



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: Laboratory Study and Constitutive Model Development on Collapse and Torsional Shear Behaviour of Kaolin Under Hydro-Mechanical Loadings

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SHORT ABSTRACT

The present study investigated the compression, yielding, and collapse response of two different partially saturated compacted kaolin soils using suction-controlled compression tests conducted. The measured yielding data were validated against the well-known Barcelona Basic model (BBM). A significant discrepancy was found between the model and the measured data. A novel comprehensive model was proposed in this work by considering the wetting-induced changes to the clay fabric associations in compacted soils. The proposed method was capable of predicting three crucial mechanical characteristics, viz., loading-collapse yield, compression, and collapse behaviour from the basic compression data at air-dry compaction state. Apart from the collapse characteristics of the clays, the shear strength response is also important for clays under extensive shear deformation in the slope stability analysis. The effect of inundation pressure, consolidation pressure, pH of the aqueous solutions, and di-electric on the shear response of kaolin was experimentally investigated. A theoretical framework was developed by including micro-mechanism of clay fabric evolution during the shear and explicit expressions for electro-chemical forces. The proposed framework provided useful expressions for predicting the shear strength behaviour of kaolin clays under large deformations, which were validated with experimental data from the present study and literature studies. This work further investigated the volume change response of treated compacted kaolin with sodium-based alkaline solution and sodium silicate as an activator at different concentrations due to inundation. The treated kaolin samples were cured for eight days to allow geopolymerization to take place. The collapse potential of treated kaolin reduced significantly at optimal concentrations of alkali activator solution. Finally, a most effective, simple method was proposed based on laboratory procedure to apply in field to minimize collapse deformations.