GBG Australia

Structural Investigations

City Centre development, Perth. Investigation of reinforcement detail and concrete strength of beams and slabs
Multiplex (2008)

Picton. Investigation of concrete quality and finish inside silos using acoustic methods
Allied Mills (2007)

Non-Destructive Investigation of selected sites of the seawall on the 3rd runway as Sydney's Kingsford Smith Airport, locating voiding under the concrete margin behind the wall
Baulderstone Hornibrook & The reinforced Earth Company

Location of pile caps in Kingsford Smith International Airport Terminal arrivals hall
Civil & Civic (1998)

Non-Destructive Investigation of a vacuum separation tank at a tissue plant, Melbourne
Carter Holt Harvey Tissue Australia

Sewerage Treatment Plant, North Bondi NSW. Assessment of concrete chamber headwall using GPR & Ultrasound
Australian Water Technologies

Gosford. Investigation to determine construction of block walls including reinforcement location and possible voids.
Next Constructions (2008)

Natadola, Fiji. Reinforcement location prior to drilling to retro-fit existing concrete beams.
Northern Projects Fiji (2008)

Investigation of the 1916 steel frame construction of the Commonwealth Bank Building, Sydney.
PDR Smart Structures (2009)

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applications for

non-destructive techniques

Methods for the determination of structural detail include:

LOCATION	RECOMMENDED TECHNIQUES
Reinforcing detail and depth of cover	Radar, Covermeter
Location of fixings, wall ties	Metal Detectors, Radar, Thermography
Concrete/ masonry thickness	Radar, ultrasonic, impact echo
Thickness of Steel	Ultrasonic thickness gauge
Foundations: Location/ Footings	Radar
Buried services	Radio Detection, Radar
Mapping flues	Radio Tracking, smoke tracking, ball tracking, Radar
Tendon Ducts	Radar, Radiography

Methods for the determination of structural defects:

LOCATION	RECOMMENDED TECHNIQUES
Moisture	Thermography, nuclear density/ moisture gauge, capacitance or conductivity/ resistivity base moisture meters
Cracks in concrete/ masonry	Ultrasonic, Crack width gauge
Delamination and debonding	Impact echo, Radar
Voids in and under concrete	Radar / impact echo
Durability of concrete	Half cell potential, Radar, MMP
Thermal performance	Thermography

GBG Australia

Non Destructive Techniques for

STRUCTURAL ASSESSMENT

GBG Australia

GBG Australia specialise in applying shallow geophysical investigation techniques for assessment of existing structures. We offer our clients innovative methods of revealing subsurface information over large areas whilst minimising both costs and disturbances on the site.

Company Expertise

GBG Australia is a subsidiary of the GBG Group, a multi-national company specialising in the application of geophysical and advanced applied physics for precision investigations of geotechnical, environmental sites and engineered structures in UK and Europe since 1982. GBG has had a presence in Australia since 1993 originally through a joint venture with CMPS&F and GHD before becoming a stand alone company in 2003, operating in three main areas of business: geotechnical and environmental investigations; non destructive investigation of structures and contracting of equipment and staff for data collection, processing and interpretation of data.

GBG Australia is an independent provider of non destructive and shallow geophysical investigation services with applications ranging from the location of a single pre-stressing strand in a concrete slab to mine scale exploration geophysics. With clients ranging from Local to Federal Government, and from developers and engineering companies to private individuals, we can provide tailored solutions to your particular subsurface investigation requirements.

Applications for

non-destructive techniques

The owners or professionals responsible for a building will need information about its arrangement or integrity at some point in its lifetime. Frequent reasons for investigation include problems associated with workmanship, deleterious materials, durability or the need to alter the fabric during renovations/ redevelopment.

Advances in technology and greater awareness of the benefits of Non-Destructive Investigation (NDI) have led to its growing use in the inspection and investigation of buildings. There are now means of investigating the arrangement and condition of most construction material and most types of structure without intrusion or damage to fabric. This sheet summarises some of the applications, benefits and limitations of NDI of buildings.

High frequency Impulse Radar is a non-destructive technique widely used by GBG Australia in engineering applications. It is quick, accurate and relatively inexpensive method of analysis, compared to more conventional physical testing. These characteristics combine to make it well suited for investigation of large building structures. Impulse radar is one of a host of advanced techniques offered by GBG Australia to provide clients with accurate and relevant structural information quickly and with minimal disturbance.

In many cases intra-slab steel and services can be marked in situ prior to penetrations or coring. This allows for minimal disruption to the site as both procedures can be completed without interrupting operations on two occasions.

INTRA-SLAB STEEL MARKED ON SITE DURING SURVEY

VOID LOCATION IN BLOCK PARTITION WALLS

The purpose of the investigation was to survey partition walls in a new block of units to determine the extent of unfilled block work.

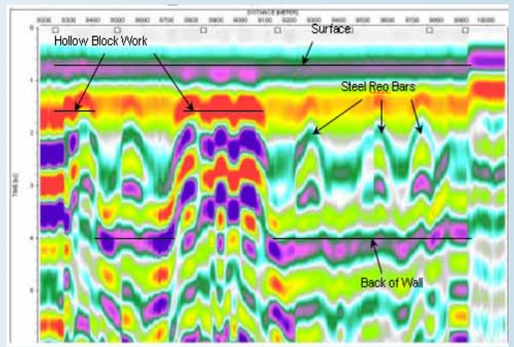
Methodology

During a survey, an antenna is used to pulse radio energy into the wall and to receive reflected responses from interfaces between materials of dissimilar electrical properties, e.g. concrete / air. A radargram is built up of continuous scans along a traverse, effectively portraying a slice through the wall. The recorded reflections may be analysed in terms of shape, travel time and signal amplitude. In the case of an unfilled cavity within the wall, the radargram produces a high amplitude responses as most of the energy is reflected back and minimal energy propagates through the wall back.

Results

The data was interpreted using REFLEX software and void locations were shown on schematic CAD drawings. Close to half the walls had large areas of hollow block work. Vertical steel reinforcement bars were found in all the walls at spacing of ~400mm. These results were used by the structural engineer to coordinate remedial grouting of the defective block work.

Data can usually be interpreted on site and marked directly on the wall for repair or can be plotted onto elevations in case evidence is required for litigation purposes

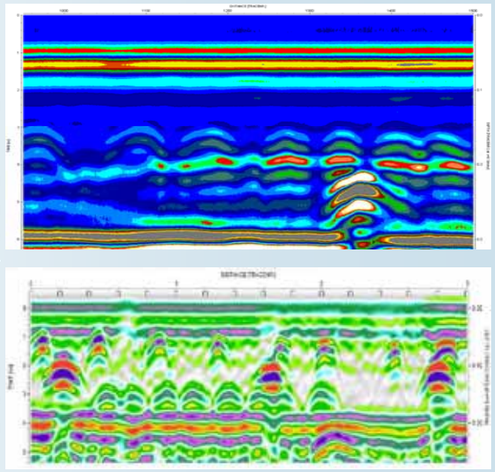


A TYPICAL RADARGRAM ALONG A VOIDED BLOCK COURSE.

TENDON DUCT LOCATION

GBG Australia investigated a ten storey concrete car park (c1970's) with lightweight design floor slabs, spanning reinforcement consisting of post tension tendons with decks sitting on a column – beam arrangement.

There were visible signs of corrosion damage to the structure, with concrete spalling occurring in a number of areas – most notably from the tendon anchor points. The investigation aimed to accurately locate the tendons and any reinforcement and to plot tendon duct location for targeted physical inspection.



RADAR PROFILES SHOWING TENDON DUCT LOCATION

Methodology

The slabs were surveyed using a 1.5 GHz antenna with a maximum profile depth of 400mm providing the best resolution of subsurface steel, and allows distinction between signals recorded from tendon ducts and reinforcement bars.

USING 1.2GHz ANTENNA FOR TENDON DUCT LOCATION

Results

The investigation accurately located the tendon ducts and also recorded some undocumented reinforcing steel bars. Results showed anomalous responses from both ducts and reinforcing steel that may be associated with corrosion. From this study, the Client was able to target physical investigations on the ducts prior to proposed repairs and updating of safety barriers.

In many instances tendon ducts and reinforcement can be located on site and marked allowing coring/penetrations through slabs to be carried out without damaging the main structural elements.

BUILDING RESPECIFICATION / FLOOR SLAB INVESTIGATION

Often when a property is undergoing assessment for redevelopment, owners / developers discover that essential building specification drawings are missing. This was the case with a Sydney site due to be converted from offices to mixed offices and residential use. Rather than base their assessment of structural capacity on minimum steel content, the developers initiated a non- destructive investigation to provide the required information. The property constructed c1940's consisted of a reinforced concrete- framed building, with brick infill walls.

Non- Destructive methods were chosen due to the requirement that tenants within the building suffer minimal disturbance during the testing. These were complimented with limited intrusive tests for correlation. It was also felt that NDT methods would provide a more complete picture than limited intrusive testing.

The main investigative method was high frequency impulse radar which provided the steel detail and floor thickness. This was complemented with a protovale CMS covermeter for greater accuracy of bar diameters and a L/CR schmidt hammer to give indicative concrete hardness.

The survey successfully identified the following:

- Reinforcing steel layout in the floor slabs, beams and columns;
- Dimensions for various column and beam types;
- Bar sizes of the various reinforced elements;
- Slab thickness information; and
- Indicative concrete compressive strengths for floor slabs, beams and columns (30-40 Mpa).

Slab investigations can be undertaken to assess thickness, reinforcement detail or areas of poor support / voids under the slab.

1.5GHz ANTENNA USED TO SCAN CONCRETE COLUMNS