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Informal document **GRB-62-23**
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agenda item 10)

Traffic noise: can the poro-elastic road surface help?

GRB Geneva
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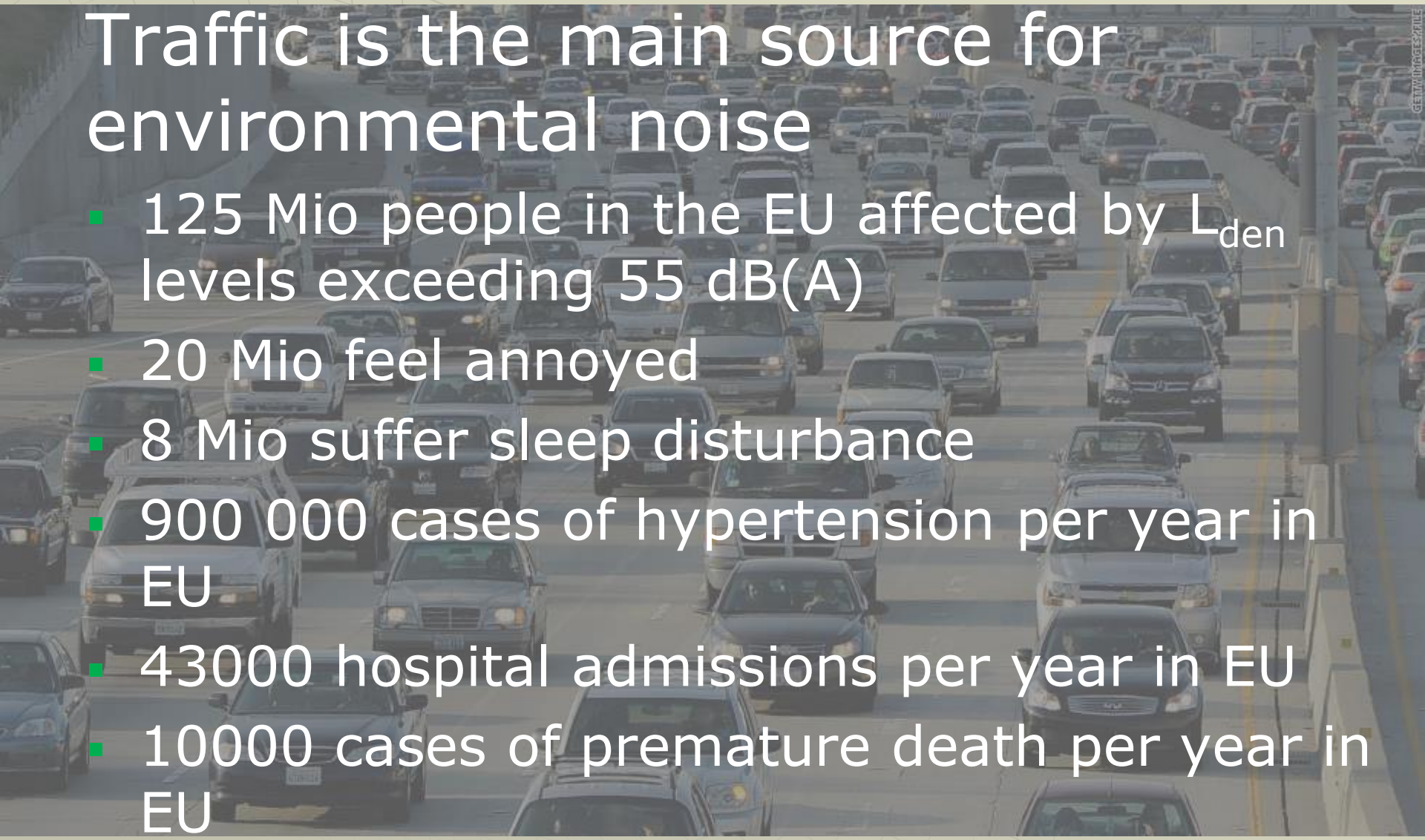
Why bother about traffic noise?



Traffic is the main source for environmental noise

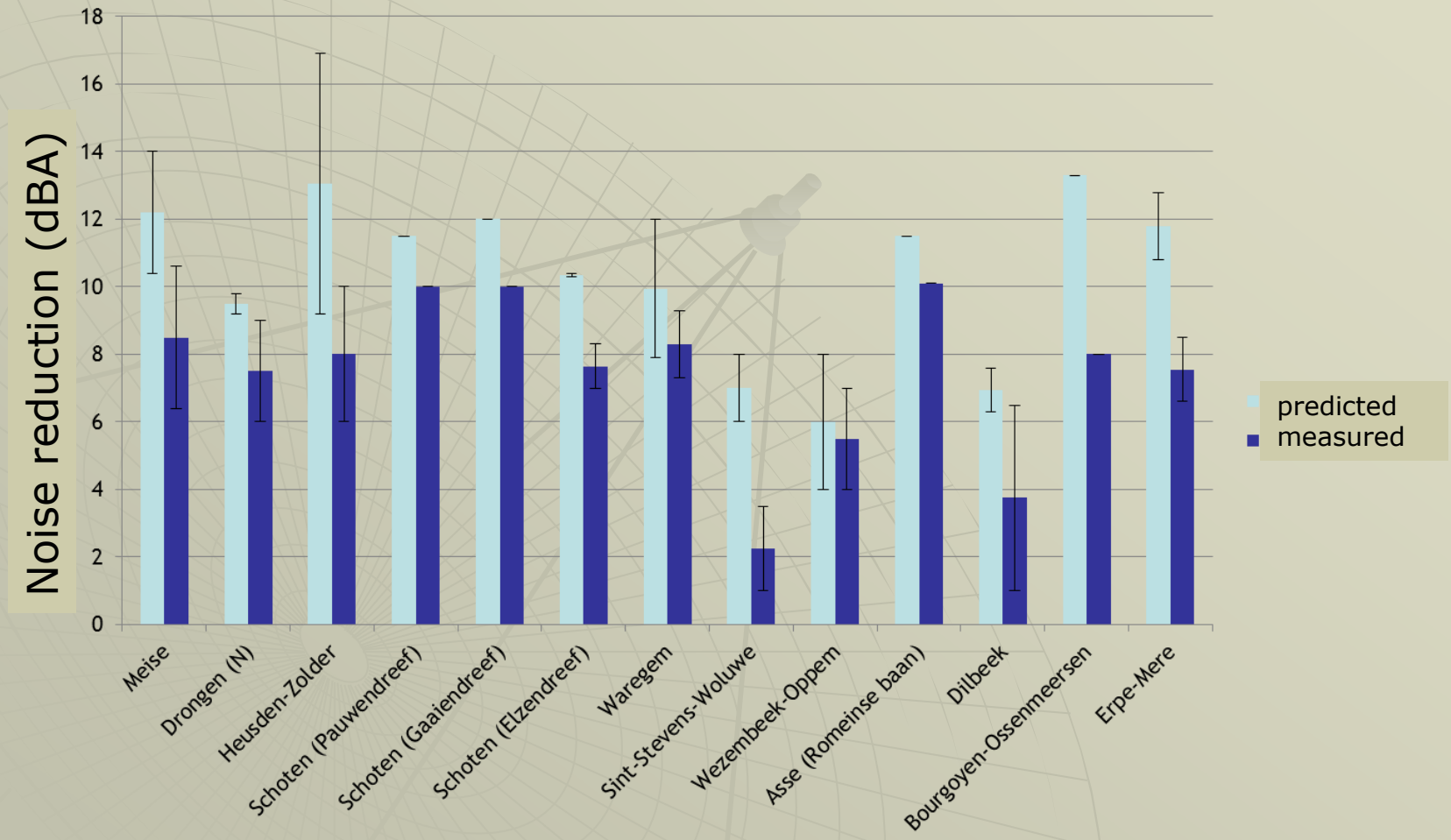
- 125 Mio people in the EU affected by L_{den} levels exceeding 55 dB(A)
- 20 Mio feel annoyed
- 8 Mio suffer sleep disturbance
- 900 000 cases of hypertension per year in EU
- 43000 hospital admissions per year in EU
- 10000 cases of premature death per year in EU

Source: European Environment Agency, Noise in Europe 2014, Report No 10/2014

Noise screens

- Often high noise reductions:
  - 2 dB/m height (< 4m)
  - 1 dB/m height (> 4 m)
- Expensive, “extra” constructions
- Intrusive
- Vandalism and dirt
- Effect on a limited area
- Effectiveness influenced by meteo
- Reflecting screens can worsen the acoustic situation on the other side
- Generally do not have “the eternal life”…

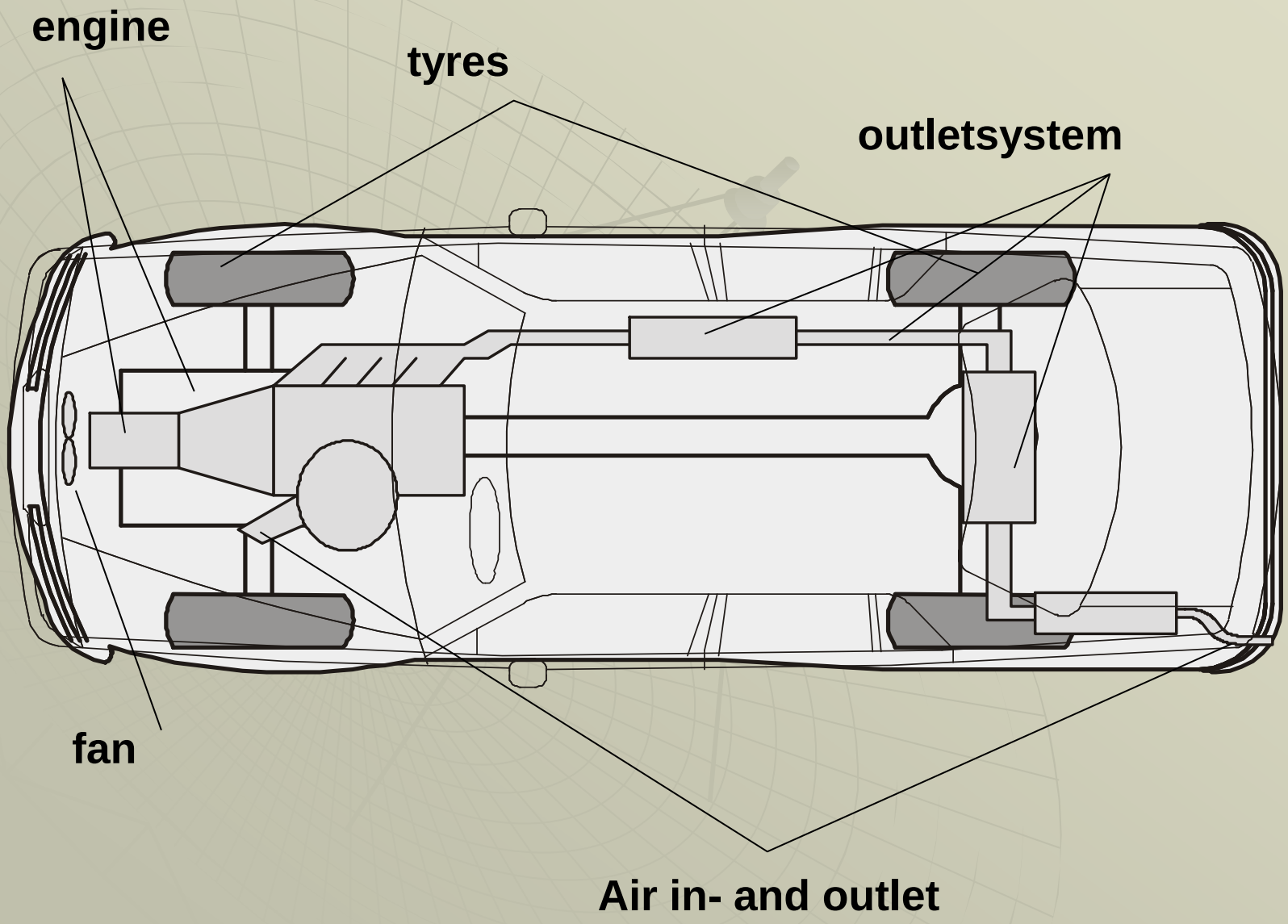
…and performance is sometimes disappointing…



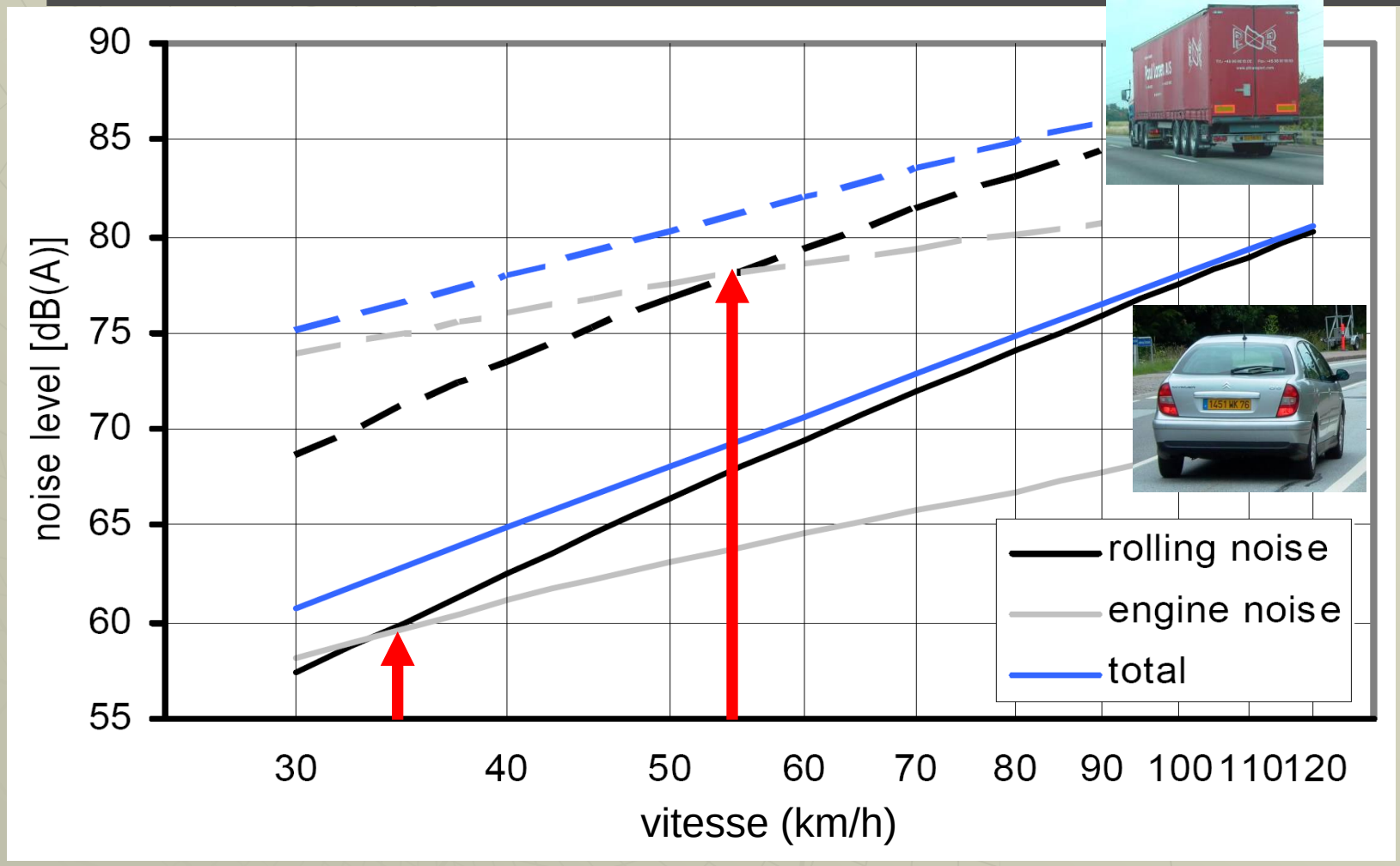
Predicted (on average): 10,4 dBA Measured (on average): 7,5 dBA

Source: Buytaert, A; Vanhooreweder, B "Control measurements near houses before and after installation of noise reducing devices", Proceedings Internoise 2013, Innsbrück, Austria, 15-18 September 2013

Where does traffic noise comes from?



Rolling noise vs. engine noise…



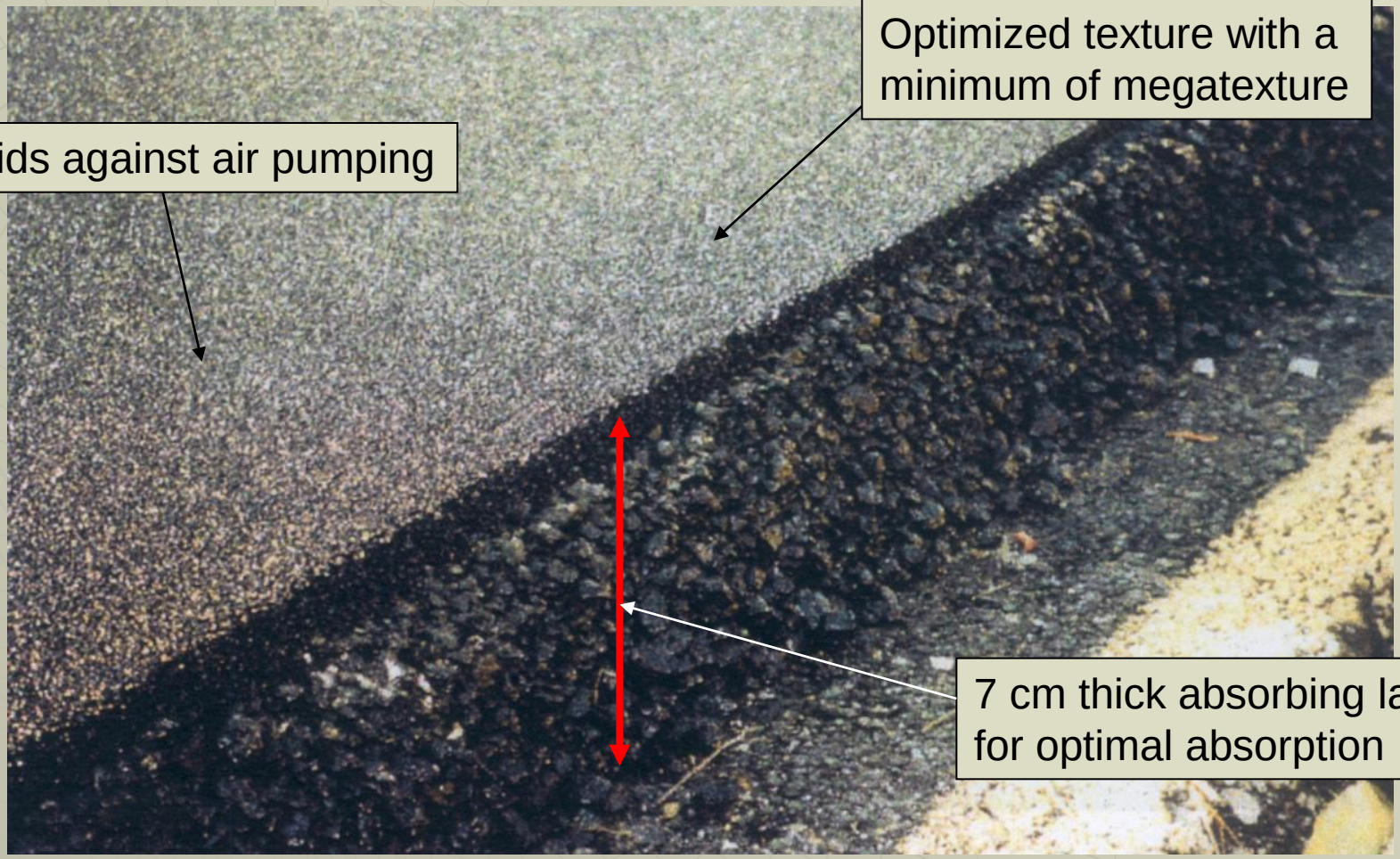
Fighting traffic noise ≈ fighting rolling noise!

Parameters influencing "noisiness" of pavement

- Texture → Thin asphalt layers

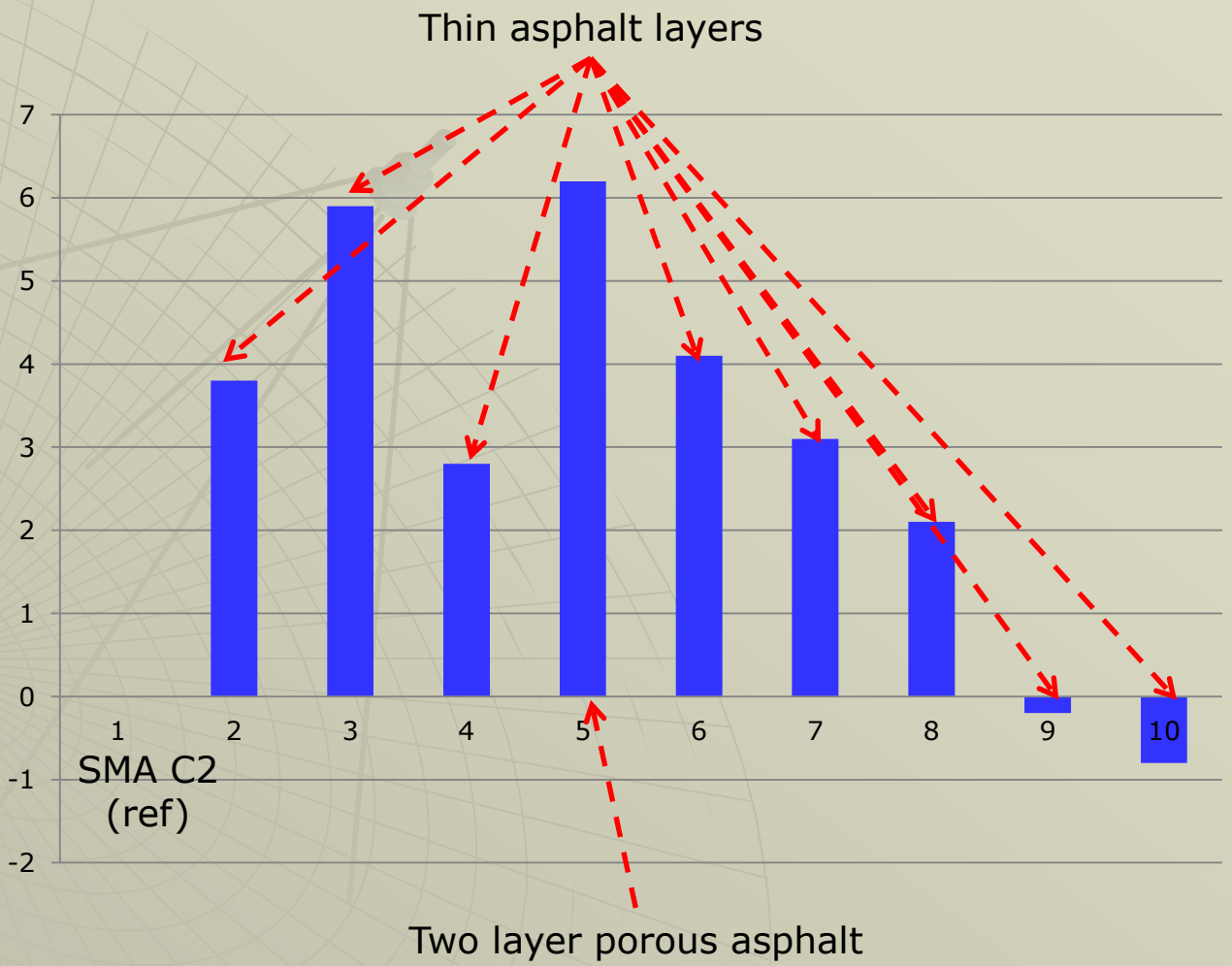
- Texture → Two layer porous asphalt
- Absorption → Two layer porous asphalt
- Absorption → Single layer porous asphalt
- Elasticity Poro-elastic road surface

The champion of "conventional" low noise pavement: two layer porous asphalt



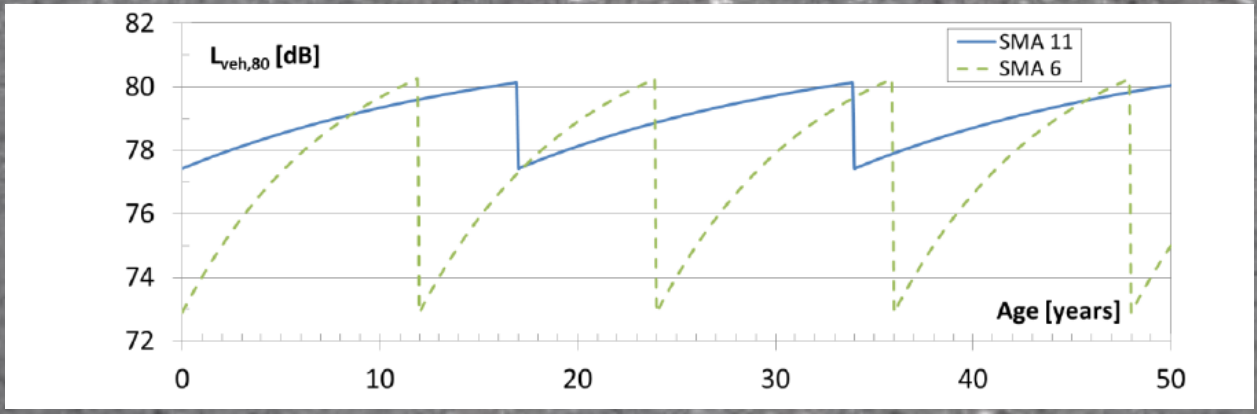
Noise reduction of up to 7 dB(A) compared to DAC or SMA 0/11

Test tracks with low noise pavements in Kasterlee (B)



Low noise pavements

- Cost effective noise reduction
- Generally lower noise reduction than screens
- Shorter technical lifetime
- Acoustic benefit appears to decrease with lifetime
- Present day LNP: the higher the initial noise reduction, the higher the pace you loose it ☹



Source: Kragh, J."Road Traffic Noise Mitigation – Recent trends and progress", Proceedings Internoise 2015, San Francisco, USA, 9-12 August 2015

How to go further? The poro-elastic road surface (PERS)!

- What is it?
  - Mix containing
    - Rubber particles
    - Stone aggregate
    - Polyurethane
    - Additives
    - NO bitumen, hence it is NOT an asphalt
- Why PERS?
  - Extreme noise reduction (7 -12 dB)
  - Tyre recycling

The concept PERS is not new…

Sweden, 1981 Photo: U. Sandberg, VTI


Norway, 1987

Sweden, 2004 Photo: U. Sandberg, VTI


Japan, 2009

Main challenges

- Combination of
  - Durability
    - Ravelling resistance
    - Bonding to sub layer
    - Resistance to fuel spills, deicing salts, frost-thaw etc.
  - Good friction
  - High noise reduction
  - Acceptable rolling resistance
  - …

The PERSUADE project

- PERSUADE = PoroElastic Road SUrface for Avoiding Damage to the Environment
- 12 partners from 8 EU countries
- Duration: 6 years
- 1 September 2009 - 31 August 2015
- Total budget: 4,7 M€
- Funding EC: 3,4 M€ (72 %)

SEVENTH FRAMEWORK PROGRAMME

The mission of the project

- … the development of a cost effective PERS type with an acceptable durability
- …moving from a promising but yet experimental concept to a usable noise abatement measure

Project plan

- Completeness
  - Technical aspect
  - Safety: environment – working environment – traffic safety
  - Economical aspect
- Stepwise approach
  - Lab testing
  - Small scale test tracks
  - Full scale test tracks
  - Monitoring
- Dissemination

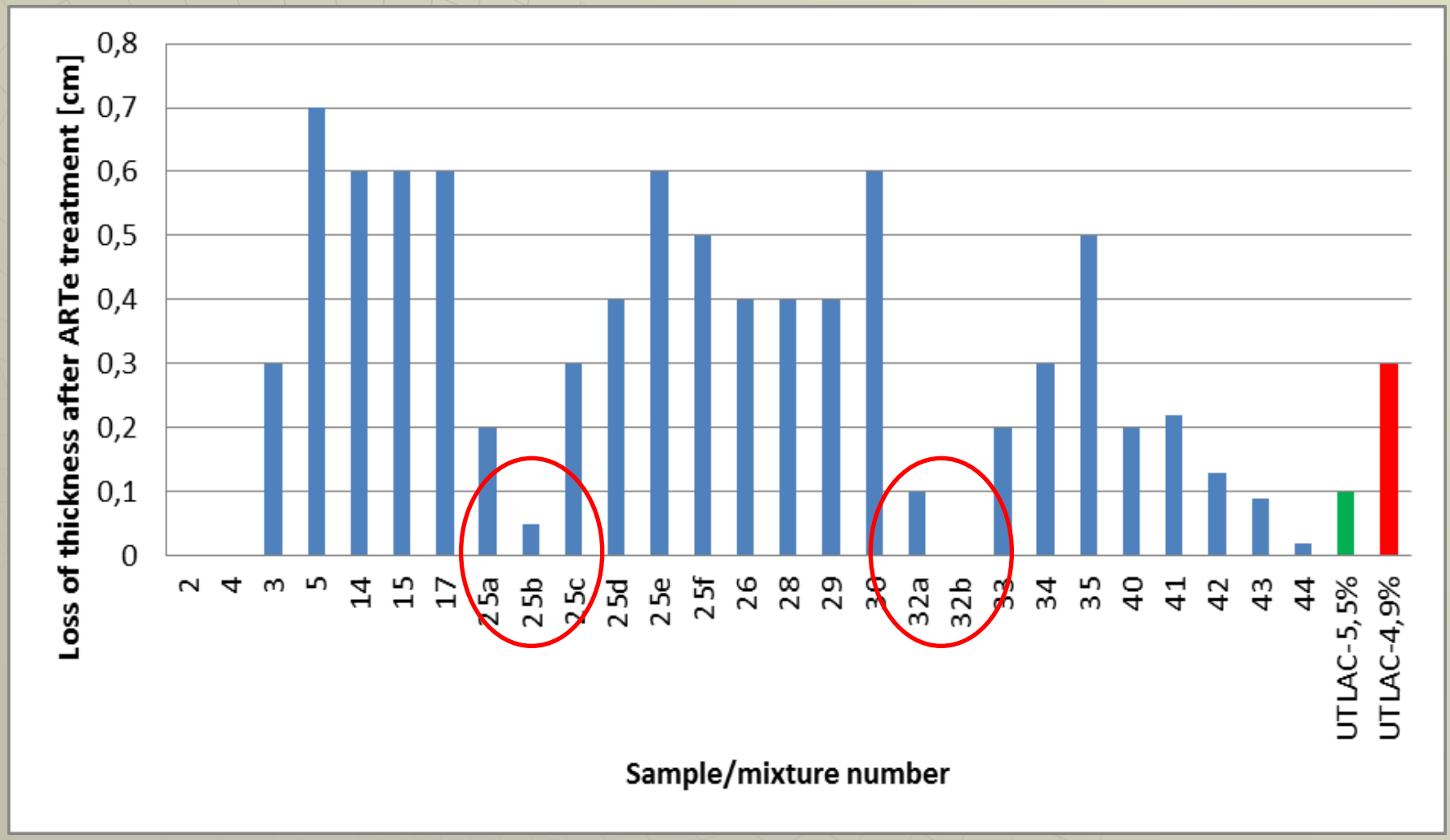
What we have done…

- Found in lab two mixes with good…
  - Ravelling resistance
  - Polishing resistance
  - Bonding to sub layer
  - Resistance to hydro-carbons
  - Fire resistance
  - …


Aachener Ravelling Tester


Bonding Testing

Testing PERS mixes with the ARTe

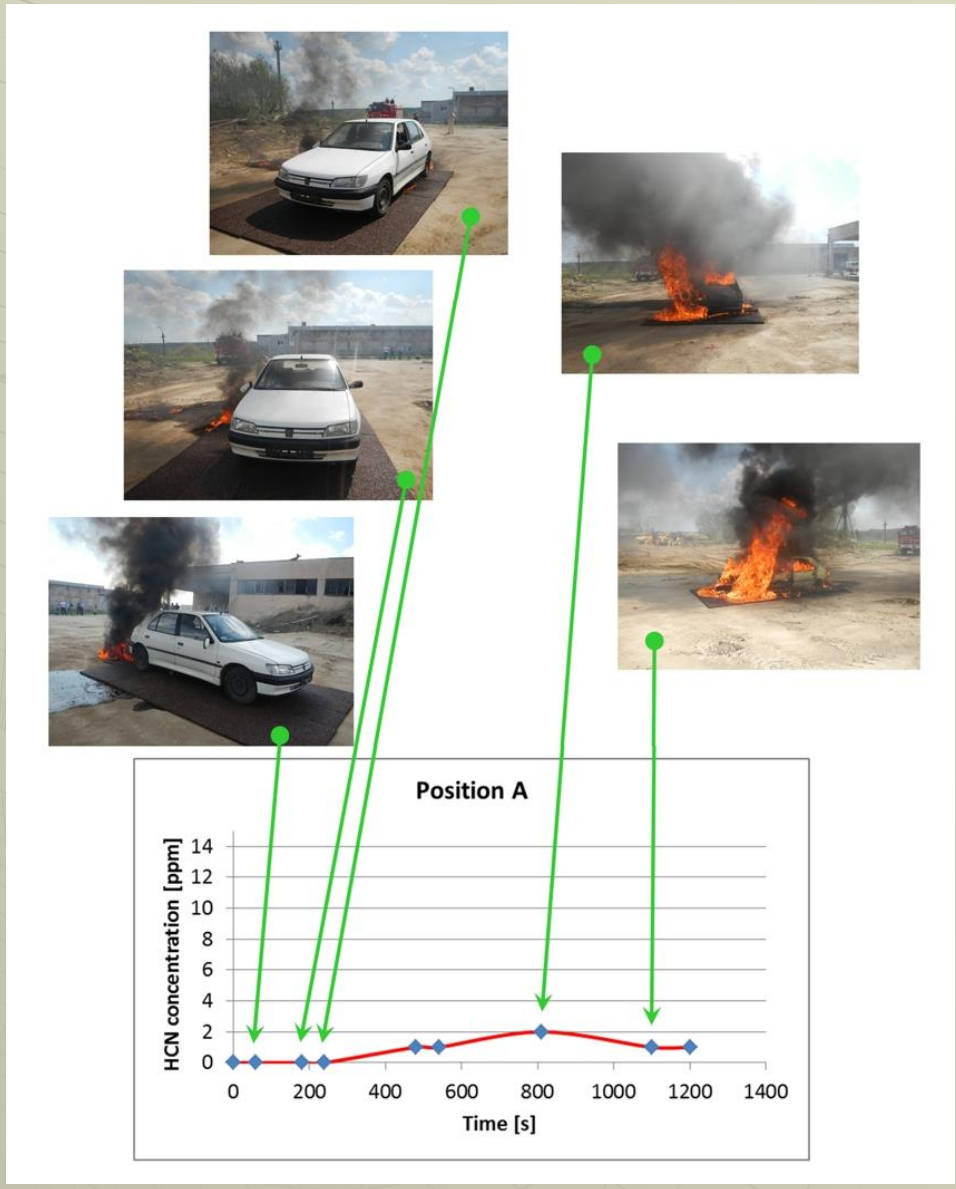


What we have done…

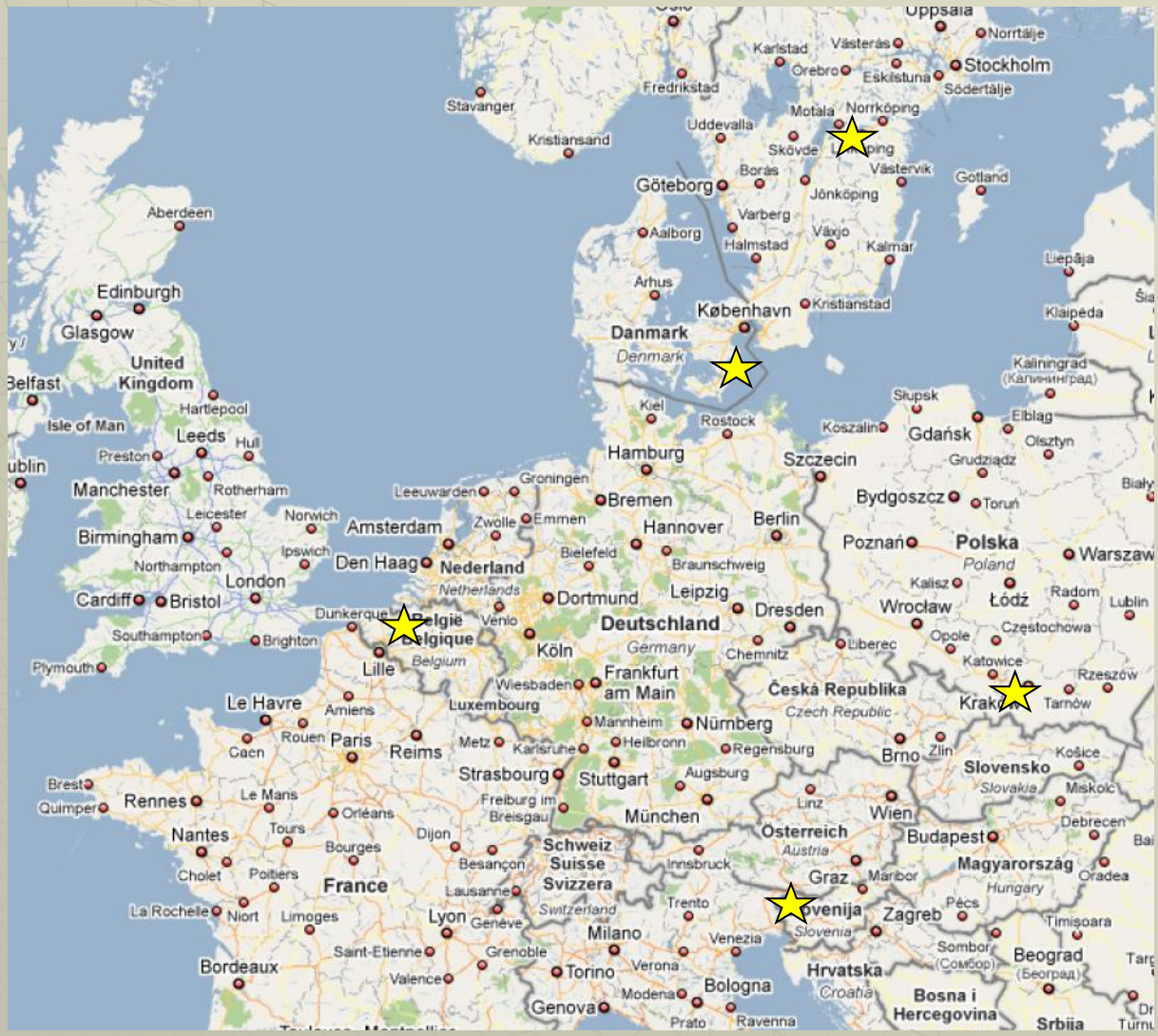
- Small scale "pilot" test tracks (10-30 m²), with little or no traffic

Full scale fire tests

Full scale fire test



Full scale test tracks



Full scale test track in Belgium

Full scale test track in Belgium

Mixing PERS in mobile cement concrete plant in Zaventem

(two batches)

Full scale test track in Belgium

Full scale test track in Belgium

Compaction

Full scale test track in Belgium

Full scale test track in Denmark

Full scale test tracks in Sweden

Full scale test tracks in Sweden

Full scale test track in Poland

Full scale test track in Slovenia

- Spreading glue on cement concrete blocks

- Manual mounting of PERS pieces on concrete blocks

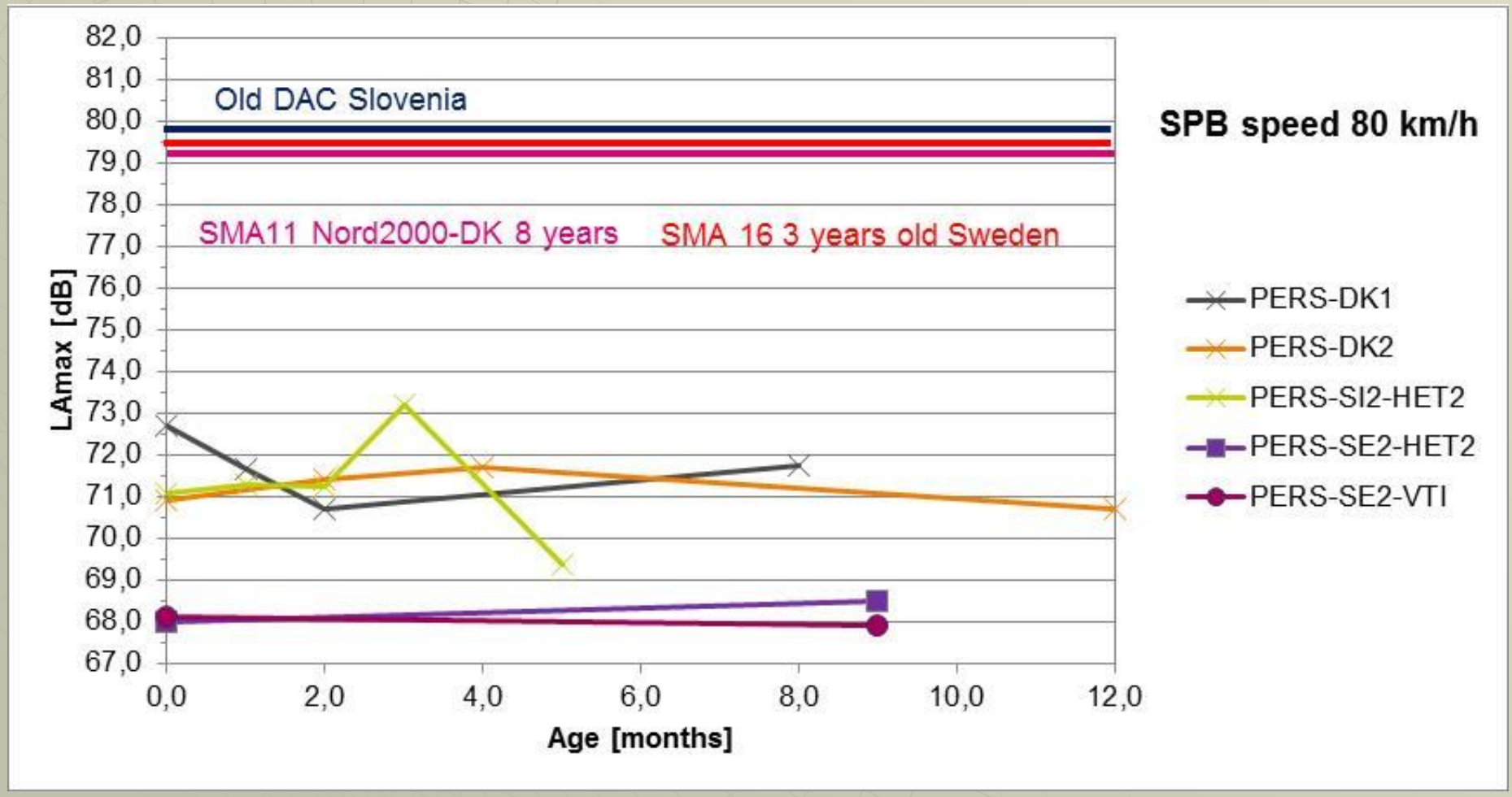
Full scale test track in Slovenia

- Laying blocks...
- When finished, joints were filled with sand 0/1 mm
- The excess sand was broomed away

What we have done…

- Monitoring
  - Noise reduction
  - Durability
  - Elasticity
  - Winter behaviour…

SPB noise reduction at 80 km/h



PERSUADE achievements - status (I)

Development of PERS mixes which

- can be quite ravelling resistant
- can yield a sufficient skid resistance
- yield a good to an excellent noise reduction…
- and the noise reduction seems to be quite stable in the time (alternative for noise screen of 4 to 6 m high !!!)

PERSUADE achievements - status (II)

- do not pose problems concerning toxicity
- are more fire safe than a DAC
- are resistant to fuel spills
- of which the winter behaviour can be handled
- reduce moderately traffic vibrations
- are already beneficial at a short lifetime (stand. CBA calculation)

PERSUADE achievements - status (II)

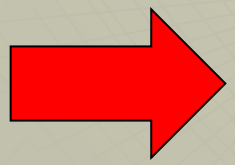
- Development of lab tests for PERS
- Development of techniques for full scale application yielding reasonable to good surface characteristics

Remaining problems

- PERS + PU tack layer + bituminous under layer + heavy vehicles → debonding
- But:
  - short term bonding quality is OK
  - long lifetime (> 4 y) feasible when exposed to moderate car traffic volume (hence without HV)
  - (Strong) indications that tack layer is more durable and does resist HV if bitumen on underlayer is removed or absent

Remaining problems

- Construction of a PERS pavement is still a delicate issue. Mistakes committed during any phase of the construction process are paid cash!
- Reproducibility of full scale results are still an issue



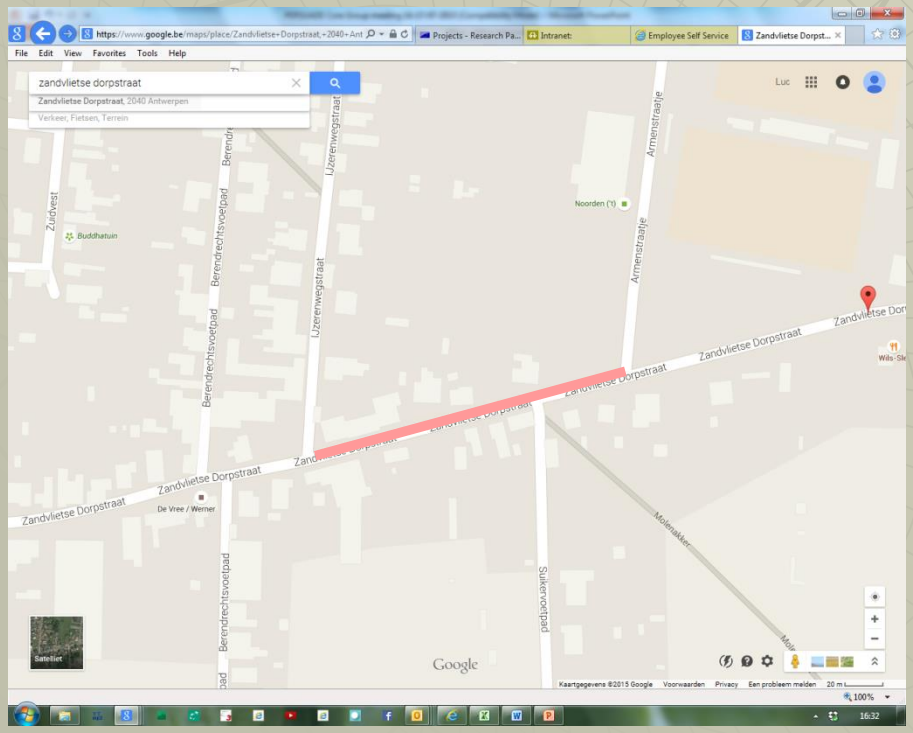
more practicing is needed

What to do now?

- Further testing of present PERS with PU tack layer on a bituminous sub layer on a road with neglible HV
- Further testing of present PERS with PU or epoxy tack layer on a bitumen free sublayer on a road with some HV
- …then larger scale test tracks (500 m and longer)

Short term project

- Construction of a new test track on a street (with low HV colume) in the city of Antwerp (local “SToLA” project)



More information

www.persuadeproject.eu

of

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