Exposed Aggregate Concrete Surfaces for low-noise roadways

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Introduction

Exposed Aggregate Concrete Surface

- It is a surface finishing technique obtained:
  - by removal of the surface mortar
  - application of a surface retarder agent on a given depth
  - sprayed on the fresh concrete
- The final appearance is obtained:
  - or by water jet
  - or by a simple brushing, wet or dry
- Purpose:
  - Low-noise roadways
  - Decorative applications

History

- **Late 1970’s**
  - Texturing of concrete roads by simple mechanical brushing of the green
  - First experiments with surface retarders for architectonic panel – costs too high
  - 1978: International Symposium on Concrete Roads in Besançon – Danish and Swiss reports
  - First experiments with sugar-based retarders as a cost-effective solution for concrete pavements
  - First test boards – 2 small projects
  - Combination of a retarder with protective sheeting

History

- **1980's**:
  - first experimental sites
  - Further reasearch and development of the retarder
  - Tests on
    - The quality of the concrete
    - La macrotexture
      - » Depth of texture measured by sand patch test
      - » Skid resistance (friction tester CFT)
  - Favourable conclusions: start of industrial operation of the technology – total ca. 800,000 m²
    - Concrete slab and continuous reinforced concrete
    - Highways, state roads, provincial highways
    - Porphyry, sandstone or crushed gravel concrete

History

- **1990’s – 2026**
  - Introduction of Exposed Aggregate Surface all over Western Europe:
    - France: Robuco France
    - Austria,
    - Scandinavia
    - Germany: coöperation with OAT
    - Netherlands,
    - Czech Republic, Poland, …
  - Further optimization of finer concrete mixtures in search of the optimal noise reduction

Execution

Technology today

Execution

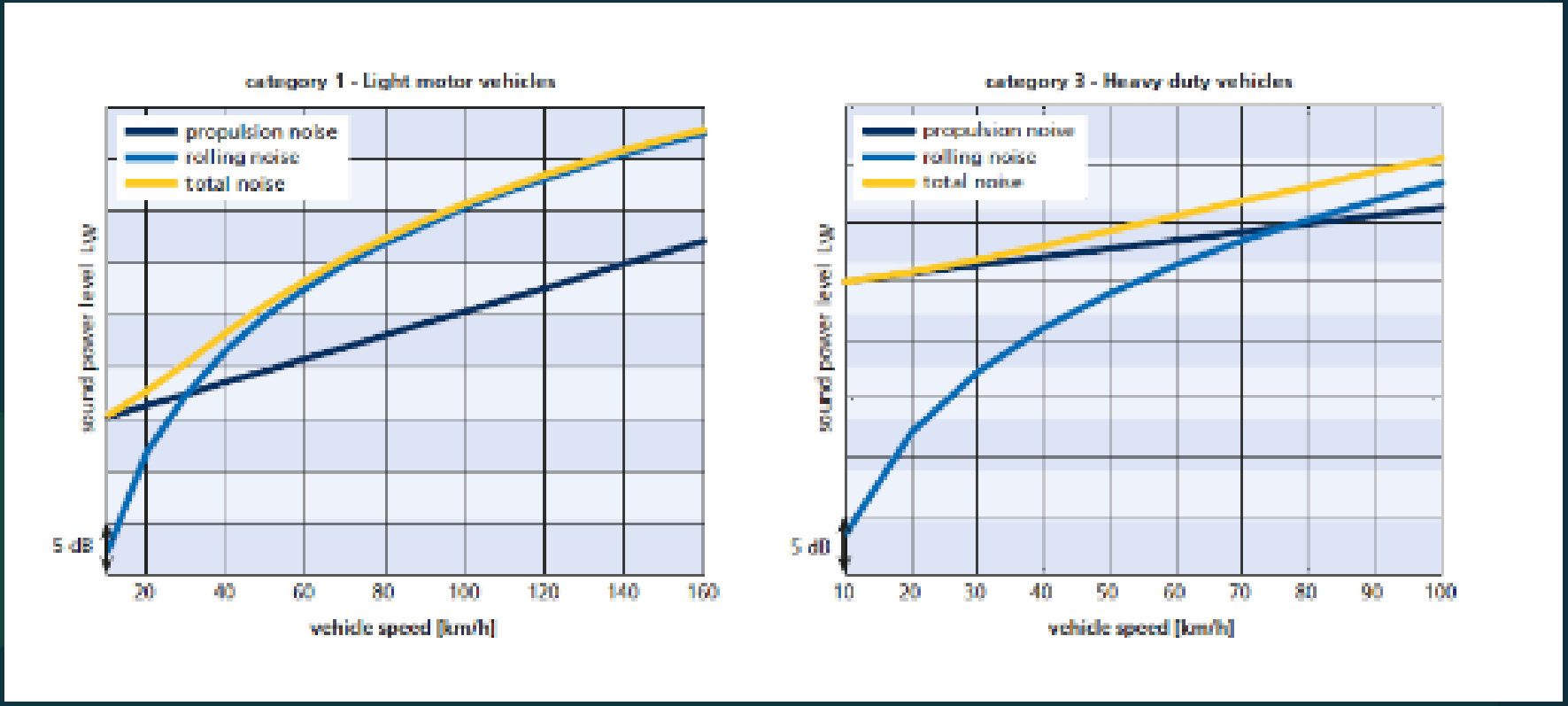
Technology today

EU Noise Directive

- "Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 on the assessment and management of environmental noise"
- Imposed on Member States
  - the production of strategic noise maps and
  - action plans to combat noise pollution and protect quiet areas.
- With regard to road noise:
  - Noise barriers
  - Less noisy running surfaces
- Challenge for road authorities
  - the creation of quieter pavements whose acoustic characteristics are maintained throughout their lifetime, without compromising in the areas of safety, comfort and durability

Traffic noise

- Propulsion: the engine, exhaust and other components of the vehicle's propulsion mechanism
- Interaction between tire and road surface
  = rolling noise
- Aerodynamic noise from wind turbulence

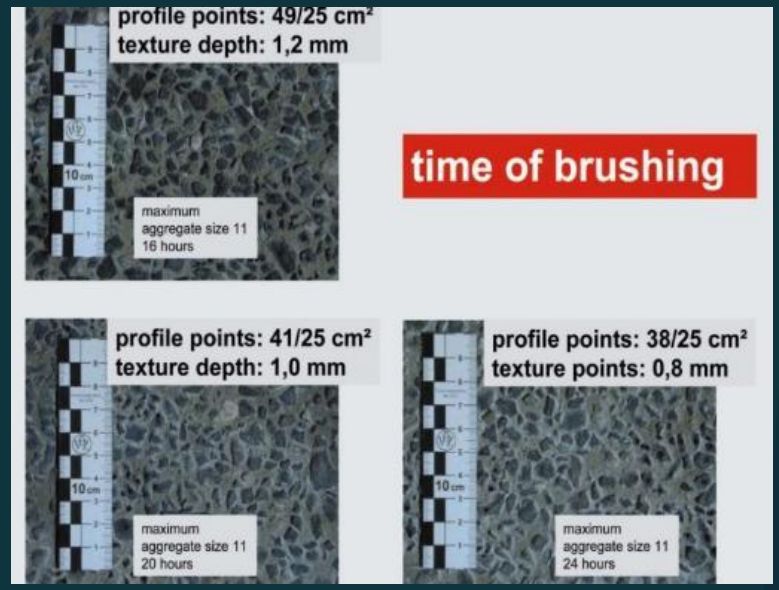


Surface Finish & Rolling Noise

- EAC
  - 1980s
    - Concrete 0/32 - 0/40
    - Large surface gravel
    - Excellent adhesion
    - High level of rolling noise

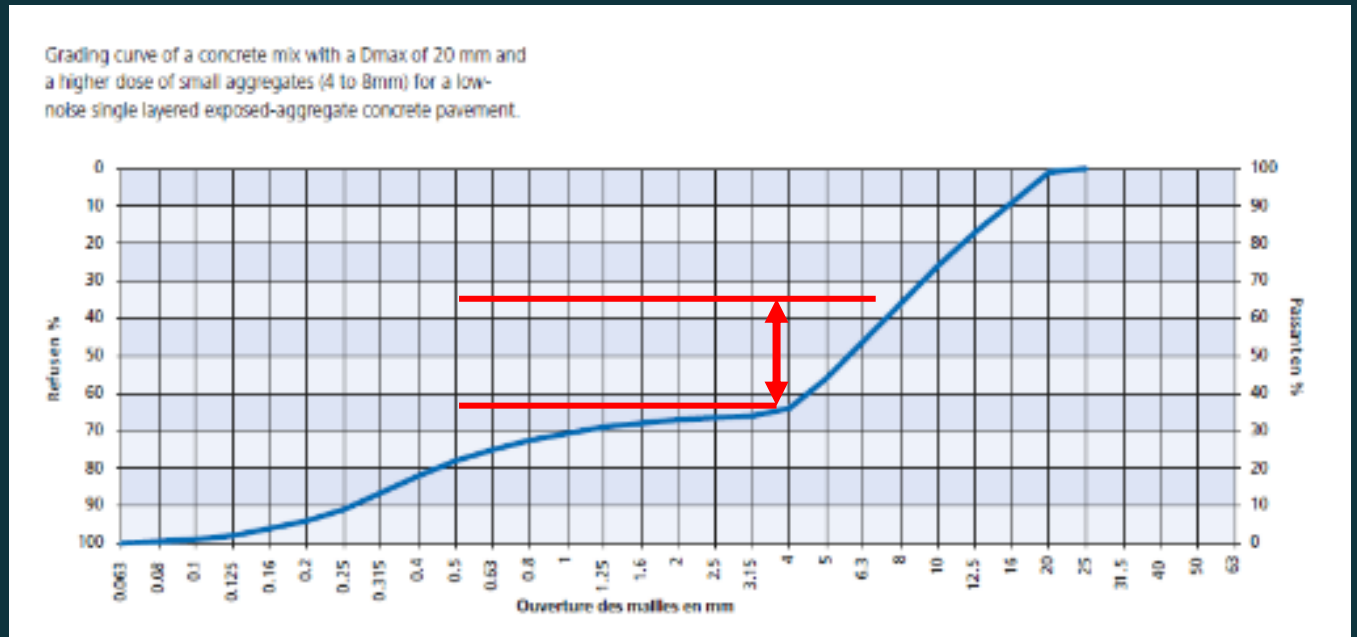
Surface Finish & Rolling Noise

- EAC
  - 1990s – Austria
    - Two-layer concrete 0/11
    - Small chippings on the surface
    - Very good grip
    - Lower rolling noise



Surface Finish & Rolling Noise

- EAC
  - 1990s – Belgium
    - Concrete 0/20 with 4/6 or 4/8 overdosed
    - Good grip
    - Low rolling noise level



Surface Finish & Rolling Noise

- EAC
  - 1995 - Belgium
    - Herne: first experiment with two-layer concrete (continuous reinforced) with 0/6 concrete top layer
    - Good grip
    - Very low rolling noise

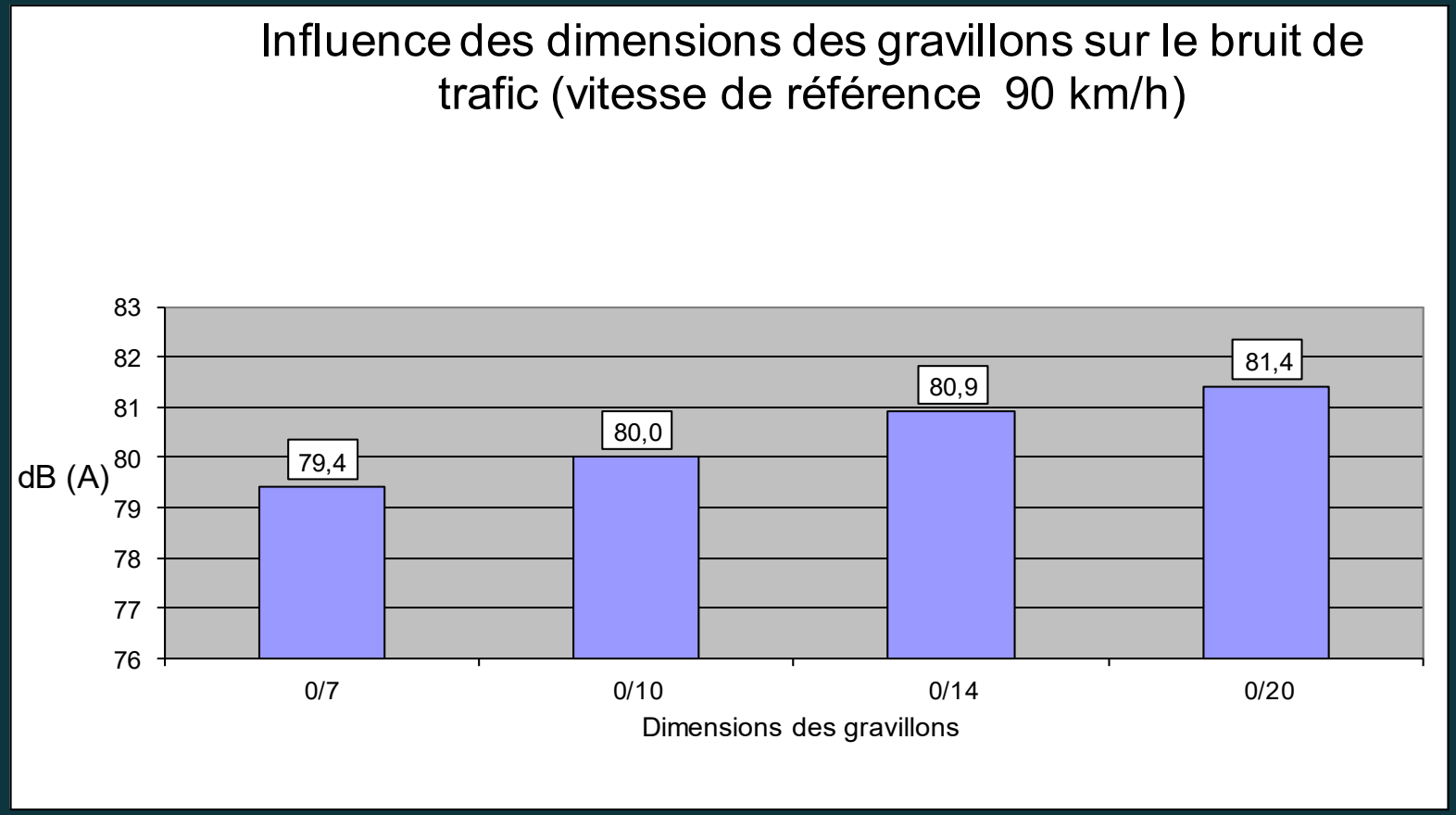
Surface Finish & Rolling Noise

- EAC
  - 2002 - Belgium
    - Estaimpuis – different test sections made of two-layer CRCP with different aggregate sizes in the top layer

    - 20 cm thick
      - 15 cm 0/32 + 5 cm 0/7
      - 14 cm 6 cm 0/10
      - 12 cm 8 cm 0/14
      - 12 cm 8 cm 0/20

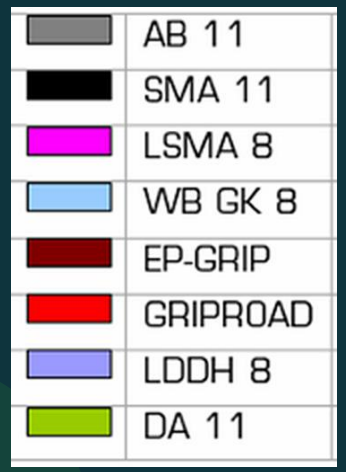
Surface Finish & Rolling Noise

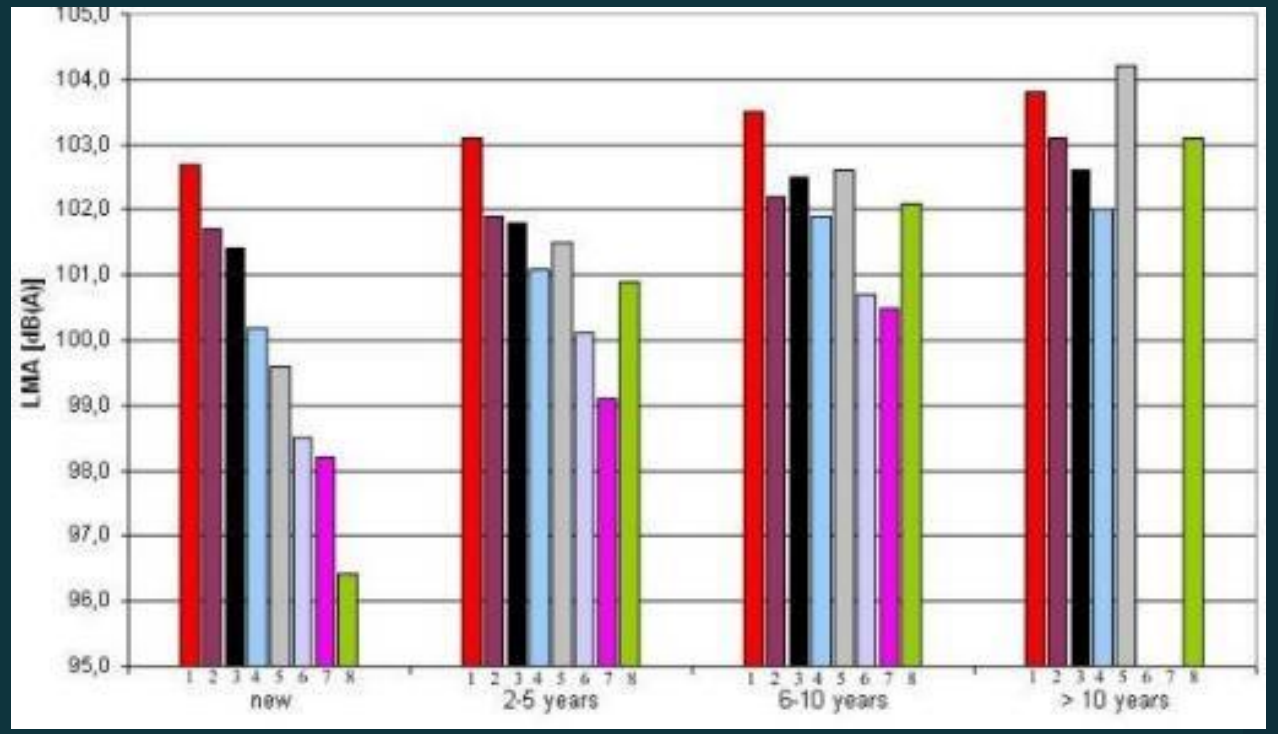
- EAC
  - 2002 - Belgium
    - Estaimpuis – SPB noise measurements



Austria: comparison of noise levels and their evolution over time

- Thin bare concrete surfaces (light blue bars) show better long-term performance

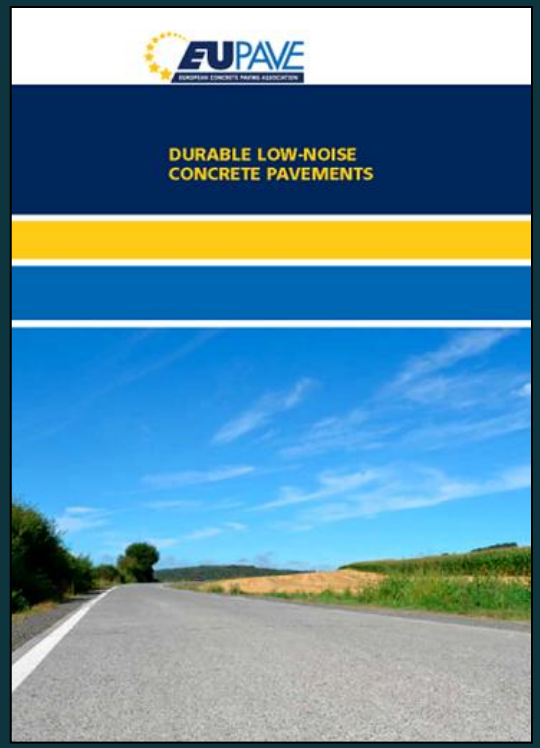


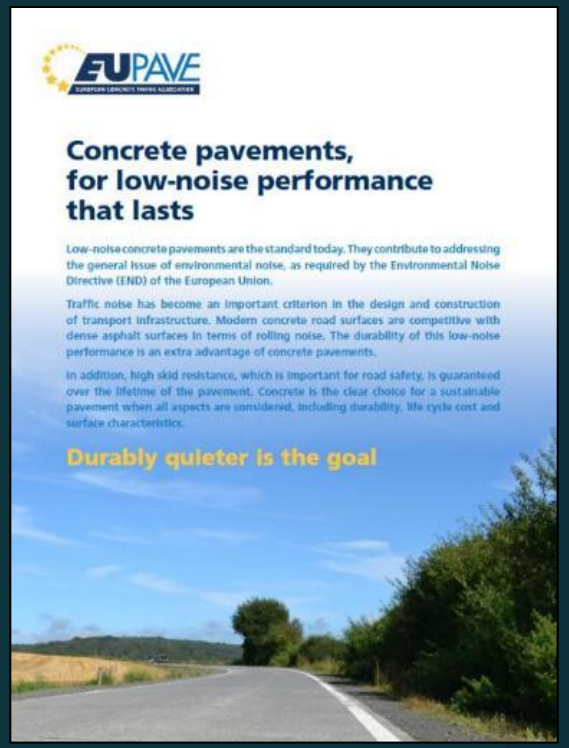


CONCLUSIONS

- Exposed Aggregate Concrete Surface
  - A proven technique with omptimization over time
  - The most widely applied surface finish in Europe
  - The other advantages of concrete are not called into question
    - Robustness – durability
    - Low maintenance
    - Respect for the environment
    - No influence on the evenness of the surface

Silent Roads Brochures






Thank you for your attention