

Time series method for profiling of London Clay with MWD data

Background

- The net drilling process is a mechanical failure of geomaterials under normal and shear stresses.
- The MWD is an external system installed on the drilling machine and records the drilling parameters to interpret the in-situ strength of geomaterial.
- The drillhole investigation around an old tunnel with cast iron segment lining at Kennington Park in London failed to establish a good correlation between the soil and the drilling parameters and to distinguish soil formation changes because of noises in drilling parameters (see Figure 1).
- The efforts for filtering noises were unsatisfactory, resulting in limitations and obstacles of the MWD technique within geotechnical engineering.

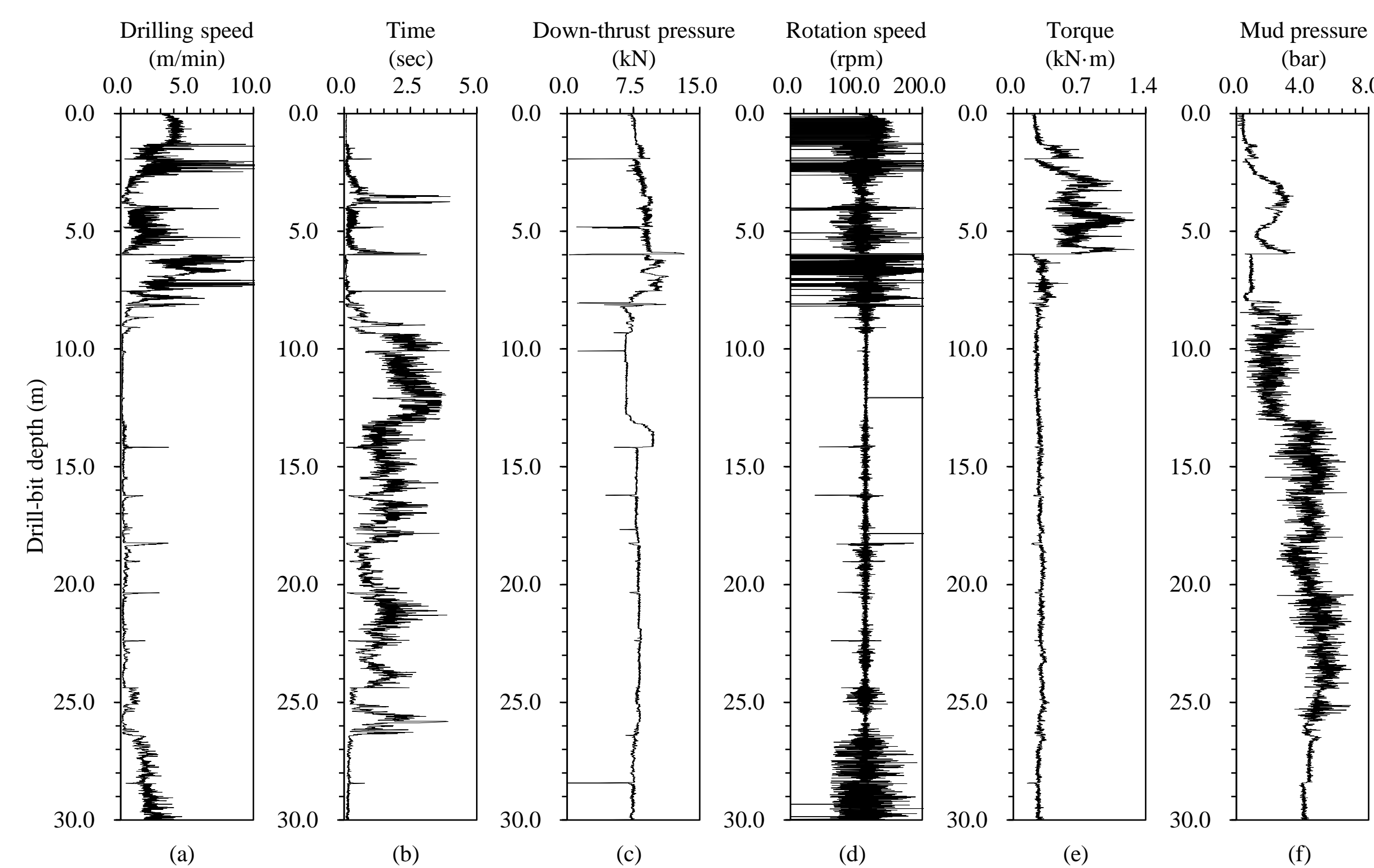


Figure 1 – Original MWD (ENPASOL) data along the drillhole of 30 depth at Kennington, South London (after Gui et al., 2002).

References:

Wu, S. Y., Yue, W. V., & Yue, Z. Q. (2023). On drilling speed of London Clay from MWD data with time-series algorithm for ground characterization. *Géotechnique*, 1-14.

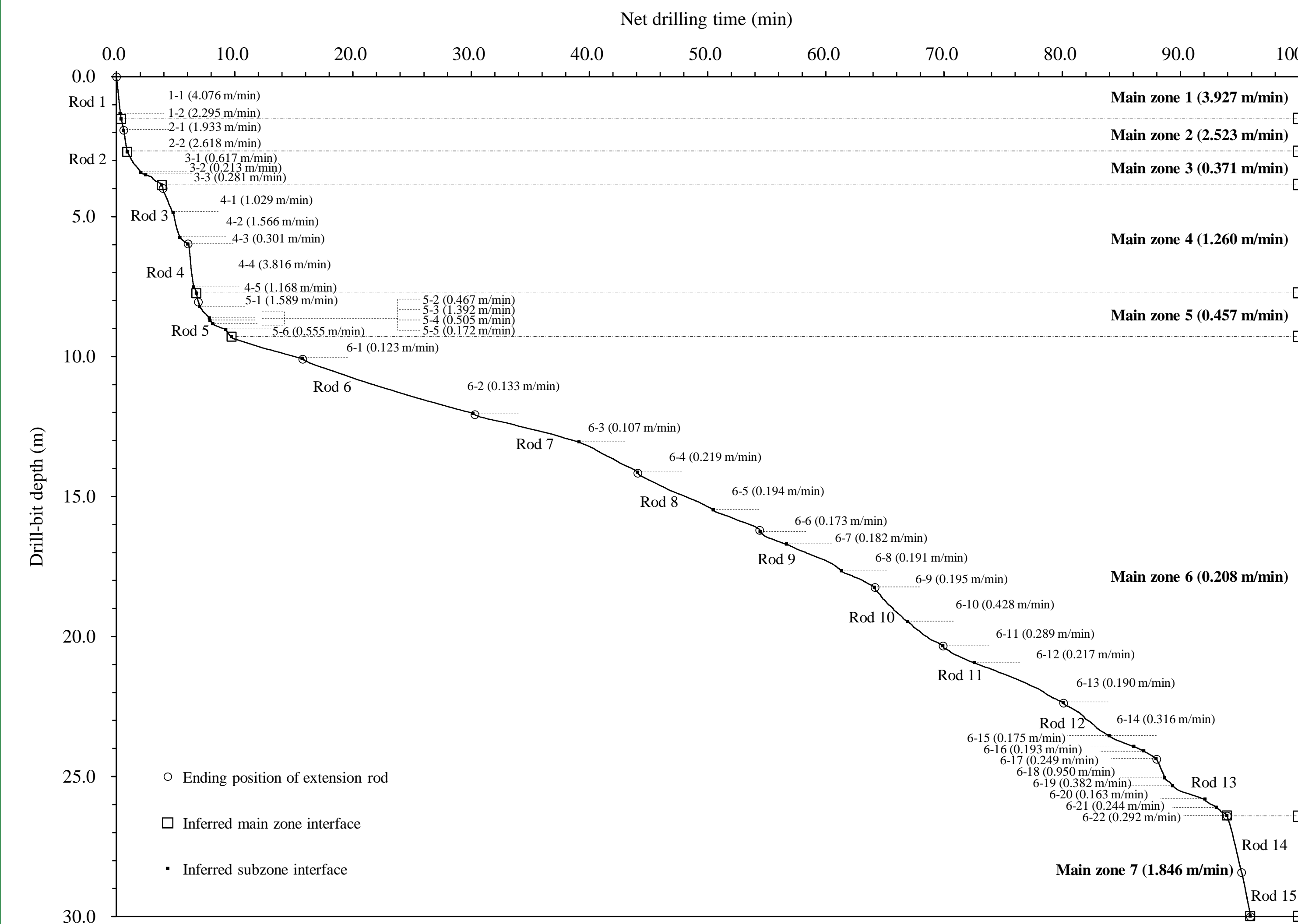


Figure 2 – Curve of drill-bit depth versus net drilling time with identified linear zones and constant drilling speeds along 30 m drillhole.

The Solution

- We transfer the MWD data in depth-series to time-series.
- The curve of drill-bit depth with net drilling time can be visually divided into many linear segments.
- Each linear segment has a gradient or constant drilling speed and represents a homogeneous geomaterial zone with constant resistance to drill bit loading.
- The smaller the constant drilling speed, the harder the homogeneous geomaterial zone.

The Contribution

- The noise in MWD data are firstly and efficiently addressed by time-series algorithm.
- London clay is not soft clay, it is very stiff and nearly claystone.
- The results and findings give a clear understanding and assessment of the London clay. It substantially improves the MWD technique for site investigation.

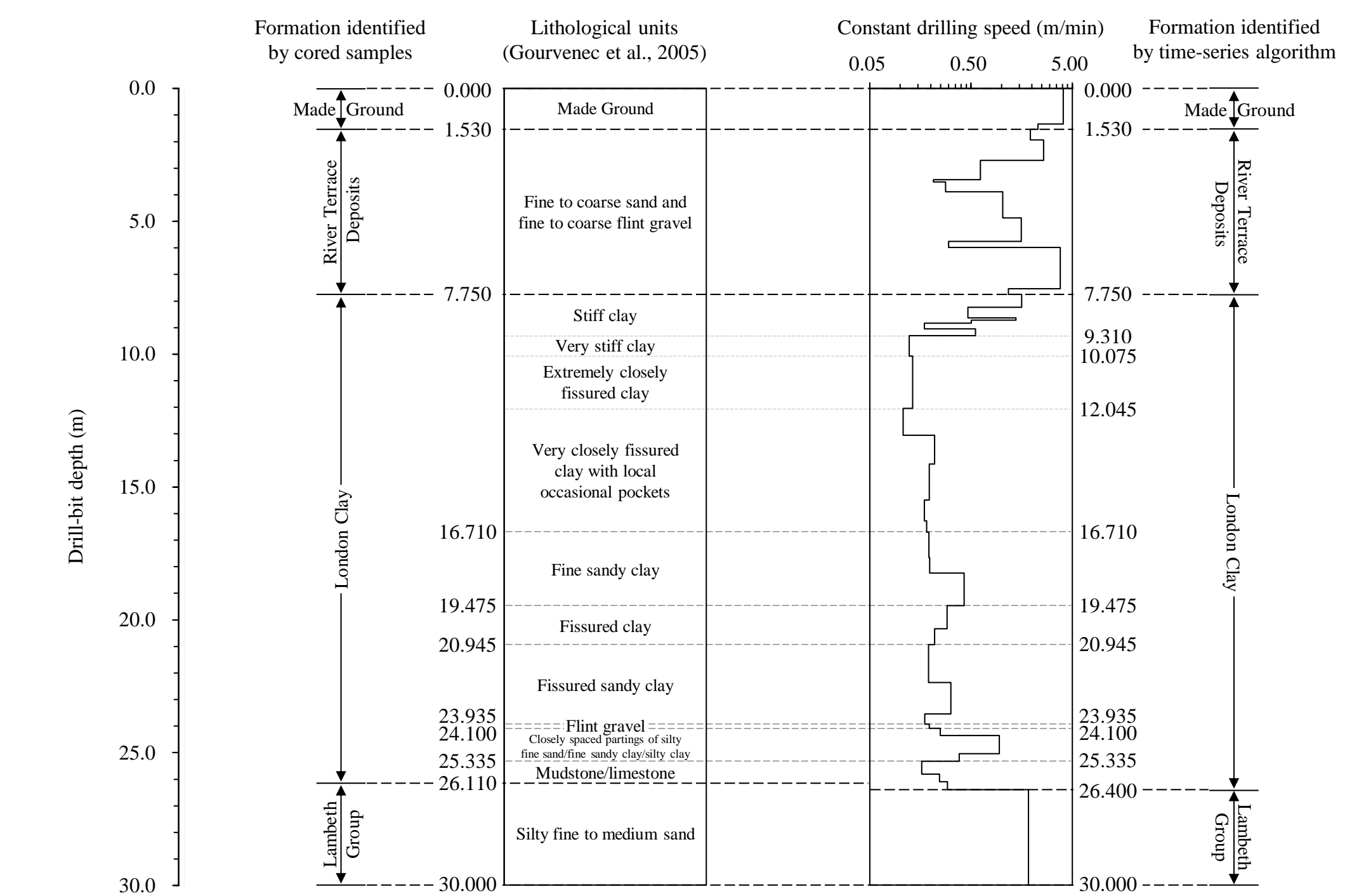


Figure 3 – Comparison between the stratigraphy profile from rotary-cored samples and the zoning profile of constant drilling speed.

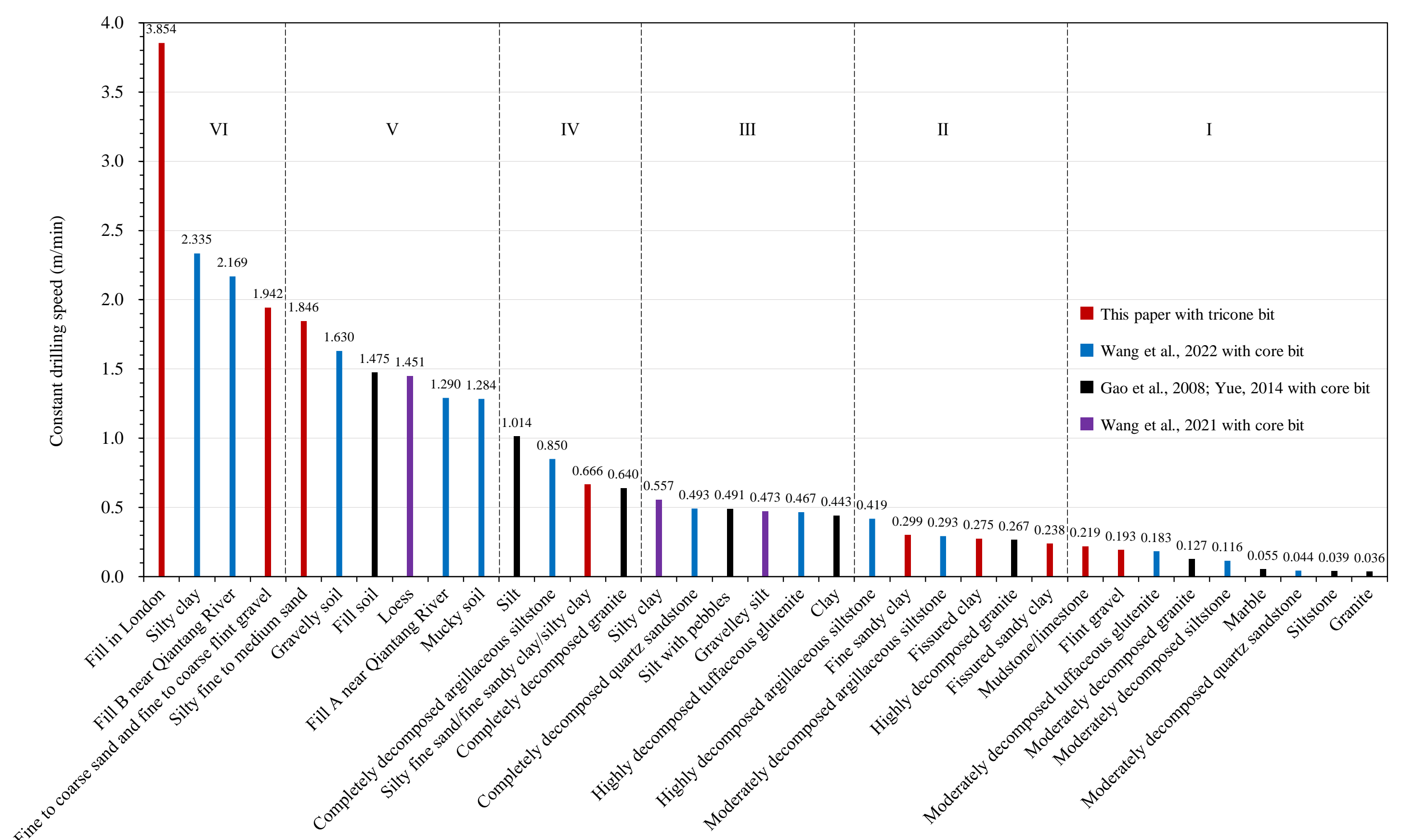


Figure 4 – Comparison of constant drilling speeds for different geomaterials drilled by hydraulic rotary drilling machines at different ground sites.