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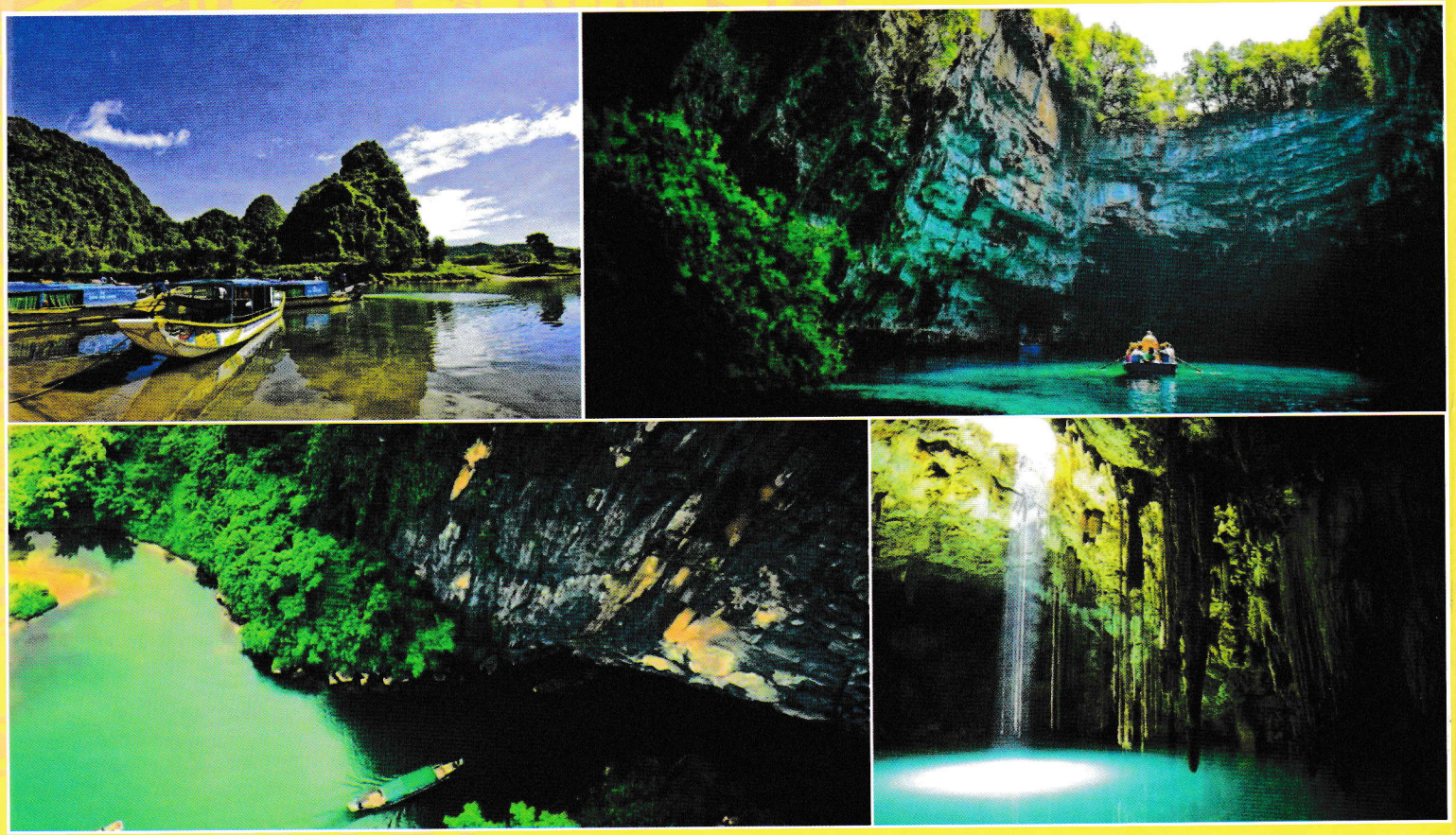
GEOLOGICAL AND GEOTECHNICAL ENGINEERING IN RESPONSE TO CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT OF INFRASTRUCTURE



SCIENCE AND TECHNICS PUBLISHING HOUSE

SESSION 2

GEOTECHNICS FOR SUSTAINABLE DEVELOPMENT OF INFRASTRUCTURE

INFLUENCE OF EMBANKMENT HEIGHT AND SOIL PARAMETERS ON PILED EMBANKMENTS BY 3D NUMERICAL SIMULATION

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Abtract: Piled embankment is a soil improvement method widely used in highway, railway and industrial storage tank projects all over the world. Although many soil mitigating methods have been applied recently in road projects in Vietnam, piled embankment still is a state-of-the-art soil improvement technique which can have a significant economic benefit. This paper investigates the behavior of the piled embankment based on a 3D numerical simulation with a typical geo-condition in Tan Vu - Lach Huyen highway in Hai Phong, Vietnam. The analyzed results in the reference case show the efficiency of the method in terms of load transfer and settlements. The influence of height embankment on both the arching effect and soft soil and embankment displacements is studied. Additionally, the change in soil properties, which are the friction angle of embankment and the pre-consolidation pressure of soft soil, are taken into consideration. The numerical results figure out that the pile efficacy increases with a rising embankment height as the ratio *H/s* is lower than 0.5, and it then declines with an increasing embankment height as the ratio *H/s* is larger than 0.5. While the friction angle of embankment fill affects the arching effect, the pre-consolidation pressure of soft soil influences the settlements.

Keywords: piled embankment; settlement; embankment height; friction angle.

1. Introduction

Piled embankments have been widely used in highway projects, railways, oil tanks, buildings, retaining walls and wind turbines in Chen et al., 2008. This system consists of a soft soil reinforced by rigid piles that is covered by an embankment fill, and a geosynthetic (optional). The surcharge and embankment loads are transferred to the piles and the soil foundation, as can be seen in Fig. 1. Due to either the significant larger stiffness of the pile than that of the ground or shearing effect inside the embankment, the shear stress increases the pressure acting on the pile heads and reduces the pressure on the soft soil layer. This load transfer mechanism is namely as 'arching effect'. The large part of load, therefore, is carried by the piles. The remaining part of load is applied to the subsoil, which leads to a reduction of the embankment and soft soil settlements. This method has some advantages compared to other methods, such as a decrease in settlements, the reduced construction time (not necessary for waiting for the consolidation during the construction), and the reasonable cost by Magnan, 1994.

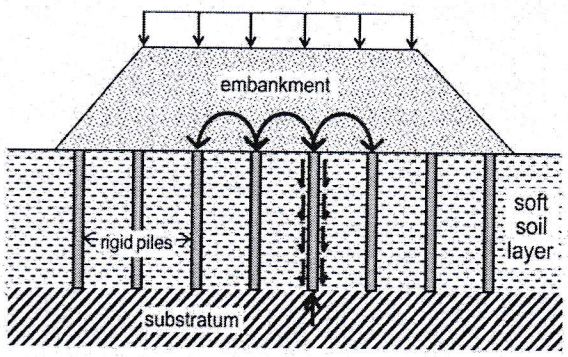

Fig. 1. Sketch of an embankment reinforced rigid piles and soil arches by Hassen et al., 2009

In order to assess the bearing capacity of the system (soil arching), an indicator of the efficacy of pile support (pile efficacy, E) is normally employed. It is defined as the proportion of the