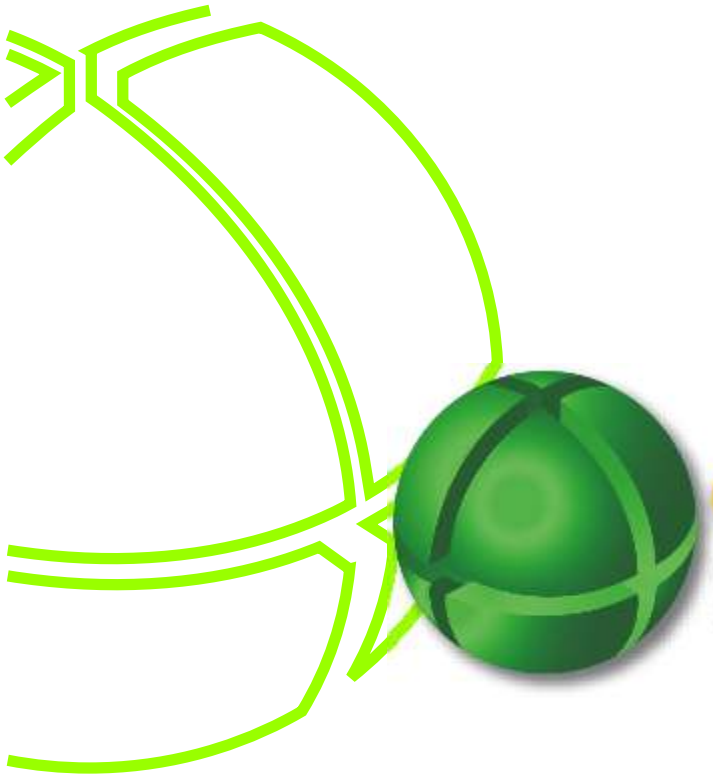


Geo Analysis

Geophysical Investigations

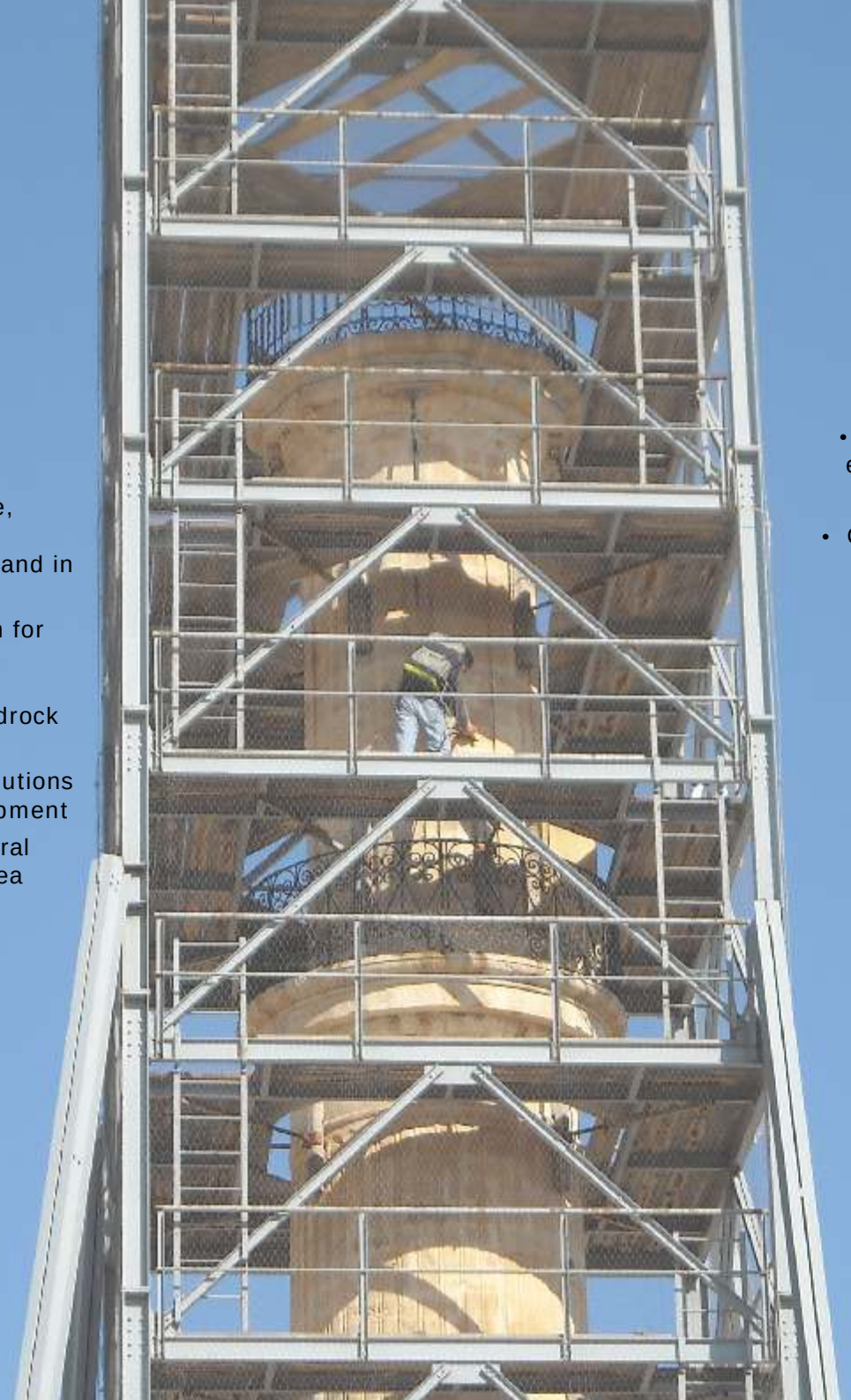
3D Subsurface Modeling


Geo Analysis
Geophysical Investigations
3D Subsurface Modeling

Geo Analysis

About us

- Created in 2003, at the island of Crete, Greece,
  Geo-analysis has expanded in the UK and in the Gulf area
- Specialized in subsurface investigation for utilities mapping, asphalt thickness, archaeology mapping, determining subsurface layers and establishing bedrock depth
- Providing high quality services and solutions utilizing cutting edge technology equipment
- Actively involved with projects in several European countries and in the Gulf area



Services offered

- Utilities: Locating and mapping utilities, pipelines, underground telecommunication networks, sewerage networks, etc.
- Archeology: Non-destructive subsurface research, fast locating of archaeological findings
- Roads: Detailed stratigraphy of pavement, evaluation of the base and sub-base levels, thickness of asphalt and gravel layers
- Geology: Detecting subsurface features and layers and depth to bedrock

Methods

- Ground Penetrating Radar - GPR
- Electrical Resistivity Tomography - ERT

The choice of method aims to achieve the most accurate, the fastest and most economical approach in order to get the best results and final conclusions.

Ground Penetrating Radar (GPR)

GPR works by sending a radio signal or series of signals into the ground. The returning signal provides information about changing characteristics with depth.

Antenna types and frequencies

Depending on the target depth and resolution, different antennas and frequencies are applied.

Low frequency

air launched and rough terrain antennas with range 25 - 100 MHz provide good resolution at maximum depth of 60 m.

The flexible snake like design allows the antenna to be maneuvered easily and efficiently in rough terrains

Medium frequency

antennas with range 200 - 800 MHz provide very good resolution at maximum depth of 10 m.

High frequency

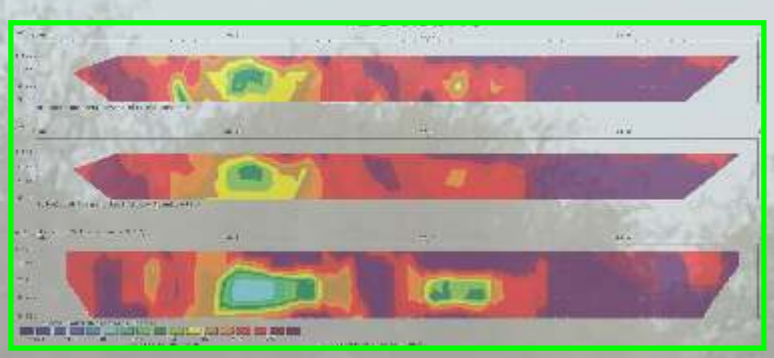
antennas with range 1.2 - 2.3 GHz provide the best resolution at maximum depth of 1 m.

Main advantages of GPR

- Non-destructive, non-intrusive
- High data density, quality and accuracy
- Fast data aquisition with wide coverage
- GPS compatibility
- Complements with other geophysical methods

Electrical Resistivity Tomography - ERT

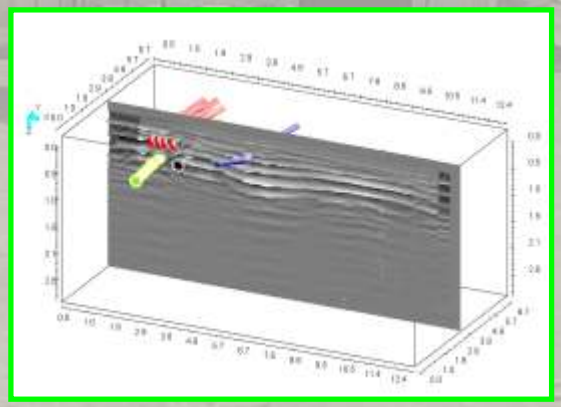
- ERT is one of the oldest geophysical survey techniques used for imaging sub-surface structures from electrical resistivity measurements

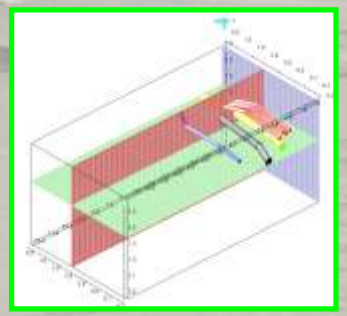


- Measurements are made by passing an electric current into the ground along different paths and measuring voltages to determine the subsurface distribution
- The number of electrodes employed, spacing between them and used array depend on the required depth of investigation and level of details expected from collected data
- Measured apparent resistivity is presented at pseudo section and through inversion process is inverted to true resistivity
- The geo-electrical sections obtained from 2D inversion can be combined to 3D image for visualizing and interpretation of results

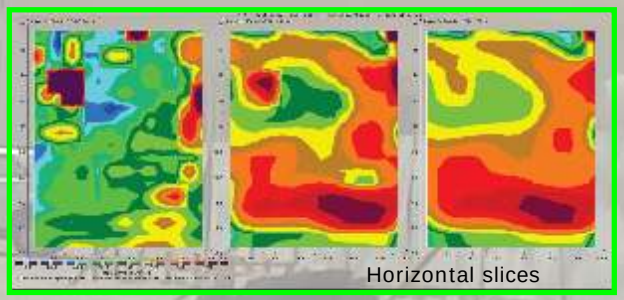
Three dimensional imaging - 3D

Multiple lines of data systematically collected over an area may be used to construct three dimensional or tomographic images. Data can be presented as three-dimensional blocks or as horizontal and vertical slices.

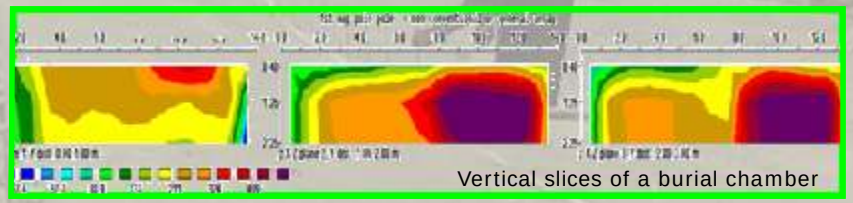




Utilities mapping
and 3D visualization



Horizontal slices



Vertical slices of a burial chamber

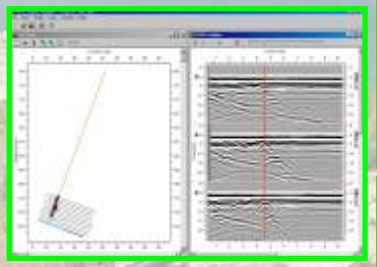
Data acquisition

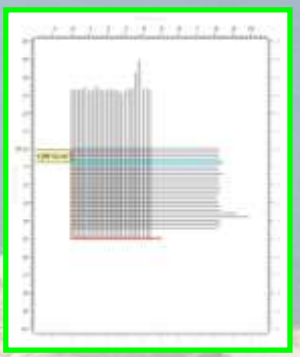
Survey methodology and the way field data is collected depends on the purpose of the investigation and the morphology of the investigation area.

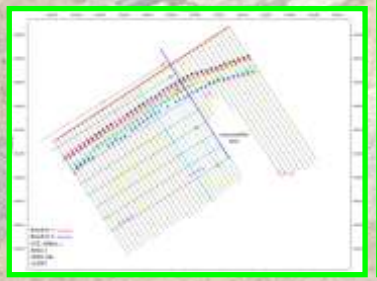
Defining suitable geophysical survey is ensuring complete, high quality and cost effective data sets.

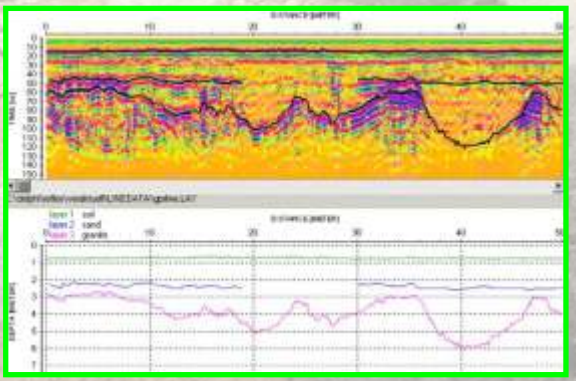
Data processing

Collected field data is processed with appropriate software in order to extract maximum amount of useful information.
By applying filters, effects of noise are removed and details of interest are emphasized.



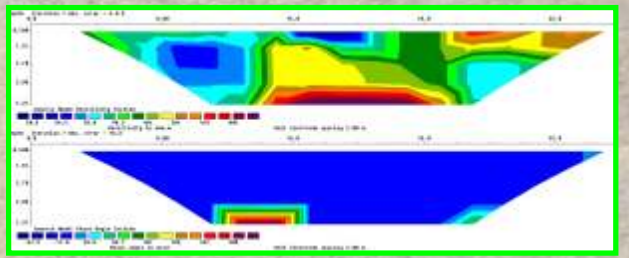






Interpretation

Interpretation of processed data is done in terms of physical property distributions.
Results and findings are provided in AutoCAD, JPEG, PDF and TXT format.



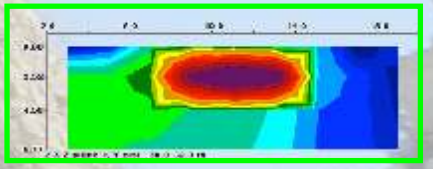
Application Areas

- Archaeology
- Construction
- Railway engineering
- Road construction and quality control
- Sport fields
- Sabkha
- Wadis
- Mining

Archaeology

GPR is a powerful tool in archeology as it has ability to locate artifacts and map features without any risk of damaging them. Also it has ability to detect small objects and distinguish the depth to buried objects.

With GPR archeological sites can be progressively scanned to collect information that might have been previously overlooked.



Main advantages

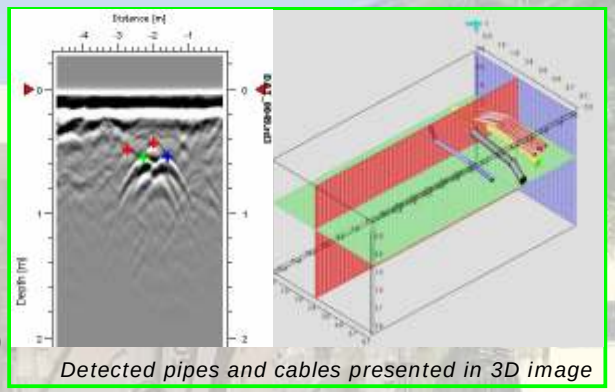
- Rapid surveys
- Non-destructive method
- Railway engineering
- Site knowledge gained
- Targeted and effective excavations

Utility mapping

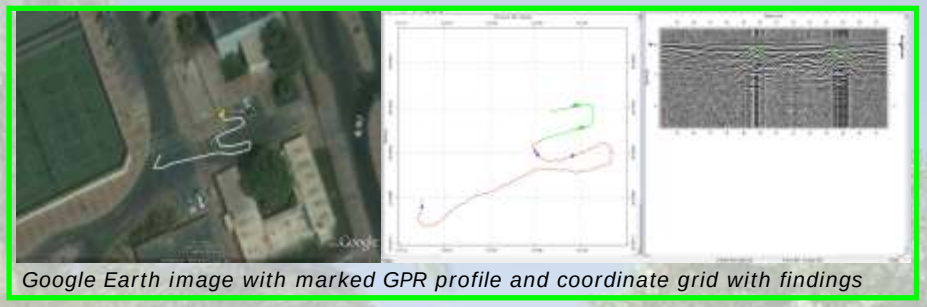
GPR is a beneficial tool due to its capability to define location and depth of metallic and non-metallic utilities prior to any excavation. Our utility locators use a combination of cable/pipe locator and GPR technology to locate:

Utility types
- electricity cable
- water pipes
- gas pipes
- fiber optic cables
- cable networks

Utility materials
- PVC
- RCP (Reinforced Concrete Pipe)
- ACP (Asbestos Concrete Pipe)
- metal



Detected pipes and cables presented in 3D image



Google Earth image with marked GPR profile and coordinate grid with findings

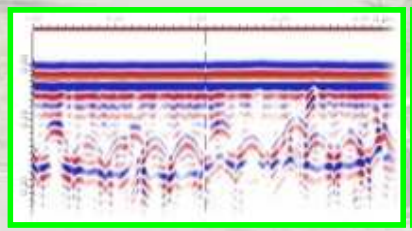
Main advantages

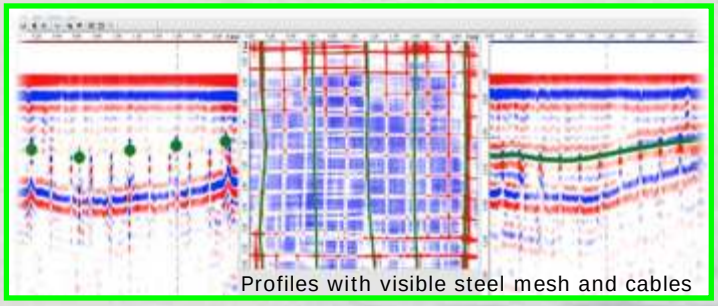
- cost reduction of project-design
- reduction of delays due to utility cuts and relocations
- permanent recording
- updating existing utility maps with precise information

Construction

GPR can help defining the exact location and depth of utilities and rebar before digging or drilling and it is usually used for:

- Concrete inspection - locating metallic and non-metalic targets in ceilings, floors and walls like rebar, tension cables, conduits and PVC pipes
- Structure inspection - bridges, towers, tunnels, slabs, monuments
- Condition assessment - mapping concrete condition for rehab planning
- Measure slab thickness
- Void location





Profiles with visible steel mesh and cables

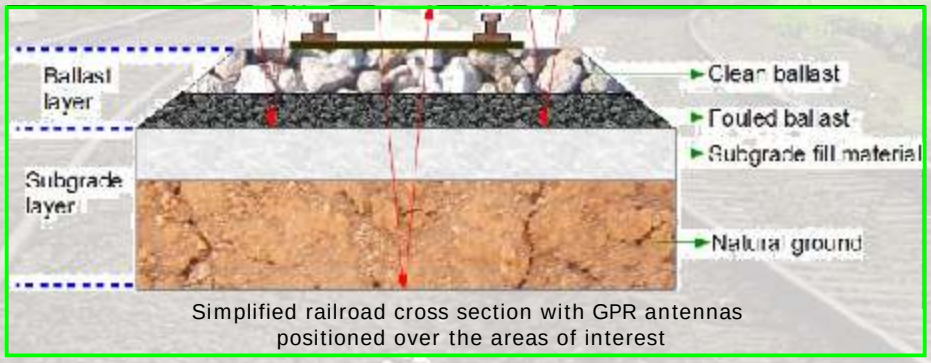
Main advantages

- reduce the risk of damage to rebar, cables and conduits
- eliminate project repairs and delays
- preserve the structural integrity of concrete
- increase the ease of drilling, cutting or coring

Railway Engineering

The results of geophysical investigation prior to construction are highly advantageous as they provide very useful information for the appropriate route design of the railway track and the soil layers up to the desired depth.

Sub-trackbed investigation
Geophysical methods can be used to assess ground conditions, for example by profiling soil and rock layers, mapping groundwater variations and mapping variations in stiffness. Surveys can detect cavities such as solution features or mineworkings.



Simplified railroad cross section with GPR antennas positioned over the areas of interest

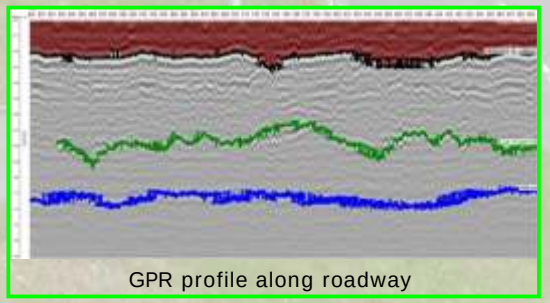
Main advantages

- In the design phase for the profiling and stratification of the soil where the railway track is supposed to pass
- In the final acceptance of new constructed or existing tracks after substructure rehabilitation

Road Construction and Quality Control

GPR provides quick and precise evaluation of the base and sub-base levels, the thickness of the asphalt and gravel layers, along new constructed, reconstructed or old roads.

The possibility of continuous linear data collection and full coverage of road structure is reducing the need for coring. Drill core methods only provide specific point information and therefore they cannot reliably be used to find defective areas in roads and pavements. Data provided with GPR will help in the assessment of any road reconstruction and confirm the properly kept standards during road constructions.

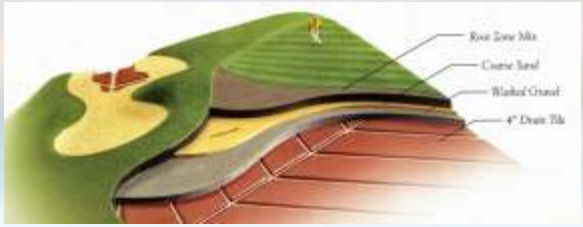

GPR profile along roadway


Interpreted pavement thickness displayed in Google Earth

Main advantages

- Fast and continuous linear data collection (can be performed from moving vehicle)
- Not destructive as traditional core drilling
- Accurate results for different layers
- Safe, precise and low cost service for all road networks
- GPS intergraded

Sport fields



Geophysical surveying, especially GPR, can be useful in all life phases of a sport field or a golf course, from pre-design to construction, renovation and maintenance in many ways:

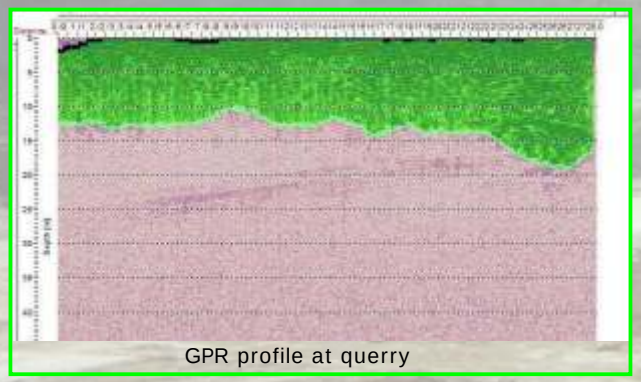
- Locate bedrock of site
- Locate and map drainage systems for restoration or repairs
- Update incomplete or outdated records of existing underground infrastructure
- Locate underground leaks and assessment of water drainage problems

Main advantages

- Non-destructive subsurface inspection
- No unnecessary damage to the greens
- Real time, on site marking

Mining

Geophysical investigation, mostly GPR, in quarries and mines provide precise information regarding the depth of the bedrock and helps the estimation of reserves of mining material. Additionally, features such as faults, joints and fractures in the body of the rock can be located.



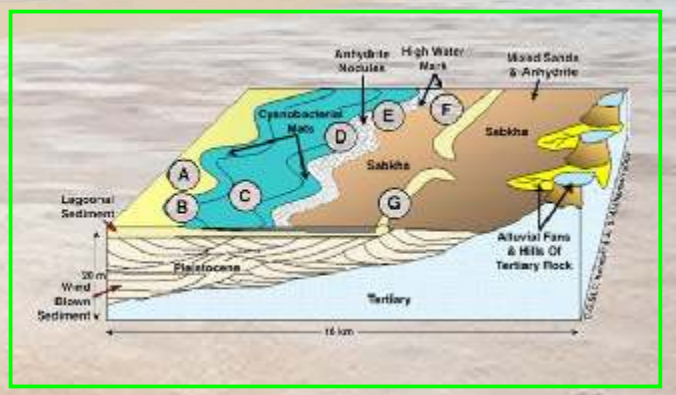
GPR profile at querry

Main advantages

- Excellent tool in deciding strategy and operational costs
- Assistance in calculating the amounts of present material
- Defining the bedrock depth

Sabkha

Sabkhas are characterized by high salinity and very low bearing capacities.The objective of the geophysical study is to quantitatively calculate the depth to bedrock and characterize the sediment material above it.



Main advantages

- Defining the bedrock depth
- Stratigraphy and definition of underground material and cavities

Wadis

Wadis are areas where underground water raises mostly during the rainy season and during the rest of the year it flows through rocky, mountainous terrain creating a complex underground water path.

Geophysical investigations of the subsurface reveal the path and depth of the underground water.

Main advantages

- Locating and mapping underground water flow paths
- Ground water table depth calculation

References

- ✓ Highway scanning (GPR) Athens - Lamia -Athens 500 km, Greece 2013
- ✓ Archaeology mapping (GPR, ERT) area of 68.000 m² in Dibba, Oman for Ministry of Culture and Heritage, Oman 2013
- ✓ Utility mapping (GPR) pipe line route 5.000 m, Muscat, for CCC, Oman 2013
- ✓ Cavities mapping 1.000 m, Muscat, for CCC, Oman 2013
- ✓ Pipe line mapping (GPR) 30.000 m, Rethymno, for Water Department, Greece 2012
- ✓ Roadway scanning, Egnatia odos, 300 km, Greece 2012
- ✓ Land mine detection (GPR), Military airport, Nato project, Crete, Greece 2012
- ✓ Archeology mapping ancient castle of Livadia for 23rd Department of Archeology, Greece 2011
- ✓ Archaeology mapping at private island for 24th Department of Archeology, Greece 2011
- ✓ Scanning at quarries Brazda and Zebrnjak (GPR), FYROM 2011
- ✓ Archeology mapping ancient wall of Herakleio, Greece 2010
- ✓ Roadway mapping (GPR) Athens - Patra, 500 km, Greece 2009
- ✓ Tunnel scanning (GPR), Al-Dammam, Saudi Arabia 2008
- ✓ Utility mapping, water and souring pipes for 13 villages, Crete, Greece 2008
- ✓ Archeology project for 13th Department of Archeology, Rethymno, Greece 2008
- ✓ Archeology research in main square Rethymno, for 28th Department of Archeology, Greece 2008
- ✓ Mapping football stadium (GPR), Rethymno, Greece 2008
- ✓ Roadway mapping 100 km, Belgrade, Serbia 2007
- ✓ Ground water research at Elounda, Crete, Greece 2007
- ✓ Mapping underground utilities between petrol tanks, Athens, Greece 2007
- ✓ Mapping foundation and reinforced steel, Katerini, Greece 2007

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