

Traffic noise and motorway pavements



Conférence Européenne
des Directeurs des Routes

Conference of European
Directors of Roads

**W. Alberts, CEDR Road Noise,
Geneva, 28.01.2015**

Question



Overview

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- objectives
 - CEDR
 - road noise
 - pavements
 - figures on use, noise, lifetime and costs
 - conclusions and final remarks

Objectives

To inform about:

- CEDR
- pavements used on motorways in Europe and their noise reduction, lifetime and costs

CEDR: profile

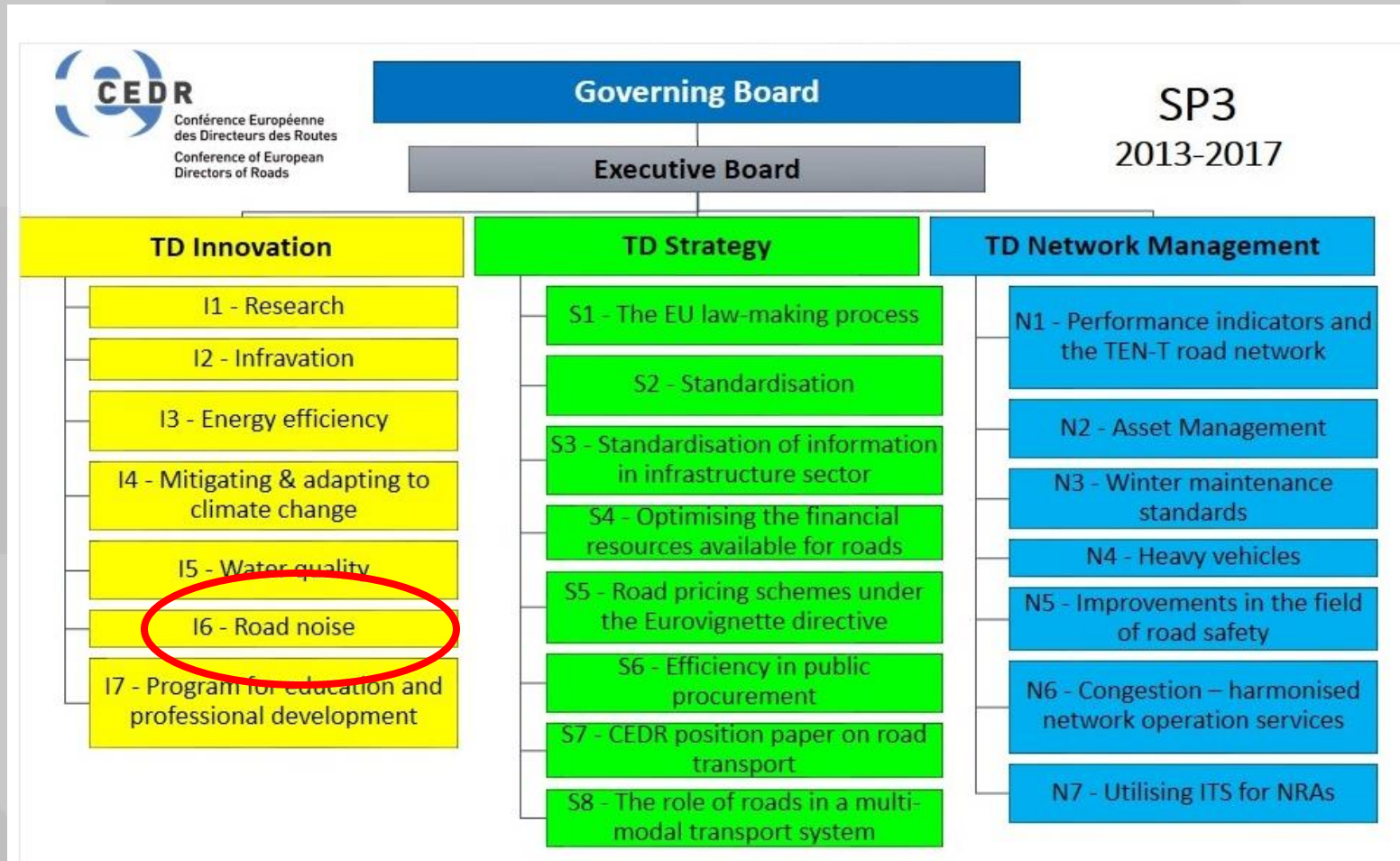
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- What is CEDR:
 - the Conference of European Directors of Roads (CEDR) is a forum for the discussion and promotion of improvements to the road system and its infrastructure
 - members represent their national road authorities (NRAs) in Europe

 - Now there are 27 CEDR member states (MS)

CEDR: mission

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- to analyze future developments of the road system
 - to promote international networks of personal contacts
 - to provide a platform for responding to common problems
 - to develop a strong involvement in EU developments
 - to use existing representations in international groups
 - to make use of the results of common understandings

CEDR: structure

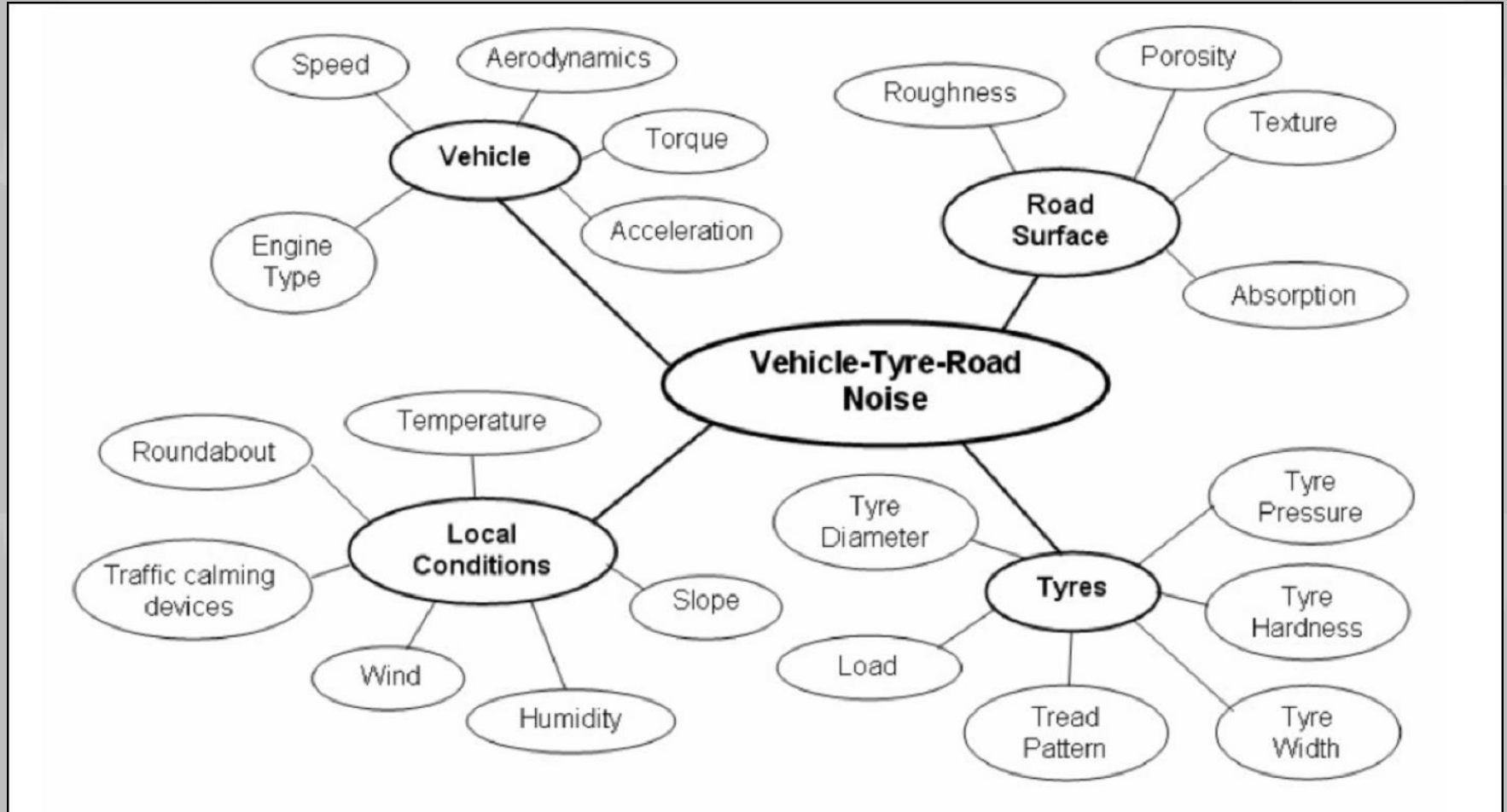


CEDR: Road Noise

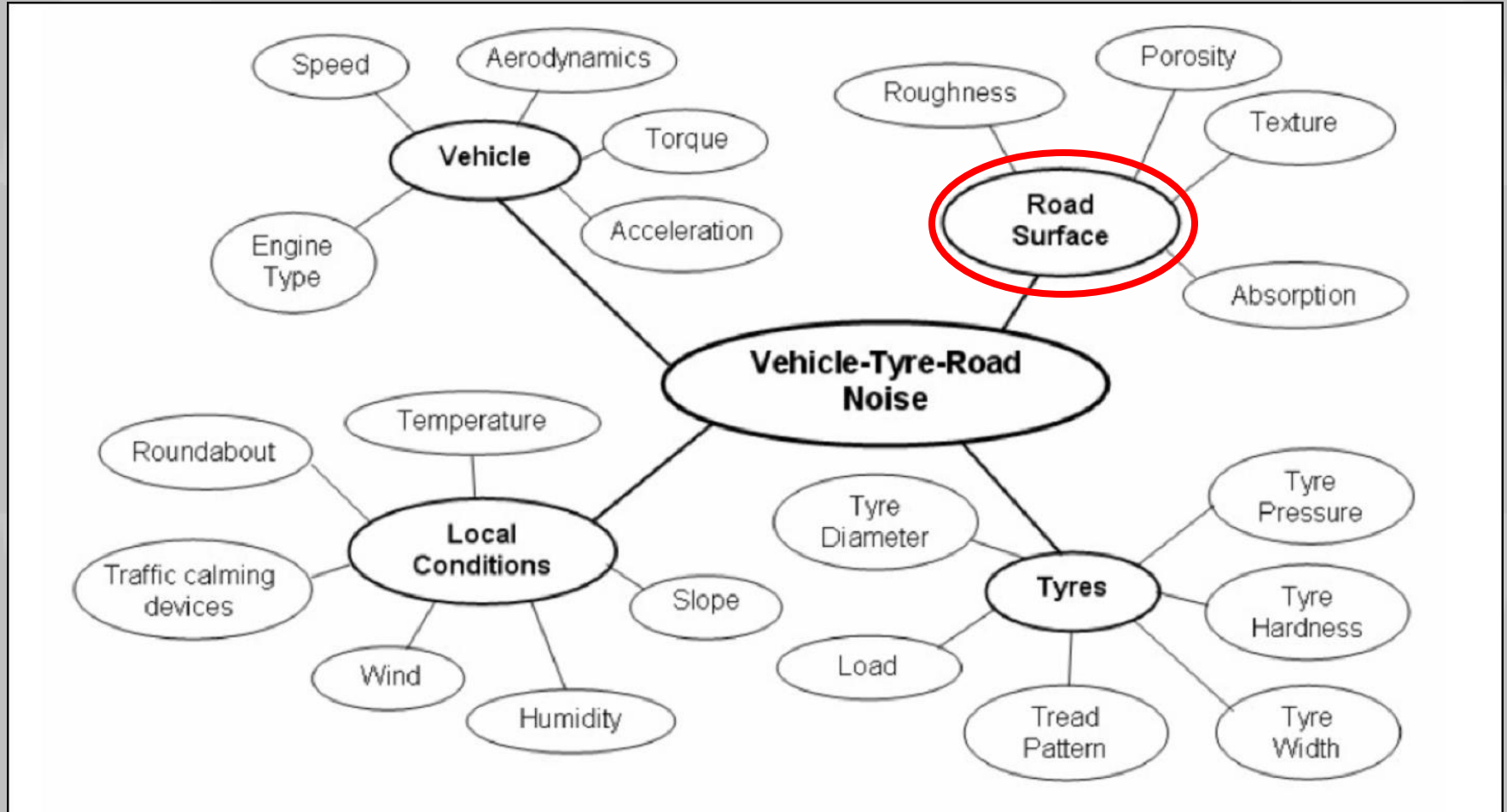
The two main goals of CEDR Road Noise 2013-2017 are:

- improve noise quality in close proximity to road infrastructure
- reduce costs in planning, building, maintaining and researching road infrastructure

Road traffic noise

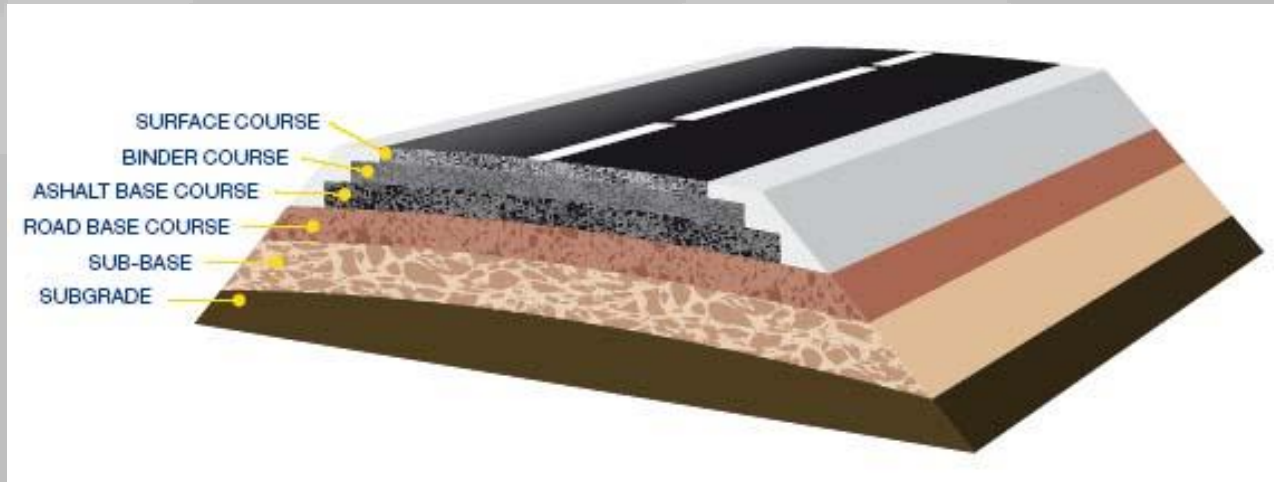


Road traffic noise



Road: layers

- a road has several layers (courses)



- for road noise the surface layer (pavement) is important
- surface layer consists of aggregates (stones) bound together with bitumen (asphalt)

Pavements

- wide range of motorway pavements available:

| MAIN PAVEMENTS: |
|--------------------------|
| Dense Asphalt Concrete |
| Stone Mastic Asphalt |
| Cement Concrete |
| Porous Asphalt |
| Thin Layers |
| Two Layer Porous Asphalt |

- these pavements differ for functional aspects like lifetime, costs, noise reduction and driver comfort (splash and spray)
- these pavements meet MS standards for skid resistance

Pavements: use

- pavements on motorways in CEDR MS (in %)

| MAIN PAVEMENTS: | AT | BE-F | DE | DK | EE | ES | FR | GR | IE | IT | LV | NL | NO | SE | UK |
|--------------------------|----|------|----|----|----|----|------|----|----|----|----|----|----|----|----|
| Dense Asphalt Concrete | 10 | | 20 | 40 | 66 | 76 | most | 70 | 74 | 97 | 60 | 12 | 65 | | |
| Stone Mastic Asphalt | 57 | 65 | 40 | 50 | 6 | | | | 22 | | 40 | | 20 | 99 | 40 |
| Cement Concrete | 30 | 35 | 30 | | | 2 | | | | | | | | | 5 |
| Porous Asphalt | 3 | | 10 | | | 12 | some | 30 | | 3 | | 69 | | | |
| Thin Layers | | | | 10 | | 10 | | | | | | 1 | | | 55 |
| Two Layer Porous Asphalt | | | | | | | | | | | | 18 | | 1 | |

- DAC and SMA are preferred pavements in most CEDR MS

Pavements: use

- pavements on motorways in CEDR MS (in %)

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|--------------------------|----|------|----|----|----|----|------|----|----|----|----|----|----|----|----|
| Dense Asphalt Concrete | 10 | | 20 | 40 | 66 | 76 | most | 70 | 74 | 97 | 60 | 12 | 65 | | |
| Stone Mastic Asphalt | 57 | 65 | 40 | 50 | 6 | | | | 22 | | 40 | | 20 | 99 | 40 |
| Cement Concrete | 30 | 35 | 30 | | | 2 | | | | | | | | | 5 |
| Porous Asphalt | 3 | | 10 | | | 12 | some | 30 | | 3 | | 69 | | | |
| Thin Layers | | | | 10 | | 10 | | | | | | 1 | | | 55 |
| Two Layer Porous Asphalt | | | | | | | | | | | | 18 | | 1 | |

- DAC and SMA are preferred pavements in most CEDR MS
- noise reducing pavements like PA, TL and TLPA are used in some CEDR MS

Pavements: noise

- initial noise reduction (in dB, MS standard pavement is zero)

| MAIN PAVEMENTS: | AT | BE-F | DE | DK | ES | GR | IT | NL | NO | SE | UK |
|--------------------------|------|------|----|--------|-------|----|----|-------|------|-------|-----|
| Dense Asphalt Concrete | 0 | | -2 | 0 | 0 | 0 | 0 | 0 | 0/-3 | | |
| Stone Mastic Asphalt | 0/-3 | 0 | -2 | 0,6/-1 | | | | | 0/-3 | 0 | 3,5 |
| Cement Concrete | +1/0 | 1 | -2 | | | | | | | | 6 |
| Porous Asphalt | -4 | | -5 | | 0/-3 | -2 | -3 | -2 | | | |
| Thin Layers | | | | -2 | -2/-3 | | | -2/-3 | | | 0 |
| Two Layer Porous Asphalt | | | | | | | | -5/-6 | | -8/-6 | |

Pavements: noise

- initial noise reduction (in dB)

| MAIN PAVEMENTS: | AT | BE-F | DE | DK | ES | GR | IT | NL | NO | SE | UK | average |
|--------------------------|------|------|----|--------|-------|----|----|-------|------|-------|-----|---------|
| Dense Asphalt Concrete | 0 | | -2 | 0 | 0 | 0 | 0 | 0 | 0/-3 | | | 0 |
| Stone Mastic Asphalt | 0/-3 | 0 | -2 | 0,6/-1 | | | | | 0/-3 | 0 | 3,5 | 0/-3 |
| Cement Concrete | +1/0 | 1 | -2 | | | | | | | | 6 | +6/0 |
| Porous Asphalt | -4 | | -5 | | 0/-3 | -2 | -3 | -2 | | | | -2/-4 |
| Thin Layers | | | | -2 | -2/-3 | | | -2/-3 | | | 0 | -2/-3 |
| Two Layer Porous Asphalt | | | | | | | | -5/-6 | | -8/-6 | | -5/-6 |

Pavements: noise

- initial noise reduction (in dB)

| MAIN PAVEMENTS: | AT | BE-F | DE | DK | ES | GR | IT | NL | NO | SE | UK | average |
|--------------------------|------|------|----|--------|-------|----|----|-------|------|-------|-----|---------|
| Dense Asphalt Concrete | 0 | | -2 | 0 | 0 | 0 | 0 | 0 | 0/-3 | | | 0 |
| Stone Mastic Asphalt | 0/-3 | 0 | -2 | 0,6/-1 | | | | | 0/-3 | 0 | 3,5 | 0/-3 |
| Cement Concrete | +1/0 | 1 | -2 | | | | | | | | 6 | +6/0 |
| Porous Asphalt | -4 | | -5 | | 0/-3 | -2 | -3 | -2 | | | | -2/-4 |
| Thin Layers | | | | -2 | -2/-3 | | | -2/-3 | | | 0 | -2/-3 |
| Two Layer Porous Asphalt | | | | | | | | -5/-6 | | -8/-6 | | -5/-6 |

- transition from much used pavements (DAC/SMA) to noise reducing pavements (PA/TL) reduces noise with 2 to 3 dB
- average lifetime noise reduction is less than initial reduction
- acoustic properties of pavements are covered in regulation and noise calculation model in CEDR MS
- harmonization at EU level (END and CNOSSOS-EU)

Pavements: lifetime

- lifetime (average in years)

| MAIN PAVEMENTS: | AT | BE-F | DE | DK | EE | ES | FR | GR | IE | IT | LV | NL | SE | range | average |
|--------------------------|-------|------|-------|-------|----|-------|-----|------|-------|-------|----|----|------|-------|---------|
| Dense Asphalt Concrete | 15 | | 12/18 | 15/17 | 20 | 6/10 | >12 | 20 | 20/22 | >20 | 20 | 18 | | 12-22 | 17 |
| Stone Mastic Asphalt | 10/15 | 15 | 16/22 | 15/17 | 20 | | | | 16/17 | | 20 | | 6/12 | 6-22 | 16 |
| Cement Concrete | 30/40 | 40 | 26/30 | | | 15/20 | | | | | | | | 15-40 | 30 |
| Porous Asphalt | 8/10 | | 8 | | | 6/10 | | 8/10 | 15/16 | 10/15 | | 17 | | 6-17 | 11 |
| Thin Layers | | | | 12 | | 6 | | | | | | 13 | | 6-13 | 10 |
| Two Layer Porous Asphalt | | | | | | | | | | | | 13 | 5/8 | 5-13 | 10 |

- lifetime of noise reducing pavements is less than lifetime of non-noise reducing pavements

Pavements: costs#1

- all-in investment costs (EUR/m²)

| MAIN PAVEMENTS: | BE-F | DE | EE | IE | IT | LV | NL | SE | range | average |
|--------------------------|------|----|----|----|-------|------|-------|----|-------|---------|
| Dense Asphalt Concrete | | | 8 | 26 | 13/16 | 7/14 | 24 | | 8-26 | 17 |
| Stone Mastic Asphalt | 8 | | 9 | 23 | | 9/13 | | 8 | 8-23 | 12 |
| Cement Concrete | 40 | | | | | | | | 40 | 40 |
| Porous Asphalt | | 26 | | 28 | 18 | | 19 | | 18-28 | 23 |
| Thin Layers | | | | | | | 22 | | 22 | 22 |
| Two Layer Porous Asphalt | | | | | | | 28/31 | 29 | 28-31 | 29 |

- little information and wide range of all-in investment costs
- investment costs of noise reducing pavements is higher than costs of non-noise reducing pavements

Pavements: costs#2

- all-in maintenance costs (EUR/m²/year)

| MAIN PAVEMENTS: | EE | IT | LV | NL | SE | range | average |
|--------------------------|-----|----|-----|----|-----|---------|---------|
| Dense Asphalt Concrete | 0,5 | 2 | 3/5 | 2 | | 0,5-5 | 2 |
| Stone Mastic Asphalt | 0,5 | | | | 1 | 0,5-1,0 | 1 |
| Cement Concrete | | | | | | | |
| Porous Asphalt | | 2 | | 2 | | 2 | 2 |
| Thin Layers | | | | 2 | | 2 | 2 |
| Two Layer Porous Asphalt | | | | 3 | 4/6 | 3-6 | 4 |

- very little information
- average maintenance costs of noise reducing pavements is more or less comparable with costs of most non-noise reducing pavements

Conclusions

In general:

- there is no standard pavement on motorways in Europe
- the use of pavements is based on NRA policy and CEDR MS regulation
- main reason for using a pavement: costs and lifetime
- constraints like winter circumstances limit the choice of pavements

Conclusions

Regarding the use of noise reducing pavements:

- some CEDR MS use noise reducing pavements
- in acoustic hot spots to lower noise levels
- noise reducing pavements are more cost-effective than noise barriers
- noise reducing pavements lower noise levels with 2 to 3 dB (max. 6 dB)
- do not overestimate the possibilities of using noise reducing pavements

Final remarks

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- the best way to lower traffic noise levels is by reducing noise production
 - three domains in traffic noise production: vehicles, tyres and pavements
 - reducing traffic noise production is a shared responsibility
 - CEDR, its NRAs and the paving industry are doing a lot of research to improve noise reducing pavements
 - at EU level CEDR is working on cooperation with the other domains



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End

THANK YOU FOR YOUR INTEREST