

Analytical Development of a Failure Limit and Iso-Uplift Curves for Eccentrically Loaded Shallow Foundations

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Abstract : Examining existing experimental results for shallow rigid foundations subjected to vertical centric load (N), accompanied or not with a bending moment (M), two main non-linear mechanisms governing the cyclic response of the soil-foundation system can be distinguished: foundation uplift and soil yielding. A soil-foundation failure limit, is defined as a domain of resistance in the two dimensional (2D) load space (N, M) inside of which lie all the admissible combinations of loads; these latter correspond to a pure elastic, non-linear elastic or plastic behavior of the soil-foundation system, while the points lying on the failure limit correspond to a combination of loads leading to a failure of the soil-foundation system. In this study, the proposed resistance domain is constructed analytically based on mechanics. Original elastic limit, uplift initiation limit and iso-uplift limits are constructed inside this domain. These limits give a prediction of the mechanisms activated for each combination of loads applied to the foundation. A comparison of the proposed failure limit with experimental tests existing in the literature shows interesting results. Also, the developed uplift initiation limit and iso-uplift curves are confronted with others already proposed in the literature and widely used due to the absence of other alternatives, and remarkable differences are noted, showing evident errors in the past proposals and relevant accuracy for those given in the present work.

Keywords : foundation uplift, iso-uplift curves, resistance domain, soil yield

Conference Title : ICCEAM 2015 : International Conference on Civil Engineering and Applied Mechanics

Conference Location : Istanbul, Türkiye

Conference Dates : February 16-17, 2015