

FOR IMMEDIATE RELEASE

## July 30, 2014

**Headline: Robbins TBMConquers Difficult Ground in Turkey**

*Sub-Headline:Double Shieldovercomes Multiple Challenges at Kargi Hydroelectric Project.*

Multiple fault zones, variable face conditions and squeezing ground requiring extensive bypass tunneling: These were just a few of the challengesovercomein order to successfully complete Turkey’s KargıKızılırmak Hydroelectric Project. A Robbins 10m (32.8ft) diameter Double Shield TBM achieved breakthrough on the project July 5, 2014 after an impressiverun through some of the most difficult conditions ever encountered by Robbins field teams. The machine type, selectedjointly by the owner, consultants, Robbins, and the contractorGülermak of Turkey, excavated through 7.8 km (4.8 mi) ofcomplex geological conditions that proved to be a challenge nearly from the outset.

The machine was launched into poor geology that resulted in delays to the project and forced team members to find innovative solutions that included major in-tunnel modifications to the machine. In the first 2 km (1.2 mi) of boring a total of seven bypass tunnels were needed to free the TBM from collapsed ground. The cutterhead stalled on numerous occasions as the conditions varied widely from solid rock to running ground.Small and wide faults along the alignment added another level of complexity, as the excavation was located very close to the North Anatolian fault line in Turkey’s relatively recentrock formations.

The contractor,owner, consultants and Robbins engineers worked together to generate solutions to improve progress in the difficult conditions.The contractor, with the assistance of the Robbins field team,installed a custom-built canopy drill and positioner to allow pipe tube support installation through the forward shield. Drilled to a distance of up to 10m (33 ft) ahead of the cutterhead, 90mm (3.5 in) diameter pipe tubes provided extra support across the top 120 to 140degrees at the tunnel crown. Injection of resins and grout protected against collapse at the crown while excavating through soft ground. As a result of successful use of the probe drilling techniques, Gülermak was able to measure and back-fill cavity heights above the cutterhead in some fault zones to over 30 m (100 ft) and,in addition, was able tohelp detect loose soil seams and fractured rock ahead of the face.

“The cooperation and trust between the contractor, project owner, and Robbins Management, Engineering and Field Service resulted in the correct modifications being successfully installed on the Kargı TBM,” said Glen Maynard, Robbins Site Manager.

Despite the slow progressinitially, the Robbins Double Shield TBM made some remarkable advances once modifications were in place. An advancerate of 600 m (1,968 ft) in one month was achieved in March 2013 and in more recent news, a project best of approximately 723 m (2,372 ft) was achieved in spring 2014, including a daily best of 39.6 m (130 ft) in April 2014. In so doing the TBM significantlyoutperformed a drill and blast heading progressing from the opposite end of the tunnel. Crews at that heading progressed in relatively good ground conditions for 4 km (2.5 mi),where they achieved very impressive advance rates of nearly 300 m (985 ft) per month. The entire tunnel, with both TBM and drill and blast portions, is 11.8 km (7.3 mi) in length.

“This has been the toughest job in my tunnelling career,” said Yunus Alpagut, Robbins’ Representative in Turkey who was involved in the project from the start. “It is a testament to the skill and dedication of the Robbins team and the Gülermak contractor team that it has ended successfully.”

Once online theKargıKızılırmak Hydroelectric Project, for Norwegian-owned Statkraft AS, will generate 470 GWh annually, which is enough to power about 150,000 homes. The tunnel will source water from the Kızılırmak River, sending it to a new generating station operated by Statkraft.

WORD COUNT: 616

Images Attached to Email. If you need a higher resolution image, please contact Amey Yong.

Captions for Images:

**Image 1:** A Robbins 10 m (32.8 ft) diameter Double Shield TBM was launched in early 2012.

**Image 2:**Crews overcame severe fault zones and squeezing ground to advance over 700 m (2,300 ft) per month at the Kargı Hydroelectric Project.

**Image 3:**The KargıKızılırmak Hydroelectric Project, for Norwegian-owned Statkraft AS, will generate 470 GWh annually, which is enough to power about 150,000 homes.

**Image 4:** The hard-working crew at Kargıexcavated seven bypass tunnels in the first 2 km (1.2 mi) of boring and successfully completed extensive in-tunnel TBM modifications to combat the unforeseen ground conditions.
**Image 5:** The Gülermak and Statkraft crew celebrate the breakthrough of the 10 m (32.8 ft) diameter Robbins Double Shield on July 5, 2014.

Contact Information:

## Desiree Willis

#### Technical Writer

Email: willisd@robbinstbm.com

Direct: 253.872.4490

##### *The Robbins Company*

*29100 Hall Street*

*Solon, OH 44139*

*USA*