

Dynamic behavior and characteristic failure response of low plasticity cohesive soil

Adarsh Singh Thakur, Saloni Pandya & Ajanta Sachan

Abstract

The present study evaluates the effect of stress history and loading conditions on dynamic behavior and failure characteristics of low plasticity cohesive soil. A series of two-way strain controlled cyclic triaxial tests were performed on soil samples collected from seismically active region of Gujarat (India). The effect of stress history and loading conditions on low plasticity soil was evaluated for OCR values of 1–4 and cyclic axial strain amplitude (ϵ_a) variation of 0.5%, 1%, 1.5%, and 2%, respectively. The low plasticity soil was observed to undergo liquefaction even at lower amplitude and higher OCR. Liquefaction resistance of soil was observed to increase with the increasing OCR (1–4) and decrease with the increment in cyclic strain amplitude (0.5%—2.0%). The rate of stiffness degradation exhibited bilinear response when pore pressure ratio (r_u) was observed to be 0.85. This indicated the generation of cyclic instability prior to flow liquefaction in low plasticity cohesive soil. Two-staged failure response was observed due to the subsequent transition from cyclic instability behavior to flow liquefaction. The low plasticity cohesive soil was found to experience first ‘clay-like behaviour’ due to commencement of cyclic instability and then ‘sand-like behaviour’ due to initiation of flow liquefaction. The low plasticity cohesive soil was observed to experience cyclic instability between $0.85 < r_u < 0.95$, and then, flow liquefaction at $r_u > 0.95$.

Keywords: Plasticity Index, Grain size distribution, Liquid limit, ymmetrical hysteresis loop, Silt