

C-thru
Dual-polarized,
high-frequency GPR

EDENBROS, LLC 

Concrete Bridges Investigation

Objective of the study



THE PROBLEM

Increasing of cars traffic and poor maintenance have seriously compromised the stability of old bridge structures

WHAT IS AVAILABLE

Technical drawings

- Old
- Missing
- Incomplete

OBJECTIVE

- Locating the reinforcing bars
- Establish geometry and dimension of structural elements of existing bridges

Concrete Bridges Investigation Requirements

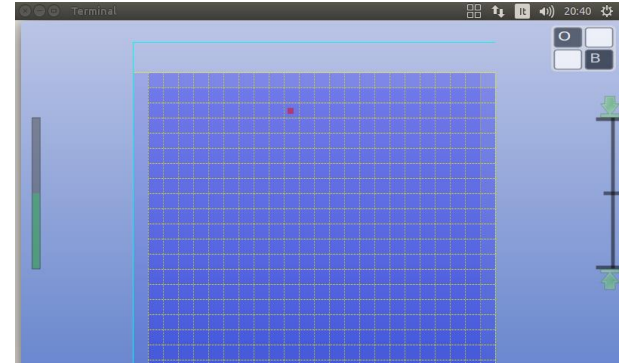
Investigation of more than 50 cm deep concrete slab

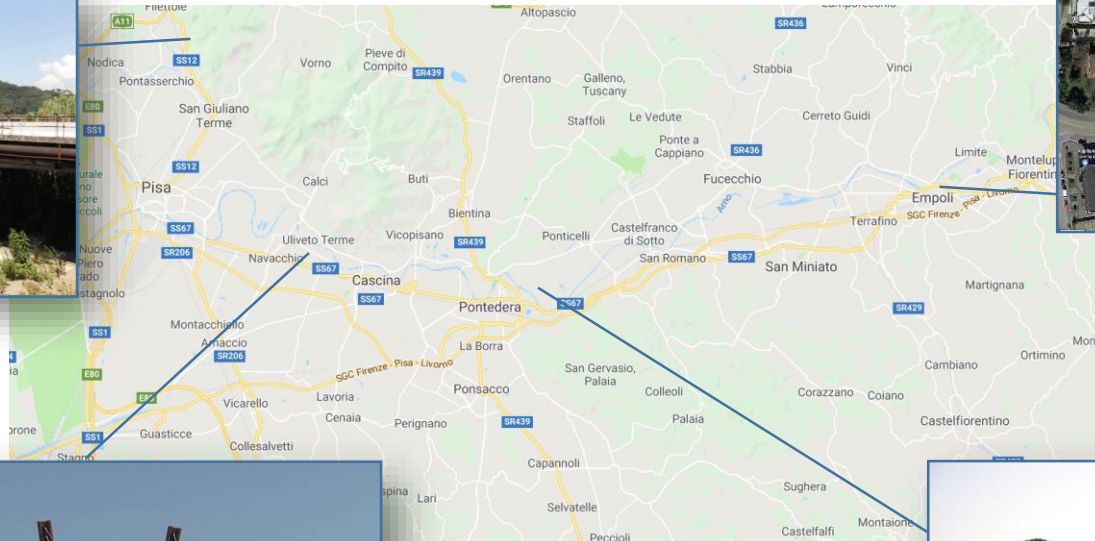
Identification of reinforcement bars under the shallow level of rebars:

- Obliques reinforcement bars
- Pre/post-tensioning cables

Technical Specs

- Dual polarized high-frequency GPR antennas
2 GHz
- Dense grid acquisition
5 cm scans
- Hand-held system
Easy to use
All-in-one





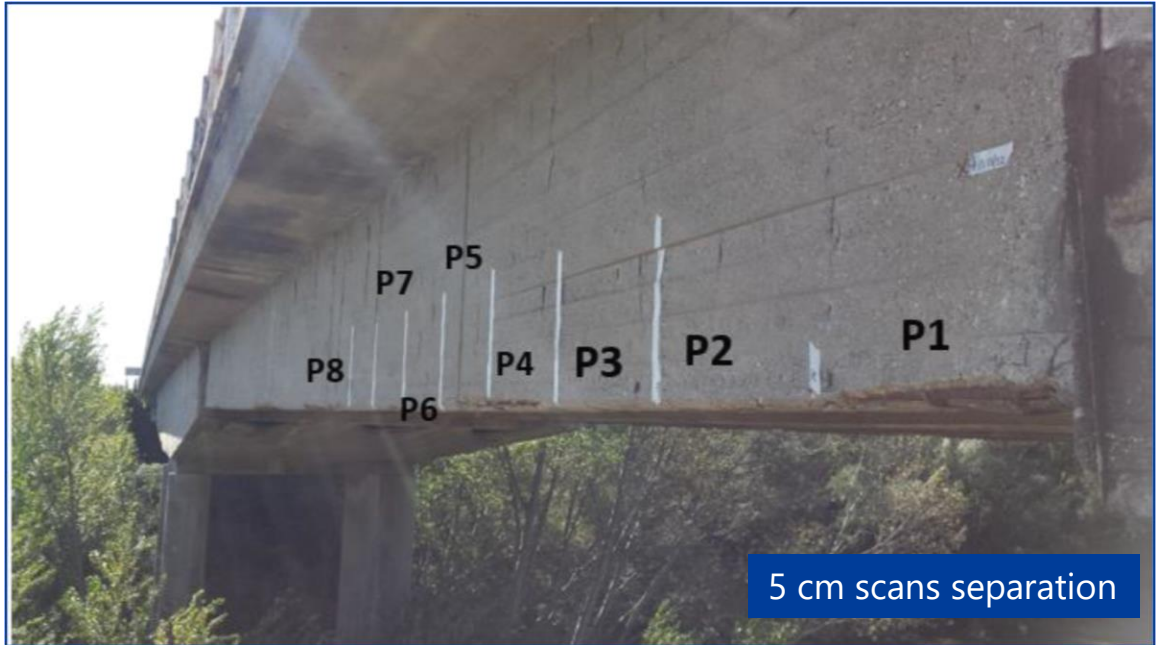
Scans of **8** areas of less than 1 meter square



Build after **WWII (1948-1955)**

No maintenance performed

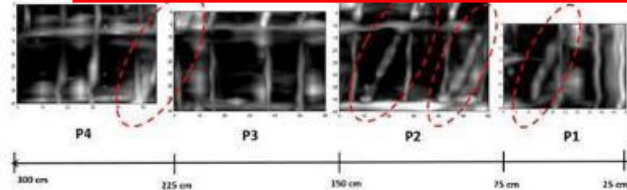
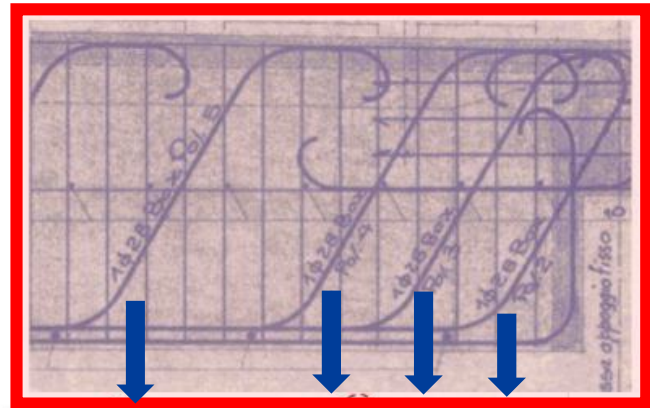
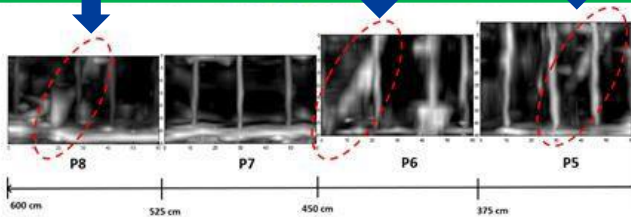
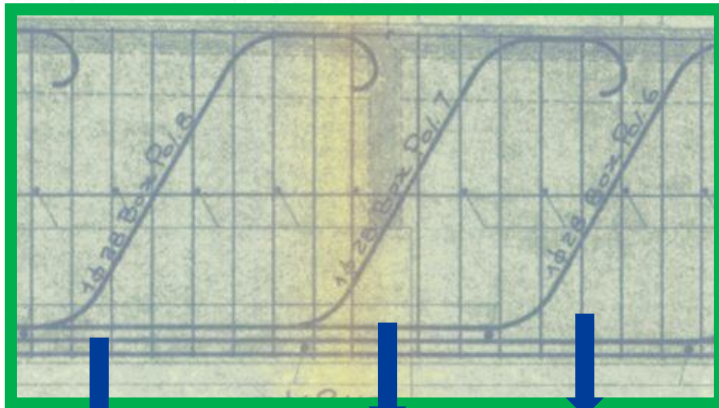
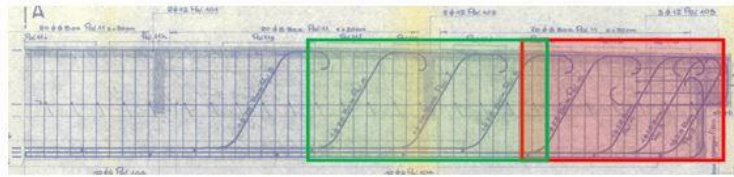
Only «**twin bridge**» drawings available



5 cm scans separation

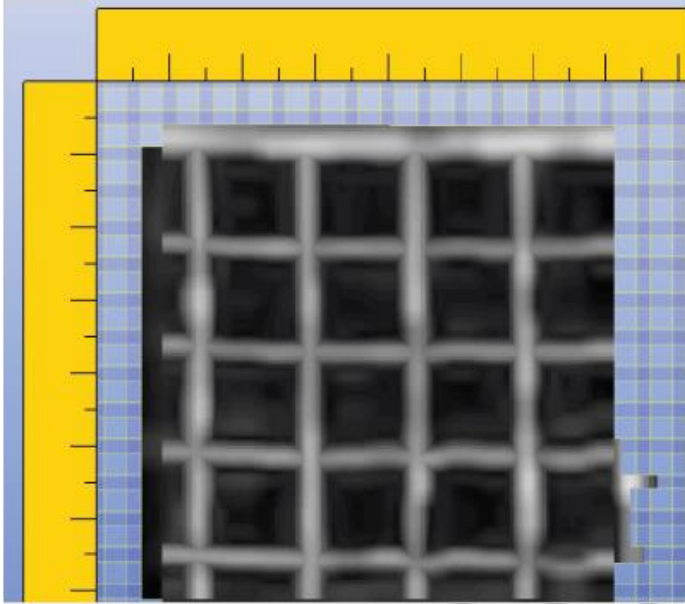
Case Study 1

"Twin Bridge" drawings comparison

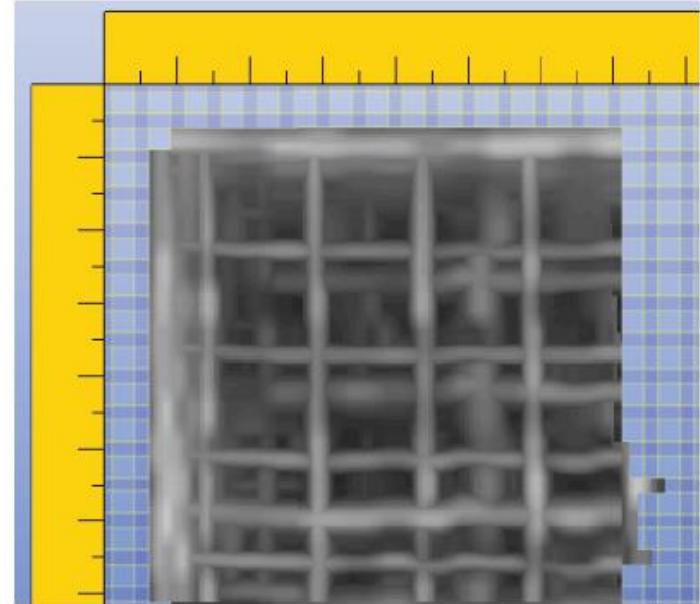


Case Study 1

"Twin Bridge" drawings comparison



Standard GPR visualisation
Rebar mesh



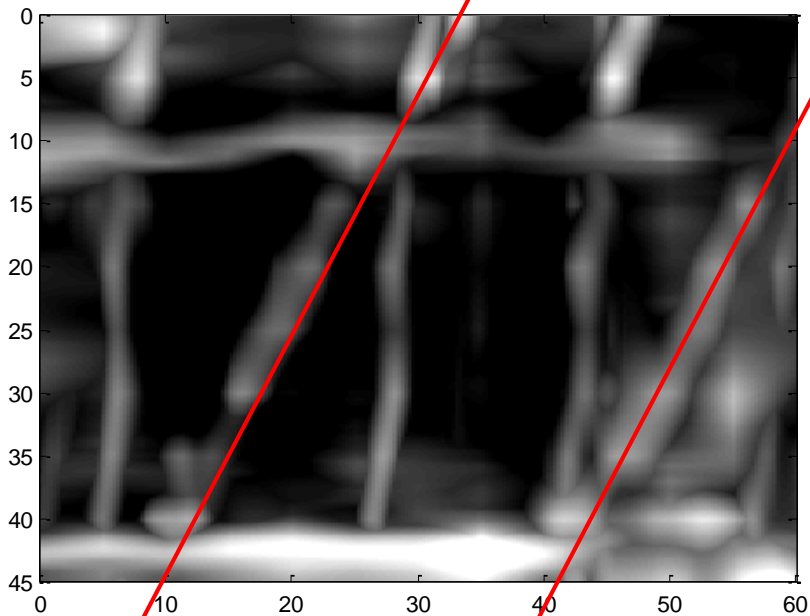
C-thru visualisation
Dual antenna polarisation allows the optimal
detection of both first and deeper levels of objects

Case Study 1

Obliques reinforcement bars



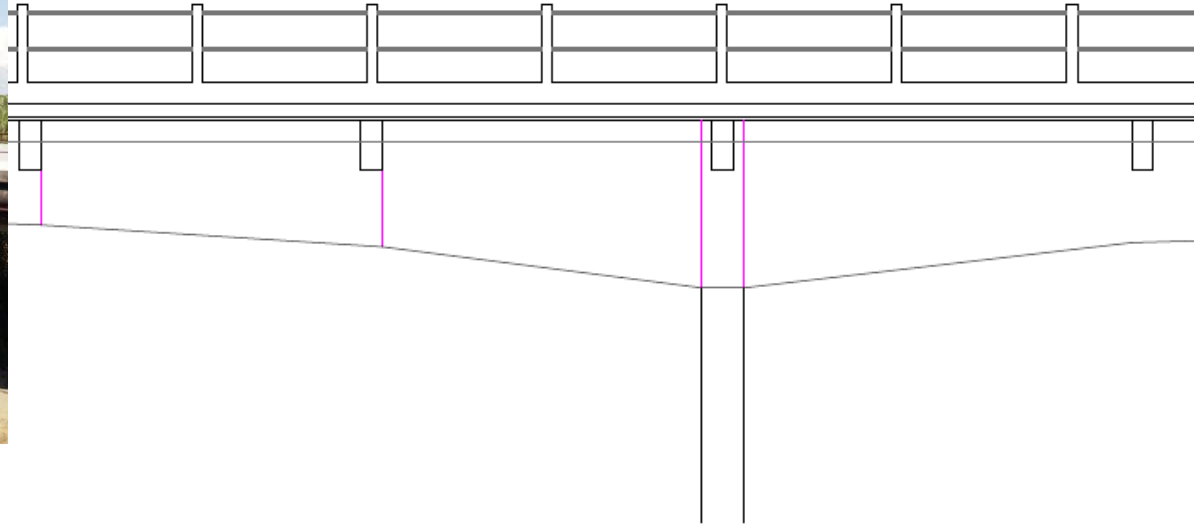
c
m



~ 63°

~ 63°

Case Study 2
Bridge in Ripafratta (Pisa)





Reinforcement bar **is missing!**

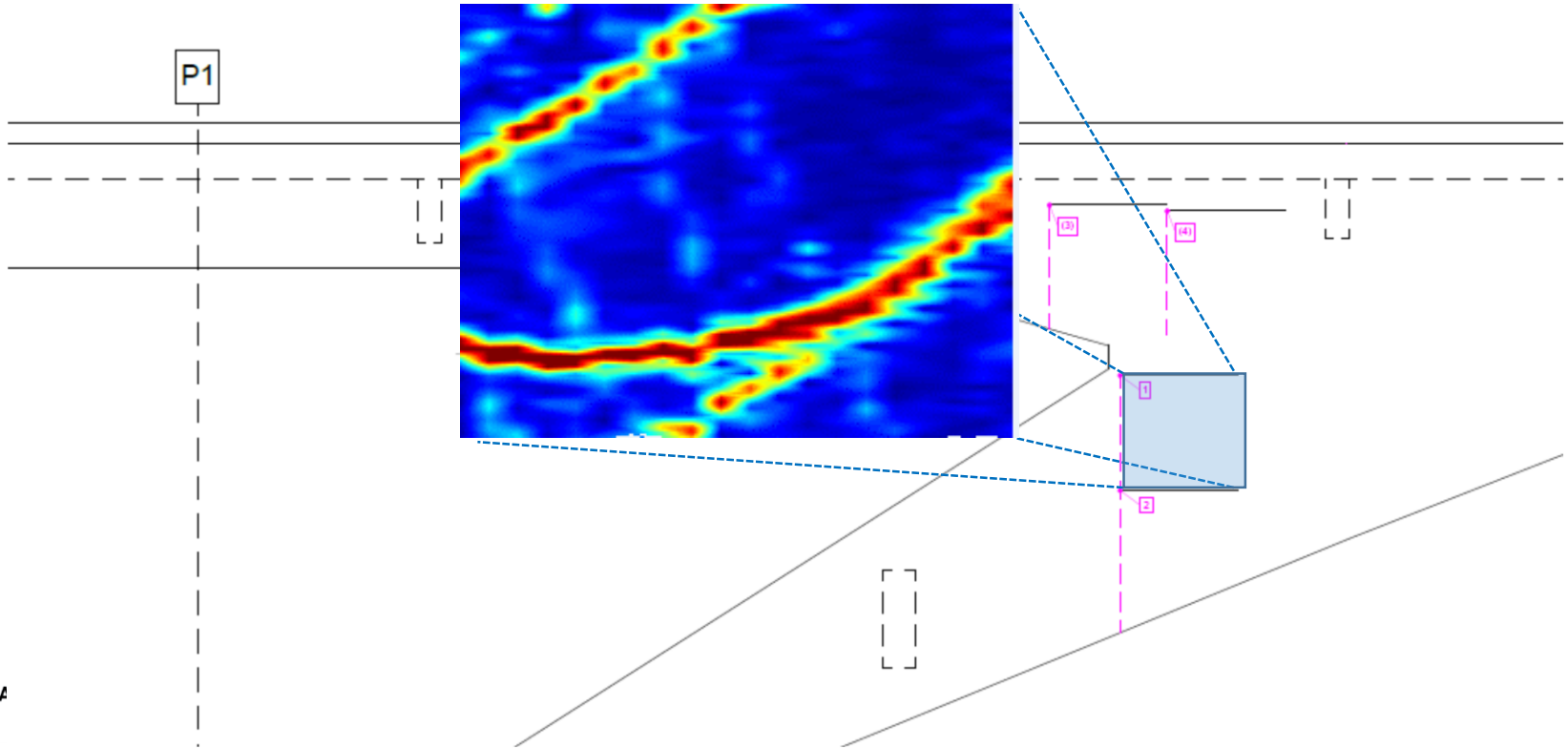
Case Study 3

Bridge in Fornacette (Pisa)



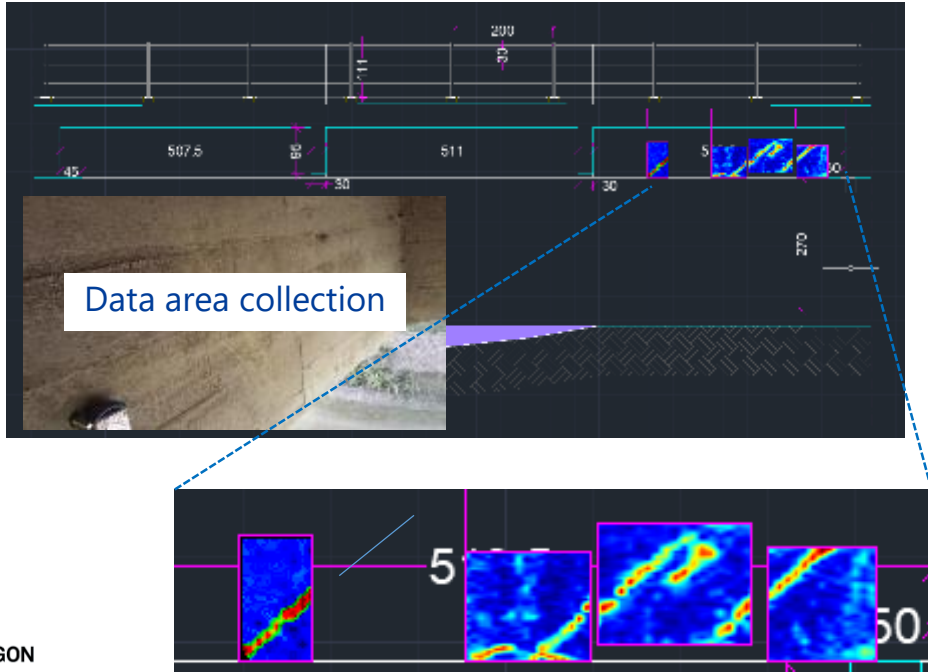
Case Study 3

Reinforcement bars located with the GPR



Case Study 4

Bridge on the Orme river (Empoli)



Reinforcement bars located with the GPR

Case Study 4

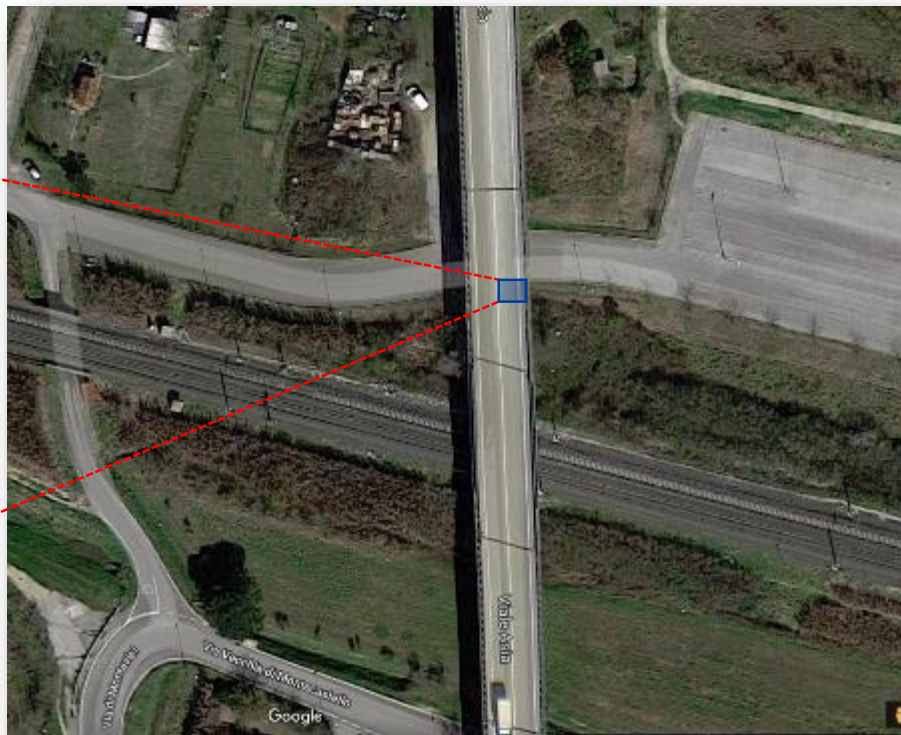
Bridge on the Orme river (Empoli)



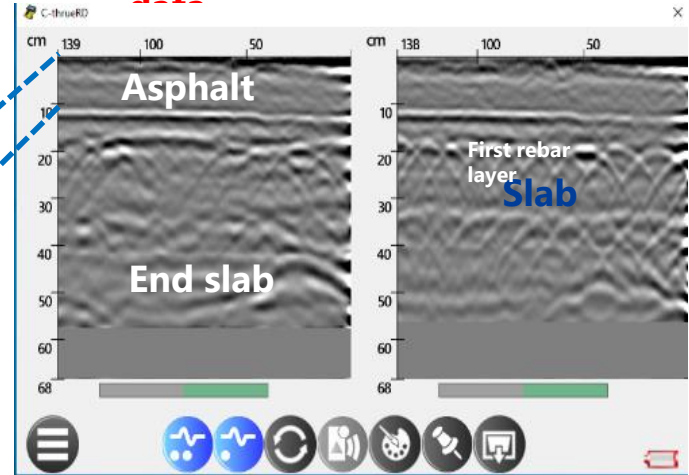
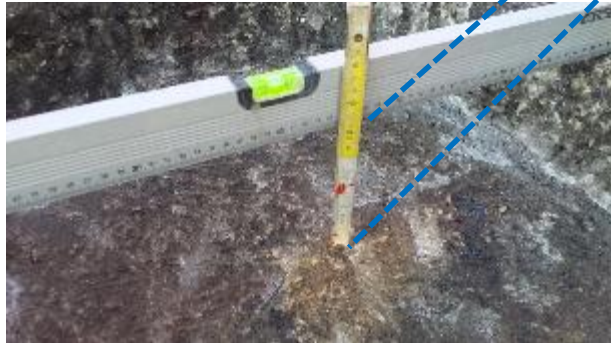
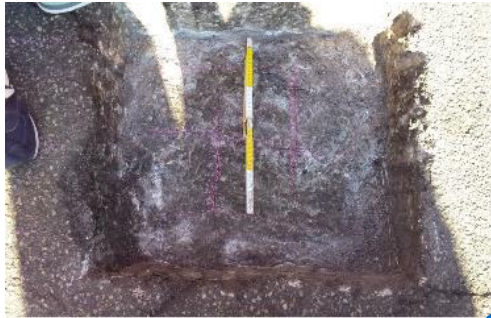
**The beams under the
bridge**



Reinforcement bars located



Real time display of the GPR data

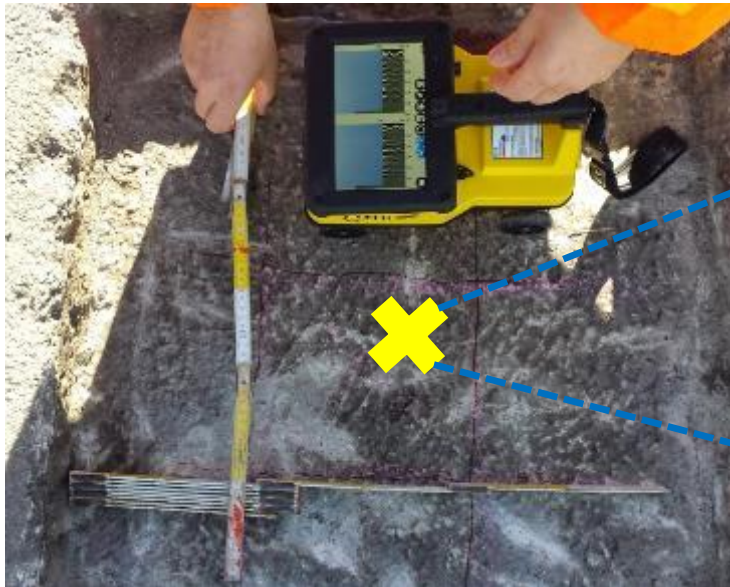


Deep

Shallow

Safe drill

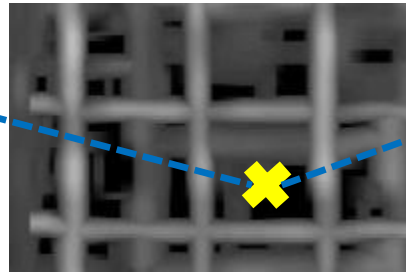
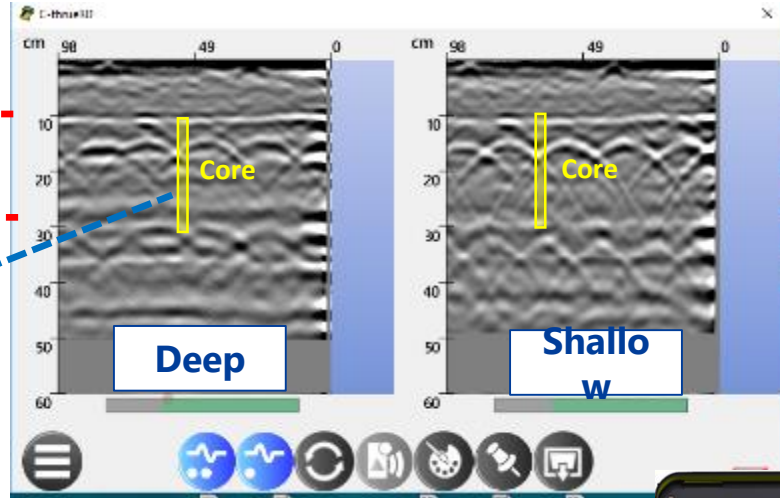
Locate the free area to drill for concrete quality check



Real time display of the GPR data

Asphalt

Slab



Locating post-tension cables



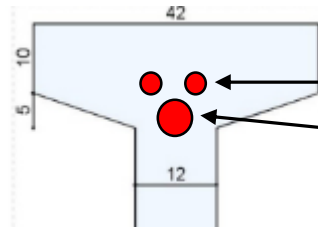
Locating post-tension cables



Locating post-tension cables

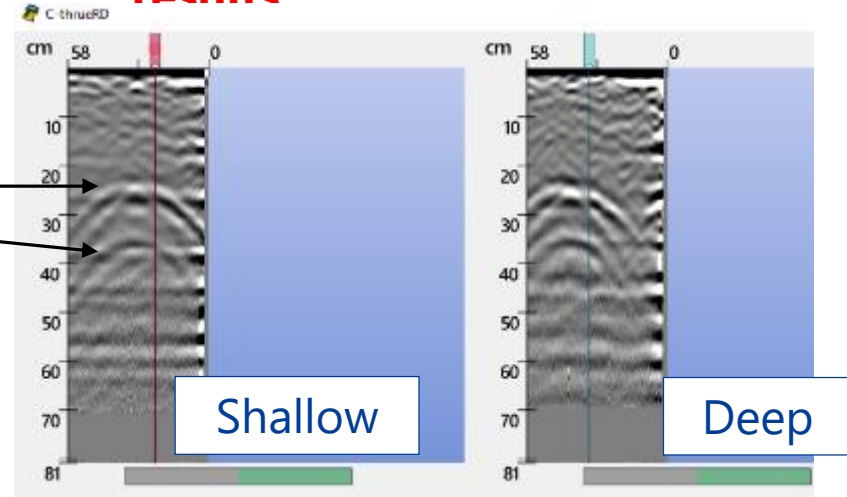


Position of the post tension cables in the bridge



Post tension cable located

Real time display map results



Shallow

Deep

The VV channel (deep) confirm the HH visualization (shallow)



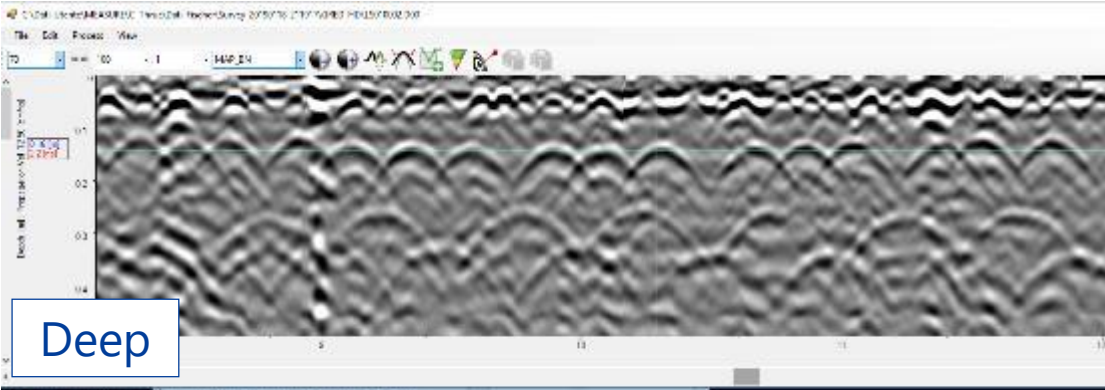
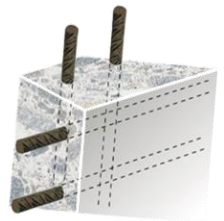
Locating post-tension cables



Hamburg Bridge, Germany



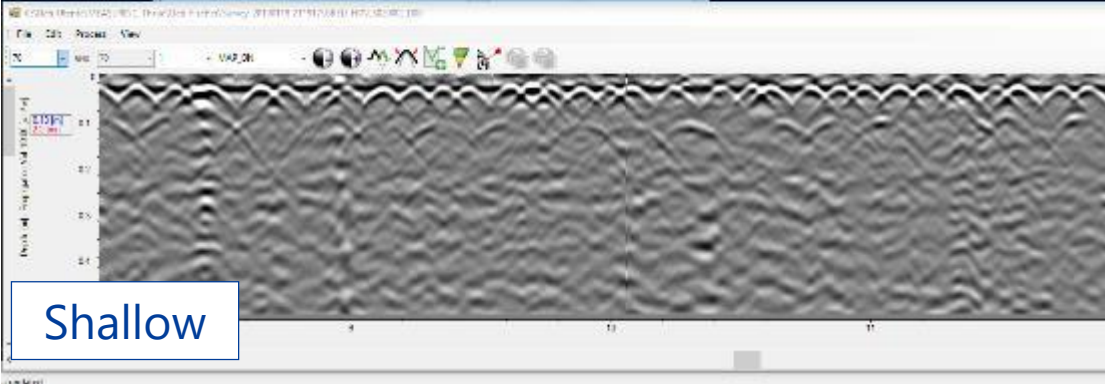
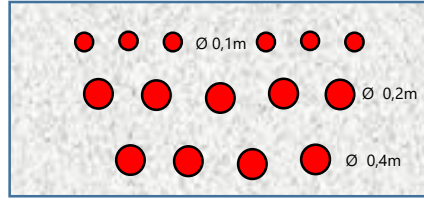
Locating post-tension cables



Deep



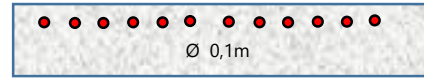
Deep rebars
Post tension
cables



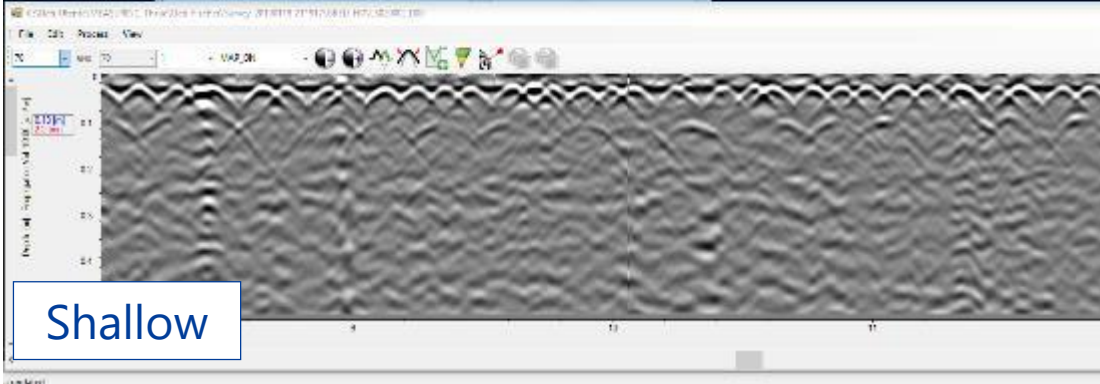
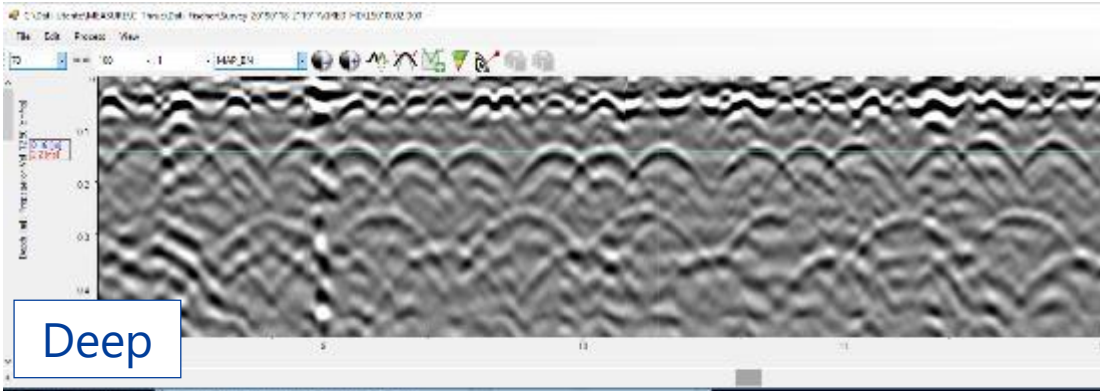
Shallow



Shallow rebars
mesh



Locating post-tension cables



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Slab/Asphalt delamination



Asphalt delamination

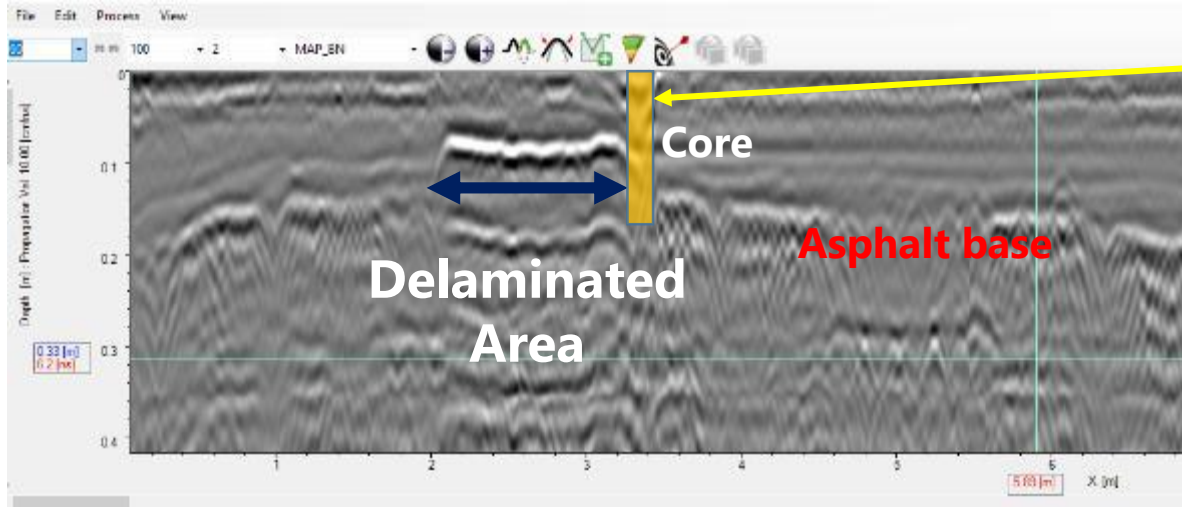


Morandi Bridge – Genova,
Italy



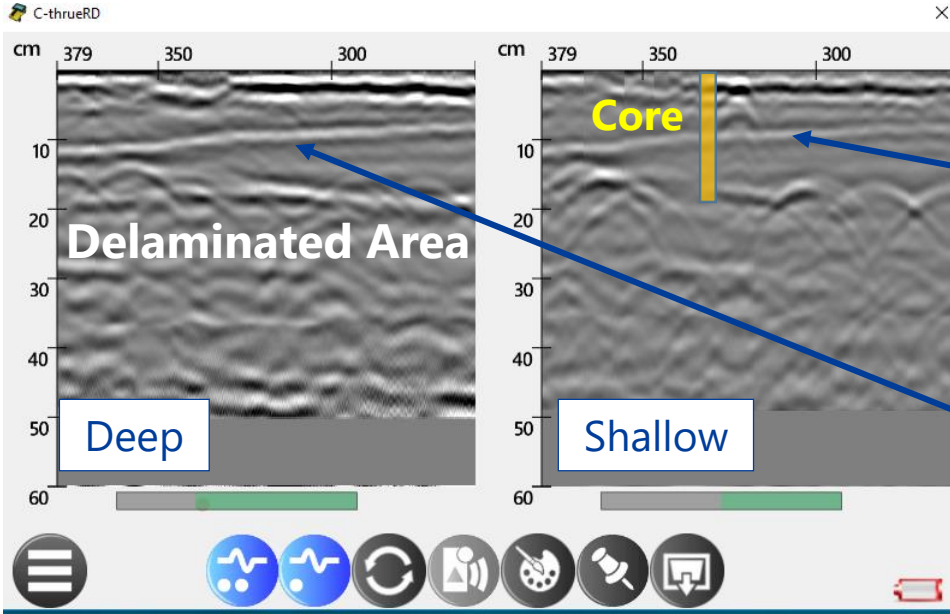
Delamination is a clear separation of the pavement surface from the layer below. Slippage cracking may often occur as a result of poor adhesion between shallow and deep layers

Asphalt delamination





Concrete road delamination

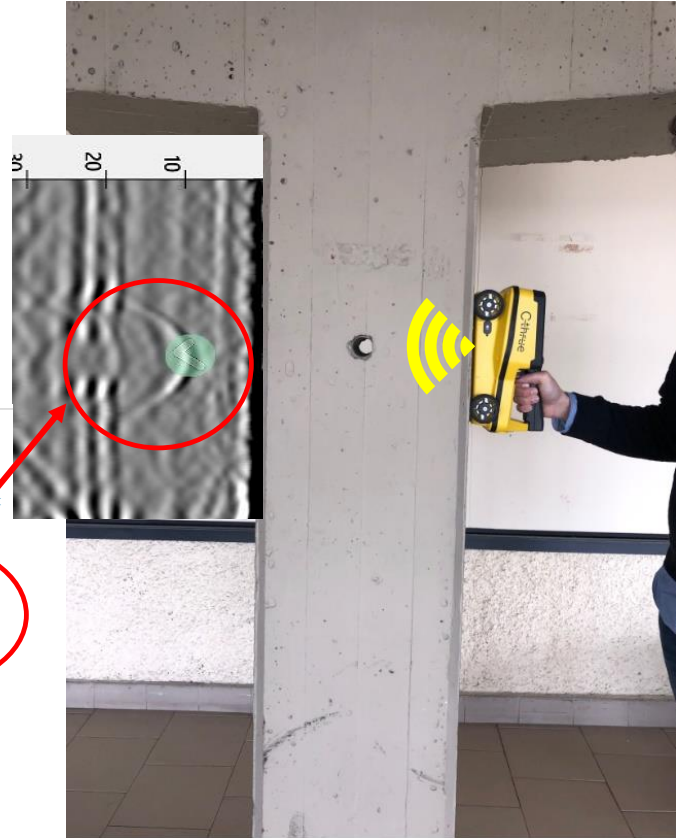
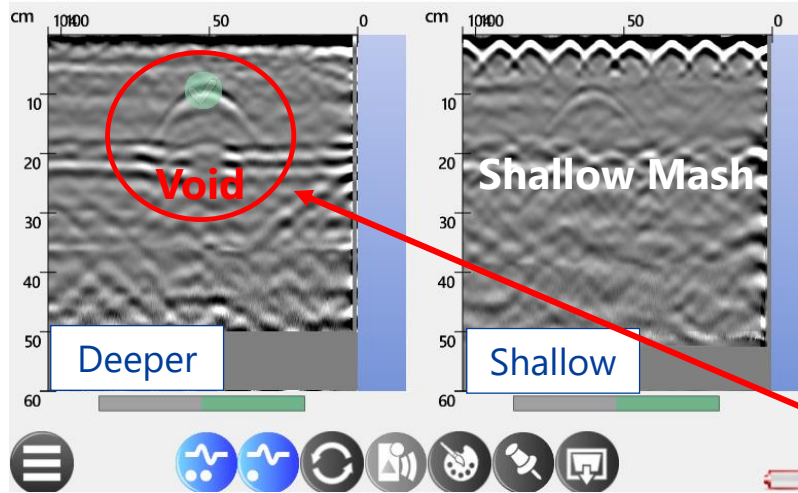


Locating voids - Slab thickness

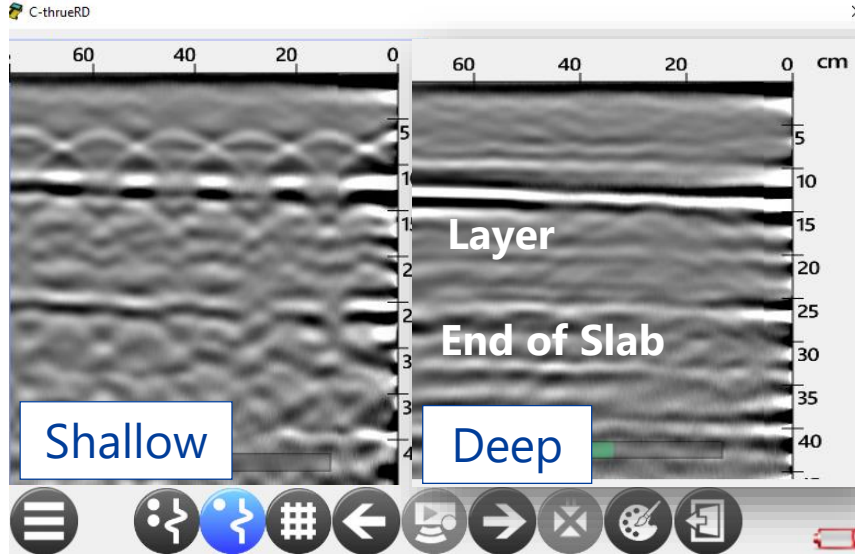


Locating voids - Slab thickness

C-thruRD



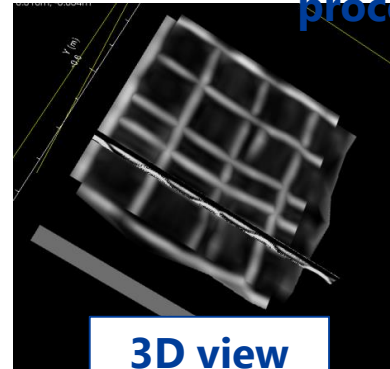
Locating voids - Slab thickness



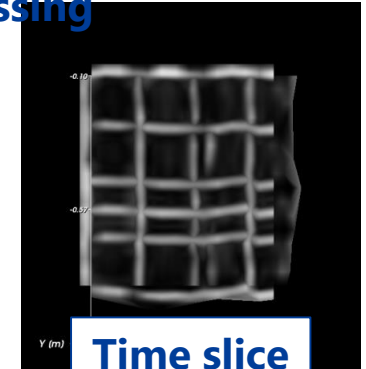
C-thru data display



Gred HD post
processing



3D view



Time slice

Thank you!

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