



# Eurasia Tunnel Project



The Eurasia Tunnel Project is a 5.4-km twin-deck bored motorway tunnel that will cross the Bosphorus at its southern end running from Sultanahmet on the European side to Selimiye on the Asian side of Istanbul.

The tunnel is the critical link of the 14.6 km route awarded through a Build Operate Transfer (BOT) mechanism to the ATAŞ (Avrasya Tüneli İşletme İnşaat ve Yatırım A.Ş. - Eurasia Tunnel Operation, Construction and Investment Inc. Co.) Joint Venture in 2010. The proposed Eurasia Tunnel crosses the strait south of two existing bridges and the light rail tunnel currently under construction. It is designed to ease İstanbul's traffic pressure providing an alternative road link to traverse the Bosphorus at about 1 km south of Marmaray, which is currently being constructed.

ATAŞ retained the services of Fugro to perform geotechnical investigation along the proposed tunnel route to estimate the soil and rock characteristics for the tunnel.

## Scope of Work:

### 'Deep water' Geotechnical Site Investigation:

The scope of the 'deep water' geotechnical site investigation was to determine the geological and geotechnical conditions for use in the design of the underwater road tunnel section that is to be drilled using a Tunnel Boring Machine (TBM). The site investigation program was designed to provide information for engineering assessment for the deep underwater tunnel section and determine adequate dynamic soil/rock properties for seismic design and analysis. The site investigation program included downhole sampling and Cone Penetration Tests (CPTs) at 9 locations, rock coring with the Fugro Marine Core Barrel (FMCB) and in-situ testing by Downhole Wireline P/S Logging. Due to the strong currents at the project site Fugro's SRV Bavenit vessel equipped with a state-of-the-art Dynamic Positioning system was mobilized to perform the 'deep water' site investigation for water depths greater than 22 m.



Skate IV Jack-up Platform working in the Bosphorus strait in front of the Old Town of Istanbul



Drilling Vessel SRV Bavenit drilling anchor-free in DP mode in the Bosphorus strait

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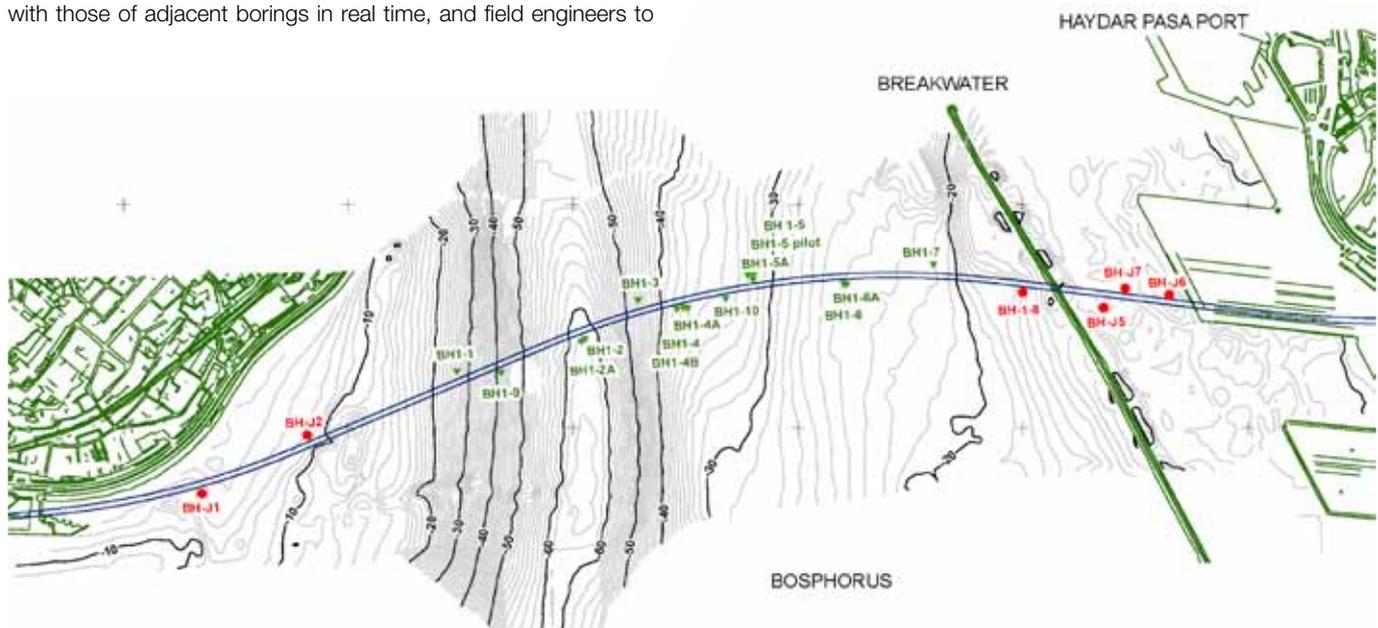
## Shallow Water Geotechnical Site Investigation:

The scope of the shallow water geotechnical site investigation was to collect subsurface soil and rock samples and characterize stratigraphic variations as well as the strength, and stiffness of those soils and rocks. The site investigation program included downhole sampling and Cone Penetration Tests (CPTs) at 6 locations, rock coring with the Fugro Marine Core Barrel (FMCB), in-situ testing by Downhole Wireline P/S Logging and measurements of hydraulic conductivity through dissipation tests. Operations were conducted from Fugro's Skate IV jack-up platform.

## Standard and Advanced Laboratory Testing:

Conducting geotechnical testing immediately upon sample retrieval is a routine component of Fugro's marine drilling operations. The "real-time" character of onboard testing allows quality control of the sample logging, comparison of laboratory test data with in situ data measured with the cone penetration tests, preparation of field boring logs with actual data rather than just sample lithologies, comparison of the engineering properties of sediments with those of adjacent borings in real time, and field engineers to

modify the drilling and sampling program in the field to optimize the exploration program. Standard testing was performed onboard the SRV Bavenit for the deepwater site investigations and on a field laboratory close to the site for the shallow water site investigations. The standard tests included moisture content determinations of all samples, wet densities of all intact extruded samples, point load tests on rock samples, shear strength estimates of all suitable fine-grained samples using torvanes and pocket penetrometers; and Unconsolidated-Undrained Triaxial Compression tests (UUTXC) on fine-grained Gradation tests to assist in classification of the soils and to determine their grain. Additional standard tests such as grain size distribution, hydrometer tests, fines content determinations, atterberg limits, corrosion potential, carbonate content; and specific gravity of solids were performed at off site laboratories. Advanced laboratory tests including permeability testing, Direct shear testing, Isotropically Consolidated Drained Triaxial Compression Tests and Cyclic Simple shear Tests on potentially liquefiable sands were also performed at off site laboratories.



Borehole location plan: nearshore Boreholes (Skate IV, red) and offshore Boreholes (SRV Bavenit, green) along the tunnel alignment at the southern end of the Bosphorus

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