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EFFECTIVE STRESS STRENGTH OF SANDS, SILTS, AND CLAYS FROM IN-SITU TESTING

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Abstract Under the effective stress strength framework, the fundamental strength of geomaterials (sands, silts, and clays) are governed by their effective stress, specifically the effective stress friction angle (φ') which is one of the most important properties of soils in geotechnical analysis and a key input for various constitutive relationships and FEM modelling. This lecture offers the interpretation of effective stress friction angle φ' from CPTu data for sands, silts, and clays. An effective stress limit plasticity framework is applied, and statistically verified by examining several global databases (lab chamber tests, centrifuge models, and 155+ field case records) involving various soil types subjected to both CPTu and laboratory reference triaxial compression tests (TC). In addition, a nexus is established and verified using global database between CPTu and DMT in soft to firm clays through spherical cavity expansion (SCE) theory, thus further provides a novel means for evaluating φ' in clays using DMT data. In combination, it shows how in situ testing techniques offer robust and expedient interpretation of fundamental soil properties and can be coupled with other facets of geotechnical research (laboratory, computational simulation…) to provide better information and increased level of confidence for engineering design.