you for your attention!

And a special thanks to

Dave Buehler, ICF

Bruce Rymer, Caltrans

Paul Donavan, I&R