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Wave-based consolidation behavior of marine soil treated with xanthan gum biopolymer

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ABSTRACT

Soft marine soils are susceptible to consolidation due to their high in-situ water content and low relative density conditions. Therefore, improvement of soil bearing capacity and settlement control are important considerations for construction on soft marine soil deposits. This study aims to introduce microbial xanthan gum biopolymer as a new environment friendly material to improve geotechnical engineering properties of soft marine soils. A laboratory consolidation test is performed with embedded PZT sensors to measure the shear wave velocity of xanthan gum-treated marine soil during consolidation. Xanthan gum significantly increases the density of consolidated soils via enhanced inter-particle bonding and particle rearrangements. In contrast, xanthan gum obstructs consolidation behavior (particularly in time) by absorbing water and clogging pore spaces, which results in reduction of shear wave velocity.

1. INTRODUCTION

With the development of geotechnical engineering, the importance of ocean land is increasing because developable dry lands are being lost to a rise in sea level. Marine soil has high fine soil content (silt and clay) and high-water content, thereby making it susceptible to consolidation by loads induced by infrastructure such as harbors, airports, energy plants, etc. Thus, it is important to improve the strength and bearing capacity or reduce the hydraulic permeability of soft marine soil.

Previously, geotechnical engineers have applied deep cement mixing methods to stabilize soft marine soil (Yin and Fang 2006). Cement has been widely used to increase shear strength and reduce the compressibility of soft marine soil. However,

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