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論文 / 著書情報
Article / Book Information

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Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

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（博士課程）
Doctoral Program

論 文 要 旨

THESIS SUMMARY

系・コース： Department of, Graduate major in	土木・環境工学 土木工学	系 コース	
学生氏名： Student's Name	SAHA Partha		

申請学位（専攻分野）： Academic Degree Requested	博士　（学術） Doctor of　philosophy
指導教員（主）： Academic Supervisor(main)	高橋　章浩
指導教員（副）： Academic Supervisor(sub)	

要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

The thesis entitled as "Seismic Retrofit for Pile-supported Bridge Abutment Subjected to Liquefaction-induced Lateral Spreading" consists of six chapters. The contents of each chapter are summarized as follows:

Chapter 1: Introduction

The first chapter is the introductory chapter that describes the concept of liquefaction and liquefaction-induced later spreading. This chapter briefly discusses the failure of the existing embankments and bridge abutment during the previous earthquakes caused by liquefaction-induced lateral spreading. Different remedial measures against lateral spreading and their limitation to implement in the target structures such as existing embankments and bridge abutments are also discussed here. Finally, this chapter proposes using an indirect reinforcement technique by installing a sheet pile to mitigate liquefaction-induced lateral spreading and the associated damage to the existing structures.

Chapter 2: Seismic response of the piled abutment subjected to liquefaction-induced lateral spreading

The finite element based numerical simulation of several large-scale shake table tests conducted by the Public Works Research Institute Japan is described in this chapter. The shake table tests are conducted to study the seismic response of the piled abutment designed according to the current and old Japanese design standards. The performance of the fixed-end sheet pile as a seismic retrofit for piled abutment resting in the 10 m thick liquefiable layer is also investigated. It is observed that the pile heads are more vulnerable to damage during lateral spreading as it experiences the maximum bending moment. It is also found that installing a fixed-end sheet pile can reduce the bending moment demand of the existing piles to some extent.

Chapter 3: Performance of sheet pile to mitigate liquefaction-induced lateral spreading of loose soil layer under the embankment

This chapter describes a series of dynamic centrifuge tests conducted to investigate the sheet pile's performance to mitigate the liquefaction-induced lateral spreading of the loose foundation soils under the embankment. The tip of the sheet pile is installed into the dense layer. The experimental results show that the installation of sheet pile can effectively mitigate the liquefaction-induced lateral spreading during the moderate to strong ground motions and equally effective in various thicknesses of liquefiable foundation ranging from 4 m to 8 m. The extension of the width of the sheet pile beyond the target area doesn't have any additional advantage. It is observed that the liquefaction of the dense layer immediately below the loose layer causes the location of the maximum bending moment of the sheet pile to move to a greater depth inside the dense layer.

Chapter-4: Effect of thickness of liquefiable layer and embedment depth on the performance of sheet pile as a seismic retrofit

This chapter describes the effect of the thickness of the liquefiable layer and the embedment depth on the sheet pile's performance against lateral spreading by using the two-dimensional finite element analysis. The numerical model is first validated with the experimental results. The validated numerical model is then used for further parametric study to investigate the effect of different geometrical configurations such as the thickness of the liquefiable layer and the embedment depth of the sheet pile. The parametric study shows that the sheet pile reinforcement can efficiently reduce the lateral spreading of the loose foundation. However, the efficiency of the sheet pile is significantly reduced in the case of a thick liquefiable foundation (nearly 10 m). Numerical results recommend that the maximum efficiency of the sheet pile as a seismic retrofit can be achieved with the embedment depth of $4/\beta$, where β is the characteristics value. Moreover, a properly designed

anchorage pile can significantly improve the sheet pile's performance to mitigate lateral spreading.

Chapter 5: Performance of sheet pile as a seismic retrofit for piled abutment subjected to lateral spreading

This chapter describes two dynamic centrifuge experiment conducted to study 1) the response of the old bridge abutment subjected to lateral spreading and 2) the performance of sheet pile to mitigate the damage of piled abutment subjected to lateral spreading. Simultaneously, several two-dimensional finite element analyses are performed to investigate the strut effect of bridge abutment and the performance of anchored sheet pile. The experimental results reveal that the old piled abutments have a minor pinning effect on the ground movement due to lateral spreading. The sheet pile can reduce the channel-ward movement of the abutment up to 40% thus, reduce the bending moment of the abutment piles. The parametric study shows that the bridge girder prevents the channel-ward movement of the abutment crest. Consequently, the abutment is subjected to backward rotation. The bridge girder is observed to carry a considerable amount of lateral load from the backfill soil, thus reducing the bending moment significantly near the pile head. The performance of the sheet pile can be improved with the installation of anchorage near its head.

Chapter 6: Conclusions and recommendations

This chapter summarizes the major findings of this study and recommends the scopes for future study.

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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