GEOREFLEX

GEOLOGY - GEOPHYSICS
TOPOGRAPHY

CONTENTS

COMPANY PROFILE

Georeflex Srl is a Service Company founded in 1995 which operates in the field of geology and geophysics applied to hydrology, archeology, environmental protection, infrastructures planning and civil works.

Georeflex Srl is mainly working for Regional and Local Administrations, Universities and Research Institutes, as well as important private civil engineering Companies.

The activities, specifically designed for Public and Private Clients, are mainly represented by:

- Surface seismic (refraction, reflection);
- Borehole seismic (down hole, cross hole);
- Seismic tomography;
- Spectral analysis of surface waves (SASW);
- Microtremors analysis (ReMi, MASW);
- Electric surveys;
- Magnetic surveys;
- Georadar;
- Non-destructive controls on foundation piles;
- Geotechnical surveys;
- Topographic surveys (using GPS total station);
- Seismic response studies for earthquake protection.
- Wind farms, thermoelectric plants, oil and gas pipelines (base projects reporting, technical support, onsite follow up).

The personnel of Georeflex Srl is constituted by qualified geologists and geophysicists of proven technical experience.

The Company is compliant to D.Lgs N. 81/2008 for what is concerning HSE laws and rules.

GEOFLEX

- Since October 1996 Georeflex Srl is included in the vendor list of Servizio Provinciale Difesa del Suolo - Risorse Idriche e Risorse Forestali (ex Genio Civile) of Parma, Reggio Emilia and Piacenza.

- Since April 1997 Georeflex Srl is in the list of the "tested" Companies of Soprintendenza ai beni archeologici of Emilia Romagna, operating in the field of geophysics for archaeological surveys.

- Since April 1998 Georeflex Srl is in the Vendor list of AQUATER S.p.A. (ENI Group).

- Since September 1998 Georeflex Srl is one of the Companies working on behalf of CNR on projects for cultural heritage preservation.

- In 1998 and 2004 Georeflex Srl accomplished geophysical surveys for archaeology and for contaminated sites delimitation on behalf of CEPAV ("Alta Velocità" project).

- In 1999 Georeflex Srl executed geophysical surveys for Regione Toscana (VEL project, "evaluation of local effects in case of an earthquake").

- In 2002 Georeflex Srl started a new collaboration with Servizio Sismico Nazionale for Seismic Microzonation studies, in order to evaluate the local effects produced by an earthquake, in compliance to the new law emanated by the Italian Government (Nuova Normativa Antisismica, Ordinanza n. 3274 may 2003 and Testo Unico NTC2008).

- Since 2003 Georeflex Srl is in the Vendor list of SNAMPROGETTI S.p.A. (ENI Group).

- Since 2003 Georeflex Srl is a contractor of SORGENIA S.p.A. for thermoelectric plants planning and relevant alimentation gas pipelines.

- Since 2003 Georeflex Srl provides geotechnical support to ENEL Distribution Group S.p.A. of Bologna for electrical transmission network planning.

- Since 2003 Georeflex Srl provides geotechnical support to TERNA S.p.A. of Rome for electrical transmission network planning.
- Since 2005 Georeflex is involved, on behalf of SAIPEM SpA, in feasibility studies for oil and gas pipelines planning and follow up activities.
- In 2008 and 2009 Georeflex Srl was involved in Urbanization projects (Province of Lodi) on behalf of SORGENIA SpA.
- Since 2009 Georeflex Srl is included in the Vendor list of SAIPEM S.p.A. (Eni Group).
- In 2009, on behalf of ANSALDO ENERGIA SpA, Georeflex Srl was involved in environmental mitigation plans and technical follow up for combined cycle thermoelectric plants.
- From 2009 to 2010 Georeflex Srl was engaged for geophysical control and topographic activities in projects for dams and water pits consolidation (SOLGEO Srl, TECNECOS Srl, GEOS Srl and ANSALDO ENERGIA SpA).
- From 2010 to 2011 base project activities and relevant follow up for pipeline crossing execution by trenchless technology (TOC, microtunneling and raise boring) on behalf of SORGENIA SpA, SAIPEM SpA and P&F Srl.
- From 2011 to 2012 Georeflex Srl was involved in the topographic monitoring of the new underground in Teheran (Iran) on behalf of PROITER Srl.
- In 2011 and 2012 base project for a horticultural crop fed by the cycle combined thermoelectric plant of Turano Lodigiano.

Georeflex Srl cooperates with local governments, universities and research institutes, as well as with important private societies working in civil ingineering field.

TECHINT

Eni

FW

PRO ITER

RODA S.p.A.

SERVIZIO SISMICO NAZIONALE
National Seismic Survey

the i group

UNIVERSITÀ DEGLI STUDI DI TRIESTE

ROMANA Costruzioni S.r.l.

SIGILLVM · ALMAE · VNIVERSITATIS · STVDII · PARMENSIS

COMUNITA' MONTANA
DELL'APPENNINO BOLOGNESE


Enel


Terna


COMUNE DI BOLOGNA


eni
saipem


SAPE


AnsaldoEnergia
A Finmeccanica Company


TELEIOS
OFFICINAd'INGEGNERIA


SORGENIA


RICCOBONI


PIZZAROTTI
General Contractor since 1910

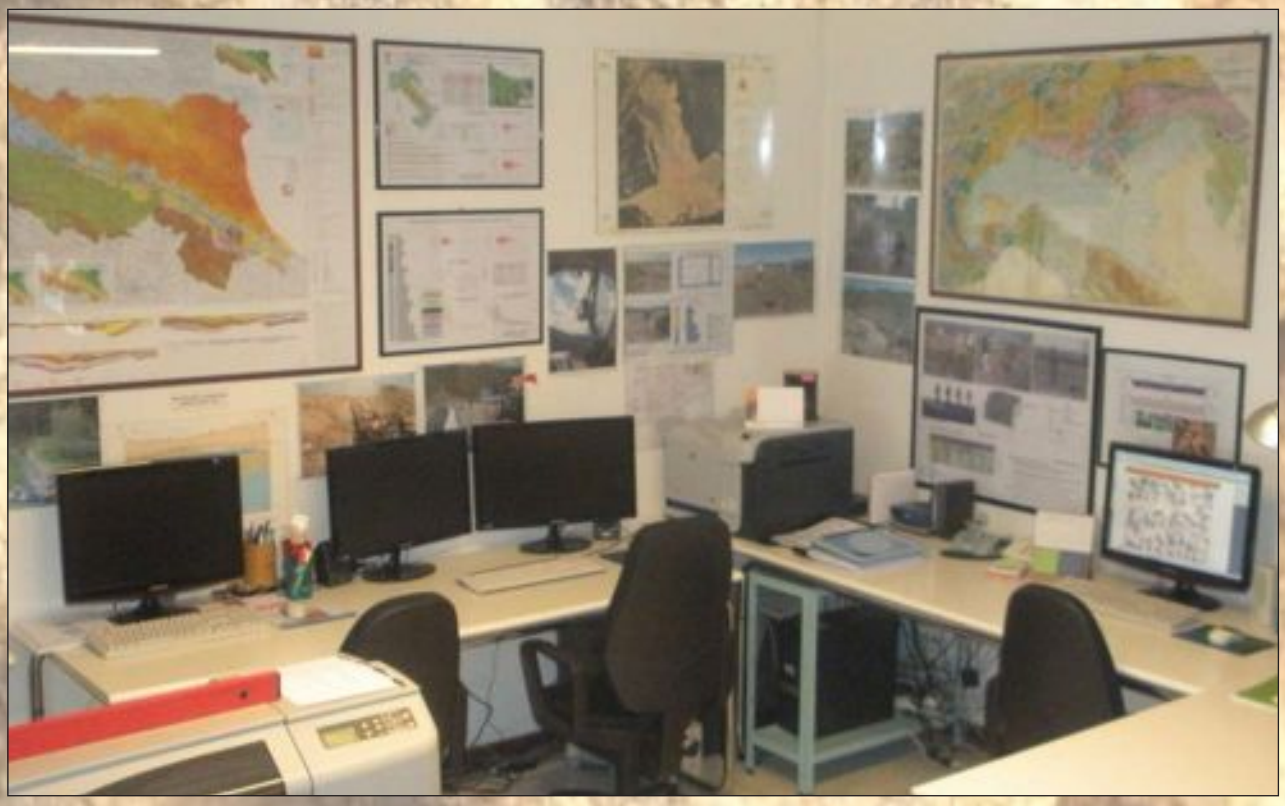

spea
autostrade

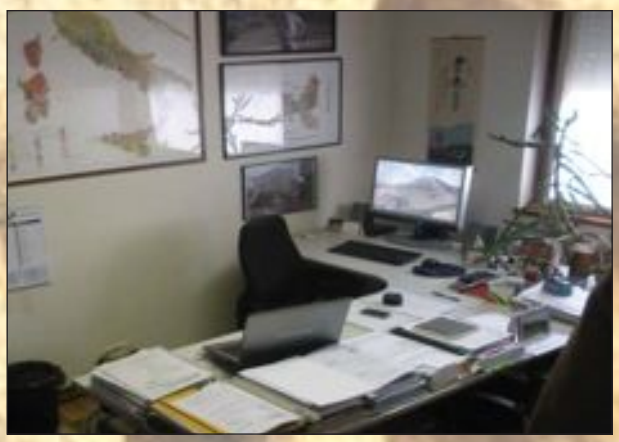

Bonatti


Regione Emilia-Romagna

The available hardware configuration is constituted by a series of workstation connected by a LAN network
Each workstation is equipped with specific software depending on the sector of activity it is dedicated to.

- Nr. 1 server and backup unit
- Nr. 2 graphic workstations
- Nr. 5 workstations for data processing
- Nr. 2 Notebooks
- Nr. 1 Plotter A0+ format
- Nr. 1 color laser printer (A4-A3) and A3 scanner
- Nr. 2 color laser printer (A4)
- Nr. 2 inkjet printers (A4-A3)





CAD software	
AUTOCAD	Autodesk
ZWCAD	Zwcad
GIS software	
ARCVIEW 3.2	ESRI
Graphic software	
PHOTOSHOP ELEMENTS 4.0	Adobe
COREL PAINT SHOP PRO PHOTO X2	Corel
MACROMEDIA FREEHAND	Adobe
ACROBAT PROFESSIONAL	Adobe
Software for topography	
LEONARDO X3	Leonardo Software House
SURFER 8	Golden Software
Geophysical software	
SEISOPT REMI 5.0	Optim
RES2DINV	M.H. Loke
G-858 MAGMAPPER	Geometrics
RADAN 3.0	GSSI
WinSASW 2.0.1	
EARTH IMAGER 1.1.8	AGI
Geotechnical software	
GEOSTRU	GeoStru Software
AZTEC	Aztec Informatica
Software for inclinometer	
OG 390 WIN PRO	OTR
Office automation software	
WORD 2007	Microsoft
EXCEL 2007	Microsoft
POWER POINT 2007	Microsoft
NOD32 ANTIVIRUS	ESET

Georeflex Srl is equipped with the best instrumentation to guarantee high level professional results for all types of survey.

Instruments for topography
OPTICAL LEVEL TECNIX NA32
LASER LEVEL SPEKTRA LL500 WITH DIGITAL LASEROMETER HL700
CRACKMETERS
TELL TALE CRACK MONITOR
TOTAL STATION TRIMBLE BS515
TOTAL STATION NIKON NPR 352
N. 2 PERSONAL DIGITAL ASSISTANTS GPS MODEL P350 MioDigiWalker
PERSONAL DIGITAL ASSISTANTS GPS MOBILE MAPPER CX Magellan
TRIMBLE SYSTEM R6II: RECEIVER TRIMBLE R6 + CONTROLLER TSC2

Instruments for geophysics
GEODE (SEISMOGRAPH 24 CHANNELS) GEOMETRICS LTD
GEOPHONES (nr. 24 14 Hz; nr. 24 100 Hz)
SEISMIC CABLE
SEISGUN
GEORESISTIVIMETER MANGUSTA TMG 255E
GEOPHONE 3-COMPONENTS BHG-3 GEOSTUFF LTD
METALDETECTOR MODEL GTI2500 GARRETT
RADAR SIR SYSTEM-2 GSSI

Instruments for geotechnics
N.2 LOAD PLATES DN300/DN 460 TECNOTEST
MANOMETER 100 kN TECNOTEST
POCKET PENETROMETER






Instruments for water monitoring
FREATIMETER
SUBMERSIBLE WATER PUMP 12V
PORTABLE ELECTRICAL FRIDGE (40l)

Instruments for landslides monitoring
PROBE Slope Indicator DGSI
CABLES 50/100 m Slope Indicator DGSI
DATALOGGER OG387

Instruments for magnetic/electromagnetic surveys
MAGNETOMETER/GRADIOMETER GEOMETRICS G858
ELETTROMAGNETOMETER GEM-300 GSSI

FIELDS OF APPLICATION

GEOPHYSICS

TOPOGRAPHY

ENGINEERING

SOIL BIOENGINEERING

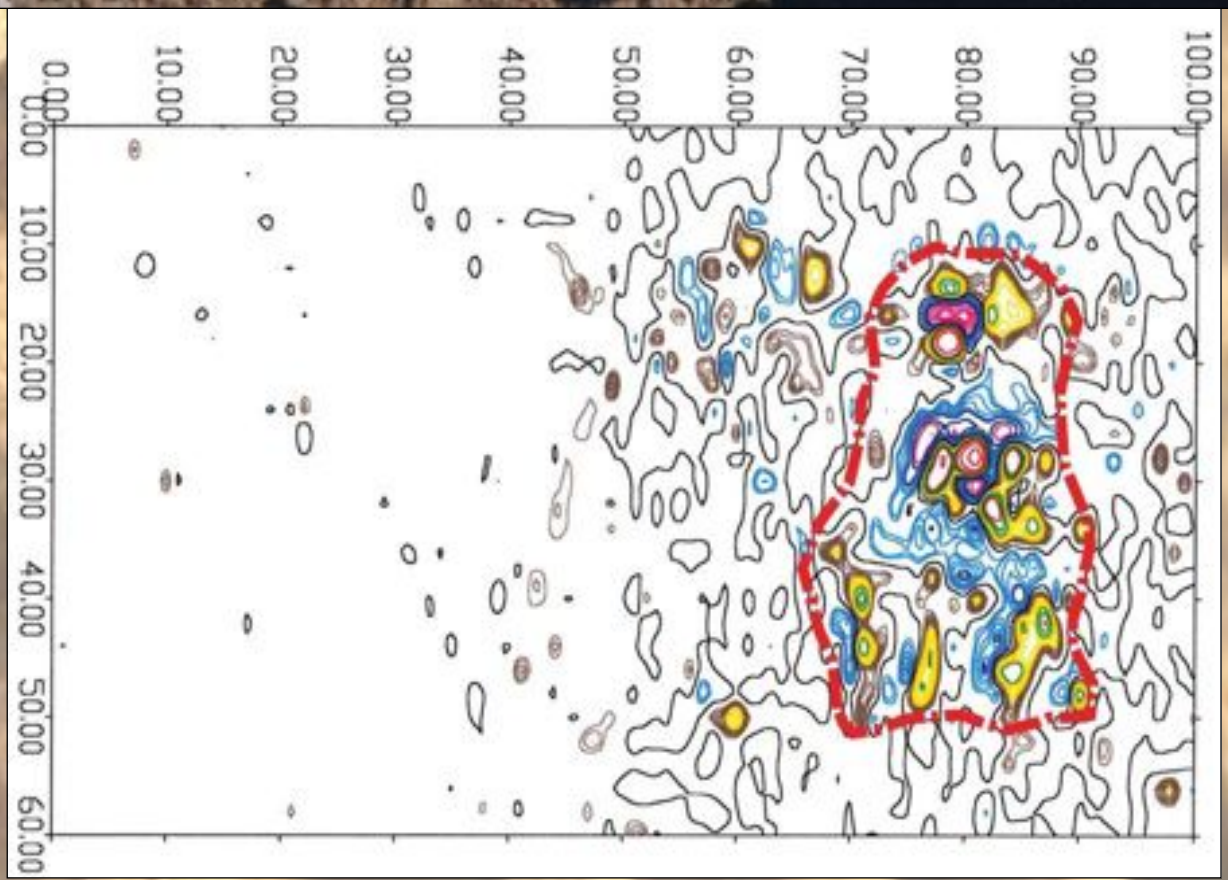
ENVIRONMENTAL GEOLOGY

GEOTECHNICAL ENGINEERING

MAGNETIC SURVEY

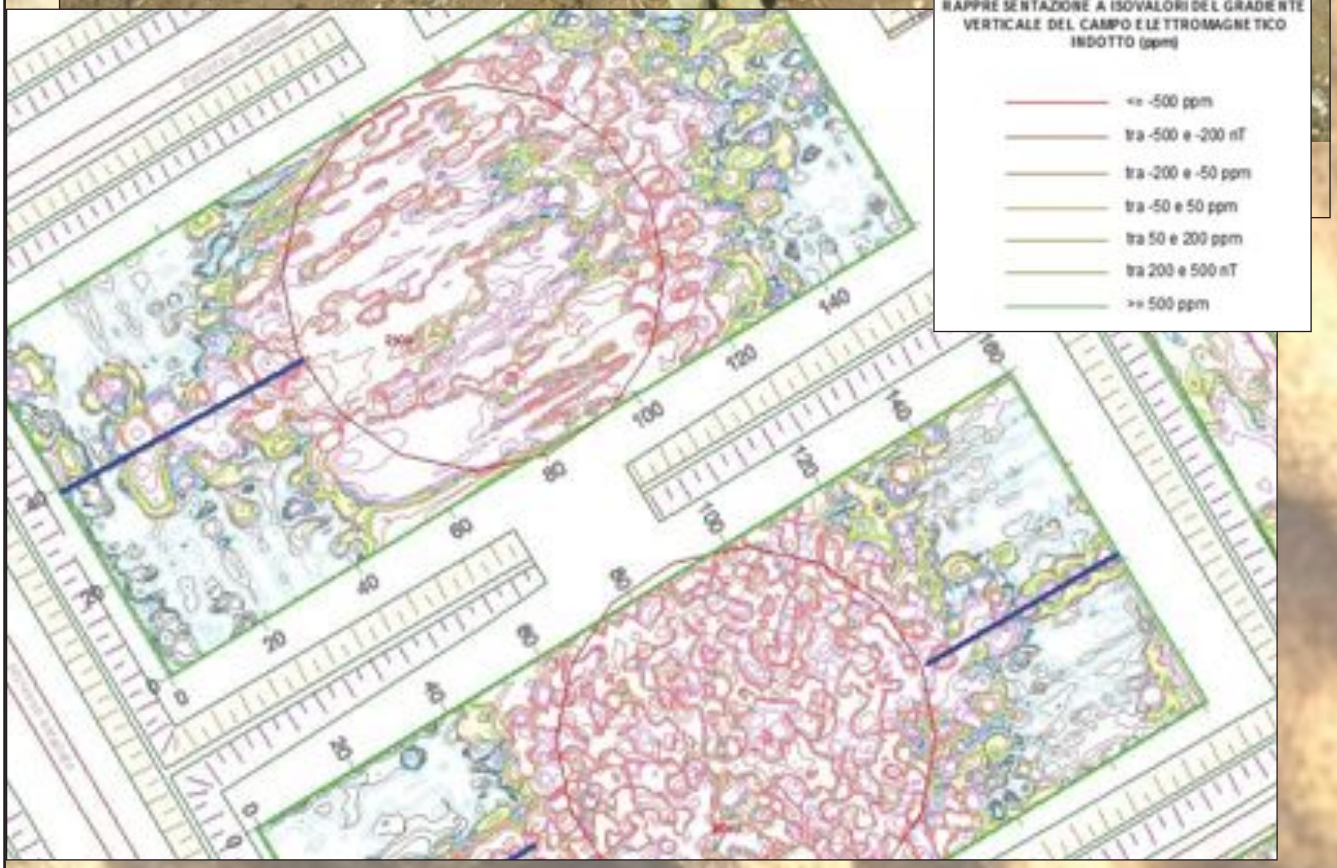
Magnetic surveys represent a method of subsurface investigation based on measuring magnetic field anomalies that can be generated by different types of ferromagnetic bodies.
This type of prospection is widely adopted for archaeological researches, in the waste sites to verify the presence of buried anomalous bodies and in the areas where the risk of dangerous waste pollution is high; it can also be used for the research of explosive devices.


tomba di epoca romana


0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
0.00
10.00
20.00
30.00
40.00
50.00
60.00

Magnetic methods provide information on 1) subsurface magnetic anomalies distribution; 2) buried metal bodies.

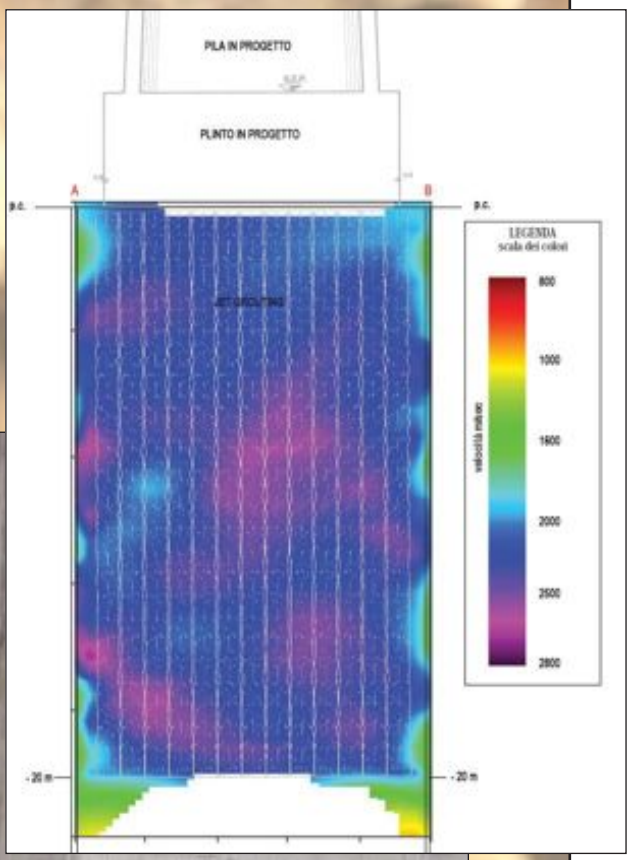
Surveys are carried out using a GSSI (Geophysical Survey System Inc) magnetometer, GEM-300 model.



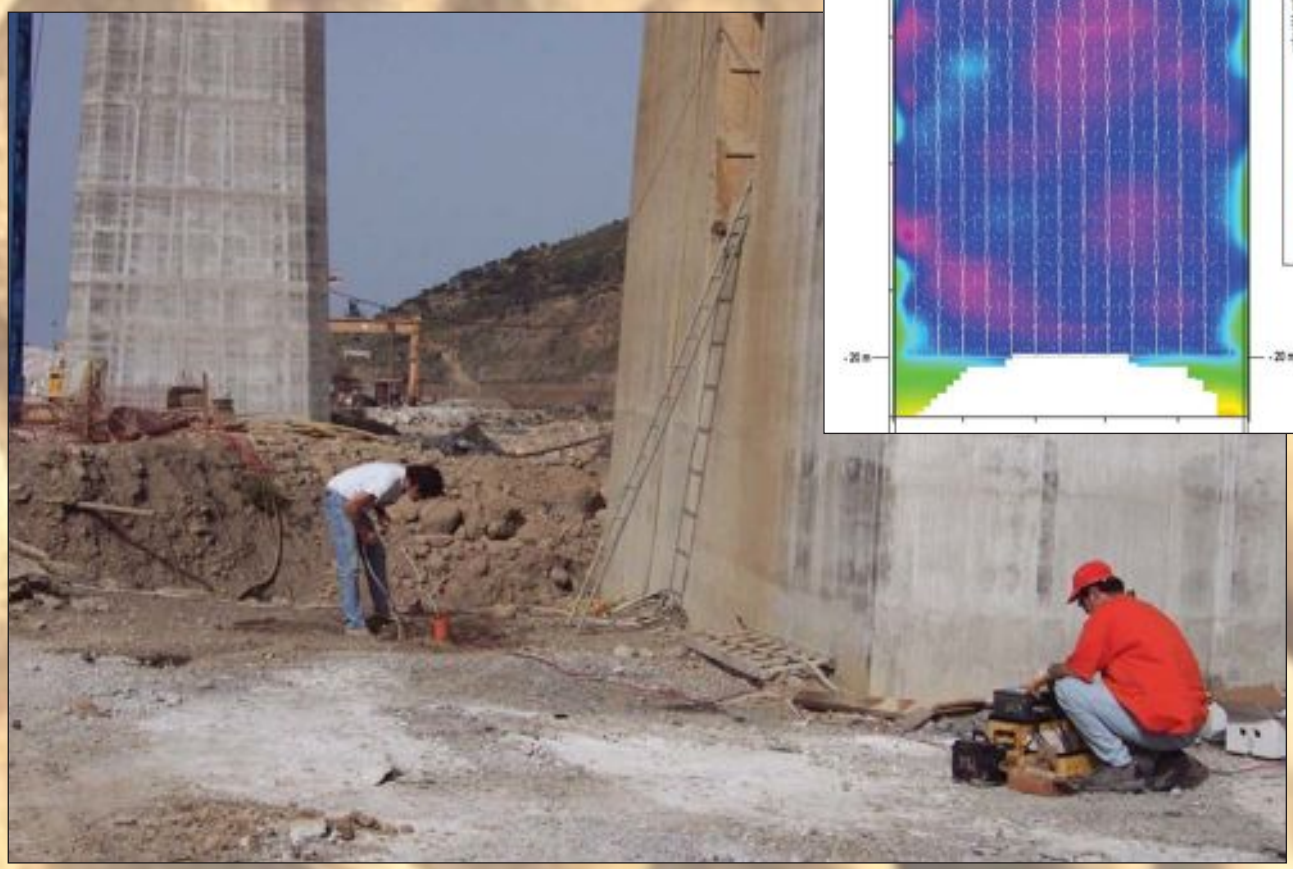
SEISMIC TOMOGRAPHY

Seismic tomography is an investigation method that allows us to obtain information about seismic velocity distribution in the subsurface through an inversion process applied to measured traveltimes (traveltime tomography).

This type of geophysical approach is generally applied between two boreholes (cross-hole tomography). Nevertheless, it can also be used using a single borehole (tomographic seismic sounding); in this case acquisition geometry provides the deployment of sensors inside the borehole while the seismic energy is produced on the surface along a linear trend.
This method can also be applied to refraction seismic, profitably integrating the results with the classical first breaks interpretation.



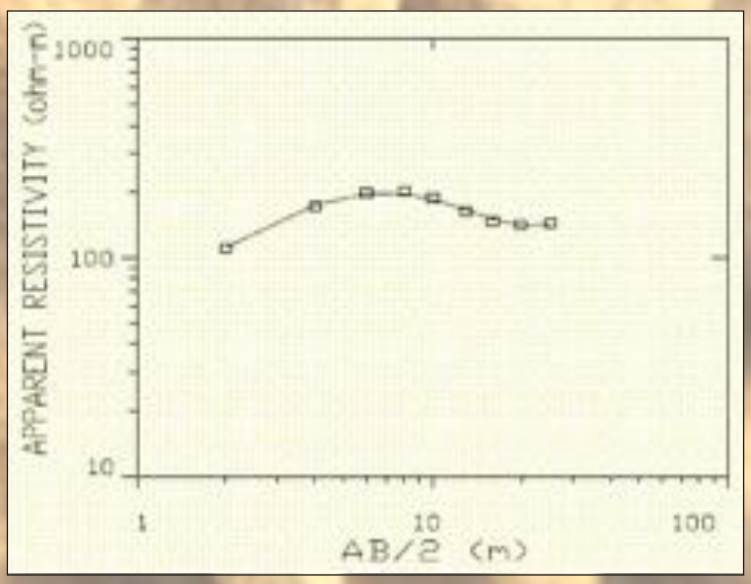
Seismic tomography applied to control of jet grouting

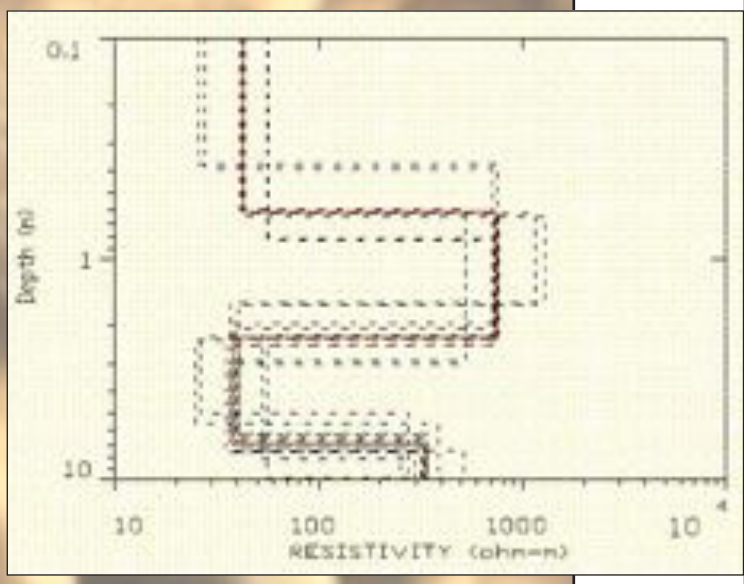


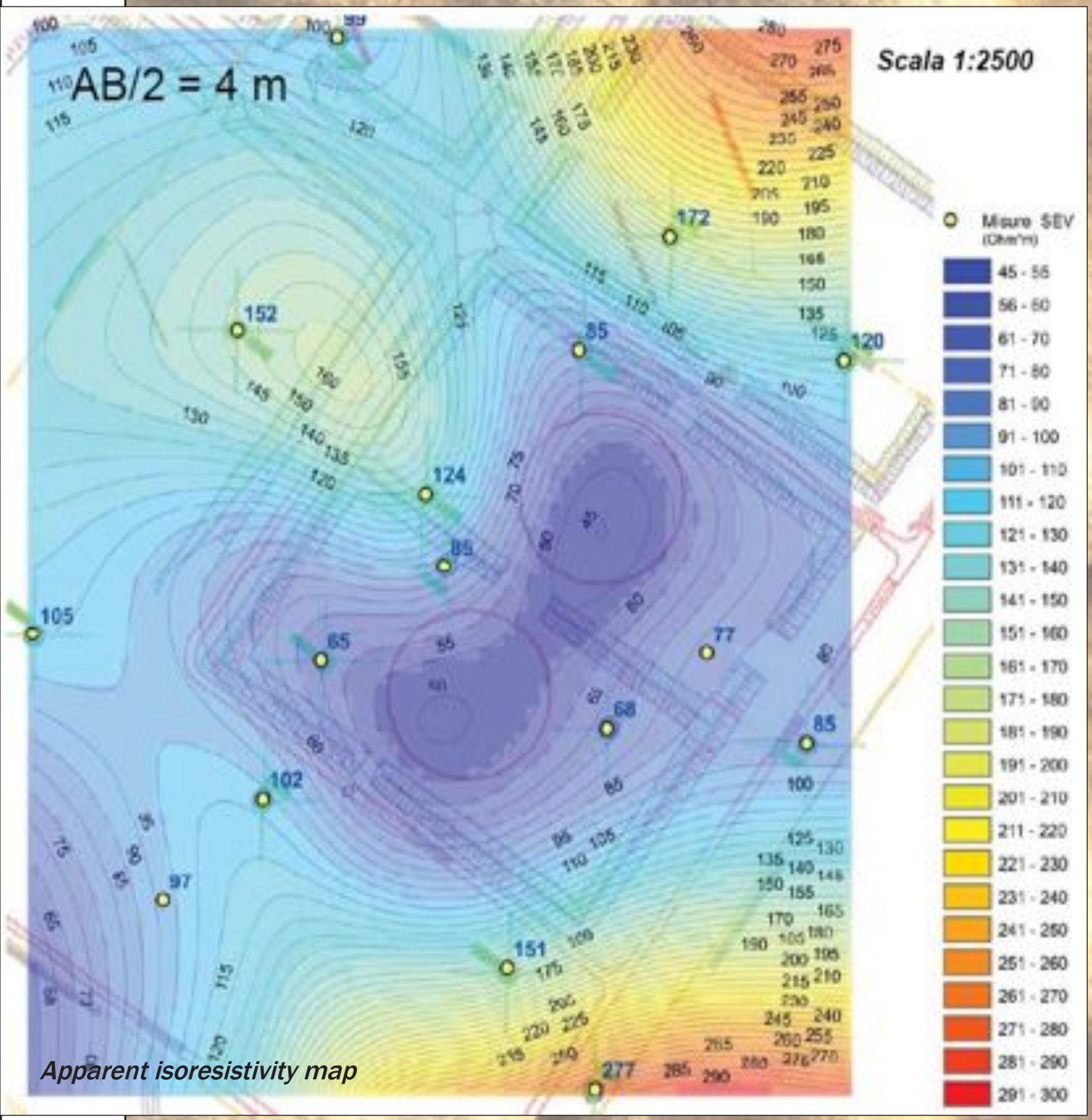
ELECTRIC SURVEY

It is a method for subsurface investigation that allows us to characterize rocks on the basis of the electrical resistivity.
Resistivity represents a very important physical property as it depends on various factors such as water saturation and porosity; it is recorded through surface measurements.
Field acquisition is accomplished by electrode configurations that may vary depending on the objectives of the investigation.
Classical methods provide the production of mono-dimension resistivity models (Vertical Electrical Soundings - SEV) or resistivity profiles, for an evaluation of lateral lithologic variations.
The integration of the above mentioned methodologies implies the acquisition of a considerable amount of “apparent” resistivity data, representing electrical properties variations along the profile.
The utilization of inversion software (tomography) allows us the production of resistivity sections able to accurately reproduce variations of this parameter in the subsurface.
Electric surveys are generally applied in hydrology studies, to verify the sealing properties of HDO liners in the waste sites, in archaeological surveys and in environmental studies.

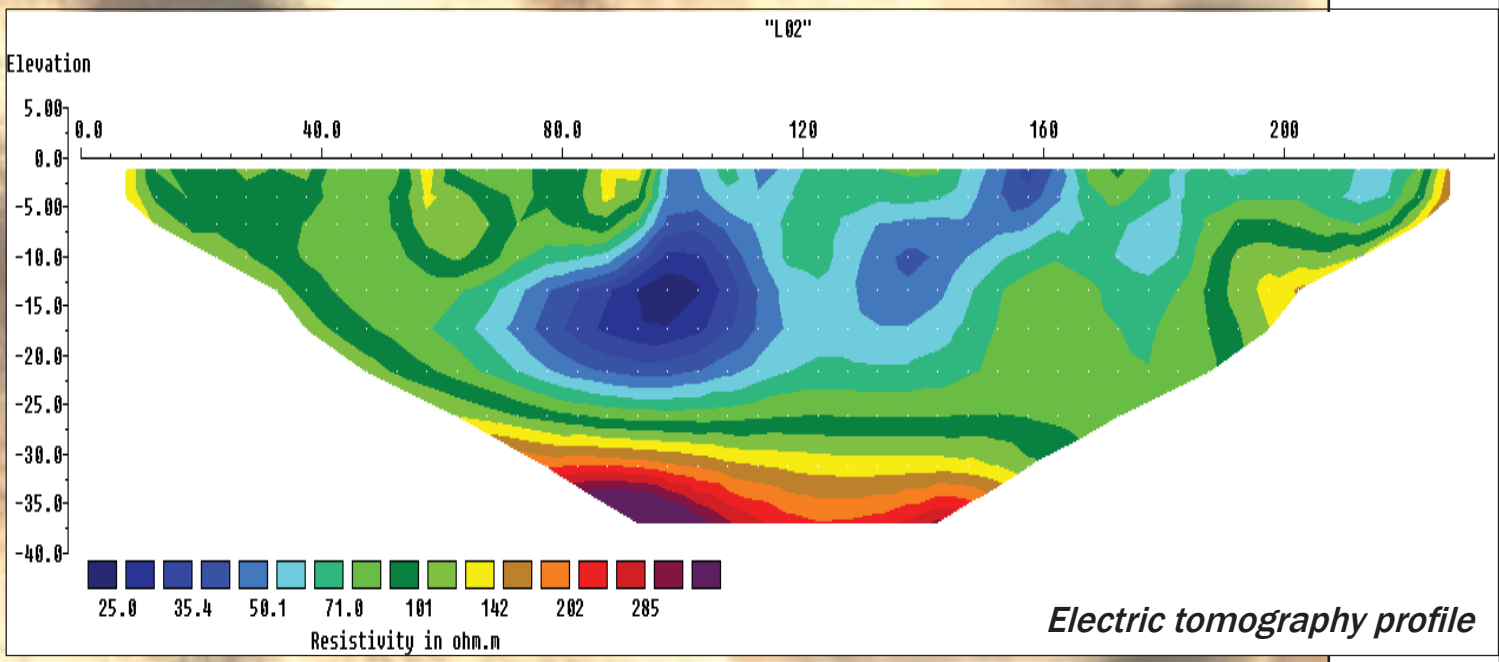
SEV


APPARENT RESISTIVITY (ohm-m)
1000
100
10
1
10
100
AB/2 (m)

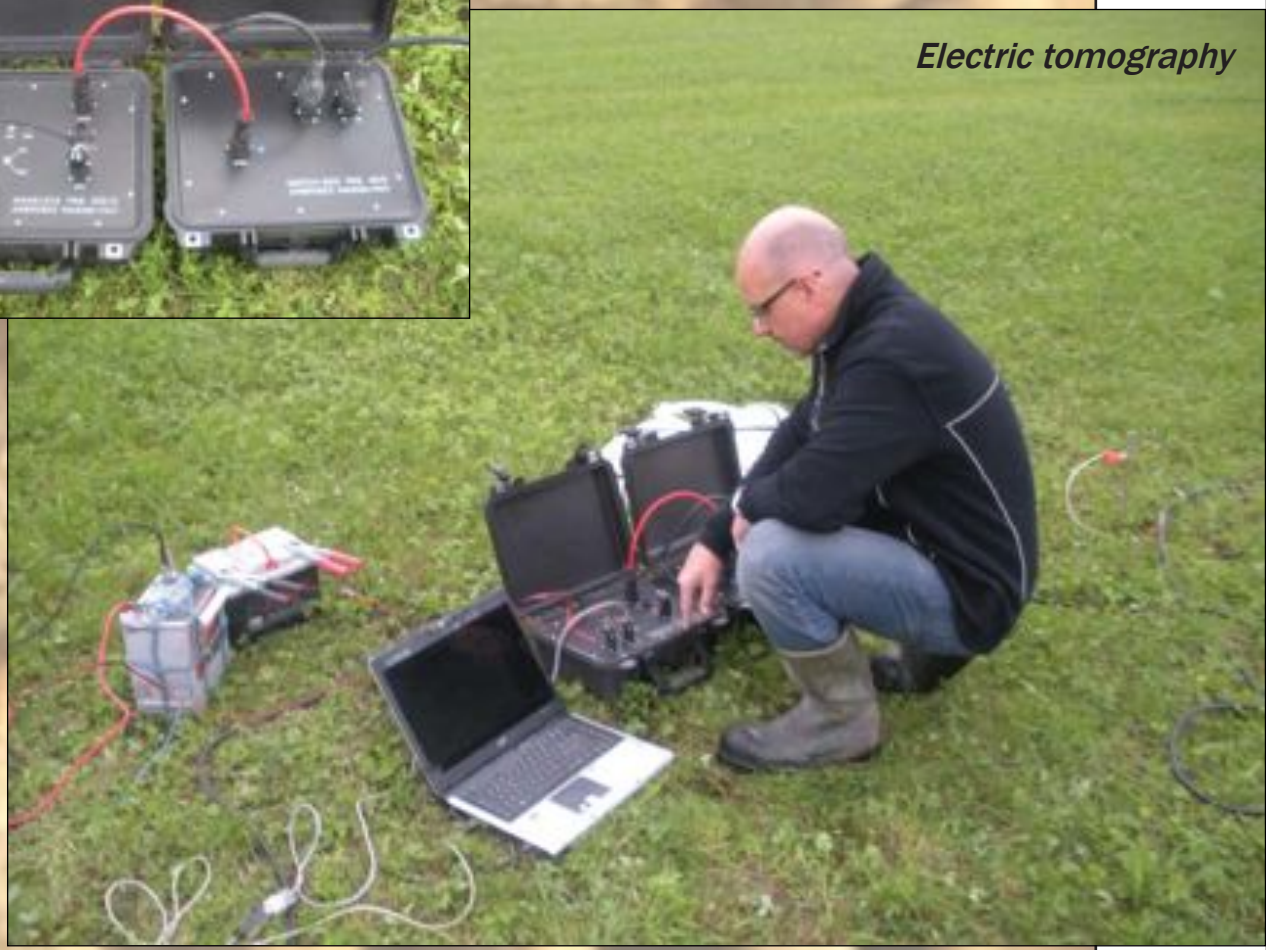

0.1
1
10
Depth (m)
10
100
1000
10
RESISTIVITY (ohm-m)



Apparent isoresistivity map



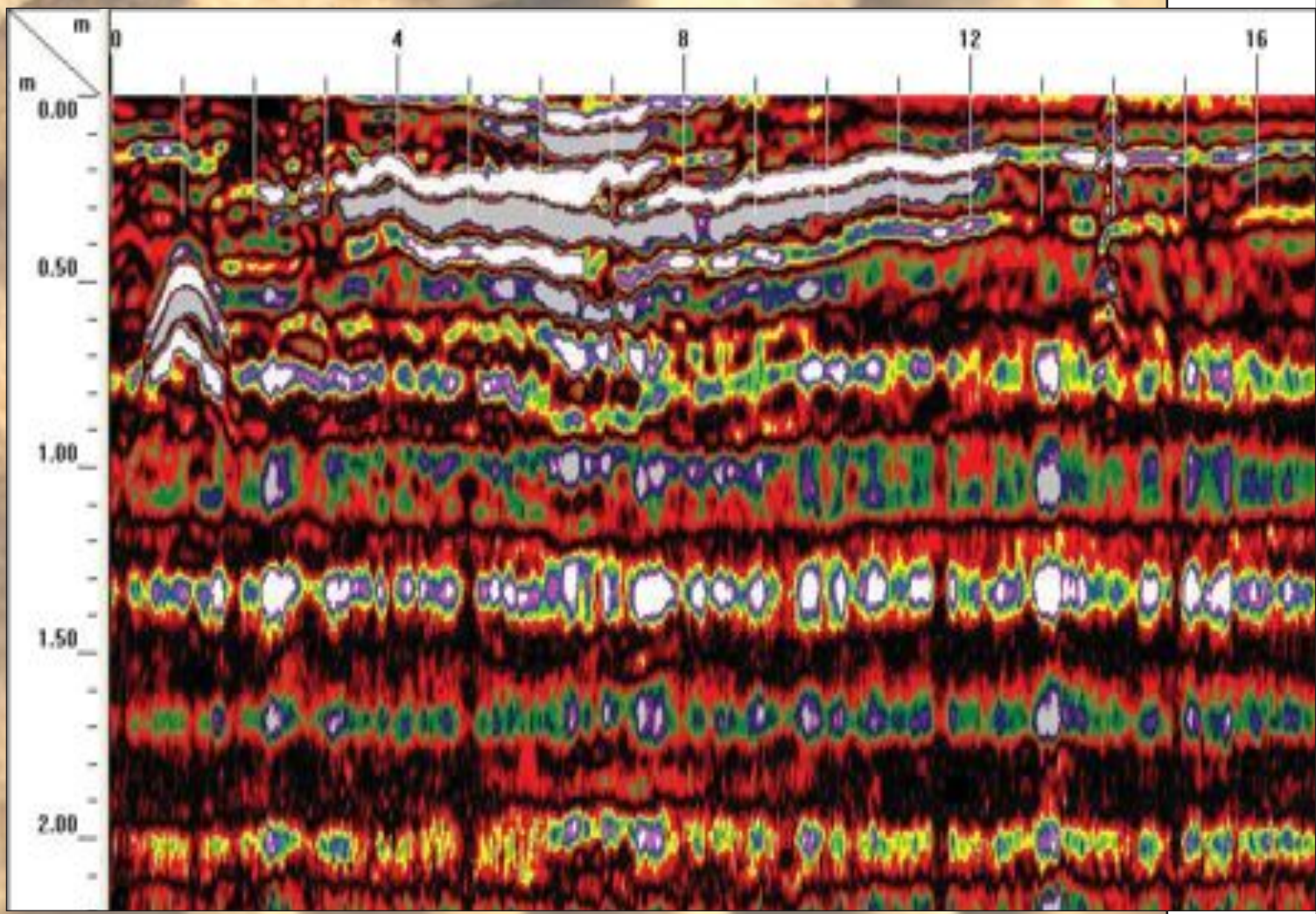
Electric tomography profile



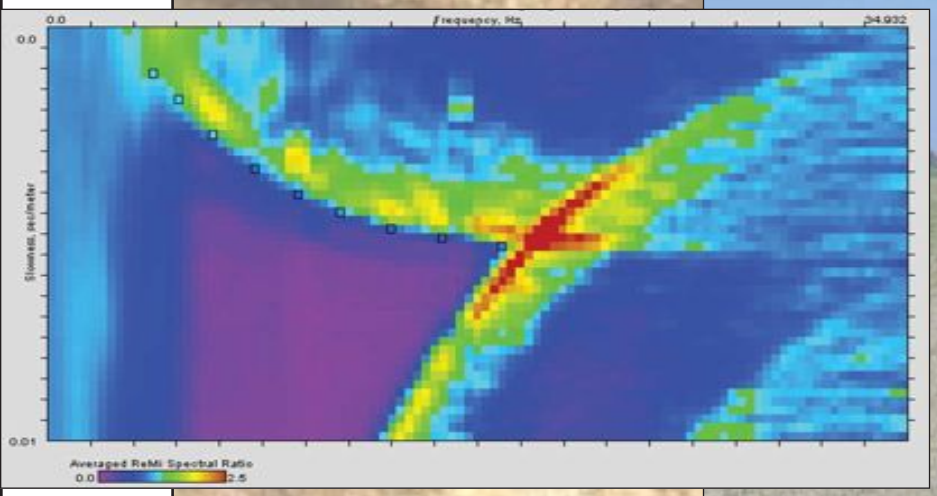
Electric tomography

GEORADAR

Georadar represents a survey method based on the transmission of high frequency electromagnetic pulses into the ground by a transmitter (antenna) and on the analysis of reflected echoes generated by buried features.
Discontinuities capable to reflect back to the surface the electromagnetic wave are generally associated to variations of ground elastic properties, caused by lithologic or water saturation changes.
Also the presence of subsurface cavities can be detected, on the basis of the contrast between the electromagnetic velocity difference between air and ground.
Depths of investigation depend on the type of antenna and the lithologic properties of investigated areas.
This method is efficiently applied for the verification and the control of infrastructures, waste sites and areas of archaeological interest.


m
m
0
4
8
12
16
0.00
0.50
1.00
1.50
2.00

MICROTREMORS ANALYSIS



The determination of Vs30 (the average shear waves propagation velocity in the first 30 meters of depth) is very important for soil definition and classification in compliance to the new law concerning the prevention against earthquakes.
For this evaluation, in addition to borehole seismic (downhole, crosshole) and surface seismic (S waves refraction and reflection), alternative methods for subsurface modeling based on the analysis of surface waves (Rayleigh) have become more and more popular in the last few years.
Among the other techniques, the microtremors analysis turns out to be particularly efficient, both from the result quality and the economic point of view. In fact, it can be accomplished using operational procedures very similar to those used for conventional surface seismic.
The process consists of transforming seismic recordings into “slowness-frequency” bidimensional spectra; these diagnostics allow us to define, by manual picking, a dispersion curve which is strictly correlated to subsurface shear wave velocity distribution of the investigated areas.
The inversion of this curve allows us to determine the Vs variation with depth and, consequently, to calculate the Vs30 value.

The MASW, a methodology that was invented by researchers of Kansas Geological Survey (Park et al., 1999), allows us to determine shear waves velocity variations with depth by the analysis of surface waves (Rayleigh) propagation.
The method can be both active and passive:

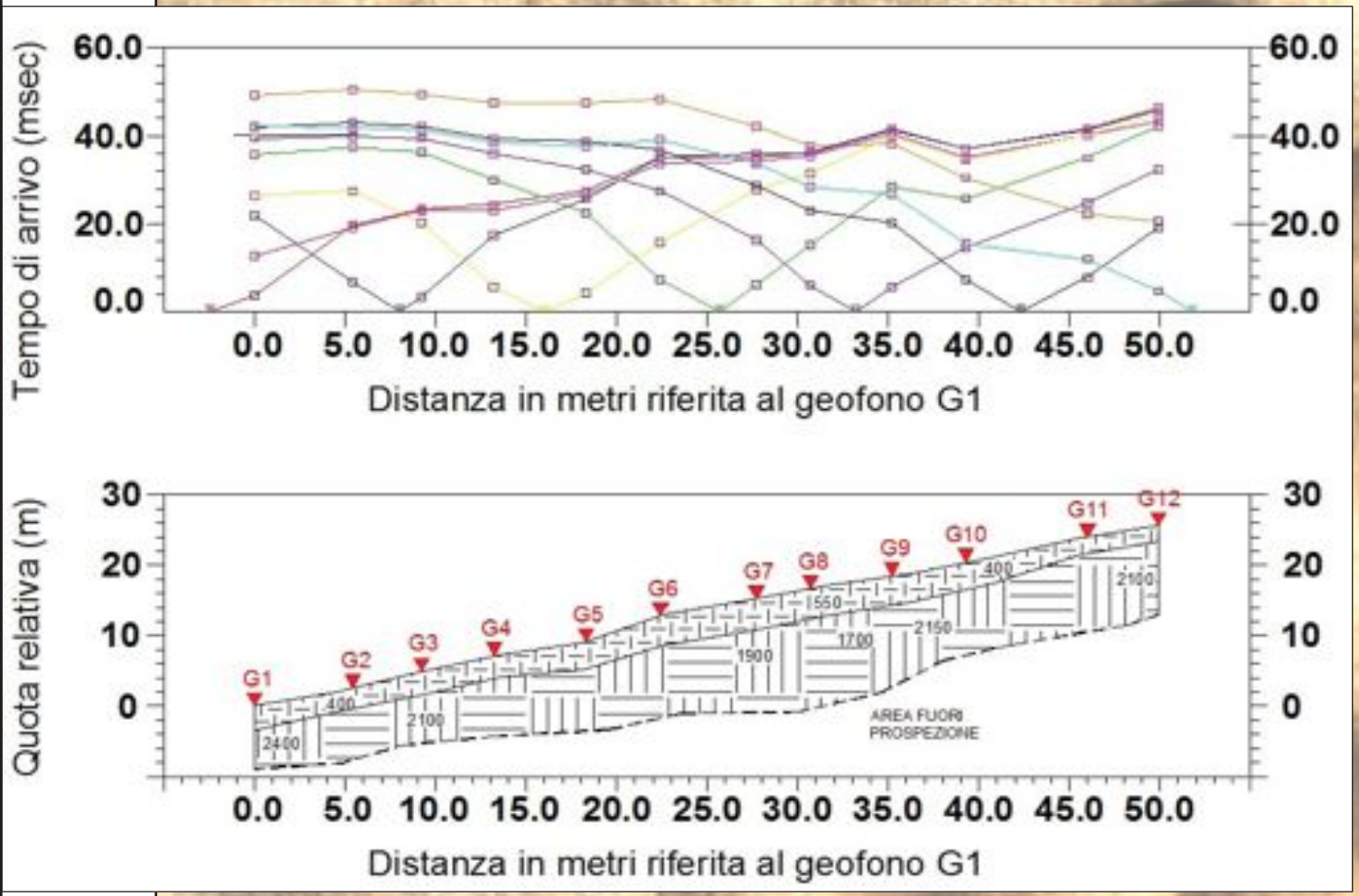
1. In the “active” method surface waves are produced by a surface source and recorded by receivers linearly deployed on the ground.
2. In the “passive” method what is recorded are microtremors generated by natural or anthropic sources (vehicle circulation, industrial activities, etc.).

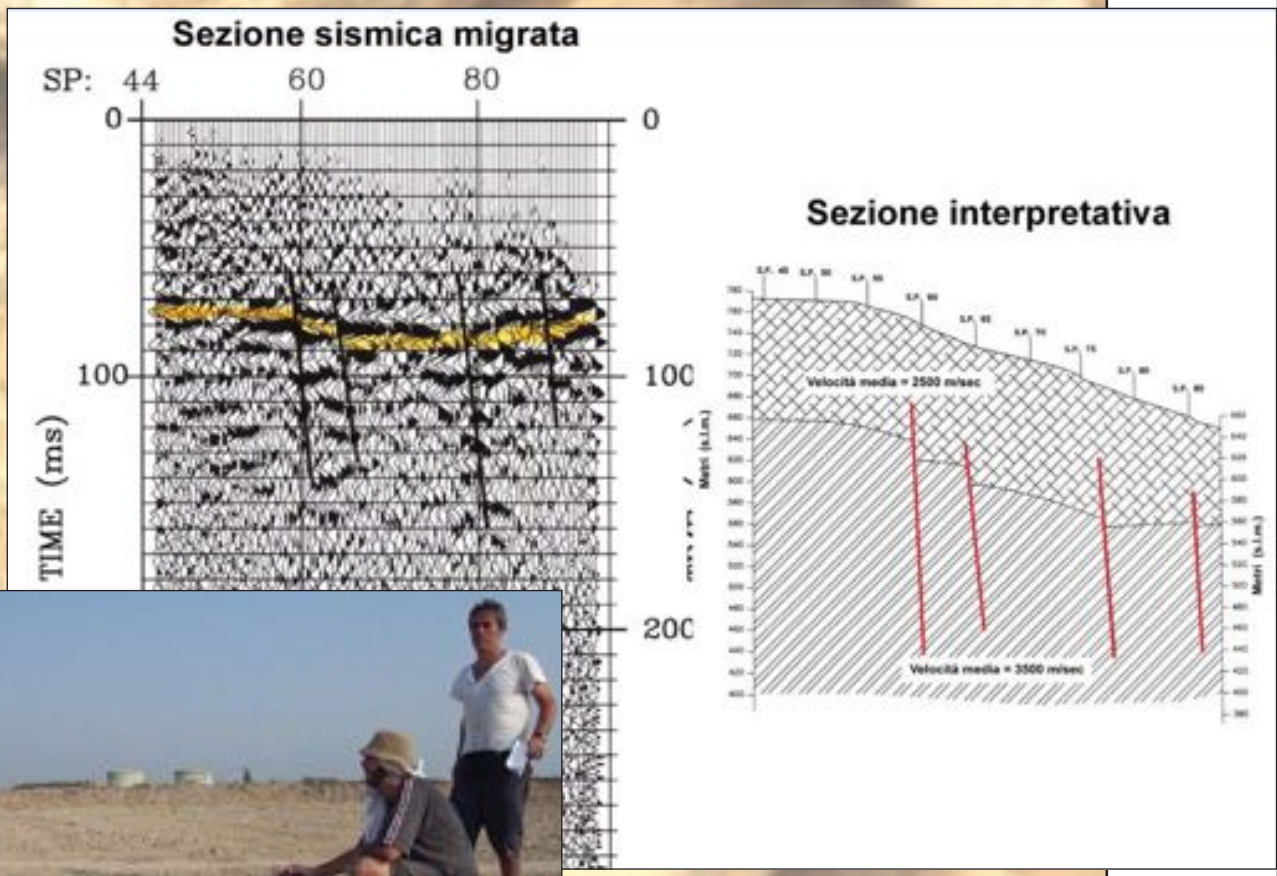
The above mentioned techniques investigate on different bandwidths; more centered on high frequencies the former (15-80 Hz) and therefore providing information on the shallow part of the subsurface; more targeted on low frequencies is the latter, with the possibility of providing information about deep layers.
The combination of the two techniques allows us to work within a wide spectral bandwidth and therefore to obtain the shear wave velocity trend both for shallow and deep layers.
The analysis and the interpretation process consist of transforming the seismic records into a phase velocity-frequency bi-dimensional spectrum on which the dispersion curve is manually picked.
By the inversion of the dispersion curve it is possible to determine shear wave velocity Vs variations with depth.

SURFACE SEISMIC

Surface seismic includes all investigation methods implying seismic energy production on surface. Among these methods, the most important ones are represented by refraction and reflection seismic.

Seismic refraction is a consolidated method for subsurface investigation based on the analysis of P refracted first breaks. Their conversion into a subsurface velocity model can be accomplished by either conventional methods (GRM, Plus-Minus) or more sophisticated tomographic inversion algorithms.
This method is generally used to determine the sliding surface of landslides, to detect lithologic boundaries and to evaluate the degree of fracturation of rocks. It can also find application in environmental studies, to evaluate, for example, the rubbish thickness in dumps.





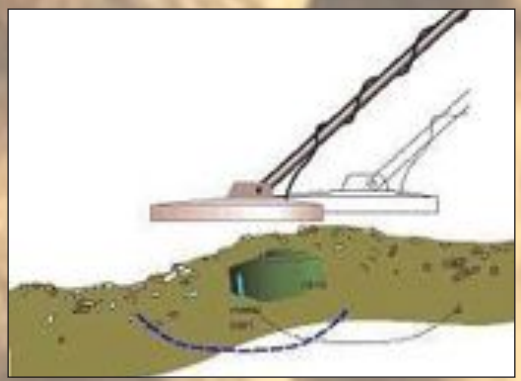
Seismic reflection represents a technique for subsurface investigation based on rock elastic properties (acoustic impedance). Every surface marking a lithologic transition, no matter if it is stratigraphic or tectonic, represents an elastic discontinuity able to reflect upward the seismic energy propagating into the ground. Reflected signals, recorded on the surface by geophones, are subsequently processed in order to produce seismic sections whose interpretation provides information about the structural setting of the investigated area.

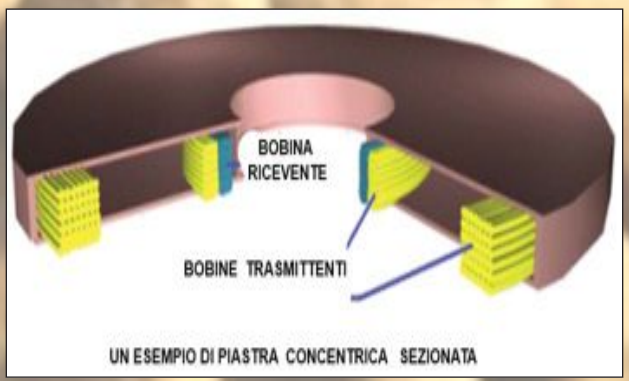
The main advantages of this method can be summarized as follows:

- high depths of investigation using low energy sources and short geophone cables;
- efficient method for interpolation and extrapolation of “point” information (boreholes);
- relatively limited costs;
- negligible environmental impact.

METAL DETECTOR

Surveys with Metal Detector are usually executed to detect buried metal objects. It is an instrument suitable for archaeological surveys, especially for the research of small metal finds.
The metal detector transmits radio waves by a portable antenna and, at the same time, records back signals.
If no metal is presents, the radio wave gets dispersed; but if it hits a metal object, it is reflected back to the surface and recorded.
The depth of investigation depends on various factors: the quality of the device used, depth, shape and size of the searched objects.





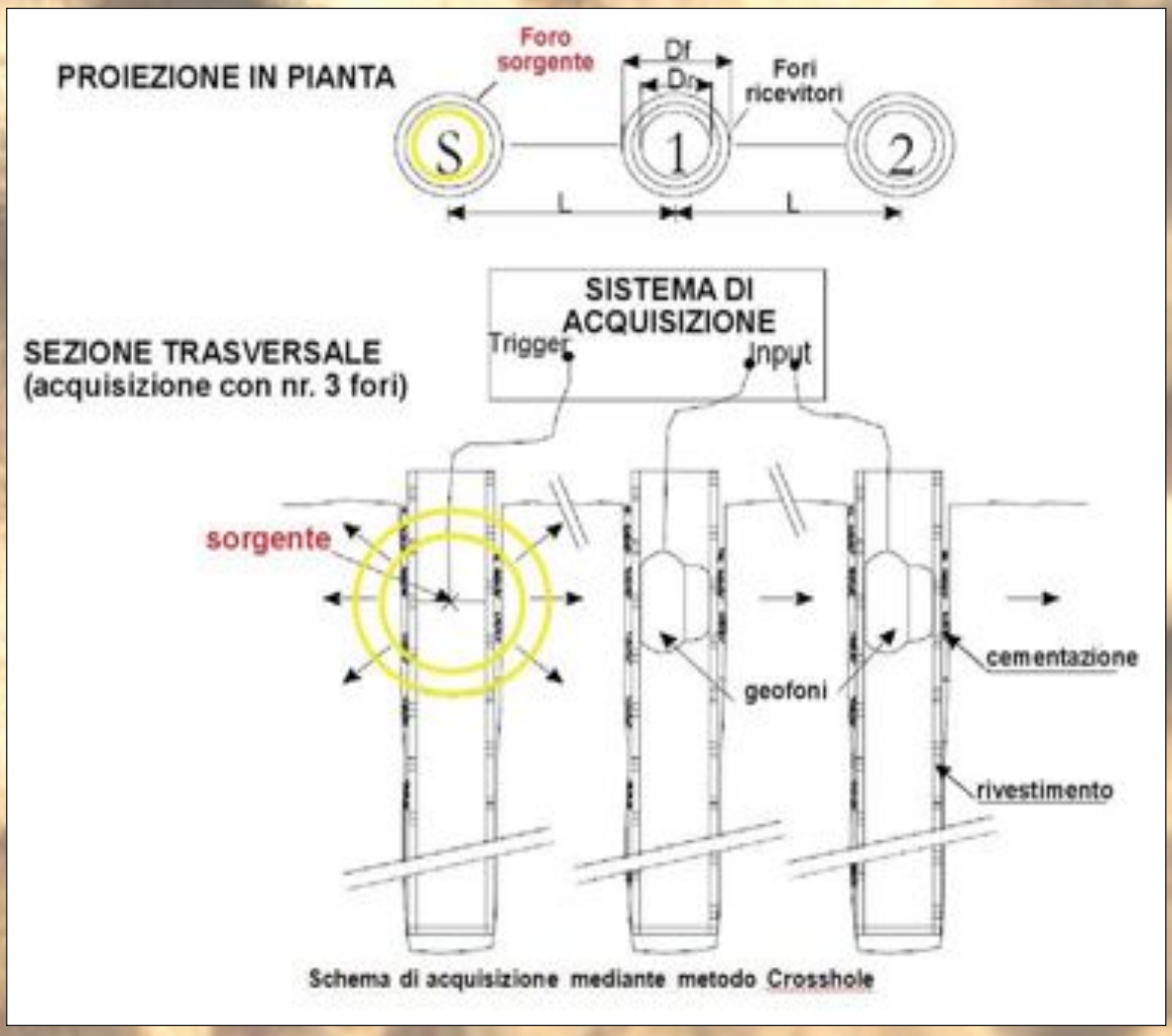
UN ESEMPIO DI PIASTRA CONCENTRICA SEZIONATA

BOREHOLE SEISMIC

Down-hole

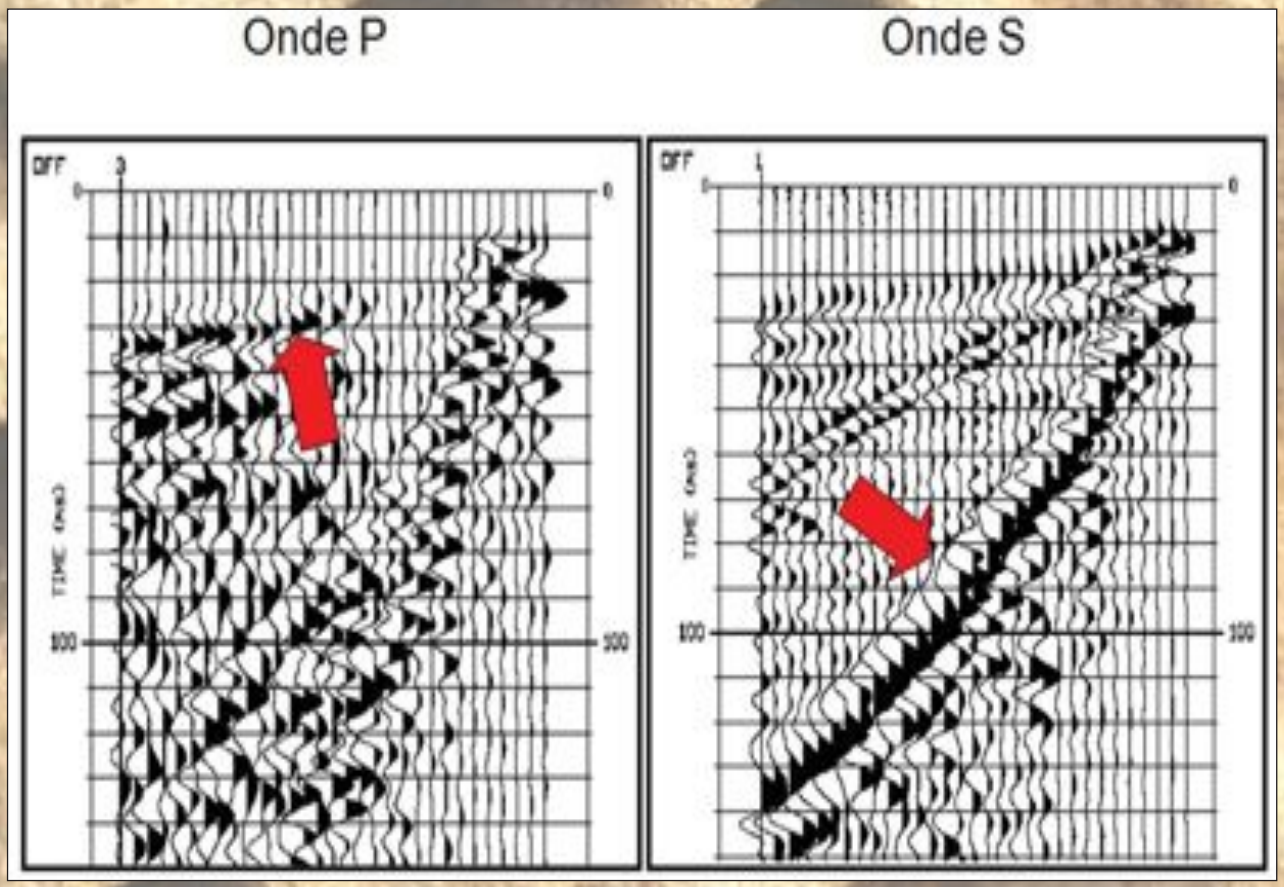
This investigation type takes advantage of the possibility to place seismic sensors inside boreholes to get more precise seismic velocity measurements in investigated areas.
Down-hole surveys use a single borehole; a tri-dimensional geophone is anchored to the wall at different depths. Seismic energy is produced at the surface near the hole. By measuring on seismograms the traveltimes it is possible to make a precise estimation of Vp e Vs and, starting from these values, calculate the elastic parameters associated to layers crossed by the borehole.
Two or three boreholes are instead used for cross-hole surveys; they are generally placed just a few meters one to the other. One hole is utilized for seismic energy production (micro-charges, blank cartridges); the other(s) are instead set for seismic recording.
The possibility to make measurements where source and receiver are placed in proximity one to the other allows us to precisely determine Vp e Vs and relevant elastic parameters.

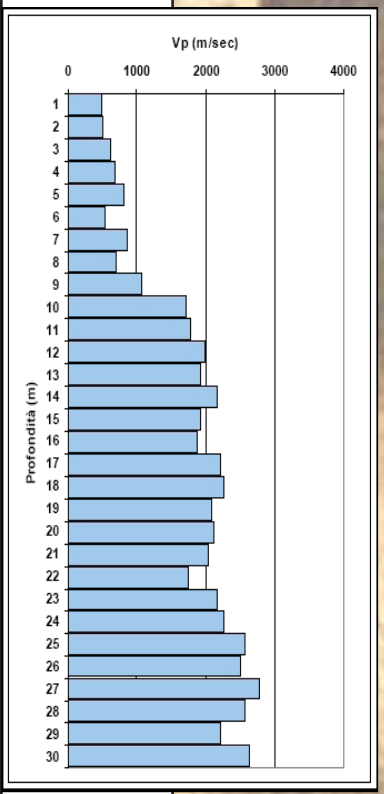
These types of investigations are generally adopted in landslide areas and also for infrastructure planning.

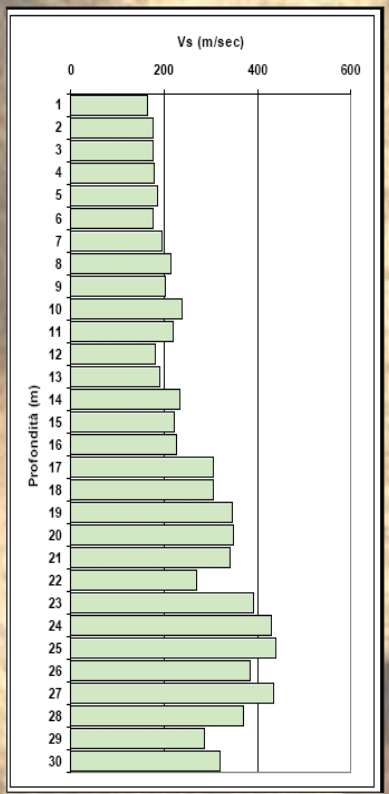


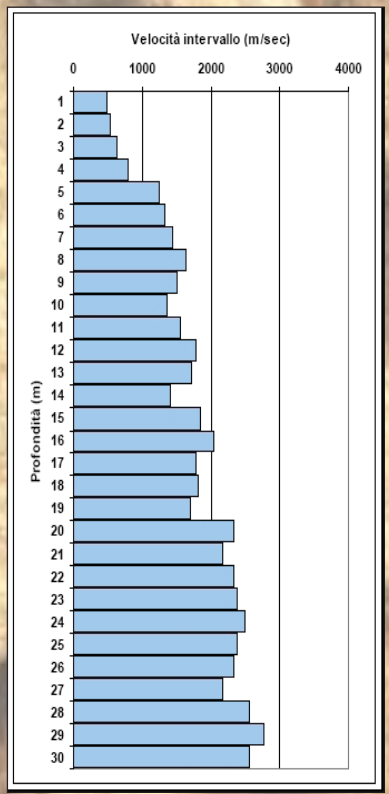
Schema di acquisizione mediante metodo Crosshole

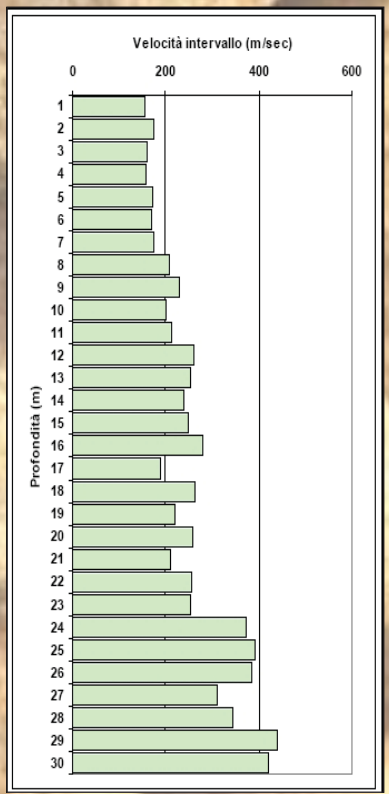
Cross-hole


Onde P
Onde S
OFF
TIME (ms)
100
200


Vp (m/sec)
0
1000
2000
3000
4000
Profondità (m)


Vs (m/sec)
0
200
400
600
Profondità (m)

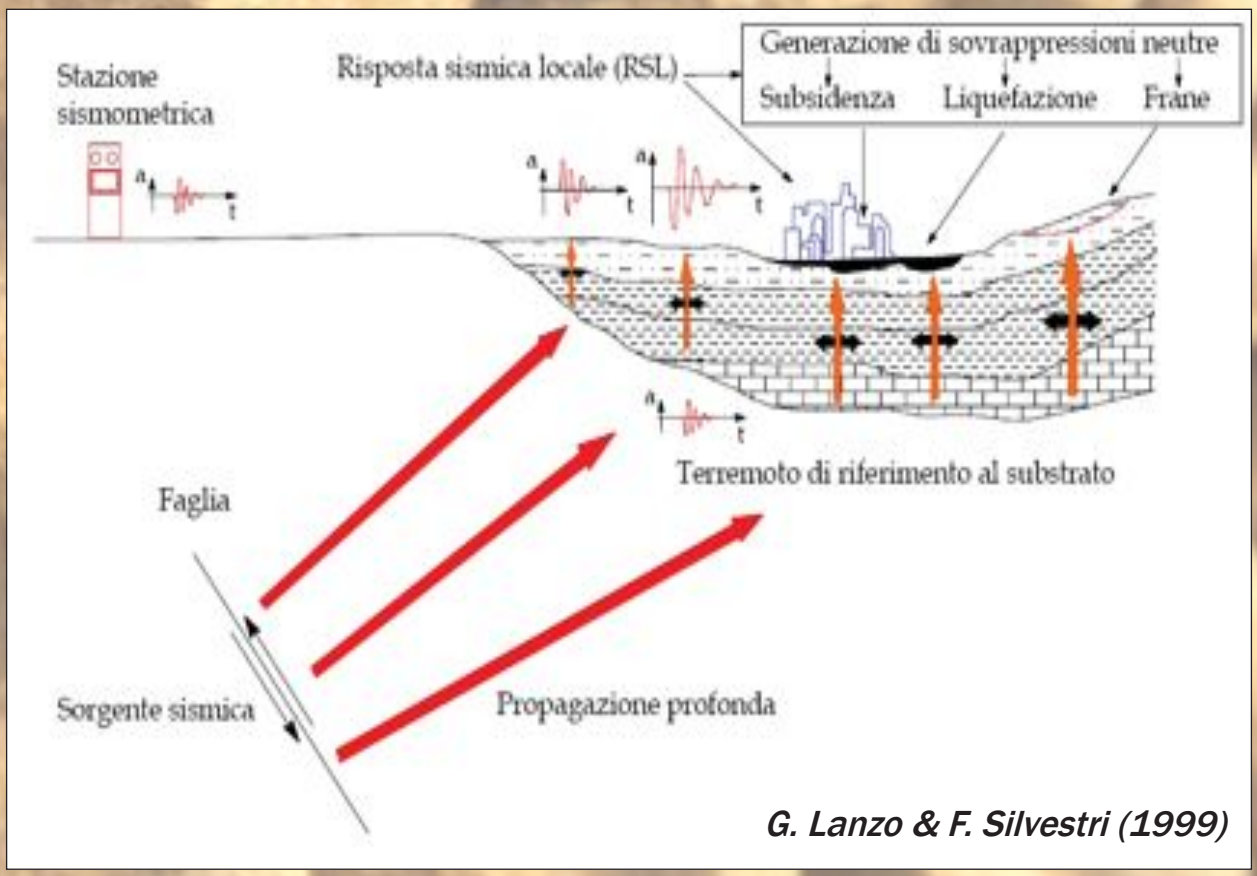

Velocità intervallo (m/sec)
0
1000
2000
3000
4000
Profondità (m)


Velocità intervallo (m/sec)
0
200
400
600
Profondità (m)

Local Seismic Response

Since early 2000 Georeflex Srl is involved in projects for Local Seismic Response (RSL) evaluation, which represents the most important activity for Seismic Microzonation studies.
Damages caused by an earthquake and local geology are strictly related. Surface morphology, groundwater regime, lithology and rock dynamic properties turn out to be factors that can greatly influence the effects of an earthquake on the surface.
The study of the territory is therefore assuming more and more importance for the evaluation of the exposure to seismic risk, particularly in areas that area critical from the point of view of urban concentration, artistic heritage and industrial activity.

The study of the Local Seismic Response and the amplification effects due to local conditions requires a multidisciplinary approach that integrates different contributions: seismology, geophysics, geotechnics and structural engineering.



G. Lanzo & F. Silvestri (1999)

NON DESTRUCTIVE CONTROL ON PILES

Non-destructive methods, thank to their low cost, offer the opportunity to test a large amount of piles, detecting those that may be affected by anomalies; the more expensive “load tests” can subsequently be limited to a more limited number, with consequent economic advantage.

Particolare della centralina di acquisizione dati (stampabili direttamente al termine della prova)

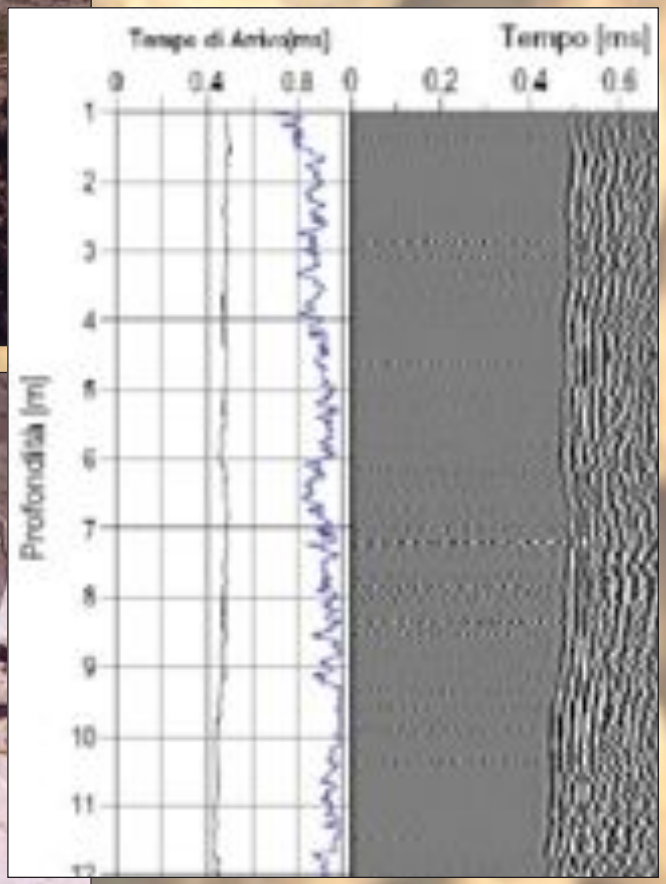
Fase di acquisizione su una sezione di controllo

Among non-destructive methods, here below the most widespread are listed:

ULTRA SONIC CROSS HOLE METHOD: method used to measure seismic velocities based on traveltime measurements of a pulse propagating through the pile. The pulse is represented by ultrasounds recorded by a transducer (receiving probe). Probes are first lowered to the bottom of the inspection borehole and, while recovered up to the surface, measurements are recorded every 10 cm.

SONIC INTEGRITY TEST: the head of the pile is hit by a hammer in order to produce a compressional wave propagating along the pile. The pile base, as well as all possible discontinuities affecting it, reflects this wave. The movement of the pile head, caused by reflected waves, are recorded by an accelerometer and converted to velocity.

PILE INTEGRITY TEST: this method is based on the mechanical impedance measurement of a pile subject to harmonic vibrations; it allows us to analyze the ground-structure interaction.
It also allows us to 1) determine the pile geometrical characteristics (length, column section area), 2) verify the presence of discontinuities, 3) estimate point element, 4) estimate the elastic break down of the pile.



In the field of construction, Georeflex Srl offers also a wide variety of geognostic services, aimed at defining the bearing capacity of terrains and their yielding, with the availability of instrumentation able to efficiently work in any type of environment.

Geognostic surveys

Installation of piezometers and inclinometers

Bearing test

Penetration test

Collecting samples to establish permeability coefficient.

TOPOGRAPHY

Georeflex Srl offers to construction enterprises, public administrations and planning companies, the following topographic services:

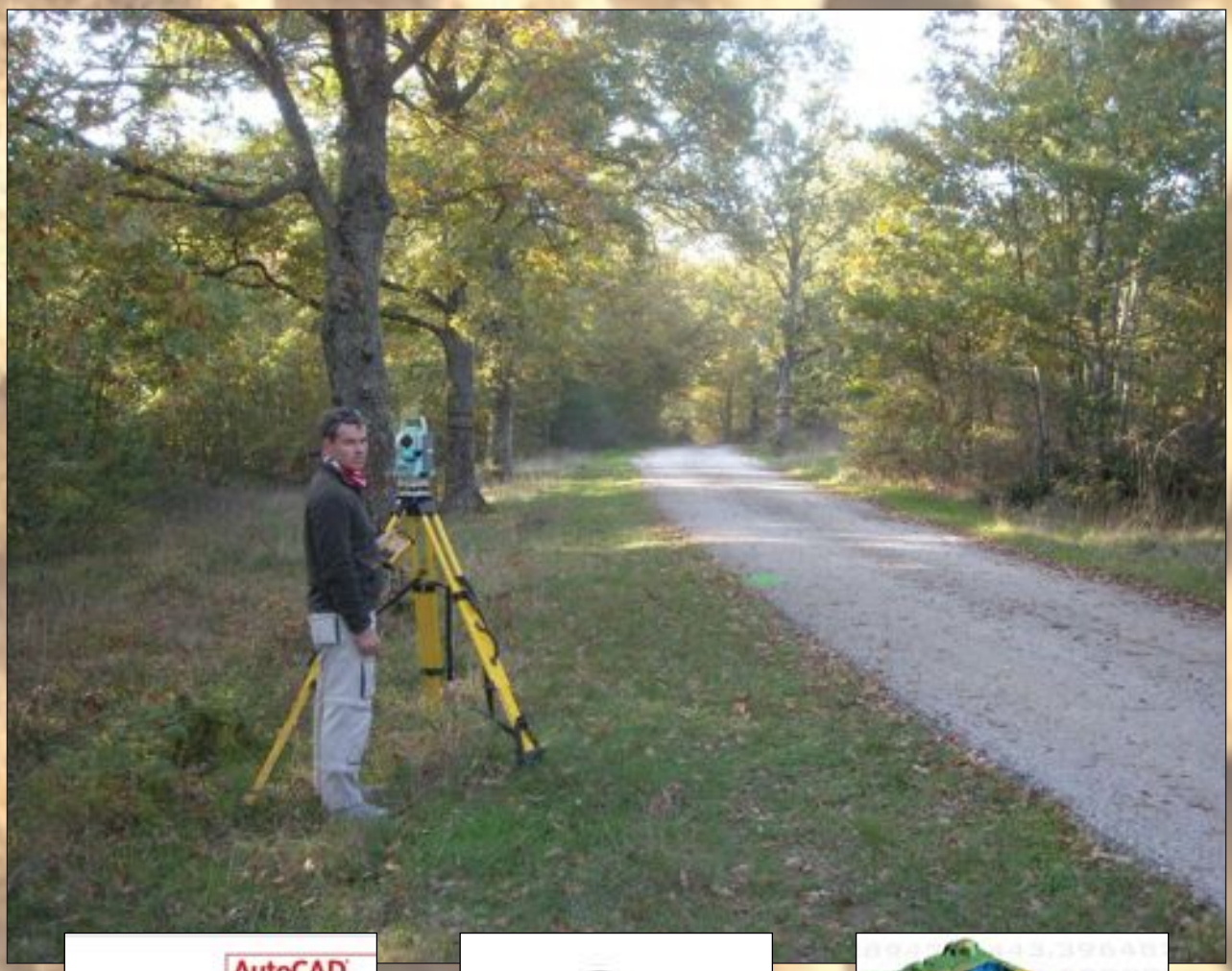
- topographic assistance on building sites;
- civil works and industrial infrastructures tracing;
- detailed topographic surveys delivered in Cad or digital format for volumes estimation.

The available instrumentation is constituted by:

- nr. 1 total station Spektra/Trimble BS 515
- nr. 1 totale total station NIKON NPR 352

both characterized by an angular precision of 5" and biaxial compensation.

- nr. 1 GPS TRIMBLE system and control unit



AutoCAD

Leonardo X3

Surfer 8

The GPS (Global Positioning System) is based on a constellation of 24 satellites orbiting around the Earth at very high altitude.
The objective of the system is to determine the position of points on the Earth surface. In order to do this, the GPS calculates distances with respect to satellites using the traveltime of the radio signal they transmit to the Earth.

The method used for topographic surveys is defined RTK (Real Time Kinematic); it allows us to considerably reduce the time necessary to determine the position and it is generally adopted for precision surveys.
A fixed receiver (BASE) is located on a reference point while a mobile receiver (ROVER) is placed on the points to be determined. During the survey both receivers have to maintain contact with at least four common satellites.

Georeflex Srl uses double frequency receivers and a procedure named IWM (Initialization While Moving) that permits to resume immediately the survey after possible interruptions due to the unavailability of the minimum number of satellites.

Fixed receiver (BASE - GPS Trimble 5700)

The interface between the data recording unit and the receiver (CONTROLLER) allows inserting codes and other useful information for final data delivery.

Mobile receiver (ROVER - GPS Trimble 5700)

Data recording (CONTROLLER - Trimble TSc2)

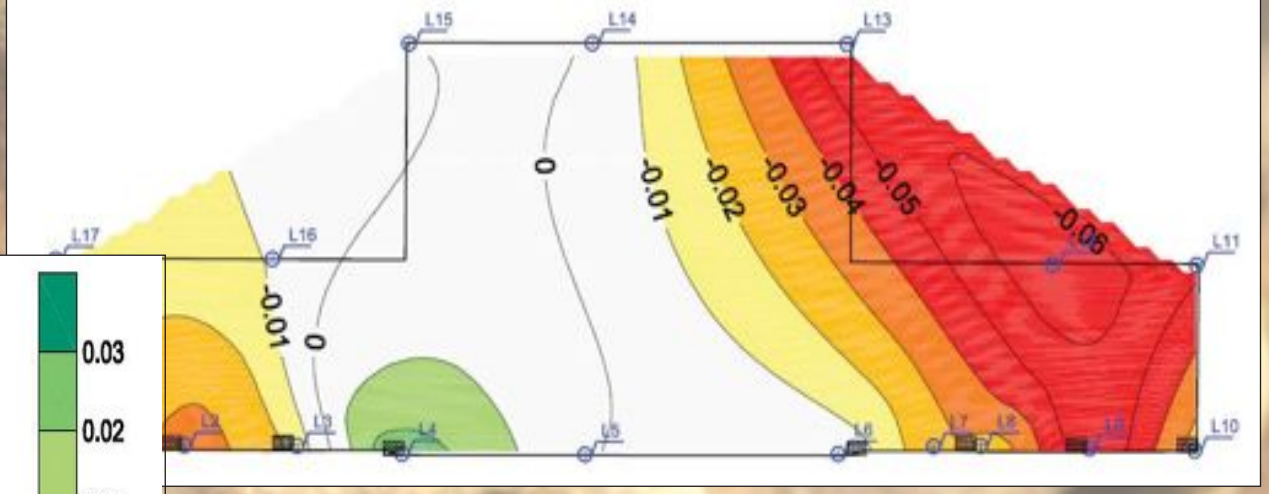
DISPLACEMENT MONITORING

Georeflex Srl is equipped with the instrumentation necessary to perform the yielding monitoring on buildings/infrastructures.
Commonly, measurements are made using a crackmater or an optical level.

The crackmeter is an instrument proper for control and measurements of cracks affecting walls and floors. At the crack edges little aluminum plates are placed and relative displacements between them are measured with the precision of cents of millimeter.

By the optical level the position of known points is recorded; in order to limit to minimum the error, every measurement is given by the average of three collimations. Measurements are expressed in centimeters and are always related to the surface elevation.

Punti di monitoraggio posizionati e rilevati tramite livella centesimale



SOIL MONITORING

This activity is generally performed monitoring shafts made by excavators. These shafts allow collecting soil samples for laboratory tests.

The material is collected from excavation walls, sieved and placed into a 12 liters steel bucket. The soil is then homogenized by a steel soil scoop ; once the complete homogenization is obtained, the soil is placed into 0,51 liters capacity glass cans.

GROUNDWATER MONITORING

Georeflex Srl performs direct measurements and sampling for chemical analysis on water inside piezometers; procedures are in compliance with regional environmental monitoring plans (PMA). The main activities carried out for environmental monitoring are:

- census of water points and sources;
- measurement of phreatic zone level;
- direct measurements on phreatic zone water (temperature, pH, conductibility, turbidity);
- water sampling for laboratory analysis.

The measurement of the phreatic zone level is accomplished by a phreatimeter, which detects the water table depth. The instrument is simple, light, easy to use and do not condition water properties.

At measure points, a probe (1 cm diameter) is lowered through a roll-up cable. As the probe reaches the groundwater an acoustic signal is emitted.

Measurement of turbidity in hole (terminal/controller MIQ/TC 2020 XT – IQ SENSOR NET).

Measurement of physical parameters in spring (multiparameter measuring system HYDROLAB MS5).

Water sampling is executed by a 12v centrifugal pump. This pump, whose diameter is 42 mm, is lowered in the piezometer and activated by a remote control.

The water collected within the piezometer is then driven into a container (10 liters) predisposed to avoid any contact with the air.
Once the container is full, a multi-parametric probe is used to measure parameters such as temperature, pH and electrical conductibility at 20°C.

When parameter stabilization is reached, also turbidity is measured using a camp probe. Collected samples are preserved into a fridge.

ARCHAEOLOGY

In the field of archaeology, Georeflex Srl has grown an important experience matured especially during excavations and control activities in areas of possible archaeological interest.

Research, detection, collection and cataloguing of archaeological materials have always been executed in collaboration with the personnel of competent Authorities.

PIPELINE PLANNING

For pipeline planning (oil, gas, water) Georeflex Srl has an important know-how matured after the collaboration with the major Companies working in this activity.

Main services offered for planning support are the following:

- feasibility reports relevant to pipeline tracing (environmental impact studies, verification of compliance with laws, etc.);
- base and final project;
- geological, geotechnical and hydrogeological assistance during construction phase;
- coordination and supervision for archaeological preservation during excavation and pipeline lay-down;
- geological studies for areas subject to geological risk (landslides);
- microzonation studies for areas subject to seismic risk;
- studies for slopes hydraulic restoration following pipeline lay-down;
- census of water points and studies about source alimentation in areas of hydrogeological risk;
- coordination of geognostic and geophysical campaigns for tracing planning;
- coordination of activities for gas and electric networks;
- permit obtainment for pipeline construction;
- high precision topographic surveys.

For pipelines planning and lay-down, Georeflex Srl operates using up to date technologies, as for example the “trenchless” one, by which it is possible to install pipelines in the subsurface limiting to maximum the open air excavations. Among no-dig or trenchless technologies, the most widely used are Auger Boring (Spingitubo) horizontal drilling, Microtunneling and Directional Drilling.

Trenchless Technologies

The drilling mud represents an important factor for the execution of Microtunneling and Directional Drilling technologies. Parameters relevant to mud such as density, pH, filter cake and sand content are constantly measured by specific instrumentation during the drilling phase.

WIND FARMS

On behalf of Sorgenia Power SpA and Sorgenia Green SpA, Georeflex Srl operated for Wind Farms planning in the following activities:

- feasibility analysis for aerogenerators and marshalling box positioning
- feasibility analysis electric network
- analysis of territory regional constraints (hydrogeology, ZPS, SIC, IBA)
- topographic surveys using total station and GPS to support Permits requests
- geologic and geomorphologic analysis for instable areas and relevant cartography
- land consolidation worksheets in critical areas
- geotechnical analysis to support building shallow and deep foundation planning
- local Seismic Response analysis (SRL)
- geo-referenced thematic maps (urban constraints, geologic, geomorphologic, seismic, etc.).

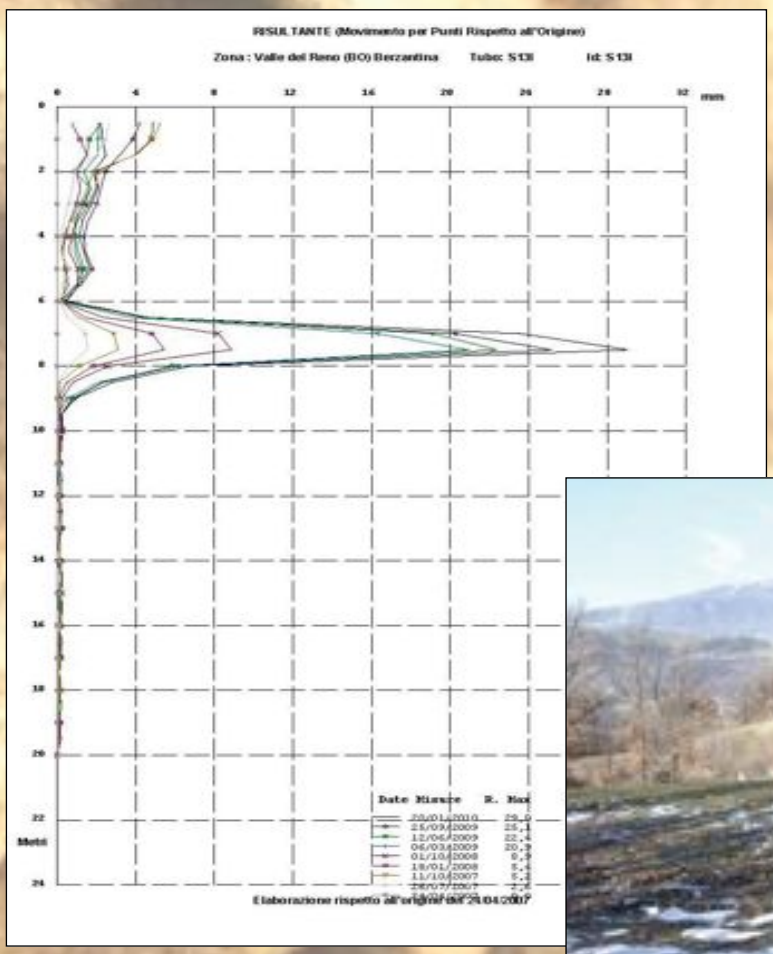
INSTABLE AREAS MONITORING

Georeflex Srl disposes of instrumentation and qualified personnel to properly monitor instable areas, namely those ones interested by landslides.

Generally, the instrumental control is executed by topographic monitoring or the installation of inclinometer stations.

Inclinometer measurements allow us to precisely detect sliding surfaces, to control magnitude, velocity and direction of landslide movements, therefore, to get very important data to evaluate hazards. The same data can then be utilized for area stabilization planning.

Landslide near Gaggio Montano (BO)


RISULTANTE (Movimento per Punti Rispetto all'Origine)
Zona : Valle del Reno (BO) Berzantina
Tubo: S13I
Id: S13I
mm
Metri
Data Misura
R. Max
Elaborazione rispetto all'origine del 29/04/2007

MITIGATION PLANS AND RESTORE

During the last few years Georeflex Srl gained a lot of experience to put in safe conditions and/or to restore the areas interested by the construction of strategic infrastructures.
The proposed interventions, generally represented by:

- artificial drainage
- reinforcements
- surface erosion control

have the objective of mitigating the hazard, warranting the safety and ensure the naturalistic restore of the areas at the end of activities. They are also finalized to limit to minimum the impact of infrastructures on territory.

Underground drainage in instable areas

Crib wall

Palisade

Gabion baskets

POWER PLANTS

Georeflex Srl followed the realization phases of Sorgenia SpA Power Plants, executing for many years topographic assistance during activities.

- Cycle combined Power Plant in Turano Lodigiano (Lodi)
- Cycle combined Thermoelectric Plant in Aprilia (Latina)

contacts

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