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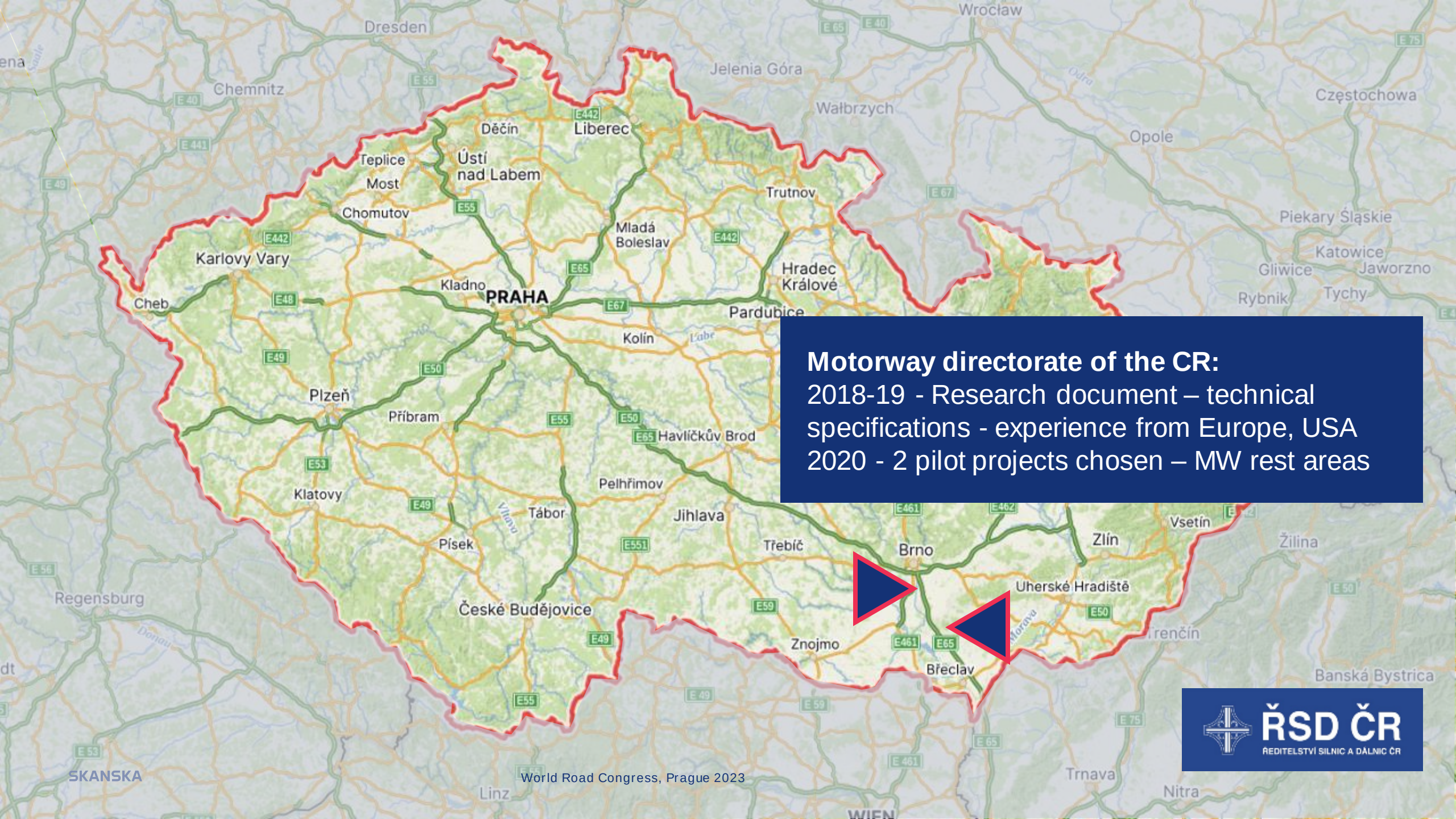
The first Whitetopping in the Czech Republic

Bohuslav Slansky,
Skanska



Motorway directorate of the CR:
2018-19 - Research document – technical specifications - experience from Europe, USA
2020 - 2 pilot projects chosen – MW rest areas

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ŘSD ČR
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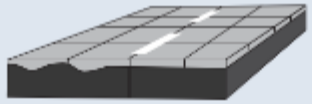
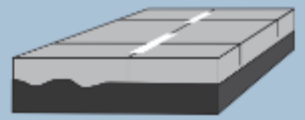
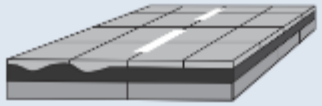
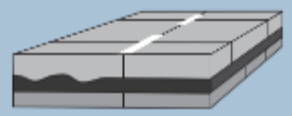
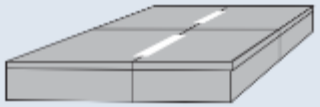
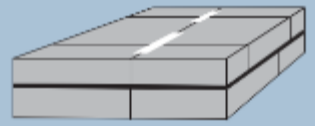
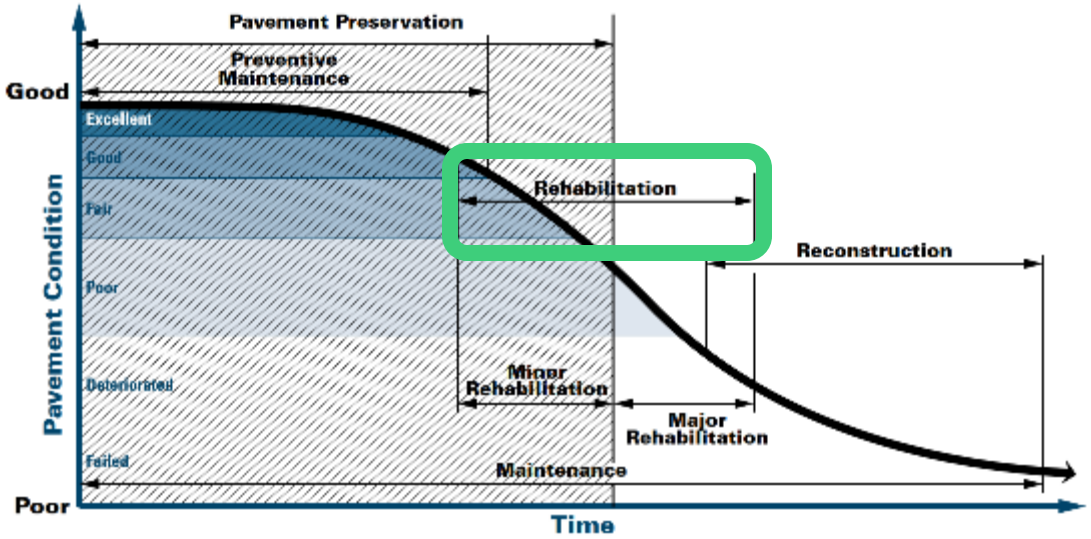
Types of concrete overlays

Bonded Overlay Option	Unbonded Overlay Option
(Preventive Maintenance/Minor Rehabilitation)	(Minor/Major Rehabilitation)
In general, bonded resurfacing is used to eliminate surface distress when the existing pavement is in good structural condition. Bonding is essential, so thorough surface preparation is necessary before resurfacing.	In general, unbonded resurfacing is highly reliable, with longer design life than rehabilitation with asphalt. Minimal preresurfacing repairs are necessary for unbonded resurfacing.
OVER ASPHALT	
	
OVER COMPOSITE	
	
OVER CONCRETE	
	



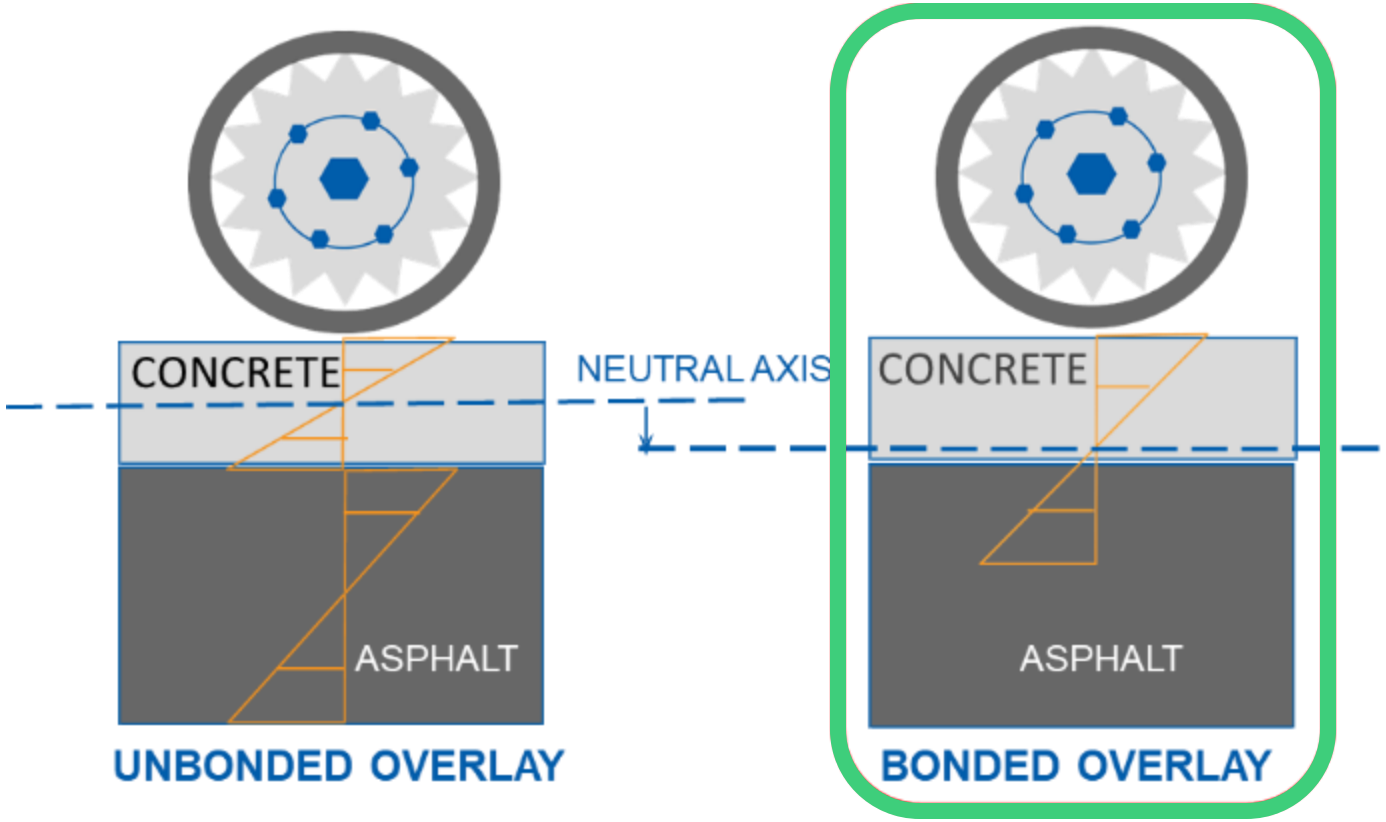
Main principles, benefits

Benefits:

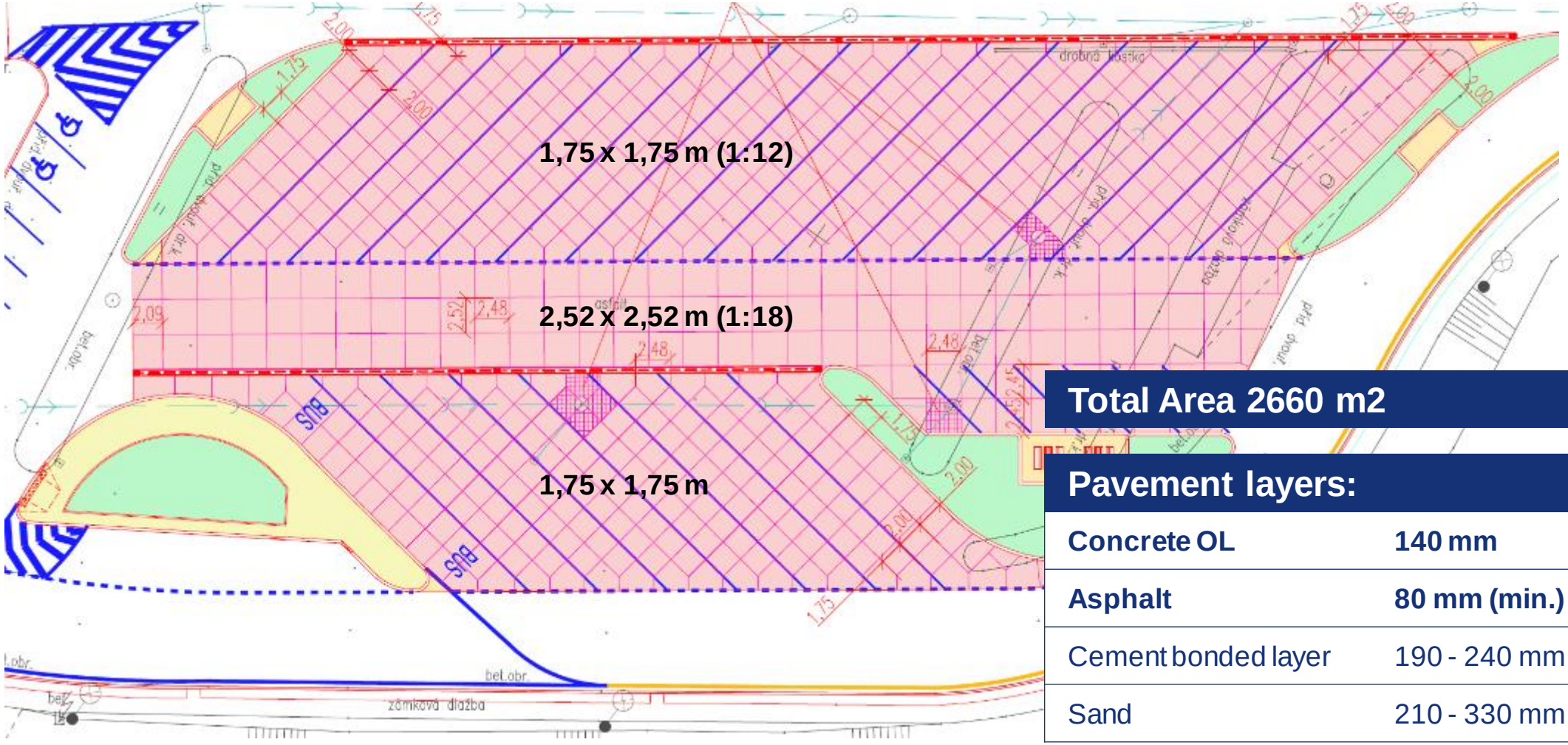
- Increase of loadbearing capacity
- Prevention from rutting
- Increase of life span
- Material, cost, CO2 reduction

Disadvatages:

- More joints
- More complicated details
- More complex technology

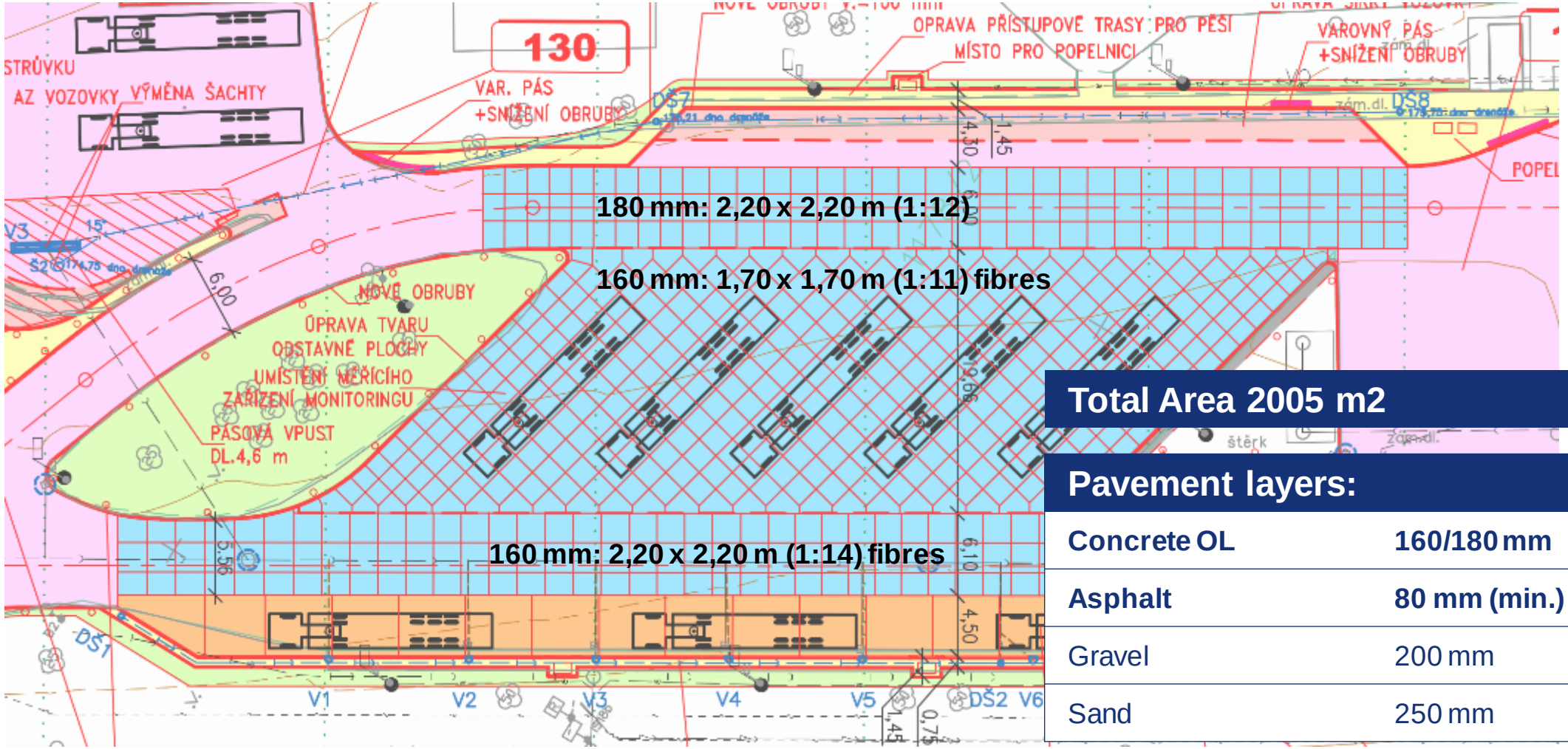


Pilot project 1 – MW D52 RA Rajhrad (09/2020)



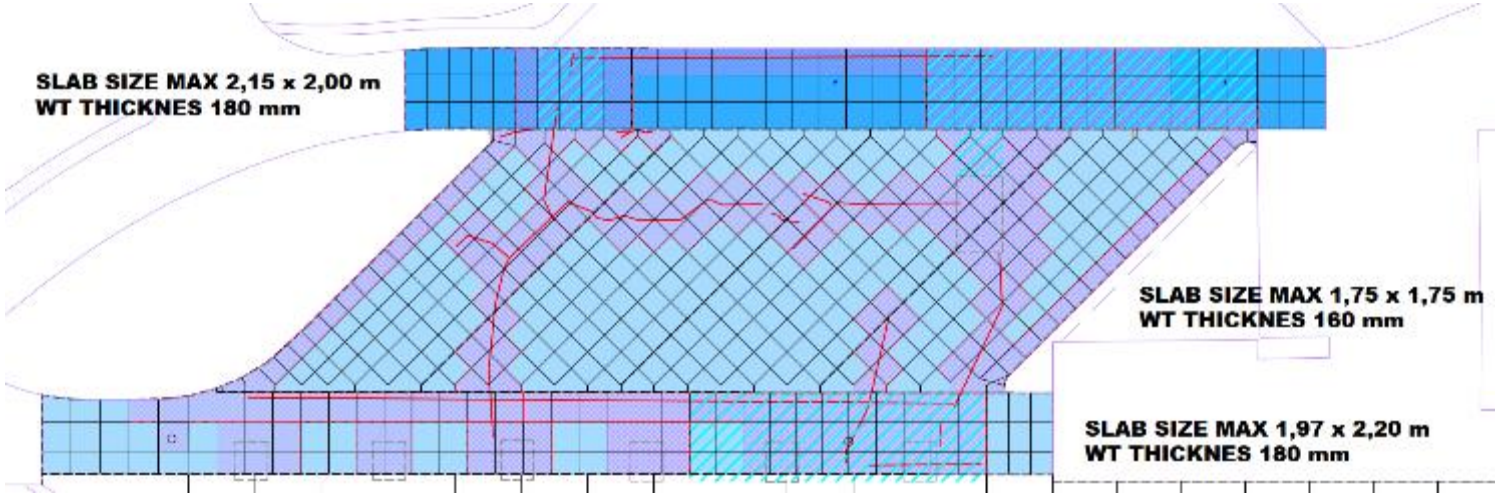
Total Area 2660 m2	
Pavement layers:	
Concrete OL	**140 mm**
Asphalt	**80 mm (min.)**
Cement bonded layer	190 - 240 mm
Sand	210 - 330 mm

Pilot project 2 – MW D2 – Ladná (05/2021)

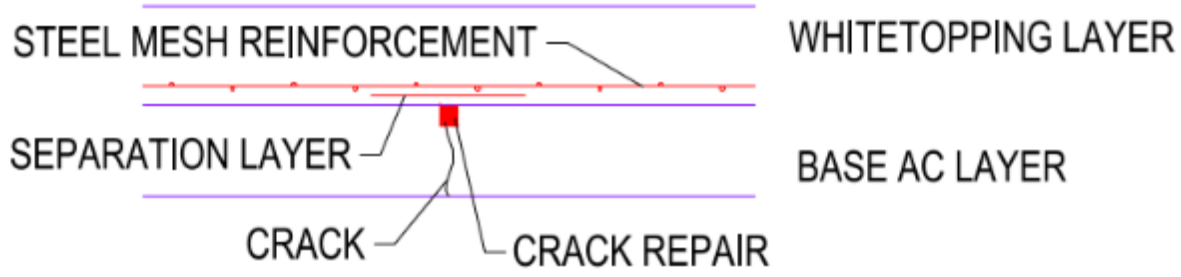


Total Area 2005 m2	
Pavement layers:	
Concrete OL	**160/180 mm**
Asphalt	**80 mm (min.)**
Gravel	200 mm
Sand	250 mm

Sublayer defects and repair



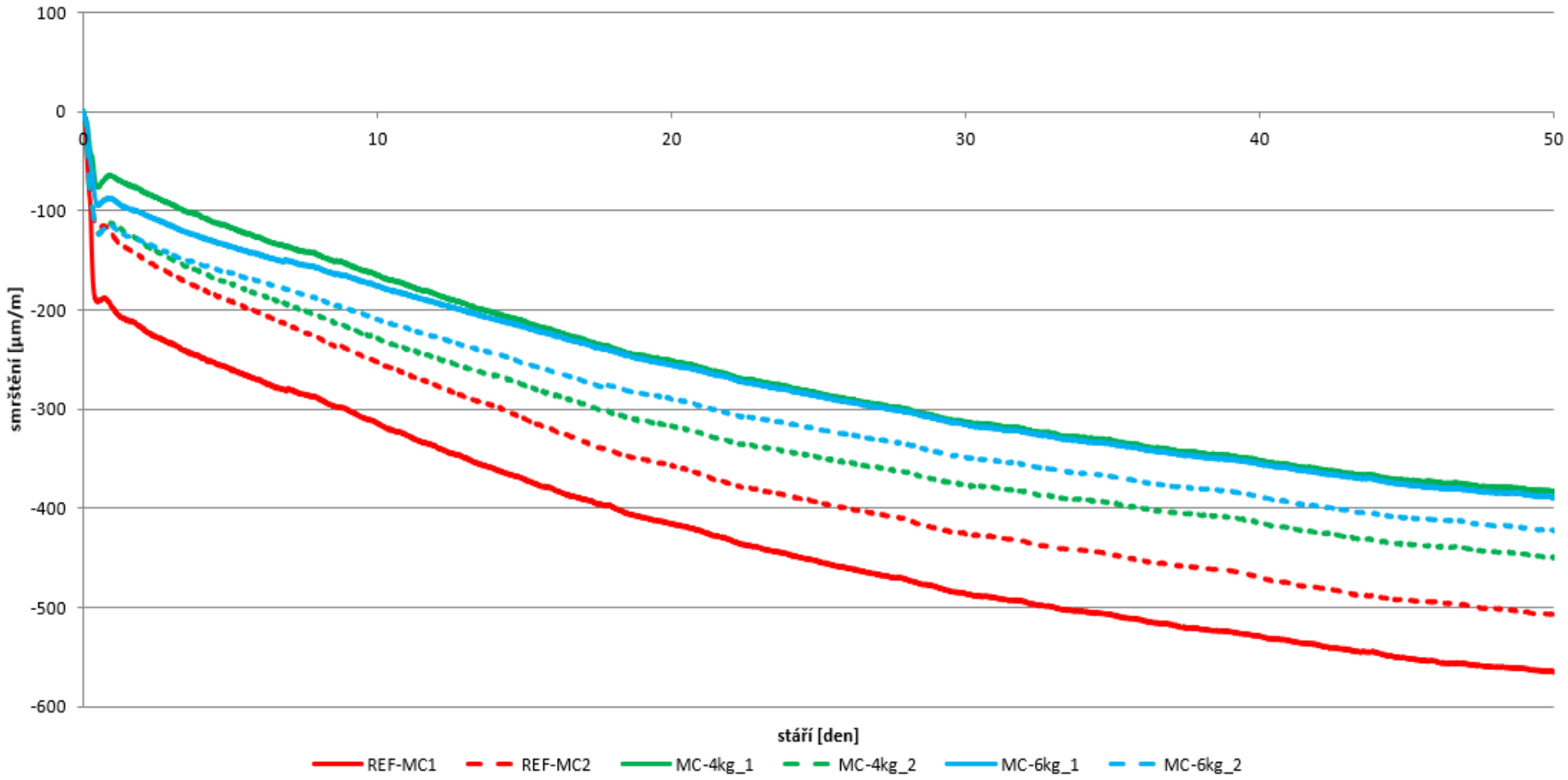
ASPHALT CONCRETE CRACK REPAIR DETAIL



Active cracs

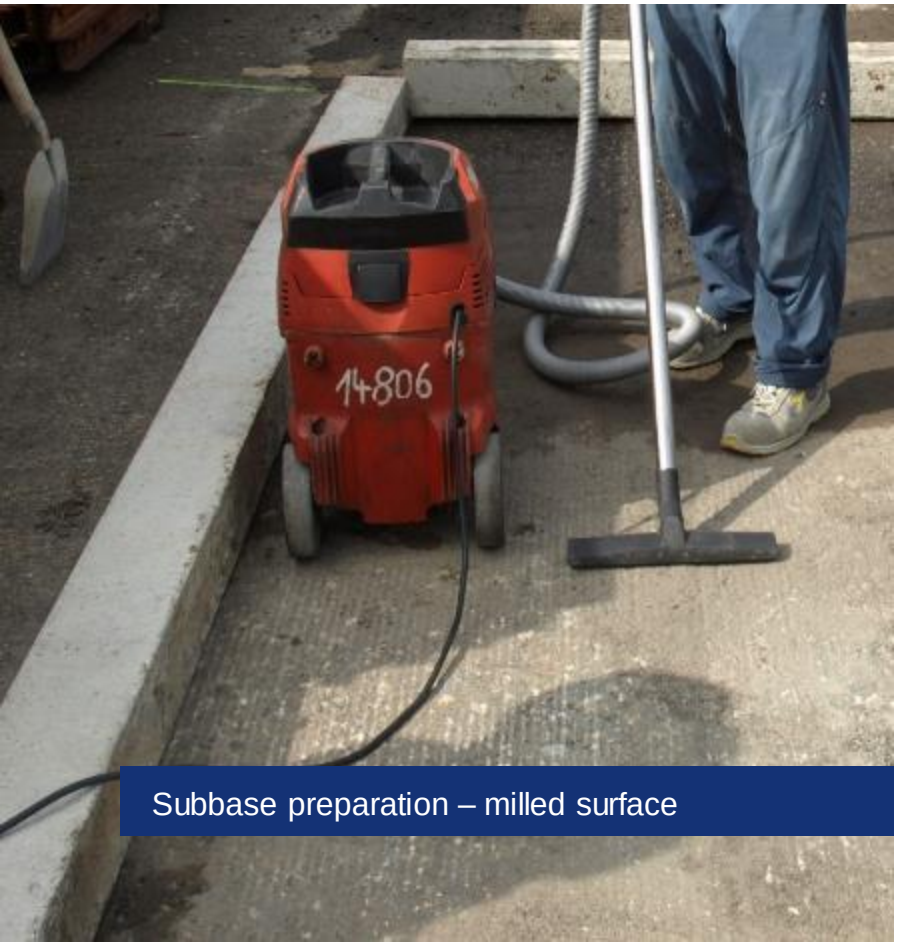
Concrete mix – shrinkage reduction

Volumetric changes in concrete



Concrete C 30/37 XF 4
Glass fibres:
E=72 GPa, 5 kg/m3

Test section – 4 types of adhesion



Subbase preparation – milled surface

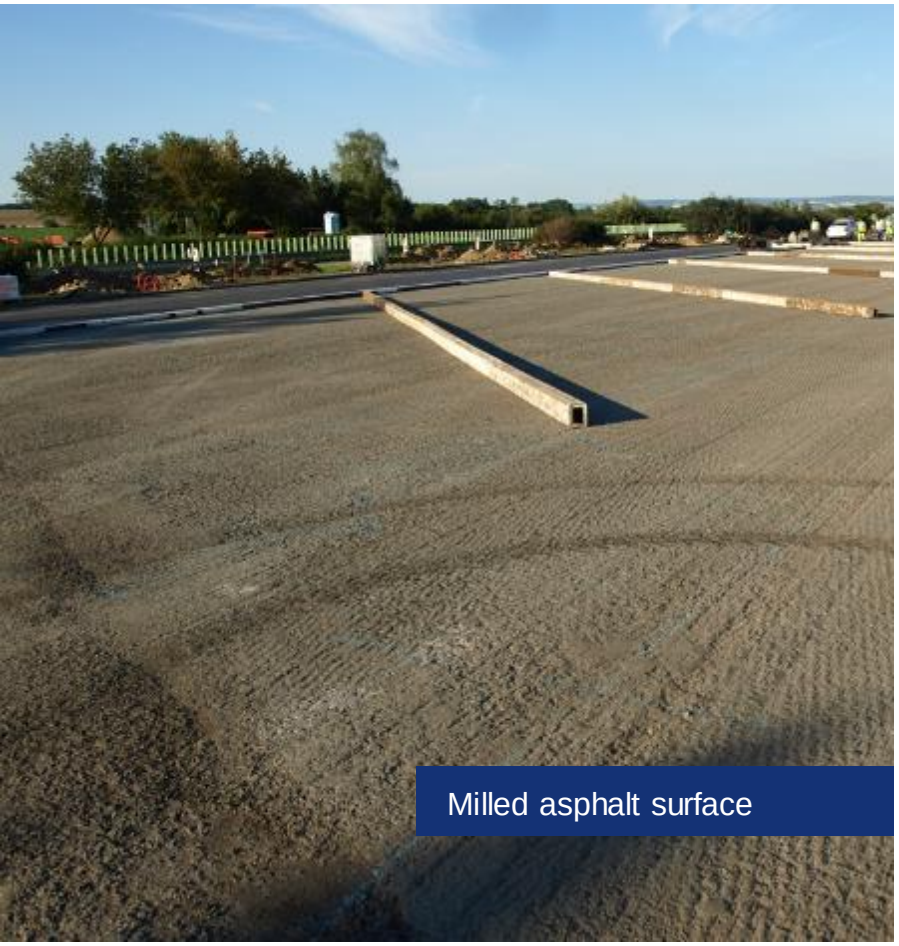
Adhesion agent fresh

Wet surface

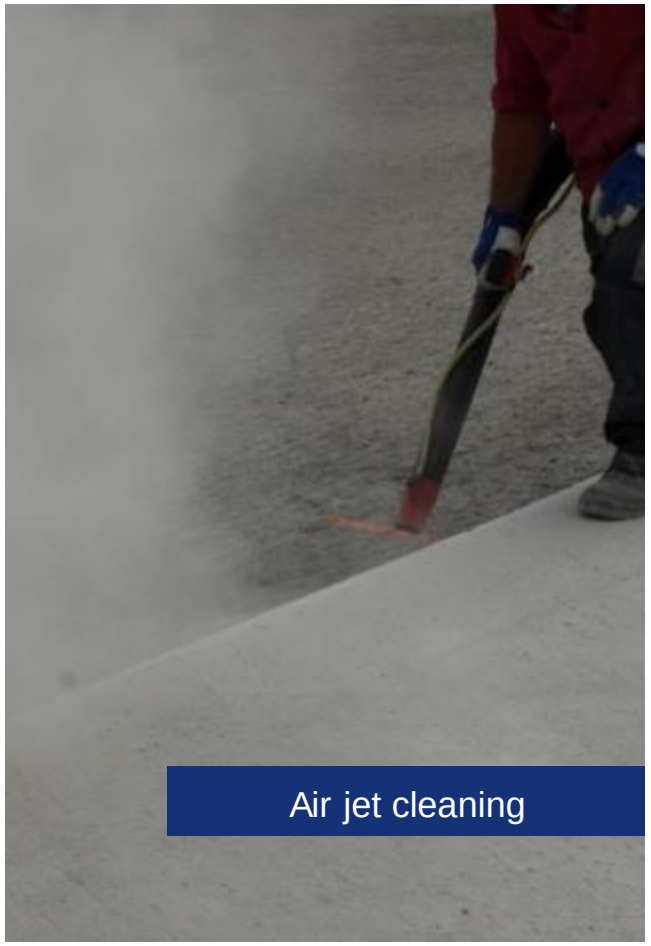
Adhesion agent dried 60 min

Dry surface

Construction – subbase milling and preparation



Milled asphalt surface



Air jet cleaning

Adhesion agent

Reinforcement over defect parts

Steel mesh over cracks in asphalt

Concrete overlay paving

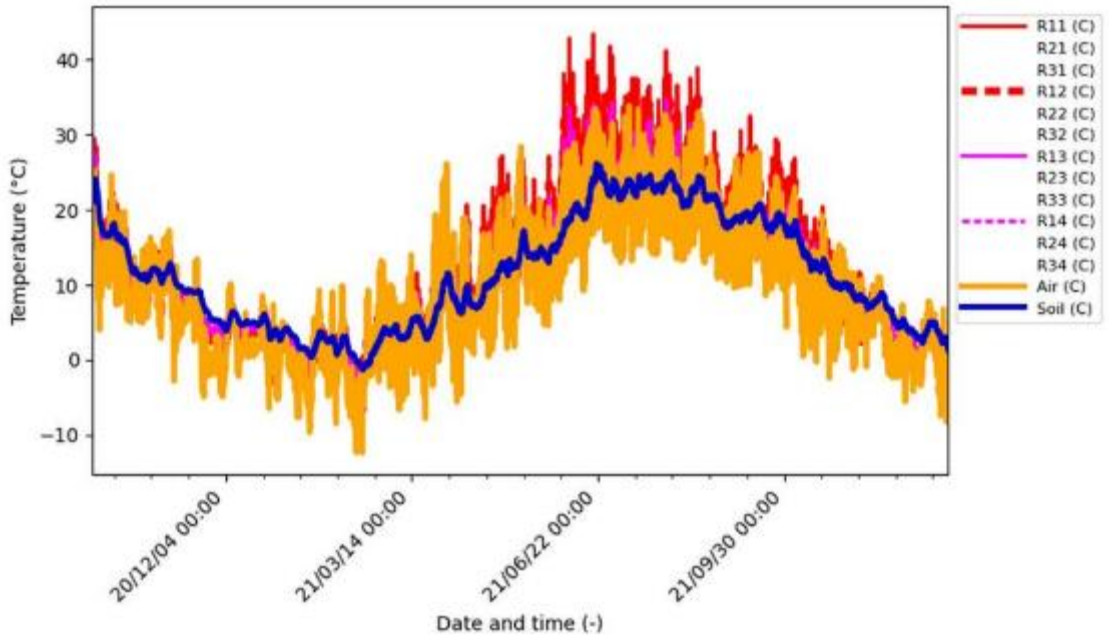
Steel mesh over cracks in asphalt

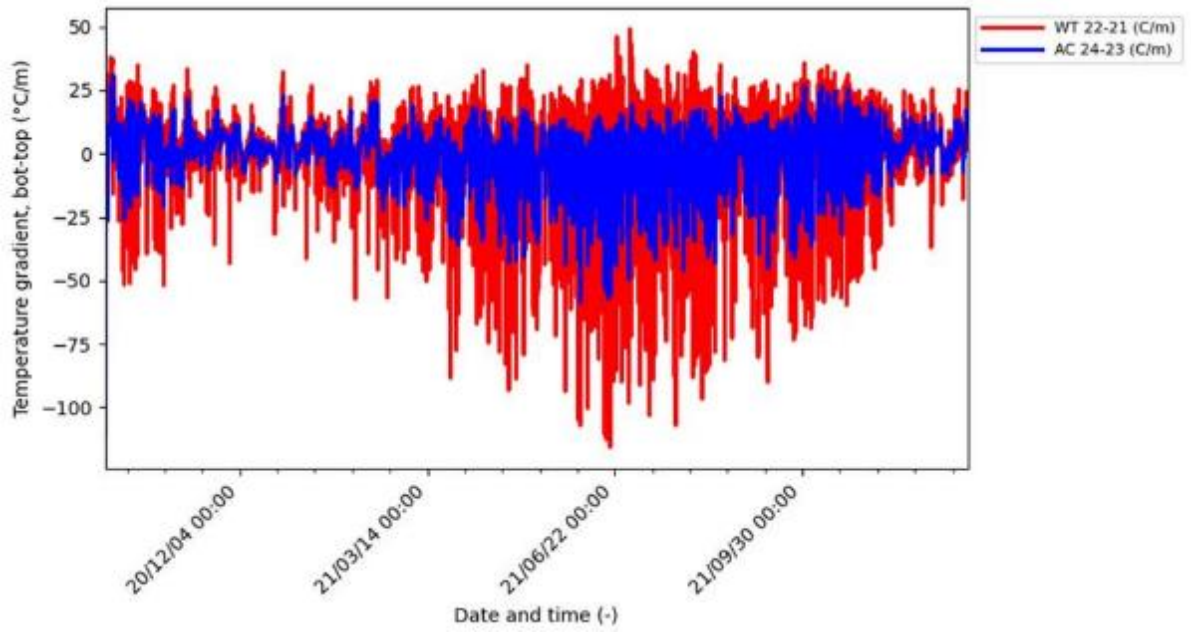
Monitoring - instrumentation

- 3×4 strain string gages + temperature sensors (AC + CO bottom + CO top) + ambient temperature + sunlight intensity
- 4 inductive sensors (layer debonding/separation)
- Data reading every 10 minutes

Results – temperature

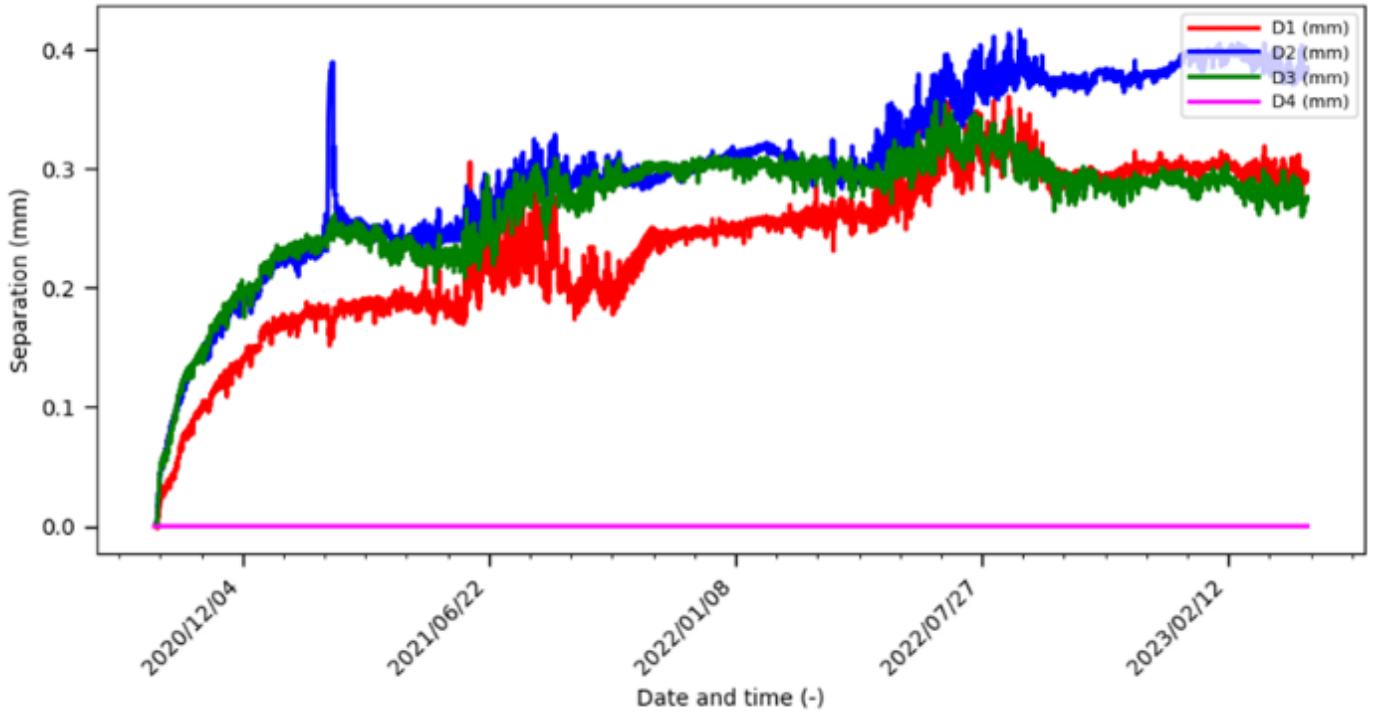
- Temperature fluctuation -8,1 ~ +40,7 (+51,1) °C
- Max thermal gradient top-bottom +16,8 ~ -6,9 °C





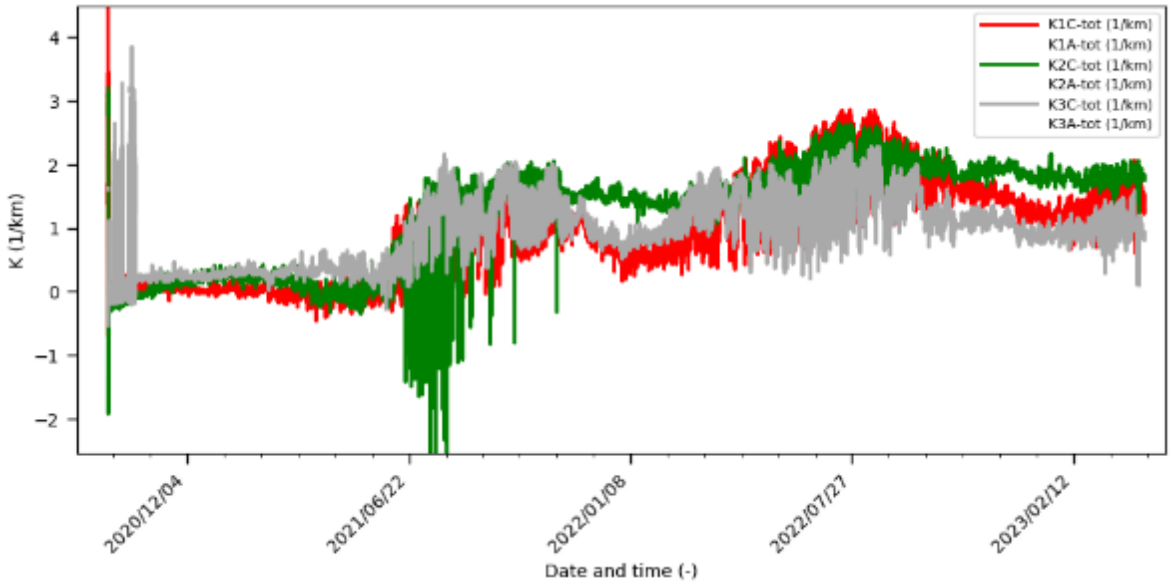
Results - debonding

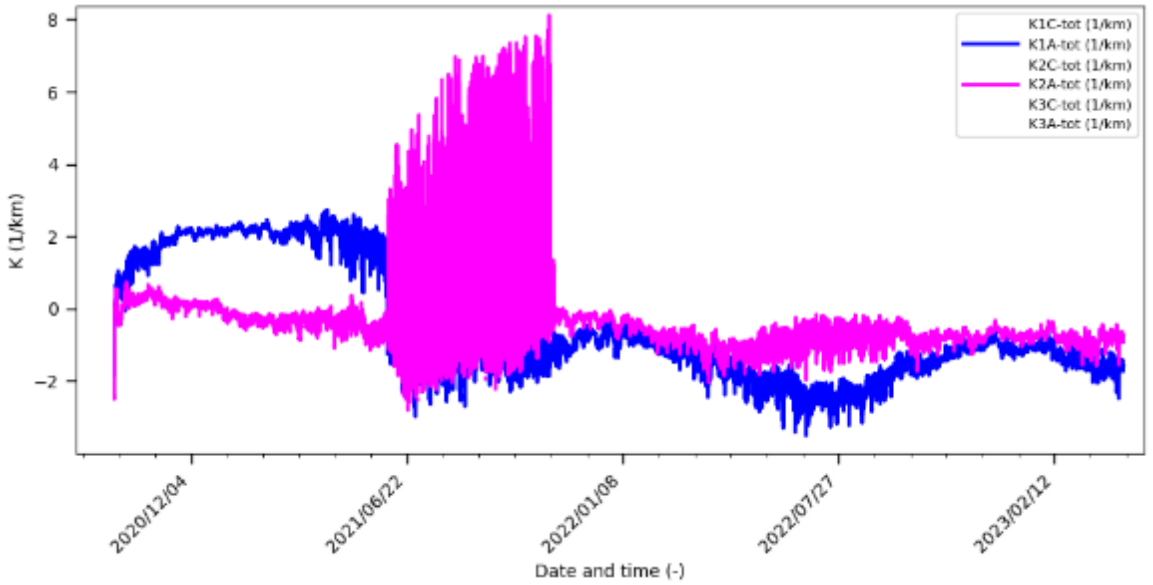
- Debonding started from beginning
- Stabilised after 6-12 months at 0,2 - 0,4 mm



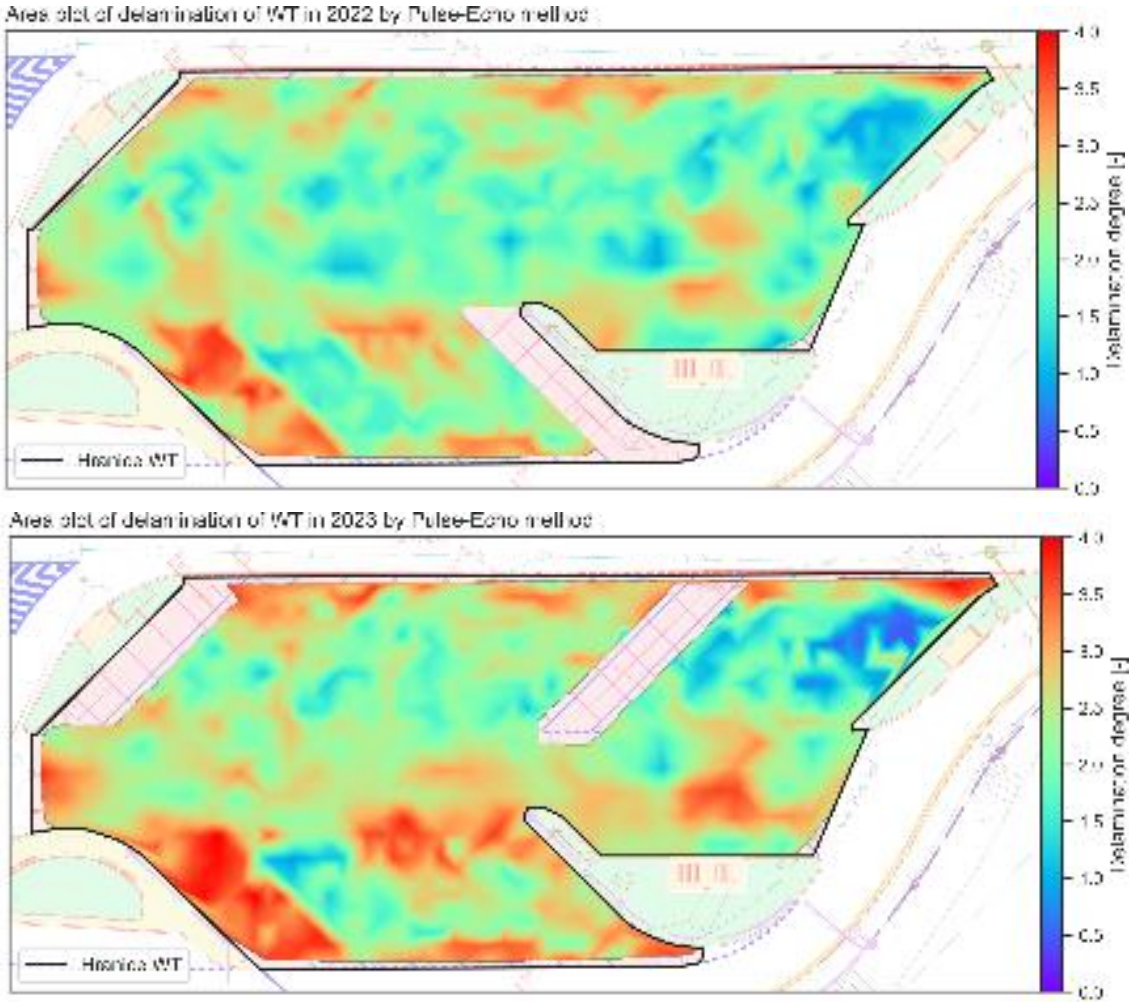
Results – curvature and stresses

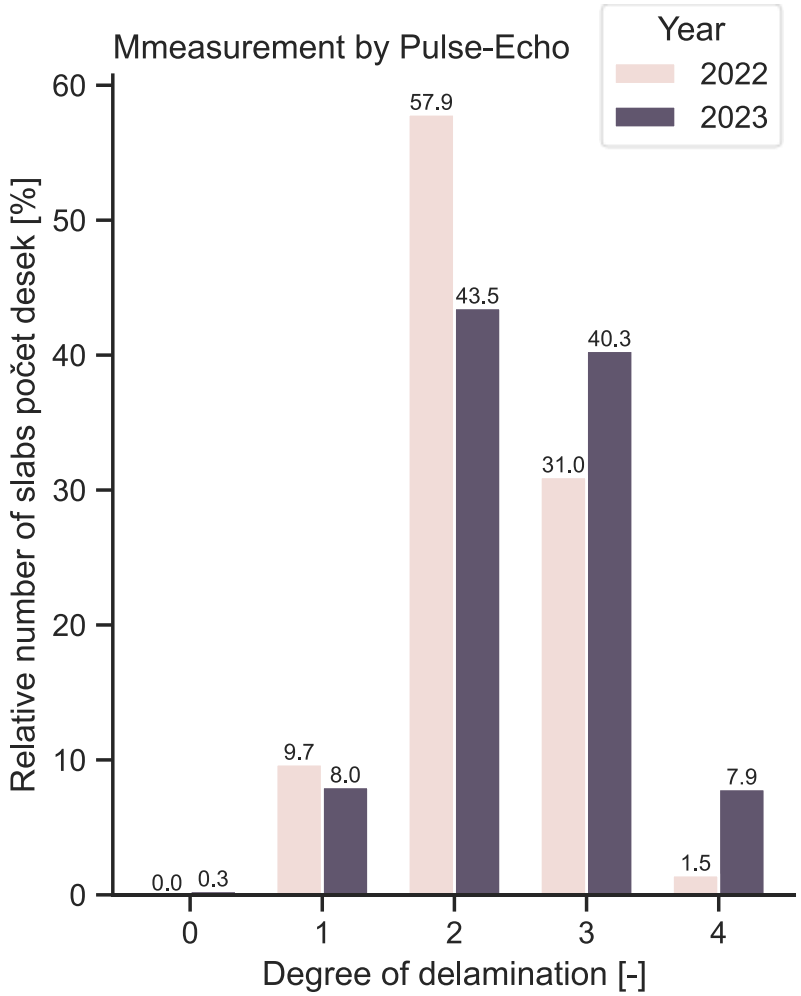
- Curvature increase of CO, stabilised after 3 years
- Max. tensile stress dayly fluctuation ±1,7 MPa





Results - debonding 2022-2023





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Monitoring - conclusions

- Thermal gradient positive 2 times higher than negative
- Debonding is developing over area but stabilizes at 0,3-0,4 mm after 1+ year
- „bonded“ doesn´t mean „glued“ – macrotexture prevents from sliding, but no full composite bending
- Shorter slabs = lower curvature/curling = lower stress

Status after 2,5 years of service

- Overall area in good conditions
- Debonding ca 70%
- Some cracks at corners – transition between concrete / asphalt, concrete / drainage slot channel
- Deformation at corner 3-8 mm >> debonding 0,4 mm
- … sub-layer deformation ?

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Conclusion, recommendations

- Pilot projects showed feasibility of the technology 30-40% cost and CO^2 reduction
- Proper diagnostics of existing pavement layers and properties
- Proper repair of defects (active cracks) in asphalt sublayer (separation, reiforcement within slab)
- Debonding cannot be prevented – calculation model
- Smaller slab dimensions (1:12 to thickness)
- Shrinkage reduction + fibres – early thermal crack prevention
- Thicker slab (full depth) for transition between concrete / asphalt

Ultra-thin concrete overlay - introduction

- Rehabilitation of concrete service road in hospital in Prague (2022)

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Trial section

- Thickness 50 mm, concrete C 70/85 XF4
- Slab dimensions: 1,0x1,1 / 1,6x2,1 m (1:20-40)
- No cracks after 2 years

Execution

- Thickness 60 mm
- Concrete C 50/60 XF4
- Slab dimensions: 1,2x1,5 m (1:25)

Finished

Thank you

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