

SUCCESS AT SEYMOUR CAPILANO

Two 3.8 m (12.5 ft) Robbins Main Beam TBMs completed Canada's Seymour Capilano tunnels in November 2010, ahead of the revised schedule.

On November 4, 2010, the final breakthrough for the second of two Robbins TBMs capped more than two years of hard rock tunneling in a four year period. Excavation at Metro Vancouver's Seymour Capilano twin tunnels culminated in a successful breakthrough following the restart of the 3.8 m (12.5 ft) diameter machines in July and August 2009. The final 3.1 km (1.9 mi) of boring in each tunnel was finished ahead of the revised schedule.

The project's second contractor, the Seymour Cap Partnership (a JV of Frontier-Kemper Constructors ULC, Aecon Constructors and JF Shea Inc.) achieved up to 29 m (95 ft) per day with both machines in variable ground conditions, including faulted and sheared rock. "We are all miners at heart here. When someone else says something can't be done, we show them that it can be. This should be taken as a big pat on the back for all those involved," said Richard Boutelle, Special Projects Manager for Frontier-Kemper.

Both Robbins machines were launched from a common cavern in July and September 2006 to bore the parallel 7.1 km

(4.4 mi) long tunnels. The two 3.8 m (12.5 ft) diameter Robbins High Performance (HP) Main Beam TBMs were supplied to the original contractor, Bilfinger Berger (Canada). Both machines came equipped with twenty-six 19-inch (482 mm) diameter cutters and installed power of 1,250 kW (1,675 HP).

Following the issuance of a new contract, Frontier Kemper began its excavation using a strict program of ground monitoring and support, ranging from no support in good ground to rock bolts, wire mesh, channel straps, and steel sets in less stable conditions. "We are quite pleased with the breakthrough. The success of this project can be attributed to having an excellent crew of knowledgeable people, good pre-planning of the work and very good TBMs," said Frontier-Kemper Project Manager, Serge Moalli.

The Seymour Capilano Water Filtration Project, for owner Metro Vancouver, is part of a large scheme to improve the quality of drinking water in Vancouver, BC. The completed filtration system will clean 1.8 billion liters (475.5 million gallons) of water per day to meet federal standards.



The 6.3 m (20.5 ft) diameter Robbins EPB at Line 2, Lot 18 of China's Chengdu Metro, seen here at an intermediate breakthrough in June 2010, completed its excavation on December 14.

ISO UPGRADE ENSURES TBM QUALITY WORLD-WIDE

The International Organization for Standardization (ISO) is globally recognized as providing the standard in quality assurance. As of December 2010, Robbins has upgraded to the latest ISO certification, 9001:2008. The new upgrades will ensure that products are manufactured using the most current procedures and practices associated with quality, for TBMs and all other Robbins equipment.

"We are a full-fledged international company with manufacturing and assembling facilities in many locations. This upgrade guarantees common quality standards in our many locations and enables us to provide high quality products to our customer at fair prices," said Lok Home, Robbins President.

Standardized practices are being implemented at all Robbins manufacturing facilities, as well as for TBMs being built using Onsite First Time Assembly (OFTA).

The OFTA method, which involves initial assembly at a jobsite rather than in a workshop, particularly benefits from rigorous quality control measures such as those in the ISO 9001:2008 system. Manufacturing of components is a standardized practice, with templates often used on critical sub-assemblies to test and ensure accurate fit-up of parts.

ROBBINS EPB CHARGES THROUGH CHENGDU METRO TUNNEL

On December 14, 2010, a record-breaking TBM wrapped up tunneling at China's Chengdu Metro. The 6.3 m (20.5 ft) diameter Robbins EPB excavated Line 2, Lot 18 of the metro tunnels, achieving up to 180 m (590 ft) in one week--faster than any of the 11 other TBMs working on the project.

The machine was launched in January 2010 to excavate two parallel 1.4 km (0.9 mi) long tunnels in highly permeable ground, which included lenses and layers of pebbles, sand, and clay. By June 2010, the Robbins EPB had exited into an intermediate station at the halfway point.

Following routine maintenance, the machine's second drive began August 7, and saw advance rates of 18 m (59 ft) per 12-hour shift. A best month of 459 m (1,500 ft) was also achieved on this drive. "We believe the Robbins TBM has been so fast because of the good quality VFD drive and segment erector," said Mr. Li Quanshe, Project Manager for the contractor, China Railway Construction Corporation (CRCC), Bureau 23.

Line 2, Lot 18 is the first TBM project for Bureau 23, which hopes to use the machine on future projects in the area.

The Robbins EPB was designed to excavate the complex matrix of alluvial geology, found nowhere else in China. A mixed ground cutterhead, mounted with 17-inch diameter disc cutters and carbide bits, was provided, along with a foam injection system to stabilize running ground.

Little to no settlement was detected by various surveys throughout TBM excavation. "The TBM allowed very good control of foam and other additives into the ground at the face," said Mr. Li. Cover was relatively shallow in the urban area, ranging from 3.5 to 22 m (11.5 to 72 ft).

China's Chengdu Metro will open in three stages. The 50.6 km (31.4 mi) long Line 2, for Chengdu Metro LLC, (with 17.6 km / 10.9 mi of underground tunnels) will include 26 stations between Longquandong and Shiniu areas. Seven lines totaling 274 km (170 mi) are planned to be operational by 2035, and will service 13.1 million daily passengers.

LANDMARK FINISH FOR FIRST LAOTIAN TBM



The first TBM to ever excavate in Laos, a 7.6 m (25.1 ft) diameter Robbins Single Shield, broke through on November 21, 2010 at the Theun Hinboun Expansion Project. Photo: Courtesy CMC di Ravenna

On November 21, 2010, a Laotian landmark was achieved for the country's first TBM-driven tunnel. Italian contractor CMC di Ravenna celebrated the breakthrough of a 7.6 m (25.1 ft) diameter Robbins Single Shield TBM for a hydroelectric tunnel on the Nam Theun River.

During excavation, the TBM averaged about 19 m (62 ft) per day, with a peak advance rate of 37 m (121 ft) in one day. Ground conditions consisted of fair to good sandstone, mudstone, and siltstone for 95% of the tunnel length, with some small sections of poorer rock quality.

The machine is now being disassembled and removed from the finished tunnel. By 2012, the Theun Hinboun Expansion project and 5.5 km (3.4 mi) headrace tunnel will bring much needed power increases to both Laos and neighboring Thailand.



BREAKTHROUGH AT CHINA'S EPIC PINGLU TUNNEL

More than 500 people gathered at a breakthrough ceremony in remote China to celebrate the completion of one of the world's longest single drive TBM tunnels. In November 2010, a 4.8 m (15.7 ft) diameter Robbins Double Shield machine completed excavation of the 25.4 km (15.8 mi) long Pinglu Tunnel.

The new tunnel is the most recent leg of China's Yellow River Water Diversion Project, for the Sino-Austria Hydraulic Engineering Co. Ltd (SAHEC) JV, led by Alpine Bau GmbH.

"The key to this project's success was the crew. We had the right mix of experienced people and young people hungry to learn," said Paul Bargmann, Head of the Machinery Dept. for Alpine Bau GmbH. The Robbins machine successfully mined through difficult geology including coal seams and abrasive sandstone with up to 70% quartzite content. Advance rates topped out at 50 ring sets, or about 70 m (230 ft), per day.

The machine was previously used on a record-breaking 12 km (7 mi) long segment of the Yellow River Diversion in 2000. On that project, the TBM set two world records in its size class

of 4 to 5 m (13 to 16 ft): best month (1,855 m/ 6,085 ft) and monthly average (1,352 m/ 4,435 ft). Both records still stand.

Though the TBM was already designed for similar geology and kept to its original specifications for the Pinglu Tunnel, the back-up was modified.

"The back-up frame was extended from one stroke to two strokes. This was a key change, especially for such a long tunnel," said Meik Mueller, Technical Director for Alpine's Asia Division. The modification allowed the machine to maintain good advance rates despite transit times averaging 70 minutes for muck trains traveling from the machine to tunnel entrance.

The completed Pinglu Tunnel will go into operation in October 2011, connecting to the North Main Line of the Yellow River Project to transfer water to Pinglu, Shuozhou, and Datong. Over 100 km (62 mi) of the South Main Line were excavated by five TBMs, including four Robbins Double Shields, between 1999 and 2001. The entire scheme will transfer water from the Yellow River to dry regions of Shanxi Province, an area that receives just 400 mm (16 in) of rainfall per year.



Left: Shanxi, China's 25.4 km (15.8 mi) long Pinglu tunnel is one of the world's longest single-drive TBM tunnels.

Above: The Alpine Bau GmbH crew celebrate the breakthrough of the Robbins Double Shield in November 2010.

Photos: Nazar-Photography

ROBBINS TBM WILL DIG DEEP BELOW MUMBAI

In late summer 2011, a 6.25 m (20.5 ft) diameter Robbins Main Beam TBM will begin excavation far below Mumbai, India. The machine will be launched from a 109 m (357 ft) deep, 11 m (36 ft) diameter shaft, and will be assembled at the shaft bottom in a 100 m (328 ft) long starter chamber and 50 m (164 ft) conveyor tail tunnel. Components will be lowered using a gantry crane.

The urban location will require an advanced Robbins continuous conveyor system with vertical conveyor for muck haulage to the surface and temporary storage at the site using a radial stacker.

The High Performance (HP) TBM will be equipped with 19-inch (482 mm) cutters and a probe drill to tackle hard basalt rock with possible fractured ground conditions and water inflows. Steel liners 4.9 m (16 ft) in diameter may also be utilized in a section below Kasheli Creek that is expected to contain fractured and faulted rock.

The 8.3 km (5.2 mi) long tunnel, for the Unity-IVRCL JV, will become part of the Mumbai Water Supply Tunnel running from Kapurbawdi to Bhandup areas. The new water tunnel is vital for the city, which currently experiences significant leakage from its aging lines, as well as intermittent flow and contamination of its drinking water during seasonal monsoons.



Left: Contractor Capitol Tunneling, Inc. has several potentially record-breaking bores, including a 72 inch (1.8 m) diameter SBU-A in Virginia, USA. Top: A second ongoing project is an over 450 ft (137 m) long bore with a Motorized SBU in Pennsylvania, USA.

CAPITOL TUNNELING UNLEASHES STRING OF SBU RECORDS

Ohio contractor Capitol Tunneling, Inc. is setting new standards for hard rock disc cutting heads. The 50-year old company has no less than three record-breaking projects, including a recently completed 440 ft (134 m) long sanitary sewer in Cold Springs, Kentucky—a record for a Robbins Small Boring Unit (SBU-A) in the 24-inch (600 mm) diameter range.

Within the last year, Capitol Tunneling has completed 2,766 ft (843 m) of bores utilizing SBUs ranging in diameter from 24 to 72 inches (600 mm to 1.8 m). Capitol is now setting its sights on more records, including two ongoing bores in Pennsylvania and Virginia. "These machines are an advantage for us, because they are a dry process, not requiring additives or slurry like other methods such as roller cone heads and microtunneling. Because of this we don't have separation issues with spoils and can operate even in the most environmentally sensitive areas," said Kyle Lucus, President of Capitol Tunneling.

Capitol's most recent record-breaker, for the Ripple Creek Sanitary Sewer in Cold Springs, Kentucky, required the expertise

of an experienced crew. Mud seams ran through layers of shale and limestone, requiring careful monitoring and adjustments for drifting. The crossing was completed in just 24 days and holed through exactly on grade. "I believe we could have pushed another 100 ft (30 m) or so in this material. The jacking pressures were lower than expected, and our rotational pressure was next to nothing," continued Lucus.

Since first using the disc cutting heads in 1997, Capitol has purchased five SBU-As and one SBU-M, and has options to purchase several more. The fleet is typically used on 8 to 10 jobs per year. As of January 2011, Capitol was in the process of launching three more.

For Capitol, the setup of an ABM paired with an SBU cutting head fills a specific need, particularly on long crossings in hard rock. "We have used roller cone heads, flat face rock heads, and bullet bit heads. Each has its intended use, but the harder the rock, the more efficient it becomes to use an SBU disc cutting head," said Lucus.

EVENTS CALENDAR

Robbins will exhibit at the following trade shows:

2011

bC India
February 8 - 11
Mumbai, India

AST Conference
March 8 - 10
Auckland, New Zealand

CONEXPO-CON/AGG
March 22 - 26
Las Vegas, Nevada, USA

NASTT No-Dig
March 27 - 31
Washington D.C., USA

ITA SEE
April 7 - 9
Dubrovnik, Croatia

World Tunnel Congress
May 20 - 26
Helsinki, Finland

RETC
June 19 - 22
San Francisco, California, USA

