Welcome to EUPAVE's 5th workshop on Best Practices

"Concrete Pavement Preservation"

14 October 2020

Words of welcome and introduction to the workshop

By Jeroen de Vrieze,
Advisor Promotion, Market and Statistics at Cement and Beton Centrum, NL and
Chairman of EUPAVE's Best Practices Working Group

Previous Workshops on Best Practices

- 1st : 26 May 2015
  - Achieving and maintaining the evenness of concrete pavement
- 2nd : 17 February 2016
  - Joints in concrete pavements
- 3rd : 23 February 2017
  - The right concrete mix for the right surface
- 2018: Berlin, 13ISCR
- 4th: 18 June 2019
  - Hydraulically Bound Base Layers

Programme

13:30 – 13:40	Words of welcome and introduction to the workshop *By Jeroen de Vrieze, Advisor Promotion, Market and Statistics, Cement and Beton Centrum, Chairman of the Best Practices Working Group*
13:40 – 13:55	Concrete Pavement Preservation: definition, concepts and strategies *By Luc Rens, Managing Director, EUPAVE*
13:55 – 14:25	Road Auscultation and Condition Assessment *By Anne Beeldens, Owner and Consulting Engineer, AB-ROADS*
14:25 – 14:55	Maintenance and repair techniques for concrete slabs-part 1 *By Pascal Buys, Managing Director, ROBUCO*
14:55 – 15:25	Maintenance and repair techniques for concrete slabs-part 2 *By Tim Alte-Teigeler, Head of Research & Development, Otto Alte-Teigeler GmbH*
15:25 – 15:45	**Coffee break**

Programme

15.45 – 16:15	Self-healing concrete by means of superabsorbent polymers *By Didier Snoeck, researcher, Magnel-Vandepitte Laboratory for Structural Engineering and Building Materials - Ghent University*
16:15 – 16:45	Durable repair and rehabilitation of CRCP *By Elia Boonen, Researcher, Belgian Road Research Centre*
16:45 – 16:55	**Q&A**
16:55 – 17:00	Conclusions *By Luc Rens, Managing Director, EUPAVE*
17:00	**Closing of the workshop**

Concrete Pavement Preservation: definition, concepts & strategies

Luc Rens, Managing Director, EUPAVE

Introduction

- Reference document

https://www.fhwa.dot.gov/pavement/pubs/hif18025.pdf

- Content:

1. Introduction
2. Concrete pavement preservation concepts
3. Evaluation of existing concrete pavement
4. Strategies for concrete pavement preservation
5. Engineering economic analysis and concepts for strategy selection
6. Summary

Definition of CPP

- Pavement preservation is known as preventive maintenance and minor rehabilitation treatments to pavements undergoing structural deterioration or materials degradation

  = at best a stop-gap measure delaying their ultimate failure

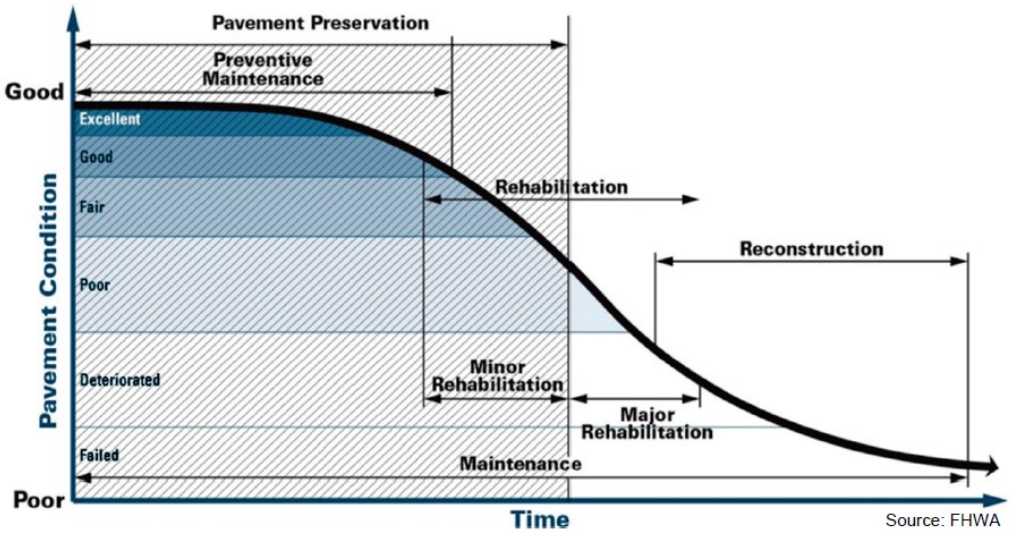


Figure 1-1. Pavement preservation activities and pavement condition (Smith et al. 2014).

Definition of CPP

- Definition reconsidered:

  "a strategy of extending concrete pavement service life as long as possible by arresting, greatly diminishing or avoiding the pavement deterioration process"

- This strategy can be achieved by

  1. Designing and constructing durable long-life concrete pavements (LLCP structurally adequate and relatively distress-free throughout a long service life)
  2. Overlays (asphalt or concrete) as a preservation treatment
  3. Maintaining serviceability of the existing concrete pavement using CPR (restoration) treatments

CPP Concepts & Strategies

- Key Factors affecting CP performance
  - Design features
    - Structural design
    - Load transfer systems
    - Foundation support
    - Drainage
  - Durability of materials
  - Construction techniques

CPP Concepts & Strategies

- Key Factors affecting CP performance
  - Design features
    - Structural design
      - Mechanistic-empirical design methods: based upon the calculation of critical stresses, strains and deflections and calibrated against field data
      - For a design service life
    - Load transfer systems
      - JPCP: avoiding pumping and faulting
      - Use of dowels!

CPP Concepts & Strategies

- Key Factors affecting CP performance
  - Design features
    - Foundation support
      - Uniformity of support
      - Erosion resistant
      - Intermediate layers serving as protection
        - » Geotextile - asphalt
    - Drainage
      - Water infiltration from above and from beneath
      - Avoid water trapped within the pavement structure
      - Sealing joints, stabilised bases...
      - Use of pervious concrete

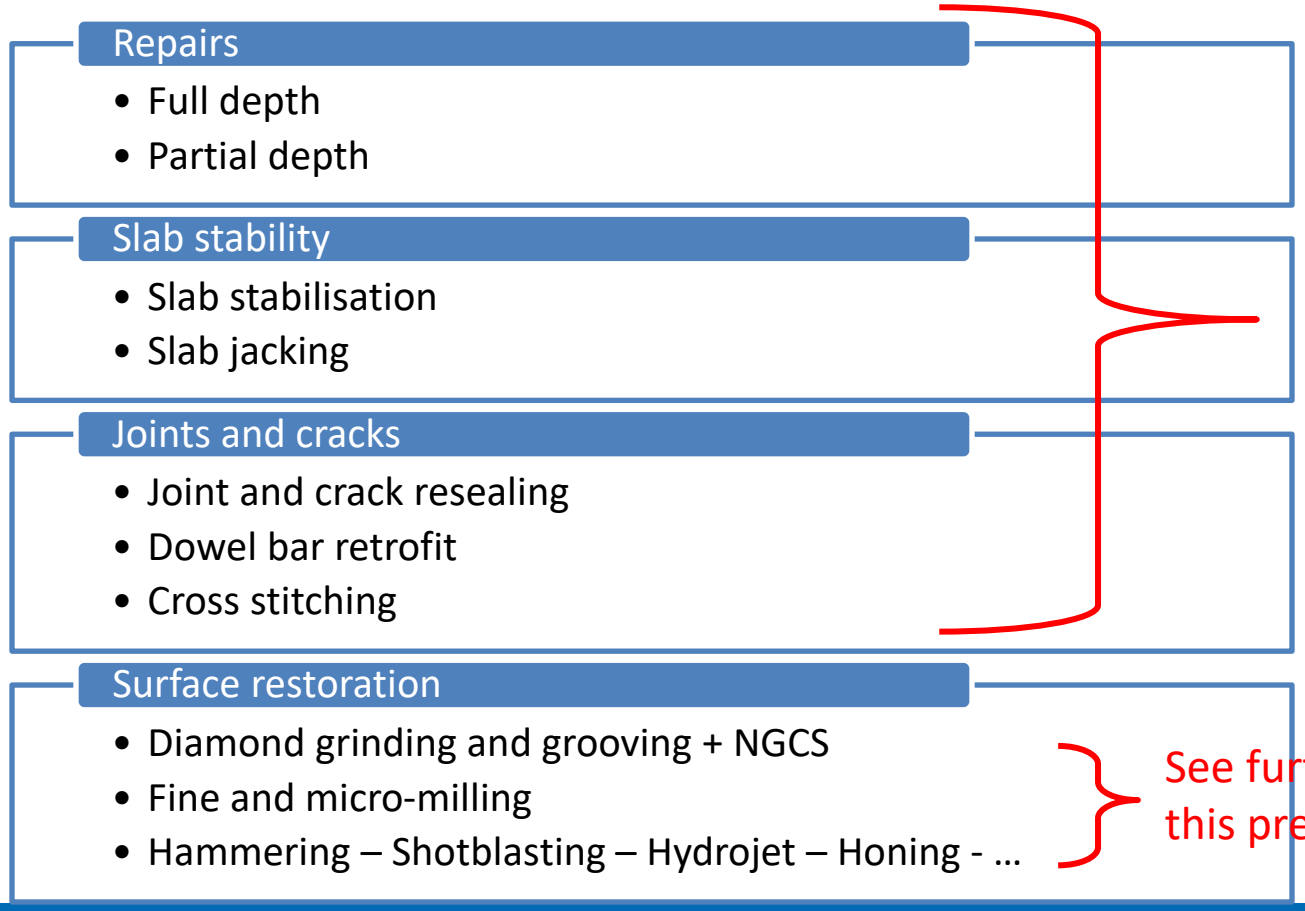
Photo: L. Tiefenthaler

CPP Concepts & Strategies

- Key Factors affecting CP performance
  - Durability of materials
    - = required for the concrete to whitstand the environment in which it serves
      - Deicer scaling
      - ASR
  - Construction techniques
    - Compaction
    - Curing

CPP Concepts & Strategies

- CPP Treatments



Evaluation of existing concrete pavement

- Methods for evaluating the condition
  - Evaluating structural adequacy
    - Layer thicknesses, strength and stiffness, uniformity of support, joint load transfer efficiency
  - Assessing durability of the pavement materials
    - Ability to whitstand environmental deterioration
  - Assessing the functional adequacy of the pavement
    - Smoothness, noise, surface friction, hydroplaning potential...

→ See next presentation by dr. ir. Anne Beeldens

Engineering economic analysis

- Provides a way of comparing the expected benefits from a proposed investment with the costs of that investment
- = aid in decision process
- Leads to identification of “preferred alternative” for the design, maintenance, preservation, rehabiliation or reconstruction of a particular project
- Discounted cash flow methods
  - PWC: present worth of cost
  - NPV: net present value
  - EUAC: equivalent uniform annual cost
  - B/C: benefit/cost ratio

Engineering economic analysis

- For EUPAVE, the use of LCCA is essential for a fair public procurement
- More information and examples are available:
  - in our publication
  - From the author: Manu Diependaele, MSCE, P.E. ,LCCA Consultant - manu.diependaele@gmail.com Mob.: +32 495 58 71 90

Surface restoration

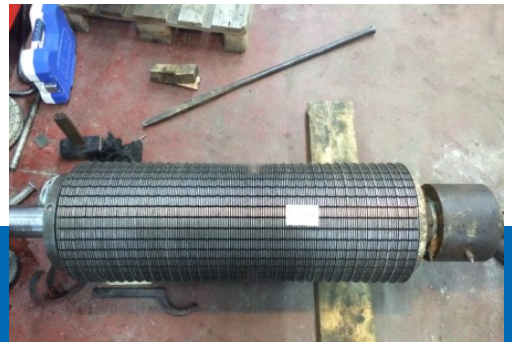
- Possible definition:
  - (Mechanical) Treatments of the hardened concrete surface in order to improve certain surface characteristics without jeopardizing other ones
    - Evennes
    - Skid resistance
    - Noise



- E.g. :
  - improving evenness while maintaining (or improving) skid resistance
  - improving noise while maintaining (or improving) skid resistance and evenness

Diamond Grinding

- Improvement of evenness – rolling noise – skid resistance
- Creation of fine, narrow spaced longitudinal grooves
- Self-driving machine
  - Rotating drum equiped with diamond blades
  - Precision suspension



Next Generation Concrete Surface

- Developed in the U.S.
- Optimised combination of grinding and grooving
- “Negative” texture: flat structure on top

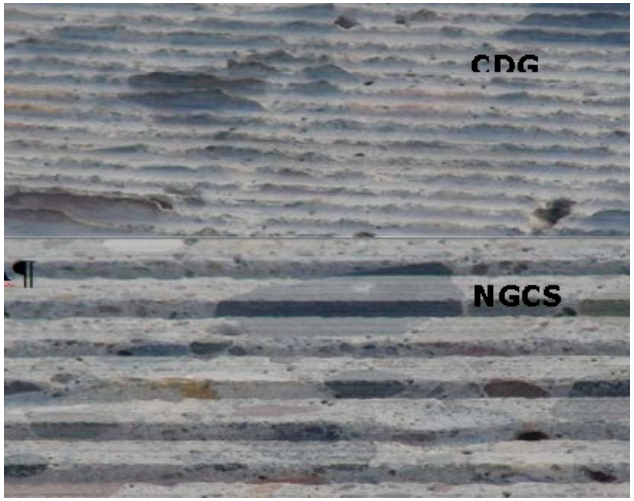
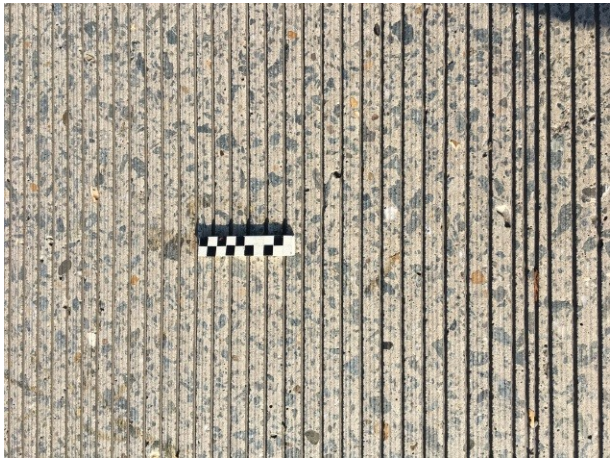


Figure 22 NGCS UTE Test Strip at MnROAD Cell 37[13]

NGCS

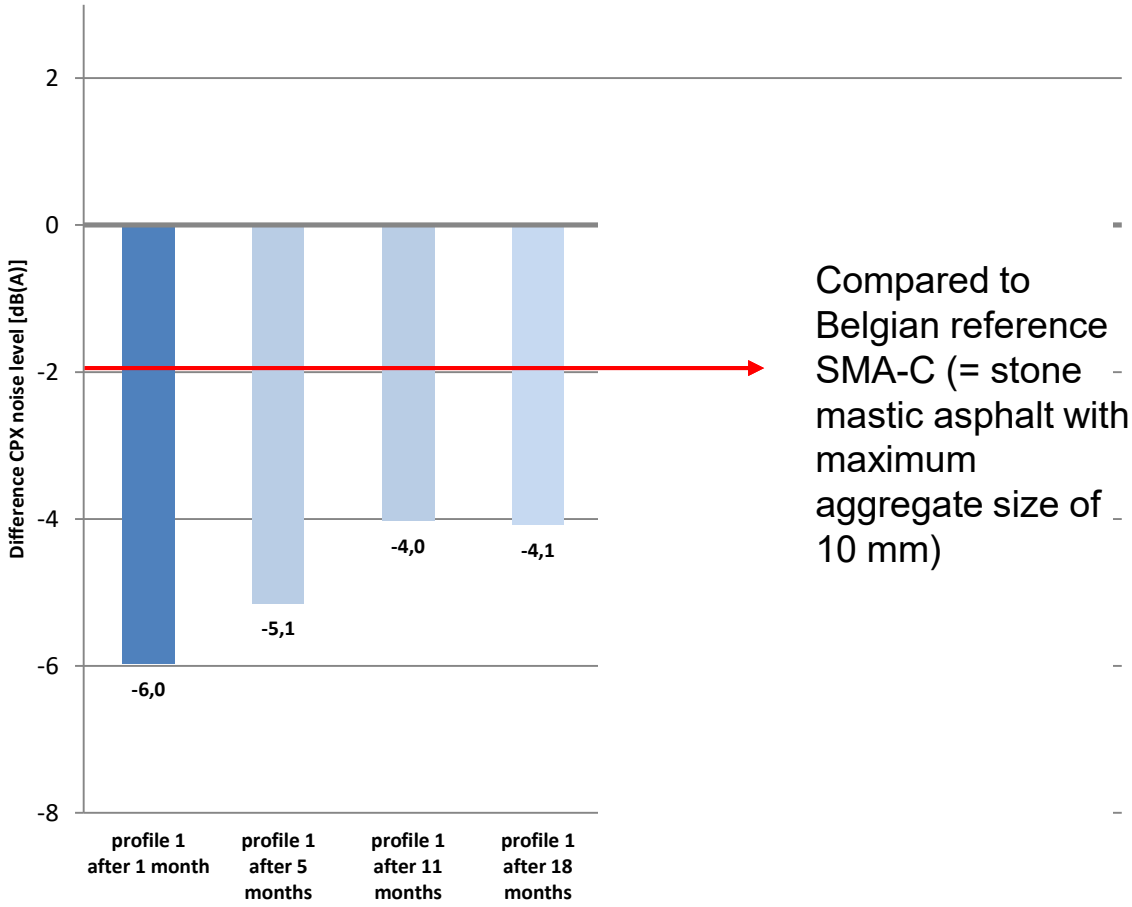
NGCS – Test section N44, BE



Profile	Longitudinal grooving: Segment blade	Diamond grinding: Segment blade	Spacer
1	Thickness: 2.8 mm Diameter: 363 mm Depth groove: ± 4 mm	Thickness: 2.8 mm Diameter: 356 mm Depth groove: ± 1 mm	1.5 mm

NGCS – Test section N44

Measured difference in CPXP noise level compared to existing road pavement – SRTT (passenger car tyre) - 80 km/h



Compared to Belgian reference SMA-C (= stone mastic asphalt with maximum aggregate size of 10 mm)

Fine milling and micro-milling

- Improvement of evenness – rolling noise – skid resistance
- Self-driving machine
  - Rotating drum equiped with picking tools
  - Similar to asphalt milling but higher number of tools
  - Precision suspension
  - Water cleaning and aspiration

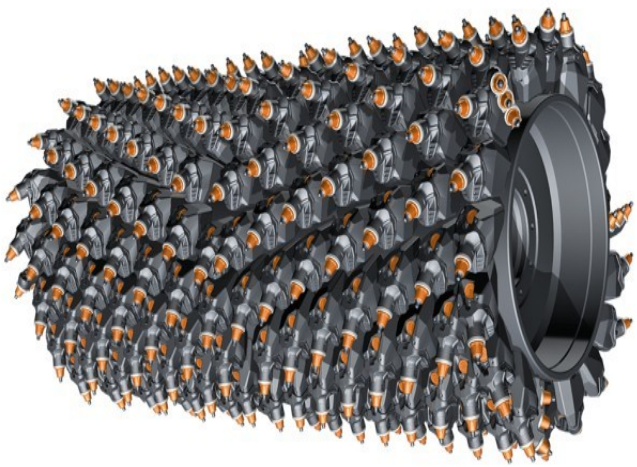
Fine milling and micro-milling

- Some results of fine milling (mainly applied on local roads)

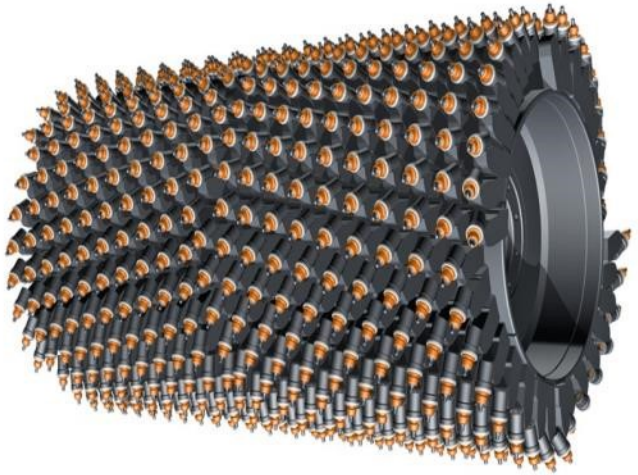
Attention to damage of the joints

Fine milling and micro-milling

Fine milling drum: for high demands on profile (e.g. removal of surface courses, corrective milling work on road profiles) Milling width: up to max. 80 mm, **tool spacing: 8 - 10 mm**

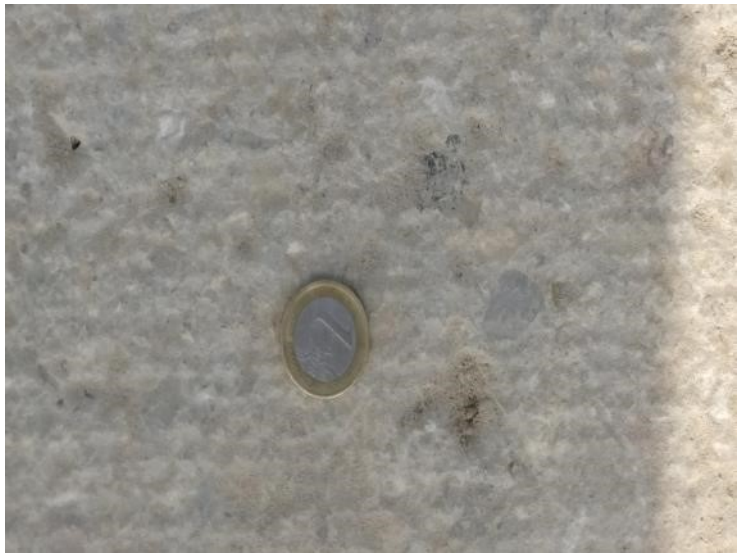


Micro-fine milling drum: For the highest demands on profile (e.g. increase in surface grip by roughening road surfaces, Preparation milling for surface treatment and cold paving of this layers, Removal of road markings) Milling width: up to max. 30 mm**, tool spacing: 3 - 6 mm**



Fine milling and micro-milling

- Some results of micro-milling



Surface restoration

- Many developments are still going on in the field of surface restoration and surface finishing, mainly the techniques of grinding and grooving
  - Improvement of machines and materials
  - New patterns for better noise reduction – skid resistance - durability

- Will be the theme for one of our next workshops in the future

Thank you for your kind attention