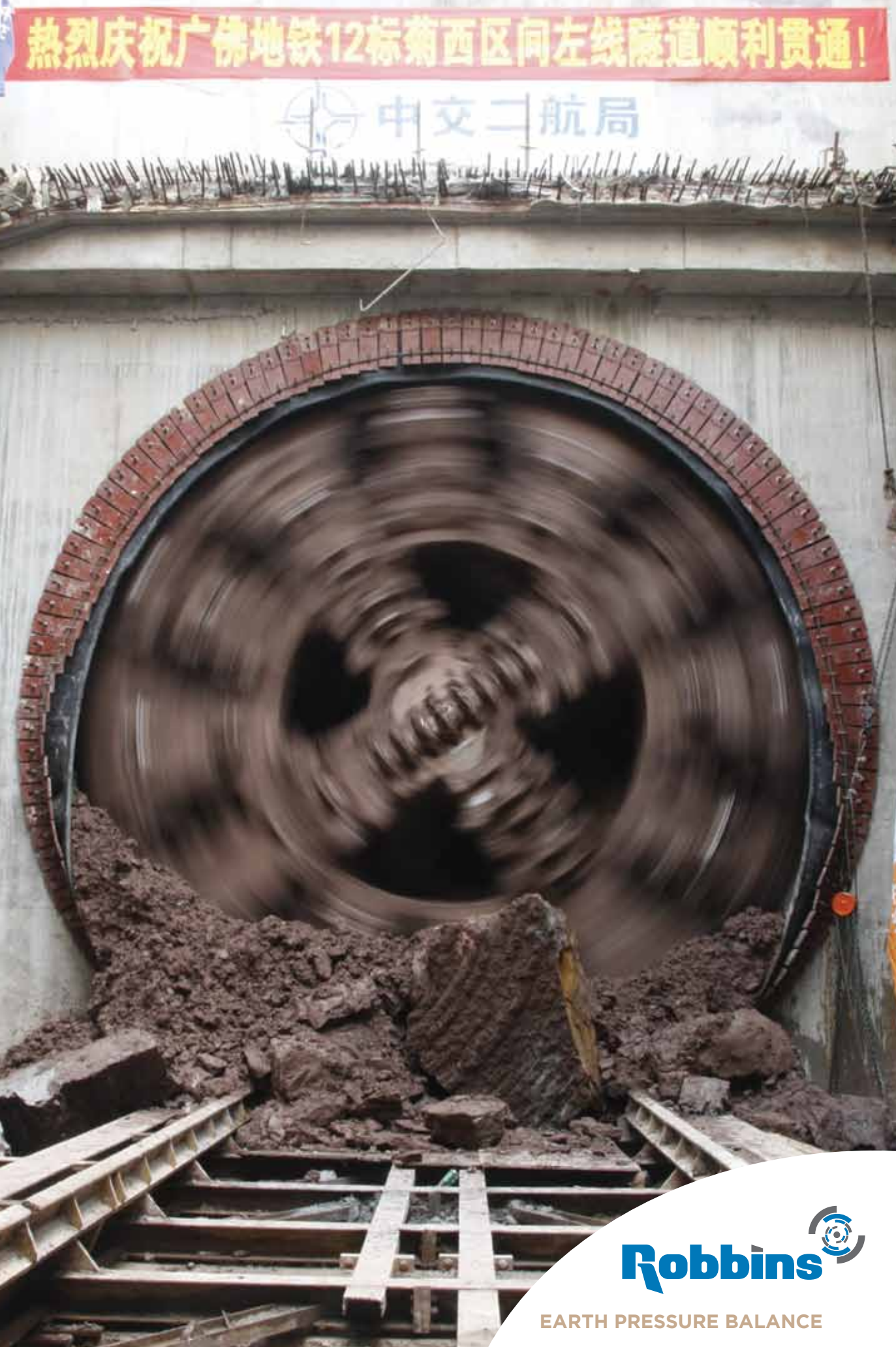
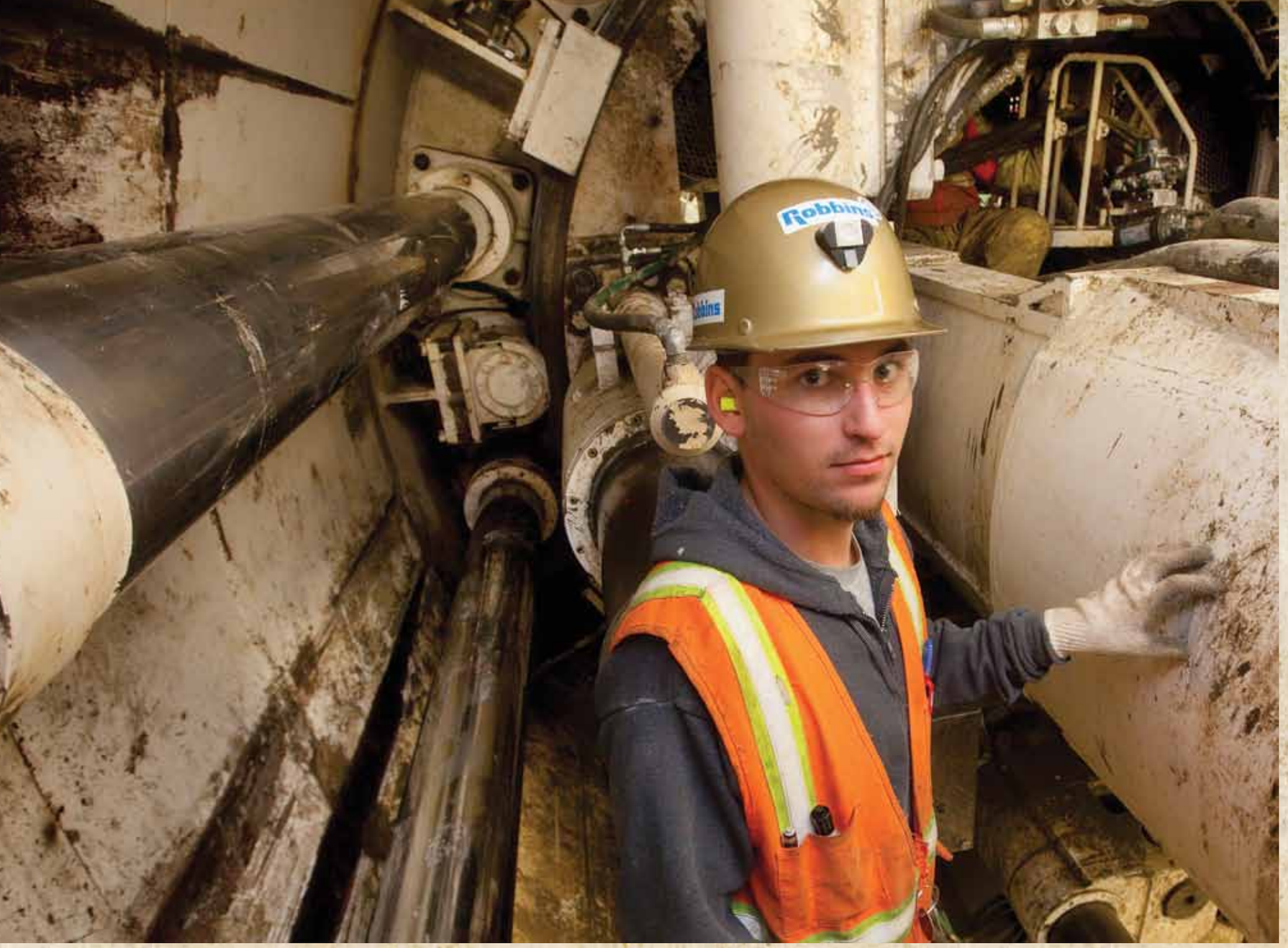
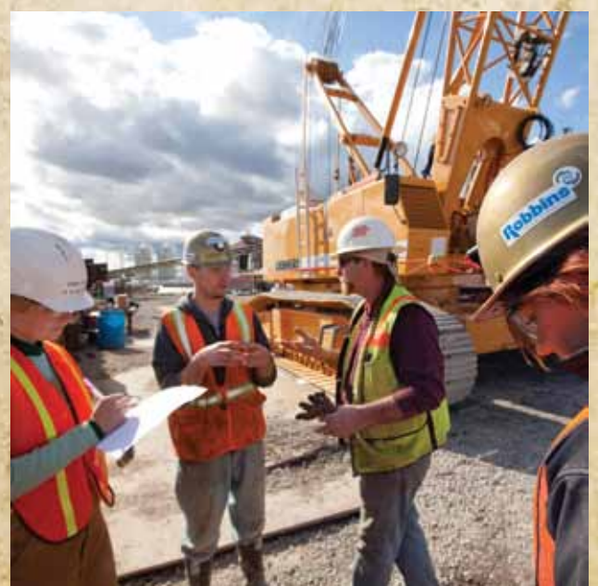


Robbins

EARTH PRESSURE BALANCE





SIMPLY A BETTER WAY TO TUNNEL.

In soft ground, selecting the correct tunnel boring machine is anything but easy. We understand your concerns: maintaining face stability, maximizing machine speed, stabilizing segment rings and avoiding ground settlement. Robbins Earth Pressure Balance Machines (EPBs) have been proven around the world, in countries including India, China, the U.S., Azerbaijan, and the Dominican Republic. Each machine is backed by our commitment to quality and cooperation that has been the essence of our name for over 50 years.

From 3 m to over 15 m machines, every project requires a customized solution to achieve fast advance rates and high system availability. At Robbins, we believe the specific conditions of your tunnel should dictate the machine design. Your project is unique, and your equipment should be too.

Robbins EPBs give you many options for the ideal machine. From smooth flow cutterheads that reduce friction to super-reliable back-filling systems and ribbon screw conveyors, we've taken the traditional EPB design to the next level.

The following pages contain brief descriptions of Robbins Earth Pressure Balance Machines and their special features. For more detailed information about these and other tunneling products, please contact us or visit our website at www.TheRobbinsCompany.com.

WE KNOW YOUR TYPE.

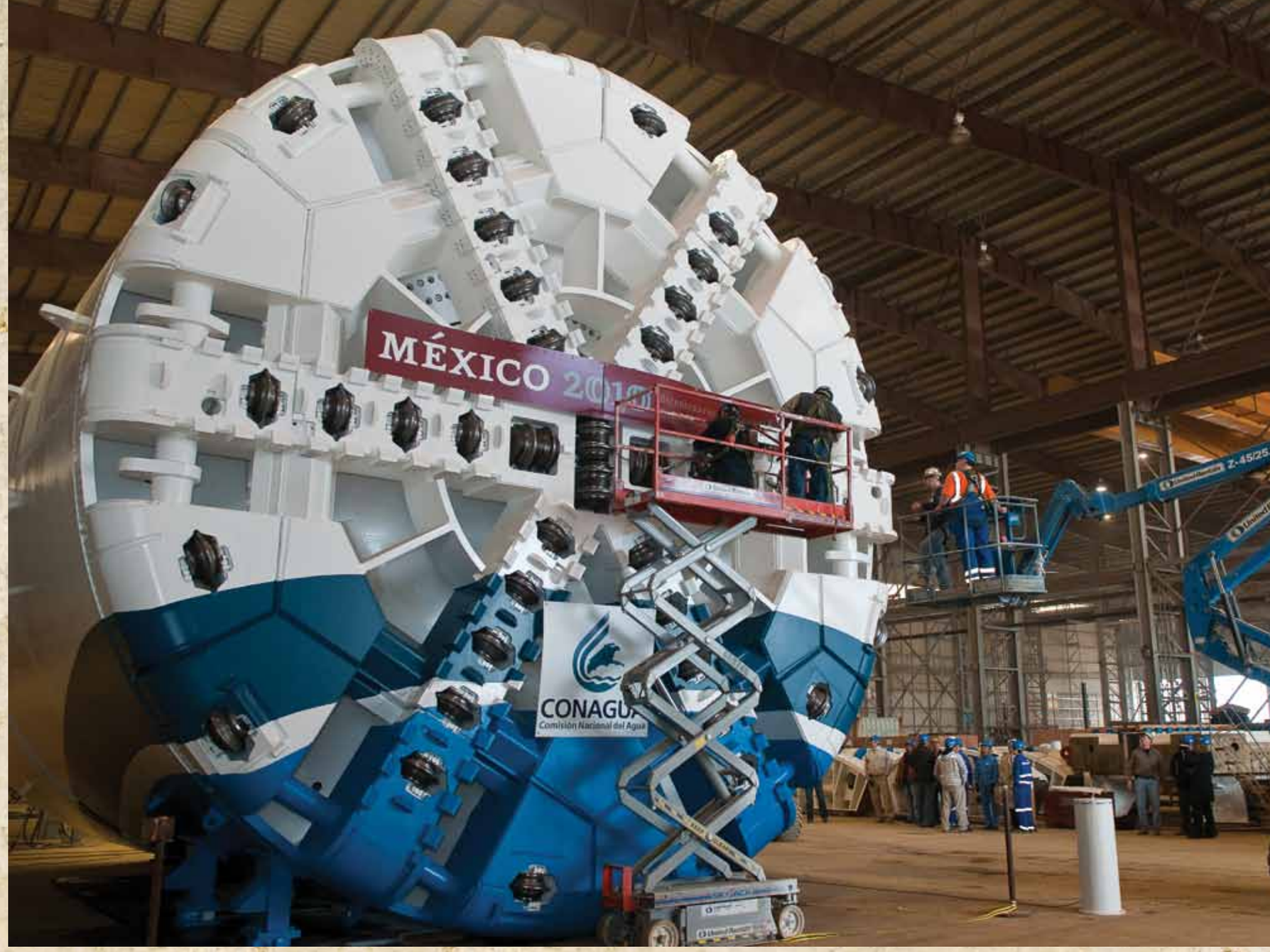
Whether your project is in clay, sand, gravel, or mixed ground, Robbins cutterheads will get you through it. From interchangeable cutters to smooth flow designs, our cutterheads are built to maximize advance rates.

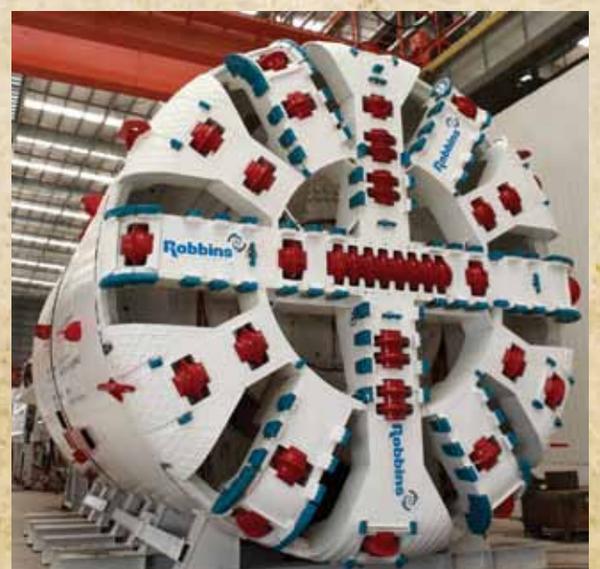
Everything Running Smoothly

For soft ground, Robbins smooth flow spoke-type cutterheads are unparalleled. The cutterheads feature a large opening ratio, which means that more material can be excavated while easily maintaining pressure and stability at the face. Specialized periphery tools are added based on ground conditions, in order to prevent cutterhead rim wear. Robbins designs decrease the chance of surface disturbance in fragile soft ground, and result in faster excavation and longer equipment life.

A Boulder Design

Mixed face conditions can range from small cobbles and large boulders to sections of solid rock. Robbins mixed ground cutterheads utilize a variety of cutting tools and wear plates to maximize consumables and keep your machine moving. From interchangeable carbide bits to single or multi-row disc cutters, our engineers give you options that you can change in the tunnel.



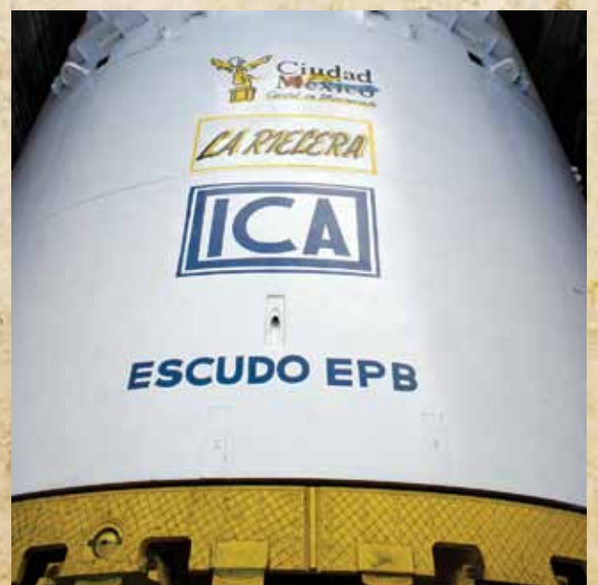


THE URBAN TUNNELING SOLUTION.

When you are tunneling beneath city streets and building foundations, ground disturbance is not an option. Our cutterheads operate with higher torque and slower cutterhead rotation than the industry standard—a combination that results in fast excavation while preventing surface subsidence. The specific torque and cutterhead speed are based on your project's needs.

Less Wear, Fewer Consumables

Why slower cutterhead rotation? Not only does it decrease ground disturbance in a wider range of geology, it often requires less additives and results in less abrasive wear to the cutterhead. Maximizing consumable life while achieving optimal advance rates—a consideration that cuts both project time and cost.



EXCELS UNDER PRESSURE.

In soft ground, the pressure is on. Selecting a screw conveyor is not only about muck removal—it also affects your face pressure control and productivity. Conveyors are a science that keeps your machine advancing through a wide variety of pressures and ground conditions.

Screw conveyors are available in shaft-type and ribbon-type designs, as well as single or double set-ups. Hybrid systems can incorporate both a screw conveyor and a belt. Robbins engineers understand the importance of selecting the correct configuration for the geology. From start to finish, Robbins screw conveyor systems are designed to minimize downtime and keep your project on schedule.

Customized Solutions

Robbins shaft-type screw conveyors offer water tight sealing while efficiently excavating a range of material with or without additives. Ribbon-type screw conveyors allow the machine to handle large boulders.

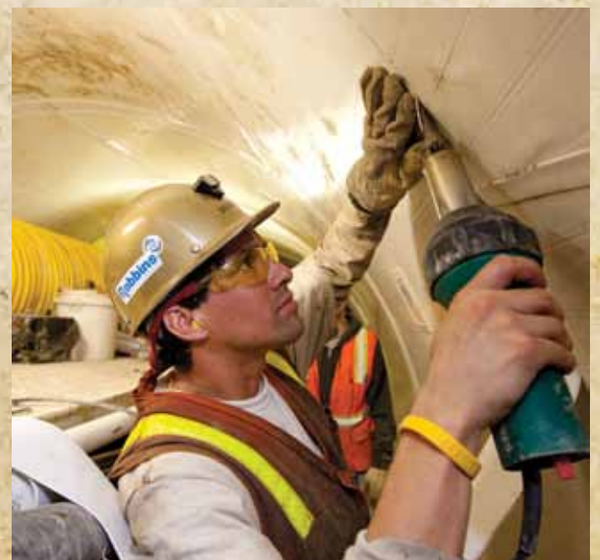
In the industry, standard machines often give you limited choices for muck removal, regardless of ground conditions. We believe that a custom designed system is the key to your success.

BETTER BACK-UP, FEWER PEOPLE.

From 1.6 m to more than 15 m in diameter, the range of Robbins back-up designs is broad. Robbins engineers work closely with your team to ensure that your back-up not only supports the TBM excavation, but also provides you with the best systems for personnel safety, segment delivery, segment lining, back-filling, tunnel de-watering, fresh air ventilation, lighting, and more.

Efficient Advance

Robbins works with your tunneling requirements to produce streamlined logistical support systems that reduce the number of personnel. Simple solutions for processes such as segment handling and back-filling result in fewer hang-ups and higher advance rates.



BECAUSE ADDITIVES ARE NOT JUST AN ADD-ON.

At Robbins, we know that the proper additive system is critical to the success of your project. From injection at the cutterhead to back-filling behind the machine, we see ground treatment as a remedy for many common problems.

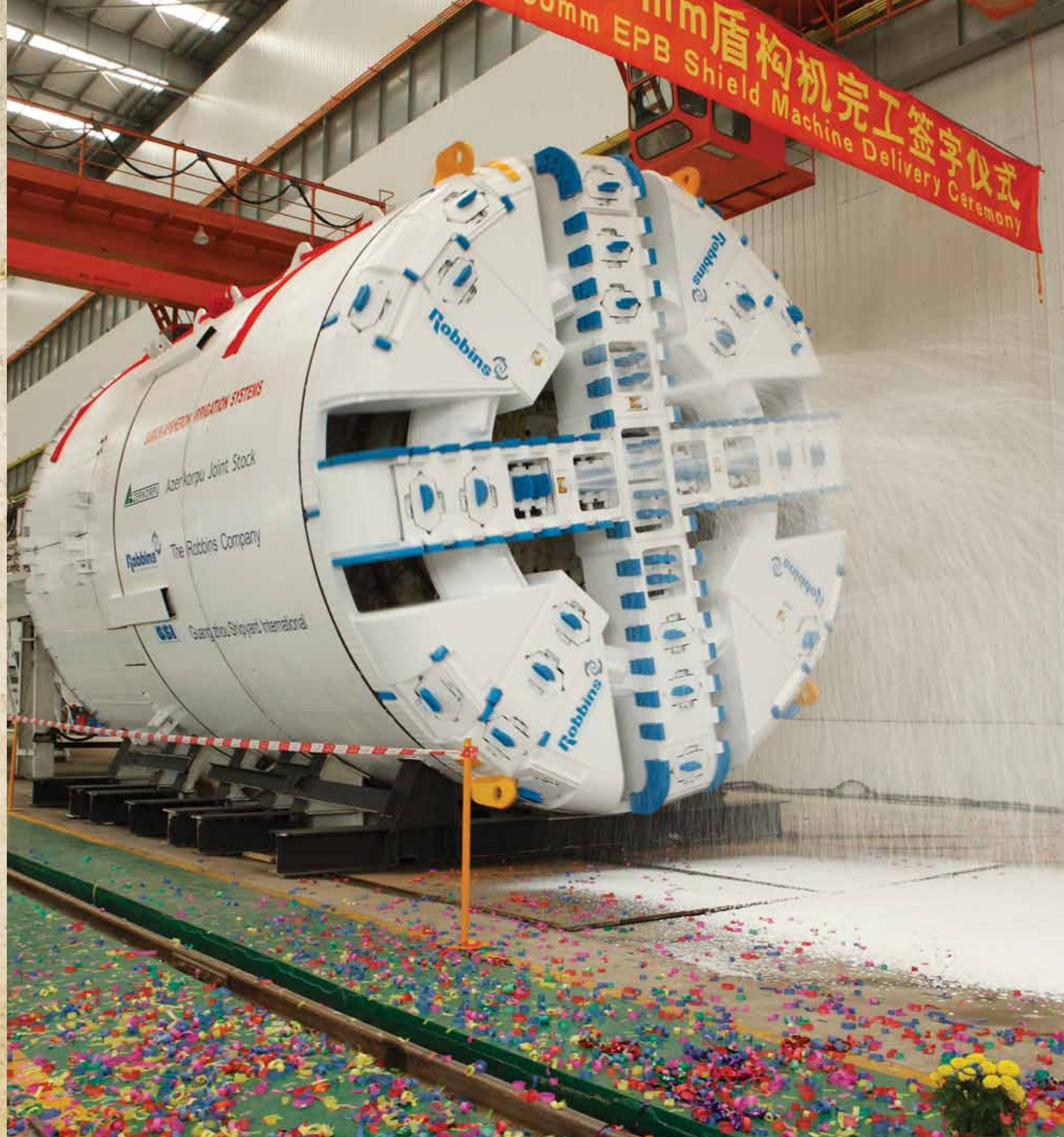
Stable Solutions

From foam to polymer to bentonite, the ideal combination of additives stabilizes the tunneling face in any number of ground conditions. Robbins incorporates methodologies from around the world into its machines, all to provide an optimal system for your tunnel. The proper additives do more than just stabilize the tunnel face—they also minimize wear and reduce cutter changes. Multiple injection ports on the cutterhead prevent lines from clogging for smooth muck flow throughout your project.

Filling the Void

Robbins back-filling systems quickly fill the annular space between segments and tunnel walls directly behind the machine. One-liquid or two-liquid systems are available depending on the ground conditions.

Swift tunneling should never mean a compromise on safety. Robbins' proven two-liquid system for permeable ground and unstable conditions hardens quickly using an accelerator. Your segments become stabilized while ground settlement is minimized.



WE'RE WITH YOU THROUGH EVERY TWIST AND TURN.

Whether straight or curved, Robbins EPBs are designed to maintain tunnel alignment from start to finish. With powerful thrust cylinders and efficient cutterhead drives, we're committed to keeping you on track.

A Smarter Way to Turn

Curved tunnels are commonplace in soft ground, but they don't have to cause complications. Many manufacturers continue to use passive articulation systems that can result in cracked concrete lining. At Robbins we have a solution: active articulation that allows our EPBs to tackle tight turns with ease and avoid segment deformation. Articulation between the front and rear shields is independent of the thrust system—a design that prevents high segment replacement costs and gives precise steering control.

Straight to the Point

Robbins provides clean, simple design paired with powerful propulsion. In straight or curved tunnels, we optimize our machines for fast excavation. Full speed ahead.

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