Road Directorate

Second generation thin layer surfacings for urban roads

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Project organization / Background

Road Directorate

Part of large EU SILENCE project:

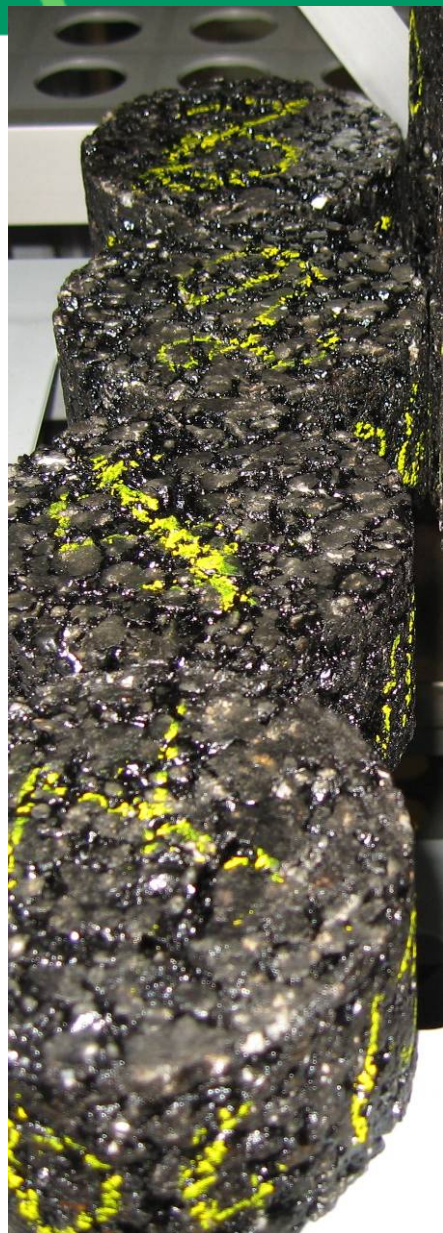
Cooperation between Danish, Swedish and Germen National Road Institutes

Background:

- 13 urban test sections with noise reducing thin layers/ In EU project SILVIA
- 6 highway test sections with noise reducing thin layers / Danish Road Directorate and Dutch DVS IPG programme

Goal:

- Optimize noise reduction of thin Stone Mastics Asphalt (SMA) layers for urban roads
- Based upon laboratory samples (Marshall)



Full scale experiment on Kastrupvej in Copenhagen - 7 promising thin layers + a dense reference were constructed 2007

Speed limit 50 km/h

Traffic 7000 (7 % heavies)

Cooperation between:

- Danish Road Institute
- Municipality of Copenhagen
- Colas Contractors

Design guidelines

Reduce <u>vibration</u> generated noise

500-1500 Hz

– even and smooth surface

- using small max. aggregate (4 – 6 mm)
- cubic aggregates + good compaction

Reduce <u>aero-acoustic</u> noise sources

Over 1000Hz

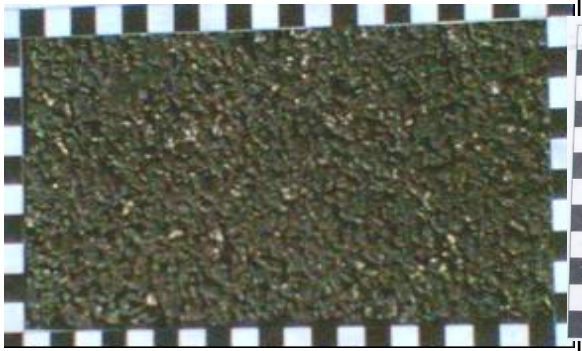
– open (but dense) surface structure

- high built-in air void
- adding 5 - 15 % oversize grains

Selected mixes

Pavement	Max. aggr. mm	Binder %	Air-void, % geo.
DAC 0/11 (ref.)	11	-	5.4
SMA 0/6	6	6.9	15.3
SMA 6+ 5/8	6 + 5/8	7.1	3.4
SMA 6+ 5/8 (1)	6 + 5/8	7.0	5.7
SMA 6+ 5/8 opt.	6 + 5/8	6.5	13.9
OGAC 0/6	6	-	-
SMA 0/4	4	7.0	8.8
SMA 4+ 5/8	4 + 5/8	6.7	10.2

SMA variants

		
SMA 0/6	SMA6+ 5/8 (1)	SMA 0/4
		
SMA6+ 5/8	SMA6+ 5/8(opt.)	SMA4+ 5/8

Measurement method

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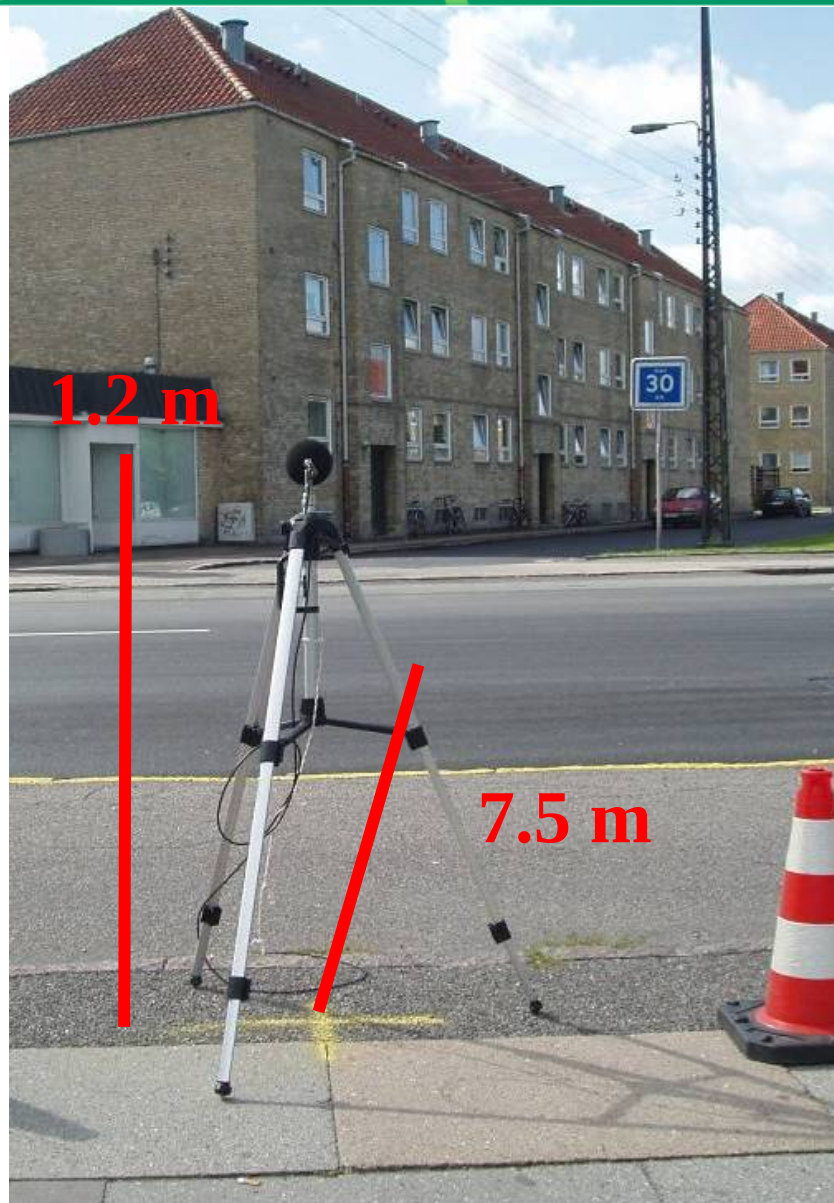
Statistical pass-by (SPB) measurements
ISO 11819-1 at 8 test sections

- cars only (few or atypical trucks (busses))
- reference speed 50 km/h
- temperature normalized (20°C)
- speed corrected due to angle error
- age of test sections ≈ 3 months

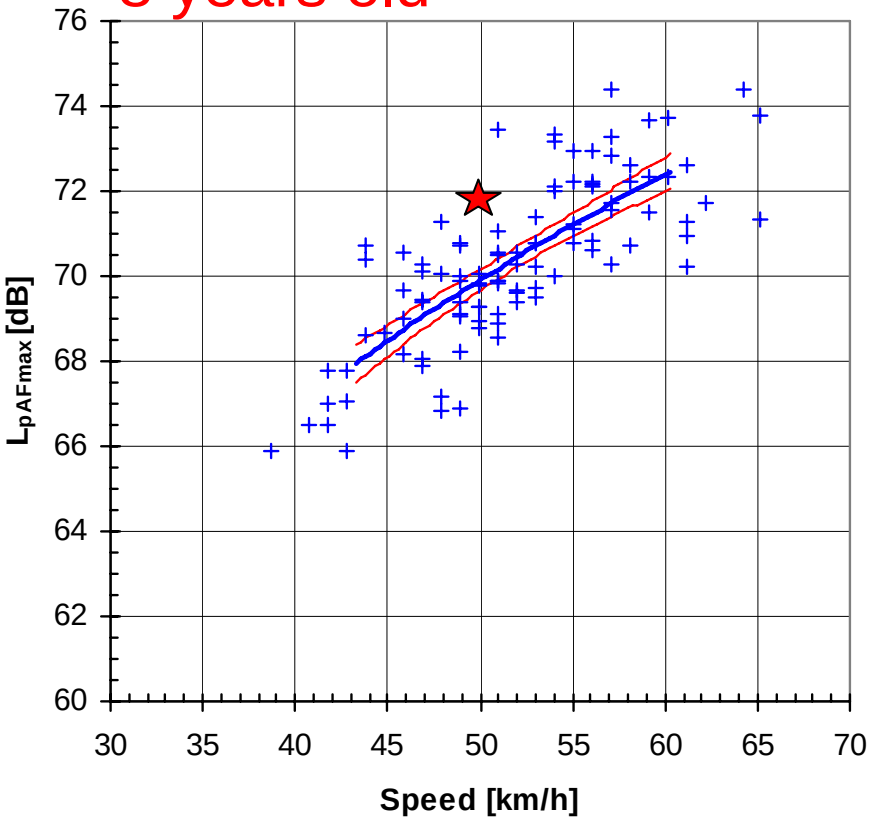


SPB-results, cars at 50 km/h

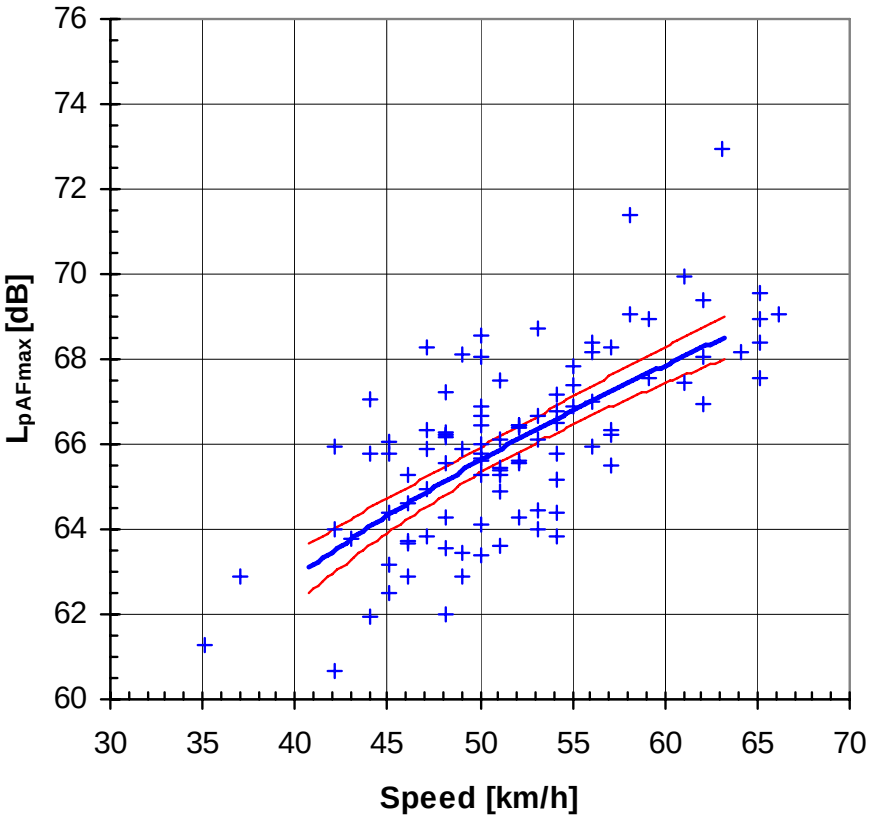
DAC 0/11, ref., (new surf.!)

Nord2000 ref. = 71.8 dB

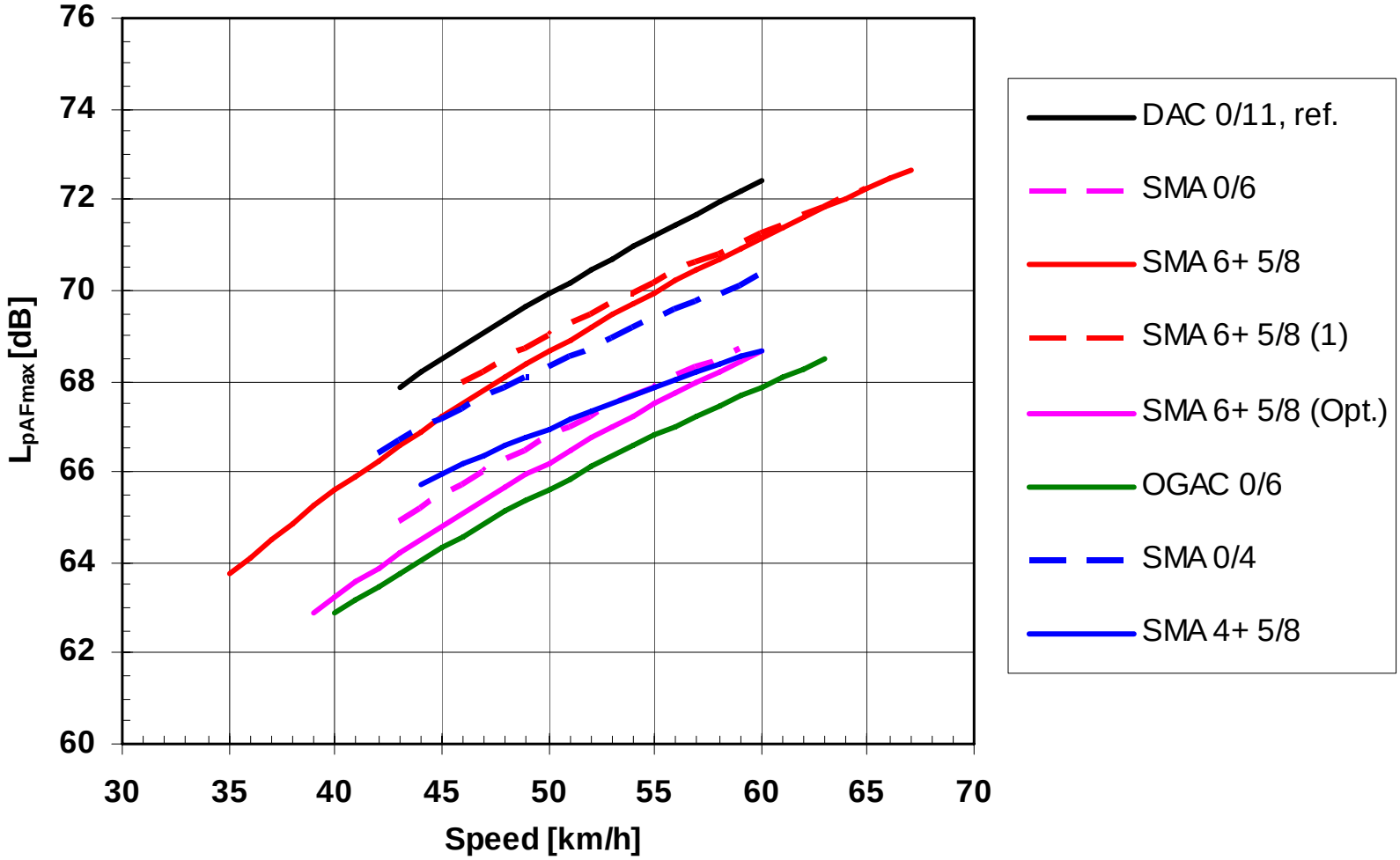
8 years old



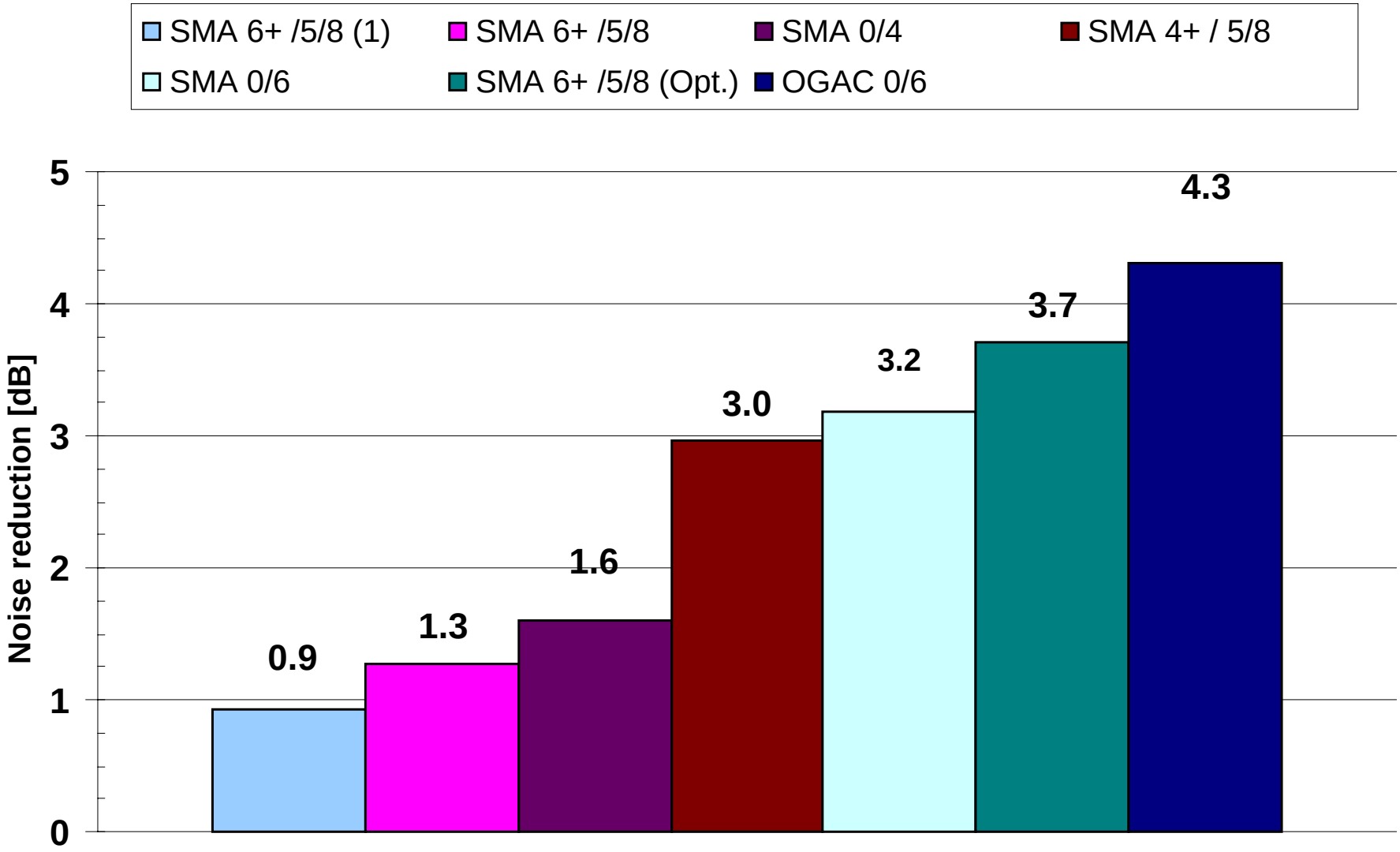
OGAC 0/6



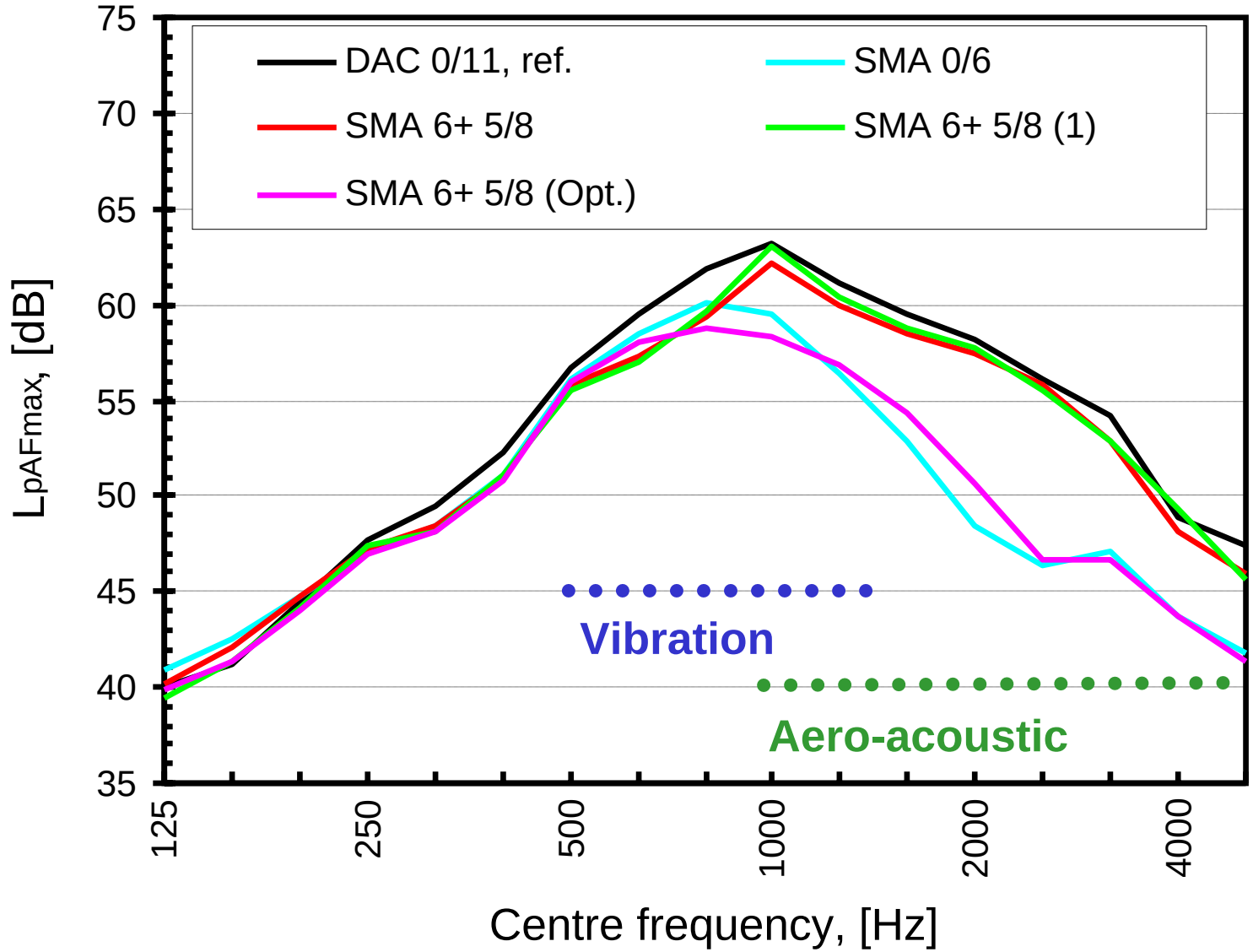
SPB regression lines - cars at 50 km/h



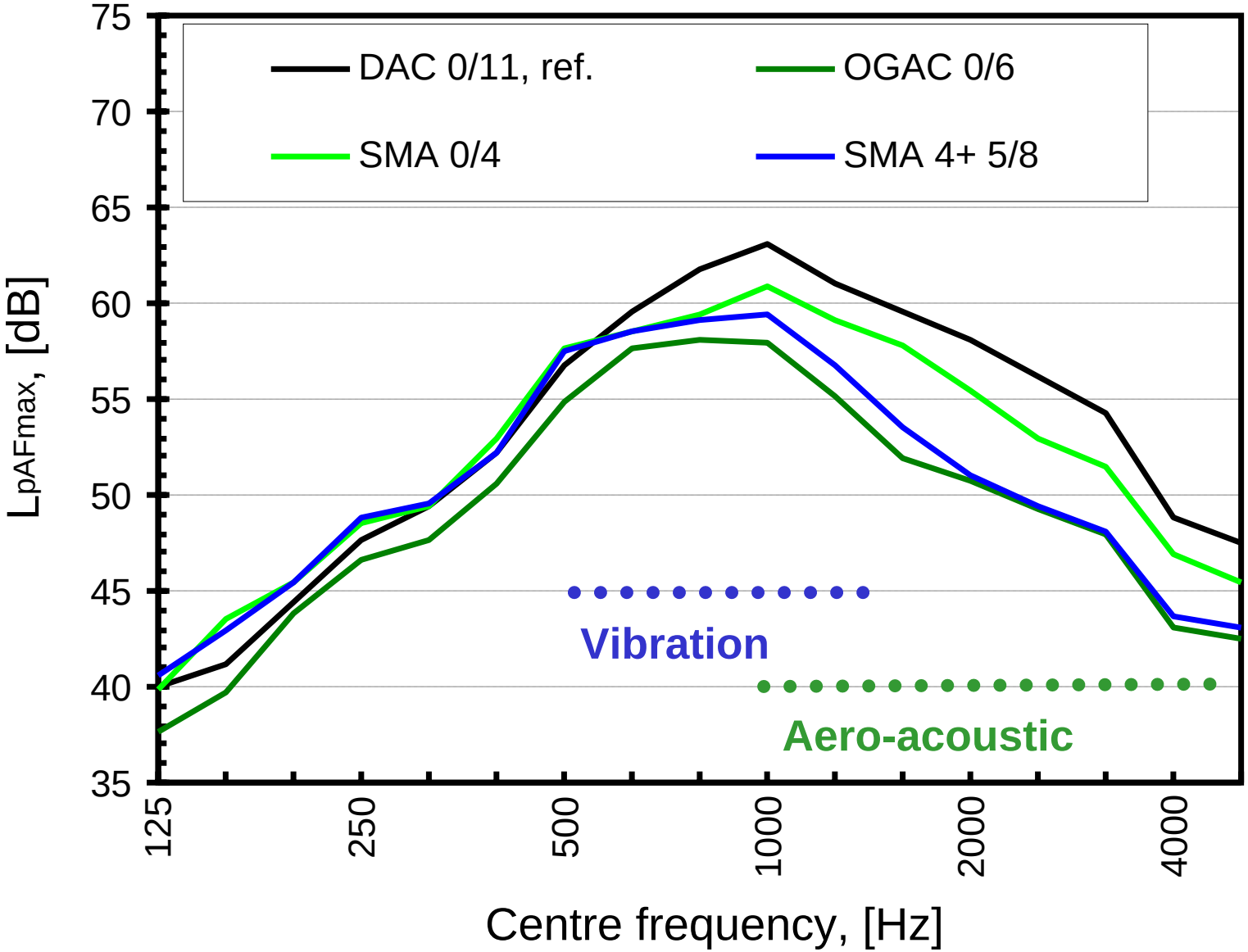
Noise reduction relative to the reference DAC 0 / 11, year 0



Noise spectra cars at 50 km / h SMA 6 variants



Noise spectra cars at 50 km / h SMA 4 variants



DRI CPX ”deciBellA”

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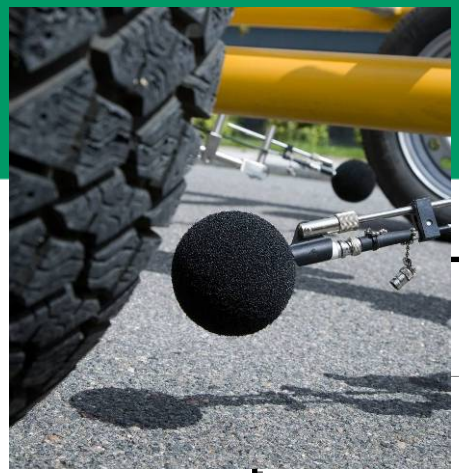
ISO/CD 11819-2 draft

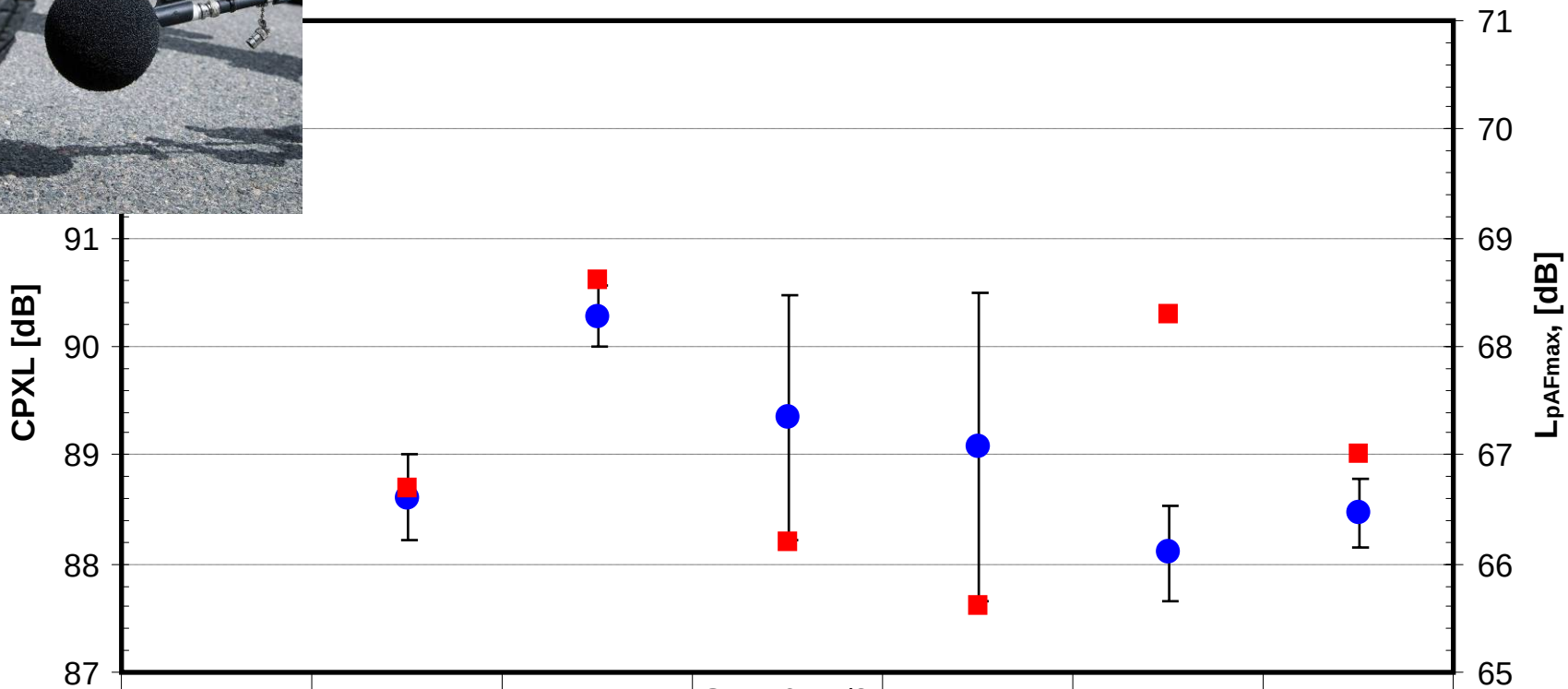
A and D tyre

Data recorded:

- The average A-weighted noise level at each wheel per 20 m
- 1/3-octave band frequency spectra
- The vehicle speed
- Gps coordinates
- Air temperatures
- Tyre temperatures

CPX index and SPB





	DAC 0/11	SMA 0/6	SMA 6+ 5/8	SMA 6+ 5/8 (Opt.)	OGAC 0/6	SMA 0/4	SMA 4+ 5/8
● CPXL	92,4	88,6	90,3	89,3	89,1	88,1	88,5
■ L_pAFmax	69,9	66,7	68,6	66,2	65,6	68,3	67

Variation along the road - homogeneity

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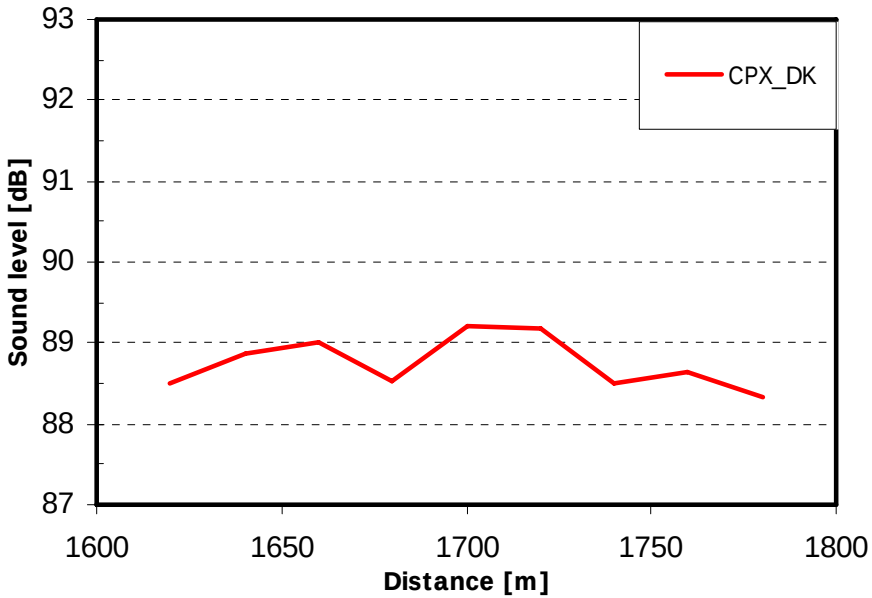
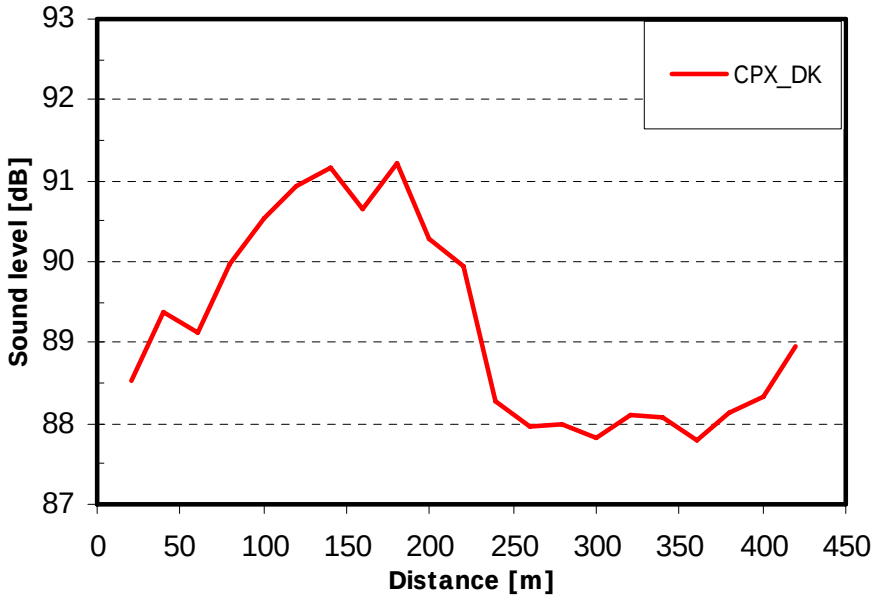
Most surfaces are homogene along the road – typical variation < ±0.4 dB

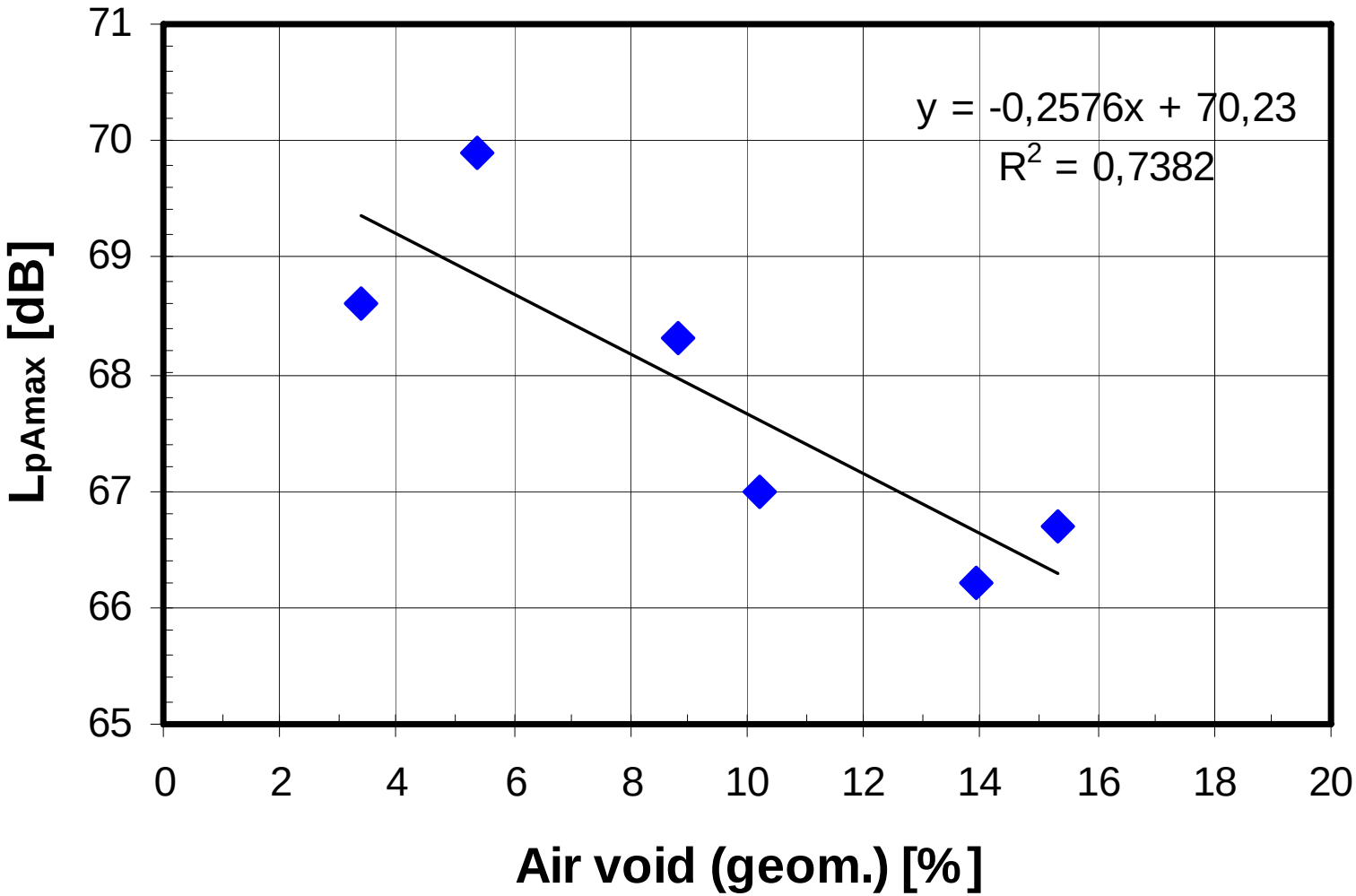
Typical: SMA 0/6



Atypical: OGAC 0/6



SPB levels in relation to air void content



Summary and conclusion

Statistical pass-by levels for cars at 7 optimized thin layer test sections showed at 50 km/h:

- noise reduction up to 4.3 dB rel. DAC11 same age, when new
- noise reduction re. Nord2000: 6,2 dB, when new
- oversize aggregate reduce noise
- high built in air void reduce noise
- 4 mm aggregate did not reduce noise
- Measurements will continue

Thank you for your attention!

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