CART: Cold Asphalt Recycling Train

Experiences with high quality cold in-situ recycling of asphalt

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kws.nl

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Asphalt roads - Netherlands

- Dutch asphalt roads
  - Relative thick asphalt layers
  - Pavement design based on stiffness and fatigue
- 100% balance of RAP in hot asphalt
- Sustainability and environmental consideration are important. Opportunities for technologies like BSM and CART
- For KWS, BSM consist of pure RAP without mixing underlaying sub-base

BSM in Netherlands

- Goal KWS: use BSM as a high-quality wearing layer, with a thin surface layer
- In past, mainly sub-base of slag with foamed bitumen and overlaid with 12-14 cm asphalt
- Working group in NL, to further develop the design philosophy of BSM
- KWS believes in South African method [TG-2]
- Local and rural roads, outside urban areas, where adjustments to the road's elevation are possible

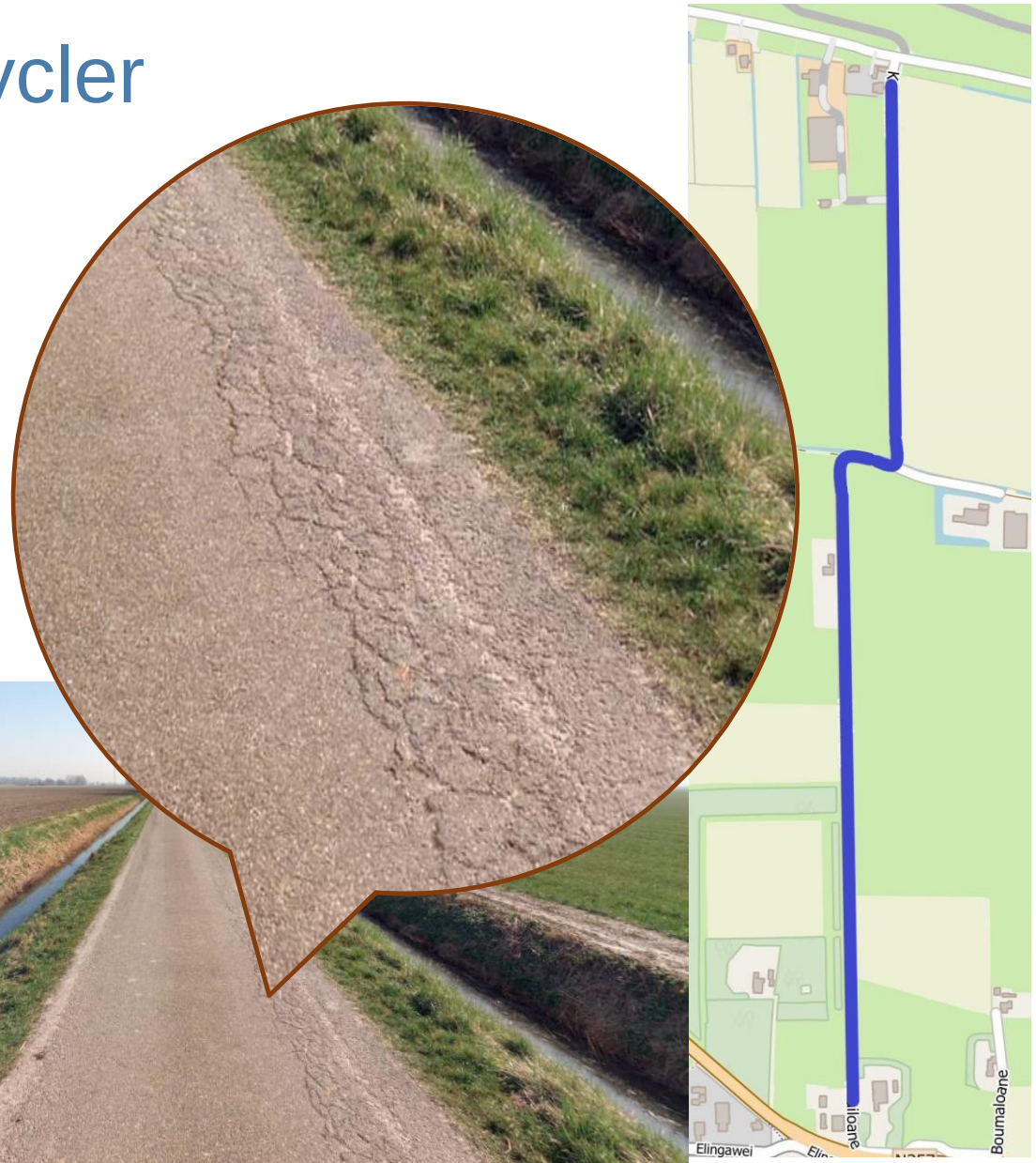
Methods for producing BSM

	Milling - BSM	Profiling - Compaction
Cold recycler		 
Soil Stabilizers	 	 
Mobile Mixing plant	 	 

Pictures : www.wirtgen-group.com

1st Pilot project – Cold Recycler

- Tertiary road, length 1.500 meter.
- Road pavement structure:
  - 205 mm – Asphalt
  - Subbase - Inconsistent thickness of brick rubble
  - Subgrade – soft clay
- Road width 3,0 m, with narrow shoulders and deep ditches.
- Overall, a high degree of cracking and unevenness/subsidence on the road edge.



1st Pilot project – Cold Recycler

- Sand – binder and RAP, needed to be levelled
- Sufficient load-bearing capacity of reaming pavement to support the machines
- Sharp corners are not possible
- After 2 years, there are still no (edge) damages

2nd pilot project – Soil stabilizer

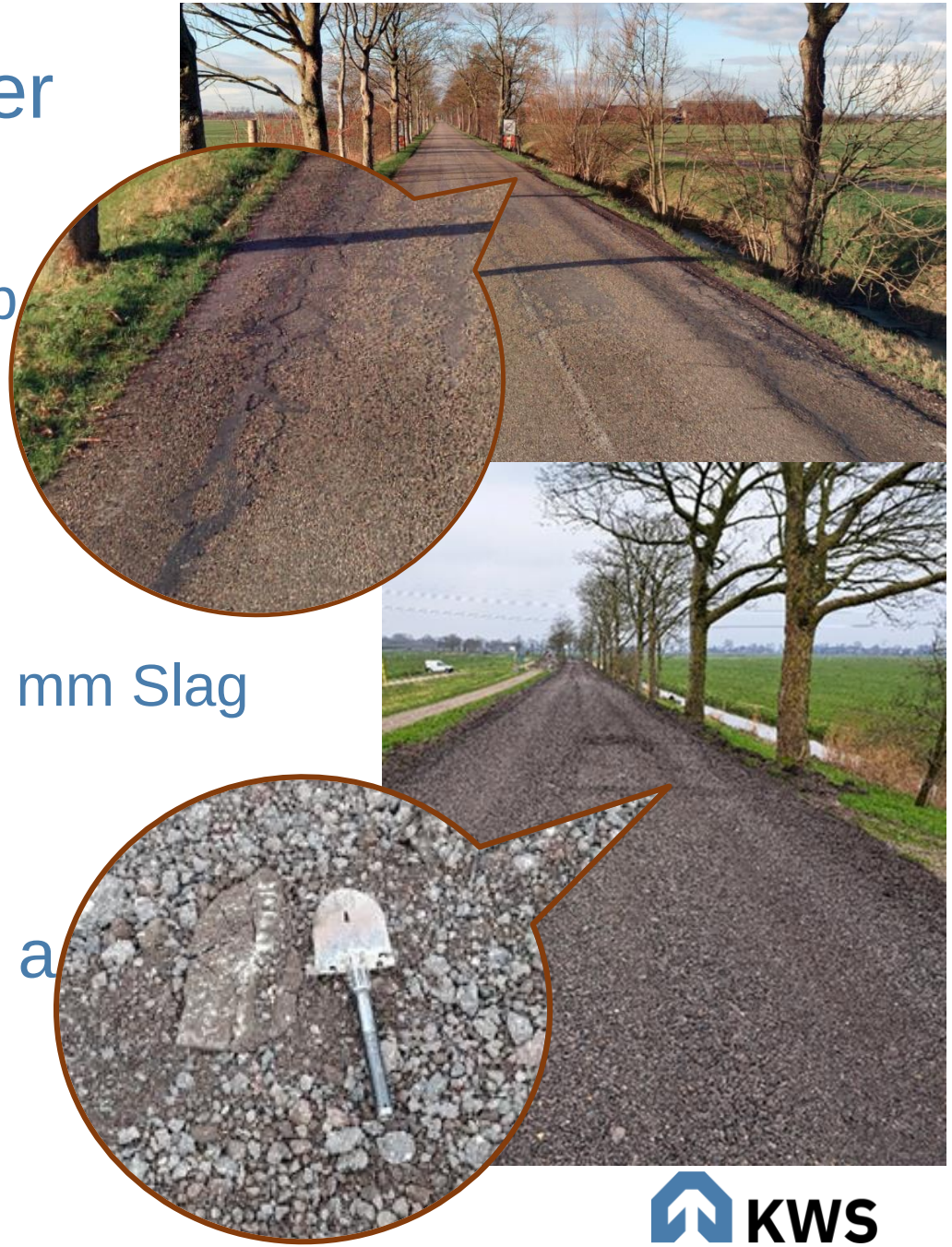
- New road on construction site
- Goal, can BSM be applied under Dutch conditions without an asphalt top layer
- Length 370 m, width 6,0 m.
  - 100 mm – BSM, finished with tack coat
  - 250 mm – Subbase, crushed concrete and masonry
  - Subgrade - Sand
- RAP is been delivered on site, from other location

2nd pilot project – Soil stabilizer

- Binder content too low, resulting in uneven distribution
- BSM surface has a non-homogeneous texture
- Usage ravelling in curves, no issue on straight section
- Because ravelling and dust, the BSM is covered with an asphalt surface layer

3rd pilot project – Soil stabilizer

- Tertiary road, length 2.300 m
  - Width 5,0-5,3 m, narrow shoulders and deep ditches
  - Asphalt construction end-of-life
- Road pavement structure:
  - 130-165 mm – Asphalt
  - Subbase – partly, 80 mm clay pavers or 200 mm Slag
  - Subgrade – Sandy clay
- Asphalt is pre-milled [120 mm] with an asphalt milling machine and profiled with a grader.
- Because up-cut of regular milling machines, big parts in RAP



3rd pilot project – Soil stabilizer

- Crushed sand and binder, added on the RAP
- BSM has a better homogeneous mix quality.
- Narrow shoulders and limited edge restrains cause issues compacting the edges. Point of attention when working with a soil stabilizer.
- Static loads on edge, leads to a deformation

Findings

- RAP in NL → $Pen_{bit.}$>10, addition of crushed sand is needed
- Cold recycler and Soil Stabilizer can both produce a high-quality BSM pavement
- Soil stabilizer has limitations, no pre-compaction (edges), limited lateral mixing and a risk of segregation
- Use of Cold Recycler in combination with paver, best solution for BSM in the Netherlands
- For smaller projects, a Mobile Mixing Plant can offer a solution and might be the best option for the Dutch situation

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Future of BSM in NL

- Design for BSM
  - Clients and road authorities are accustomed to thick asphalt constructions. Transition to a thin asphalt layer on BSM, is new and considered risky
  - For now, BSM test sections on lower-order roads. This helps to gain experience and build trust among clients for future projects
- BSM is a promising product for sustainability of road constructions in NL. However, it can only be applied in complete asphalt reconstruction
- Compared to normal asphalt, producing BSM using Cold Recycler results in:
  - **50% CO2 savings**
  - **35% ECI reduction**

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