

TIRE / PAVEMENT NOISE CHARACTERISTICS OF WEARING COURSE ASPHALT MIXTURES

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PRESENTATION OUTLINE

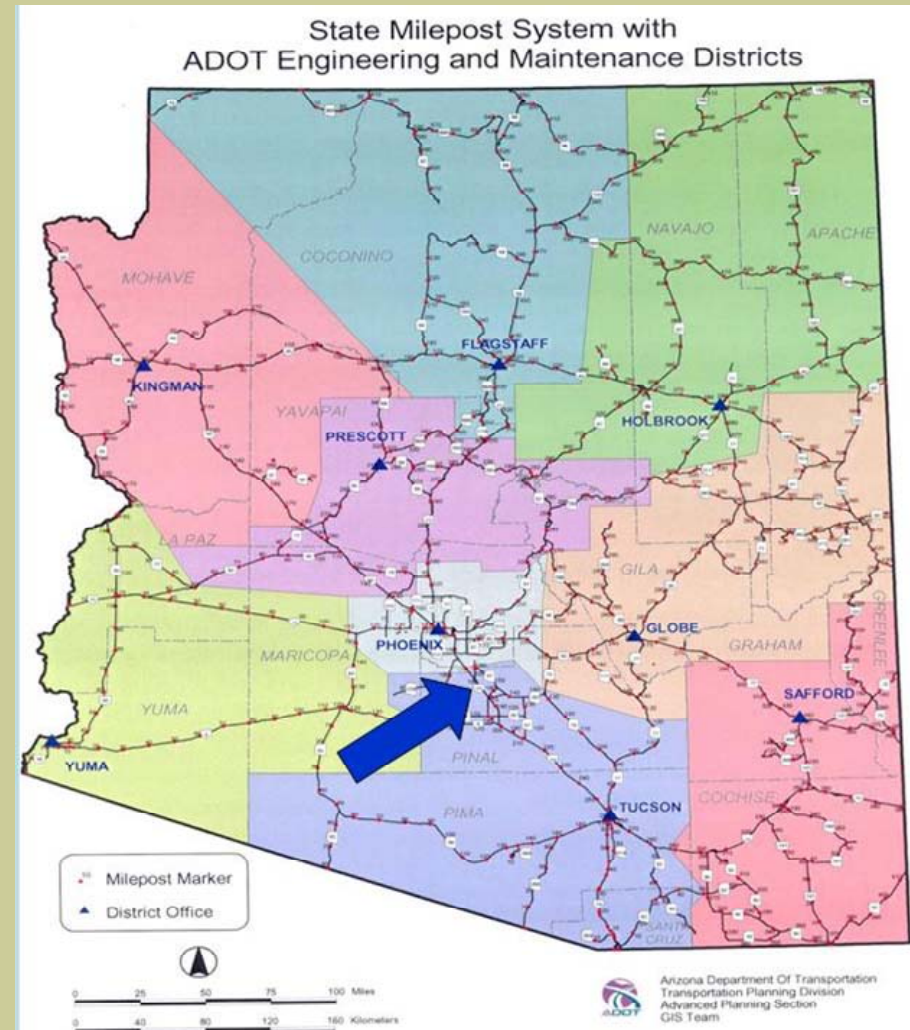
- **Research Objective**
- **Interstate – 10 Wearing Course Test Sections**
 - *Background*
 - *Pavement Types*
 - *Pavement Mix Design*
- **Field Noise Studies**
 - *Scofield, 2002*
 - *Carlson et al, 2007*
 - *Dynatest Inc. 2008*
- **Conclusions & Future Research**

OBJECTIVE

- *Evaluate tire / pavement noise characteristics of five different pavement wearing courses placed as test sections on the Interstate-10, Arizona, by means of field noise measurements.*

I-10 WEARING COURSE EXPERIMENT

- ✓ Arizona DOT Preventive Maintenance Pavement Preservation Experiment – 1999
- ✓ Mile Post 186.2 to 195.3 East Bound
- ✓ Annual Daily Traffic (ADT) ~ 60,000 with 25% trucks
- ✓ Total Equivalent Single Axle Loads (ESALs) ~ 26 Million
- ✓ 5 Asphalt Concrete Pavement Types as Test Sections
- ✓ 32 Replicate Test Cells



SCHEMATIC OF I-10 TEST SECTIONS

TPSS No.	Mil/ Fil	MP	EB	EB (Cont)	MP	Mil/ Fil	
		190.74				190.74	
99-16	3 1/2" 3"	191.02	ACFC (3/4")	SMA (3/4")		3 1/2" 3"	99-15
99-17	3 1/2" 3"	191.31	AR-ACFC (3/4")	ACFC (3/4")		3 1/2" 3"	99-14
99-18	3 1/2" 3"	191.59	SMA (3/4")	AR-ACFC (3/4")		3 1/2" 3"	99-13
99-19	3 1/2" 3"	191.88	PEM (1 1/4")	P-ACFC (3/4")		3 1/2" 3"	99-12
99-20	3 1/2" 3"	192.16	P-ACFC (3/4")	PEM (1 1/4")		3 1/2" 3"	99-11
99-21	4 1/2" 4"	192.44	ACFC (3/4")	SMA (3/4")		2 1/2" 2"	99-10
99-22	4 1/2" 4"	192.73	AR-ACFC (3/4")	P-ACFC (3/4")		2 1/2" 2"	99-9
99-23	4 1/2" 4"	193.01	SMA (3/4")	PEM (1 1/4")		2 1/2" 2"	99-8
99-24	4 1/2" 4"	193.30	P-ACFC (3/4")	ACFC (3/4")		2 1/2" 2"	99-7
99-25	4 1/2" 4"	193.58	PEM (1 1/4")	AR-ACFC (3/4")		2 1/2" 2"	99-6
99-26	4 1/2" 4"	193.86	ACFC (3/4")	ACFC (3/4")		2 1/2" 2"	99-5
99-27	4 1/2" 4"	194.15	PEM (1 1/4")	PEM (1 1/4")		2 1/2" 2"	99-4
99-28	4 1/2" 4"	194.43	AR-ACFC (3/4")	P-ACFC (3/4")		2 1/2" 2"	99-3
99-29	4 1/2" 4"	194.72	SMA (3/4")	SMA (3/4")		2 1/2" 2"	99-2
99-30	4 1/2" 4"	195.00	P-ACFC (3/4")	AR-ACFC (3/4")		2 1/2" 2"	99-1
99-31	3 1/2" 3"	195.28	AR-ACFC (1/2")	AR-ACFC (1/2")		3 1/2" 3"	99-0
						189.89	
						189.60	
						189.32	
						189.03	
						188.75	
						188.47	
						188.18	
						187.90	
						187.61	
						187.33	
						187.05	
						186.76	
						186.48	
						186.20	

WEARING COURSE PAVEMENT TYPES

- Asphalt Rubber Open Graded Friction Course (AR-ACFC)
- ADOT Standard Open Graded Friction Course (ACFC)
- Polymer Modified Open Graded Friction Course (P-ACFC)
- Permeable European Mixture (PEM)
- Stone Matrix Asphalt (SMA)

Size	AR-ACFC	ACFC	P-ACFC	PEM	SMA
3/4	100	100	100	100	100
1/2	100	100	100	80-90	100
3/8	100	100	100	35-60	70-90
No. 4	30-45	35-55	35-55	10-25	30-50
No. 8	4-8	9-14	9-14	5-10	20-30
No. 200	0-2.5	0-2.5	0-2.5	0-2.5	8-13
AC (%)	9.2	6.0	6.0	6.0	6.5
Binder Grade	PG 76-22+	PG 64-16	PG 76-22+	PG 76-22+	PG 76-22+

AR-ACFC 3/4" (19 mm)



SMA 3/4" (19 mm)



P-ACFC 3/4" (19 mm)



December 2007



PEM 1 1/4" (32 mm)

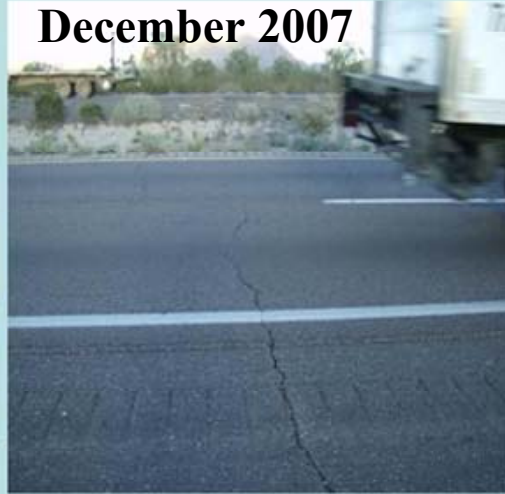
December 2007



ACFC 3/4" (19 mm)



December 2007



TIRE / PAVEMENT NOISE STUDIES

✓ OBSI NOISE MEASUREMENTS

☐ Scofield, 2002:

- Fall 2002
- Arizona's QPP
- AR-ACFC Quietest

Pavement Type	Sound Intensity at 60 MPH
AR-ACFC	98.90
ACFC	99.80
P-ACFC	100.60
PEM	101.00
SMA	99.80

☐ Dynatest, Inc. 2008:

- March 2008
- CA – AZ Noise Study
- AR-ACFC Quietest
- P-ACFC Loudest

Pavement Type	Sound Intensity at 60 MPH
AR-ACFC	99.94
ACFC	102.84
P-ACFC	104.68
PEM	101.56
SMA	102.17

SPOT CHECK TIRE / PAVEMENT NOISE STUDY

- ✓ **CARLSON ET AL, 2007:**
 - ❑ **Fall (December) 2007; ADOT ↔ RPA ↔ ASU**
 - ❑ **OBSI technique was not used**
 - ❑ **A hand held noise meter attached to the running board of a van**
 - ❑ **Noise meter in close proximity to the tire / pavement interface**
 - ❑ **A similar technique used historically in AZ (early 1990's)**

SPOT CHECK TIRE / PAVEMENT NOISE STUDY CONT'D...



SPOT CHECK TIRE / PAVEMENT NOISE STUDY CONT'D...

- ❑ Sound meter calibrated to measure sound intensity in the range of 80 to 130 decibels (dB)
- ❑ A computer connected to the sound meter to store the data
- ❑ Stored data transferred to a PC via an RS-232 interface and analyzed using the system software
- ❑ 4 runs performed at three different speeds

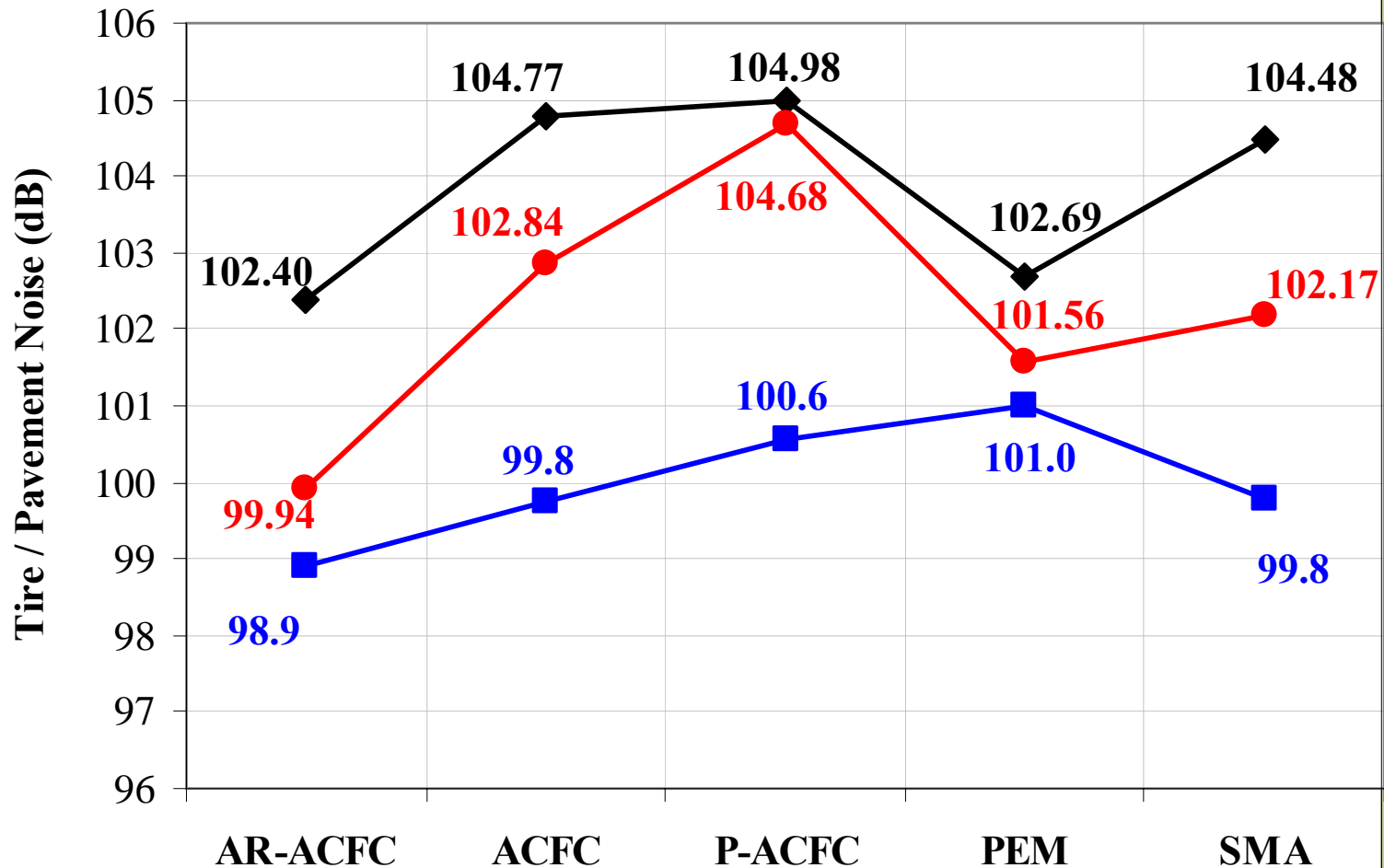
➤ 60 MPH (100 Km/h)

➤ 72 MPH (120 Km/h)

➤ 75 MPH (135 Km/h)

Pavement Type	Sound Intensity at 60 MPH
AR-ACFC	102.40
ACFC	104.77
P-ACFC	104.98
PEM	102.69
SMA	104.48

TIRE / PAVEMENT NOISE COMPARISONS BETWEEN 2002, 2007 & 2008



◆ 2007 Measured at 60 MPH
■ Scofield-Donovan 2002 at 60 MPH

● Dynatest 2008 at 60 MPH

CONCLUSIONS

➤ OBSI Noise data for 2002 & 2008 >>

➤ 1. AR-ACFC

➤ 2. ACFC & SMA

➤

➤ 4. P-ACFC

➤ 5. PEM

1. AR-ACFC

2. PEM

3. SMA

4. ACFC

5. P-ACFC

➤ 2007 spot check technique agrees with 2008 OBSI measurements, in terms of rank. Difference ~1.5 dB

➤ *Noise level of each test section appeared related to the degree of surface deterioration*

- AR-ACFC experienced the least cracking and wear after 8 years of service

Future Work: Field Cores collected will be used for laboratory Noise Evaluation



Questions & Comments