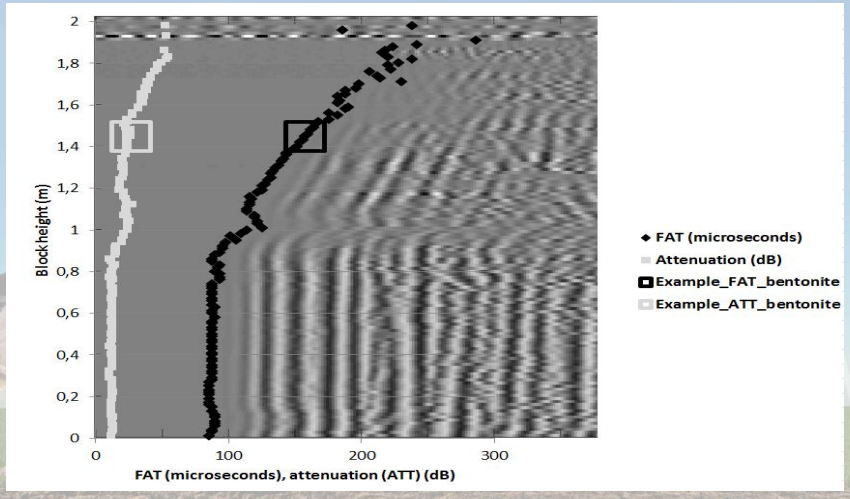
Techniques

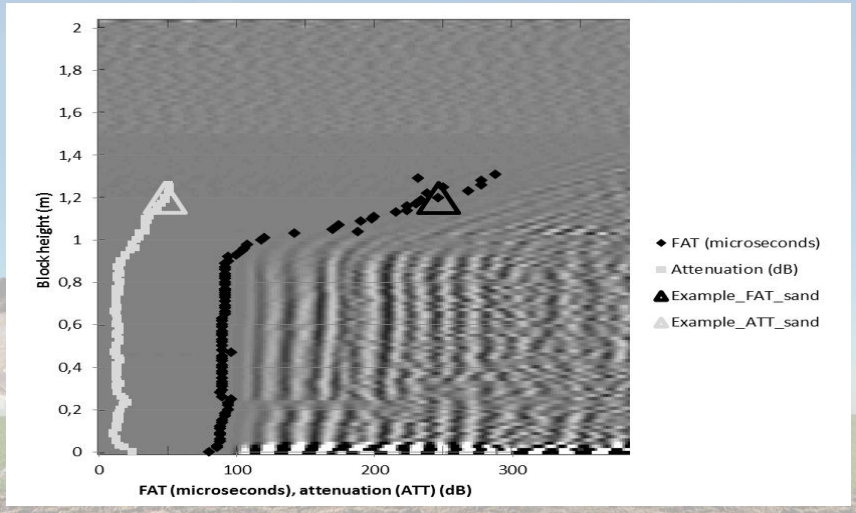
- Cross-hole Sonic Logging (CSL)
- Distributed temperature measurements with optical fibers (DTS)
- Impedance (Resistivity / ERT)

bentonite



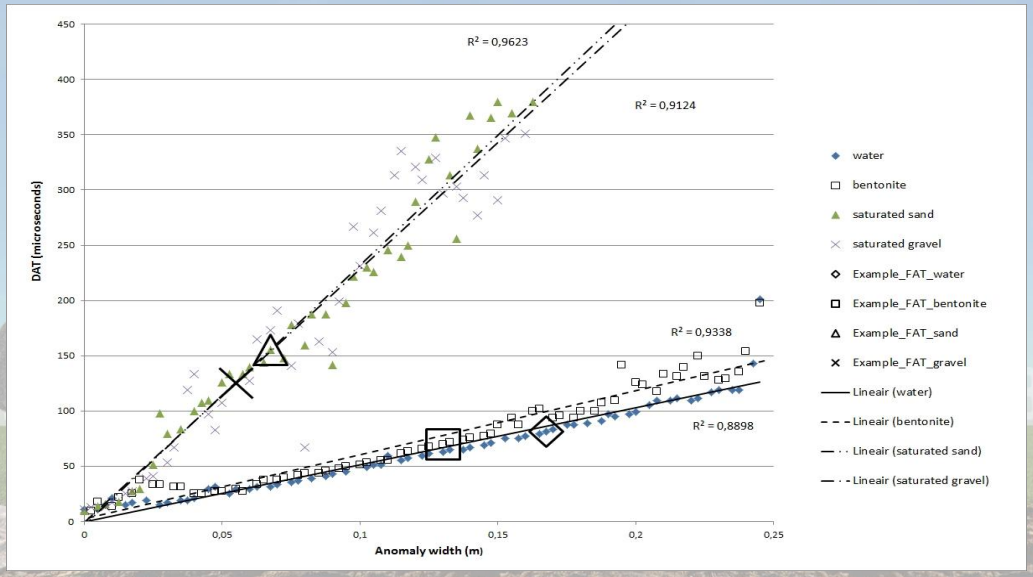
Gemeente Rotterdam
Gemeentewerken

sand

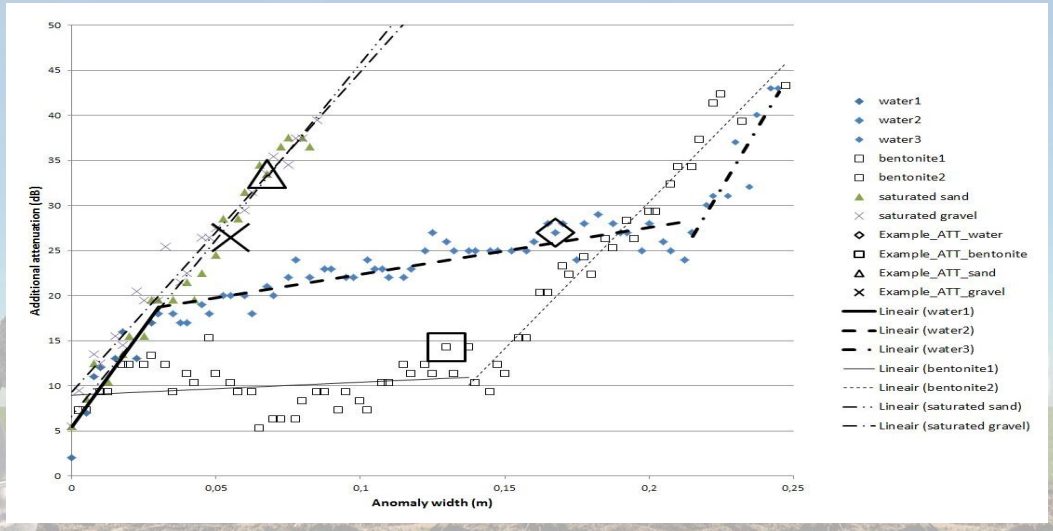


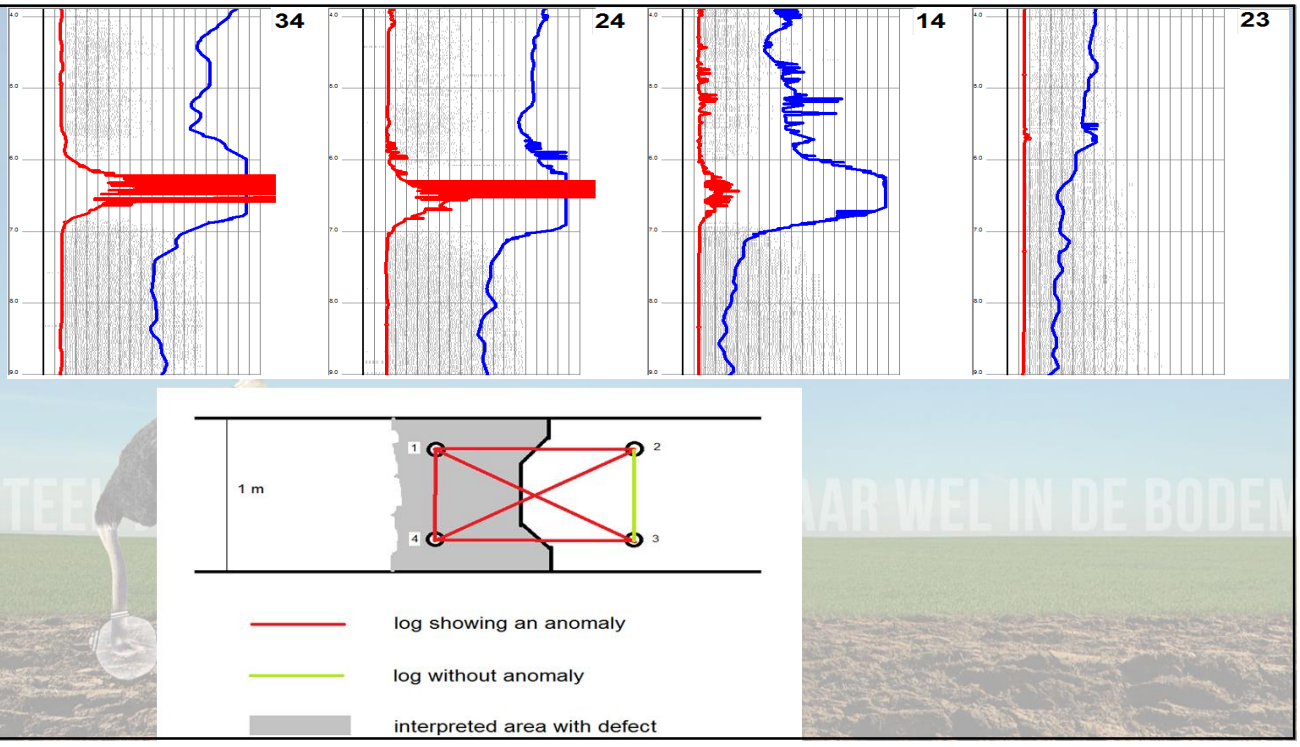
Gemeente Rotterdam
Gemeentewerken

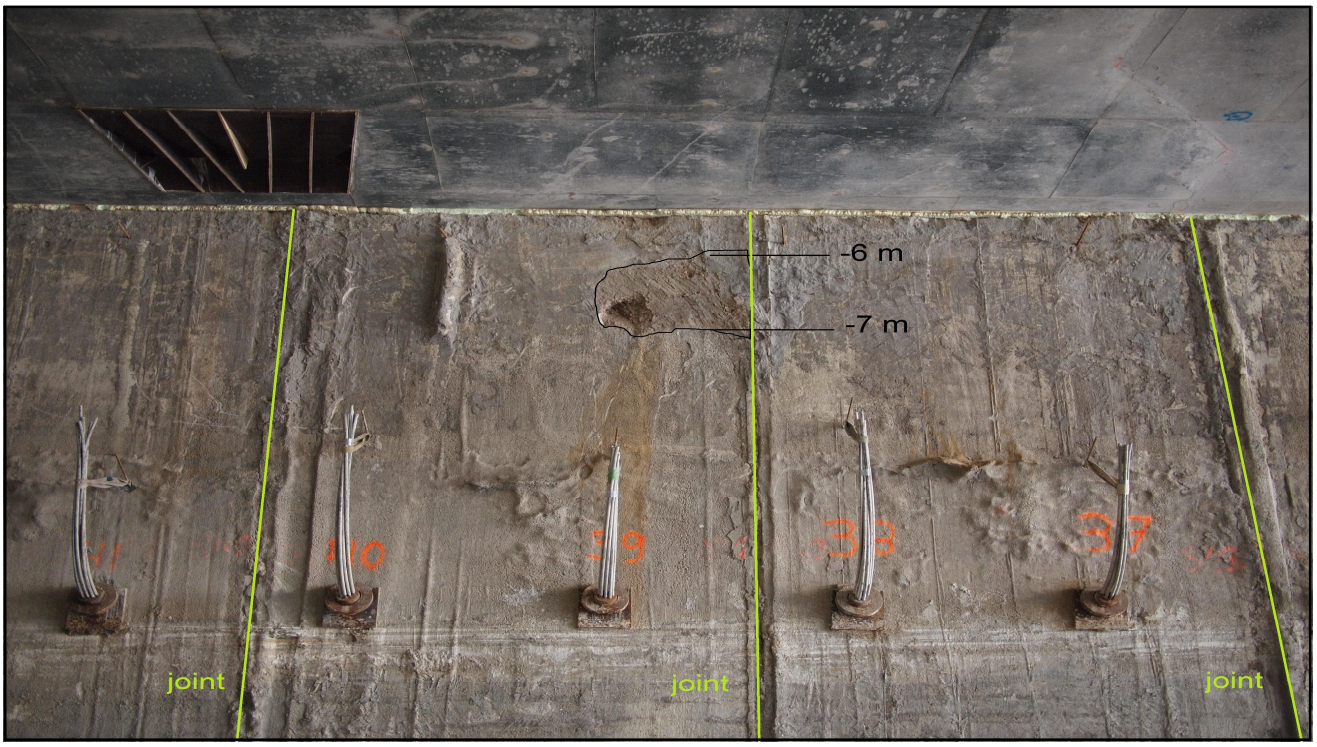
DAT vs anomaly width

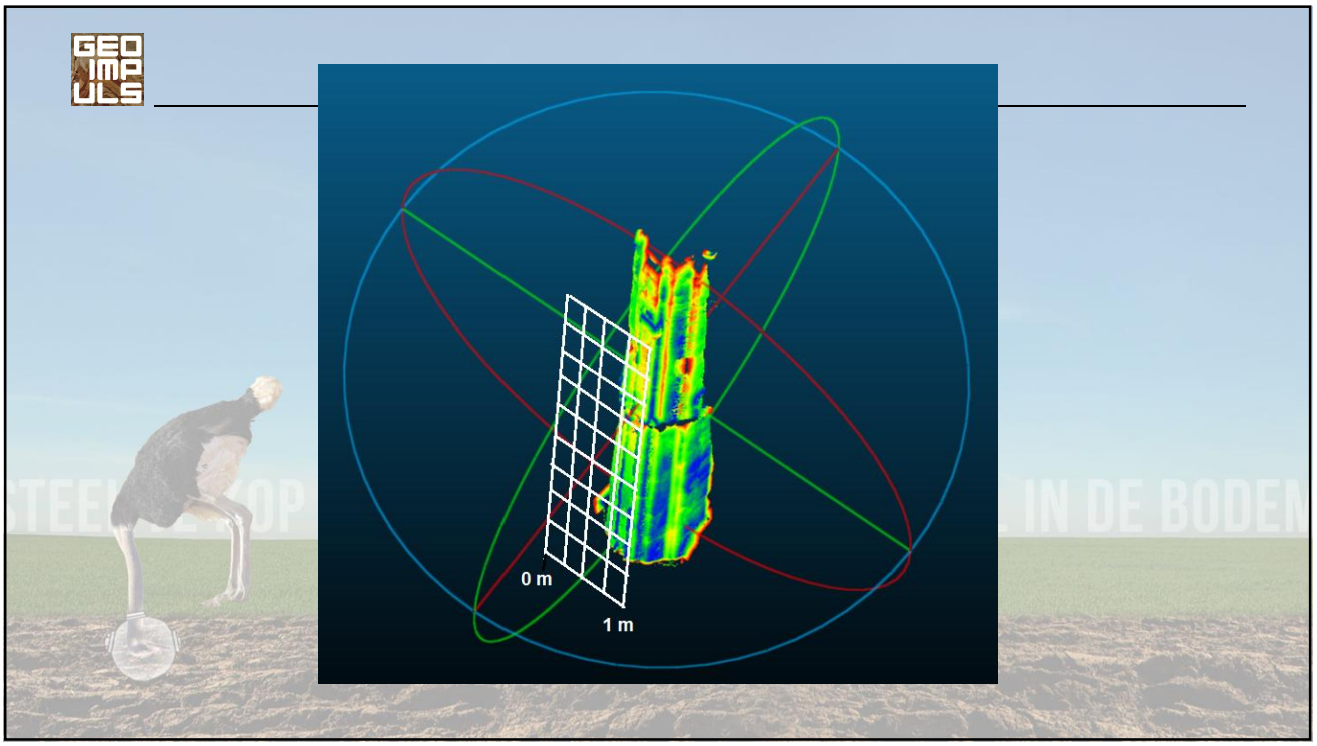


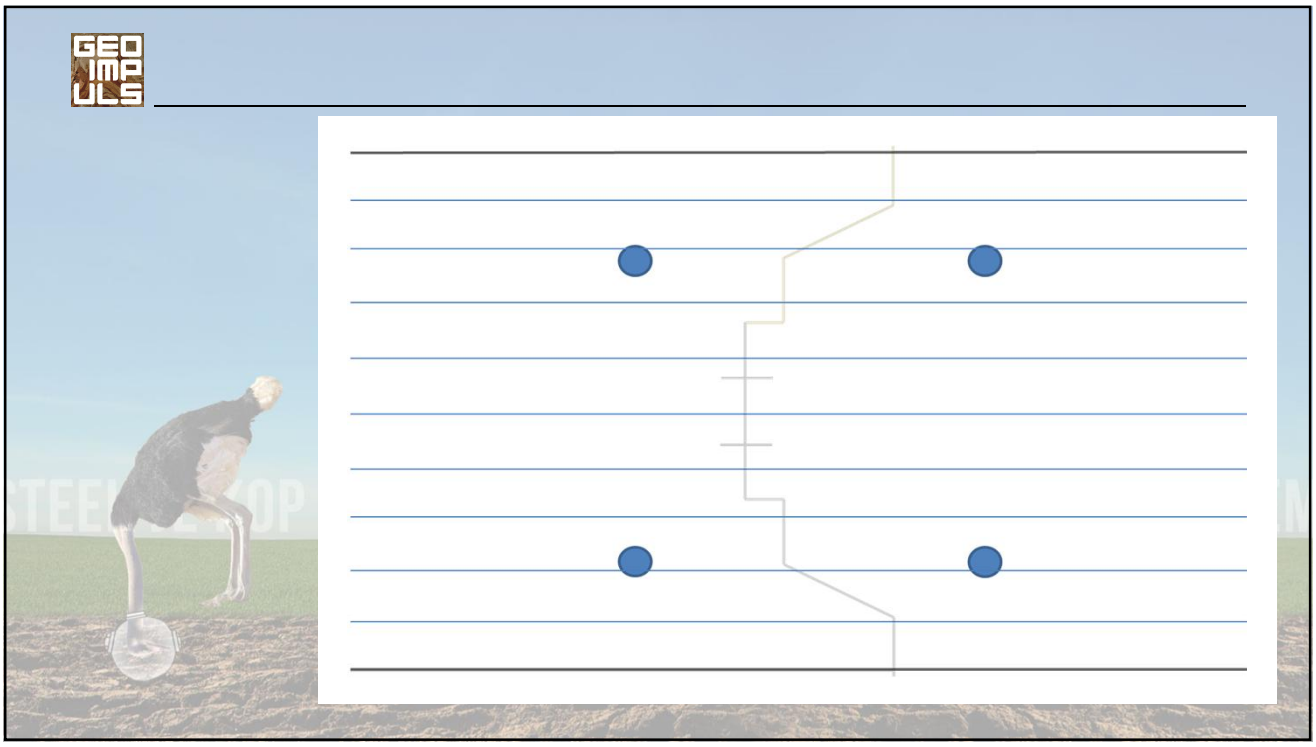
Attenuation vs anomaly width

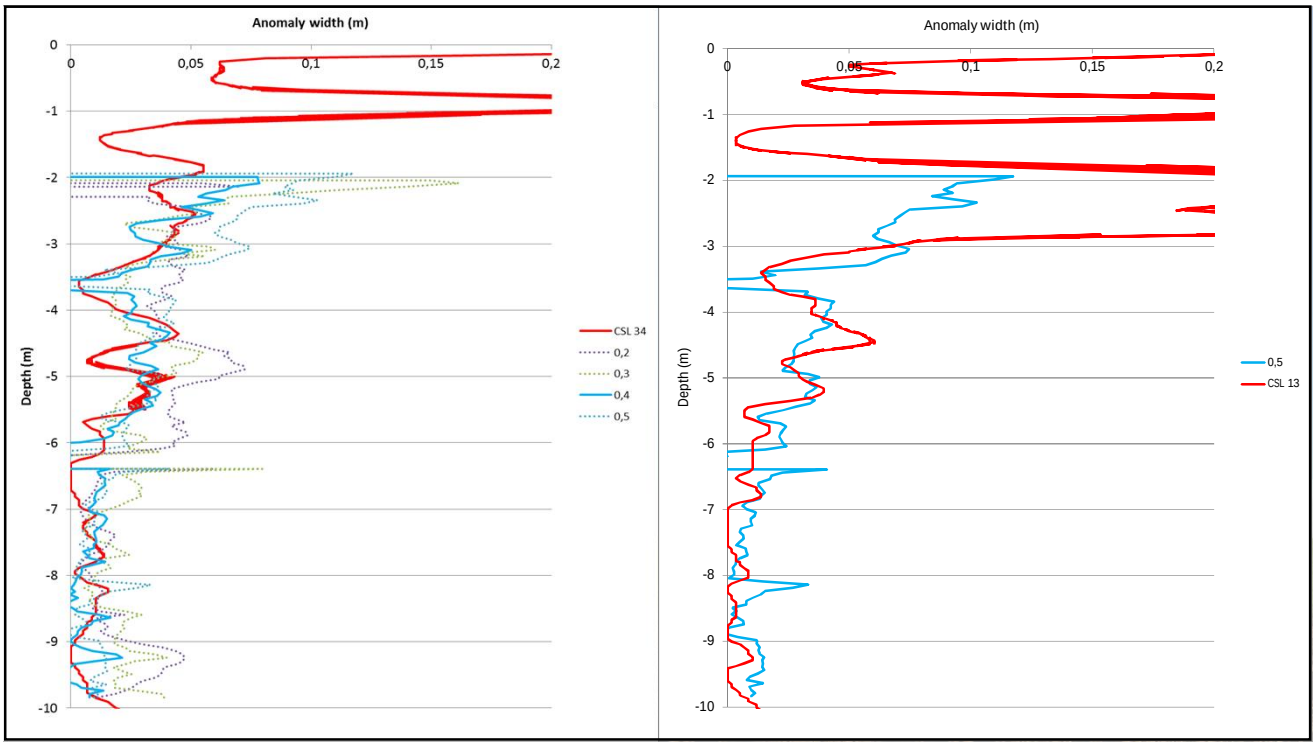


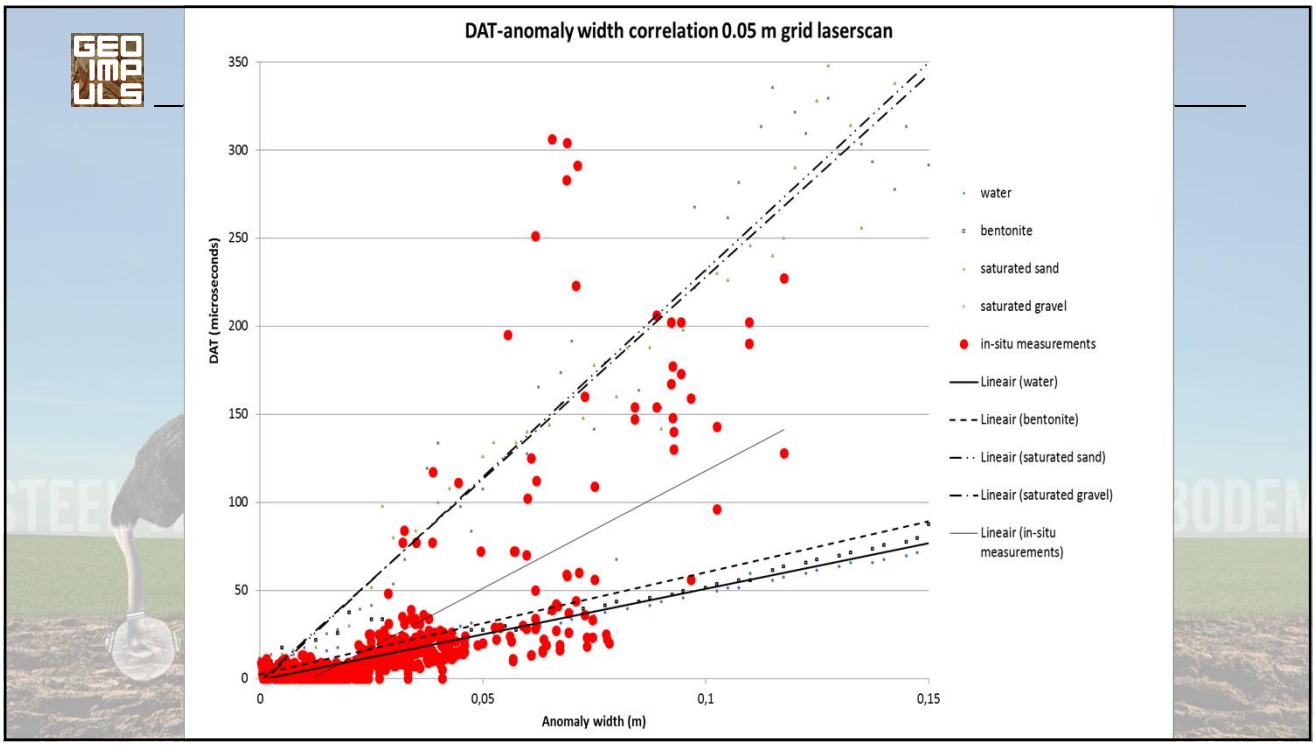


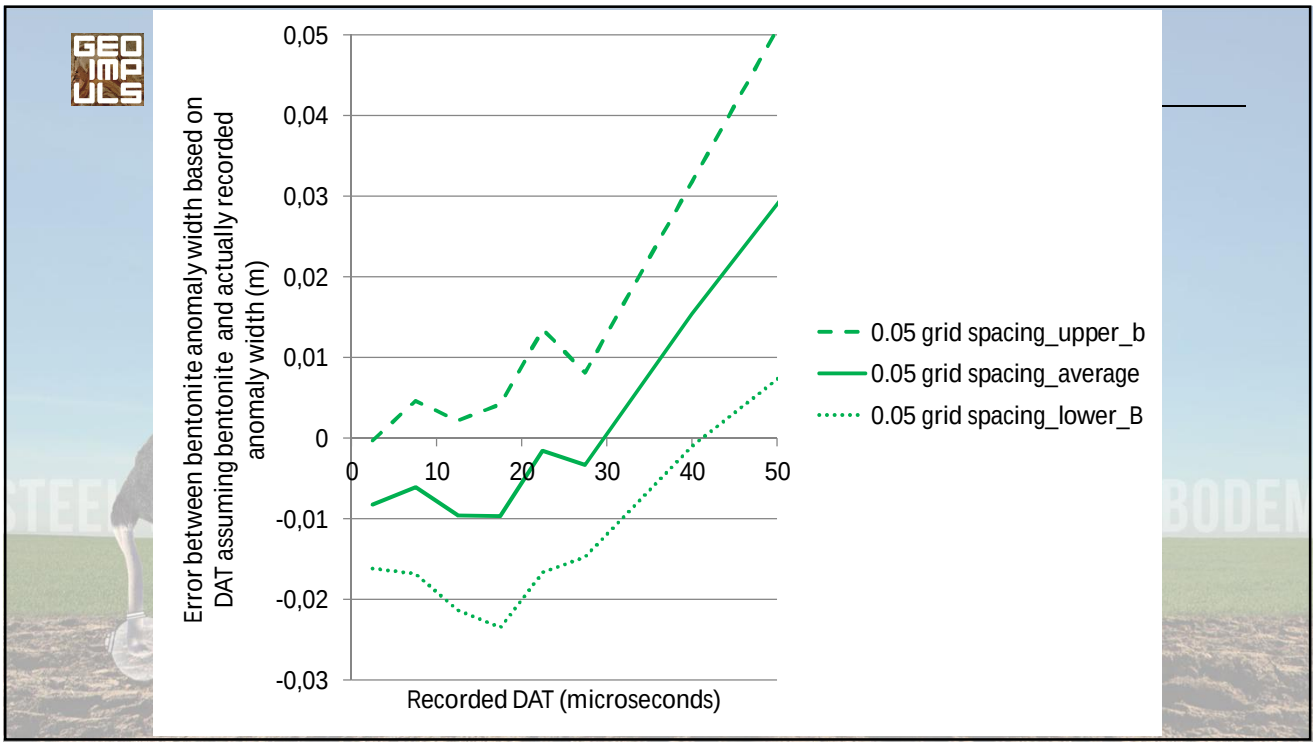

-6 m
-7 m
joint
joint
joint


0 m
1 m



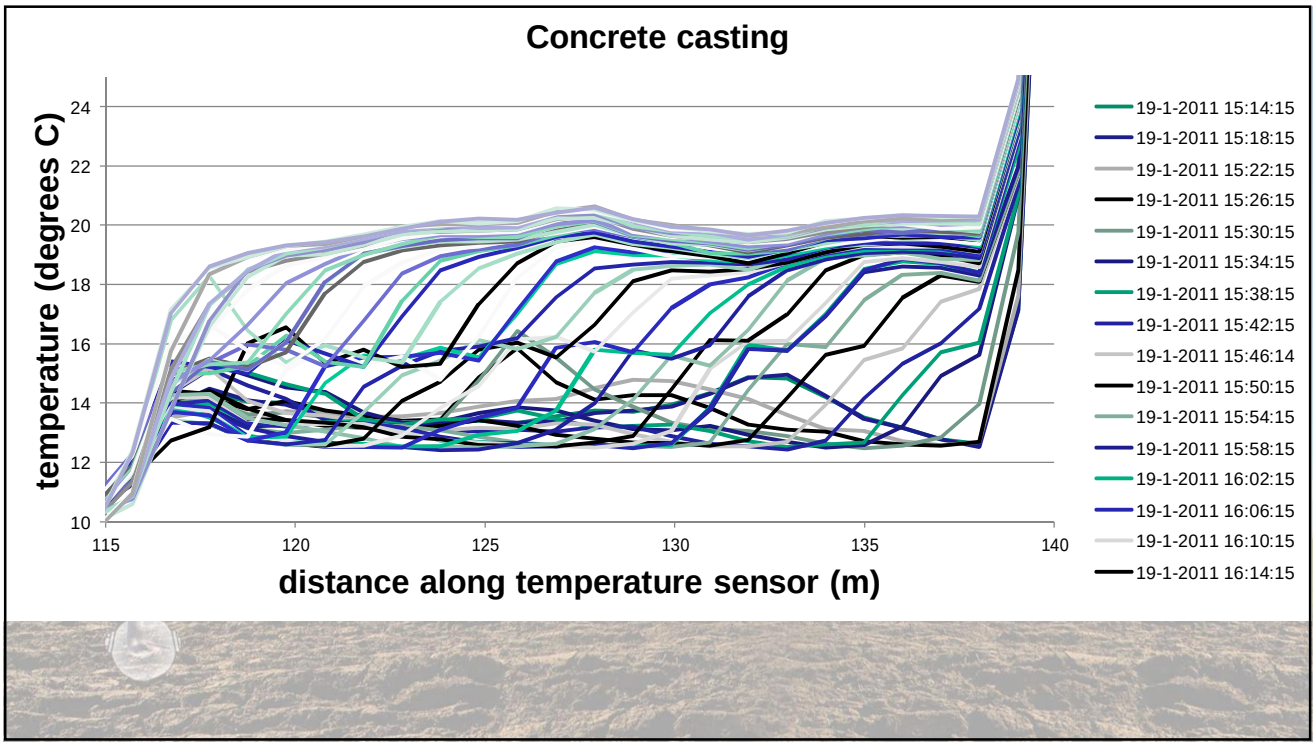

Anomaly width (m)
0
0,05
0,1
0,15
0,2
Depth (m)
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
CSL 34
0,2
0,3
0,4
0,5
Anomaly width (m)
0,5
CSL 13

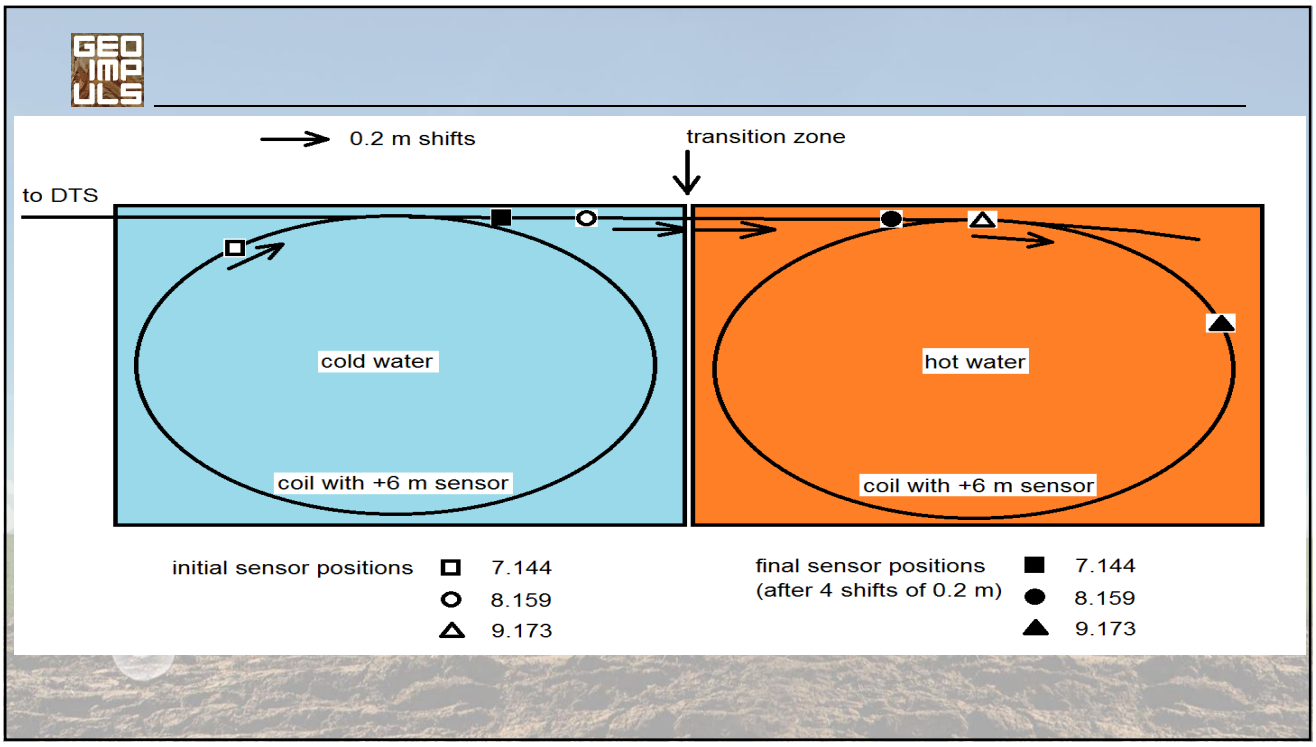

DAT-anomaly width correlation 0.05 m grid laserscan
DAT (microseconds)
350
300
250
200
150
100
50
0
0
0,05
0,1
0,15
Anomaly width (m)
water
bentonite
saturated sand
saturated gravel
in-situ measurements
Lineair (water)
Lineair (bentonite)
Lineair (saturated sand)
Lineair (saturated gravel)
Lineair (in-situ measurements)

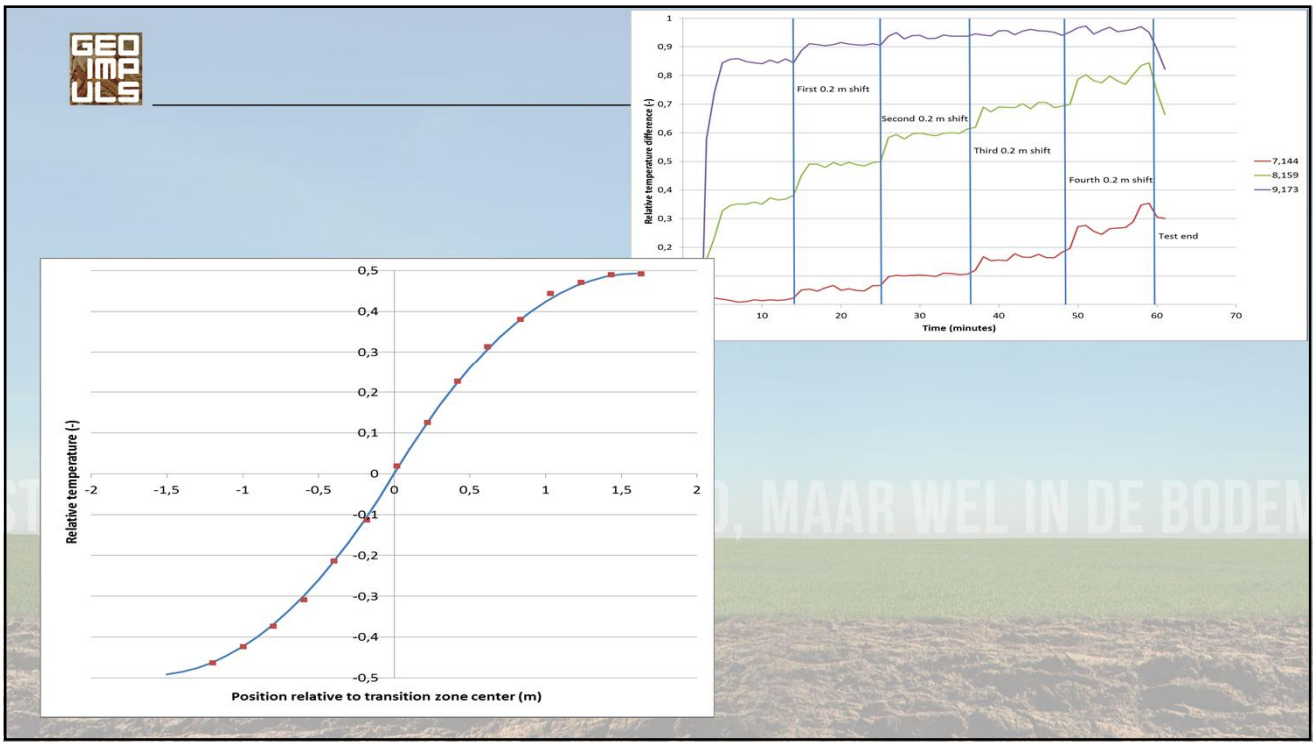

Error between bentonite anomaly width based on DAT assuming bentonite and actually recorded anomaly width (m)
0,05
0,04
0,03
0,02
0,01
0
-0,01
-0,02
-0,03
0
10
20
30
40
50
Recorded DAT (microseconds)
0.05 grid spacing_upper_b
0.05 grid spacing_average
0.05 grid spacing_lower_B

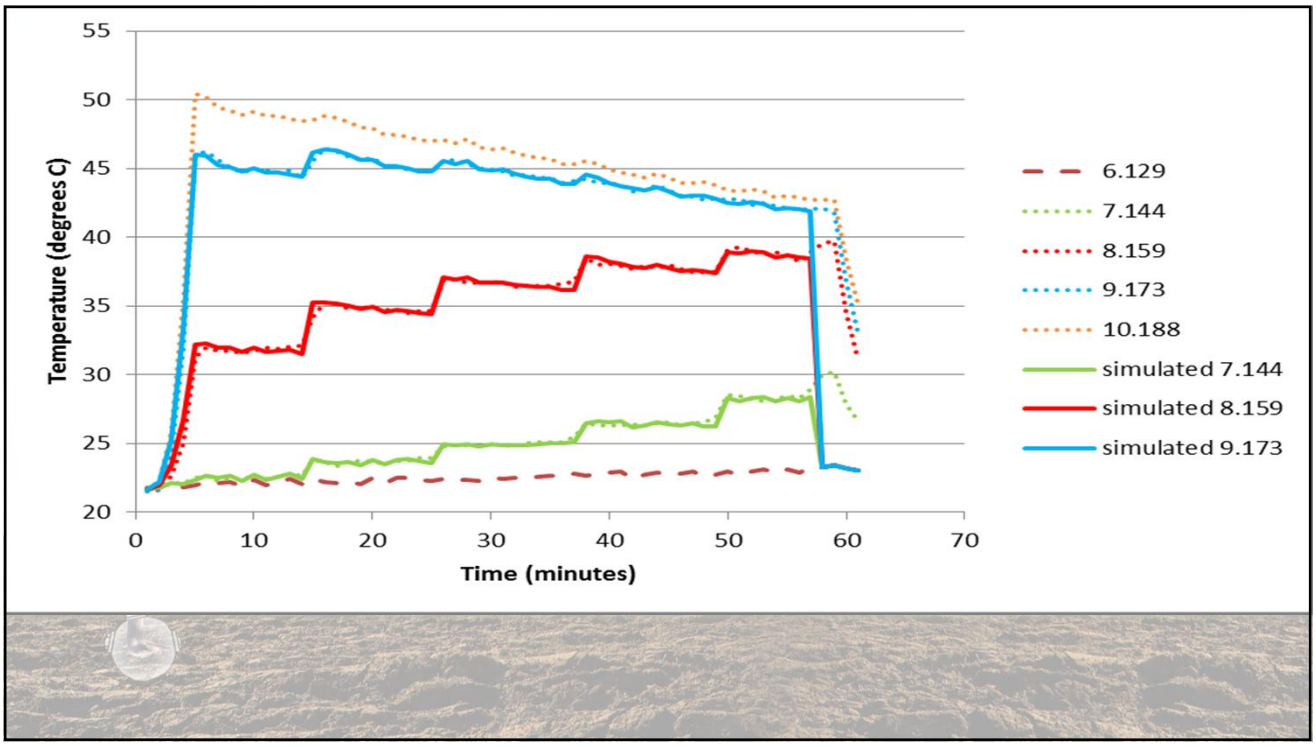
Projects

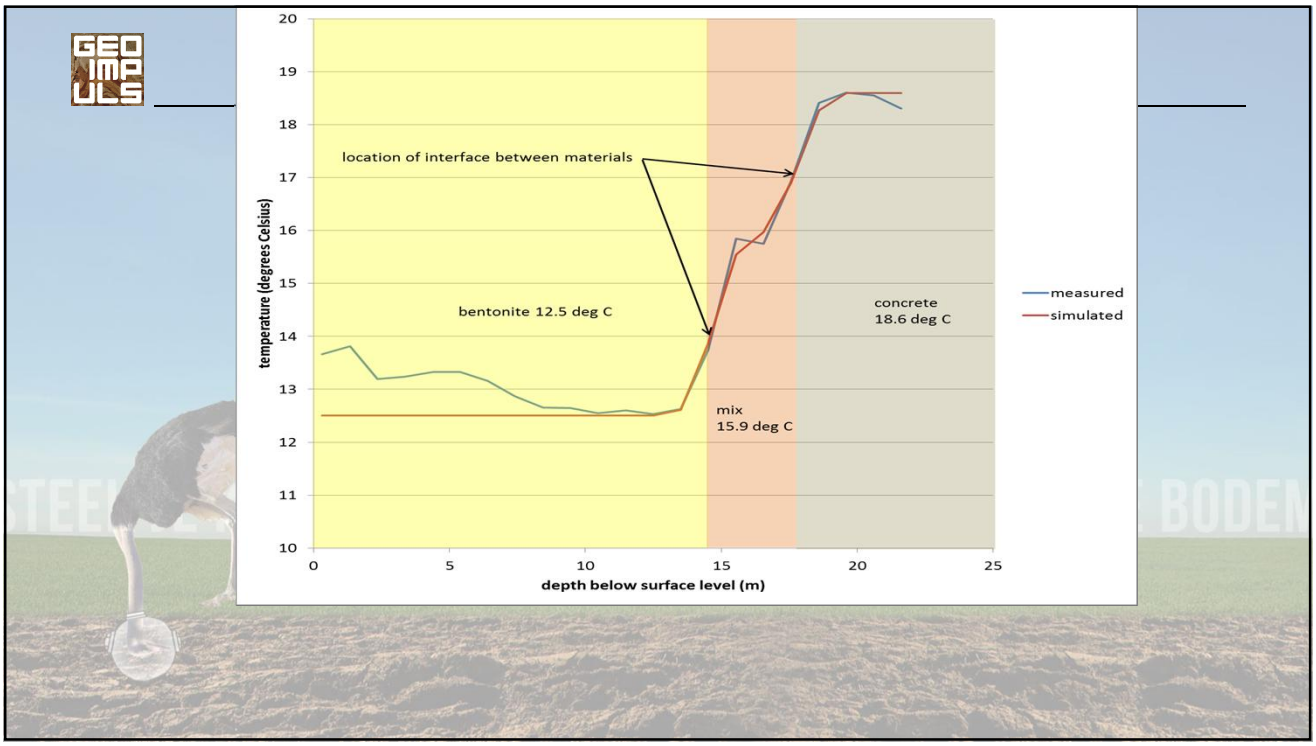
- Kruisplein Rotterdam underground parking
- Spoorzone Delft railway tunnel
- Avenue2 Maastricht road tunnel
- Oceanco Alblasserdam dry dock
- Foundation adaptation railway bridge Nijmegen
- Foundation adaptation railway bridge Deventer

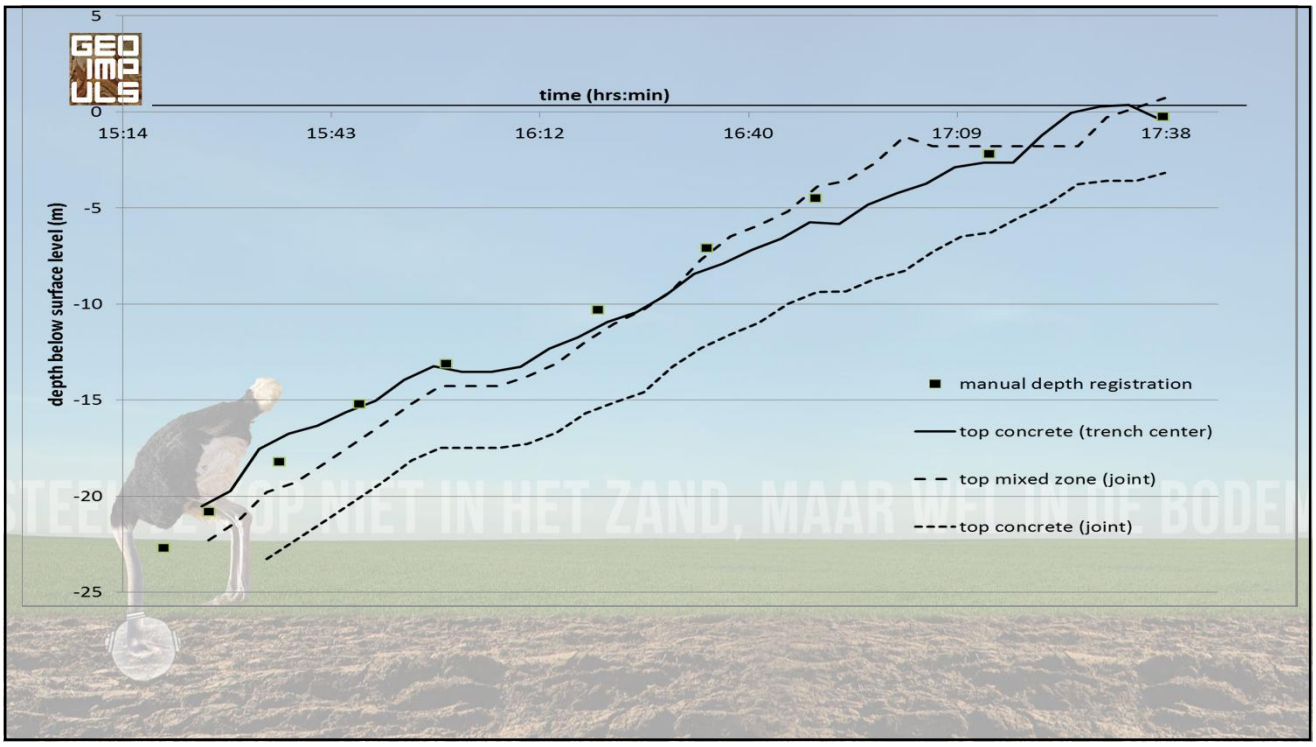


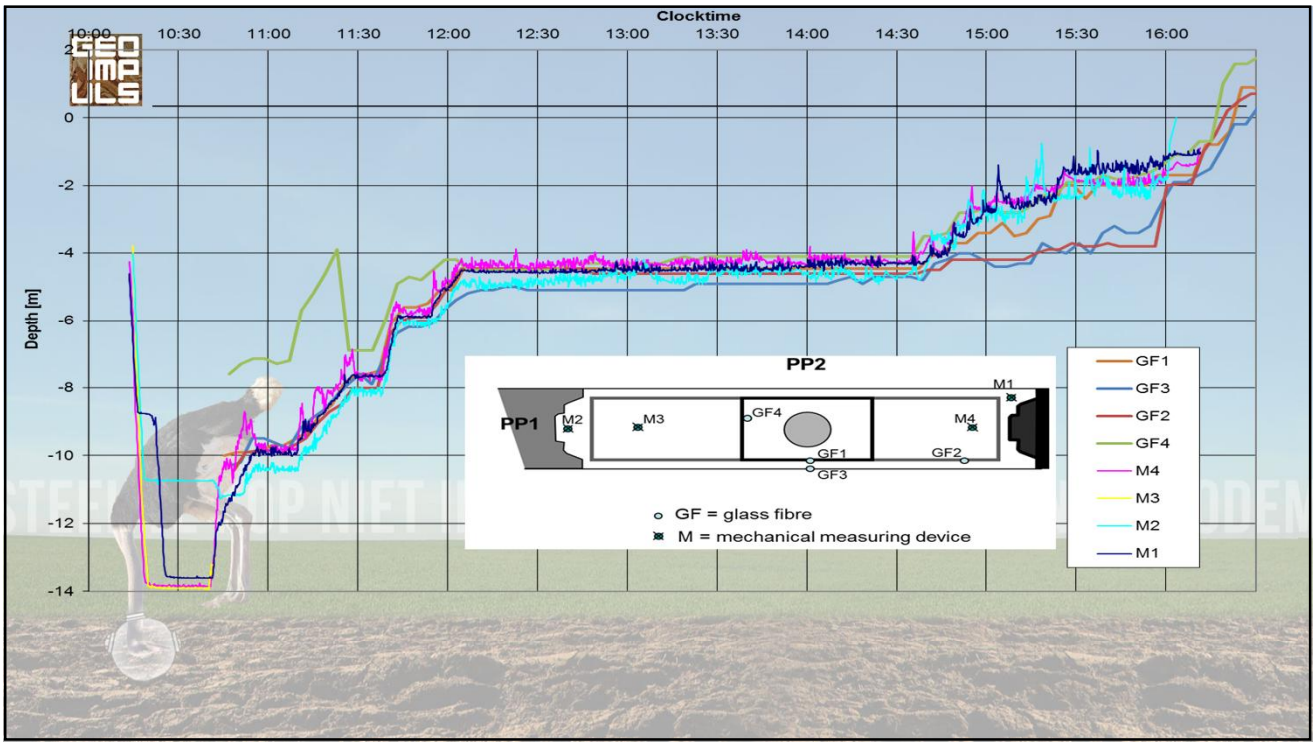

0.2 m shifts
transition zone
to DTS
cold water
hot water
coil with +6 m sensor
coil with +6 m sensor
initial sensor positions
7.144
8.159
9.173
final sensor positions
(after 4 shifts of 0.2 m)
7.144
8.159
9.173

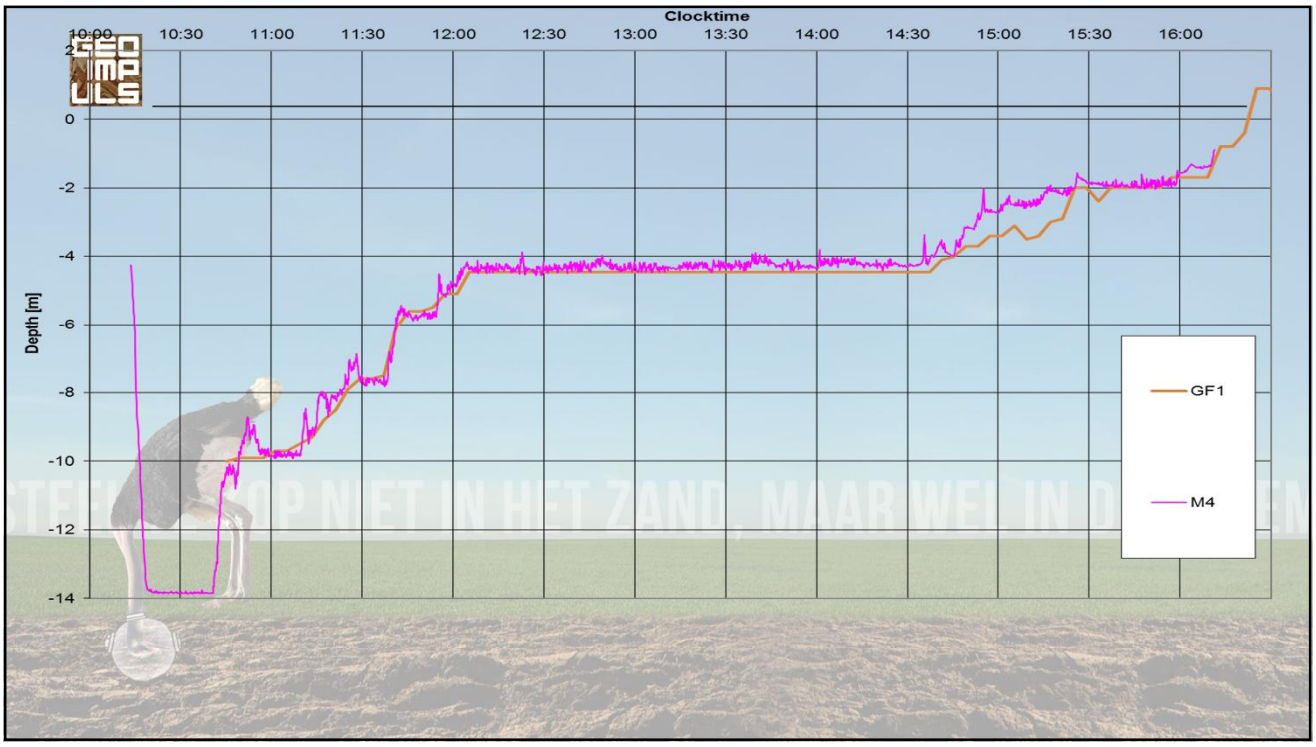

Relative temperature difference (-)
Time (minutes)
First 0.2 m shift
Second 0.2 m shift
Third 0.2 m shift
Fourth 0.2 m shift
Test end
7,144
8,159
9,173
Relative temperature (-)
Position relative to transition zone center (m)


Temperature (degrees C)
Time (minutes)
6.129
7.144
8.159
9.173
10.188
simulated 7.144
simulated 8.159
simulated 9.173


location of interface between materials
bentonite 12.5 deg C
mix
15.9 deg C
concrete
18.6 deg C
temperature (degrees Celsius)
depth below surface level (m)
measured
simulated


time (hrs:min)
15:14
15:43
16:12
16:40
17:09
17:38
depth below surface level (m)
5
0
-5
-10
-15
-20
-25
manual depth registration
top concrete (trench center)
top mixed zone (joint)
top concrete (joint)

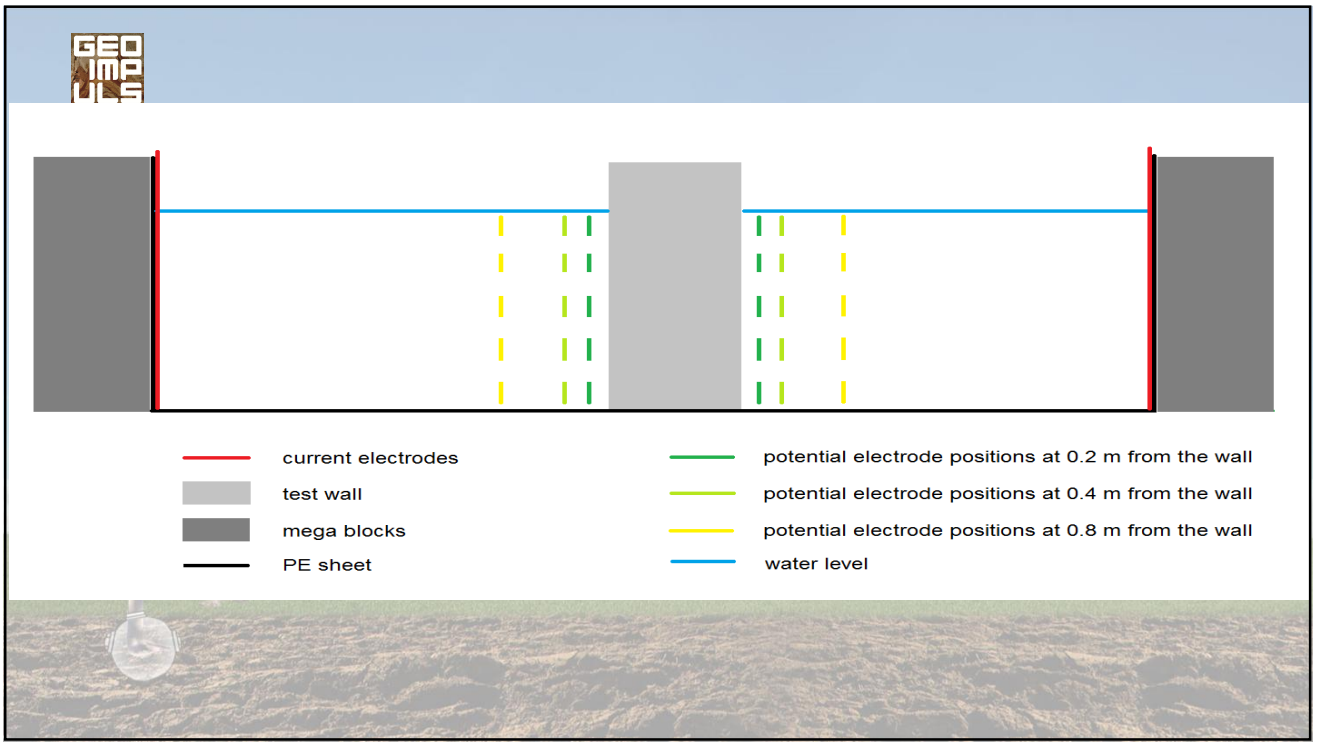

Clocktime
10:00
10:30
11:00
11:30
12:00
12:30
13:00
13:30
14:00
14:30
15:00
15:30
16:00
Depth [m]
2
0
-2
-4
-6
-8
-10
-12
-14
PP2
PP1
M1
M2
M3
GF4
M4
GF1
GF2
GF3
GF = glass fibre
M = mechanical measuring device
GF1
GF3
GF2
GF4
M4
M3
M2
M1



Test wall

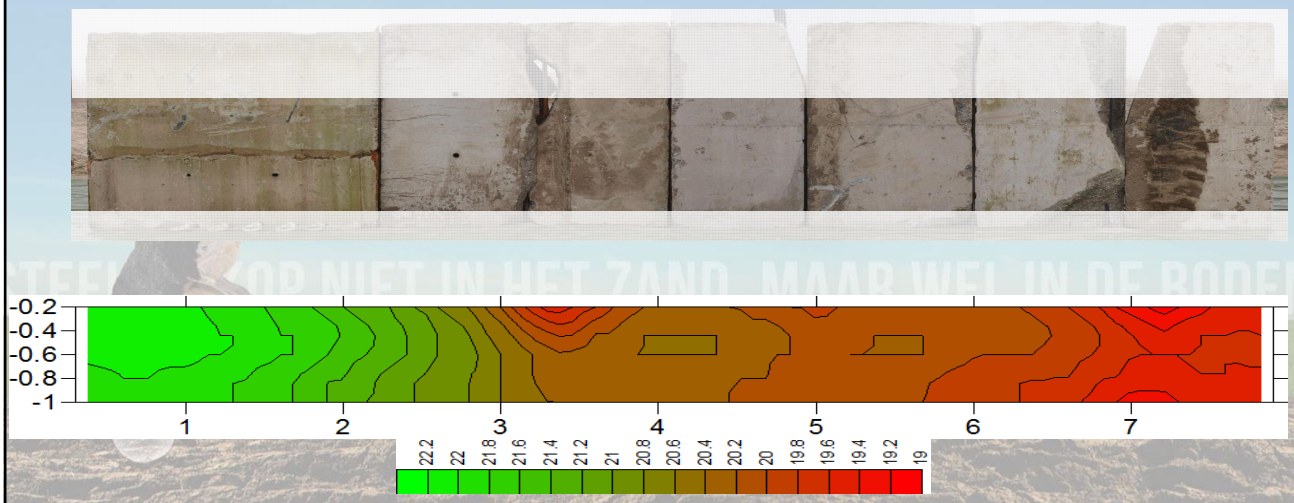
- Block 1
- Block 2
- Block 3
- Block 4


AM-59-85


current electrodes
test wall
mega blocks
PE sheet
potential electrode positions at 0.2 m from the wall
potential electrode positions at 0.4 m from the wall
potential electrode positions at 0.8 m from the wall
water level

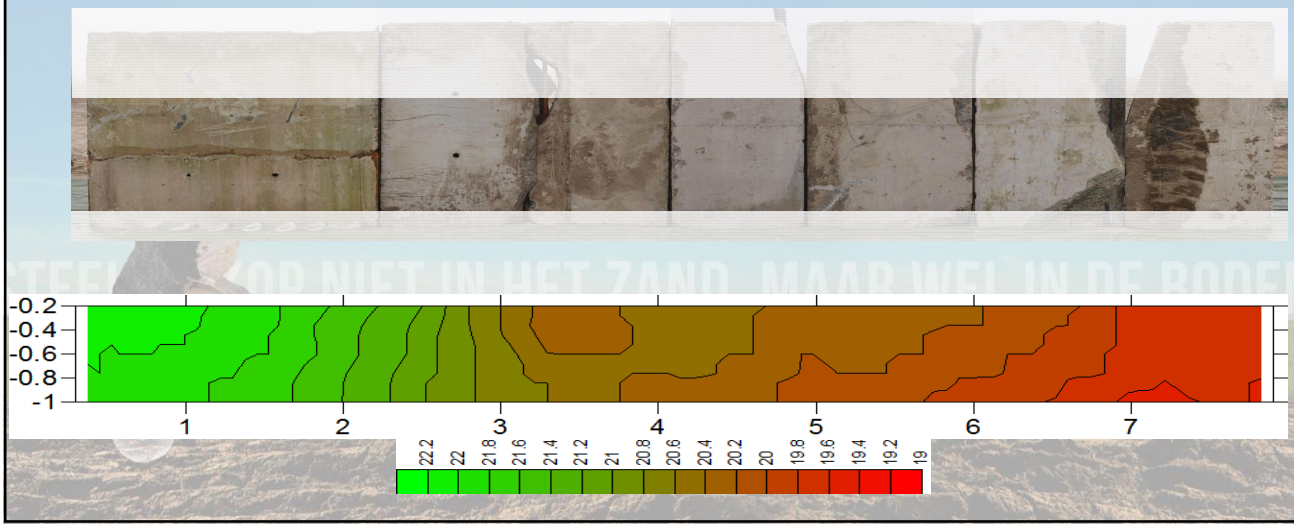
Results 0,2 m

- Impedance in Ohm



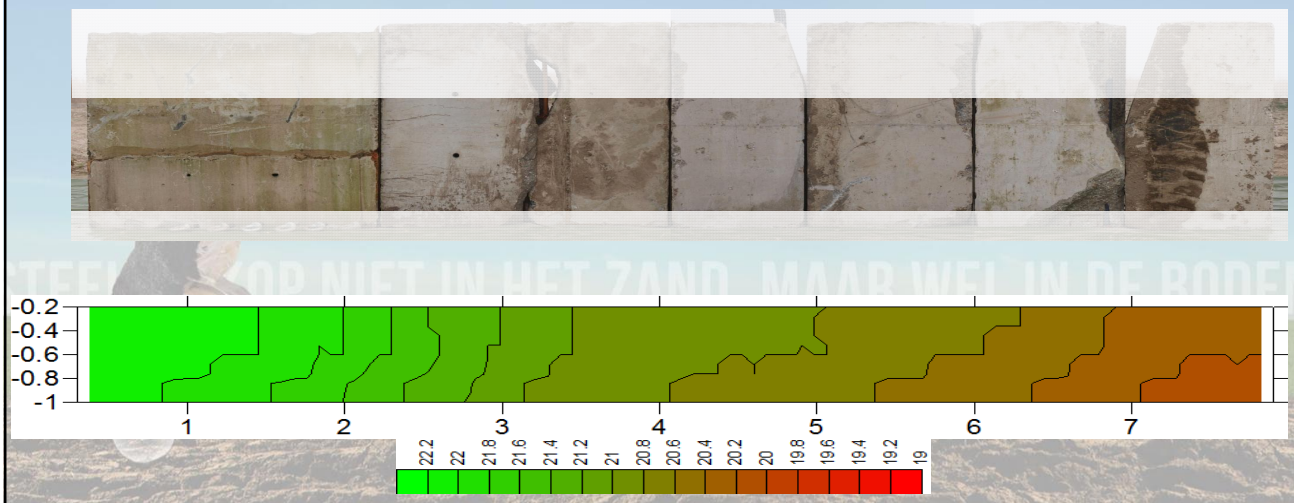
Results 0,4 m

- Impedance in Ohm



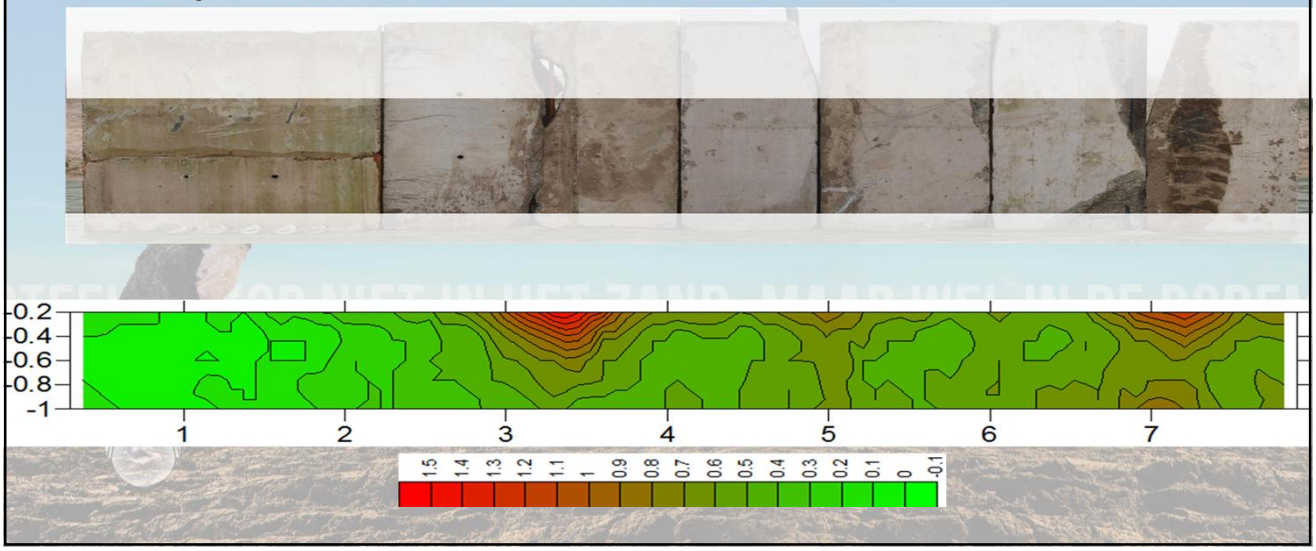
Results 0,8 m

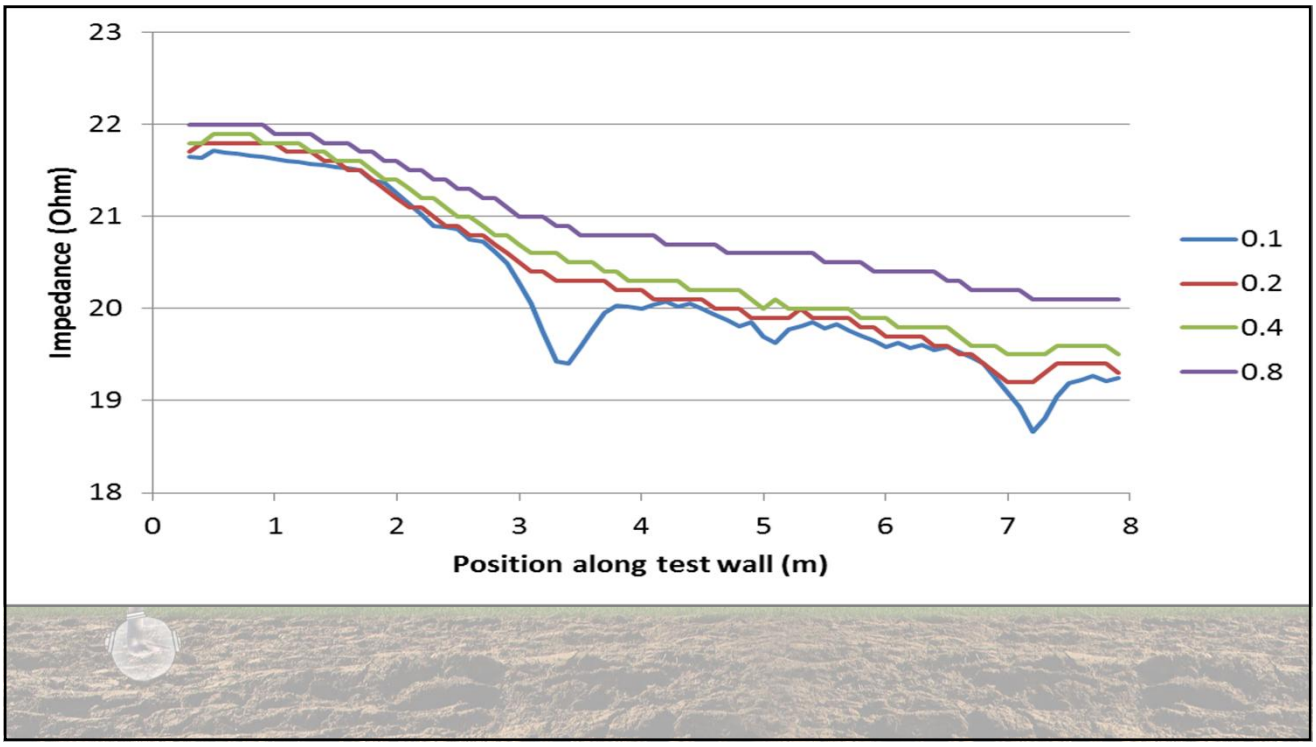
- Impedance in Ohm

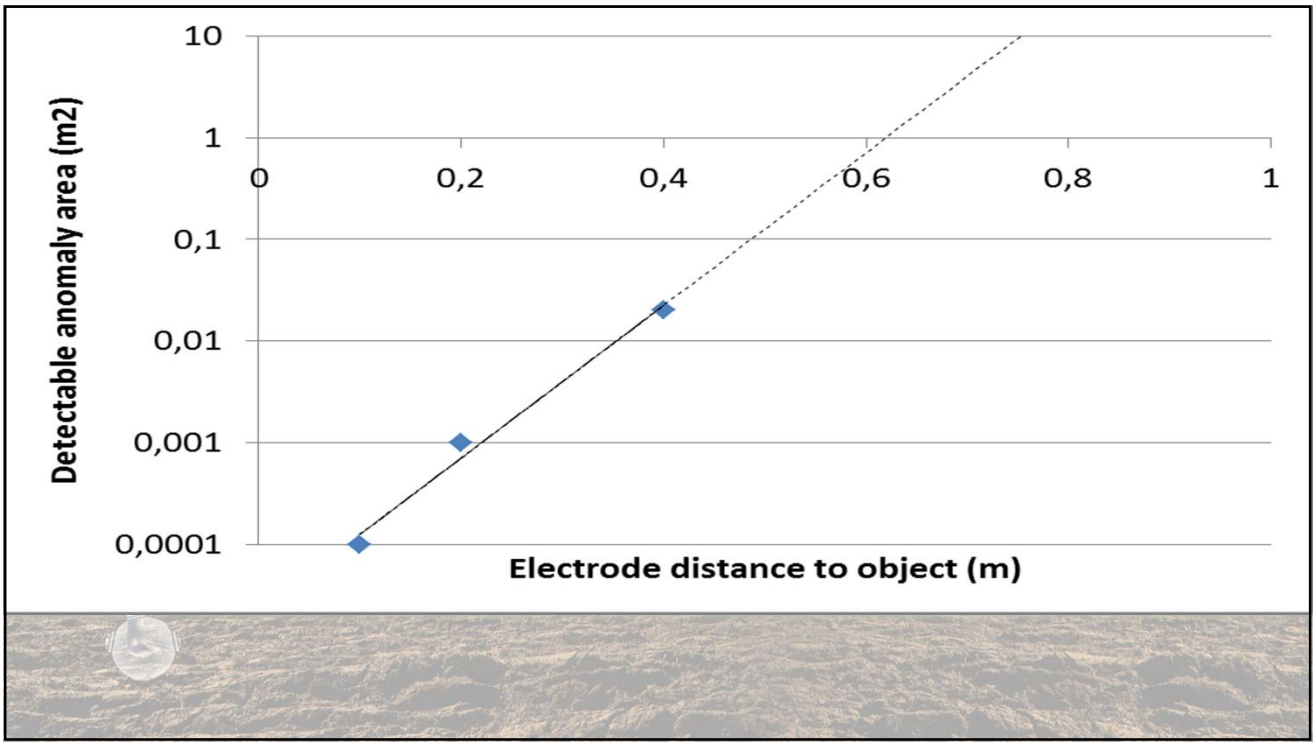


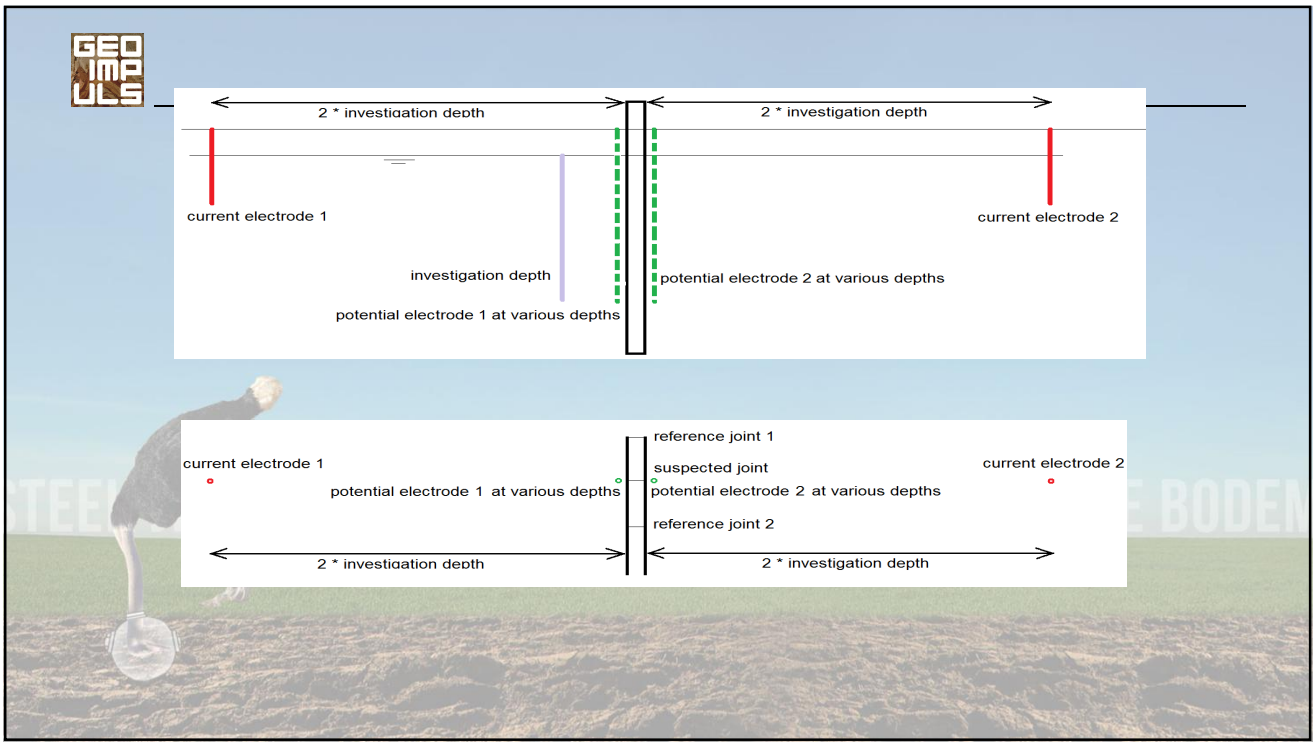
Results 0.2 minus 0.8 m

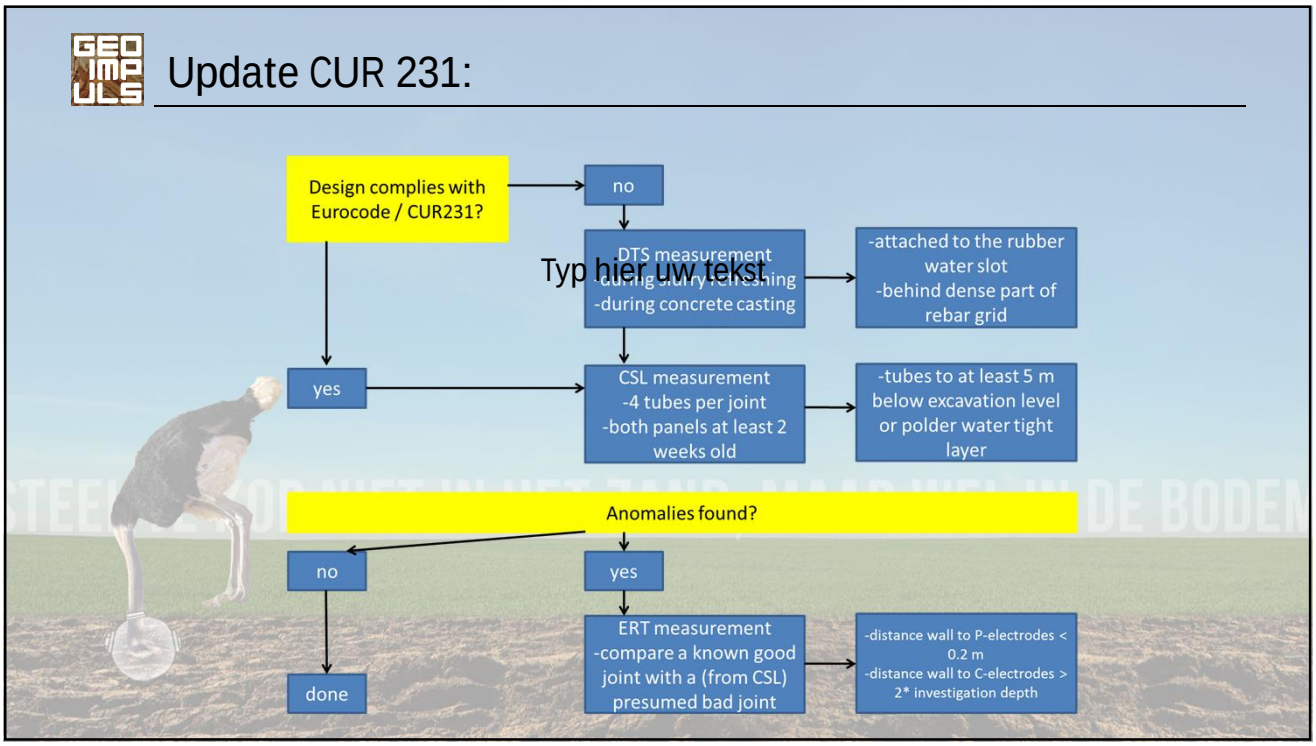
- Impedance difference in Ohm




23
22
21
20
19
18
Impedance (Ohm)
0
1
2
3
4
5
6
7
8
Position along test wall (m)
0.1
0.2
0.4
0.8


10
1
0,1
0,01
0,001
0,0001
Detectable anomaly area (m2)
0
0,2
0,4
0,6
0,8
1
Electrode distance to object (m)





Typ hier uw tekst