New Technologies for Proactive Road Maintenance for Rural Roads

Timo Saarenketo, PhD, Adj.Prof.

CEO, Roadscanners Group

ROADSCANNERS 2022

Complete
Instrumentation Solutions

ROAD DOCTOR

ROAD DOCTOR RDLS
LASER SCANNER

ROAD DOCTOR RDSV
SURVEY VAN

ROAD DOCTOR RDTD
THERMAL DIAGNOSTICS

ROADSCANNERS PRODUCTS & PROJECTS AROUND THE WORLD

Complete Instrumentation Solutions

Alaska, Angola, Antarctica, Australia, Austria, Azerbaijan

Bahrain, Botswana, Brazil, Bulgaria

Canada, China, Croatia, Czech Republic

Denmark

Estonia

Finland, France

Germany, Greece, Greenland

Hungary

Iceland, Iran, Ireland, Israel, Italy, India

Japan

Latvia, Lithuania

Macedonia, Malaysia, Mexico, Mozambique, Morocco

Namibia, Netherlands, New Zealand, Norway

Papua New Guinea, Poland, Portugal

Russia

Saudi Arabia, Serbia, Slovakia, Slovenia, South Africa, South Korea, Spain, Sudan, Sweden, Switzerland

Taiwan, Thailand, Trinidad & Tobago, Turkey

United Kingdom, Uruguay, USA

Vietnam

5 continents 64 countries

Complete
Instrumentation Solutions

The ROADEX Network

24 years in rural road collaboration

- Share best practice
- Research and develop new knowledge
- Implement and test new solutions

The ROADEX philosophy:

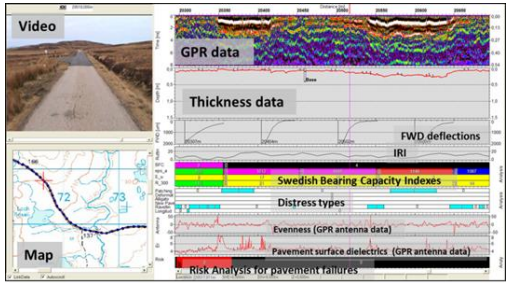
ROADEX Network
For better rural roads

Complete Instrumentation Solutions

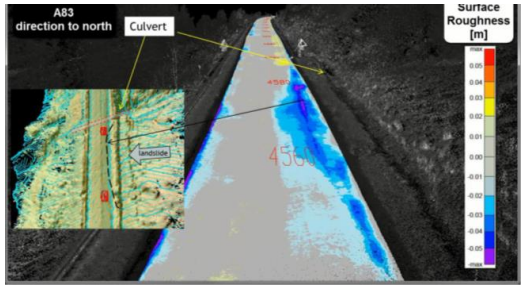
“FOCUS, FOCUS, FOCUS”

- Precise survey to map the weak sections and focus in on them
- Understand the underlying reasons for the problems
- Design ‘fit for purpose’ structures and treatments
- Consider the timing of remedial works – and improving the drainage
- Implement a programme of follow-up preventative/proactive maintenance

Fully equipped road survey vehicle, Iceland



Integrated analysis and mapping

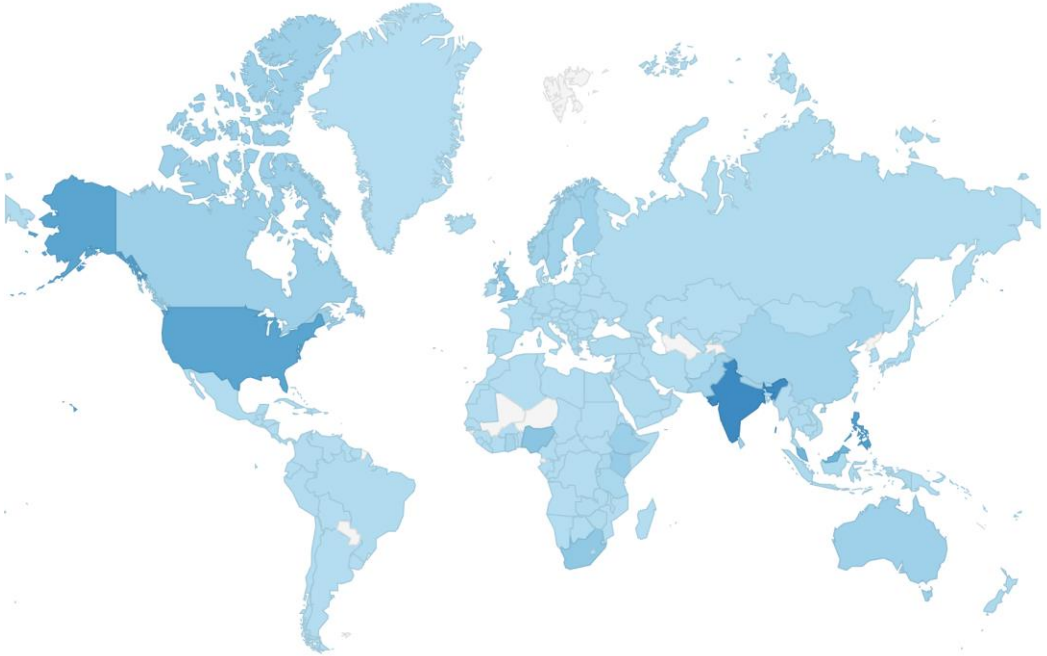


Easy to understand visualisations

ROADEX ELEARNING WEB STATISTICS: LOCATION AND USERS APR-SEP 2021

Complete Instrumentation Solutions

Country	Acquisition Users ↓
	46,745 % of Total: 100.00% (46,745)
1. India	7,240 (15.44%)
2. Philippines	5,311 (11.33%)
3. United States	4,838 (10.32%)
4. Malaysia	3,535 (7.54%)
5. Nigeria	2,119 (4.52%)
6. United Kingdom	1,919 (4.09%)
7. South Africa	1,758 (3.75%)
8. Kenya	1,529 (3.26%)
9. Ethiopia	1,202 (2.56%)
10. Finland	1,156 (2.47%)



Common problems across the Northern Periphery

Complete Instrumentation Solutions

- Drainage
- Heavy trucks and permanent deformation
- Poor quality road materials
- Roads on peat
- Widened roads

Survey, data collection & mapping

Complete Instrumentation Solutions

ROADEX technologies (all to GPS):

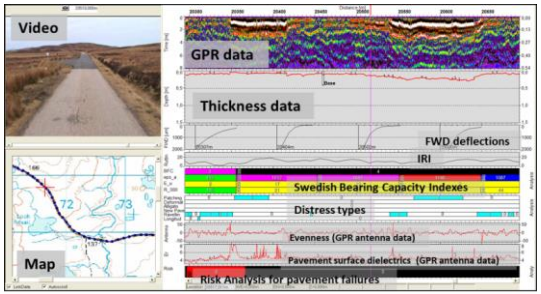
- Digital video
- Drainage
- Ground Penetrating Radar
- Falling Weight Deflectometer
- LIDAR - 2D / 3D scanning
- Drill cores
- High Speed Road Monitoring
- Drone survey
- 360° camera
- Thermal camera
- 3D accelerometer

FWD & GPS

GPR, GPS & Video

Data processing and analysis:

- Cloud based data handling
- Road Doctor processing
- Map presentation
- Point cloud models



Integrated analysis & mapping

INVESTING TO DRAINAGE IS THE MOST PROFITABL DECISION IN ROAD ASSET MANAGEMENT

Complete Instrumentation Solutions

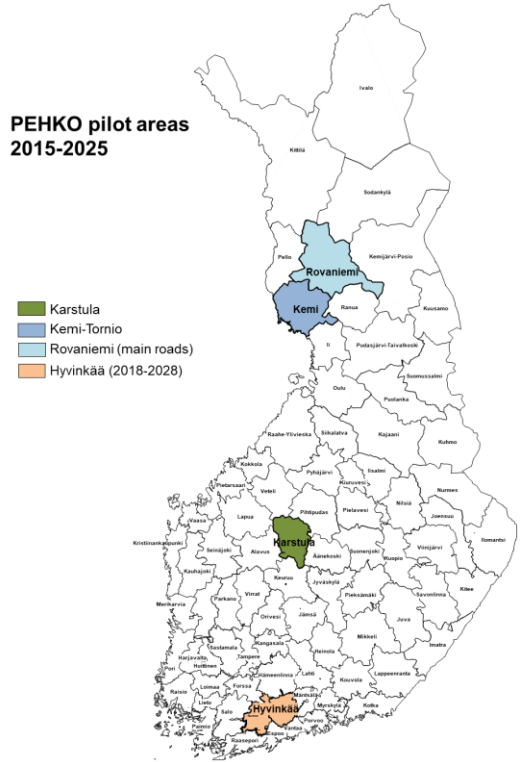
ROADEX Network
For better rural roads

VÄYLÄ
Finnish Transport Infrastructure Agency

ROADSCANNERS

Complete Instrumentation Solutions

INTELLIGENT ASSET MANAGEMENT: FTA PEHKO PILOT FOR PAVED ROADS 2015-2025 IN KEMI-TORNIO AND KARSTULA AREA AND 2018-2028 IN HYVINKÄÄ AREA



pehko

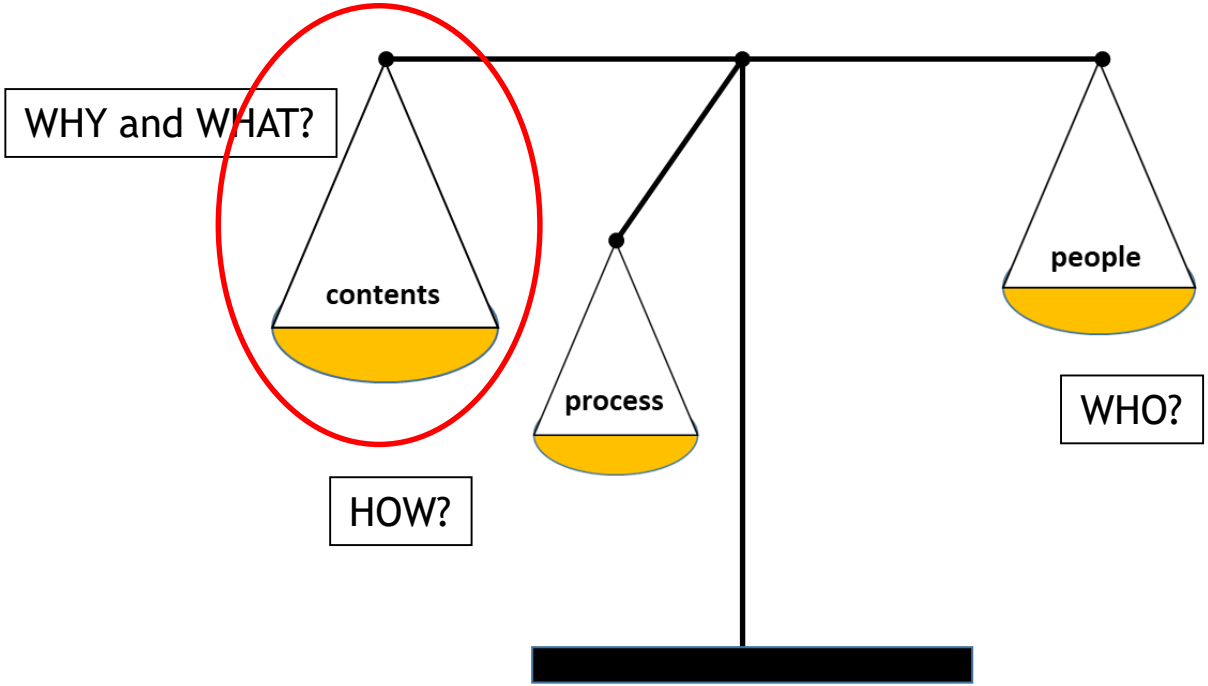
Final goal in 2025:
Paved road network will be in better shape and annual paving costs 50% lower than current levels.

ROADEX Network
For better rural roads

Calculations were based on ROADEX recommendations
www.roadex.org

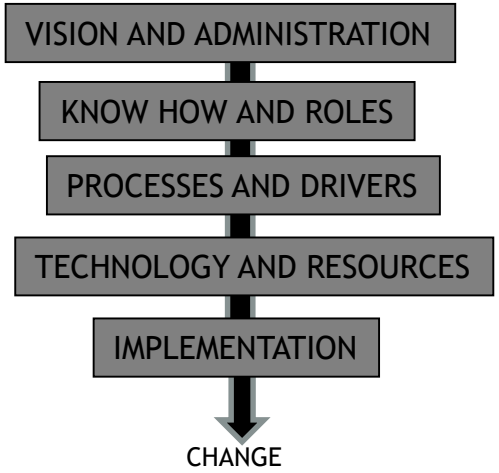
TRANSITIONING TO BALANCED PROACTIVE ROAD ASSET MANAGEMENT

Complete Instrumentation Solutions



Modified after Key Consulting (Heikinheimo 2021)

ELEMENTS OF A SUCCESSFUL CHANGE



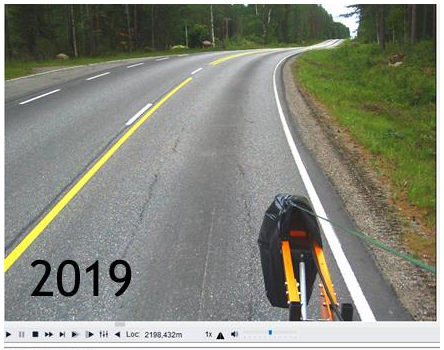
Proactive Road Asset Management Means Disruption!

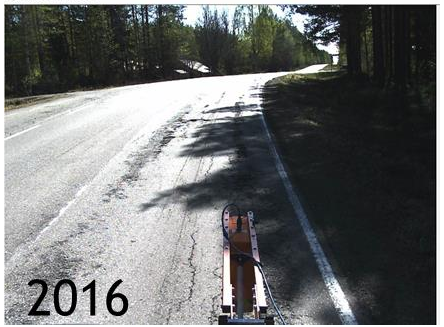
Complete Instrumentation Solutions

What is required in order to sell the idea to stakeholders?

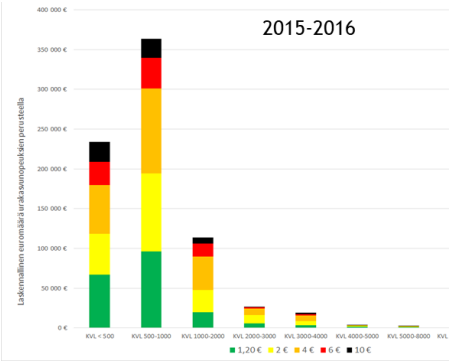
New Technologies

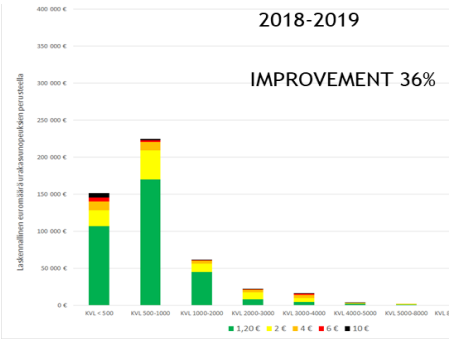
Case Histories





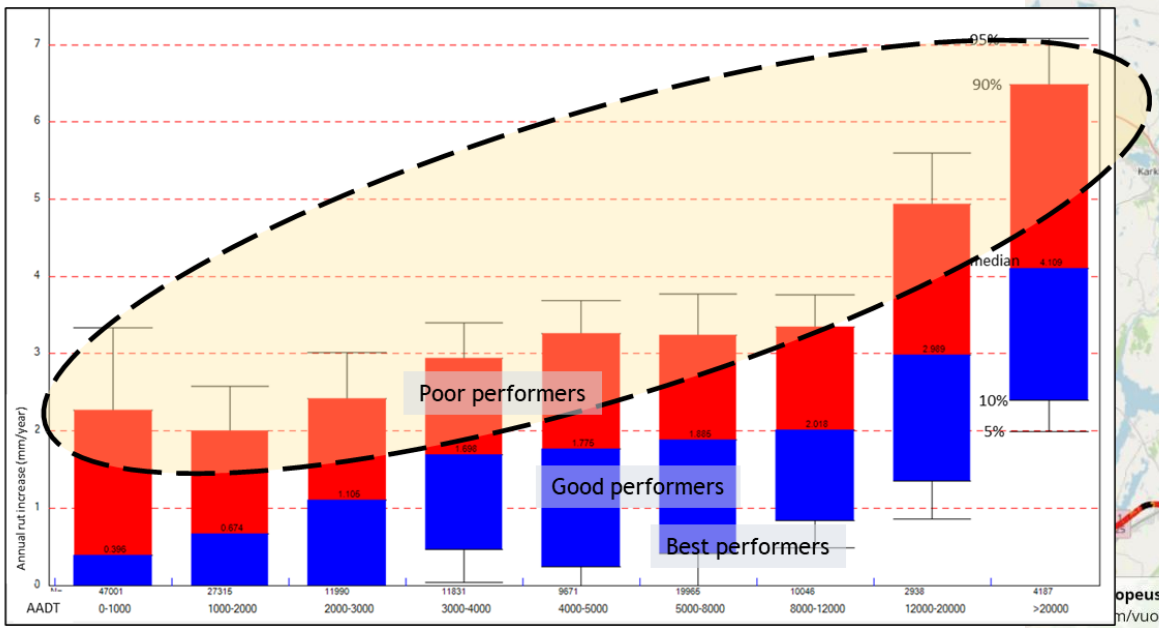
Turn the Results into Money

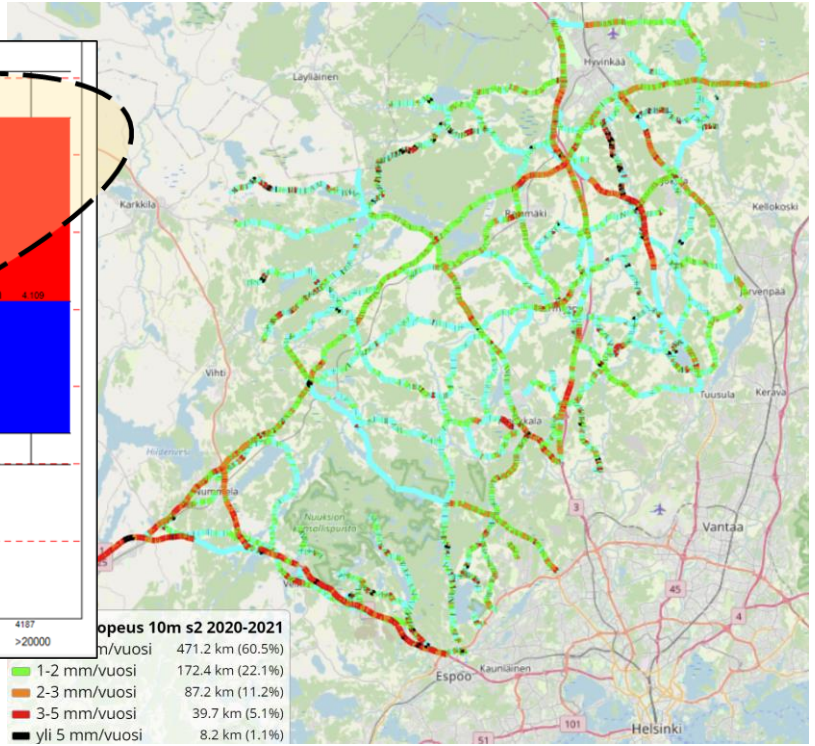




FINDING THE WEAKEST LINKS IN THE ROAD NETWORK

Complete Instrumentation Solutions





pehko

NEW TECHNOLOGIES FOR PROACTIVE ROAD MAINTENANCE

Complete
Instrumentation Solutions

Annual

PMS, RAMS ,Diagnostics, Design, QC

Road Doctor Survey Van (RDSV)

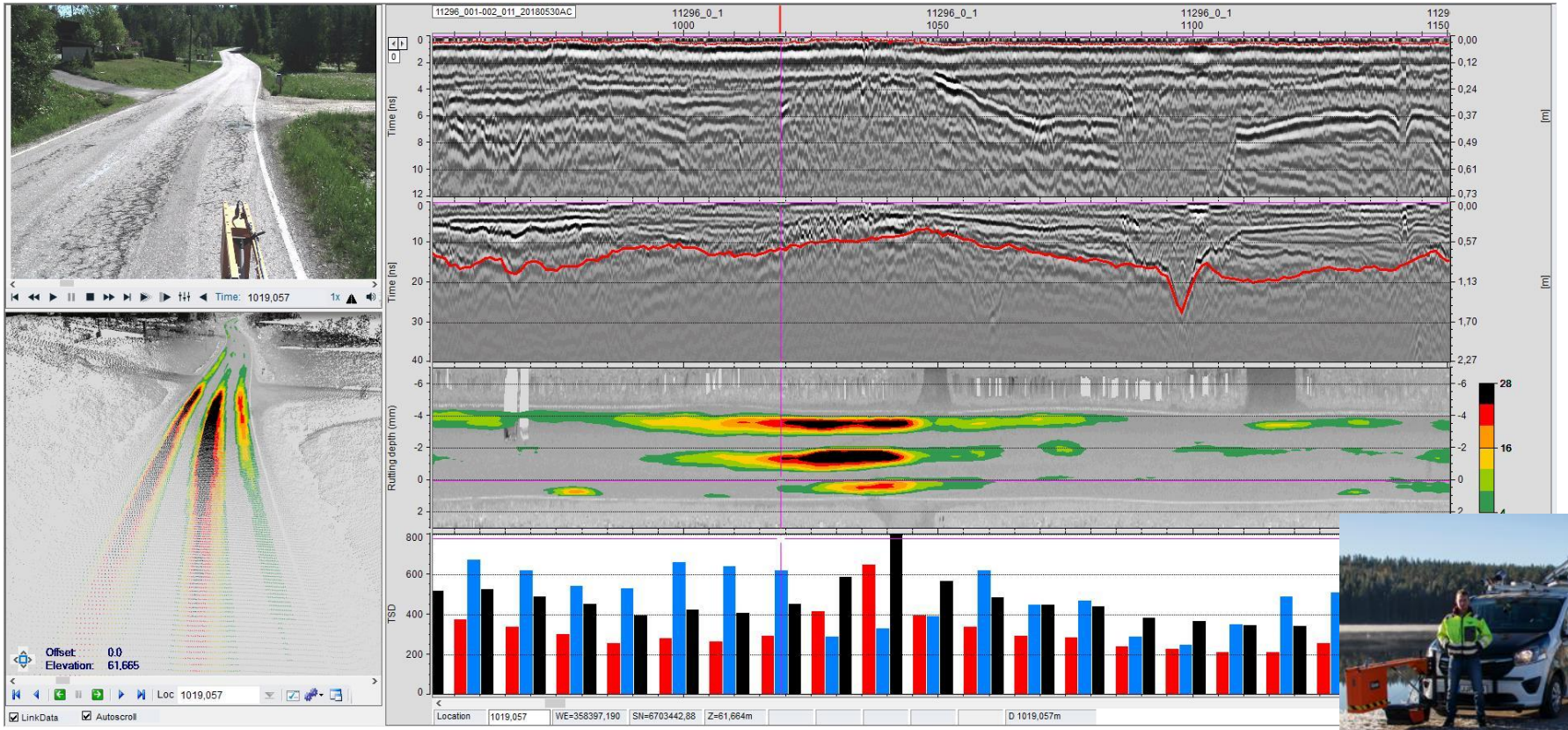
Monthly/Weekly

Real Time Maintenance Management

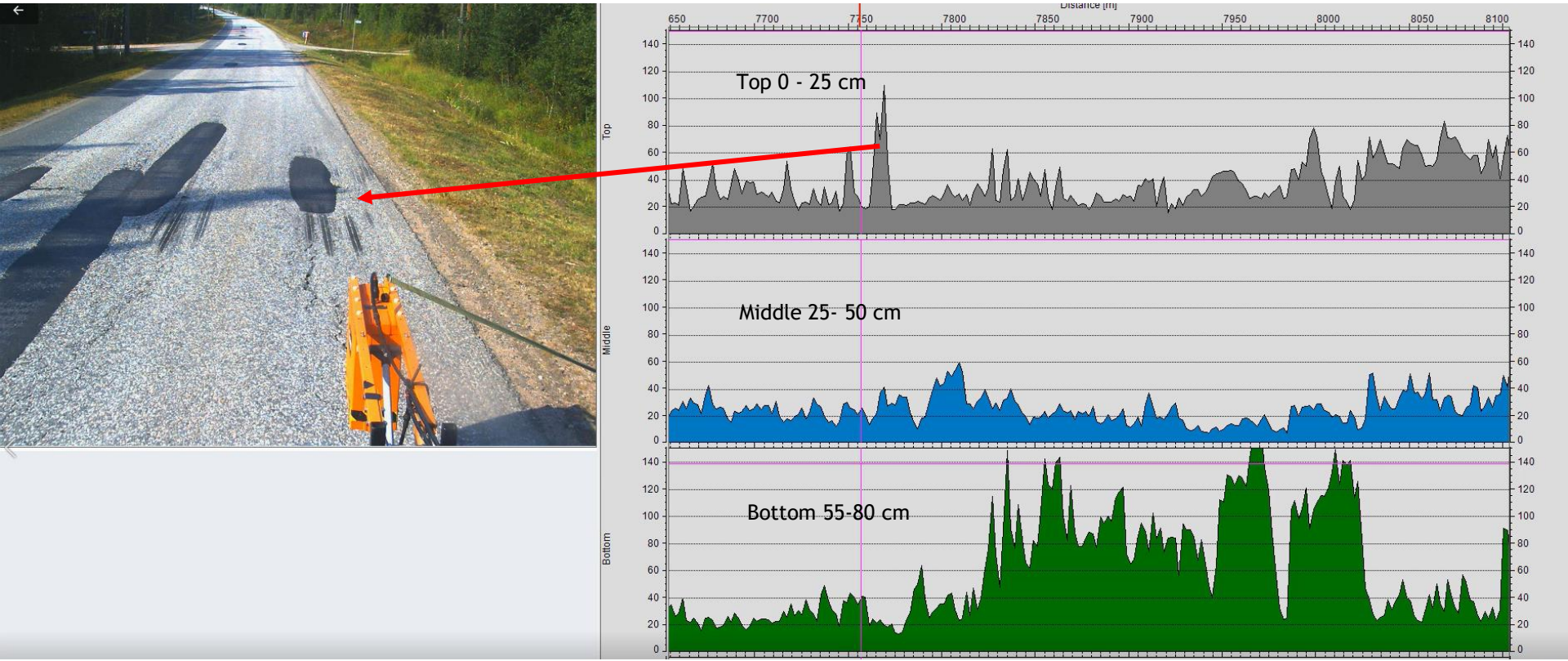
Road Doctor Maintenance Control (RDMC)

RDSV Based Problem Diagnostics

Complete Instrumentation Solutions



GPR BASED - MOISTURE DAMAGE INDEX



ROAD ROUGHNESS IN KARSTULA AND ÄÄNEKOSKI MAINTENANCE AREAS, CENTRAL-FINLAND: AUGUST 2021 MAP AND STATISTICS

Complete Instrumentation Solutions

KARSTULA

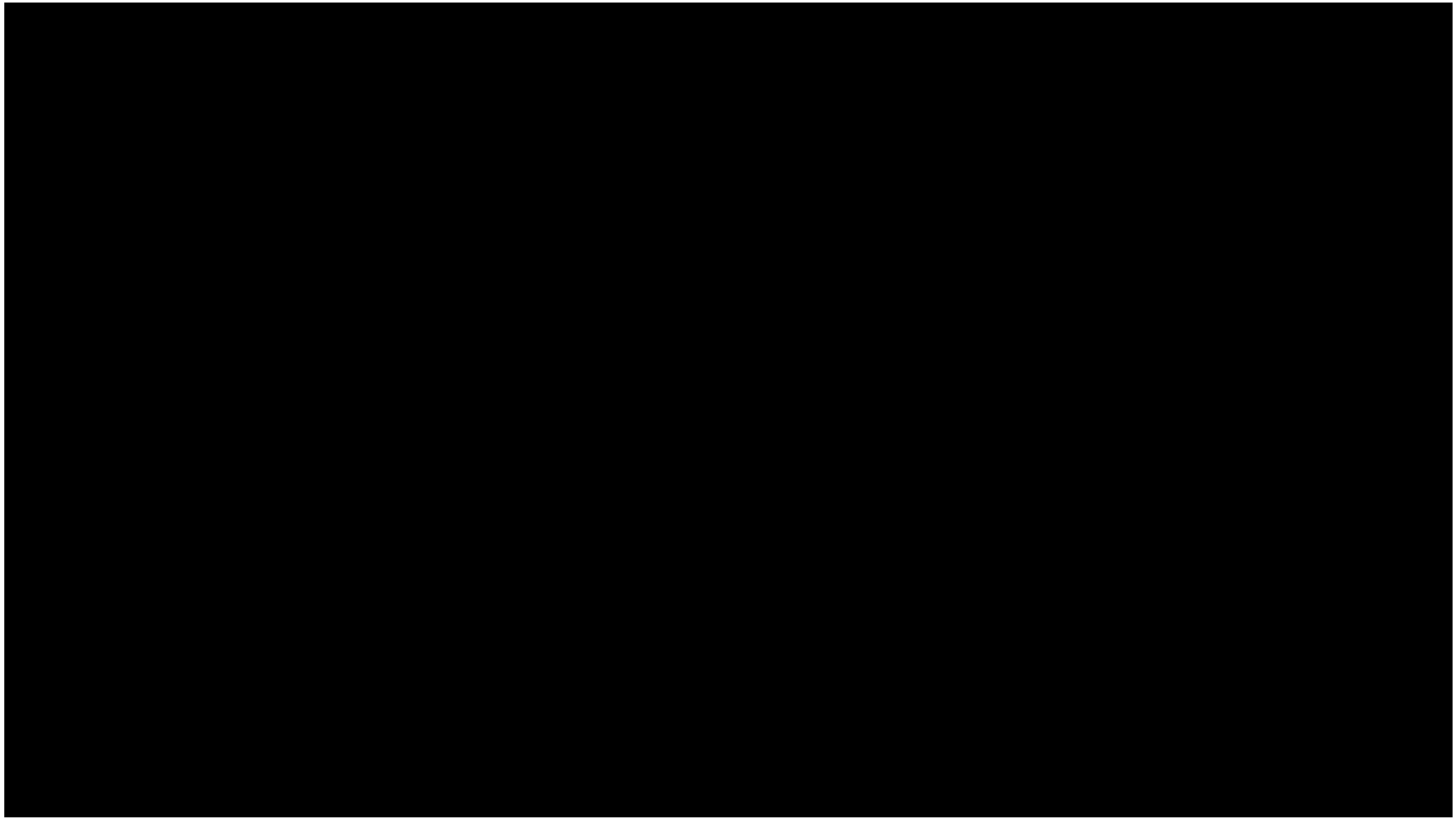
ÄÄNEKOSKI

Karstula kaikki

alle 11	1374.1 km (45.7%)
11-12	1057.4 km (35.2%)
12-13	408.4 km (13.6%)
13-14	98.8 km (3.3%)
14-16	49.1 km (1.6%)
16 - 20	16.0 km (0.5%)
20 - 25	1.9 km (0.1%)
yli 25	0.4 km (0.0%)

Äänekoski kaikki

alle 11	3714.7 km (56.0%)
11-12	2019.6 km (30.5%)
12-13	605.5 km (9.1%)
13-14	168.6 km (2.5%)
14-16	88.7 km (1.3%)
16 - 20	27.4 km (0.4%)
20 - 25	4.0 km (0.1%)
yli 25	0.8 km (0.0%)



ROADEX AND PEHKO EXPERIENCES
BENEFITS OF THE NEW TECHNOLOGIES

Complete
Instrumentation Solutions

- Better understanding of root causes of road damages
- Better road drainage maintenance management
  - Drainage structure follow up
  - Risk management
- Better pavement design practises:
  - Heavier measures focused on exact problem locations
  - New structural solution for road over weak subgrades (steel grids)
  - Enabling monitoring performace of new structures (learning process)
- Enabling proactive pavement maintenance policies
  - Repaving before pavement looses its strenght
  - Real time situation picture of the road network
- Better understanding and more motivated road maintenance staff
- Longer pavement life times, better roads

Happier Road Users, Majors saving with annual paving costs

Asset Management

Complete
Instrumentation Solutions

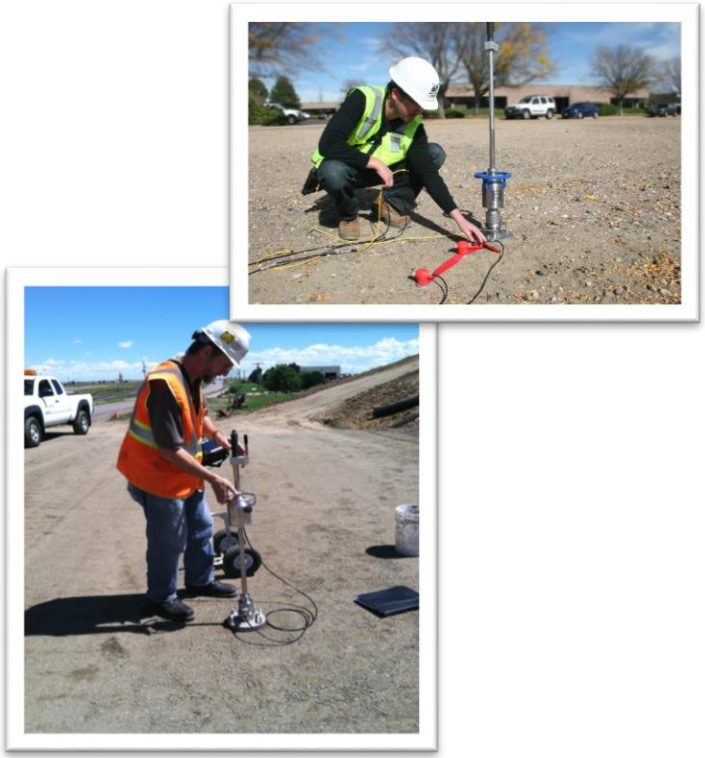
Structural Health Testing and Monitoring

Complete Instrumentation Solutions

Complete
Instrumentation Solutions

Light Weight Deflectometer

- 2 additional geophones- exceeds ASTM E2835
- Measurements on roadbase, subbase and subgrade fill
- Measures impact force and displacement
- QA for soil Young's moduli and stiffness increase for cement, lime and chemically stabilized soils by testing at time of placement & after curing



3D NETWORK SURVEY VEHICLE- LCMS

Complete
Instrumentation Solutions

- Longitudinal profiles and Roughness (IRI)
- Transverse Profiles
- Cross slope, Gradient, Radius of curvature
- Rut depth, width and cross-sectional area and shoving
- Automatic Cracking (including, width, **depth**, length, type and even sealed cracks),
- MPD Macro-texture, Raveling detection, Bleeding,
- Pothole detection (including area, max depth and average depth),
- Curb height/drop off
- Concrete joints and faulting,
- Lane markings (in progress)
- Water pooling depths,
- Pavement images automatically overlaid with defects.
- ROW images (.JPEG),GPS Coordinates , Detailed GIS maps (.kml, .shp),
- Asset and condition rating,New algorithms continually developed

International Standards

Complete
Instrumentation Solutions

- ASTM E950; Can collect longitudinal profile and compute IRI
- ASTM E1845; Can collect macro texture and compute MPD
- ASTM E965; Can collect macro texture and compute MTD
- ASTM E1703; Can compute rutting according to standard
- AASHTO PP67; Can quantify cracking
- AASHTO PP68; Can collect images of pavement surfaces
- AASHTO PP69; Can determine pavement deformations
- AASHTO PP70; Can collect transverse profiles

ROMDAS- Network Survey Vehicle With LCMS-2

Complete Instrumentation Solutions

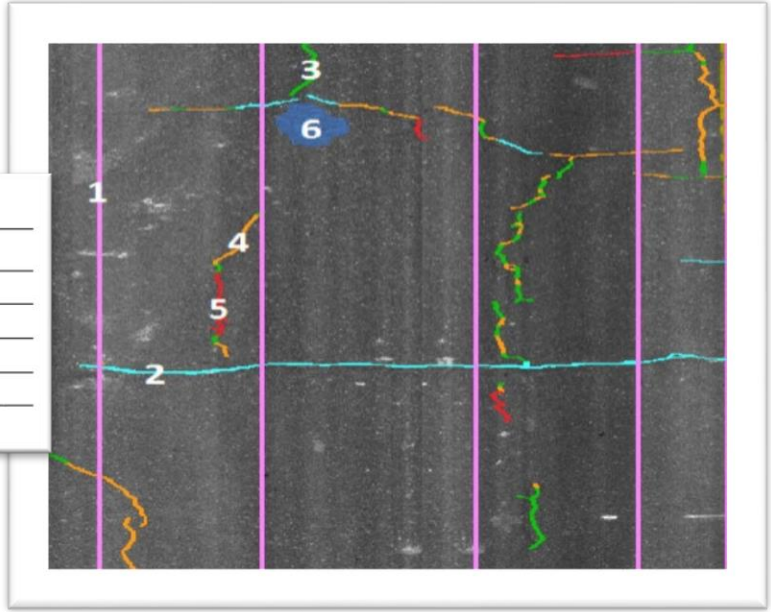
3D Profiling

Complete
Instrumentation Solutions

Data Processing- LCMS

Image Overlay Colours

	Colour	Description	Dimension (mm)
1		Lane and Macro-Texture Band markings	
2		Very weak cracks. Severity = 0	< 3
3		Weak cracks in the results images. Severity = 1	< 6
4		Medium cracks in the results images. Severity = 2	< 20
5		Major cracks in the results images. Severity = 3	> 20
6		Pothole	> 150 diameter



Complete
Instrumentation Solutions

Intelligent Falling Weight Deflectometer

Retroreflectometers

Complete Instrumentation Solutions

- The Minireflecto Vertical is an up to four angle retroreflectometer designed to accurately measure the retroreflection RA of road signs, safety clothing and other materials.

- HORIZONTAL MiniReflecto - Horizontal measures the night visibility RL, the Day Visibility Qd, the visibility under wet RL wet and continuous wetting conditions RL rain of road markings.

Mobile Bridge Inspection Units

Complete
Instrumentation Solutions

Complete
Instrumentation Solutions

THANK YOU