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< Track & Infrastructure



# High-Yield Geophysical / Geotechnical Characterisation of Existing Railway Tracks

Sol Solution (geotechnical consultancy) has developed innovative methodologies and tools for stealth geophysical / geotechnical investigations, to help ballasted track infrastructure managers with maintenance / renewal planning on revenue service lines.

Rail is the most sustainable mode of transport in these trying times of climate change. Railway infrastructure is widely spread out in many developed countries of the

world. Most track is ballasted, old and has been maintained and partly renewed to mainly meet the change of rolling stock (from steam train to diesel, to electric) and safety standards.

Given the extent of these existing networks and the global trend towards increasing capacity and safety, the asset manager needs decision-making support for maintenance / renewal programmes taking into account existing substructure features such as geotechnical properties.

To address this new need of the industry, Sol Solution has developed a new methodology for railway

track characterisation based on the coupled use of geophysical and geotechnical tests, providing the asset manager with key point indicators helping with the optimisation of the maintenance / renewal strategy. This methodology complies with all the constraints of revenue service lines (limited possession time, difficult access, non-destructive testing etc.)

## Fig.1 – GPR Setup and Pandoscope® Test

First, we would set up continuous monitoring of the railway substructure thanks to GPR acquisition that could be run at more than 80km/h. The data

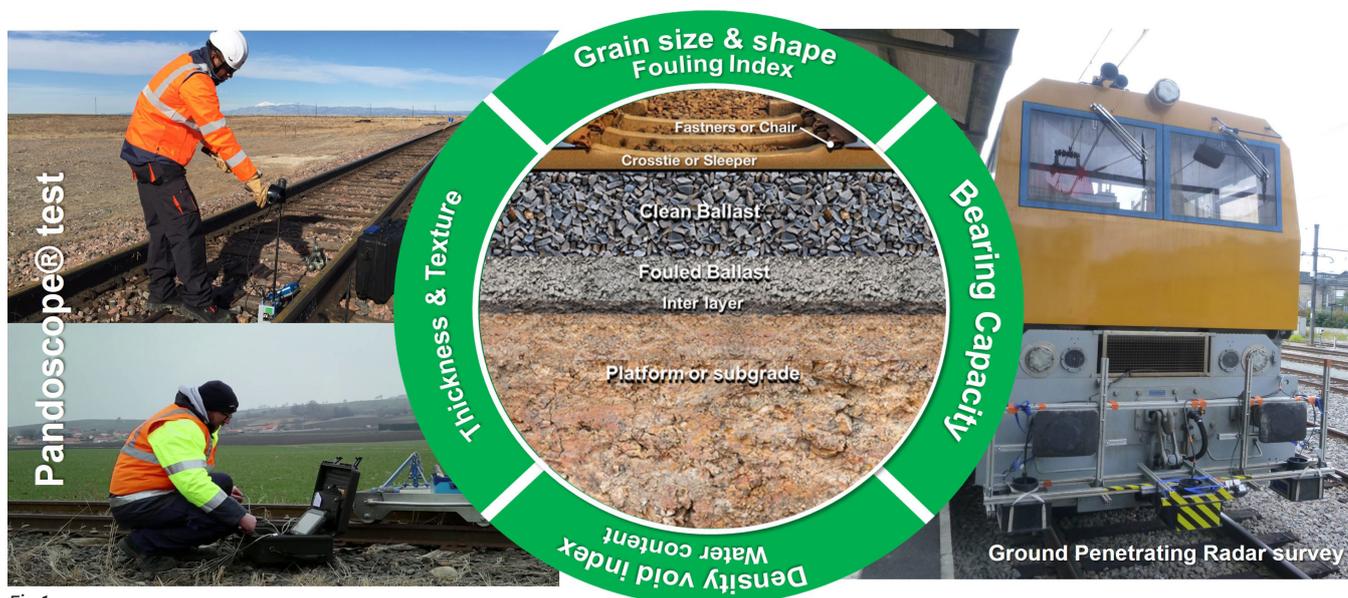


Fig 1

processing would provide the location of homogeneous and poor conditions sections (humidity, fouling, mud...).

These locations would be crossed with geometry and maintenance information to build up a sounding campaign.

The geotechnical characterisation is done with the Pandoscope® which is the combination of PANDA® and Geoendoscopy®, both of which are very light and unintrusive devices (cf. fig.1).

The dynamic penetration test PANDA® provides resistances, whereas geoendoscopy® provides precise information on the nature and state of the tested soils (thickness of the layers, type of soil, GSD...).

Once the pandoscope data has been processed, the results can be presented as follows (cf.fig.2): the right-hand graph shows the evolution of the PANDA® cone resistance according to depths.

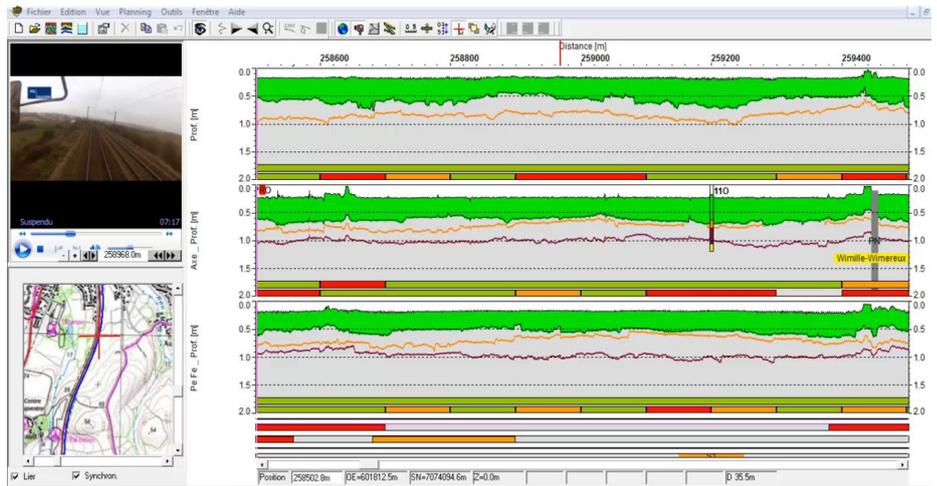


Fig 3

The left-hand window shows the stratigraphy of the track layers (thickness, nature and hydric state).

### Fig.2 – Pandoscope® Results

These localised results are reinjected and correlated with GPR analysis in order to provide the final continuous information to the asset manager (cf. fig.3).

### Fig.3 – GPR Results

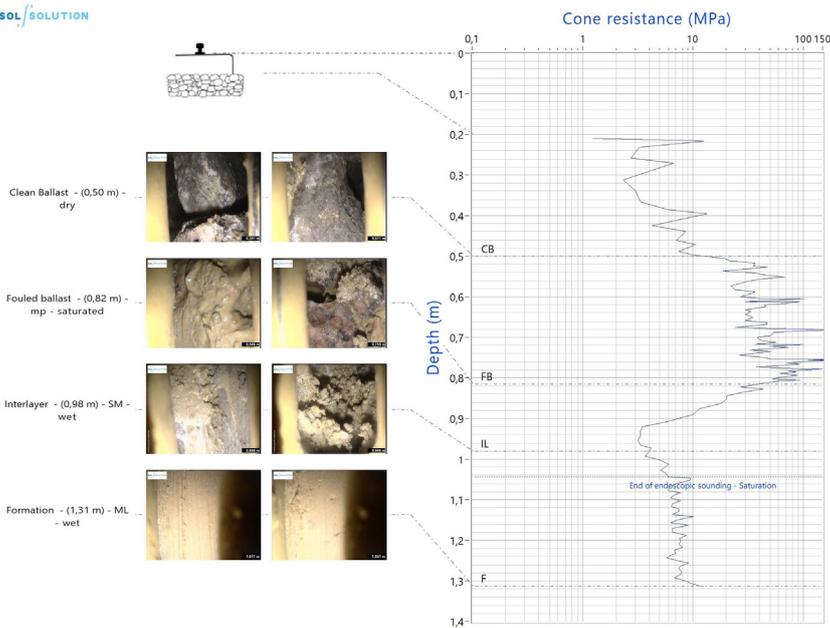
These results are used, in

conjunction with other metrics (geometry, hydrogeology etc.) to make recommendations for maintenance / renewal works, and to design the renewed track.

Advanced analysis, such as image-based grain size distribution, can help with ballast return rate assessments for more sustainable ballast management and a substantial economy.

This methodology has been used in more than 10 countries for a total of 5,000km of tracks investigated and more than 100,000 Pandoscope® soundings.

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PANDOSCOPE® Site: Line: Track id: UP MP: 131.395 Pos: L Area: Plain Track Sounding: 003

Fig 2

Click or scan the QR code to find out more about Sol Solution



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# SOL SOLUTION

## RAILWAYS SUBSTRUCTURE INVESTIGATIONS ON REVENUE SERVICE LINES

*GPR and Pandoscope®: An innovative methodology for an efficient asset management system*



### OBJECTIVES

- Geophysical & Geotechnical characterization of ballasted track substructure
- Continuous monitoring of layers of revenue service lines

### ADVANTAGES

#### *Easy implementation :*

- Non destructive and continuous survey
- Quick adaptation to local constraints
- No heavy machines, light tools for the geotechnical campaign
- No sampling, no tamping

#### *Accurate characterization :*

- Characterization of trackbed layers : mechanical properties, thickness, nature, hydric state
- Ballast and sub-ballast thickness and condition

### RESULTS

- Recommendations for maintenance or renewal works
- Key metrics for the design of track renewal
- Image-based grain size distribution of the ballasted layers
- Ballast return rate assessment



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