

Assessment of Mechanical Behavior and Failure Criteria under Varied Confining Pressures in Treated Calcareous Sand

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Abstract: Ensuring project safety for maritime geotechnical structures primarily composed of calcareous sand is crucial. Cement-based reinforcement is a promising strategy to enhance integrity and deformability, especially for overlying infrastructures in high-pressure ocean engineering. Firstly, the specimens are created by blending Portland cement and Gypsum into calcareous sand at contents of 16% and 22% and then subjected to curing periods of 7 and 3 days to explore their resistance to loading. Secondly, a triaxial consolidated drained test is conducted, applying different confining pressures ranging from 100 to 1200 kPa. This test aims to assess the mechanical behavior, strength parameters, failure criteria, and stress dilatancy behaviors of treated specimen. The results illustrating the peak shear strength points of all treated specimens display a concave nonlinear shape sloping downwards. An equation is presented to modify the mean effective stress and accommodate the influence of bonding strength. Finally, A revised criterion is formulated by integrating this equation into the failure criterion. Significantly, this refined failure criterion accurately defines the failure envelopes. An equation was established to reveal the relationship between the brittleness index and confining pressure. Additionally, two stress ratio parameters are defined based on the brittleness index to describe bonding degradation comprehensively.

Keywords: Treated calcareous sand; Mechanical behavior; Strength parameters; Failure criterion; Bonding degradation