G

round investigation can be constrained by conventional techniques but Fugro’s Deep Line offers a new approach. Onshore investigation methods used in the London Basin illustrate how ground investigations can be limited by the available techniques. Cone penetration tests (CPTs) performed from the surface using a truck or crawler rig can achieve 200kN thrust per push to refusal, which is generally enough to penetrate down to river deposits or consolidated clays, but insufficient for reaching the anticipated design pile depth or design tunnel alignment.

Cable percussion (CP), involving disturbed sampling and standard penetration tests (SPTs), is a relatively inexpensive way for engineers to view rudimentary samples as an input to design and decision-making. However, traditional CP rig design and its reliance on manual handling exposes workers to greater risk of injury.

Finally, rotary coring offers some improvement, providing a guarded rotating drill string and remote hydraulic control for operator safety and extracting high quality cored or pushed samples for laboratory testing. This technique is highly effective through hard ground layers but drawbacks include disturbance from rotary drilling with flush and the challenges of taking samples in varying ground conditions.

For example, Harwich and Lambeth Group deposits are difficult to sample due to lateral variation in the material, ranging from sand channels to shelly beds and clays. This leaves gaps in the vertical dataset, resulting in greater subsurface uncertainty and less information for design decisions.

Based on long-proven offshore technology, Fugro’s Deep Line innovation is an onshore wireline CPT system that can be deployed within industry standard coring systems. It works with any existing onshore drilling rig to advance the borehole and deploy a cored sample technique or an insitu CPT method at any vertical reference point. Wireline coring and wireline CPT provide a flexible operational setup and are safer options as they reduce manual handling exposure for workers.

Deep Line can be used to deploy a wide range of cones, where the main parameters of tip resistance, pore water pressure and sleeve friction provide an instant indication of stratigraphy based on robust, automated digital interpretation using empirical datasets. In the Harwich Beds, where sand layers, clays and silts combine to present almost impossible to core soil conditions, CPTs can provide shear strength range and estimate relative density in granular material.

The acquisition of data in previously challenging stratigraphy helps project engineers make informed design choices supported by early data, and engineering methods can be honed, reducing conservative design and improving operational safety.

Best of all, Deep Line gives project teams near real-time access to geo-data to allow live decision-making onsite; for example, ground information that informs decisions on whether to core or use an insitu CPT – or both – can significantly reduce schedule time. Conventional ground investigation techniques all have limitations but the right solution can reduce manual processes and exposure to health and safety risks, while delivering live digital data for the superior management of ground risk. Deep Line promises a long-awaited transformation.