APPLICATION OF COLD REMIX TECHNOLOGY IN THE HUNGARIAN ROAD BUILDING

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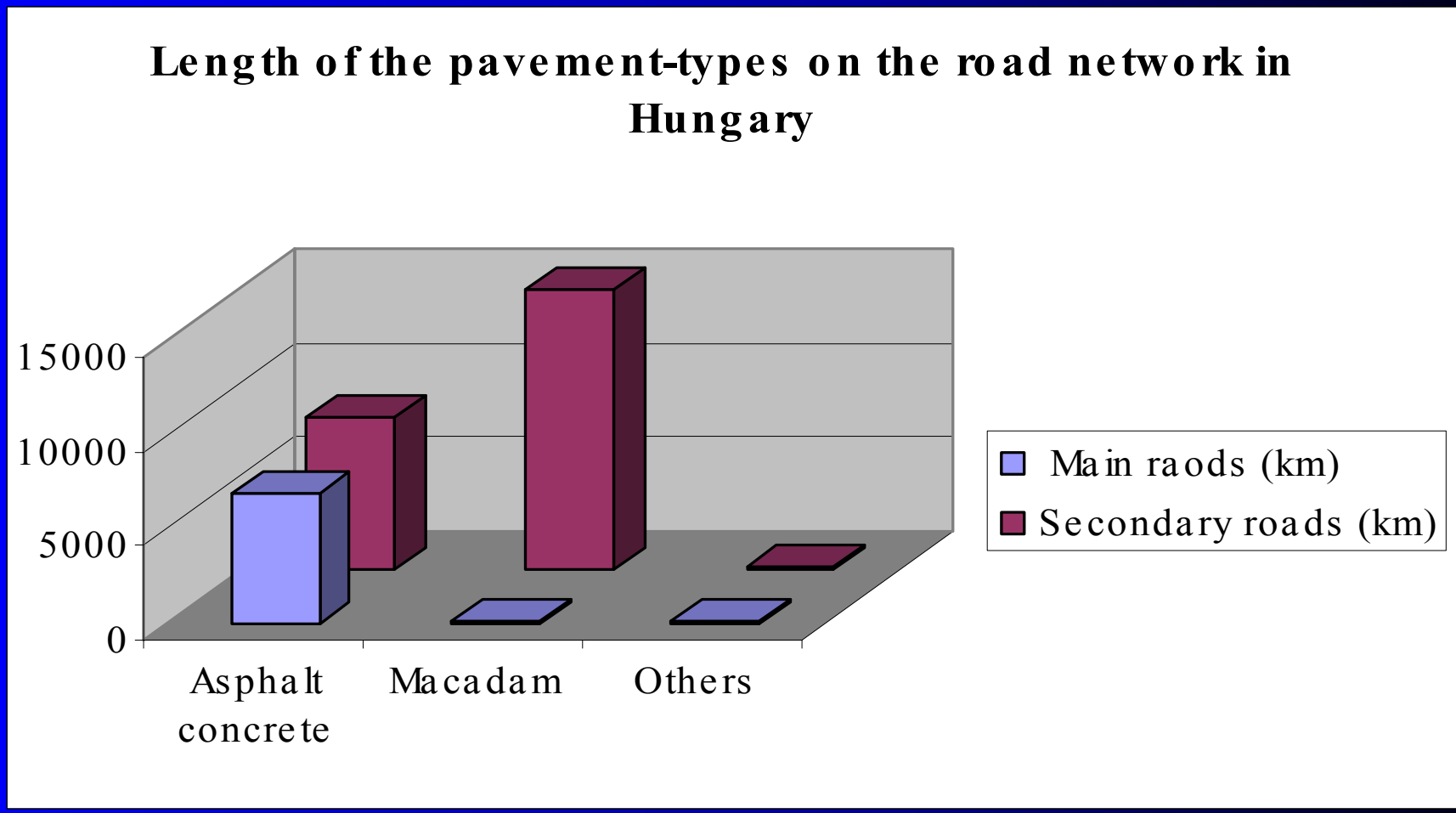
Topics of presentation

- ✓ Data of Hungarian road network
- ✓ Cold recycling techniques in-place in Hungary
- ✓ Study cases
- ✓ Conclusions

Data of Hungarian road network



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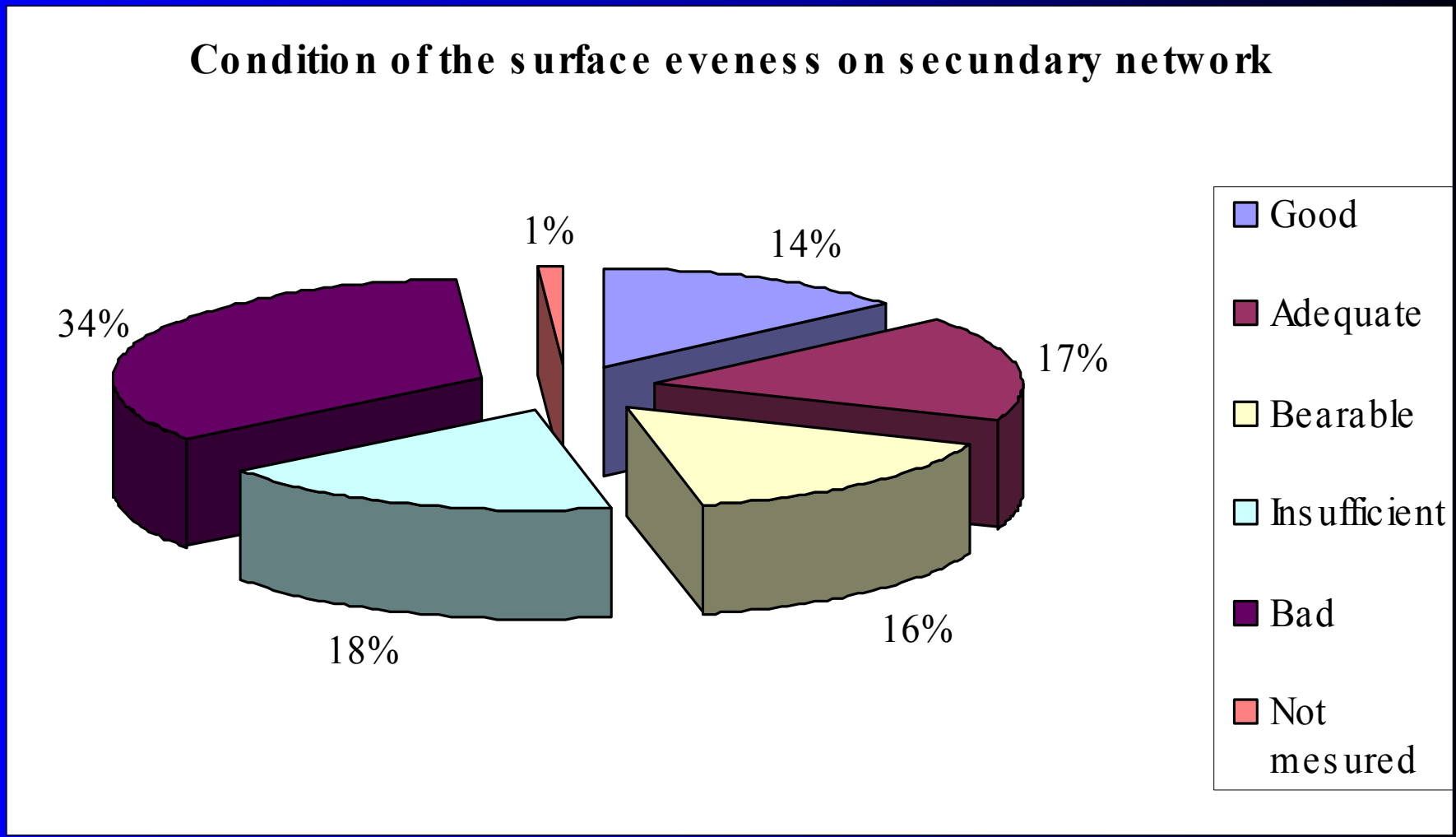

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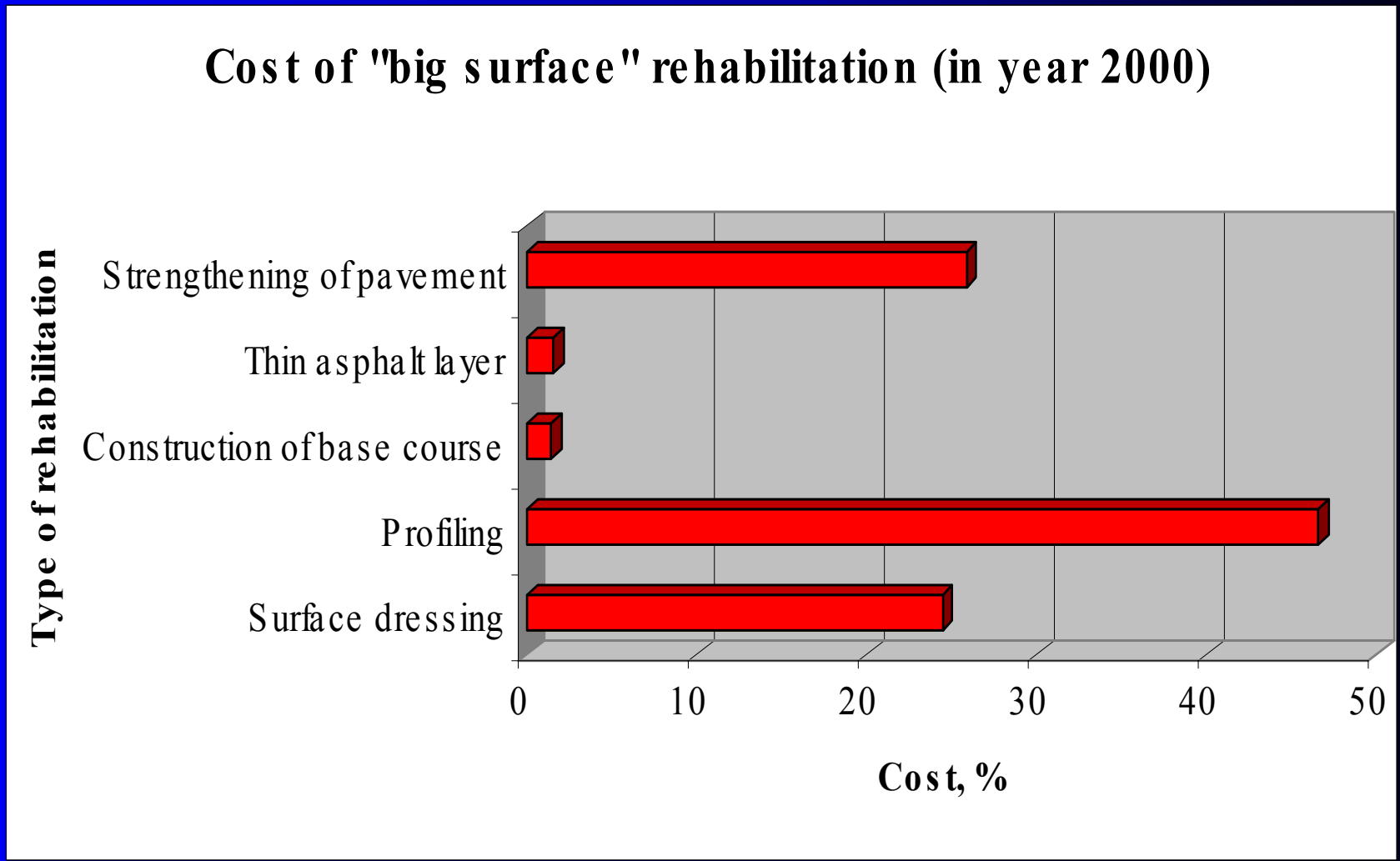


Cold recycling techniques in-place in Hungary

- ✓ **recycling asphalt with binder spraying**: milled/demolished asphalt spreading, bitumenemulsion spraying, 2/5 mm chipping spreading, rolling the layer

- ✓ **remix technology with mixed recycling asphalt**: milled/demolished asphalt spreading, bitumenemulsion spraying, in place milling and mixing the existing layer with the spreaded asphalt, laying the new mixture, rolling the layer

- ✓ **deep remix technologies in situ**:
  - reparation adding water and bitumenemulsion
  - reparation with cement
  - reparation adding cement slurry
  - reparation adding cement slurry and bitumenemulsion
  - reparation with foamed bitumen
  - reparation adding foamed bitumen and cement

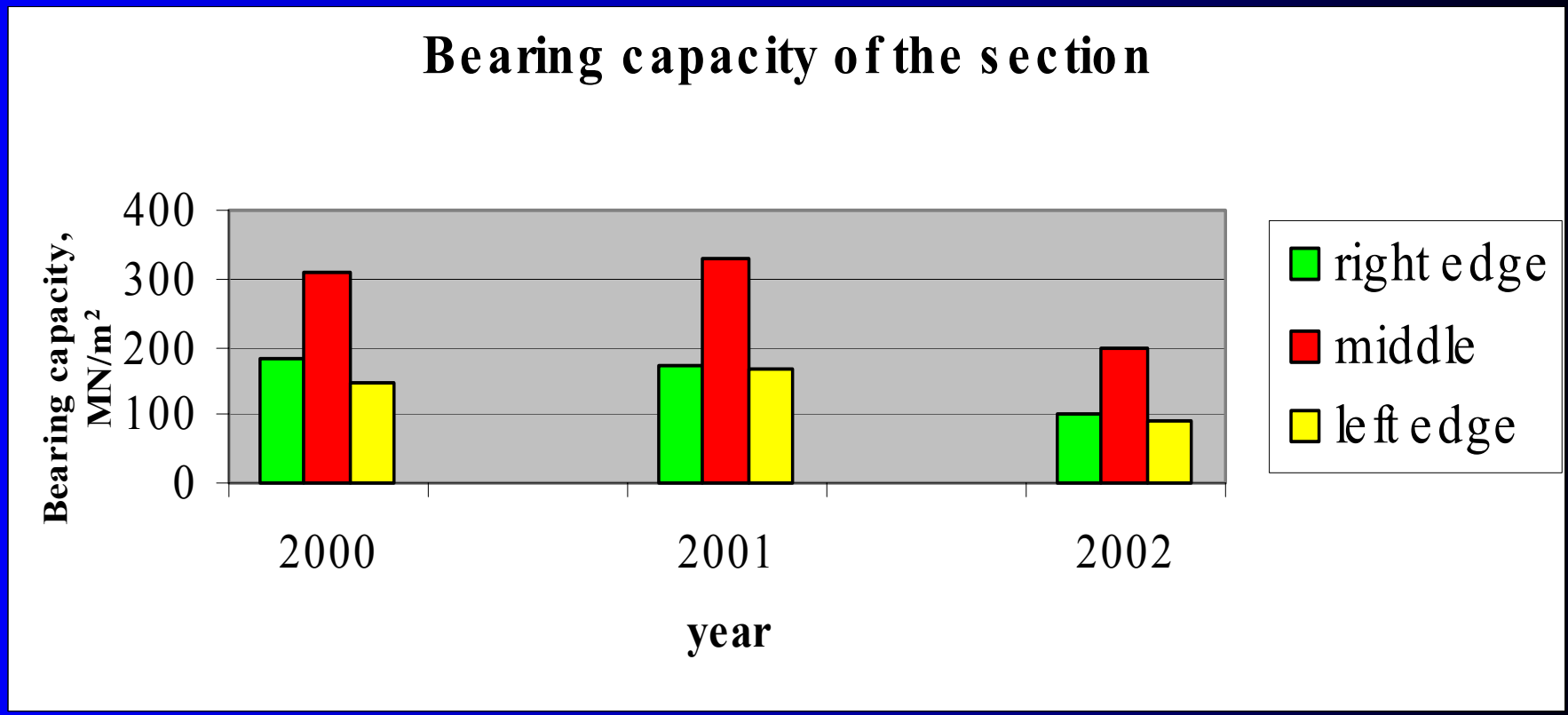
Application example
Remix technology with mixed recycling asphalt

Experimental section

- Year of construction ⇨ 1999
- Length of the section ⇨ 1, 6 km
- Traffic loading: AADT = 520 PCU/day, heavy traffic: 147 V/day.
- Width of the existing layer ⇨ 3,5 – 4, 0 m
- Before the cold remix procedure widening on both sides altogether to 6 m.
- The existing structure was 7-10 cm coated macadam and 15 cm crushed stone base.
- Widening ⇨ with 20 cm lime crushed stone.
- On the widened surface a finisher laid 6 cm thick 0/25 mm grain size old asphalt granulate and the recycler mixed it thogether with 6 cm thick milled layer of the existing pavement.
- After precompaction of the layer by rubber roller the cold remix layer was stabilized with special (patented) cationactiv bitumemulsion in 2x2 l/m^2 amount. The binder is suitable for the rejuvenation of the aged asphalt layer.
- 10 kg/m^2 UKZ 2/5 crushed stone was layed on top of the cold remix layer and it was compacted.

Application example

Remix technology with mixed recycling asphalt



- Prescribed value of plate bearing capacity $E_2 > 80$ MN/m^2

Application example
Remix technology with mixed recycling asphalt

Texture depth data of surface

Year of measurement	Texture depth (mm)	
	Right side	Left side
2000	0,39	0,43
2001	0,45	0,38
2002	0,44	0,53

The texture depth is equal to the surface mean texture depth of an AB-20 type asphalt concrete where the required value is MTD = 0,50 mm.

Application example

Remix technology with mixed recycling asphalt

experimental section in 2002

texture of the surface

Application example

Deep remix technology with foamed bitumen and cement

Experimental section

- Year of construction ⇨ 1999
- Length of the section ⇨ 4, 9 km
- Traffic loading: AADT = 2842 PCU/day, heavy traffic: 427 V/day.
- The perliminary tests were carried out on core samples.
- Criteria of mixdesign (modified Proctor test):

  unconfined compressive strength (after 7 days on 5 °C) > 1,5 MN/m^2
- Optimal mix composition: 85 % existing material, 15 % 0/20 mm crushed dolomite, 3 % cement (CEM 32,5 type), 3 % foamed bitumen, 6 % water content (w_{opt})
- Production of foamed bitumen ⇨ on 170-180 °C
- Applicated bitumen type ⇨ B 70/90 bitumen
- Needed water for foaming ⇨ 2 % based on bitumen.

Application example

Deep remix technology with foamed bitumen and cement

Construction procedure

- Laying of cement and crushed dolomite on the existing surface.
- The 17 cm thick part of the existing pavement was milled by the recycler (Recycler 2500)
- After adding the water and foamed bitumen the materials were mixed
- The treated materal was layed by the recycler
- Precompaction by rubber roller
- The required surface was shaped by grader and compacted by vibrating rollers
- In the top of deep remix course was layed 6 cm AB-16/F asphalt concrete type wearing course

Application example

Deep remix technology with foamed bitumen and cement

Qulity reqiurements and test results

Parameter	Frequency	Pescriptions	Test results
Unconfined compressive strength (after 7days)	every 2000 m^2	1,5-3,5 MN/m^2	1,52 - 2,37
Compaction rate	1000 m/cuts	97 % (min. 95 %)	97,1 - 101,0
Thickness	1000 m/cuts	prescribed value –15 %	18,1 - 23,1
Bearing capacity (light falling weight deflectometer)	200m/cuts	min. 120 MN/m^2	102 - 187

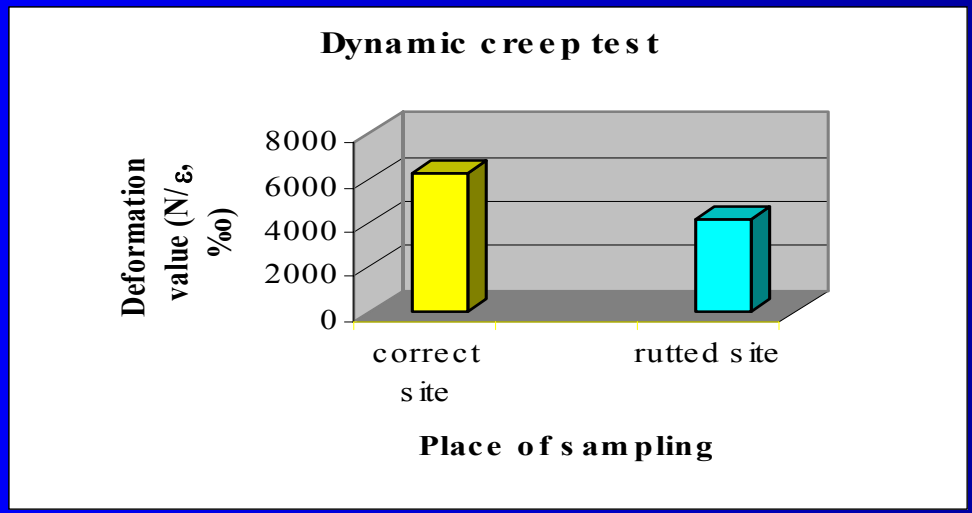
Application example

Deep remix technology with foamed bitumen and cement

experimental section in 2002

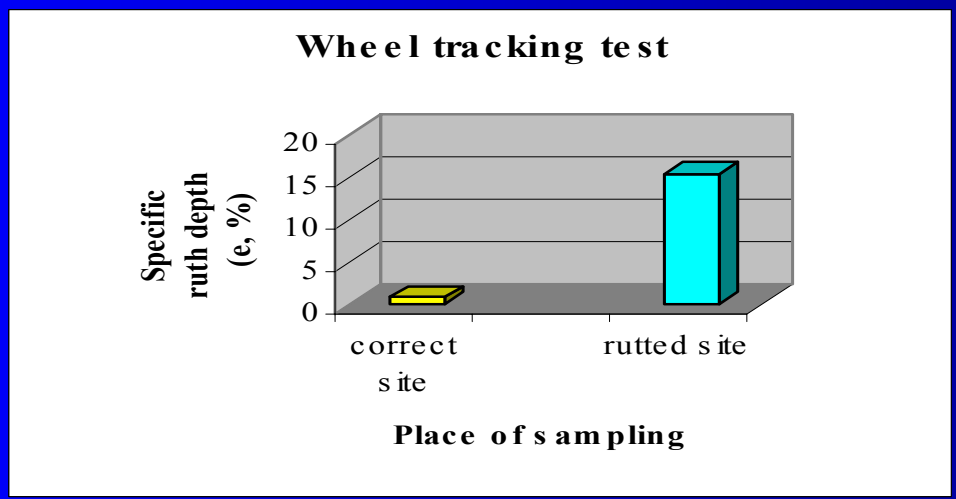
Application example

Deep remix technology with foamed bitumen and cement



Dynamic creeping test of the wearing course

type AB-16/F asphalt concrete



Wheel tracking test of the deep remix layer

Application example

Deep remix technology with foamed bitumen and cement

Deflection data

Place of measuremet	Deflection (mm) measured by KUAB	
	Outer wheel track	Inner wheel track
Correct site	0,34	0,28
Faulty site	0,67	0,60

Conclusions

- The behaviour of the experimental sections since the constructions time was generally favourable.

- It is very important:
  - the sufficient dewatering of the existing pavement structures
  - the equal bearing capacity of the existing pavement
  - the sites having weak bearing capacity should be repaired before constructions

- At the cement-bitumen deep remix techniques the keeping of the determined cement-bitumen rate is very important. Altering of the rate will result either a rigid, susceptible for cracking mixture or developing of site having weak bearing capacity.

Conclusions

- The utilization of milled/demolished asphalt materials for cold recycling techniques is favourable in Hungary because of the milled/demolished asphalt is qualified as „dangerous waste product” and therefore its deposition is strictly regulated.

- From costs aspects
  - the techniques using bitumenemulsion are appr. 30 % more expensive
  - the cement-foamed bitumen techniqeus are appr. 80 % more expensive

  than the conventional rehabilitation of big surfaces (preshaping and laying of 4 cm hot asphalt mixture). Because of the cost aspects the cold recycling techniques are still experimental state in Hungary.

THANK YOU
FOR THE ATTENTION