UPPER BOUND SEISMIC STABILITYANALYSIS OF EMBEDDED FOOTINGS

Seyyed Mojtaba Mousavi Orimi
M.Sc. Student of Geotechnical Engineering, Department of Civil Engineering, Qum University of Technology, Iran
Mousavi.Mojtaba@rocketmail.com

Morteza Jiryaei Sharahi
Assistant Professor of Geotechnical Engineering, Department of Civil Engineering, Qum University of Technology, Iran
jiriay@qut.ac.ir

Hossein Rezaeii
M.Sc. Student of Geotechnical Engineering, Department of Civil Engineering, Qum University of Technology, Iran
Rezaeii.Hossein@Gmail.com

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ABSTRACT

The paper pertains to the pseudo-static seismic stability analysis for finding the bearing capacity of embedded strip footings subjected to both horizontal and vertical earthquake forces using upper bound limit theorem assuming single-sided Prandtl-like failure mechanism. The least upper bound value is found using optimization technique. Results are obtained by developing a MATLAB computer code, which is validated by comparing the results with similar solutions available in literature. The comparison shows that the obtained results for surface footings agree well with the available solutions. Bearing capacity is observed to increase with embedment ratio; for a given embedment ratio, it decreases with increasing seismic acceleration coefficient. These are in tune with the expected results.

INTRODUCTION

Bearing capacity of foundations is one of the most interesting and widely studied topics in geotechnical engineering. Unreinforced footings are used commonly as foundations for different structures, provided it suffices the bearing capacity requirements. For unreinforced soils several studies have been conducted in the past for the estimation of bearing capacity of strip footings, beginning with Prandtl (1921), Terzaghi (1943), Meyerhof (1951) and so on. Different approaches such as, limit equilibrium method, limit analysis and method of characteristics etc. have been used for such analyses.

Limit analysis is being increasingly used for analysis of various stability problems in geotechnical engineering. Limit theorems proposed by Drucker, Prager and Lundgren (1953) facilitate to obtain the upper as well as lower bound values of the exact solution, which bracket the true collapse load. Here upper bound approach is made use of to evaluate the upper bound solution for bearing capacity of strip footings. Bearing capacity of shallow surface strip footings resting on unreinforced foundation beds has been extensively studied using this approach for static as well as seismic cases (Chen (1975), Michalowski (1997), Soubra (1999), etc). In this paper, upper bound limit analysis has been used to find the bearing capacity of footings, surface as well as shallow embedded strip footings, considering the seismic effects.