# Case Study

**Earthquake Early Warning**
**Kenitra-Tangier High-Speed Rail Line**
**Tangier, Morocco**

GeoSIG
swiss made to measure

In Cooperation With
GeoSIG Partner

SYGEO

## Background

Morocco—located in NW Africa—is characterized by a rugged mountainous interior, large tracts of desert and a long coastline along the Atlantic Ocean and Mediterranean Sea. It has a population of over 33.8 million and an area of 446,550 km$^2$. When Morocco wanted to modernise its transportation network by installing a high-speed rail line between Tangier and Casablanca, they decided to do so in stages over three decades. The first step was the Kenitra-Tangier High-Speed Rail Line. Morocco's rail company ONCF awarded to the consortium consisting of Ansaldo-STS France and Cofely Ineo, the design and supply of the railway signalling, telecommunications and control traffic centre for the Kenitra-Tangier high-speed rail. Ansaldo-STS France has developed the signalling and train control systems that contribute to the constant improvement in railway safety and capacity on main lines and mass transit railway systems all over the world. For this project, Ansaldo-STS put together a complete system that allows safe and reliable commercial operations on the new line, up to 320 km/h.

## Challenge

Unlike some of the more highly seismic countries in the Mediterranean, Morocco is affected by a moderate seismic activity largely related to the convergence between Africa and Eurasia. Still, every year there are earthquakes felt by the population and in some cases they cause extensive local damage. Historical documents show that much larger earthquakes have occurred in the past in Morocco, particularly along the Atlantic coast between Tangier and Agadir. In addition, the 14 Euroduplex double-deck trains purchased for the high-speed rail line are each capable of carrying 533 passengers. The potential for injury is elevated should anything deform the tracks or if any ground motion should generate forces to affect the safe travel of the train at high speeds. Passenger safety is of utmost importance.

## Solution

Our Partner in Morocco, SYGEO, is experienced in the supply, installation and maintenance of monitoring equipment for the inspection of civil engineering, dams, hydrology, oceanography, laboratories and meteorology. SYGEO provided instruments from GeoSIG for a high-speed train seismic monitoring system, which can be used to take emergency actions for critical infrastructure in case of detection of a damaging seismic event.

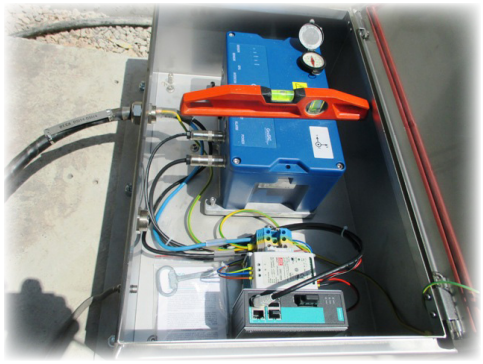
There were 18 seismic stations inside stainless steel field housings consisting of a three channel GMSplus recorder with an internal triaxial AC-73 sensor and with all necessary accessories as an integrated single unit, deployed at 10 km intervals along the tracks, either near or inside signalling stations. These were linked to the SMS-AEP computer at the data centre over LAN/FO. The seismic station continuously monitors and records the ground motion and periodically sends state-of-health and other files to the data centre. In case of a threshold exceedance, a digital alarm signal is immediately sent to the data centre and made available to the train control system utilising GeoSIG's proprietary GeoDAS software, which assists the system operator to decide whether to take actions to slow down or stop trains. GeoDAS uses special optional software modules which provide an advanced configuration interface for voting logic, an intuitive alarm / status display as well as an industry standard ModBUS communication to the train control system.

Another solution using GeoSIG instruments, effectively showing that quality and reliability can also be cost-effective.

## Product links

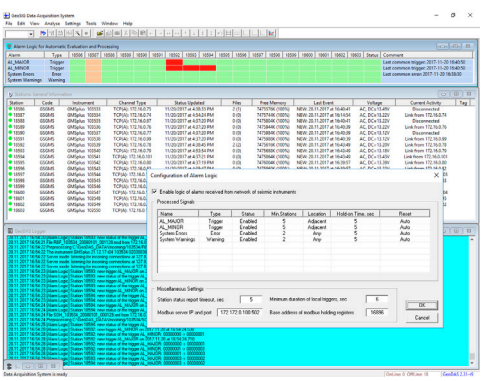
GMSplus
AC-73
SMS
GeoDAS
ETH-FLAN


**SYGEO engineers installing the seismic station.**



**Precise levelling and orientation of seismic instruments are important for correct operation of the system.**

**Rugged concrete vaults and heavy covering slabs protect installed instruments from the environment and vandalism.**



**GeoDAS software in the data centre displays status of all the seismic stations and their Early Warning alarms.**