

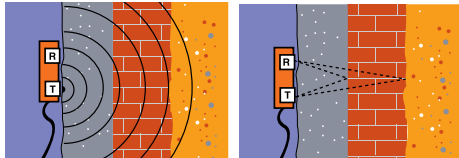


Ground penetrating radar

Ground penetrating radar (GPR) is effective through concrete, asphalt, brick, stone and most soil types. It provides construction and condition information for pavements, structures and buildings without damage or disruption.

APPLICATIONS

GPR is one of the most powerful and versatile geophysical techniques for engineering applications. Vehicle mounted systems can survey hundreds of kilometres of road or rail network per day delivering continuous construction and layer thickness data. Used with care, GPR can also provide high resolution imaging of shallow building details or defects.



Pulses of radio energy are transmitted into the structure by an antenna moved over the surface.

Reflections are recorded as the transducer is swept over the surface

PRINCIPLES

GPR is an echo sounding method where an antenna (transmitter/receiver) is passed over the structure under investigation. Low power radio pulses are fired into the structure and reflections are recorded from material boundaries or features such as voids or embedded metal. Sampling is so rapid that the collected data effectively forms a continuous cross section, enabling rapid assessment of thickness, arrangement and condition over large areas. By assessing the strength and the scatter of signals it is often possible to find cracking, corrosion and changes in compaction, bond and moisture content.

Aperio use a range of advanced digital radars for different applications and sophisticated processing software that enables filtering and enhancement of the data to improve resolution and enable cost effective processing.

SURVEYING

Surveys of buildings and structures are typically conducted by a two-person team. One member will operate the control instruments and log the data, while the other sweeps the antenna over the surface in a series of profiles. The position of each profile is recorded and distance along a profile is measured using an odometer wheel that controls the sampling rate of the radar system. The equipment is rugged, self powered and is suitable for use in confined spaces and at height using mobile hoists or access cradles. Using advanced digital systems mounted in vehicles, large areas such as runway and highway pavements can be rapidly assessed. Detailed pavement surveys are conducted at 5–10 km/h and inventory surveys at 50–70 km/h.



GGSi SIR10 multi channel radar



Cart based GPR



GPR transducers

BENEFITS

- Portable rugged equipment for site use
- Safe – very low per radio waves (typically 1/1000th the power of a mobile phone)
- Work from one accessible surface without surface preparation
- Cover large areas rapidly and penetrate multiple layers
- Typically accurate to ±8% (depth through bound layers)

LIMITATIONS

- Reduced effectiveness in conductive material eg. metal, closely spaced reinforcement, clay rich or highly saline ground
- Calibration or verification needed for best results
- Complex data – expert analysis and interpretation needed

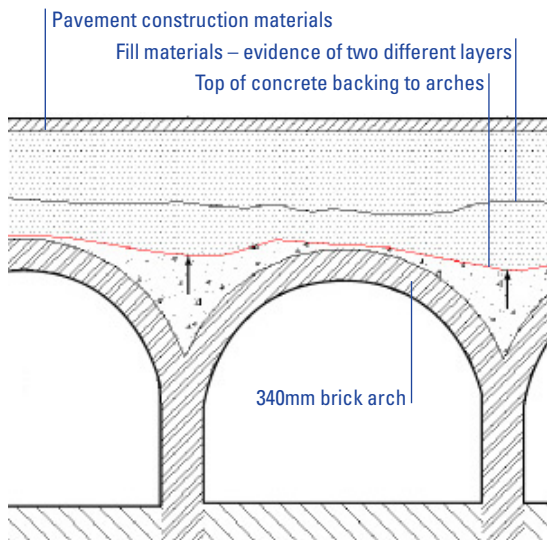
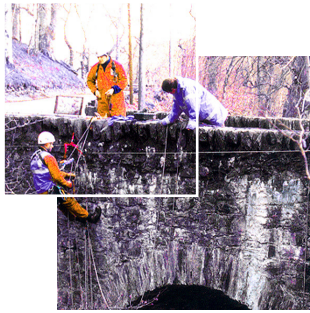
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ENGINEERING INFORMATION THROUGH TECHNOLOGY

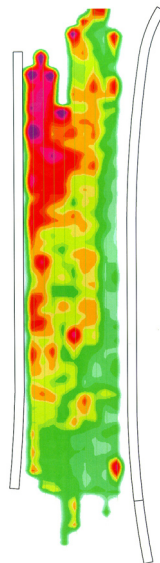


Non destructive investigation of masonry bridges



TYPICAL PROJECTS:

- Mapping the extent of backing / haunching to masonry arch bridges to determine the effective springing level
- Detecting delamination between brick rings of a railway bridge
- Determining the construction detail, thickness and extent of different construction phases on a multi-arch road bridge



GPR map of fill compaction

Non Destructive methods can provide valuable construction and condition information as part of routine or special inspections. Benefits include greatly reduced need for destructive testing and rapid coverage allowing comprehensive sampling.

APPLICATIONS

Britain's transport infrastructure includes more than 70,000 masonry bridges. With increasing traffic levels and loading requirements however, there is a need to establish the arrangement and condition of many of these structures. Often, close visual inspection and access to records will provide sufficient data for loading calculations or planning maintenance. More information may be needed though, for example where arch thickness can't be observed, or where the arrangement appears to vary across a structure. 'Traditional' intrusive methods such as coring and trial pits can determine material type and thickness, but information is restricted to discrete points and the testing method itself causes damage to the structure under investigation. Non Destructive Investigation (NDI) methods offer larger data samples with less disruption to the structure and to traffic. Reliable interpretation of NDI data relies on a good structural understanding, close visual observation and often requires calibration by selective exposure of the structure.

CONSTRUCTION ARRANGEMENT

A summary of frequently required information and useful investigation methods for establishing the physical dimension and arrangement of bridge structures follows:

Requirement	Recommended Techniques
Thickness of surfacing, fill, arch etc	GPR, Selective calibration drilling
Identify spandrel walls	GPR
Identify saddling / haunching over arch	GPR
Locate services	'CAT Scan' service locators, GPR

CONDITION

NDI methods for identifying and determining the extent of defects associated with workmanship, fatigue, or deterioration of materials include the following:

Requirement	Recommended Techniques
Masonry strength	Compressive testing of samples, Ultrasonics, Impact Echo
Cracking	Ultrasonics, GPR
Delamination of brick rings	GPR, Impact Echo
Compaction of fill	GPR, Endoscope
Moisture in masonry and fill	Ground Conductivity, GPR
Mapping scour around piers	Low Frequency GPR

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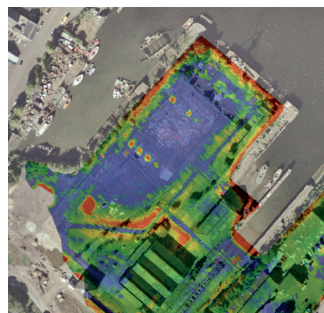
About Fugro Aperio

International specialists in engineering geophysics and non destructive investigation

WHAT DO WE DO?

We help engineers make better decisions by providing a picture of the construction and condition of the built environment and the ground below it. Whether your project involves the ground, a structure or a highway we can uncover the information you need with minimal disruption. Using our advanced methods we can reveal what lies beyond the surface of most engineering materials from depths of as little as a millimetre to tens of metres.

As part of the Fugro group, with offices around the world, you can rely on us to bring to your project specialist skills and knowledge and the support of a world leader in geoscience.



WHO ARE FUGRO APERIO?

The company was formed in 2006 with the integration of Aperio Limited and Fugro Engineering Services. With more than 40 staff we offer what is probably the world's largest and best-equipped team of geophysical specialists working in civil engineering. This means we have specialists in different investigation technologies and in many geotechnical and structural applications. It also means we can handle the largest contracts reliably and have the resources to respond when you need us.

You can rely on Fugro Aperio when you need an integrated investigation package because we can follow up the geophysical surveying with targeted intrusive works to calibrate and verify the results and truly characterise the materials under investigation. All this, with the convenience of a single supplier.

WHAT IS THE FUGRO APERIO DIFFERENCE?

Because we invest in the most advanced technology and train our staff to the highest level, Fugro Aperio are the natural choice for a better understanding of the built environment and the ground below it:

- We deliver knowledge, not just data. We provide reports in engineering formats that you can use – not just as geophysical plots with a few notes.
- Innovation. We invest heavily in research and development, have partnerships with groups such as the Royal Society and specialist companies so you can benefit from new services, software and bespoke test instruments.
- Quality. All projects are managed through a documented workflow system and safety and environment are under continuous review.
- Experience. A management team with 20 years experience and a track record of over 2,000 projects in more than 20 countries.

That's why all the top 10 UK consulting engineers, the top 10 contractors, the leading infrastructure companies and more than 100 local authorities have chosen Fugro Aperio.

To find out what we can do for you, give us a call or visit www.fugro-aperio.com



INVESTOR IN PEOPLE



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 - Tunnels
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 - Land Sites
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 - Ground Penetrating Radar
 - Metal Detection
 - Ultrasonics
 - Acoustics
 - Moisture Meters
 - Impact Echo
 - Vibration Monitoring
 - Magnetometry
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