TERRATEC

BORE LONGER. BORE FASTER.

Company Milestones

Incorporated in 1990, TERRATEC is the world-renowned Australian designer and manufacturer of Tunnel Boring Machines, Raise Boring Machines and other custom-made products for tunnelling and mining applications.

TERRATEC's success is based on the experience and excellence of its engineering team. The team includes engineers with over 40 years experience in the design and manufacture of tunneling and mining machines who have also worked on some of the world's largest underground projects. TERRATEC is fully managed by Engineers and this gives quick and efficient solutions to meet the Customer's expectations.

TERRATEC products are well-known in the industry as Robust, Durable and Safe, basic principles which must prevail in the conception of any equipment made to work in the extreme conditions encountered underground. As a provider of Total Tunnelling Solutions, TERRATEC's scope of work extends to include operation and maintenance of boring equipment during the execution of works as well as supply of ancillary equipment.

Today, TERRATEC is well placed to meet the growing global market, demanding the highest Quality and Reliability of Equipment for fast and efficient execution of Projects anywhere in the World.

Tunneling Production World Record

The new TERRATEC concept of continuously advancing conveyor system sets the production World Record in the Blue Mountains Project, which is still unbroken for that diameter tunnel today.

Jul 1993

Sept 1990

Incorporation of Terratec

Mr. Tony Peach and Mr. Al Jones establish TERRATEC in Australia.

Sept 1995

Oscillating Disc Cutter (ODC) Prototype

After several years of Research and Development, a full scale prototype of the ODC is designed, manufactured and tested to prove its effectiveness to Cut Rock up to 10 times more efficiently than conventional Disc Cutters.

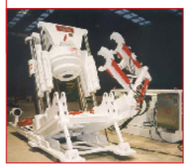
Nov 1996

First Export to China

TERRATEC obtains its first contract in CHINA for the supply of one TBM and two Segment Erecting Machines for the Strategic Sewer Disposal Scheme in Hong Kong.

Apr 1999

Nov 1998



First Exports to USA

TERRATEC receives an Order from Stillwater Mining Co. and BHP Copper Inc. for the supply of three Raise Boring Machines (TDRL-600 TDRL1000's) in the difficult USA Market controlled by American competitors up to that time.

World's Largest Down Reaming Drill

TERRATEC supplies the world's largest down reaming production drill (TDR2000) which was purchased by Xstrata's Mount Isa Mines, one of the largest mining companies in the World.

Dec 2002

Apr 2005

First EPB Project

TERRATEC participates in the design and supply of the tunneling equipment together with Mitsubishi Heavy Industries for the New Metro Rail City Project in Perth, Australia.

First Export to Europe

TERRATEC receives the first order to export its equipment to Europe, consisting of a TBM and related Back-Up System for a water transfer project in Portugal.

Aug 2009

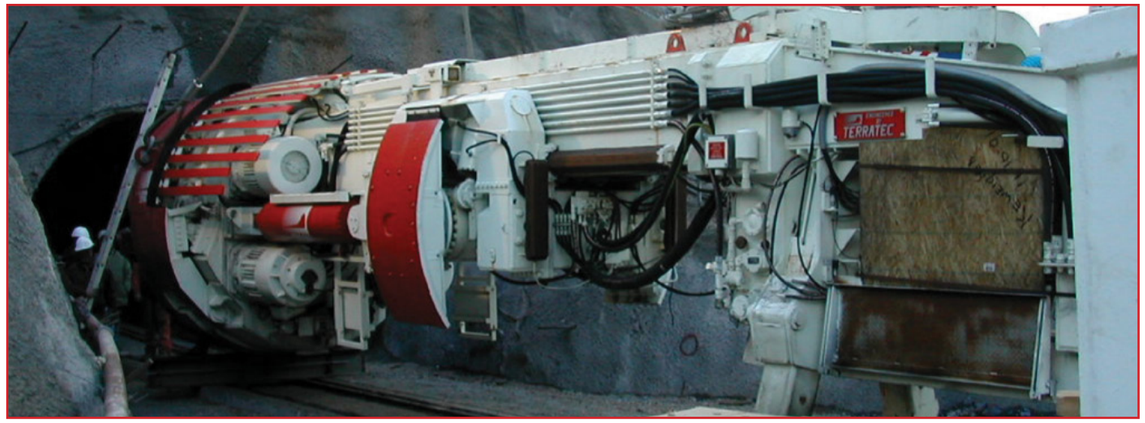
First TBM for Latin-America

TERRATEC receives an order for the supply of complete tunnelling system, including 9.56m EPB-TBM, Conveyor System and Rolling Stock, for the construction of the Line 2 of Metro in Santo Domingo, Dominican Republic.

Tunnel Boring Machines (TBMs)

HARD ROCK TBMs

From its establishment, TERRATEC has been providing Hard Rock Tunnel Boring Machines for varied geologies, from soft shale to extreme hard and abrasive quartzite. TERRATEC offers the following TBMs for hard rock applications:



Open TBM

The Open TBM is the most traditional among the Hard Rock TBMs and is the fastest and most effective for boring tunnels in healthy Hard Rock formations.

During the boring operation, the rear part of this TBM, called the Gripper Device, is firmly anchored to the tunnel walls by two large gripper pads while the front part of the TBM, containing the CutterHead, is extended by the action of 2 or 4 hydraulic cylinders called the Propel or Thrust Cylinders.

Double Shield TBM

For those rock formations containing unstable or faulty zones, using a Double Shield TBM is the safest and most efficient way to excavate tunnels.

Double Shield TBM propulsion is achieved also by using a Gripper Device, but in difference from the Open TBM, the Front and Rear parts of the TBM are completely shielded and the TBM can install a concrete lining ring formed by precast segments to perfectly protect the tunnel from the surrounding ground, at the same time as the CutterHead excavates, allowing excellent advance rates.

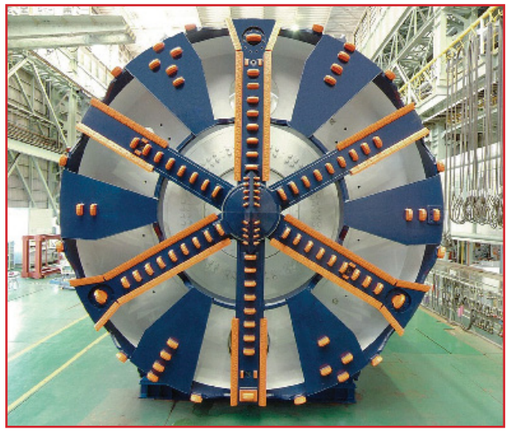
Single Shield TBM

When rock strength is weak and the tunnel walls cannot react against the action of the Gripper Pads, the excavation of the Rock has to be done with a Single Shield TBM.

The Single Shield TBM reacts against the concrete lining ring to advance forward, and due to this, installation of Segments and excavation cannot be done simultaneously.

SOFT GROUND TBMs

For tunnelling projects in soft geology with small overburden, generally carried out under cities, the TBM has to perfectly control the pressure in the excavation face, which must be larger than the atmospheric existing inside the boring machine. TERRATEC produces the following Soft Ground TBMs.

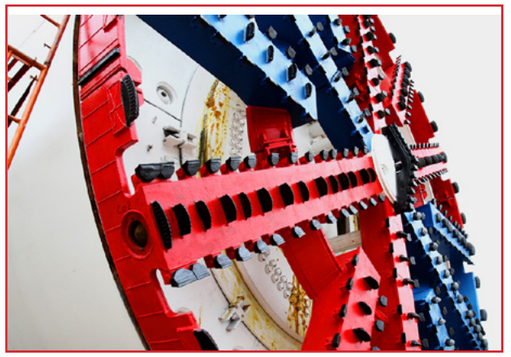


Earth Pressure Balance Machine

The Earth Pressure Balance Shield Machine (EPBM) evacuates the material through a Screw Conveyor. The pressure in the front of the machine is controlled by regulating the advancing speed of the shield and the evacuation flow. The EPBM can work with or without pressure in the front in stable layers.

Slurry Shield

The Slurry Shield TBM is suitable for excavating soils with high water content. This TBM is equipped with a Slurry System which controls the pressure in the excavation face by injecting pressurized slurry into the Cutter Chamber where the slurry is mixed with the excavated material and the mixture is pumped out of the Tunnel to a separation and recirculation plant.



MICROTUNNELLING

TERRATEC offers a wide range of Small Boring Machines (<2.5m) which does not require the presence of an operator inside the Tunnel, as the excavation is fully controlled from outside the Tunnel.

These trenchless solutions are in demand in large cities where conventional methods can cause unacceptable disruption to the daily life of citizens.

Raise Boring Machines (RBMs)

TERRATEC has developed through the years its own series of Raise Boring Machines, which today is recognized as a superior product due to its innovative and high-performance design.

The following TERRATEC standard Raise Boring Machines are available:

TDR Series

The TDR Series (Terratec Down & Raise) allows reaming conventionally upwards, as well as downwards, up to 2,000mm diameter shafts.

TERRATEC's design of the TDR Series is low profile and all the components can pass through the working table, allowing the user to work comfortably in confined spaces.

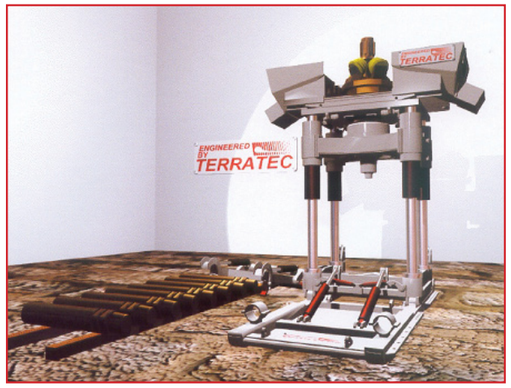
TR Series

For the excavation of large shafts, TERRATEC's TR (Terratec Raise) Series offers an optimized design to ream only upwards shafts up to 6,000mm in diameter.

UB Series

The design of the Universal Borer (UB) Machine allows the Raise/ Down/Boxhole drilling of shafts, which makes the UB the most versatile of the RBM's.

The standard model of the Universal Borer allows raise boring shafts of 1,500mm and Down or Box hole reaming up to 1,060mm.



TERRATEC also supplies accessories for the operation:

- *Drill Pipe*
- *Reamers*
- *Cutters*
- *Crawlers*

Project Report: Queensland Project

RBM Type:	TDR-1000	
Series Number:	R07	
Location:	Queensland, Australia	
Year:	2000	
Customer:	Mount Isa Mines Limted	
Hole Diameter:	Down Ream	1.06 m
	Up Ream	1.5 m
Installed Power:	110kW + 22kW	
Torque:	Pilot Drilling	9,350 Nm
	Reaming	48,800 Nm
	Make-Up	53,600 Nm
	Break-Out	58,400 Nm
R.P.M:	Pilot Drilling	0 - 80 (Stepped)
	Reaming	0 - 12 (Stepped)
Thrust:	Down	800 kN
	Up	1,368 kN
Derrick Dip Angle:	Standard	90° - 45°
Derrick Extended Height:	4,300 mm	
Drill String Length:	1,524 mm	

Conveyor Systems

Project Report: Blue Mountains Project

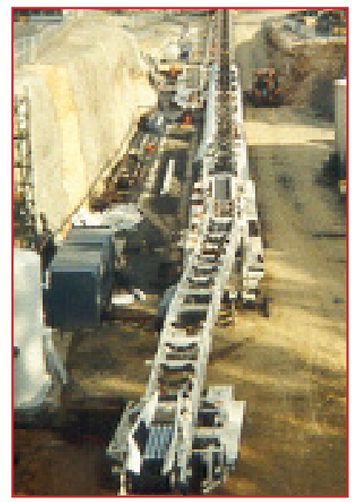
The Project involved a scheme to collect sewage from the upper reaches of the Blue Mountains for transfer to a new advanced treatment plant in the lower mountains.

This entailed the construction of 3 tunnels of approximately 3.4 m in diameter each and totalling 18 km in length, from which the majority (13.5 km) was excavated by TBM. The construction was undertaken by a Joint Venture of McConnell Dowell Constructors (Australia) and the Obayashi Corporation (Japan).

TERRATEC designed and manufactured a Backup System and a new patented concept of Continuously Advancing Conveyor System for the TBM, which set new world records in production for tunnels of this size. These records have remained unbeaten today.

Project Name:	Blue Mountains Sewage Transfer Scheme
Location:	New South Wales - Australia
Year of Contract:	1993
Customer:	McConnell Dowell Constructors & Obayashi Corporation
Tunnel Diameter:	3.4m
Tunnel Length:	13,500m

- *Best Day 172.5m*
- *Best Week 703.3m*
- *Best Month 2,166m*



The success of the construction of a tunnel depends not only on the selection of the most suitable tunnelling machine but also the most efficient system to evacuate the spoil excavated from the TBM out of the tunnel. Interruption in the evacuation works very often leads to interruption to the boring availability of the TBM and subsequently, to the overall production.

Especially when tunnels are long, when slopes are steep or when space for unloading spoil is limited in the tunnel portal, the usage of a Conveyor System has innumerable advantages over evacuation by Muck Cars in terms of productivity, safety and operation and maintenance costs.

TERRATEC has designed and built sophisticated continuous conveyor systems specifically for individual tunnel and TBM conditions. These include continuous conveyor systems in the tunnel, transfer systems, vertical conveyors and stacker systems at the tunnel portal.

TERRATEC Conveyor Systems have been successfully installed by its own TBMs or TBMs made by other companies over the last 20 years with excellent results in more than 12 different projects.

Bunker Conveyor

For mining applications or tunnelling by conventional methods, TERRATEC's Bunker Conveyor is the perfect solution to evacuate the muck due to its robust, simple and reliable design.

The TERRATEC Bunker Conveyor is designed to be pulled along a monorail as the tunnel advances. It is equipped with a telescopic hopper which facilitates the load of the muck into the conveying system. The filling of each truck is radio controlled by the operator so the exact amount of muck can be loaded every time.

Other Products

In addition to TBMs, RBMs and Conveyor Systems, TERRATEC designs and builds other equipment and machinery for the tunnelling and mining industry. The following are some representative samples:

MINING EQUIPMENT

Ore Belly Dumper

The direct transportation by road of ore material from the open mines to the Sea Port in West Australia is becoming a more tried and proven method of transferring ore to the port in the absence of rail infrastructure in remote locations.

TERRATEC Ore Belly Dumpers are the best choice to meet such a need of mining companies. Each Dumper has a capacity of 16m^3, and it is specially designed to allow up to 3 of them being linked together to form a complete Ore Belly Dumper Train of capacity of as much as 48m^3.

Simplicity in design, durable wear resistant construction, along with strict adherence to the Australian Road and Safety Standards, make TERRATEC Ore Belly Dumper a cost-effective choice of transport.

Blast Hole Cleaner

For mining applications, TERRATEC supplies robust and reliable Blast Hole Cleaner Systems of easy use and reliability.

TERRATEC Blast Hole Cleaner System is designed to accurately position a stored length of poly pipe over an existing blast hole, feed the poly pipe down the hole while the hole is flushed with water and/or air. The amount of poly pipe fed into the hole is monitored at the console (L.E.D. Readout). Poly pipe feed pressure, air and water pressures are also monitored on gauges at the console.

The unique positive spring preloaded in the pipe pusher/tractor feed mechanism ensures that the poly pipe will be securely held while working and will not experience any slippage.

TERRATEC Blast Hole Cleaner System allows mining and drilling contractors to complete blast holes in a safe, accurate and economic manner.

TUNNELLING EQUIPMENT

Tunnel Lining Equipment

For those tunnelling projects bored by Open TBM which need separate final lining to ensure perfect tightness, TERRATEC designs and builds machinery to facilitate the process.

TERRATEC has successfully custom-designed and manufactured Robotized Systems for its Customers for the installation of shotcrete on the newly excavated tunnel walls, Segment Erecting Machines for installation of precast concrete segments and Special Carriages to allow installation of waterproof membranes in tunnels.

Rolling Equipment

TERRATEC can specify and supply haulage equipment for any Project.

Especially when the TBM and Back-Up System are supplied by TERRATEC, the best choice is to allow TERRATEC to design and supply the Train which best suits the TBM and Back-Up requirements, ensuring perfect synchronization of the Total Tunnelling System.

Also, TERRATEC has wide-ranging experience in supplying auxiliary structures for Rolling Equipment such as Rail Crosses and complete Rolling California Switches for usage in tunnels.

Services

REFURBISHMENT

For Customers having an existing TBM and intending to use it in a new job, TERRATEC offers reconditioning or refurbishment of the equipment. Irrespective of whether the machine was originally from TERRATEC or any other supplier, our engineering team, having been present in the Industry over the last 40 years, is well aware of all the technologies and can easily find a replacement for any part or overhaul any component to match the new desired specification.

Where budget and delivery time constraints exist, TERRATEC can locate a suitable 2nd hand TBM, either from its own stock or through its network, and recondition or remanufacture it to meet the Project requirements.

Before

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After

TERRATEC not only offers refurbishment of TBMs and RBMs but also any other tunnelling or mining equipment including Rolling Stock or Locomotives.

AFTER SALES: SPARES AND FIELD SERVICE

TERRATEC supports the operation of its TBMs through its spares and field service departments.

With the acquisition of a TBM, it is recommended that the Customer obtain an initial package of spare parts and contract the supervision of the assembly of the TBM to TERRATEC's field service experts. This will guarantee smooth erection and commissioning of the machine.

Even in cases where projects are being operated without the assistance of TERRATEC personnel, Customers can still enjoy immediate response and quick supply of spares and field services through TERRATEC's worldwide network of representatives and the support by our regional offices around the world.

CONSULTING

TERRATEC's relationship with the Customer is not limited to the Supply of the TBM. TERRATEC's extensive experience in the tunneling industry allows customers to benefit from advice from TERRATEC in following fields related to their new Tunneling Projects:

- Review of project requirements and specify TBM technology
- Selection of suitable TBM
- Design of suitable Segment Lining
- Development of Tunnelling Method Statements
- Cost analysis for the equipment and tunnelling works

ENGINEERING

Irrespective of having purchased the TBM from TERRATEC or from another Supplier, TERRATEC is always willing to support the Customer with the design and/or supply of any custom-made equipment which may be needed for the TBM assembly or operation such as Reaction Frames, Launching Cradles, TBM Pulling Systems, etc.

TERRATEC can either supply the equipment, or where it may be more convenient, provide the manufacturing specifications for Customers to arrange local fabrication.

TOTAL TUNNELLING SOLUTION

The capacity to provide a wide range of services means that TERRATEC not only is an equipment supplier but a qualified and experienced partner to utilize for the execution of the Tunnelling Works.

As a result, it is more and more common for TERRATEC to supply the Total Tunnelling Solution, a package consisting of the TBM, other main equipment in the tunnel (Trains, Conveyors, Segment Moulds and Ventilation), the spares and consumables for the equipment and a team of TERRATEC field personnel who is responsible for operating and maintaining the equipment throughout the whole project.

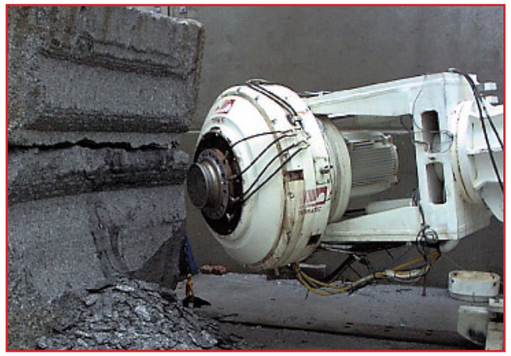
Innovation

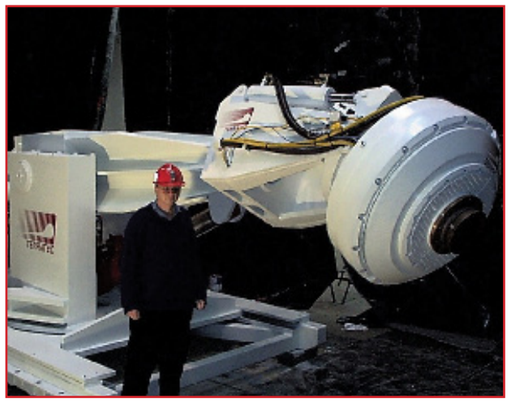
The innovative spirit of TERRATEC and consequent introduction of new ideas in the Industry has been always present since the incorporation of the Company.

A sample of it is the patented design of advancing tail piece for a continuously extending conveyor, which allowed McConnell Dowell of Australia and Obayashi Corporation of Japan to achieve the world record advance of 172.4m in a day, 703.3m in a week and 2,067m in a month in the Blue Mountains Project in 1993, only 3 years after TERRATEC was established. This is still a record for this diameter tunnel.

Many other inventions and contributions to the industry have been introduced by TERRATEC's Research and Development, but the most progressive of all is perhaps the Oscillating Disc Cutter System. For this R&D project, a full scale prototype was designed and manufactured by TERRATEC in cooperation with the Centre for Mining Technology and Equipment of Australia (CMTE) in 1995 which proved its effectiveness and ability to cut rock up to 10 times more efficiently than conventional Disc Cutters.

Today, TERRATEC continues to cooperate with various Universities and Government Institutions in Australia for the development of new Tunneling and Mining alternative technologies by the increase of next-generation Machinery.






CERTIFICATE of MEMBERSHIP

The Standards Association of Australia is proud to include amongst its members

Terratec Asia Pacific Pty Ltd

and confers on them the privileges to which membership of the Association entitles them.

Chief Executive

1st May 1997

MEMBER

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