New Road Survey Technologies in Rural Road Asset Management
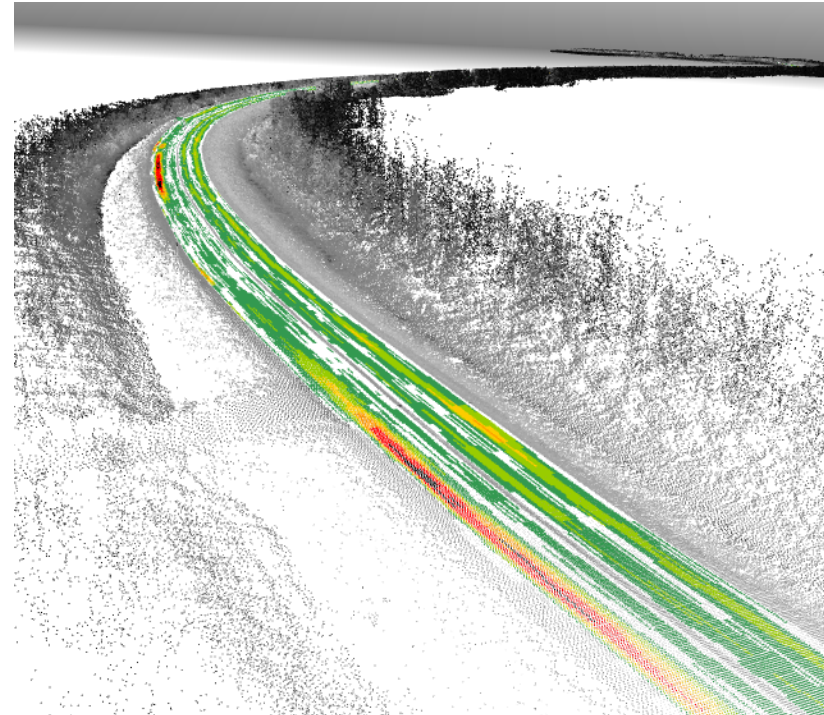
Annele Matintupa, MSc. civ.eng

Roadscanners, Finland

What is Intelligent Asset Management
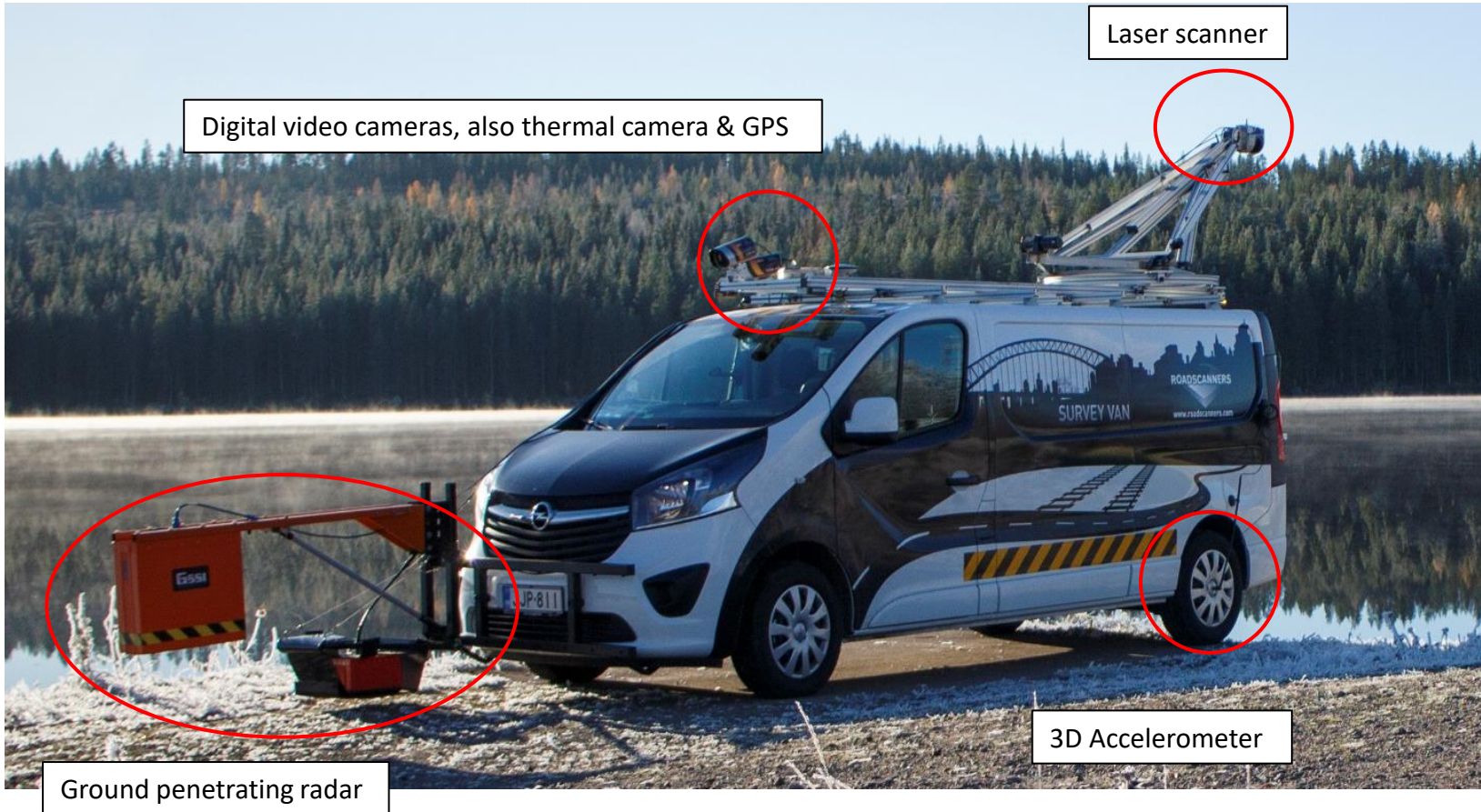

1. **Reactive:** measures are taken based mainly on the surface condition monitoring results (=symptoms)

2. **Proactive:** monitoring is made to detect root causes of the surface condition problems (diagnostics) and measures are taken before damages appear

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Modern Road Survey Technologies

Laser scanner

Digital video cameras, also thermal camera & GPS

3D Accelerometer

Ground penetrating radar

Traffic speed deflectometer

Falling weight deflectometer

Ground Penetrating Radar (GPR)

-layer thicknesses

-asphalt air voids content

-moisture (saturation degree)

-moisture susceptibility

-frost & ice lenses detection

-cracking & microcracking

-delamination

Survey Methods and Parameters / Variables that are Used / Tested for Road Condition Diagnostics

Laser Scanner (Lidar)

- rut depth / rut depth increase
- rutting mode
- cracking (big cracks)
- patches
- road width / road widening
- road paintings
- ditch slopes
- verges & edge drops
- ditch depths
- clearance
- winter maintenance monitoring
- tunnel walls
- design parameters for CAD
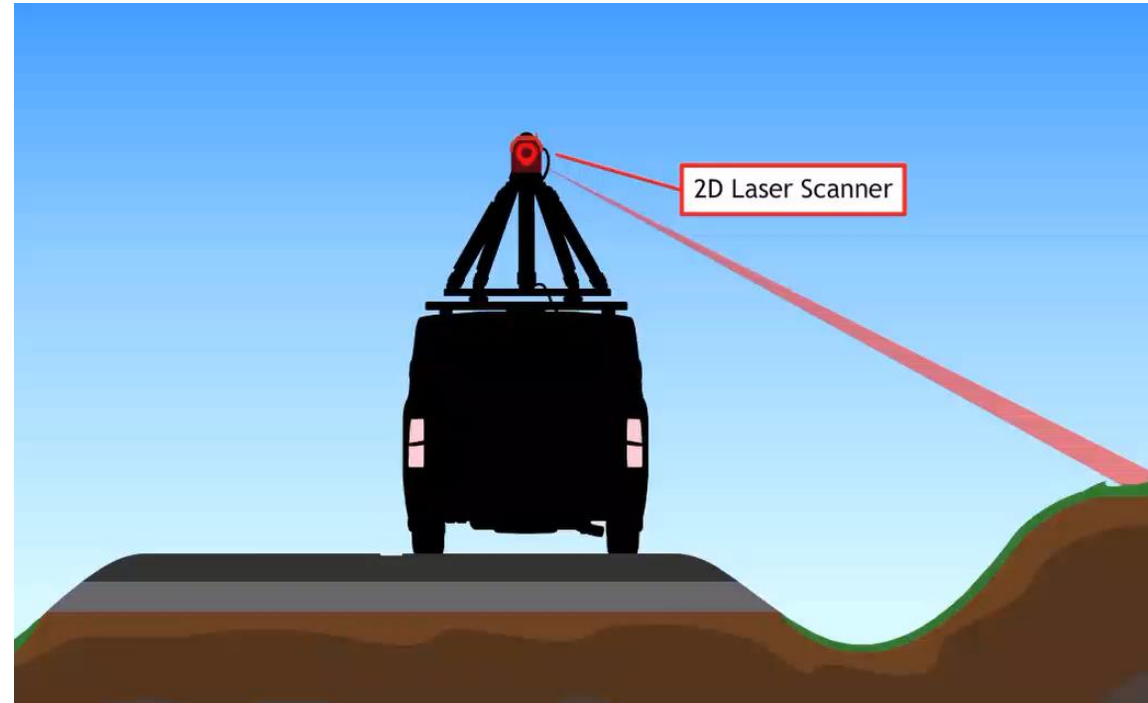
2D Laser Scanner

Laser Scanner Data based Proactive Maintenance
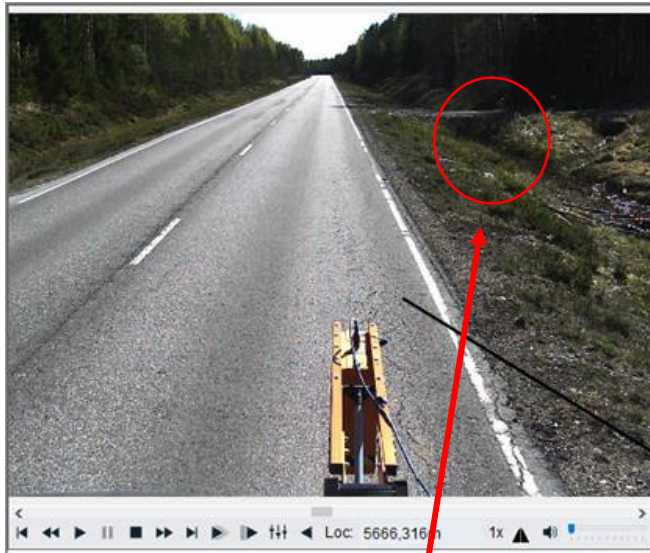
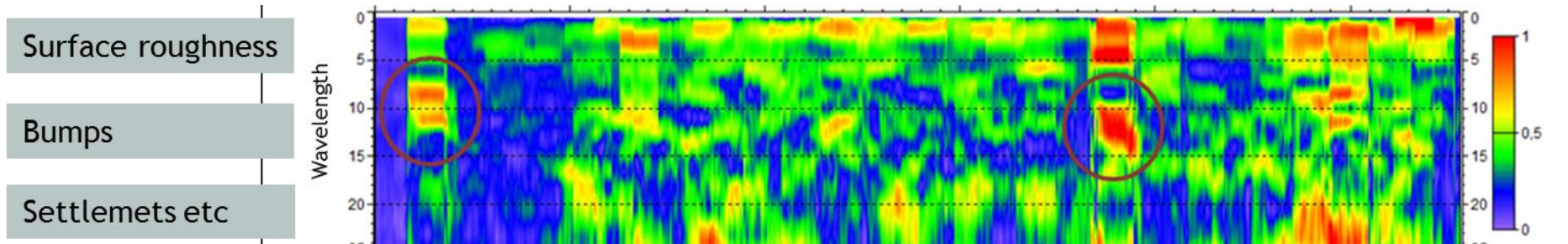
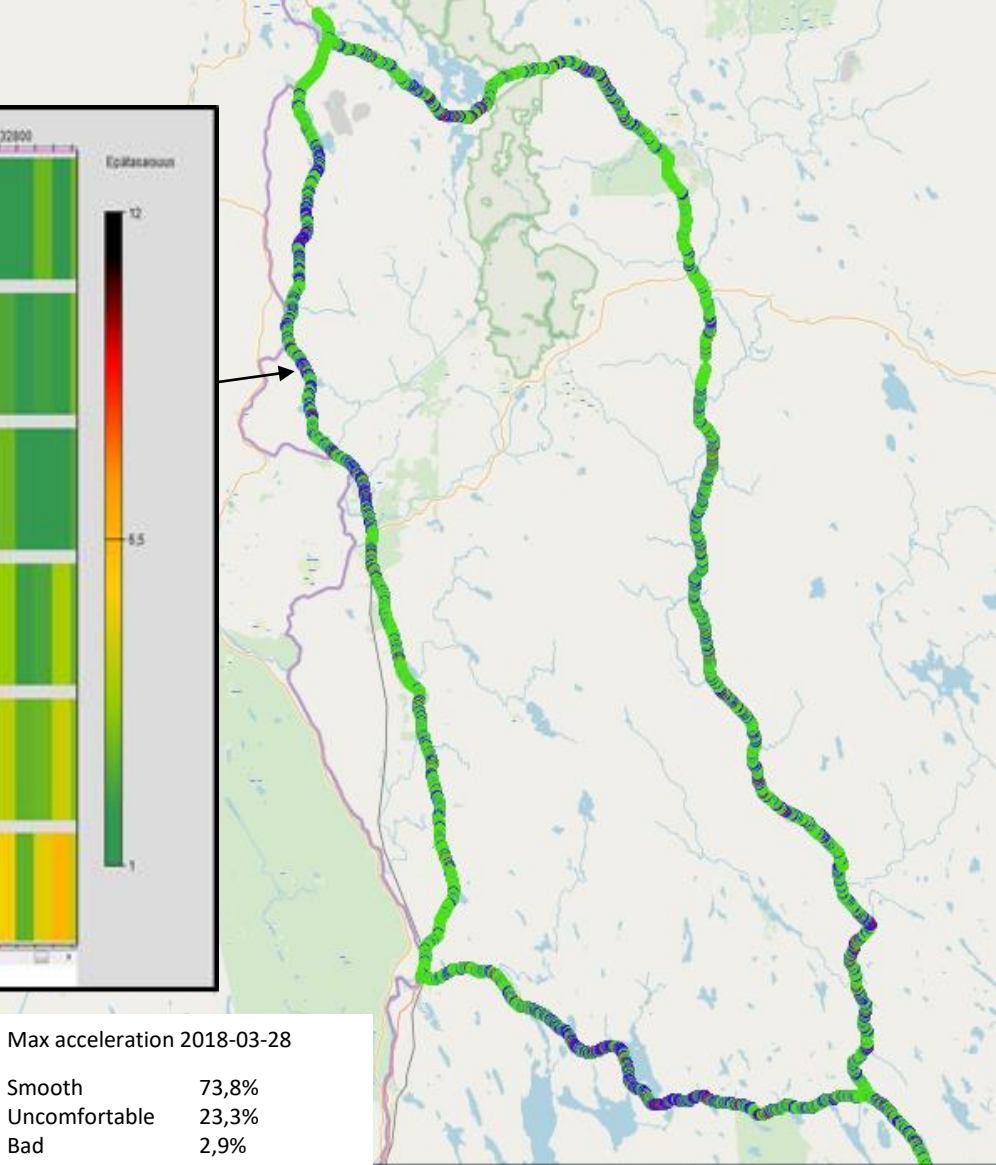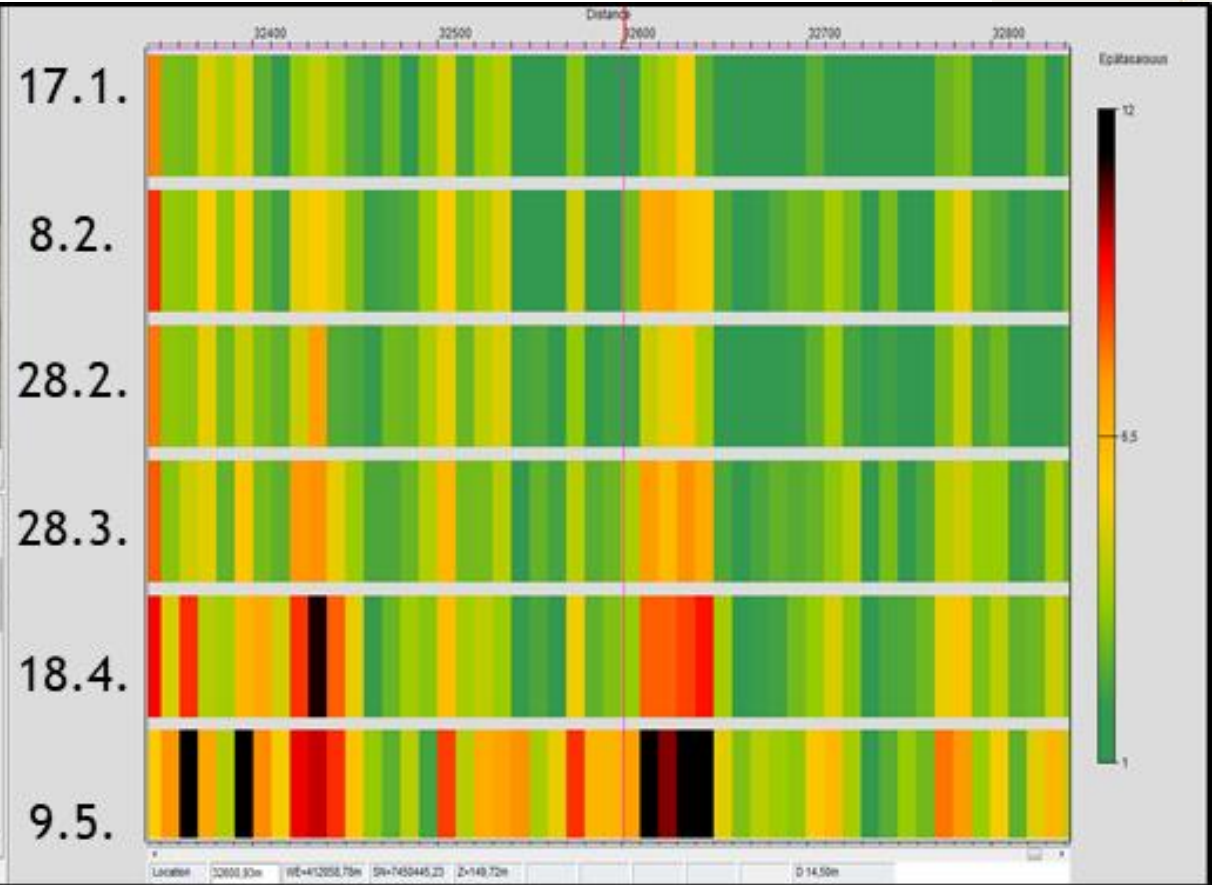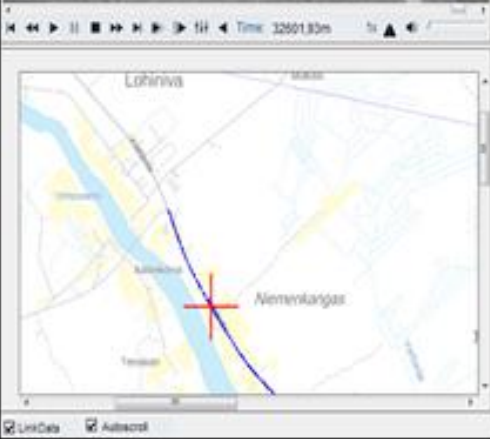Fixing the root cause of the problem before it turns to be an expensive and serious problem
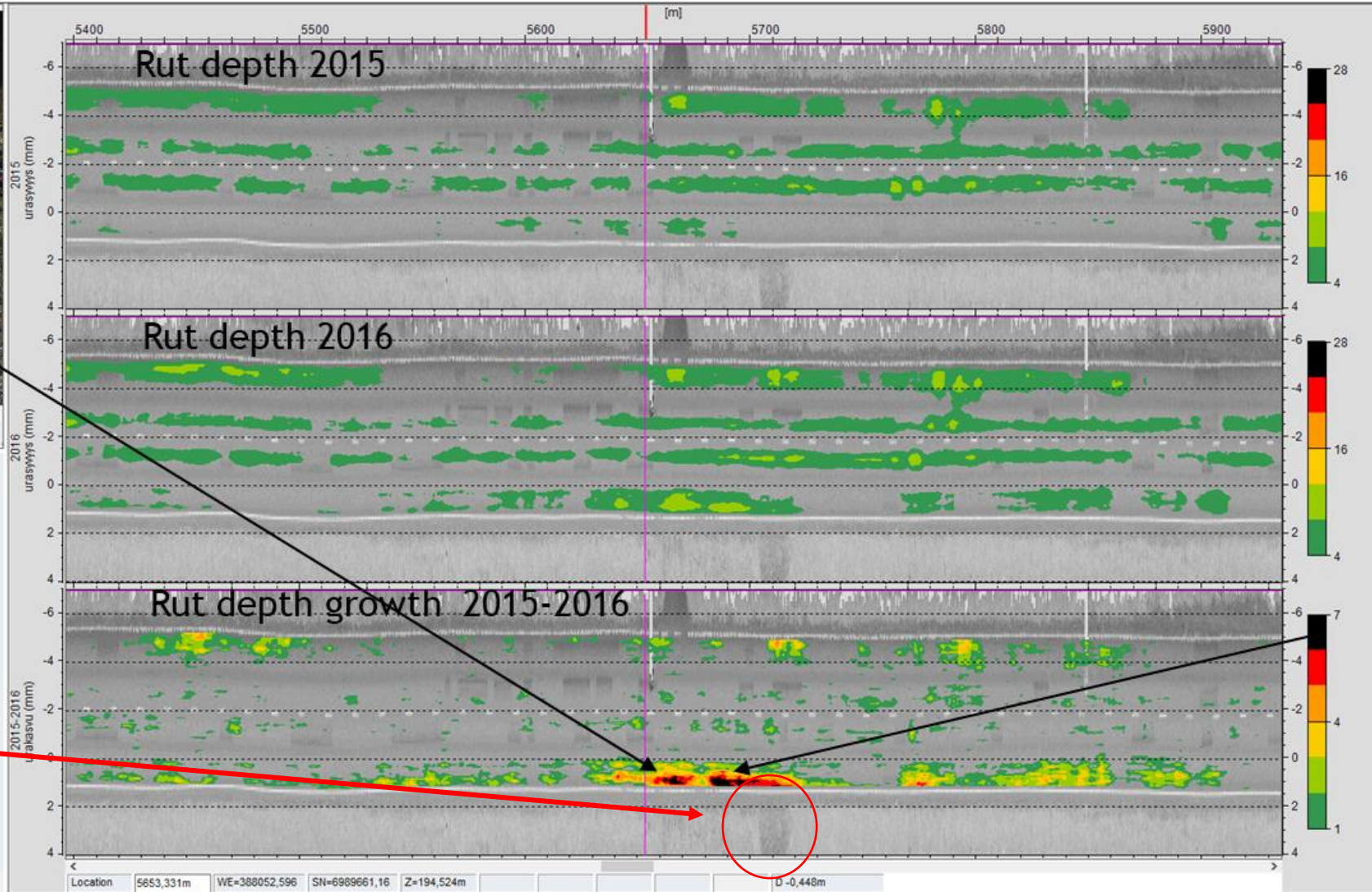
Rut depth 2015

Rut depth 2016

Rut depth growth 2015-2016

3D Accelerometers

- acceleration in x,y,z
- angular velocity x,y,z
- roughness (IRI etc) also from gravel roads
- cross fall (up to 60 km/h)
- warping risk

Accelerometer Data - Roughness Development

Max acceleration 2018-03-28

- 🟢 Smooth — 73,8%
- 🔵 Uncomfortable — 23,3%
- 🔴 Bad — 2,9%

Survey Methods and Parameters / Variables that are Used / Tested for Road Condition Diagnostics

TSD / FWD

- Continuous deflections (TSD)
- Bearing capacity indexes (SCI, BCI, Strain)
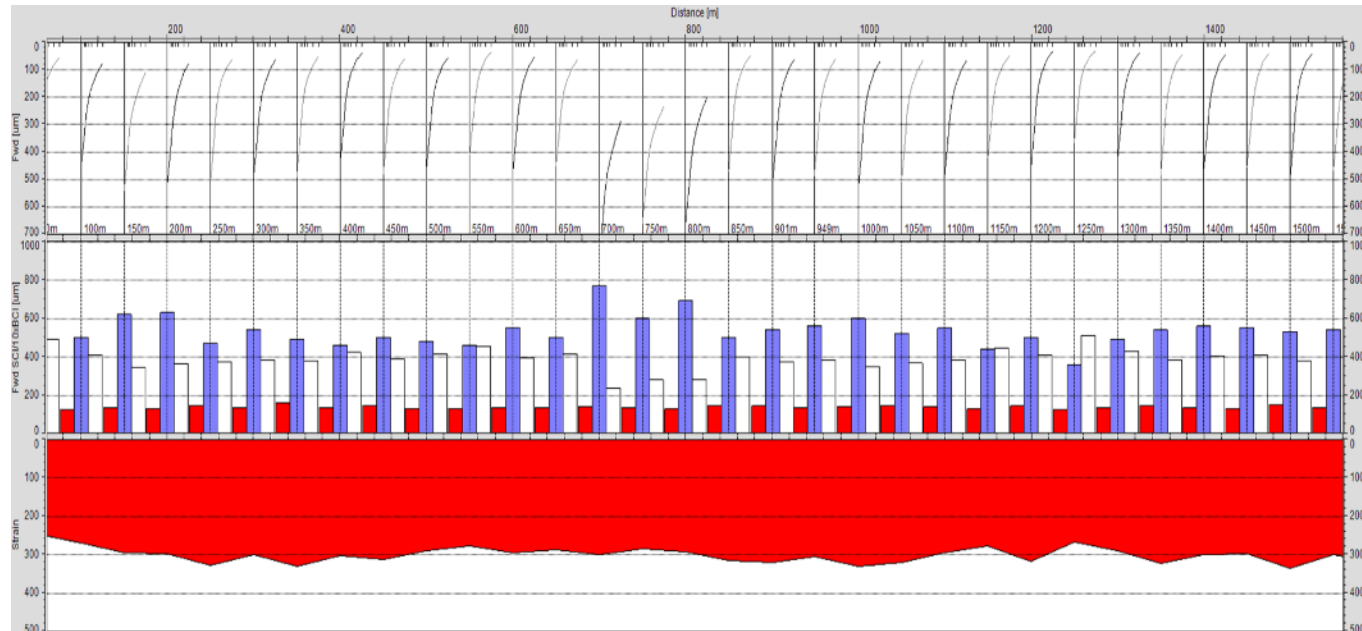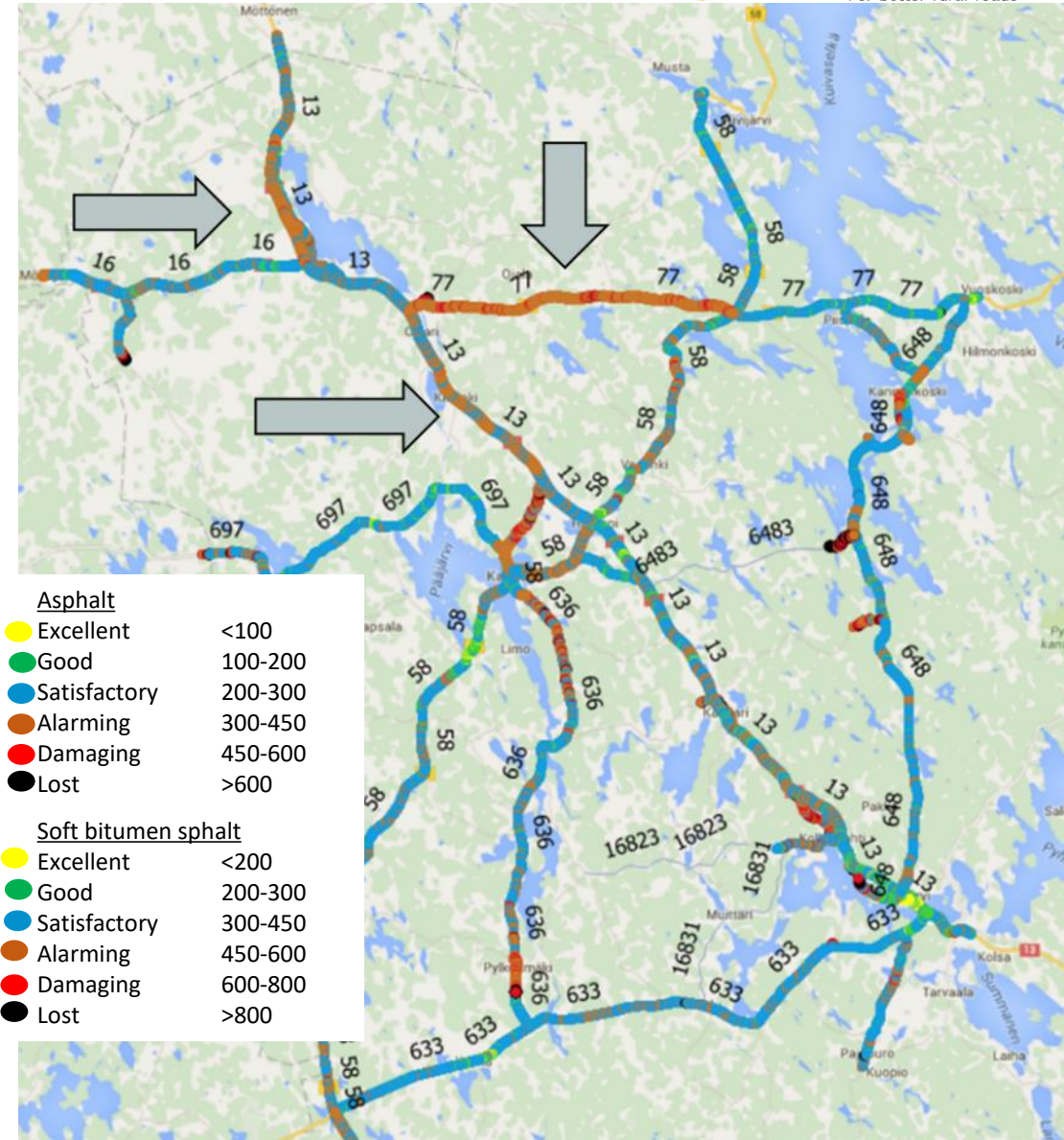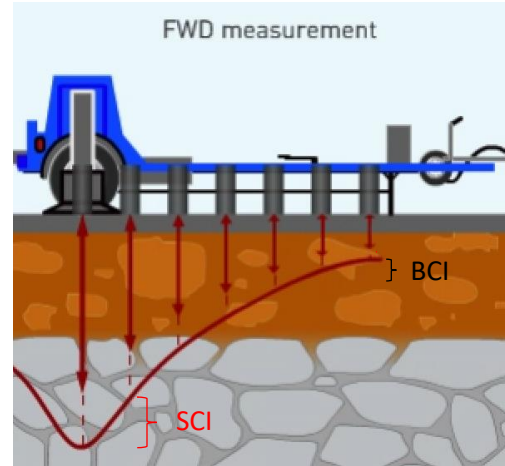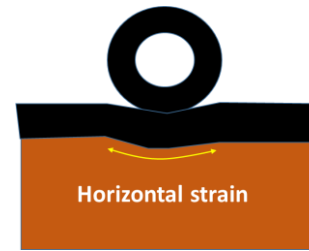- Structure and subgrade moduli values

TSD / FWD data

Horizontal strain

**Strain** = Calculated based on GPR and FWD / TSD data
Indicates the fatique damage risk of pavement

SCI = Surface Curvature Index
Describes the bearing capacity of upper part of the structure

BCI = Base Curvature Index
Desribes the bearing capacity of subgrade

FWD measurement

BCI

SCI

Asphalt
Excellent	<100
Good	100-200
Satisfactory	200-300
Alarming	300-450
Damaging	450-600
Lost	>600

Soft bitumen sphalt
Excellent	<200
Good	200-300
Satisfactory	300-450
Alarming	450-600
Damaging	600-800
Lost	>800

Road Doctor Software Based GPR / TSD / Laser Scanner Based Structural Performance Prediction – Poor Perfomers
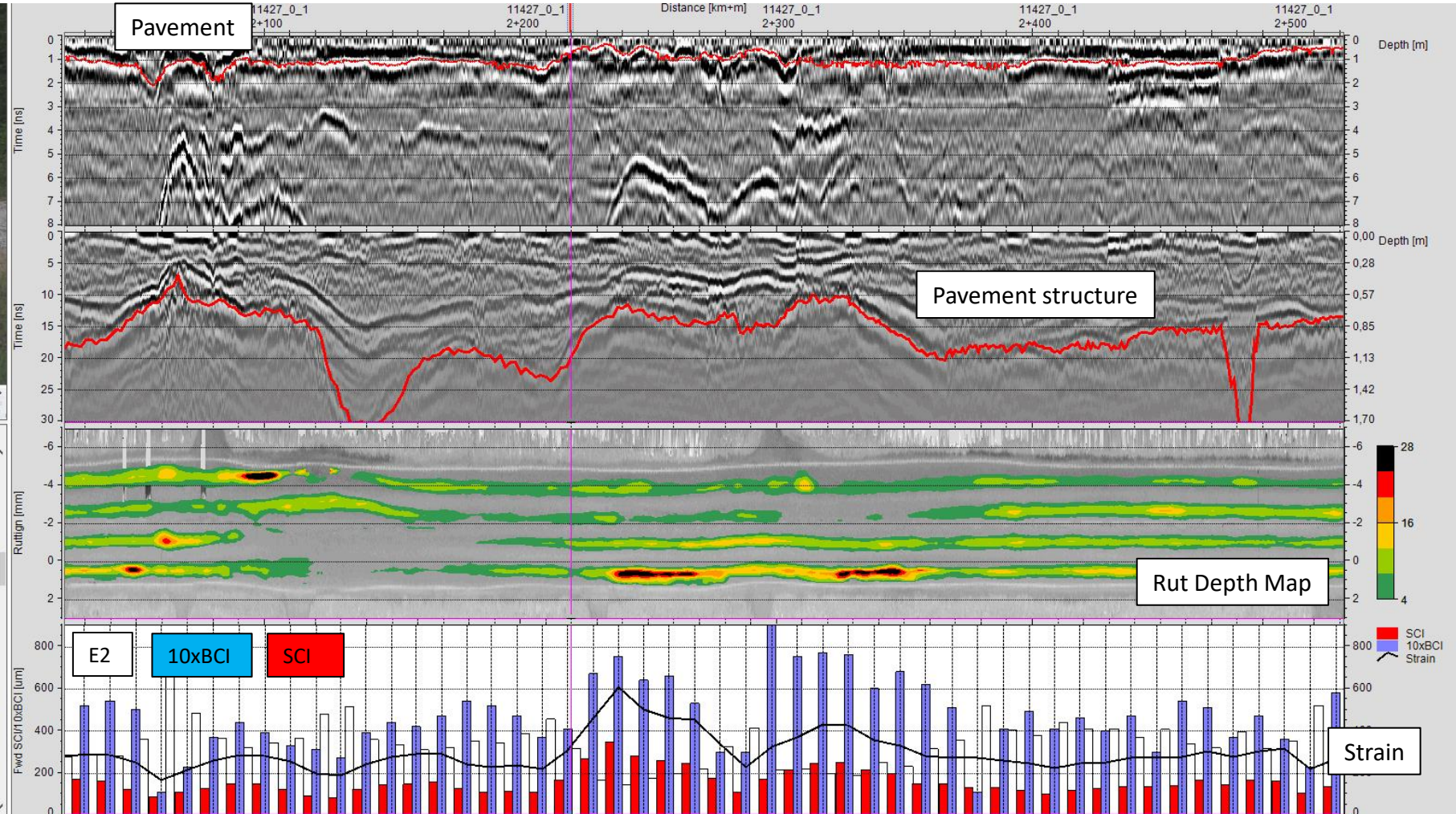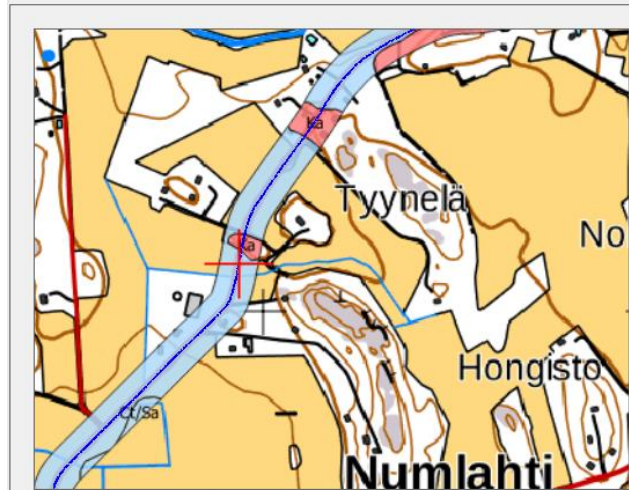
Summary

- The **development of NDT techniques** has been **rapid** in recent years.

- The **goal:** put together fast, good quality and versatile data collection systems and **collect large amounts of data** with as many parameters as possible.

- A new advantage is that with wide angle laser scanner, the **road surroundings** can also be measured and evaluated. This allows engineers to tackle one of the major problems affecting pavement lifetime, drainage.

- The **TSD method** provides **continuous information on bearing capacity** with a high-speed survey

- The **actual reason behind** a road's **anomalous behavior** can be found and evaluations of life-cycles can be done

Thank You!

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