

**Client:** Turkish State Railways (TCDD)

**Project period:** January - September 2013



### Initial situation

The Turkish State Railway is planning the construction of a double tracked, 13 kilometre long railway tunnel under the Bosphorus. On the one hand, it shall merge the existing suburban lines B1 and B2, on the other hand, it will be used by long distance passenger traffic and freight traffic.

The suburban trains will operate with a moving block signalling system, whereas all other train runs will be secured conventionally (ETCS Level 1) with fixed block sections.

Furthermore, the aboveground tracks on both sides of the river towards Mandıra and Arifiye will be expanded and modernised.

The evaluation area contains the whole suburban line from Halkalı in the west to Gebze in the east. The existing lines on both sides of the Bosphorus are triple track lines. Only a few stations have a platform for the third track. Interchange stations of the single-way third track also have a limited effective length. Three new stations are planned inside the tunnel (Yenikapı, Sirkeci and Üsküdar).

### Challenge

It is our job to evaluate the tunnel capacity for the two time horizons 2015 and 2030. A high increase of freight traffic is prognosticated for the 2030 timetable. Additionally, it has to be proven that the freight trains can use the tunnel without restrictions, despite some of the significant gradients.

### Strategy

For the investigation we use our software system RailSys®. The first step is the evaluation of the future infrastructure with its track layouts, signals, sets of points etc. and the illustration in RailSys®.

Based on this data, the dynamic running performance of the freight trains through the tunnel can be evaluated. Apart from non-stop train runs, we also analyse the stopping of freight trains in critical, very steep locations.

The next step includes the development of operational concepts for both 2015 and 2030 while considering the prognosticated numbers of trains (per train type and time slice). After the construction of a timetable without conflicts, we evaluate the amount of possible train runs on this infra-structure. Subsequently, an operational simulation was performed to evaluate the operational quality of the resulting timetables.

### Result

Freight trains with the specified loads can travel through or stop in the Marmaray tunnel with no additional load restrictions. Due to the high amount of passenger rail transport during the day, the freight traffic has to be operated at night. The operational quality has been evaluated for all train types. Bottlenecks have been detected and recommendations concerning the enhancement of the conventional signalling system and additional interchange stations as well as freight yards have been given.