



The Effect of Initial Static Shear Stress on the Liquefaction Resistance of Babolsar Sand using Cyclic Simple Shear Tests

S. M. Haeri¹, M. Pouragha²

1 - Prof., Civil Eng. Department, Sharif University of Tech., Azadi Ave., Tehran, Iran

2- Gard. Student, Civil Eng. Department, Sharif University of Tech., Azadi Ave., Tehran, Iran

1. smhaeri@sharif.edu

2. pouragha@civil.sharif.edu

Abstract

The effect of initial static shear stress on undrained cyclic behavior of sand, with special reference to liquefaction, is studied and reported in this paper. The study includes the results of a set of laboratory tests carried out on Babolsar sand samples with relative densities of 20%, 40% and 60% and two different initial normal stresses of 50 kPa and 150 kPa, using cyclic simple shear apparatus. All tests were performed under the constant volume condition. The results of the study show an increase in liquefaction resistance with increase in initial static shear stress for low confinements while the higher confinements result in a complex behavior which is explained in the paper.

Keywords: Initial static shear stress, Liquefaction resistance, Cyclic simple shear.

1. INTRODUCTION

The effect of initial static shear on the liquefaction potential of sand first was noticed after Niigata earthquake in 1964 where a medium dense sand beneath an oil tank did not liquefy while numerous liquefaction cases were reported for such sand in other conditions [1]. Another example happened for dense sand during 1978 Miyagiken-Oki earthquake in which no settlement was observed under reservoirs [2].

Early researches on the effect of initial static shear on the liquefaction potential of sand, like what is available from Seed & Lee (1967), Idriss (1973) and Makadisi (1975) give evidences for an increase in liquefaction resistance for higher initial static shear stresses [3]. But further researchers, working on different sands with a wider range of initial conditions like relative density and confining pressure, showed that the presence of static shear stress would cause more complicated effect on the liquefaction potential. In the present study, this effect is investigated through cyclic simple shear tests on the Babolsar sand.

2. TEST PROGRAM

As mentioned before, cyclic simple shear test under constant volume condition is used in this study. Tests were conducted on the Babolsar sand samples. Index properties of this sand are presented in table 1.

Table 1: Index properties of Babolsar Sand

<i>Specific Gravity, G_s</i>	2.74
<i>Maximum void ratio, e_{max}</i>	0.77
<i>Minimum void ratio, e_{min}</i>	0.56
<i>Effective grain size, D_{10} (mm)</i>	0.14
<i>Mean grain size, D_{50} (mm)</i>	0.22
<i>Uniformity coefficient, C_u</i>	1.8
<i>Coefficient of gradation, C_c</i>	1.0