



Old Haydarpaşa Station

Kerem Ateş

The Railway System Connecting Two Continents: Marmaray

Marmaray, an advanced commuter rail system with a total length of 76 km, passed by a tube tunnel under the Bosphorus, is also a line that will provide uninterrupted railway operation between Europe and Asia. The Marmaray railway system allowing commuter railcars with high-speed trains, regional trains and freight trains to pass, is the largest investment in the region in terms of economically sustainable and uninterrupted railway operation.

Istanbul is one of the most developed and crowded metropolis of the world with more than 16 million citizens and is located on two continents and has one of the world's most advanced suburban systems at the same time: Marmaray. For the first time electric train operations started in Turkey in 1955 with several commuter trains on existing railways built in 1869 in Istanbul. The idea of connecting the rail systems operating separately on two different railway which are coming from Europe to Istanbul and the railway connecting Istanbul to the Middle East and Asia through Anatolia under the Bosphorus came first in 1878 during the Ottoman Empire. Projects were drawn by French engineers. However, the realization of this project has passed through the twenty-first century.

Under the patronage Ministry of Transport, Maritime and Communications of the Republic of Turkey, Construction started in 2003 with the Marmaray Bosphorus Tube Crossing project. Due to the receipt of archaeological artifacts encountered during the construction process

under protection, transport between the two continents just began in 2013. The Marmaray system, operated by 5 stations and a 13,6 km track is operated by Turkish State Railways (TCDD) Transportation JSC. The distance between the two continents and, is as short as 4 minutes. Carrying an average of 66 million passengers a year, Marmaray has been active for 5 years.

The Marmaray project covering a total length of 76 km, have been tendered separately BC1, CR1, CR2 and CR3 stages. The BC1 contract covers construction works of 13.6 km, including the tube tunnel passing under the Bosphorus. The CR1 contract covers the construction works of the 20 km Gebze-Pendik route starting from the east end of the route. The CR2 contract covers the railway fleet consisting of 440 cars to be used in the Marmaray system and CR3 covers the construction works of Pendik- Ayrılıkçeşme and Kazlıçeşme -Halkalı stages and all signaling and superstructure works. Signalization systems have been completed with BC1 and CR1 constructions that have been completed so far. Rail cars have been purchased with CR2 contract and the rest of CR3 works are expected to be completed by the end of this year and the entire line will be opened to service.

Marmaray is not only a special system that uses the most advanced trains and transit systems in the world, but also a system that goes under the Istanbul Bosphorus, which is manufactured and built with advanced technology. The Bosphorus crossing, built in the Marmaray project, which will contribute to the growth of the railway transportation systems in the region to be economically sustainable,



Kazlıçeşme Station



Sirkeci Station



Historical monuments discovered in tunnel excavations exhibition on Yenikapı Station

has a 1,4 km immersed tube tunnel and 11,6 km tunnel constructed with Tunnel Boring Machines (TBM).

Tube tunnels built 62 meters below the Istanbul Bosphorus, which is designed as 2 lines constructed as resistant to 8 Richter magnitude earthquakes. Seismic activities are monitored 24 hours a day and there are effective security measures in the tunnel for possible disasters such as fire, flood. Giant diesel generator sets installed locally on both sides of the tunnel for power failures provide tunnel energy in emergency situations. Operational safety is kept at the maximum level in the tunnel which is continuously monitored with the operation control center.

On the other hand, the Marmaray trains are equipped with Automatic train operators so that they are not affected by human error and possible delays and negatives. Thanks to the advanced CBTC signal system, the trains are driven fully automatically by the computer and the passenger comfort is kept at the highest level. It is anticipated that the Marmaray train fleet consisting of 20 sets of 5 cars and 34 sets of 10 cars will be used within 2.5 minutes at peak times within the tunnel.

CR3 supply constructions are running at a very high speed and construction is expected to be completed in August. Later, installation and testing of the signaling systems is expected to start and at the end of this year for the entire Marmaray passenger transport system will be on operation.

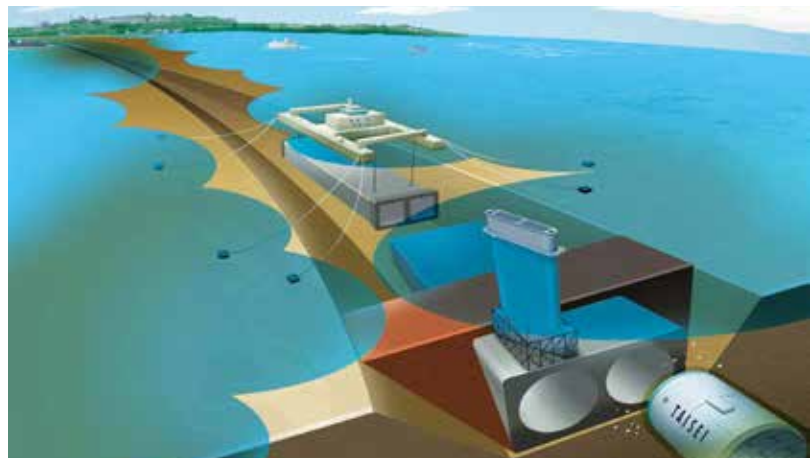
With the interchange stations, Marmaray system will be directly and indirectly connected to 10 different metro lines, 4 different tram

Tab. 1. Marmaray with figures

Total line length	76,3 km
Surface Subway Section Length	63 km
- Number of stations on the surface	37
Railway Bosphorus Tube Cross Section Total Length	13,6 km
- Drilling Tunnel Length	9,8 km
- Immersed Tube Tunnel Length	1,4 km
- Open - Close Tunnel Length	2,4 km
- Number of Underground Stations	3
Station Length	225 m (min.)
Number of Passengers at one direction	75.000 passenger/hour/direction
Maximum Slope	18
Maximum Speed	100 km/h
Commercial Speed	45 km/h
Number of Train Route	2-10 minutes
Number of Cars	440



Yenikapı Station



Marmaray Tube Crossing Illustration

lines, 2 cable cars and 2 funicular lines. It's expected to carry 1 million passengers a day. The Marmaray system expected to greatly contribute to the solution of the increasing transportation problems of the city of Istanbul, which has grown with great acceleration, will be able to reduce the CO₂ emissions from the conventional transportation vehicles in the city in serious proportions and provide a comfortable and quick transportation alternative to the people.

Marmaray project, which will contribute to improving people's quality of life also will allow to run high-speed trains, regional trains and the transit of freight trains between the European side and the Asian side. In this way, the transportation costs of the country will be reduced and will increase the added value of the railway system, as well as transportation costs will decrease in general terms by providing faster transportation. At the same time, it is expected that the train services operating and planned to be operated on the international railway network in the region will contribute to the development of international trade and tourism with lower costs and higher speed.



Kerem Ateş

In addition to undergraduate education in Mechanical Engineering, Kerem Ateş received his master's degree in Traffic Planning and Implementation Department. Prior to the transport sector, he worked for the Ministry of Energy and Natural Resources. Later, he worked in Ankara for 2 years in Directorate

General of Turkish State Railways, Chamber of Factories about the National Train Project. After his assignment at the National Train Project, he started to work in Marmaray Operations Management in Istanbul. He has been working for maintenance of Marmaray rolling stock for about 2 years.