

A Study on the Applicability of In-Situ Piling Method using Electrical Power

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ABSTRACT

This paper introduces PDT (Pulse Discharge Technology) piling method. The PDT piling method is to install in-situ a pile using electrical power so called Pulse power. Since this piling technique can make not only a bore hole to be expanded but also the ground to be improved by compaction, the pile installed by PDT appears to be able to develop shaft and end bearing capacity efficiently. In this study, couples of pile loading tests were carried out. As a result, it was examined the piling technique using pulse power can be expected not only increased end bearing capacity but also shaft resistance.

KEY WORDS: Pulse Discharge Technology, electrical power, end bearing capacity, shaft resistance.

INTRODUCTION

Since 1990s the piling technique, by which piles are installed in the ground after boring, has been widely used in Korea especially in urban area (Lee et al, 2003). Even though this technique induces much less vibration and noise than pile driving, it has several disadvantages as following. First, the ground disturbance is inevitable during boring and it gives rise to the reduction of shaft resistance. Second, this technique requires the final blows to drive the piles into the ground so that the end bearing capacity becomes high enough. These final blows induce some degree of vibration, noise and pile head damage and so on (Lee et al, 2003; Hong et al, 1997; De Beer, 1988; Broms et al, 1988). For these reasons, a new piling method which can take advantages from both driven and bored piles is necessary to be developed.

In this paper, a new piling technique, so called PDT (Pulse Discharge Technology) piling method, is presented. The PDT piling technique is to install in-situ piles using electrical power. A series of pilot field tests were conducted in order to investigate the characteristics of bearing capacity and applicability. As a result, it was examined the piling technique using pulse power can be expected not only increased end bearing capacity but also shaft resistance.

PILING TECHNIQUE

Pulse Power

Pulse power is the physical value that indicates the energy change per unit time (dE/dt). The power depends on how fast the energy is released. In other words, if a unit of energy is discharged in 1 sec, a watt of power will be generated. However, if the energy is discharged in 10^{-6} sec, the power will be 1MW (10^6 Watt) as shown in Fig. 1.

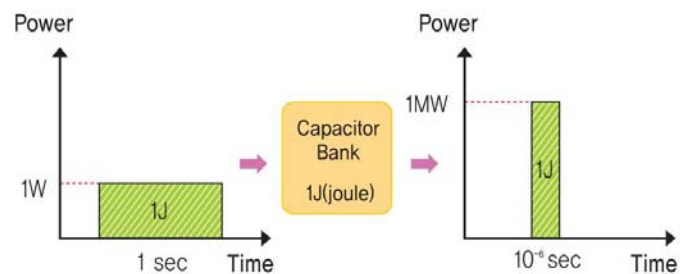


Fig. 1. Pulse power

Shock wave

Shock wave can be generated by the pulse power in a fluidal medium. When a high voltage generates between two electrodes inserted in the medium, the fluidal material between electrodes may heat up. Then the material will be going to expand outward. Meanwhile the material outside the electrodes remains cold and will restrain the heat-up material from expanding. Because of this opposite characteristics between expansion and restraint, a high pressure will be generated at the boundary. Finally this pressure is changed into a different type of energy so called shock wave and propagates through the medium until meets a different type of medium. Once the shock wave reaches the different type of medium, which herein represents a soil layer, it