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Shear Wave Velocity Evaluation on Reclaimed Soil in West Taiwan

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ABSTRACT

The hydraulic sand fill method is the most widely adopted land reclamation method in West Taiwan. In this study, the soil samples were obtained from the reclaimed soil in the Yun-Lin area of West Taiwan. This paper discusses the influence of different fines content, void ratio and effective confining pressures on the shear wave velocity of reclaimed soil. The relationship between SPT-N values and the shear wave velocity of reclaimed soil in the Yun-Lin region is evaluated. A critical wave void ratio ($e_{f.c.}$) is defined in this paper. As shown in the results, for a critical wave void ratio ($e_{f.c.}$) with 10% of fines content, there exists a maximum shear wave velocity. As the fines content exceed 10%, the shear wave velocity decreases as the fines content increases. Based on the laboratory and in-situ test, a modification factor (M) is defined. From the results, the modification factor (M) increases as the soil depth increases. The relationship between shear wave velocity, SPT-N value and soil depth is also discussed. The results can be presented for soil property evaluation in land reclamation and coastal areas.

INTRODUCTION

The hydraulic sand fill technique has been widely adopted in Taiwan for land reclamation and coastal utilization. During the reclamation process, the reclaimed soil is obtained from the seabed or river mouth by cutter and pump. Therefore, many factors influence the arrangement of the soil fabric in the hydraulic reclaimed soil. Fines content, relative density and effective stress in the reclaimed soil are factors affecting the stability of the reclamation area. Thus, by understanding the soil properties involved, the stability of reclaimed land can be improved. In this study, the soil samples are obtained from the Yun-Lin offshore area in West Taiwan.

In early studies, the elastic wave transmission theory was applied in the exploration of the ground stratum and earth crust. Richart (1962) was the first to adopt the elastic wave transmission theory into geotechnical engineering. The elastic wave can be separated into surface wave and body wave. The shear wave velocity in body waveform was widely adopted to discuss the properties of soil. As shown in the basic soil mechanics, soil properties are related to the void ratio of soil. Therefore, analysis of the shear wave velocity and void ratio is important for safety evaluation in an earthquake region. In this paper, the relationships between shear wave velocity (adopted by the resonant column test), SPT-N values and soil depth are presented, and the influences of different fines content, void ratio and effective confining pressures on the shear wave velocity of reclaimed soil are discussed. Based on the shear wave velocity measured in the Yun-Lin reclamation area, this paper illustrates the differences between the shear wave velocity measured in the laboratory and those measured at the reclamation site.

SHEAR WAVE VELOCITY MEASUREMENT METHODS

Shear Wave Velocity Measurement Methods in Laboratory

In the laboratory, the shear wave velocity can be measured by the travel time method and the resonant column test. By using the travel time method, the shear wave velocity can be measured by a Piezocermic bender element (Shirley and Hampton, 1978). Based on the wave oscillator, the shear wave emitted by the Piezocermic bender element on the soil specimen is recorded. In recent years, the Piezocermic bender element has been adopted by scholars (Horn, 1980; Davik and Madshus, 1985; and Robertson, 1995) to evaluate the relationship between shear wave velocity and soil properties.

In the resonant column test, the shear wave velocity is adopted from the resonant frequency applied on the soil specimen. In this study, the shear wave velocity is measured by using resonant column test apparatus manufactured by Seiken Inc. (Model DTC-158) in Japan.

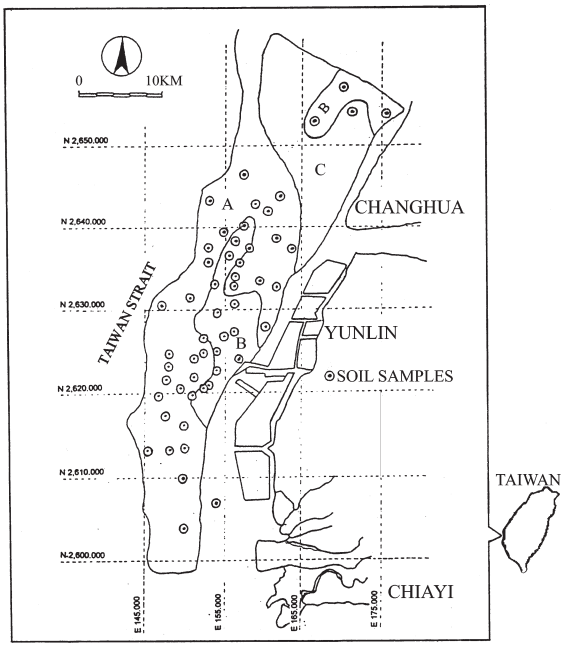

Fig. 1 Location of soil sample obtained from Yun-Lin offshore area in West Taiwan (Sinotech, 1990)

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KEY WORDS: Reclaimed soil, shear wave velocity, fines content, modification factor.