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Evaluation of Liquefaction Hazards in Soil Layers alongTabriz Metro Line 1 based on Practical Methods

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ABSTRACT

Settlements in the ground and deep soil layers can occur after the liquefaction phenomenon—these deformations damage structures, buildings, and lifelines. Several practical methods have recently been proposed based on fields and laboratory data for evaluating volumetric strain (settlement) and maximum shear strain due to liquefaction. The present study mainly aimed to compare liquefaction potential assessment findings in terms of risk intensity and settlement values of soil layers after liquefaction using Standard Penetration Test (SPT) and Energy Methods along Tabriz Metro Line 1. Thus, 31 boreholes along the path were selected in this regard. Then, the liquefaction potential of soil layers was assessed based on the above-mentioned methods, and the liquefaction potential risk index was determined as well. Finally, the settlement value of soil layers was evaluated according to the two proposed methods' findings. The findings showed that both processes were relatively correlated, and the energy method proposed higher liquefaction potential risk compared to the SPT procedure.

Keywords: **Energy, Liquefaction, Settlement, Standard Penetration Test, Tabriz Metro Line 1**

1. INTRODUCTION

Settlements and reductions in the soil particles of layers happen when loose and saturate sandy soil layers are subjected to earthquake loading. These conditions can cause severe damages to structures, buildings, metro, underground structures, and lifelines. In the dry sand, settlement happens very quickly due to earthquake shaking and constant effective stress. Therefore, settlement and reductions in the volume of soil particles are completed before the earthquake. In the saturated sand and when the drainage is limited, the production of excess pore water pressure in soil layers is the major effect of earthquake shaking in constant-volume conditions. In this state, the settlement and dissipate of excess pore water pressure simultaneously occur in soil layers. This trend can continue even after the end of the earthquake. Therefore, the settlement in saturated soil layers requires longer time, although it depends on permeability, compressibility, and drainage path length. Different field tests are used to evaluate the liquefaction potential of soil layers, including the Standard Penetration Test (SPT), Cone Penetration Test (CPT), and Shear Wave Velocity (Vs). Given that the SPT test has several advantages such as past measurements at liquefaction sites, detecting the variability of soil deposits and the retrieved soil sample is useful compared to other field tests for liquefaction resistance assessment [1]. Considering the risk of settlement, the present study sought to evaluate liquefaction potentials in soil layers along Tabriz Metro Line 1 based on practical methods.