



HERRENKNECHT press information.

May 7, 2009

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## **FIRST MECHANICALLY-EXCAVATED TUNNEL BENEATH THE BOSPORUS. COMPLETED SAFELY AND ON SCHEDULE WITH HERRENKNECHT TECHNOLOGY.**

**In mid-April 2009, the Herrenknecht S-391 tunnel boring machine (Ø 6.11m) reached its target shaft in Istanbul. The new "Melen 7" tunnel crosses beneath the Bosphorus, which is the sea strait between the Asian and the European parts of the Turkish metropolis. When the interior construction is completed, the tunnel will supply the European part of the city with water from the Asian part. At its deepest point, the tunnel route runs 135 meters below the sea strait's water level. The construction team and the tunnelling machine excavated this challenging section safely. The first mechanically-excavated tunnel beneath the Bosphorus was built in 13.5 months only.**

**Istanbul, Turkey / Schwanau, Germany, May 7, 2009.** After tunnelling 3,400 meters beneath the Bosphorus, the Herrenknecht S-391 tunnel boring machine (Ø 6.11m) reached its target shaft on the Asian side of Istanbul on Monday, April 13, 2009. The Earth Pressure Balance Shield (EPB Shield) had started tunnelling on the European side in March 2008. With up to 20 meters per day the machine (total length 157m, total weight 700t) advanced according to schedule, mastering depths of up to 135 meters below the water level of the Bosphorus. After finishing work is completed, the tunnel, which was excavated in only 13.5 months, will transport water from the Asian to the European part of Istanbul from the year 2010 onwards.

The "Melen 7" tunnel is the key element of a large-scale project to secure an improved long-term water supply for the huge city of Istanbul, which today is home to more than 10 million inhabitants. This water is not only required on the European side of Istanbul for the inhabitants' drinking water supply, but is also urgently needed for agriculture and regional industries. For this purpose, the river Melen has been dammed on the Asian side, 170 kilometers outside the gates of the city. From this high-rainfall area, the water will be channeled to Istanbul in several stages. To lead the water to the European part of the city too, the tunnel must cross beneath the Bosphorus.

The biggest challenge within the project was to excavate the tunnel tube at the enormous depth of up to 135 meters beneath the water level. Therefore, the machine had to be sealed to withstand water pressures of up to 13.5bar. The initial tunnel tube built by the tunnel boring machine was constructed with lining segments (prefabricated components made of reinforced concrete) which are equipped with special seals designed to withstand a water pressure of up to 20bar. The moulds for production of the lining segments were supplied by Herrenknecht Formwork GmbH to Turkey. The final finishing work for water conveyance will be made of steel tubes and is expected to be completed in spring 2010.

The launch shaft for the machine was situated in the city quarter of Sariyer on the European side. The first approx. 2.3 kilometers were constructed with a gradient of 7.45%. The overburden to the seabed was only 35 meters in some parts, with a water column which was twice as high, at 70 meters. The rest of the route (1.1 kilometers) ran almost horizontally. In mid-April 2009 – 13.5 months after the start on the European side – the Herrenknecht

tunnelling shield appeared on schedule in the 140 meter deep target shaft in the Asian city quarter of Beykoz. In order to be able to recover the machine from the small target shaft, which had a diameter of only 8 meters, the Herrenknecht engineers designed the machine with small shield segments.

With the breakthrough of the Herrenknecht S-391 EPB Shield in the target shaft, the construction team of the Russian construction company OAO Mosmetrostroy successfully excavated the first tunnel beneath the Bosphorus. This was the first connection between two continents created by a tunnelling machine. In view of the challenges mastered, this is an excellent reference for mechanized tunnelling.

#### **5<sup>th</sup> World Water Forum 2009 | Istanbul | Turkey**

One of the biggest challenges of the 21st century is to use the world's water reserves effectively and fairly. The 5<sup>th</sup> World Water Forum was held in Istanbul in March 2009, where experts, politicians and citizens discussed future possibilities and precise plans. In a review of the 4<sup>th</sup> World Water Forum 2006 in Mexico the Director General of the National Water Commission CONAGUA, José Luis Luege Tamargo, reported on the measures introduced by the Mexican government since then. On the occasion of his visit of the Melen 7 construction site, José Luis Luege Tamargo referred to the world's largest waste water project, "Emisor Oriente" in Mexico City for which Herrenknecht is delivering three tunnelling machines for a total of 30 kilometers of tunnel.