RELATIONS BETWEEN LIQUEFACTION RESISTANCE AND SHEAR WAVE VELOCITY AS AFFECTED BY AGING OF SAND DEPOSITS

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Keywords: Aging Effect, Liquefaction Resistance, Shear Wave Velocity, Cyclic Yield Strain

ABSTRACT

Since shear wave velocity is determined by non-destructive experiments in the narrow range of small strain, some researchers have reservations in employing it in the assessment of medium-to-large phenomenon, i.e. liquefaction. However, some others confirm that the shear wave velocity is more likely to suit for distinguishing the liquefaction and non-liquefaction susceptibility of sand deposits by means of the chart correlating liquefaction resistance to shear wave velocity, similar to the other types of indices, i.e. SPT and CPT, despite of its few limitations. Such liquefaction charts have commonly been proposed based on the liquefaction resistance of young Holocene deposits, without taking "age" into account. In an attempt to bridge the gap between those ideas, relations between liquefaction resistance and shear wave velocity of sand deposits are proposed under aging effect using a new-introduced index property, i.e. "cyclic reference strain" or "cyclic yield strain", to differentiate between new and old sand deposits. The smaller the cyclic yield strain, the less ductile response of soil and vice versa. It may be concluded, therefore, that this parameter can be employed as a criterion for taking into account the cementation or the effect of age in sandy soils.

INTRODUCTION

Youd and Hoose (1977) and Youd and Perkins (1978), the first pioneers recognized that the liquefaction resistance of sandy deposits increases noticeably with geological age, indicated that the older sediments of Pre-Pleistocene and Pleistocene epoch are essentially more resistant to liquefaction than the younger sediments belonged to Holocene epoch. Seed (1979) pointed out that the liquefaction resistance of undisturbed specimens extracted from a fill deposited during 1000 years over that of freshly deposited specimens of the same sand increases approximately 50-100%. Kokusho et al. (1983) observed that the cyclic strength resistance of undisturbed Narita sand relative to the cyclic resistance of freshly reconstituted laboratory samples reaches up to 80%. Troncoso et al. (1988) reported on the order of 200-350% gain in cyclic resistance of undisturbed sandy specimens, obtained from two tailings dam locations at El Cobre in Chile with various ages of 1, 5, 30 years, relative to freshly deposited specimen in laboratory. It should be noted that the preceding studies had not directly considered the aging effect along with any soil indices such as shear wave velocity, CPT and SPT.