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AUGUST 2008

tunnels & tunnelling INTERNATIONAL

MACHINERY, MATERIALS & EQUIPMENT REVIEW

T&TI's annual review of tunnelling product developments

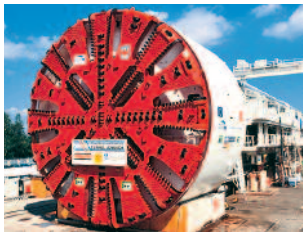
AUSTRIA: ALLROUND SOLUTION IN THE LOWER INN VALLEY.

The Lower Inn Valley railway in Austria is under construction as part of the 2,200-kilometer-long high speed Berlin–Palermo railway route. The section between Innsbruck and Wörgl runs along a length of almost 40 kilometers, 37 of which are underground. The Austrians are relying on an allround solution from Herrenknecht for the tunnel sections H3-4 Münster–Wiesing and H8 Jenbach, consisting of two large Mixshields, including high-performance separation plants, and one AVND machine.

The two Herrenknecht Mixshields S-352 and S-381 (Ø each 13m) are constructing a total of more than 9 kilometers of tunnel beneath the valley floor of the River Inn. A challenge which the two machines are mastering with bravura under the direction of our customer. Almost half of the section has already been completed. The retractable AVND4000AB with tiltable gauge cutters, which excavated the lateral emergency escape tunnels, is also delivering a convincing performance: 6 blind hole drills have already been successfully completed.

MÜNSTER, JENBACH | AUSTRIA

PROJECT DATA	CONTRACTOR
S-352, S-381 **2x Mixshields** Diameter: 13,000mm each Driving power: 3,200kW each Tunnel lengths: 5,840m, 3,470m Geology: pebbles, sand, coarse-grained clay, broken rock, gravel (S-352); mottled sandstone components, sand, gravel, stones (S-381)	ARGE Münster-Wiesing (S-352), Porr AG, Max Bögl Bauunternehmung GmbH & Co. KG, ARGE Tunnel Jenbach (S-381), Strabag AG, Hochtief Construction AG, Ed. Züblin AG
M-1193 **AVND4000AB (retractable)** Diameter: 4,810mm Max. torque: 700kNm Tunnel lengths: 16 tunnels with lengths ranging from 20 to 130m Geology: fine and medium sands, silt, silty clays, gravel	Züblin Baugesellschaft mbH



Herrenknecht AG
D-77963 Schwanau
Phone +49 7824 302-0
Fax +49 7824 3403
marketing@herrenknecht.com

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Tunnelling Systems

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FRONT COVER:
Montage of photographs supplied by tunnelling manufacturers and suppliers for this years' "Machinery, Materials & Equipment Review" (p15).

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A Robbins TBM driving with high overburden in the Andes for the Los Olmos project in Peru

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2008 Machinery, Materials and Equipment Review

REVIEW

COMMENT

It really is amazing to think that what eventually looks like a long hole in the ground, usually with a fancy lining (not that you can see it), is made using such a diverse amount of cutting edge technology.

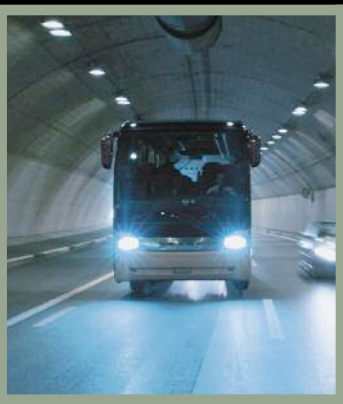
Some of the engineering that goes into this machinery is astonishing, as more and more manufacturers strive to achieve faster and cheaper results, and importantly increase safety in the underground environment. It is good to see manufacturers still have the will to push the boundaries, because contractors of the near future are going to need them.

Although much of the world is in the grip of a financial depression, with the construction sector hit hardest, the good news is civil engineering has shown no sign of being pulled under by this international downturn. In fact, if anything it is picking up for the tunneller.

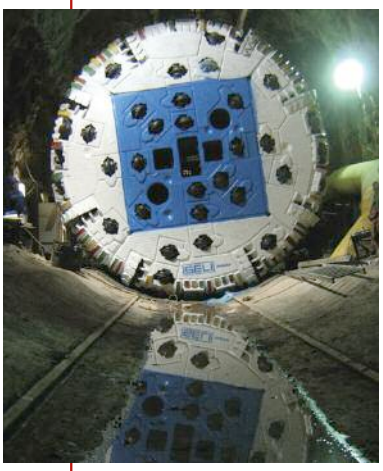
To use the UK as an example, as the house-building industry hits the skids, for us Crossrail gets the go-ahead, whilst Thames Tideway gets ready, and a host of cable tunnels are out to tender.

So, there's plenty of work coming up and as tunnels get longer and deeper, through more challenging conditions than ever before, remember to tip you hard hat to the people behind the scenes who build the equipment that makes these projects possible.

Tris Thomas



Seli TBMs take off in Ethiopia



Seli's TBM on inlet drive of the Gilgel Gibe II project, Ethiopia

Seli is set to relaunch its DSU-TBM on the inlet drive of the Gilgel Gibe II headrace tunnel in Ethiopia after many months of recovery work to overcome extremely difficult soft ground dominated by high-pressure mud.

The 6.98m diameter shield unexpectedly encountered a fault zone with mud at pressures up to 40 bar, which pushed the TBM back several metres and partly filled the tunnel for some distance (*T&TI*, April 2007, p6).

Mud problems were met approximately 4.2km into the drive after already having dealt with unexpected ground conditions that required chemical grouting to stabilise the face, bypass digs and overcutting to counter squeezing ground. Competent basalt had been anticipated, except for a few local faults, which consequently led to a standard DSU being specified for the job.

The company has, however, enjoyed far better geological conditions on the drive from the outlet portal.

The 6.98m DSU-TBM has bored more than 14km and has been regularly achieving advance rates of 500m-600m per month, and up to 900m in an early best month. The power tunnel is 26km long and Seli expects about half the length to be in poor ground.

Elsewhere in the country, Seli has also enjoyed success on the Beles Multipurpose ('Beles II') project with the completion of excavation of the tailrace tunnel, work having started in mid-2007.

The firm completed the 7km long tailrace drive in 11 months using a standard, 8.03m diameter DSU-TBM.

For the headrace tunnel though, one of the company's most advanced machines – its first EPB-DSU with capabilities including handling squeezing ground and face treatment.

The 8.1m diameter EPB machine was selected and specified to handle a long zone of soft lake deposits that is expected to stretch over approximately 2km while most of the bore is through granite. Almost two-thirds of the headrace tunnel – 7,400m – has been excavated since the machine was launched in October 2006.

Seli said that the TBM is now approaching the poorest ground on the drive and is preparing to switch over the excavation mode from open to EPB. The company has also supplied backups, rolling stock and ancillary equipment on the drives.

The main contractor on Gilgel Gibe II and Beles II is Italian firm Salini Costruttori, and the client is the state power utility, the Ethiopian Electric Power Corp.

Push below the Big Apple

Tunnel workers in the east bound tunnel of the East Side Access (ESA) project in New York. Contracting JV Dragados/ Judlau has completed the first drive of one of the rail project's bifurcation and the Seli TBM is being retracted for relaunch.

The 6.7m diameter Robbins machine driving the twin, parallel bore is making good progress to end its first run shortly (*T&TI*, July, p10). The TBMs were launched late last year on the Metropolitan Transportation Authority's project to connect the Long Island Rail Road (LIRR) to Manhattan's Grand Central Terminal.

AP PHOS/MARY ALTAFFER

Hole in road over TBM driving Gautrain tunnel, South Africa

Hole over TBM drive on SA's Gautrain project

A hole recently opened up just ahead of the 6.68m diameter TBM excavating below Oxford Road, Johannesburg, for part of the Gautrain tunnel project, being built by contractor Bombela Civils JV. Ground over where the shield was approaching was softened due to a leaking sewer in early July and a hole, which was 12m long by 7m wide, eventually developed before the pipeline was isolated. The road has since been repaired but concerns over the condition of utilities then instigated a regime of road closures into this month as the TBM was cleared to continue tunnelling (*T&TI*, July, p6). The TBM (S-386) was manufactured by Herrenknecht and will drive just over 2,820m on the project.

Above: The 5.3m diameter Robbins TBM assembly at Los Olmos, Peru; **Right:** The open shield was chosen due to high overburden

Odebrecht completes first third of Los Olmos

Odebrecht had excavated just over a third of the 13.9km long transfer tunnel in Peru by last month using a Robbins main beam TBM under high overburden conditions and despite flood damage to the jobsite earlier this year.

The 5.3m diameter TBM was launched in March 2007. Having advanced more than 5,150m by last month, the machine is more than half way into the scheduled construction period that ends in March 2009.

Geology along the alignment comprises quartz porphyry, andesite and tuff, the UCS ranges from 60MPa-225MPa and there are many faults, including two zones approximately 50m wide.

A major challenge for the high altitude project is the overburden of up to 1,800m and, therefore, the contractor elected not to have a shield TBM to avoid the possible risk of the machine becoming caught by squeezing ground.

An average progress rate of 22m per day has been achieved with best daily rates of up to 33.8m. The machine is equipped with a drill probe and is capable of overboring by 50mm. Support includes rock bolts, arches, ring beams, mesh and shotcrete.

The tunnel will be used to convey water from east to the west of the Andes as part of a 20-year build and operate concession awarded four years ago to Trasvace Olmos, a subsidiary of Odebrecht, by the national and regional governments. The subcontractor building the tunnel is Odebrecht Peru Ingeniera y Construccion (OPIC).

Crews are operating the TBM 18-20 hours each day with the balance a dedicated morning shift for routine maintenance and checks of equipment. The TBM is fitted with a ventilation and air cooling system designed by Robbins for the high temperatures in the tube. The system reduces the temperatures by about 20˚C from 52˚C. Robbins has the contract to supply the TBM plus the backup, spares, cutters and operational staff.

The TBM bore is only part of a transfer tunnel project that is 20km long in total. Efforts began in the 1950s using drill and blast methods to excavate the Olmos Trans-Andean tunnel, but the concept for the scheme goes back more than century (*T&TI*, November 2006, p11).

The first phase of the scheme is to be operational for irrigation by March 2010 and then more excavation – by drill and blast – is planned to build tunnels for hydropower generation.

Above: The Robbins TBM being prepared for launch at Los Olmos

Crossrail greenlight

The Crossrail project received Royal Assent last month. The Bill was first lodged in early 2005 and as good progress was made in its progression it had been anticipated, last year, that it might receive Royal Assent by April but planning was based on approval by mid-year.

With the powers now are in place under the Crossrail Act to build the £16bn (US$31.3bn) scheme, the developer - Cross London Rail Links (CLRL) – has a firm construction programme planned.

CLRL is in the process of procuring consultants and delivery partners for the project (see p11), enabling works are to start in 2009 and main construction is scheduled to commence in 2010 for trains to start running over 2017-18.

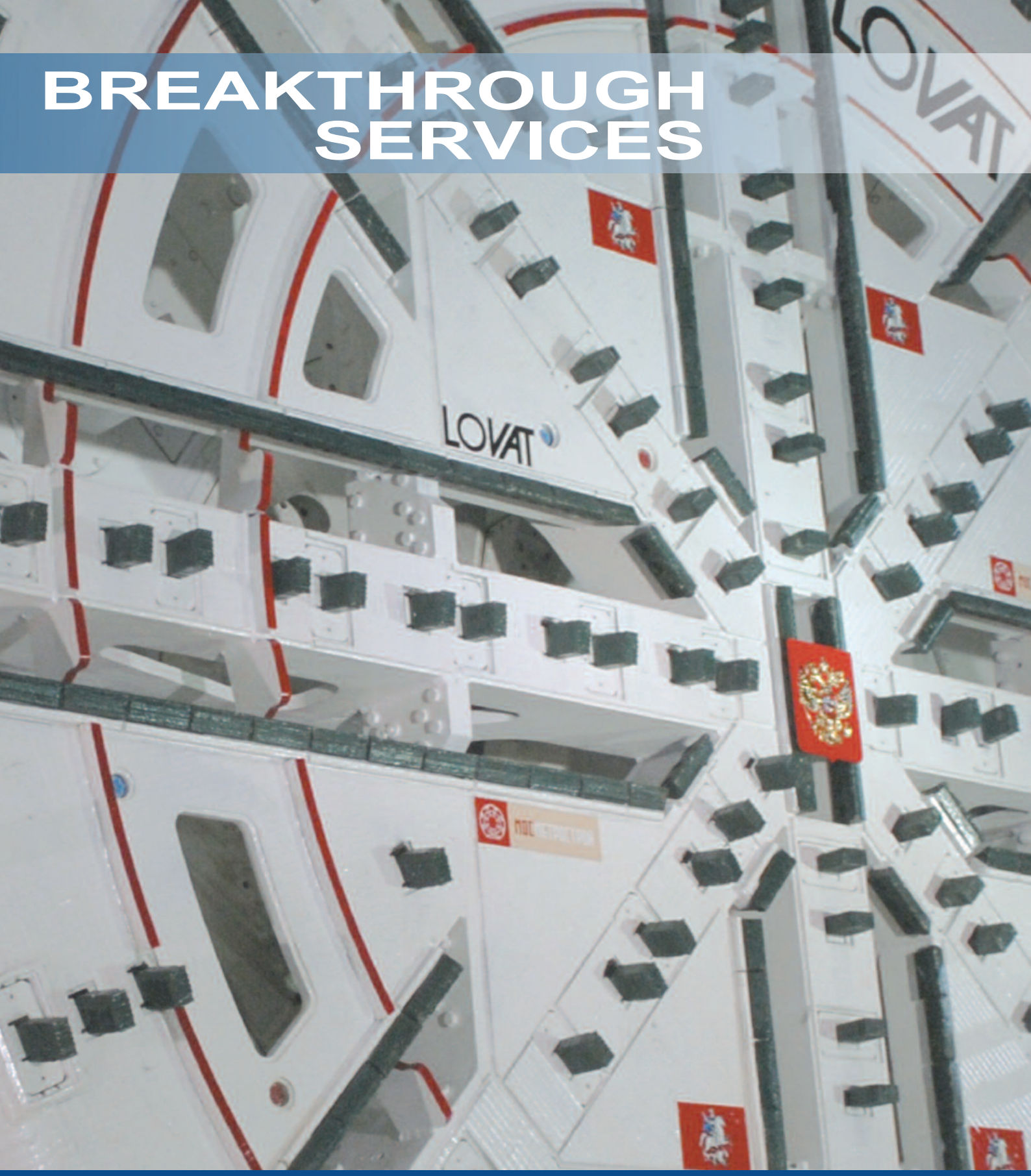
The scheme will create an east-west running main rail link through the heart of London, from Liverpool Street to Paddington with branches off each side of the capital.

The total length of the twin-track project is 118.5km, including a total of 41.5km of bored tunnels (earlier estimated at 46km) mostly through central London. Crossrail will also include eight underground stations and many deep shafts.

Tunnel excavation for the 6m i.d. tubes is expected to require seven TBMs – EPBMs for the drives under central London and a slurry shield for the crossings under the river Thames. The first machine is due to be launched in mid-2011.

The stations are to be constructed by SCL with steel fibre reinforcement for primary and secondary linings.

BREAKTHROUGH SERVICES



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First hole through for North Shore connector

The TBM driving the twin tunnels under the Allegheny river in Pittsburgh for the North Shore Connector light rail project has holed through on the first drive.

Contractor North Shore Constructors, a JV of Obayashi and Trumbull, launched the 6.5m diameter Herrenknecht Mixshield in late January. The launch had been scheduled for last year but poor ground conditions on the construction site on the north side of the river delayed the start of boring. The TBM arrived on site in August 2007.

Geology along the alignment comprises primarily silts, sands, gravel shales and claystone with lenses of limestone. Progress rates achieved during the drive with cover of 6.5m to the riverbed were up to 12.3m per day, as planned. The hydrostatic head at the deepest point on the 680m long drive was 14.5m.

The TBM (S-374) holed through south of the river on 10 July at the reception pit that had been excavated in the road between two buildings on Stanwix Street. The breakthrough was delayed a half day by a malfunctioning pillow block bearing on the slurry plant conveyor belt.

Last year the construction schedule anticipated that both bores would be completed by now but the shield is now being prepared to be relaunch on the northbound drive from Stanwix St. Along with the stations either side of the river and the cut and cover sections, the entire underground stretch of each tunnel is most of the 1.9km extension to the rail link.

The light rail project is being funded mostly with federal money and will enable further branches to help economic redevelopment of the region, said the Port Authority of Allegheny County.

In the early planning of the project the start of construction was scheduled for late 2005. However, when bids for the tunnel package were markedly higher than estimated the procurement was rethought and rebids were called for with different package possibilities.

The JV contractor won with a new package bid of US$156.5M for the tunnels and a stretch of alignment on the North Shore and the shell of the North Side station. The client's estimate of US$140M. The award was confirmed in early 2007.

The TBM driving the rail extension in Pittsburgh has completed the first bore

Tunnel bores advance in India hydels

Completion of the heading excavation for the headrace at Uri II and the pilot bore for the surgeshaft at Rampur, and also advancing ground treatment ahead of the recovered TBM at Parbati II, mark a series of milestones achieved in tunnelling works on hydro projects in India (hydels)

Project developer National Hydroelectric Power Corp (NHPC) has reported that the heading of the 4,233m long headrace tunnel at Uri II was finished at the end of June, and bench excavation of the 8.4m wide horseshoe shaped tube is 60% completed. The 240MW project is being built in Jammu & Kashmir.

More than 80% of the heading for the 3,615m long tailrace tunnel has been bored. NHPC said that almost a quarter of the bench excavation has been completed.

Other underground works on the project that have been completed include pressure shafts and the 133m long by 15m wide by 40m high powerhouse cavern. The project's transformer cavern is two-thirds complete.

At the Rampur project, which is being developed in Himachal Pradesh state by Satluj Jal Vidyut Nigam (SJVN), the 7.15m diameter pilot bore for the surgeshaft has been completed. The 149.4m pilot was excavated over 11 months and is to be widened to 38m diameter for the main surgeshaft by the end of the year. Works are being undertaken by the Patel Gammon JV.

Headrace drives are underway on multiple faces and progress has been slow due to poor ground. The circular, concrete-lined tunnel will be 10.5m i.d. and almost 15.1km long. Half of the heading was excavated by the end of June, and the target completion is late March 2009.

The heading for the 68m long, 10.5m diameter tailrace tunnel is to be completed a month earlier. Rampur also calls for a total of 3,300m of excavation for five adits.

Rampur is being built downstream of the Nathpa Jhakri plant on the Satluj river, and obtained US$400M in World Bank financing earlier this year. SJVN is developing the project with the state government, which has a 30% stake.

NHPC also reports that ground treatment was being finalised ahead of the recovered TBM on the Parbati II project in Himachal Pradesh state. The shield was excavating Face 4 on the headrace when, in November 2006, it was buried a heavy ingress of ground and water. Following months of recovery and repair, NHPC said the ground ahead of the TBM was almost ready for excavation to resume.

The 31.5km long headrace tunnel at Parbati II is being driven by both TBM and drill and blast, and by the end of June was just over 80% excavated. Almost 15% of the 6m diameter tunnel has been concrete lined. Both inclined pressure shafts have been completed (T&TI, January 2007, p9).

Swedish nuke waste vault verdict in '09

Above: Site investigation for Sweden's nuclear waste final repository; **below:** Tests at the Hard Rock Laboratory in Aspo

A choice between two locations for the site of the proposed underground storage vault for nuclear waste in Sweden is expected to be made by mid-2009.

Bedrock drilling at both sites – Forsmark, near Osthammar, and Laxemar, near Oskarshamn – that were completed at the end of last year. The Swedish Nuclear Fuel and Waste Management Co (SKB) said that both locations look favourable according to analyses performed so far.

SKB said it expects to choose the site in May or June next year and then submit an application around mid-2010 to develop the tunnels and cavern waste storage system. The towns and SKB hope that a decision on the application would be made around 2012-13.

Based on an approval of the project to the schedule envisaged, SKB said it would take approximately five years to excavate and complete the vaults – almost a decade after site is elected and application submitted.

The final repository vaults will be at depths of 400m-700m, and the spent fuel will be held in copper canisters that are welded shut and embedded in bentonite clay within deposit holes in the caverns.

At Forsmark, SKB is considering having the repository slightly deeper – approximately 450m-500m below the surface compared to early plans of 400m depth as rock stresses do not increase as rapidly as assumed. Deeper vaults are also better in terms of minimising the proximity of fracture zones. The preliminary site investigation data at Laxemar indicated that vaults could be located at a depth of approximately 500m.

SKB said in its interim research report of September 2007 that one of the construction challenges will be to develop grouts and equipment to manage inflows that may occur in the final repository. It added that a particular challenge would be learning to seal small fractures with high water pressures, especially as the grout must not produce a high alkaline leachate that would affect the storage capability.

Excavation research for the final repository project has been underway in co-operation with a number of countries on various aspects of general tunnelling, and also specific bores for deposition holes, at the Hard Rock Laboratory on Aspo, near Oskarshamn, on the south east coast.

Nuclear waste is presently stored at an interim repository near Oskarshamn, and a repository at the Forsmark power plant.

Walking under the Mersey

Above: A mass walk through the Queensway Tunnel in Liverpool as part of the city's celebration as 2008 European Capital of Culture

Ahead of the 75th Anniversary of the Queensway tunnel next year but on time approximately15,000 people took part in a walk through the 3.2km long tube below the Mersey before getting the ferry back. The closure for the walk was the fourth time in the tunnel's history and was a celebration of a key feature of the Liverpool as it is the 2008 the European Capital of Culture (pre-1999 the celebration was called the European City of Culture). Last year, the tunnel won plaudits as the safest structure of its kind and age in Europe. The single tube was refurbished and upgraded with a series of safety refuges added below the road deck by the owner and operator, Merseytravel (*T&TI*, February 2006, p24-26). The tunnel's sister tube, Kingsway is twin bore and opened in 1971.

Belfast bore advances

The 4.7m diameter Lovat EPBM working on the sewer upgrade project in Belfast was more than 156m into its second, 2.2km long drive by late last month, buildings 12 rings on average per shift.

JV contractor of Morgan Est/ Farrans (Construction) is installing the pit bottom crossing that will enable advance rates to increase to 18-19 rings per shift, said Lovat.

Best daily and weekly production rates for the mixed face EPBM have been 19 rings and 138 rings, respectively. The rings are 1.2m long and on the second drive so far the average mining time has been 20 minutes and the build time is 15 minutes.

Geology along the second drive comprises boulder clay in the early part and then a mix of clay, sandstone and malone sand. It is expected that dolerite intrusions may also be met, which would require a tool change from rippers to disc cutters.

Fast forward

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Progress in Vietnam

Cavico has recently made further headway with tunnelling work on hydro schemes in Vietnam with the breakthrough at the Nam Chien 2 project which followed a contract award at Huoi Quang and also at the Dambri and Dak My 4 schemes earlier in the year.

The company's progress extends its successful run of local tunnelling contract over the last couple of years in which it has also won work on projects including Ngoi Phat, Ta Thang, Nho Que 3, A Luoi and Thai An.

However, construction cost inflation has been adding margin pressure for the company, especially due to fuel costs. Clients on the strategic hydro project developments are starting to make cost adjustments as work continues, such as recently done for Cavico on the A Luoi scheme. The company said more than 80% of its entire construction workload is eligible for cost adjustments.

On the Nam Chien 2 project the contractor holed through on the 1,300m headrace tunnel contract two months early. The original contract was to drive 2,768m for US$4.7M but the length was reduced and price of the 4.8m diameter bore adjusted down to US$2.4M. Including the final concrete lining work the package is valued at US$3.52M. The work is to be finished by March 2009.

Nam Chien 2 is being developed by Northwest JSC in Son La province approximately 350km north west of Hanoi.

Cavico was recently awarded a US$9.43M contract for tunnelling work on the Huoi Quang project, one of the countries largest hydro schemes. Details on the work to be done were not immediately available, but the contract value is much less than the tunnelling awards totalling US$30.5M earlier in the year for construction on the Dambri project.

On the Dambri project the company is to drive bores of 5km and 3.2km, respectively, and up to 4.3m wide. The associated contract values are US$19.2M and US$11.3M. The client is South Hydropower JSC.

For the Dak My 4 project, the company is to build headrace tunnels and a surge tank for US$11M. The headrace tunnel will be 3.85km long and the surge tank 90m high with its diameter varying from 5m-8.6m. The client is Industrial and Urban Development Corp.

Light and show below

Recently discovered luminescent surface caused by crystalised zinc silicate, or willemite, after ultraviolet illumination of the brick lining of a remote tunnel in the Jihlava catacombs, near Prague, in the Czech Republic. The tunnel is the second to be found in the complex but the only one encrusted by willemite (Lubos Pavlicek/ AP/PA Photos).

Heavy engineering conservation work in the Saqqara Serapium – a tunnel of tombs at Saqqara, south of Cairo, which was discovered by French archeologist August Mariette in 1850 and has been closed to the public for 10 years (Nasser Nasser/AP/PA Photos).

Waterfront tunnel option alive in Seattle

The political wrangling and construction economics that favoured a replacement viaduct being built on the waterfront at Seattle instead of a tunnel, but failed to get clear public backing in a vote, will have to square up against underground alternatives later this year.

Tunnels options on the table are mainly for a four-lane bored tunnel or a four-lane cut and cover tunnel, although a four-lane lidded trench is also being considered.

Washington state government said that the central waterfront project is being approached from a broader, more geographically strategic perspective. It is looking at integrating the replacement for the Alaskan Way viaduct on SR 99 with a re-think on the entire transport network from Lake Washington to Elliott Bay.

In a statement, the state said: "We are reviewing a number of options for SR 99, including above-ground, surface and below-ground concepts".

More than a year ago the decision on how to replace the seismically-damaged and aging viaduct, which dominates the waterfront, was kicked into the long grass. The alternatives had been run for touch down by opposing teams at city and state level, but when the referee call was given to the public there was a marked failure to elect a clear winner.

Some 18 months ago the early tunnel option was for a six-lane structure, which as costed at US$4.6bn compared to a replaced viaduct being built for US$2.8bn. The tunnel cost was at least US$1bn up on the US$3bn-US$3.6bn for the 'core' project given in the Supplemental Draft Environmental Impact Statement (EIS) in mid-2006.

Before those adjustments the full cost of the tunnel option was put at US$3.7bn-US$4.5bn. The estimates went up due to the state not reflecting construction cost inflation and general inflation, noted an expert review panel.

However, as the opposing camps continued to fight over the viaduct or tunnel options the city authority pushed a smaller, four-lane tunnel concept shortly before the public vote (*T&TI*, June 2007, p7). The vote was instigated by the state governor to bring an end to the debate but did not work.

New prequals at S-C; Bilfinger countersues

Metro Vancouver has a contractor prequalification process underway at the stalled Seymour-Capilano project, in Canada, to finish the interrupted excavation while Bilfinger Berger – which saw its contract terminated over a tunnelling dispute – has launched a counter lawsuit against the client, Hatch Mott MacDonald (HMM) and a local authority.

The client plans to restart excavation of the twin tunnels on for the raw and treated water transfer scheme. When it terminated the right of Bilfinger Berger to continue with the contract, in May, approximately 55% of the 7.1km bores had been excavated. It said approximately 3km remains to be driven in each tunnel, mostly in granite.

At present, the equipment on site and the tunnels are being maintained by Procon Mining, which was hired by the client immediately upon it ending the contract with Bilfinger Berger.

Metro Vancouver has requested qualifications from 15 firms that have expressed interest in undertaking the works, and it led a surface-only site visit on 28 July. Discussions are underway on the type of contract and payment basis for the works, the client said.

It added that interested firms would receive general geological information from the original contract plus selected contractor drawings for the prequalification stage. More detailed information is to be given to shortlisted firms. HMM continues to serve the client on the project. Deadline for submissions is mid-August and the client hopes work can resume with a new contractor near the end of the year.

Bilfinger Berger suspended part of its tunnelling work in January over safety concerns caused by unexpected high insitu rock stress, which it claims meant the open TBMs and support system was unsuitable for those sections of undetermined length. It has countersued with claims there was no warning of such conditions in the bid documents. It added that the client had sole responsibility to provide a safe, viable design for tunnelling and support works, and that Metro Vancouver also took the geological risk on the project.

The contractor claims that proposals produced for the client by HMM for adjustments to the tunnelling and support were not properly authorised to enable contractual execution, and payment and programme consequences were not allowed for. It further adds that while the contract allows also for mediation this was not activated prior to the client terminating the contract and taking possession of its equipment and materials on site, including a pair of Robbins TBMs.

A lawsuit was then brought at the Supreme Court of British Columbia by The Greater Vancouver Water District, which together with some associated Greater Vancouver authorities operate jointly as Metro Vancouver. The suit was brought against the contractor: Bilfinger Berger AG and its subsidiaries Bilfinger Berger (Canada) and Fru-Con Construction, and the subsidiaries JV on the project (*T&TI*, June, p7).

In a countersuit, submitted in late June, the contractor has made claims jointly and severally against the client, HMM and North Vancouver, the landowner. The financial claims are unspecified as required by local law but it also has claim of Builders' Lien for Can$22.5M (US$21.3M) against outstanding invoices for the cost of labour, equipment and materials over January-May to maintain its capability to resume works. In addition, it expects its own and leased assets on site to be maintained before return, and said their value is more than Can$35M (US$33.2M) including Can$16M (US$15.2M) for the TBMs.

No date for the case has yet been set.

Bilfinger bid for the contract in August 2004 and was awarded a final lump sum contract of Can$103.4M (US$78.3M-2004 rates). It said the client's estimated was just under. Nearest bids were Can$186M from Frontier Kemper/Aecon/Shea and Can$237M from Kiewit.

Tarmac moves segment plant

UK construction and material group Tarmac is to relocate its tunnel segment manufacturing plant as part of a wider rationalisation of its precast concrete business. The tunnel segment manufacturing plant is to be moved within England from Kirkby, Nottinghamshire, to Tallington in Lincolnshire. Tarmac told *T&TI* that the changeover would take about six months and would not lead to a reduction in output of segments for the tunnelling sector.

Tarmac added that the majority of existing orders would likely be fulfilled at Kirkby but new orders would start to be transferred to the Tallington site, at which Tarmac plans significant investment in its general precast concrete production capabilities.

Details were not immediately available on whether the planned £1.5M (US$3M) investment in segment manufacturing plant at Tallington would lead to an increase in production capacity. The segments are marketed by Tarmac Precast Concrete under the Charcon Tunnels brand.

The Kirkby site is to be closed and about 130 workers are at risk of redundancy. At Tallington, the investment in tunnel segment production could create about 80 jobs. Tarmac added that the changes came from a review of its entire precast business as overall demand has decreased. The review of the business preceded the recent credit crunch.

Crossrail procurement pushes ahead

Close on the heels of winning legislative approval, London's £16bn (US$31.3bn) Crossrail project plans this month to invite prequalified firms to bid for contracts as framework consultants and delivery partners, and it expects to make appointments by the end of the year.

The project developer, Cross London Rail Links (CLRL), said that the definition design for the scheme should be ready next month for the new consultant framework partners to manage a programme of work packages. The definition design is being finalised by the multi-disciplinary consultants that have been onboard during the passage of the Bill through Parliament.

Separately, CLRL plans to use Optimised Contractor Involvement (OCI) for the scheme to have trains running east-west through the heart of London from 2017-18.

Calls for expressions of interest were issued in April for returns in May, and both attracted "very positive" responses. Enabling works are to start next year and main construction in 2010. Seven TBMs are to drive the 6m i.d. twin bores for rail project over a total distance of 41.5km, and the first is to be launched in mid-2011.

The developer previously said that early talks with industry indicated there was no appetite for Design & Build contracts. The OCI approach is a development of Early Contractor Involvement (ECI), and the client said "the aim is to engage the contractor at the optimal time before construction commences".

CLRL added that OCI should help get the right balance of design needed before a project is put to tender but still leave scope for contractor and supply chain ideas.

The bored tunnels packages are between: Royal Oak and Farringdon; Limmo and Farringdon (which may also include Stepney Green to Pudding Mill Lane if this section is not let separately); and, Plumstead to North Woolwich. The tubes are to run generally at depths of 20m-25m but will go down to 30m-35m and reach 40m-50m in east London.

Crossrail will also include eight underground stations. Five stations in central London will be constructed by SCL with steel fibre reinforcement for primary and secondary linings. The stations will typically be 245m long and of 95m^2 in section. There will also be three box stations, including the Woolwich box that was reintroduced through private sector intercession and sponsorship.

London cable tunnel fiesta

Three cable tunnels in London with a combined length of almost 30km are out for tender by National Grid, which has set submissions deadlines of early September.

National Grid is preparing the tender stage for a fourth 4m i.d. tunnel, but the schedule for issue of documents and submissions has yet to be fixed.

The longest tunnel amongst those out to tender is the Hackney to Willesden route, which is 22km long and will have nine permanent shafts and three temporary shafts.

The tunnel is split into two sections: Hackney to St John's Wood; Willesden to St John's Wood.

The entire tunnel between Hackney and Willesden is to be built over 2009-15. Geology along the alignment comprises mostly clay. The tunnel was designed by Donaldson Associates Ltd.

The shortest of the tunnels out to bid, at 7.1km long, is the Hurst to Eltham section, which will have three shafts. The tunnel is to be built over 2009-2014 and has been designed by PB Power. Excavation will be mostly through chalk.

The fourth tender that is to be called shortly will be for the Wimbledon to Kensal Green tunnel, which will be 12.4km long and have five shafts. At Kensal Green, the tunnel links with the Willesden to St John's Wood section of cable tunnel.

The construction programme calls for the Wimbledon to Kensal Green tunnel to be built over 2009-2016. Geology along the alignment is comprised mostly of clay. The designer is Mott MacDonald.

All tunnels four tunnels, with a total length of 41.5km, have been sized to provide space to lay additional 400kV cables in future, said the client. They will be excavated at depths of 12m-60m.

National Grid said the total investment in the four tunnels is approximately £600M (US$1.2bn).

Further ahead, it is considering construction of a 10.7km long cable tunnel from Eltham to New Cross.

National Grid has a number of cable tunnels in London out to tender

Nepal water tunnel for Pöyry JV

A design contract for a major water supply project in Nepal calling for a 26.5km long diversion tunnel and additional works has been awarded to a consortium including Pöyry.

Excavation work on the tunnel is due to commence next year and is scheduled for completion by 2013. It is being designed to transfer 170,000 m^3/day of water from the Melamchi river to Kathmandu valley.

The tunnel construction is the biggest civil works package on the US$350M Melamchi scheme to improve water supplies for Kathmandu, said Pöyry. Earlier plans for the tunnel, which will have a 7.5m^2 cross section, envisaged it to be 28km long. The Melamchi scheme is to be completed by mid-2013.

Funding for the project is being provided by the Asian Development Bank (ADB), Nordic Development Fund (NDC), the Japan Bank for International Co-operation (JBIC), the Japan International Cooperation Agency (JICA), OPEC, and also the local government which is contributing US$90M.

Pöyry said its share of the consultancy contract is approximately 7M Euro (US$11M), which is most of the design consortium fee. The other firms in the consortium are Hifab International of Sweden and local company Multi Consultants.

The green light for the delayed project was given after ADB agreed to revised terms for the project, including dropping its requirement to have a management company to oversee the country's water resources. Severn Trent Water, a UK utility, was initially selected but the government refused to ratify the appointment (*T&TI*, May, p6).

In February, ADB said that the overall project cost was US$317M, which was much lower than the estimate of US$464M in 2000. The bank is providing the project with loans totalling US$137M.

The project development work began in the late 1980s to address the long-term water shortage in the Kathmandu valley. It is proposed that the Melamchi project will be the first stage in a series of water transfer projects that tap the rivers of neighbouring valleys, such as the Yangri and Larke. Eventually, the scheme is to transfer more than 500,000m^3/day.

Lane Cove traffic weak for Moody's

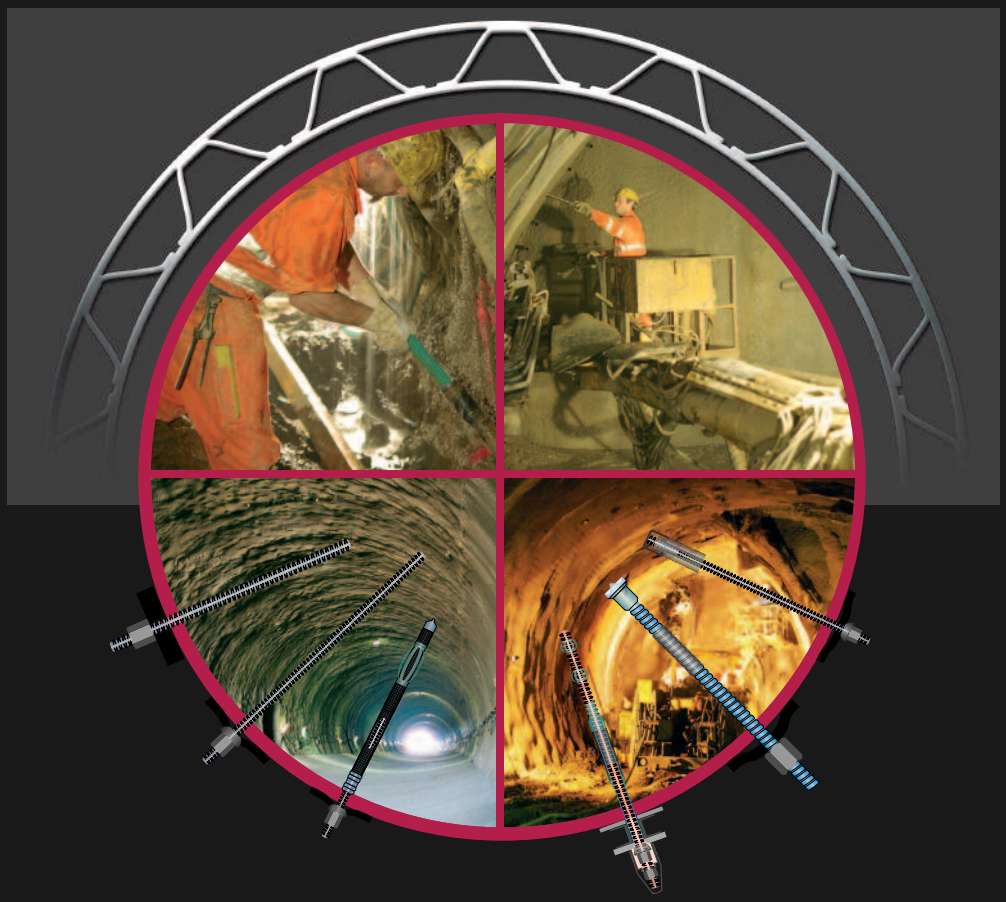
Ongoing weak traffic take-up of the Lane Cove toll tunnel in Sydney, Australia, has led Moody's to further downgrade its view on the scheme's finances.

Traffic volumes were down in May though had edged up slightly in the previous two months, helped by seasonal travel factors. The 3.6km long tunnel was opened in March 2007, a month early (*T&TI*, June, p13).

Moody's said volumes will not increase enough for Lane Cove Tunnel Finance Co to service debt at current levels. It added that the firm's parent, Connector Motorways Group (Connector), is developing a plan to re-capitalise the business, and has sufficient liquidity to meet cash calls until mid-2009, and further if volumes rise.

The credit ratings agency downgraded the senior secured rating of Lane Cove Tunnel Finance Co from Ba3 to B2, and the rating remains under review. The change affects Aus$1.14bn (US$1.08bn) of debt.

GROUND CONTROL SOLUTIONS



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E-Mail office@alwag.com

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Creator of underground spaces

Precision acquisition

Leading German exploration and geo-surveying company, DMT, has introduced three instruments for planning, construction and operation:

Summit II Monitoring is the latest multi-channel engineering seismograph. With up to 24 channels, the box has a frequency range from 0.1 to 24kHz for continuous or event-based recording. Communication is via Ethernet, USB or wireless. It is said to offer excellent time accuracy (GPS or DCF), a high dynamic range with 24 bit technology and a low noise level "for ultra sensitive observations".

GYROMAT 3000 is claimed to be the most accurate precision surveying gyroscope worldwide. Ergonomically designed with wireless remote control and data transmission, the GYROMAT 3000 offers a fully-automated measuring sequence with a claimed precision of 1 mgon within a measuring time of approximately 10 minutes.

DMT CoreScan II is designed for drill-core image acquisition, evaluation and storage of full circumference and slabbed cores. An integrated data management system allows the building up of a digital drill-core library. CoreLog integration, evaluation and orientation of structures, derivation of geomechanical parameters, true depth, strike and dip, differentiation of mineral phases, grain size distribution and analysis, porosity analysis, and quality management and assurance are the claimed features of this system and software. It is applicable in exploration, geotechnics and scientific deep drilling.

DMT
Tel: +49 201 172 1970
Email: exploration@dmt.de
Web: www.dmt.de

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 Setout, TMS Profile and TMS Tunnelscan.

Amberg Technologies
Tel: +41 44 870 92 22
Email: info@amberg.ch
Web: www.amberg.ch

Scan plan

The Atlas Copco Tunnel Profiler is a fully integrated 3D scanning system designed to tell the drill rig operator, after just a few minutes of scanning, how the excavation conforms to the pre-planned design. Using the system, underbreak, overbreak and shotcrete thickness can be checked and corrected at an early stage of the tunnelling cycle, says Atlas Copco.

After setup at the face, the Atlas Copco Tunnel Profiler conducts three-dimensional automatic scanning of a defined section. The resulting data is immediately available and displayed in the Rig Control System (RCS) with a claimed coordinate accuracy of +/- 2cm.

It takes about five minutes to scan a 65m^2 face/roof area, Atlas Copco says. The underbreak and overbreak is calculated and presented graphically to the operator on the RCS screen.

Atlas Copco
Tel: +46 (0) 19 670 7516
Email: morgan.kanflod@se.atlascopco.com
Web: www.atlascopco.com

Controlled combustion

Controls offers the 75-B0008 automatic analyser, which uses the ignition method for what the company says is a fast and precise determination of bitumen content. It has an automatic test cycle with simultaneous display of all the test parameters.

The heating system, with additional burner, is said to conform to CE specifications and offer complete combustion of exhaust fumes. Other features of the 75-B0008 analyser include:

- PID closed loop temperature control
- Test performance menu comprising the simultaneous display of all the test data
- Internal database, up to 100 tests. Each test can be displayed and printed, or sent to a PC
- Optional Windows XP software

The machine is, says Controls, provided with a high-precision system combining an ignition oven and continuous weighing system to detect the weight decrease of the asphalt sample and automatically detect the end of the test and the binder percentage.

A second, independently controlled, combustion chamber is designed to decrease exhaust fumes.

Controls
Tel: +39 029 21841
Email: controls@controls.it
Web: www.controls.it

All angles covered

Geokon's Model 6100 MEMS inclinometer probe uses two micro-electro-mechanical systems (MEMS) sensors as basic tilt sensors. It is used in conjunction with inclinometer casing to measure lateral deformation that might occur in tunnels, unstable slopes, landslides, dam and roadway embankments, landfills, walls of excavations, shafts, caissons and piles.

The Model 6100 is said to offer a significant reduction in cost and a gain in robustness over more conventional inclinometer probes using servo-accelerometer sensors.

Its range is ±15° and the resolution is 10 arc seconds. Total system accuracy is said to be 6mm/30m. Readout is via the Geokon GK-603 readout box.

MEMS sensor technology is also available in tilt meters and in-place/horizontal inclinometers.

Geokon
Tel: +1 603 448 1562
Email: chuck@geokon.com
Web: www.geokon.com

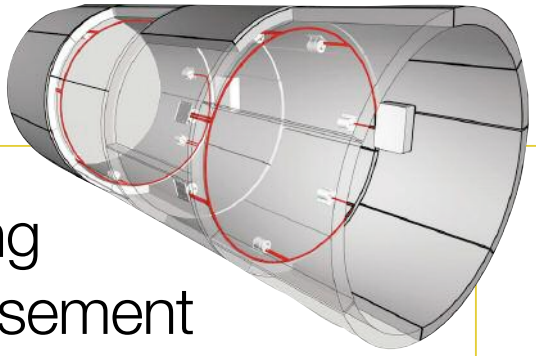
Avoiding overload

Localised pipe overload and angular deflections during pipe installation can cause pipe damage. Sometimes spalling or longitudinal cracks are only detected years later when leaks occur. Herrenknecht has expanded its product portfolio in order to reduce this risk.

The Online Load Control (OLC) system is designed to allow the user to avoid overloads in advance. Four distance sensors measure the gap widths of selected pipe joints. The angular deflection is calculated according to the latest standards (A125) of the German Association for Water, Wastewater and Waste (DWA). It is then compared and recorded in detail by the data acquisition system.

But Herrenknecht says that the OLC offers even more: "The admissible load of the joint 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 visualised. 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."

Herrenknecht
Tel: +49 7824 302 0
Email: pr@herrenknecht.com
Web: www.herrenknecht.com



Ringing endorsement

Clients often define specific locations where deformation measurements have to be performed by the contractor along segmentally lined tunnel projects. According to VMT, the most important considerations to the initial deformation of a ring that has just been built are the pressure of the jacks during the next advance and the subsequent load changes. For example, the passing of the shield's tail, primary and secondary grouting, passing of the last back-up trailer and any potential long-term effects.

The company's Ring Convergence Measurement System, RCMS, is based on the implementation of a series of inclinometers on the ring to be observed for deformation.

One inclinometer is installed in each segment of the ring to be measured. VMT explains: "Deformations can only take place along the longitudinal joints, which are treated as articulations. Any movements of the rigid segments have as primary components some changes of their vertical inclinations, which can be observed by appropriately installed inclinometers."

Deformation measurements by the RCMS for evaluation of the changes in shape of the ring within the confined back up equipment area, where conventional survey techniques are problematic to say the least, are now in use on several projects in Europe, says VMT.

VMT
Tel: +49 7251 96 99 0
Email: international@vmt-gmbh.de
Web: www.vmt-gmbh.de

Core competence

Devico is supplier of directional core drilling equipment and surveying tools for tunnel ground investigation and mineral exploration. The company offers services and tools in the following segments:

- Directional core drilling – DeviDrill system comprising steerable wireline core barrel including Measure While Drilling system, as well as software for borehole planning, borehole data survey presentation and calculations
- Borehole surveying – of family magnetic and non-magnetic tools including DeviTool – Standard probe, acc-mac based multishot inclinometer; DeviTool - Pee Wee probe, small diameter (30mm) acc-mac based multishot inclinometer; DeviFlex – non-magnetic surveying tool, and DeviCore – continuous core orientation system
- Software – DeviSoft – Windows-based software for borehole planning, surveying data presentation, reporting and plotting

The company also specialises in project execution worldwide and is a major directional core drilling supplier on the HATS – 2A project, Hong Kong, as well a number of prospecting projects.

Devico
Tel: +47 72 87 01 01
Web: www.devico.com

Vibration watch

Instantel says that its monitors have set the standard in more than 100 countries for 25 years and the company expects the Minimate Pro^6 vibration monitor to set a new standard for tunnelling professionals worldwide.

The Series IV Minimate Pro^6 is, says Instantel, built for long-term monitoring in extreme environments. The design includes a cast aluminium case, water-resistant connectors and improved RF and EMI shielding.

Combined with ethernet communications for local networking, a real-time operating system, and expanded memory, the Minimate Pro^6 is said to offer unrivalled features in a compact unit.

The six channel capacity allows for two smart, plug and play, tri-axial geophones. Each monitoring point can be up to a kilometre away from the unit with additional extension cables.

The Instantel Auto Call Home feature, available with the Blastware Compliance Module companion software, is designed to monitor and collect data remotely.

Instantel
Tel: +1 613 592 4642
Email: sales@instantel.com
Web: www.instantel.com

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Drilling for quality

Rock drilling tools supplier Helso specialises in button bits 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
Tel: +358 192 461 101
Email: info@helso.fi
Web: www.helso.fi

Making the cut

Alpine Equipment has supplied roadheaders and shaft sinking machines since 1968. New to the company'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 cutter head, hammer, drill-bolter, 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.

Alpine's line-up of cutters is claimed to offer the most cutting force in the industry thanks to patented gear reduction and the drum and pick configuration.

Alpine Equipment
Tel: +1 814 466 7134
Email: info@alpine-aec.com
Web: www.alpinecutters.com

Precision rigs get bigger

Boomer E-series – Atlas Copco's newest series of face drilling rigs for medium to large tunnels – can be delivered with a row of options such as the Rod Handling System E, specially designed for the E-series.

The Boomer E-series is the first generation of drill rigs equipped with the BUT 45 boom which, the company says, represents a rethink of the rotation units, resulting in the BHR 20 with its double rotation head.

Offering ±190° of rotation around the axis of the boom and a choice of top- or side-mounted feeds, the BHR 20 is claimed to open the way to faster boom and feed movements when drilling the tunnel face or roof.

With ±135° of sideways boom rotation and higher bracing force, crosscut and rock bolt drilling is said to require fewer set-ups. The increased boom stiffness permits a longer boom extension and more accurate positioning, resulting in greater coverage area and more precise drilling, says Atlas Copco.

The higher carrying capacity of the BUT 45 allows more flexibility of choice of boom-mounted options, such as the Rod Handling System, RHS E, which is developed solely for the E-series rigs and can accommodate eight 10ft or 10 8ft extension rods. RHS E enables the drilling of longer holes, for grouting, probing or drainage, without manual rod extension.

Boomer E-series rigs are equipped with one to three booms and the rigs feature the computerised Rig Control System (RCS) for improved control of the drilling process, and boom and feed movements.

The COP 3038 rock drill, claimed to be the fastest in the field with a top penetration rate of over 5m/min, can also be fitted to the Boomer E-series.

Atlas Copco
Tel: +46 (0) 19 670 7516
Email: morgan.kanflod@se.atlascopco.com
Web: www.atlascopco.com

Maintaining the seal

The Chongming Island tunnel project comprises two tunnels of 3736 rings, (2m) each, under the Yangtze River in China. Two 15.43m diameter slurry machines were used for this job. One major concern was keeping the tail seal system working properly (to ensure safety and good grouting conditions) under a hydrostatic pressure of up to 7 bar (8 bar grout injection).

Condat China was chosen as supplier of all sealing and lubricating products: WR89, HBW, GR130, and Hydrolub ZS46.

The first tube has been completed and the second machine is awaited for breakthrough in August after respectively 3736 rings and 3000 rings boring. There have, says Condat China, been no leaks on the wire brushes thanks to the high performance of the WR89. The sealing brushes of the first machine are said to have remained in excellent conditions with less than 0.2mm of wear.

The main bearing protection was performed with GR130 and HBW and grease analysis proved that no pollution occurred in this very sensitive point of the TBM, says Condat.

Condat
Tel: +33 (0) 4 7807 3838
Web: www.condat-lubricants.com

Precise guidance

Guidance systems specialist VMT recently expanded its product portfolio to include a navigation system for roadheaders (SLS-Roadheader). Based on a motorised theodolite, the continuous position of the cutting tool is displayed on the machine monitor in near real-time, permitting precise excavation.

Expensive and time-consuming rework is said to be avoided and production times are, claims the company, 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 and the cutter arm's overbreak and underbreak can be documented in reports.

With the WLAN tunnel data network developed by VMT, the SLS-Roadheader navigation system is integrated in the existing site network. 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.

Meanwhile, the SLS-SL and SLS-HR guidance systems for segmentally lined tunnels are characterised by a basic structure that combines hardware and software. The SLS concept ensures unified data processing and operation. VMT says the systems have been successfully applied on shield and gripper tunnel boring machines. They can be used for driving tunnels in soft or hard rock.

Both guidance systems are target unit based and, in both systems, the beam from the laser theodolite is projected onto the Active Laser Target Unit, which is mounted in the shield or on the machine frame of the TBM where the position and orientation of the laser beam is determined and the pitch and roll of the machine is measured.

During the tunnel advance, the position of the target unit is continuously measured and its position in relation to the axis is determined by transformation and shown to the operator.

The use of the Ring Management Programme is said to give optimal sequence and rotation of the segments to improve the build quality of the ring.

VMT
Tel: +49 7251 96 99 0
Email: international@vmt-gmbh.de
Web: www.vmt-gmbh.de

Tooled up

BETEK offers complete tool systems for road header 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 weld-on 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 adds.

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 customised solutions," the company adds.

BETEK
Tel: +49 7422 565 130
Email: e.staiger@betek.de
Web: www.betek.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^2 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 utilise 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 i-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, optimised 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
Tel: +46 (0) 26 260000
Email: nina.lehtonen@sandvik.com
Web: www.sandvik.com

Flexible roadheaders

Antraquip is a leading manufacturer of roadheaders, hydraulic rock cutting attachments, shaft sinkers, special tracked machines with a variety of boom options, and tunnel support systems. The company's roadheaders and rock cutting attachments are currently being used all over the world.

Antraquip offers standard machines in the 12 to 70t weight class as well as project-oriented engineering solutions. Based on what it describes as a committed staff of service engineers and a large parts inventory for its own machines, Antraquip says it continues to be a reliable partner for any tunnelling project.

Antraquip
Tel: +1 301 665 1165
Email: sales@antraquip.net
Web: www.antraquip.net

Blast-free fracturing

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

Dã-mite is mixed with water and placed in pre-drilled holes, where it sets and expands with a compressive strength of over 18,000psi – Dã-mite has more than enough force to get the job done. No license or permits are required. There are four grades of Dã-mite, providing enough versatility to be used in drilled hole diameters from 1in to 3in.

Daigh Company
Web: www.daighcompany.com

Record-breaking TBMs

Herrenknecht develops, manufactures and sells mechanised tunnelling systems with diameters ranging from 0.1m to 19m. The systems are individually adapted to the projects and their specific geological and hydrological conditions. For traffic tunnelling (Ø >4.2m), the product portfolio includes hard rock machines and open-face shields, earth pressure balance shields and Mixshields.

Herrenknecht completes its business with a range of services, and 41 subsidiaries as well as eight associated companies are part of the Herrenknecht Group.

In Shanghai, two tunnels are being excavated with the world's largest diameter TBM to date. The TBMs (Ø 15.43m) are crossing beneath the Yangtze River to connect to the Changxing River Island with two 7.47km, three-lane road tunnels.

The first Herrenknecht Mixshield (S-317) started in September 2006 and reached the target shaft end of May 2008. The second TBM (S-318) is expected to reach its goal in August 2008. These two tunnels are to be opened for traffic in April 2010 when Shanghai hosts the World Expo.

With its 2 x 57km tubes, the Gotthard Base Tunnel in Switzerland will be the longest railway tunnel in the world, says Herrenknecht. The company's Gripper TBMs have already excavated nearly 55km and, in total, they will bore and secure 90km of the two main tubes.

Herrenknecht
Tel. +49 7824 302 0
Email: pr@herrenknecht.com
Web: www.herrenknecht.com

Online guidance

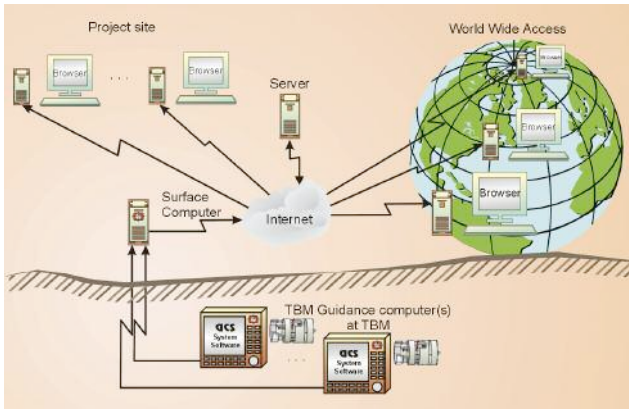
The acs WebInfo application is an enhancement of tacs' acs Viewer application, which is usually used in the network on a local construction site.

The company explains: "For the acs WebInfo application you just require a computer with internet access and a standard web browser and you have world-wide access to the actual position of your TBM and information provided from the acs Guidance System. No additional software is required."

Graphical information windows are provided on a web server. This information includes:

- TBM position – actual position of the TBM
- Ring position – position of the last erected ring
- Clearance – clearance and position of the last erected ring inside the TBM tail shield
- Plan view – plan view of the project with actual graphical position of the TBM
- Geological profile – geological profile of the project with actual graphical position of the TBM

tacs
Tel: +49 89 7857 675 0
Email: info@tacsgmbh.de
Web: www.tacsgmbh.de



Clean excavation

The ITC Superloader 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^3/min, even under difficult conditions such as hard and abrasive rock. ITC says a 20m^3 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
Web: www.itcsa.com

Cutting remarks

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

The company recently released its improved TD Rockwheel range, a series of hydraulic excavator-mounted attachments (otherwise known as rotary cutters or transverse cutting units).

The Rockwheel can be used in conjunction with, or as an alternative to, hydraulic hammers and buckets. The TCU is claimed to provide 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.

The Rockwheel features a direct drive design. A high torque, low speed hydraulic motor is mounted between the two cutting heads, each of which has its own bearing assembly. A motor is selected to suit the hydraulics for the selected excavator range with a torque range capable of giving the maximum pick forces possible. The set up process is now made much easier when matching the unit to the excavator's hydraulic power band, says Webster.

Each unit has two cutting drums mounted on a transverse shaft driven by a hydraulic motor powered and controlled from the excavator's auxiliary hydraulic circuit.

The 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.

Webster Equipment
Tel: +44 114 2488262
Email: info@websterequipment.com
Web: www.websterequipment.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 94m2 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
Web: www.eickhoff-bochum.de

Guiding light

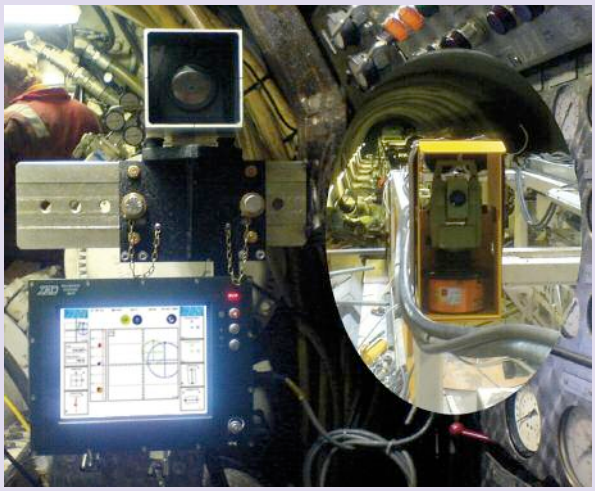
TBM guidance systems manufactured by ZED are modular so that they can be assembled and configured by the customer to suit a given set of requirements.

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-screen display, accessing pages showing graphics of all guidance and associated survey data. Unit packaging uses milled aluminium boxes, without welded joints and O-ring sealed lids.

ZED Tunnel Guidance
Tel: +44 1932 251 440
Email: sales@zed-tg.co.uk
Web: www.zed-tg.co.uk



Compact tunnel boring

The compact DSU TBM and its back-up have been designed by SELI to reduce to a minimum transport, assembly and operation costs. This is said to allow the company to make the mechanised boring of shorter tunnels much more competitive.

Says SELI: "The main aim of this type of equipment is to be very short (in particular, the space between TBM and back-up is generally about 50m) and to consist of just a few elements."

There are a limited number of service decks pre-assembled and wired-up. Each deck is designed for a particular kind of service (hydraulic, electric, ventilation, tunnel lines, and so on), and the size of its container is said to make transport and assembly on the jobsite quicker and easier.

The TBM can be disassembled in several parts, which can then be transported by containers, saving time and money, says SELI.

The heavy-duty system is claimed to be reliable and features of DSU are said to include a wide range of rock supports.

SELI
Tel: +39 06 5929 241
Email: selispa@selitunnel.com
Web: www.selitunnel.com

Customised cutters

One of TunnelTec's core competences is the supply of specialised drilling tools for soft rock TBMs. Claimed special features of these tools are their durability and efficiency. The tools are mounted on existing cutterheads without any further alterations. Roller discs suitable for the geology complement the tools selection.

TunnelTec says its tools allow the daily headway of the TBM to be increased, and tool changes and down times to be reduced.

TunnelTec also supplies complete, customised cutterheads for microtunnelling machines and what it says is the first rock cutterhead equipped with double roller cutters so that it can be converted from hard rock to soft ground conditions.

In addition, TunnelTec offers analysis and optimisation of cutterhead designs, which, it claims, can lead to significantly improved tunnelling advances. It adds: "Optimised centre and gauge openings and a change in cutterhead tool arrangements often result in remarkable improvements."

Finally, the company offers full service for tunnel construction projects from consulting to project planning and sale, as well as TBM overhauling.

TunnelTec
Tel: +49 (0) 2431 948 200
Email: support@tunneltec.de
Web: www.tunneltec.com

Getting the thread

Rockmore International has announced a new thread design, XR32, designed to improve precision and efficiency in drifting and tunnelling operations, and to extend thread life.

The company claims that extensive lab and field testing has demonstrated the effectiveness of the XR32 thread system in providing more efficient energy transfer, higher bit penetration rates, and longer thread life for both bit and rod.

The new XR32 thread is employed at the bit connection end for hex drifting and tunnelling rods, and is used for both male and female components – both tunnelling bit and rod. The other end of the rod, connected to the coupling or shank adapter, has a standard thread such as R38 or T38. "That means smooth integration into your existing drill string," says Rockmore.

In standard R32 connections, the end of the male rod is seated at the bottom of the bit cavity. As a result, percussive energy travels through the rod and bit threads, causing excess vibration and thread wear. The new XR32 connection is designed to provide stability at the thread end, reducing stress on the thread connection. The ContactZone design is said to provide stronger rod support, increased rigidity and added strength to minimise rod bending due to complex rock formations or uneven surfaces. This means less wear, higher precision collaring and straighter holes, according to Rockmore.

The XR32 is designed to create a rigid, powerful drill string. Better bit guidance is said to result in increased hole precision and better drilling accuracy, while less reflex vibration is claimed to mean less wear and increased thread life for both bit and rod.

Rockmore International
Tel: +1 503 682 1001
Email: info@rockmore-intl.com
Web: www.rockmore-intl.com

Onsite first assembly

The Robbins Company manufactures TBMs for the tunnelling industry custom-designed to specific project requirements. TBMs are available in several types, including main beam, double shield, single shield, and now earth pressure balance machines (EPBs).

In 2008, Robbins ventured into the soft ground tunnelling market to supply EPBs worldwide. Orders have been received for EPBs in China, the US and Azerbaijan in addition to two 6.5m EPBs currently excavating the New Delhi Metro extension project in India.

Also in 2008, Robbins has continued development of a new assembly process called Onsite First Time Assembly (OFTA). This allows for the TBM to be assembled onsite rather than in a manufacturing facility and is said to save time on the construction schedule as well as shipping costs.

First used on the world's largest hard rock TBM (14.4m diameter) at the Niagara Tunnel Project, OFTA is now being used for shielded machines as well. Using this method, Robbins recently completed assembly of a 10m diameter double shield machine for India's AMR project, and assembly of a 12.4m main beam machine at China's Jinping-II project is ongoing.

The Robbins Company
Tel: +1 440 248 3303
Web: www.therobbinscompany.com

Successes in China boost sales

NFM Technologies specialises 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@nfm-technologies.com
Web: www.nfm-technologies.com

Custom versatility

Lovat 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.

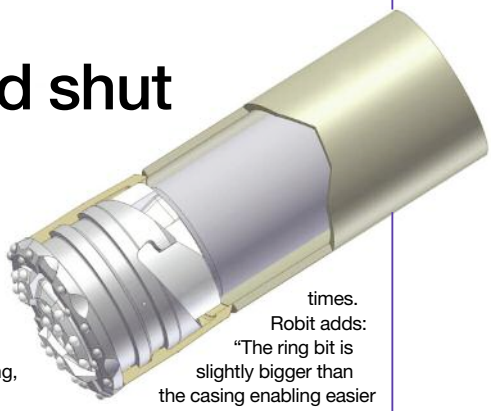
Lovat
Tel: +1 416 675 3293
Email: tbm@lovat.com
Web: www.lovat.com

Simple surveying

VidaLaser tunnel lasers are produced in a range of versions and models. The Halley86 5mW output power is the biggest, and the 12Vdc version comes in 12Vdc or 230Vac versions. The FBL91 2mW is used for small work while the VL102 is a special laser for drilling machines. The company also produces an anti-explosion tunnel laser.

vidaLaser
Tel. +39 02 9371038
Email: info@vidalaser.com
Web: www.vidalaser.com

Open and shut case



Robit casing systems consist of pilot bit and ring bit using a patented locking system designed to be easy to use. They can be used for ground drilling applications such as forepoling, anchoring, piling, water and thermal well drilling, site investigation and horizontal drilling.

RoX and RoX+ series are for various top hammer drilling applications with relatively shallow hole requirements. Robit down-the-hole system DTH-RoX+ is for permanent casing drilling applications which require deeper holes with larger diameters. More robust design of the heavy duty ring bits enables wells and piles more than 100m deep, says the company.

With what is described as a stronger and more durable composition, the multi-use series is designed to be used several times.

Robit adds: "The ring bit is slightly bigger than the casing enabling easier recovery of the casings from the ground. This is a useful feature whenever there is a need for temporary casing."

Concept 3-1 pilot bit is a new product in the Robit casing systems product line designed to be compatible with the standard DTH, multi-use, and horizontal drilling ring bits. Set-up times are shorter and tool inventory levels lower since the same pilot bit fits for different applications, the company explains.

Robit Casing Systems
Tel: +358 3 3140 3400
Email: robit@robit.fi
Web: www.robit.fi

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 is 12.5kg.

The company adds: "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 cuttershop, reduces downtime and increases productivity of the TBM and reduces heavy work for the TBM operators."

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

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

Split-Ring
Tel: +47 4816 3940
Email: post@split-ring.no

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: +44 191 516 5353
Email: sales@continental-conveyor.co.uk
Web: www.continental-conveyor.co.uk

Capable conveying

Marti Technik has developed a range of systems for muck removal with the goal of maximising 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."

Among the projects Marti Technik has been involved in are:

- Sydney desalination plant, Australia: 2 x 2500m, 240tph
- Perschling tunnels, Austria: 2900m in total
- Line 4, São Paulo Metro, Brazil: 7860m, 20 horizontal curves, three boosters
- Jinping II HEPP, China: 7200m, 6200tph & 14700m, 1800tph, one booster
- Castle Peak Cable Tunnel, Hong Kong: 4500m
- Crevola Toce III HEPP, Italy: 6200m, 500m radius curve, one booster
- Aica-Mules exploratory tunnel, Brenner, Italy: 10500m, 450tph, two boosters
- Appennine Bypass, Bologna-Florence, Italy: 2030m
- Gautrain, South Africa: 3000m, 450tph
- Hallandsås, Sweden: 7500m, 1200tph.
- Bure, Transjurane motorway A16, Switzerland: 2900m

Marti Technik
Tel. +41 31 858 33 88
Web: www.martitechnik.ch

Communicating the message

Austdac is one of Australia's largest suppliers of conveyor communication and signalling systems for tunnelling projects. The Austdac tunnelling system uses a single cable and eliminates the need for a wire-rope pullwire. This is said to remove the need to have a tensioned pull-wire switch, reducing spurious tripping of the switches.

It is designed for non-hazardous areas, but is claimed to include all the benefits of the underground conveyor system, such as communications, safety, reliability, easy installation and fault finding, yet remains price competitive. It has proven to be an effective tool to increase productivity and reduce downtime.

The system is designed to provide a fully monitored prestart audio/visual alarm, plus emergency stop over a long distance. Says Austdac: "Switch lock-out is indicated accurately and there is full two-way voice communication between stations along the conveyor using IP68 microphones."

Additional claimed features include fault detection, volume detection, LCD backlit displays, and back-up batteries for every amplifier. Each amplifier is designed to indicate any individual faults for line current, battery voltage, PSDA and speaker. The cable can carry other analogue and digital signals such as for temperature monitoring and motor currents. Full PLC interfacing provides conveyor logic control and there can be a direct communications link to the surface.

Recent projects in which Austdac was involved include providing the conveyor monitoring and control system for the Bogong Tunnel in the Australian Snowy Mountains, and the Pike River Tunnel Project New Zealand.

Austdac
Tel +61 2 8851 5000
Email: austdac.nsw@austdac.com.au
Web: www.austdac.com.au

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 Anläggngsen-treprenad, 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 18.2m² face areas according to project manager, Peter Ahlgren.

A digging arm loads the rock onto a conveyor, which fills the haulage trucks at a constant rate. The conveyor can be raised and lowered to suit the loading height of different haulage vehicles; allowing the 10 HR to operate on ramps as steep as 1:7 going down and 1:5 going up.

The 10 HR offers a loading capacity of 3-4 m³/min and has an electric-powered hydraulic system to ensure good air quality.

GIA Industri
Tel: +46 240 797 00
Email: info@gia.se
Web: www.gia.se

Compact flexibility for soilds separation

Schauenburg MAB supplies soil separation plants for the regeneration of bentonite suspensions in:

- Slurry TBM/microtunnelling – solids removal from slurry circuit
- Horizontal directional drilling (HDD) – recycling of drilling mud
- Slurry wall/diaphragm wall construction – solids control of bentonite suspension

The company has redesigned soil separation plants with slurry capacities ranging from 100m^3/h-500m^3/h to be used in conjunction with microtunnelling machines with a focus on easy transportation and erection on site. All components of the separation plants are installed inside standard ISO container frames of 20ft or 40ft and are available in three configurations. Separation plants for bigger slurry TBMs with throughput capacities up to 4000m^3/h are available in semi-mobile, containerised or stationary design and are built according specific project requirements. Recycling plants for HDD drilling range from 25m^3/h to 300m^3/h.

Separation plants are equipped with double hydrocyclone system for desanding and desilting and are claimed to be the most compact and flexible plants on the market in terms of transportation and erection.

Schauenburg MAB
Tel: +49 (0) 208 9991 0
Email: hwm@hwm-engineering.de
Web: www.schauenburg-mab.com

Rocking and rolling

Mining Equipment supplies new and remanufactured rolling stock and tunnelling equipment. Examples 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
Tel: + 1 970 259 0412
Email: info@miningequipmentltd.com
Web: www.miningequipmentltd.com

Fast desilting

Solids 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 Hydrofraise 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, double-deck shaker with more than 4.8m^2 of screening area spread over the two inclined decks, each of which carry four interchangeable, pre-tensioned, stainless steel woven wire screen panels. Twelve extra-long bodied 5" hydrocyclones 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 flowrate of up to 300m^3/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.

PSD
Tel: +44 1772 690076
Email: adam@psdmud.co.uk
Web: www.solidseparation.com

Conveyor taken to new lengths

The Robbins Company specialises in the design and manufacture of continuously extending conveyor systems for use behind TBMs. The company also produces muck removal systems for drill and blast tunnels, mines and quarries.

Robbins conveyor systems have been used in several projects in 2008. The East Side Access Project, in New York City, is said to use efficient muck removal in an urban setting using several different belt conveyors. The system transports muck across a busy highway and underneath a metro line using overland conveyors and a completely enclosed box truss.

Another project, this time located in India, will feature one of the longest single-flight conveyor systems ever. The Pula Subbaiah Veligonda conveyor system will use steel cable belt and will stretch up to 19.2km using one main and three booster drives. The conveyor components have also been designed as interchangeable with the nearby AMR project, making replacement of and additions to the conveyor components a more efficient process, says Robbins.

Each conveyor system is customised to the complexity of the project. 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. Depending on the project, conveyor types may include vertical conveyors, overland conveyors, stacker conveyors, and/or speciality conveyors. All Robbins' conveyor systems can be manufactured using either steel cable or fabric belt.

The Robbins Company
Tel: +1 440 248 3303
Email: homeb@robbinstbm.com
Web: www.therobbinscompany.com

Locomotive climb

Besides the full range of two-axled tunnel locomotives from 5 to 45 tonnes, Schöma says it has gained much experience in the design of special traction systems for steep gradients of 4 to 7%.

The traction system consists of one locomotive with one or two driven platform cars. The drive system is hydrostatic and the vehicles are connected via high pressure hoses. The vehicles are two-axled or four-axled bogie type weighing up to 60 tonnes. The platform cars are designed to carry muck, mortar or gravel containers.

The locomotives are equipped with diesel engines up to 500hp, complying with the applicable exhaust emission regulations, says Schöma. The company adds: "The hydrostatic transmission enables wear free braking of the train, supported by an additional electro-magnetic retarder brake so that the consumption of brake blocks is reduced to a minimum."

The locomotives are controlled by a microcontroller PLC system developed by Schöma comprising synchronised operation of locomotives with two or more units operated by one driver, wheelslide detection and CANBUS comms.

Schôma
Tel: +49 5441 997 0
Email: sales@schoema.de
Web: www.schoema.de

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 rubber bonded suspension and dynamic braking.

All the company's equipment is custom-made and will, it claims, meet the most stringent emissions standards.

Brookville Equipment
Tel: +1 814 849 2000
Web: www.brookvilleequipment.com

Right on track

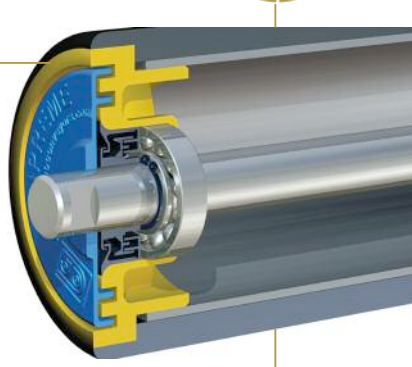
Valente has operated in the fields of railway equipment, rails, tunnelling and mining equipment and special steel structures since 1919. In the railway field, Valente engineers and manufactures switches, turnouts, steel wheels, axels and special vehicles.

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, chairplates 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
Web: www.valente.it

Rugged roller



The Rulmeca Group supplies the Supreme heavy-duty corrosion and abrasion resistant roller whose advantages, features and benefits are said to include:

- Steel tube to ensure adequate mechanical strength for heavy duty loads
- Ultra thick abrasion and corrosion resistant 12mm thick HDPE sleeve
- HDPE containing carbon black increasing ultra violet resistance
- Steel and HDPE tube combination to reduce weight
- A bearing housing that effectively locks the HDPE tube in position preventing movement along the steel tube
- Minimum "C dimension" to decrease load induced shaft deflection
- Large diameter stoneguard with integral labyrinth design to minimise possibility of being jammed by spilt material and p provide additional protection from water and dust
- Multi part labyrinth seal to protect the bearing from contaminants
- Ultra low running resistance and break away mass to reduce power consumption for start up and continuous operation
- Machined finish to ensure low run-out, minimising vibration and noise emission
- Castellated HDPE tube with a tight fit on the steel tube

Typical applications are mining, coal-fired power stations, belt scales, aluminium smelters, steel plants and fertiliser plants.

Rulli Rulmeca
Tel. +39 035 4300111
Email rulmeca@rulmeca.it
Web: www.rulmeca.com

GHH on the move

German manufacturer GHH Fahrzeuge specialises 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 Polish Mining 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
Tel: +49 208 46940
Email: info@ghh-fahrzeuge.de
Web: www.ghh-fahrzeuge.de

Rail-bound expertise

For 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 specialises 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 tailbolts," the company adds.

Irwin Car & Equipment
Tel: +1 724 459 6814
Email: kbartholow@irwincar.com
Web: www.irwincar.com

Drainage solution

Many tunnels are designed with pressure relieved/ drained lining and Finesse Cavidrain from ABG Geosynthetics is one such system for use with TBM, NATM or drill and blast tunnels. Cavidrain is a dimpled HDPE sheet designed to perform as the barrier and drainage path and is applied to the tunnel walls and invert in either new tunnels or refurbishment of existing tunnels.

A typical installation would then have sprayed or concrete cast onto the Cavidrain. Alan Bamforth, marketing manager for ABG, says: "This makes Cavidrain a very quick and cost-effective solution."

On one recent project, a 60mm deep Cavidrain was installed in the invert of a large diameter rail tunnel. The sheets of Cavidrain were laid onto the prepared formation and taped together.

A 12m bay was prepared and the concrete base slab is cast into the Cavidrain. On this project, the Cavidrain replaced a conventional 300mm thick granular drainage filter and carrier pipe. This not only saved the cost of the granular stone but also the excavation depth required for the granular stone.

The Cavidrain has a large bearing area so that the forces from the trains are effectively transferred to the tunnel formation.

ABG
Tel: +44 (0) 1484 852250
Email: geo@abgltd.com
Web: www.abgltd.com

High-performance wire

Darmit steel wire fibres have been manufactured by Bekaert of Belgium for almost 35 years and are used in many construction applications worldwide. Claimed features include end hooks for greater anchorage and gluing into bundles.

The company says: "The main technical feature that relates to performance is the length to diameter ratio - this determines the volume of fibres per kilogram. There are three main aspect ratios as we call it – 45, 65 and 80, with 80 being the most performance-based fibre."

Darmit is used in sprayed concrete linings with these fibres generally being 30mm and 35mm in length, and Bekaert has also developed the use of Darmit in pre-cast segmental lining.

Recent projects include CTRL in London, the Terminal 5 tunnels at London Heathrow International airport, the DLR Extension in Woolwich London, the new metro line in Madrid Spain, Beacon Hill, San Vicente and Brightwater Conveyance System in Seattle, USA.

Bekaert
Tel: +44 114 2427 480
Email: john.greenhalgh@bekaert.com
Web: www.bekaert.com/building

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-Self-drilling 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 4 meter 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 Drainages spiles 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
Tel: +43-7229-6 10 49 0
Email: office@alwag.com
Web: www.alwag.com

Intelligent bolting

Atlas Copco offers five bolters designed to install all popular types of bolts with full- or semi-computerised control. The company also offers a two-boom cable bolter.

The fully-mechanised bolting rigs, equipped with the MBU bolting unit, include larger models that can handle bolts up to 6m long and roof heights up to 11m.

Two models, the Boltec MC and Boltec LC, are equipped with a computerised rig control system with interactive operator control panel with full-colour display of the computer-based drilling system.

Automatic functions in the drilling process, such as auto-collaring and anti-jamming, as well as improved regulation of the rock drill, are claimed to provide high performance and outstanding drill steel economy. The rigs also feature an integrated diagnostic and fault location system.

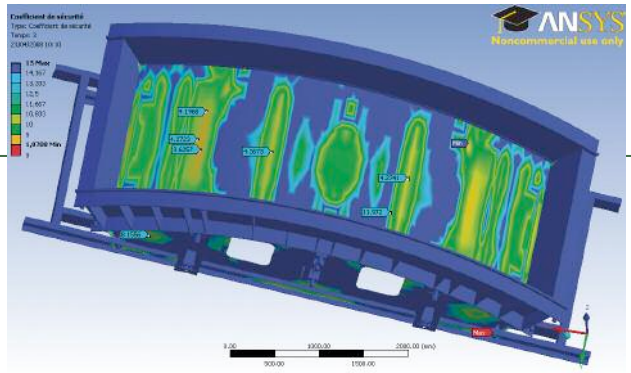
The MBU bolting unit is a single feed system using a cradle indexer at the rear end, and a drill steel support, plus indexer, for grouting at the top end. It has a low-mounted magazine for 10 bolts.

Atlas Copco also produces three bolting rigs with direct hydraulic control, the Boltec 235, Boltec MD and Boltec LD, together with the Boltec SL, a semi-mechanised low headroom model for roof heights down to 1.8m.

The Cabletec LC is a fully-mechanised dual-purpose rig with RCS computerised control system. It is equipped with two booms. Separated cement grouting and drilling operation is said to enable increased bolting capacity and better availability.

Dry cement is stored in an onboard silo and is fed by a screw system into the mixer, where each batch is mixed according to a pre-programmed recipe.

Atlas Copco
Tel: +46 (0) 19 670 7276
Email: mathias.edhammer@se.atlascopco.com
Web: www.atlascopco.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 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 optimisation 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.

CBE
Tel: +33 247 37 60 95
Email: cbe@cbegroup.fr
Web: www.cbe-tunnels.com

Slide lining success

Ceresola TLS of Switzerland, received the contract from Kiewit Pacific to design and manufacture the final lining forming system for the 20km long Devil's Slide Tunnel project south of San Francisco, California.

The final lining formwork system consists of two steel forms, each being 10m wide x 8m high x 12m long with each form having its own traveller with independent electro/hydraulic controls and drive wheels for precise movement and placement.

The complete lining system also includes two rebar placing, electrical component placing and shotcrete placement mobile gantries as well as three concrete curing gantries with automatic humidity and temperature controls to prevent surface micro-cracking.

The whole range of Ceresola TLS tunnel lining products consists of:

- Segment moulds and precast concrete segment production plants
- Tunnel formwork systems
- Steel support systems for excavations

Ceresola TLS
Tel. +41(0) 61 845 93 40
Email: info@ceresola.com
Web: www.ceresola.com

Reinforcing benefits

Barchip reinforcing fibre is a leading structural synthetic fibre for civil underground construction and mining applications with over 500km of underground development in the last five years. Current projects include: 1.4km twin bore Devil's Slide Tunnel (USA), the 5.3km Atlantic Tunnel, E18 motorway project with over 5.7km of twin bore tunnel and a 7km TBM tunnel using Barchip fibre to reinforce primary shotcrete, precast segments and the secondary lining.

Barchip fibre is said to be suitable for use:

- In precast concrete such as tunnel segments
- In readymix concrete; and
- As primary support shotcrete reinforcement

The Barchip range includes SHOGUN, Kyodo and Macro structural fibres claimed to offer excellent cost benefits over steel fibre.

Barchip's design incorporates an embossed texture and surface coating designed to enhance mixability. Says the company: "The embossing gives the fibre exactly the right amount of concrete/fibre bond so as to resist pullout but also prevent the fibre from snapping, ensuring equivalent post crack performance to steel fibre."

Claimed advantages include:

- Non rusting, so that it offers a long-term durable solution to tunnel support
- No risk of puncture injury - common with contact with steel fibres
- Improves shotcrete's fire resistance; and
- Less weight for handling when dosing fibres

Elasto-Plastic Concrete (Europe)
Tel: + 44 1425 629 017
Email: europe@elastoplastic.com
Web: www.elastoplastic.com

Award-winning concrete innovation

Cellular Concrete has been offering Low-Density Cellular Concrete solutions for the geotechnical construction industry for almost 60 years. Its Geofoam liquid concentrate produces stable pre-formed foam able to withstand the vigorous requirements of geotechnical applications and especially those of the underground construction market. Backfills, annular fills, mining applications, abandoned pipes and tanks, replacement for poor soils, and bridge approaches are just a few of the many applications for which we have found solutions.

Cellular Concrete's latest endeavor is the invention of an open cell concentrate, Geofoam SP, which produces Pervious Cellular Concrete. This just won Cellular Concrete the Most Innovative Product distinction at the 2008 World of Concrete.

Cellular Concrete
Tel. +1 610 398 7833
Email: info@cellular-concrete.com
Web: www.cellular-concrete.com

Performing seals

Dätwyler Rubber is a leading provider of compression gaskets for precast segmental lined tunnels. Dätwyler elastomeric sealing systems are in place today in over 100 tunnels on five continents.

The company says it develops individual solutions based on specific geologic conditions, water pressure and design requirements. It holds numerous patents, valid worldwide, for gasket profiles, corner designs and elastomeric mixtures.

The engineers in charge of the extension of the 66km Singapore Metro Circle Line have, says Dätwyler, been counting on its sealing gaskets. Most of them are sealed with CoexSwell profiles. CoexSwell combines in one gasket a conventional EPDM profile plus integral swelling compound. CoexSwell profiles are also currently being used on other projects such as: The North South Bypass Road Tunnel, in Brisbane, Australia; the Marmaray Railway Tunnel, in Istanbul; and Vancouver Rapid Transit's new Canada Line.

Dätwyler's past projects also include:

- The Mitino and Strogino Lines, Mosco Metro, Russia
- New metro lines in Istanbul and Ankara, Turkey (Otogar-Bağcılar and Kadıköy-Kartal)
- Delhi Metro projects BC18, BC24 and the Airport Link
- In the USA: The Brightwater Treatment System East project, North Dorchester Bay CSO and the Allegheny river crossing for the North Shore Connector light rail project, in Pittsburgh

Dätwyler Rubber
Tel: +41 41 875 11 23
Email: tunnel.ch@daetwyler-rubber.com
Web: www.daetwyler-rubber.com

Rentable formwork

As part of the E6 "Nordre avlastningsveg" (northern relief-road) project in the Norwegian port city of Trondheim, a high-capacity bypass is being built to skirt the harbour area. Scheduled to open to traffic in 2010, the new bypass is intended to permanently alleviate traffic congestion in the city centre. Part of this bypass road will run in a tunnel 10m beneath sea level.

This 505m long tunnel is being built by Bilfinger Berger using non-monolithic casting, with two rentable travelling tunnel-formwork units from Doka. The travelling formwork units are based on standardised rentable system components, and are fitted with Wall formwork FF 20 and Doka 3-SO formwork sheeting.

The construction trench is inside a sheet-pile cofferdam with walls up to 16m high. Following completion of the in-situ concrete base slab, the tunnel walls and the cover-slab are poured in a single operation using the Doka travelling tunnel-formwork units, in 12.5m long sections cast in a weekly cycle.

After each casting section has been completed, the entire formwork construction is backed off the concrete by hydraulic cylinders and travelled on rails to the next casting section.

Varying by up to 2m in both height and width, the tunnel cross-section is said to make great demands of the formwork construction in terms of its adaptability. Interchangeable and compensating elements are incorporated here "to ensure precise, rapid adaptation to this varying cross-section".

Both tunnel approach ramps are being formed using extra-large elements of Large-area formwork Top 50.

Doka
Tel: +43 (0) 7472 605 0
Email: info@doka.com
Web: www.doka.com

Setting the standard

ChemGrout's CG-600 heavy-duty, high volume colloidal grout plants are claimed to have provided the tunnelling industry with the standard for both water cut-offs and back-filling since 1963. The series is said to combine the latest advances in colloidal mixing with ChemGrout's patented 3L6A pump, providing outputs of up to 20g/m (75l/m) and 261psi (75 bar).

These grout plants feature a 13 cubic ft capacity "Turbomixer", along with a rotating bridge breaker, 13 cubic ft 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 2000 rpm to prevent flocculation and achieve complete particle wetness. Mixing time is said to be significantly reduced by the high shear action of the colloidal mixing pump, aided by a powered bridge breaker device to enhance induction.

Says ChemGrout: "These high shear colloidal mixers have been shown to increase apparent fluidity of slurry mixes by 20% over paddle mixers, an important advantage 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
Tel: +1 708 354 7112
Email: info@chemgrout.com
Web: www.chemgrout.com

Fibre adds strength

Istrice is a recently patented synthetic structural fibre which is added to concrete mixtures with the aim of increasing tensile strength, ductility and durability. It is claimed to enhance concrete performance without significantly affecting the product's workability so that little or no superplasticiser is required and the inclusion of a high level of fibre reinforcement is possible.

Istrice is said to conform to the type III ASTM class1 as it presents a long-term resistance to deterioration. It is a structural fibre with a tensile strength claimed to be higher than 400MPa with a 15% elongation. Secant Young modulus is about 2.7GPa.

Istrice comes in different shapes according to the size of the cast and the customer requirement. Typically, it ranges in length from 20mm to 50mm and from 0.5mm to 1mm equivalent diameter (1500 to 6000 denier).

The fibre is said to be waterproof, chemically inert and exhibits a strong resistance to acid and alkali making it ideal for application in marine, humid or aggressive environments.

Fili & Forme
Tel. +39 059 921462
Email: info@fiberistrice.com
Web: www.fiberistrice.com

Comprehensive sealing

Flag has set up a single-layer compartment waterproofing system with active joints, known as "MCG". It is currently being used along a 9km long Bologna-Florence motorway tunnel, in Italy.

The waterproof system is installed using a 2mm thick PVC-P membrane set dry with double track heat-sealing. The compartment system is formed using PVC-P water-stop joints, hot-sealed to the waterproofing membrane (longitudinally W4 joints and W6 joints transversally to the tunnel axis).

As soon as the system is completed, re-injectable PVC hoses are laid. Double coating with openings and slots allows the material to be injected and make water-stop joints active. The hoses' injection ends are connected to fit junctions boxes set in accessible spots to facilitate control and repair with resins.

Flag
Tel: +39 035 4940 949
Email: info@flag.it
Web: www.flag.it

Sending in the reinforcements

Fortius supplies strengthening products for the tunnelling industry and other civil engineering applications throughout the world. Steel and polypropylene fibres are used to manufacture prefabricated tunnel segments and used as reinforcement in shotcrete.

Steel fibres or structural synthetic fibres, used instead of conventional steel reinforcement, can, says the company, provide superior performance with reduced costs from materials, time and labour.

The company also supplies Aslan glass fibre rebar, which are used to stabilise the front of tunnels and to make a "Softeye" in the start-shaft and/or end-shafts for tunnelling with TBMs.

Fortius explains: "Breaking through the reinforced concrete of the shafts with a TBM has always been a challenge for tunnelling contractors. This is because the TBM cannot cut through a wall reinforced with conventional steel reinforcement. But this problem has been resolved through the development of the Aslan GFRP rebars. These have twice the strength of steel rebars, but can easily be cut by a TBM. This makes them ideal as reinforcement in the area where the TBM will exit or enter the shaft."

Fortius
Tel: +32 13 326 873
Email: info@fortius.be
Web: www.fortius.be

Powerful light mesh

FiReP 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 cutability. 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
Web: www.firep.com

Water control made easy

The WG Tunnel Arch T200 (WGTA) is a newly developed drainage system for waterproofing road tunnels. The system is a complete fire-retardant lining system for water control, humidity protection, and frost insulation.

The patented WGTA system consists of steel pipe arches spaced at 1.5m combined with WG Tunnel Sealing Fabric. All joints of the fabric are hot air welded to produce a waterproof surface. After installation, the system is ultimately covered by a minimum 80mm thickness of sprayed concrete.

All steel arch construction consists of hot dipped galvanised pipe bent to the actual tunnel radius. Each arch section consists of a back-pipe and double front pipe-band, which press the sealing fabric. Each 2.5m section is bolted directly to the rock. In sub-sea tunnels, an epoxy coating is designed to give added protection.

Giertsen Tunnel
Tel: +47 5594 3030
Email: hans.larsen@giertsen.no
Web: www.tunnelsealing.com

Pump up the volume

Häny claims to offer one of the largest ranges of grouting equipment with 10 different pump models from 1.5 to 13m^3/hr output and pressures up to 200 bar. The ZMP 700 series of grout pumps are most suitable for backfilling tunnel liners as well as for pressure grouting. This combined use is said to offer cost and space savings on TBM back-up systems.

Says Häny: "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."

Mixing plants with fully-automated weigh batch systems can prepare as much as 40m^3/hr of bentonite for slurry shield TBM operations, the company says.

Häny
Tel. +41 44 925 4111
Email : info@haeny.com
Web: www.haeny.com

Precision lining

Herrenknecht Formwork Technology offers equipment for the production of tunnel lining segments including moulds, handling equipment and turnkey segment production plants.

"Segment production solutions are tailored to each project and its construction site. Customers also can be provided with technical service (maintenance, repair) as well as provision of skilled personnel," says the company.

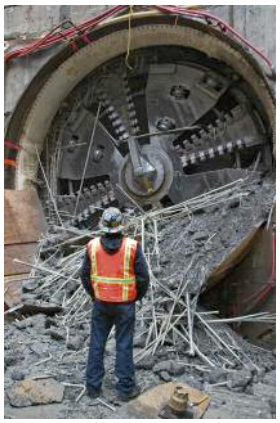
For supply and disposal tunnels, Herrenknecht Combisegments turns the traditional two-step process of segmental lining into a one-step operation: "The variable structure of the Combisegments moulds allow the production of segments for different tunnel purposes. Segments, both with or without integrated coating, and segments for different sealing concepts can be produced. This is by means of special flexible bars in the mould walls - a variety of seals 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."

Installations for tunnel operation, such as cable attachments can also be fixed onto these mounting bars.

Herrenknecht Formwork Technology
Tel: +49 7824 302 0
Web: www.herrenknecht-formwork.com

Raising the (FRP) bar

The 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
Tel: +1 800 869 0359
Email: doug@hughesbros.com
Web: www.aslanfrp.com

Segment manufacturing trio

As well as its main activities in muck haulage and logistics equipment, Marti Technik also provides a variety of tunnel formwork. This includes invert shutters, deck shutters, vault shutters, false ceiling shutters, partition shutters and full round shutters, as well as precast concrete segment moulds.

Marti Technik currently has three projects involving precast concrete segment moulds:

- For the 2 x 1300m Buettenberg tunnel and the 2 x 2500m Laengholz tunnel on the east branch of a bypass motorway in Biel, Switzerland, Marti Technik will design, manufacture and deliver segment moulds to a Marti segment production plant in Klus. The precast concrete segments will then be transported by train to the jobsite. A 12.56m diameter EPB TBM will commence working at the beginning of 2009. The client is the Atubo JV (Walo Bertschinger, Specogna Bau and Porr Technobau+Umwelt).
- As part of an overflow mitigation of Lake Thun in Thun, Switzerland, the JV of contractors formed by Implenia and its partners purchased segment moulds from Herrenknecht and delivered them to a Marti factory in Klus. Marti Technik produces and delivers the segments to the contractors.
- For the 2.9km Bure tunnel on the trans-Jura motorway A16, in Switzerland, Marti Technik designed and delivered segment moulds to a Marti segment production plant in Klus to produce and deliver the precast segments to Marti Tunnelbau at the job site. A 12.6m diameter TBM started boring in January 2008.

Marti Technik
Tel. +41 31 858 33 88
Email : pierre-alain.scherwey@martitechnik.ch
Web : www.martitechnik.ch

Added value...

International Fibre Technology (IFT) is a manufacturer of fibres and dosing systems, concentrating on DUOLOC steel fibre for reinforcement purposes and POLYLOC PP fibres for fire protection.

The last successful application in underground construction was the delivery of 220 tonnes of UNOLOC 30/0.6mm steel wire fibres to the Roppen Tunnel project, in Austria. IFT's DINO 100 cws dosing system was used for dispersing and transport of the fibres.

DINO systems are modular and can be individually adapted to local conditions.

IFT says DUOLOC fibres using DINO systems are faster to install than mesh reinforcement.

IFT Fasertechnik
Tel: +49 2305 419 050
Email: info@ift-fasertechnik.de
Web: www.ift-fasertechnik.de

Injection of speed

MC-Bauchemie's injection systems are used to create start-up sealing, said to be guaranteed through a rapidly foaming elastomer resin or using a soft-elastic hydro structure resin. Hydro structure resins are also claimed to ensure reliable sealing of the tunnel interior when repair works to the tail seals becomes necessary during TBM advance.

Hydro structure resins are also used in the retrospective sealing of horizontal or vertical segment joints. For this purpose, special polymer-reinforced hydro structure resins are used that have heightened mechanical properties.

The company says: "Crack injections in segments can be managed both prior to installation of the segments with rigid-operant duromer resins, and after segment installation with elastomer resins that flexibly seal against moisture. The finest of segment cracks demand the use of particularly low-viscose MC injection substances."

MC-Bauchemie's tunnel construction range is rounded off by concrete repair and concrete coating systems, tailored to job specific requirements.

MC-Bauchemie
Tel: +49 2041 101 10
Email: protection-technologies@mc-bauchemie.com

Tunnel strengthening

To reduce the risk of collapse of over-stressed strata during tunnelling and prevent expensive stand-stills, Minova CarboTech has designed 'One Step Bolt Technology' using steel or GRP anchors and resins.

After drilling, the newly developed thixotropic injection resin GEOTHIX MV 1:2, is injected under controlled pressure. It flows through the anchor and fills fissures, cracks, joints, and planes connected to the borehole. This is said to result in a perfectly coagulated surrounding and resistant strata. According to Minova, it takes only 45 seconds to allow the anchors to be brought to their full support capacity.

The company concludes: "The advantages of this method are enormous. It drills and injects in only one working step, reduces safety issues, saves enormous production times, and brings the tunnel driving performance to unparalleled levels."

Minova CarboTech
Tel: +49 201 172 1038
Email: info.de@minovaint.com
Web: www.minova-ct.com

Flexible financing

Normet Finance is the wholly owned Normet subsidiary offering equipment rental and customer financing. Rental offerings from Normet Finance consist of a range of mobile equipment for man lifting, installing and explosive charging, concrete spraying, and transport of muck and concrete.

The company says: "Demand for equipment rental and customer financing is steadily growing. This trend results from increased competition for contracts and consequently less funds for the development of contractors' machinery fleets. Moreover, the tendency to split projects into smaller lots than before favours rental rather than investment."

Using Normet Finance's services, customers can limit their use of capital and solve sudden or temporary machinery needs for their projects. "The cost of renting is spread evenly from beginning to end of the project, thus renting helps cash management and eliminates the risks related to ownership of the equipment at the end of the project," Normet adds.

Finally, renting cuts customers' fixed costs as the maintenance of the equipment is included in the renting contract.

Normet International
Tel: +41 41 768 52 00
Email: info@normet.fi
Web: www.normet.fi

Seals of approval

Elastomer profiles and gaskets manufacturered by Phoenix Dichtungstechnik (PDT) offer project related and tailor-made sealing solutions for tunnel construction as well as railway track components for sound and vibration control. In 2007 Phoenix supplied its gaskets to more than 60 international projects.

Since the take over of the former Phoenix Group by ContiTech AG (a division of Continental AG) in 2004, PDT has broadened its elastomer segment gaskets range for TBM tunnels.

A new development is a gasket for a corrosion protected lining design for sewage tunnels, which is directly embedded in the concrete segment and ready installed after the de-moulding process. This is currently being used on a tunnel in Moscow.

Other developments from the company include load distribution packers and hydrophilic sealing strips, both made of EPDM materials.

Phoenix (PDT)
Tel: +49 40 7667 2761
Email: andreas.diener@phoenix-dt.de
Web: www.phoenix-dt.de

Simple spraying

The Meyco Poca mobile concrete spraying unit has, says the company, been designed after direct consultation with the customers who will be using it daily under extreme conditions.

The company adds: "Special attention has been paid to achieve a vehicle concept combining the central demands of mobility around a tunnel complex, serious application capability and incorporating simple Meyco technology. The system can be either entirely diesel driven, independent of outside power sources, or electrically driven for spraying operations."

The three main components are Meyco Simpla concrete pump, Meyco Rama 6 manipulator and a Dieci chassis with 4WS, 4WD including crab steering. It is equipped with a peristaltic pump for dosing and a 500 litre accelerator tank. Dimensions for driving are 6.2m x 2m x 2.24m with a maximum spraying height of over 9m. The concrete pump produces 14m^3/h at 80 bar and 65mm MEYCO nozzle system is fitted as standard.

Meyco Equipment
Tel: +41 58 958 2700
Email: meyco@basf.com
Web: www.meyco.basf.com

Modular formwork

The 35km long passage through the Lötschberg 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 pre-mounted 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
Tel: +41 52 3 20 03 03
Email: info@peri.ch
Web: www.peri.ch

Waterproofing expertise

Millions of square metres of Renolit geomembrane waterproofing film have been installed in tunnels all over the world for more than 30 years.

Renolit Waterproofing produces synthetic membranes for waterproofing roofs, hydraulic works (dams, canals, ponds and reservoirs) and underground works (tunnels and foundations). Renolit Waterproofing offers three families of membranes: Alkorplan (PVC-P), Alkortop (polypropylene) and Alkortene (polyethylene).

Renolit achieved overall sales of 970M Euros in 2007 and employs some 4,300 people. The annual volume of production spanning all 34 production locations amounted to around 300,000 tons of membrane.

Renolit Iberica
Tel: +34 93 848 40 00
Email: Nicolas.dewalque@renolit.com
Web: www.renolit.com

Sealing technology expertise

Trelleborg 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
Email: bakker@trelleborg.com
Web: www.trelleborg.com/bakker

Long-distance pumping

REED's new "Tunnel Version" C50SS-SKE pump was designed for long distance underground shotcrete applications. Powered by the 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 JF Shea Company, a US$3bn-plus, Southern California-based construction firm in its second century of operation.

REED
Tel: +1 909 287 2100
Email: mike.newcomb@reedmfg.com
Web: www.reedpumps.com

Locking dowels

Dowelock 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.

Dowelock 20 - for rings where a lower tensile resistance is required, e.g. smaller elastomeric gaskets or hydrophilic seals.

Tunnelling Accessories
Tel: +44 (0) 1424 854112
Email: dave@tunnellingaccessories.co.uk

Sealed to specification

Acting as an official agent of Ein Shemer Rubber Industries, WGD Werner Grabe Development, offers EPDM rubber gaskets according to STUVA guidelines. A new product TunnelFlex 33 Plus has recently been developed, with a soft corner design, which gives security against concrete spalling.

- WGD has more than 20 years of experience in the development of sealing gaskets for tunnelling
- Competence in specifications and testing technology
- Independent tests at MPA Bau Hanover, Germany
- Rubber compounding and laboratory, ISO 9001 and DVGW
- Extrusion and vulcanization on modern production lines
- Corners - vulcanization with injection moulding process
- Training on use of adhesivess

WGD Werner Grabe Development
Tel: +49 2548 98157
Email: werner.grabe@wg-d.de
Web: www.wg-d.de

Mould measurement

The industrial measurement side of VMT uses a laser interferometer system to measure moulds used in the manufacture of segments as well as segments themselves. Says the company: "The precision required for the manufacture of moulds used in the casting of tunnel segments is frequently not stated, the tender documents for a typical project only stating the dimensional tolerances for the finished segments. These increasingly tight tolerances of a few tenths of a millimetre demand a fast, accurate and reliable method for determining values."

The use of a laser interferometer system is said to enable the accurate digitisation of surfaces by direct polar coordinate measurement with an accuracy of a few hundredths of a millimetre.

VMT says: "Measurement to a single spherical retroreflective prism enables the skilled operator to comprehensively measure the full profile of the object with up to 20 segments per shift achievable."

This technique, which only requires one operator, has been used on the City Tunnel project in Malmö, Sweden, as well as many projects in Europe and the Far East.

VMT
Tel: +49 7251 96 99 0
Email: international@vmt-gmbh.de
Web: www.vmt-gmbh.de

Increased productivity

Akkerman has introduced the 4812 guided boring machine (GBM) system, which features long, dual-wall pilot tubes and augers and casings in a bid to increase productivity. The 4812A jacking frame can jack pipe lengths up to 2m with a maximum OD of 48".

The pilot tubes, casing and auger and pipe are advanced through a single and continuous hydraulic action. Says Akkerman: "Fewer joints to go the same distance and this translates into reduced project costs and presents the contractor with a variety of pipe diameter and length options."

The 4812A can, adds the company, produce up to 200 tons of jacking force, up to 100 tons of pull back force and up to 20,000 foot pounds of torque.

Akkerman
Tel: +1 507 567 2261
Email: landerson@akkerman.com
Web: www.akkerman.com

Direct Pipe premier

Herrenknecht has introduced Direct Pipe technology, whereby a borehole is drilled in a one-step operation while a prefabricated and tested pipeline is inserted simultaneously. This single-stage system is said to speed up trenchless installation, especially of large diameter pipelines and reduce the related costs significantly.

Similar to pipe jacking, the excavation of the soil is carried out with a Herrenknecht Micromachine. The navigateable machine conveys the excavated material via a slurry circuit above ground. At the same time the prefabricated pipeline is pushed forward by the Herrenknecht Pipe Thruster. The pipe transmits the thrust force, required for drilling, to the cutterhead.

The Direct Pipe method was used for the first time to lay a 464m long steel casing for a water pipeline as well as power and telecommunication cables beneath the Rhine River near Worms, Germany. Breakthrough occurred only 13 days after the beginning of the construction work.

Herrenknecht
Tel. +49 7824 302 0
Email: pr@herrenknecht.com
Web: www.herrenknecht.com

Extreme drilling

Prime Drilling is a developer and producer of horizontal directional drilling (HDD) rigs with pulling forces from 25 to 500 tonnes as well as other HDD equipment like mixing systems, recyclers and pumps.

Prime Drilling also offers service and jobsite support around the world. The company claims its machines have the reputation of getting the job done – "even in very extreme environments like northern Siberia or in the Sahara desert".

Prime Drilling
Tel: +49 2762 930 96 0
Email: info@prime-drilling.de
Web: www.prime-drilling.de

Magical pipe bursting

The 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
Web: www.ditchwitch.com

Customised boring

The Robbins Company offers a line-up of small diameter equipment for utility installation. The machines are available worldwide through Robbins corporate offices in the US and through representatives in Europe, Asia, Australia, and South America.

In addition to standard small boring units, Robbins also says it offers a variety of equipment for use with pipe-jacking machines, including motorised 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.

The SBU-M is said to be ideal on bores longer than 100m where line and grade are critical. The machine, available in diameters from 1.2m to 1.8m, uses an electric centre drive for high torque and is steered from an in-shield operator's console. In hard rock models, disc cutters are used to excavate rock from 25 to more than 175MPa UCS. All machines can be customised for boring in mixed ground with cobbles and boulders.

For longer bores (over 150m), Robbins offers the Rockhead. The Rockhead is available in single shield (SBU-RHSS) or double shield (SBU-RHDS) models from 1.5m to 1.8m in diameter. 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.

Robbins small diameter utility installation products have, says the company, been proven on multiple international projects, including a recent project in South Wales. Two SBU-Ms were used to excavate four crossings on a large natural gas pipeline.

The Robbins Company
Tel: +1 440 248 3303.
Web:
www.therobbinscompany.com

Long-distance drilling

EON 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. The water will reach the end consumer at about 70°C and flow back to the plant at 40°C, with pumps keeping the circuit flowing.

Bonded outer pipes from Isoplus were installed for the forward and reverse flow system. Within these 280mm PE outer pipes, 168mm OD steel pipes were bedded into hard foam to provide heat insulation. The pipes are suitable for operating temperatures of up to 155°C and pressures of up to 25 bar.

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, in a residential area it was virtually impossible to use this method due to existing surface development. Installation in these areas was planned instead using Horizontal Directional Drilling (HDD).

EON hired local contractor Friedrich Meier to carry out the installation, who in turn selected the new Grundodrill 15N system from Tracto-Technik 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.

The installation depth was 1.3m on average, dropping to 1.8m in some areas. The pilot bore took around 4.5 hours in the clayish soil with lenses of gravel. In the meantime the heating pipes, which were delivered in 16m lengths, were welded together to form two pipe lengths each of 96m, as there was insufficient space to lay out the total length of 192m on the target side.

Initially, the bore had to be expanded in two working processes, to 385mm and 485mm diameter, and cleaned. The pulling-in process was carried out without any problems. After the installation of the first 96m length there was a short interruption, so that the second pipe length could be 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
Email: export@tracto-technik.de
Web: www.tracto-technik.de

Bursting on the scene

TT Technologies has introduced a cutterhead for its Grundoburst static pipe bursting system for use with large diameter steel pipes. The specially designed bladed roller cutting head is said to allow contractors to burst/split steel pipes up to 32" in diameter when used with larger Grundoburst static bursting systems.

The Grundoburst static pipe bursting system uses the bladed cutterhead to make bursting ductile iron and steel pipe possible. Pulled by a hydraulic bursting unit, the cutterhead's cutting wheels are designed to split the host pipe. An attached expander spreads and displaces the split pipe into the surrounding soil while pulling in the new pipe.

QuickLock bursting rods are linked together not threaded. This is said to save time, prevent twisting and extend the life of the cutter head. Models range in pullback force from 60,000lb to 650,000lb.

Grundoburst models are designed for bursting 2" through 52" diameter pipe and larger. Six Grundoburst models are available. The 32" cutterhead is claimed to be the largest cutterhead of its kind in the world.

TT Technologies
Tel: +1 630 851 8200
Web: www.tttechnologies.com

One stop jacking shop

Tunnelling Accessories claims to be a one-stop-shop for pipe jacking and microtunnelling 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
Tel: +44 1424 854112
Email: dave@tunnellingaccessories.co.uk

Modular guidance

With its modular guidance system, VMT says it offers the full range of navigation technology for microtunnelling and pipe jacking, enabling users to configure modules to suit project requirements.

A sea outfall tunnel in San Pedro del Pinatar, Spain, built using a Herrenknecht AVN 2000, is said to be a good example of this concept. Two tunnels with lengths of 1.15km and 640m including curved sections required a concept that used a 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-Microtunnelling LT Lasertachymeter system or the SLS-Microtunnelling – G gyro navigation system. VMT says: "By using the Herrenknecht AVN, with an expected high rate of performance, the customer decided to use the SLS-Microtunnelling LT Lasertachymeter system. Due to limited cover at several sections of the lines, it was expected the built pipeline may float up. To avoid any influence on the guidance system the client added an electronic hose levelling system to the concept."

The company concludes the system was the best choice and rates of more than 100m/week were achieved and buoyancy of the pipeline made the observation of the vertical movements essential.

VMT
Tel: +49 7251 96 99 0
E-mail: international@vmt-gmbh.de
Web: www.vmt-gmbh.de

Getting in the mix

Häny offers a wide range of bentonite mixing and pumping units for the microtunnelling industry.

Different models offer outputs from 1.5 to 13m^3/hr and pressures up to 200 bar. Häny's HCM high-shear (colloidal) mixers are said to be renown for their mixing capabilities, wear resistance and easy handling. The mobile units are of a very compact design without compromising easy access 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.

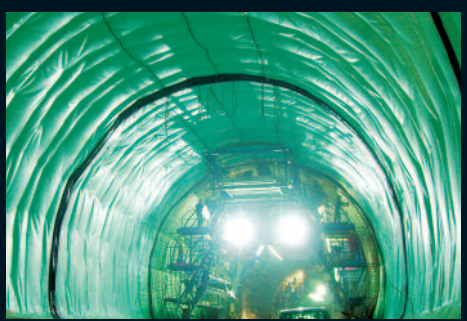
Häny
Tel: +41 44 925 4111
Email: info@haeny.com
Web: www.haeny.com

FLAG®
SOPREMA GROUP

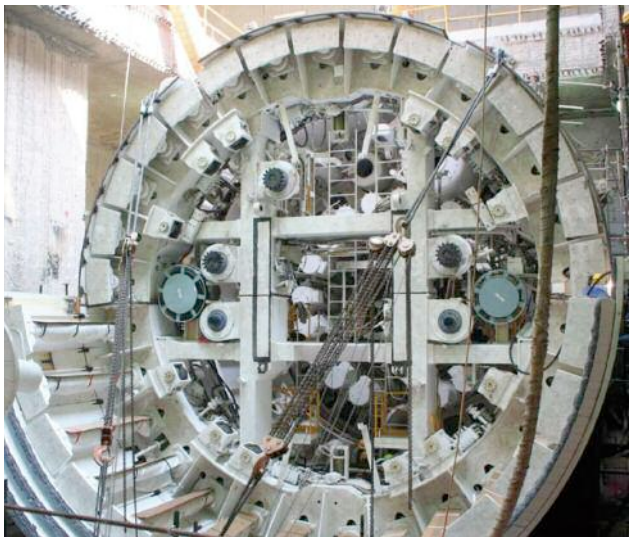
Total Protection
Extreme Reparability

The Flag's tunnel waterproofing systems guarantee maximum impermeability and total reparability

Flag waterproofing membranes guarantee high-quality hydraulic sealing in tunnels as well as underground works. Flag waterproofing systems offer a unique approach to repairing any instance of water or liquid ingress throughout the life of the products; the system can be completely re-sealed without the need to carry out expensive and intrusive demolition.



FLAG S.p.A. | 24040 Chignolo d'Isola (BG) | Italy | T. +39.035.494.09.49 | www.flag.it | info@flag.it



Cabling capabilities

Aristoncavi manufactures electric cables insulated with rubber, cross-linked synthetic rubbers and thermoplastic compounds. The product range includes cables for low and medium voltage distribution, and special applications.

The URSUS cable family, for example, is designed for power and signalling mobile connections, under severe mechanical stresses. The cables are typically used for tunnelling and tunnel boring machines, harbour and container cranes and other handling machines.

The low voltage range includes URSUS, URSUS VS, URSUS PUR HF; the medium voltage version URSUS MT is available up to 20kV and in a halogen-free polyurethane version. NSSHOU 0.6/1kV and PURFLEX HF 0.6/1kV, meanwhile, are low voltage cables for mining and tunnelling operations.

Aristoncavi
Tel. +39.0444.749900
Email: sales@aristoncavi.com
Web: www.aristoncavi.com

Breaking the mould

If you add a solid body hydraulic breaker to a proven folding boom on the world's most tested underground carrier, you have the Scaletec MC, says Atlas Copco. This is said to offer higher face productivity, fewer accidents, and a giant step along the route to full mechanisation.

The company adds: "Mechanised scaling reduces the risk of accidents from rock falls at the face, both during and after scaling. The Atlas Copco Scaletec MC scaling rig is based on the same well-proven components and system solutions as their two-boom Boomer rigs, and is built from similar modules. It is equipped with a folding boom on which is mounted an SB 300 hydraulic scaler hammer."

The SB scaler hammer is fabricated from a solid, one-piece body with no side bolts, and is claimed to be stronger, lighter and more manoeuvrable than conventional units. Atlas Copco again: "It has been optimised for scaling, with increased stroke frequency and decreased impact energy. They have an integrated water channel to keep dust levels down."

A shovel blade is mounted ahead of the front wheels of the Scaletec MC for levelling the working area. The rig is equipped with a FOPS-approved cabin and a grizzly bar protects the windshield. The cabin is also equipped with the optional 375mm of vertical lift and 15 degrees of tilt.

The Atlas Copco Rig Control System, RCS, provides the operator with a colour display, along with joystick controls and the facility to transfer data and to store optimal settings.

Atlas Copco
Tel: +46 (0) 19 670 7276
Email: mathias.edhammer@se.atlascopco.com
Web: www.atlascopco.com

The right connection

Over 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 970
Web: www.bauer.de

Heavy load movement

ALS (Freight Management Group) is a global freight forwarder founded in 1980 in Hull, UK as Abnormal Loads Services (ALS) offering a "one stop shop" for the worldwide movement of abnormal and heavy loads.

For many years, ALS has been involved in turnkey project management, providing manufacturers, engineers and contractors with "experience and knowledge in the global movement of complete and part TBMs and ancillary equipment by: road, air, barge, deep/short sea chartering, rail and canal".

ALS has entered a phase of expansion to support individual customer requirements by opening new offices in: Turku – Finland (Baltic market), Bucharest – Romania, Singapore and Hong Kong (Chinese market), Antwerp – Belgium (CIS Russian market, container and deep sea services) and London (WGC) – UK (project forwarding sales office).

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

With 16 offices in the UK, Belgium, Finland, Germany, Holland, Hong Kong, Italy, Romania and Singapore, worldwide agents and partners in Australia, China, Canada and the USA, ALS says it can handle logistics requirements no matter how large or small.

ALS Freight Management
Tel: +44 1482 796214
Email: info.tunnelling@als-europe.com
Web: www.abnormal-loads.com

Super-silenced breeze

Jetair fans are manufactured by Mining Equipment in Farmington, New Mexico. Jetair says it uses highly-durable components in the construction of these fans including cast-iron motors and blades that are forged instead of cast. A range of fans are available from 3hp to 500hp and 18" to 84" diameter.

Jetair now also offers its "Super-Silenced" line of fans comprising an integrated fan and silencer. These units are said to meet sound levels of standard fans with two silencers. "The benefit is a much more compact and easy to handle fan, which is competitively priced," the company says.

Jetair
Tel: +1 (970) 259 0412
Email: miningequipment@obii.net
Web: www.miningequipmentinc.com/jetair.html

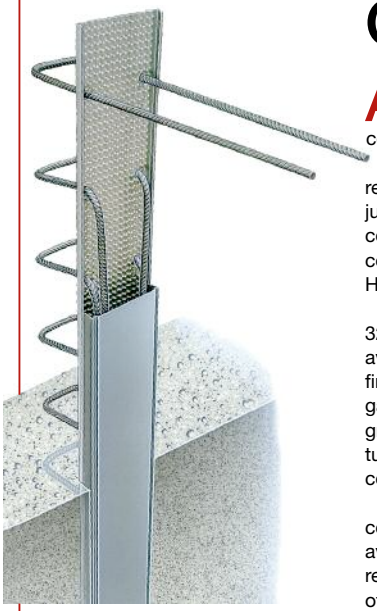
Seeing the light

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

Henry Cooch
Tel: +44 (0) 1732 884484
Email: henrycooch@btconnect.com
Web: www.henrycooch.co.uk



Connecting service

Adjustable cast-in connections, reinforcement connections, adjustable support framing for services, and reliable precast lifting systems are just a selection of the range of connection products for tunnel construction available from Halfen.

Supporting point loads of up to 32kN, Halfen cast-in channels are available straight or radiused in finishes ranging from hot dip galvanised to the special HCR grade stainless steels used in tunnels with high corrosive gas concentrations.

Three Halfen reinforcement connection systems are available, allowing concrete reinforcing bars with diameters of up to 32mm to be connected.

Halfen framing products comprise a selection of channel and accessory products for the support of tunnel services, including the Powerclick system for free standing support.

Three Halfen lifting systems are available for the installation of precast concrete units.

Halfen
Web: www.halfen.com

Durable pumping

Grindex has introduced a 'new generation' of submersible drainage pumps. These new pumps introduce several features that give the pumps triple length durability says the company.

Wear resistance is said to have been tripled, and in some applications more, by preventing abrasive particles from reaching the vulnerable parts of the pump, thus minimising wear.

The newly designed hydraulics section with its closed impeller is also said to dramatically reduce the performance drop caused by long-term wear. This makes the new pumps capable of operation in really demanding applications with maintained capacity. The new design also allows easy adjustment of the impeller to regain optimal performance. This simplifies service and ensures both longer lifetime and stable dewatering during the whole pump life. "By means of this new generation of pumps customers can save money because the pumps last longer, said Peter Schmid, managing director of Grindex.

Grindex
Tel: +46 8 606 66 33
Web: www.grindex.com

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 EN 12101-3.

TLT-Turbo GmbH
Tel: +49 6332 808 0
Email: tlt@tlt.de
Web: www.tlt.de

Generating an electric connection

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

The company's main line of work is the supply of generators, transformers, switchgear, distribution equipment, lighting systems, communication systems and power cables.

Projects can also be undertaken on a turnkey basis where the company will also take responsibility for the engineering of the electrical supply requirements and the installation and commissioning of the equipment supplied.

It says it can offer innovative electrical packages based around the purchase, buy-back or hire of equipment that allow clients to "gain the maximum benefit of high quality, reliable equipment at a cost effective price".

Rutherford has recently constituted a new company in Milan, Italy to cater for the needs of the European tunnelling industry. The group now has three strategic operations, based in Italy, Singapore and Australia.

Rutherford Power
Tel: + 61 (0) 2 4961 9619
Email: steve.rush@rutherfordgroup.com.au
Web: www.rutherfordgroup.com.au

Clearing the atmosphere

Schauenburg Flexadux ventilation ducting has been part of the Schauenburg product range for nearly 50 years. It can, says the company, be used wherever ventilation is required for coal, salt and ore mining as well as for tunnelling and shaftsinking.

Flexadux ducting is, Schauenburg adds, being continuously developed in cooperation with customers, government authorities and mining industries: "Our programme offers layflat ducting with diameters up to 3500mm for forced ventilation. For forced and exhaust ventilation, we manufacture spiral ducting up to 2400mm diameter. Schauenburg Flexadux Ventilation Ducting is manufactured from ducting fabrics, which have been continuously developed over the years and so have been adapted to the requirements of each particular application."

Schauenburg Tunnel-Ventilation
Tel: +49 208 882 7611
Email: vandenmond@tunnel-ventilation.de
Web: www.tunnel-ventilation.de

Ducting and weaving

ABC claims to offer the highest quality vane axial and prop fans certified by the Air Movement and Control Association. The company also aims to provide:

- Personal customer service
- Best quality ducting and accessories
- On-time delivery
- Vane axial fans
- Prop Fans
- Flexible wire-reinforced and layflat ducting
- Rigid glass fibre ducting
- Custom ducting is also available.

ABC Industries
Tel: +1 800 426 0921
Email: sales@abc-Industries.net
Web: www.abc-Industries.net

Sliding solutions

Typically, an expensive steel plate deck and an elaborate strand jack pulling system are required in the horizontal shaft for the assembly of TBMs. Barnhart Crane & Rigging offers an optional method for moving the TBM during assembly, which does not require the laying of steel plate or using a strand jack system. It is Barnhart's "slide system". The slide system is comprised of beams, which are pin connected. The top flange of the beam is "notched". The notches allow for "gripper lugs" attached to hydraulic rams to grab the notches, then systematically stroke out, release, stroke in and grab again.

This repeated provides the horizontal force along the beam, which moves the TBM. The load of the TBM is transferred to the TBM cradle, which in turn rests on customised "slide shoes" that slide on two parallel beams. A material with a very low coefficient is on the underside of the slide shoes, which allows the hydraulic force of the rams to move the TBM easily along the slide beams.

While much of the load of the TBM is carried by a rail system, the main load of the TBM is moved by the slide system. Unlike the typical method of laying steel plate for the whole length of the TBM, the slide beams can be "hop scotched" forward as needed. Once the TBM can move under its own power, the slide system is removed. It has been proven to be a very efficient and cost effective alternative.

Barnhart Crane & Rigging
Tel: +1 251 654 0541
Email: wsmith@barnhartcrane.com
Web: www.barnhartcrane.com

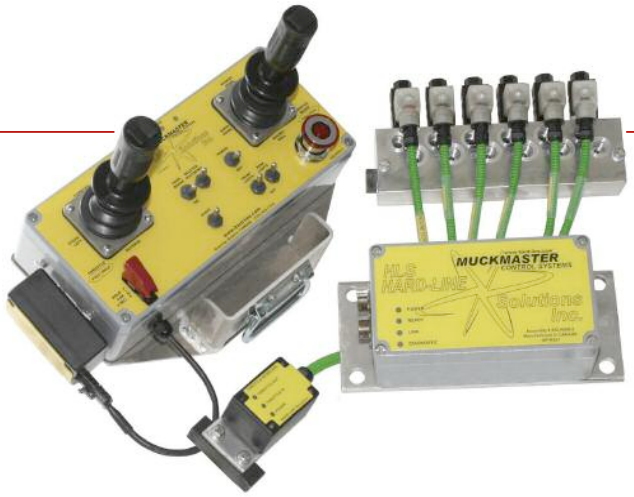
Tailored tail seals

In segmental tunnelling, the gap between the inside of the tailskin and the outside of the segment can best be sealed by fitting rows of Wire Brush Tailseals. Wires within the seals are infinitely flexible to fill the opening and when used in conjunction with specially formulated fibrous lubricants provide a seal between the TBM and tunnel lining.

A significant name in the tunnelling industry, Lanesfield Engineering is a leading worldwide supplier of Wire Brush Tailseals, supplying both machine builders and contractors. Seals can be built to any design to suit any make of TBM. "Available individually or as pre-welded sets, and fitted in one, two, three or four ring systems, Lanesfield Wire Brush Tailseals can withstand substantially high water pressures," says the company.

With its experience in the construction of these specialist seals, Lanesfield can also offer additional design features to meet customer specific requirements. Reverse flow stop plates can be fitted to the outer row seals, helping to restrict the backflow of grout along the length of the TBM.

Lanesfield Engineering
Tel: +44 1902 497 777
Email: seals@lanesfield.com
Web: www.lanesfield.com



Bespoke automation

HLS Hard-Line Solutions designs, manufactures, installs and services radio remote control systems, exporting all over the world. By conferring with clients on a regular basis, the company says it diligently ensures that customers are more than satisfied with its products. "Within the underground equipment industry, clients almost never require a standard radio remote control," says Hard-Line. "Modification is often necessary in order to develop a system that properly suits the purpose at hand."

HLS Hard-Line's commitment to surpassing customer expectations with innovative, quality products and services has also led it to develop the televideo rock breaker systems, tele-operated LHD systems, hazardous waste handling systems, and a mine wide digital communications infrastructure, the 'Mine Area Net'.

HLS Hard-Line Solutions was the 2006 winner of the Ontario Global Traders award for service exporting. "Hard-Line is committed to providing the best product and service. Staffed by qualified technicians and backed by an extensive inventory of replacement parts – Hard-Line service is available 24 hours a day, 7 days a week," says the company.

HLS Hard-Line Solutions
Tel: +1 705 855 1310
Email: sales@hard-line.com
Web: www.hard-line.com

Serial pumping performance for Austria's Koralm tunnel

When the pumping distance becomes too great for any one pump, Japanese experts Tsurumi recommend installing wastewater pumps in series. Sometimes construction projects require a level of performance that cannot be fulfilled by any one pump.

One example is the Koralm tunnel in Austria, which at 32.8km will be the longest rail tunnel in the country. Its construction presents a serious geotechnical challenge. Exploration tunnels are currently being built to evaluate the feasibility of the route, which will pass at depths of up to 1200m.

Contractors Max Bögl and Swietelsky are already on site carrying out this initial phase of the project. Starting from the west portal, the 2.6km long 'Mitterpichling' section is close to completion. Work has also begun on the 6km long 'Paierdorf' connection tunnel, where the groundwater had to be delivered upwards via the 120m high supply shaft.

"Considering the scale of the task it was unsurprising that no single-solution pump could be found at an acceptable cost," says Tsurumi.

"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. The multi-purpose pumps, designed for tough jobs are best sellers for the company, whose European operation is headquartered in Düsseldorf, Germany.

The range includes 250 models offering delivery volumes of up to 50m^3/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)
Tel: +49 211 4179 373
Email: sales@tsurumi-europe.com
Web: www.tsurumi-europe.com

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Germany

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Taking the pressure

Fogtec 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.

Fogtec Fire Protection
Tel: +49 (0) 221 962 23 0
Email: contact@fogtec.com
Web: www.fogtec.com

Finnish protection

Marioff 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.

Marioff Corporation
Tel: +358 (0)9 870 851
Email: landsales@marioff.fi
Web: www.marioff.fi

Raising the alarm

For more than 20 years, LISTEC's "Linear Fire Detection System" has protected tunnels worldwide with more than 1,000,000m of sensor cable.

LISTEC also supplies the LISTcontroller. With its ARM9T embedded processor and two secondary processors, the system is said to allow rapid and reliable recognition, detection and signalling of fires.

One or two sensor cable lengths or a group of sensor cable branches may be connected to the controller, which performs the cyclic addressing of all connected sensors to receive actual temperature values.

In the case of a temperature increase within programmable levels, a fire is recognised and indicated. An alarm is given if a differential alarm threshold is exceeded or if a maximum temperature value is reached.

The alarm is indicated on the controller's front panel by LEDs and on the clear text liquid crystal display. Alarms are highlighted by red and faults by orange background lighting in the display.

LISTEC
Tel: +49 8083 5385 0
Email: info@listec-gmbh.de
Web: www.listec-gmbh.de

Integrated tunnel control

PDucker Systems (PDS) claims to be leading the road tunnel control systems market with its MATRIC's IP Operator System. This is a fully-integrated solution in which video (CCTV), audio (PA and telephones), plant (lighting, ventilation, electrical and pumping) and traffic data (VMS, MIDAS and signs) is integrated using IP technology. This enables analysis, data management and recording in a common format, and offers a unified and cohesive control, monitoring and operating facility, says PDS.

The company adds: "This use of co-ordinated data enables improved traffic analysis, emergency situation detection and fire and security response. MATRICs IP is now being 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 pre-determined event plans."

MATRIC's IP can be used to integrate and test whole tunnel system solutions prior to installation on site.

P Ducker Systems
Tel: +44 1332 280 195
Email: info@pdslimited.co.uk
Web: www.pdslimited.co.uk

Sensing danger

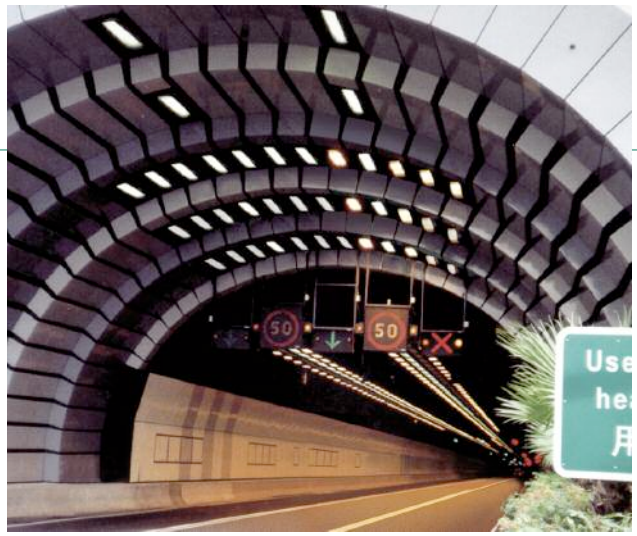
Securiton develops and manufactures a range of different fire detection systems to fulfil a broad spectrum of customer needs.

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.

Securiton
Tel: +41 31 910 11 22
Email: info@securiton.eu
Web: www.securiton.eu



Glowing report

Thorlux 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.

Thorlux Lighting
Tel: +44 1527 583200
Email: thorlux@thorlux.co.uk
Web: www.thorlux.com

Mitigating disaster

The 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^2 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.

Kidde Italia
Tel: +39 02 903 011
Email: info@kidde.it
Web: www.kiddeitaly.com

Breath easy

Over 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 exceed 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
Tel: +1 419 865 5000
Email: jpenka@awv.com
Web: www.awv.com

Air power deployed

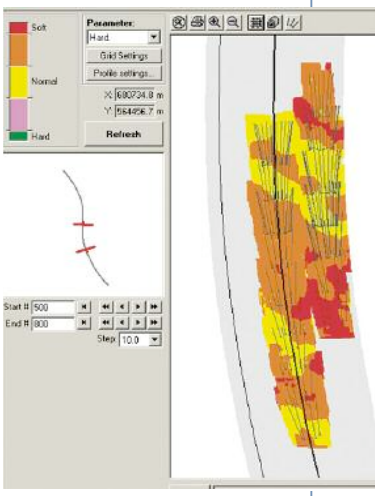
Fläkt Woods is an industry leader in air movement technology - the company's expertise in tunnel ventilation ranging from road, rail and metro tunnels to tunnel construction and mining. Under a recent contract Fläkt Woods supplied ventilation solutions on the Valsassina Tunnel, which connects the Italian 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
Tel: +44 1206 222 549
Web: www.flaktwoods.com

Tunnel management made simple



Informative and intelligent data support during the tunnel excavation process is said to be available with Atlas Copco's three upgraded packages of the software Tunnel Manager.

The Windows based program is suited for Atlas Copco Boomer rigs equipped with the Rig Control System (RCS) and the Advanced Boom Control function (ABC) Regular or ABC Total.

The upgraded Tunnel Manager software is available in three packages – Tunnel Manager, Tunnel Manager Pro and Tunnel Manager MWD.

Tunnel Manager offers basic functions such as generating drill plans and following up the result. Tunnel Manager Pro contains the upgraded "Measure While Drilling" (MWD) function.

The most advanced package, Tunnel Manager MWD, also contains the ability to analyse the collected data. This means that the user can translate rock drilling data into relevant rock mass characteristics such as rock hardness and fracturing.

Atlas Copco says: "The MWD technique is a well-proven and useful method for collecting drilling data, such as penetration rate, feed force, rotation speed, percussive pressure, rotation pressure, water pressure and water flow while drilling a hole.

Previously, data had to be sent to consultants or transferred into a separate tool for analysis, but now Tunnel Manager MWD offers the possibility to analyse and translate the data directly by the user."

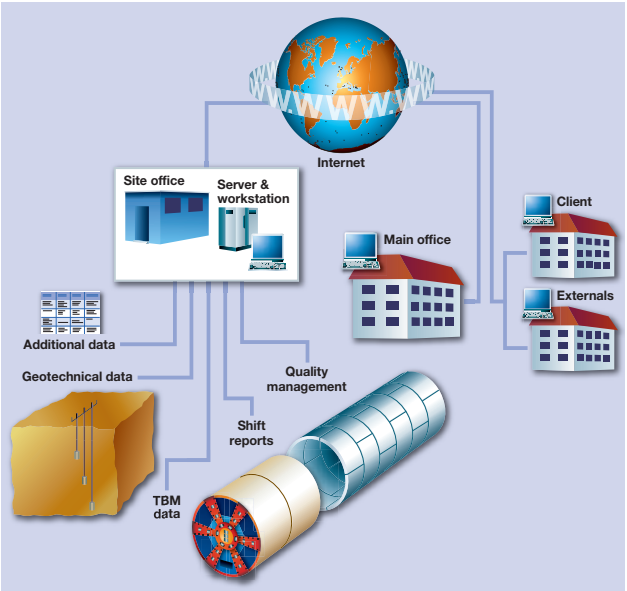
Atlas Copco
Tel: +46 (0) 19 670 7516
Email: morgan.kanflod@se.atlascopco.com
Web: www.atlascopco.com

Info control

TPC – Tunnelling Process Control "permits a new level of information and control for your tunnelling project," say its makers Babendererde Ingenieure. "TPC is the culmination of years of hands-on experience in consulting and construction management work.

During construction complex decisions are made on daily basis, especially in highly-mechanised operations like TBM tunnelling. How you interpret the available data has a significant impact on decisions and control of any situation."

It is said that TPC can collect any and all required data automatically from any source on site and present it in one concise report. The software can also be tailored to meet specific needs, "you even have the option to evaluate and display data in real-time mode for instant screen display, as a hard copy report or as a PDF-file for email distribution," the company adds.



Babendererde Ingenieure
Tel: +49 451 300 939 0
Email: contact@bab-ing.com
Web: www.bab-ing.com

Web-based vibration monitoring

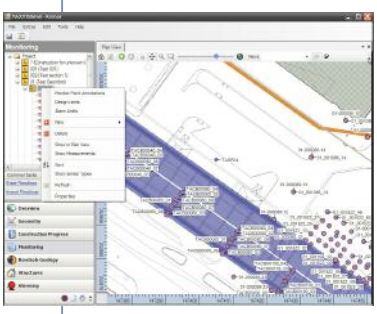
Instantel InstaLink is a web-enabled database and reporting program that allows the user to view vibration data that has been recorded remotely. This web-based monitoring system is claimed to be the perfect extension for remotely installed Instantel vibration monitors.

Says the company: "Access and share vibration data in real time from your semi-permanent tunnel monitoring systems anywhere, anytime. Using an Instantel vibration monitor remotely connected to a computer running Blastware software and an Internet connection, the Blastware Auto Call Home feature sends event data, storing it on the local computer.

"A Forwarding Agent software application detects the new event data files and sends them over the Internet to the InstaLink server database. Multiple clients may then securely view the event data through the InstaLink interface over the Internet."

Instantel
Tel: 613.592.4642
Email: sales@instantel.com
Web: www.instantel.com

Comprehensive acquisition



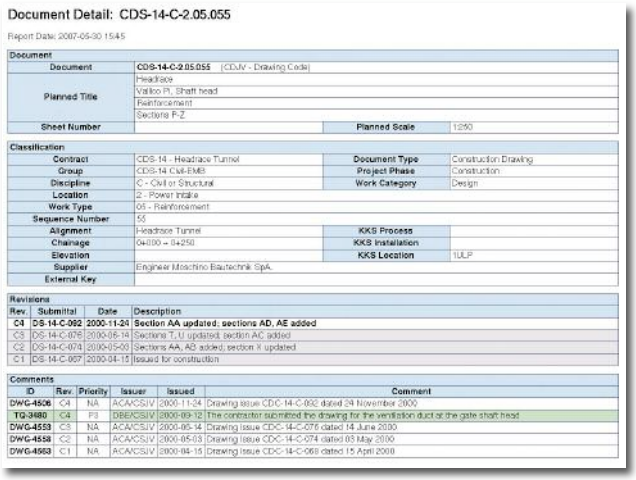
Geodata offers the new Kronos tunnel information software system for data acquisition, data management, automatic alerting and visualisation and to cover relevant data related to geotechnical measurements, geotechnics and geology, support systems, 3D geometry and building data, surveying, construction progress and TBM data. Main features of the software include:

- Uniform procedure for systematic storage of relevant data from different sources, with intuitive graphical user interface
- Visualisation of measurements in tabular form and as diagrams with associated information
- Interactive graphical overviews, extensive reporting functions and availability of the reports on the Internet (Web reports)
- Administration of pictures, plans, drawings, borehole logs, measurement data etc, with the option for exporting and importing via open interfaces
- Network capability
- Configurable notification of multiple addresses when conditions turn critical (alarm) and automatic management of measuring programmes.

Geodata Group
Tel: +43 3842 26555 0
Email: office@geodata.at
Web: www.geodata.com

Web-based drawing management

DrawMGT is a web application that manages construction drawings, documents and the tasks necessary to create, update and distribute them. DrawMGT assists collaboration between all project team members, including external partners. The user can provide access to suppliers, partner companies and the owner's organisation.



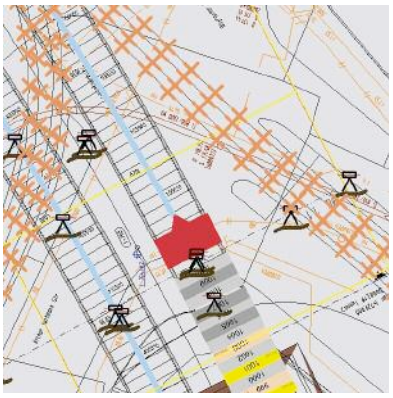
Created specifically for the heavy construction and tunnelling industry, DrawMGT is suited for large or small projects with participants from multiple organisations, at multiple sites. This ensures that all parties are working from the same plans, regardless of their physical location or their place in the project's organisation.

Claimed features include:

- Version/revision management – all file types supported
- Design management – workflows for internally and externally produced documents
- Task management – common tasks supported (site queries, punch lists, etc)
- Drawing submittals – automatic delivery of approved drawings
- Engineering classification – documents and tasks tags, with standard and project specific criteria
- Lists/reports – drawing and task lists, multiple formats and sorting
- Multi-language – available in English, German and French
- Secure – multiple permission levels and comprehensive audit trail

SoftXS
Tel: +41-41-511-9776
Email: drawmgt@softxs.ch
Web: www.softxs.ch

Integrated information system



With increased monitoring of the environment associated with the use of tunnel boring machines, it is essential information can be suitably processed and presented in such a way as to be useful for the safe and effective driving of the TBM with due regard to any settlement of surface structures.

Geodetic and geotechnical data need to be integrated with the TBM control parameters in order to inform the machine operator of the interrelationship of all these parameters to assist him in optimising the performance of the machine.

VMT has developed its Tunnel Construction Information System (CBP) feature designed to enable the integration of all this data into one common database to give near real-time evaluation of all incoming data for the continuous monitoring and visualisation of surface structures and for the display of deformations in front, above and behind the TBM. This will include the implementation of steering aid options for the shield driver and the supply warning messages in case of dangerous drive conditions.

The entire presentation can also be transmitted to the offices of the client as well as the contractor for even closer monitoring during critical situations.

VMT
Tel: +49 7251 96 99 0
Email: international@vmt-gmbh.de
Web: www.vmt-gmbh.de

Ground predictions

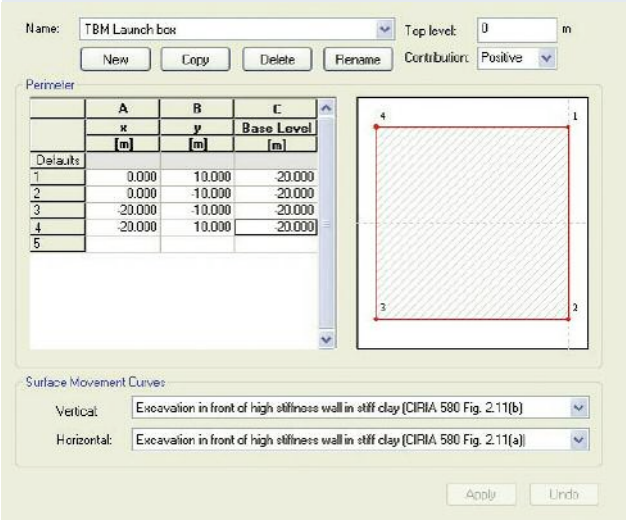
For most tunnelling or basement excavation works in urban areas, there is a need for ground movement and structural damage assessments to be carried out to establish the effect of the works on adjacent structures.

Tunset, from Oasys, automates an otherwise time-consuming task in predicting 3D ground movements arising from tunnelling, mining in rock and the installation of, and excavation beside, embedded wall excavations. The program uses these soil movements to calculate assessments of building damage in accordance with the Burland (1995) methodology. Recent projects such as Crossrail have advocated the use of this method.

The software has been recently improved accounting for guidance from Arup engineers who have experience of working on complex urban tunnelling projects in cities such as London, New York and Hong Kong.

The latest release of Tunset, version 18.4, includes 3D graphics. These allow complex geometries of components and results to be viewed, enhancing a client's understanding of a project, providing immediate visual identification of data input errors and aiding the engineer in the interpretation of results.

Oasys
Tel: +44 191 238 7559
Email: oasys@arup.com
Web: www.oasys-software.com



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www.coyles.co.uk/tunnelling

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The selected persons are a team and have experience of at least five to seven years (at least of two TBM projects). Please response with Salary bracket (Budget) in EURO. for each category /position the facilities and packages shall be commensurate with the industry standard.
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- **Tunnel Engineers (Immersed Tunnel Exp.)** - Tyne & Wear
- **Tunnelling QS** - South East
- **Immersed Tunnel Design Engineers** - Abu Dhabi, UAE or UK Based
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Email: gtween@tunnelsonline.info Fax: +44 (0)20 8269 7840

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Dates & Events

08-10 SEPTEMBER
Underground Spaces 2008
New Forest, UK
Organised by the Wessex Institute of Technology and the National Technical University of Athens, this conference focuses structural and material character-isation and trends regarding the utilisation of underground space. Contact: enquiries@wessex.ac.uk; web: www.wessex.ac.uk/conferences/2008/underground08/index.html

10-12 SEPTEMBER
12th International Conference "Geotechnica 2008 - Geotechnics, Slovak Republic
The conference organised by the Technical Universities of Ostrava (CZ), Kosice (SK), and Gliwice (PL) focuses on techniques, technologies and monitoring of geotechnical construction. Contact: Nora Badíková. Tel: +421 (0)2 659 36 486; email: orgware@mail.t-com.sk

10-12 SEPTEMBER
Breakthroughs in Tunneling
Golden, Colorado
The Colorado School of Mines, in conjunction with Tunnel Business Magazine and Microtunneling Inc, presents a Short Course that will cover all aspects of conventional and mechanised tunnel design and construction in hard rock, soft ground and soils. Presented by international experts. Contact: timcoss@microtunneling.com; web: www.tunneling.com

17-18 SEPTEMBER
IUT '08 International Tunnel Fair
Sargans, Switzerland
Held in the Hagerbach Test Gallery (VSH), this tunnelling exhibition sees all the industry's main suppliers gathering in a unique venue. The event also includes live demonstrations and a full seminar. Contact: IUT; web: www.iut.ch

22-27 SEPTEMBER
2008 ITA World Tunnel Congress
Agra, India
The 34th ITA General Assembly and Congress will be held at the Hotel Jaypee Palace, in Agra. In view of the large scale tunnelling works due to be undertaken in India, there is much scope for agencies within as well as outside the country, to demonstrate their capabilities and network. Contact: CBIP; email: sunil@cpib.org; web: www.wtc2008.org

23-26 SEPTEMBER
InnoTrans 2008
Berlin, Germany
This international convention and trade fair for transport technology, including railway infrastructure, interiors, public transport and tunnel construction. The conference has become an increasingly popular addition to the event calendar. Contact: Messe Berlin; Web: www.innotrans.com

6-8 OCTOBER
International Congress 'Building Underground for the future,' Monaco
Organised by the Association Francais des Tunnels et de l'Espace Souterrain (AFTES), the three day event will consider the future use of the underground space with papers presented from all walks of the tunnelling spectrum. Contact: AFTES: email: aftes@snc.fr; web; www.aftes.asso.fr

8-10 OCTOBER
6th Austrian Tunnel Day 2008
Salzburg, Austria
Organised by the Austrian Society for Geomechanics (OEGG), topics for the 6th Austrian Tunnel Day include: Tunnelling in the past and present; Special challenges on large current projects; and a panel discussion entitled "Fair construction execution - economic construction". Contact: OEGG: email: salzburg@oegg.at; web: www.oegg.at

16 OCTOBER
Tunnelling 2008
London, United Kingdom
This one day conference, supported by the British Tunnelling Society, includes project updates on the Crossrail and Thames Tideway projects, as well as National Grid's cable tunnel projects. Contact: Melanie Putzki; Tel: +44 20 7728 5232; web: www.tunnelling2008.co.uk

22-24 OCTOBER
Underground Infrastructure of Urban Areas, Wroclaw, Poland
The conference is organised by the Urban Engineering division of the Institute of Civil Engineering, Wroclaw University of Technology, in association with the ITA, ISTT and EFUC (European Forum on Underground Construction). Contact: tel: +48 71 320 2914; email: andrzej.kolonko@pwr.wroc.pl; web: www.bliw.wroc.pl/uiua/2008

27-28 OCTOBER
20th National Conference, Tunnelling Technology & The Environment
Niagara, Ontario, Canada
Organised by TAC, the Tunnelling Association of Canada. Contact: +1 604 629 1736; email: info@tunnelcanada.ca; web: www.tunnelcanada.ca

10-12 NOVEMBER
ICDE 2008, Challenges and Risk Management of Underground Construction, Singapore
The International Conference on Deep Excavations (ICDE) is an ITA sponsored event organised by TUCSS. It aims to be a forum for contractors, engineers and owners to share and discuss experience. Contact: TUCSS; email: info@tucss.org.sg

MAY 2009
Tunnels & Underground Spaces for Transportation & Urban Development
Tehran, Iran
The 8th Iranian conference on tunnelling and underground spaces is designed to act as a platform for national and international companies to demonstrate their capabilities, in view of the large number of tunnelling projects being planned in this country. Contact: Iranian Tunneling Association; Tel: 98 21 8863 0495; email: info@irta.ir; web: www.irta.ir

23-28 MAY
2009 ITA World Tunnel Congress
Budapest, Hungary
The 35th ITA General Assembly and Congress will be held in Budapest. With a large amount of tunnelling underway and in planning, the organisers are confident it will be a successful event. Contact: Diamond Congress; email: secretariat@ wtc2009.org; web: ww.wtc2009.org

BRITISH TUNNELLING SOCIETY

18 SEPTEMBER: **Kings Cross Station**
Following the annual summer break, meetings resume with a presentation on the complex network of caverns, tunnels and inclined shafts recently constructed at London's King's Cross Station. 5.30pm for 6pm start, at the ICE, Westminster, London.

14-17 JUNE
RETC 2009
Las Vegas, Nevada, USA
Since the first conference in 1972, RETC has been recognised as a leading international tunnelling event for contractors and engineers. Last year, conference attendance exceeded 1500 professionals from more than 30 countries and the exhibition sold out in record time. With a venue of Las Vegas, 2009 is sure to be even more of a success. Contact: SME; web: www.retc.org

22-25 JUNE
5th Symposium of Strait Crossings
Trondheim, Norway
Organised by SINTEF and the Norwegian University of Science and Technology, this major symposium aims to act as a forum for the exchange of information, research, new technology and recent experience. The event will also include an exhibition. Contact: NTNU; email: sc09@adm.ntnu.no; web: www.straitcrossings.com

09-11 SEPTEMBER
EURO:TUN 2009
Bochum, Germany
The 2nd International Conference on Computational Methods in Tunnelling. Organised by the Institute for Structural Mechanics. Contact: Conference Secretariat: Tel: +49 234 32 29051; web: www.eurotun.rub.de

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.
Fax: +44 208 269 7840
Email: tthomas@tunnelsonline.info
Web: www.tunnelsonline.info

Contacts

HEAD OFFICE
Progressive Media Markets
Progressive House
2 Maidstone Road
Sidcup, Kent
DA14 5HZ
United Kingdom

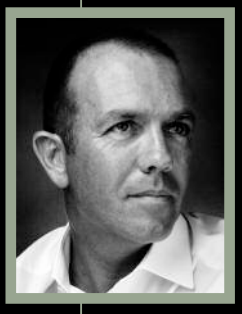
WEB
www.tunnelsonline.info

TEL
+44 20 8269 7789

FAX
+44 20 8269 7840

Tris Thomas

Amanda Foley



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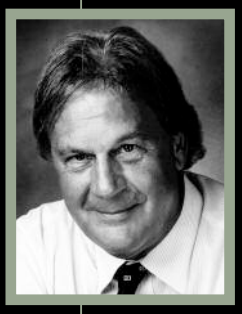

David Wildman

HOW TO CONTACT US

EDITORIAL

EDITOR
Tristan Thomas BSc (Hons)
Tel: +44 20 8269 7893 Fax: +44 20 8269 7840
Email: tthomas@tunnelsonline.info

DEPUTY EDITOR
Amanda Foley
Tel: +44 20 8269 7789 Fax: +44 20 8269 7840
Email: afoley@tunnelsonline.info

CONTRIBUTING EDITOR
Patrick Reynolds MEng
Tel: +44 20 8269 7748 Fax: +44 20 8269 7840
Email (copy to both): patrickjreynolds@hotmail.com; preynolds@tunnelsonline.info

DESIGN
Natalie Kyne

TECHNICAL ILLUSTRATOR
Nick Stenning

PRODUCTION CONTROLLER
Loraine Lee
Tel: +44 20 8269 7799 Fax: +44 20 8269 7840
Email: llee@progressivemediagroup.com

ADVERTISING

GROUP ADVERTISEMENT MANAGER
Gary Tween
Tel: +44 20 8269 7849 Fax: +44 20 8269 7840
Email: gtween@tunnelsonline.info

NORTH AMERICAN MANAGER
Steven Caming - Granite Media Services
Tel: +1 603 447 1187 Fax: +1 603 447 6166
Email: granitemediaservices@yahoo.com

EUROPEAN MANAGER
Randolf Krings
Tel: +49 611 5324 416 Fax: +49 611 5324 519
Email: t&t@emcmedia.de

ITALIAN OFFICE
Ediconsult
Tel: +39 02 477 10036 Fax: +39 02 477 11360
Email: milano@ediconsult.com

PUBLISHING

PUBLISHING DIRECTOR
David Wildman
Tel: +44 20 8269 7778 Fax: +44 20 8269 7840
Email: dwildman@progressivemediagroup.com

HOW TO SUBSCRIBE

Tel: +44 845 155 1845 7511 Fax: +44 20 8606 7301
Email: progressive@optimabiz.co.uk

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