

USING OBSI RESULTS TO DEFINE STATISTICALLY SIMILAR PAVEMENTS IN MA

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Massachusetts Testing

- Utilized OBSI equipment to conduct a pavement noise evaluation in eastern Massachusetts
- Pavements tested spanned 8 years of age
- Tested 9.5mm Superpave, 19mm Superpave, OGFC, ARGG, and Novachip



MA Concerns and Goals

- **Winter maintenance in the northeast is a big concern**
- **Interested in comparing different pavements quickly**
- **Pavement preservation is crucial to alleviate overall costs of the pavement over its lifetime**
- **Pavement preservation - \$\$ savings**
- **At the same time, keep noise levels low**



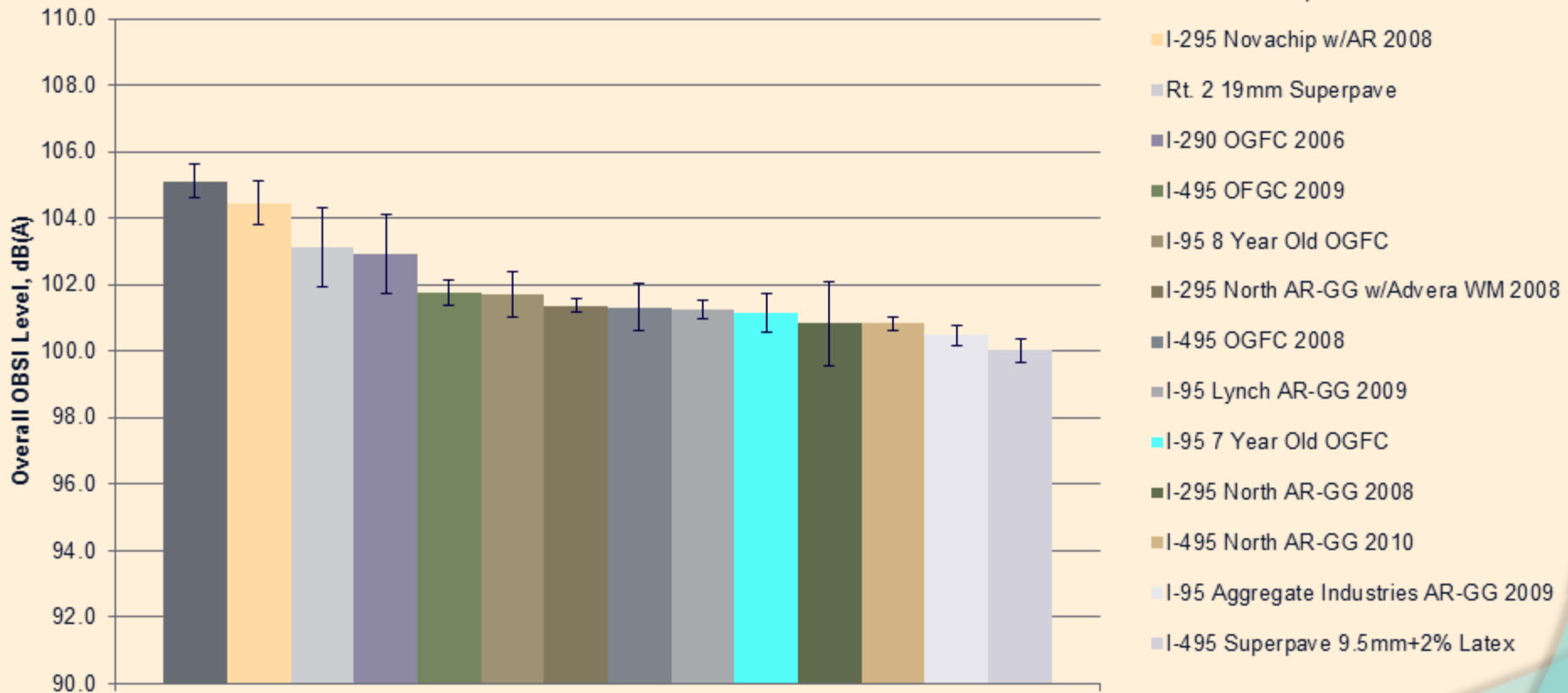
OBSI Results

Table 1 – Overall Noise Levels

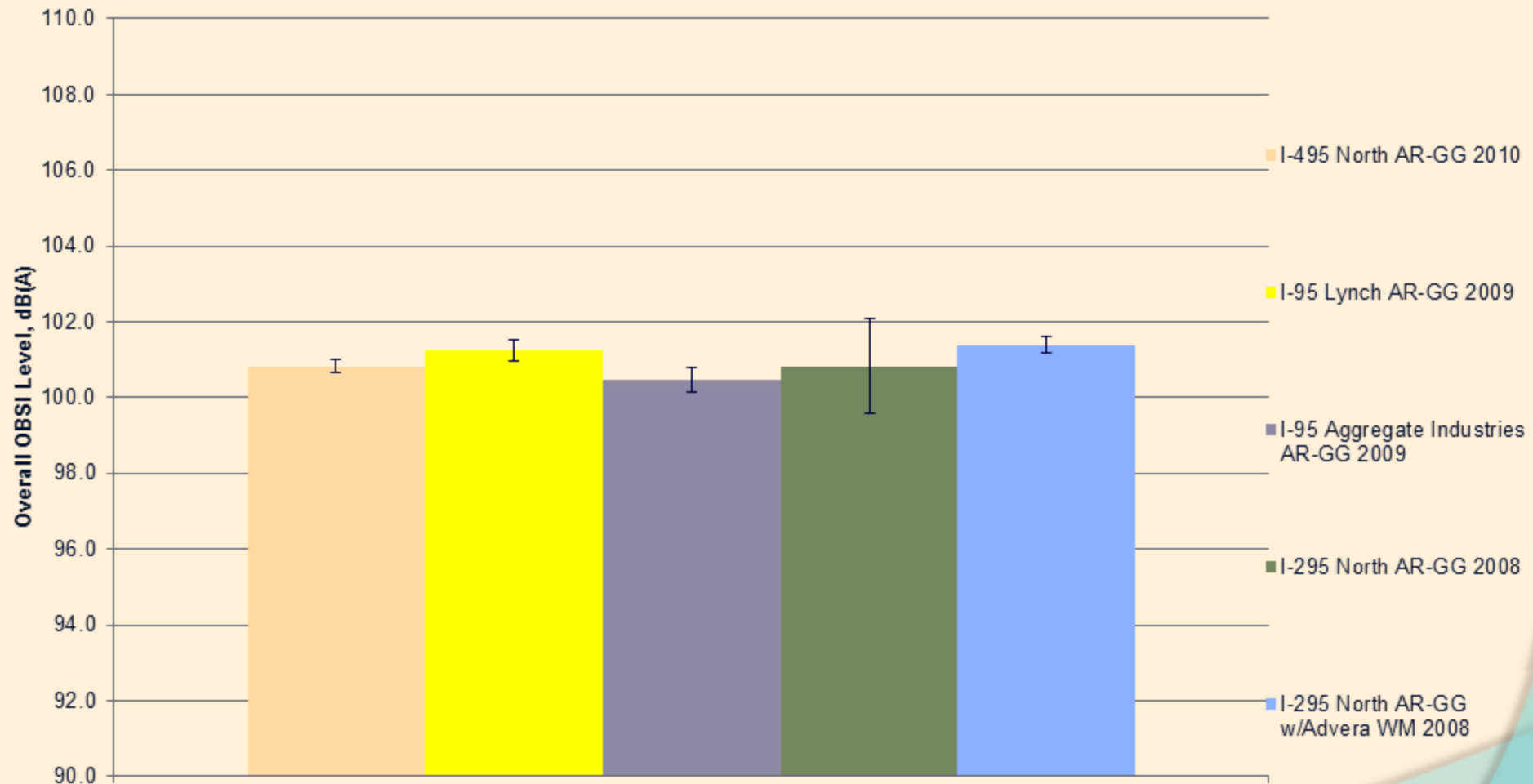
Road	Material	dB(A) Overall	Stdev (1s)
I-495 S	9.5mm Superpave + 2% Latex	100.0	0.4
I-495 N	ARGG 2009	100.5	0.7
I-95 S	ARGG 2009	100.5	0.2
I-95 N	ARGG 2009	100.5	0.2
I-295 N	ARGG 2008	100.8	1.2
I-495 N	ARGG 2010	100.8	0.2
I-95 S	7 year old OGFC	101.2	0.6
I-95 S	Lynch ARGG 2009	101.2	0.2
I-95 N	Lynch ARGG 2009	101.3	0.2
I-495 S	OGFC 2008	101.3	0.7
I-295 N	ARGG w/advera warm mix 2008	101.4	0.3
I-95 N	8 year old OGFC	101.7	0.7
I-495 S	OGFC 2009	101.8	0.4
I-495 N	OGFC 2008	102.0	0.2
I-290 E	OGFC 2006	102.9	1.2
I-290 W	OGFC 2006	102.9	1.2
Rt-2 E	19mm Superpave	103.1	0.6
Rt-2 W	19mm Superpave	103.1	0.6
I-295 S	Novachip w/asphalt rubber 2008	104.5	0.2
I-295 S	Novachip 2008	105.1	0.2

Overall Noise Levels, dB(A)

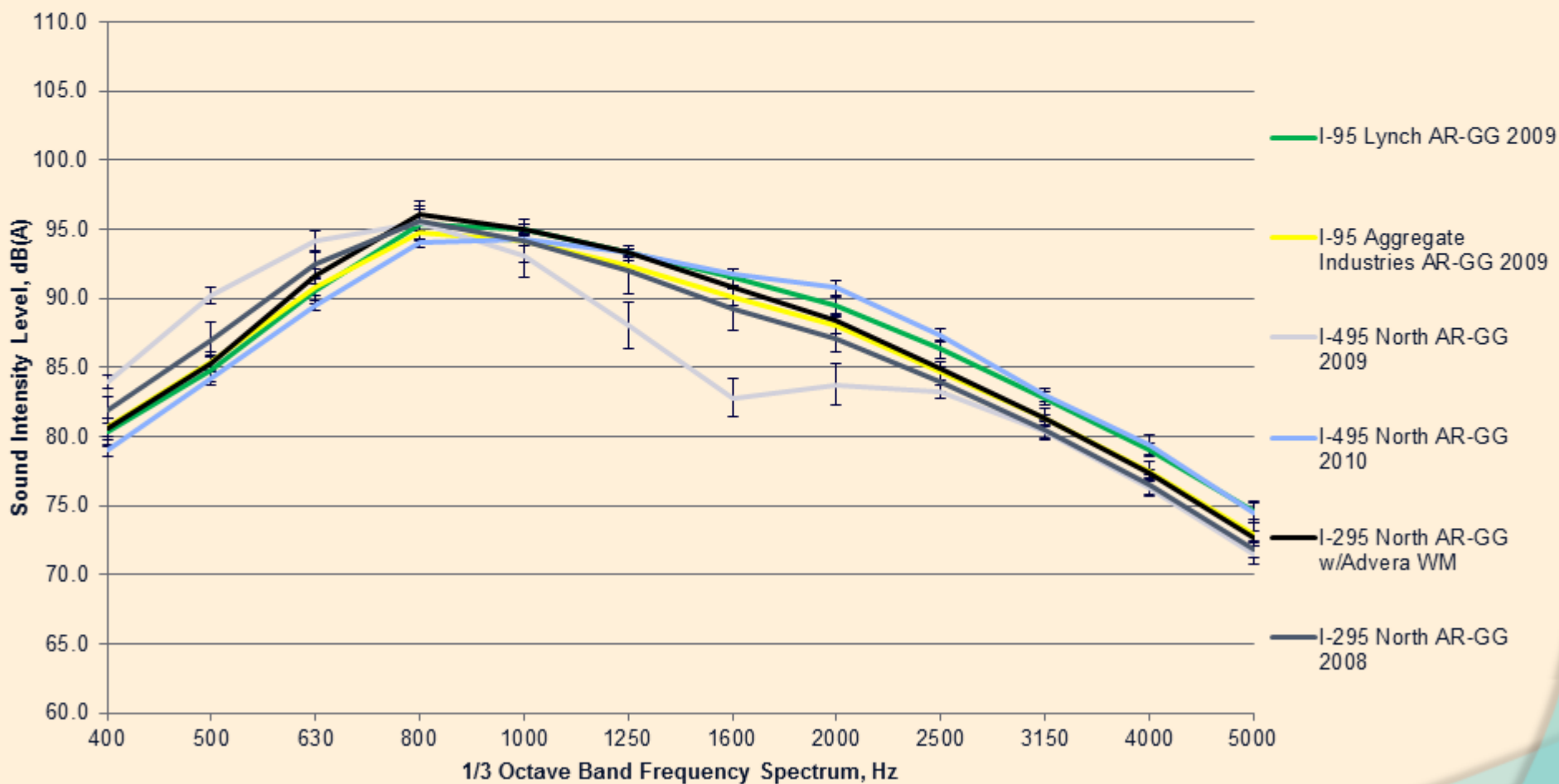
Overview of Tested Materials



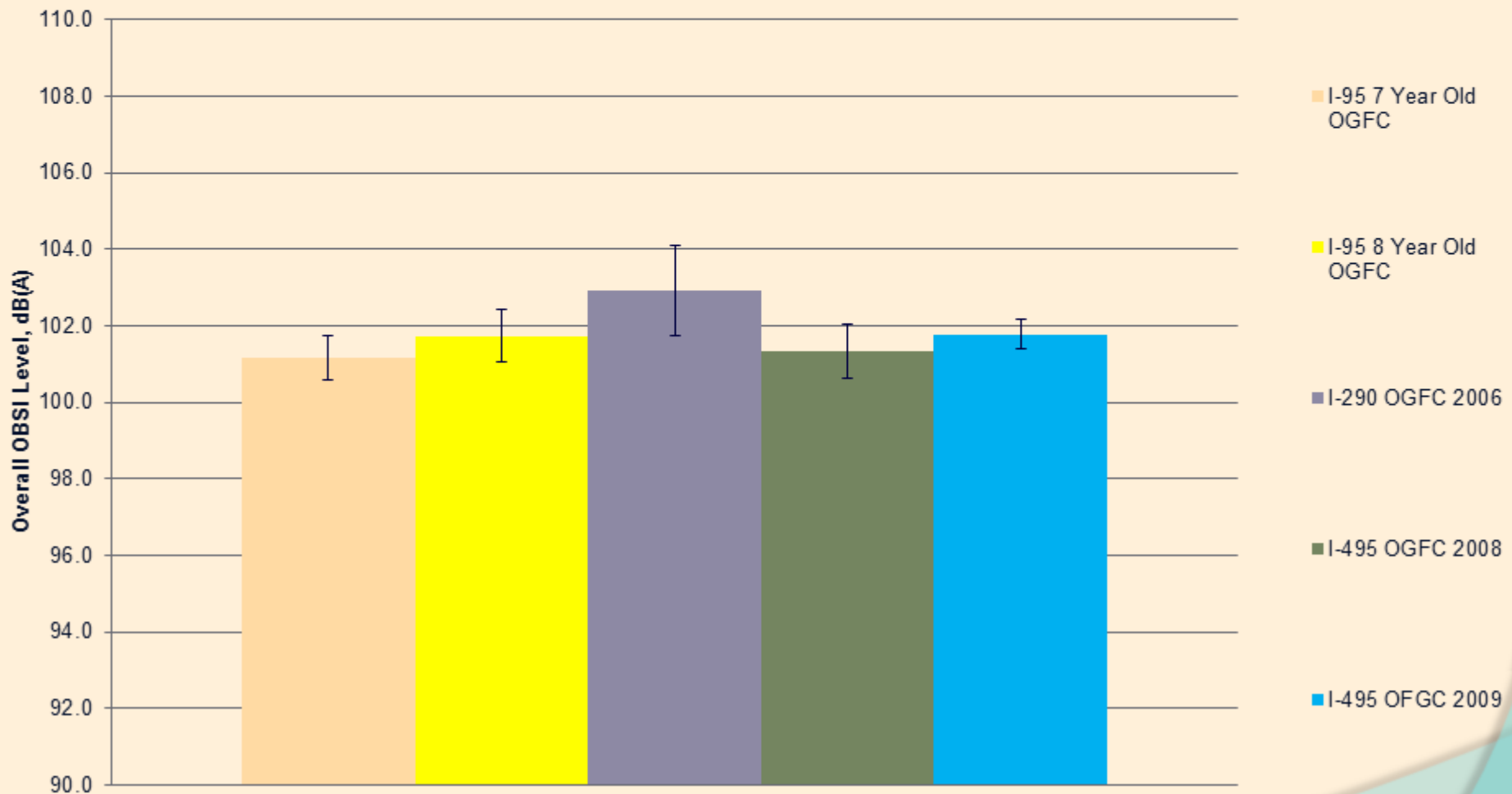
ARGG Overall Levels, dB(A)



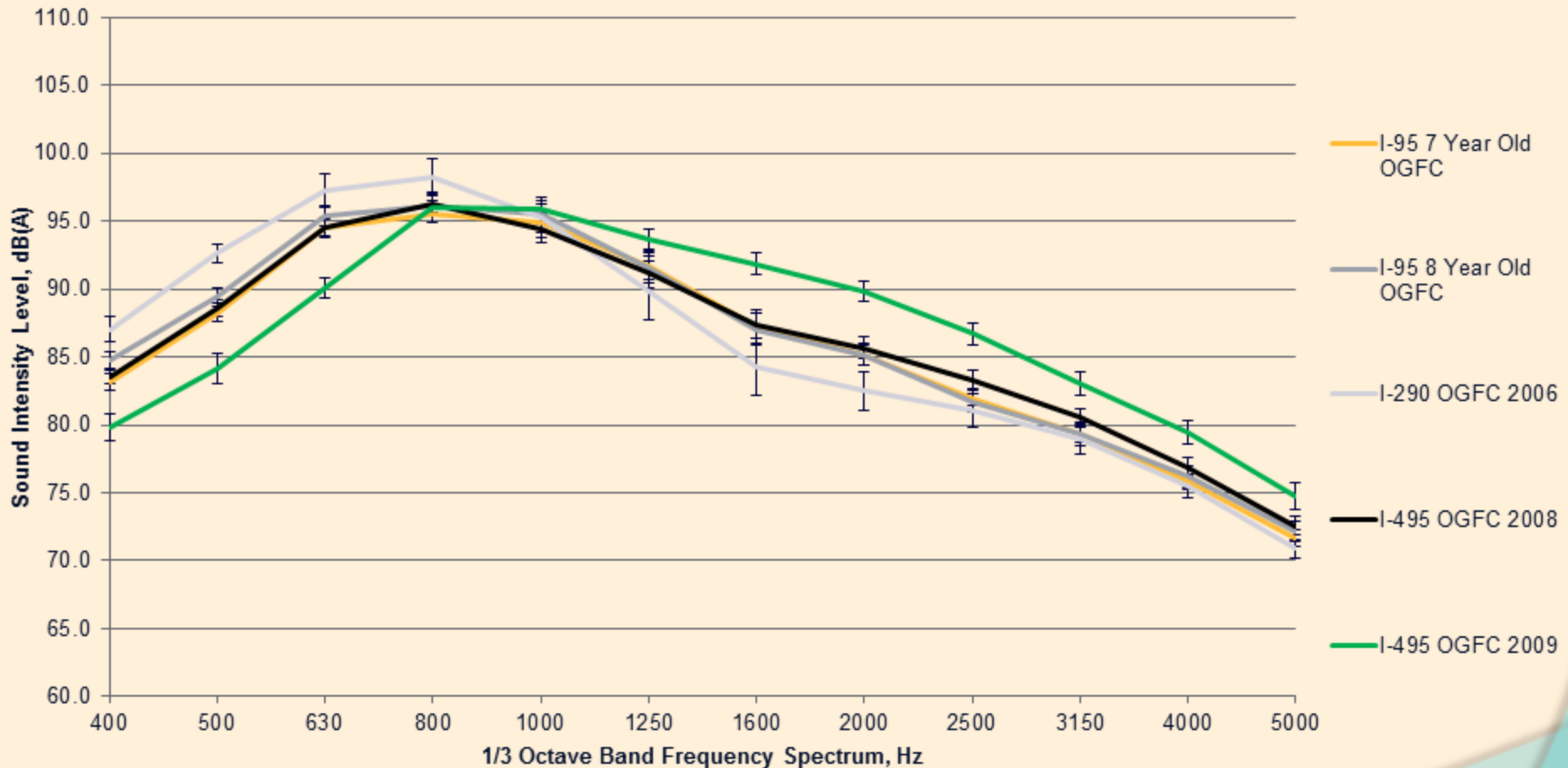
ARGG Spectrum Comparison



OGFC Overall Levels, dB(A)



OGFC Spectrum Comparison



T-test:	Two-Sample	
	Assuming Equal Var	
	<i>8 year old OGFC I- 95 N</i>	<i>OGFC 2008 I-495 S</i>
Mean	101.735	100.7333
Variance	0.462322	0.249524
Observati	16	15
Pooled Va	0.359592	
Hypothesi	0	
df	29	
t Stat	4.647656	
P(T<=t) or	3.37E-05	
t Critical o	1.699127	
P(T<=t) tw	6.75E-05	
t Critical t	2.04523	

- **F-test used for two-sample variance analysis**
- **Appropriate Student's T-Test was utilized on the results of the F-Test for each pavement**
- **A 95% confidence interval was used to determine the statistical significance**

Not significantly similar

Statistical Matrix

	OGFC 2006 I-95 S	OGFC 2002 I-95 N	AROG 2009 I-95 Lynch S	AROG 2009 I-95 Lynch N	AROG 2009 I-95 Aggregate Industrial S	AROG 2009 I-95 Aggregate Industrial N	Novachip w/AM 2006 I-295 S	AROG 2006 I-295 N	Novachip 2006 I-295 S	AROG 2006 I-295 N w/adverse WM	OGFC 2006 I-290 W	OGFC 2006 I-290 E	19mm OGA RL 2 W	19mm OGA RL 2 E	AROG 2010 I-495 N	9.5mm OGA I-495 S	AROG-2009 I-495 N	OGFC 2006 I-495 S	OGFC 2006 I-495 N	OGFC 2006 I-495 S	
OGFC 2006 I-95 S		N	N	N	Y	Y	N	Y	N	Y	N	N	N	N	N	N	N	N	N	N	N
OGFC 2002 I-95 N			N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	Y	N	Y	N
AROG 2009 I-95 Lynch S				Y	N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N
AROG 2009 I-95 Lynch N					N	N	N	N	N	Y	N	N	N	N	N	N	N	N	N	N	N
AROG 2009 I-95 Aggregate Industrial S						Y	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	Y
AROG 2009 I-95 Aggregate Industrial N							N	N	N	N	N	N	N	N	N	N	N	Y	N	N	Y
Novachip w/AM 2006 I-295 S								N	N	N	N	N	N	N	N	N	N	N	N	N	N
AROG 2006 I-295 N									N	N	N	N	N	N	N	Y	N	N	N	N	Y
Novachip 2006 I-295 S										N	N	N	N	N	N	N	N	N	N	N	N
AROG 2006 I-295 N w/adverse WM											N	N	N	N	N	N	N	N	N	N	N
OGFC 2006 I-290 W												N	N	N	N	N	N	N	N	N	N
OGFC 2006 I-290 E													N	N	N	N	N	N	N	Y	N
19mm OGA RL 2 W														N	N	N	N	N	N	N	N
19mm OGA RL 2 E															N	N	N	N	N	N	N
AROG 2010 I-495 N																N	N	N	N	N	N
9.5mm OGA I-495 S																	N	N	N	N	Y
AROG-2009 I-495 N																		N	N	N	N
OGFC 2006 I-495 S																			N	Y	N
OGFC 2006 I-495 N																				N	Y
OGFC 2006 I-495 S																					N

ARGG
 OGFC
 Statistically Similar (95%)

Summary of Matrix

Table 2 – Summary of Statistical Matches

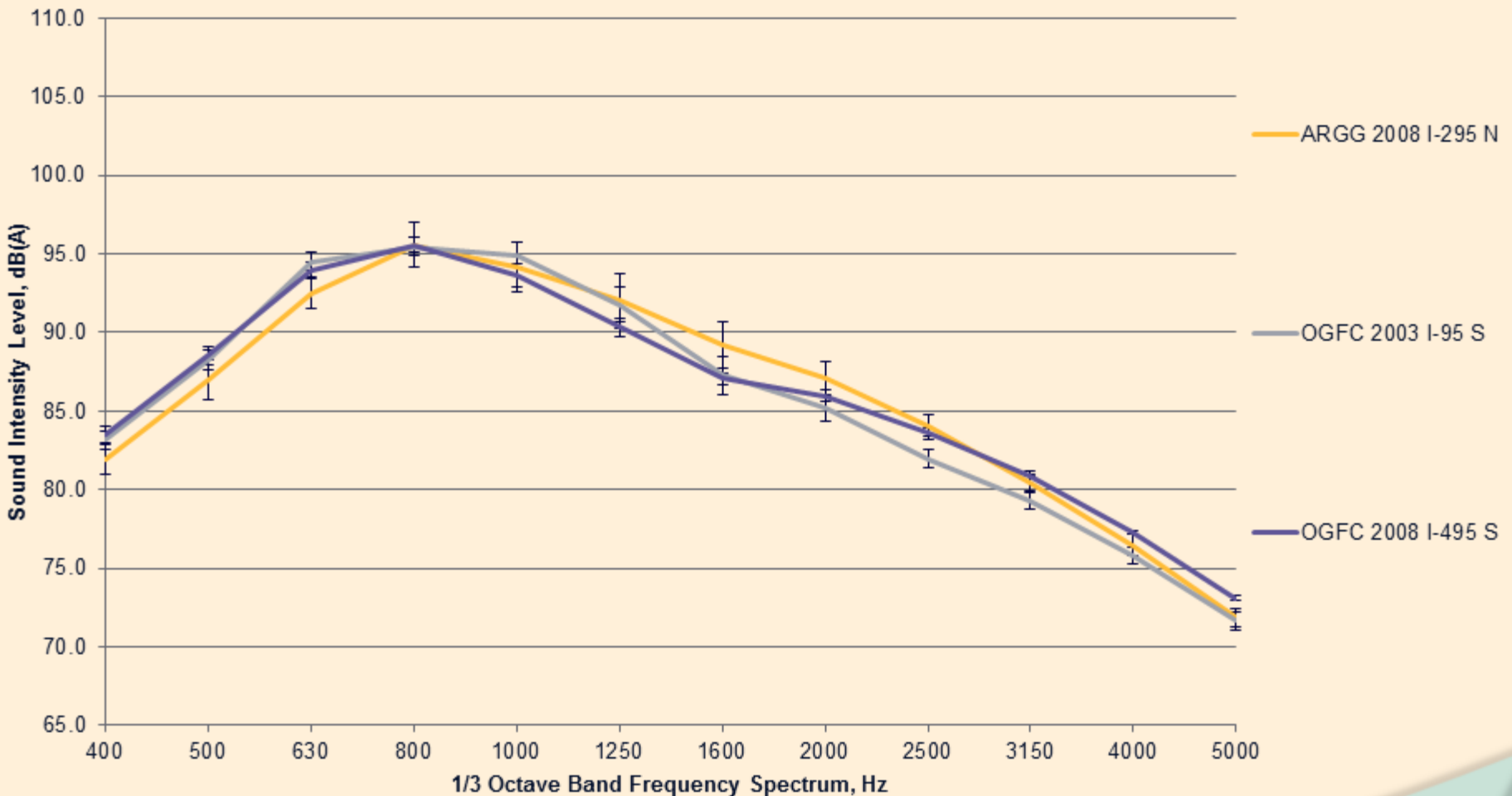
Reference Pavement	Statistically Similar Pavement
OGFC 2003 I-95 S	ARGG 2009 I-95 N Aggregate Industries
OGFC 2003 I-95 S	ARGG 2009 I-95 S Aggregate Industries
OGFC 2003 I-95 S	ARGG 2008 I-295 N
OGFC 2003 I-95 S	ARGG 2008 I-295 N w/advera WM
OGFC 2003 I-95 N	ARGG 2009 I-495 N
OGFC 2003 I-95 N	OGFC 2008 I-495 N
ARGG 2009 I-95 S Lynch	ARGG 2009 I-95 N Lynch
ARGG 2009 I-95 S Lynch	ARGG 2008 I-295 N w/advera WM
ARGG 2009 I-95 N Lynch	ARGG2008 I-295 N w/advera WM
ARGG 2009 I-95 S Aggregate Industries	ARGG 2009 I-95 N Aggregate Industries
ARGG 2009 I-95 S Aggregate Industries	OGFC 2009 I-495 S
ARGG 2009 I-95 S Aggregate Industries	OGFC 2009 I-495 S
ARGG 2009 I-95 S Aggregate Industries	OGFC 2008 I-495 S
ARGG 2009 I-95 N Aggregate Industries	OGFC 2009 I-495 S
ARGG 2009 I-95 N Aggregate Industries	OGFC 2008 I-495 S
ARGG 2008 I-295 N	ARGG 2010 I-495 N
ARGG 2008 I-295 N	OGFC 2008 I-495 S
OGFC 2006 I-290 E	OGFC 2008 I-495 N
ARGG 2010 I-495 N	OGFC 2008 I-495 S
ARGG 2009 I-495 N	OGFC 2008 I-495 N
OGFC 2009 I-495 S	OGFC 2008 I-495 S



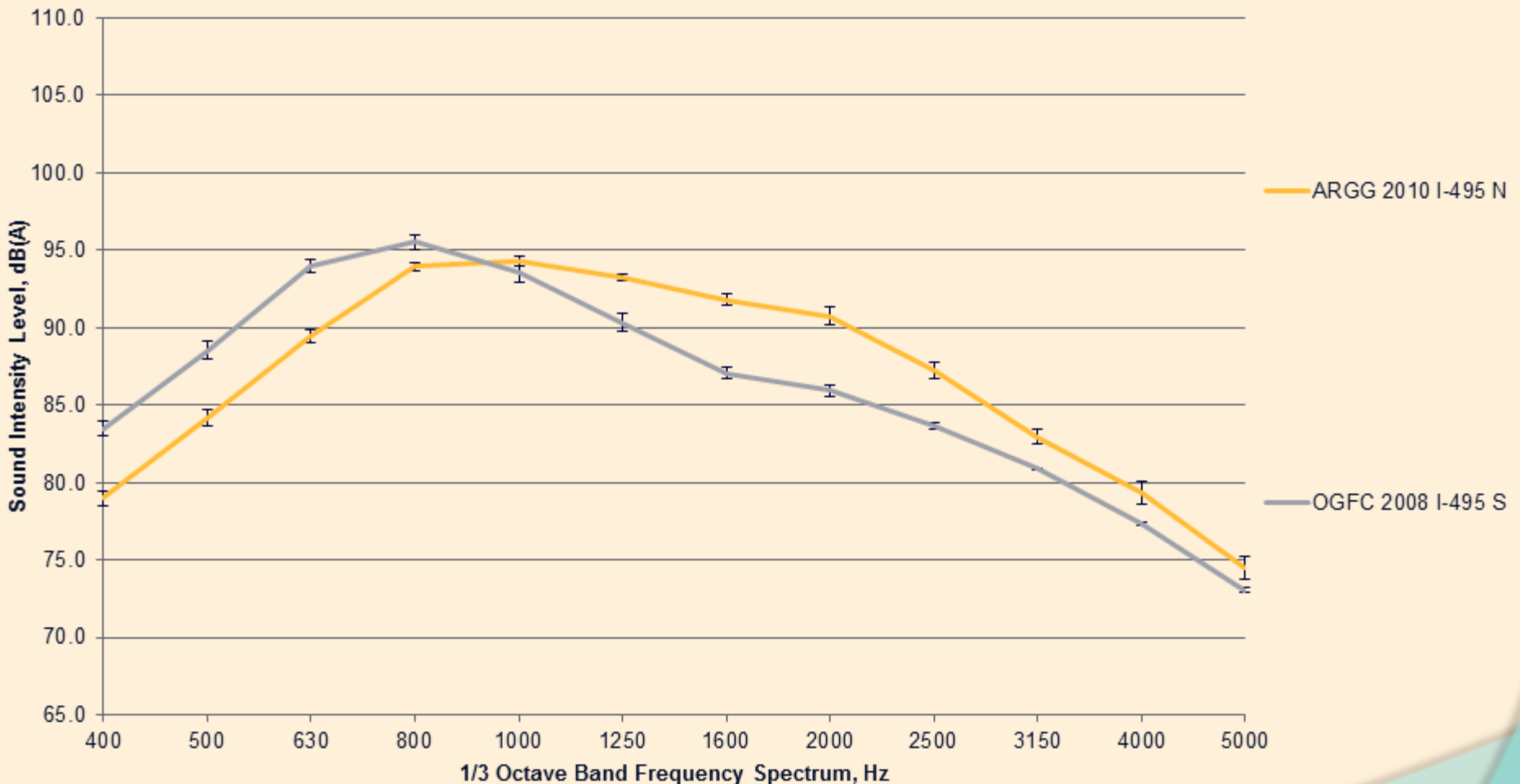
Benefits

- **Some of the pavements were statistically similar!**
- **All of the pavements that were not expected to be similar were validated**
- **Some of the pavements that were expected to be similar were not**
- **The results lead to more interesting and more refined questions about specific pavements themselves**

Associated Problems (Good Results)



Associated Problems (Bad Results)





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