THE UPLİFTİNG BEHAVİOR OF SHALLOW BURİED PİPELİNES WİTHİN THE LİQUEfiABLE SOİLS UNDER CYCLİC LOADİNGS

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Keywords: Baseline, Liquefaction, Buried Pipelines, Finite Difference Method, Flac- 2D, Finne Model.

ABSTRACT

The liquefaction of soils under earthquake loadings has always been a main concern for geotechnical engineering practices. As an earthquake causes the ground to liquefy, the effective stress and hence the shear strength of the soil decreases sharply, and large deformations happen in the area. This phenomenon occurs only rarely when the liquefaction occurs at a large depth. However, deformations increase extensively when this layer is located in shallow depths near the ground level. In this case super structures and also underground structures may be severely damaged. Pipelines buried in saturated sand deposits, during earthquake loading could damage from resulting uplift due to excess pore water pressure generation. Especially for previously buried pipelines, in order to set the priority for seismic retrofit, evaluating the risk of floatation in each region could be a concern. In this paper, effects of several parameters including soil dilatancy angle, soil friction angle, density ratio of natural soil, diameter and burial depth of pipe on uplift of pipe by construct an advanced soil- pipe model in Flac- 2D software and Finn behavior model under cyclic loading, have been investigated. Results show the prominent role of friction angle of soil, diameter of pipe and exist an optimum level for burial depth in pipe response reduced floatation.

1. INTRODUCTION

When the ground is subjected to strong shaking during an earthquake, liquefaction and subsequent ground settlement and/or flow failures, which involve extremely large movements of soil masses, may cause serious damage to civil/geotechnical infrastructures. Among those infrastructures, lifeline systems buried underground, such as common utility conduits and sewage systems, are vulnerable to medium to large ground movement. The geotechnical structures buried near the surface have a wide range of applications, from small-scale pipelines for gas transmission, telecommunications, water supply, and sewerage pipelines, to large-scale structures, including tunnels for various transportation system (Koseki J et. al, 1997 and Kang GC et. al, 2014).Moreover, destruction of water pipelines could prevent fire fighter's activities in restraining these fires. The 1989 Loma Prieta earthquake (O'Rourke et. al, 1991), 1994 earthquake of Northridge (Schiff AJ, 1997) and 1995 earthquake of Kobe(Shinozuka M et. al, 1995)were the well-known examples of lifeline failures, which drew more attention towards investigation of circumstances that cause pipeline failures. The underground tunnels that act like large diameter pipes could experience the same problems. Urban subway system of Taipei in 1999 earthquake of Chi-Chi encountered damages, as reported by Chou et al.(Chou HS et. al, 2001).In literature, seismic behavior of buried pipelines under earthquake excitations has been