MONITORING THE FOUNDATION OF THE AMSTERDAM-PARIS HIGH SPEED RAILWAY

THE FOUNDATON OF THE HSL.

The Rheda 2000 railsystem of the high speed railway (HSL) between Amsterdam and the Belgian border is supported by a reinforced concrete slab structure that is founded on piles over most of the track's length. The slab is divided in 30m long sections, separated by expansion joints. Displacements, if any, at the location of a joint may not exceed clearly defined critical values.

FIBER OPTIC SENSORS.

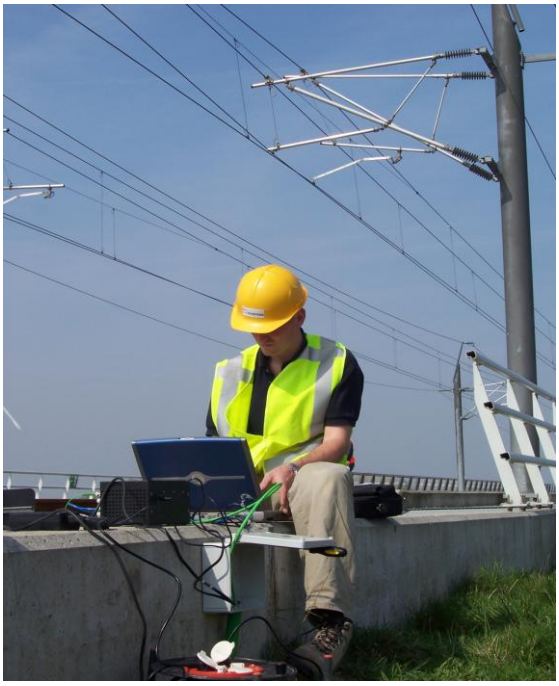
Inventec received the order from the railway's contractor BAM HSL Infraprovider to engineer, supply and install a system of fiber optic sensors that would have to monitor displacements of the joints. The system comprises a total of 126 sensors spread over 26 locations along the 70km long HSL track between the cities of Hoofddorp and Breda. In particular those joints had to be monitored that form the transition of the foundation slab to a structure such as the approaches to the Groene Hart Tunnel, the Moerdijk bridge, the aquaduct crossing the Ringvaart of the Haarlemmermeer polder and the fly-over at the intersection with the A4 motorway.

Each sensor measures, with an absolute accuracy of 0,05mm:

- Vertical displacement.
- Lateral displacement (i.e. perpendicular to the track).
- Rotation of the slab in cross-sectional direction.

An additional challenge was that, as a result of thermal expansion/contraction in the longitudinal direction of the track, the width of the joint could vary over as much as 55mm and that this movement was not permitted to influence the accuracy of the vertical and lateral measurements. For this very demanding application Inventec succeeded in engineering a fiber optic sensor system with a maintenance free lifetime of 25 years.

MONITORING.

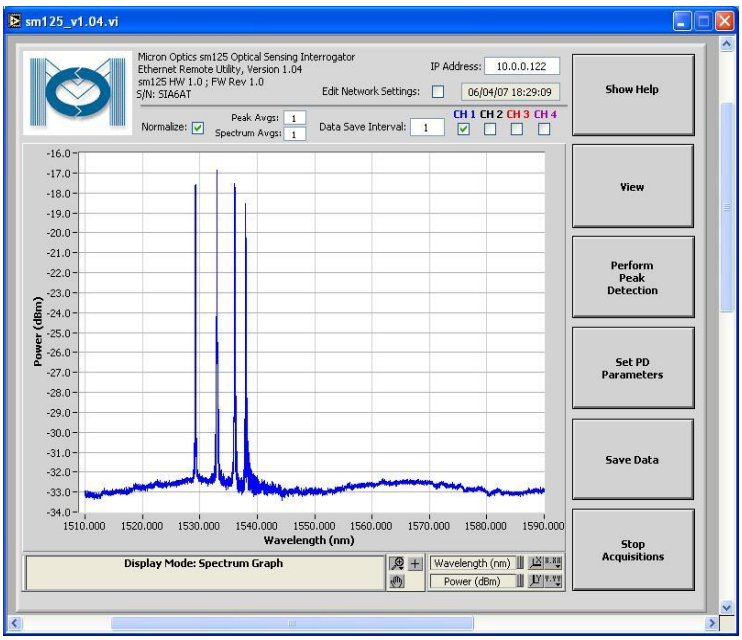


Inventec carries out the measurements on a monthly basis. The report is submitted to Infraspeed Maintenance, the operator of the HSL railway. Evaluation of the measurements takes place during regular meetings of an expert team of which Inventec is one of the members. Although until now Infraspeed has decided to have the measurements made on a monthly basis, it obviously is possible to interrogate the sensors remotely, even in real-time. This is an option when traffic on the track will increase in the future.

MEASURING WITH FIBER OPTIC TECHNOLOGY.

In the selection process for this project the outstanding properties of fiber optic technology, again, were the decisive factor:

- Unrivalled reliability and accuracy.
- Measurements are not influenced by electromechanical induction (in the HSL case: 25KV!).
- Unaffected by humidity, water, vibrations.
- No drift, not even over periods of many tens of years.
- Measurements fully compensated for variations in temperature.
- Very small size.
- Sensors can be put in series, limiting the amount of cabling.
- Resistant against the most demanding and hostile environments.
- Intrinsically safe, so ideal for application in hazardous areas.



These properties render fiber optic sensors ideally suitable for long term structural monitoring applications.

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