



TUNNELLING AND URBAN INFRASTRUCTURE

- ▲ Earth Retention & Shoring
- ▲ Groundwater Control
- ▲ Soil Stabilisation
- ▲ Settlement Control
- ▲ Shafts

GLOBAL STRENGTH AND LOCAL FOCUS



TUNNELLING AND URBAN INFRASTRUCTURE

Geotechnical Services for soil and rock retention and improvement

Keller has unrivalled global experience in providing expertise in geotechnical construction for the tunnelling industry. Whether the challenge relates to ground conditions, urban constraints or the need for innovation, Keller has the capability to address the unique construction challenges for tunnels and deep excavations. Keller provides, design and build or build only solutions that recognise and mitigate risks and deliver value.



- ▲ Local understanding of geotechnical conditions and risks
- ▲ World leading experience in complex geotechnical construction processes
- ▲ Design, management, and field staff experienced in application of techniques for tunnelling projects
- ▲ The most complete suite of geotechnical construction techniques to provide ground retention and improvement
- ▲ Over 20 regional offices in Asia Pacific with local workshop facilities to respond quickly and efficiently
- ▲ An extensive fleet of modern equipment and specialty tooling to address geological and logistical conditions.
- ▲ In house Data Acquisition systems to record performance and provide industry leading quality assurance.
- ▲ Part of the globally connected group of Keller companies with direct access to the largest geotechnical construction knowledge base in the industry.

THINK SAFE

Safety is critical to all operations at Keller. The ultimate goal of our global THINK SAFE program is zero incidents. Our crew begin each day with a site hazard analysis meeting in which hazards related to the specific tasks being performed that day are identified and the required safety measures to avert an incident are implemented.



EARTH RETENTION & SHORING

The construction of tunnel launch and retrieval chambers, dive structures and station boxes typically require deep retaining walls. While there are many techniques available for forming these structures, what sets Keller apart is our deep understanding of the construction risks involved with these methods and more importantly how they can be innovated to meet the specific challenges of complex urban infrastructure projects. Just ask Keller, the chances are we have faced similar challenges somewhere in the world.

LUCKNOW METRO, INDIA



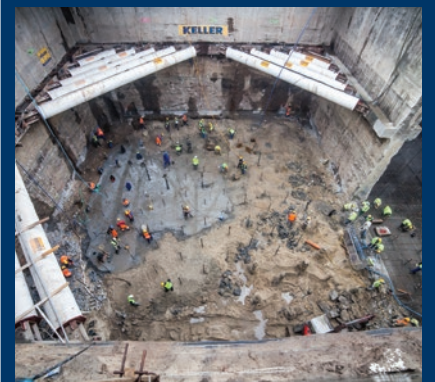
A new metro line in Lucknow, India required a station box to be constructed in the midst of a very busy urban environment. With our reputation for safety Keller were chosen to install 1m thick diaphragm walls up to 25m deep for a 275m long 25m wide box together with barrettes and plunge columns for the internal structure.

KUALA LUMPUR MRT, MALAYSIA



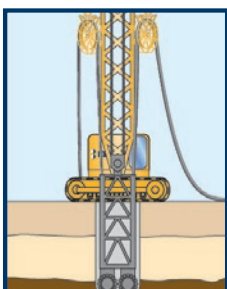
Kuala Lumpur's Karst geology provides significant challenges for geotechnical construction with both the highly variable rockhead and potential for solution features presenting risks to tunnellers. With our wide range of specialty capabilities Keller was chosen to deliver diaphragm wall 'boxes', secant piled shafts as well as significant ground improvement works.

GDAŃSK RIVER TUNNEL, POLAND

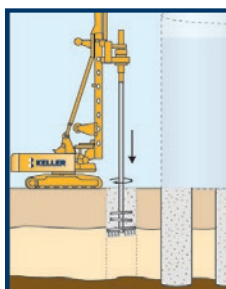


The first TBM tunnel project in Poland, Keller were selected as design and construct contractors to deliver dive structures, TBM launch and retrieval chambers and cross passage ground improvement. With excavations up to 22m deep in soft fine grained soils the integration of ground improvement and retaining wall designs was vital to deliver a robust efficient system.

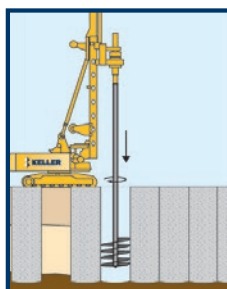
Typical Earth Retention Techniques



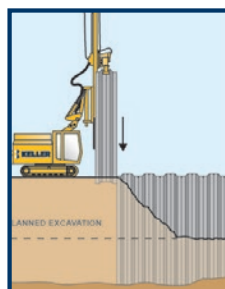
DIAPHRAGM WALL



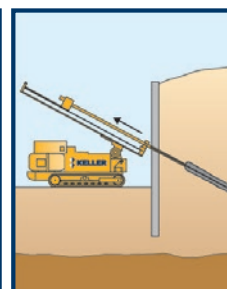
WET SOIL MIXING



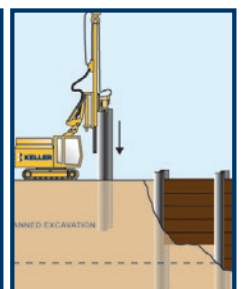
SECANT & CONTIGUOUS PILE WALL



SHEET PILE WALL



GROUND ANCHORS



SOLDIER PILES & LAGGING

GROUND WATER CONTROL AND SOIL STABILISATION

As engineers, designers and constructors we are increasingly challenged with building in confined sites next to sensitive and valuable existing infrastructure. Keller has the tools and more importantly the know how of how soil can be stabilised and groundwater can be controlled to ensure that we build without damage to the existing infrastructure of our communities.

SYDNEY WESTCONNEX, AUSTRALIA



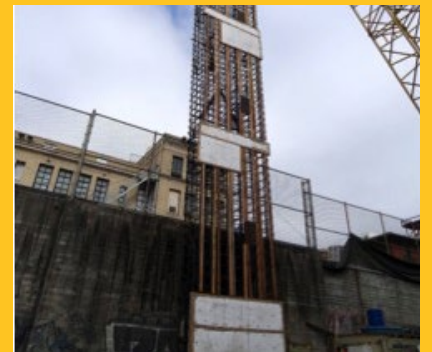
Keller provided a range of grouting techniques including Jet Grouting and rock grouting to minimise groundwater inflows into the dive structure for Sydney's Westconnex urban motorway project. Our ability to provide solutions ensures the best method is applied to the challenge.

VICTORIA STATION UPGRADE, LONDON



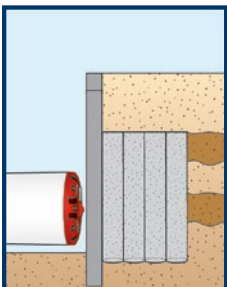
The addition of new passenger access tunnels to the already complicated underground space around Victoria station required highly detailed planning and construction. Keller used BIM to ensure Jet Grout columns were built in and around the myriad of services to provide the necessary improvement ahead of hand tunnelling through the water bearing Thames gravel.

SAN FRANCISCO THIRD STREET RAIL, USA

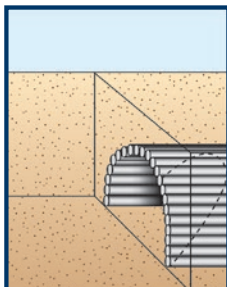


The Central Subway is the second phase of San Francisco's Third Street Light Rail Program and took place within highly populated neighbourhoods. Simultaneous execution of multiple foundation techniques at three small sites with limited staging availability and laydown areas, required top level planning, coordination, and performance. Jet Grouting Soil Stabilisation and Compensation Grouting was used in conjunction with over 20,000m² of Diaphragm Walls.

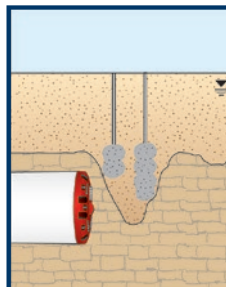
Typical Ground Water Control and Soil Stabilisation Applications



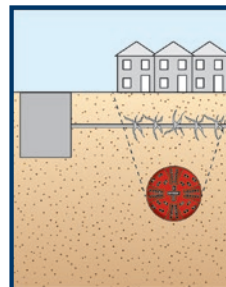
TUNNEL BREAK OUT/
IN STABILISATION



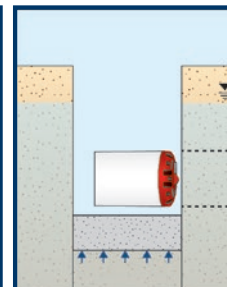
CANOPY TUBE/PIPE
UMBRELLA ROOF SUPPORT



FACE STABILISATION/
STABILITY IMPROVEMENT



COMPENSATION GROUTING
SETTLEMENT CONTROL



GROUND WATER CONTROL
FOR PIT EXCAVATIONS

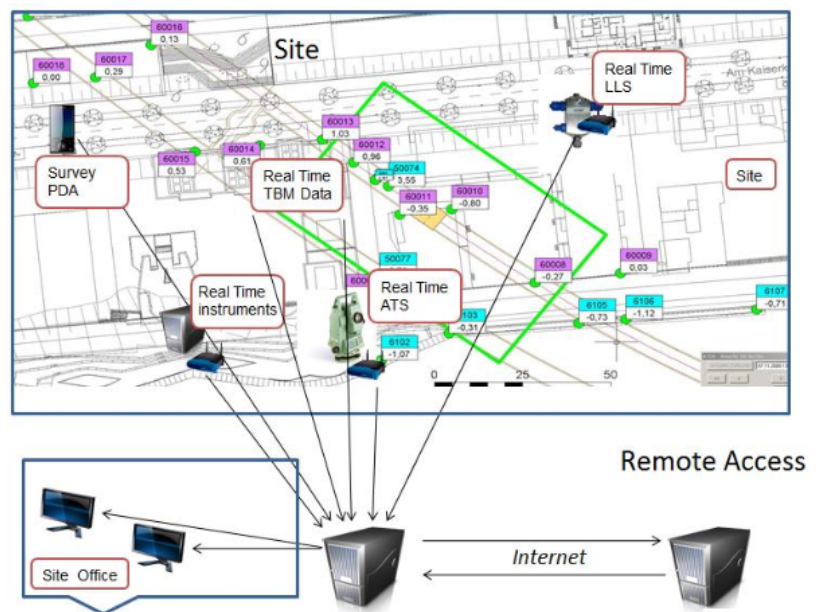
AS PART OF THE CONNECTED COMPANIES OF KELLER, we have access to the largest centralized geotechnical knowledge base and more techniques than anyone in the industry. This means we're ready to respond with the optimal solution to the project, whenever required, whatever the challenge, wherever the location.



INSTRUMENTATION & MONITORING

Keller, through its specialist Getec & Geo Instruments businesses, is an industry leader in the development and implementation of computerized systems for real-time monitoring of critical excavation, tunnelling and drilling activities. Further, we have developed our systems to incorporate monitoring and control for drilling and grouting parameters.

Long-range wireless and GSM communication with remote high precision structural and geotechnical sensors, grouting plant and TBM's can provide engineers with ground , process and tunneling performance data from multiple production locations. For control systems, panel excavation, drilling and grouting data are collected through a network of sensors within machines by on-board computers which sync to a site dedicated server, providing real time monitoring , production and quality data in archival form or BIM compliant packages.



Common Uses

- ▲ Settlement Control
- ▲ Tunnelling data
- ▲ Grouting Processes
- ▲ Geotechnical data
- ▲ Diaphragm Walls and Piling

Advantages

- ▲ Provides real-time, continuous quality control to verify compliance with design parameters.
- ▲ Allows real-time analysis from multiple inputs.
- ▲ Allows monitoring of pressure-displacement and ground response during compaction grouting.
- ▲ Provides the ability to quickly identify problems, control risk and value engineer.

WHAT MAKES US DIFFERENT?

Expertise

We are leaders in the technologies we provide. We maintain this leadership via our connected **Global Product Team** structure that facilitate the adoption of **world leading product best practice** and company minimum standards. This expertise is made available to our customers at all stages of the project.



HSE Focus

We are relentlessly focused on ensuring the Health, Safety and Environmental well being of our employees and worksites. With **decades of experience** with works associated with tunnelling **we understand the elevated level of risk** and have developed the focus and process required to mitigate those risks.



Global

As the world's leading geotechnical solutions provider we provide the surety that we'll be **with you until the project is complete**. Our strong balance sheet, corporate compliance and resources makes us an **attractive partner for owners and general contractors** seeking to include specialist capability on major projects bid teams.



Local

We are a truly local business. Our understanding of the local geotechnical and market conditions is based on our superintendents and operators having **completed numerous local projects**, many of our engineers and project managers attended local universities and we often play leading roles in industry bodies. Our **local workshops** and rig fleets ensure we have the capacity to deliver.





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