

論文 / 著書情報
Article / Book Information

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論文要旨

THESIS SUMMARY

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学生氏名 : Student's Name	SAHRAEIAN, Seyed Mohammad Sadegh		指導教員 (主) : Academic supervisor(main)	竹村 次朗	
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要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

Some level of settlement is allowed in the design of oil tank if the uneven settlement can be controlled in an allowable value. Considering the critical condition of Piled Raft Foundation (PRF), that is, secure contact of raft base to the ground surface, and the expected function of piles to impose additional resistance against the local settlement, the piled raft foundation is considered as one of the rational foundation systems for the oil storage tanks. However, this foundation system has a complex interaction with soil under horizontal seismic loading, especially if the tank rests on a liquefiable soil, which may cause an extreme change of the soil stiffness under the tank.

On the other hand, pile installation method might affect the pile bearing capacity and the liquefaction resistance of the sand as well. In this study, a series of centrifuge model tests was performed to investigate the mechanical behavior of oil tank supported by the piled raft foundation on the liquefiable saturated sand and non-liquefiable dry sand. In the tests, two types of foundations were modeled for oil tank; one slab foundation and another one piled raft foundation. In the case of piled raft foundation two different methods of pile installation (Driven and non-Driven) were modelled and the result was compared. Also the Driven piled raft foundation was modelled with two different numbers of piles to consider the effect of piles number on the foundation performance. Using the observed results, such as accelerations of the tank and ground, dynamic and permanent displacement of the foundation, excess pore water pressures of the ground and sloshing behavior of liquid in the tank, the advantage and limitation of piled raft foundation for the application to the oil storage tanks on non-liquefiable and liquefiable sandy soil are discussed.

Regarding the tests results, the performance of piled raft foundation of oil tank on the dry sand was positive. The foundation system could efficiently reduce the tank rocking motion, settlement and uneven settlement due to the contribution of the piles. Although the piles load proportion was significant in this condition, both piles and raft contributed against the loads and rotational moment in the dynamic loading.

On the other hand, the behavior of piled raft foundation of oil tank on saturated sand was more complicated. The raft base contact pressure changed considerably during the dynamic loading. As a common trend in the piled raft foundation cases, the raft load proportion increased by the reduction of piles resistance due to liquefaction and decreased gradually by the recovery of piles resistance during the EPWP dissipation period. The pile driving process (Driven piles) could increase the density and lateral stress of sand between piles, so the reduction of pile resistance could be slowed by the pile driving but effect was diminished after a large shake. Also the driven PRFs comparing to non-driven PRFs were more effective in reducing the tank rocking motion. The piled raft foundation was effective in reducing the tank settlement compared to the slab foundation but relatively large raft load proportion which can develop enough and uniform raft base contact, is a necessity for preventing a large settlement and uneven settlement of the foundation. Generally, the better performance of piled raft foundation comparing to slab foundation cannot be guaranteed in case of complete liquefaction in the entire ground and piles length.

Another concern in the behavior of oil tank is liquid sloshing inside the tank. The sloshing of liquid was relative to the tank acceleration and it was more critical in dry sand cases while the tank acceleration was larger in such a condition. But the PRF could reduce the sloshing waves of tank liquid in the condition that tank resting on the dry sand while it was not so impressive in case of saturated sand.

Also considering this research results and prior investigations, some practical hints for the application and design of piled raft foundation for oil storage tanks are indicated. The practical points are presented for the conditions that oil tanks are located on non-liquefiable or liquefiable sandy soil separately.

備考 : 論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note : Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).

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