

AUGUST 2009

# tunnels & tunnelling INTERNATIONAL



## MACHINERY, MATERIALS & EQUIPMENT REVIEW

T&TI's annual review of tunnelling product developments

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**FRONT COVER:**  
View along China's TBM driven Pinglu Tunnel showing the hexagonal segmental lining, Pinglu is part of the 200km long Yellow River Diversion Project (p10).

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## REVIEW

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Launch preparations for the Robbins TBM on the Veligonda project

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The annual review of tunnelling products

## COMMENT

It's that time of year again, where *T&T* brings you a round up of what's new in the world of tunnelling products. Once again the range of services available, from millimeter diameter bolts to mega diameter TBMs, is astonishing. Hopefully you will enjoy browsing through this exhaustive listing, and maybe find a piece of gear you didn't even know existed.

On an entirely different note I make no apology for again flagging up the first joint venture, so to speak, between *T&T* and the British Tunnelling Society in the form of our 1 day conference on September 29th in London. The reason I'm doing this is delegate places are going fast and we don't want you to miss out!

The full line up of speakers and times of the presentations is included in this issue, but if it's been 'mislaidd' by the time you get your office copy you can check it out, and register at: [www.tunnelsandtunnellingconference.com](http://www.tunnelsandtunnellingconference.com)

We're delighted with the quality of the speakers we've persuaded to 'enlighten' us with their experiences, research findings and technical know how, so as I say, don't run the risk of missing out and register you and your colleagues now!

There's little space for the usual comment in the August issue so I'll leave by thanking the companies who've helped put the issue together. See you in September!



Tris Thomas



# Northern Line extension gains momentum

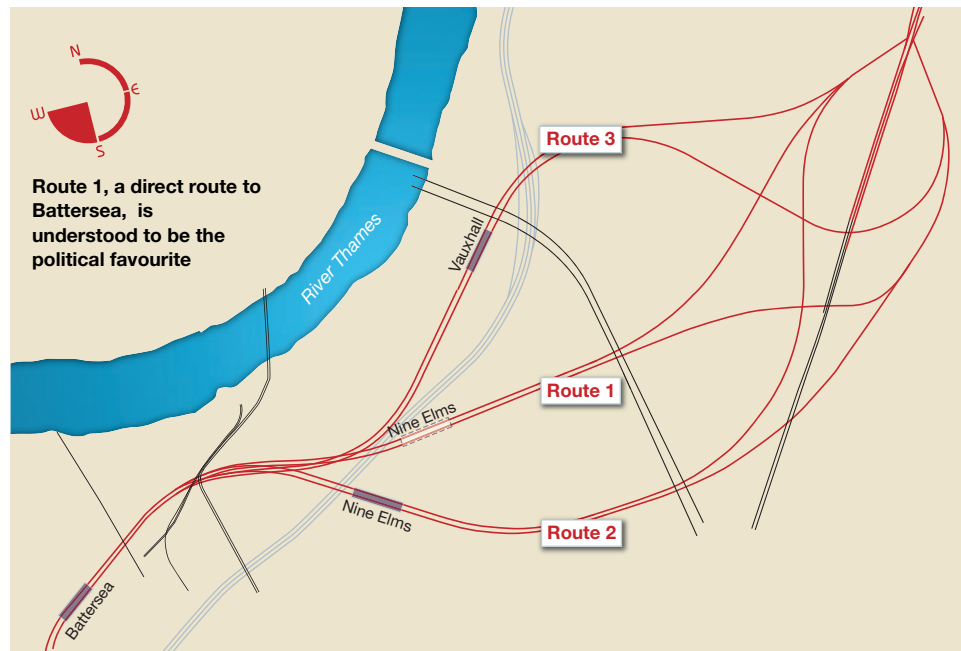
**P**lans for a Northern Line extension from Kennington to Battersea in South West London are gaining considerable momentum. Project developer Treasury Holdings UK, on behalf of site owners Real Estate Opportunities, is expected to put in a planning application for the associated 740,000 sq m of mixed use development at the Battersea Power Station site in the next few weeks.

T&T understands that Treasury Holdings will also seek tenders for a RIBA Stage C Reference Design contract for the 3km tube extension at the same time.

A source close to the US\$800M tube project told T&T that the developer will pay close scrutiny to the individuals offered in bid responses and won't accept a "B team" if top expertise, particularly in tunnelling engineering, has been assigned elsewhere.

Consultant Parson Brinckerhoff last year studied three possible routes for the link. The feasibility study, endorsed by London Underground, showed the project was feasible. Cost consultants Corderoy drew up cost estimates based on Q1 2008 prices. A direct route running from Kennington to Battersea was estimated to cost US\$625M. A second route creating an additional station at Nine Elms was estimated at US\$755M. A third route creating an interchange with Vauxhall station on the Victoria line was priced at US\$1bn.

T&T understands that the interchange with Vauxhall will prove



unpopular with Transport for London (TfL) as the Victoria line is already running at capacity. The running favourite is a direct route between Battersea and Kennington with the option for later adding a station at Nine Elms.

Cross-party political backing was thrown behind the tube project earlier this year as Wandsworth and Lambeth Borough Councils, the Greater London Authority and TfL in June petitioned the Government to consider the extension for an innovative private funding mechanism.

TfL's limited budgets means the extension will only be able to move forward on private funding. Treasury Holdings called in PricewaterhouseCoopers (PwC) to identify funding scenarios.

Development levies will be imposed on private developers by the Local Authority before consent for development is given. Development in the Nine Elms area would make significant contributions available.

Ticketing securitisation will allow Treasury Holdings to borrow against the future ticket sales of the

extension.

Finally, Tax Incremental Financing (TIF) or Accelerated Development Zones (ADZ) is a novel method of raising funds already being employed in the US. The method borrows against the incremental revenues of the local authority or central government generated by the underlying development.

The UK government is currently evaluating the TIF/ADZ method with an eye to trailing it in the UK.

If all goes to plan, the extension will be completed in 2015/2016.

## Eight dead in Gaza tunnels



Tunnels are largely hand dug

**T**wo tunnel accidents shook the Gaza strip late last month leaving at least eight dead, five missing and many injured. An explosion in a tunnel near the boarder town of Rafah killed seven Palestinians. Days later another tunnel near the town collapsed killing one and seriously injuring another. Five others remained missing as T&T went to press.

The tunnel explosion, the worst recorded accident in the illicit Gaza tunnel network, was believed to

have been caused by an electrical spark igniting fuel being smuggled through the tunnel. Officials said they believed there are more bodies trapped in the tunnel but could not say how many.

Palestinians have relied upon the tunnel network since 2007 when Israel and Egypt blockaded Gaza's borders after Hamas was elected to power. In 2008 Israel destroyed hundreds of tunnels with aerial bombardment but their commercial value meant they were quickly re-dug.

The number of Palestinians killed while working in the tunnels,

which are largely hand dug, is believed to exceed 100. Israel maintains that the tunnels are used to transport weapons as well as food, fuel and livestock.

Researchers in Israel earlier this year announced they had developed a system of buried fibre optic cables to detect ground movement due to such excavations. The system, developed by Technion-Israel Institute of Technology's civil and environmental engineering dept, is based on strain measurements in the cables caused by ground movements.

## NFM despatches to Kazan

After a gap of four years, and a couple of months on from the originally proposed schedule, a second TBM has been shipped by NFM technologies to work on the metro in Kazan, in the Republic of Tatarstan.

The manufacturer won the order for the 5.89m diameter EPBM last year from the city's metro developer, Kazmetrostroy. Then, the original programme aimed at a June delivery to the republic in the Russian Federation (*T&T*, October 2008, p8).

NFM said the foam-injection shield, which is to be used on Line 1 of the metro, was to be despatched at the beginning of this month for arrival on site by late September. The formal acceptance of the TBM took place at the Le Creusot plant, in France, last month.

The EPBM will be used to bore a single, 2km long tube through sand and sandy clay on Line 1, also called the Central Line, between Kozya Sloboda and Moskovskaya stations. The new, twin tube section is to be opened by 2011.

In 2004, NFM supplied a 5.89m diameter refurbished shield to Kazmetrostroy.

# Repair, probe at Eiksund

Cleaning and minor repairs were needed in the world's deepest subsea road tunnel – the Eiksund tube on the west coast of Norway – following the fatal crash and fire in late June, according to the Norwegian Public Roads Administration (NPRA, or Statens Vegvesen).

Five people were killed when two cars collided in the tunnel on the late Sunday evening of 28 June. One of the vehicles burned out but the fire damage to the tunnel was limited due to retardant in the structure and forced ventilation to clear smoke.

The police investigation is ongoing but NPRA, which handed its report to the authority, said that one of the cars was believed to have been travelling

at approximately 190km/h, more than twice the speed limit which at that point is 80km/h.

NPRA plans to complete a detailed investigation of the accident over the coming three months.

The accident happened about 1.5km from the west portal of the almost 7.8km long tunnel, at a point where the vehicle with four passengers had travelled more than half the tube. The final stretch rises at almost 10% gradient and westbound traffic have two lanes, the descending eastbound traffic one lane.

NPRA was cleared to reopen the tunnel the following morning with a 50km/h speed restriction to enable repair work to be undertaken over the following

weeks. The work in the still operational tunnel was completed late last month and while relatively minor the precise details were not immediately available.

Construction of the tunnel, half of which runs below the sea, started in 2004 and it came into service in February 2008. The west side of the vertical alignment is about 3km long with three lanes and an 87m<sup>2</sup> section, and the east side has a gradient of 7.6% for 4.7km with two contraflow lanes and a 63m<sup>2</sup> section.

The tube tunnel was built by local contractor Mesta, which completed the mostly drill and blast drive, which goes to a maximum depth of 287m, in early 2007 (*T&T*, April 2007, p8).

## Compact DSU assembly in Chile

The commodity markets may have taken a hammering over the last year but one of the new breed of TBMs from Seli, a Compact DSU, is being assembled in Chile to help a mining company probe how to most efficiently exploit a new

'world class' copper deposit.

The mining company and customer, Anglo American Chile, said at the end of July that the planned exploratory tunnel would cost approximately US\$60M and take two years to excavate. The earlier estimate was just over a

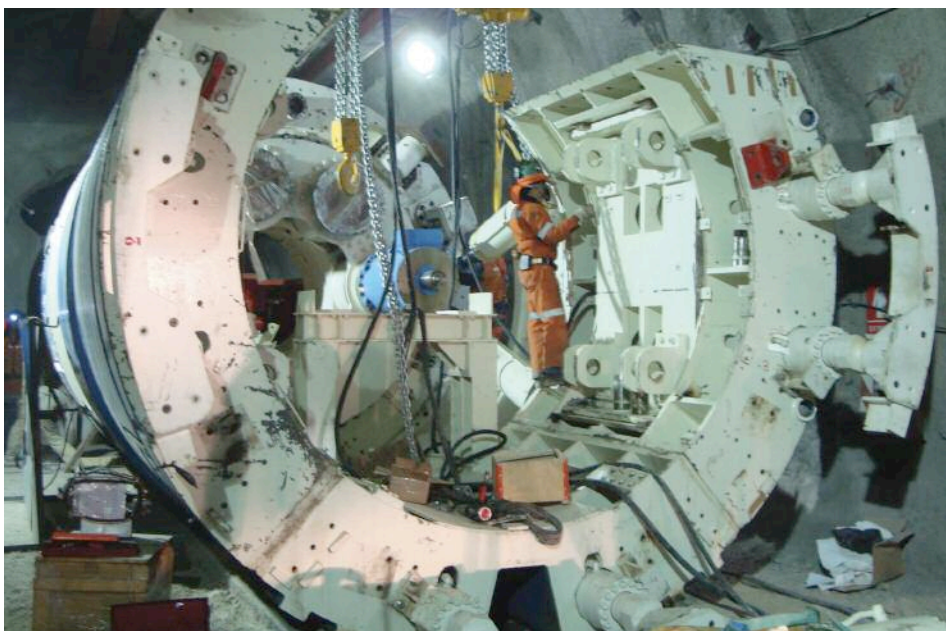
year (*T&T*, March, p12).

Seli's simpler, shorter shield is a 4.5m diameter unit and will be used to bore the tunnel. To handle variable ground, the machine can also install rock bolts, steel sets and wire mesh.

The TBM is the key part of the US\$14.4M design and supply package awarded by the customer, which also includes backup, equipment plus provision of specialised workers and technical assistance.

A JV contractor, Dragados-Belsaco, will use the Compact DSU – the manufacturer's second to be made – to bore just over 8km at the Los Sulfatos prospect, near Los Bronces mine, in the Andes about 65km north east of Santiago. Los Bronces is an open pit copper and molybdenum mine.

Anglo American said last month that early exploration of the prospect has indicated a significant deposit of an estimated 1.2bn tonnes, containing about 17.5M tonnes of copper.




**Left:** Seli's compact DSU will bore over 8km in the Los Sulfatos prospect



## SWITZERLAND: SUCCESS AT ST GOTTHARD.


### GOTTHARD I SWITZERLAND

**PROJECT DATA**

 S-210, S-211  
**2x Gripper TBM**  
 Diameter: 8,830mm or  
 9,430mm (after overhauling)  
 Cutterhead power: 3,500kW  
 Tunnel lengths: 13,069m,  
 14,099m, 10,678m, 10,538m  
 Geology: gneiss, granite, slate

**CONTRACTOR**

TAT Consortium:  
 Zschokke Locher AG,  
 CSC Impresa Costruzioni SA,  
 Impregilo S.p.A.,  
 Alpine Mayreder Bau GmbH, Hochtief Construction AG

 S-229, S-230, S-421, S-422, **4x Gripper TBM**  
 Diameter: 9,580mm  
 Cutterhead power: 3,500kW  
 Tunnel lengths: 10,725m,  
 10,703m, 7,178m, 7,178m  
 Geology: gneiss, granite, slate

AGN Consortium:  
 STRABAG AG Tunnelbau Schweiz (CH)/  
 STRABAG AG (A)



Six months prior to schedule the Herrenknecht tunnel boring machine "Gabi I" (S-421) reached its target in Amsteg on June 16, 2009 at the Gotthard Base Tunnel. This means another milestone in the construction of the world's longest railway tunnel has been reached. Politicians, tunnel workers and 650 guests cheered on the Gripper TBM as it arrived.

"Gabi I" completed the 7.2 kilometers of the most northerly section of the east tube within only 18 months. The engineers and workers of the AGN Consortium reached daily performances of almost 40 meters of newly excavated tunnel tube. The breakthrough was made with the utmost precision, with both the horizontal and vertical deviation amounting to less than one centimeter.

"Gabi II" in the parallel tunnel is accomplishing impressive performances of up to 56 meters in 24 hours. In the southern section from Faido to Sedrun the S-210 and S-211 are progressing very well, too. The tunnelling work is expected to be successfully completed by 2011. "Good luck" to everyone contributing to the success of this epoch-making project.

The Herrenknecht AG's Board of Management congratulates everyone.

     
 Dr. Martin Herrenknecht      Gebhard Lehmann      Kurt Stiefel      Werner Suhm

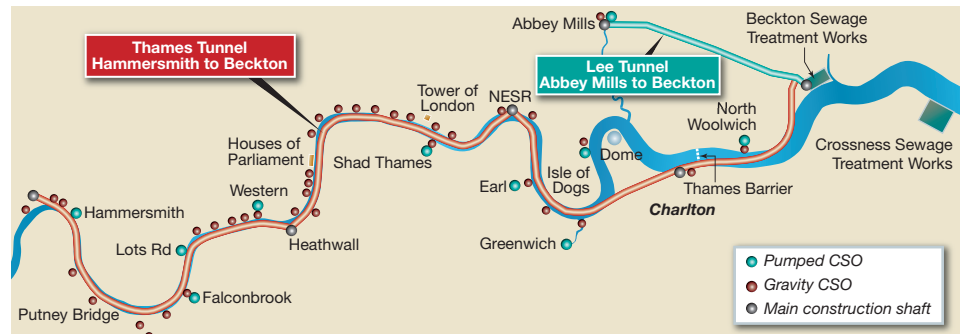
# Boreholes go down for Thames Tunnel

The Thames Tunnel last month moved a step further towards construction as contractors began sinking boreholes into the bed of the River Thames. The 32km, 7.2m i.d. sewer will be excavated by TBMs at depths of 30m-70m. The US\$4.5bn scheme is needed to collect overflow discharge from heavy rain.

The exploratory works began in the riverbed outside the Palace of Westminster, where a borehole had been sunk from a large rig to analyse the ground conditions. The full program of boreholes along the river will take nine months to complete.

The Thames Tunnel, which will broadly follow the route of the River Thames, and the Lee Tunnel, a 6.5km sewer to stop sewage overflows into the River Lee due for completion in 2014, are together known as the London Tideway Tunnels.

About 32 million cubic metres of untreated sewage currently overflow into the river each year during rainfall. Thames Water spokesman Simon Evans said, "The London Tideway Tunnels will



Work on the 6.5km Lee Tunnel is underway while boreholes are being sunk for the Thames Tunnel

dramatically reduce this unless, in November this year when Ofwat sets bill limits for water firms for the next five years, Thames Water receives a deal that leaves the company unable to fund this vital work."

Ofwat's draft bill setting decision last month left Thames Water with US\$1.4bn less funds than it sought. Evans told T&T that if the cut backs go ahead in November they will be spread across all the programs and would not be enough to stop the Thames Tideway project.

The Thames Tunnel is planned

to run from West London to Thames Water's Beckton Sewage Treatment Works in Newham, broadly following the course of the river. Although the precise route is not yet finalised, it will need to connect to the 34 most-polluting combined sewer overflows (CSOs) where sewage currently flows into the river from the original Bazalgette network.

Overflows into the Thames currently occur more than once a week on average, driving the need for the Thames Tunnel.

Thames Water's director of Strategy and Regulation Peter

Antolik said, "The boreholes in the river are key to helping us develop a detailed design for the Thames Tunnel. Ahead of submitting a planning application in 2011, we first need to build up a thorough technical understanding of the potential constraints along the proposed route.

"A maximum of three rigs will be in place at one time, for up to three weeks at each location. Ground data obtained, from previously unexplored depths under London, will be added to a national library of samples, which is held by the British Geological Survey."

## Gautrain tunnel nears end

Some 14km of the 15km long tunnel for South Africa's 77km long Gautrain rapid rail project have been completed. Breakthrough on the final section is expected this month.

The underground route of the Gautrain stretches from Johannesburg's Park station in the south to Parktown Ridge and on to Rosebank, Sandton, to where it surfaces at the Marlboro portal.

Breakthrough has been achieved on all but one section with the most recent on 22 June between Emergency Shaft 7 and Sandton station. The final hole through will be on the southern Rosebank to Park Station stretch between Emergency Shaft 2 and Park Station.

A portion of this 5554m stretch heading south from Rosebank was excavated using a 6.68m diameter

Herrenknecht TBM (S-386) but the remainder will be excavated in the opposite direction using drill and blast technology. At the end of June 1323m had been excavated north of Park Station.

Spokeswoman for Gautrain Rapid Rail Link Ingrid Jensen told T&T that at the end of June some 14,302m of tunnel had been fully excavated.

The contractor is the Bouygues-led joint venture Bombela Civils, and the tunnel was designed by Atkins. Bombela Concession Co developed the entire 77km long rail project. The Gautrain, which government estimates will carry 300,000 passengers a day by 2011, will see a minimum of six trains an hour running in peak times between Johannesburg, Tshwane and O.R. Tambo International Airport.

Final breakthrough on the 15km tunnel is expected this month



# Pir Panjal makes headway

Indian Railways last month celebrated a breakthrough on the southern section of the 11km long Pir Panjal Tunnel in the foothills of the Himalayas. Some 7.5km of tunnel has been excavated using the NATM technique but the remaining 3.5km will take a further year according to Indian contractor IRCON.

The US\$134M tunnel is a crucial part of the 17km long Banihal-Qazigund section of the Jammu-Udhampur-Katra-Quazigund-Baramulla link (JUSBRL) or Kashmir rail link. The 335km railway links the Kashmir Valley with Srinagar, the capital of Jammu and connects into the existing network to provide a direct 900km link to Delhi.

The single-track tunnel cuts through the Pir Panjal range below the snow line and some 450m below the only road tunnel linking Banihal and Qazigund. The tunnel has an average elevation of some 1750m and a maximal overburden of 1100m.

According to Caltrop, which provided construction management service for IRCON, ground conditions through the tunnel length vary greatly. The geology of the Pir Panjal mountain range includes a mixture of very hard and soft to moderately hard rock strata (Cambro-Trias). Hard rock types include andesite/basalt (Panjal Traps), quartzite, silicified limestone and agglomerates while the soft to moderately hard rock types include shale, limestone,

agglomeratic shale and tuff.

The portal areas are situated in soft ground made up of fluvio-glacial sediments. It covers both portals for more than 500m. Tunnel excavators were used for the portal areas while roadheaders and drill and blast methods were employed in the main tunnelling works.

The basic tectonic setting of Pir Panjal range in the area of tunnel alignment is dominated by a folding structure leading to different dipping directions on both sides of the range. Contacts between rock units are often faulted. Folding is also common especially in central areas. Bedding of rock is striking sub perpendicular to Pir Panjal tunnel axis.

## Activity mounts in Melbourne

Four TBMs are now working in Melbourne to expand the sewer network in the Victoria state capital in two separate construction schemes being built by John Holland.

The contractor launched a Lovat EPBM early this month on one scheme while, elsewhere in the city, it had a Robbins double shield nearing completion on its second drive and two Herrenknecht EPBMs continuing to make progress.

The 2.92m diameter Lovat machine (RME115SE) is being used on Melbourne Main Sewer and has a mixed ground cutterhead with 15.5" discs. An almost 2.1km long tunnel is being bored through marine and estuarine deposits of sand, silt and clay, and possibly some basalt.

Melbourne Main Sewer is being developed by Melbourne Water to the east of the city on behalf of the state Government. The utility is also working, separately, with Yarra Valley Water, to build a total of 12.6km of sewer in the north of the city, also on behalf of the state, by 2012.

The utilities are handling Stage 1 (8km) and Stage 2 (4.6km) of the Northern Sewerage Project, respectively. In total, the seven new sewer tunnels will be excavated using the Robbins TBM and Herrenknecht EPBMs.

Robbins' 3m diameter TBM ("Julia") holed through last month after its first, 2.1km long drive. Geology comprised massive basalt to weathered basalt with clay filled seams, and roof conditions remained competent for installation of split set rock bolts, as planned.

The TBM is advancing on the final, 1.1km long bore and is due to hole through next month.

Herrenknecht's 3m and 4m diameter TBMs – "Victoria" and "Gemma" – were launched earlier. The smaller machine was launched in May 2008 on a 1.6km drive and achieved the first programmed breakthrough on the project at the end of last year, driving at depths of 19m-37m.

## AMR, Veligonda progress for Robbins

With almost 5km bored already by the first 10m diameter Robbins shield on the Alimineti Madhava Reddy (AMR) water scheme in India, the partly assembled sister TBM is to start excavation in October after land acquisition delays last year.

The first machine was launched in May 2008 and the second was to have been assembled later in the year, but the programme was setback about a half year. In July, assembly of the second shield

**Wet weather delayed launch of the Robbins TBM at Veligonda**

was nearly half completed for launch in a couple of months from the inlet end of the tunnel.

Contractor Jaiprakash is using the twin machines to drive a 43.5km water transfer tunnel in Andhra Pradesh state. The TBMs were assembled first-time onsite. Geology comprises layered quartzite and shale, and granite.

On a separate water transfer project in the state – the Pula Subbaiah Veligonda scheme – excavation got underway in late June with the second, and larger, TBM on the project. The Robbins machine was originally earmarked to launch around February but was delayed by heavy wet weather and difficulties with site preparation.

The TBM will drive a 19.2km long tunnel that will run parallel to the 7m diameter bore being excavated by a 7.9m diameter Herrenknecht machine (S-370). The first bore has been underway for about a year. Geology along the alignments comprise quartzite, shale and phyllite.

The larger Veligonda tube will be built by a JV of Coastal Projects and Hindustan Construction Co (HCC). The former is part of a separate JV driving the smaller tunnel. The tunnel are to open in 2014.



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## Expanding Horizons

## Underground

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# Record breaking TBM making ground in China

**C**hina's Pinglu Tunnel, the latest installment on the 200km Yellow River Water Diversion Project, is nearing completion as the Robbins double shield TBM boring the 4.8m diameter tunnel last month set its 15,000th ring. With this placement the 25.4km tunnel is three quarters complete.

Sino-Austria Hydraulic Engineering Co. (SAHEC) is responsible for the Pinglu tunnel, of which about 7km were left to excavate in mid-July 2009. The machine has been boring since September 30, 2006 in mixed strata up to 50 MPa UCS. "We've had high output in some very challenging ground conditions, from soil to often sticky, medium hard rock, to highly abrasive

sandstone and traces of coal," said Paul Bargmann, machinery dept. head for Alpine Bau GmbH, lead partner in the SAHEC JV.

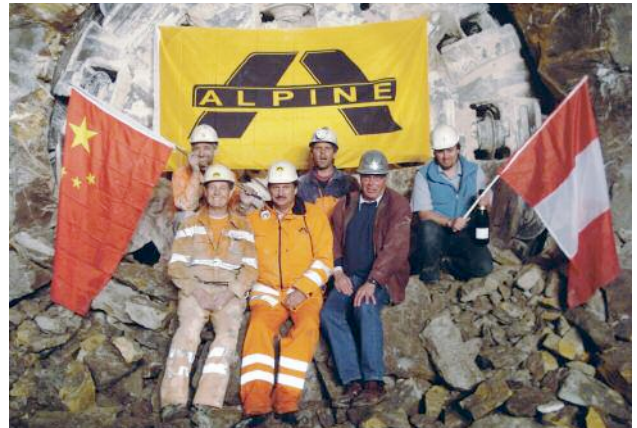
The machine broke through into a shaft chamber at the 13 km halfway point in October 2008, and was refurbished before starting up again in December. The final breakthrough is scheduled for the end of April 2010.

The Robbins machine has been operating in China since 2000, when it was used to bore the 12km long Lot 5 tunnel on an earlier section of the Yellow River Diversion. During the course of excavation, the machine set two world records in its size class of 4 to 5m: best month (1,855 m/ 6,085 ft) and monthly average (1,352 m/ 4,435 ft). Both records still stand.

Lining for all of the TBM-driven tunnels has consisted of hexagonal segments, produced in the city of Shuozhou about 15km from the Pinglu jobsite. Segments are placed in rings of four elements, in a honeycomb configuration staggered longitudinally. The design was created to allow for high-speed, continuous boring with no downtime while erecting segments.

The Pinglu Tunnel will connect to the North Main Line of the

**Left and Below: The 4.8m TBM is excavating mixed ground including soil and hard rock**



**Left and Below: Crew celebrate the halfway point breakthrough**

Yellow River Project, which additionally includes about 15km of drill and blast tunnels that will transfer water to Pinglu, Shuozhou, and Datong areas. Over 100km of the South Main Line were excavated by five TBMs, including

four Robbins Double Shields, between 1999 and 2001. The entire scheme will transfer water from the Yellow River to chronically dry regions of Shanxi Province, an area that only receives about 400mm of rainfall per year.

## Brixton breakthrough marks milestone

**T**unnellers on the US\$63M Thames Water Ring Main in London reached a major milestone this month with a breakthrough at Brixton. The TBM 'Helen' broke through at the Brixton shaft completing the drive for the 4.8km tunnel. Once in operation the tunnel will link the existing Brixton Thames Water Ring Main pump out shaft with Honor Oak Reservoir, carrying 200 million litres of potable drinking water per day.

Project manager for contractor Morgan Est David Brown said: "This has been a challenging drive." Some 4,000 tunnel rings were built and approximately 48,500m<sup>3</sup> of chalk, clay and sand were excavated, removed from the site and recycled. It also required the construction of two of the deepest jacked caisson shafts the contractor had ever engineered.

Brown added, "The tunnel breakthrough represents a key



**Helen holes through in Brixton**

milestone on the project and the focus will now change to the mechanical and electrical fit-out of the shafts at Honor Oak and Brixton."

Work is scheduled for completion in Spring 2010.

# PPP Arbiter on benchmarking, infracos

A further report to compare the costs of metro improvements underway in London against other major international cities is to be published later this year by the Arbiter of the Public-Private Partnerships ("PPP Arbiter").

The benchmarking report will expand on the original study published earlier this year, which only used about one year of data. The PPP Arbiter said a further two years of data will be added for the wider analysis, which is also being undertaken by BSL Management Consultants (*T&T*, February, p12).

BSL recently completed an extra study to gather the additional data for the expanded

benchmarking study. The research drew further upon information from the earlier metro systems examined, focusing on track, rolling stock and signalling.

The metro systems that co-operated in the original study were in Hong Kong (Kowloon Canton Railway Corp), New York, Munich, Barcelona, Toronto, Stockholm and Boston. There were also data from parts of Network Rail in the UK.

BSL's work to obtain extra data also drew upon another benchmarking study (CoMET/Nova). Broadly, the added data confirmed earlier findings. However, the PPP Arbiter noted that those data were provided anonymously

# HK taps Jacobs for XRL role

Jacobs is to be the Government's project representative on the Hong Kong section of the Express Rail Link (XRL) to mainland China.

The group's Hong Kong office is to undertake monitoring and verification work on the early stage work of the project, which is being executed by MTR Corp. In particular, the engineering services will cover the design and site investigation stages of the scheme.

Jacob's contract is valued at US\$3M, and the consultant will be working for the railway development unit of the Highways Department.

The twin tunnel scheme will link a new station in West Kowloon, Hong Kong, to Shenzhen and Guangzhou in China.

The section of XRL between Hong Kong and the border will be 26km long, and is being developed in two stretches of

approximately 15km and 10km, respectively. Construction work on the Hong Kong side of XRL is scheduled to start later this year and is scheduled for completion in 2012.

Across the border, work has already been underway on the mainland section which is due to come into service next year.

Separately, MTR Corp last month signed the project agreement to design, build, operate and fund the West Island Line (WIL), which involved tunnel construction. The Government is providing a grant of US\$1.64bn, Net Present Value to a baseline of June, to help fund the strategic link (*T&T*, July, p14)

Jacobs has another project representative role on a major rail project – Crossrail, in London, for the Department for Transport (DfT). It also recently won the design job for intermediate shafts on the project (see p12).

# Funds OK'd for Caldecott tunnel

The California Transportation Commission has approved US\$90M in funding towards the cost of expanding the Caldecott road tunnel on SR-24 with a two-lane, fourth tube.

Complexity of the project has led the state's Department of Transportation (Caltrans) to seek contract award by November. The initial plan was for construction to start this month.

It has also sought a 50% increase, or 18-month, extension to the construction period to complete the scheme after 54 months, in November 2014.

The new tunnel will be 1,033m long with a finished width of 12.58m. Seven cross passages will link the new tube to the third bore. Geology along the alignment comprises steeply dipping marine and non-marine sedimentary formations with stretches of crushed rock and crossing four fault zones.

Funding for the tunnel, which is located in Berkeley Hills at the boundary of Alameda and Contra Costa counties, which allocated as part of a larger, US\$1bn package for 95 projects. There was a 1.5% contribution to the package from federal stimulus funds.

which meant some duplication with BSL's first study could not be eliminated.

The new work obtained information also from Berlin, Mexico City, Madrid, Moscow, Paris, Santiago, Shanghai, Sao Paulo, Buenos Aires, Bangkok, Delhi, Glasgow, Lisbon, Milan, Montreal, Newcastle, Naples, Rio de Janeiro, Singapore, Sydney, Taipei and MTR Corp in Hong Kong.

The new findings will be used for the PPP Arbiter's negotiations with Tube Lines, one of the infrastructure companies ("Infracos") undertaking the refurbishment and upgrade work on the London tube network, much of which is in tunnel.

The talks are underway and, as noted before with the original report, interpretation of the new

benchmarking study will depend on factors such as relevance of comparators, robustness of the methodology used, and the volume and quality of underlying data.

An independent report by KPMG and Halcrow has been produced for the PPP Arbiter on Tube Lines' 2009-10 asset plan. The report will be used to help judge the company's plans for 2010-17, which it submitted in late June.

Separately, accounting giant KPMG and consultant Halcrow have also reported on the 2009-10 position and plans of the two Metronet infrastructure companies, which are now held by Transport for London (TfL) after they exited Administration last year.

# Motts on Song Bung 4

Mott MacDonald has been awarded a contract by part of Electricity of Viet Nam (EVN) to provide a range of support services to the development of the Song Bung 4 hydropower project, which involves extensive tunnelling work.

The project calls for excavation of an approximately 3.2km long headrace tunnel of 7.2m width, a 16m diameter surge shaft and a powerhouse (65m by 20m).

The consultant is to undertake design reviews and monitoring

plus provide advice as well as supervision and knowledge transfer services to the developer, Song Bung 4 Hydropower Management Board.

Particular services will include assistance with procurement and resettlement advice.

The project is being built in Quang Nam province and is to be finished by 2013-14. It is being funded by EVN, a local bank and also the Asian Development Bank (ADB), which recently approved a major loan shortly before the contract award to Motts.

# Crossrail awards list grows

Jacobs, Mott MacDonald, Capita Symonds and Scott Wilson were winners in the latest round of design contracts for the Crossrail project, in London.

Jacobs was awarded the US\$9.9M contract (C123) for Intermediate Shafts while Mott picked up a further two US\$3.3 contracts (C125, C162) – for M&E works in Tunnels and the Signalling, Traction Power and Platform Screen Doors design packages, respectively.

Capita Symonds was awarded the US\$0.41M contract (C175) for the Tunnelling Academy Design. The Bulk Power Distribution & HV Power design contract (C164) was awarded by Crossrail Ltd to Scott Wilson.

The Mayor of London has also moved to help deliver its share of

funding for the US\$26.8bn transport scheme, which involves major tunnelling works, by issuing a proposed tax of bigger business in the capital. The new levy would come into force in April 2010.

With preparatory site works already underway, main construction work is to start next year with excavation of the 6m i.d. twin tubes due to start in 2011. Royal Assent for the project was granted in 2008 and rail services are due to start in 2017.

A number of companies were prequalified at the end of last year to bid for design contracts on Crossrail under a framework supplier system, and the latest round of awards marks the half way mark on the process.

Motts already won the

contracts for Sprayed Concrete Lining (C121) and the Tunnel and Shafts Aerodynamics and Ventilation (C124).

Capita Symonds is also undertaking design of Royal Oak Portal (C150).

Scott Wilson previously picked up the design contracts for Farringdon station (C136) and Pudding Mill Lane Portal (C152).

Separate to the design contracts, Jacobs is working with the support of KPMG as Project Representative for the Department for Transport (DfT).

Design of the main bored tunnels, which involve more than 40km of TBM excavation in total, was awarded as a contract (C122) earlier to a pairing of Arup and Atkins. The pair also are working together on Tottenham Court Road station (C134).

Other companies with key roles in the scheme to support the client include the Project Delivery Partner (Bechtel, supported by Halcrow and Systra) and Programme Partner (Transcend – a JV of Aecom, CHSM Hill and Nichols Group).

The Mayor's funding tax is to be a Rates Supplement on, what is expected to be, 20% of larger businesses in London. The levy is to raise US\$6.9bn, roughly equivalent to a quarter of the project cost.

The Mayor, Boris Johnson, said: 'Despite the economic climate it is essential that we do not allow our investment in the future to falter. We need to take a long view and move ahead with projects that will ensure that we emerge from the downturn in the best possible shape.'

## Fed funds for NS Connector

The US federal stimulus funds sought for the North Shore Connector light rail project, in Pennsylvania, were confirmed last month when the Government gave a grant to help meet escalated costs of the scheme which involves construction of twin bore tunnels.

A grant of US\$62.5M was given to the project by the Federal Transit Administration (FTA), part of the Department for Transportation.

A spokesman for the client, the Port Authority of Allegheny, said that the funds were anticipated and would mean the project had enough money for at least another year of construction.

'The US\$62.5M helps,' he said,

and added: 'We still need more and are in the process of finalising those details.'

In January, the client was seeking more than US\$100M in stimulus funding for the project which, at US\$539M, was about a quarter over the original budget of US\$435M. It was trying to ensure the project was not shut down (T&T, January, p7).

Tender costs for many parts of the scheme, including tunnel construction, were greater than expected resulting in a budget shortfall. The client's spokesman said the project had faced the same inflationary hurdles that plagued many US construction projects over recent years.

The contractor for the tunnelling works on the project, and the shell of the North Side station, is a JV of Obayashi and Trumbull. The tunnels run below the Allegheny river, and are constructed of bored and cut and cover sections.

Excavation of the second of the two tubes was completed by a 6.5m diameter TBM in January, a few months later than originally planned because of a delayed start. The Herrenknecht Mixshield (S-374) was used to drive each 680m long bored section below the river through mainly silts, sands, gravel shales and claystone. There were lenses of limestone and the head of water was up to 14.5m.

## HCC wins Bhutan job

Contracting giant, Hindustan Construction Co (HCC) has been awarded a contract involving major tunnelling work on the Dagachhu hydro power project in Bhutan.

HCC is to excavate headrace tunnels, a surge shaft, a pressure shaft, powerhouse and transformer caverns, and the tailrace tunnel as part of a package of work on the project.

The value of the contract, awarded by Dagachhu Hydro Power Corp, is US\$80M. The length of the contract period for the package of works is approximately three years and five months.

The contractor's success with the project comes only a few months after another hydro contract award in Bhutan – for the Punatsangchhu-I scheme – that also involves another significant amount of tunnelling works.

Much more tunnelling work is anticipated in the country as part of major pact with India to jointly develop a series of large hydropower projects in the next decade.

## Lovat wins Spadina order

Lovat has won an order to build four EPBMs and supply ancillary equipment for the Spadina metro extension on its doorstep, in Toronto.

The contract is valued at US\$54.7M, inclusive of taxes, freight, duties and other costs, to supply the TBMs and equipment to excavate a total of some 13.5km of twin tunnels.

Last month the contract (A35-16) was approved by Toronto Transit Commission (TTC), which had

received eight requests for information from potential suppliers after the call for submissions issued last August. Ultimately, two companies bid in the multi-phase procurement process.

The rival bid of US\$60M was submitted by Herrenknecht, said TTC.

Lovat's contract price for the four shields also includes the supply, as an alternative, of mixed ground cutterheads with face isolation doors. In addition, it is to supply

items such as trailing gears, segment cars and air compressors.

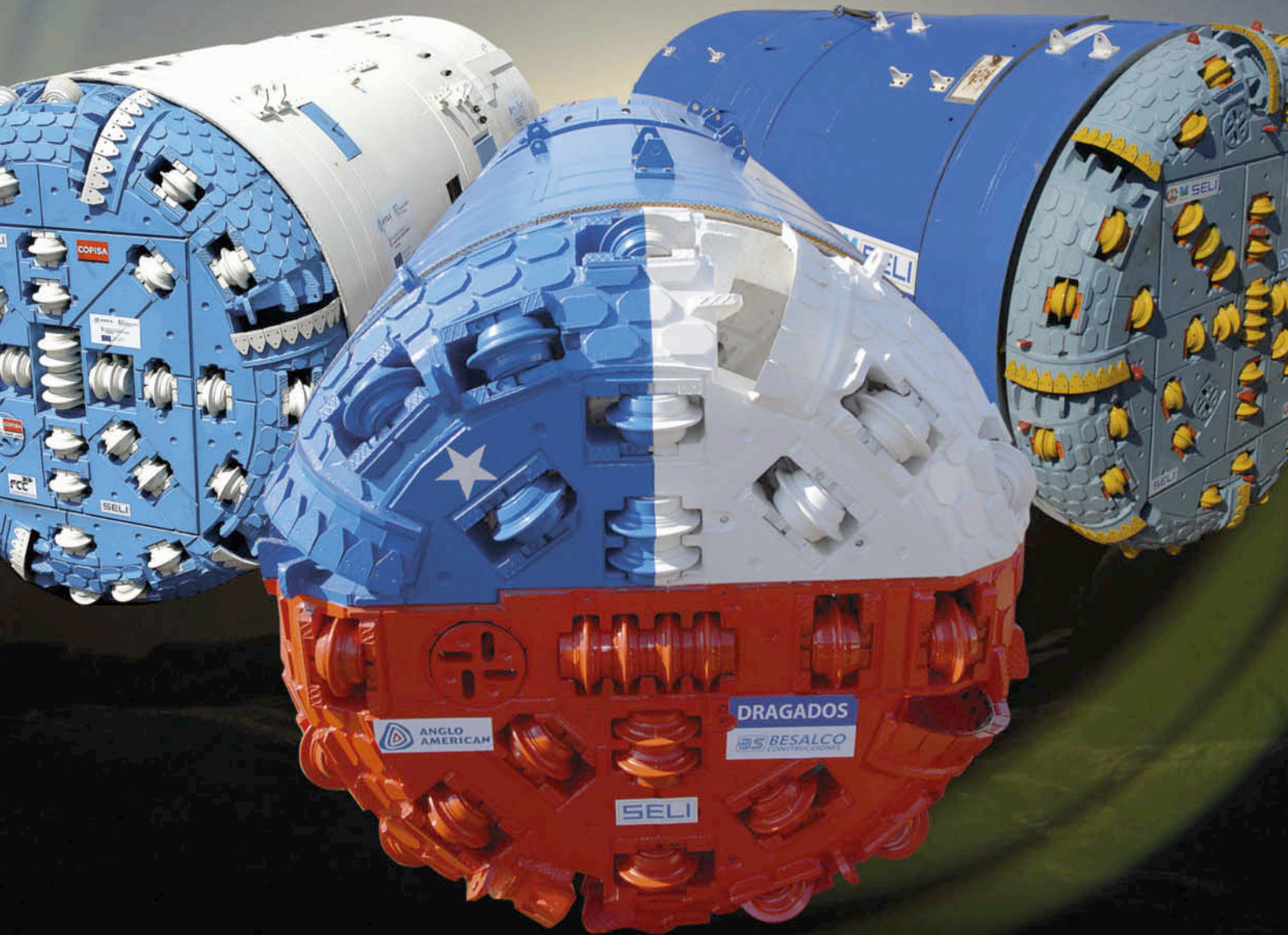
TTC said Lovat's offer of a buyback option may be considered following the award of the contract.

Security of at least 15% of the contract value, by Performance bond or irrevocable Letter of Credit, is to be provided by Lovat.

Funding for the US\$2.43bn Toronto-York Spadina subway extension was approved by the city council at the end of last year.



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# Boring through future

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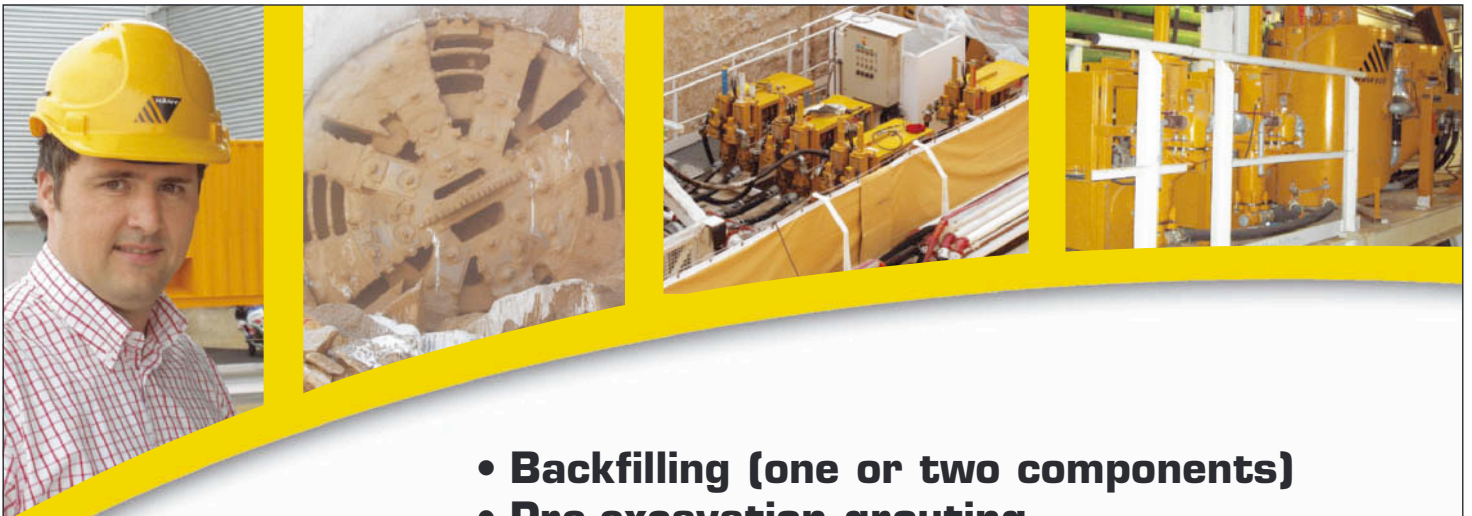
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## Measure of success

Amberg Technologies offers a surveying solution called TMS Solution that, it claims, sets new benchmarks in measurement and automation for conventional tunnelling. Successful tunnel builders increasingly rely on intelligent surveying solutions as an integral part of their tunnelling equipment. They require:

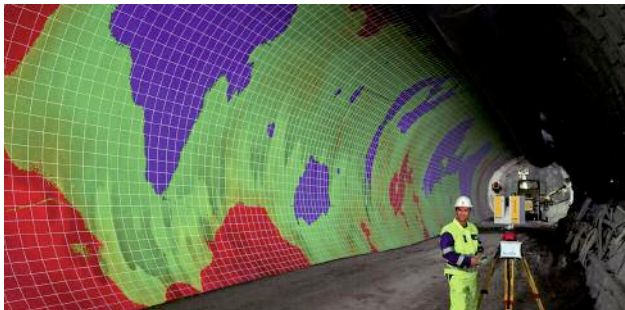
- Effortless transfer of complex planning data
- Short preparation times
- Multifunctional and flexible operation
- Optimal support for all tunnel

construction processes

- Round-the-clock availability

The TMS Solution is an integrated system designed to bring together these benefits in one surveying solution, resulting in efficiency and precision in all phases of conventional tunnel construction, says Amberg Technologies. It is available in three system packages – TMS Set out, TMS Profile and TMS Tunnelscan.

**Amberg Technologies**  
 Tel: (+41) 44 870 92 22  
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 Web: [www.amberg.ch](http://www.amberg.ch)



## Monitoring Systems

Established in 1972, Bergsaker AB manufactures and supplies measuring and monitoring systems for harsh environments of construction & mine sites. Parameters normally monitored are vibrations, slope stability and ground water level. The main part of the system is Bergsaker AvaNet® Webb.

Bergsaker AvaNet® Webb product range includes monitoring and analysis of data and adjustments of field instruments, done remotely via Internet with CO2-friendly feature.

Bergsaker AvaNet® Webb communicates via GSM/GPRS with monitoring equipment in the field. The product provides possibility to view and analyze data, on-site or on travel. It provides data storage facilities for project analysis folder.

**Bergsaker AB**  
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 Email: [thomas.larsson@bergsaker.se](mailto:thomas.larsson@bergsaker.se)  
 Website: [www.bergsaker.se](http://www.bergsaker.se)

## Directional Core Drilling

Devico AS supplies specialized directional core drilling and borehole surveying equipment. It provides investigation and monitoring needs for the mining, exploration, petroleum and tunnelling industry.

The directional core drilling products provide pre-investigations. The product drilling technique is used for borehole and trajectory facilities for tunnel alignment, and at the same time collects a core sample over the full hole length. The core indicates rock quality near the borehole as well as structural information and indications of the amount of water present.

The quality of the data obtained from directional drilling is high, since the hole can be kept within a short distance from the centerline of the tunnel. The properties of the collected core are therefore highly relevant and descriptive of the ground properties that will be encountered during construction.

Devico has worked on projects all over the world, including Hong Kong, Japan, Turkey, Australia, Norway, Canada, US and more.

**Devico AS**  
 Tel: (+47) 72 87 01 01  
 E-mail: [devico@devico.no](mailto:devico@devico.no)

## Subway Monitoring

InstanTel Vibration Monitors finds use in subway monitoring, an activity that is critical for safety and regulation considerations. There is a growing need to monitor and protect existing subsurface transportation tunnels during construction and demolition for which InstanTel vibration and overpressure monitors can be used. It is currently in use in the Brisbane tunnels in Australia which run 60m under the Brisbane River. Other locations include the construction project of the South African Gautrain, which has 20 monitors installed, and the East Side Access project in New York with over 20 monitors on site.

The InstanTel Minimate Pro4™ and Minimate Pro6™ offers RF and EMI shielding, CE Compliance to Class B, as well as water resistance – all ideal for tunnel environments containing conduit and high moisture. They provide cost effective hardware and software



features to simplify the design and installation of semi-permanent tunnel monitoring systems. The InstanTel Auto Call Home™ call-in feature automating modem communications, makes it easy to configure instrumentation in remote and difficult to access locations. To reduce the cost and complexity of the system, the Minimate Pro6™ 6-channels with two geophones (DIN or ISEE Triaxial Geophones) can be configured on the same monitor.

**InstanTel**  
 Tel: (+1) 613 592 4642  
 Email: [sales@instanTel.com](mailto:sales@instanTel.com)  
 Website: [www.instanTel.com](http://www.instanTel.com)

## Sensing Subtle Variations

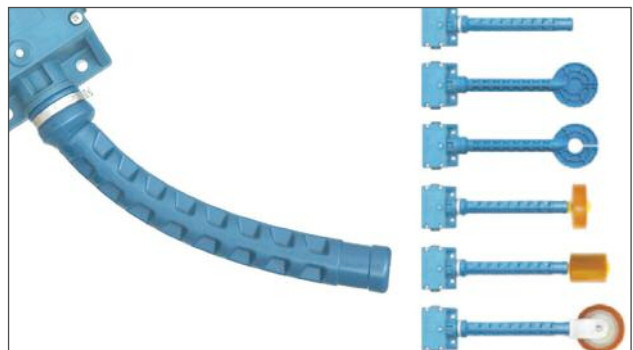
Troxel, a manufacturer of sensors and sensing systems, has launched a new version of its Flexiprobe multi-purpose limit switch that has extensive applications in the tunnelling and construction industries.

Troxel has used its in-house expertise to develop the new Flexiprobe that has a rugged design that could make it reliable in the most hostile working conditions. The new product can be used for position sensing, movement detection, safety interlocks, level detection, conveyor detection and vehicle detection. This means that it can be used to detect and monitor such things as material flow along a conveyor belt, belt alignment, water flow, spillage, rope run-out

and emergency stop detection.

The Flexiprobe has been built without a single electronic component to ensure long reliability and low cost maintenance. The unit features a rugged housing moulded in impact-resistant reinforced nylon 66 and an almost indestructible hi-flex urethane polymer probe actuator. The materials used are corrosive resistant, and it is dust tight and waterproof to IP67 standards. Internally, there is a heavy duty 10amp rated contact at 300Vac with large easy-access connection terminals. There are two M20 threaded cable entries on the sides of the housing.

**Troxel Ltd**  
 Tel: (+44) 161 483 1435  
 Email: [info@trolex.com](mailto:info@trolex.com)  
 Website: [www.trolex.com/flexiprobe](http://www.trolex.com/flexiprobe)



## Roctest monitoring system

The Roctest Group's system permits survey of the structural behaviour of a tunnel, based on a single fiber optic cable. This system is incorporated within a special cable, called SMARTprofile, for the measurement of strain distribution, and a powerful Data Acquisition Unit, called DiTeST. Through the dedicated software, DiView, it's possible to obtain a graphical representation of the evolution of the deformation trend in the structure.

Some of the factors, which make this system unique and inimitable are ease of installation, data management, and user-friendly interface. All sensing elements are seamlessly integrated into a single database and user

interface, and there is one measurement point per each meter of SMARTprofile.

In 2006, Roctest acquired Smartec SA, a privately held Swiss company specializing in the development, production and distribution of measurement and structural health monitoring solutions based on cutting-edge technologies, becoming the only manufacturer of measuring instruments for the civil and geotechnical engineering markets to offer a complete set of technologies to meet the requirements of the most challenging and demanding environments.

**ROCTEST Ltd**  
Tel: (+1) 450 465 1113  
Email: info@roctest.com  
Website: www.roctest.com

## A peep down the hole

Reflex Instruments has introduced a new non magnetic gyro surveying instrument, the Reflex Gyro, for use in the civil construction industries. It is a highly accurate down-hole survey instrument capable of surveying in any direction in all magnetic and non-magnetic environments.

Measured data is transferred from the instrument's onboard memory to the field PC via Bluetooth. The data can then be processed using the sophisticated inertial navigation software. Users



can also tabulate, plot and export data with DisplayIT.

Reflex's non magnetic instrument range also includes the Reflex Maxibor II, an advanced instrument for accurate surveying in magnetically disturbed environments such as tunnelling applications or inside metal drill strings.

**Reflex Instrument AB**  
Mobile: (+61) 0415 181 172  
Email: kym.clements@imdexlimited.com  
Website: www.reflexinstruments.com

## Pollution Control In Tunnels

Tunnel Sensors is a company that supplies, installs and maintains tunnel atmosphere monitor systems worldwide. The company provides a range of sensors for visibility, carbon monoxide (CO), nitric oxide (NO), nitrogen dioxide (NO<sub>2</sub>) and air velocity/direction monitoring - with a variety of interface and configuration options.

**Tunnel Sensors**  
Tel: (+44) 1280 850563  
Email: sales@tunnelsensors.com  
Website: www.tunnelsensors.com



## Testing solutions

MATRIC's is an IP operator system developed by P. Ducker Systems Ltd. for road tunnel infrastructure projects that acts as a fully integrated solution where video, audio, plant lighting, ventilation, electrical and pumping and traffic data are integrated.

It can be used to integrate and test whole tunnel system solutions prior to installation on site, with obvious benefits. Enabling an integrated approach, MATRIC's IP can deliver a substantial reduction in project timescale, cost and risk for all involved.

This solution forms the basis

of PDS provision of all tunnel systems for the new tunnel being built on the A3 at Hindhead.

The use of coordinated data can enable improved situation analysis and event response. MATRIC's IP can be configured to enable determination of event status and provide recommended response to events, greatly aiding response to emergency situations where positive action is needed based on predetermined event plans.

**P. Ducker Systems Ltd**  
Tel: (+44) 1332 280195  
Email: info@pdslimited.co.uk  
Website: www.pdslimited.co.uk

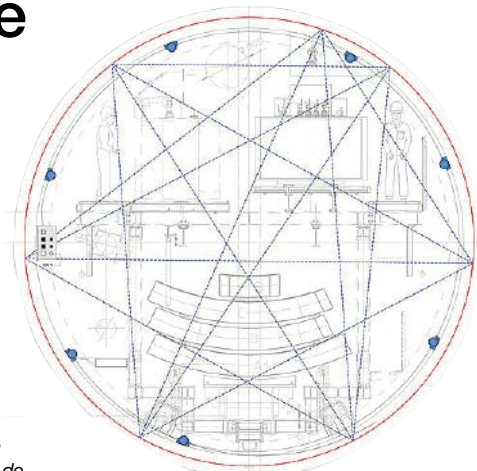
## Measuring ring convergence

On segmental lined tunnel projects, the clients often define specific locations where deformation measurements have to be performed by the contractor. Crucial considerations to the initial ring deformation are the pressure of the jacks during the next advance and subsequent load changes, e.g. the passing of the shield's tail, primary and secondary grouting, passing of the last back-up trailer and any potential long term effects.

VMT has a new system that works based on the implementation of a series of inclinometers on the ring to be observed for deformation. An inclinometer is installed at each segment of the ring to be measured. Deformations can only take place along the longitudinal joints, which are treated as articulations. Any movements of the rigid segments have primary components can then be observed by appropriately installed inclinometers.

Deformation measurements by the Ring Convergence Measurement System (RCMS) for evaluation of the changes in shape of the ring in the area within the confines of the back up equipment are now in use on several projects in Europe

**VMT GmbH**  
Tel: (+49) 7251 96 99 0  
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In Australia too, our people have made significant contributions to the design and construction of many of the region's largest infrastructure projects.

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As an integral member of PB in Australasia, you'll work in an environment that values integrity, customer service and teamwork. You'll relish the opportunity to bring innovative solutions to the most significant and challenging projects in the region and add value with your outstanding design skills and management expertise.

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## Making the cut

New to Alpine Equipment's line-up is the Multi-Tool Miner (MTM) design. The company says its objective was to create heavy, but compact, carrier vehicles with loading and conveying capability, equipped with a quick-coupler on which hydraulic attachments such as cutterhead, hammer, drillbolter, blast hole drill, bucket, support erector and shotcrete manipulator could be installed and quickly exchanged as ground conditions change.

"When rock is too hard or competent for excavation by cutter head or hammer, the MTM can be used as a drill-jumbo and mucking machine for the conventional drill-and-blast method." Alpine Equipment says. The latest

ABM330-MTM is a 60 ton machine with cutter motor power from 140 to 240kW.

Alpine Equipment also offers hydraulic roadheader-type cutter head attachments for tunnelling and rock excavation. These grinders are available in eight size classes from 18 to 240kW. With a range of hydraulic motor sizes and mounting options, a grinder can be matched to carriers of any size. Applications include mass excavation, mining, shaft sinking, trimming, profiling, trenching, slot cutting, and low-vibration rock or concrete cutting.

**Alpines Sales & Rental Corp**

Tel: (+1) 814 466 7134

Email: [info@alpine-aec.com](mailto:info@alpine-aec.com)

Website: [www.alpinecutters.com](http://www.alpinecutters.com)



## Tooled up

BETEK offers complete tool systems for roadheader machines, long wall shearers and continuous miners including holders as a solution from a single concept – with locking systems according to requirements and a shank diameter of 25 to a step shank 35/43mm. The tool line for TBMs includes scraper blades and reamers as well as a large selection of Weldon teeth.

BETEK produces tools for all machines including scraper blades for Herrenknecht systems. The tungsten carbide qualities are specifically adapted to the

application and are claimed to excel through their high wear-resistance. A high feed rate, long service life and short tool changing times ensure a high daily production volume.

BETEK says it supports its customers in selecting the right tools and advises when to change the tools. "BETEK helps to solve the most demanding drilling tasks. If required, BETEK can also develop customized solutions.

**BETEK**

Tel: (+49) 7422 565 130

Email: [e.staiger@betek.de](mailto:e.staiger@betek.de)

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## Blast-free fracturing

Daigh Company is the supplier of the innovative Dā-mite rock splitting mortar. Dā-mite is used specifically to fracture rock and concrete in "no-blast" conditions. Dā-mite is an effective tool for fracturing mass rock, boulders, trench rock, dimensional stone, concrete and reinforced concrete.

Dā-mite is mixed with water and placed in pre-drilled holes, where it sets and expands with a compressive strength of over

18,000psi – Dā-mite has more than enough force to get the job done.

No license or permits are required for its use. There are four grades of Dā-mite, providing enough versatility to be used in drilled hole diameters from 1in to 3in.

**Daigh Company**

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Website:

[www.daighcompany.com](http://www.daighcompany.com)

## A cut above

Founded in 1864, Eickhoff operates worldwide as a manufacturer of heavy-duty roadheaders for tunnelling and mining applications. Current jobsites include road and rail tunnels in Switzerland as well as metro extensions in different cities around the globe.

The first of the new Eickhoff ET 480 roadheaders is due to be commissioned shortly in a Swiss hard rock tunnel. Thanks to its 800mm telescopic boom with 300kW cutting power, upgraded heavy-duty machine chassis, bigger crawler carriers and a new easy-maintenance (low-cost)

conveyor system, this latest model in the well-proven ET 400 series not only allows cutting a cross-section of up to 94m<sup>2</sup> from a stationary position but also exceptional excavation rates in extremely hard and wear-intensive rocks.

Eickhoff also offer a broad range of hydraulic milling cutters for standard excavators, derived from decades of experience in hard rock cutting conditions.

**Eickhoff**

Tel: (+49) 234 975 2043

Email: [vt@eickhoff-bochum.de](mailto:vt@eickhoff-bochum.de)

Website: [www.eickhoff-bochum.de](http://www.eickhoff-bochum.de)



## Drilling for Quality

**R**ock drilling tools supplier Helso specialises in buttonbits for percussive rock drills. The quality of Helso products is, says the company, based on continuous development in Finland, while cost-effective manufacturing is claimed to allow for the attractive pricing. The manufacturing plant has achieved the ISO 9001 quality certification.

Helso products, which include top hammer drilling tools, DTH hammer drilling tools and furnace tapping tools, are available in Scandinavia and elsewhere in Europe and Asia.



**Helso Oy**  
Tel: (+358) 192 461 101  
Email: info@helso.fi  
Website: www.helso.fi

## TBMs

**H**errenknecht AG located in Germany, is a technology and market leader in mechanized tunnelling. Herrenknecht manufactures and supplies mechanized tunnelling systems with diameters ranging from 0.1m to 19m. The systems are individually adapted to the projects for specific geological and hydrological conditions. The product portfolio includes Hard Rock Machines and Open-Face Shields, Earth Pressure Balance Shields and Mixshields for traffic tunneling.

The company also provides state-of-the-art deep drilling rigs, to bore to depths of 6,000m (Herrenknecht Vertical). The most recent subsidiary (Bohrtec Vertical) supplies small drilling devices for the use of near-surface geothermy.

The Group includes 30 subsidiaries and seven associated companies in related sectors, in Germany and abroad.

Around 150 large diameter machines from Herrenknecht are in operation worldwide.

In Shanghai, China, the world's two largest tunnel boring machines excavated two three-lane road tunnels – 7.47km long each under the Yangtze River. The two machines (diameter 15.43m) reached their targets in May and September 2008 one year ahead of schedule. These two tunnels are to be opened for traffic in April 2010 when Shanghai hosts the World Expo.

The 2x57km Gotthard Base Tunnel in Switzerland, will be the longest railway tunnel in the world. Four Herrenknecht Gripper TBMs have already excavated nearly 70km in the project. In June 2009, the first TBM reached its final breakthrough on the northern section. In total, the four machines will bore and secure 85km of the two main tubes.

**Herrenknecht AG**  
Tel: +49 7824 302 0  
Email: pr@herrenknecht.com  
Website: www.herrenknecht.com



## Clean excavation

**T**he ITC Super loader comprises a basic frame on a crawler with a 1m wide integrated, heavy duty conveyor. The machine is driven by one diesel and one electric engine to allow emission free working at the face and is equipped with a cable reel and mucking boom equipment.

This Superloader, which is said to be simple to handle, allows the operator to reach loading

capacities up to 8-10m<sup>3</sup>/min, even under difficult conditions such as hard and abrasive rock. ITC says a 20m<sup>3</sup> dump truck can be loaded in just two minutes. "Thanks to this easy handling and maintenance system the running cost of this machine are extremely low," the company adds.

**ITC SA**  
Tel: (+41) 277 222 191  
Email: info@itcsa.com  
Website: www.itcsa.com

## Custom versatility

**L**ovat is a leader in the design, service, refurbishment/ modification and manufacture of TBMs, with over 35 machines currently operating in 10 countries.

Lovat specialises in rock (single and double-shield), soft-ground (EPB and non-pressurised), slurry and mixed-face TBMs, ranging from 0.75m to 15m in diameter. To date, the company has built over 250 TBMs and performed over 150 full refurbishments for more than 700 tunnelling projects. Lovat TBMs have excavated more than 2M meters of tunnel worldwide.



**Lovat**  
Tel: (+1) 416 675 3293  
Email: tbn@lovat.com  
Website: www.lovat.com

## Successes in China boost sales

**N**FM Technologies specializes in heavy mechanical equipment. Covering all types of tunnels above 3m in diameter for the worldwide market, tunnelling technology offered by the company includes EPBs, Slurry shield (Benton'air), combined modes, hard rock single or double shielded TBMs and gripper machines. Services include on-site service, partnering, technical assistance, especially during equipment start-up, maintenance and spare parts management.

Recently, two NFM Technologies slurry type tunnel boring machines with a diameter of 11.38m crossed the River Yangtze at Wuhan in China. Two further 5.75m diameter hard-rock machines are on order for a project to divert the waters of the Tahoe River, a tributary of the

Yellow River, in China.

To date, NFM Technologies has supplied more than 65 machines for European, Chinese and Middle-Eastern infrastructure projects.

**NFM Technologies**  
Tel: (+33) 426 848 700  
Email: contact@nfmtechnologies.com  
Website: www.nfm-technologies.com



## The Powerhouse Drill

Established in 1962, Redpath Mining provides services that provide continuous improvements in safety standards and tackles sophisticated and technologically challenging projects.

Built by raisedrillers, Redpath's Redbore 100 has the capacity to bore a raise up to 1000m in depth and up to 8m in diameter. Its compact design and low profile construction enables underground mobility and

minimizes excavation requirements. Powered by a 600 HP variable frequency AC motor, the Redbore 100 delivers 15,569kN (3.5 million lbs) thrust and 56.9kN.m (770,000 ft-lbs) breakout torque.

Affectionately named "The Queen Louise" the Redbore 100 is currently drilling her inaugural raise at IAMGOLD's Westwood Project in Quebec, Canada. Redpath's experience in raiseboring began in 1970 and

today the company owns and operates one of the most extensive fleets in the world.

Redpath Mining Contractors and Engineers are located in Australia, Canada, Chile, Indonesia, Mongolia, South Africa and United States.

**Redpath Raiseboring Division**

Tel: (+1) 705 474 2461

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info.raisedrills@redpathmining.com

Website: www.redpathmining.com



## Robit Rocktools

The Robit casing system consists of a pilot bit and ring assembly that forms the key component of the ground drilling tools product line. The patented locking system and design for

concentric drilling enables ease of use across various ground formations. The casing system is available for top hammer and DTH equipment. There models are used for single and multi-use systems. While the casing is left in the ground for single-use systems, for multi-use ones the casing is recovered.

The company also announces its entry into fore poling, also known as Tube Umbrella drilling, which is an application to strengthen tunnel roofs in overburden or broken rock conditions.

**Robit Rocktools Ltd**

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Email: robit@robit.fi

Website: www.robit.fi



## Drilling On The Rock

Rockmore International is a global manufacturer of rock drilling tools serving the mining, construction, and water-well sectors for more than 60 years. The company has developed a new carbide insert design for their button bits, called the MultiPoint. In percussion drilling, penetration rates depend on efficient crack propagation. The conventional hemispherical insert, there is a single tangent point striking the rock, resulting in the rapid development of wear flats.

Rockmore's exclusive new carbide insert design provides multiple strike points for more efficient rock fracture and longer insert life.

Rock-drilling trials showed that Rockmore's button bits with MultiPoint inserts last up to 20% longer than the standard hemispherical design, and

increased penetration rates by 10%. The wear flats appeared slower and later in the insert life than with hemispherical inserts. Testing revealed that the MultiPoint inserts provided smoother bit rotation and advancement.

The new Rockmore MultiPoint design, is better transfer of energy, imparting more effective rock fracture. Button wear is reduced and overall bit life enhanced in even the most abrasive and hardest rock conditions.

The MultiPoint design is currently available in 1/2" to 3/4" (12 - 19mm) diameter carbide inserts, in Rockmore's DTH and top-hammer bits, 3.5" to 10" (89 - 254mm) diameter.

**Rockmore International, Inc.**

Tel: (+1) 503 682 1001;

Email: info@rockmore-intl.com

Website: www.rockmore-intl.com

## Tunnel Boring At A Frenetic Pace

The Robbins Company currently has 14 earth-pressure balance machines (EPBs), the latest addition to its range of high-performance TBMs, operating across the world. These TBMs are operating in the United States, Mexico, China, India and Azerbaijan.

Custom-designed to meet specific project requirements, the Robbins Company machines are available in several types, including Main Beam, Double Shield and Single Shield.

Of late, the EPBs have been setting some impressive project records, including the boring of a 6.52m diameter tunnel in India's New Delhi Metro Extension. The EPB set a weekly advance record of

202m, which is higher than any of the 14 TBMs used on the project. In addition, two 6.3m EPBs excavating China's Guangzhou Metro have achieved feats of their own, the company says. In 2009, Robbins has continued to perfect the use of hard rock TBMs under high cover conditions. In December 2008, a 9.7m diameter Main Beam TBM completed the main adit for the Ceneri Base Tunnel in Switzerland. Advance rates averaged 18.5m per day using 19-inch disc cutters under 600m of cover.

**The Robbins Company**

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homeb@robbinstbm.com

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www.therobbinscompany.com

## Cutting to the core

The Split-Ring cutter has a cutter-ring made out of two halves clamped to the cutter hub. This allows changing of the cutter-ring while the cutter itself remains on the TBM.

Split-Ring says that cutter-ring replacement can be carried out by one operator in approximately 10 minutes and requires only a lightweight nut driver; the heaviest element to handle in the system is 12.5kg.

"The cutter is strongly built to allow many cutter-rings to wear out before the cutter itself needs servicing; for many cutter positions 10 cutter-rings. This eliminates the cutter shop,

reduces downtime and increases productivity of the TBM and reduces heavy work for the TBM operators."

The individual cutter is more expensive, but the much increased component life is believed to more than compensate for this.

"The Split-Ring cutter offers savings on budget, schedule and labour" say the company. It is also the only cutter development that satisfies the HSE requirements and is patent protected.

**Split-Ring**

Tel: (+47) 4816 3940

Email: post@split-ring.no



## Real-time excavation tracker

VMT GmbH, the specialist for guidance systems for segmentally lined tunnels (SLS-SL), has expanded its product portfolio to include a navigation system for roadheaders (SLS-Roadheader).

Based on a motorized theodolite, the continuous position of the cutting tool is displayed on the machine monitor in near real-time, permitting the machine driver to execute precise excavation. This eliminates expensive and time-consuming rework, whilst production times are shortened significantly.

With the help of the optional profile analysis software, a 3D image of the excavation profile can be calculated from the recorded movements of the cutter arm and displayed in the site office immediately. The cutter arm's over break and under break can then be documented by easily created reports.

The WLAN tunnel data network developed by VMT, the SLS-Roadheader navigation system is integrated in the existing site network without problems. This makes it possible to carry out production data saving, representation of the tunnelling progress and remote maintenance of the system in the site office.

Additional network compatible equipment can be integrated into the WLAN tunnel network at any time with no inconvenience.

Constant advancement in development and the experiences from current and successfully completed projects demonstrate that the use of the SLS-Roadheader increases profile quality, accelerates tunnelling, and reduces project costs.

**VMT GmbH**

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Website: [www.vmt-gmbh.de](http://www.vmt-gmbh.de)

## Doing the QuickStep

The new Sandvik i-series tunnelling jumbos are said to combine precision and power with intelligence and a user-friendly working environment. The latest addition to the series is the Sandvik DT1130i, a three-boom jumbo for excavation of 20-183m<sup>2</sup> cross sections. With the new i-series, Sandvik claims to take tunnelling performance to a new level. The company adds: "Fast, accurate and user-friendly, the jumbos utilize state-of-the-art technology. The intelligence features offer, among others, built-in diagnostics, condition monitoring and a possibility to plan charging and blasting already in the early phase."

The drifter and the control system play a key role in the new series, offering easy-to-use screen views for different functions and a QuickStep system that lets the operator fine-tune the automatic functions if necessary. "Equipped with powerful, high-frequency HFX5T rock drills, robust booms and advanced drill string guides, the new i-series jumbos are fast and

accurate drillers. They make a perfect combination with Sandvik rock tools for tunnelling which optimise the energy transfer, enhance fast penetration and produce excellent hole straightness," says the company.

The i-series features a modern cabin with large window surface that provides excellent visibility in all drilling applications. "The jumbos have ergonomically designed workstations with armrest integrated controls, efficient air filtration, optimized flow as well as excellent noise (under 75 dB (A) and vibration suppression," it adds.

Sandvik's tunnelling jumbo range is designed to be configured with different sets of features and components to handle multiple tasks in the tunnelling cycle and in different rock conditions.

**Sandvik Mining & Construction**

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[nina.lehtonen@sandvik.com](mailto:nina.lehtonen@sandvik.com)

Website: [www.sandvik.com](http://www.sandvik.com)

## Guiding The Diggers

Vidalaser is an Italian company that has specialized in production and sale of laser instruments used in tunnelling and construction industry. The company has 30 years of expertise in the field of topographical instruments.

Vidalaser tunnel lasers are produced in a range of different versions and models. The Halley86 5mW output power is

the biggest, and in the 12Vdc version you could use either 12Vdc or 230Vac. The FBL91 2mW is used for small work whilst the VL102 is a special laser for drilling machines. Vidalaser also produces an antiexplosion tunnel laser.

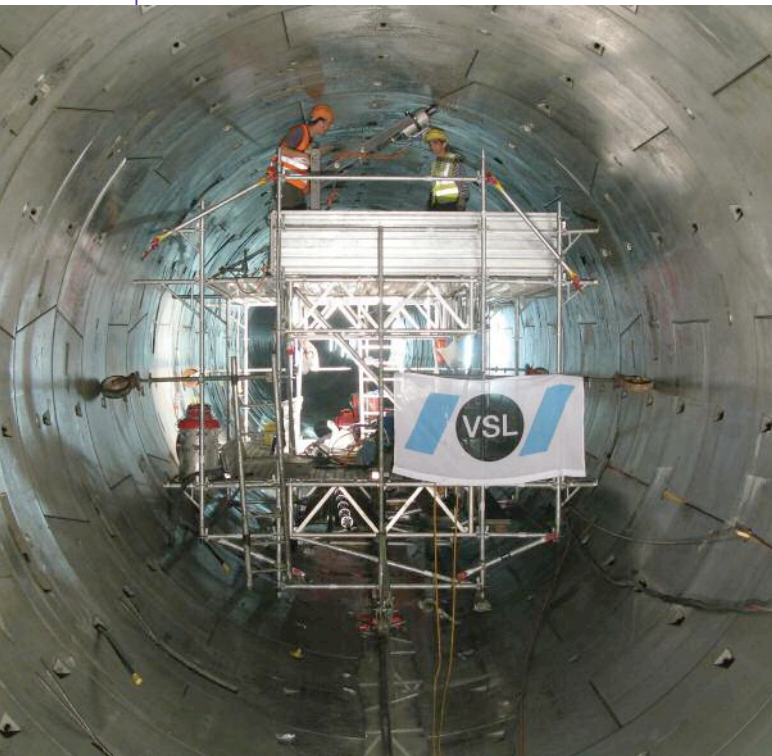
**Vidalaser SAS**

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Website: [www.vidalaser.com](http://www.vidalaser.com)





## Solutions around tunnelling

VSL offers widespread solutions in the field of tunnelling. Its department of post-tensioning and anchoring supports the preparation of tunnel walls and foundations. The Heavy Lifting department with strand lifting systems provides tough solutions for tunnel drilling; the transport and retaining of tunnel drilling machines.

VSL Heavy Lifting is able to provide the most effective solution for projects in which cranes or other conventional handling equipment cannot be used because of excessive weight, dimensions or space limitations.

VSL (Switzerland) uses the Z anchorage, which gives the benefit of having continuous forces around the ring and a limitation of the number of stressing pockets. VSL also uses PE plastic ducts PT-Plus 59 and mono-strands measuring 0.5 inch (100 square millimeters), in order to limit the frictional losses along the tendon, with a special PE sheet of 2mm, in order to increase quality and safety. After stressing, the box outs can be grouted with a special mortar usually used in the geotechnical application.

**VSL International Ltd**  
Tel: (+41) 32 613 30 30  
Website: [www.vsl-intl.com](http://www.vsl-intl.com)

## A hydraulic cut for tunnels

Webster Technologies Ltd is an international engineering design and consultancy company that specialises in the development of hydraulic cutting machinery for the construction, mining, tunnelling and civil engineering.

The TD Rockwheel Range (better known in the industry as transverse cutting unit) features a direct drive design. A high torque low speed hydraulic motor is mounted in between two cutting heads, each of which has its own bearing assembly, and is powered to suit the hydraulics for the selected excavator range with a torque range capable of giving the maximum pick forces.

The latest development is the TS Rockwheel Range (an excavation tool designed specifically for narrow trenching). The action of the bucket ram lowering the cutting head into the cut causes the stabilising wheel to bite into the ground. The axial cutting head can now be used with minimal shock loading on

the excavator slew ring. The lift, dipper and bucket cylinders can all be used while the load is maintained on the stabilising Wheel.

These cutting units are individually sized for output torque, pick force, pick speed and excavator weight. Cutting heads can also be supplied with water injection for dust suppression or water jetting to assist cutting.

The Webster Ranges provides the plant operator with a robust and versatile cutting facility which can quickly be attached to the bucket linkage of an excavating machine to provide a hard dig capability, combining robustness, simplicity, flexibility and reliability. The set up process is now made much easier when matching the unit to the excavator's hydraulic power band.

**Webster Equipment Ltd**  
Tel: (+44) 114 2488262  
Website: [www.websterequipment.com](http://www.websterequipment.com)

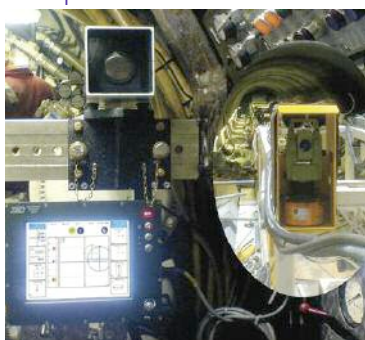
## Alignment laser for tunnels

UK-based Bramall Laser Systems (IOM) Ltd is a manufacturer and supplier of alignment lasers for tunnel and roadway alignment. Their equipment has been used successfully in many of the world's major tunnel projects: Channel Tunnel, UK; Lesotho Highlands Water, Africa; Nathpha Jhakri, India; Zimapan Tunnels, Mexico and Xiolangdi Tunnels, China.

The equipment is used for the alignment control of TBM, road header, drill and blast, and hand

excavated tunnels. The product range includes Mk7L lasers together with a comprehensive package of accessories to suit varied applications, including curved tunnelling. The company has a worldwide network of agent and distributors to advice on all types of tunnel alignment needs.

**Bramall Laser Systems (IOM) Ltd**  
Tel: (+44) 1624 834931  
E-mail: [sales@bramall-lasers.co.uk](mailto:sales@bramall-lasers.co.uk)  
Website: [www.bramall-lasers.co.uk](http://www.bramall-lasers.co.uk)



## A guiding light

TBM guidance systems manufactured by ZED are modular so that they can be assembled and configured by the customer to suit a given set of requirements. When the demands of a project change, additional modules and features can be downloaded on-site via the Internet.

System software uses an

embedded version of MS Windows. Where local area networks are present on TBMs, the equipment can be integrated within those or to more remote positions away from site. Hardware is PC-based and includes low power, surface mount technology said to provide greater reliability and resistance to vibration and heat. The user interface has a

toughened touch-screendisplay, accessing pages showing graphics of all guidance and associated survey data. Unit packaging uses milled aluminium boxes, without welded joints and Oring sealed lids.

**ZED Tunnel Guidance**  
Tel: (+44) 1932 251 440  
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Website: [www.zed-tg.co.uk](http://www.zed-tg.co.uk)

# Tunnels & Tunnelling CONFERENCE 2009

in partnership with the **British Tunnelling Society**

**Tuesday 29th September 2009**

The Queen Elizabeth II Conference Centre, Westminster, London SW1P 3EE

Photography by Steve Bates

**8.15 - 9.00** Registration & Coffee

**9.00 - 9.10** Editor's Comment, Tris Thomas

**9.10 - 9.50** TBM technology up-date - Dr Martin Herrenknecht, Chairman of the Board of Management, Herrenknecht AG, Germany.

An in-depth presentation covering modern advances in TBM technology.

**9.50 - 10.30** A TBM/NATM synergy? - Lok Home, President of The Robbins Company, US.

A discussion on whether TBMs can be designed to achieve daily advance rates in caving, squeezing, unconsolidated ground conditions equal to those achieved by the NATM method. Further, the talk will go into whether some of the NATM rock support principles can be applied and integrated into an overall systems approach.

**10.30 - 11.00** Tea & Coffee

**11.00 - 11.40** Advances in Sprayed Concrete Lining technology and practices - Alun Thomas and Ross Dimmock, Mott MacDonald, UK

A review of the latest developments in sprayed concrete linings (SCL), charting the development from traditional two pass linings through the use of permanent sprayed concrete for secondary linings to "single-shell" permanent SCL, both with spray-on waterproofing membranes and without any additional waterproofing. The move from steel mesh reinforcement to steel and synthetic fibres will also be presented. The advances in technology that have permitted these shifts towards realising the full potential of SCL tunnelling will be reviewed as well as the improvements in design methods needed to support this. Practical examples will illustrate the benefits and remaining challenges.

**11.40 - 12.20** Experiences and research findings on sprayed concrete - Volker Wetzig, Research Director, Hagerbach Test Gallery, Switzerland. The presentation will cover exclusive research findings relating to:

- Sprayed concrete under high temperatures (> 40°C rock temperature) at the Gotthard Base Tunnel
- Producing high quality concrete out of crushed aggregates of a tunnel
- Producing concrete with limited resources of aggregates
- New additives to reduce the rebound of sprayed concrete
- Possibilities to increase the fire resistance of concrete/sprayed concrete
- Advantages of nozzle-man training

**12.20 - 13.20** Networking Lunch

**13.20 - 15.00** Extended Crossrail Project Special + 15 minutes Q&A:

- Project overview – the last six months and the next - Chris Dulake, Client Package Manager, Tunnels, Shafts and Portals
- Planned approach on procurement and design and construction delivery - Bill Tucker, Director, Tunnels, Shafts and Portals
- TBM requirements - Bob Hodgetts, Construction Manager, Tunnels, Shafts and Portals
- Ground Movement and Monitoring strategy - Neil Moss, Crossrail Tunnelling Engineer
- Establishing the Academy - Paul Chatten, Client Manager
- Crossrail Panel questions & answers session

**15.00 - 15.30** Tea & Coffee

**15.30 - 16.00** Avoiding conflicts in Tunnelling - Michael Stokes /Garry Crossley, Navigant Consulting:

Proactive examples of how to avoid conflict on underground construction projects using speakers' experiences of disputes on major construction contracts.

**16.00 - 16.40** Building Barcelona's Line 9 - Nicola Della Valle, specialist tunnelling consultant:

The presentation will deal with various aspects of the 46km long Line 9 Metro Project, from the innovative conceptual design to the construction challenges. In particular the tunnel station system will be illustrated consisting of a deep large diameter tunnel with stacked tracks and self-contained passengers platforms. Details on issues like tunnel structural design, ground treatments, excavation volume losses, as well as site logistics and work progress will be discussed.

**16.40 - 17.20** Croydon Cable Tunnel – Colin Eddie, Morgan EST:

Details of the planning, design and construction of the challenging Croydon Cable Tunnel project will be presented. The tunnel was constructed through a sensitive drinking water aquifer. Particular emphasis will be paid to the special measures necessary to ensure that the aquifer remained undamaged and uncontaminated.

**17.20 - 17.30** Closing Address

For more information please contact:

Delegate registration: Natasha Denney Tel: + 44 (0) 208 269 7833

Email: [ndenney@progressivemediagroup.com](mailto:ndenney@progressivemediagroup.com)

To exhibit and sponsorship opportunities: Gary Tween

Tel: + 44 (0) 208 269 7849 Email: [gtween@progressivemediagroup.com](mailto:gtween@progressivemediagroup.com)

[www.tunnelsandtunnellingconference.com](http://www.tunnelsandtunnellingconference.com)



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# WHEN PERFORMANCE MATTERS...

## Why do tunnelling contractors rely on Continental?

They know **Continental** engineers its systems to deliver superior performance in the demanding world of tunnelling.

Take **Continental** tripper booster drives. They add power allowing the conveyor to be lengthened and when strategically placed, they reduce belt tensions at critical points along the conveyor simplifying the design of tight curves common in tunnel projects.

The **Continental High Angle Conveyor (HAC)** system solves many steep angle conveying challenges, up to 90° (vertical) - including tunnel to surface lifts - common to tunnelling.

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## Continental changes

Continental Conveyor says it has further enhanced its project success in Europe with new contracts in Spain, Italy and the UK over the last year.

In Spain, the company is supplying conveyor systems for the new Metro extension to Barcelona International Airport. Later this year it will deliver two conveyors (two 3800m conveyors handling 600tph) and an associated "surface" muck removal system for the Ute Tunnel Terrassa joint venture.

In Italy, contracts have been secured with Metro C in Rome for the supply of the HAC (High Angle Conveying System), which will lift tunnel spoil vertically from the tunnel excavation box access. In addition, a contract from SELI to supply two tunnel conveyors and a HAC for the Rome Metro B project



is also in hand for delivery this year.

In the UK, tunnel conveyors have been supplied for the Hindhead (A3) Road Tunnel development and more HAC activity is being undertaken at the Croydon Cable Tunnel, Brixton Water Tunnel and Belfast Sewer Tunnel projects.

In February 2008, Continental was added to Joy Global. Continental Conveyor is now known as Continental Crushing & Conveying and will incorporate the Stamler range of underground and surface crushers.

### Continental Crushing & Conveying

Tel: (+44) 1915 165353

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sales@continentalconveyor.co.uk

Website: www.continental-conveyor.co.uk

## Improving air quality



DCL offers OEM and retrofit catalyst products for construction, earthmoving and tunnelling vehicles. These products include soot and odor control technologies for diesel engines such as oxidation catalysts, flow-through filters and wall flow particulate filters.

DCL's CARB verified MINE-X SOOTFILTER diesel particulate filter removes diesel particles and fumes from engine exhaust emissions and is used to meet MSHA standards for particulate matter in underground mines, EPA or CARB mandated standards for particulate emissions in diesel vehicle retrofits, or simply to improve the air quality in a work site containing diesel engines.

The MINE-X Flow-Through Filter is a patent pending, flow-through diesel particulate filter that removes diesel particulate matter and lower backpressure than conventional wall-flow particulate filters.

DCL designs and manufactures catalytic converters, catalytic

mufflers, diesel particulate filters and stock mufflers for the air pollution control of off-road vehicles and stationary engines. DCL products are used in the material handling, construction, mining gas compression and power generation markets.

Technologies and capabilities include product design and development, catalyst substrate manufacturing, catalyst substrate packaging and catalyst coating.

### DCL International Inc.

Tel: (+1) 905 660 6450

Email: info@dcl-inc.com

Website: www.dcl-inc.com

## Powerful loading

A third GIA 10 HR Häggloader has been delivered to the 7km long Solberga power cable tunnel project in Stockholm. Swedish specialist tunnelling contractor, Oden Anläggningstreprenad, placed the order for three 10 HR loaders at the start of the 23 month drill and blast contract in February 2007. The GIA Häggloader was considered to be the ideal loader for the project's main tunnel 18.2m<sup>2</sup> face areas according to project manager, Peter Ahlgren.

A digging arm loads the rock

## Carry on Dumping

Established in 1946, Astra designs and manufactures on and off-road heavy-duty vehicles. The company's products are used for tunnelling and quarry applications while its rigid and articulated dumpers find use in tactical and logistic purposes. With two, three or four axles, simple or four-wheel drive, homologation for standard or exceptional loads, the Astra HD vehicles with electronically controlled Cursor Euro 5 engines specialize in quarry transportation. In the past few years Astra has posted a continuous growth and is today present across 32 countries with 49 dealers and 160 service points. The Astra



product range is attested via international certifications like UNI EN ISO 9001-2000, UNI EN ISO 14001-2004 and the NATO AQAP 110. The company became a part of Italy's Iveco Group since 1986.

### Austdac

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austdac.nsw@austdac.com.au

Web: www.austdac.com.au

## Staying on the rails

Brookville Equipment manufactures underground, rail-mounted diesel tunnelling locomotives that range in capacity from 4 to 45t. The company also offers battery-powered locomotives from 4 to 20t.

Personnel carriers are offered in 18 to 22-person capacity, battery or diesel powered, and from 8 to 25 ton. Combination units are also available with a five

to 26-person capacity; this equipment is available in diesel or battery.

Claimed features of the locomotives, personnel carriers and combination units include heavy-duty frames, planetary axles, bolt-on wheels, v-spring.

### Brookville Equipment Corporation

Tel: (+1) 814 849 2000

Website:

www.brookvilleequipment.com

## GHH on the move

German manufacturer GHH Fahrzeuge specializes in load haul dumpers (LHDs) and dumper trucks for the underground construction and mining industries. "To date, GHH

Fahrzeuge has produced and sold more than 2400 LHDs and 400 dump trucks and, thanks to continued growth, the company has recently relocated to Gelsenkirchen," says the company.

GHH believes its new premises, which it says have been equipped with state-of-the-art production and communication facilities, will further strengthen its market position through improved quality and faster delivery times.

Following the company's recent part-acquisition of Mine Master (formerly Boart Longyear's

PolishMining Capital Equipment division, Boart Longyear Sp.z o.o), a range of drilling jumbos (Face Masters), roof bolting machines (Roof Masters), and excavator drilling attachments (Flexi

Masters) are also now on offer.

### GHH Fahrzeuge

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## Rocking and rolling

**M**ining Equipment supplies new and remanufactured rolling stock and tunnelling equipment. An example of equipment the company has recently fabricated or supplied includes:

- California switches and moveable passing switches
- Muck wagons – lift off, side dump, fifth wheel, roll over, etc
- Flat cars, segment cars, grout cars and mantrips
- Locomotives, battery and diesel units from 1.5 to 35 tons (non CE certified)

Mining Equipment has now been

in business for more than 25 years and has worked on more than 200 projects on six continents. It has recently placed equipment on projects in France, Spain, Colombia, Australia, Hong Kong and North America.

For the European market, the company says it exclusively supplies CE certified equipment.

**Mining Equipment, Ltd**

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[www.miningequipmentltd.com](http://www.miningequipmentltd.com)



## An Efficient Dumping Bucket

**G**jerstad has launched a range of dumping bucket equipment for the construction and mining market that can be used for underground excavations. The new product works within limited space and would reduce the mucking out time by as much as 25 per cent compared to other methods, says the company. It also promises a reduction in the wear and tear on tyres as well as a cut in fuel

consumption. The company says that tunnel contractors in Norway have already started using the dumping buckets manufactured by Gjerstad. The dumping buckets ranging between 2 to 7.5 cubic meters are being delivered across the world by the company.

**Gjerstad Mek Industri AS**

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Website: [www.gjerstad.com](http://www.gjerstad.com)

## Rail-bound expertise

**F**or more than a century Irwin Car & Equipment has been designing and manufacturing material handling equipment for the underground mining and tunnelling industries – offering battery and diesel locomotives, muck cars, lift off or Granby style supply and personnel cars, as well as a variety of speciality cars.

In addition to designing and manufacturing new rail-based haulage equipment, Irwin Car also specializes in the refurbishment of

existing locomotives and cars, sourcing surplus equipment and supplying replacement parts.

“Irwin’s extensive in stock inventory includes items such as kingpins and centre plates, wheels and wheel assemblies, rubber springs and outboard rollers, Willison couplers, draft gears and tail bolts,” the company adds.

**Irwin Car & Equipment**

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Web: [www.irwincar.com](http://www.irwincar.com)

## Excavating in tandem

**T**he JCB JZ235 tracked excavator comes with a powerful Isuzu engine that meets all emission regulations, good stability that provides a higher lift capacity and one or two-way flow option that can be automatically selected to switch attachments. In addition, the advanced management system (AMS) has four operating modes for optimum efficiency.

The Auto mode switches between economy and max power for outstanding efficiency and power while economy mode gives maximum fuel savings in light applications. The lifting adjusts flow and pressure to give smooth and powerful lift performance, while the Precision mode allows for smooth responsive grading performance.

North-East contractor, Holystone Ltd, is using two purpose-built JCB tracked excavator models with unique boom and dipper configurations, to carry out specialist ground works on the new Tyne Tunnel Project in Newcastle-upon-Tyne. Wallsend-based Holystone Ltd has

been awarded the earthmoving contract by the project’s main construction firm, Bouygues UK. In order to carry out the complex work, it has purchased a 46-tonne JCB JS460 tracked excavator with a Kocurek telescopic dipper and 1.5m<sup>3</sup> clam-shell buckets and a 24-tonne JCB JZ235 zero tailswing model with a shortened Kocurek boom and dipper. The two machines’ unusual configurations were specified by

Holystone and developed in conjunction with dealer Scot JCB Ltd and Kocurek.

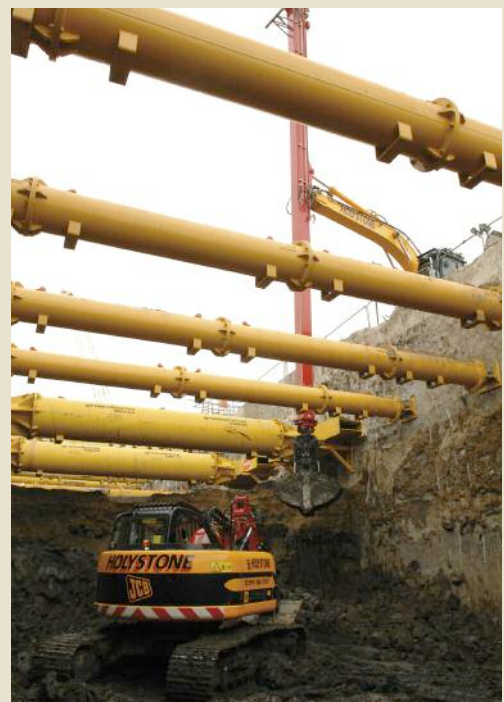
The material the JZ235 excavates is collected by the JS460 - which is positioned above, at ground level. This larger machine uses its telescopic dipper to reach vertically down to depths of up to 20m and gather the excavated material in its clam-shell bucket which it then raises and empties into dump trucks to be taken away from the site.

**JCB - JC Bamford Excavators**

Tel: + 44 1889 593592

Email: [nigel.chell@jcb.com](mailto:nigel.chell@jcb.com)

Web: [www.jcb.com](http://www.jcb.com)



## Fast desilting

**S**olids separation specialist PSD has launched the SU300DP desilter. Its first project was working downstream of a client's own desander in support of a diaphragm walling operation. The client, SPIE Foundations, excavated the 45m deep diaphragm wall panels at Quai d'Ivry in Paris using a grab through approximately 15m of clay and with a Hydroraise through the remaining underlying limestone. The desilter was used to remove very fine particles from the bentonite so that it could be reused.

The SU300DP uses a new



generation PSD high speed linear motion, inverter-controlled, doubledeck shaker with more than 4.8m<sup>2</sup> of screening area spread over the two inclined decks, each of which carry four interchangeable, pretensioned, stainless steel woven wire screen panels. Twelve extra long bodied 5" hydro cyclones are fed by a Metso MM200 pump. The machine has an integral inverter controlled Metso MM200 discharge pump with 30kW motor and a staircase with handrails for access to the shaker module. It is designed to handle a flow rate of up to 300m<sup>3</sup>/hr and the shaker will handle up to 25t/hr of suitable solids with the appropriate screens fitted to the shaker.

The SU300DP transports as a single 20ft container unit and is said to be ideally suited to a range of applications including working downstream of a desander for diaphragm walling, pipejacking and tunnelling work. A further two SU300DP desilters are currently in production.

**Pigott Shaft Drilling Ltd**

Tel: (+44) 1772 690076

Email: adam@psdmud.co.uk

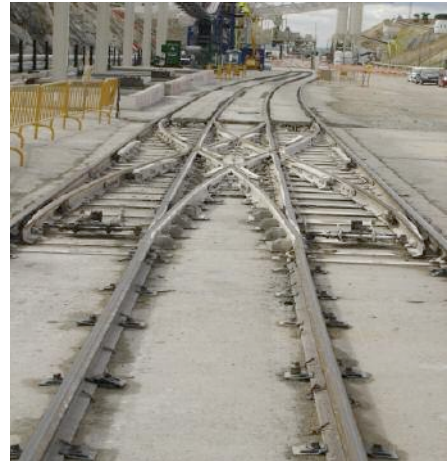
Website: www.solidseparation.com

## Right on track

**V**alente has operated in the fields of railway equipment, rails, tunnelling and mining equipment and special steel structures since 1919. In the railway field, Valente engineers and manufactures switches, turnouts, steel wheels, axles and special vehicles.

In the field of rails, besides marketing and machining crane rails, MRS, CR, train rails, light rails, and special components, Valente also offers fastening systems and related accessories like clips with rubber nose, steel and textile pads, chair plates and anchorage bolts. All the fastening systems have been developed with and tested by the Politecnico of Milan.

Valente claims to be a leader in the tunnelling and mining



field with its muck cars, special cars, tippers, mixers, back-ups, switches, Californian switches, and diesel and electric locos. It also continues its traditional production of turntables and special steel structures.

**Valente**

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E-mail: info@valente.it

Website: www.valente.it

## Capable conveying

**M**arti Technik has developed a range of systems for muck removal with the goal of maximizing advance rates. "Complex applications demand belt conveying systems able to cope with curves, slopes or lack of space, especially in urban areas," the company adds.

Marti Technik says it is able to produce a computer-aided calculation of the conveyor system in a few hours. "All the essential parameters of the system, such as belt tension, stationary or non stationary drive power, behaviour in curves (inclined position), fill rate, and friction coefficients are developed into 3D computer models and integrated into the tunnelling method concept."

**Marti Technik**

Tel: (+41) 31 858 33 88

Website: www.martitechnik.ch

## The Challenge of Mucking Out

**R**obbins Company has extended its conveyor systems to cover both soft ground and hard rock projects in 2009. The company, which specializes in design and manufacture of continuous conveyor systems used by TBMs, says that it achieved quick results by using a fabric belt conveyor system at Sacramento in California. The 6.1km long system is being used at the Upper Northwest Interceptor Sewer Project for the Traylor/Shea JV in sand and clay. Another project, located in India, will feature one of the longest single-flight conveyor systems. The Pula Subbaiah Veligonda conveyor system will utilize up to 19.2km of steel cable belt with one main drive and three booster drives. While each conveyor system is fully customized, the advanced PLC systems allow for continuous monitoring at points along the entire conveyor.

Depending on the project,



conveyor types may include vertical conveyors, overland conveyors, stacker conveyors, and/or specialty conveyors. All Robbins Conveyor Systems can be manufactured using either steel cable or fabric belt. Patented self-adjusting curve idlers can guide a belt through curved tunnel paths, while booster drives can maintain low

belt tension for even the longest tunnels. Robbins Conveyor Systems are an industry standard, with a wide range of features to fit most project requirements.

**The Robbins Company**

Tel: (+1) 253 872 4484

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Website:

www.therobbinscompany.com



## Self-drilling first in NA

To overcome difficult geological conditions in short tunnel sections the use of spiles is common. As an alternative to pipe roof systems, Alwag's new AT-Selfdrilling Tubespiles can be used as a fast Shortforepoling system. The tube spiles can be installed quickly and help significantly to reduce ground settlement says the company.

Standard lengths are available on short notice in 2, 3 and 4m lengths and have been designed for installation with standard drill jumbos. "No more pre-drilling of holes with the risk of hole collapses in soft ground is necessary," says Alwag.

Slight modification also allows the Tubespiles to be used for two new applications: A self-drilling

drainage System and a Vacuum System. All three products have been used in several tunnels in Europe and North America.

The first time the Drainagespiles were used on a tunnel was for the Koralm rail tunnel, in Austria. A standard AC L2C drill jumbo was used to install the self drilling spiles, and to extend their life a plastic filter tube was placed inside the tube. By connecting several spiles with a vacuum pump, the spiles help to dewater complete sections of the tunnel says Alwag.

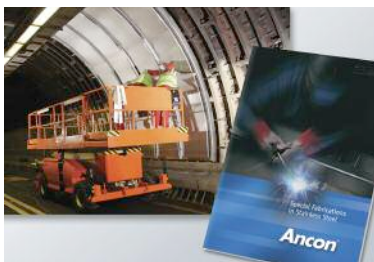
Self-drilling vacuum tubes are said to be easy to install and easy to connect with hoses to a system.

**Alwag Systems**  
Tel: (+43) 7229 61049 0  
Email: [office@alwag.com](mailto:office@alwag.com)  
Website: [www.alwag.com](http://www.alwag.com)

## Fabricating Stainless Steel

Ancon Ltd designs and manufactures high integrity steel components for the construction industry. The company's manufacturing facilities in the UK, mainland Europe and Australia specializes in fabricating various types and grades of stainless steel.

The company supplies non-standard stainless steel fabrications to major infrastructure projects worldwide. Some of Ancon's recent fabrication contracts include architectural, fire-resistant linings on the Clyde Tunnel, bridge cappings on the Channel Tunnel Rail Link, road deck endplates on the Dartford East Tunnel, the Brisbane North-South Tunnel in Australia



and the Thessaloniki Metro in Greece.

In addition to standard ISO 9001 and ISO 14001 accreditations, the company is also a member of the British Stainless Steel Association, Swiss Inox and the Australian Stainless Steel Development Association.

**Ancon Ltd**  
Tel: (+44) 114 275 5224  
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Website: [www.ancon.co.uk](http://www.ancon.co.uk)

## Low- voltage Reeling Drum Cables

Aristoncavi is a manufacturer of electric cables insulated with rubber, cross-linked synthetic rubbers and special compounds. The product range includes low voltage power distribution cables, medium voltage power distribution (up to 18/30 KV) cables, special applications (LV and MV) cables, cables resisting fire and high temperature, cables resisting heavy-duty conditions and cables resisting liquids. The company also provides applications facilities.

The product range for tunnelling sites and mining applications includes flexible low voltage cables for equipment energy supply, with heavy duty rubber and

polyurethane halogen free outer sheath used for fix and mobile laying (NSSSHOU, PURFLEX HF).

The low voltage reeling drum cables are used for tunneling and drilling equipment with heavy duty rubber and polyurethane halogen free outer sheath (URSUS, URSUS VS, URSUS PUR HF), medium voltage cables for TBM's reeling drum (URSUS MT BM) and medium voltage cables for energy supply lines along tunnels (URSUS MT TUNNEL).

**Aristoncavi**  
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Tel. (+39) 0444 749900  
Email: [info@aristoncavi.com](mailto:info@aristoncavi.com)  
Website: [www.aristoncavi.com](http://www.aristoncavi.com)



## Steel support for tunnels

Bruno F.lli S.r.l., an internationally recognized Italian firm that began its operations in 1959, has 50 years of experience in careful manufacturing.

Bruno F.lli S.r.l. manufactures tunnel steel supports, lattice girders, steel arches, anchor bolts, steel sheet spill (in varied customized sizes), metallic panels, wire netting, and structural steel work for all kinds of tunnels and for road, motorway and underground works. The company uses modern fabrication equipment.

**Bruno F.lli S.r.l.**  
Tel: (+39) 0174 68 11 45  
Email: [brunoflli@mcmlink.it](mailto:brunoflli@mcmlink.it)  
Website: [www.brunofratelli.com](http://www.brunofratelli.com)



## Optimised segments

The control of vibration by studying mechanical constraints applied to segment moulds has a direct impact on the cost of prefabrication, says renowned French manufacturer CBE.

CBE, has made a serious investment in the modelling of vibration and integrated these studies into the design of its moulds; in order to reduce the risk of weakness as a consequence of resonance.

"This reduction of the risk in the long-term implies a consequent reduction of maintenance costs. This control also makes it possible to increase the lifespan of the

moulds," says the company. The optimization of the vibration cycles on the basis of this modelling is also claimed to improve the final quality of the concrete and significantly reduce vibration times and thus concreting.

As well as productivity improvements, CBE says the resultant reduction in the consumption of energy and raw materials, which are required for manufacture and use of the segment moulds, is also good for the environment.

**Z.I. Les Aubuis**  
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 Email : cbe@cbegroup.fr  
 Website: www.cbe-tunnels.com

## Tunnel Lining Specialist



Ceresola TLS AG is a well respected supplier of tunnel lining systems. The extensive product range includes segment moulds and pre-cast concrete segment production plants, tunnel formwork systems, canopy pipe systems, and steel support systems for excavations.

The machined steel moulds and handling equipment for de-moulding, lifting, turning, rotating and moving of segments are characterised by their simple and economical operation and maintenance. For industrial scale mass production Ceresola supplies

fully-automated carousel installations

Ceresola also supplies individually designed tunnel formwork systems that can be made of steel or combined with timber.

Creating innovative and economical formwork solutions, Ceresola designs formworks such as vaults, invert, soffit/suspended slab, niche and cross passage, outside/counter formwork, and reinforcement, profiling and membrane-gantries formworks.

**Ceresola**  
 Tel: (+41) 61 845 93 40  
 Email: info@ceresola.com  
 Website: www.ceresola.com

## Setting the standard

ChemGrout is a US-based designer and manufacturer of grouting equipment. The concepts of mixer-pump balance, user-friendly operation and ease of maintenance are emphasized in the design of the grouting systems.

ChemGrout manufactures a wide range of standard and custom built grouting equipment to handle a diverse range of materials and capacities from 1 to 45GPM and pressures from 50 to 2000 PSI. High-pressure pumps handle pressures to 2000PSI and flows to 20GPM.

The product series consists of colloidal mixing with ChemGrout's patented 3L6A pump, with outputs of up to 20g/m (75l/m) and 261psi (75 bar). ChemGrout's CG-600 heavy-duty, high volume colloidal grout has provided water cut-offs and back-filling for the tunnelling industry.

These grout plants feature a 13 cubic feet capacity "Turbo-mixer", along with a rotating bridge breaker, 13 cubic feet capacity vertical

shaft paddle agitator, and a three-stage, size 6, closed throat progressive cavity pump. Mixer and pump are mounted on a single skid "for quick, easy set-up and immediate operation." Water and solid materials are drawn through a diffuser type pump rotating at speeds of up to 2,000 rpm to prevent flocculation and achieve complete particle wetness. The high shear action of the colloidal mixing pump is aided by a powered bridge breaker device to enhance induction and reduced mixing time.

These high shear colloidal mixers increase apparent fluidity of slurry mixes by 20% over paddle mixers for rock and soil grouting where the ability to penetrate tight formations is necessary. The colloidal series comes in several mix tank sizes with power options that include air, hydraulic, electric and diesel/hydraulic.

**ChemGrout Inc.**  
 Tel: (+708) 354 7112  
 E-mail: info@chemgrout.com  
 Website: www.chemgrout.com

## Self Drilling Anchor Bolt Systems

CMP is a supplier of self drilling injection anchor bolt (hollow bar) systems, and provide expertise in the area of rock & soil support reinforcement technology.

Their full product range includes the full series hollow bar with rope thread form (R25, R32, R38, R51) and trapezoid thread form (T30, T40, T60, T76); hollow bar materials' characteristics comply with or exceed ASTM615; machined and casting coupler and nut, hundred and more type, and size drill bit; domed and flat plate, and lining support.

CMP hollow bar system is a fully threaded hollow core bar that initially serves as a drill rod with a lost bit and later, once grouted in, becomes an anchor tendon that can be stressed and locked off with a nut. CMP hollow bar system provide the optimal solution for nailing, bolting, micro piling, and as ground anchors in



difficult ground and rock conditions.

In certain situations with solid and fractured rock, intrusion of water, or required a pre-stress, it is necessary to load anchor bolt immediately, CMP Expansion Shell Anchor Bolt is a better solution for corrosion protection and for sealing off the intruding water CMP Expansion Shell Anchor Bolt is injected with grout.

**CMP International Inc.**  
 Tel: (+1) 905 886 4813  
 Email: cmpcanada@yahoo.com



## Sealing it up

**D**aetwyler Rubber provides high-quality seals and gaskets for use in tunnels. These sealing systems have been developed through in-house research and engineered to meet the requirements of specific tunnels. The company offers a combination of gasket and hydrophilic seal as primary and secondary seal or as a co-extruded solution.

For segmentally lined tunnels they develop project-specific solutions for the customers, to suit the geology, water pressure and design requirements. A strong basis for this engineering is Daetwyler's worldwide patents for

gasket cross sections, corner designs and elastomer compounds.

Seals manufactured by the company have been used in over 100 tunnels across five continents. The rubber seals keep tunnels watertight, thus contributing significantly to uninterrupted operation, protection of electromechanical equipment and long service life of the tunnel.

**Daetwyler Rubber**  
Tel: (+41) 41 875 11 23  
Email: [tunnel.ch@daetwyler-rubber.co](mailto:tunnel.ch@daetwyler-rubber.co)  
Website: [www.daetwyler-rubber.com](http://www.daetwyler-rubber.com)

## Reinforcement Solutions



**F**ortius, which means "stronger" in Latin, is a supplier of reinforcement system products (special bonding products) such as composites and fibres, in particular for the internal and external strengthening of concrete, masonry and wood, for the tunnelling and construction industry, as well as in civil engineering applications.

Steel-and polypropylene fibers are used to manufacture prefabricated tunnel segments and used as reinforcement in shotcrete (gunite). Synthetic fibers are used for plastic shrinkage control and fire-resistance in tunnel linings. Steel fibers or structural synthetic fibers are used instead of conventional steel reinforcement. The product provides superior performance with reduced costs from materials, time and labour.

**BK International**  
Tel: (+32) 13 326873  
Email: [info@fortius.be](mailto:info@fortius.be)  
Website: [www.fortius.be](http://www.fortius.be)

## Powerful light mesh

**F**iReP bolts, lattice girders and pipe roof FRP casings are claimed to have doubled the strength, but only a quarter the weight, of steel. The company says its FRP bars are corrosion resistant and come in almost any shape or form.

It adds that designers and contractors are showing a growing interest in the new FiReP FRP-Powermesh for reinforced concrete structures. "FiReP engineers developed this light

mesh according to standard grid application. It fulfils the typical tunnel requirements on durability or curability. The high load capacity at each joint – comparable to welded steel mesh is unique and makes the design of FRP grid reinforced RC-structures easy," the company explains.

**FiReP International**  
Tel: (+41) 55 221 45 77  
Email: [info@firep.ch](mailto:info@firep.ch)  
Website: [www.firep.com](http://www.firep.com)

## Facade Fixing Systems

**H**ALFEN is a global supplier of concrete anchoring, façade fixing systems for use in pre-cast concrete elements, commercial and residential construction, as well as civil engineering and for transport and infrastructure buildings.

HALFEN channels will enable adjustable connections to the pre-cast tunnel lining segments for the system parts of the overhead traction line. Pre-assembled in pairs with spacers and short-circuit-proof connections, curved to the radius of the lining, they avoid the hazards of dust and noise associated with drilling in confined spaces. A special strip filler to prevent concrete ingress during casting and to enable normal handling of the lining segments with a vacuum erector is factory installed inside the channels.

HALFEN channels are used worldwide in both the inner and final lining of NATM tunnels, and the segmented pre-cast linings of TBM tunnels.

The product involves no drilling, no damage to earthing, reinforcement or concrete, and is time saving. Additionally, drilling, surveying and marking for hole positions is avoided, better worker health and safety is provided with a lack of dust, noise, vibration or power tools, and better connection. The products are reliable as they are much less dependent on the skill of installer; they are clean, fast, and adjustable, require no maintenance due to optimal corrosion protection, and are permanently sustainable.

**Halfen**  
Phone: (+49) 2173 970-0  
Email: [info@halfen-deha.de](mailto:info@halfen-deha.de)  
Website: [www.halfen.com](http://www.halfen.com)





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A member of the Orica Group

## Hany grouting system

**H**any is a German supplier of grouting equipment with 10 different pump models from 1.5 to 13 cubic meters per hour output and pressures up to 200 bars. The grout pumps of the ZMP 700 series are most suitable for the backfilling of tunnel liners as well as for pressure grouting. This combined use effectively saves cost and space on the backup systems of tunnel boring machines (TBM). During normal operation, the pumps are used for backfilling. In difficult ground

where pre-excitation grouting is required, the same pumps are used for pressure grouting.

In a HCM high-shear (colloidal) mixer, which is placed near the pumps, any type of cement, including ultra-fine cements or bentonite can be efficiently mixed. Touch-panel equipped controls are available for pressure and quantity controlled backfill systems for single or two component backfill grout.

The product consists of five different high-shear colloidal mixers from 100 to 2500 liters that guarantee highest quality mixes. Containerized mixing plants with fully automated weigh batch system can prepare as much as 40 cubic meters per hour of bentonite for slurry shield TBM operations.

**Hany AG**  
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 Website: [www.haeny.com](http://www.haeny.com)



## Concept for fire protection

**I**nternational Fibre Technology is a developer and manufacturer of steelfibres and dosing systems, distributed under the name DUOLOC and DINO, and used across tunnelling operations. IFT developed a concept of fire protection based on the knowledge that short and fine polypropylene (PP)-fibres are the most effective tool for passive fire protection directly mixed and poured with the concrete itself.

Working closely with a German control institution, IFT proved the

effectiveness of POLYLOC PP fibres. As a result of these tests, tunnel builders have started using this extensively. The UTE BYPASS sur Tunnel Norte Madrid, Diabolo Tunnel in Brussels and the City Tunnel Malmo has seen use of more than 400 tons of POLYLOC PP fibres. As a dispersing and dosing system DINO PP CWS can be used.

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 Website: [www.ift-fasertechnik.de](http://www.ift-fasertechnik.de)



## Combisegments

**H**errenknecht Formwork Technology GmbH is a 100% subsidiary of Herrenknecht AG and offers integrated solutions ranging from mould systems for the forming and manufacturing of lining segments and the corresponding handling and transport equipment, to turnkey lining segment factories.

Herrenknecht Combisegments turns the current two-step process of segmental lining, to a one-step operation. The variable structure of the Combisegments moulds allows the production of segments for different tunnel purposes. Both, segments with and without integrated coating, and segments for different sealing concepts can be produced. By means of special flexible bars in the mould walls, a variety of sealings can be positioned on different levels. The use of mounting bars, which are assembled in the mould, and cast in a shear-proof connection with the segment, offer even more flexibility. Later on, installations for tunnel operation can be fixed onto these mounting bars (for example, shelf constructions, cable attachments etc.).

In addition to the project-specific design for lining segment factories,

Herrenknecht Formwork provides and installs all the corresponding facilities and equipment. This includes handling equipment to turn, orientate, remove, deliver and store the segments, as well as equipment to install seals and produce the surface finish of the segments. All common transport systems to transfer the lining segments to the tunnel production site just in time are also provided. The lining segment production solutions are optimally tailored to each project and its construction site. Since 2007, Herrenknecht Formwork has provided formwork technology to 80 tunnelling projects, including in Sochi (Russia) and Brisbane (Australia).

Herrenknecht tunnelling machines are currently at work on 100 traffic tunnelling construction sites and on over 600 projects for supply and disposal tunnels.

Customers are also provided with technical service such as maintenance and repair, as well as provision of skilled personnel.

**Herrenknecht Formwork Technology GmbH**  
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 Website: [www.herrenknecht-formwork.com](http://www.herrenknecht-formwork.com)

## Raising the (FRP) bar

**T**he practice of incorporating glass fibre reinforced polymer (GFRP), reinforcing bars in diaphragm walls to facilitate TBM launch and reception, known as a "soft-eye" opening and pioneered by the Aslan FRP team is said to have achieved the milestone of over 300 TBM breakthroughs.

GFRP reinforcing bars are, according to Hughes Brothers, high strength, light weight non-corroding rebars that are strong primarily along the length of the bar, but can be abraded away, or

consumed by excavating equipment and TBMs.

A number of projects have been completed recently such as on the East Side Access, in New York, Delhi Metro, in India, Thessaloniki, in Greece, Brightwater and the Big Pipe CSO in the Pacific Northwest, Docklands Light Rail, in the UK, Taipei Metro, Shanghai, Dubai Metro and many others.

**Hughes Brothers**  
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 Email: [doug@hughesbros.com](mailto:doug@hughesbros.com)  
 Website: [www.aslanfrp.com](http://www.aslanfrp.com)

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**David R. Klug & Associates, Inc.,** 6000 Waterdam Plaza  
 Drive, Suite 120, McMurray, PA 15317, T (724) 942 4670  
 F (724) 942 4671, dklug@drklug.com, www.drklug.com

## Instant Road Repair



Instarmac has introduced an enhanced 3mm Instant Road Repair ultracrete that helps fill up potholes almost instantly and on a more permanent basis. The new product finds extensive use in tunnels because of its ability to be trafficked instantly in all weather conditions.

Ultracrete IRR 3mm can be used to repair roads, pavements,

driveways and car parks, works well in wet, freezing and hot conditions and at the same time is compatible with existing flexible road surfaces. It includes fully graded, high PSV interlocking aggregate and has specially formulated bitumen which provides a first time permanent product.

Instarmac have been providing highways maintenance solutions for over 30 years with its cold lay macadam and have recently overhauled and improved their 3mm product.

The simple 3-step application process includes (1) ensuring the pothole is free of debris and standing water, (2) applying the spray bitumen sealant to pothole edges and (3) applying Ultracrete Instant Road Repair.

The product comes packed in 25kg plastic containers that are recyclable.

**Instarmac**  
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Email: [enquiries@instarmac.co.uk](mailto:enquiries@instarmac.co.uk)  
Website: [www.ultracrete.co.uk](http://www.ultracrete.co.uk)

## Sound and vibration control

Elastomer profiles & gaskets manufacturer PHOENIX Dichtungstechnik GmbH (PDT) from Germany – formerly known as PHOENIX AG – has put to the market project related and tailor made sealing solutions for tunnel construction as well as railway track components for sound and vibration control.

One of their latest developments is a hydrophilic EPDM Elastomer which can be used both as a strip for composite compression gaskets or as a pre-seal outside the compression gasket.

The product offers major advantages such as a

consistent performance and durability for the tunnel's entire service life because of its long lasting flexibility even after back drying.

Further developments are integrated segment sealing gaskets and self-sticking load distribution packers made from EPDM Elastomer.

PDT focuses on their sealing profile business and has come out with high quality sealing solutions for tunnelling using its experience of more than four decades.

**PHOENIX**  
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Website: [www.pdt-group.com](http://www.pdt-group.com)



## Modular formwork

The 35km long passage through the Lotschberg Mountain is said to be the third-longest tunnel in the world. Altogether, the project consists of 88km of tunnelling work.

East and West operations control centres are located at the Mitholz base. According to Peri, rentable standard components that formed the basis for the formwork carriage construction, provided efficient construction sequences for both operating centres at the Mitholz base. The tunnel formwork carriage was moved on rails using chain hoist equipment and served first to form the arched side walls, including brackets required for the subsequent fitting of crane tracks on the side and the crown bar.

Concreting forces were safely transferred via the load-bearing system sub-structure. Two hydraulic cylinders on each side are said to have allowed simple and fast striking of the foldable filler element for

the crown bar.

Peri adds: "The flexible and customised Peri modular construction system with premounted units easily fulfilled all requirements."

Arched slab formwork was added to the carriage for the second phase. Lifting and lowering of the formwork was carried out by four hydraulic drive components. Concreting the calotte took place in a second stage, i.e. the arched slabs. After disassembling the side formwork, the formwork carriage was retracted into the starting position and the calotte formwork for the arched slabs could then be installed on the carriage.

Lifting and lowering of the formwork carriage was comfortably carried out by four hydraulic drive components, which had already served as height adjustment units for the arched side walls.

**Peri GmbH**  
Tel: (+41) 52 3 20 03 03  
Email: [info@peri.ch](mailto:info@peri.ch)  
Website: [www.peri.ch](http://www.peri.ch)

## Reinforce!

NV Bekaert SA manufactures Dramix Steel Wire Fiber for reinforcing concrete. The company supplies Dramix for underground construction to reinforce sprayed concrete and precast concrete segmental linings for water tunnels, sewer tunnels, rail and metro tunnels and roads tunnels projects for ore and mineral extraction.

Dramix can either be manufactured in low carbon, high carbon wire or in zinc coating. Some recent tunnel projects with Dramix are DLR Extension in London, UK, Brisbane Desalination Plant, Australia, Brightwater, USA, Heathrow Baggage Tunnel Terminal 5 in London and Heathrow International Airport UK.

For Precast elements, Dramix steel fiber reinforcement is manufactured by Bekaert. Bekaert product range includes high-end steel fibers (with l/d = 80, glued into fiber bundles and with hooked ends for optimum anchorage). The product offers minimum handling damage, minimum repair requirements and, consequently, a highly reduced production cost.



Tougher requirements on construction lifetimes (120 years) have significantly stimulated the use of SFRC. Dramix Green galvanized steel fibers offer precast concrete applications and galvanized steel. Galvanized steel fibers also provides rust-free concrete surface.

Dramix Green is based on a patented Bekaert technology, which passivates the zinc in an alkaline environment and avoids the formation of gas (hydrogen).

**NV Bekaert SA**  
Tel: (+32) 56 766111  
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Website: [www.bekaert.com](http://www.bekaert.com)



# 38 000 km

The distance travelled per year by the Arctic Turn „Sterna paradisaea“ and the average air miles collected by one **VMT service engineer** installing systems and training operators.

## Being **PAID** **PEANUTS** ?

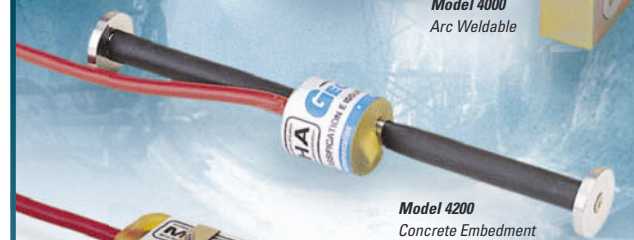
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## Vibrating Wire Strain Gages for Tunnel Support Monitoring



Model 4000  
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Model 4200  
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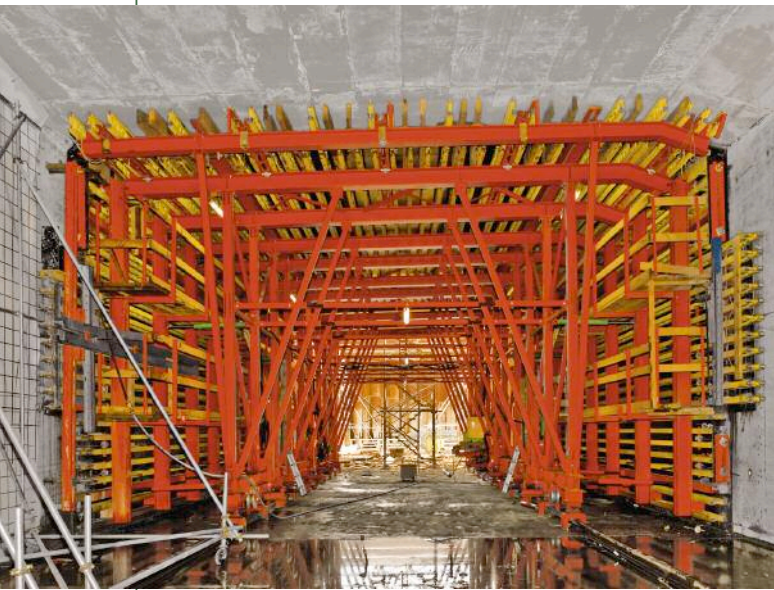


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## Long-distance Pumping

**R**EED's new "Tunnel Version" C50SS-SKE pump was designed for long distance underground shotcrete applications.

Powered by the powerful combination of a 125hp electric motor and 180cc main hydraulic pump, it has a maximum output of 40m/hr at 129 bar concrete pressure.

REED Concrete Placing Equipment is part of the well known US contractor, JF Shea Company, a US\$3bn plus, Southern California-based construction firm with years of tunnelling experience and in its second century of operation.

**REED**  
Email: [mike.newcomb@reedmfg.com](mailto:mike.newcomb@reedmfg.com)

## Sealing technology expertise

**T**relleborg Bakker says it has unrivalled expertise in seal design and elastomer technology, and claims to be the leading manufacturer of elastomeric gaskets for immersed tunnels, cut & cover tunnels and bored tunnels.

The company supplies tunnel segment gaskets (TSGs) for the segmental lining of bored tunnels under the trade name Heinke. Heinke TSGs are designed to give a secure rubber-to-rubber waterproof seal as soon as the segments are bolted together.

Says Trelleborg Bakker: "The

low compression set and stress relaxation values of the elastomeric compound used in their manufacture enable elastomeric TSGs to recover under reduced applied load thereby maintaining a positive seal between segments despite ground movements."

The company manufactures a range of Heinke TSGs designed for precast concrete, steel and cast iron segments.

**Trelleborg Bakker**  
Tel: (+31) 180 495 555  
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Website: [www.trelleborg.com/bakker](http://www.trelleborg.com/bakker)

## Locking dowels

**D**owelock was developed as a circle joint connection for segmental tunnel rings, to counteract the problem of keeping elastomeric gasket seals fully compressed between rings. It consists of a connecting dowel moulded from plastic, together with two locking assemblies; one cast into each of the adjacent lining segments. These locking assemblies incorporate patented collets that allow the dowel to enter with minimum compression force and then lock, preventing the dowel from withdrawing.

Dowelock 30 (30mm diameter dowel) has been used throughout

the world, leading to the development of two further sizes. Dowelock 45 - high tensile (12.9t) and shear (17t) resistance to deal with the requirements of gaskets with high compression and thick segments, and Dowelock 20 rings used in a situation where a lower tensile resistance is required, e.g., smaller elastomeric gaskets or hydrophilic seals.

**Tunnelling Accessories Ltd**

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## Measuring moulds and segments

**V**MT is a German company providing navigation for tunnelling projects with its guidance systems helping achieve desired alignments to a wide range of tunnel boring machines (TBMs). The company has now used the latest laser Interferometry technology to provide precise surveying of moulds used in segment manufacturing and also in the segments themselves.

The precision required for the manufacture of the moulds that are used in the casting of segments for tunnel linings is often not mentioned. The tender documents for a typical segmentally lined tunnelling project often only states the dimensional tolerances for the finished segments and in some cases only the tolerances for a sample build of two test rings is given.

Increasingly tight tolerances for segments of a few tenths of a

millimeter now included in many specifications demand a fast, accurate and reliable method for determining these values.

The use of a laser interferometer system, which only requires a single operator, enables VMT to accurately digitalize surfaces by direct polar coordinate measurement with an accuracy of a few hundredths of a millimetre. Measurement to a single spherical retro-reflective prism enables the skilled operator to comprehensively measure the full profile of the object with up to 20 segments per shift.

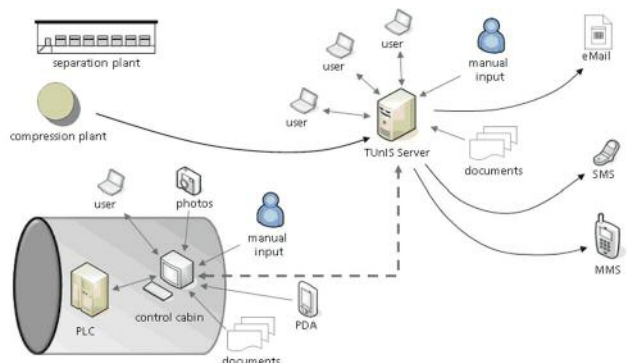
Extensive use of this technique has been made on the City Tunnel project in Malmo, Sweden, as well as many projects around the world in Europe, Korea and Australia.

**VMT GmbH**

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# Injection systems for tunnel construction

**M**C-Bauchemie produces innovative product systems that enhance concrete properties and protect and maintain building structures. They have a presence across 30 countries.

Single-layer tunnels with segmental linings are a preferred mode of construction, from a commercial and engineering view. However, geological imponderables often impact construction, which makes it impossible to rule out partial damage to structures. However, such damage can now be remedied with sealing systems without subsequent restrictions in tunnel use.

There are proven and innovative grouting systems available for subsequent sealing of cracks and joints. Cracks are best sealed with elastomer resins, while joints can

also be sealed with hydrostructure resins. Water tightness can be achieved by injection into the joint space, sealing all possible water ingress points in the form of infiltration in the boundary layers "gasket/concrete", faults in the gasket joints (at the T-joint), cracks, pockets or other faults.

The injection systems have been tested and used in numerous tunnel construction reference projects. These reliable injection systems are used to create start-up sealing, guaranteed through a rapidly foaming elastomer resin or alternatively, by way of using a soft-elastic hydrostructure resin.

**MC-Bauchemie Müller GmbH & Co. KG**

Tel: (+49) 2041 101 10

E-mail: [protection-technologies@mc-bauchemie.com](mailto:protection-technologies@mc-bauchemie.com)  
Website: [www.mc-bauchemie.com](http://www.mc-bauchemie.com)

## Waterproofing the tunnels

**R**ENOLIT has manufactured geomembranes for more than thirty years. The company's range of geomembrane tunnel equipment meets the different specifications required for tunnel lining in Europe.

The company's latest development is the waterproofing of tunnels with a bonding systems which is executed with geomembranes laminated together with a PP fleece. The geomembrane is heat welded to the surface of the tunnel.

A geomembrane "signal layer" (ALKORPLAN 35041) tunnel is used in countries like Germany, Switzerland and Austria with thicknesses of up to or less than 200µ, to ensure its role as a

warning in case of mechanical damage.

Translucent geomembrane (ALKORPLAN 35036) is used for tunnel lining in countries like France, and other French-speaking countries, with its high resistance against micro-organisms, whereas Geomembrane "opaque" (ALKORPLAN 35034) is used in Italy and other countries.

All geomembranes can be produced with different mechanical characteristics, different fire resistance and up to a thickness of 3mm.

**ALKOR DRAKA N.V**  
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Website: [www.alkorgeo.com](http://www.alkorgeo.com)

## ES Sealing Gaskets

**E**S Ein Shemer Rubber Industries, Israel, and WGD Werner Grabe Development, Germany have come out with EPDM rubber gaskets for segmental liners according to STUVA recommendation. They specialize in stable internal W-structure of seal and soft corner design for small reaction loads.

WGD now has 25 years of experience in developing sealing gaskets for tunnelling and special solutions, adjusted

to specific projects. In addition, over the past 40 years, they have their own rubber compounding and laboratory, ISO 9001 and DVGW certifications and also offer extrusion and vulcanization on modern production lines according to tolerance class E1.

**Dr.-Ing. Werner Grabe,**  
Tel.: (+49) 2548 98157  
Email: [werner.grabe@wg-d.de](mailto:werner.grabe@wg-d.de)  
Website: [www.wg-d.de](http://www.wg-d.de)

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## Akkerman's EPBM machine

**A**kkerman Inc. is a provider of 2.9m diameter EPBM machine. The product is used to create a 1.9km tunnel, which features 11 curves with 2.4m I.D. concrete segments.

EPBMs, a previous product of Akkerman are used for pipejacking and liner plate installations. The new machine erects pre-cast tunneling segments and advances

off the segments to move forward. It is equipped with a 400hp (298kW) variable speed electric cutter head drive, 47cm open center ribbon screw conveyor, foam and slurry additive system and mixed face cutter head with disc cutters.

**Akkerman Inc**  
Tel: (+1) 507 567 2261  
Website: [www.akkerman.com](http://www.akkerman.com)



## Bexonite mixing and pumping unit

**H**äny is a supplier of bentonite mixing and pumping units for the micro tunnelling and pipe jacking industry. The product range includes different models that provide outputs from 1.5 to 13m<sup>3</sup>/hr and pressures up to 200 bar. The HCM high-shear (colloidal) mixers have excellent mixing capabilities, resistant to wear and tear, and are easy to handle. These mobile units have compact design and are easily accessible for maintenance and cleaning.

For small bore tunnels, a two-component backfill system has been developed to place the grout mixing and pumping plant on surface. The two components are mixed in a special nozzle just before the point of injection. Distances of

over 600m have successfully been pumped.

The product consists of five different high-shear colloidal mixers from 100 to 2500l with mixing pumps of up to 100 l/s circulation capacity that guarantees highest quality mixes.

**Häny AG**  
Tel: (+41) 44 925 4111  
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Website: [www.haeny.com](http://www.haeny.com)



## Heavy load movement

**A**LS (Freight Management Group) is a global freight forwarder offering the worldwide movement of abnormal and heavy loads.

ALS is involved in turnkey project management, providing manufacturers, engineers and contractors with the global movement of complete and part TBMs and ancillary equipment

ALS has entered a phase of expansion to support individual customer requirements by opening

new offices worldwide. Additional services include route surveys, feasibility studies, crane and plant supply/management, project forwarding/chartering, general forwarding, warehousing and storage and spare parts logistics.

**ALS (Freight Management Group) Limited**

Tel: (+44) 1482 796214

Email:

[info.tunnelling@alseurope.com](mailto:info.tunnelling@alseurope.com)

Website: [www.abnormal-loads.com](http://www.abnormal-loads.com)

## Magical pipe bursting

**T**he Charles Machine Works, manufacturer of Ditch Witch underground construction equipment, has recently added three systems to work in the pipe replacement market. The new Ditch Witch PR50, PR75, and PR95 pipe bursting systems are designed to fracture or cut most types of existing pipe - water, sewer, or utility - and pull in new pipe with 50, 75, or 95t of pullback force, respectively.

Advantages of these new pipe bursting systems are said to include outstanding durability, simplicity of operation, productivity and the ability to easily and efficiently cut or fracture most types of pipe such as clay, PVC, steel, ductile iron and cast-iron pipe.

Other standard features include quiet, fully enclosed power packs and load-sensing hydraulics that automatically shift the unit to high speed when there's no load, and downshift the unit when a load is introduced to increase machine productivity.

**Ditch Witch**

Tel: (+1) 800 654 6481

Website: [www.ditchwitch.com](http://www.ditchwitch.com)



## Online Load Control

**O**nline Load Control (OLC) System manufactured by Herrenknecht avoids any angular deflections during pipe installation, avoiding pipe or tube sheet damage in advance.

Four distance sensors measure the gap widths of selected pipe joints. The angular deflection is calculated, compared and recorded in detail by the data acquisition system.

Online Load Control (OLC) System product range includes admissible load of the joint, which is calculated based on the angular deflection, thrust force and material specification of the pressure transfer ring. Actual and admissible thrust forces are compared and visualized. The operator can intervene and adapt the thrust force through the high-precision

operation of the interjack stations. Therefore, overloads can be avoided before critical limit values are reached or even exceeded.

With the Herrenknecht Direct Pipe technology, a borehole is drilled in a one-step operation, while simultaneously a prefabricated and tested pipeline is inserted. Direct Pipe@ significantly speeds up trenchless installation, especially of large diameter pipelines, and reduces the related costs accordingly. Similar to Pipe Jacking, the excavation of the soil is carried out with a Herrenknecht Micro machine. At the same time, the prefabricated pipeline is pushed forward by the Herrenknecht Pipe Thruster.

**Herrenknecht AG**

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## Magnetic sensors

**P**rimé Horizontal, a HDD drilling guidance company, has adapted a guidance technology involving the use of the ParaTrack magnetic sensing system to achieve the close tolerances required for parallel freeze holes.

Prime's technique has been used in the excavation of the Underground Metro Station Network project in Naples in 2005 and in the boring of the Hallandsas Rail Tunnel in Sweden in 2007. In Naples 70m boreholes were drilled through volcanic ash within a 50 cm tolerance.

The cost effectiveness and even the success of freeze hole consolidation of soft or water saturated formations depends on maintaining precise positions of the bore holes containing the 40°C freezing brine since any unfrozen gaps in a structure supporting hundreds of tons of silt and water under pressure would be catastrophic once excavated.

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Website: [www.prim-horizontal.com](http://www.prim-horizontal.com)

## Microtunnelling business

**T**he Robbins Company Trenchless boring machines are available worldwide through Robbins offices and representatives in more than 15 countries. Last year, Small Boring Unit (SBU-A) technology made its debut in India. The SBU-A is a type of small diameter cutting head for use with standard Auger Boring Machines (ABMs). Available in diameters from 600mm to 1.8m, the SBU-A can be used in both mixed ground and hard rock up to 175MPa UCS. In addition to SBUs, Robbins also makes equipment for use with pipe-jacking machines, including Motorized Small Boring Units (SBU-M) and Rockheads (SBU-RH). The machines can be used with

different types of pipe and can bore longer crossings with continuous steering capabilities.

In 2009, a Robbins Rockhead is also gearing up for its first project in India. The Rockhead is available in single shield (SBU-RHSS) or double shield (SBU-RHDS) models from 1.5 to 1.8 m in diameter, and is typically used on longer bores (over 150m). Double shield machines are self-propelled using a gripper system, while single shield machines are used with a pipe-jacking system or any other primary liner.

**The Robbins Company**  
Tel: (+1) 253 872 4484  
Email: [homeb@robbinstbm.com](mailto:homeb@robbinstbm.com)  
Website: [www.therobbinscompany.com](http://www.therobbinscompany.com)

## Jacking shop

**T**unnelling Accessories claims to be a one-stop-shop for pipe jacking and micro tunnelling ancillaries. As well as selling its own products, such as packers, entry/exit seals, secondary seals and joint lubricants, the company also supplies the 'Baroid' range of drilling fluid products, which are specifically designed to reduce jacking loads and make spoil removal and handling both easy and environmentally friendly.

The company is also the UK distributor of Bullflex grout bags - used for a variety of applications such as sealing between the tunnel ring and its entry/exit eye, and between an existing tunnel and a smaller pipe.

**Tunnelling Accessories Ltd**  
Tel: (+44) 1424 854112  
Email: [dave@tunnellingaccessories.co.uk](mailto:dave@tunnellingaccessories.co.uk)  
Website: [www.tunnellingaccessories.co.uk](http://www.tunnellingaccessories.co.uk)

## Modular navigation concept

**W**ith its modular guidance system, VMT offers a full range of navigation technology for micro-tunnelling & pipe jacking. This enables users to configure various navigation and additional modules to suit project requirements for a successful and economical pipejack.

The sea outfall tunnel in San Pedro del Pinatar, Spain, using a Herrenknecht AVN 2000 TBM, is a perfect example to describe the high flexibility of this concept. Two tunnels of 1,150m and 640m including curved sections required a guidance concept, which uses an economical standard laser system for the first 300m and curved guidance system for the rest of both drives.

For long distance and curved drives VMT offers either the SLS-Micro-tunnelling 'LT' laser Total Station system or the SLS-Micro-tunnelling 'G' gyro navigation system.

The customer used Herrenknecht AVN machine, with its expected high speed performance, alongside the SLS-Micro tunnelling LT in combination with an electronic hose leveling system. Due to the limited cover at several sections, it was expected that the built pipeline may float. To



avoid that, these effects would influence the guidance system.

The course of the project confirmed that the combination of the SLS-Micro-tunnelling LT and electronic hose water level was the best choice and high performance rates of more than 100m/week could be achieved and buoyancy of the pipeline made the observation of the vertical movements essential.

**VMT GmbH**  
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Website: [www.vmt-gmbh.de](http://www.vmt-gmbh.de)

## Long-distance drilling

**E**ON Energie-Service is currently completing a new bio-gas plant in Hessisch Oldendorf, Germany. Hot water, resulting from the plant's waste heat, will be fed into a long distance heating network for the town.

About 2km of the total 2.5km length from the bio-gas plant to the town was installed using trenching. However, for two sections, of 192m and 100m, it was virtually impossible to use this method. Installation in these areas was planned instead using HDD.

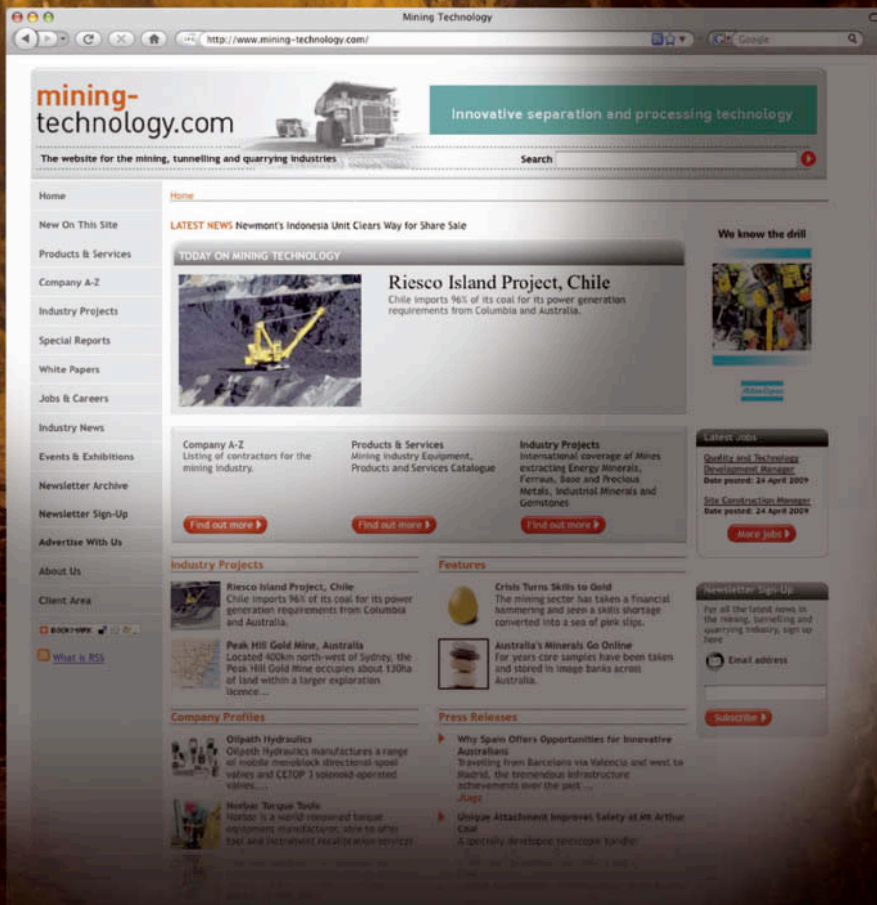
A Grundodrill 15N system from Tracto-Technik was selected to carry out the task. The bore path was chosen to allow a flat entry and exit angle, in order not to overstrain the bending stiffness of the heating cables. This provided

a bore length of 228m and 1.3m deep.

The pilot bore took around 4.5 hours in the clayish soil with lenses of gravel. Initially, the bore had to be expanded in two working processes, to 385mm and 485mm diameter, and cleaned. After the installation of the first 96m length the second pipe length was welded on. After 4 hours, required for the welding, x-raying and subsequent insulation of the connection seams, the remainder of the pipe was then pulled in. The total pipe weight was guessed at 7 tonnes, but the maximal pulling force was only 3 tonnes. The project was completed in 12 days.

**Tracto-Technik**  
Tel: (+49) 2723 8080  
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Website: [www.tracto-technik.de](http://www.tracto-technik.de)

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## Ventilation systems expertise

**A**BC Industries is a provider of ventilation systems consisting of vane axial and prop fans, certified by the Air Movement and Control Association. Its product range includes high volume-low pressure prop fans, direct drive fans, belt drive fans, mineduct exhaust tubing, minevent blower

tubing, rigiduct fiberglass tubing and silencers and cassettes.

The company also provides personal and professional customer services for ventilation ducting and accessories service.

**ABC Industries, Inc**

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Website: [www.abc-industries.net](http://www.abc-industries.net)

## Seeing the light



**H**enry Cooch & Son has been manufacturing the Skylite range of mobile floodlighting units since 1968. These units were used on the first attempt on the Channel Tunnel and also on the second Channel Tunnel and associated road works.

The Skylite 95, Skylite 10 and 12 units can be supplied with rotating head frames if required. All floodlight fittings are universally mounted thus allowing "maximum manual adjustment through both the horizontal and vertical planes".

Cooch offers units with gas-powered engines or trailers without generators that can be used with an external supply. Units can be built to a client's own specification although the standard range of units measures from 5m portable to 18m trailer-mounted.

**Henry Cooch**

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## MineVent Blower Tubing

**A**BC Industries is a process provider for manufacturing MineVent Blower Tubing. MineVent Blower Tubing is a collapsible, layflat tubing product for positive pressure applications. It is available in a variety of fabric weights/strengths, diameters and lengths for tunnelling facilities.

The product range includes

high volume-low pressure prop fans, direct drive fans, belt drive fans, mineduct exhaust tubing, minevent blower tubing, rigiduct fiberglass tubing and silencers and cassettes.

**ABC Industries, Inc**

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Website: [www.abc-industries.net](http://www.abc-industries.net)

## Amco's ducting solutions

**A**mco Plastics Ltd. is a supplier of large diameter forced ventilation ducting in Spain through their distributor Abyo S.A. The product range includes the Madrid Metro line extensions and tunnels in Malaga, Barcelona, Valencia and on the Spanish French border at La Jonquera.

The product consists of 12,000m of 2,600mm diameter Amflex layflat ducting for the Pajares 5 contract in Asturias. The high speed rail tunnel comprise twin 6km long tunnels from Los Pontones and Jomezana by Sotiello UTE, a joint venture between Acciona Infraestructura and FCC



Construccion.

**Amco Plastics Limited**

United Kingdom

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E-mail: [info@amco-plastics.co.uk](mailto:info@amco-plastics.co.uk)

Website: [www.abnormal-loads.com](http://www.abnormal-loads.com)

## The right connection

**O**ver the past 60 years a connecting device is said to have made an essential contribution to the successful evacuation of liquids in the tunnelling industry – the Bauer quick coupling, invented in 1947 and patented shortly afterwards.

This invention is claimed to

have revolutionised the international flexible pipeline construction sector. The Bauer quick coupling, suitable for diameters up to 8", is bendable in every direction and can be coupled quickly and easily. The more sophisticated HKS system is also said to meet an extremely high security standard. Says Bauer: "Specially developed thin walled, but high strength pipes together with the Bauer coupling system guarantee a lowest weight with utmost stability."

A complete range of fittings in all kinds of diameters from 2" to 8" make this coupling system an extremely flexible overall product."

**Bauer Group**

Tel: (+49) 8252 97 0

Email: [bag@bauer.de](mailto:bag@bauer.de)

Website: [www.bauer.de](http://www.bauer.de)



## Lighting up Tunnels

INDO's induction lamps are energy efficient and rated to last 100,000 hours while maintaining light quality. Unlike some LEDs there is no green colour shift in the INDO induction lamp which means that the lighting is largely maintenance free for at least 11 years. INDO uses electronic gear, with instant strike and re-strike capability, reduced start loads and under half the typical HID circuit power consumption. INDO's 2009 ballast offers DALI programmable functionality enabling tunnel operators to maximize the potential of their



systems through real time strike/re-strike of lamps and dimming by up to 50. Compared to LEDs the INDO claims that their lamps are

cheaper compared to some other brands in the traditional tunnel illumination market  
**Indo Lighting Ltd**  
 Tel: (+44) 7747 462139  
 Website: [www.indolighting.co](http://www.indolighting.co)

## Breath of fresh air

TLT-Turbo is a specialist in ventilation and smoke extraction. It claims to offer fans for all applications in the field of road and rail tunnels. These include jet fans, axial fans and overpressure fans for escape tunnels with the associated accessories "for a safe and economic operation".

The fans are made in Germany and said to be certified in accordance to EN12101-3.

**TLT-Turbo GmbH**  
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 Website: [www.tlt.de](http://www.tlt.de)

## Electric vibrations

Italian firm Italtibras, the benchmark standard for electric vibrators, has extended its MVSI product range with the launch of a model capable of creating as much as 30,000kg of centrifugal force. Currently the highest centrifugal force generated by a single electric vibrator, the launch reaffirms Italtibras focus on research and development, geared towards extending the use of electric vibrators to new sectors and fields of application.

The electric vibrator is offered with six, eight, 10 and 12 pole options with electrical and mechanical over-sizing to allow the vibrator to be used in applications requiring increased starting and peak torque.

The specially designed and oversized mechanical and electrical parts ensure that the

electric vibrator can withstand the typical heavy wear-and-tear associated with the use of such machinery. To aid eccentric mass regulation operations, the latest model has been equipped with two standard split covers with ring seals, ensuring the same IP66 protective strength as traditional seals.

The entire Italtibras electric vibrator production cycle is carried out at the new plant in Fiorano. The investments in innovative fully-automatic, semi-automatic and robotic electric motor assembly lines, latest-generation work areas, and stator winding lines is by choice and part of an overall company policy.

**Italtibras G. Silingardi SpA**  
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 Website: [www.italvibras.it](http://www.italvibras.it)



## Protecting surfaces

The repair of internal tunnel wall shells has always been one of the most demanding tasks where concrete repair is concerned. Being the final coating, surface protection systems play an important role here. In addition to the comprehensive protection of the concrete they must also offer a degree of functional reflection and must provide a certain level of lightness. Being very easy to clean is also an important requirement.

The watery, organosilicium-modified polyurethane acrylate "Emcephob NanoPerm P" developed by MC-Bauchemie, fulfils all these requirements.

On top of this the system features a whole host of product properties that are vital for a lasting repair given the particular operation conditions in tunnels. For instance, in a layer thickness of 200 µm Emcephob NanoPerm P offers a resistance against carbon dioxide of 3,600m which equals a calculative concrete cover of 4.4m! Outstanding resistance against scouring or cleaning cycles even when removing graffiti is a further advantage.



The surface protection system Emcephob NanoPerm P is open to water-vapour diffusion, is water-resistant, chloride-proof, UV-resistant, scratch-proof, and resistant to frost and de-icing salts.

**MC-Bauchemie Müller GmbH & Co. KG**  
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 Email: [protection-technologies@mc-bauchemie.com](mailto:protection-technologies@mc-bauchemie.com)  
 Website: [www.mc-bauchemie.com](http://www.mc-bauchemie.com)

## Fibre reinforcement solutions

**P**ropex Concrete Systems is a global provider of Fibre Reinforcement Solutions to the construction, civil engineering and tunnelling industries.

The range of FIBERMESH polypropylene and NOVOCON steel fibres offer practical, technical and economic advantages when used in underground applications. Propex has also pioneered the development of high performance polymer (HPP) and ENDURO synthetic macro fibres, primarily for precast and sprayed concrete tunnel linings.

The FIBERMESH 150 micro-synthetic fibres is used globally and provides a high level of resistance to explosive spalling during tunnel fibres and have been used on tunnel projects world-wide. Their ability to offer a complete range of fibres has led to the development of NOVOMESH, a family of products that combine the



benefits of steel and synthetic fibres, tailored to address the demanding needs of specific applications.

Propex Concrete Systems also provides the fibre solutions for crack control, ductility/toughness or resistance to explosive spalling,

**Propex Concrete Systems Ltd**

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## A Concrete Spray

**T**he MEYCO Suprema is used for conveying and spraying of wet-mix sprayed concrete and for the pumping of concrete. It is used for the spraying of concrete and its features are designed for pulsation free spraying and the most accurate and constant dosing possible.

MEYCO also manufactures mobile concrete spraying units MEYCO Potenza and MEYCO Roadrunner equipped with all components necessary for large volume, high quality work in civil tunnelling environment. These industry benchmarks have integrated MEYCO TDC (Total Dosing Control) systems together with MEYCO Data for information gathering and analysis as standard. Other mobile systems include the articulated MEYCO Cobra.

The company also designs and constructs tailor-made spraying systems for integration within TBMs. MEYCO cooperates worldwide with companies such as Herrenknecht and Robbins on many special projects, the Jinping HEPP for example. Another project getting underway is West Qinling,

China where twin rail tunnels of 10.3m diameter are to be bored. Each TBM will be equipped with ring-beam mounted dual spraying manipulators with a spraying area length of 8m plus 2 MEYCO Suprema 30s specially constructed to be accommodated perfectly within the TBM back-up rig.

MEYCO Equipment is an integral part of the MEYCO Global Underground Construction team within BASF Construction Chemicals

**Meycos Equipment**

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## PolyVision ceramic steel panels

**P**olyVision ceramic steel is a fusion of glass and steel fired at temperatures over 800°C, produced according to ISO 9001 (quality), ISO 14001 (environmental), OHSAS 18001 (safety) and E.E.A. (European Enamel Authority) standards.

Being non porous and graffiti-proof, PolyVision ceramic steel panels is scratch resistant and immune to physical and chemical attacks. The non-combustible or fire resistant panels with ever

lasting color, gloss and brilliance and the easy water-and-some-soap maintenance is an ideal solution for tunnels.

The PolyVision ceramic steel panels combine beauty with durability and are applied for flat or curved wall cladding panels in car tunnels, railway and subway station.

**PolyVision NV**

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## Pumping performance

**W**hen the pumping distance becomes too great for any one pump, Japanese experts Tsurumi recommend installing wastewater pumps in series.

One example is the 32km long Koralm tunnel in Austria. Its construction presents a serious geotechnical challenge. Starting from the west portal, the 2.6km

long 'Mitterpichling' section is near completion. Work has also begun on the 6km long 'Paierdorf' tunnel, where groundwater had to be delivered upwards via a 120m high supply shaft.

"To solve the problem we developed an efficient cascade connection system. Two rising pipes are installed in the shaft and

smaller pumps are fitted at 40m intervals. The units are equipped with a pressure relief valve, so that the accumulated water does not damage the mechanical seal."

At the base of the shaft the abrasive groundwater is channelled into a basin, into which the lowermost pumps are submerged. "This solution has delivered such positive results that 17 Tsurumi pumps are now being used on the project," adds the company.

The pumps come from Tsurumi's KTZ-range which includes 250 models offering delivery volumes of up to 50m<sup>3</sup>/minute or 170m head. The model currently installed on the 'Paierdorf' site has an 11kW motor and is equipped with a four inch coupling, which can deliver 1440 litres per minute.

**Tsurumi (Europe)**

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## Keeping a Tunnel Completely Dry

For over three decades, Stirling Lloyd has protected some of the world's most important structures. The company, which specializes in the development, manufacture and application of high-performance waterproofing and structural protection



membranes and systems, has come out with more efficient ways to extend the life of structures.

Stirling Lloyd's latest waterproofing membrane, Integritank HF, has been developed for the internal lining of SCL/NATM tunnels. Uniquely in tunnelling it is able to be electrically integrity tested, prior to encapsulation by the secondary concrete lining, proving its 100% effective protection.

Spray-applied and seamless, Integritank HF eliminates the risk of leaking seams; of particular benefit in tunnels and underground spaces with complex geometry with which

sheet systems would struggle to cope. Integritank HF also dramatically reduces construction costs. Its rapid application and cure minimises build time while the high bond strength between the membrane and linings ensures that water doesn't circulate behind the waterproofing; giving the highest possible level of confidence in the waterproofing – imperative when maintenance is near impossible.

**Stirling Lloyd Polychem Ltd**

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## Ventilating tunnels

Schauenburg Tunnel-Ventilation GmbH has been in the business of flexible ventilation ducting for tunnels over the past 50 years. The company has a range of bespoke products called lay-flat and semi-rigid ducting that is manufactured as per customer requirements. The diameter ranges between 200 to 3000mm while the single lengths range between 1 to 200m. The company also offers different connection systems viz., the flexible end-rings, ZIP and Velcro. All fabrics come with a guarantee of maximum safety and handling. Apart from the manufacturing of ducting with a wide range of accessories, the company also assist in the planning of complete ventilation system. Schauenburg ventilation ducting has been used in projects requiring auxiliary ventilation.

**Schauenburg Tunnel-Ventilation GmbH**

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Website: [www.tunnel-ventilation.de](http://www.tunnel-ventilation.de)

## Concrete piston pump

The new Centurion 6E sprayed concrete piston pump from TAM International, is manufactured for use in small diameter tunnels.

The design is based on a proven robust, fast switch dual cylinder and S-Tube design. With a 2,200mm length, 750mm width, 1,050mm height, and 820kg dry weight, it allows the Centurion 6E to be positioned in the most confined areas of small diameter tunnels and cross passages. With a variable output of 0 – 6 cubic meters per hour, and a pumping distance of up to 100m, it is equipped with enough power for long distance pumping and small enough for hand spraying applications.

The Centurion 6E is designed with an onboard hydraulically driven Peristaltic Accelerator Dosing Pump with a variable output up to 120 liters per hour, giving a constant flow of TamShot 80AF (Alkali-free) accelerator to the 50mm diameter Spray Nozzle Injector System.

**TAM International**

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## The new DSC TBM

The DSUC TBM system substitutes open type TBMs in their typical fields of application and at the same time offers much of the same advantages as traditional double shield TBMs.

DSUC TBM system improves safety and worker's environment; reduces transport and installation time; reduces the operation and maintenance costs and crews; improves performances in a wider range of rock conditions and reduces the typical length of tunnels, where TBM excavation becomes competitive with conventional heading.

The design process has been augmented by considering a few

guidelines, including the need to minimize the total system length, as well as the number of track/containers to transport the system to site; minimize the number of components the system is made of; simplify the hydraulic and electronic circuits; full mechanization of NATM support installation; allowing the TBM to thrust off the steel supports where the ground is too weak, and extend capacity to investigate and treat the ground ahead of the tunnel face.

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## Equipment and cables

The Rutherford Group of Companies is a major supplier of temporary electrical equipment and cables for mining, tunnelling and civil engineering projects throughout the world.

The main line of work is in relation to the supply of electrical equipment packages involving the supply of generators, transformers, switchgear, distribution equipment, lighting systems, communication systems and power cables. Additionally projects can be undertaken on a turn-key basis where the company also takes responsibility for the engineering of the electrical supply requirements, and the installation and commissioning of the equipment supplied.

Rutherford offers customized electrical packages based around the purchase, buy-back or hiring of equipment that allows clients to gain maximum benefit out of its equipments.

The New South Wales-based company has recently expanded to Italy, by setting up a company in Milan to cater to the European tunneling industry.

A substantial fleet of equipment and cables are stored at specific locations throughout Europe, South East Asia and Australia; offering clients efficient, and



technically viable solutions.

The core strength of the Rutherford Group is in its ability to provide a "Single Supplier Solution" to the electrical needs of the mining, tunneling and construction industries.

**Rutherford Power Pty Limited**

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## Finnish protection

**M**arioff Corporation has been selected to install a HI-FOG water mist system in Helsinki's new underground tunnel service network. The installation will be Finland's first automatic tunnel fire protection system.

The Helsinki underground service network will allow the city to expand its pedestrian zones by limiting traffic through the downtown area. The project includes a 2km service tunnel, 1km of which will be protected by the HI-FOG system.

"This is an important project for Helsinki, and we are

pleased to be working with the City's planners to make the tunnels safer," said Markku Vuorisalo, Marioff's general manager of transportation and infrastructure.

The HI-FOG system uses high pressure to produce a fine water mist that combines the extinguishing characteristics of water with the penetrative qualities of gases to minimise property damage and environmental hazard upon activation.

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## Taking the pressure

**F**ogtec Fire Protection supply high-pressure water mist systems for the protection of tunnels. Starting with consultation and customer research, the company offers turnkey installations in co-operation with local partners. Design criteria for Fogtec's tunnel systems are derived from results generated by research projects such as UPTUN and SOLIT.

One result of the European UPTUN project was the "UPTUN Guidance 251 for Water Based Fire Fighting Systems for Underground Facilities" giving basic requirements on design, installation and maintenance of such systems. As of now, it is the only international guidance for the design of water mist systems.

Fogtec recently equipped the 1km long Virgl Tunnel on the Brenner Highway, in Italy, and the



most critical sections of the M30 underground highway around Madrid, Spain, with a high pressure water mist system. The latest installation of such a system is the 2km long Silver Forest Tunnel in Moscow, Russia.

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## Supporting Pipes and Cables

**T**RANSFORGE (UK) supplies modular bracket and walkway systems to the tunnelling industry. The system works on the principle of lightweight shelves being clipped into a backplate to support the pipes and cables. Walkways themselves are produced using 3m long panels with an anti slip surface.

The walkway panels also clip into the bottom of the backplate and can be available from 460mm wide to 900mm wide. The backplate can be fixed to existing segment bolts or via holes drilled into the wall. Shelves normally cater for standard sized cables and pipes. Additional roller or lighting

shelves reduce the need for additional drilling and fixing to the tunnel lining.

All products are designed to weigh less than 25kg to enable ease of handling. Shelves, backplates, etc. pack onto pallets for easy transportation and can be re-used for future projects. Lightweight temporary sleepers and bespoke tunnel steelwork of all types are also part of our large range of specialised tunnel steelwork.

**Transforge**

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## Sensing danger

**S**ecuriton develops and manufactures a range of different fire detection systems to fulfil a broad spectrum of customer needs.

The SecuriSens TSC 515 is said to provide fire detection in road and rail tunnels, multi-storey car parks, refineries and industrial premises. "The system features a high level of safety, low planning expenditure and simple

installation and mounting," says Securiton. It meets response behaviour according to EN 54-5, class A1, and is VdS approved.

Small temperature sensors are fitted at regular intervals along a sheathed ribbon cable used as a data and supply bus. The TSC 515 is an encapsulated acquisition and BUS system integrated in the cable and has a high resistance to environmental pollution.

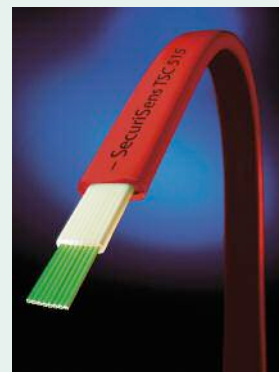
The sensors are continually scanned for the latest measured values. An evaluating logic uses the values obtained to determine when to report a fault or alarm. Special software is used for the settings and configurations. The system can be connected either to a PC or to a fire alarm control panel and also provides OPC and Modbus standards.

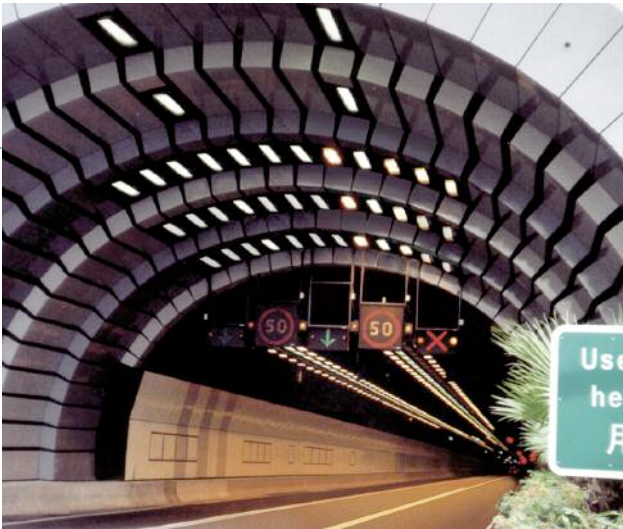
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Website: [www.securiton.eu](http://www.securiton.eu)





## Glowing report

**T**horlux is a road tunnel lighting supplier that has supplied more than 25,000 luminaires worldwide. A collaboration between Thorlux and P Ducker Systems (tunnel control and monitoring specialists) capitalises on the latest lighting and control technology (Scanlight) to provide what Thorlux describes as “a reliable, energy efficient and user friendly solution for road tunnel applications”.

The company says that working with consultants and contractors has enabled it to design and supply luminaires and associated control systems “to the highest performance and quality standards required for the rigorous demands of road tunnel environments”.

Quick release cover latches, flexible mounting brackets, “plug and play” mains and data leads can all be provided to suit any given specification.

Control gear and lamps are used to achieve maximum luminaire and system longevity. Soft start, digitally dimmable control gear regulates each individual lamp output according to the external ambient light conditions offering extended maintenance periods and substantial running cost savings when compared with conventional tunnel lighting systems.

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## Mitigating disaster



**T**he subject of fire suppression and mitigation in tunnels has always been contentious within the fire safety engineer community. “For many years hydrants and hose reels were provided for early intervention and the Fire Brigade dealt with surviving fires,” says Kidde Italia.

Kidde’s automatically-operated deluge system (Tunnel Fire Protection system – TFP), which uses low expansion foams produced by a specific agent

(Tunnel Aqueous Film-Forming Foam, T-AFFF) was patented in 1999 by Silvani Antincendi and tested in the same year in the Piota Negra tunnel, in Switzerland, with the collaboration of the Swiss Fire Brigade.

Kidde says that analytical and numerical analysis, and the fire tests performed by the University Politecnico di Torino show that: The system is able to slow down the fire growth phase, and to reduce the fire magnitude so that smoke generation and temperature levels are reduced

The system extinguishes class B fire sources such as a small petrol tanker with a heat release of 50-60MW and liquid pools with a 30-40m<sup>2</sup> surface area, and prevents their re-ignition

The system is able to mitigate and control class A fire sources such as a car and a van with heat release of 20MW.

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## Breath easy

**O**ver a century of dedication to the manufacture of quality products has enabled American Warming and Ventilating (AWV) to become an industry leader in the design and manufacture of tunnel ventilation and fire dampers, says the firm.

AWV offers a range of heavy-duty dampers for tunnel applications. The company meets or exceeds requirements for BS476, Part 20, for four hours, 400°C/2hr applications, as well as NFPA 130 and 502 requirements.

Dampers can be equipped with seals to meet UL Class I leakage requirements or other leakage rates as required. Pneumatic or electric operators are available, double acting or spring return features with or without manual overrides. Other accessories such as gaskets, screens, limit switches or structural supports are available to make a complete package ready for installation.

AWV offers in-house testing (as required) for AMCA air performance,

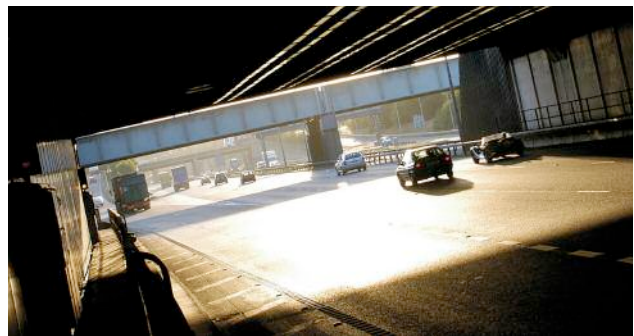


leakage, temperature testing, deflection and stress analysis.

“There is a wide choice of options available for all AWV damper models, and we are always keen to respond to any special requirements,” says the company.

**American Warming & Ventilating**  
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Website: [www.awv.com](http://www.awv.com)

## Air power deployed



**F**läkt Woods is an industry leader in air movement technology - the company’s expertise in tunnel ventilation ranging from road, rail and metro tunnels to tunnel construction and mining. Under a recent contract Fläkt Woods supplied ventilation solutions on the Valsassina Tunnel, which connects the Italian city of Lecco to the Valsassina valley. The mixed type ventilation system is said to consist of two large ventilation rooms and 67 of the company’s Jet Thrust Fans, constructed in stainless steel and certified for operation in emergency situations at 400°C for a maximum of two hours. The fans are positioned over the tunnel entrances, along the side roads and near to the slipways.

The peculiarity of this system is the Bione ventilation room, which is said to be unique, as it is not designed on a horizontal plane but vertical. The room occupies a total of four floors and starts at the level of the false ceiling where the ducts are situated, separated for fresh air intake and polluted air extraction.

Serving these ducts are four Fläkt Woods unidirectional Aerofoil JM fans with an impeller diameter of 1600mm, two for each fresh air duct, and two large two-stage JM Aerofoils with an impeller diameter of 2500mm for the extraction of polluted air. The fans are vertically mounted.

**Fläkt Woods**  
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Website: [www.flaktwoods.com](http://www.flaktwoods.com)

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# Documenting rock mass

**G**eologic documentation of rock mass conditions on site is an important and often underestimated task. ShapeMetriX3D significantly supports geologic documentation at the tunnel face and brings it to the next level of quality.

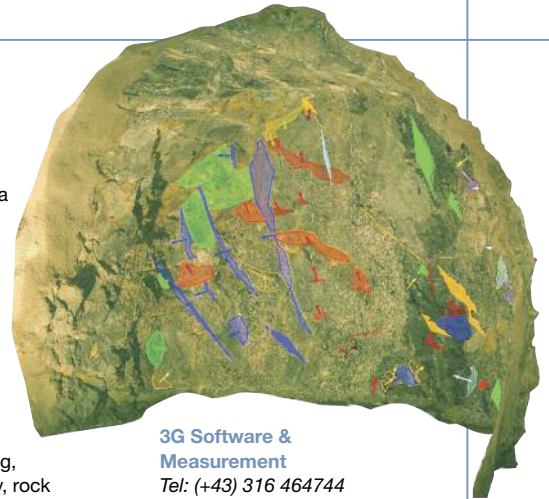
Using calibrated digital photos ShapeMetriX3D can easily generate accurate 3D images from the tunnel face and the sidewalls – with only two photos you capture the whole geometry of the rock face within a few

glances. Together with the draped photo these 3D images serve as a high-quality input for geologic documentation and the characterization of the rock mass.

JMX Analyst is software that allows identifying and virtual mapping of rock structures such as joints or faults. The system delivers the corresponding geometric parameters such as discontinuity orientations, trace lengths, spacings, or statistics. JMX Analyst provides a geologically sound data structure

and interfaces with a number of standard file formats for data transfer.

ShapeMetriX3D is currently used in more than 20 countries worldwide. The served industries include tunnelling, mining and quarrying, engineering geology, rock mechanics & rock engineering as well as blasting.



### 3G Software & Measurement

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Website: www.3gsm.at

# Precision Tunnelling

**A**tlas Copco is a provider of High Precision Tunnelling (HPT) with five options for drill rigs and machines.

The HPT product range includes Tunnel Manager, a PC-software product that enables the worksite office to provide operational support to Atlas Copco Boomer rigs equipped with Rig Control System (RCS).

Rig Remote Access (RRA) product provides rapid and secure transfer of the latest data to and from the drill rig. Total Station Navigation product navigates the rig into the right position with limited need for surveyors.

The Atlas Copco Tunnel Profiler is a 3D-scanning system for tunnelling facilities. The Measurement While Drilling



(MWD) technique product range includes rock mass for tunnelling and drift mining.

**Atlas Copco**

Tel: (+44) 1442 222100  
Email: ac.cmtuk@uk.atlascopco.com  
Website: www.atlascopco.com

# BEBO Arch System

**B**EBO Arch International AG designs arch structures for the last 40 years, with over 800 structures already in place around the world using the BEBO patented design.

The company is a provider of Arch product for cut and cover tunnel designs. The precast arches span distances of up to 31m and can be used in a wide variety of structures. BEBO system optimizes the interaction between the slender BEBO arch and the backfill material to obtain structure.

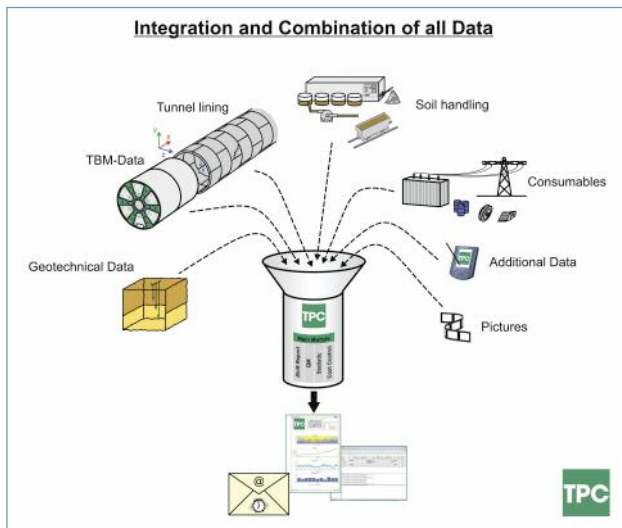
The BEBO Arch System is provided through license holders existing in Australia, USA, Canada, Malaysia, South Korea and the UK. BEBO Arch International AG is currently seeking to enlist further license holders across the globe.

### BEBO Arch International AG

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Email: techcenter@beboarch.com  
Website: www.beboarch.com



# Information control



**T**unnelling Process Control (TPC) permits a new level of information and control for the tunnelling project. During the construction, decisions are made on a daily basis and interpreting the available data has a significant impact on decisions and control of any situation.

TPC can collect all required data automatically from any source on site and present it in one concise report. The software has an option to evaluate and display data in real time mode for instant screen display, as a hard copy or a PDF-file for email distribution.

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Ref: PN3785 **Tunnel Design Engineer**, Singapore

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# Dates & Events

9-11 SEPTEMBER

## **IBTTA 77th Annual Meeting Chicago, USA**

The International Bridge, Tunnel and Turnpike Association's (IBTTA) 77th Annual Meeting and Exhibition will once again bring together more than 1000 toll agency professionals for 3 days of networking and current innovations in the toll industry. Contact: IBTTA: Tel: +1 202 659 4620; web: <http://www.ibtta.org>

9 -11 SEPTEMBER

## **EURO:TUN 2009 Bochum, Germany**

The 2nd International Conference on Computational Methods in Tunnelling is organised by the Institute for Structural Mechanics and promising interesting presentations from leaders in specialists in the field. Contact: Conference Secretariat: Tel: +49 234 32 29051; web: <http://www.eurotun.rub.de>

13-17 SEPTEMBER

## **9th International Symposium on Rock Fragmentation by Blasting, Granada, Spain**

Organised by the Universidad Politécnica de Madrid, this conference will cover all aspects of the blasting process. An accompanying exhibition will also be present. Contact: Scientific Coordination, Prof José Sanchidrián: Tel: +34 913367060; web: <http://www.fragblast.org>

29 SEPTEMBER

## **Tunnels and Tunnelling Conference 2009, London, UK**

T&T with the British Tunnelling Society present a one day conference packed with cutting edge site reports and technical content. Speakers include Martin Herrenknecht, Barcelona Metro Line 9, and a special presentation by key members of the Crossrail team that will include a Project Update, TBM requirements, Settlement and Monitoring Strategy, and the establishment of the Crossrail Academy. More TBA soon. Contact: Natasha Denney: tel: +44 (0) 208 269 7833; email: [ndenney@progressivemediagroup.com](mailto:ndenney@progressivemediagroup.com)

07-09 OCTOBER

## **58th Geomechanics Colloquy 2009 Salzburg, Austria**

The popular annual event will be held in the Salzburg Congress Centre with session topics including Projects in Austria, Grouting in Rock, Deep Tunnels, and Reuse of tunnel excavated material. Contact: OeGG: email: [salzburg@oegg.at](mailto:salzburg@oegg.at); Web: <http://www.oegg.at/events/geomechanics-colloquy>

28-30 OCTOBER

## **China's 4th International Symposium on Tunnelling, Shanghai, China**

Organized by :China Civil Engineering society; Shanghai Society of Civil Engineering; Shanghai Tunnel Engineering Co., Ltd. Contact: Mr Lou Ruyue; Tel: 86-021-54640607; email [forum@tunnelling.cn](mailto:forum@tunnelling.cn); Fax: 86-021-54641018; web : <http://english.stec.net/>

NOVEMBER 2009

## **Hong Kong Tunnelling Conference 2009, Hong Kong**

With more than 10 major infrastructure projects currently at the design and planning stage for the region, the Institute of Materials Minerals and Mining is organising this conference. Date and speakers TBA. A call for abstracts will be issued soon. Contact: Email: [secretary@iom3.org.hk](mailto:secretary@iom3.org.hk)

4-5 NOVEMBER 2009

## **Nordic Symposium of Rock Grouting - Geotechnical Seminar - Rock Mechanics/Engineerin Seminar, Helsinki, Finland**

Sponsored by ITA-AITES. Underground Space Seminar contact: Bjarne Liljestrand; tel: +358 400 362850; email: [bjarne.liljestrand@sroy.fi](mailto:bjarne.liljestrand@sroy.fi). Rock Mechanics/Engineering Seminar contact: Erik Johansson; tel: +385 50 5112162; email: [erik.johansson@sroy.fi](mailto:erik.johansson@sroy.fi). Nordic Symposium of Rock Grouting contact: Ursula Sievänen; email: [ursula.sievanen@sroy.fi](mailto:ursula.sievanen@sroy.fi)

18-19 NOVEMBER

## **12th International Conference of ACUUS, Shenzhen City, China**

'Using the Underground of Cities: for Harmonious and Sustainable Urban Environment' is the theme of this conference. Contact: Dr Guo Dongjun, Ms. Peng Xiaoli, Ms. Sun Xiaoyuan, Dept of Civil Engineering, Nanjing Engineering Institute. Fax: +86 25 84272793; email: [ACUUS2009@163.com](mailto:ACUUS2009@163.com); web: [www.mwwtg163.com/kehu/auc/index.html](http://www.mwwtg163.com/kehu/auc/index.html)

26-27 NOVEMBER

## **Austrian Southern Railway Link Conference 2009 Leoben, Austria**

This event focusses on Austria's Southern Railway Link, specifically, the design and construction of the 32.8km long Koralm Tunnel and the 27km long Semmering Base Tunnel along the route. November 27 involves a site trip to the currently under construction Koralm Tunnel Lot KAT 1. Contact: Marion Kainrath: email: [technologieakademie@unileoben.ac.at](mailto:technologieakademie@unileoben.ac.at); Web: <http://technologieakademie.unileoben.ac.at>

01-03 DECEMBER

## **STUVA TAGUNG'09 Hamburg, Germany**

Every two years the STUVA conference takes place with various topics from the fields of underground

construction. The conferences draws some 1,500 tunnelling experts from more than 30 different countries. An exhibition accompanies the event. Contact: STUVA: email: [info@stuva.de](mailto:info@stuva.de) web: <http://www.stuva.de/>

27-29 DECEMBER

## **13th International Conference on Structural & Geotechnical Engineering 2009, Cairo, Egypt**

This two day event will cover all aspects in the field of structural and geotechnical engineering, organised by the conference secretariat, Ain Shams University Faculty of Engineering, Structural Engineering Department. Contact: Prof. Dr Eman Soliman; tel: +2 02 26839318; email: [Info@ICSGE2009.com](mailto:Info@ICSGE2009.com); web: [www.ICSGE2009.com](http://www.ICSGE2009.com)

## BRITISH TUNNELLING SOCIETY

17 SEPT: **Seismic Response of Tunnel Linings**

Segmental lining radial and circumferential joint behaviour during seismic activity and mitigating designs are discussed by Gary Kramer, Hatch Mott MacDonald. 6pm start at the ICE

15 OCT: **Channel Tunnel Repairs**

Following the fire in September 2008 in the Channel Tunnel, all aspects of the swift repair works will be discussed by Christian Maquaire of Eurotunnel. 6pm start at the ICE

17-19 MARCH 2010

## **ISTSS 2010 Frankfurt, Germany**

The 4th International Symposium on Tunnel Safety and Security. Manuscript abstracts should be submitted to the Secretariat by 01 June 2009, poster abstracts by the 01 October 2009. Contact: Anders Lönnermark, SP Technical Research Institute of Sweden; tel: +46 10 516 56 91; email: [anders.lonnermark@sp.se](mailto:anders.lonnermark@sp.se); web: <http://www.sp.se/en/units/fire/news/ISTSS2010/>

14-20 MAY

## **2010 ITA World Tunnel Congress, Vancouver, Canada**

Not long after the 2010 Winter Olympics, the International Tunnelling Association (ITA) visits the spectacular city of Vancouver, British Columbia, for its yearly conference and exhibition. The usual combination of working groups, open sessions and technical talks will all be included. Contact: web: <http://www.wtc2010.org>

8-10 JUNE

## **InterTunnel 2010 Turin, Italy**

Tunnelling exhibition aimed specifically at clients, contractors and consultants involved in the construction of and equipping and operation of tunnels. Contact: Mack Brooks Exhibitions; web: <http://www.intertunnel.com>

## A DATE TO REMEMBER...

If you know of a tunnelling related conference, event, seminar or exhibition that is not listed here, we would be delighted to hear from you. Please contact the editor by post, email, fax or through our web site: **Tris Thomas, 'Tunnels & Tunnelling International', Progressive House, 2 Maidstone Road, Sidcup, Kent DA14 5HZ, United Kingdom.**

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Tunnels & Tunnelling International ISSN number 0041-414X is published monthly for US\$226 a year by Progressive Media Markets Ltd, Progressive House, 2 Maidstone Road, Sidcup DA14 5HZ, UK. Periodicals postage paid at Rahway, NJ.

**POSTMASTER:** send address corrections to Tunnels & Tunnelling International c/o BTB Mailflight Ltd, 365 Blair Rd, Avenel, NJ 07001. US agent: BTB Mailflight Ltd, 365 Blair Rd, Avenel, NJ 07001.

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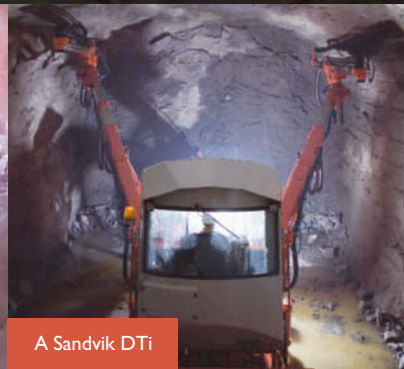
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