Investigation of Inclined-Eccentrically Loaded Shallow Foundations on Florida Limerock

ABSTRACT

This study investigates the bearing resistance of typical shallow foundations on Florida limestone under inclined and eccentric loading. The Florida Department of Transportation (FDOT) has developed settlement and bearing capacity design methods for shallow foundation support of bridge piers over limestone. The study was needed because the existing methods in AASHTO is developed for jointed rock with brittle failure, which isn't representative of the porous, low density strength Florida limestone, which exhibits ductile behavior under service loads, and bearing capacity reduction factors for the effect of inclined-eccentric loads were developed for shear through cohesive and cohesionless soil.

For this study homogeneous rock layers are being investigated where 3D finite element modeling (FEM) simulations are being performed for different footing sizes, shapes, and embedment depths. The analysis of square, rectangular, and strip footings were conducted subjected to concentric, vertical eccentric, inclined-centric, and inclined-eccentric loads on Miami Limestone, Anastasia Limestone and Fort Thompson Limestone using PLAXIS 3D. Swipe analysis under displacement control is used for this study, where displacements are applied at footing nodes. The experiment was developed to evaluate conditions typical of engineering practice in Florida related to the design and construction of shallow spread footings. Footing models with widths of 5 ft were analyzed at embedment depths of 0 and B. The tests included inclination angles of 3, 7, 14 and 20 degrees, as well as eccentricity of B/6 and B/12. Bearing capacity was estimated using approaches outlined in the AASHTO specifications and other established methods from the literature for rock as well. The PLAXIS results from this study were used to develop inclination factors for specific Florida limestone formations. The numerical results are being validated against different equations for footing in rock behavior and compiled to develop appropriate inclined-eccentric load-deformation models to be used in bridge design software (Florida MultiPier).