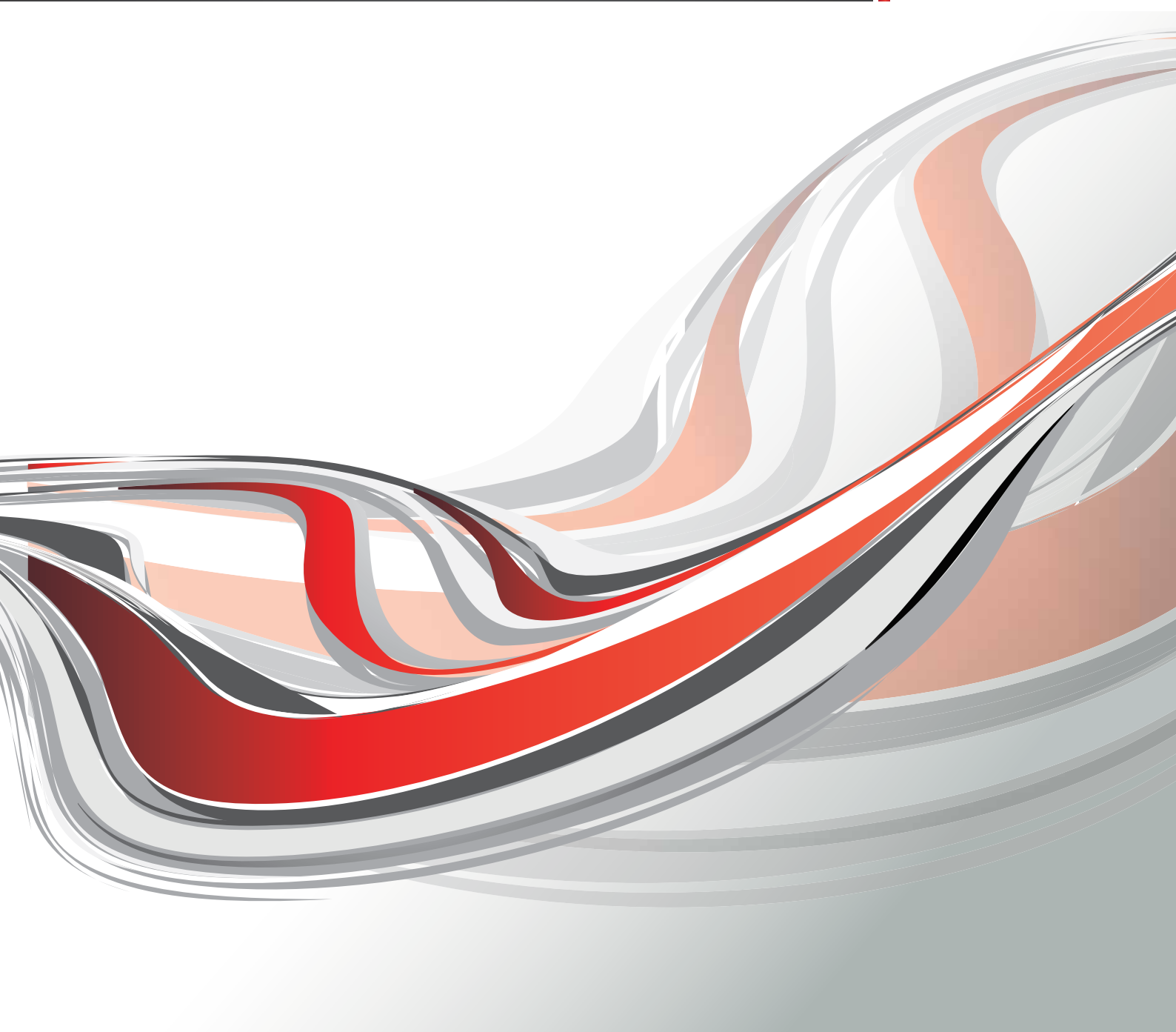




Advanced Sub-surface Investigations

Railway and Road Infrastructure



About Us

GBGMAPS, formed in 2008, is a joint venture between GBG Australia and McMullen Nolan Group (MNG). The partnership brings GBG's advanced subsurface investigation techniques together with MNG's industry leading survey and spatial information services.

Through a process of consultation and pre-project planning, GBGMAPS can tailor a geophysical solution to provide enhanced structural or subsurface information to add value to almost any geotechnical, engineering or remediation project including:

- **Mining and infrastructure**
- **Marine**
- **Environmental and groundwater**
- **Archaeology**
- **Structural and non-destructive testing**

The application of appropriate geophysical methods carried out by trained and experienced personnel makes GBGMAPS a leader in subsurface geophysical solutions.



Railway and Road Infrastructure

The structural integrity of transport infrastructure including railways and roads is of vital importance to the smooth running of major population hubs. Damaged infrastructure can lead to major delays and can cost millions not just in direct repair, but in lost revenue for associated businesses. GBGMAPS specialise in geophysical and non-destructive techniques to rapidly and accurately assess the condition of railway and road infrastructure and associated assets, minimising impact on network use while providing detailed analysis for use in maintenance planning and development.

GBGMAPS can provide valuable information such as:

- **Structural defects**
- **Construction layer thickness and structural composition**
- **Location of underground assets including utilities**
- **Subsurface integrity evaluation including voids, poor compaction, fouling**
- **Geotechnical data for design and construction**

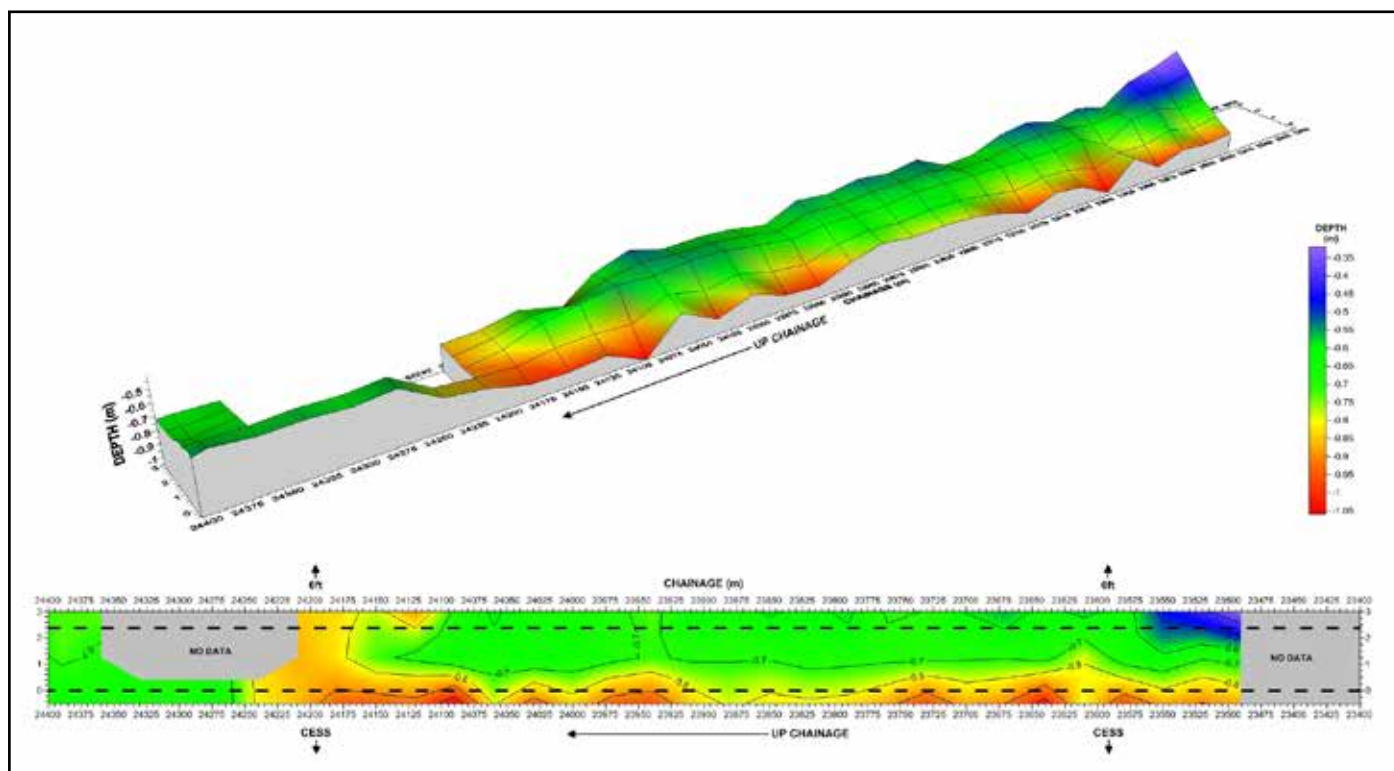


Railway Assessment

An efficient and safe railway system is essential for industry development and the community as a whole. They are expensive to build and maintain but provide a key role in the movement of freight and commuters over long distances. GBGMAPS parent company GBG Australia was instrumental in the application of Ground Penetrating Radar (GPR) for a holistic approach to sub track investigations in Australia. Major asset investigations undertaken on coal lines in the early 2000's helped establish the data collection methodology, analysis and interpretation of results. This has made GPR profiling of track beds more common place and accepted technology as an asset management tool.

GBGMAPS is still improving on the available technology and its applications and use for rail asset investigations. We regularly conduct non-invasive and continuous investigations to provide our clients with vital assessments of rail network and associated assets.

GBGMAPS investigates three main areas of rail infrastructure: rail tracks, station platforms and easement infrastructure.



3D display of ballast thickness

Rail Track

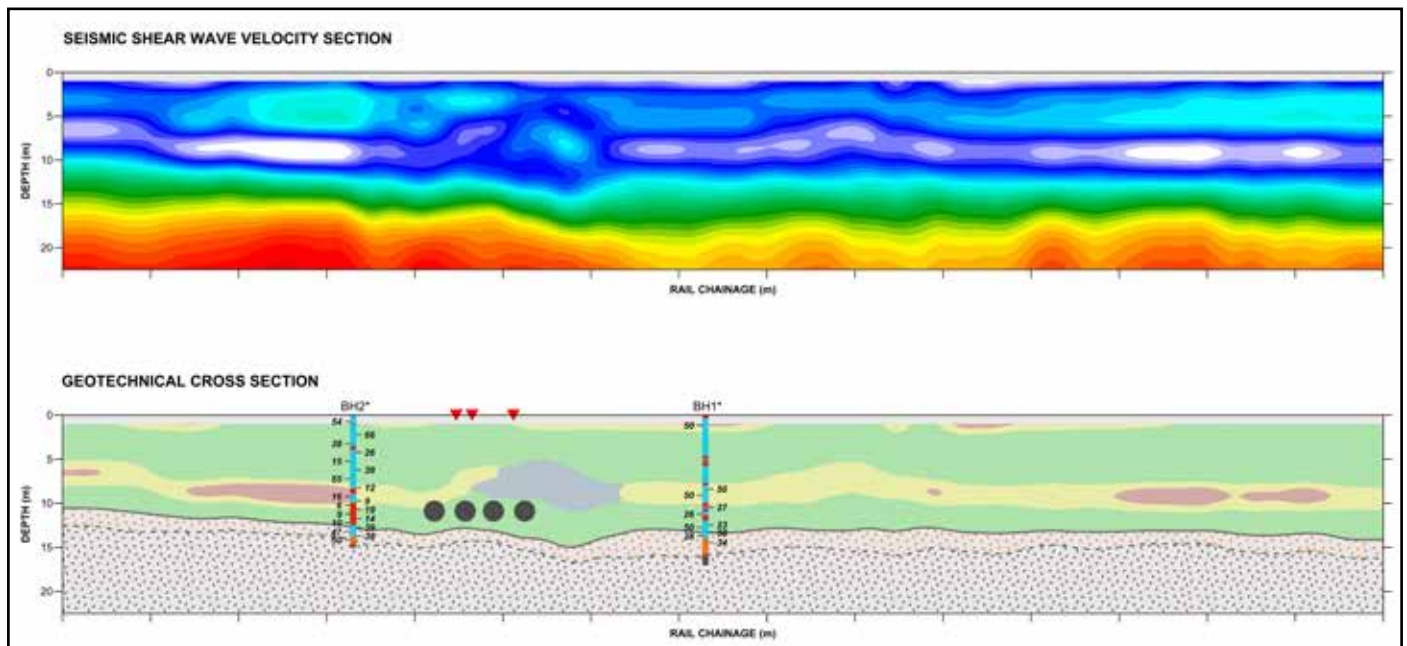
- **Ballast and formation thickness**
- **Assessment of ballast condition**
- **Assessment of formation stiffness & condition**
- **Moisture content, which may contribute to track malformation**
- **Culvert investigations for voids and sinkholes**

Station platforms

- **Structural integrity of concrete slabs and reinforcement details**
- **Thickness and condition of retaining walls**
- **Heritage building condition and re-specification**
- **Location of buried utilities**

Easement infrastructure

- **Footing and foundation assessments for overhead infrastructure**
- **Location and mapping of services within the rail corridor**
- **Earthing / soil resistivity Investigations**
- **Structural & Geotechnical assessments for railway bridges, tunnels & culverts**



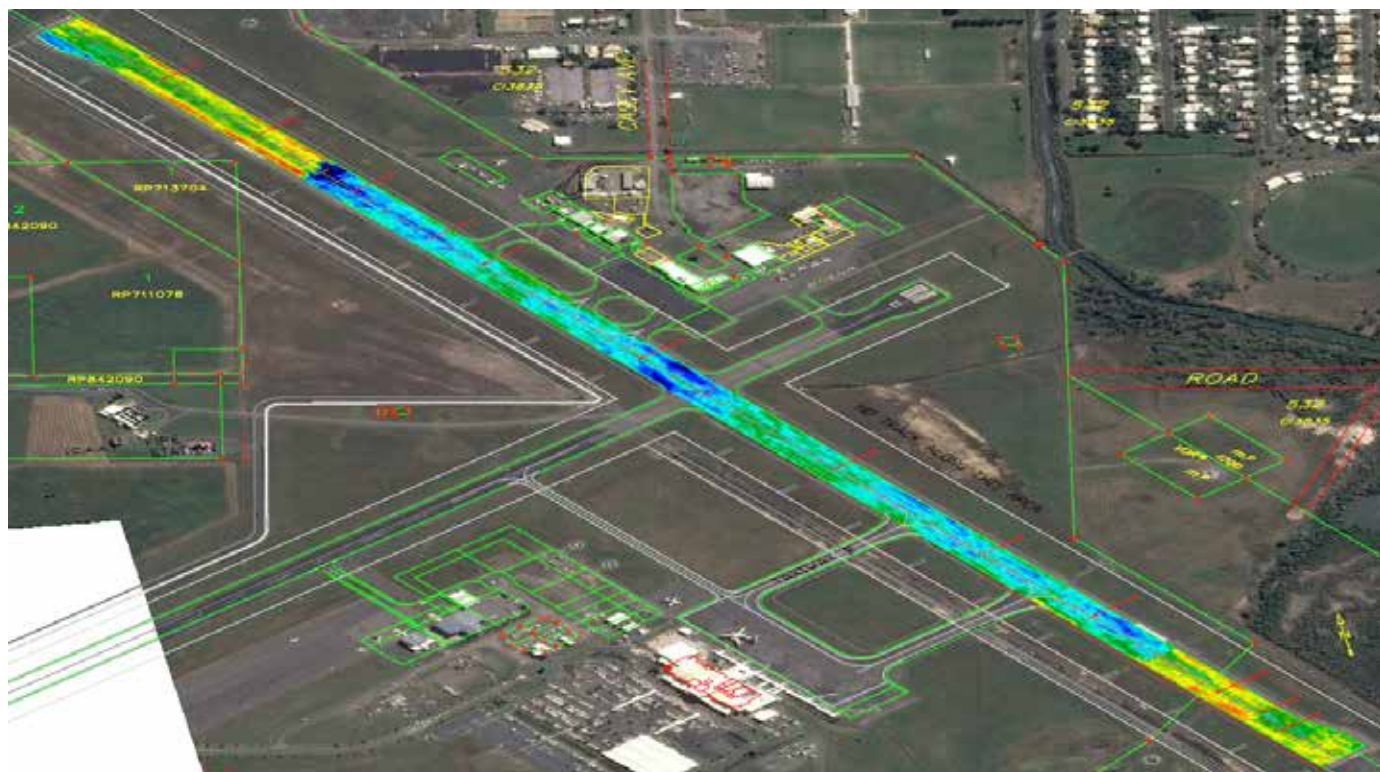
Seismic S-wave interpreted sections for track bed formation stiffness assessment around culverts, Western Australia

Pavement Asset Assessment

Australia is connected by approximately 353,000km of sealed roads and another 550,000km of gravel roads. We build and upgrade new roads annually and maintain those that exist. Data acquisition and management on existing assets and provision of geotechnical information for new assets is of extreme importance. Methods used must maximise data obtained whilst minimizing disruption to the network.

GBGMAPS together with parent company GBG Australia have over 20 years experience in the application of geophysical and non-destructive testing methods for provision of high quality subsurface construction and condition information. With our partnership with MNG (surveyors) we can also provide 3D spatial information on the surface and surrounds of pavement assets and provide this information for engineering design.

Parent company GBG Australia is an accredited panel supplier of geophysical investigation services to Roads and Maritime Services New South Wales. We were the first company in Australia to apply ground penetrating radar technology to pavement network assets by undertaking an investigation of the Sydney Metro Network and have collected and reported on 1000's of km of pavement since.



Contoured RL depths to base of AC construction for regional airport as part of due diligence – note thinner construction at extended ends

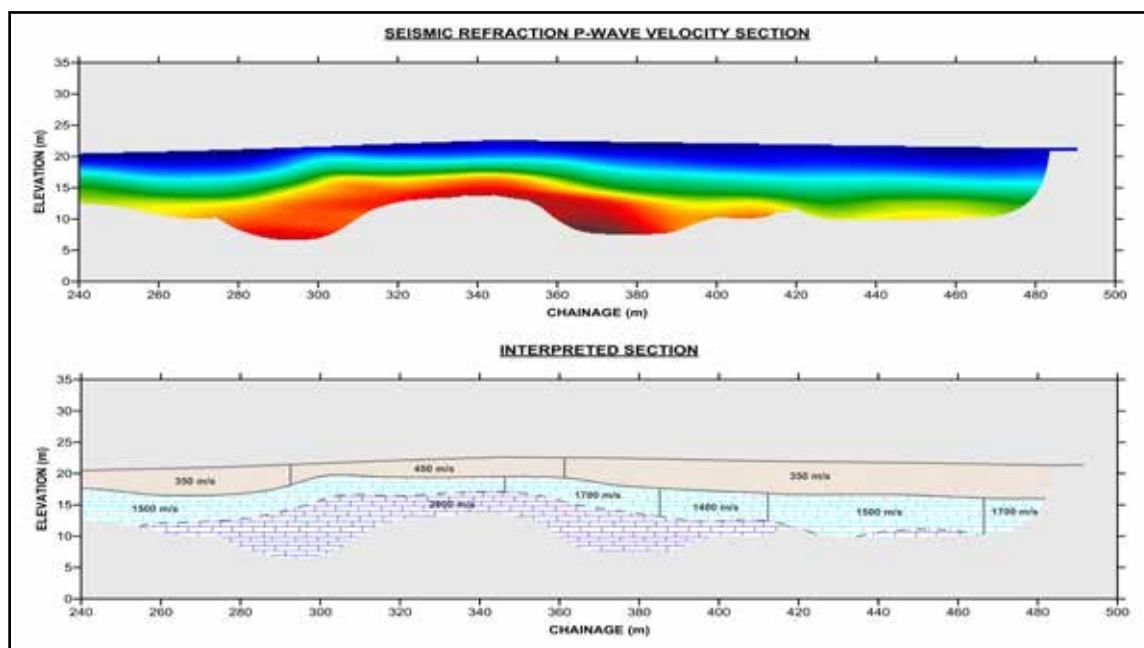
GBGMAPS undertakes investigations on road, airport and hardstand pavements using:

- **Multi-channel, multi-frequency GPR profiling for detailed project or network evaluation**
- **FWD testing of pavements**
- **Mobile laser scanning (through MNG survey partnership)**

The above methods can provide the following asset information:

- **Pavement construction thickness (network and detail)**
- **Pavement condition information (detail)**
- **Pavement elastic modulus for residual life estimation (detail)**
- **Identification of construction materials and type (network and detail)**
- **Location of buried utilities (detail)**
- **Voids and areas of poor support (detail)**
- **As built survey of road corridor (network and detail)**

As part of new road design and construction GBGMAPS can supply geotechnical information for cuttings such as material stiffness, rippability and road base quarry reserves. This information provides an overview of subsurface material and reduces costs and time associated with traditional engineering methods such as boreholes and test pits.



Seismic refraction profiling - output as P-wave velocity image and interpreted section



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