Lågbullerbeläggning E4 Huskvarna

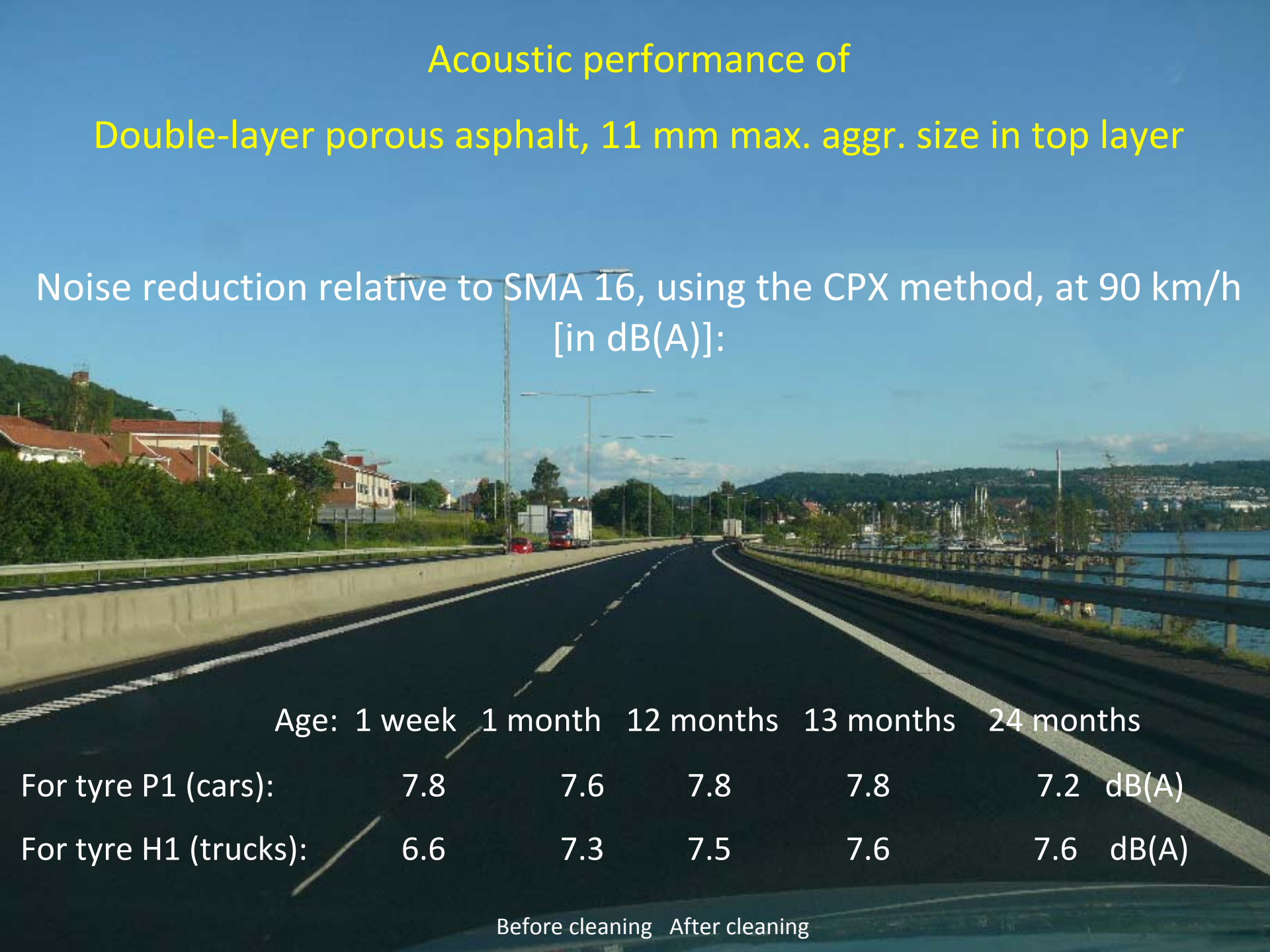
Appearance of surface texture

Double-layer porous asphalt (top)
Single-layer porous asphalt

Reference – SMA 16

Acoustic performance of

Double-layer porous asphalt, 11 mm max. aggr. size in top layer

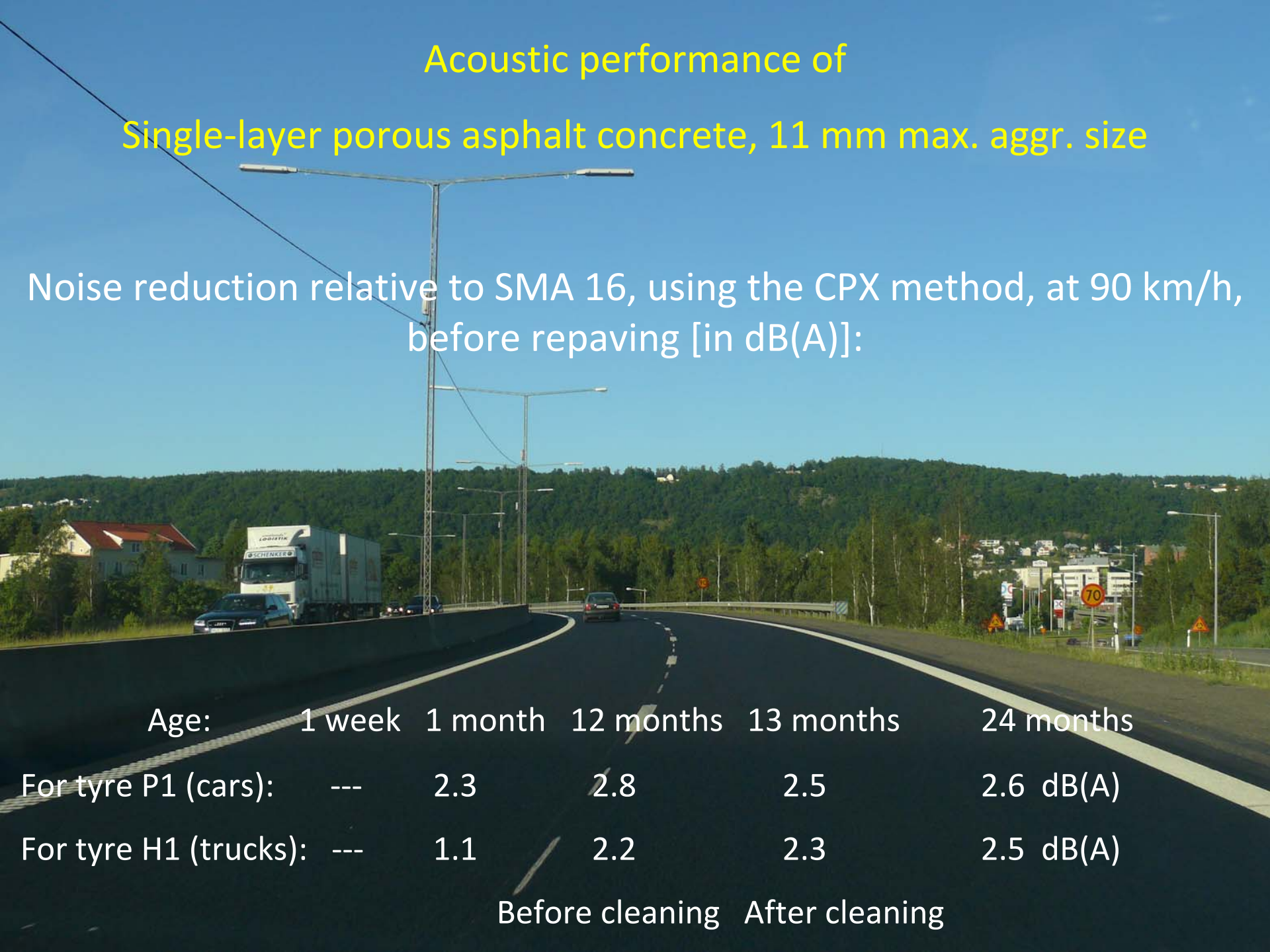


Noise reduction relative to SMA 16, using the CPX method, at 90 km/h [in dB(A)]:

Age:	1 week	1 month	12 months	13 months	24 months	
For tyre P1 (cars):	7.8	7.6	7.8	7.8	7.2	dB(A)
For tyre H1 (trucks):	6.6	7.3	7.5	7.6	7.6	dB(A)
	Before cleaning		After cleaning			

Acoustic performance of

Single-layer porous asphalt concrete, 11 mm max. aggr. size

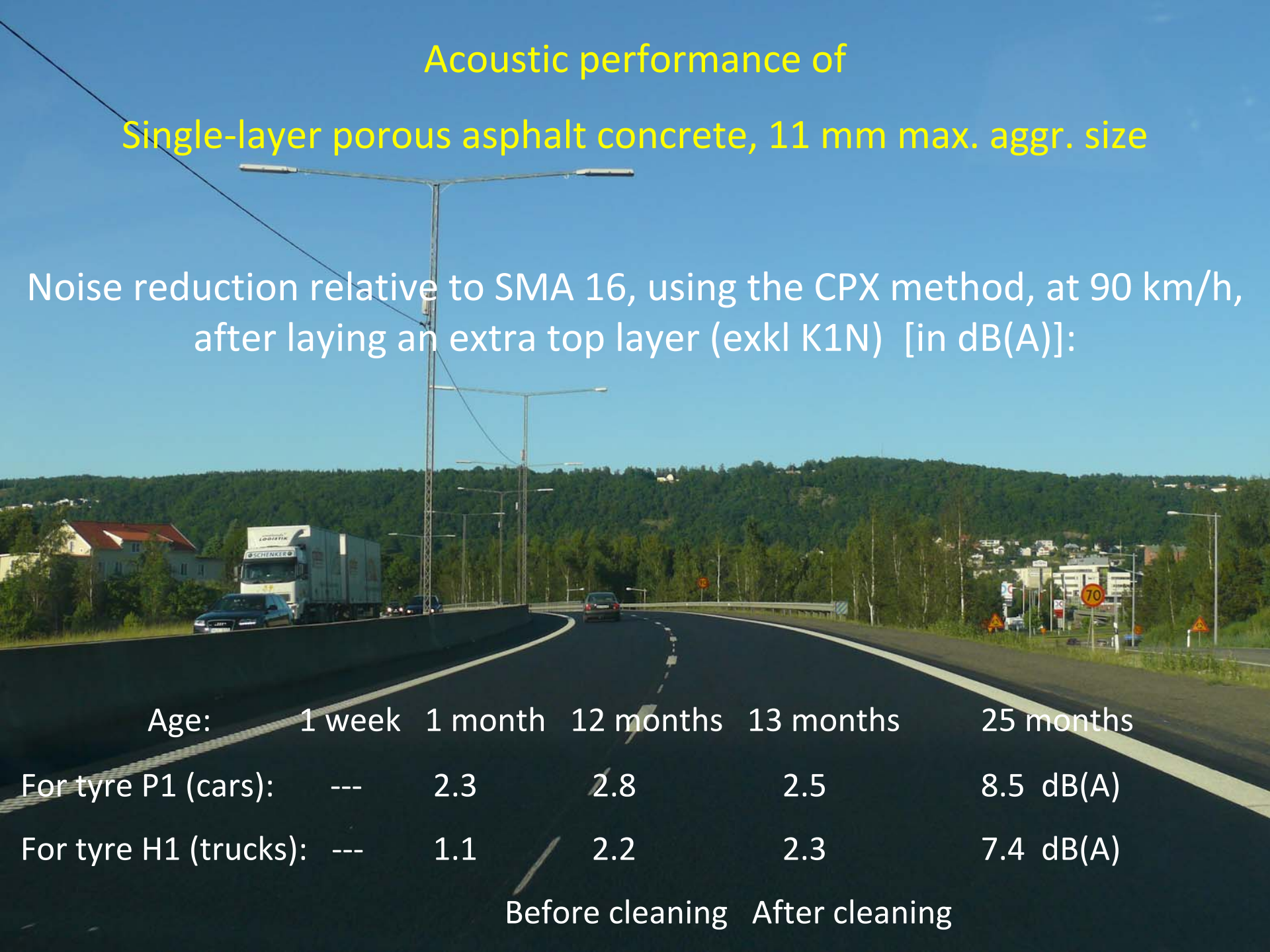


Noise reduction relative to SMA 16, using the CPX method, at 90 km/h, before repaving [in dB(A)]:

Age:	1 week	1 month	12 months	13 months	24 months
For tyre P1 (cars):	---	2.3	2.8	2.5	2.6 dB(A)
For tyre H1 (trucks):	---	1.1	2.2	2.3	2.5 dB(A)
			Before cleaning	After cleaning	

Acoustic performance of

Single-layer porous asphalt concrete, 11 mm max. aggr. size

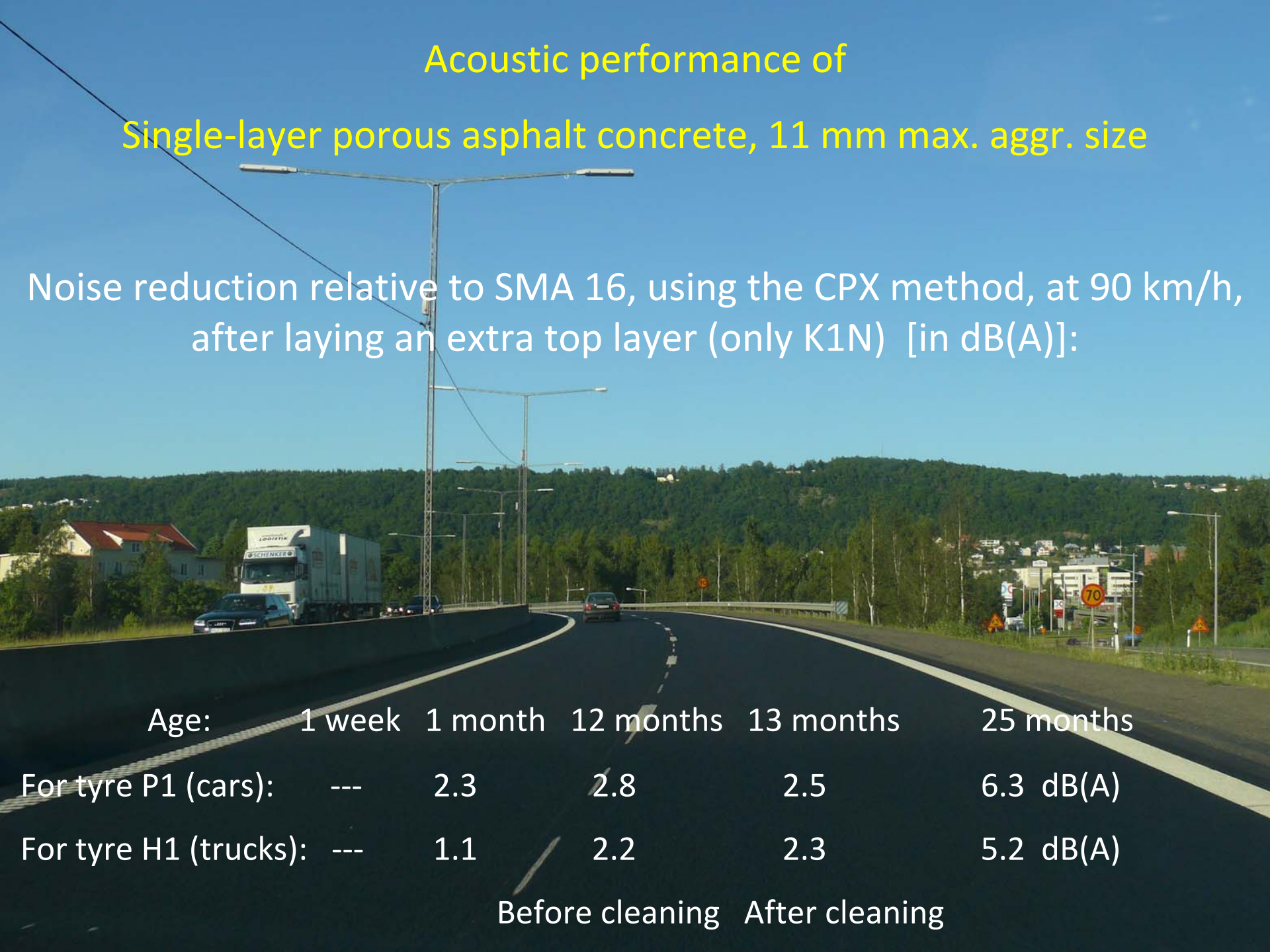


Noise reduction relative to SMA 16, using the CPX method, at 90 km/h, after laying an extra top layer (exkl K1N) [in dB(A)]:

Age:	1 week	1 month	12 months	13 months	25 months
For tyre P1 (cars):	---	2.3	2.8	2.5	8.5 dB(A)
For tyre H1 (trucks):	---	1.1	2.2	2.3	7.4 dB(A)
			Before cleaning	After cleaning	

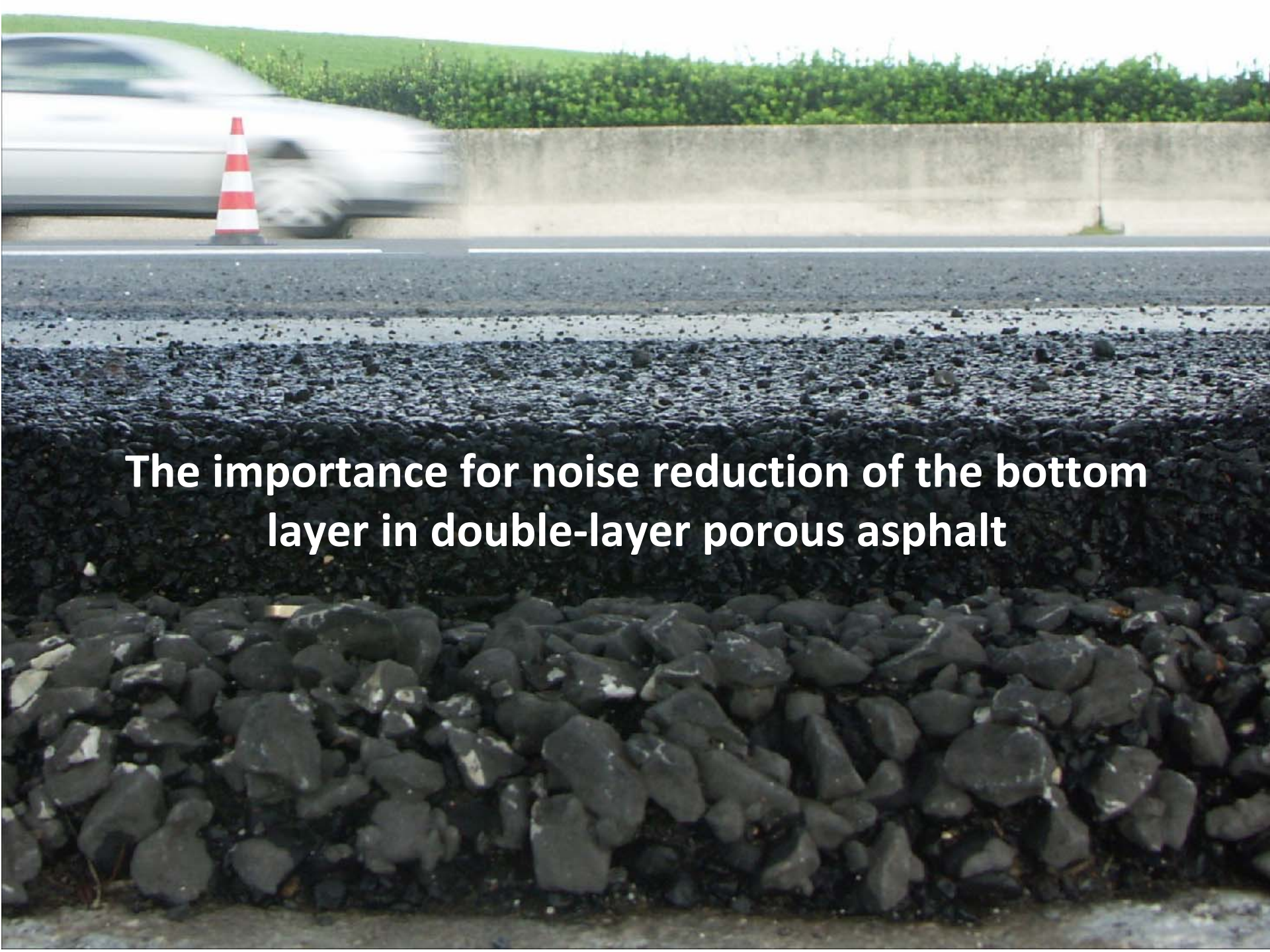
Acoustic performance of

Single-layer porous asphalt concrete, 11 mm max. aggr. size



Noise reduction relative to SMA 16, using the CPX method, at 90 km/h, after laying an extra top layer (only K1N) [in dB(A)]:

Age:	1 week	1 month	12 months	13 months	25 months
For tyre P1 (cars):	---	2.3	2.8	2.5	6.3 dB(A)
For tyre H1 (trucks):	---	1.1	2.2	2.3	5.2 dB(A)
			Before cleaning	After cleaning	


The importance for noise reduction of the bottom layer in double-layer porous asphalt

Extra noise reduction provided by the double-layer vs the single-layer porous asphalt; i.e. the effect of the bottom layer

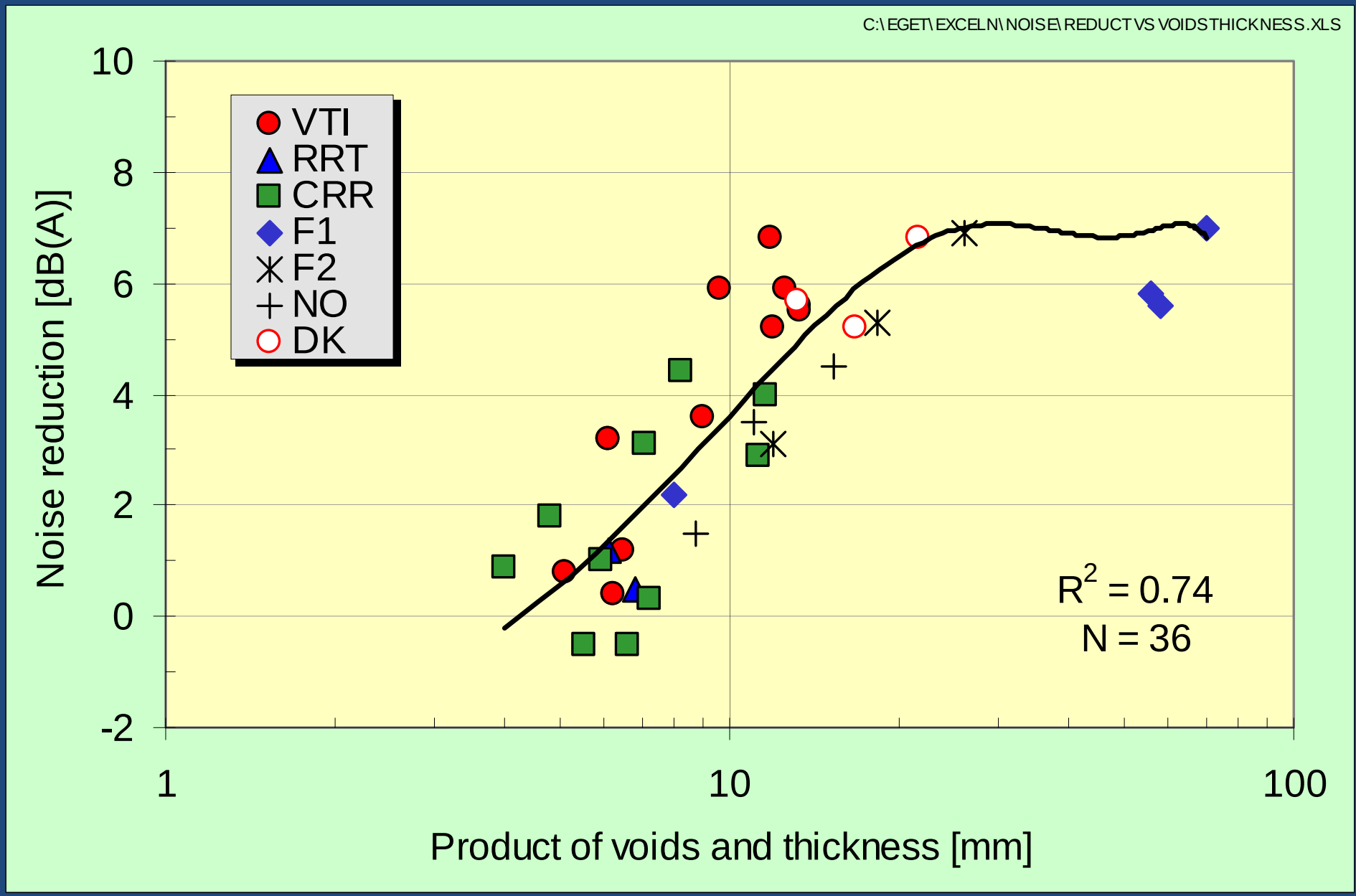
Age:	1 week	1 month	12 months	13 months	
For tyre P1 (cars):	---	5.3	5.0	5.3	dB(A)
For tyre H1 (trucks):	---	6.2	5.3	5.3	dB(A)
			Before cleaning	After cleaning	

Why this dramatic effect of something that lies 30-80 mm under the surface?

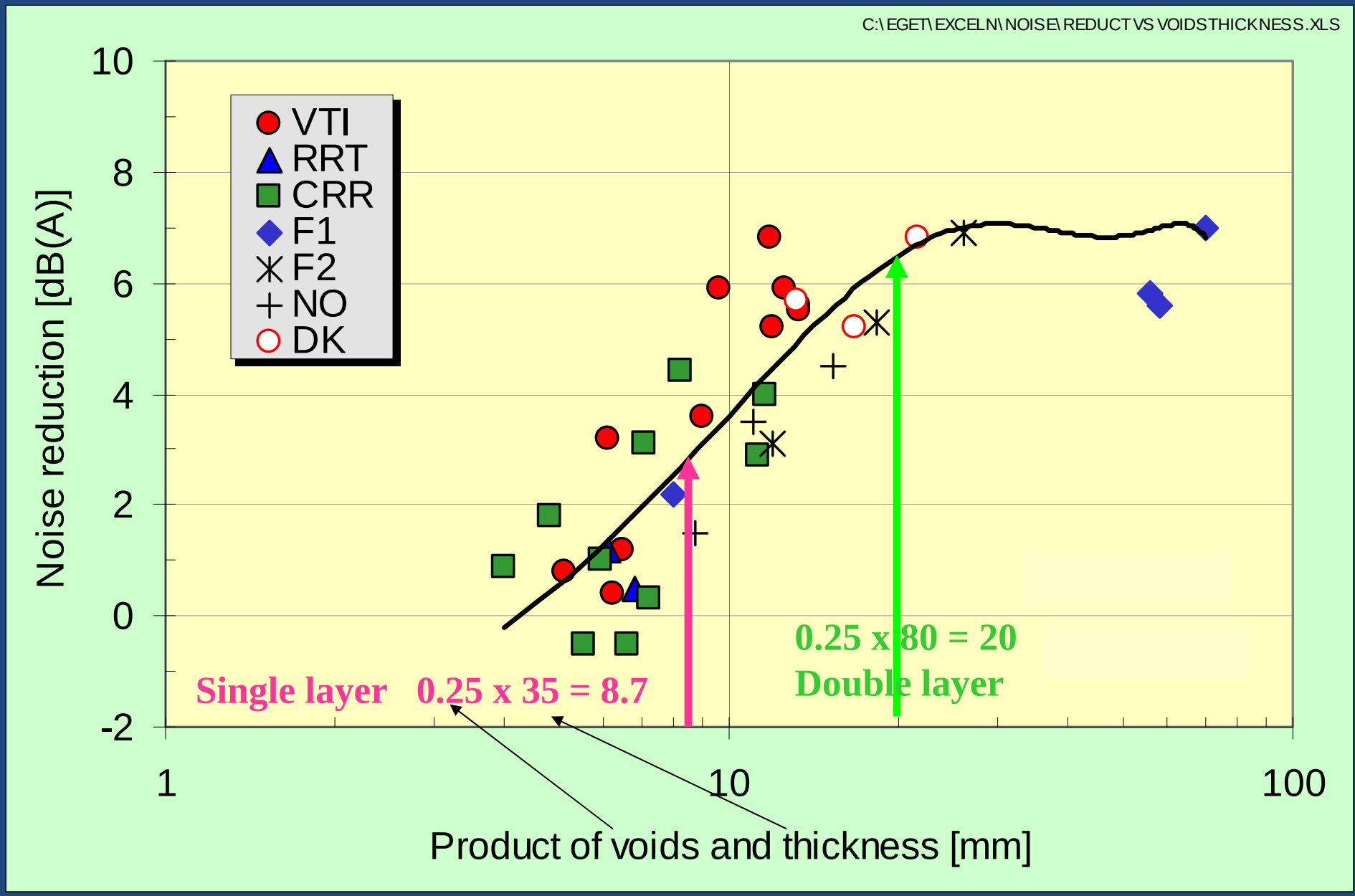
Texture and unevenness measurement results on the porous pavements

Pavement type	Time	Macrotexture MPD [mm]	Megatexture RMS [mm]	IRI
Single-layer asphalt	July 2010	1.76	0.70	0.82
Double-layer asphalt	July 2010	1.79	0.71	0.61
Single-layer asphalt	May 2011	1.86	0.84	0.93
Double-layer asphalt	May 2011	1.81	0.79	0.65

Noise reduction of porous pavements as a function of their voids content and thickness – data compilation in the 1990's from various countries

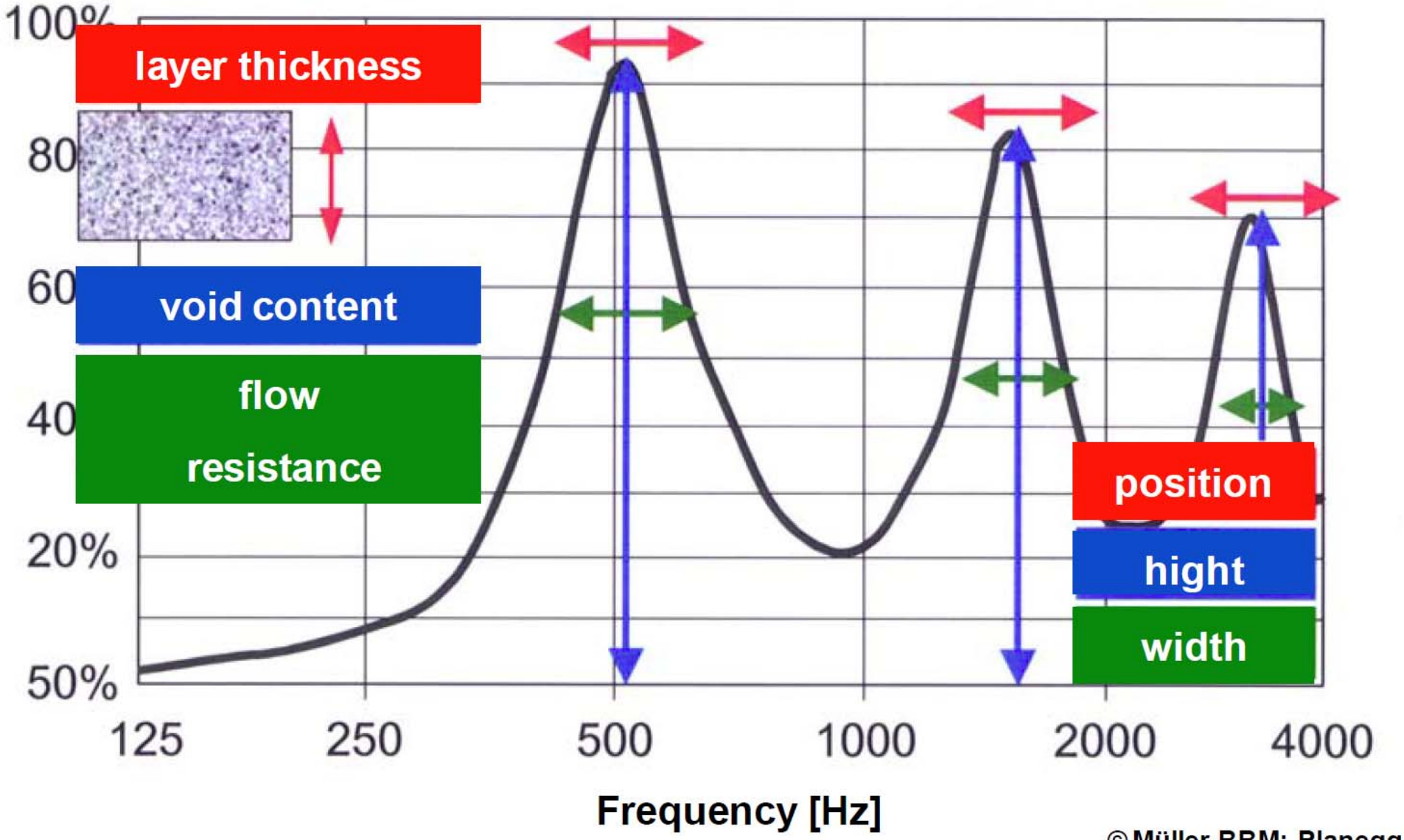


Noise reduction of porous pavements as a function of their voids content and thickness – applied to this case

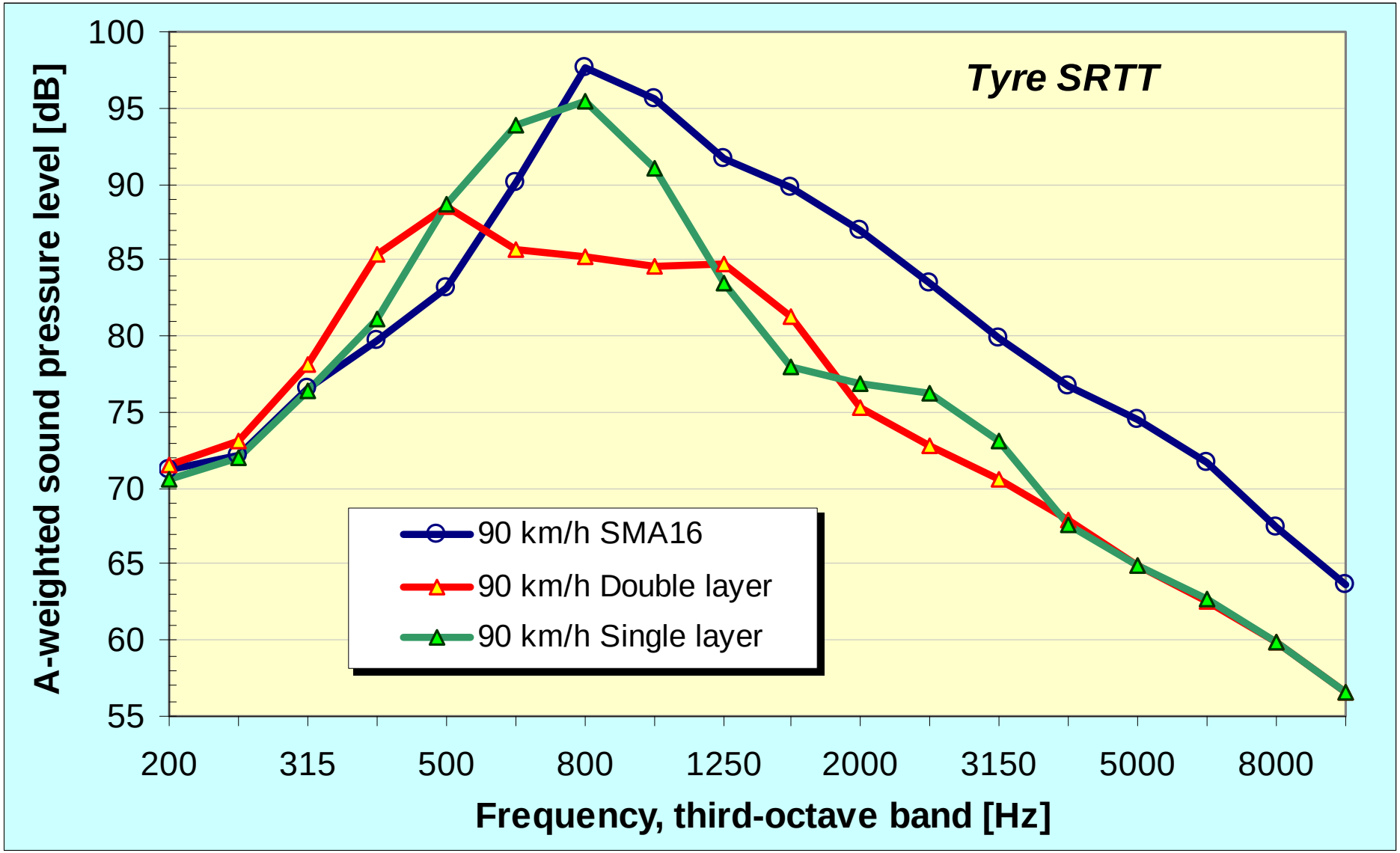


Sound absorption model by T Beckenbauer, Germany

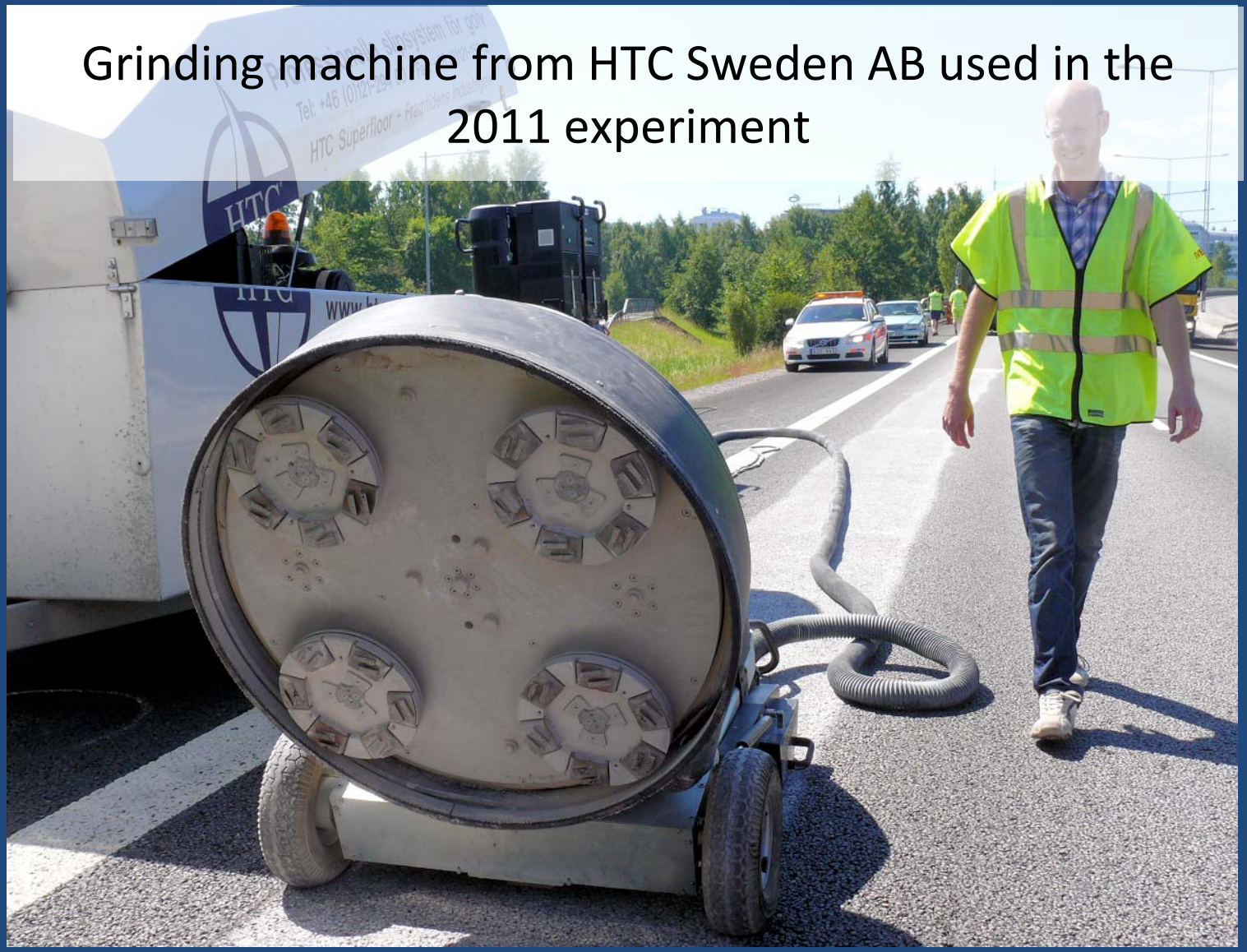
Beckenbauer, T. (2008): 'Physik der Reifen-Fahrbahn-Geräusche', Geräuschmindernde Fahrbahnbeläge in der Praxis – Lärmaktionsplanung, 4. Informationstage



Frequency spectra at one month of age and 90 km/h



Gaining extra noise reduction and lower rolling resistance by grinding a porous asphalt pavement



Ground strip of approx. 65 m x 0.9 m as it appeared before it was vacuum-cleaned

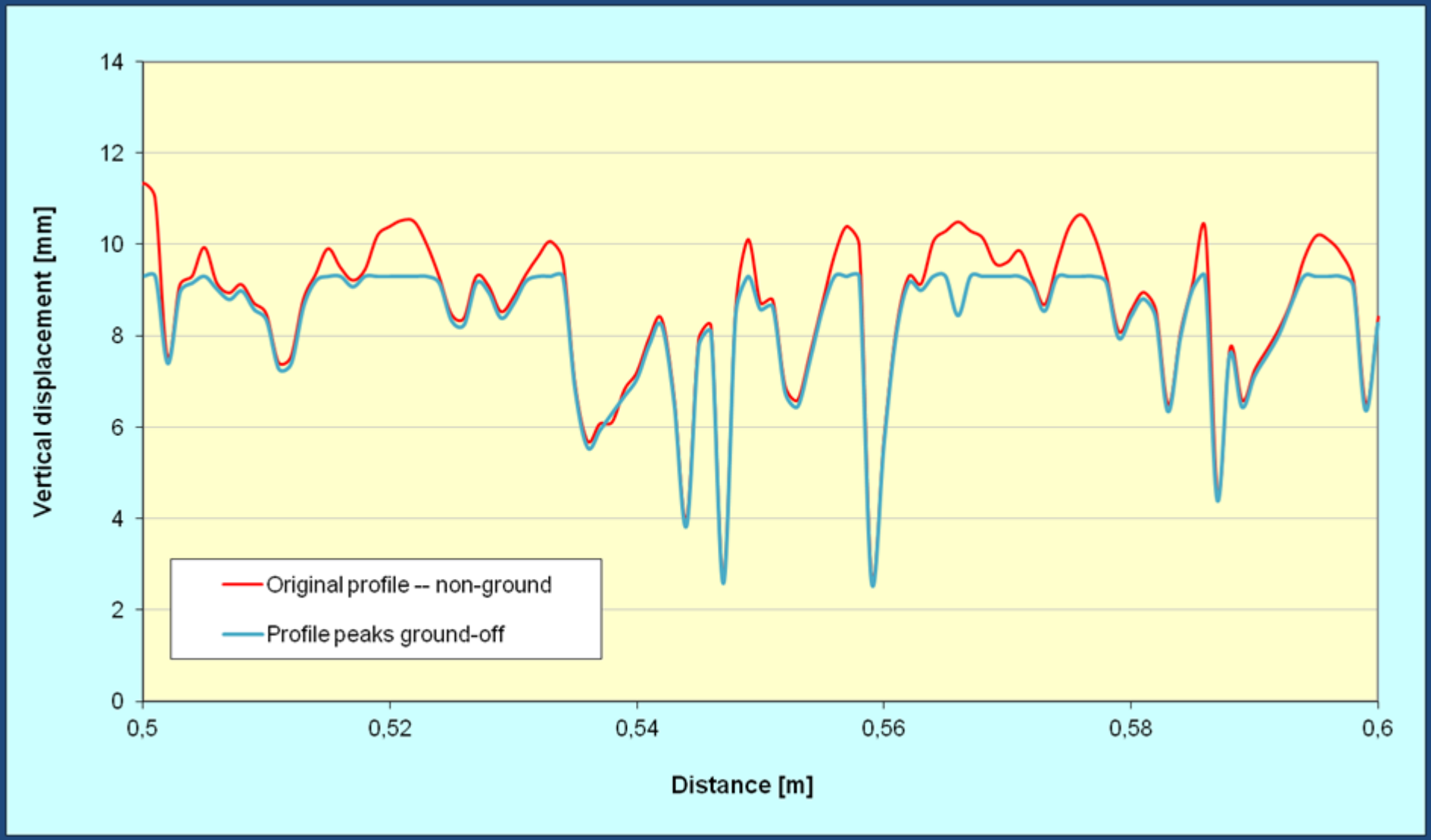
Comparison of the surfaces before and after grinding

Original, non-ground surface

Modified, ground surface

Illustration of original profile curve – before grinding

Illustration of new profile curve – after grinding

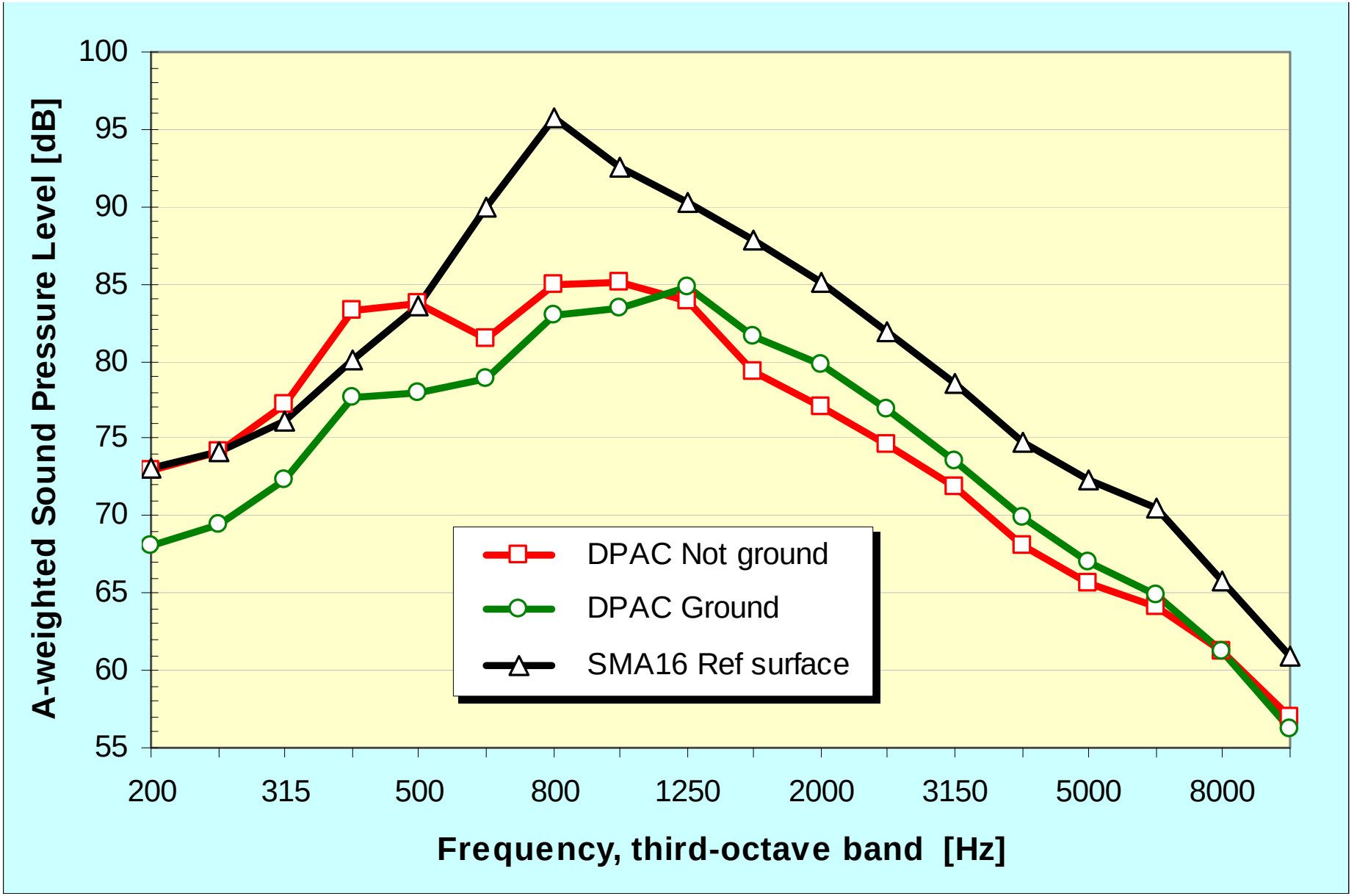


Noise measurement results

Pavement/surface	Measured noise level for tyre P1			Measured noise level for tyre H1		
	50 km/h	70 km/h	90 km/h	50 km/h	70 km/h	90 km/h
Ref. surface (SMA 16)	93.7	98.5	102.3	92.4	97.4	101.2
Non-ground DPAC	87.9	92.1	94.7	86.3	90.6	93.6
Ground DPAC	85.2	89.5	92.8	85.9	90.2	93.0
Red. vs non-ground	**2.7**	**2.6**	**1.9**	**0.4**	**0.4**	**0.6**
Reduction vs SMA 16	8.5	9.0	9.5	6.5	7.2	8.2

Frequency spectra before and after grinding

CPX method, average for the two ref tyres and for speeds 70 and 90 km/h



Effect on rolling resistance coefficient

Rolling resistance coefficient, for 3 tyres (P1 - SRTT, H1 – AAV4, and MCPR) and 2 speeds