



**ROADEX**  
**Network**  
For better rural roads

# Using New Technologies in Road Asset Management

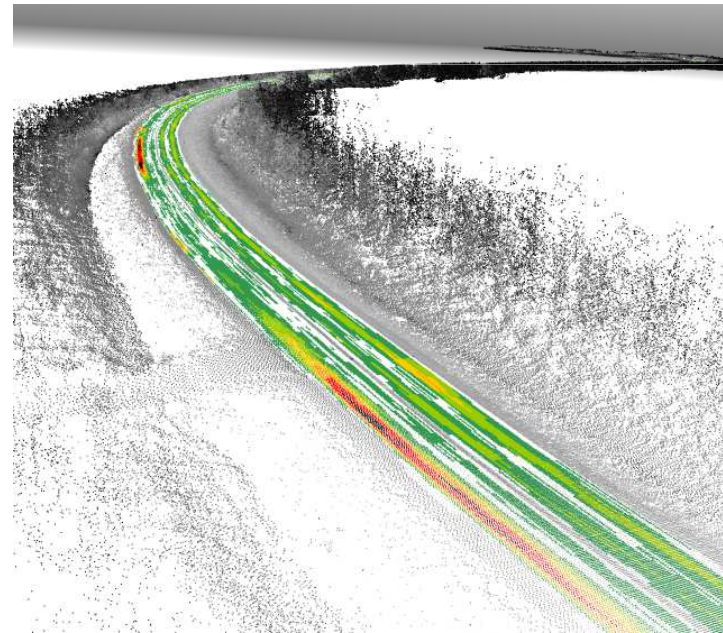
Annele Matintupa, MSc. civ.eng  
Roadscanners, Finland

# 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



# Modern Road Survey Technologies



Laser scanner



Ground penetrating radar



Digital video cameras, also thermal camera & GPS



Traffic speed deflectometer



Accelerometer

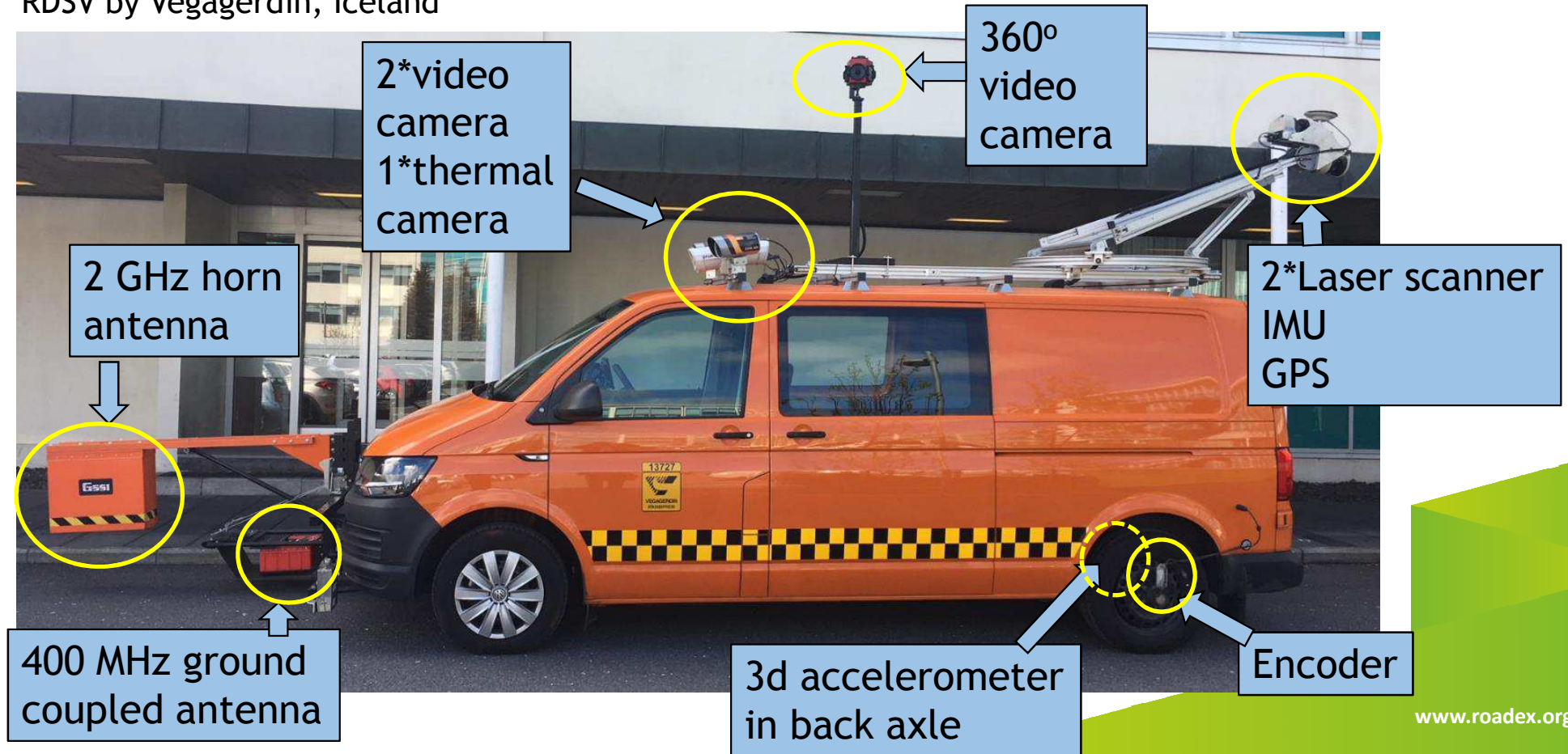


Falling weight deflectometer

# Modern road survey technologies

## Road Doctor Survey Van, RDSV

RDSV by Vegagerdin, Iceland



# Survey methods and parameters used for road condition diagnostics

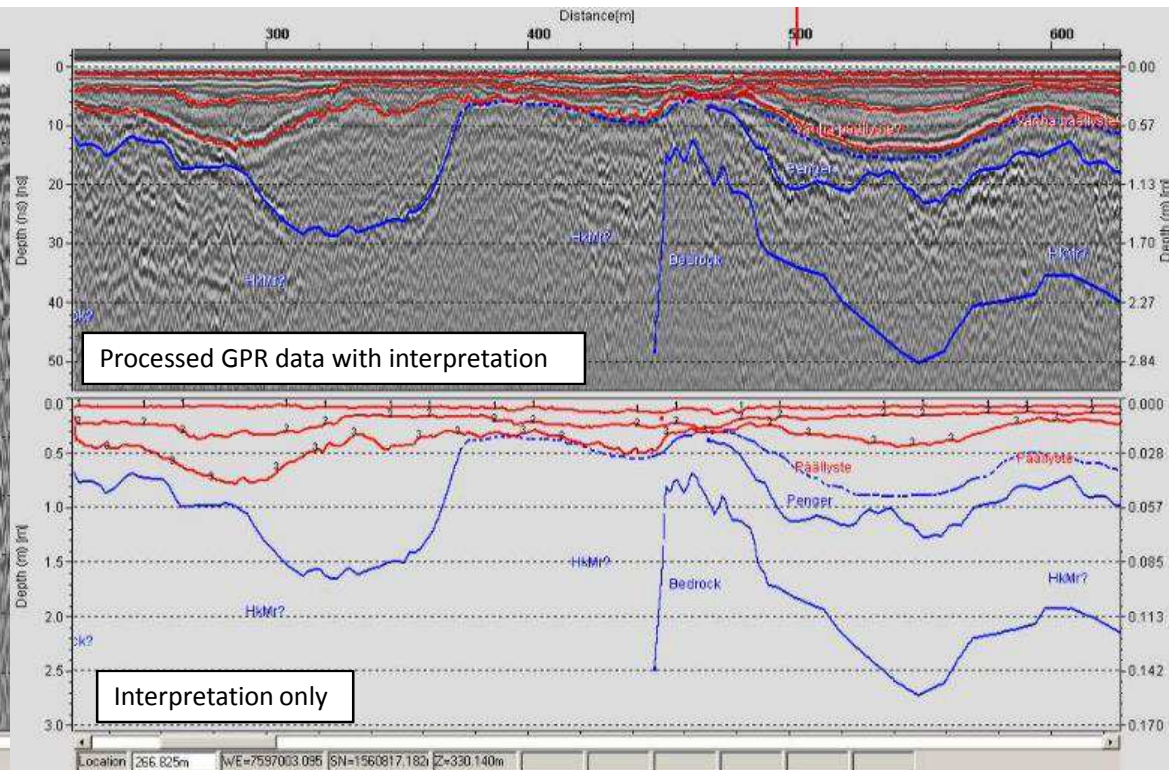
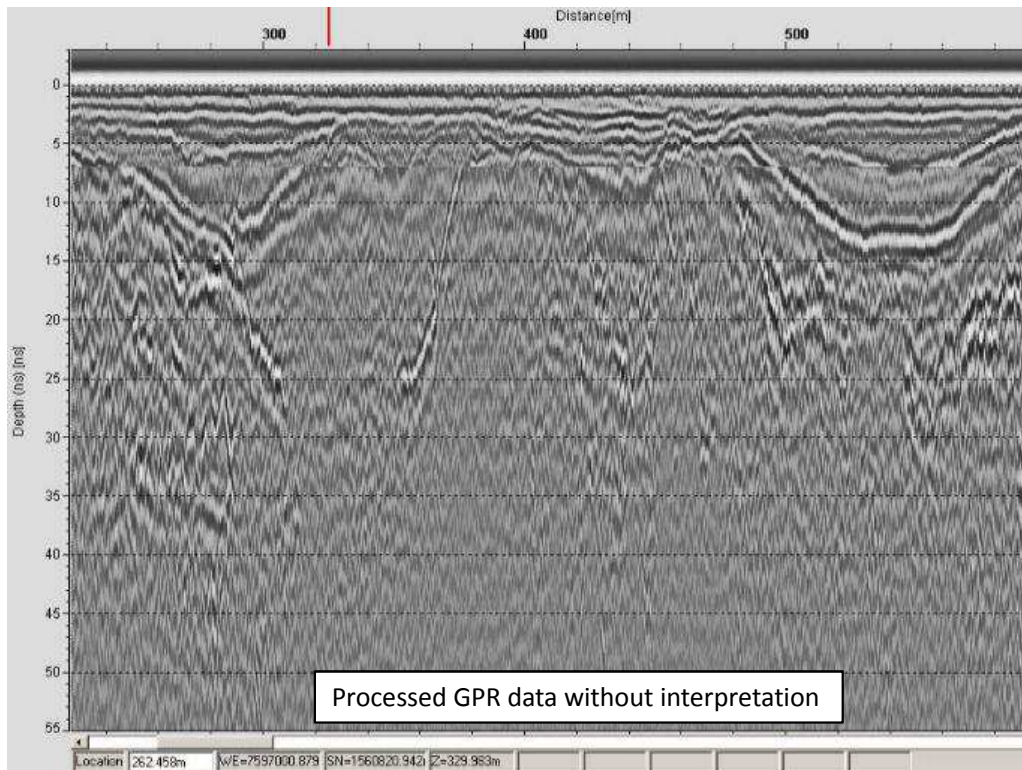


## Ground Penetrating Radar (GPR)

- layer thicknesses
- asphalt air voids content
- moisture (saturation degree)
- moisture susceptibility
- frost & ice lense detection
- cracking & microcracking
- delamination



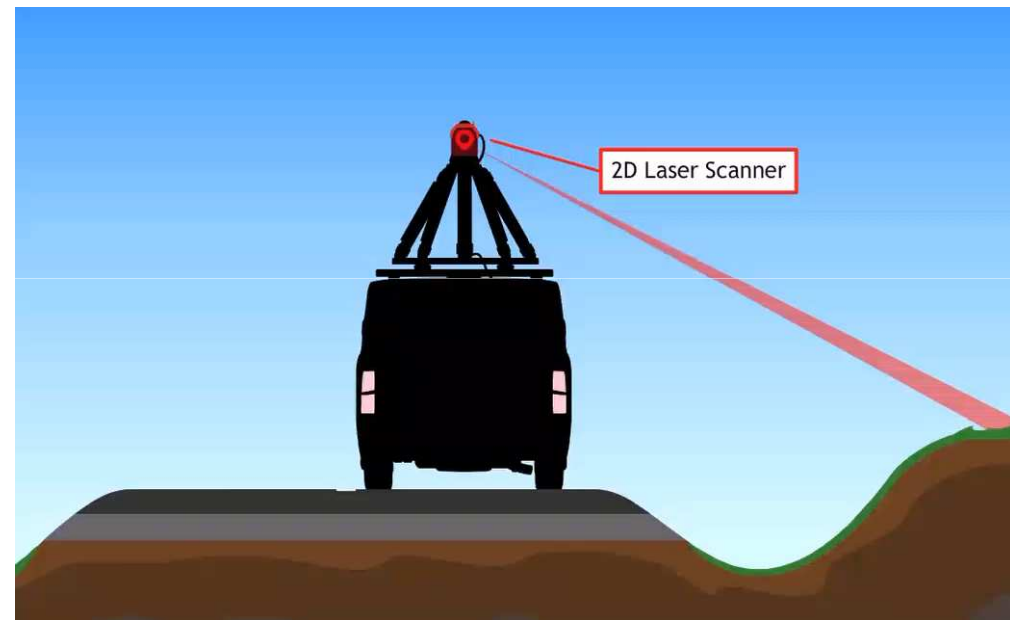
# Ground Penetrating Radar (GPR) data



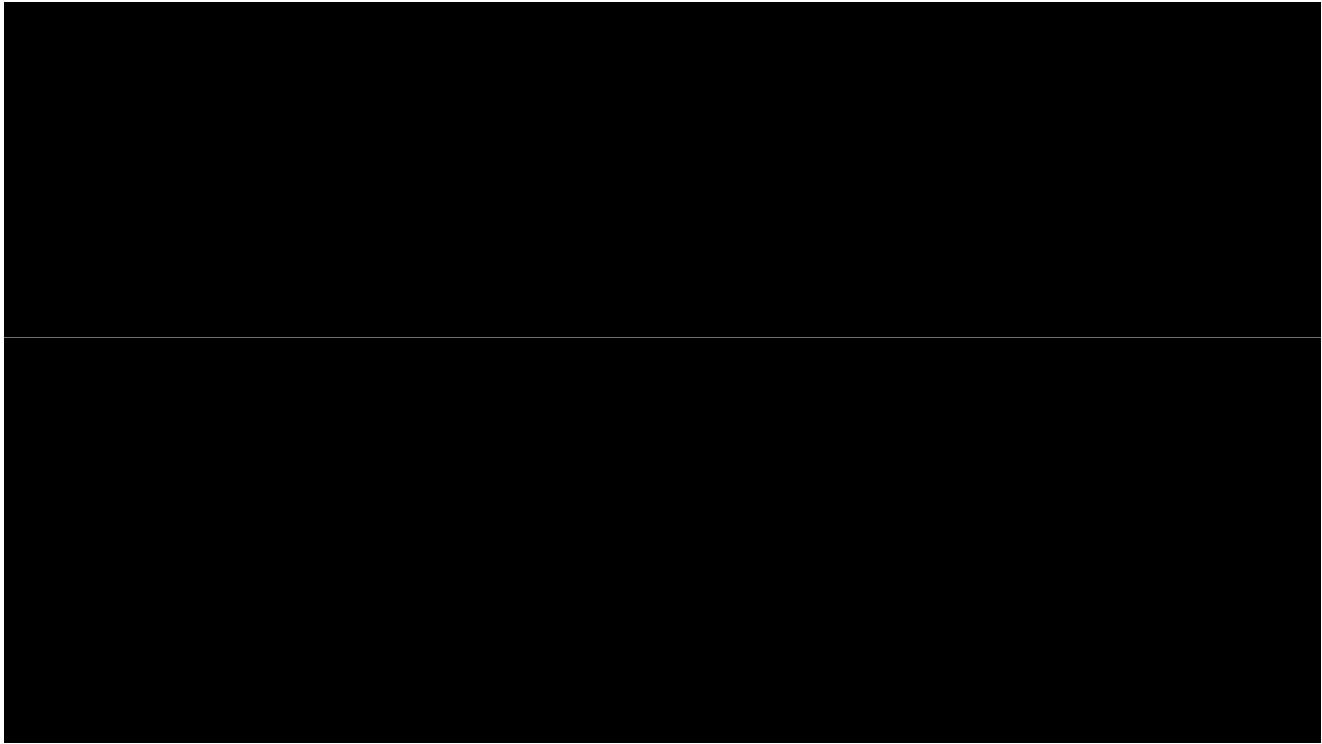
# Survey methods and parameters used for road condition diagnostics

## 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

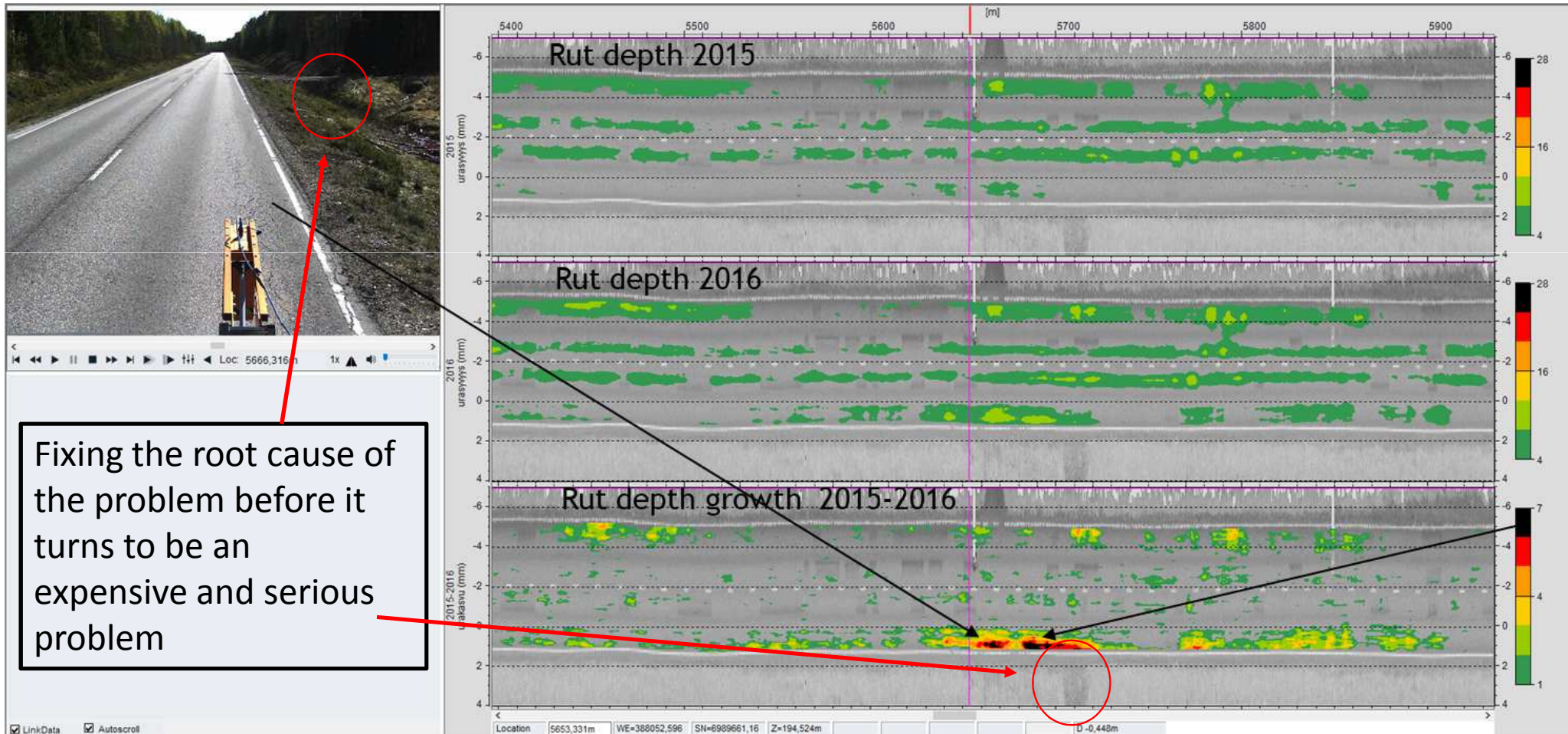


# Laser Scanner Data





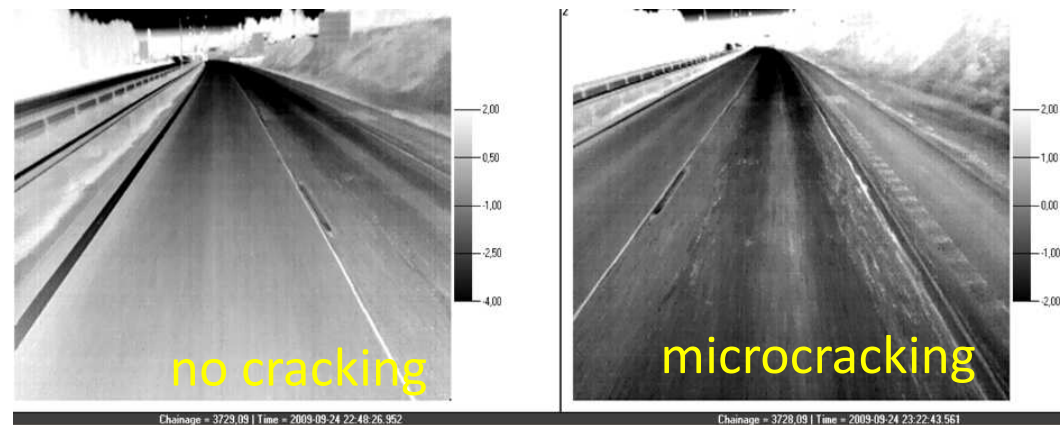
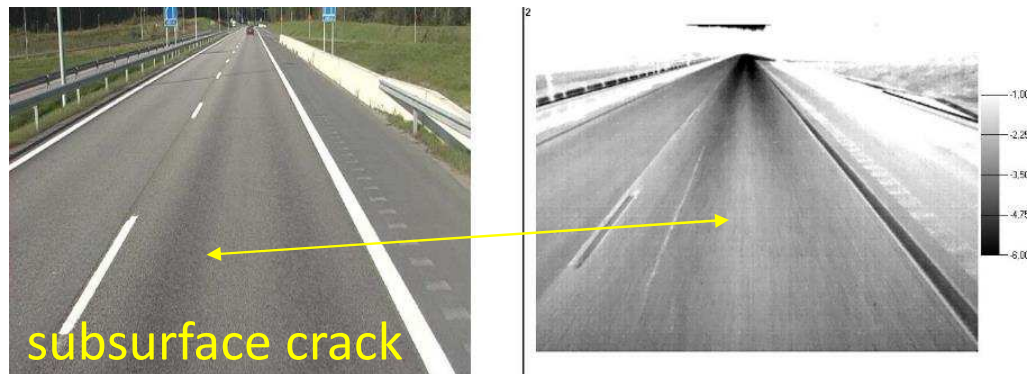
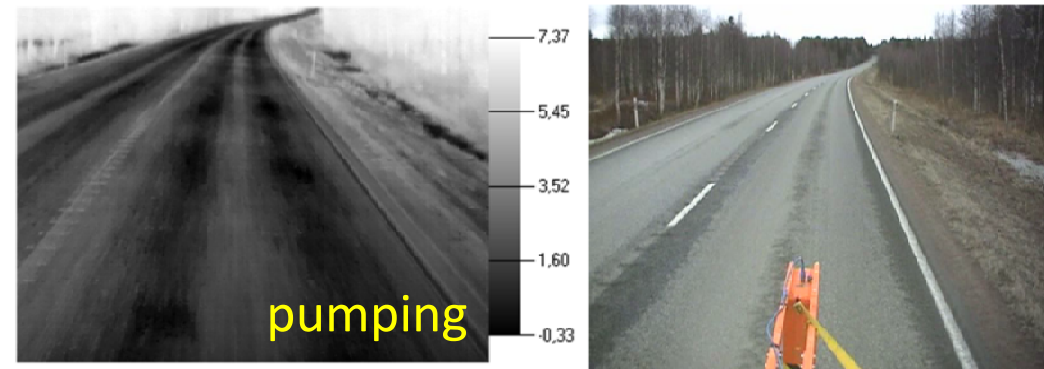
# Laser scanner data based proactive maintenance



# Survey methods and parameters used for road condition diagnostics

## Thermal cameras

- subsurface asphalt cracking
- microcracking
- crack healing monitoring
- segregation
- water pumping
- bridge decks



# Survey methods and parameters used for road condition diagnostics

## 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

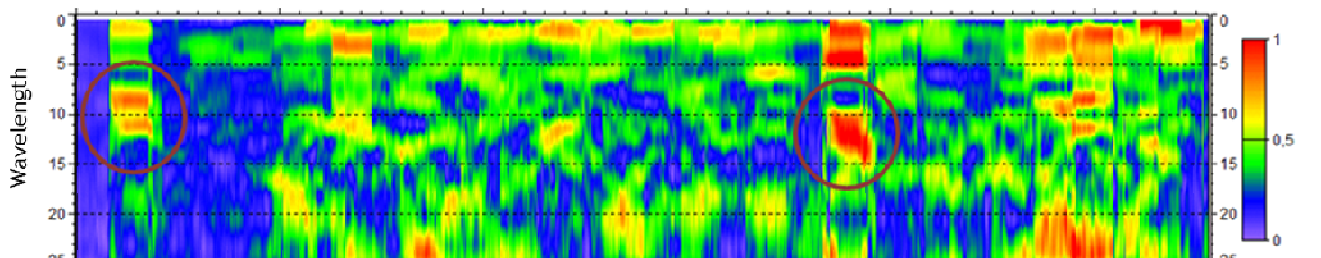


KM15

Surface roughness

Bumps

Settlements etc



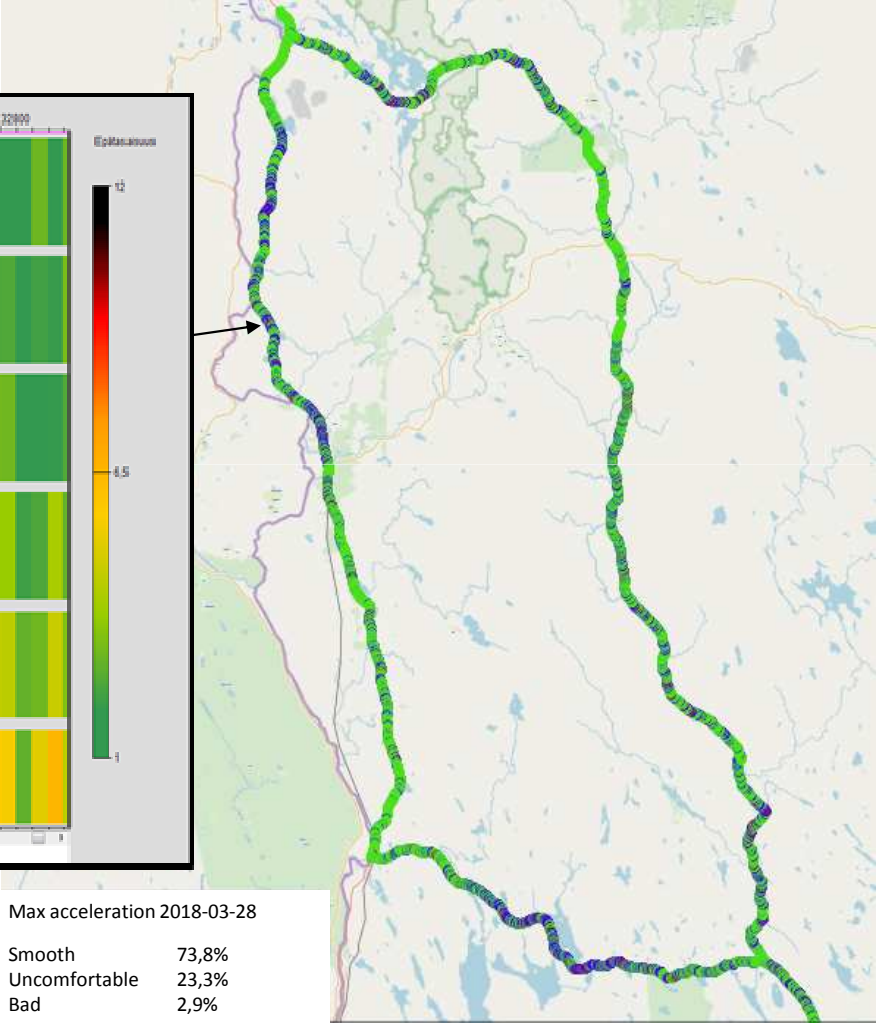
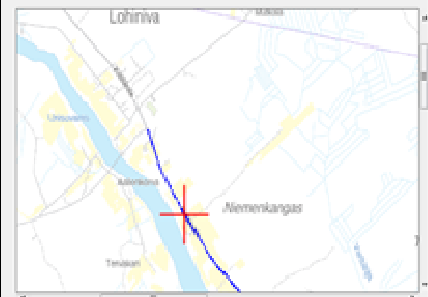
**Slide 11**

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**KM15**

picture: Settlements  
Kent Middleton, 25/08/2017

# Accelerometer Data - Roughness Development



Max acceleration 2018-03-28

Smooth	73,8%
Uncomfortable	23,3%
Bad	2,9%

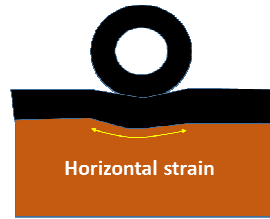
# Survey methods and parameters used for road condition diagnostics

## TSD / FWD

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



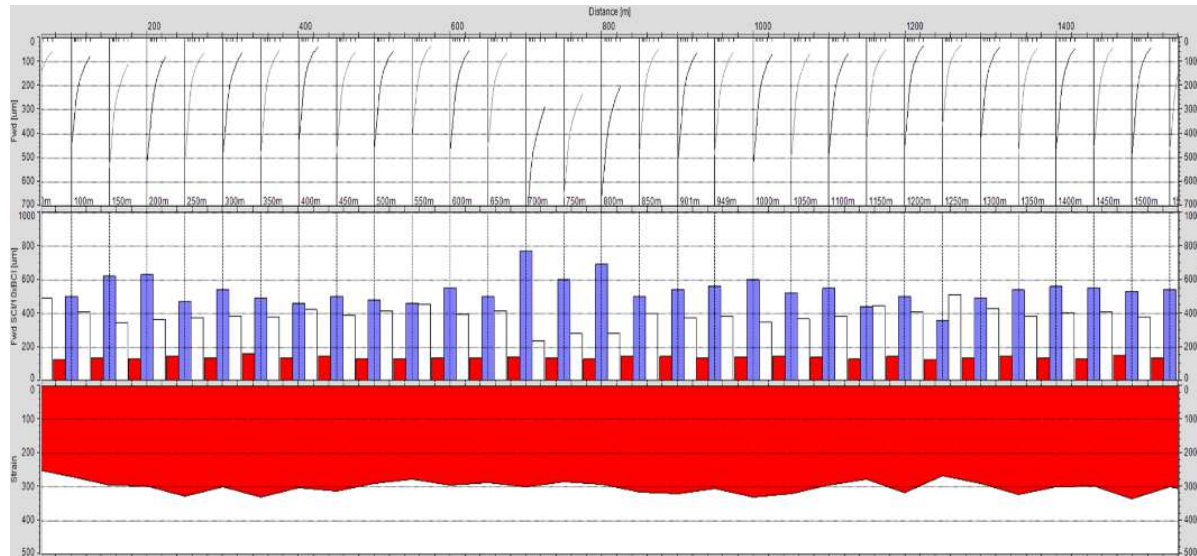
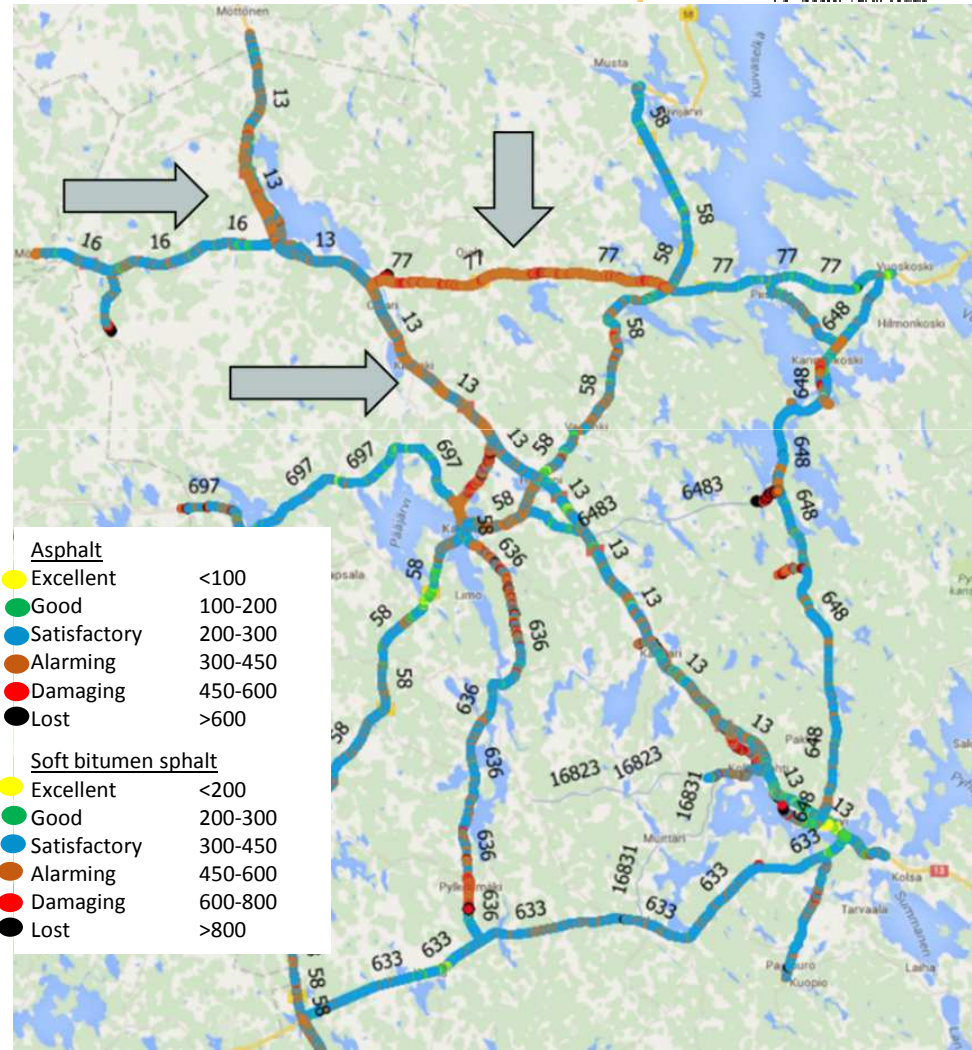
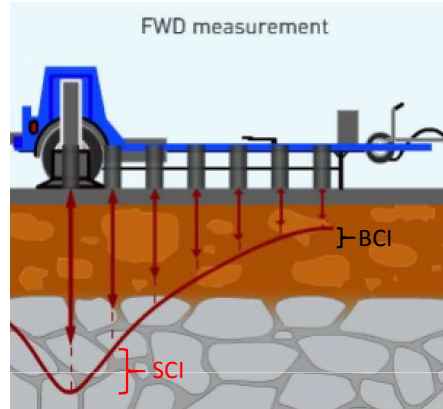
# TSD / FWD data



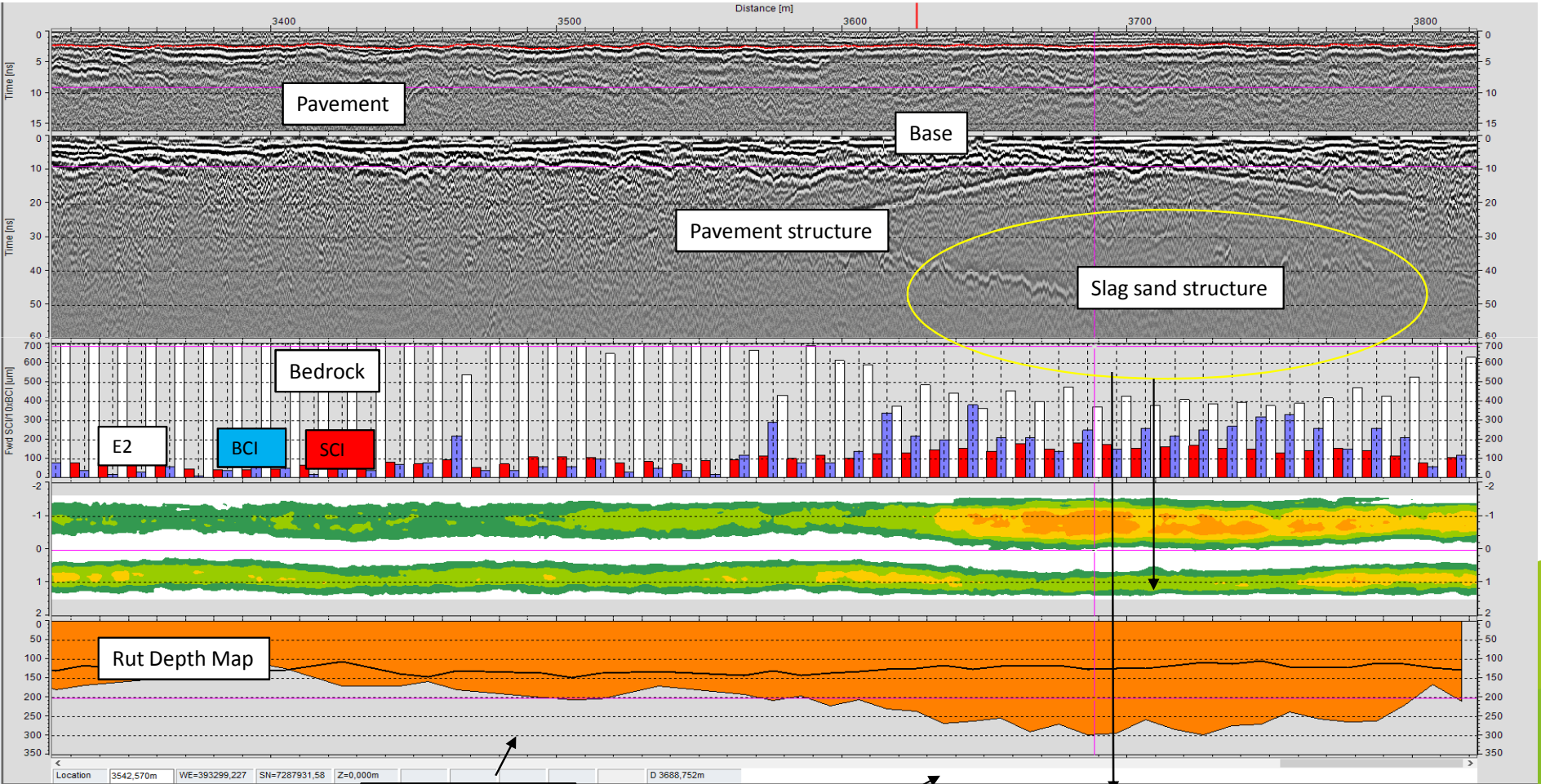
**Strain** = Calculated based on GPR and FWD / TSD data  
Indicates the fatigue damage risk of pavement

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

**BCI** = Base Curvature Index  
Describes the bearing capacity of subgrade



# Road Doctor output for a poorly performing road

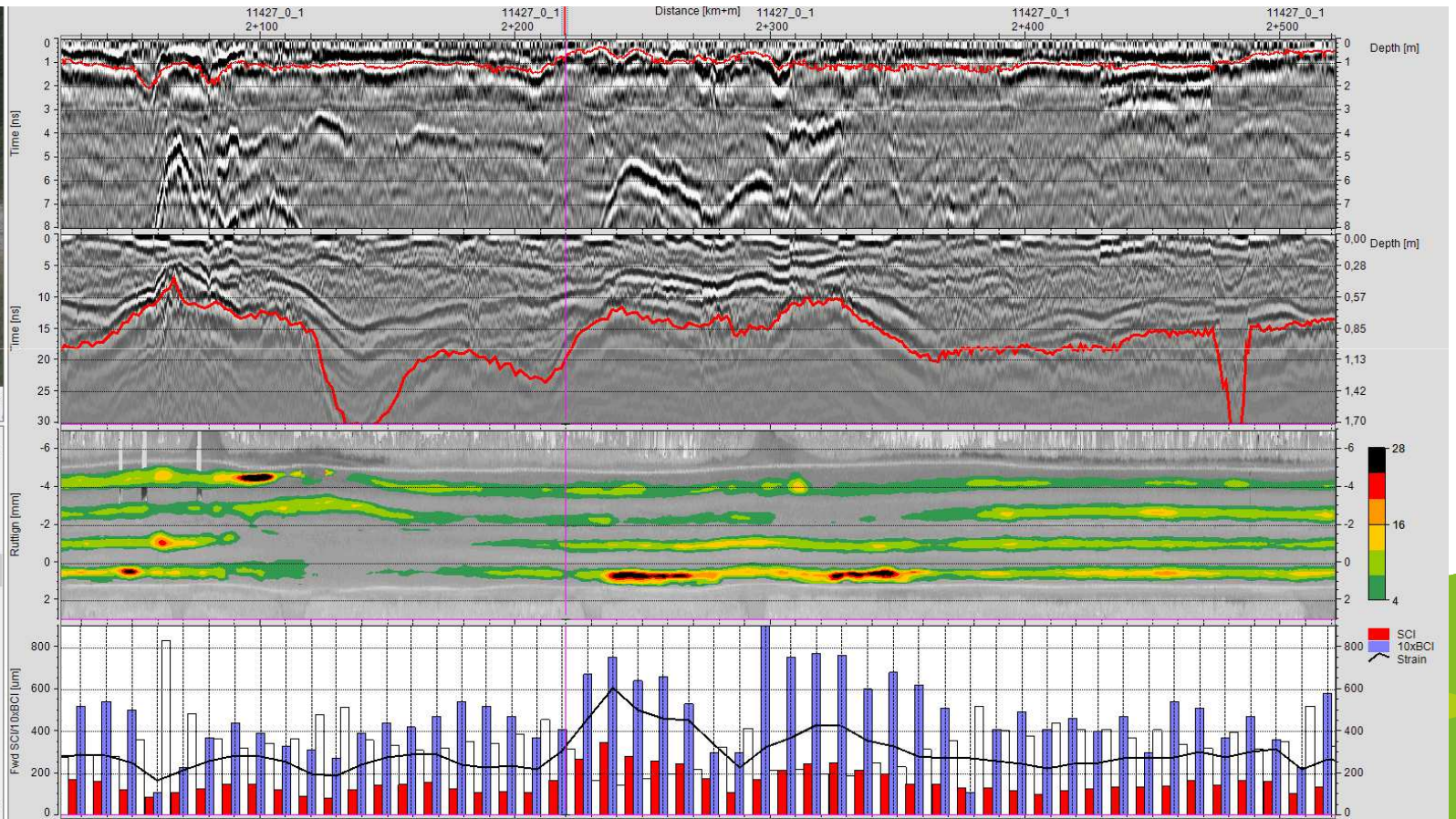
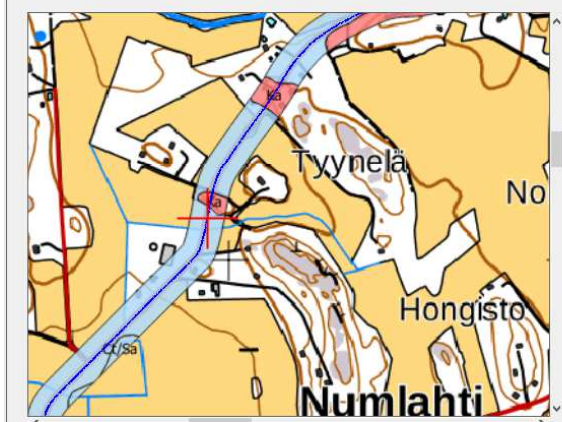
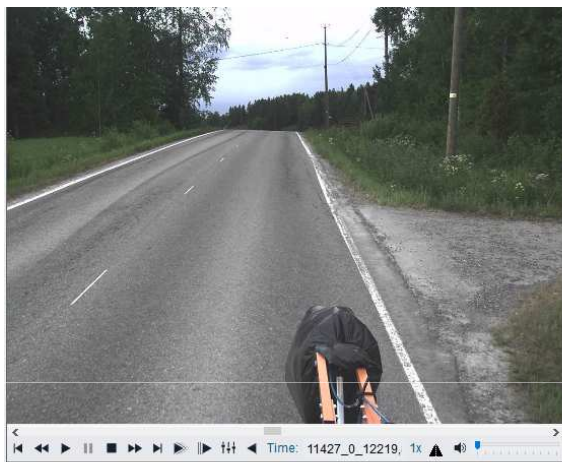


Pavement thickness

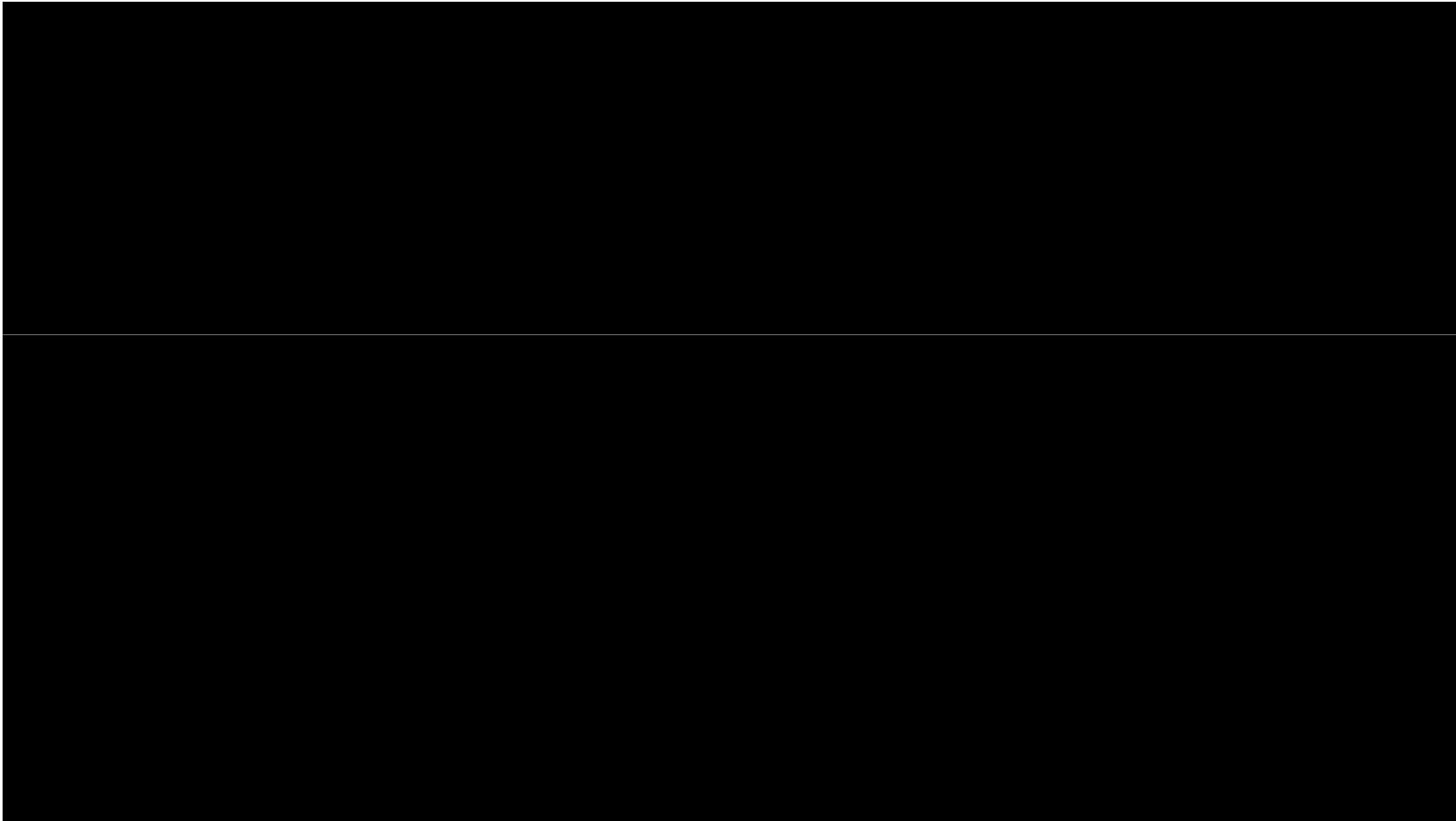
Strain



# Road Doctor output for a poorly performing road



# GPR moisture analysis and Laser Scanner point cloud data analysis



Visualization is already here



[www.roadex.org](http://www.roadex.org)

# Summary



- The **development of NDT techniques** has been **rapid** in recent years.
- The **goal** is to 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 the 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 of bearing capacity** with a high speed survey
  - On local roads, where the changes in bearing capacity are sudden and local, the dense testing interval is very important. Note that on the smallest roads this method cannot be used because the truck needs enough space.
- The combination of **modern data collection methods** and **joint analysis of the results** allows
  - The diagnostics capabilities for road problems to reach new levels.
  - Possibilities to develop automatic diagnostic methods.
- The **actual reason behind** a road's **anomalous behaviour** can be found and lifecycles can be evaluated
  - This makes **proactive maintenance** possible with significant **savings** in road **lifecycle costs**.

Thank You!

13.5.2019



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