

CASE HISTORY



Application: **Linear Infrastructure**

Technology: **Hi-OPTV®, HRAT®, PS Logger®, Formation Density, 3-Arm Caliper**

Location: **HS2 Rail Development, London to Birmingham, UK**

Requirement:

The HS2 project involves building major structures including tunnels, embankments, cuttings, bridges and viaducts across 140 miles of new high-speed line for modern electric trains travelling at speeds up to 225mph. Boreholes, for geotechnical investigation, were drilled all along the route but were mainly concentrated in areas where major structures would be required. Robertson Geo Services (RGS) acquired data from over 70 boreholes along the proposed route.

Equipment:

Televiewers were run in each borehole to determine bed boundaries and to delineate fractures and bedding. The High Resolution Optical Televiwer (Hi-OPTV)® was run first as this produces the highest resolution images where the borehole is dry or the borehole fluid is clear. If the borehole fluid remained cloudy the High Resolution Acoustic Televiwer (HRAT)® was also run. On selected boreholes the Formation Density and PS Logger® probes were run to provide density profiles and velocity profiles respectively, from which small strain moduli could be readily calculated. The 3-Arm Caliper provided information on the borehole condition and its natural gamma profiles could be used to align beds across multiple boreholes.

Operations:

The proposed route crossed mainly rural areas and to be environmentally responsible the use of mud-mats, to minimise damage to the fields, was widespread. This allowed 2WD vans to be deployed in some cases with 4WD vehicles being the default and portable systems were also deployed at times. Following completion of drilling a shooting plan was devised so that unstable areas of the borehole could be negotiated safely. This involved withdrawing the drill string in stages (casing pulls) to protect weak areas and passing the probes through the drill string every time. The drill rig remained over the borehole for the logging operation where casing pulls would be required.

Challenges and solutions:

Some of the more inaccessible boreholes could not be reached by 4WD vehicle and a fully portable system was deployed in these cases. As the HS2 route crossed several lakes, some over water logging was required. For RGS engineers, fully trained in offshore working, this was relatively simple compared to harsher marine conditions.

End value to client:

The data from borehole logging made a significant contribution to the overall geotechnical investigation. By characterising the subsurface properties relating to structure and rock strength and in particular the presence of fractures and faults, the logging was invaluable for design planning and risk mitigation for the project.

