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## PLATINUM SPONSORS

### John Holland Pty Ltd

Contact: Rob Muley  
Tel: 03 9934 5688  
Fax: 03 99345269  
Email: rob.muley@jhg.com.au  
70 Trenerry Crescent, Abbotsford VIC 3067  
www.johnholland.com.au



### CPB Contractors Pty Ltd

Contact: Glen Ashton  
Tel: 07 3215 4600  
Email: glen.ashton@cpbcon.com.au  
Level 6, HQ South Tower, 520 Wickham Street, Fortitude Valley Queensland 4006  
www.cpbcon.com.au



### Bekaert Maccaferri Underground Solutions

Contact: Brad Boardman  
Tel: +61 405 393 995  
Fax: +32 53 43 10 19  
Email: brad.boardman@bm-underground.com  
SkyliE40, Korte Keppestraat 21/02-9320 Aalst, Erembodegem  
BELGIUM  
<http://bm-underground.com/>



### Bamser Holdings P/L

Contact: Tim Brown  
Tel: 07 3217 5153  
Email: timbrown@bamser.com.au  
Unit 2/4 Park Rd,  
Milton Queensland 4064  
www.bamser.com.au/



### Herrenknecht (Australia) Pty Ltd

Contact: Charles Howarth  
Tel: 07 3291 2700  
Email: howarth.charles@herrenknecht.com  
93 Links Avenue South, Eagle Farm,  
Brisbane Queensland 4009  
www.herrenknecht.com



### Lend Lease

Contact: Grant Andersen  
Tel: 0419 222 253  
Email: grant.andersen@lendlease.com  
476 St Kilda Road,  
Melbourne, Victoria 3004  
www.lendlease.com



## GOLD SUPPORTING MEMBERS

### Abergeldie Complex Infrastructure

Tel: 02 8717 7777  
Fax: 02 8717 7778  
Email: mail@abergeldie.com  
PO Box 3019, Regents Park NSW 2143



### Acciona Infrastructure

Tel: 03 9027 1000  
Fax: 03 9027 1001  
Email: Julian.elliott@acciona.com  
Level 1, 95 Coventry Street, South Melbourne VIC 3205



### CIVIL MINE SERVICES P/L

Tel: 02 4935 2500  
Email: admin@civilmineservices.com.au  
Address: 54 Kalaroo Road, Redhead  
NSW 2290



### BASF Australia Ltd

Tel: 07 3633 9965  
Email: warren.mahoney@basf.com  
731 Curtin Ave East, Eagle Farm  
Qld 4009



### Xypex Australia

Tel: 02 6040 2444  
Fax: 02 6040 2411  
E-mail: xypenq@xypex.com.au  
PO Box 255 Lavington NSW 2641  
76 Merkel Street, Thurgoona NSW 2640



### Parchem Construction Supplies Pty Ltd

Contact: Chris Lowien  
Tel: 1300 737 787  
Email: sales@parchem.com.au  
7 Lucca Road, Wyong NSW 2259



### Bluey Technologies Pty Ltd

Tel: 07 3399 3635  
Email: bill.green@bluey.com.au  
PO Box 898, Hamilton QLD 4007



### Douglas Partners Pty Ltd

Email: john.braybrooke@douglaspartners.com.au  
Tel: 02 9809 0666  
96 Hermitage Road, West Ryde NSW 2114



### GHD Pty Ltd

Tel: 07 3316 3885  
Email: Brendan.henry@ghd.com  
Level 8, 180 Lonsdale Street, Melbourne  
VIC 3000



### Hard Metal Industries

Tel: 07 3714 5700  
Fax: 07 3715 8609  
Email: sales@hmi.com.au  
PO Box 1467, Kenmore QLD 4069



## GOLD SUPPORTING MEMBERS

### McMillen Jacobs Associates

Tel: +64 9 551 2331  
 Email: romero@mcmjac.com  
 Level 14, 41 Shortland Street,  
 Auckland 1010, New Zealand



### Arup Pty Ltd

Tel: 07 3023 6000  
 Fax: 07 3023 6023  
 Email: owen.francis@arup.com  
 108 Wickham Street, Fortitude Valley QLD 4006



### A C Whalan & Co Pty Ltd

Tel: 02 6574 6811  
 Fax: 02 6574 6815  
 Email: Singleton@acwhalan.com.au  
 523 Putty Road, Singleton NSW 2330



### SMEC Australia Pty Ltd

Tel: 02 9925 5555  
 Fax: 02 9925 5566  
 Email: alexander.gomes@smec.com  
 Level 5, 20 Berry Street, North Sydney NSW 2060



### AECOM Australia Pty Ltd

Tel: 0402 347 283  
 Email: Bill.Tsoumbanos@aecom.com  
 Collins Square, Level 10, Tower Two,  
 727 Collins Street, Melbourne VIC 3008



### Stacey Agnew Pty Ltd

Tel: 0407 637 705  
 Email: nick@staceyagnew.com  
 Unit 4, 35 Limestone Street, Darra QLD 4076



### McConnell Dowell

Tel: 03 9816 2400  
 Fax: 03 9818 3553  
 Email: Roy.Lye@mcdgroup.com  
 Level 3, 109 Burwood Road, Hawthorn Vic 3122



### The Rix Group Pty Ltd

Tel: 02 9668 9955  
 Fax: 02 9668 9633  
 Email: matt@therixgroup.com.au  
 Edward Park Unit 1, 274 Captain Cook Drive, Kurnell NSW 2231



### Normet Asia Pacific Pty Ltd

Tel: 08 8152 7700  
 Email: scott.Graham@Normet.com  
 10 Ashwin Parade, Torrensville SA 5031



### Terratec Australia Pty Ltd

Tel: 03 6223 3282  
 Fax: 03 6223 6268  
 Email: info@terratec.co  
 171 Davey Street, Hobart TAS 7000



### Aurecon

Tel: 03 9975 3333  
 Email: anthony.bennett@aurecongroup.com  
 Level 8, 850 Collins Street, Docklands VIC 3008



### Mapei Australia Pty Ltd

Tel: 07 3276 5000  
 Email: m.pawelski@mapei.com.au  
 180 Viking Drive, Wacol QLD 4076



### Pells Sullivan Meynink

Tel: 02 9812 5000  
 Email: Andrew.deAmbrosis@psm.com.au  
 G3, 56 Delhi Road, North Ryde NSW 2113



### The Robbins Company

Tel: +12538724531  
 Email: YunN@robbinstbm.com  
 29100 Hall Street, Solon, OH 44139, USA



### Mobile Conveying Services Pty Ltd

Tel: 1300 665 409  
 Email: enquires@mobileconveyors.com.au  
 631 Uhlmann Road Burpengary East QLD 4505



### Austunnel Pty Ltd

Tel: 1800 AUSTUNNEL  
 Email: info@austunnel.com.au  
 4, 1 Chaplin Drive, Lane Cove West, NSW 2066



### Promat Australia Pty Ltd

Tel: 08 8301 8206  
 Fax: 08 8352 1014  
 Email: r.fox@promat-tunnel.com  
 1 Scotland Road, Mile End SA 5031



### Bamser

Contact: Tim Brown  
 Tel: 07 3217 5153  
 Email: timbrown@bamser.com.au  
 Unit 2/4 Park Road, Milton Qld 4064 www.bamser.com.au/



### Mott MacDonald

Tel: 02 9098 6806  
 Email: caroline.beirne@mottmac.com  
 Level 10, 383 Kent St, Sydney NSW 2000



### Veris Australia Pty Ltd

Tel: 0422 656 335  
 Email: s.lawrence@veris.com.au  
 Suite 1, Level 5, 8 Australia Avenue  
 Sydney Olympic Park, NSW 2127



### Geodata Engineering Pty Ltd

Tel: 02 8920 1474  
 Email: office.sydney@geodata.it  
 201 Suite, 110 Pacific Highway,  
 North Sydney NSW 2060



### Vermeer Equipment Holdings

Tel: 1300 VERMEER  
 Email: sales@vermeer.com.au  
 PO Box 3136, Mount Ommaney QLD 4074



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## BREAKING RECORDS

Since 1990, TERRATEC's machines have been breaking production records all over the world. Most recently, one of two 6.56m diameter Earth Pressure Balance Tunnel Boring Machines (EPBMs) employed on the Dudullu-Bostancı Metro Line project, in Istanbul, completed an impressive advance of 19 rings in a single shift.

Equating to 26.6 meters of excavation in just 12-hours, the TERRATEC TBM worked non-stop – alternating between 20-minute mining and ring building cycles – to accomplish a new production record for a TBM of this size and class in Turkey.



**Cover photo:**

Completion of New M5 tunnel excavation – photo courtesy of Sydney Motorway Corporation

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# President's Foreword

To members, supporters and friends of the ATS,

The rapid jump into the new year, seemingly without a pause, has caught me out. No one in our industry should be complaining that they have nothing to do. The reality is, many have too much to do and are becoming over stretched. Such pressures will inevitably expose weaknesses and so impact on the industry's ability to deliver.



Of course, it is the human element that wears most of the brunt. More and more people are joining projects and many come with very little in the way of relevant experience. I have said in the past that our industry will need do more training to ensure the competencies and technical skills are developed. We must feed the heart and mind and manage the health and safety of all of our workers.

There have been some exciting developments along this same theme. The official launch of the Air Quality Working Group suite of documents occurred on 5th February. This was the result of a significant amount of time, energy and bi-partisan commitment from the members of the working group. The ATS and industry thank Kate Cole for her passionate leadership of the group. This endeavour went straight to everyone's obligation of employee health and safety.

At the same time, as part of the commitment and initiative as part of the Melbourne Metro Project, the Victorian Tunnel Centre planning is well underway and will be a magnificent training asset to support the Australian industry as a whole.

The ATS is planning several short courses and workshops throughout the year and the planning for our next National conference in 2020 is commencing. These events should be a must attend for all those new to tunnelling.

Many thanks again to our Editor and Tunnelling Journal staff for this latest edition. You will notice our new cover design reflecting the change in name of the ATS but maintaining a continued partnership with our NZ friends.

As always, enjoy the read.

**Ed Taylor,  
President  
Australian Tunnelling Society**

## EDITOR'S NOTE

Herewith the first issue of the Journal for 2019 with a new name. We started as the Australian Construction and Tunnelling Association (AUCTA) and are now known as Australian Tunnelling Society. The Journal cover has been changed over the years as well, as shown here.

I am pleased that this issue includes an excellent article by the Air Quality Working Group and I continue to encourage all members and supporting



companies to send me articles for publication – these may be news items or technical articles – all we be gratefully received and considered.

**David Lees  
Editor  
ATS Journal**

# NorthConnex tunnel completion

Tunnelling of Australia's longest and deepest road tunnels, which will allow drivers to travel between Newcastle and Melbourne without stopping at a single set of traffic lights was completed in October 2018.

NorthConnex will remove 5,000 trucks a day from Pennant Hills Road, bypass 21 sets of traffic lights and save drivers up to 15 minutes in travel time.

NSW Minister for Transport and Infrastructure Andrew Constance said

tunnelling started back in mid-2016 when the project's first road header entered the ground at West Pennant Hills. "Fast forward two years, 14 breakthroughs, 2.4 million cubic metres of spoil and the twin nine-kilometre tunnels are ready to be paved," Mr Constance said.

The project has been an enormous one with around 2,550,000 cubic metres of spoil has been excavated across all sites almost 300,000 cubic metres of shotcrete and concrete has been poured.

Under the original plans, the NorthConnex tunnel below Pennant Hills Road was due to be completed by December next year. Lendlease has now said that it "now expected" the project to open in 2020. This is understood to be due to "harder geology" after deciding to tunnel deeper to avoid property acquisitions.

Subcontractors who were originally due to start work on NorthConnex in June have had their start dates delayed several times.



## WestConnex in full swing

Each week more than 17 million passenger journeys take place across Sydney, 69% of these trips are by car. The \$16.8 billion WestConnex motorway will be the backbone of Sydney's transport network, supplemented and enhanced by a new metro rail, light rail and the various other transport projects which are currently under construction.

Construction of WestConnex, Australia's largest road transport infrastructure project, is now in full swing with the first underground section on track to open this year.

At around 30 kilometres in length WestConnex will provide a long overdue underground link to create a seamless free-flowing western bypass of Sydney's CBD by widening and extending the M4, duplicating the M5 corridor and connecting the two motorways via the M4-M5 link tunnels.

When WestConnex is completed, motorists will also be able to travel between the Anzac Bridge or St Peters to Penrith without stopping at a single traffic light.

There is currently more than 4,000-strong workforce across all stages of the project, helping to support construction activities, with more than 10,000 to be created across the life of the project.

WestConnex will also provide up to 18 hectares of new open space and around 23 kilometres of new and improved cycle-ways and walkways.

## New M4 tunnels pushes on

Work to deliver the New M4 Tunnels between Homebush and Haberfield is pushing ahead and the project remains on track to open to traffic in the second quarter of this year.

"Significant progress has been made to deliver the first underground section of WestConnex which includes construction of twin 5.5 kilometre tunnels that will connect to the widened M4 at Homebush, to provide a bypass of the congested Parramatta Road," New M4 Project Director Terry Chapman said.

"Tunnelling activities for the project was completed last year and work underground has turned to the electrical and mechanical fitout of the tunnels, and commissioning of all the equipment and control systems .

"Of the 2,200 people currently working on the project, including around 90 apprentices and trainees, there are around 1,000 people dedicated to the mechanical and electrical testing and installation work."

The new Powell's creek westbound on ramp was commissioned in late 2017, with other major pieces of infrastructure including the new Concord Road bridge, part of the new Concord Interchange now largely completed and ready to open in line with the new M4 Tunnels. Surface works for the project are almost complete with only residual works under way.

Motorists will soon be able to bypass up to 22 sets of traffic lights on Parramatta Road when the New M4 tunnels open in the second quarter of this year.



# Final tunnel breakthrough on New M5

At the end of last year the final roadheader completed the last underground tunnel breakthrough on the New M5, marking the completion of tunnelling for the project.

The breakthrough took place around 50m below ground, linking the Arncliffe tunnelling site with the new St Peters Interchange and completing key tunnelling works on the twin nine-kilometre New M5 tunnels.

At the peak of tunnelling around 750 workers made the underground journey each day to excavate around 20km of tunnels and ramps across four tunnelling sites.

Opening to traffic in early 2020, the \$4.3 billion New M5 will run parallel to the existing M5 East and provide a non-stop underground journey between Kingsgrove

and St Peters, doubling capacity of the corridor from two to four lanes in each direction.

New M5 Project Director Ken Reynolds said CPB Dragados Samsung Joint Venture is contracted to deliver the New M5 which will open to traffic in 2020.

“The breakthrough was a significant milestone for the project with tunnelling having been under way for almost two years. At its peak, 21 roadheaders were working around the clock and more than 6 million tonnes of spoil has been excavated to date,” Mr Reynolds said.

“As one of Australia’s biggest infrastructure projects, WestConnex is a major employer of apprentices and tradespeople, including 3,000 from



Western Sydney on the New M5 alone so far.

“Construction of the New M5 is also supporting local businesses with more than 70 per cent of more than 800 contracts signed to date going to NSW-based suppliers and companies.

“Work underground has now turned to the installation of the road pavement and the

mechanical and electrical fitout of the tunnels with 40% of the road pavement already laid.”

When the New M5 opens, it will cut up to half an hour from an average peak journey between Liverpool and South Sydney, providing relief for more than 100,000 drivers who use the congested M5 each day.

## M4-M5 Link Tunnels and Rozelle Interchange

The \$7.2 billion M4-M5 Link is the most important stage of WestConnex, providing the missing underground link between the New M5 at St Peters and the M4 East at Haberfield, allowing the full benefits of the project to be realised. When this stage opens in 2023, the future travel time between the New M5 and New M4 is expected to be 8 minutes.

The M4-M5 Link will be delivered in two stages:

- **Stage One (3A)** - The mainline tunnel connecting the New M4 in Haberfield and the New M5 in St Peters, as well as the stub tunnels to the Rozelle Interchange, and;
- **Stage Two (3B)** - the Rozelle Interchange is a new underground interchange which provides connectivity to the M4-M5 Link Tunnels and the City West Link, and an underground bypass of Victoria Road between Iron Cove Bridge and Anzac Bridge. The Rozelle Interchange also provides a connection to the future

Western Harbour Tunnel. This stage is being delivered by Roads and Maritime Services.

The design & construct contract for the M4-M5 Link mainline tunnels was awarded to the joint venture of Lendlease, Samsung and Bouygues in June 2018.

The mainline tunnels will be approximately 7.5kms long and accommodate up to four lanes of traffic in each direction. The mainline tunnels will be approximately 7.5kms long and accommodate up to four lanes of traffic in each direction. At the peak of tunnelling around 25 roadheaders will be in operation.

When the M4-M5 Link Tunnels open, more than 100,000 trips a day are expected on the M4-M5 Link, removing vehicles which would otherwise clog suburban and city streets.

A Joint Venture between CIMIC Group company CPB Contractors and John Holland were selected to deliver the Rozelle Interchange. Construction will

start in 2019 and is expected to conclude in late 2023.

CPB Contractors completed the WestConnex M4 Widening project with its joint venture partner Rizzani De Eccher. CPB Contractors is also delivering the WestConnex M4 East (New M4 Tunnels) and WestConnex New M5 with its joint venture partners.

The \$3.9 billion Rozelle Interchange design and construct contract includes a complex underground motorway junction and will transform the formerly unused rail yard site, delivering 10 hectares of new open space to the local community and improving access to public transport.

The contract includes works to enable connections to the proposed Western Harbour Tunnel and road upgrades around the Bays Precinct and Inner West.

The tunnel connection between Rozelle and the Iron Cove Bridge is forecast to reduce traffic by up to half along this section of Victoria Road, allowing for improved public transport options.

## Western Harbour Tunnel scoping study

NSW Treasury, working with Transport for NSW, wants advice on how to fund the proposed new road under Sydney Harbour, the Western Harbour Tunnel, which is part of a wider roads project expected to cost about \$15 billion.

It is understood the government agencies sent a request for proposal to

investment banks in November 2018, inviting them to pitch to run a scoping study.

The proposed scoping study comes after significant work planning the proposed Western Harbour Tunnel and an adjoining road, the Beaches Link, which have been bundled together.

The proposed Western Harbour

Tunnel would run from the Rozelle interchange under the Sydney Harbour to the Warringah Freeway in the city's north. It would be mostly underground and designed to take traffic off the Sydney Harbour Bridge and Tunnel, which is used by more than 4.3 million people each week according to the government's numbers.

## Sydney Metro City and Southwest



TBM tunnelling has begun in Sydney's inner west on two metro railway tunnels that will run below the CBD and Sydney Harbour to form part of the Sydney Metro.

One of five tunnel boring machines, dubbed Nancy, commenced excavation at Marrickville in October 2018.

The TBMs will excavate a total of 31 kilometres of tunnel from the inner west to Chatswood for the new Sydney Metro City and Southwest. The project is due to be completed in 2024.

Two of the TBMs will excavate from Marrickville to the new metro station sites at Waterloo, Central, Pitt Street, Martin Place and Barangaroo before they are removed. Another two machines will dig from Chatswood to the edge of Sydney Harbour before a specially-designed machine takes over work on underwater twin tunnels.

Tunnelling is expected to be complete within 18 months an average of 120 metres a week.

## Line-wide works award

CPB Contractors and UGL have been selected by the NSW Government to deliver the Line-wide works package in support of the Sydney Metro City & Southwest project, Australia's biggest public transport project. This is the seventh Sydney Metro City & Southwest contract to be awarded. Works are scheduled to be completed in 2024.

The joint venture will play a pivotal role in the design, construction and commissioning of:

- Major rail systems in the new twin 15km Sydney Metro tunnels from Chatswood to Sydenham;

- The expansion of the existing Sydney Metro Trains Facility at Rouse Hill and delivery of the new Sydney Metro Trains Facility South at Marrickville; and
- Tunnel ventilation, mechanical and electrical systems for seven underground stations, and power systems for the Sydenham to Bankstown section.

Sydney Metro showcases the capabilities and strength of the CIMIC Group, with member companies CPB Contractors, UGL, EIC Activities and Pacific Partnerships all playing key roles in its development, delivery and operations.

A large tunnel under construction with concrete walls and yellow pipes. A worker is visible at the top center, illuminated by a light. The tunnel is illuminated by a series of lights along the walls, creating a perspective effect towards the end of the tunnel.

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**JOHN  
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# Melbourne Metro advances

The construction of the two new stations for the Melbourne Metro, under Swanston Street in the heart of the city, presents a range of engineering and construction challenges.

These include:

- Navigating existing below-ground infrastructure, such as water, gas and electricity services and the City Loop.
- Managing the effects on vehicle, pedestrian, cyclist and tram movements.
- Minimising disruption to residents, traders and businesses.
- Maintaining a safe environment for the project workforce and the community.

To keep Swanston Street open and trams running while the Metro Tunnel is built, access shafts up to 11 storeys deep are being dug adjacent to Swanston Street at Franklin Street (east and west of Swanston Street), A'Beckett Street, La Trobe and Little La Trobe Streets, City Square, Federation Square and behind Young and Jackson Hotel. These shafts will be used to transport machinery, equipment and workers underground. Equipment is then used to excavate and line the stations below the surface of Swanston Street.

This construction approach minimises disruption at surface level and is commonly used overseas, particularly in constrained city environments. The above ground disruption to businesses, cyclists, pedestrians and surrounding streets is

greatly reduced as a result.

To better respond to the unique ground conditions in the CBD, and to provide more spacious and accessible station platforms, an innovative trinocular design has been proposed for the State Library and Town Hall stations. A trinocular design combines three overlapping tunnels that integrate the concourse and platforms on a single level to create a wide, central tunnel space, improved passenger circulation and vertical transportation.

While TBMs are being used to build most



of the Metro Tunnel, road headers will excavate the CBD tunnels and station caverns. Temporary support will be shotcrete and rockbolts followed by a final concrete lining.

The stations will be built as 'trinocular' caverns. Three overlapping tunnels will be mined by the road headers to create wide platforms with supporting columns and vaulted ceilings. The total platform width will be around 19 metres – one of the widest

metro platforms in the world.

The eastern tunnel entrance will be located in the South Yarra Siding Reserve. A decline structure, or descending tracks, will be built so trains can enter the new Metro Tunnel near William Street and pass underneath the Sandringham and Frankston lines.

To construct the eastern tunnel entrance, the rail corridor between William and Chapel streets will need to be widened, and the train tracks reconfigured to allow two additional tracks to be constructed. These new tracks will then enter the new Metro Tunnel.

The decline structure and tunnel entrance are proposed to be built via a 'cut and cover' method, which will see them excavated from the top down and the surface then reinstated over the top of the tunnels.

A TBM retrieval box will be constructed in the rail reserve between Osborne Street and the existing Sandringham line.

TBMs will be used to create the tunnels linking the eastern tunnel entrance to Anzac Station and the rest of the network.

These tunnels will pass under Osborne Street, Davis Avenue, Powell Street, Myrtle Street and Macfarlan Street and travel west under Toorak Road and St Kilda Road to connect with the new Anzac Station.

South Yarra Siding Reserve will be closed for up to four years.

## Rail Infrastructure Works

Work is set to ramp up on the western and eastern entrances to the Metro Tunnel and upgrades on the wider rail network. The \$1 billion Rail Infrastructure Alliance (RIA) works package will build the tunnel entrances in Kensington and South Yarra, as well as a new platform at West Footscray and associated suburban rail upgrades that will maximise the benefits of the Metro Tunnel by providing more services for all passengers.

A consortium comprising John Holland, CPB Contractors and AECOM will

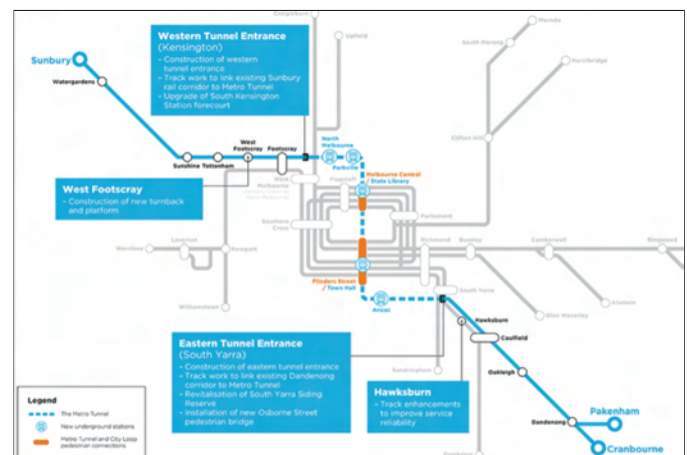
deliver the RIA, in partnership with Rail Projects Victoria and Metro Trains Melbourne.

Turnbacks will be built at West Footscray and Hawksburn stations, allowing services to start and end at these stations during timetabled peak periods for the first time, instead of travelling further down the line..

Public spaces near the eastern tunnel entrance, including South Yarra Siding Reserve, will be rejuvenated as part of these works before being returned to the local community once tunnel entrance works are complete.

Around 1000 people will work on the RIA package, including almost 100 apprentices, trainees and engineering cadets.

The majority of RIA works are expected to be finished in line with the completion of the tunnels and stations, ready for opening by the end of 2025.



# Westgate Tunnel Project

The West Gate Tunnel Project will be built over five years, opening in 2022 to provide a vital alternative to the West Gate Bridge, quicker and safer journeys and remove over 9000 trucks from residential streets in the inner west.

The project is a partnership between the Victorian Government and Transurban and will be built by a joint venture between CPB Contractors and John Holland. The Western Distributor Authority is managing the project on behalf of the Victorian Government.

The project consists of twin tunnels under Yarraville between the West Gate Freeway and the Maribyrnong River.

The two state-of-the-art TBMs have been named Bella and Vida and are currently being built in China and Germany, before arriving in Melbourne to start tunnelling in early 2019. These machines use the latest tunnelling technology and are custom designed and built to suit ground conditions in Melbourne's west.

Bella and Vida will start their journey at the northern portal in Yarraville and move south-west towards the southern portals in the West Gate Freeway near South Kingsville. Work will start on the 4 kilometre outbound tunnel first, closely followed by the 2.8 kilometre inbound tunnel. The longer tunnel will take around 18 months to dig.

## Benchmark Awards 2019 Finalists: Aurecon Jacobs automates digital tunnel drawings

Construction of a city-shaping project to deliver a vital alternative to the West Gate Bridge, providing a much needed major second river crossing, was never going to be easy. With such a massive project, it's imperative engineers have quick access to accurate and highly detailed plans - a task that would have required hiring a fleet of drafters to hand-draw around 3,000 individual, yet highly similar, plans.

Aurecon Jacobs Joint Venture (AJJV) decided in 2017 to look into automating the process in a bid to speed up production, reduce communication barriers between engineers and the outsourced drafters, and improve coordination between the many project disciplines working on the tunnel.

AJJV assembled a team of eight people to develop an automated solution, including three dedicated in-house coders and one full-time designer to explore what could be done.

Using open source code available in Dynamo for Revit as building blocks, AJJV's digital design team adapted the

Revit API to create a flexible environment for automation. The team developed bespoke code to retrieve design data and write routines associated with the design parameters, checking those designs and implementing required views of the drawings in the process.

Engineers now, at the click of a button, can produce accurate 3D models that can be cut into sections and used to produce drawings that would have been painstakingly hand-drawn. It also removes the risk of human error associated with drafting by one person being interpreted differently to another.

However, extra time did have to be spent ensuring engineers were comfortable and confident with the new software. The company enlisted some of its younger, more flexible engineers to pair up with more experienced staff to train on the software, with any growing pains limited to the short term.

This project has been named a finalist in the Industrial category of the iTnews Benchmark Awards 2018/19.

## Melbourne North East Link

The North East Link Authority, on behalf of the Victorian Government, has invited suitably qualified Respondents to submit expressions of Interest to deliver the EUR4.46-5.73 million (AUD7-9 billion) Primary Package, involving construction of the 6km twin tunnel, of North East Link deadline 10.05.2019. This procurement process will take 18 months to complete.

Procured as an availability public private partnership, the Primary Package presents an

outstanding opportunity for the private sector to partner with the State to deliver the most complex elements of North East Link, including the construction of 6km of twin tunnel, submission of a concept design for aspects of North East Link and on-going responsibility for operating and maintaining the entire North East Link corridor.

Submit your response in hardcopy to Head Office 1, Basement Level B2, 121 Exhibition Street, Melbourne, VIC, 3000.

## Melbourne airport rail link

Soil testing to inform the business case for Melbourne airport rail link has also begun.

Rail Projects Victoria, which is overseeing the delivery of the airport link, is assessing ground conditions at six sites around the M80 Ring Road in Tullamarine and near the Maribyrnong River to guide further planning for the preferred Sunshine route.

Minister for Transport Infrastructure Jacinta Allan said the new infrastructure will "deliver a new super-hub at Sunshine" which sits 11 kilometres from the CBD in

Melbourne's west.

Subject to all required approvals construction on the Melbourne Airport Rail Link is scheduled to start in 2022 with a construction timeline that would take up to nine years.

State government has committed up to \$5 billion to build the project, which would run from the CBD to Melbourne Airport via Sunshine and form the north-western section of the suburban rail loop.

The total cost of the project will be determined in the full business case and is estimated in the range of \$8-\$13 billion.

# Forrestfield Airport Link

The construction timeframe for Perth's new \$1.8 billion airport tunnel has been delayed by one year, after the head contractor apologised for flooding and a sinkhole that temporarily halted the project.

A water leak, which began in September, created the sinkhole on Dundas Road in Forrestfield and caused the tunnel below to flood. A review into the incident released revealed a 26-metre section of the tunnel was damaged as a result.

The leak caused the tunnel's shape to distort and created movement to 16 concrete rings along the impacted section. There were several potential causes, revolving around a process where grout was injected into the ground to give the soil structure. "All the probable causes are being addressed by a change in the methodology for future cross passages," Ms Saffioti said.

The 26-metre section had been temporary stabilised, but a long-term solution was still under consideration. Either the damage would be repaired from the inside, or the section would be removed and rebuilt.

WA Government says the project would be delayed by one year to the second half of 2021. "I'd like to have seen it delivered earlier, there's no doubt about it. It's a challenging project." The minister said, "the two boring machines digging the tunnel were also moving slower than anticipated and increased safety stoppages had contributed to the year-long delay." But the Government promised the delay would not come at a cost to taxpayers. "We believe this is an insurable incident," they said, "and we still believe that the \$1.86 billion project will hold." Meanwhile the Forrestfield-Airport Link is continuing to move forward, with significant progress made on the project. Tunnel boring machine (TBM) Grace has been very busy in 2018 reaching the halfway mark (3571m) of her underground journey in November, and clearing the airside environment in December. TBM Sandy isn't far behind,

with both machines having successfully tunnelled under the airport's two major runways. The TBMs are expected to arrive at Redcliffe Station in the first quarter of 2019.

Works across all nine construction sites are also well-advanced and segment



production is now at 85 per cent, with 7640 rings produced.

Tunnelling under the Swan River will take place in 2019 together with the construction of three stations, three emergency egress shafts and 15 cross passages.

A major milestone for the project this year was the opening of the Dundas Road realignment in Forrestfield. Further south, construction of footings for the 150m-long station platform is underway and services have been installed at concourse level.

The year at Redcliffe started off with the excavation of the station box and construction of the ground slab for the future station building. Once some 45,000 cubic metres of soil had been removed, the construction of the 1.5m-deep base slab followed. Approximately 5500 cubic metres of concrete and 1300 tonnes of steel, along 3750 square metres of waterproof lining were used to seal the structure.

With these three major pieces of work now completed it's all hands on deck to prepare for the arrival of the TBMs in early 2019.

While the project budget remains unchanged, the timeline has been revised and the first trains are now expected to

run on the line in the second half of 2021.

The 26 metre damaged section of Tunnel 1 has been stabilised and made safe with solid temporary supports. Cement grouting has sealed the leaks and the voids created by ring movement. Investigations have indicated a number

of potential causes, including construction defects in the grout block or failure of the joint between the tunnel lining and grout. Tunnelling through the grout block and/or vibration from excavation of the cross passage may also have contributed.

New measures will be put in place for the construction of future cross passages to reduce the risk of a similar event occurring. The construction of the next cross passage

started in January 2019.

Options for a permanent repair include fixing the damage from inside the tunnel or rebuilding the impacted section of tunnel by removing the old rings and casting the new tunnel lining in-situ - either from the surface down, or from within the tunnel. Either solution will be required to achieve the tunnel life of 120 years.

Stabilisation of the ground around Dundas Road is also ongoing, with two traffic lanes to be opened later this month while compaction works continue.

The State Government has repeatedly stressed the importance of safety on the worksite. Safety measures that have been introduced over the last four months include increasing the number of safety compliance officers from two to five, while the contractor has appointed a superintendent of tunnel operations to provide greater oversight and focus on safety. The Public Transport Authority has conducted 658 safety walks, 430 safety compliance inspections and 72 targeted process inspections during 2018. A rolling roster of safety staff also monitor site safety for both day and night shifts. Meanwhile, WorkSafe has inspected the site 35 times, and unions close to 300 times.

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# Spencer St Sewer



The microtunnel boring machine (MTBM) excavating the Spencer Street Sewer Upgrade finished major microtunnelling works on 21 December 2018.

The 9m long, 1.5m diameter MTBM has been installing more than 700m of new sewer main under Melbourne's CBD between Lonsdale Street to Flinders Lane as part of City West Water's Spencer Street Sewer Upgrade.

The new sewer will connect with an existing pipeline to support the population growth in city over the next 35 years.

Quinn Civil is the Principal Contractor of the project, with microtunnelling operations subcontracted to Bothar Boring.

The upgrade was complete, finished ahead of schedule, safely and within budget. The upgraded sewer has been connected to service residents and commuters who live and work along Spencer Street, increasing the existing capacity of the 122-year-old sewer by approximately 25 times.

# Bulimba Sewer Trunk Main



pipe-jacked and open cut sections, as well as nine maintenance holes for the Stage 2 works.

An Abergeldie owned AVN slurry shield tunnel boring machine (TBM) is being used on the pipe-jacked sections of the sewer. The boring machine is guided by a VTM navigation system and is coring out a

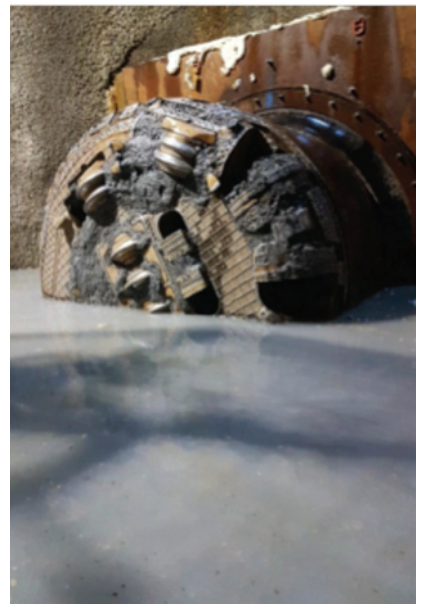
drives have been completed.

Over the course of construction, the team has overcome challenges such as flooding in the tunnel at Bulimba Creek, varying geological ground conditions, high water ground water pressures requiring hyperbaric interventions, undertaking 24 hour tunnelling in close proximity to residential properties and working in environmental sensitive locations.

Investing to upgrade Brisbane's sewerage network, the Bulimba Creek Trunk Stage 2 Sewer Upgrade involves installing a 4.25km gravity trunk sewer between Wecker Road, Mansfield and Settlers Street, Carindale, with 3.6km being installed using trenchless technology. The Stage 2 project is a continuation of duplicating the existing sewer network and increasing capacity in the network. Stage 1 and 1A upgrades were completed in 2004-2006 and 2011-2013 in Mansfield, Wishart, Eight Mile Plains and MacGregor.

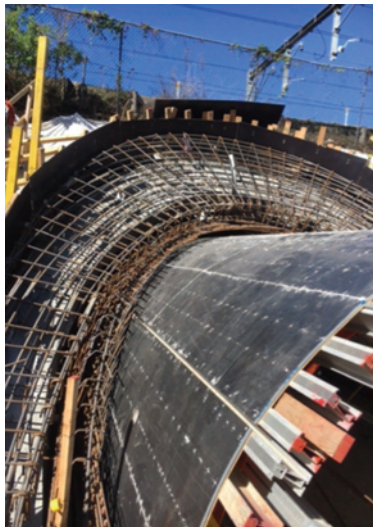
In this Australian-Japanese joint venture, Abergeldie and Obayashi are engaged to design and construct the

1800mm tunnel, pushed forward by a jacking machine with sections of the sewer pipe following behind the TBM. This micro-tunnelling method is highly effective as it minimises impacts and disruption to the shaft locations avoiding the need to have extensive open trench construction along the whole 4.25km alignment, thus reducing the overall impact to the community and environment of these large infrastructure projects. The works have been divided into 5 x 700-850m jacked pipe sections requiring construction of six temporary shafts to launch and retrieve the TBM, the deepest of which is 45m. Currently, 4 of the 5 tunnel





# Tunnelling Solutions Presentation to ATS Sydney - October 2018



## Arncliffe Pedestrian Link

Tunnelling Solutions completed the excavation and permanent lining of the Arncliffe Pedestrian Tunnel on time and without incident.

The tunnel was constructed through a rail embankment with only 2.5m of cover to live rail tracks and extremely poor ground conditions.

The original design was for a complete array of clutched canopy tubes to be installed by the previous contractor but unfortunately during the installation process they ran into significant problems.

The Canopy Tubes became unclutched resulting in significant gaps between them of up to 1m which caused major challenges through the excavation and support phase.

A Permit to Tunnel process was strictly applied during the excavation period with attendance from the client and the designers signing off on the sequence of excavation that was required for that day.

Steel sets were installed every metre along with infill shotcrete which made up the temporary support along with 50mm-100mm of shotcrete applied daily for face support.

Surface and convergence monitoring was frequently carried out but with good tunnelling practices being implemented no settlement was reported.

The excavation was completed well

ahead of schedule then a purpose built form was erected and used to line the tunnel. Both portals were constructed using traditional formwork systems that were challenging to build due to the potential of significant uplift pressures but with a robust design in place the final product was excellent.

Collaboration was fundamental to the success of this project with the main contractor John Holland Bouygues Joint Venture and TFNSW all involved.

## Darebin Rail Underpass

Tunnelling Solutions have recently completed the Darebin Rail Underpass (under Darebin and Hawdon Streets in Heidelberg, Melbourne) for the North East Program Alliance - which includes Laing O'Rourke, Fulton Hogan, Jacobs, Metro Trains Melbourne and Level Crossing

Authority.

The construction of an adjacent tunnel next to the existing rail tunnel was provided as a Design and Construct solution for our client. Total length of the underpass is 70m.

Differing support types were used to address low cover and proximity to critical services including gas main, water main and various telecommunications. Support of works included a combination of steel ribs with shotcrete; pile bars; rock bolts; soil nails; and canopy tubes (DN300mm – 9 no. each 36m long).

Tunnel construction was completed on time with no disruption to the existing rail line and zero settlement recorded on surrounding roads.

The project team have done an exceptional job and must be recognised for this outstanding achievement.



# Tunnelling labour shortage

A labor shortage has struck Australia's A\$75 billion (\$55 billion) infrastructure spending spree, threatening to bloat project costs in a bidding war for tunnelling specialists and engineers. Australia is 20 percent to 30 percent short of the skilled labor required for the raft of roads, metros and railways being rolled out nationwide.

There's a particular need for civil engineers and operators of tunnel boring machines that drill holes for roads or railways, Marco Assorati, Salini's executive director for the Asia Pacific region, said in an interview. The shortfall is challenging all construction companies in Australia -- and pushing up costs -- as they compete for talent, he said. "There is a shortage in all sectors," Assorati said at Salini's offices in Sydney. "We need to think today of our resources for the next five, 10, 15 years."

Five years ago, Australia's biggest mining boom in 150 years turned welders and truck drivers into some of the country's best-paid laborers.

The government has pledged A\$75 billion in infrastructure

funding and financing over a decade, spanning everything from roads and an airport in Sydney to an inland rail route connecting Brisbane to Melbourne. The outlay is partly aimed at freeing up a transport network jammed by population growth.

There aren't enough tunnel engineers, program directors and other specialists to keep pace with construction on the east coast and labor costs are rising, according to Infrastructure Partnerships Australia, an independent public policy think tank based in Sydney.

"These are not skills that can be acquired overnight," the organization's Chief Executive Officer Adrian Dwyer said in a statement. Australia needs to better target qualified overseas workers while developing a more highly skilled domestic workforce, he said.

Assorati called on the Australian government to address the skills shortage by collaborating with universities and encouraging more young people to enter the industry. "Let them understand that engineering is sexy," he said.

# Snowy Mountains Phase 2

Snowy Hydro has named the Future Generation Joint Venture (JV) as the civil works contractor for the Snowy 2.0 project.

Following an 18 month competitive tender process, Snowy Hydro named the JV comprising Australian engineering company Clough and international tunnelling specialist Salini Impregilo as preferred tenderer for the civil works contract.

The Snowy 2.0 project will link the two existing Snowy Scheme dams, Tantangara and Talbingo, through underground tunnels and an underground power station with pumping capabilities.

The project will generate hydro power as water is recycled between the two dams to efficiently produce energy and make the most of the available water over an operating life of 70 years or more.

The project will involve underground excavation and tunnelling works between Tantangara and Talbingo at depths of up to 1 km; surface works for the intake-outlet structures, surge shaft, cable and ventilation portal sites; and supporting works for upgrading access tracks, roads and electricity connections to construction sites.

Snowy Hydro also named Voith Hydro as preferred electrical and mechanical tenderer and contracted Leed Engineering for exploratory works during pre-construction activities.

The contracts are currently being finalised, with contract execution subject to shareholder approval of the project.

The first power generated from Snowy 2.0 is expected in late 2024.

# Financial woes cripple engineering firm

A 120-year-old Australian engineering firm that was set to help build the underground network for Auckland's City Rail Link has went into administration in November 2018

New Zealand-based RCR Infrastructure, in conjunction with Opus International, won the contract in October to have the rail link ready by to open by 2024. But its parent company in Australia, RCR Tomlinson, was placed in the hands of administrators McGrathNicol, who immediately started a sales process for the business and urgently seeking funding from financiers.



# City Rail Link unveils connections

The CRL is one of New Zealand's biggest transport projects, costing \$3.4 billion. The 3.4 kilometre underground CRL train line will connect four stations in central Auckland. Britomart and Mt Eden stations will be redeveloped and new stations will be built at Karangahape Rd and Aotea Square

Auckland's City Rail Link unveiled the connection of the Commercial Bay tunnels to the Albert Street tunnels in December 2018. The \$3.45 billion central city transport infrastructure project is expected to be finished in 2024.

Mayor Phil Goff says they are now one step closer to delivering Auckland's first underground rail line. "The CRL is the most significant infrastructure project in New Zealand. When it is complete it will carry more than 50,000 passengers during peak hours and completely transform the way people move about the city.

CRL's chief executive Dr Sweeney says the nature of this project has made today's milestone even more significant. "It's fair to say that getting to this point has not been without its challenges. This is the largest transport project ever



undertaken in New Zealand and building it within the middle of a built-up city is no small task."

# Central Interceptor project award



Watercare has selected Ghella-Abergeldie Harker Joint Venture as preferred bidder for the construction of the Central Interceptor wastewater tunnel.

Ghella-Abergeldie Harker Joint Venture is one of four contractors that tendered for the project. The other three are: CPB Contractors; Pacific Networks (comprising McConnell Dowell, Fletcher Construction and Obayashi); and VINCI Joint Venture (comprising VINCI Construction Grands Projets, HEB Construction and Soletanche Bachy).

The Central Interceptor will run for 13-kilometres from Western Springs to a new pump station at the Māngere Wastewater Treatment Plant. At 4.5 metres diameter, it will be Auckland's largest wastewater tunnel and the biggest wastewater project ever undertaken in New Zealand.

The contractors submitted their tenders in mid-September 2018 and on 27 November, Watercare's Board of Directors approved the Central Interceptor team's request to move forward with Ghella-Abergeldie Harker Joint Venture because it represents the best overall value for Auckland.

If the conditions and issues can be successfully worked through, the Central Interceptor team will take a recommendation to the Board of Directors in the first quarter of 2019. If the conditions and issues cannot be successfully worked through, then liaising will start with the second bidder.

The joint venture of Ghella and Abergeldie Harker combines more than 30 years of tunnelling expertise in New Zealand with over 150 years of Italian and international tunnelling experience and ability. Ghella has successfully completed numerous projects of this scale worldwide. These include the Legacy Way tunnel project in Brisbane which achieved world records in tunnel boring machine excavations. Currently, Ghella is working on some of the biggest tunnelling projects around the world, including the Follo Line in Oslo, the Sydney Metro and the Riachuelo sewage system in Buenos Aires.

Abergeldie Harker has successfully delivered complex underground construction projects across New Zealand over the past four decades and is one of New Zealand's foremost shaft sinking and pipejacking contractors. Its parent company Abergeldie is one of Australia's leading three waters contractors with extensive experience working on major water and wastewater assets throughout Australia. Between 2007 and 2010, Abergeldie Harker carried out \$118-million Project Hobson in which a 90-year-old sewer pipe that crossed Hobson Bay was replaced with a three-kilometre-long wastewater tunnel that connects to large pump station at Orakei.

While Project Hobson has reduced overflows in Hobson and Okahu bays, the Central Interceptor will reduce overflows into central Auckland waterways that flow into Waitemata Harbour. Parts of the old Auckland City Council area have no stormwater system, so when it rains the stormwater goes into the wastewater pipes and then overflows into streams and beaches. It was designed to do that in the early 1900s because it was acceptable back then – and with fewer houses, there was more land for the rain to soak into. But Aucklanders' expectations have changed – they want a clean and swimmable water environment. The Central Interceptor will address wet-weather overflows by collecting the wastewater and stormwater from these overflow points and transporting it to Māngere for treatment. It is expected to reduce the volume of overflows by at least 80 per cent. It also provides time for Auckland Council to install stormwater pipes in areas where there are none.

The project has been on the agenda for many years and is part of the \$5.8 billion planned to be spent on upgrading and expanding the city's infrastructure over the next decade. Construction will begin next year and continue until 2025.

# Army Bay Wastewater Treatment Plant



A microtunnel boring machine (MTBM) called 'Blanche' set a new world record with a drive of 1496.48m.

The MTBM, located at Watercare's Army Bay Wastewater Treatment Plant in Whangaparaoa, New Zealand, completed what is currently the longest ever stretch of pipe laid by the Direct Pipe® tunnelling methodology.

According to the contractor, McConnell Dowell, the installation is a new world record surpassing the previous record of 1,495m set in Texas, US last year. The MTBM is being used to replace an old 2.8km outfall pipeline.

Direct Pipe is a Herrenknecht trademarked MTBM that combines the benefits of microtunnelling and horizontal directional drilling into one machine, allowing the borehole to be excavated as a

prefabricated pipeline is installed in one long drive.

The Direct Pipe system has been designed to achieve drive speeds of up to 30m a day and is generally used to install pipelines under rivers and other large bodies of water in Europe.

"This is the first time the Direct Pipe system has been used in New Zealand," said McConnell Dowell Project Manager Chris Powell. "As a consequence we weren't constrained by traditional applications and were able to use the Direct Pipe system in ways not explored before. We set some pretty high expectations, we learnt much and achieved a real global step-change in how this new tunnelling technology can be used."

Construction upgrades to the treatment plant began in August 2017 and is expected to be completed in early 2019.

## China's largest homemade slurry TBM

China's largest slurry tunnel boring machine (TBM) rolled off the production line in Zhengzhou, capital of central China's Henan Province, in September 2018.

The machine, named Chunfeng, has a diameter of 15.8m, making it the largest slurry TBM designed in China. It weighs around 4,800 tonnes and is 135m long.

The machine is developed by China Railway Engineering Equipment Group Co. Ltd. (CREG) and will be used for excavating a tunnel in the



southern city of Shenzhen.

According to the company, CREG is a leading TBM supplier worldwide. As of June, 2018, the company had signed 788 TBMs for tunneling projects, in which 656 are operating around the world.

## Green light for undersea tunnel link in Eastern China

A feasibility study has cleared the way for a 16.2 kilometer high-speed rail corridor between Ningbo and the island of Zhoushan in eastern China, expected to cost US\$3.63bn

China Railway Corporation has given the green light for a 16.2-kilometer undersea high-speed railway tunnel that will allow bullet trains to race at up to 300km/h between the eastern port city of Ningbo and its neighboring island of Zhoushan.

Approved following a feasibility study, the tunnel is part of a 71-kilometer rail line that will reduce travel time to just 25 minutes when it opens in 2022.

The two cities in the eastern province of Zhejiang are at the centre of a major industrial hub. Ningbo is a burgeoning trading hub while Zhoushan is home to a Boeing 737 jet assembly plant and has been designated as a pilot free trade zone. Together the Ningbo-Zhoushan port is the world's largest port in terms of annual cargo throughput.

Local authorities say the tunnel is essential to avoid the new express rail artery hampering the narrow stretch of waterway serving the busy port.

The proposed tunnel is much shorter than the 50km Channel Tunnel between France and the United Kingdom, but it will be constructed in a region prone to super typhoons and will be underneath legions of container berths, thus creating big challenges for engineers. Also, bullet trains will travel at no less than 250km/h inside the future tunnel, while the Eurostar passenger trains shuttling between Paris and London normally slow down to 160km/h while they are in the Channel Tunnel.

Some experts believe the experience gained in the project will help Beijing prepare for a much more ambitious tunnel that would extend the mainland's sprawling rail network to Taiwan. Plans for a tunnel spanning the 130km Taiwan Strait are being floated, though the current animosity between the two sides means there is no timetable.

# China's longest and deepest undersea subway tunnel

Chinese workers have built a subway tunnel reaching as deep as 88m under the surface of the sea. The passage measures 8.1 kilometres (five miles) long, with 3.49 kilometres (2.1 miles) submerged under the Yellow Sea. It is the longest and deepest undersea subway tunnel in China.

It is also about 100 feet deeper than the Bosphorus rail tunnel in Istanbul, which is said to be the world's deepest underwater railway tunnel.

At nearly 290 feet below the ocean, the pressure becomes so great that each square metre of the tunnel has to bear a force equivalent to the weight of 300 cars, according to a

project manager from the project.

Construction of the impressive cross-sea link was finished in November 2018 after having started in 2015. It is part of the No. 1 Metro Line in Qingdao, an eastern metropolis with around nine million people. A former German colony, the city is dubbed China's 'capital of beer' because of its famous lager Tsingdao.

The new 37-mile-long subway line has 23 stops and is set to start running in 2020. The tunnel could help cut passengers' travel time across the Jiaozhou Bay down to six minutes. The subway line adds to Qingdao's current 11



subway lines and connects downtown with the city's Huangdao district.

The news of the completion of the Qingdao tunnel comes

less than a month after China opened the world's longest sea-crossing bridge, linking Hong Kong, Macau and Zhuhai.

## China-Laos railway

Chinese engineering company has completed the first over-1000-meter tunnel along the China-Laos railway.

Nateuy No. 1 Tunnel, some 360km north of Lao capital Vientiane, is located in the northern Lao province of Luang Namtha bordering China in the north.

Huang Zongwen, a senior official with the China Railway No. 5 Engineering Group (CREC 5), which is in charge of the tunnel's construction, told Xinhua the construction of the Nateuy No. 1 Tunnel, with 1158 meters, was started on June 3, 2017.

In December 2017, Ban Somsanook No. 2 Tunnel with a length of 301m in Laos' Vientiane Province, was bored by the Chinese project contractor Sino Corporation Engineering Bureau 15 Co., Ltd., and became the first completed

tunnel along the China-Laos railway route, and the first road and railway tunnel in Lao history.

The China-Laos railway is being promoted by the leaders of the two countries as a project of interconnectivity. Since the commencement of construction in December 2016, the building of tunnels, bridges, roadbeds and other sections has progressed smoothly.

The China-Laos railway has a total length of more than 414km comprising 60 percent of bridges and tunnels (around 198km), linking Mohan-Boten border gate in northern Laos and the capital of Vientiane.

The operating speed of trains on the route is designed to be 160km per hour. The railway is expected to be fully operational in December 2021.

## Bheri-Babai project, Nepal

More than 75 per cent tunnel construction of Bheri-Babai Diversion Multipurpose Project has been completed to date. Over nine-kilometre of the tunnel has been dug using TBM. The total length of the tunnel is 12.2 kilometres.

It is the first time in the country's history, a TBM has been used in Nepal.

In the first phase, 12-kilometre tunnel will be constructed and 48 megawatts electricity will be generated while irrigation system will be developed in the final stage.

Located between Bardiya of Province 5 and Karnali Province, the TBM is excavating 40m of the tunnel daily.

After the completion of tunnel work, a dam will be built at Chiple of Surkhet and a powerhouse at Chepang of Bardiya. After the construction



of a 15m tall dam, water from Bheri will be diverted to Babai at the speed of 40 cubic centimetres per second. The water brought to Babai will be used for irrigation.

A target has been set to generate 48 megawatts electricity from the project by constructing a powerhouse in Bardiya. Earlier, the project had set a deadline of 2020 to complete the tunnel work. As many as 600 people, including Chinese and Nepali nationals, are working on the project. The total estimated cost of the project is Rs 16 billion. The project is being built with domestic investment.

# Melamchi contractor arrested

Police have arrested eight staffers of Italian contractor from the Melamchi Water Supply Project Cooperativa Muratori e Cementisti (CMC) di Ravenna which is close to bankruptcy and handed them over to the Ministry of Water Supply.

The Italian company that earned around US\$15bn, around 75 percent of that from

infrastructure projects outside Italy, was suffering from cash flow problems from the start of 2018.

The work of concrete lining 960m of the Melamchi tunnel is still remaining, according to the MWSDB. Intake and closing the hydro-mechanical gate also have yet to be completed.

A ministry official told Setopati that all these works

would have been completed by April at the current pace. But this project is again facing uncertainty due to the financial problem of the contractor.

The government had promised to bring water from the Melamchi project, that started in 2001, to Kathmandu by October 2018 but it could not do so.


The government had brought

CMC di Ravenna in 2013 after terminating the previous contract with China Railway 15 Bureau Group following their sluggish work. The Chinese company had constructed only 6.5km of the 26.3km tunnel from Ribarma in Sindhupalchowk till Sundarijal in Kathmandu and CMC was roped in to construct the remaining part of the tunnel.

## Rishikesh–Karnaprayag Railway

### ABOUT THE PROJECT

The rail line will be a boon for locals as well as pilgrims



- The rail project will have the country's longest tunnel of 15.1 km between Devprayag and Lachmoli
- The rail link will cut down the travel time between Rishikesh and Karnaprayag from seven hours to two hours
- The project has been delayed by six years mainly due to the Union environment and forest ministry's initial objections to handing over the possession of forestland to Rail Vikas Nigam Ltd.

**₹16,200 cr**  
The current cost of the proposed 125-km rail link is about four times the original cost

The Rishikesh–Karnaprayag Railway runs from Rishikesh railway station to Karnaprayag. It is Indian Railways' proposed route for the Char Dham Railway to connect to the Chota Char Dham. It is one of the initiatives of Modi Government to counter China's expansion. This 125km route starts at New Rishikesh railway station at 380m AMSL and ends at Karnaprayag 825m AMSL. It will have 16 bridges

and 105km or 85% of the project inside tunnels. A 15.1km tunnel, reported to be the country's longest, will be built between Devprayag and Lachmoli on the route. The design consultancy contracts for tunnel and bridge construction shall be awarded in 2018-19 and construction shall start in 2019-20. Work for the first block section from Virbhadra Railway station to New Rishikesh station commenced in June 2018.

## Mumbai's Metro-3

In September 2018 the first tunnel of the 33.5km Colaba-Bandra-Seepez (Metro-3 line) was completed.

The 1.26km tunnel between Pali ground in Marol, Andheri (East) and the International airport terminal T2 was completed in 259 days.

According to the Mumbai Metro Rail Corporation (MMRC), the TBM started working on the tunnel on January 8 from Marol. It was completed with an average speed of 4.6m/day.

The 4.15km package section between Terminal T2 to Aarey, of which the 1.26km tunnel is a part, is being constructed by engineering giants Larsen & Toubro and Shanghai-based STEC.

The tunnelling done by TBM 'Wainganga - 1' broke through rocky strata made of basalt, breccia and tuff near Terminal T2, where an underground station is proposed.

Three months after the first tunnel of the 33.5km Metro-3 (Colaba-Bandra-Seepez) was completed, the second tunnel completed over Christmas. With this, the Mumbai Metro Rail Corporation (MMRC) had complete approximately 15km of tunnelling in the city.

The 568m tunnel, extending from the Sariput Nagar launching shaft to the Seepez station, was completed in 125 days. The work on the tunnel had commenced on



**Metro-3 line workers celebrating the first tunnel breakthrough in Mumbai.**

August 23, 2018.

According to officials, the TBM Wainganga 2, covered a distance of approximately 10m per day. The 17 TBMs used for the project have been named after rivers in the state. The tunnel is a part of a 4.15km package, with three proposed underground stations – MIDC, Marol Naka and Seepez.

The fully underground line connecting south Mumbai's Colaba to Seepez in the western suburbs is touted to change the face of public transportation once operational. It is Mumbai's costliest Metro route and also called India's longest underground rail stretch.

MMRC, which is executing the first and only fully underground line in the city, is expecting to complete 80% of the tunnelling work by December 2019. The line will be partly operational starting 2021.



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# New Penang tunnel proposal

One of the proposed highways in the controversial Penang Transport Master Plan (PTMP) will feature a double-deck tunnel leading from Gurney Drive to Pangkor Road. The PTMP Special Purpose Vehicle (SPV) chief said the highway, under Package Three, required a tunnel as Pangkor Road was too narrow.

“There will be two layers, one is for incoming traffic and

another layer for outgoing traffic,” he told a press conference today to explain details of the project for the three highways project that is also part of a RM6.3bn undersea tunnel project.

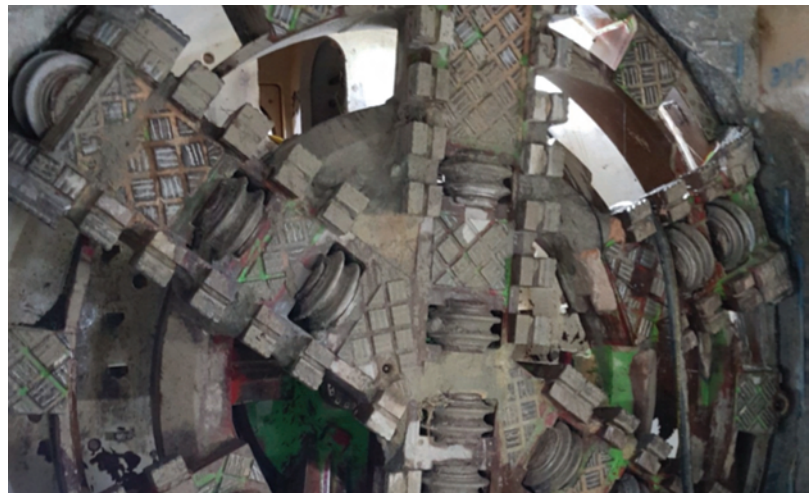
Lim said the tunnel will emerge along Jalan Sungai Pinang, adding the two-tier format will also be retained from Jalan Sungai Pinang due to inadequate width to support the projected traffic.

## New drains for Singapore

In Singapore, a Herrenknecht EPB Shield, Ø 5,250mm has excavated two large drains for the Stamford Diversion Canal. After the final breakthrough of the 1,000 meter long twin tunnels, the new drains will take the pressure off the Singapore River and reduce flooding in future.

The new tunnels expand the existing drainage system and will relieve the Singapore River long-term, for example during heavy rain. This greatly reduces the risk of flooding in the city-state.

In the very heart of Singapore, the twin tunnels complement the existing five kilometer long Stamford Canal. Due to the inner-city location, the smallest possible diameter of 24m was chosen for the round launch shaft. Because of the limited space, during design already attention was paid to



it was ready for its tunnel mission.

On completion of the first tunnel the machine was returned to its starting launch shaft, where it began

inner city of Singapore. In 2010 and 2011 Orchard Road, which runs near the Stamford Canal, was repeatedly affected by major flooding because the existing drain could not accommodate the water masses during heavy rain and flash floods. In recent years, rains have become heavier and floods in Singapore more frequent, reports the National Water Agency. The expansion of the drainage system is designed to prevent this in future and relieve the Stamford Canal by up to 30 percent.

Additional challenges were posed by the short distance between the two tunnels and a tight curve radius of 180m in the course of the alignment. Precision and intricate work were called for here: with shield articulation cylinders, the curve drive was continuously adjusted so that deviations were always within the tolerance. In this way a continuous advance with top performances of up to 18 meters per day and 91m per week was possible. The site crew of customer Tiong Seng Contractors (Pte) undertook the project.



making the machine as compact as possible. The individual parts of the EPB Shield arrived just-in-time at the jobsite. Herrenknecht engineers gently lowered the TBM component by component into the launch shaft until

excavation of the second tunnel tube. With a drive power of 630 kilowatts, the TBM worked its way through complex ground conditions (highly weathered granite) and with small overburdens crossing under the busy



# TERRATEC EPBM success in Bangkok

**A new 4.27 m diameter TERRATEC tight radius TBM will enable a challenging alignment on the Bangkok Metropolitan Electricity Authority's Klong Daan Cable Tunnel, in Thailand .**



At the end of November 2018, TERRATEC celebrated the successful Factory Acceptance Test of another tight radius machine. This machine is a new 4.27m diameter Earth Pressure Balance Tunnel Boring Machine (EPBM) destined for the Klong Daan Cable Tunnel Project, in Bangkok, Thailand. The event was attended by representatives of Bangkok's Metropolitan Electricity Authority (MEA) and Thai contractor See Sang Karn Yotah (1979) Co., Ltd. Designed to accommodate a new high-voltage cable system, the Klong Daan Cable Tunnel

Project is one of a series of tunnelling projects being undertaken by the MEA, which are being built to meet increased power demands in the Thai capital. Located to the south east of the city, the Klong Daan Cable Tunnel Project is situated in the Bang Bo District of Samut Prakan, and is subject to tight alignment constraints imposed by the need to follow public road easements. To achieve this, the TERRATEC EPBM has been designed with an X-type articulation system, which can accommodate extremely tight horizontal curves. The

machine, which is capable of excavating a minimum radius curve of 48m, will be used to conduct three tunnel drives (of 1,128m, 875m and 795m in length), at a maximum depth of 31m, each beginning or ending with a tight curve. "We have used a number of TERRATEC machines on past tunnel projects, including contracts for the Bangsue Wastewater Collection System and Installation Main Underground Conduit for Electric and Relation Works," says See Sang Karn Yotah (1979)'s Project Manager, Mr. Ekaphong Rungruang. "Those machines were very well suited to the ground and that, along with TERRATEC's experience in designing high performance TBMs and the quality of its field service, was the reason we decided to select TERRATEC for the cable tunnel at the Klong Dan Substation." Geological conditions along the tunnel alignments will consist of mixed faces of very stiff to hard or silty clay and very dense to very fine sand. The TBM's soft ground cutterhead therefore features a spoke design with a 70% opening ratio and the addition of knife bits to assist break-in and break-out of the concrete shaft eyes. Traditionally reinforced, 250mm thick by 1200mm wide, Universal tapered precast concrete segments (4 + key) will be installed as the machine progresses and muck removal, segment transport and machine supply will be via rail bound equipment.

Machine operation will be assisted at all times by TERRATEC's highly-experienced Field Service staff, providing quality after sales support to ensure optimum performance and successful project completion. Following the successful factory acceptance test, the machine will be now shipped to Thailand and is expected to arrive in mid-2019. The TBM will then be transported to the project site where it will be launched on its initial 1,128m-long drive.

## Kiyotsukyo Gorge Tunnel

Visitors to the Kiyotsukyo Gorge Tunnel reflect on a new way to enjoy the spectacular winter vista. Water has been spread on the floor of the tunnel, while stainless steel plates now cover the walls. The setting allows for the outside scenery

to be reflected within the tunnel.

The artwork titled "Tunnel of Light" was created by the Chinese architect Ma Yansong and others within the pedestrian tunnel, which offers panoramic views of the Kiyotsukyo Gorge.



# Hiroshima Expressway Line 5 project

On September 18, 2018, a Robbins mega-sized slurry machine, measuring 13.7m in diameter, made its first cut into hard rock. The epic launch at an urban jobsite was made possible by Onsite First Time Assembly (OFTA) of the TBM in Japan for the Hiroshima Expressway Line 5 project. The contractor, a joint venture of Obayashi-Taisei-Kosei, had a strict timeline of eight months to adhere to when it came to machine assembly. “This deadline was very important. After assembling the TBM, I think OFTA was appropriate for this project,” said Mr. Ryota Akai, Deputy Project Manager for the Obayashi JV.

Due to the project location there were also restrictions on delivering the TBM—in order to meet controlled transportation limits within the city, the TBM had to be divided into small transportable weights and sizes, then assembled in a small jobsite measuring just 30m wide x 60m long. The 2,400 metric ton machine will bore 1.4km of the 1.8km long tunnel that, once completed, will significantly improve traffic conditions in Hiroshima.

The massive machine is the country’s first foreign-made large diameter Slurry TBM to excavate hard rock in Japan. “There is a lot of hard rock in Hiroshima,”



said Mr. Akai, “and Robbins has a lot of experience boring hard rock.” The machine is expected to encounter granite with rock strengths up to 130MPa UCS. Those involved in the project are excited to see what effect this will have on how Slurry TBMs are used in the future. “The development of this TBM is a milestone,” said Mr. Kiyomi Sasaki, General Manager of Robbins Japan, “it will lead to new tunnel applications worldwide.”

The design of the Slurry machine is robust in anticipation of potentially abrasive rock conditions and water pressures up to 13 bars. “The Robbins machine is very tough, for example the weight is very heavy. The cutterhead, both its material and structure, are very tough. It will not break in hard rock,” said Mr. Akai.

In preparation for the conditions, the machine was designed for 20-bar water

pressure. The robust cutterhead was fitted with 20-inch and 17-inch diameter pressure compensating cutters, which utilize a patented design to effectively operate under high pressure. The joint venture intends to change the disc cutters an estimated 10 times during the bore as part of the machine’s maintenance.

Throughout the assembly and launch process the joint venture crew worked with Robbins Supervisors who assisted and provided guidance. “Robbins crews have a lot of experience; they help us every day despite the language barriers. I appreciate it,” said Mr. Akai.

The new Expressway Line 5 tunnel will directly connect Hiroshima’s urban area with a major national highway network and is expected to improve access to Hiroshima Airport. Tunnel completion is planned for 2020.

# Jakarta-Bandung high-speed railway project

A TBM for the 142-kilometer Jakarta-Bandung high-speed railway project has arrived in Jakarta after being transported on the Phoenix Pine ship from the Zhanghuabang Wharf in Shanghai, China.

“The TBM is able to construct a tunnel for double-track railways for high-speed trains,” the president director of railway developer PT Kereta Cepat Indonesia China (KCIC), Chandra Dwiputra, said at an event welcoming the machine at Tanjung Priok Port in North Jakarta on Thursday.

The machine, which weighs 3,649 tons with a diameter of 13.19m and a length of 105m, will first be operated in Halim, East Jakarta, to assist in the development of a 1,885m tunnel called “Tunnel #1”, one of 22 points that will use the TBM.

The machine would be operated using a shield tunnelling method to ensure that



construction does not affect crowded areas above ground, like the Cikampek toll road and the Jatiwaringin overpass, Chandra said.

“The TBM will work for 24 hours

without pause with a drilling rate of between 8 to 10 meters per day,” Chandra said, adding that technicians needed 45 days to assemble the machine before it would be operated in March.

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# Gold 'mother lode' unearthed in Kambalda

Underground miners in outback Western Australia have unearthed rare gold specimens which geologists are calling a "once-in-a-lifetime discovery".

Workers at the Beta Hunt mine near the small town of Kambalda, 630 kilometres east of Perth, have brought more than \$15 million worth of gold specimens to the surface in just four days.

The gold-encrusted rocks were found about 500 metres below the surface in an area just three metres wide and three metres high.

The largest specimen weighs in at 90 kilograms and took three men to lift it onto the back of a ute. The quartz rock is covered in an estimated 2,300 ounces of gold worth about \$3.8 million at today's gold price. Another 60kg specimen is estimated to contain 1,600 ounces, or about \$2.6 million in gold.

Senior geologist Zaf Thanos said in most mines around the world it is only possible to see gold through a magnifying glass. "You might go your whole life and you'll never see anything like it. It's definitely a once-in-a-lifetime discovery," he said. "As a geologist, like I said, you get excited by a pinhead speck. But to see something on this scale is just phenomenal. This sort of bonanza zone is incredibly unique."

The rich cluster of high-grade gold has so far produced more than 9,000 ounces.

Kambalda miner Henry Dole is credited with the discovery, describing it as hitting the "mother lode". Mr Dole had drilled holes into the wall of the mine and planted explosives which were fired once he was safely on the surface.

When he came back to the same area for his next shift, Mr Dole thought it was business as usual. "Everything was covered in dust, and as I watered the dirt down there was just gold everywhere, as far as you could see," he said. "I've been an airleg miner for 16 years. Never in my life have I ever seen anything like this. "There was chunks of gold in the face, on the ground, truly unique I reckon. "I nearly fell over looking at it ... we were picking it up for hours."

Security tightened but temptation remains. A handful of gold rocks could be worth several thousand dollars, so security has been beefed up in the days since the find. Armed guards have been transporting the gold to a secure vault.



**Above: acting general manager Trevor Steinhauser, senior geologist Zaf Thanos and geologist Lachlan Kenna holding gold specimens ranging from 13kg to 18kg.**



**Left: Henry Dole found the rich patch and said he nearly fell over at the sight of the sparkling rocks.**

Workers are under constant video surveillance and the area of the mine where the gold was found has been fenced off and padlocked.

The irony is that Beta Hunt has been mined for nickel, which is a key ingredient in stainless steel, since the 1970s, and gold has always played second fiddle. There are stories among the

workforce dating back to the early days of the mine which suggest similar bonanza finds may have been made in the past but were not considered significant at the time because of low gold prices. There are also tales that workers in those days would bury bags of gold rocks in the event the commodity came back stronger.

## Andy Well gold mine

Doray Minerals has announced the sale of its first operating gold mine Andy Well to Galane Australia, a subsidiary of Canadian gold miner Galane Gold, in a \$10-million deal.

The Andy Well project is 43km north of Meekatharra in the northern Murchison region of Western Australia. It has produced more than 300,000 ounces (oz) of gold for

Doray since first production in 2013.

The mine suspension was driven by its declining production profile and profit margin, and further capital investment required to extend its mine life. Galane Gold plans to bring back the Andy Well mine into production within six months of recommencing underground development.

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# BHP Flags Major Copper Find Near Olympic Dam

An announcement from BHP has confirmed that very quietly the next resources boom is taking shape, mostly in the states of WA and South Australia. This time it's not coal or iron ore – the old mainstays – but lithium, gas, copper, gold, silver, lead, and zinc.

BHP have announced that a potentially massive medium to low-grade copper deposit had been found, with low grades of gold, silver and uranium – similar in fact to the profile at Olympic Dam.

The Olympic Dam mine works an

extremely large iron oxide copper-gold deposit with estimated reserves of 2.95 billion tonnes of ore grading 1.2% copper; 0.04% uranium, 0.5 g/t of gold and 6 g/t of silver. BHP has said in the past that Olympic Dam has 500 years of reserves, especially copper. The new area could add centuries to that. This new find and its similarities to Olympic Dam tells us there could be other huge deposits hiding hundreds of meters underground in South Australia and other states.

Early indications that the new areas

could be a smaller, richer deposit than Olympic Dam, especially so far as copper, gold, and silver are concerned. There is one hole where copper grades of 6.07% have been achieved, with high silver readings as well and some gold and uranium.

Like Olympic Dam it is underground, so the cost of a new mine could be large. Olympic Dam is already Australia's biggest underground mine, it is the 4th largest copper deposit in the world and the largest deposit of uranium. Now it could have a rich but smaller deposit nearby.

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## Cannon Gold Mine Development

Southern Gold hopes to accelerate the development of the Cannon gold mine after accepting a mining lease transfer from Northern Star.

In a new agreement between Northern Star and Southern Gold, the latter will accept a transfer of the mining lease for the Georges Reward deposit, immediately to the north

of Cannon, from Northern Star.

“The execution of this agreement with Northern Star is an important development. It enables Southern Gold to move forward with the asset where there is considerable value to be unlocked by a small underground mining operation,” said Southern Gold Managing Director Simon Mitchell.

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## Cowal gold mine underground expansion

Evolution Mining Ltd' Cowal gold operation near West Wyalong in NSW, Australia, has been granted regulatory approval from the NSW Department of Planning and Environment to commence construction of the Galway-Regal-E46 (GRE46) exploration decline. This will allow Evolution to conduct further resource definition and discovery drilling following the announcement in April 2018 of a maiden GRE46 underground Mineral Resource of 5.90 Mt at

3.17g/t Au, for 603,000 oz of gold. It will also facilitate further drilling and delineation of the recently discovered high grade Dalwhinnie Lode.

Development is expected to commence early in the March 2019 quarter and will involve capital expenditure of approximately A\$20 – A\$22 million over FY19 and FY20. A further investment in underground drilling of A\$6 – A\$7 million is expected to be spent on an initial 36,000m drill program.

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## EPCM for Tanami underground gold mine

WorleyParsons has been awarded an engineering, procurement and construction management services contract (EPCM) by Newmont Mining Services Pty Ltd in Australia. Under the contract, WorleyParsons will provide the EPCM services including pre-commissioning, commissioning, start-up and performance testing services for Newmont's underground gold mine operations located in the Tanami Desert in the Northern Territory of Australia.

The EPCM contract is for four years and will establish deep shaft and related mining infrastructure to increase mining production at the mine. “We look forward to continuing our successful relationship

with Newmont and supporting the further development of the Newmont Tanami operation”, said Andrew Wood, Chief Executive Officer of WorleyParsons.

Dacian delivers first ore from Allanson deposit

Dacian is set to reach commercial production targets at its Mt Morgans gold operation near Laverton, Western Australia after achieving first ore at the Allanson deposit. Allanson is one of three underground declines at Mt Morgans' Westralia mining area. The other two declines within Westralia are the Beresford North and Beresford South deposits.

Dacian also announced that it was set

to hit another milestone with stopping scheduled to begin at Beresford North soon. Each deposit is expected to produce an average of 1000 tonnes a day at Westralia.

At the end of the September 2018 quarter, the company was achieving an average of 1900 tonnes a day at Westralia, with the majority coming from Beresford South. Mt Morgans has a 2019 financial year target of 180,000–210,000 ounces of gold.

The \$200 million Mt Morgans project achieved first gold in March 2018 with an initial ore reserve of 1.2 million ounces and a mineral resource of 3.5 million ounces.

# Ramelius goes underground at Edna May

Edna May is currently an openpit operations but will go underground early next year. Gold miner Ramelius Resources has opted for underground operations at Edna May, rather than developing a large Stage 3 openpit cutback at the Western Australia-based operation. Starting in early 2019, the company will start underground mining and ore production is expected from the start of the 2020 financial year, with an initial life of two-and-a-half years.

Announcing a development decision, Ramelius MD Mark Zeptner said that the decision to move underground at Edna May was not taken lightly. "After extensive studies and considering our future operations around other potential ore sources in the area, we believe this is a prudent decision that will lead to exceptional future outcomes for our shareholders."

An underground mine will realise substantial savings on capital expenditure. Prior to the acquisition of Edna May by Ramelius, Evolution Mining spent about A\$20-million on a mine portal inside the current openpit, plus some 250 m of vertical development. The September 2018 prefeasibility study (PFS) for underground development estimates upfront capital of A\$5.9-million for the underground mine.

## Fire at North Goonyella

The fire at the Bowen Basin mine, the workplace of 225 employees had the potential to rage for years. The situation at the mine, about 65km north of Moranbah and 160km west of Mackay, became progressively worse over a few weeks in September-October 2018.

Peabody implemented a detailed plan to address the situation:

- Implementing use of a mobile GAG unit - a specialist piece of equipment that generates high-moisture inert gases to displace oxygen supply at a fire zone;

- Installing temporary seals into mine openings following completion of risk assessments and utilising remote-control equipment to pump a fire-resistant expandable material called Rocsil;

- Ensuring the area is further isolated by additional drilling and sealing of the old longwall panel;

- Working with air quality

- monitoring experts on a voluntary program of environmental monitoring at North Goonyella, including regular site visits and boundary inspections to assess and analyse air quality data from key points;

- Ensuring all aspects of the exclusion zone and other safety protocols are in place and observed; and

- Efforts to extinguish an underground fire at Peabody's North Goonyella Mine were finally successful in October and the mine is now planning for the future.

"The recent fire incident at Peabody Energy's North Goonyella longwall mine in Queensland - which has cost the company US\$58 million in firefighting and longwall equipment that had to be sealed off -- should not hold back the company's march towards greater profitability", Peabody CEO Glenn Kellow said.



## New block cave project at Northparkes Mines

China Molybdenum Company (CMOC) and Sumitomo have announced the final approval of a new block cave mine at Northparkes Mines (Northparkes) called E26 Lift 1 North (E26L1N). The investment will be more than \$200M over a three and half year period with construction scheduled to commence this month and with full production expected in mid-2022. The project will produce approximately 40Mt of ore over a 10 year period.

Executive Chairman and CEO, CMOC Group, Steele Li said, everyone is really excited to see this project come to fruition and to watch Northparkes continue to develop and grow. "Northparkes plays a pivotal role in our strong and long-term presence in Australia as an internationally renowned mining company," he said.

The project will deliver 11km of underground development, an underground primary crusher, conveying systems and associated infrastructure. At the peak of construction, the project will employ up to 180 people which will be a mixture of employees and contractors. This project is covered by the current project approvals, licences and permits.

An upgrade to the ventilation system is currently being developed which will provide the new E26L1N mine with sufficient air flow to support development and production activities.

The E26L1N operation will be designed to utilise an increased level of automation and digitisation, helping to deliver a safer and more productive mine.

Northparkes was the first mine in Australia to use the highly efficient block cave mining method, becoming a more widely used mining method throughout the world.

In 2015, Northparkes became the world's most automated underground mine with 100% of production from automated loaders.

Northparkes has approved development consent to mine until 2032. As of December 31, 2017, Northparkes has reserves of 125 million tonnes of ore and in addition resources of 471 million tonnes.



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# Automation at Lady Loretta

In December 2017, Redpath Australia was selected to be the Site Operator at Glencore's Lady Loretta high-grade Pb-Zn (lead-zinc) orebody which will be mined at a rate of 1.6 Mt/y with the scope of work including the entire underground and surface operations, along with the associated facilities management on site.

Redpath reports that to date its work at Glencore's Lady Loretta mine has delivered excellent physical results, exceeding all key targets for Glencore. "Significant planning and teamwork, especially in areas such as recommissioning the paste plant, batch plant and crushing plants has made this possible. There have been many learnings during the mobilisation/commissioning period, but overall, Redpath is meeting or exceeding the client's expectations and is on track to meet the nameplate capacity of 1.6 Mt/y of ore crushed by the end of December 2018. A key process implemented is having quarterly "alignment sessions" involving all key Redpath and Glencore management so that all aspects of how the project is operating are maturely debated, and actions put in place to improve in the subsequent quarter. These sessions flush out any uncertainty or issues present, and ensure that the management team align and work together to the common goal."



The mining method at Lady Loretta is conventional sub-level open stopping (a slot is opened up using a Redbore 30 raisebore raise drill) with paste used to fill the void upon completion. Ore is removed by Sandvik LH621 loaders (LHDs), using the Sandvik AutoMine system and is trucked to the surface ROM using Epiroc MT65 underground trucks. The surface crushing plant is then loaded, operated, and maintained in addition to loading the Glencore-controlled roadtrains which deliver the crushed ore to the Mt Isa processing plant.

"The excellent work that Glencore did in

setting the mine up with underground WiFi, has allowed Redpath the opportunity to embrace some of the modern technologies available in underground mining. These include Sandvik's AutoMine which provides for automated tramming of underground loaders allowing operation over shift changes and optimised performance. Mobile fleet monitoring has commenced through Certiq and OptiMine which help operators to operate equipment better and data analysis for continuous improvement. Plodtrack, for recording shift by shift mine activity, is the start of a move toward real time information capture."

## Spectrum snaps up historical gold



**Spectrum Rare Earths has continued its high-grade gold strategy in Western Australia by purchasing the First Hit gold mine, located 50km west of Menzies in the Goldfields region.**

The company has acquired 100% of the historic and now mothballed, high-grade gold mine, including two granted mining leases, from the previous tenement holder in a deal costing \$200,000. Ore at



# Drones unlock safer future for underground mines



A new autonomous drone start-up from Queensland, Emesent, has received venture capital backing for its technology to make underground mines safer and more productive.

Emesent's first product, Hovermap, is installed on drones to automate data

collection in underground areas too dangerous or difficult for people to survey, such as in mines.

Minister for Industry, Science and Technology Karen Andrews said Emesent featured world-leading drone technology, developed by

former researchers from CSIRO's Data61 and supported by the Coalition Government's National Innovation and Science Agenda.

"Emesent has developed game-changing technology with the potential to boost the global mining industry. This is a prime example of how investment in Australian research can create new opportunities and value for our economy, including our mining sector," Minister Andrews said.

"This could help improve the productivity of mines and the safety of workers. The data collected provides a better understanding of underground mine conditions, without placing miners in hazardous situations," she said.

"The Coalition recognises the importance of our science, research and technology capabilities to Australia's economic growth and jobs of the future – that's why we've invested \$2.4 billion in this year's Budget to grow these sectors."

Hovermap can be deployed in GPS-denied environments without a human controller to create 3D maps, and record gas

readings, videos and images.

The data can be used to compare the stope design to the actual post-blast shape to detect over-break and under-break, identify geotechnical structures and generate accurate post-blast volume reconciliations.

Emesent raised \$3.5 million in a funding round led by Main Sequence Ventures — CSIRO's Innovation Fund and also received support from CSIRO's ON Accelerator program, both supported by the National Innovation and Science Agenda.

Last year, Hovermap enabled the world's first fully autonomous beyond line-of-sight drone flight in an underground mine, 600 metres below the surface of Western Australia.

The Hovermap system is already being used commercially for a variety of applications by early adopters in Australia, the US, Canada, China and Japan. The real world applications of this technology extends beyond mining and can be integrated into industries such as underground rail and road transport, telecommunications, and disaster response.

## mine in WA

**the First Hit mine was extracted between September 2001 and December 2002 by then, private mining services contractor Barminco Ltd.**

**A box cut at surface leads to underground mine access and stopes that are developed vertically over a height of about 150m, with the ore body plunging at a shallow angle southward on the main Evans lode.**

**Surface and underground drilling at the base of the existing workings shows that the gold mineralisation is open to the north, south and down-plunge,**

**according to the company. There is also an indication that a parallel footwall lode, the Evans FW lode, exists unexploited in the southern end of the main lode structure.**

**Spectrum says there are numerous other opportunities within the newly acquired tenement package for further discoveries of gold mineralisation too.**

**The last time the mine was worked and subsequently mothballed, the prevailing gold price was sitting around A\$570 per ounce, about a third of what it is today.**

# Forgotten rail tunnel for heritage protection

A disused railway tunnel has been reclaimed by local residents and artists who are now fighting for its preservation. Built in 1888, the Ernest Junction railway tunnel at Molendinar is a remnant of the South Coast railway line, which connected Brisbane and the Gold Coast.

Judith deBoer remembers



**Graffiti artists are encouraged to be creative.**

catching the train when she was a young girl. "I used to catch the train from Brisbane to Southport at Christmas time to visit my aunt and I realised it was through this tunnel," she said.

Five years ago she and her husband, Ted, were looking for a venue for a music concert and thought of the tunnel. "We came out to take a look at it and it was ghastly," she said. Both entrances were overgrown with lantana and the 110-metre tunnel was filled ankle deep with mud, empty spray cans, and rubbish.

Ms deBoer went to a heritage fair and asked for community help to clean up the tunnel. "We had one Saturday morning work party fill truck, after truck, after truck and then Ted and I just kept going," she said. The couple do a weekly rubbish run, mow the lawns and it has now become a community asset. "The community thinks they own it now," Ms deBoer said.

The tunnel walls are lined with graffiti and the volunteer said locals and artists had reached a truce. Spray painting is welcome as long as the messaging and the tunnel is kept clean. "We always call them tunnel artists," Ms deBoer said. "We don't refer to their work as graffiti and it's the only place on

the Gold Coast, or I think in south-east Queensland, where they can actually create and not get into trouble.

"All creative endeavours are welcome. A lot of filming ... wonderful stuff goes on here."

Photographer Ness Stretton used to ride her motocross bike through the tunnel as a child and now uses it as a backdrop for her photography. "You can do things during the day that you can [usually] only do at night like steel wool spinning," she said. "The university is using it for film practice now.

The South Coast rail line was used to transport people and goods until it was shut down in 1964.

Amateur historian, Peter Jones, said the tunnel was one of the last remnants of the railway line.

"There's only two main items left of the railway line — this [tunnel] and the Nerang Station — which is at the Mudgeeraba Museum and that's all that's left," he said.

He said the railway line was ripped up because the weight of

the trains kept increasing beyond the engineering design of the tracks. "They would have had to have rebuilt the whole line due to the engines getting heavier," Mr Jones said. "The track was not designed that way."

The tunnel has been placed on the Gold Coast Heritage Register, but Judith deBoer, and a committed group of locals, now want it placed on the Queensland Heritage Register to give it another layer of protection from future development in Molendinar.

Divisional Councillor, Dawn Crichlow, said the tunnel had two owners and an agreement was needed. "We had a problem before because it was half-owned by the council and half-owned by the state," she said. "Now the state is happy to pass it over to the council and the council has supported the Heritage Register.

The Friends of the Ernest Junction Tunnel are hoping the tunnel will be added to the Queensland Heritage Register by the middle of 2019.

## Gold Creek Dam tunnel

It appeared unannounced hidden in the Australian bush, a reminder of a forgotten past, still echoing the voices of one of Australia's greatest engineers, British aristocracy, and an overlooked Brisbane goldrush. This was a tunnel lost in time, built ninety years ago and instrumental in the development of Australia's third largest city.

The pipeline was built in 1928 to connect the colony's first dam Enoggera Creek Reservoir with its second, the reservoir at Gold Creek.

Surrounding the tunnel entrance is an Australian eucalypt forest and rusting remnants of ninety-year-old machinery. Inside was a time vortex that traces back to colonial times 138 years ago to when the Gold Creek dam itself was built.

The dam was designed and constructed by John Baillie Henderson (pictured right), Queensland's first

Government Hydraulic Engineer. Henderson was famous as "Hydraulic Henderson" because he successfully combined the science of hydrological engineering with local concerns in a region characterised by drought and flood, like few who preceded him ever did.

The dam that he built has the world's first concrete stepped spillway which was the precursor of modern roller compacted concrete stepped spillways today. The site was visited in 1883 by Lord Lewis Henry Hugh Clifford, the 9th Baron Clifford of Chudleigh (pictured below), who later became the Aide-de-Camp to King Edward VII. The construction was completed in 1885.

Traces of gold had long been found in the area, and in 1895 payable amounts were reported by the local postmaster William Butler who had been

prospecting there for some time. Two years earlier, Butler was a founder of the first church council of Brookfield's Anglican Church of the Good Shepherd. His family bible from 1881 can still be seen in the church today.

A gold rush threatened in 1922 when a number of new finds were reported. By August of that year, seventeen claims had been pegged out that employed around fifty men. Some of these mines can still be seen in Brookfield to the present day.

The tunnel was constructed in 1928 while there was still enthusiastic prospecting happening. Water from Gold Creek dam was originally supplied to Brisbane via gravity main. The tunnel was dug through a quarter of a mile of rock separating Gold Creek and Enoggera Creek. One hundred and thirty-nine pipes were laid through the ridge alone. The two bodies of water then operated as a single connected storage to help satisfy the thirst of the burgeoning city.

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# Adelaide Wartime bunkers

The world was in shock when Japanese planes bombed Pearl Harbor in December 1941, forcing Australian prime minister John Curtin to join other nations and declare war on Japan. The Australian mainland came under direct attack for the first time, as Japanese aircraft bombed towns including Darwin and Japanese submarines attacked Sydney Harbour.

Curtin warned the nation to be ready for attack and South Australia and Adelaide heeded his warnings.

Bunkers were built throughout the suburbs at Glenelg, Unley, Norwood, Prospect, Woodville, Port Adelaide and Thebarton and housed telephone networks that would relay messages back to the Bank of South Australia's underground tunnels in King William Street.

The bunkers were manned by emergency services, while volunteers ran the switchboards and young girls and boys were

on stand-by to act as bicycle couriers. The communication bunkers were put next to football grounds as part of overall evacuation plans should the city come under attack.

Adelaide was in lockdown mode, with air raid shelters built in Victoria Square. Residents were even encouraged to build their own backyard trenches to hide in, should the city be bombed.

Now, just three of the communications bunkers remain at Prospect, Thebarton and Glenelg, while another is used as an infrastructure building by the Unley council.

Neil Rossiter, from the Prospect Local History Group, has made it his mission to save the run-down and often forgotten Prospect bunker. "If we lose our history, what do we actually tell our kids about what it was actually like," he said. When he and other residents stepped in, the bunker was full of water and graffiti and in danger of



**The entrance to the Thebarton bunker which is now used to conceal different kind of secrets.**

being demolished for a dog park. With the help of the City of Prospect, a pump was put in to take care of most of the water that came from the local water table.

The volunteers have been given some money to put up honour boards and paint a mural, but it is estimated it could cost up to \$250,000 to fully restore the bunker.

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# Tunnel below Macquarie lighthouse

Look closely and you can just make out the rectangular entrance about halfway down the cliff face below Macquarie lighthouse at Vaucluse.

Despite the use of radar, the exact route of the tunnel remains unclear. Also something of an unknown is its precise purpose, although there are theories.

The existence of the tunnel, previously only known to a few, emerged after Macquarie University (which has the lighthouse as its logo) worked on a 3D imaging project in partnership with the Sydney Harbour Federation Trust to mark the 200th anniversary, at the end of November, of the building of the lighthouse which replaced an earlier crumbling tower. "We don't think the tunnel led to the lighthouse. We did a bit of work with ground penetrating radar which so far is inconclusive. We are looking for that tunnel but if you look at the plans for the lighthouse there's no hidden basement and it's on solid rock. It could have gone to the gatehouse, which has since gone, or to one of the properties next door."

And while the general consensus is that the tunnel was constructed in the 1940s, around WWII, the team have also received some anecdotal evidence to the contrary with reports from locals indicating a different history:

Julia Wright wrote: "My grandfather, William Thompson, was a relieving



lighthouse keeper at Macquarie lighthouse in about 1919. My grandmother told me about going along a tunnel which enabled her to see ships coming in and out of the harbour."

Terry Wolfe, 79, who grew up in the area, said on the northern side of the lighthouse a concrete square shed stood with a steel door. "When the war ended we were able to open the door and we could see inside and there were a series of steel railings going down below.

"In the 1950s a construction firm was asked to go and work on that tunnel to turn it into a nuclear research laboratory. We went there to install an 11-tonne electromagnet and a 10-tonne spectrometer for the Sydney University Nuclear Research

Foundation. They were in the horizontal tunnel where we excavated and formed a cave."

Mark Flitcroft grew up one street back from the lighthouse. "There was ladder fixed to the wall and you could climb all the way down and that took you to where the photo is taken in front of the lighthouse and there was a searchlight. There was a winch [by the entrance] for lowering stuff up and down."

David Lyall, from Clareville, said he believes the platform was a searchlight emplacement. "The idea was if Japanese ships were spotted by the searchlight they would fire at the searchlight, hit the cliff face but the guns on the top of the hill were defended.

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# Industry bands together to address **Silica Dust Exposure in the Tunnelling Industry**

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## **Background**

Each year in Australia on average 250 workers will die from an injury sustained at work, while over 2000 workers will die from an occupational disease, validating the real need to adequately focus on work-related health hazards. Within the context of the tunnelling industry, tunnel construction workers have an increased risk of developing occupational disease when compared to those in the general construction industry due to increased exposure to occupational health hazards. Such diseases include lung cancer, silicosis and chronic obstructive pulmonary disease for example.

In an economic context, tunnel construction in Australia is exceptionally strong as significant building construction, along with major infrastructure projects continue to take place, particularly in metropolitan regions. This has led to the

delivery of more kilometres of tunnels in Australia in the next seven-years than what has been constructed over the past two decades. Of note, almost two-thirds of such tunnel construction is planned to take place in Australia's largest city, Sydney.

Sydney has been shaped by its inherent underlying geology, Hawkesbury sandstone. Geotechnically, tunnelling through sandstone offers enormous benefits as it is soft enough to prevent significant equipment wear and tear, however, is strong enough to hold the shape and form of the excavation. Such characteristics afford huge benefits when constructing tunnels; however such benefits are met with challenges through the generation of silica dust, an inherent health hazard associated with excavating rock containing high quartz concentrations.

Tunnelling through quartz containing rock generates dust known as respirable

crystalline silica, commonly referred to as "silica dust". Overexposure to silica dust causes incurable diseases such as silicosis and lung cancer. Previous studies have demonstrated tunnel construction workers had the highest silica dust exposures in the construction industry, therefore, the control of exposure needs to be prioritised to prevent ill-health in tunnel construction workers.

## **Industry collaboration & taking action**

In 2016 the NSW state health and safety regulator SafeWork NSW published a Work Health and Safety Roadmap, which included a strategy to enable a continued decline in fatalities, serious injuries and illnesses with a specific focus on key priority areas. In mid-2017 SafeWork NSW had finalised a Hazardous Chemicals and Materials Exposures Baseline Reduction



The Australian Tunnelling Society is a strong proponent of the importance of health and safety in the tunnelling sector. The issue of silica dust exposure in construction and tunnelling has received much attention of late, both within the media, and across our industry. The ATS took a proactive approach to this issue through leveraging the strong experience of our membership, and has produced a much needed body of knowledge to support our ever-growing industry.

Collaboration with industry stakeholders is an essential part of raising awareness of the important issue of silica dust control, but also to enable effective strategies to be developed that are practical and a positive step forward. This information produced benefits the wider tunnelling industry and therefore is now made freely available on the ATS website here:

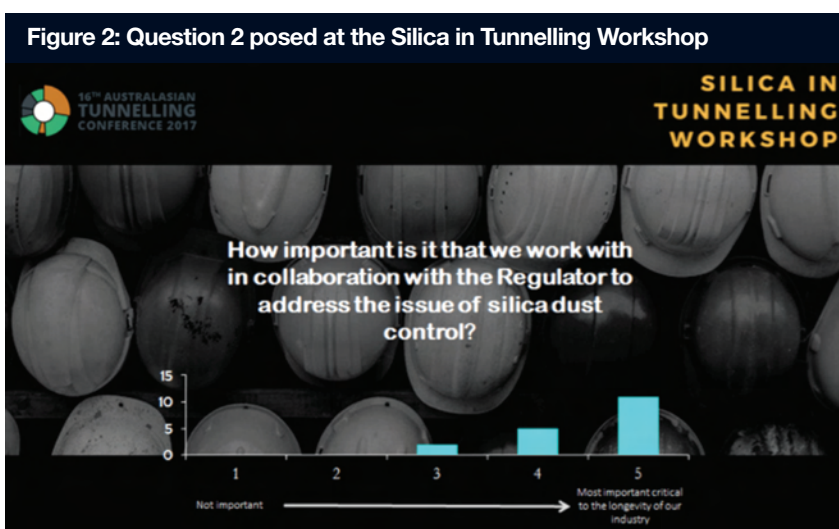
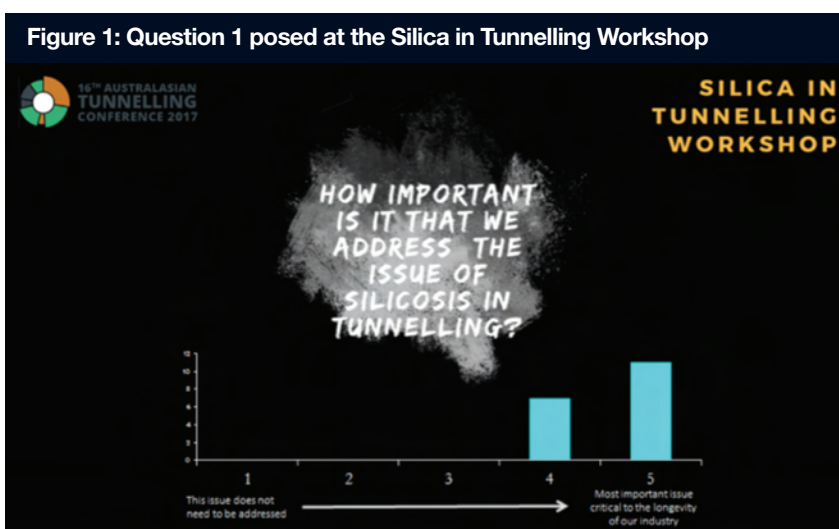
<http://www.ats.org.au/resources/working-group-papers/>

Strategy which resulted in focusing on two priority chemicals, one of which was crystalline silica. At that same time, a Churchill Fellowship report was published that investigated global best practice in this area, and identified engagement and collaboration as critical elements to a best practice approach for reducing illness and disease in Australian tunnel construction workers.

The ATS membership includes contractors, designers, client representatives, asset operators, and members of academia in the tunnelling industry. The ATS was therefore uniquely positioned to facilitate collaboration on this significant topic, recognising the importance of cooperation with regulatory and industry stakeholders in being essential to raising awareness, in addition to enabling the development of effective practical strategies.

Consequently, the ATS executive commenced initial discussions on this issue in September, 2017 and initiated collaboration at the industry's first "Silica in Tunnelling Workshop". The workshop was held at the triennial ATS conference in October 2017 with the aim of bringing together key stakeholders representing major tunnel projects alongside the health and safety regulator, SafeWork NSW to understand if improving silica dust control could be achieved through a strengthened all-industry approach.

The workshop was attended by stakeholders from both client and contractor organisations, representing NorthConnex, WestConnex M4 East, WestConnex New M5 and Sydney Metro City & Southwest, along with representatives from the health and safety regulator, SafeWork NSW.



### The Silica in Tunnelling Workshop

The Silica in Tunnelling workshop involved a facilitated discussion, framed around the participants answering questions regarding

the importance of addressing the issue of silicosis in tunnelling (refer to Figure 1) and working with the regulator to achieve such (refer to Figure 2). Existing control

practices that were working well in the industry were discussed, as were the challenges that needed to be addressed to improve performance outcomes.

Recognising that the workshop was a one-off event and continued collaboration could facilitate improved awareness and industry performance, the notion of an Air Quality Working Group (AQWG) was advocated. Workshop participants were asked to confirm their interest in continuing their participation in a working group for the following 12-month period. Overwhelmingly, all participants nominated either themselves or another individual from their organisation, identified as likely to add value, in addition to being in a position to influence change on individual projects as improvement opportunities were developed.

### The Air Quality Working Group

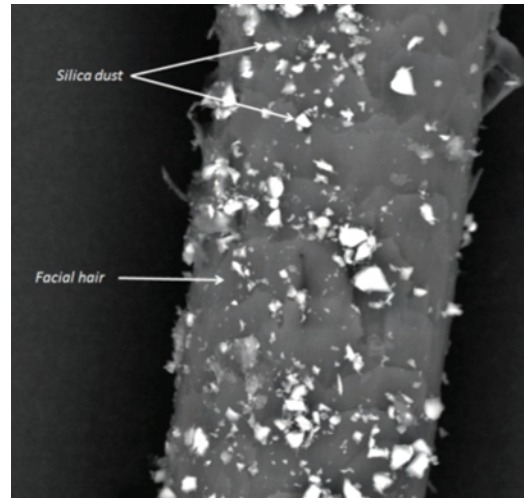
The ATS formed the Air Quality Working Group (AQWG) as a collaborative platform to enable industry to work together to develop and implement health strategies in conjunction with regulatory efforts to improve occupational health outcomes, with an initial focus on respirable crystalline silica (“silica dust”). Over the past 12-months, the AQWG membership have worked to collectively produce reference material that previously did not exist in the tunnel construction industry’s body of knowledge.

leadership positions, those directly accountable for project delivery, in addition to technical representatives such as engineers and occupational hygienists. SafeWork NSW were invited to provide representation, as was the attendance of representatives from Comcare and icare at later meetings.

It should be noted that during the AQWG functioning, further major tunnelling project contracts were awarded and as such, the membership of the AQWG was extended to include representatives from the Western Harbour Tunnel, WestConnex M4-M5 Link and Sydney Metro Central Station.

During the operation of the AQWG, members actively participated and worked together to share their knowledge, information and experience. The ATS communicated the AQWG progress to members via the ATS website, along with supporting Safe Work Australia by participating the Virtual Seminar Series on Silica Dust.

The AQWG focused on sharing information to address the challenges associated with controlling silica dust that were identified in the Silica in Tunnelling Workshop. A body of reference material



**Male facial hair sized in relation to silica dust. Image obtained through the use of a Scanning Electron Microscope**

developed, along with speakers notes, which is able to be easily delivered at tool box talks or at project inductions for example.

At a higher-level, business processes associated with the tunnel construction life-cycle were identified such that the risk of silica dust exposure needed to be effectively considered by client organisations during project planning and design. Reference material targeting design and procurement was therefore developed.

Numerous case studies on engineering controls were developed including those on ventilation scrubber systems, portal misting systems and Roadheader cabin air filtration, in addition to general information on ventilation.

The need for a consistent approach for the performance of health monitoring of tunnel workers was identified as a key challenge, including improving the methods applied to determine which workers are required to participate in crystalline silica health assessment activities. Therefore material was produced to address this gap.

The need for a standardised and consistent approach for personal exposure monitoring, including the methods applied to sampling personal silica dust exposure concentrations was also addressed.

Information was provided on the effective use of respiratory protection and the limitations of use, including the need to be clean shaven; and case studies of practical engineering controls were collated that had been applied at tunnel construction projects to reduce silica dust exposure.

The ATS formally launched this new body of knowledge in Sydney on February 2019. The material is considered to benefit the wider tunnelling industry and therefore is freely available on the ATS website.



### GOLDEN RULES

1. Minimise dust generation
2. Good ventilation
3. Clean cabins
4. Use water
5. Use respiratory protection
6. Routine measurement
7. Health Monitoring

The AQWG functioned as a technical working group under the governance of the ATS between November 2017 and November 2018 and was chaired by independent occupational hygienist and Churchill Fellow, Kate Cole.

Membership included those with tunnelling experience who were working on major tunnel construction projects in NSW. The aim of group membership included representation of those occupying senior

was developed for purposes of communicating information that did not exist in the tunnel construction industry’s body of knowledge.

### Silica in Tunnelling Resources

Information produced included standardised, yet practical awareness material that could be effectively delivered during toolbox talks and tunnel inductions. A “Silica Dust Awareness Package” was

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**As used in:**

- Perth Airport Link
- Sydney Metro

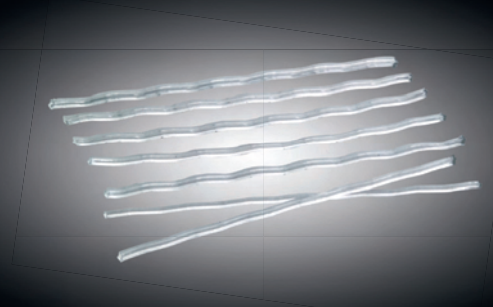
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# Queensland Group Report

Mrs Diane Mather  
Chairperson  
Queensland ATS

Activity	Outcome/Report
<p><b>AGM held Thursday 7<sup>th</sup> December 2017. The 2018 committee nominations were accepted.</b></p>	<p><b>2018 QLD ATS Committee</b>  <b>Chair</b> – Diane Mather (Standards Australia Rep)  <b>*Immediate Past Chair</b> – Dr Harry Asche  <b>Vice Chair</b> – Andrew Ridout  <b>Secretary</b> – Stuart Schmidt  <b>Treasurer</b> – Jurij Karlovšek  <b>Young Member Representative</b> – Monique Quirk, Brodie Aitcheson, Jiwoo Ahn (webmaster)            Committee Member – Alan Robertson            Committee Member – Mark Claassen            Committee Member – Thanh Phan            Committee Member – Jeremy Kruger            Committee Member – Anthony Harding            Committee Member – Brendan Henry            Committee Member – Martin Cunningham            Committee Member – Tino Ferrero            Committee Member – Morteza Ghamgosar            Committee Member – Scott Keniston            *National Treasurer – Geoff Archer            *Shotcrete Society Representative – TBA            * ATS National Austroads Representative – Tony Peglas</p> <p>*denotes role on National executive</p>
<p><b>Technical Sessions &amp; Events</b></p>	<p>26<sup>th</sup> November – AGM + Vermeer Cutting Systems on Northconnex backend works            4<sup>th</sup> December – St Barbara Day Function Regatta Hotel  <b>Upcoming 2019 Events:</b>            26<sup>th</sup> November – AGM + Vermeer Cutting Systems on Northconnex backend works            4<sup>th</sup> December – St Barbara Day Function Regatta Hotel  <b>2019 Proposed Events:</b>            Feb 14 2019 Austroads Taskforce update            March 14<sup>th</sup> 2019 overview of the Westconnex projects            March 28<sup>th</sup> 2019 – David Sugden – Young Members @ University of Queensland            4<sup>th</sup> April 2019 NBAQ4 Manila            Thursday 9<sup>th</sup> May Sydney Heads Rail Tunnel            Thursday 13<sup>th</sup> June 2019 Sydney metro Under Harbour TBM Crossing            18<sup>th</sup> July 2019 One day technical workshop            Thurs 8<sup>th</sup> August Bulimba Stage 2 Joint ASTT            Thurs 12<sup>th</sup> Sept Westgate Tunnel            Fri 19<sup>th</sup> Oct Golf Day            Nov 14th AGM + Technical Session            4th December – St Barbara Day Function</p> <p>Typically sessions second Thursday of the month through 2018 venue the Hawken Auditorium at Engineers Australia Attendance is around 70 people.</p>
<p><b>Young Professionals</b></p>	<p>Proudly provided by the Australian Tunnelling Society Young Members, the authors of the top three David Sugden Writing Award winning entries will present a summary of their paper and provide insights into the award itself, including the value of technical development and mentoring in tunnelling. 5.30pm, Thursday 28 March 2018 University of Queensland St Lucia, Building 49: Advanced Engineering Building</p>
<p><b>Industry</b></p>	<p>Tunnelling industry in QLD still has many committee and technical society members commuting inter-state NSW, Victoria and SA.</p> <p>ARTC Inland Rail design has been awarded, Early works for Cross River Rail have begun and the Tunnel and Station tenders have been submitted. Brisbane Metro EOI has been shortlisted with tender to begin Q1 2019.</p>
<p><b>General</b></p>	<p>Stacey Rawlings General Manager for EA QLD has attended the QLD ATS committee meetings (2018). QLD Committee and working closely with EA QLD Division for upcoming events.</p>
<p><b>Student and graduate engagement</b></p>	<p>QLD ATS Chapter are working closely with EA and CSIRO promoting “The STEM Professionals in Schools” initiative.</p> <p>Further info can be accessed through the following CSIRO website <a href="https://education.csiro.au/sps/">https://education.csiro.au/sps/</a></p>
<p><b>Austroads</b></p>	<p>No update for this quarter</p>
<p><b>World Tunnelling Day – St Barbara’s Day Event</b></p>	<p><b>ATS Christmas Dinner:</b> The ATS Queensland Chapter celebrated St Barbara’s Day and World Tunnel Day in style at the Regatta Hotel last night in Brisbane. The event brought together tunnelling specialists from around Queensland for a night of celebration.</p>





**Andrew Ridout (Vice Chair,)  
Harry Asche 2018 Chair,  
Jeff Lipman RBWHF, Alan  
Robertson, Andrew Day (left  
to right)**

Our special guest and keynote speaker was Professor Jeffrey Lipman, anaesthesiologist and intensive care consultant at the Royal Brisbane and Women's Hospital. Lipman guest speaker addressed ATS members about the importance of medical research and funding, and the many international clinical trials he has conducted over his time. QLD ATS are proud to say we have donated a total of \$70k to the Royal Brisbane Women's Hospital Foundation through our Annual Golf Days.

The tunnelling community also celebrated Andrew Day's long-term contribution to the ATS. Andrew has been a key figure in the tunnelling industry and his presence will be missed. We wish Andrew all the best in his retirement.

Santa also made a special appearance to raffle off the many lucky-door prizes; including Hilti Cordless Drill Kits, electronics and beach summer gear.

A special thanks to the major sponsors of the event: Vermeer, Barchip and Noma.



**Left: ATS Long  
Service  
Retirement  
Presentation  
for Andrew  
Day. Alan  
Robertson,  
Diane Mather,  
Andrew Day,  
Harry Asche**



**Left: ATS Young  
members Special  
Guest: Father  
Christmas  
Andrew Day,  
Monique Quirk,  
Father Christmas,  
Diane Mather,  
Harry Asche, Jeff  
Lipman (RBWHF)**

## Western Australia Chapter Report February 2019

With the Forrestfield Airport Link project ongoing in Perth, the interest in tunnelling in the west continues to grow, with attendances of 40 to 50 at our most recent technical sessions.

The FAL project has provided regular visits from interstate and international specialists and the chapter is capitalising wherever possible, with invitations to present at our technical sessions.

Most recently we welcomed Nick Shirlaw, over from Singapore, to present at the Perth Transport Authority on Mixed Ground TBM Tunnelling in Hong Kong and Singapore. Between the two cities, several hundred pressurized TBMs have been used over the last 30 years. Initially, EPB TBMs predominated. There were particular problems with tunnelling in mixed faces of weathered granite using EPB TBMs, and the use of slurry machines has become more widespread, particularly in weathered granite and for relatively deep tunnels. Examples of recorded TBM data were presented to illustrate the problems experienced, with Nick touching on the

use of big data to study the interaction of the TBM with the ground to analyse factors affecting TBM performance and advance rates.

In the latter part of 2018 the chapter committee focused on the calendar of events for 2019, with the first event in February, a presentation by Dr Karin B  ppler of Herrenknecht on the recent developments in mechanised tunnelling.

Our biggest event planned for 2019 will be the Tunnelling Short Course which has been scheduled for May. The short course follows a similar format to the highly successful 2018 Melbourne Short Course, will consist of two days of technical sessions with an optional half day for a site visit to the Forrestfield tunnel project. With a line up of quality speakers, the course will appeal to both aspiring tunnellers and experienced practitioners wanting to refresh their knowledge and stay on top of recent developments.

**Jayson Bebek, Chair, Acting Chairperson**

## Victorian Chapter Report February 2019

The Victorian Chapter of the ATS has seen a degree of change in the past year with number of previous committee members stepping aside due to work and personal commitments, including our previous Chair Mr David Grist. I would like to thank David and other departing committee members for their work in supporting the society over the past couple of years. Consequently, the Victorian Chapter has undergone a change of guard with some new members voted into the committee in November, and therefore I would like to take this opportunity to welcome them aboard.

Due to the number of significant tunnelling project ongoing in Melbourne at present, and also waiting in the wings with a variety of exciting future prospects, the tunnelling scene in Melbourne and Victoria looks to have a healthy future. As such, the technical sessions run by the Victorian Chapter during 2018 have been very well attended, with a broad cross section of industry professionals present at the events. Key technical sessions hosted by the Victorian Chapter during 2018 included a presentation of the current TBM technology being deployed on metro tunnelling projects, the involvement of diaphragm wall structures on key tunnelling projects and how the development of immersed tube tunnelling is helping to create efficient infrastructure connections in China. The 2018 events calendar also saw an interesting presentation by Linda

Miller on transportation infrastructure, on her 12th Brunel International Lecture Series.

The Victorian Chapter was also proud to run the ATS Short Course in November. The event was organised and managed by a dedicated committee within the Chapter, even with their day jobs to contend with. Attendance on the Short Course was very good with over 140 people attending the events over three days, and good feedback has been received from the attendees.

2019 looks to be an equally busy year for the tunnelling industry within Victoria, and as such the Victorian Chapter will very much be part of the scene and will be hosting a number of locally focused technical presentations within the calendar of events, as well as those with a national and international flavour. With the ongoing projects in the region, as well as significant projects due to go to tender during the year, there is certainly a lot of interest and optimism with regards to the pipeline of future tunnelling work and opportunities to expand and highlight the industry in Victoria.

**Richard Buckingham, Chair, Victorian Chapter**

# ATSym March 2019 Report



The ATSym team all made our way to Melbourne for the 2018 ATS Design and Construction Short Course. The team shared ideas and initiatives with the target to improve the visibility of the young members team with events and networking opportunities.

The event also saw the 2018 David Sugden Award presented to Matthew Bennett. The group has also been successful in our proposal to tour the top three papers from the 2018 awards around the country. Matthew Bennett, Aaron Lippett and Brodie Aitchison will each present in Melbourne, Sydney, Brisbane and Perth over the coming months, keep an eye on the ATS website for event specifics. The David Sugden Award was originally instigated in 2004 to encourage young engineers to develop the art of technical writing. The 2018 competition has seen a new high-water mark in the received submissions, with several outstanding papers which would have challenged for the prize in any other year.

Matthew Bennet's paper on Vulnerable Road User Inclusion in Spoil Removal Route Planning was selected by the independent review panel as the recipient of the 2018 award. Matthew's prize includes a trip to WTC2019 in Naples Italy to be held in May next year.

ATSym celebrated the ITAym's #WorldTunnelDay on the 5th of December. This day is traditionally celebrated as St Barbara's Day, the patron saint of tunnellers. The Sydney team organised a joint ATS/Rail Technical Society of Australasia (RTSA) entitled TBMs and Trains to bring together young rail engineers and young tunneller. The post event networking led to new connections between professions.

Keep in touch via the ATS facebook page (@AustralasianTunnellingSociety) or ats.ymc@gmail.com if you would like to know more about ATSym! Also visit the ITAym facebook page (@ITAYoungMembers) to keep up with what the next generation of tunnellers area up to in all corners of the globe.

Happy tunnelling

**Keith Bannerman, ATSym Chair & ITAym Chair**



**Matthew Bennett receiving the David Sugden Award from Ed Taylor (ATS President) and Keith Bannerman (ITAym and ATSym Chair)**



**ATSym TBMs and Trains Networking**



## CSMA Australasian Showcase Gold Coast Friday 14<sup>th</sup> June 2019 Sponsorship Opportunities available

**Lanyard Sponsor:** Supply lanyards for delegate name badges – can have corporate logo

**USB Sponsor:** Supply USB for pdf papers and presentations

**Platinum Sponsor: \$2000** Includes 2 registrations, prominent marketing opportunity including banner and logo on mail outs and name badges

**Gold Sponsor: \$1000** Includes 1 registrations, prominent marketing opportunity including banner and logo on mail outs

**Silver Sponsor: \$500** marketing opportunity including banner and logo on mail outs

Supply of corporate merchandise welcome.

All sponsors will have acknowledgement in the CSMA journal, in marketing material and at the event.

To secure sponsorship please contact: Huw Rossiter [Huw.Rossiter@mpckinetic.com](mailto:Huw.Rossiter@mpckinetic.com) or Diane Mather [dvmather@yahoo.com.au](mailto:dvmather@yahoo.com.au)

### CSMA Showcase 2019 - 14th June @ Kurrawa S.C. Gold Coast

Start Time	End Time	
9:00	9:10	Welcome and introductions
<b>Session 1 -</b>		<b>Case studies and cross industry developments</b>
9:10	9:30	TBC
9:30	9:50	TBM Decline at Grosvenor Mine - Richard Murrell
9:50	10:10	Exploration at Cue, exploring in a historically mined region - Geoff Willets, Golden State Mining
10:10	10:30	Design and construction of Australian tunnels- Diane Mather, and / or Richard Buckingham
Break		
<b>Session 2-</b>		<b>Business</b>
10:50	11:10	The Nitty-gritties of due diligence, the mining/technical aspects - Alex Thin
11:10	11:30	Mining Heritage – The Business Case for Respect - Ric Davies
11:30	12:15	<b>Keynote 1 - Mike Moore. Founding and taking an exploration company public - lessons whilst they are still fresh in my mind.</b>
Lunch		
<b>Session 3 -</b>		<b>Equipment</b>
13:15	14:00	<b>Keynote 2 - Gary Hughes: Digitilisation in the mining industry</b>
14:00	14:20	Developments in the value proposition of borehole geophysics; new sensors and automation - Huw Rossiter, MPC Kinetic
14:20	14:40	Using surface seismic interferometry to locate a large underground void here at Glencore's Mount Isa Mines - David Matthews, Glencore
14:40	15:00	TBC
Break		
<b>Session 4 -</b>		<b>Moving in to the future...?</b>
15:15	15:35	Research and emergency technical support for the Queensland mining industry - Gareth Kennedy, Simtars
15:35	15:55	Utilisation of urban area, an underground perspective - Rob Pesch, Pesch & Partners (provisional based on data release)
Prepare for Q&A Session (with beverages)		
16:05	16:45	<b>Q&amp;A Session - TBD</b>
16:45	17:00	Close out and comments

# New South Wales Group Report

Activity	Outcome/Report
<b>Office Bearers and Committee Members</b>	<p><b>Office bearers:</b>            Chair – Nigel Casey            Vice-Chair – Phil Clark            Treasurer – Hashim Mohammed            Secretary – David Oliveira            Co-ordination of Technical Sessions – Todd Clarke            Young Members – Aaron Lippett, Simon Brinkmann            Golf Day – Brad Boardman            Past Chair – Rob Nievergelt</p> <p><b>Additional Committee Members:</b>            Alex Gomes            Abdullah Al Mahmud            Phil Martin</p>
<b>Technical Programme</b>	<p><b>2019 Sydney Program</b></p> <p>Confirmed Technical Sessions:</p> <ul style="list-style-type: none"> <li>• 05/02/2019 – ATS Air Quality working Group</li> <li>• 20/02/2019 – A Sydney Heads Rail Tunnel (with Australian Geomechanics Society)</li> <li>• 20/03/2019 – The David Sugden Award 2018 Roadshow</li> </ul> <p>Suggested future Technical Sessions (tbc)</p> <ul style="list-style-type: none"> <li>• Lane Cove Tunnel Collapse During Construction</li> <li>• WestConnex</li> <li>• Snowy Hydro</li> <li>• Sydney Metro Under Harbour TBM Crossing</li> <li>• Westgate Tunnel</li> <li>• Update on Austroads Tunnel Task Force and PIARC Road Tunnel Operations Committee</li> <li>• Hilti Technical Seminar</li> <li>• David Lees PhD</li> </ul>
<b>Young members</b>	<p>Young Members are hosting the David Sugden Award 2018 Roadshow.</p> <p>Simon Brinkmann (ATSym Representative NSW) is on a six month secondment to Singapore starting March 2019.</p>
<b>ATS Executive</b>	<p>Aaron Lippett / Simon Brinkmann / Keith Bannerman are assisting with the Executive (Young Members) initiative to author a 'Tunnel Design Guideline'.</p>
<b>EA Liaison</b>	<p>Natalia Kontsevaya is the Group Engagement Officer of Sydney EA. The committee appreciate the good work being undertaken by Natalia.</p>
<b>Events</b>	<p><b>The following tunnelling related conferences are being held in Sydney in 2019.</b></p> <p>Tunnel Operations &amp; Maintenance, Sydney, Feb 2019 (Criterion Conferences)</p> <p>Australian Tunnelling Conference, Sydney, Oct 2019 (Informa Conferences)</p>
<b>Charity Golf Day</b>	<p><b>2019 – ATS Sydney Golf Day</b></p> <p>Brad Boardman is the lead organiser for the 2019 event.</p> <p>A date is to be confirmed informed by proposed dates of similar events in other states.</p>
<b>ATS NSW Technical Workshop 2019</b>	<p>There is a suggestion to host a workshop on tunnel collapse and incidents. Further details being progressed.</p>
<b>Gender Diversity</b>	<p>ATS NSW wish to promote female membership of the society and are keen to hear opportunities for female presenters at Technical Sessions and Workshops.</p>
<b>Shotcrete Society</b>	<p>Members of the ATS NSW committee are assisting as part of the Shotcrete Society review and update of their guideline entitled 'Shotcrete Practice in Australia'.</p>
<b>Contact</b>	<p>For suggestions related to ATS NSW please contact nigel casey (ATS NSW committee chair) at ncasey70@gmail.com or 0455094437.</p>

# Australian and New Zealand Tunnel

Region	Location	Project	Client	Technical Advisor	Designer	Contractor
NSW	Sydney	NorthConnex	RMS	AECOM	Aurecon-SMEC JV	Lendlease-Bouygues
NSW	Sydney	WestConnex Stage 1B (M4 East)	Sydney Motorway Corporation		Arcadis-MJA-PSM	CPB-Samsung-John Holland JV
NSW	Sydney	WestConnex Stage 2 (New M5)	Sydney Motorway Corporation	AECOM	Aurecon-Jacobs	CPB-Samsung -Dragados JV
NSW	Sydney	WestConnex Stage 3A (M4-M5 Link)	Sydney Motorway Corporation	AECOM	Aurecon-Jacobs	Lendlease-Bouygues-Samsung JV
NSW	Sydney	WestConnex Stage 3B (Rozelle Interchange)	Sydney Motorway Corporation	AECOM	Arcadis-MJA-PSM	John Holland - CPB
NSW	Sydney	Sydney CBD and SE Light Rail	Transport for NSW			ALTRAC Light Rail
NSW	Sydney	Sydney Metro City and South East TSE Contract	TfNSW		Arcadis-MJA-PSM	John Holland/ CPB/ Ghella JV
NSW	Snowy Mtns	Snowy 2.0	Snowy Hydro	SMEC		
NSW	Illawarra	Maldon to Dombarton Rail Link	TfNSW	WSP		
NSW	Sydney	HarbourLink - Western Harbour Tunnel	RMS	WSP/ARUP		
NSW	Sydney	HarbourLink - Northern Beaches Link	RMS			
NSW	Sydney	F6 Extension Stage 1	RMS			
NSW	Illawarra	Shoalhaven Hydro	Origin Energy	Jacobs		
NSW	Sydney	Sydney Metro West	TfNSW	WSP-AECOM		
NSW	Sydney	Sydney Metro Western Sydney Airport	TfNSW			
NSW	Illawarra	Burrawang to Avon Water Transfer Tunnel	Water NSW			
Qld	Brisbane	Bulimba Trunk Sewer Upgrade Stage 2	QUU			Abergeldie - Obayashi JV
Qld	Brisbane	Cross River Rail	Cross River Rail Delivery Authority	ARUP		
Qld	Far North Qld	Kidston Hydro	Genex Power	Mott MacDonald		
Qld	Brisbane	Brisbane Metro	Brisbane City Council	Jacobs		
Qld	Toowoomba	Toowoomba Rail Tunnel Lowering	Dept Transport & Main Roads	SMEC	WSP	BMD
Qld	Toowoomba	Inland Rail Kagaru to Gowrie PPP	ARTC	ARUP/SMEC	Aurecon/AECOM (Reference design)	
SA	Adelaide	Adelaide Bus Tunnel	DTIE		KBR	McConnell Dowell
Vic	Melbourne	Kalkallo Main Sewer	Yarra Valley Water	Aurecon (Project Manager)	Jacobs	Abergeldie
Vic	Melbourne	Melbourne Metro Tunnel and Stations PPP	MMRA	Aurecon Jacobs Mott MacDonald	ARUP/Arcadis/WSP	Cross Yarra Partnership comprising Len John Holland, Bouygues and Capella Co
Vic	Melbourne	West Gate Tunnel	Transurban	AECOM	Aurecon/Jacobs	John Holland/CPB Contractors JV
Vic	Melbourne	North East Link	VicRoads			
Vic	Melbourne	Epping Main Sewer	Yarra Valley Water			John Holland
Vic	Melbourne	Kalkallo Creek Main Sewer Stage 1E	Yarra Valley Water	Jacobs	Jacobs	John Holland
Vic	Melbourne	Lockerbie Main Sewer Stage 1	Yarra Valley Water	Jacobs		
Vic	Melbourne	Hobson Bay Main Sewer Upgrade	Melbourne Water			
WA	Perth	Forrestfield-Airport Link Project	Public Transport Authority	Various	GHD, Geodata	Salini-Impregilo-NRW JV
NZ	Auckland	City Rail Link	Auckland Transport	Aurecon-Mott MacDonald		Downer NZ and Soletanche JV McConnell Dowell and Hawkins JV
NZ	Auckland	Central Interceptor Project	WaterCare	Jacobs/MJA/AECOM		
NZ	Wellington	Wellington Northern Corridor	NZ Transport Agency		AECOM, Parsons Brinckerhoff and Beca	
NZ	Tauranga	Tauranga Tunnel	Local Govt			

# Prospects

	Scope of work	Current status
	Spanning 9km, NorthConnex will be the longest road tunnel project in Australia. Cost \$3B	Under construction for completion in 2019
	Includes twin 3-lane, 5km long tunnels from Ashfield to Strathfield	Contract awarded June 2015 for completion in 2019
	Provision of additional four new lanes in a driven tunnel next to the existing the M5 East tunnel	Contract awarded in Nov 2015. Under construction for completion in 2019
	Twin 8.5km road tunnels linking M4 East and M5 East Duplication and major underground interchange at Rozelle	Contract awarded June 2018. Under construction for completion in 2023
	Underground interchange linking the M4-M5 Link to Anzac Bridge, Iron Cove Link and future Western Harbour Tunnel	Contract awarded in December 2018 for completion by 2023
	Proposed cut and cover tunnels beneath Surry Hills and through under Anzac Parade through Moore Park	Under construction
	Underground rail Link from Chatswood to Sydnham via Central Station	Contract awarded June 2017. Under construction for completion in 2021
	2,000 MW pumped storage hydro scheme	Tenders submitted. Award to preferred contractor expected in March 2019
	4km single line rail tunnel forms part of 20km rail link to Port Kembla	Registrations of Interest closed in April 2015 - On hold
	Road tunnel linking WestConnex with North Sydney (Military Road)	Expected to come to market mid 2020
	Road tunnel beneath Mosman connecting City with Northern Beaches	In planning
	4 km of motorway tunnel from New M5 to Presidents Ave Kogarah	Tender expected Q3 2018
	250 MW Pumped Storage Hydro Project	Tender expected Q1 2019
	Twin metro rail tunnels each 20 km long	Tender expected 2020
	Rail link to new Western Sydney Airport which will be a mixture of surface rail and tunnels	Tender expected 2020
	20 km long water transfer tunnel (3.3m diameter) from the Burrawang Pumping Station to the Avon Dam	In planning
	4.2km of pipejack sewer tunnels	Under construction for completion in 2019
	New north-south tunnel(s) with connections running from Dutton Park in the south to Victoria Park in the north and new underground stations at Boggo Road, Woolloongabba, Albert Street and Roma Street.	Tenders submitted. preferred contractor to be announced Q2 2019
	250 MW Pumped Storage Hydro Project	Award of contract to the preferred contractor expected Q2 2019
	Busway link which includes short tunnels	Tender expected Q1 2019
	Invert lowering for existing rail line to allow double stacked containers	Under construction
	126km rail link which includes three tunnels totalling 8.5km in length	Tenders expected Q3 2019
	\$160M extension of O-Bahn bus track through tunnel to Hackney Road in City North. 650m cut and cover tunnel	Under construction
	Comprises 662m of DN1250 and 2,774m of DN1050, at depths varying between 4m and 15m. Nine manholes, ranging from 1.8m to 6m in diameter.	Contract awarded Feb 2017
ndlease, apital.	New rail tunnel between Footscray and South Yarra with new stations in North Melbourne, Parkville, CBD (2) and St Kilda Road.	Contract awarded in Dec 2017. Under construction
	Proposed twin road tunnels (6km) and elevated road structures linking the Westgate Freeway at Williamstown Road with City Link	Contract awarded in Dec 2017. Under construction
	Potential road tunnel from Greensborough to Bullen linking the Western Ring Road to the Eastern freeway	EoI's in preparation. Tenders expected Q3 2019
	2.4km of DN1800 pipejacked sewer	Contract awarded Sept 2017. Under construction
	1.2 km of DN1200 pipejacked sewer	Contract award Nov 2018
	9.2km of DN750-DN1200 sewer pipes constructed using both pipejacking and trenching techniques	Tender expected Q1 2019
	Upgrade of existing main sewer crossing of the Yarra River	Tender expected late 2019
	7.1km twin-bored, concrete-lined and 6.2m internal diameter tunnels extending from Guildford Road in Bayswater to Dundas Road in Forrestfield. Three stations; Airport West station will be located underground in the Brearley Avenue road reserve, between Second Street and Dunseith Drive, close to the current Domestic Airport precinct	Under construction
nell	A 3.5km loop linking Britomart with the current western line. Three new underground stations at Aotea Square, Newton and K' Road. Britomart to Downtown involves tunneling under the historic Central Post Office building which is now home to Britomart station. On the other side of Downtown up to Wyndham St will be cut and cover tunnels	Tenders in preparation for main tunnel contract
	New sewer tunnel approximately 14km in length from central Auckland to Mangere Wastewater Treatment Plant	Preferred contractor is Ghella-Abergeldie JV. Contract award expected early 2019
	Four lane expressway from Levin to Wellington Airport including duplication of Mt Victoria and Terrace tunnels	Site investigation underway
	Three routes for a road tunnel through the Kaimai Ranges, linking Tauranga with the Waikato	Currently being investigated by the NZ Transport Agency

# Contacts



**David Lees**  
ATS Journal Editor  
d.lees@gfwaust.com



**Tris Thomas**  
TJ Editorial Director  
Tel: + 44 (0) 1892 522 585  
Mobile: + 44 (0) 7812 011 139  
tris@tunnellingjournal.com



**Amanda Foley**  
Contributing Editor  
Tel: +44 (0) 1449 710 005  
Cell: +44 (0) 7973 158065  
amanda@tunnellingjournal.com



**Gary Tween**  
Managing Director  
Tel: + 44 (0) 1892 522 585  
Mobile: + 44 (0) 7973 205 638  
gary@tunnellingjournal.com



**Daniel Lee-Billinghurst**  
Sales Director  
Tel: +44 (0) 1892 522 585  
Mobile: +44 (0) 7818 422712  
daniel@tunnellingjournal.com



**Kristina Smith**  
Contributing Editor  
Mob: +44 (0) 7833 230 853  
kristina@tunnellingjournal.com



**Mark Piper**  
Finance Director  
Tel: + 44 (0) 1672 563 662  
Mobile: + 44 (0) 7768 554 646  
mark@tunnellingjournal.com



**Rory Harris**  
Chairman  
Mobile: + 1 (859) 321 3164  
rory@tunnelingjournal.com



**Peter Bell**  
Director  
Tel: + 44 (0) 1892 522 585  
Mobile: + 44 (0) 7770 441 867  
peter@tunnellingjournal.com



**Steve Caming**  
Director  
Mobile: + 1 (603) 662 6263  
stevencaming@gmail.com  
steve@tunnelingjournal.com



**Peter Lawrence**  
Art Editor



**Pete Beach**  
Illustrator

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