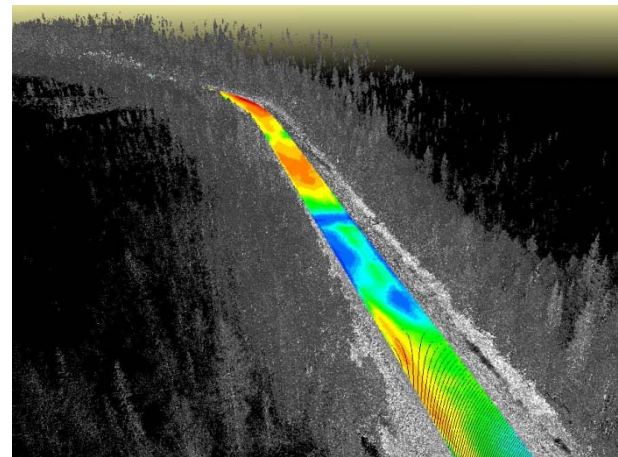




ROADSCANNERS

BEYOND THE SURFACE

EXPERIENCES IN THE USE OF LASER SCANNERS AND GPR TECHNIQUES IN FROST DIAGNOSTICS ON ROADS AND STREETS



Timo Saarenketo, PhD
Managing director
Roadscanners Group

EM TECHNIQUES IN NDT ROAD SURVEYS

GPR



0.1 - 1 m

Thermal Camera



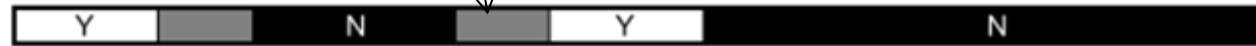
8-12 microm

Laser Scanner

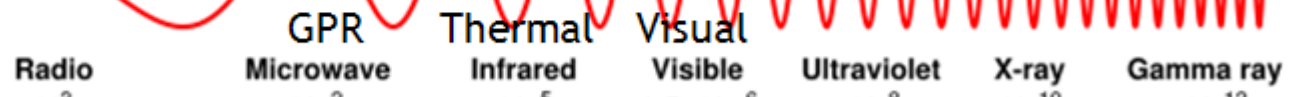


905 nm

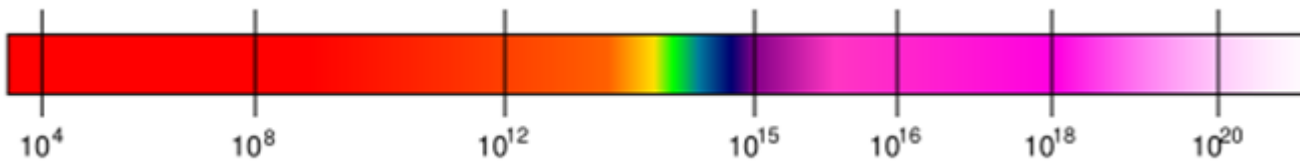
Penetrates Earth's Atmosphere?



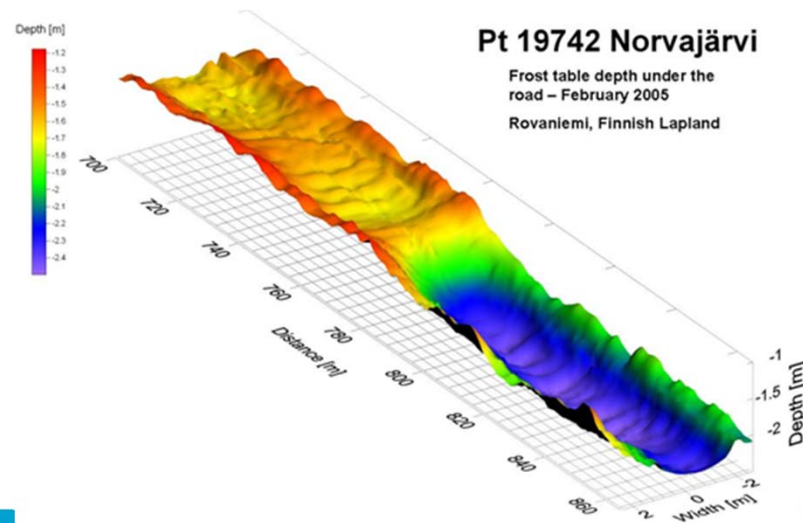
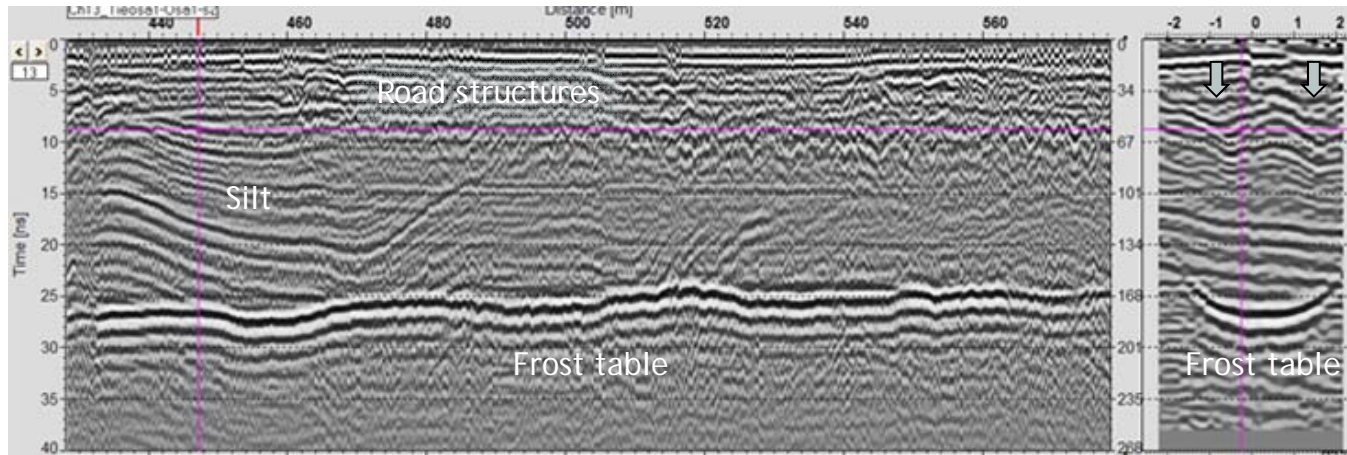
Radiation Type



Frequency (Hz)

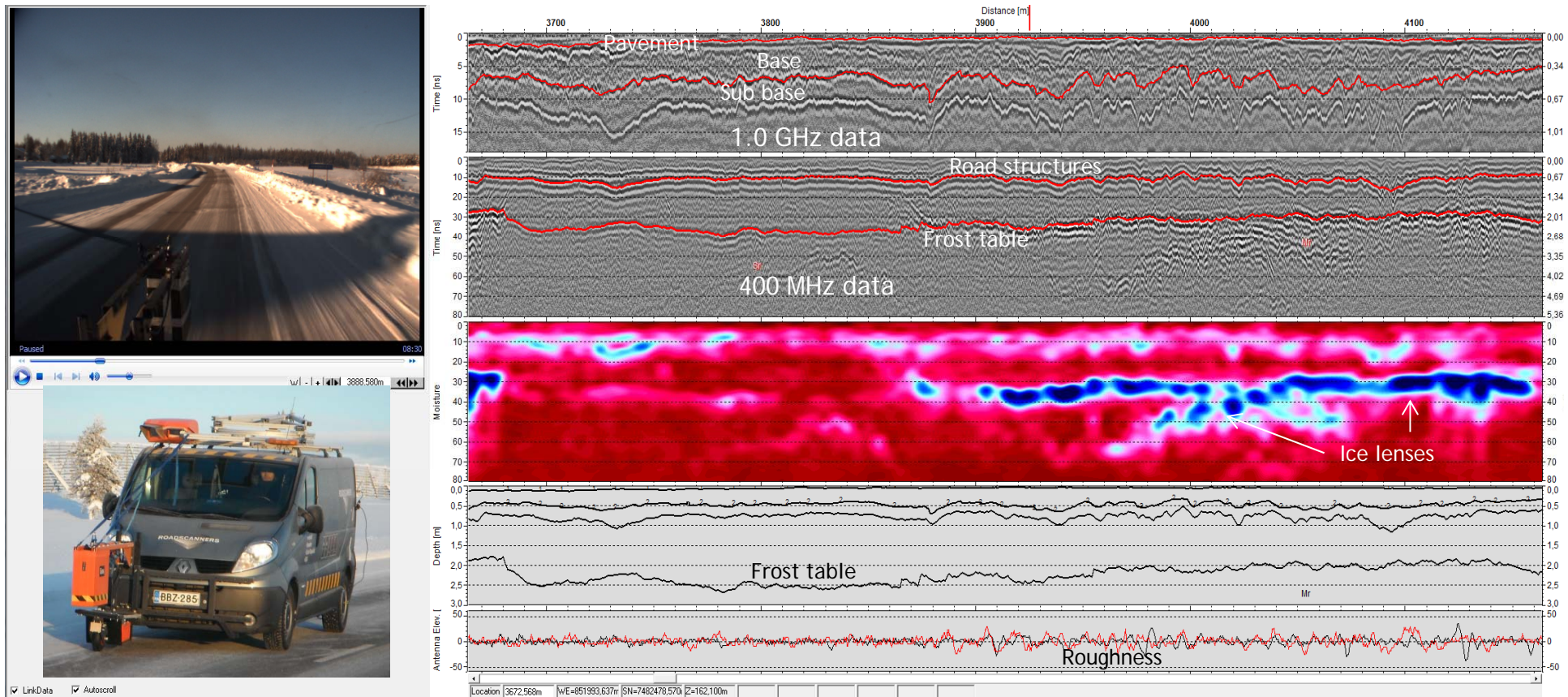


3D GPR AND FROST ANALYSIS



2D GPR FROST ANALYSIS IN WINTER

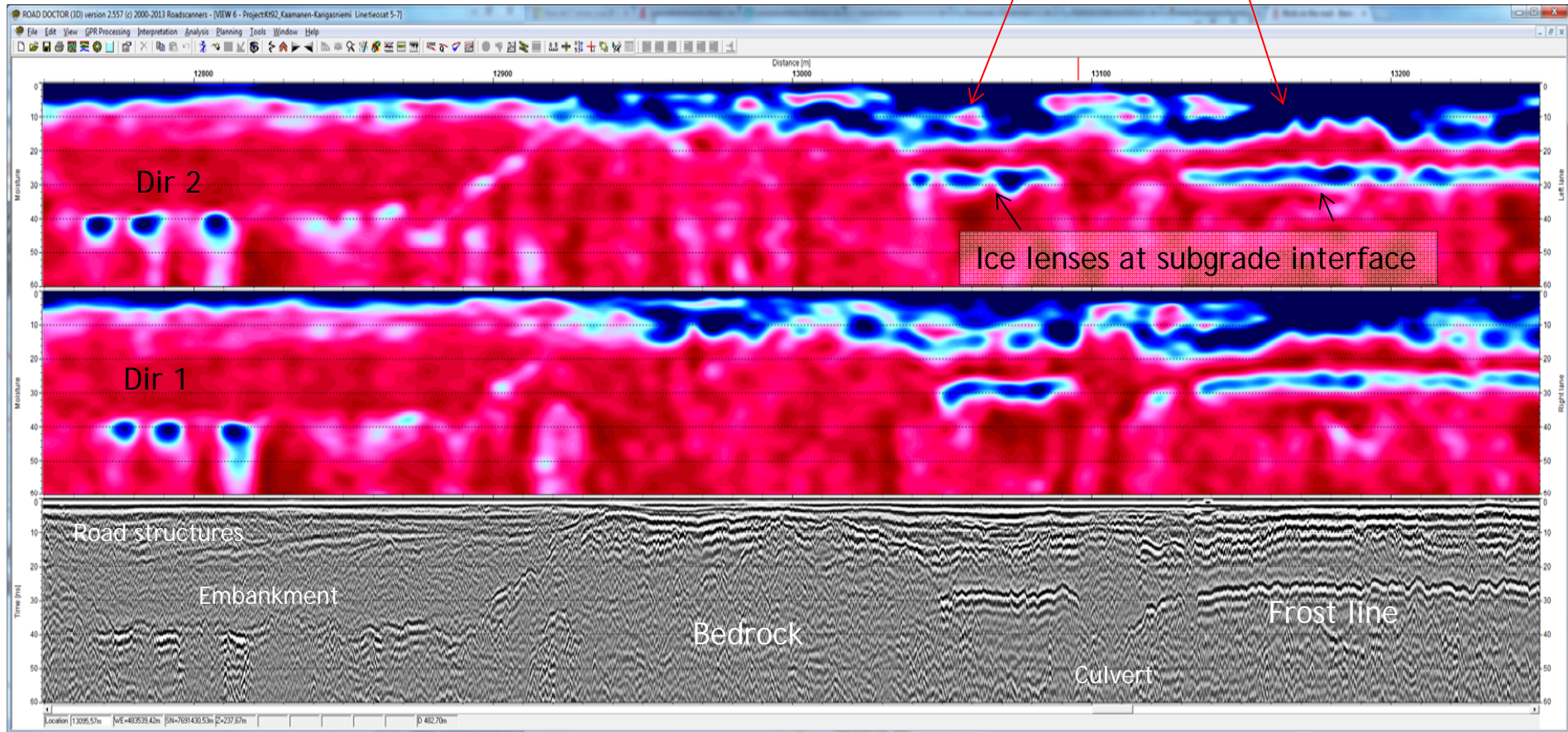
Detection of unfrozen water (ice lenses) in frozen ground



EXAMPLE OF GPR FROST ANALYSIS: RD 92, FINLAND

400 MHz GPR data

Ice in road structures



Small risk for deformations

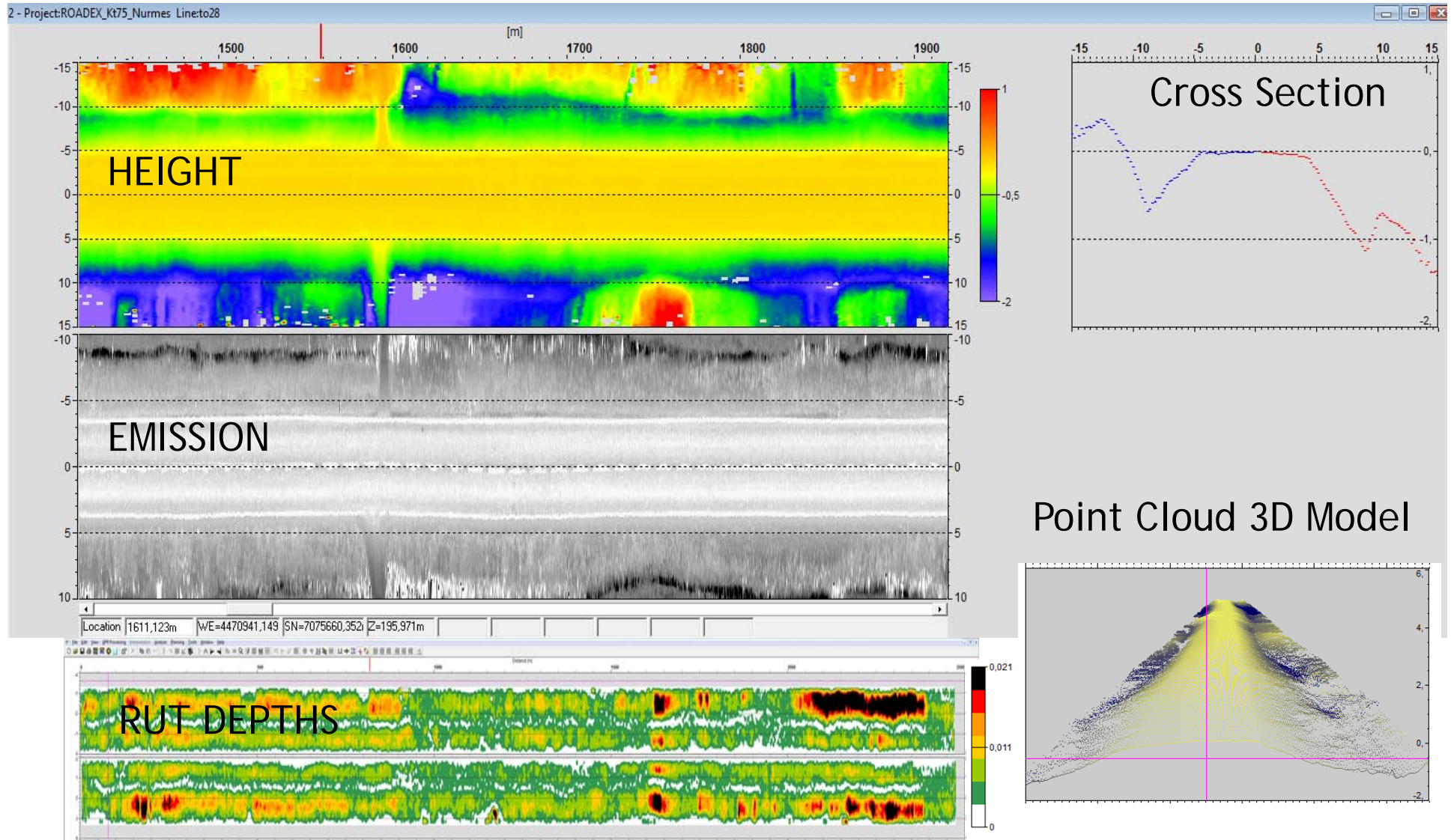
Bedrock close road surface -
high risk for Mode 1 rutting

High risk for both Mode 1 and Mode 2
rutting during spring thaw

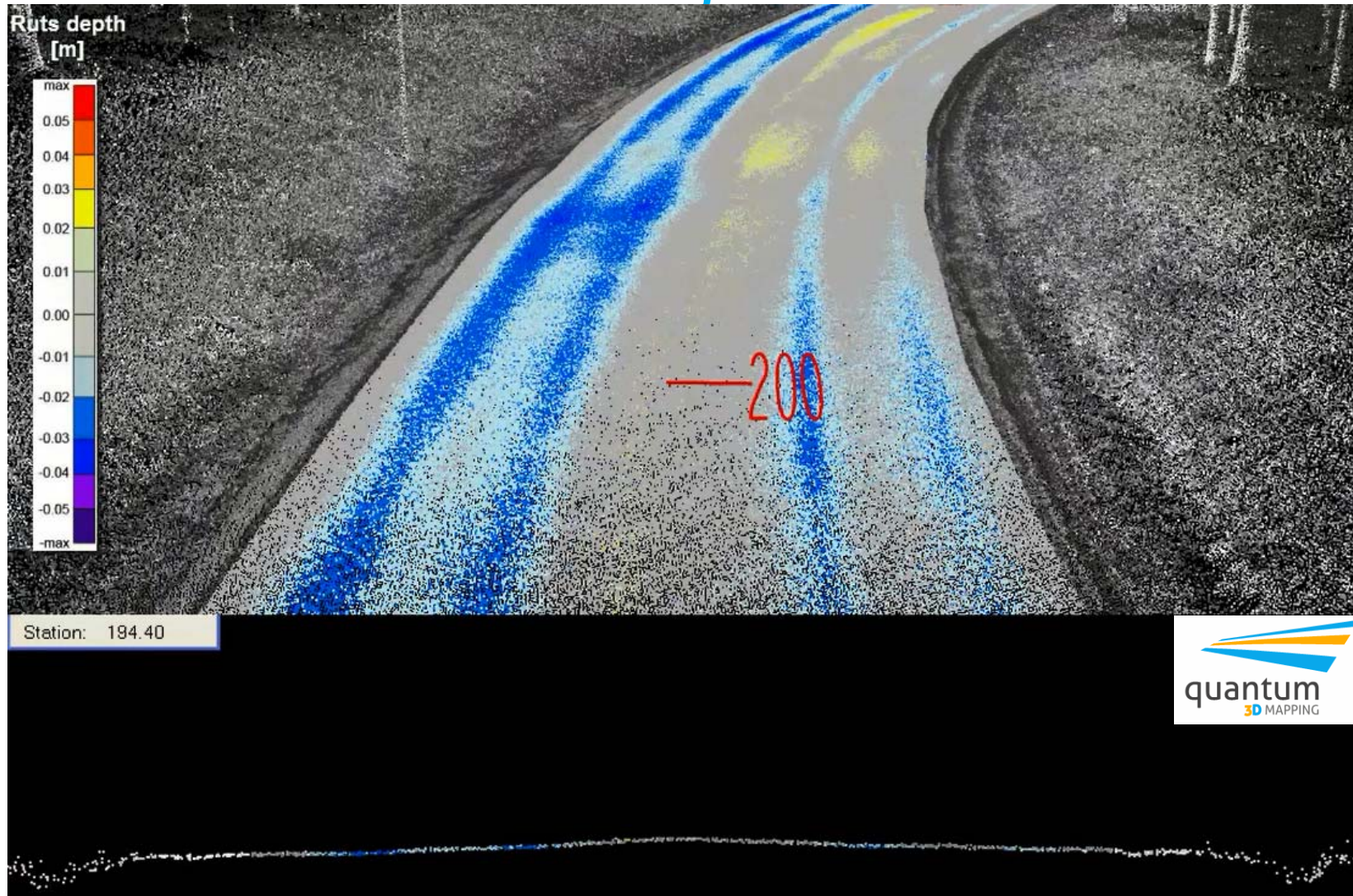
Laser Scanners (Lidars) in Frost Diagnostics



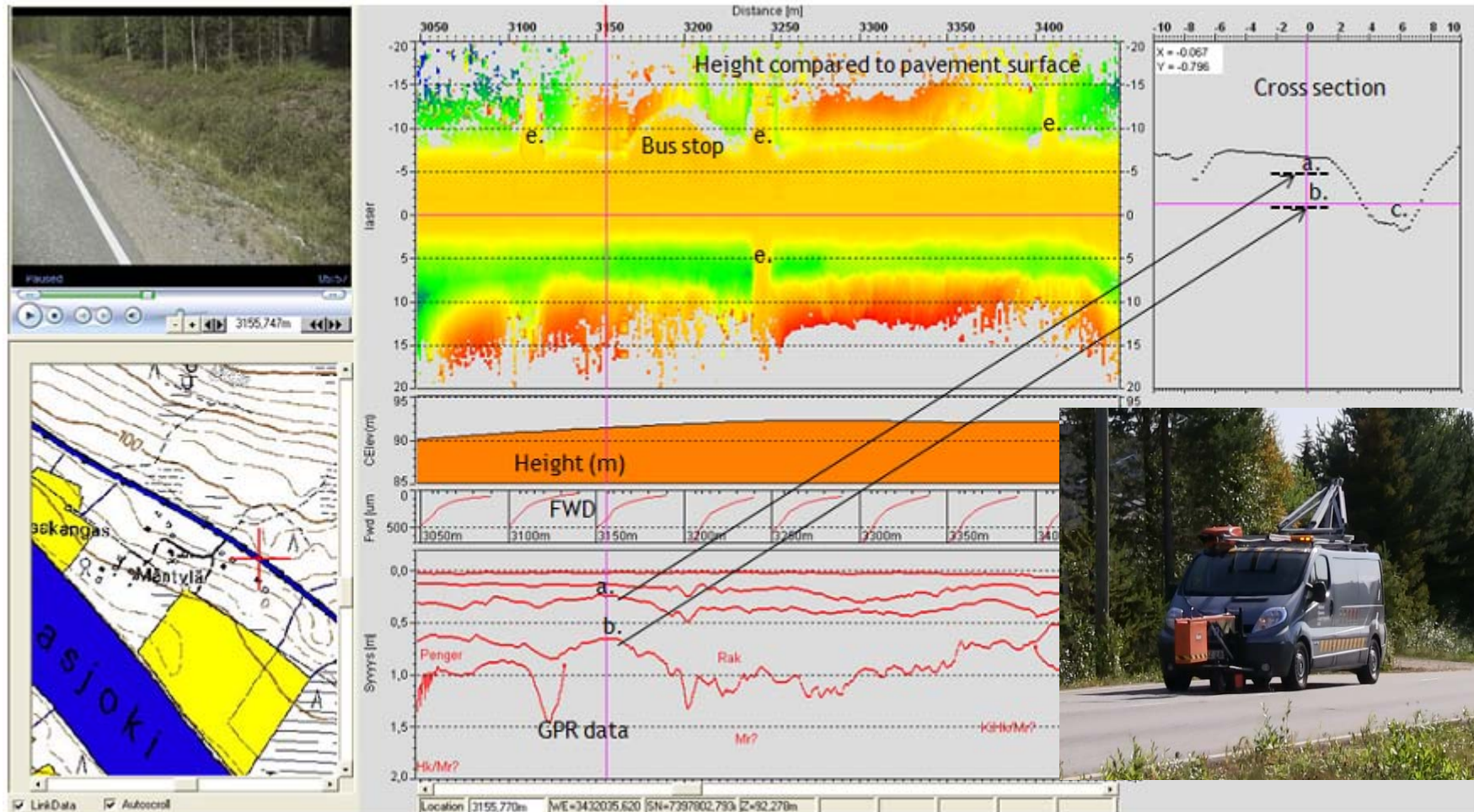
Laser Scanner Information



Laser Scanner Information: Rutting Diagnostics

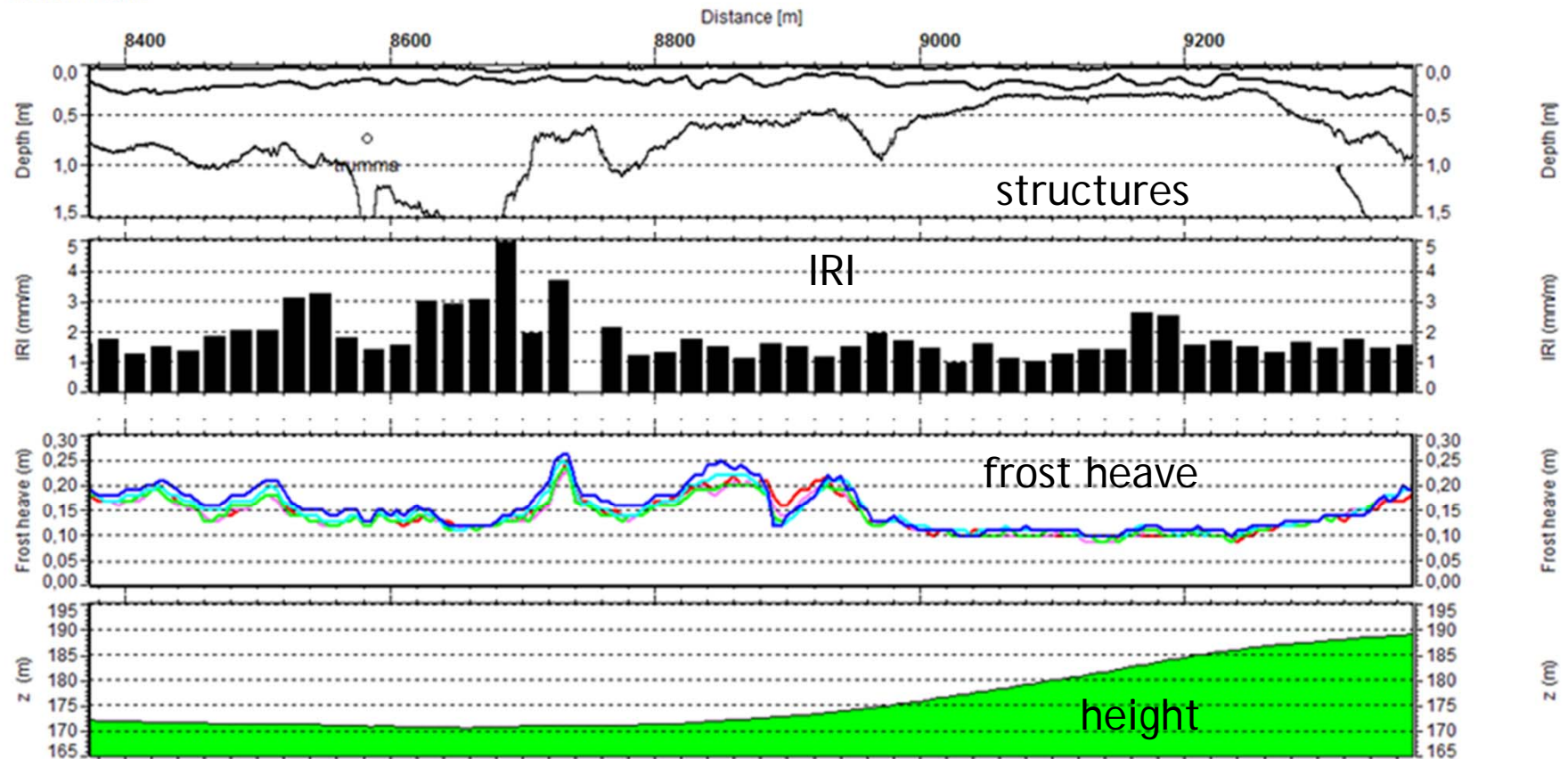


Integrated Analysis of 2D Laser Scanner, GPR and FWD data

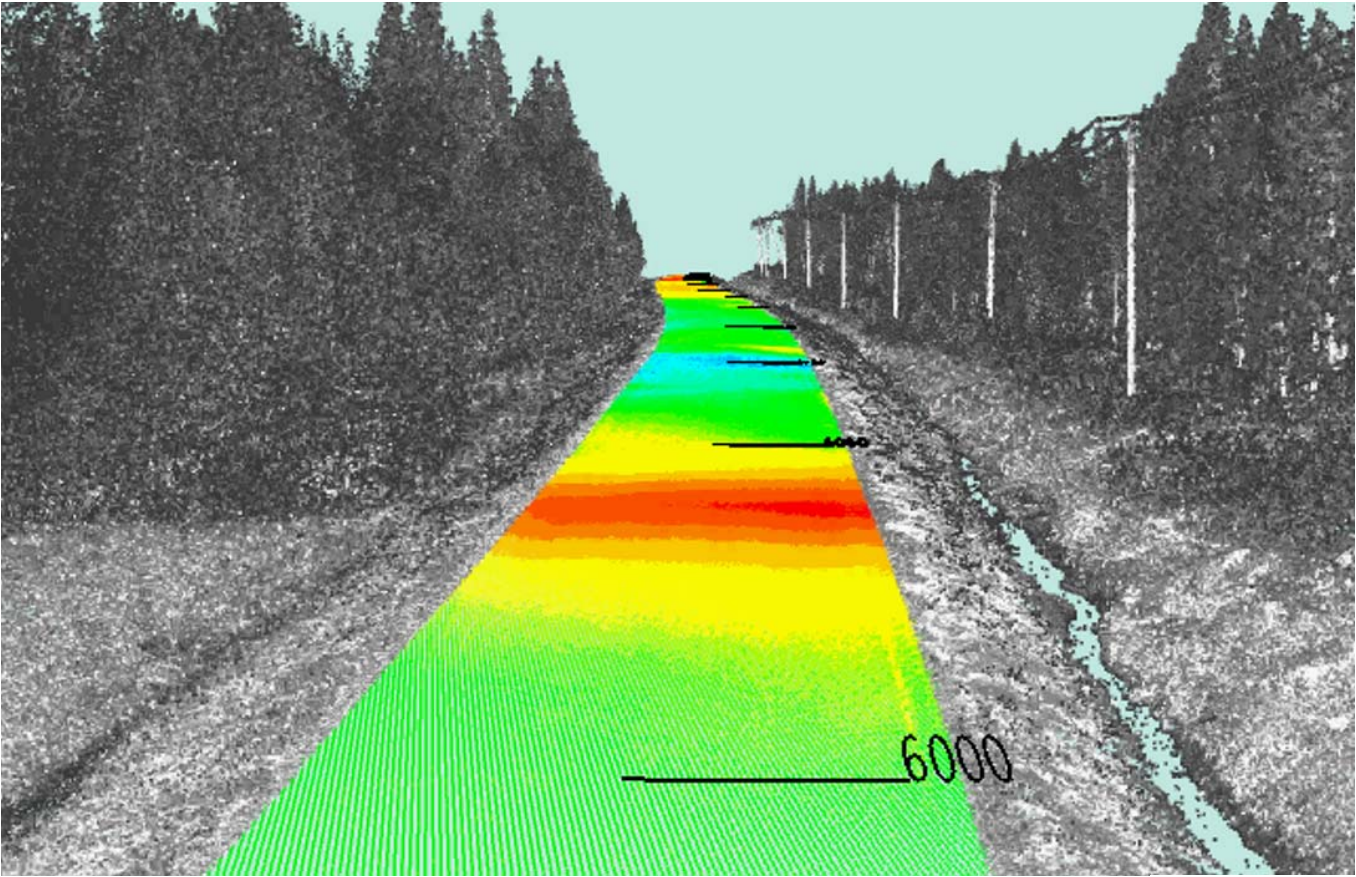
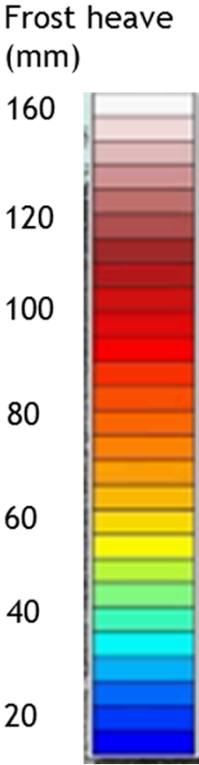


FROST ANALYSIS - RD 99 SWEDEN

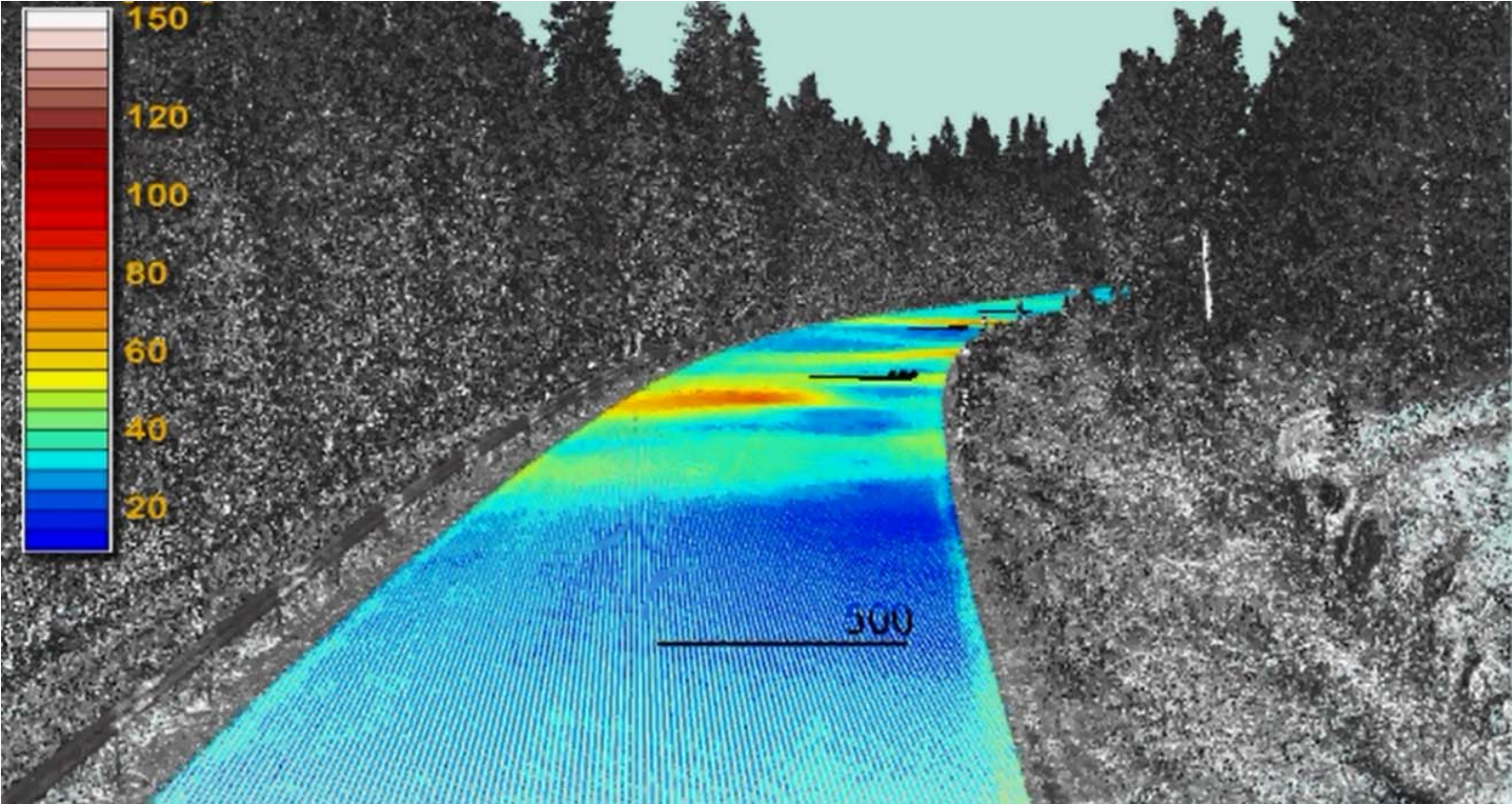
Sektion 1 Väg 99



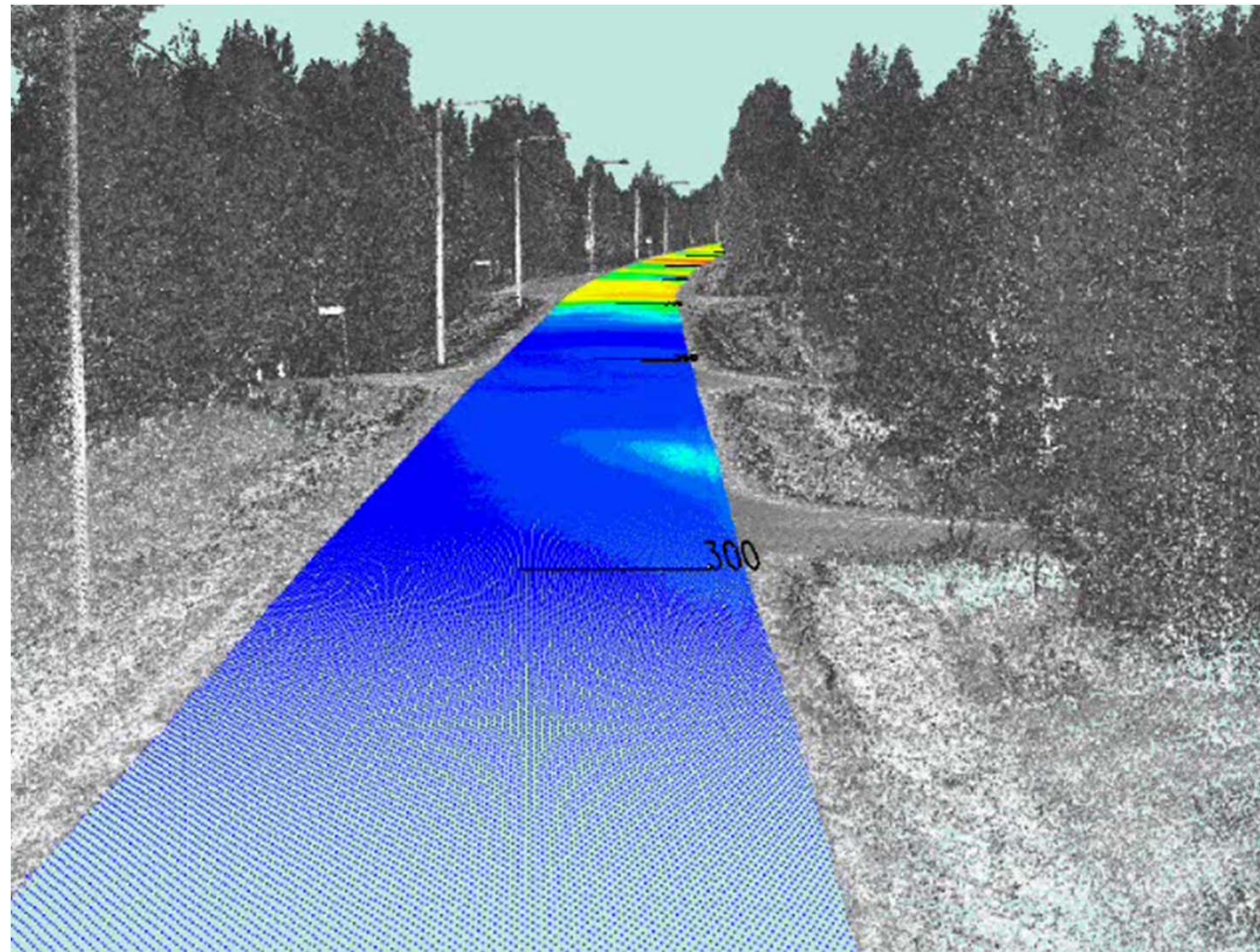
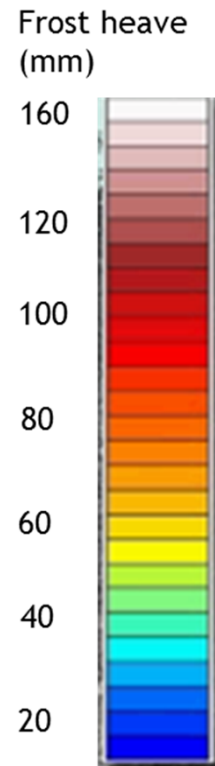
FROST HEAVE DIAGNOSTICS - TRADITIONAL "TRANSITION WEDGE" PROBLEMS



FROST HEAVE DIAGNOSTICS - BEDROCK POCKETS

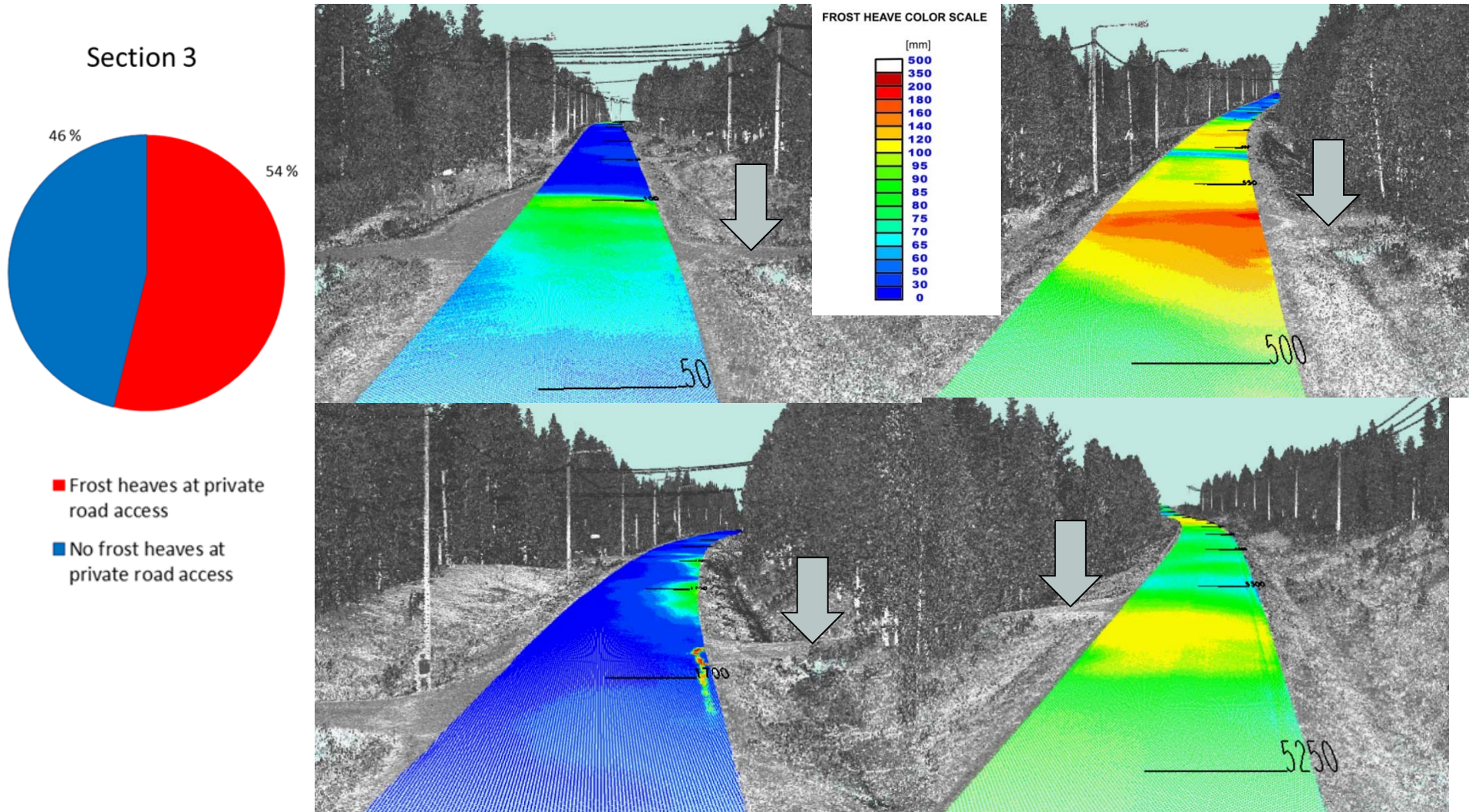


3D Laser Scanning Frost Heave Survey, Case: HW4, Rovaniemi



Frost Heave Diagnostics Findings:

Great Amount of Frost Heave Problems can be Related with Private Access Roads

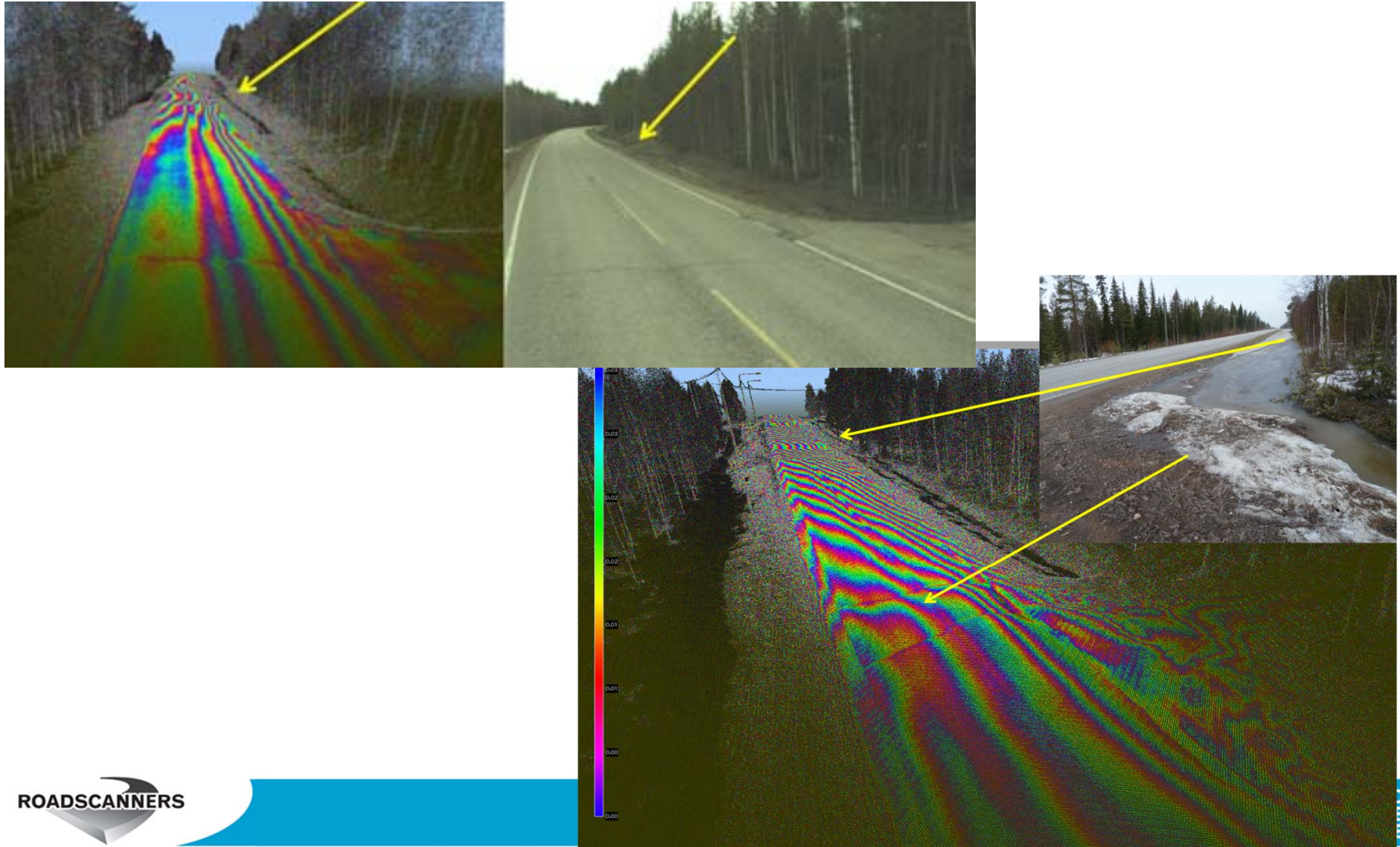


Frost Heave Diagnostics Findings:

Special problem: Glogged Private Acces Road Culverts



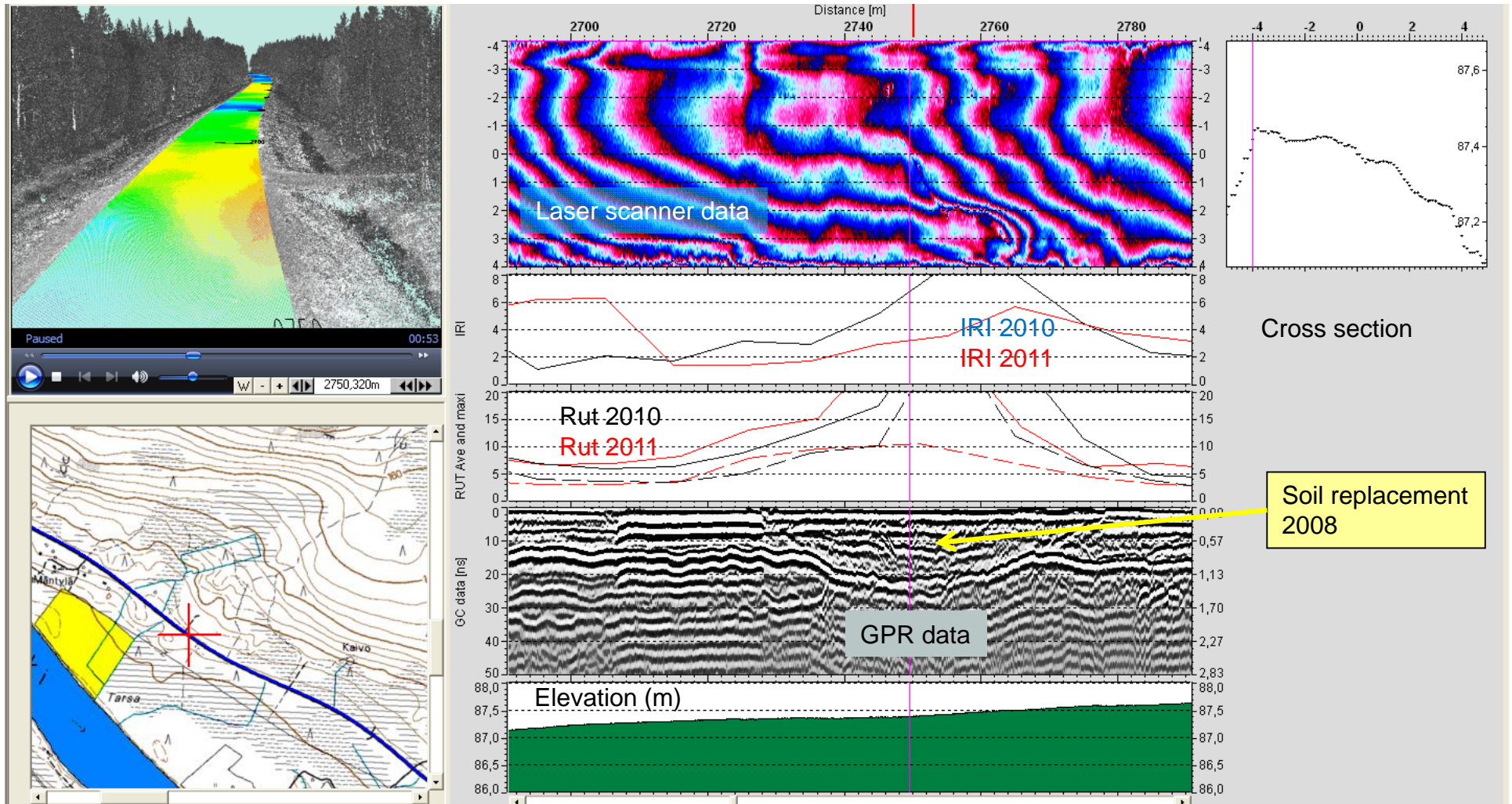
Frost Heave Diagnostics Findings: Location of the Problems Caused By Glogged Culverts



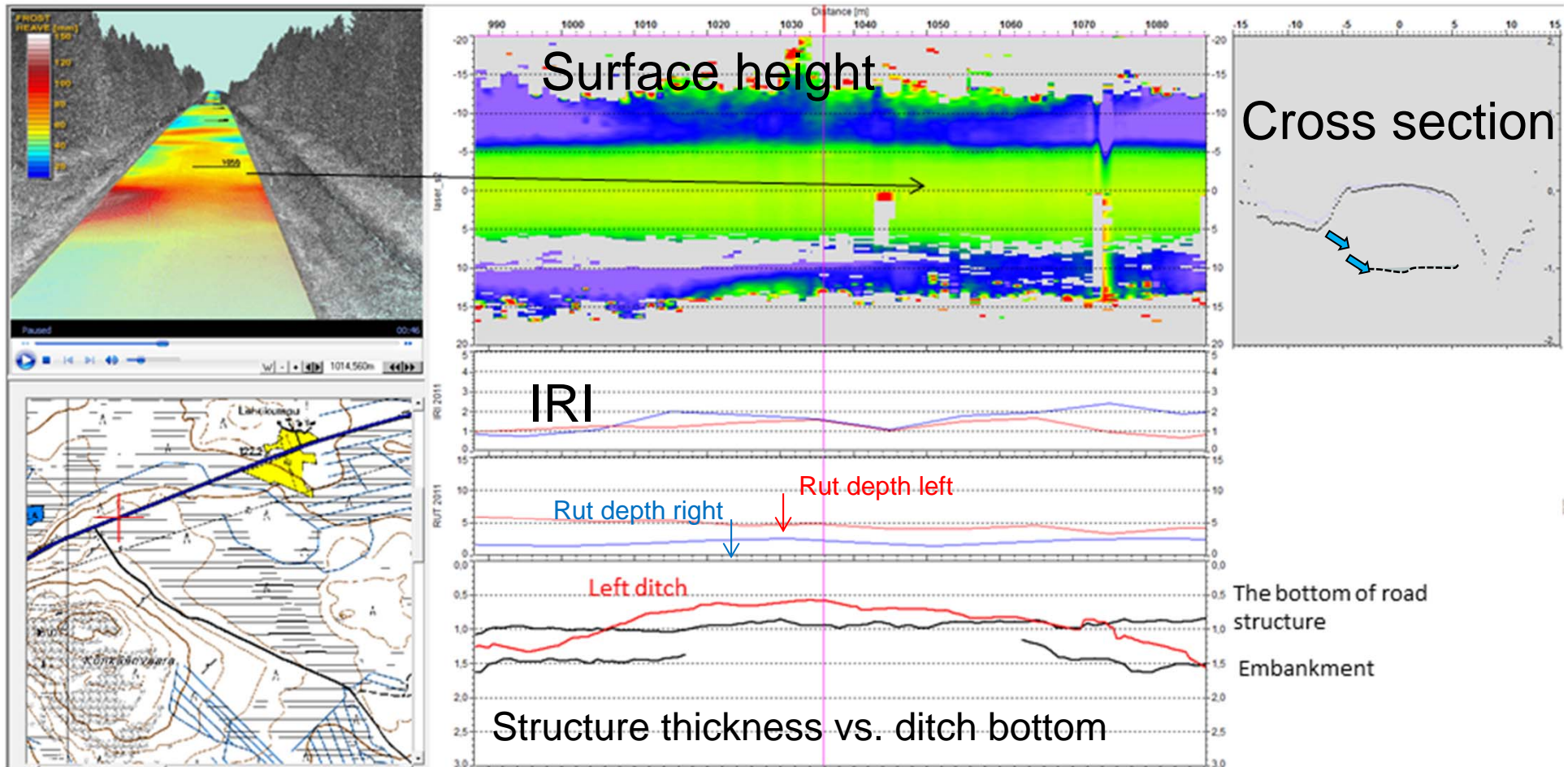
Differential frost Heave at the End of Flooded Ditch



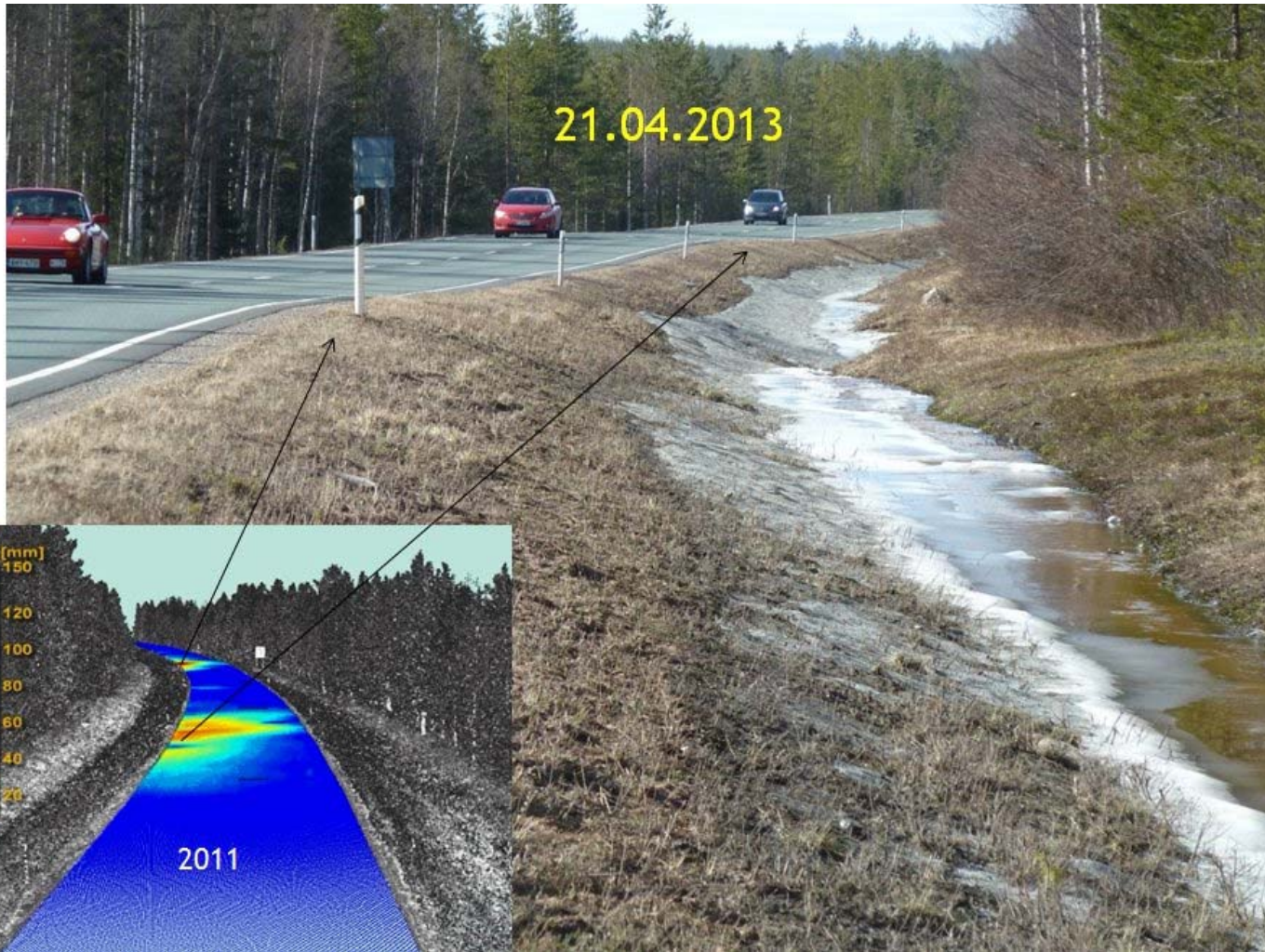
We have been Fixing Symptoms Instead of Reasons!



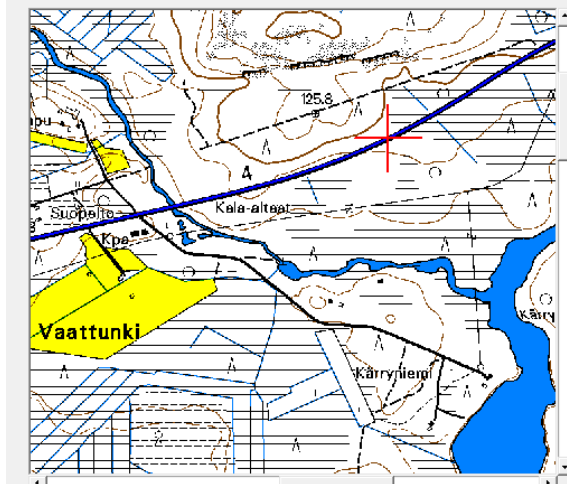
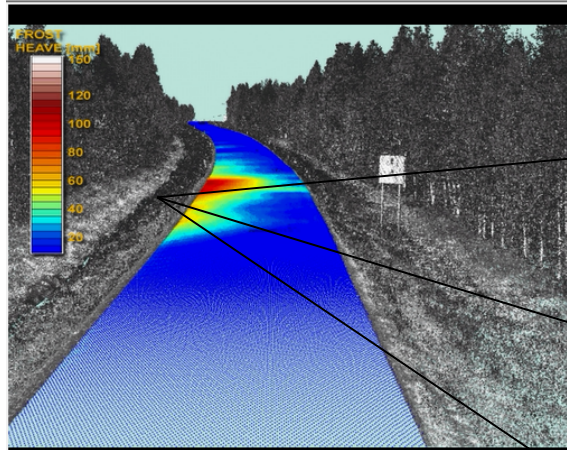
FROST DIAGNOSTICS: DITCH BOTTOM TOO HIGH - CASE HW4



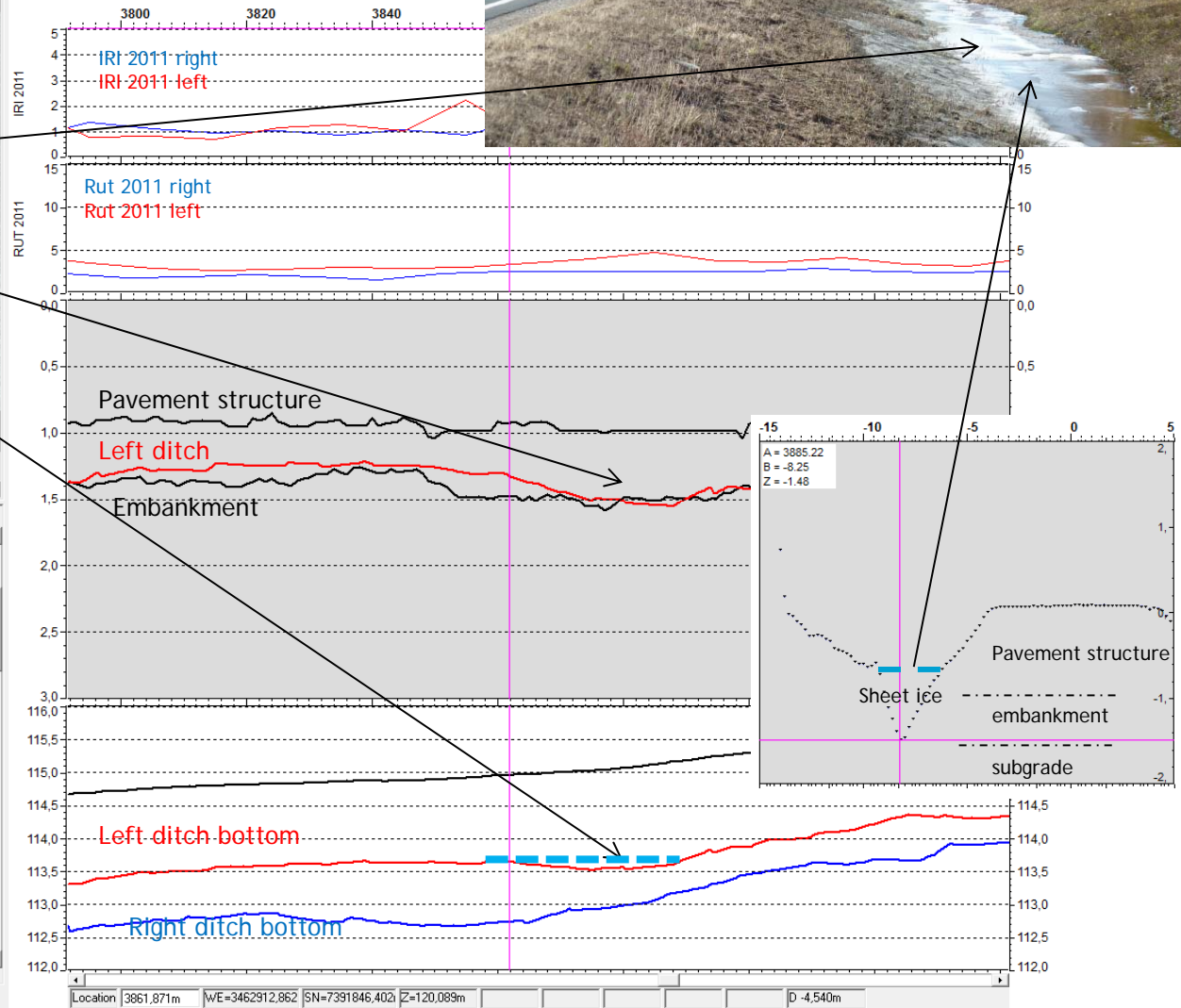
FROST DIAGNOSTICS: POOR WATER FLOW IN DITCH, SHEET ICE AND FROST HEAVE



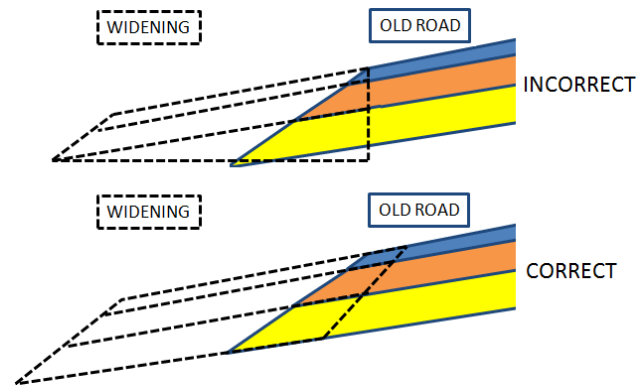
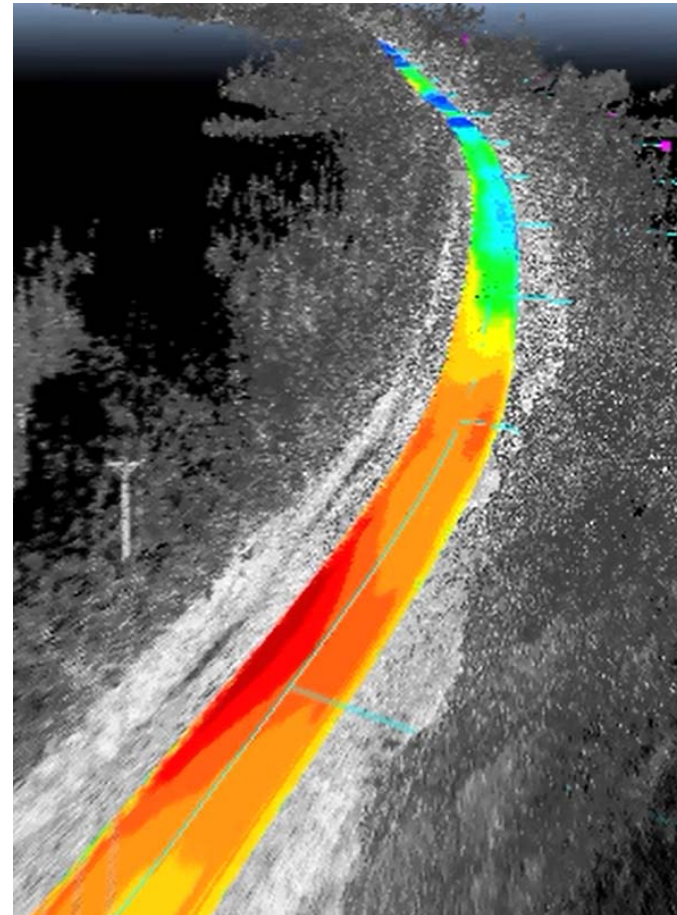
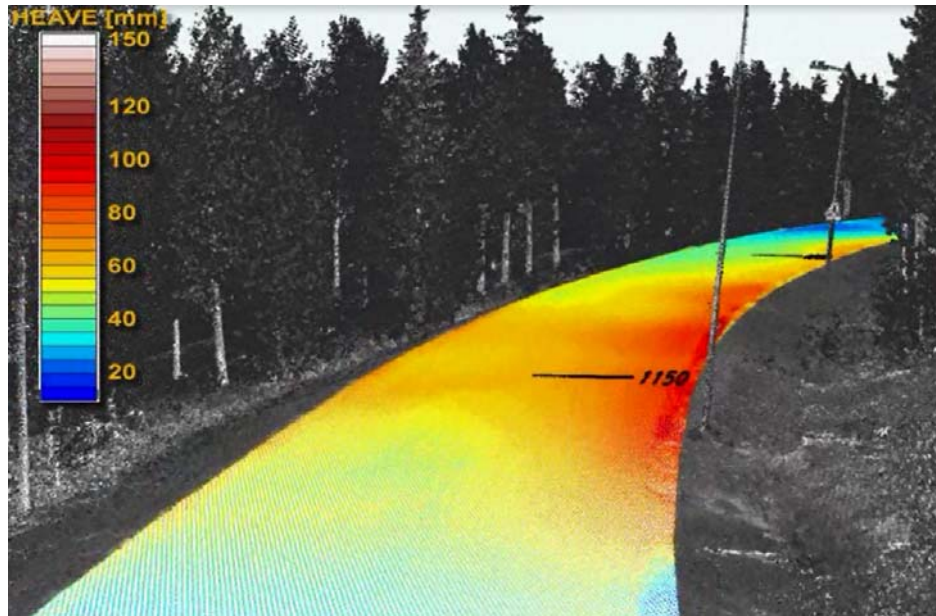
VT4 505/3850



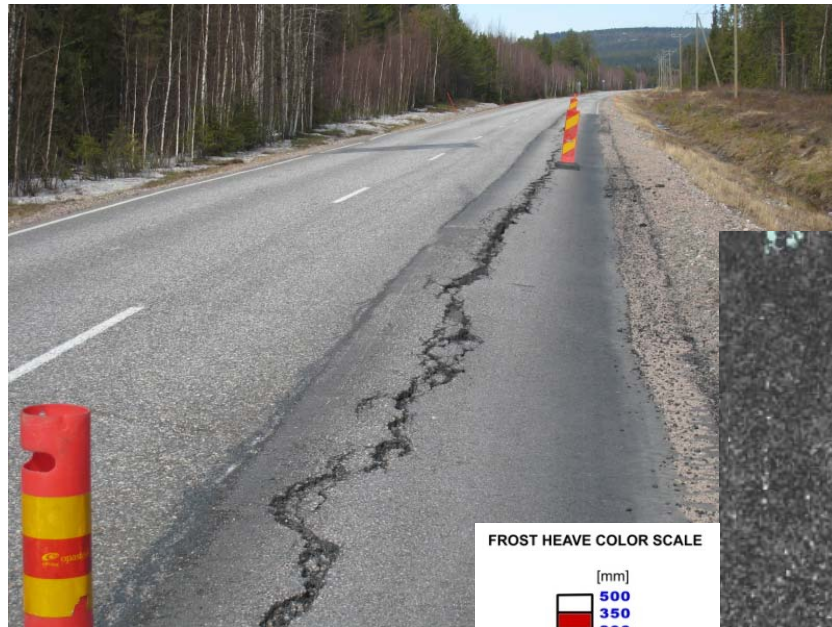
LinkData Autoscroll



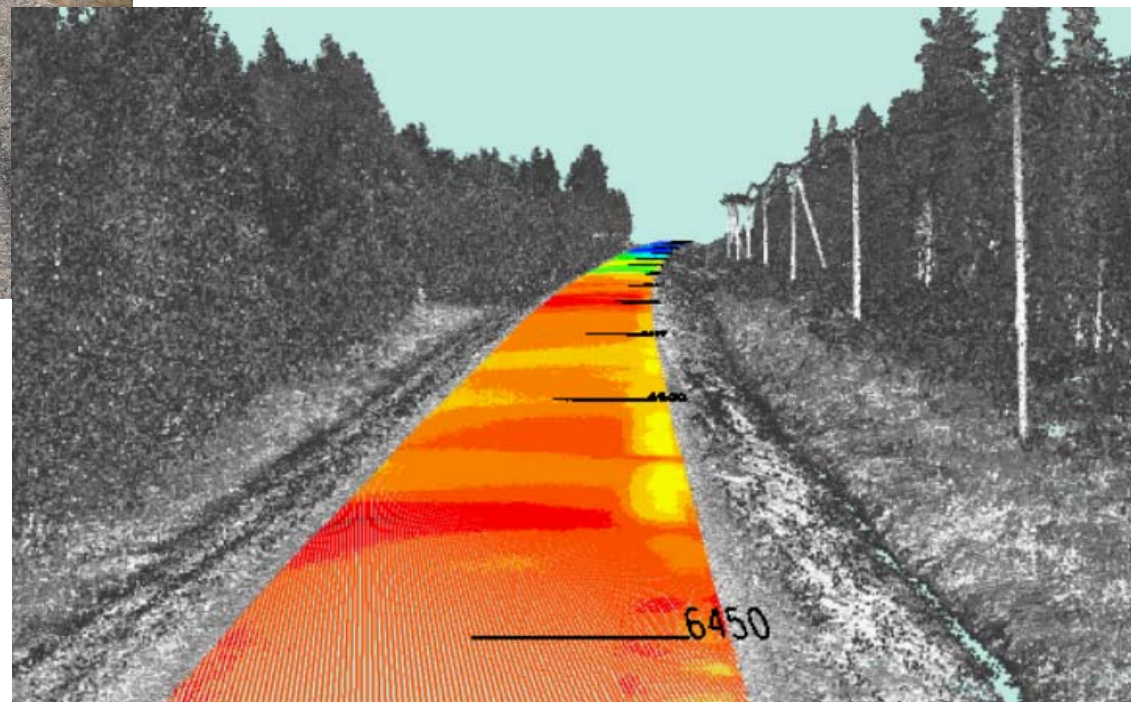
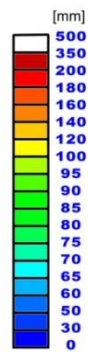
Frost Diagnostics: Frost Heave in Inner Curves



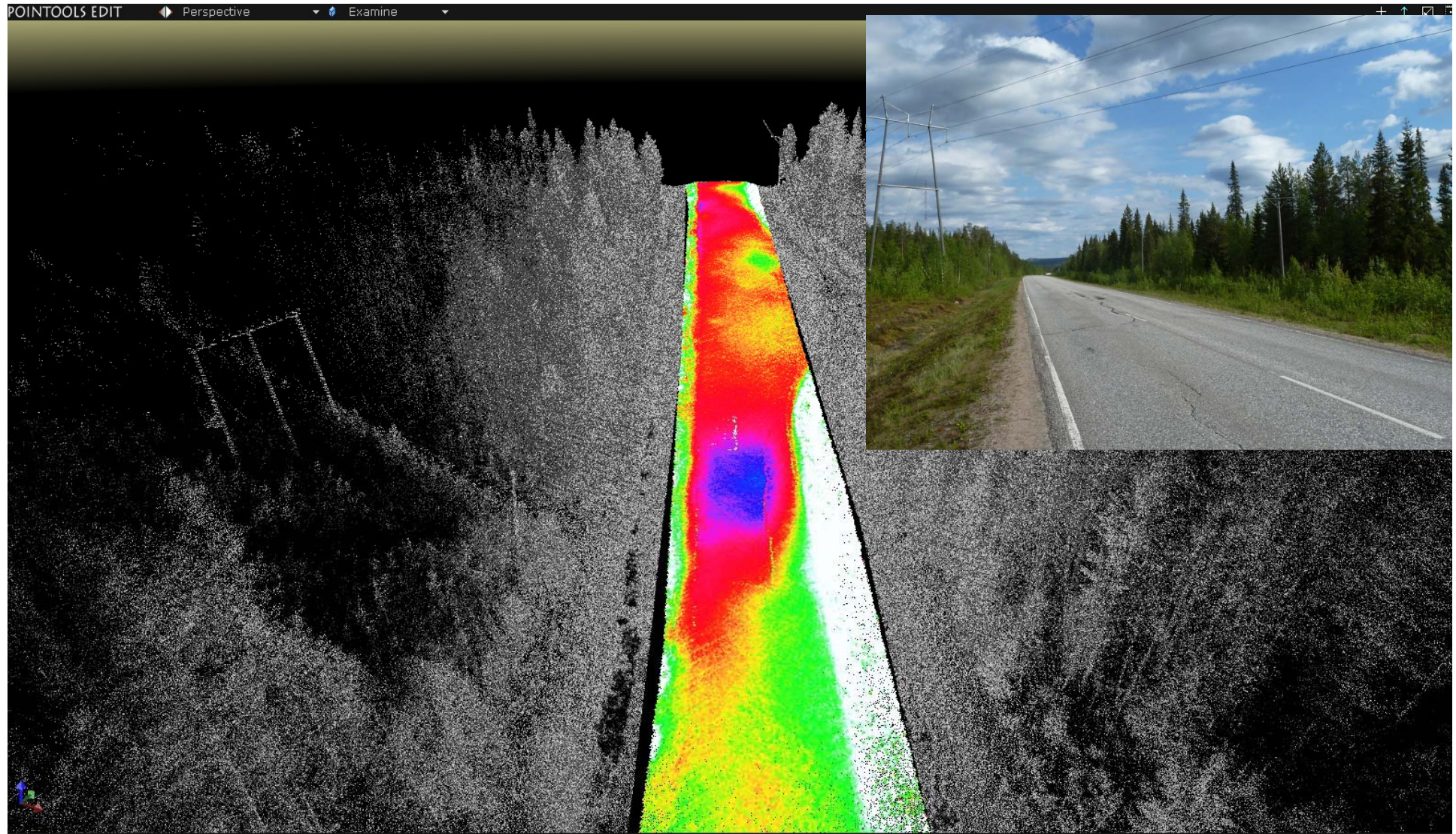
FROST HEAVE DIAGNOSTICS - ROAD WIDENING



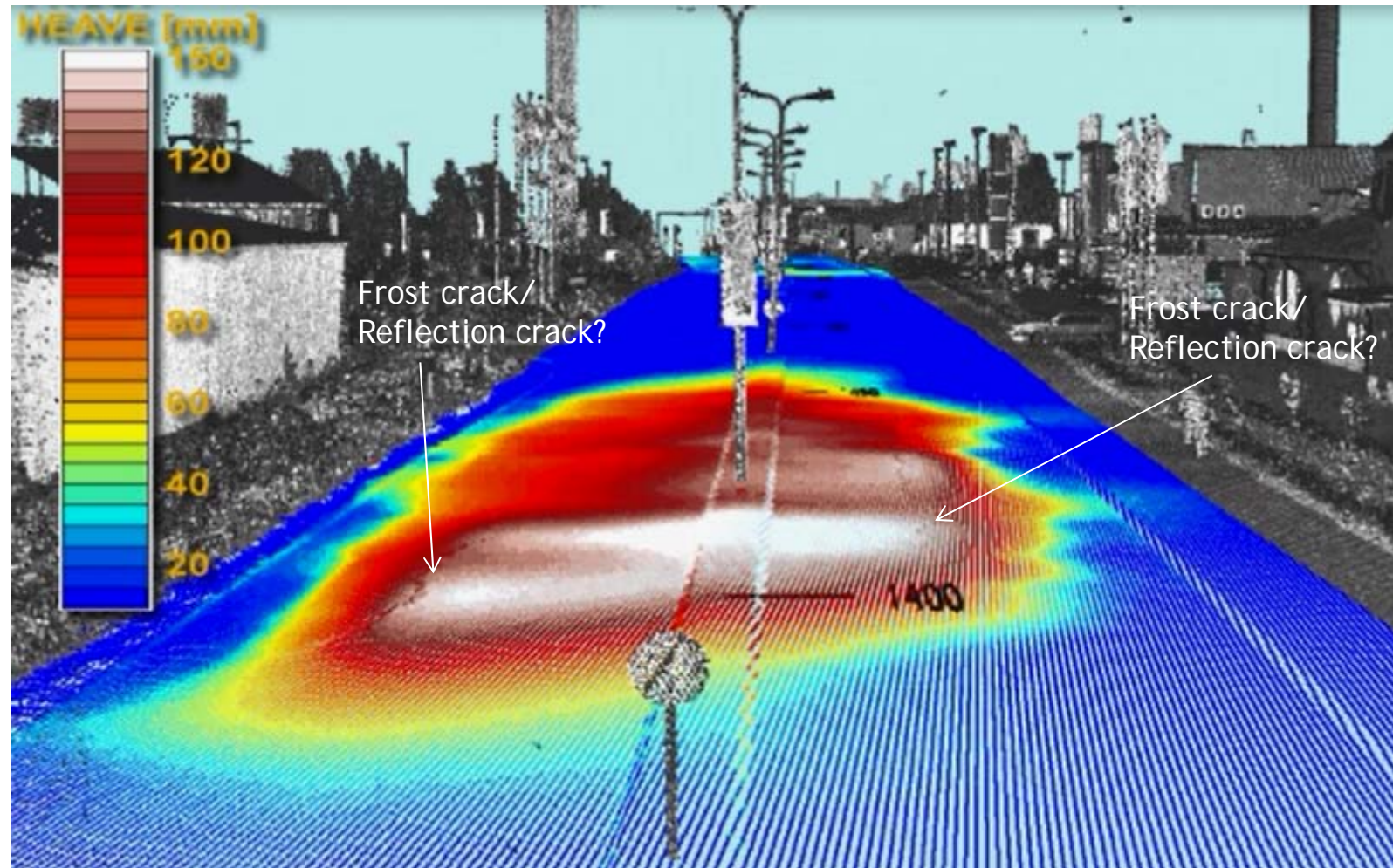
FROST HEAVE COLOR SCALE



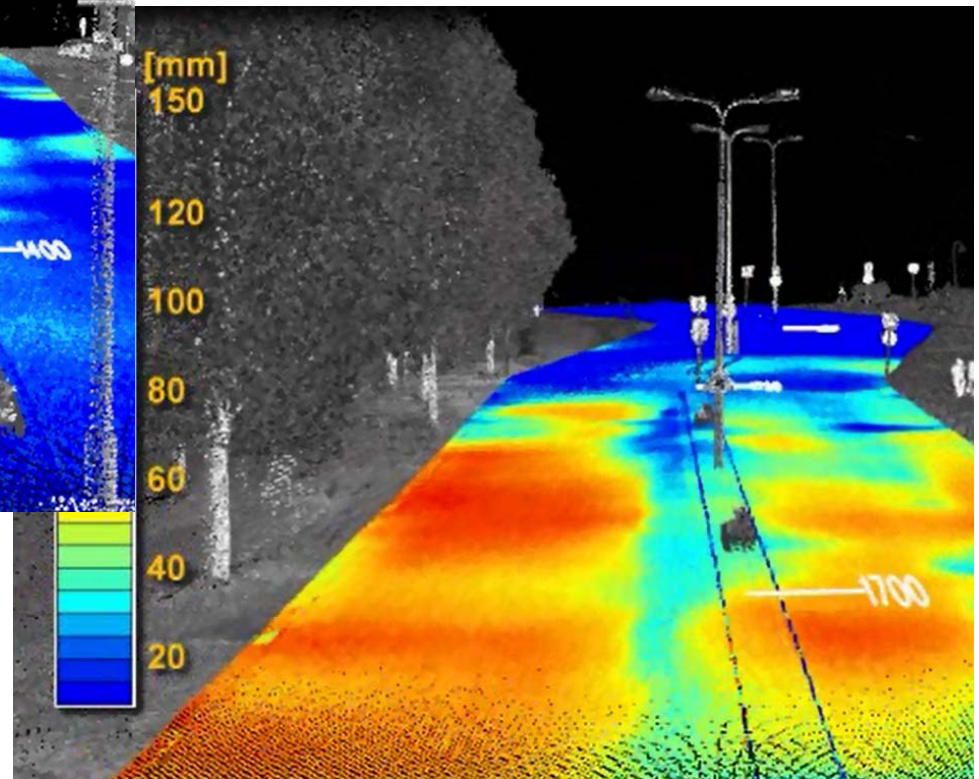
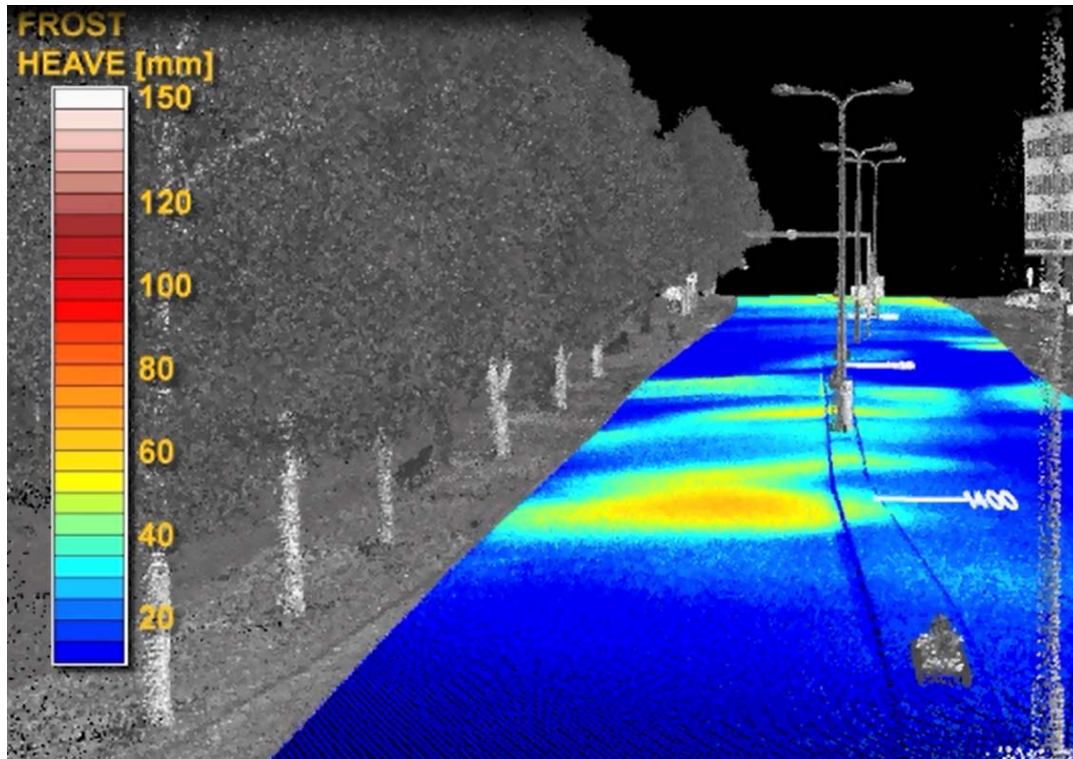
FROST HEAVE DIAGNOSTICS - OLD ROAD BENEATH



FROST HEAVE DIAGNOSTICS - OLD STREET BENEATH



FROST HEAVE DIAGNOSTICS - TREES CLOSE TO ROAD

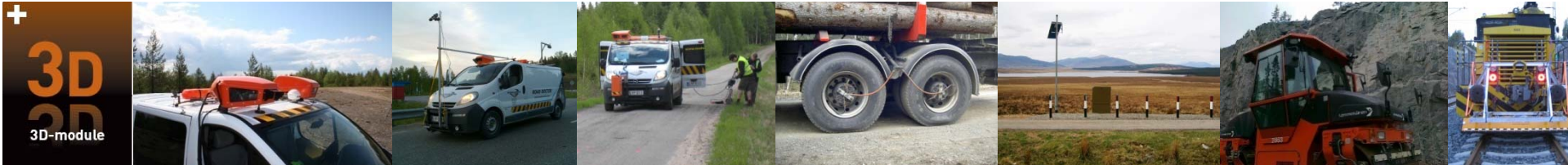
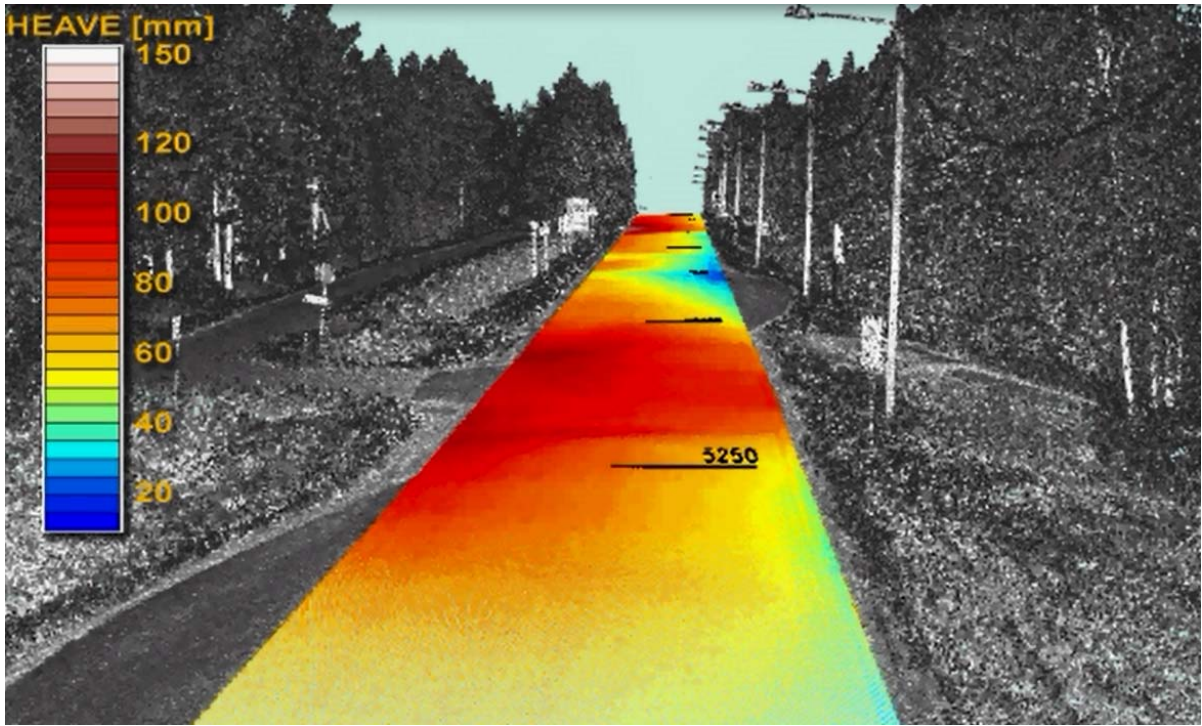


BEYOND
THE
SURFACE



RD PRO
 Road Doctor™
 Pro

THANK YOU



+
3D
 3D-module

ROADSCANNERS

**BEYOND
 THE
 SURFACE**