

# Ensuring the safe delivery of a metro tunnel in Melbourne

**Country**  
Australia

**Project type:**  
Tunneling

**Sector:**  
Transportation infrastructure

**Main product:**  
Worldsensing Monitoring Solution

## Challenge

Melbourne’s Metro Tunnel Project will deliver twin nine-kilometer rail tunnels from the suburbs of Kensington to South Yarra, in addition to five new underground stations. Worldsensing Partner, Geomotion Australia, has been tasked with monitoring excavations and potential movements of surface and third party assets related to the construction of this project which is being designed and constructed by a public-private partnership joint venture.

The scope of works includes bored tunnels together with excavation of cut-and-cover stations, caverns and cross-passage of which must be monitored for below ground and surface movements. At any stage of the project, it is important to confirm that ground and support systems are behaving in accordance with the design predictions.



Figure 1: Project scope



Figure 2: Anchor load cells connected to a 5-channel vibrating wire data logger.



Figures 3: Tiltmeters installed under a bridge.

# Solution

Geomotion has an important involvement in the monitoring of the excavation of the ground surfaces and selected third party assets related to project construction. Instrument installation started in 2018 and just over five years later thousands of geotechnical instruments have been installed project-wide to ensure the full, in-depth monitoring of the construction area and its surroundings.



Figures 4, 5 and 6: Gateway gathering data from tiltmeters and extensometers installed with data loggers on the track.

A wide range of geotechnical instruments have been deployed to provide data related to the potential movement risks to infrastructure. The instruments included tiltmeters, in-place inclinometers, strain gauges, beam electrolevels, extensometers, piezometers, vibrating wires, crack meters and load cells. Instruments are connected to wireless data loggers, which are part of the Worldsensing IoT remote monitoring solution, to ensure effective transfer of data. Gateways collect the data from the LoRa-powered nodes spread throughout the project and send the data to the Connectivity Management Tool network monitoring software to help furnish a near real-time picture of the project's critical aspects.



Figures 7 and 8: Data loggers connected to piezometers around the shaft and TBM alignment



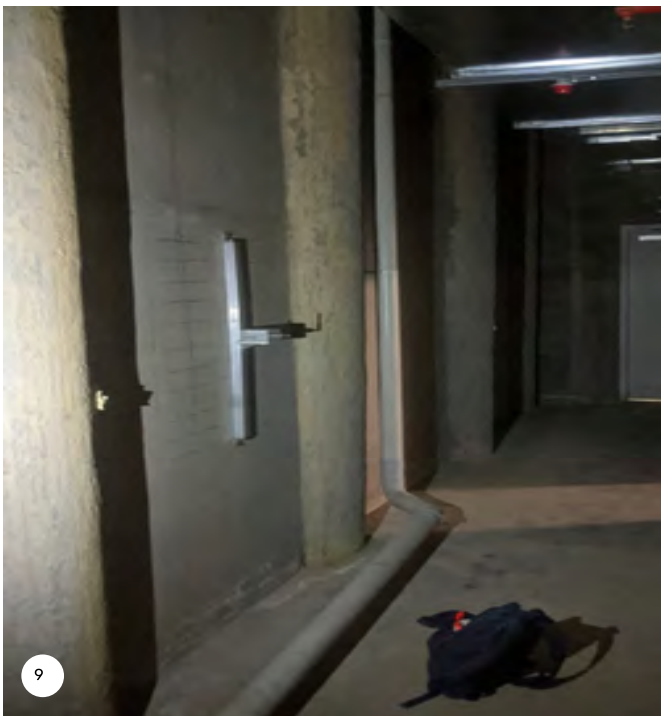
## Benefits

Information from strain gauges, tiltmeters and other instruments allows construction management to monitor that the project is following the design.

Data from all instruments such as piezometers and load cells can also trigger pre-planned contingency actions to control risks associated with the construction work. Meanwhile, the Worldsensing equipment gathers instrument information in near real-time, which helps the construction team to make informed, timely decisions.

## Advantages

- Worldsensing devices can cover long distances, picking up data from kilometers inside the tunnel or underground in caverns, which saves not only cabling costs but also manual maintenance.
- Instruments from different suppliers can be connected to a single wireless monitoring solution.
- Wireless communication does away with the need for cabling, speeding up installation.
- Network management software provides the status of the devices in the network and enables integration with an engineering service provider's proprietary software or other visualization tools



Figures 9 and 10: Tiltmeters on tilt beams installed in basements.

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“Worldsensing products are very easy to use. We can connect any type of sensor: strain gauges, extensometers, piezometers... we often install simultaneously with other trades on site, being able to connect to the logger in just a few minutes saves the customer time and money.

It couldn't be more simple – we connect our device to the logger, fill out the information and the data will start transmitting to the gateway and online.

Another great advantage of the system is the ability to change the reading frequency from a click of a finger without the need to go on site. For example, before starting excavation the frequency required is daily. But once the excavation starts it has to be every 4h. So no need to access every logger to change it, it can all be done online.”

### Geomotion Australia



Figures 11 and 12: Personnel installing a digital logger connected to an in-place inclinometer (IPI).

### About Geomotion Australia

Geomotion Australia specialises in the installation and monitoring of structural, environmental and geotechnical instrumentation for assets in civil engineering, mining, railway and road infrastructures.

Their reputation as leaders in this field is based on more than 15 years of operation in Australia, bringing the latest technologies and innovations to their customers to ensure operational efficiency and value.