

Case Study

application | Railway Embankment over Subgrade with Cavities
location | Arbois, France
product | GeoDetect®

client & designer
contractor

SNCF
DVF, Arbois

TenCate™ develops and produces materials that function to increase performance, reduce costs and deliver measurable results by working with our customers to provide advanced solutions.

THE CHALLENGE

The railway line between Mouchard and Bourg in the East of France crosses areas where underlying strata are suspected to contain large cavities. Since damage had already occurred in the past, the client (SNCF - French Railways) decided to reinforce one of the most sensitive sections with geosynthetics. In order to avoid any additional risk, a permanent monitoring of the section was required. Here, GeoDetect® was the optimum solution, considering both technical and economical aspects. Both

requirements can be fulfilled with just one single product. In addition, GeoDetect® is insensitive to electromagnetic interference which is unavoidable in the vicinity of electrified rail tracks.

THE DESIGN

The superstructure of the single track section consists of 500 mm of ballast placed on top of a nonwoven geotextile filter fabric. The section reinforced and monitored with GeoDetect® has a length of 50 m. The following surface-settlement criteria was established for design monitoring. Notifications were sent at:

- Warning = 6 mm settlement
- Reduction of speed = 9 mm settlement
- Closure and maintenance = 21 mm settlement

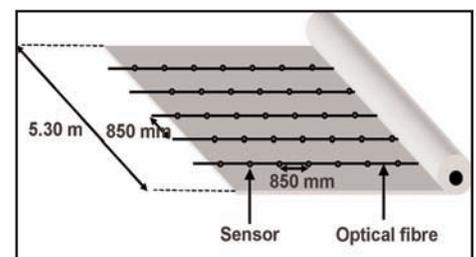
The design of the geosynthetic was carried out using the analysis method derived from the RAFAEL project. In the present case, an ultimate tensile strength of 300 kN/m was required. This project is the first practical realization of the RAFAEL research project on the use of high-strength geosynthetics for base courses over cavities, and GeoDetect®, the first “intelligent” geosynthetic. The configuration of the sensors assumed a cavity diameter of 1.2 m. The design led to a sensor spacing of 850 mm, both between the longitudinal optical lines and the sensors along each line. This resulted in a total of 300 sensors within the whole section to be monitored.



Overall view of the refurbished and reinforced railway section.



All necessary connections and cables are factory-installed, ensuring simple and speedy installation of GeoDetect®.



Configuration of the sensors; in total, 300 sensors are available for the 50 m long section.

THE PRODUCT

GeoDetect® combines the benefits of a high-strength geocomposite (TenCate Rock PEC) with those of optical fibres. This enables the designer to both reinforce soil structures, and to detect and evaluate possible deformations and settlements in order to provide timely maintenance. The use of GeoDetect® increases safety and enables cost-effective construction, especially in areas prone to sudden settlements such as karstic and mining zones, or with embankments on piled foundations.

THE PERFORMANCE

In order to minimize impediment to traffic, all work was carried out in just one single night between 23:00 and 6:00 o'clock. In this short time span, the top layers were removed, GeoDetect® installed, and both base course and ballast re-installed again. As scheduled, the line was re-opened to traffic at 7:00 o'clock. Despite the difficult conditions (darkness, lack of space, bad weather) the tight time schedule was achieved. This was only possible because GeoDetect® had been equipped with all necessary cables and connections in advance in the factory. Since 2004, measurements have proven the system fulfills all requirements in full.



Installation of the GeoDetect® roll.



Installation of the GeoDetect® and ballast layers.



First measurements yield satisfactory results.

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