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Use of Shear Wave Velocity in Evaluation of Soil Layer's Condition After Liquefaction

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ABSTRACT

After liquefaction occurrence, summits on the surface of the earth and inside the soil layers that damage the structures based on them or buried structures and vital arteries. In the last two decades, various quasi-experimental methods have been presented to determine the amount of strain (siting) and shear strain maximum based on field data and laboratory data. The main purpose of this study was to compare the results of evaluation of the potential of liquefaction occurrence from the viewpoint of the risk of occurrence and the amount of settling after the occurrence of liquefaction on in the soil layers based on the use of the results of the standard penetration resistance (SPT) and shear wave velocity (Vs) along the path 2nd line of Tabriz metro. In this study, 54 borehole loops were first collected along the line 2 of the metro mentioned. Then, the liquefaction potential in the studied area is based on the proposed methods and the liquefaction risk index (LPI) is estimated. Then, the amount of probable sum of the soil layers due to liquefaction occurred based on the results of the two proposed methods. The results of the research show that the two methods are not suitable for matching and the risk of liquefaction arising from the SPT method is less than the Vs method. Also, the prediction of the amount of settling after the occurrence of liquefaction in the soil layers has more amount based on the shear wave velocity method in comparison with the standard penetration resistance test method.

Keywords: Liquefaction, settlement, standard penetration resistance test (SPT), shear wave velocity (Vs).

1. INTRODUCTION

Liquefaction is a phenomenon that is due to hardening and soil resistance due to rotational forces such as earthquakes under drainage conditions and simultaneously with increasing cavity water pressure [1, 2]. Before the earthquake, the water pressure of the cavity is relatively small, but when the soil, and especially a sand sediment, is subjected to vibration, it tends to accumulate and reduce the volume. In this case, if drainage is not possible, the water in the sand sediment increases and its amount is equal to the overhead pressure, so that the effective stress is equal to zero. Under these conditions, the sand will not have any shear strength and will become liquid, which ultimately will be called soil liquefaction. [3] Due to this process, some layers will be denser on the ground, and often asymmetrical stacks are observed on the ground. Other layers remain in very loose conditions and will be subject to re-emergence during future earthquakes. Occurrence of liquefaction can affect buildings, bridges, coastal structures, vital arenas, slopes and many other built-in appliances in different ways. Liquefaction is associated with various phenomena such as increased pore pressure, sand burst and various deformation states [4]. In recent years, several laboratory and field studies have been proposed to evaluate soil leakage resistance. Regarding the significant effect of sample handicap on the properties of soil rocks, field methods are more accurate in determining the characteristics of these soils. SID and Mohammad et al. [5] and Robertson et al. [6] compared the applications of laboratory and field tests to determine the dynamic variables of the soil to find that field tests are a rapid and effective method for obtaining the characteristics of soil grazing. At present, the simplest and most commonly used method is SPT standard penetration resistance. However, in recent years, Vs has found a good position due to the continuous nature of the soil profile, and the increase in the database. [7-9] The main objective of this study is to evaluate the rate of