

DEFORMATION MONITORING

CLIENT: IV-INFRA B.V. | A-LANES A15 | **BOTLEK RAILWAY TUNNEL**



THE CHALLENGE

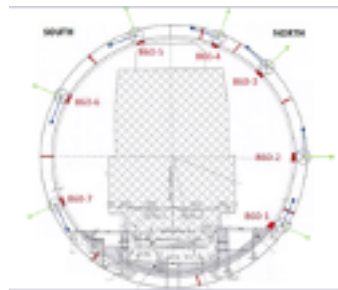
The Botlek railway tunnel is the first bored railway tunnel in the Netherlands. It is located under Oude Maas river and next to the existing Botlek railway bridge. Due to the reconstruction of the existing infrastructure from A-Lanes in the area of Botlek, the Botlek railway tunnel would be subjected to deformations and the monitoring of the tunnel was necessary during the execution works.

A monitoring system was required starting from mid-2017. The system had to be easy to install, as well as accurate, discreet but most of all reliable. The 8.65m diameter concrete segmental lining tunnel stretched 1.8km and no mobile signal or internet access was available. The site engineers estimated the maximum movement to be up to $\pm 3\text{mm}$.

Iv-Infra contacted Senceive to find a solution, because of their pedigree with their tunnel wireless remote condition monitoring solutions.

OUR SOLUTION

Senceive proposed six segments (out of seven) and one closing/key segment be monitored every 30m. In total 434 FlatMesh Triaxial tilt sensor nodes were installed over 1.8Km of tunnel and these are taking readings every 30 mins. The tilt node triaxial capability mean that they can be positioned at any orientation, with no fiddly levelling required.



To overcome the lack of internet/mobile connectivity, Senceive used two Monitoring Hubs located 800m from each entrance, to receive the data from the wireless nodes. These Monitoring Hubs utilized the tunnel's 220V power supply and relay data via a 2km telecommunications cable to a Telemetry Hub located outside the tunnel entrance. Data can then easily be transmitted through a mobile network to visualization software.

THE OUTCOME

Iv-Infra opted to use their own software to read and process the data, however Senceive's WebMonitor software also allowed the support team to undertake system health checking accessed on a computer, tablet or smart phone worldwide.

FlatMesh triaxial tilt nodes were the ideal choice, as they could be installed with ease and efficiency. This reduced man-power, time and saved on costs. Senceive were also able to offer training and comprehensive support throughout the project. The extremely reliable and robust system also eliminated the need for any further maintenance or visual checks. For example, when construction works above ground commenced, Iv-Infra requested the reporting rate of the nodes to be increased to 7.5 mins in certain areas. The system allowed this to be done remotely with no physical intervention at all.

Monitoring is thought to continue for the full battery life of the nodes, up to 15 years, with the view to replace the batteries and continue monitoring for a duration of 25 years.

