



# PERTH, AUSTRALIA PASSENGER RAILWAY TUNNELS

Fugro carried out remote monitoring of twin concrete live rail tunnels prior and during construction of a new tunnel directly above the existing ones. GeODin is part of the fully automated system for data capture, processing, backup, alarms & reporting.

## TUNNEL MONITORING

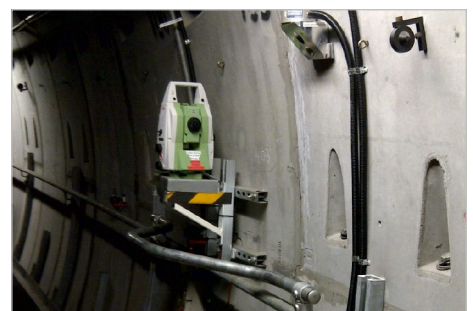
Twin existing railway tunnels in Perth are remotely monitored 24 hours a day. Each tunnel is concrete lined at ca. 6m in diameter. During new tunnel construction measurements were made every 30 minutes over a period of two years. Monitoring commenced in Q4 2010 and will run at least 8 years. The project requirements included 12 months of baseline data prior to the commencement of construction. Equipment installation was only possible during two weekend 'shutdowns' totalling 70 hours and general access to the site is limited to 00:30 to 04:30 nightly.

## DATA PROCESSING

Data collection and processing is highly customised and 100% automated, due to the large amount of data collected (over 32,000 measurements a day). Fugro developed software for controlling total stations, whilst a vendor supplied software for crackmeters and vibration meters. Measurement, data from all instruments is formatted and sent to the GeODin database. Triggers within the database are used to begin processing the data adjusting for changes in pressure and temperature. After passing a series of quality tests, the processed data is then written to the database.



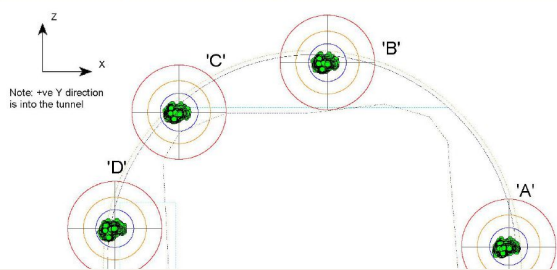
Tunneling machine



Total station installed in a tunnel



Prism array: Tunnel 2 / Ring 81

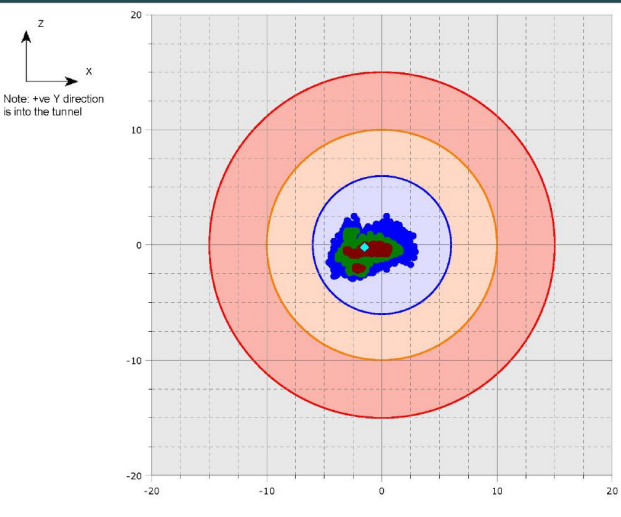


Prism Name	First Measurement	Latest Measurement	Position Clockwise
MP2-081-A	16/11/2010	07/05/2013	3
MP2-081-E	16/11/2010	07/05/2013	7
MP2-081-D	16/11/2010	07/05/2013	9
MP2-081-C	16/11/2010	07/05/2013	10
MP2-081-B	16/11/2010	07/05/2013	12

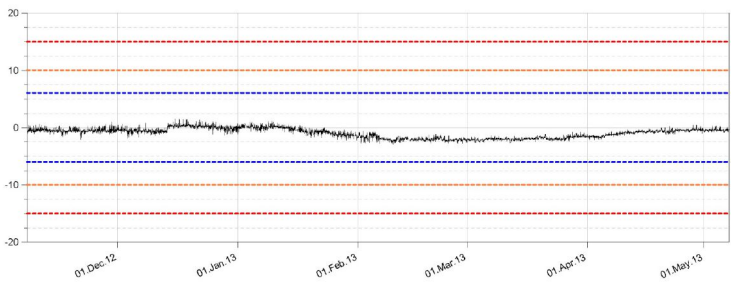


View details Prism MP2-081-A - DZ Timeline Last Measurement: 07/05/2013 14:46

View details Prism MP2-081-A, DX - DZ Plot



First Measurement	Minimum	Maximum	Last Measurement	Total # of Measurements
07/11/2012	-0.0029 [m]	0.0016 [m]	-0.0003 [m]	8222



- < 50th Percentile
- 50th to 90th Percentile
- > 90th Percentile
- ◆ Latest Measurement

**REPORTING**

GeODin provides an online portal for managing, presenting and analysing measurement data from geological and geotechnical instrumentation. Generally, reports consist of changes relative to the first measurement, with prisms for reporting x,y,z position around a concrete segment and crackmeters measuring displacement. Reports can be saved as PDFs or the data can be downloaded as .csv files.

Reports are not saved automatically as data is continually updated - reporting uses the most recent data. Fugro made a customised notification system for measurements outside allowable tolerances and for instrumentation that has failed to make a measurement when expected. All client users require username and password access to the monitoring portal.

**TECHNICAL DETAILS**

The recommended system requirements are PCs running Windows 10 (32- and 64-bit) with 4GB RAM and a display resolution of a 1920 x 1080 px. GeODin may also be run from a Windows 2012 Server or Citrix. Previous Windows operating systems and RAM configurations may work, but these are not supported. When working with client/server databases the appropriate database drivers must also be installed. Please contact your network administrator for further information.

GeODin can be used as a stand-alone program or integrated in a multi-user network. GeODin is available in English, French, German, Italian, Portuguese, Spanish, Russian and Turkish. Integrated contextual help is provided in English and German.

GeODin is designed, programmed and distributed exclusively by Fugro. Visit [www.geodin.com](http://www.geodin.com) for further information.

