

GBG Australia

Pavement and subsurface utilities Investigations

Subsurface utilities investigation of South Rd, Regents Park, Adelaide, SA.

Department for Transport, Energy and Infrastructure, SA (2009)

Subsurface investigation of pavement condition, Wareemba, NSW

Canada Bay Council, NSW (2009)

Subsurface investigation of pavement condition – Victoria Road median lane, outbound from iron cove bridge to west-bourne st, drummoyne, NSW.

RTA Technical Services Group, NSW (2009)

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Applications for Non-destructive Techniques



MIRA 3D GPR system can be utilized for subsurface investigation in open ground areas.

Applications include :

- Subsurface utilities detection and location
- Road pavement investigation
- Contaminated site assessment
- Archaeology / Grave location
- Tree root mapping



Non Destructive Technique

3D Ground Penetrating Radar (GPR) Survey

Using MIRA (Mala Imaging Radar Array)

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.



Figure 1: MIRA 3D system behind the GBG survey vehicle.

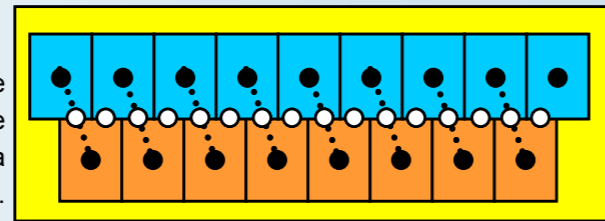
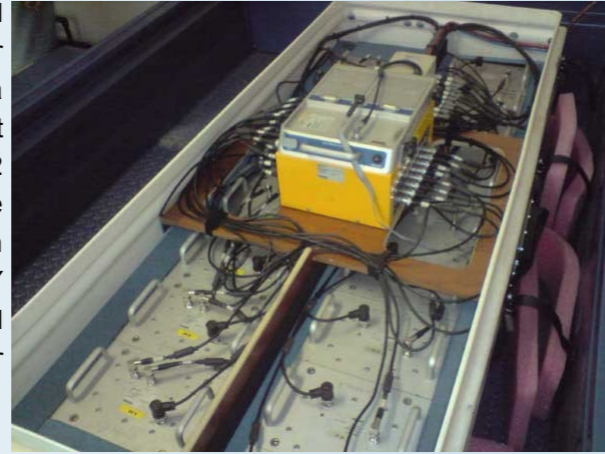
Company Expertise

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 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

With the increases in computer speed, CPU power and storage space the European GPR manufacturer Mala Radar systems has developed a true 3D system that collects up to a 2.6m swath of radar data and presents in a spatially correct plan view image. The system works by linking as many as 32 transmitters and receivers in a 2.6m wide bar and linking the transmitters and receivers so that multiple ray path acquisition is achieved providing equal sample resolution in the X and Y directions. Figure 2 is a photo of the multiple antennae and schematic plan of the transmitter / receiver configuration for the system used in Australia (16 channels, 1.3m swath width).



16 channels, 400 MHz
16 traces recorded

Figure 2 : 16 channel antennae array and schematic plan of configuration

Data collection

The swath unit is towed behind a vehicle or positioned on the front of a ride on lawn mower for ease of deployment. Because swathe data is being collected and will require stitching in a mosaic during processing very accurate positioning is required. This is acquired by using a combination of highly accurate onboard optical odometer system to give antenna position along a profile and by either a robotic theodolite system or high accuracy RTK to provide cm location referencing of swath position.

Increased computer power and the use of a dual CPU system have increased the sampling rates of GPR systems and even though this system is collecting from multiple antenna it is still possible to collect data at speeds up to 20km per hour (although in reality positioning and driving parallel straight lines are generally limiting factor). In an open field situation this system has collected up to 1Ha an hour to provide grid sampling of 8cm x 8cm over the site.

As a result of its ability to provide high resolution spatially even data, it very clearly defines buried linear features and as such is very good at resolving buried pipes, cables, trenches, buried pits and man holes.

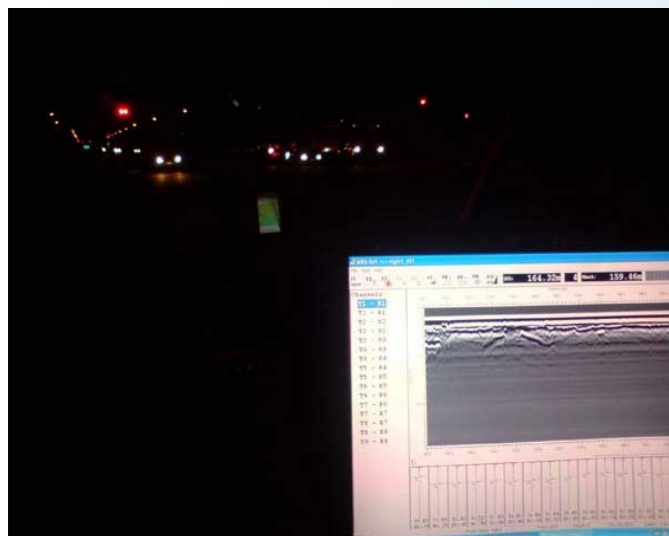


Figure 3 : Data collection during the night. A laptop computer acquisition in vehicle and a navigation for the driver in front (a small screen to top left of laptop).



Figure 4 : Post-process of GPS data of each GPR profile. GPS positions with high error (in red) will be removed from profile path. Positional accuracy can be achieved to less than ±5 m every 1 km.

Data Processing

The raw data was processed using a combination of the Mala Geoscience proprietary software called rSlicer and bespoke software developed at GBG to correct positioning errors from the RTK navigational data.

Processing involved importing the raw data and assessing for navigational data positioning errors. Correcting errors and stitching swaths together, migration of data to provide velocities for depth assessment and to correct diffraction offset errors that occur because of the way waves behave and reflections are recorded. Bandpass filtering and background removal are undertaken to provide better signal to noise ratios.

The resultant swath data can then be sliced horizontally at different depths to assess the subsurface for linear features or anomalies from buried infrastructure. Figure 6 is an indicative image of slicing through vertical profiles.

On completion of these processing steps the pavements were broken into sections and reviewed for targets. Interesting areas were then “binned” to enhance the features of interest by varying gains and filters. Features are then tracked and picked in plan view with the feature being tagged at different depths by scrolling through depth slices of data.

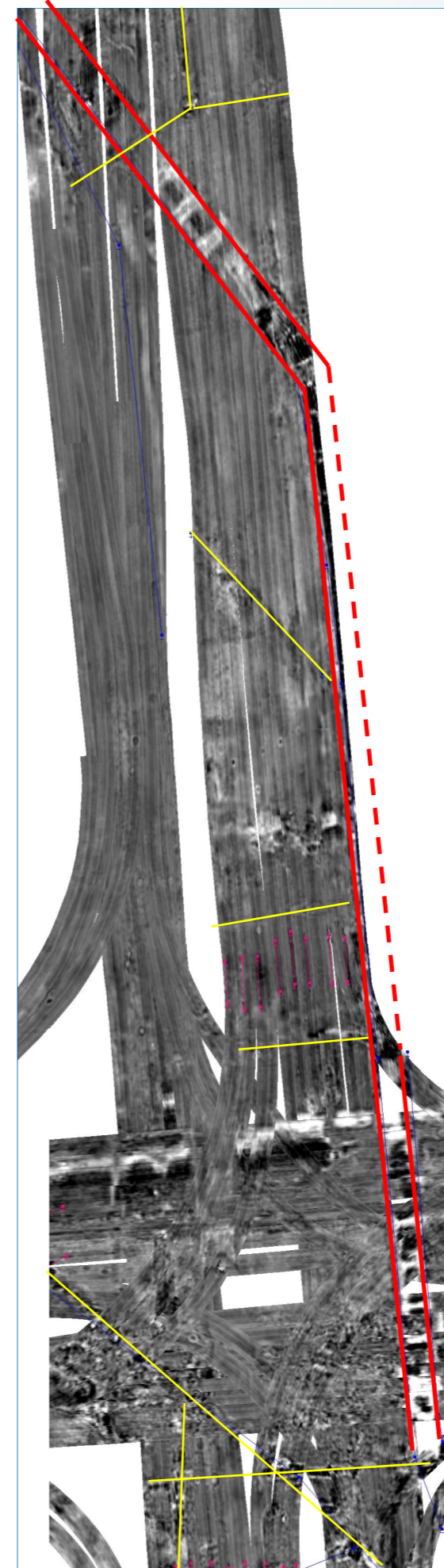


Figure 5

Figure 5 (left): A sample slice at a depth of 650mm from a junction. A bank of big power ducts is highlighted in red. Other features at similar depth are plotted in yellow.

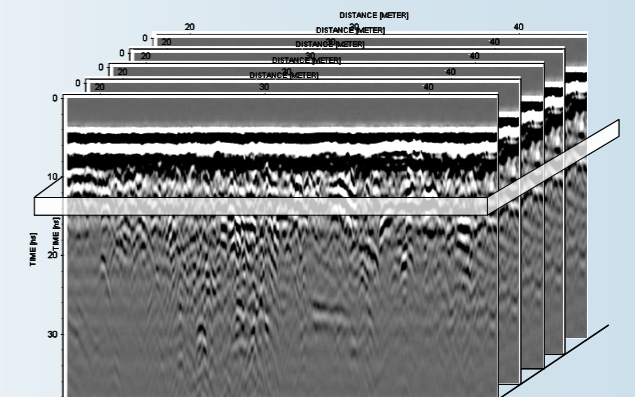


Figure 6 : Horizontal slicing through Vertical profiles