TUNNELLING
OUR TUNNELLING CAPABILITIES

ROAD

RAIL

WATER

POWER

UTILITIES

SEWERS

PLACING YOUR NEEDS FIRST
YOU SEEK...
WE DELIVER...

CONNECTED COMMUNITIES. NEXT GENERATION TRANSPORT OPTIONS THAT PLACE PEOPLE FIRST

WATER AND POWER SECURITY. SUSTAINABLE SOLUTIONS TO MEET FUTURE REQUIREMENTS
DYNAMIC AND ADAPTIVE COMMUNICATION NETWORKS. WORLD-CLASS PROJECTS THAT PROMOTE DEVELOPMENT AND INVESTMENT

SAFE, RELIABLE, COST-EFFICIENT TRANSPORT. STATE-OF-THE-ART, SERVICE-CENTRIC INFRASTRUCTURE
Increased population in our major urban centres and the strain this is placing on above ground infrastructure demands that we look for new ways to move people and essential services.

This challenge not only calls for smarter designs that take construction below street level to avoid disruption and increase the efficiency of the end solution, but also innovative tunnelling methods that can meet the requirements of more complex underground networks.

Smart planning for our new world cities is literally taking transport and utilities infrastructure to a new level, providing a sustainable long-term solution.

We are leading the way with new methods of underground construction, delivering Australia’s longest and most complex tunnelling projects, including Australia’s largest road infrastructure project the $4.8 billion Airport Link.

OUR TUNNELLING PROJECTS ARE:

» Creating more efficient road and rail networks
» Securing our energy, water and utilities needs for the future
» Introducing new techniques to allow for longer tunnels that are excavated in less time
» Delivering a whole-of-life approach, including mechanical and electrical works and infrastructure management

THE NEED FOR SMARTER, MORE EFFICIENT TRANSPORT AND RESOURCES SOLUTIONS WILL REQUIRE US TO DIG DEEPER, FURTHER AND FASTER
INCREASED GROWTH AND RAPID URBANISATION MEANS WE HAVE TO BE SMART ABOUT HOW WE PLAN FOR THE FUTURE

By 2050 Australia’s population is expected to increase to 35 million. Most Australians will live and work in and around major cities. Tunnel networks provide the opportunity to move our essential services below and around established systems – a solution that synchronises current and future infrastructure and allows for effective operation and maintenance.

Australia deserves systems and services that match the expectations of its people. We have the opportunity to transform our cities in the same way that the London Underground and New York Subway have become more than just transport systems – they are landmarks that have shaped the landscape without imposing on it.

These smarter networks allow us to directly link people, places and essential services while ensuring minimal disruption to communities. They also ensure that vital infrastructure has the capacity to meet future needs without placing extra strain on our already stretched above ground urban developments.

The name Thiess is synonymous with tunnelling. Our experience in this highly technical engineering capability goes back to 1958 and the Snowy Mountains Hydro Electric Scheme. Since then, we have continued to innovate with new technologies allowing for faster, safer and more accurate construction.

We provide the expertise, equipment and innovation for the nation’s most advanced tunnelling projects. Our team has also developed comprehensive procedures to help address community issues and achieve environmental excellence.

We are currently completing two of the largest infrastructure projects ever undertaken in Australia. Airport Link in Brisbane comprises a dual 6.7km mainly underground toll road and a 1.5km tunnel for the Windsor to Kedron section of the Northern Busway. By 2026, Airport Link is expected to be carrying 150,000 vehicles per day while the Northern Busway will carry one bus every 20 seconds.

In Victoria, two 4.8 metre diameter slurry Tunnel Boring Machines (TBMs) were used to construct the underground seawater intake and outlet tunnels for the State’s desalination plant. This $3.5 billion project will be capable of supplying up to 150 billion litres of water a year – about a third of Melbourne’s annual water needs – independent of rainfall.
**CLIENT SATISFACTION**
Thiess was the first contractor in Australia to use a Geotechnical Baseline Report as part of the contract documentation to provide a fair distribution of risk and return between the client and the contractor. To ensure client satisfaction, we are flexible in the type of contract we use. We partner with our clients at the earliest opportunity to ensure we capture and deliver on the needs of all stakeholders.

**TRACK RECORD**
A unique technique used on the construction of the Epping to Chatswood Rail Line in Sydney allowed a concrete roadbed to be poured while the TBMs continued excavation. As the TBMs advanced, precast elements were installed between the machine’s back-up support rails, which provided the sideforms for an unreinforced concrete infill. This not only provided cost savings, it was also a safer and more efficient work method as it allowed the use of rubber-tyred vehicles during excavation and the rapid installation of train tracks.

**COMMUNITY FOCUS**
Detailed planning prior to construction enabled us to deliver the City West Cable Tunnel with no community impacts. Predictive vibration modelling, based on our previous tunnelling projects, was used to demonstrate that we could excavate the tunnel with no vibration or regenerated noise impact to the Sydney CBD community. An acoustic shed was built above the primary access shaft and surrounding work area, enabling the project to proceed on a 24 hour basis.
The City West Cable Tunnel (CWCT) is an example of how sustainable design can reduce long term maintenance costs and increase the working life of a significant piece of infrastructure. Passing below Sydney’s CBD, the 1.6km long CWCT carries 132kV electricity transmission feeder cables from TransGrid’s bulk supply point to the new City North Substation. This substation is designed to supply up to one quarter of the city’s future electricity requirements.

The cable tunnel solution for client EnergyAustralia eliminated major disruption to the city’s CBD by providing an alternative to the traditional ‘pit and trench’ method, which would have required extensive excavation in busy city streets.

Construction involved the use of a 3.75 metre diameter TBM for 1.62km of tunnel and a roadheader for excavation of 100 metres. The tunnel varies from about 25 metres to 45 metres deep, with a maximum gradient of 3 per cent for the TBM sections, which allowed efficient spoil removal. Excavation was primarily through Sydney Sandstone, but also passed through the Pittman Dyke and the Great Sydney Dyke, comprising very hard igneous material.

The $54 million project is relatively unique among hard-ground cable tunnels in that it is a segment-lined tunnel rather than shotcrete lining and groundwater drains. We took responsibility for the design of the precast concrete segments, plus analysis and monitoring of any settlement. Conservative estimates demonstrate the additional cost of lining the tunnel will be recovered within seven years through reduced maintenance.

This commitment to sustainable excellence was carried across every facet of the project. Initiatives including water recycling and the use of 100 per cent GreenPower for construction has seen the CWCT become a world class example of how major tunnelling projects can reduce their environmental impact.

The CWCT has set a new standard for the design, delivery and operation of critical infrastructure.
PROJECT ACHIEVEMENTS

» Passes within a few metres of major city office towers and infrastructure, including the Cross City Tunnel.

» A critical part of Sydney’s future energy infrastructure network.

» The first tunnel project in Australia to be driven by 100 per cent accredited GreenPower.

» Approximately 45,600 tonnes of sandstone spoil was excavated during construction with 100 per cent of the spoil excavated beneficially reused.

» A recycling system was developed that enabled the cooling and segregation of process water.

» By recycling cooling water the project reused 134 million litres of water that would otherwise have been drawn from the municipal supply.

» Features include automated lights and ventilation fans that operate on an engineer’s arrival to the tunnel and shut off when exiting.

» A tunnel lining was designed that ensures the integrity of every structure in the CWCT zone of influence.
From smart planning and integrated design, to our fit-for-purpose solutions, full mechanical and electrical fitout, and ultimately operation and maintenance, every aspect of our delivery is focused on achieving first class outcomes for you.

We go beyond simply delivering the project – we develop smart ideas to ensure sustainable solutions.

As a founding member of the Australian Green Infrastructure Council, we are committed to the delivery of more sustainable outcomes from the design, construction and operation of Australia’s infrastructure.

No matter what the project, the goal is to complete it with as little impact on the environment and community as possible.
As one of Australia’s largest tunnelling contractors, we have a strong history of introducing new techniques to meet some of the most challenging project requirements. Our team is one of our key points of difference and is adept at providing expertise and management from the earliest stages of project definition.

Our extensive knowledge extends from excavation in hard rock through to soft soils and flowing sands. We can develop a tunnelling methodology for any specific circumstance to meet the needs of the client and the project.

Our specific tunnelling methods are based on the precise requirements and purpose of the infrastructure. This ensures the integrity of both the asset and all above ground structures covering the project alignment.

Forward thinking designs, precision planning and safe, low risk methods ensure fit-for-purpose solutions.

"OUR WEALTH OF EXPERIENCE COVERS ALL AREAS OF TUNNELLING, UNDERGROUND EXCAVATION AND CONSTRUCTION"

WE DON’T JUST CONSTRUCT AND SERVICE, WE THINK AHEAD:
» Maintaining a clear focus on safety
» Being flexible in our approach
» Working in partnership with all stakeholders
» Offering certainty of delivery

OUR EXPERTISE COVERS:
» TBM hard and soft rock - segmentally, slip-form-lined and unlined
» Earth Pressure Balance TBMs
» Slurry TBMs
» Continuous miner excavations
» Micro tunnelling and pipe jacking
» Roadheader excavations in hard and soft ground and low depths of cover
» NATM (New Austrian Tunnelling Method)
» Drill and blast
» Shaft sinking
» Raise bore
» Canopy tubes
PLANT & EQUIPMENT

WE WORK WITH THE WORLD’S MOST SOPHISTICATED TUNNELLING PLANT AND EQUIPMENT

Our plant fleet includes TBMs and roadheaders together with the necessary equipment for a range of tunnelling activities, including ventilation systems, shaft construction and waste removal. We own, operate and maintain a diversified fleet of tunnelling and construction equipment and have longstanding and deep relationships with the major plant suppliers.

Five world-first tunnel lining machines have been utilised on the Airport Link Project. The ‘variable arch forms’ are a critical component of the project, lining the tunnels with a series of concrete arch segments and ensuring a top quality finish. The variable nature makes them unique as it is the first time an arch form has been designed to line tunnels with multiple lane configurations. Through the use of hydraulics and a series of steel segments, the arch forms can transform from a three-lane, 17 metre diameter, 350 tonne machine to a cavern-lining 30 metre, 500 tonne machine. The Airport Link Project also includes the largest underground caverns in the world for a road tunnel project and the third largest jacked box in the world.

The two TBMs that constructed the tunnels for the Victorian Desalination Project are 91 metres long and consist of a 4.8 metre diameter rotating cutter head followed by trailing support mechanisms. The machines operated 15 to 20 metres below the sea floor, the cutter head excavating a length of ground which was then lined with pre-cast concrete rings, forming a watertight concrete tunnel. Hydraulic jacks then pushed the TBM forward a short distance with the process repeated until the tunnels were completed.

Airport Link’s dual 5.7km tunnels have been excavated using the two largest TBMs ever to operate in Australia. The $90 million machines, which are 165 metres long and 12.48 metres in diameter, cut through about 85 metres of rock each week. Requiring 22 operators each and weighing about 3000 tonnes, they travelled 55 metres below the surface at the deepest section of tunnel. Seventeen roadheaders were also used on the project, the most on any Australian infrastructure project, each requiring seven operators for each shift and travelling about three to six metres each day depending on ground conditions.
WHOLE-OF-LIFE

Multi-disciplined projects are delivered with single point accountability. The advantages of our whole-of-life approach include the promotion of the smooth transfer of knowledge and innovation throughout the project, a reduction in the number of project interfaces and a reduction in the overall project cost. Our experienced team is one of our key points of difference and is adept at providing expertise and management from the earliest stages of project definition.

MECHANICAL & ELECTRICAL

Major road, rail and utilities tunnels require an extensive network of mechanical and electrical (M&E) equipment to ensure smooth operations.

Our tunnelling capabilities extend beyond construction to include the full M&E fitout of the infrastructure, including the installation of the operation and management control systems.

OUR M&E CAPABILITIES INCLUDE:

- Surveillance cameras
- Lighting
- Electronic signage and traffic signals
- Over height detection devices
- Ventilation systems
- Fire detection/protection systems
- Drainage systems
- Communications systems
- Electronic tolling systems

OPERATION & MAINTENANCE

Thiess Services is experienced in delivering strategic asset management for tunnelling projects. We develop a total infrastructure management service delivery model to meet the specific requirements and objectives of our clients.

As a result, multi-disciplined projects are delivered seamlessly. This approach allows us to provide a value for money solution that reduces any risks for our clients and enhances the value of the asset.

Our Infrastructure Group includes people experienced in strategic asset management, maintenance management and facilities management, providing totally integrated scalable solutions. From 2012 to 2017, Thiess Services will manage 24/7 operations and maintenance of the Airport Link toll road. It will comprise Australia’s longest road tunnel, three ventilation stations and a complex array of bridges and overpasses. Our key priority is to ensure the safety of all road users.

On the Victorian Desalination Project, Thiess Services will operate and maintain the plant, marine tunnels and structures, an 84km water transfer pipeline and co-located underground pipeline for the 30 year project term.

OUR ROAD TUNNEL INFRASTRUCTURE MANAGEMENT CAPABILITIES INCLUDE:

- Managing and performing traffic operations and incident response
- Continuous monitoring and management of tunnel air quality and ventilation
- Maintaining tunnels, bridges and roadways
- Maintaining buildings, systems and equipment, including, communications, lighting and Intelligent Transport Systems
LaNE COVE TUNNEL
This key component in Sydney’s orbital road network involved the construction of a twin 3.6km tunnel. Seven roadheader machines were used to excavate the tunnels. Challenges included the difficulties of working on a route that catered for about 90,000 vehicles per day and the requirement that there be no reduction in the number of traffic lanes during peak hours. Construction was subject to stringent conditions covering the management of water and air quality, noise, dust control and other environmental aspects, traffic management, community consultation and community information programs. As well as improving travel times between the city and Sydney’s north-west suburbs, the project relieves traffic congestion and improves pedestrian and public transport facilities around Lane Cove.

EASTLINK
Among the most significant features of the $2.6 billion EastLink Project in Melbourne are the twin 1.6km three-lane tunnels, which lie between 15 metres and 50 metres below ground level. Both oval shaped tunnels are about 12 metres high by 15 metres wide. Cross passages were excavated every 120 metres, ensuring motorists are no less than 60 metres from an emergency exit. The tunnels were built in several stages with much of the rock excavated using four $4.1 million roadheader machines. This allowed the rock to be crushed and reused for road base. More than 450,000m³ of material was excavated out of the tunnels, which are supported by 25,000 rock bolts. About 50,000m³ of concrete was used in the tunnel lining process.

OUR INTEGRATED CONSTRUCTION AND SERVICES CAPABILITIES ALLOW US TO MANAGE EVERY ASPECT OF THE PROJECT
The Epping to Chatswood Rail Line (ECRL) is one of the largest publicly-funded infrastructure projects ever completed in NSW. The $980 million underground passenger rail line was a massive and complex engineering endeavour that challenged construction know-how from project onset to completion.

Preparing for construction of the 12.5km of tunnels involved a geological review of the route, ground support classification and model development for driving the tunnels and excavating underground station caverns.

Each of the two circular tunnels is 7.2 metres in diameter. They are on average 14 metres apart with connecting cross passages at approximately 200 metre intervals.

Excavation was undertaken by two, 210 metre long TBMs weighing more than 1000 tonnes and with 7.2 metre diameter cutter heads. The TBMs operated on a 24-hour basis with most of the rock excavated for the tunnelling works removed via a conveyor system through the tunnels and almost 100 per cent reused or recycled. The tunnels were lined with a 200mm thick concrete lining, installed by six 15 metre long self-propelled lining forms that progressed up to 90 metres a day.

The specifications for the ECRL included full bidirectional signalling, with three crossovers spaced along the tunnel length. The Advanced Train Running and Control System provides enhanced running information, identifies individual trains and provides centralised signal control. High and low voltage power supplies, tunnel ventilation, communications, fire detection and suppression, control systems, lighting and station building services were all provided as part of the civil and systems contract.

The rail line, which opened in February 2009, is fully integrated into the CityRail network. It has created the capacity for an additional 12,000 rail passengers a day with train services running approximately every 15 minutes in each direction.
The station caverns are the first in Australia and some of only a handful in the world to combine passenger cross-track circulation and platforms in a single volume. Having an instant and all encompassing view of the total station environment assists passenger orientation, facilitates efficient station operations, improves safety and reduces stress for commuters.

Having two island platforms at Chatswood Station, one for northbound and one for southbound, allows commuters from the city on a northbound North Shore train to get off at Chatswood and stroll to the other side of the same platform to wait for the next train going towards Epping. Excavating beneath the tracks and their two island platforms made Chatswood Station effectively a 400 metre bridge.

One of the most significant challenges was the construction of the tunnels under the Lane Cove River. The rail line had to be taken just under the river bed to minimise the vertical distance the track had to come down from the high ground at Chatswood. TBMs could not drill safely so close to the surface, so the crossing was constructed using a cut and cover technique utilising a coffer dam. The roof of each tunnel is just 1.5 metres below the river bed.

The lost time injury frequency rate across the life of the project was 4.4, compared with a construction industry average of 16.7.

In the final stages of tunnelling, a new world record was set by excavating 92 metres of tunnel in a 24 hour period.
“During the past 50 years we have undertaken work on more than 100 linear kilometres of tunnels.”

In 1958, we worked our way into tunnelling history when we began work on the landmark Snowy Mountains Hydro Electric Scheme. We were the first Australian company to be awarded a major construction project on the Scheme, going on to excavate numerous tunnels and complete about 25 per cent of the civil works on the project.

During the past 50 years we have undertaken work on more than 100 linear kilometres of tunnels, including the famous Sydney Harbour Tunnel’s North Shore works and marine elements, and are currently constructing the dual 5.7km tunnels for Airport Link, Australia’s largest road infrastructure project.

With our sights firmly fixed on the future, we are working with our clients to deliver sustainable projects for the long term.
PROJECT SHOWCASE

NATIONAL RECOGNITION

» The EastLink Project was Australia’s largest urban road development at the time of construction and was named Project of the Year at the 2008 National Infrastructure Awards.

» Examples of our excellent health and safety record are the Lane Cove Tunnel Project’s 7 million manhours worked with a lost time injury frequency rate of one and the City West Cable Tunnel Project’s achievement of completing the project without a single lost time injury.

» At the 2010 National Infrastructure Awards, we won the Financial Excellence Award for our Victorian Desalination Project. It was recognised as a major piece of infrastructure being delivered during extraordinarily difficult economic times.

» At the City West Cable Tunnel Project, we worked night and day under Sydney’s CBD with no negative impacts on the community.

» In 2007, the Lane Cove Tunnel Project received both the NSW and National Master Builders Association Award for Infrastructure Projects Over $100 million.
A HISTORY OF EXCELLENCE

» Airport Link and Northern Busway (11,800m), Qld, 2012
» Victorian Desalination Project (2700m), Vic, 2012
» City West Cable Tunnel (1720m), NSW, 2009
» Boggo Road Busway and Eastern Busway 1 (430m), Qld, 2008
» EastLink (3200m), Vic, 2008
» Lane Cove Tunnel (7200m), NSW, 2004
» Epping to Chatswood Rail Line (25,000m), NSW, 2002
» Inner Northern Busway, Stage 3 (420m), Qld, 2002
» South East Transit Project Section 2 Water Street to O’Keefe Street (455m), Qld, 2000
» Storm water diversion tunnel and pipeline at the KPC Coal Mine in Kalimantan (1440m), Indonesia, 1998
» Upper Mt Gravatt Busway Station: Early Works Package Section 4 (370m), Qld, 1998
» Olympic Dam Expansion Project, Underground Works, SA, 1998
» Beaconsfield Mine Development & Associated Works, Tas, 1997
» Moranbah Conveyor, Personnel and Equipment Drifts, Qld, 1997
» Newlands Underground Coal Mine, Qld, 1997
» Gossan Hill Decline Development, WA, 1996
» Pajingo Underground Gold Mine, Qld, 1996
» Teemburra Dam, Qld, 1995
» Crimun Underground Mine Project, Conveyor and Drifts and Upcast Shafts, Qld, 1994
» Otter Juan Mine Rockcutting Trial, WA, 1993
» Binnalong Point (Sydney Opera House) Parking Station, NSW, 1992
» Sydney Harbour North Shore Tunnels (750m), NSW, 1991
» Sydney Harbour Tunnel Marine Works, NSW, 1991

» Sydney Harbour Pilot Tunnel, NSW, 1990
» Sydney Harbour Tunnel, Bradfield Park Site Works for North Shore Ventilation Station, NSW, 1989
» Myer Centre Car Exit Tunnel, Qld, 1988
» Queen Street Bus Tunnel (1.9m), Qld, 1987
» Chadstone Railway Tunnel (160m), Vic, 1987
» Bulimba Sewerage Tunnel (3500m), Qld, 1987
» Bayswater Power Station’s Cable Tunnels (3500m), NSW, 1984
» Thomson Dam Outlet Tunnel Works (270m), Vic, 1981
» Tarong Power Station, Qld, 1979
» Repairs to Eucumbene-Snowy Tunnel, NSW, 1979
» ACT Water Supply, ACT, 1978
» Loy Yang Power Station, Vic, 1978
» Googong Dam Diversion Tunnel (220m), ACT, 1975
» Dartmouth Dam Pressure Tunnel (606m), Vic, 1974
» Dartmouth Dam Diversion Tunnel (853m), Vic, 1973
» South Blackwater Mine Water Supply Pipeline, Qld, 1969
» Talbingo Dam Diversion Tunnel, NSW, 1967
» Liddell Dam Diversion Tunnel (121m), NSW, 1966
» Corin Dam Diversion Tunnel (396m), ACT, 1966
» Geelhi River Aqueduct Tunnel (2,440m), NSW, 1964
» Snowy-Geelhi Tunnel (9207m), NSW, 1962
» Geelhi Dam Spillway Tunnel (205m), NSW, 1962
» Geelhi Dam Diversion Tunnel (336m), NSW, 1962
» Murray 1 Pressure Tunnel (11,700m), NSW, 1962
» Moondarah Dam Diversion Tunnel (183m), Vic, 1959
» Tooma Dam Outlet Tunnel (488m), NSW, 1958
» Tooma-Tumut Tunnel (14,298), NSW, 1958