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Using Micro piles for Liquefaction Mitigation in Low Compacted Sandy Soils for Onshore Structures , Case Study: Koohestak Fishery Harbor

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Key words: *Liquefaction, Micro Piles, Low Compacted Sandy Soils, Onshore Structures.*

Abstract

Micro-piles are principally used as elements for foundation support to resist static and dynamic loading conditions, less frequently as in-situ reinforcements for slope and excavation stability and construction of onshore coastal structures in low consolidated sandy beds. The study was performed on Koohestak fishery harbour (Fisheries Organization, IFO), Hormozgan Province, IRAN. In this paper, using perforated micro-piles instead of steel piles were studied. Case study is located at 200 km east Bandar Abbas and 45 km south coast Minab on the northern shore of Persian Gulf with geographical coordinates equal to 260 8` N -570 1`E. According to the geotechnical tests and analysis, the basement has a significant liquefaction potential which could cause serious settlements in the foundation of the wharf. The design of the micro piles has been done in three steps. First, structural design, the bearing capacity of the elements was determined. For the next step, geotechnical design, the bond strength of the micro pile was calculated. Finally, the punching shear control was performed. Furthermore, based on the field and laboratory tests, especially SPT test, the rectangular and triangular shapes were considered for the micro piles arrangement under the basement. As a result of the design procedure, 180 micro-piles with 12 meter initial length were designed to be installed in the basement of this project instead of using steel piles. Using this method has several advantages. As construction advantages, the installation procedure causes minimal vibration and noise. Also, the construction time will decrease. From geotechnical point of view, using micro-piles in this project will lead to about 30% decrease in liquefaction in comparison with steel bars that have no effect on the soil properties. In addition, from economical point of view, about 15% will be saved by using micro piles instead of steel bars in this project.

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1- Introduction

Safe design of foundations for on-shore structures needs an understanding of soil-structure interaction effects under dynamic loads. The stability and integrity of structures will be at risk if the soil fails due to liquefaction as a result of the shaking of the soil. This kind of failure also can be catastrophic, as observed in the earthquakes in Japan and in Turkey.

Evaluation of liquefaction potential of soils at any site requires a combination and interaction of two sets of parameters; cyclic loads (seismic motion or wave action) and soil properties (such as grain characteristics, relative density, soil structure, fabric, stress history and strain history). Liquefaction-induced damage to marine structures has been documented quite extensively in the literature. The procedure for predicting liquefaction resistance of