



THE HELLENIC RAILWAY LINE ON THE FAST TRACK

DISCOVER HOW GPS IS PLAYING AN IMPORTANT ROLE IN THE DEVELOPMENT OF THE GREEK RAILWAY

Surveyors recently played a crucial role in upgrading the 240-kilometer rail link from the city of Thessaloniki in Greece's northeastern Thrace region to the Turkish border. Their challenge: to create a three-dimensional land survey for real estate registration and topographic contours along the length of the railway's rugged terrain. Despite difficult conditions, the survey has been efficient, fast and accurate, thanks to the capabilities of GPS-based survey systems.

Early in 2004, METRON Consulting Engineers, one of Greece's largest survey engineering firms, surveyed a swath 60 meters wide along the railway's entire length using the track as a center line. The region's rough landscape made achieving the survey's required accuracy a difficult task. Using total stations to survey was not possible. From the start of the project, planners realized that setting up and operating total stations would be far too time-consuming and costly for this type of linear work. Instead, they opted for GPS-based survey systems to measure the triangulation network and the required detail points.

A 240-kilometer survey in three and a half months

METRON put seven surveyors to work on the job, choosing a combination of five Thales Z-Max GPS receivers and four Thales Z-Xtreme GPS receivers, completing the entire 240-kilometer project within three and a half months. The receivers, chosen for their flexibility and high performance, were purchased from JGC GPS Consultants of Athens who recommended the equipment.

ABOVE: Greece's northeastern Thrace region: A challenging multipath environment



LEFT: Mr. Pasis and Mr. Valtinos (from left to right) - Directors of METRON, Thales Z-Max RTK GPS receiver.

BOTTOM LEFT: Equipment operation

BOTTOM RIGHT: Static survey in high multi-path environment

station, they surveyed in greater detail, and in some cases, when under cover in stations or in dense foliage, a total station was enlisted for part of the work. The total stations and the equipment were able to work together seamlessly. The team established RTK control points in the area and set up and oriented the total station in a short time. Because FAST Survey software provides flexible support for a wide range of instruments and data formats, the total station points were able to quickly and conveniently collect and log data within the same job as the RTK data from the GPS-based systems.

For METRON Consulting Engineers and their client, O.S.E Railway, the 240-kilometer survey project was completed in a very short time with accurate and precise results. For METRON, which handles many rural survey projects throughout Greece, the choice of Thales GPS-based survey equipment systems is boosting productivity on many of its major jobs. Recently completed assignments include a cadastre study of 4.5 million square meters for a part of the national highway from Athens to Thessaloniki, real estate registration for 60 kilometers of railway in the Messologgi province, and surveying 20 kilometers of forest road construction.

JGC GPS Consultants (www.jgc.gr) and **METRON Consulting Engineers** (www.metrontopo.gr). For more information – (www.thalesgroup.com/navigation).

In recommending Thales, they pointed to the brand's patented Z-Tracking capabilities, an advanced technology that acquires GPS signals and reads them with high accuracy even in difficult conditions. Even though the region was very mountainous and affected by multi-path, the operation went smoothly due to Z-Tracking's ability to mitigate many of the problems caused by weak signals, interference and noise.

The survey team used static methods for the triangulation network and RTK for control and detailed points. In static surveys, of course, moving between triangulation points is far more time-consuming than the actual taking of measurements once the receiver is set up. For that reason, the team deployed a total of nine receivers. Using so many receivers effectively reduced the time needed to transfer receivers between sites. Multiple baselines were thus formed. The entire triangulation network, consisting of 140 triangulation points, was reconnoitered and measured, and pillars were constructed all within 15 days. All data for the project was post-processed using Thales' GNSS Studio software, which had no

difficulty handling the large amount of data from the large network.

Using RTK for control points

In addition to the triangulation points, another 2,000 control points were established and measured using RTK surveying and taking a minimum of 20 epochs time duration. These points were then imported from Symbol controllers into GNSS Studio and adjusted with the whole network to achieve a unified accuracy.

Detailed points were collected in RTK mode using one Z-Xtreme system as a base station along with eight rover receivers. The team collected RTK data using Thales' FAST Survey software, a graphical field solution that optimizes the functionality and performance of the Thales GPS systems. Using geoid files in FAST Survey during RTK data collection provided excellent results in orthometric heights.

The receivers were placed in a straight line about 20 paces apart, perpendicular to the track. One coordinator sketched the arrangement as the rovers were collecting the points. When the team reached a train

