Concept: The Multi-Friction Sleeve CPT Attachment is used with a conventional 15 cm cone and provides four additional independent measurements of interface strength. This allows for direct in situ quantification of soil-counterface strength for a range of surface roughness values.

Test Results: A field testing program was undertaken to validate the capabilities of the attachment in a variety of configurations. Fig. 1 shows the results of soundings performed with a CPT and the Multi-Sleeve Attachment with four smooth (ASTM standard) sleeves in series. As evident, the attachment sleeve profiles exhibit high repeatability, with minimal difference between the successive sleeve values (fs#1, #2, #3, #4) and reflect the same trend as the CPT fs profile.

A configuration with 4 diamond textured sleeves of equal roughness was also tested (Fig. 2). The textured sleeves yield fs values that are 3 to 4 times larger than the conventional smooth sleeve values and are much more sensitive to stratigraphic variations. Results clearly indicate consistency between the 4 attachment measurements with minor degradation occurring between consecutive measurements. In addition, there is a strong similarity between the textured sleeve profiles and the CPT qc profile reflecting the similar dependence of the two measurements on horizontal stress.

Testing was also performed with alternating smooth and textured sleeves (Figure 3). This setup verifies that sleeves positioned in order of increasing roughness will not be significantly affected by previous sleeves and therefore evaluation of the surface roughness-interface strength relationship can be attained with a single sounding.

Summary: The Multi-Friction Sleeve CPT Attachment provides the ability to determine through direct in situ measurements, the relationship between surface roughness and interface strength without altering the current CPT configuration.

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