Drainage Maintenance Digital Management Development – Experiences from Finland

Roadscanners Oy I Annele Matintupa I NADim Seminar Oslo I 28.11.2024

BEYOND THE SURFACE

PROJECT IN COOPERATION

Pilot project 01/2022–06/2023

Finnish Transport Infrastructure Agency

ROADSCANNERS

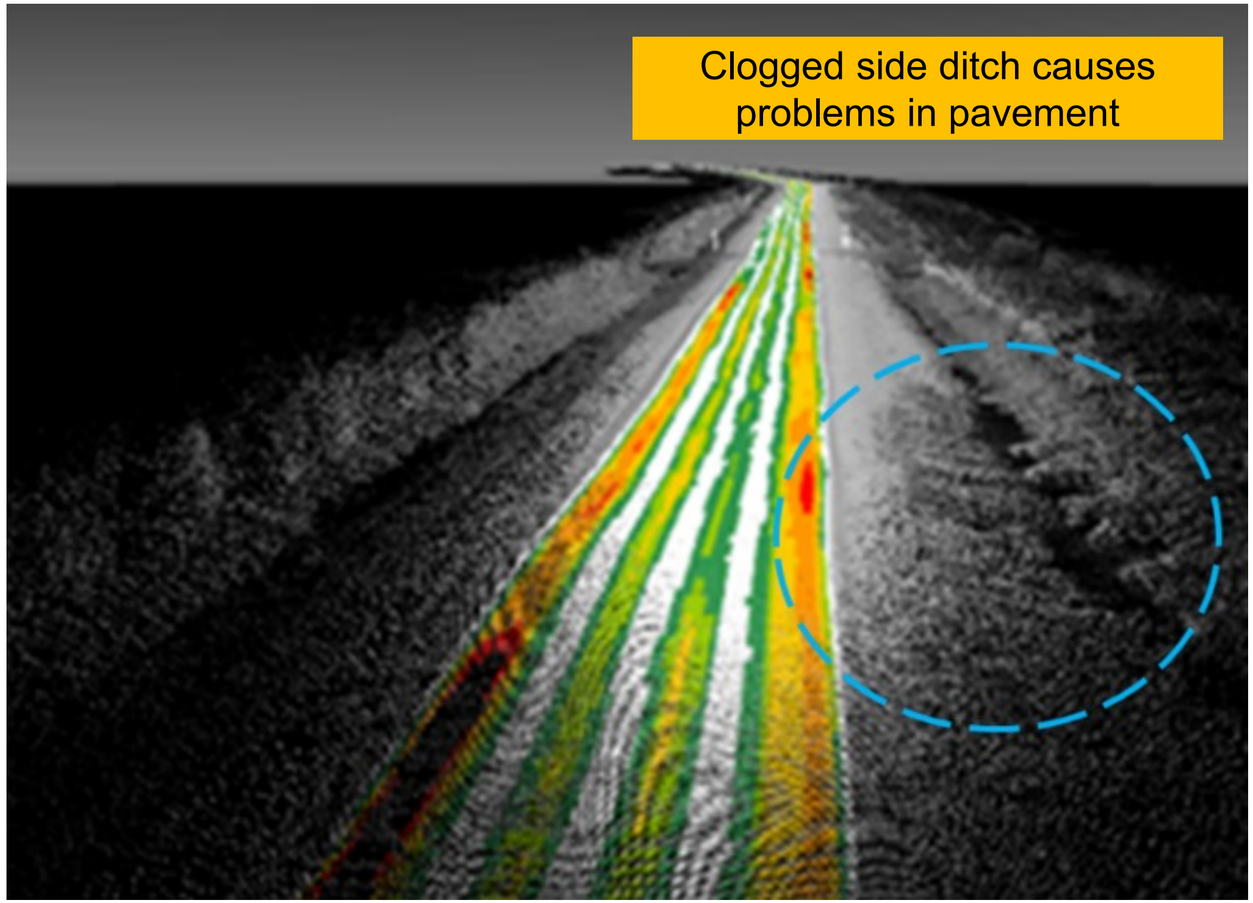
SivilPoint
an ARKANCE SYSTEMS company

Tampereen yliopisto

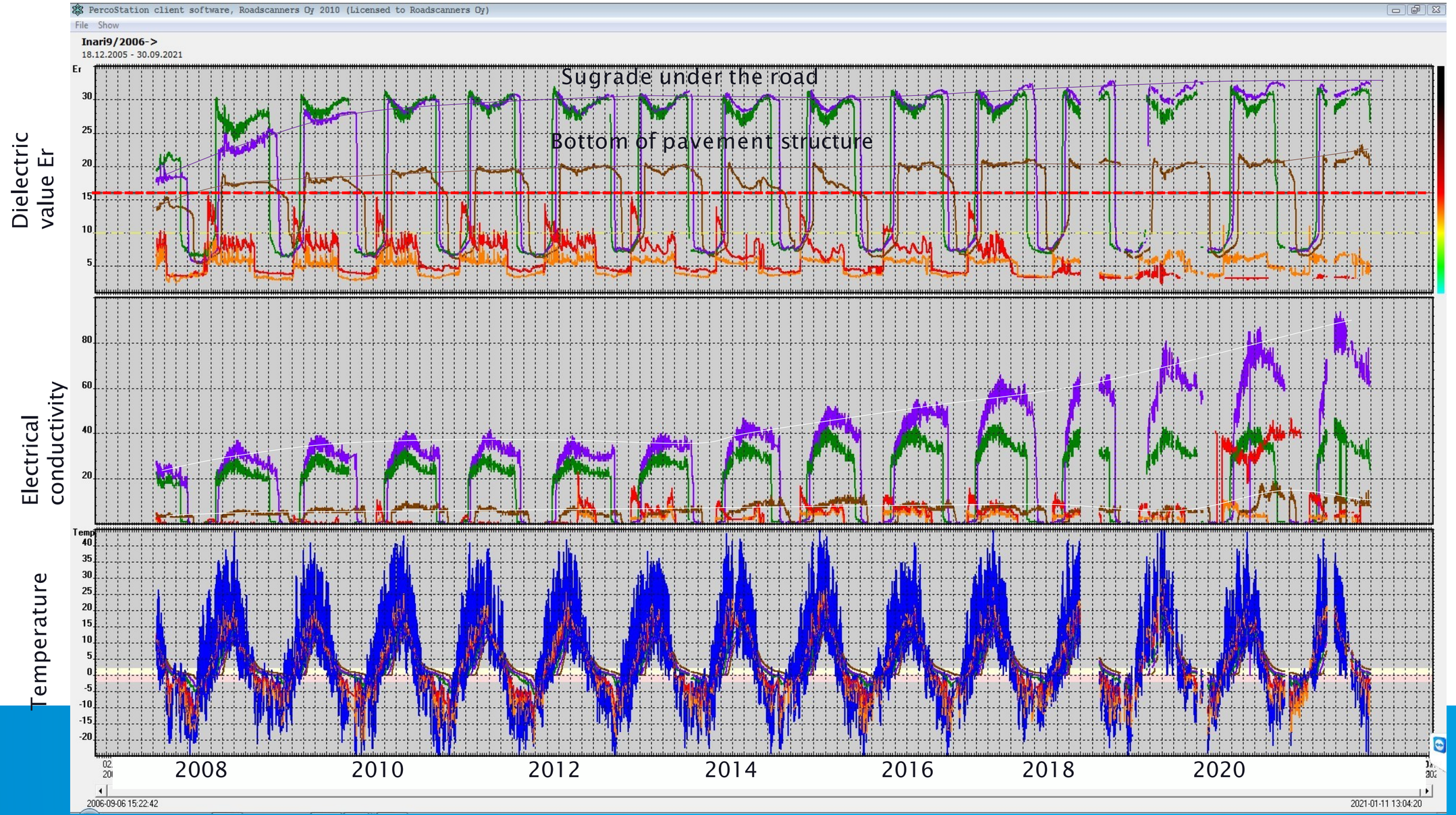
Research Centre TERRA Geo Road Rail

BACKGROUND

- Access road junctions – big problem, but easy to repair
- Side ditch (and outlet ditch) related problems cause bearing capacity and frost problems
- Winter drainage problems – delayed removal of snow walls: Major impact on shoulder deformation and roughness



MONITORING MOISTURE IN ROAD STRUCTURES AND SUBGRADE
INARI PERCOSTATION



BEYOND THE SURFACE

PROJECT GOAL

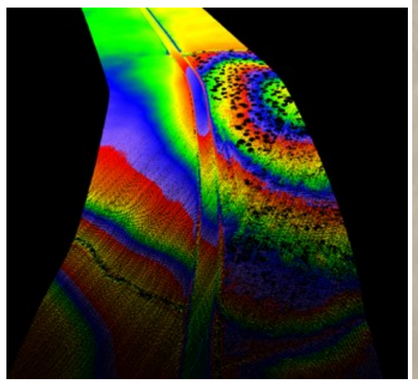
- Main goal is to keep ditches in good condition – not just a one-time improvement
  - Goal is ongoing regular maintenance
  - Ditches can fill by 2-3 cm / year, so in 15 years a ditch would be filled without attention
- Decisions related to drainage management should be based on measured information - so that costs do not get too high
- Longterm – 15-25% in savings could be achieved

PROJECT PHASES

- Drainage condition diagnostics measurements
- Drainage design
- Drainage improvement through a virtual model that the excavator operator follows
- Ensure good drainage condition with regular measurements

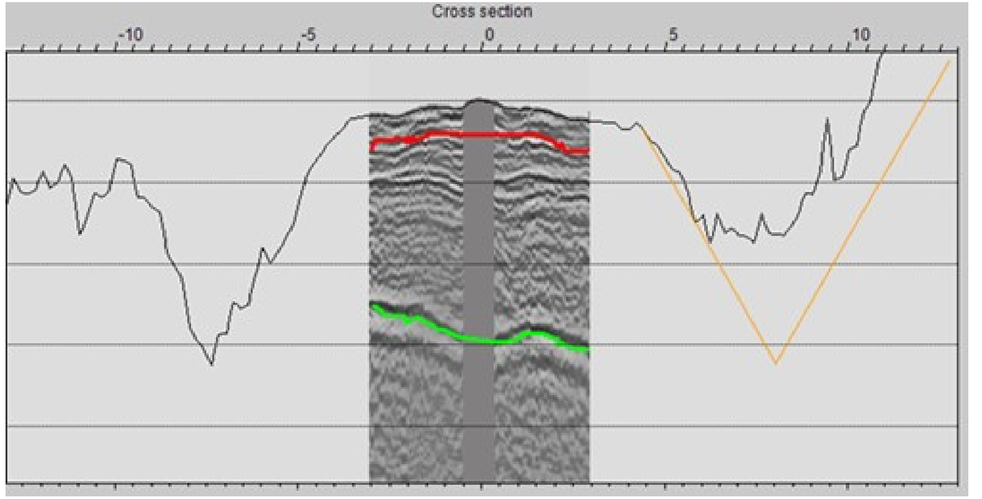
DATA COLLECTION

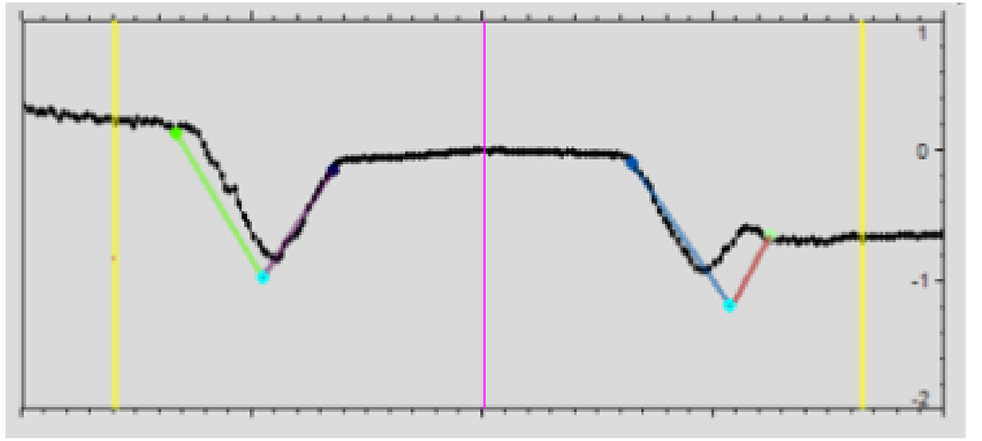
- Road Doctor Survey Van - measurements
  - Ground penetrating radar
  - Lidar
  - Digital videos
- National Land Survey maps and 3D terrain models
  - Road area info
- Register information
  - Culverts, bridges
- Underground cable locations



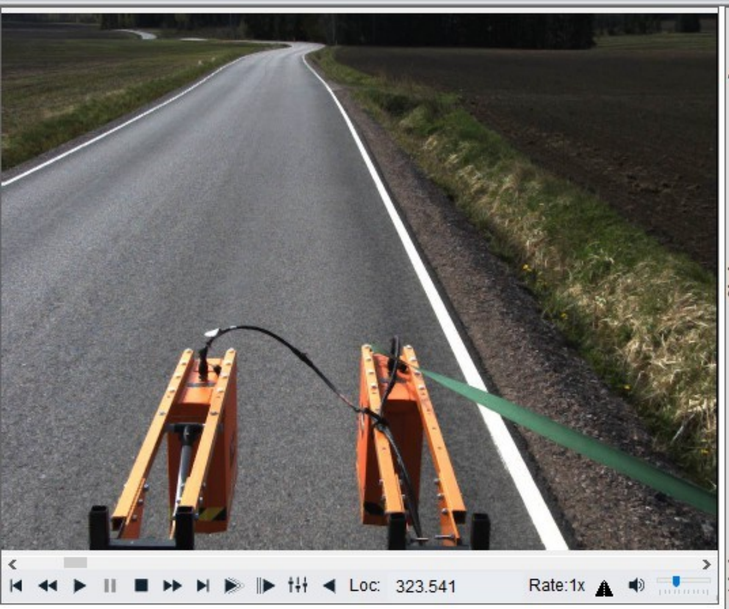
DESIGN PRINCIPLES

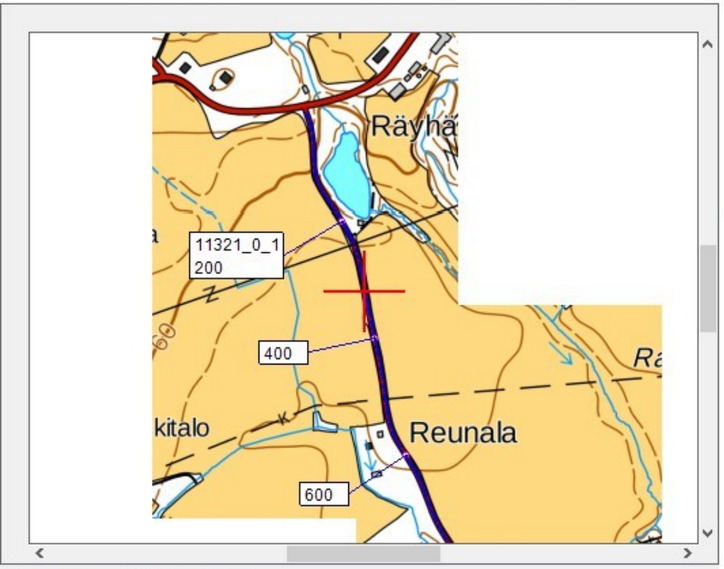
- Ditches need to be deep enough
  - Goal is that bottom of ditch should be 20-30cm lower than bottom of road structure
- Correctly inclined ditches and properly pitched slopes
- The following should also be considered
  - Fixed points like culverts, outlet ditches, watershed
  - Cables and other obstacles
  - Road area limits
- Final design is a compromise of the above issues

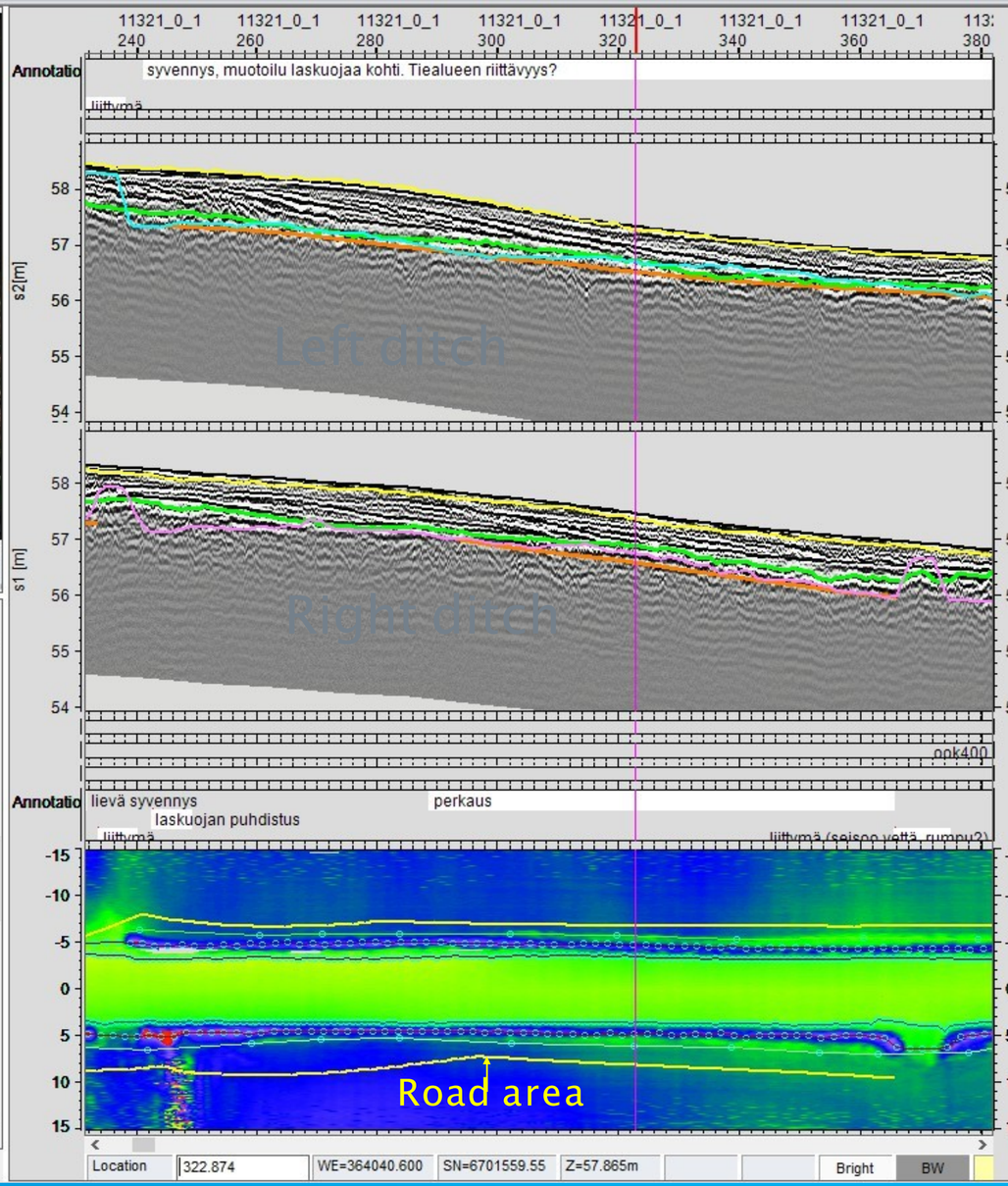


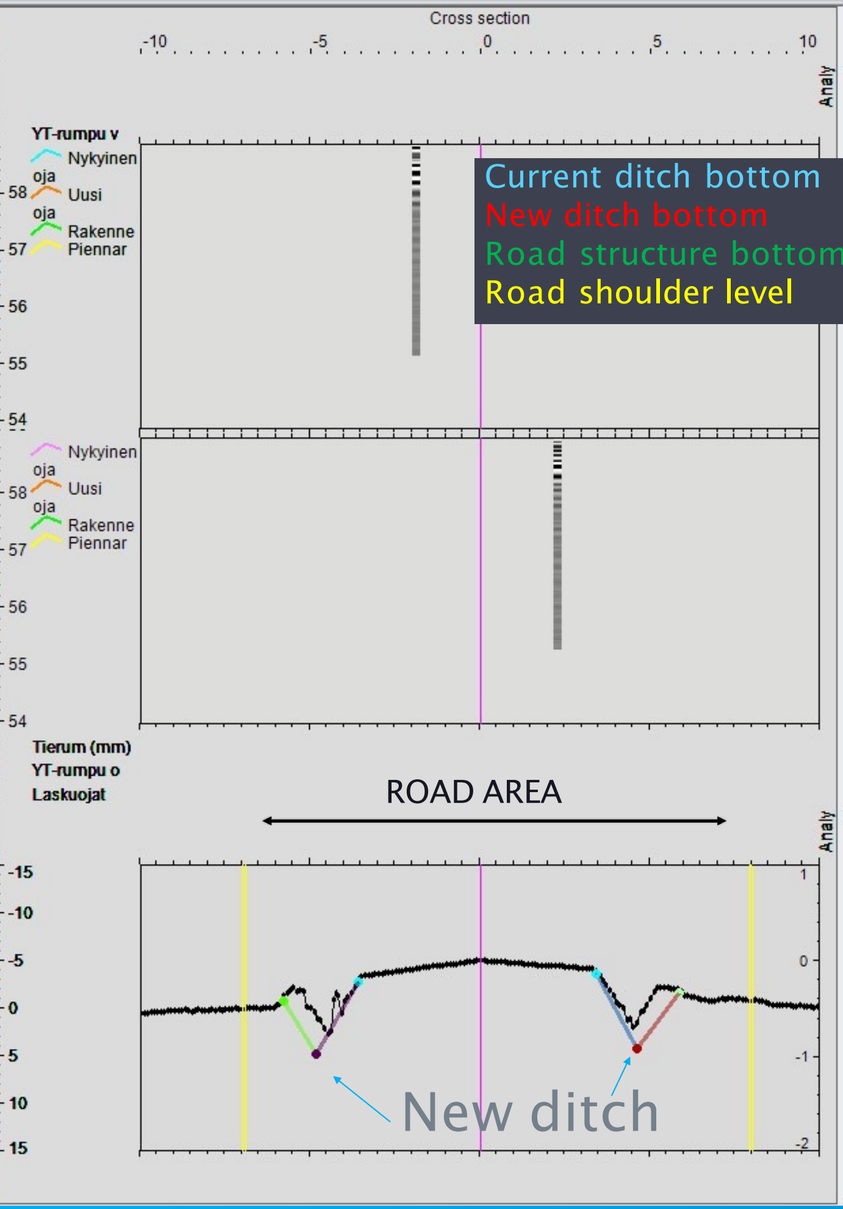


DRAINAGE DESIGN IN ROAD DOCTOR



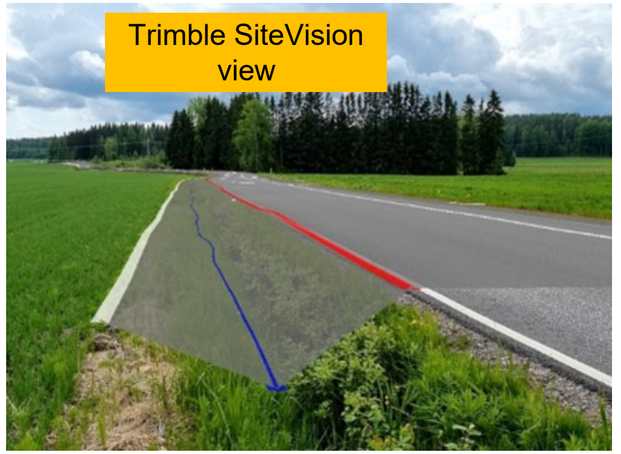






KEY ISSUES IN IMPLEMENTATION

- Light 3D machine control model including:
  - Uppermost surface
  - Road area limits
- Inframodel –format from USB memory stick or from cloud service to machine
- Nowadays a familiar work method to contractors
- Lane surface as an elevation reference

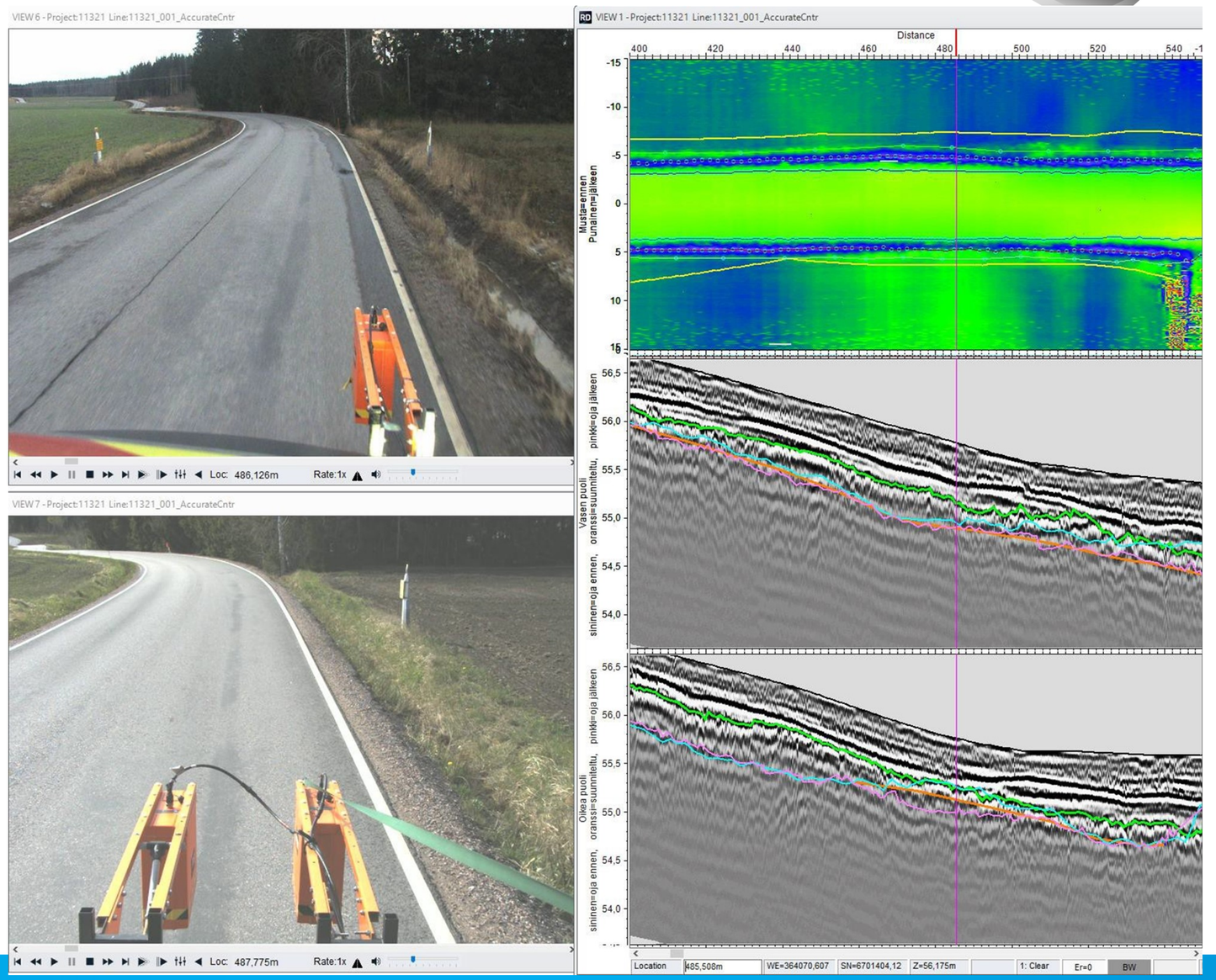


DITCHING IN UUSIMAA

- Wheel-mounted excavator
- Outer slopes were problematic
- Stability problems were detected on inner slopes

QUALITY CONTROL

- The goal was to excavate ditches to designed depth – not just clean the ditch bottom
- As such quality control was necessary and important
- Follow-up quality control measurements were made with RDSV



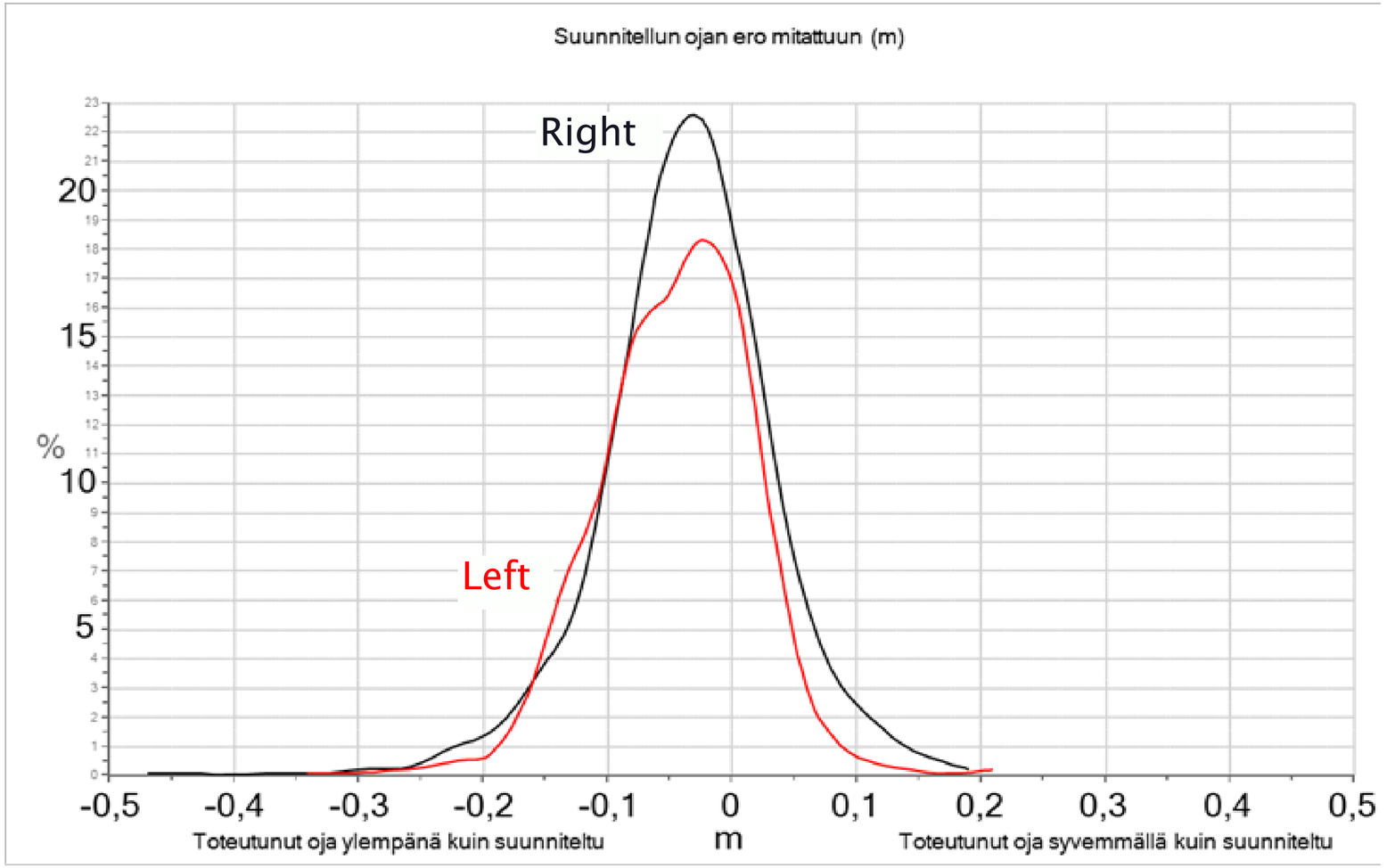
ACCURACY – Ditch Depth Design vs. QC

LEFT DITCH

- median was 3,2 cm higher than planned
- standard deviation 6,2 cm

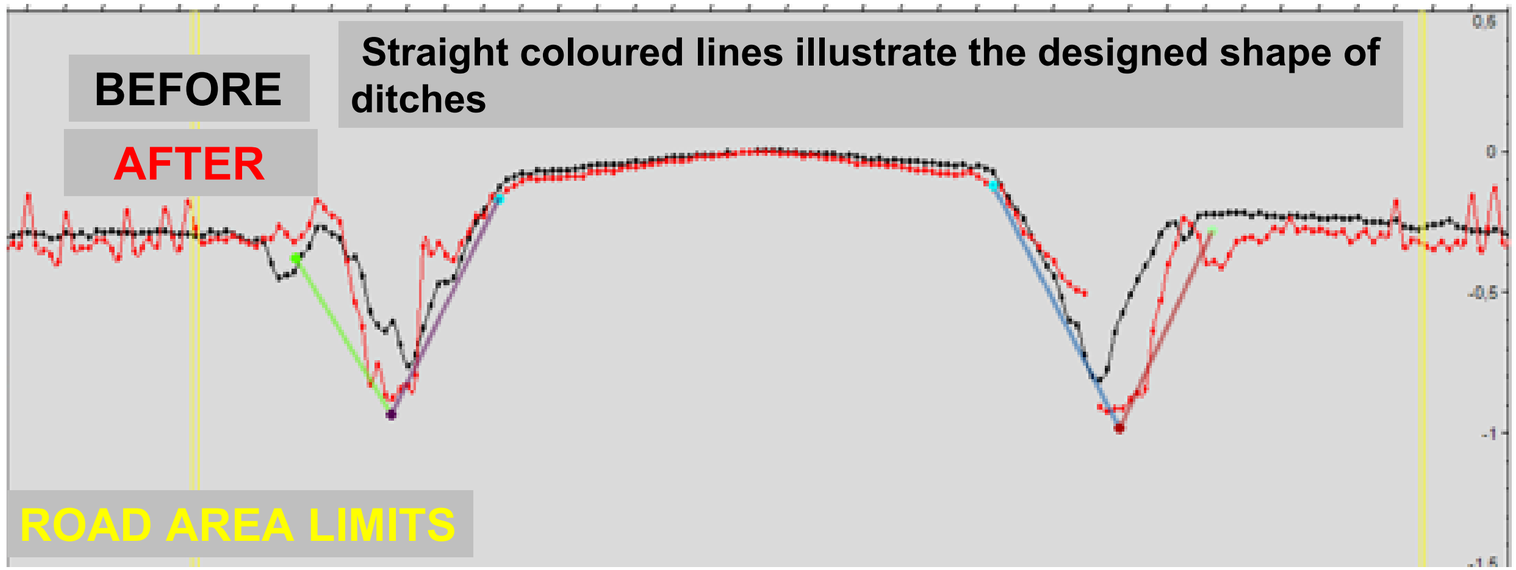
RIGHT DITCH

- median was 4,0 cm higher than planned
- standard deviation 6,9 cm



ACCURACY – Ditch Depth Design vs. QC

- Not as much was excavated from the outer slope as was planned
- => outer slope was, as a result, steeper than planned
- V-shaped ditching buckets have a 30cm wide flat part and are not a perfect V shape like the design assumes
- In general – very promising results from the pilot project!

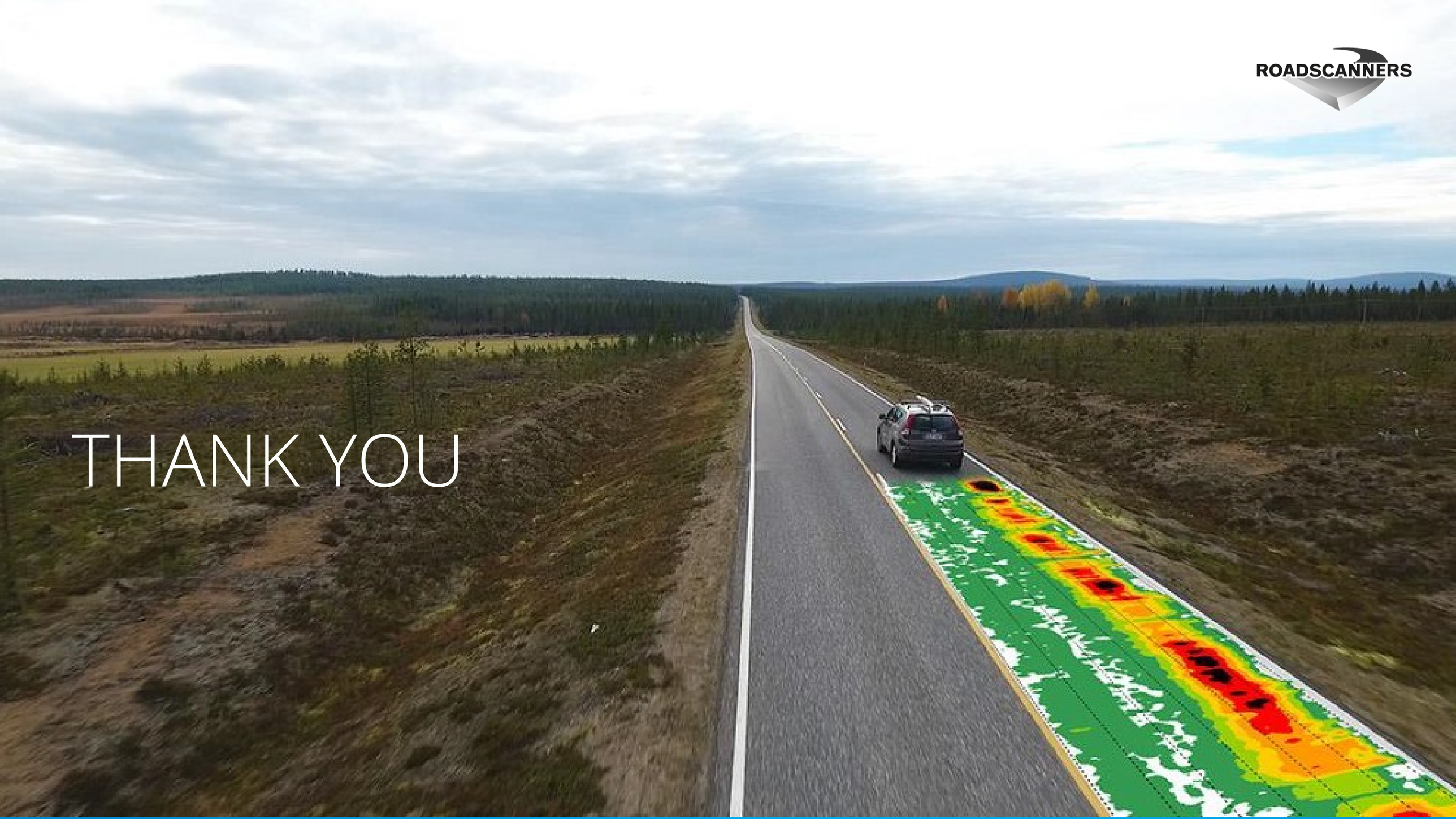


EXPERIENCES

- Model based excavation work helps to produce well working drainage system
- Farm fields commonly encroach on the road area. Equipment operators' deviation from the design was often a result of trying to preserve such encroachments
- A model-based work method opens the market to greater competition
- Measurements and design work does create some costs
- Communication between road authorities and local people, landowners and farmers is important
- A new work method like this needs a change in mindset for it to become standard practice

BENEFITS AND SAVINGS

- With this method, ditch bottom will be set to the correct level – the original planned level
- According to PEHKO RDSV survey results only 30% of side ditches meet this standard
- Measurements are needed – cannot be observed with human eye
- Follow up with lidar – problematic sections could be repaired before they cause problems in the road structure - > proactive maintenance!
- According to calculations, savings based on drainage improvement yearly are 2-4 €/ m / year, which means that investment repayment is only 2-4 years


ROADSCANNERS
THANK YOU