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# Marmaray project

Crossing the Bosphorus with cutting-edge-technology



## Marmaray, a unique world-class project

The Marmaray project, a core element of Turkey's ambitious rail investment plan, includes the design, execution and completion of an upgrading of 63 kilometres of the commuter rail system through the metropolitan areas on both sides of Istanbul strait plus the construction of a railway tunnel of 14 kilometres under the Bosphorus.

This significant infrastructure project will provide a seamless high-capacity commuter rail system, an inter-city passenger service and a freight link between Europe and Asia. The Gebze–Halkali section is also part of the Ankara–Istanbul corridor and will serve the transport needs for not only the city of Istanbul and its hinterland, but also for the whole of Turkey.

The first phase of the project, the section under the Istanbul strait has been opened for revenue service on October 29, 2013, the 90th anniversary of the founding of the Republic of Turkey. The tunnel marks the centerpiece of one of the biggest transport infrastructure projects in the world.

### Leading signalling solution

The contract includes the design, supply, installation, tests and commissioning of the Trainguard Futur 1300 Level 1 ERTMS and Trainguard Sirius CBTC equipment; a new signalling system including Trackguard WESTRACE Mk II electronic interlocking; train detection systems (jointless track circuits and axle

counters); LED wayside signals; Control-guide Rail 9000 centralised traffic control (CTC) and the telecommunication and SCADA systems for the entire project. The contract also includes maintenance for two years with an option to extend it to a further five years.

The state of the art technical solution offered by Siemens Rail Automation is all proven technology and includes the ERTMS solution that has been recently installed in the new Ankara-Konya high-speed line plus the Trainguard Sirius CBTC system currently in operation in Madrid Metro and in Singapore Downtown Line, also under execution in three of the Sao Paulo commuter lines of the Sao Paulo commuter network CPTM, in Caracas Metro and in Singapore Downtown Line.

In terms of infrastructure, the existing double track network will be replaced by a two-way triple track international gauge system. The new third track will be equipped with ERTMS Level 1 system and will be used for operating mainline intercity trains. The double track will be used for mass transit commuter trains

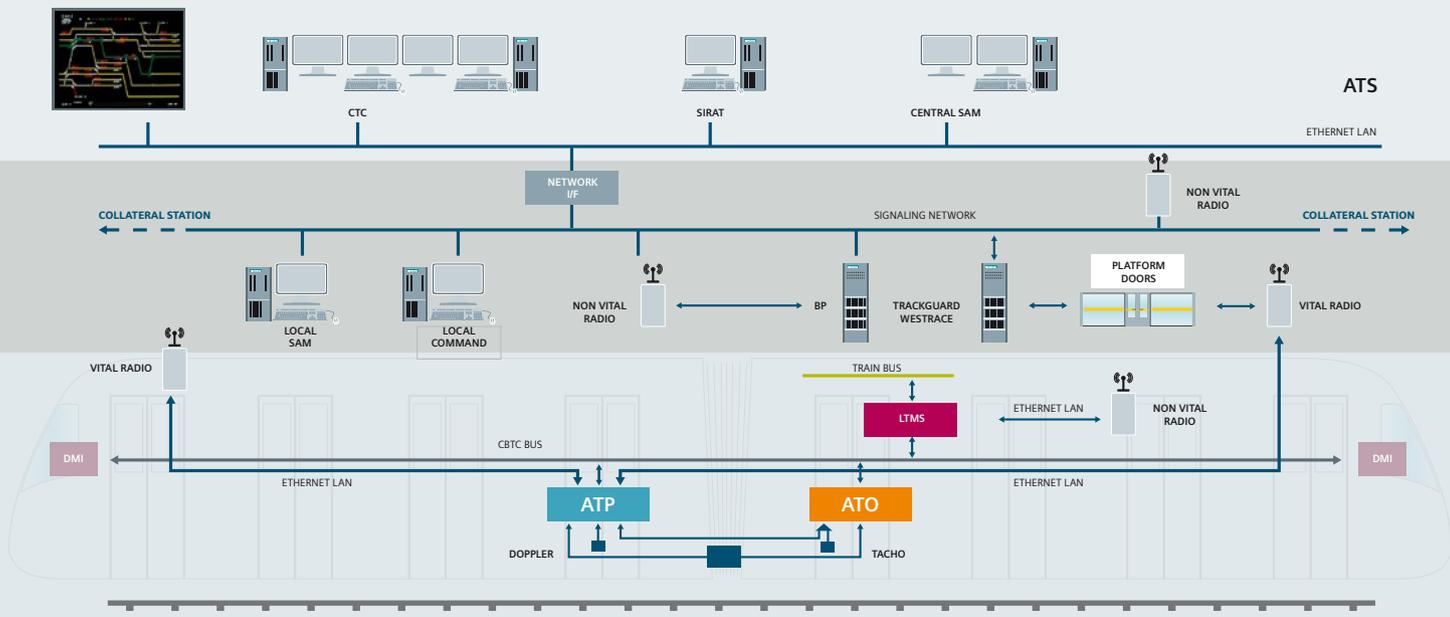
and will be equipped both with CBTC system for passenger service and ERTMS Level 1 for freight transportation.

### Siemens Rail Automation's ERTMS system: Trainguard Futur

Trainguard Futur is the integrated train planning and control system from Siemens Rail Automation compliant with the specifications of the European Train Control System (ETCS). ETCS, together with GSM-R, the radio system for voice and data, they form a significant element of ERTMS, the signalling and management system for Europe and the world.

Within the range of the Trainguard Futur system, Trainguard Futur 1300 is the ERTMS Level 1 system, a complete automatic train protection system based in the punctual information sent to the train when passing over the system's balises.

Trainguard Futur 1300 provides great performance for operation and maintenance features for railway administrations in Europe and the world.



Trainguard Sirius CBTC architecture.

**Trainguard Sirius, the Siemens Rail Automation's CBTC system**

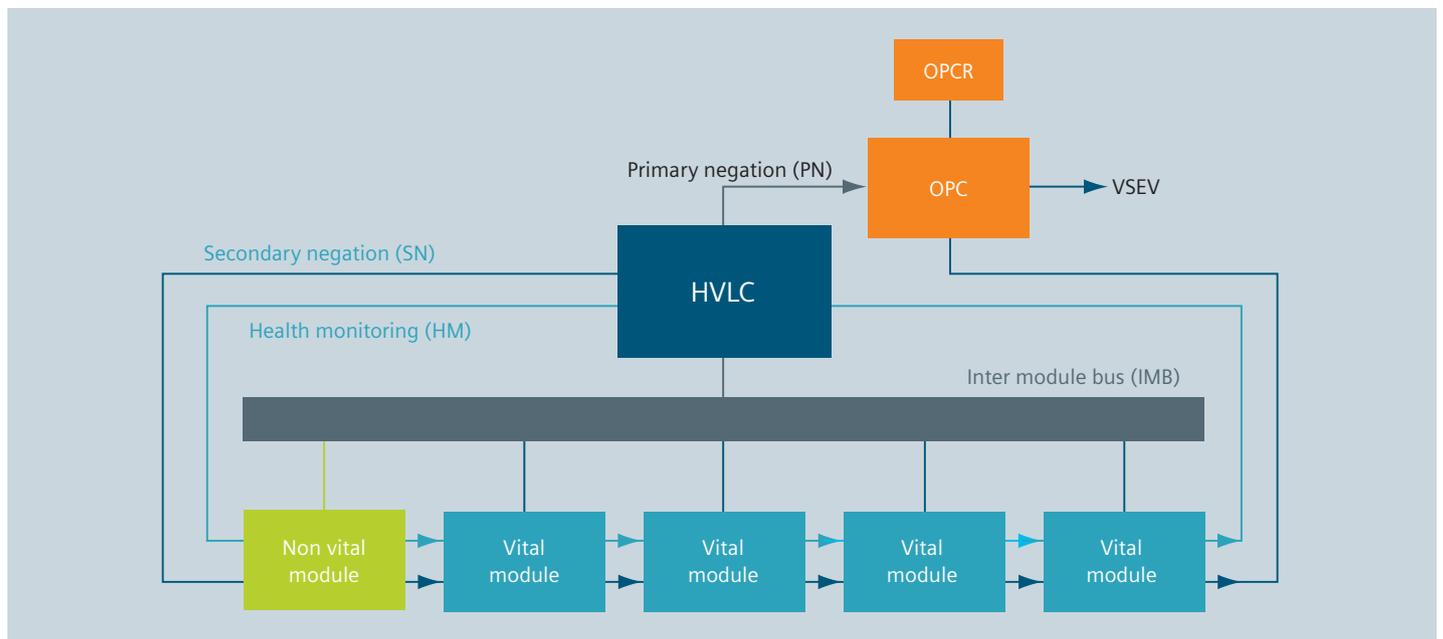
Trainguard Sirius is the overall solution for automatic train control (ATC) system for all kind of mass transit and suburban railways, whether for conventional, driverless, or fully automatic operation. Trainguard Sirius uses the latest state-of-the-art digital radio transmission techniques and has been specifically designed for high density traffic lines. By optimising the headway, the shortest

possible interval between consecutive trains is granted, thus allowing the operator to reach maximum transport capacity and optimize rolling stock usage.

**Centralised traffic control (CTC): Controlguide Rail 9000**

Controlguide Rail 9000 is a flexible system that allows the integration of functions such the automatic route setting function and the regulation function. The integration with other

systems present in the operational control centre (OCC) is granted through a safe interface with a dedicated, open protocol for exchanging information with external system. Controlguide Rail 9000 can easily be adapted to different types of rail networks and a high-technology showcase that has become an essential instrument in any rail network.



Trainguard Futur 1300 ERTMS Level 1 architecture.

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The information in this document contains general descriptions of the technical options available, which do not always have to be present in individual cases. The required features should therefore be specified in each individual case at the time of closing the contract.