Consolidation Characteristics of Residual Foundation Soils; a Tailings Dam Case History

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Keywords: consolidation, case study, residual soil, tailings dam

# ABSTRACT

Residual soils pose unique challenges for geotechnical engineers due to their complex geological and stress history. Chemical and physical bonding mechanisms in residual soils contribute significantly to their strength and stiffness. However, even minor disturbances during sample collection, transportation, and testing can alter these properties, potentially leading to inaccurate geotechnical assessments.

The consolidation characteristics of residual soils differ significantly from the conventional frameworks developed for transported sedimentary soil types such as alluvial soils. Sedimentary soils' consolidation behaviour is traditionally explained by their formation following water, wind, or gravitational-driven movement, followed by self-weight (or external force, such as glaciation) compression. The genesis of residual soils is vastly different from that of sedimentary soils and, in many cases, renders the conventional approach unsuitable. Consequently, a unique approach is often needed to accurately characterize the consolidation behaviour of residual soils.

This paper presents a comprehensive case study on the consolidation characteristics of a residual soil weathered from low-grade metamorphosed sedimentary rock. The case study compares laboratory and in-situ data to assess the consolidation characteristics of the material. The degree of disturbance of intact laboratory samples is quantified and the impact of disturbance on the consolidation behaviour is investigated. Additionally, the laboratory testing is directly compared to CPT-derived empirical correlations. The study identifies discrepancies between the apparent over-consolidation ratio and yield stress determined through laboratory oedometer testing and in-situ Cone Penetrometer Tests (CPT). The findings reveal limitations in existing characterization methods and propose a refined approach for minimizing sample disturbance during long-distance transport.

This research contributes to the development of more accurate and reliable methods for characterizing residual soils, ultimately enhancing the safety and efficiency of geotechnical projects. The proposed approach has implications for the design and construction of tailings dams in regions with residual soils, and its adoption could lead to improved project outcomes and reduced costs.