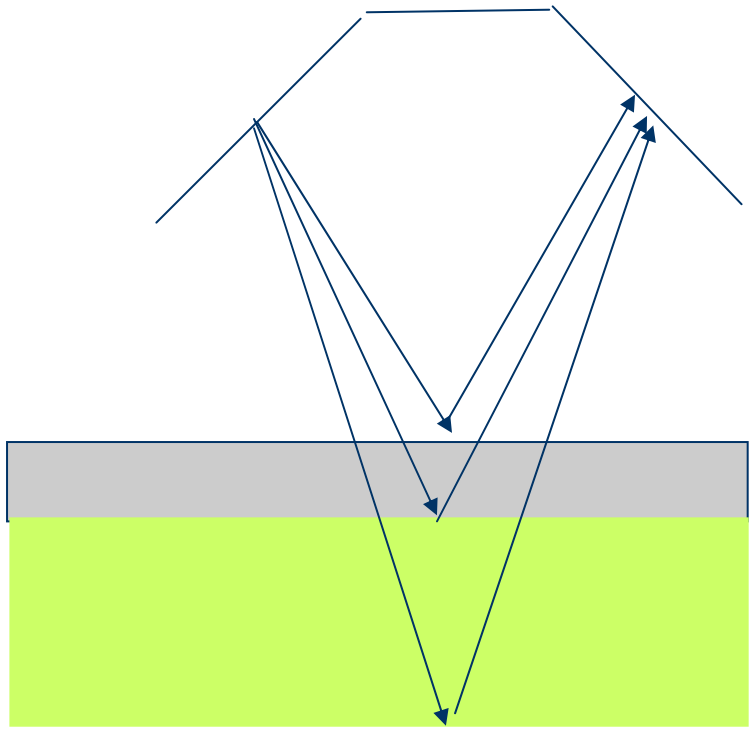
Use of Ground Penetrating Radar (GPR) for pavement assesment

Inge Hoff

SINTEF Building and Infrastructure

NTNU/SINTEF bought this type of equipment October 2007

Principle



- Radar signals transmitted
- Reflection dependent on:
  - Dielectric properties
  - Conductivity
- Reflected signal used to form image of layers and objects beneath surface


3D-RADAR


MITTAUS


GeoScope

Products

GeoScope™ 3-dimensional GPR

- Step-frequency radar
- Controls up to 63 antennas
- GPS/Total Station interface
- 30 MHz - 1000 MHz (2 GHz option)

Ultra-wideband antenna array

- 100 MHz - 2.0 GHz
- 16 - 63 antenna elements
- 1.2 - 2.4 meter swath width
- 3.75 - 7.5 cm antenna element spacing

Technical properties

Frequency range	100MHz – 2GHz
No of antenna elements	31
Speed of measurements	2-80 km/t
Widt	2.4 meter
Depth range	1-3 meter

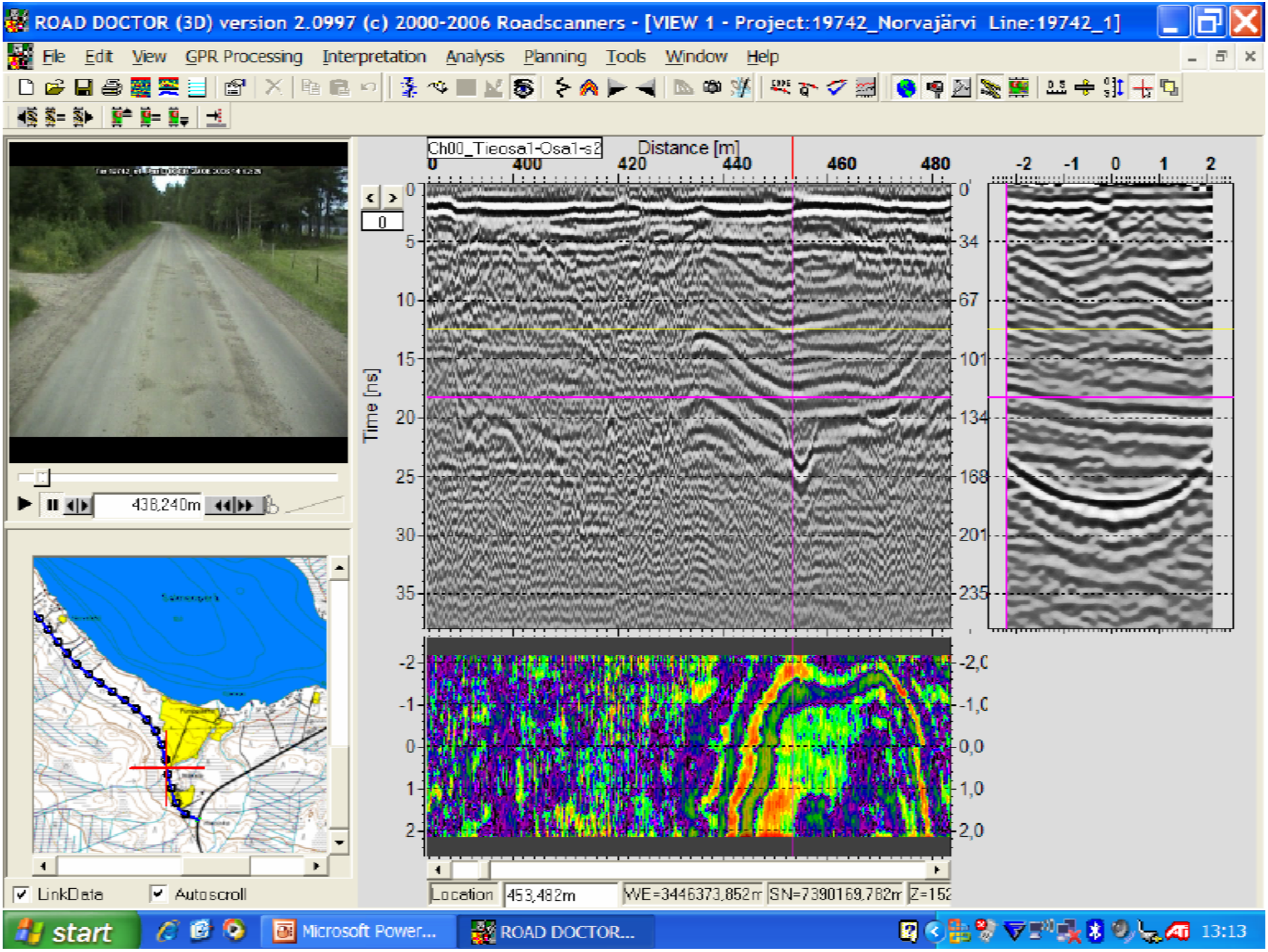
Areas of appliaction (roads)

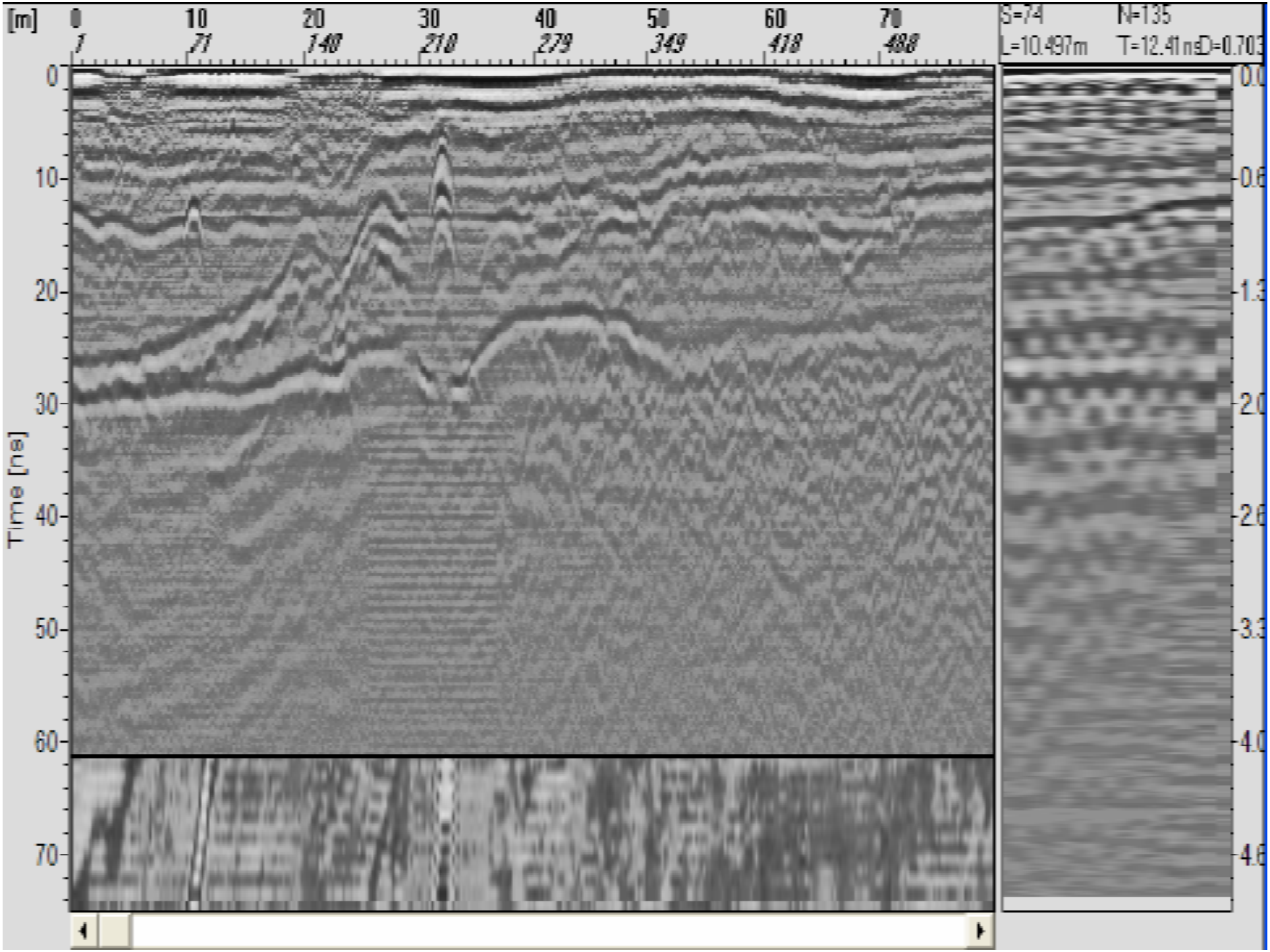
- Rehabilitation (inspection before planning)
- Control of rehabilitation
- Quality control of new roads
- Localisation of objects in the ground

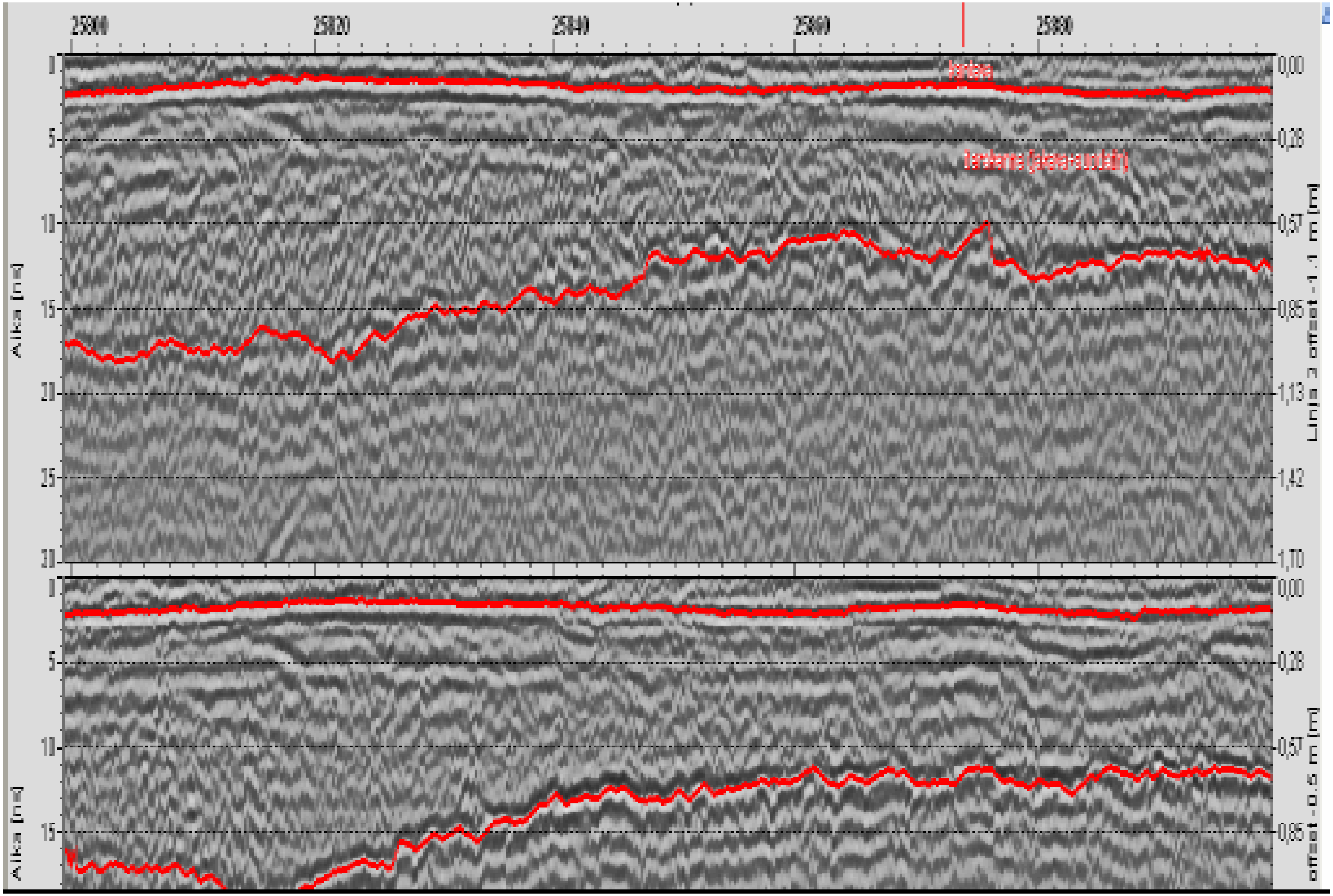
Other appliactions

- Airports
  - Runways, taxiways (similar to roads)
- Railways
  - Fine graded material in ballast
- Bridges
  - Coverage over reinforcement
  - Damages
- Tunnels
  - Air voids behind frost protection walls

- Other: water and sewer pipes, forensic, archaeology, etc


ROAD DOCTOR (3D) version 2.0997 (c) 2000-2006 Roadscanners - [VIEW 1 - Project:19742_Norvajärvi Line:19742_1]
File Edit View GPR Processing Interpretation Analysis Planning Tools Window Help
438,240m
Ch00_Tieosa1-Osa1-s2
Distance [m]
0 400 420 440 460 480
-2 -1 0 1 2
Time [ns]
0 5 10 15 20 25 30 35
0 34 67 101 134 168 201 235
-2 -1 0 1 2
-2,0 -1,0 0,0 1,0 2,0
LinkData
Autoscroll
Location 453,482m
WE=3446373,852m
SN=7390169,782m
Z=152
start
Microsoft Power...
ROAD DOCTOR...
13:13

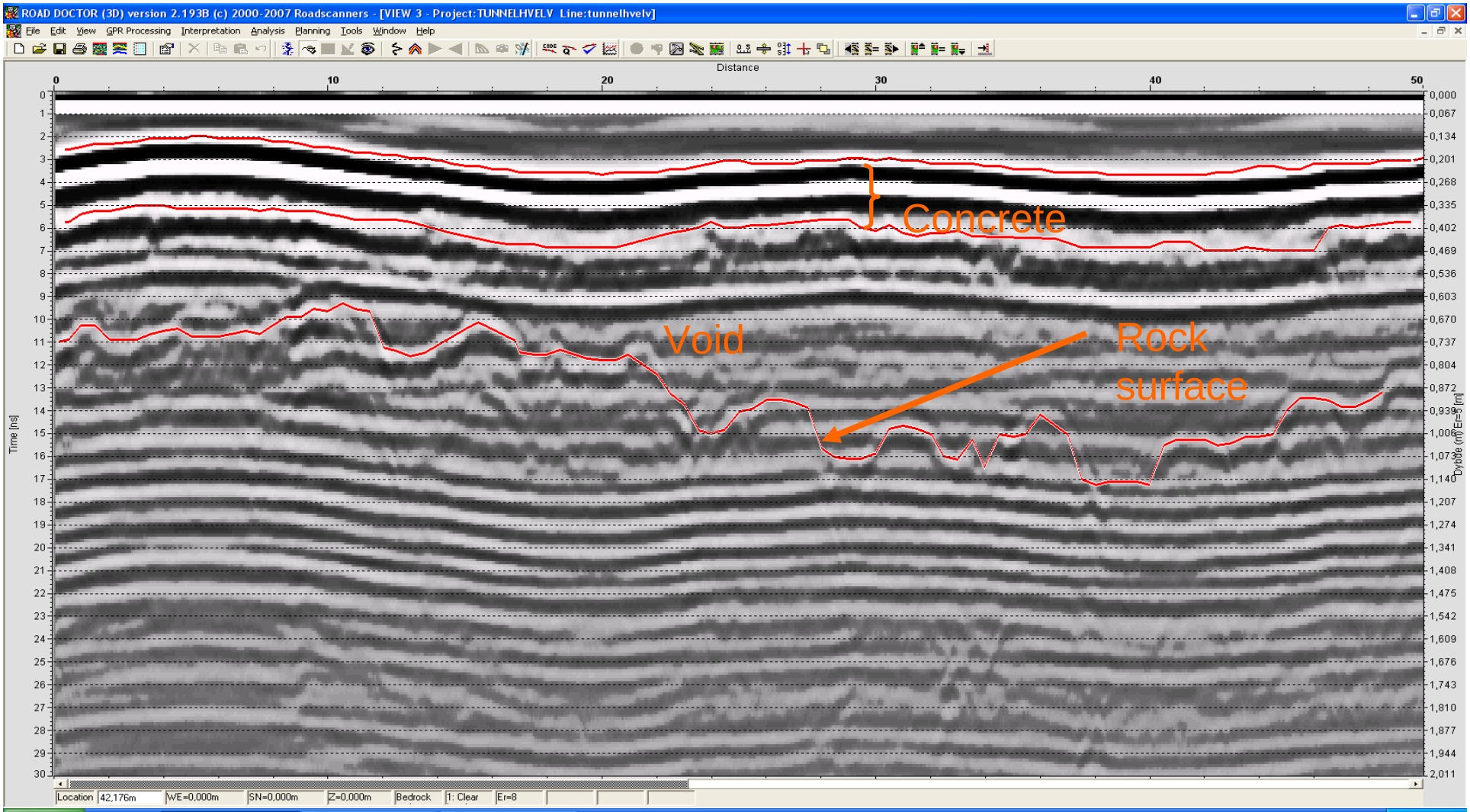

[m]
0
10
20
30
40
50
60
70
1
71
140
210
279
349
418
488
S=74
N=135
L=10.497m
T=12.41 nsD=0.703
Time [ns]
0
10
20
30
40
50
60
70
0.0
0.6
1.3
2.0
2.6
3.3
4.0
4.6



25800
25820
25840
25860
25880
Aika [ns]
Linja 3 offset -1.1 m [m]
offset -0.5 m [m]
0
5
10
15
20
25
30
0,00
0,28
0,57
0,85
1,13
1,42
1,70

Measurements

Tunel wall IIa



Conclusions

- Relatively new tool in Norway
- Interpretation of results is not straigth forward
- Standard investigation before rehabilitation
- Cost effective
- Combination with other methods of investigation
  - FWD, coring, etc
- Some modification of hardware necessary
- Will be very usefull with some adjustments