

論文 / 著書情報  
Article / Book Information

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著者(和文)	Jitrakon Prasomsri
Author(English)	Jitrakon Prasomsri
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Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

# 論文要旨

THESIS SUMMARY

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

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

要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words )

The title of the thesis is “Experimental investigation on internal erosion and its impact on mechanical responses of gap-graded and well-graded sandy soils.” It is divided into seven chapters. The following is a summary of the contents of each chapter:

## **Chapter 1: Introduction**

This chapter introduces the background of internal erosion, followed by a discussion of internal erosion-induced impacts on earthen structures. A literature review is summarized to provide the background of internal erosion and its impact on the mechanical response, as well as to identify research gaps. Then objectives are narrow down along with the scope of the thesis. A brief outline of different chapters is also presented.

## **Chapter 2: Literature review**

This chapter summarizes the relevant internal erosion studies, factors influencing internal erosion, the effect of internal erosion on soil mechanical response. An extensive review is conducted to gain better knowledge of how to investigate internal erosion in the laboratory. Commonly used internal erosion testing apparatus and their results are discussed, as well as their limitations and capabilities.

## **Chapter 3: Triaxial erosion apparatus and testing procedure**

This chapter addresses the modification of the triaxial erosion apparatus used to generate test data in this study and the testing procedure. The main modification part of the apparatus is a revised seepage control system, which is based on the hydraulic head control concept. A novel seepage control system allows the capability of an internal erosion experiment with a high back-pressure under a pressure-controlled seepage condition. The calibrations of transducers, accuracy, precision, and resolution of the measurements are also discussed. Specimen preparation, saturation, consolidation, seepage testing, and triaxial compression testing are all part of the testing procedure.

## **Chapter 4: Role of finer fraction on instabilities and its impact on undrained mechanical response of gap-graded soils**

This chapter discusses the impact of finer fraction content on instabilities and their impact on the undrained mechanical response of gap-graded soils. Seepage experiments are performed and analyzed to establish the seepage-induced instability mode of each test using measurements of eroded mass, hydraulic conductivity, and volume change. The instability mode is defined using the distinct seepage responses found in the literature. The initial and post-erosion microstructure and densification status of the soils are evaluated and discussed. Finally, the effect of instabilities on the undrained mechanical response of soils is studied. It is found that instability progress of the underfilled soils exhibits self-filtering and suffusion initiated at a low hydraulic gradient. Depending on initial fines content contributing to soil microstructure, the instability progress of the overfilled soils can be suffusion, seepage-induced failure, or internally stable initiated at large hydraulic gradient. Seepage results also highlight the importance of the combination of eroded mass, volume change, and hydraulic conductivity for evaluating instability initiation and progress. The instability identification diagram is proposed for accessing its initiation and progress, as well as possible soil microstructure. The undrained triaxial compression tests results show that suffusion makes the eroded soils looser and more contractive than non-eroded soils, while suffusion makes the eroded soil more dilative at a large strain level.

#### **Chapter 5: Suffusion under multiple seepages and its impact on undrained mechanical responses of gap-graded soil**

This chapter presents the experimental investigation of suffusion under multiple seepages conditions and its impact on undrained mechanical responses under monotonic and cyclic loading conditions of the underfilled gap-graded soil. The repeatability of the seepage testing and triaxial compression are also discussed. It is observed that the number of seepages significantly affects erosion progress. With increasing the seepage cycle, the eroded mass and hydraulic conductivity increase, resulting in an increasing void ratio. The post-suffusion shear strength consistently decreases with increasing the amounts of eroded mass and void ratio. Suffusion creates loose material structure, as demonstrated by sudden drops in shear stress and stiffness with a sharp increase in pore water pressure. As the eroded soil is already unstable, the disturbance caused by cyclic loading produces the collapse of the soil, leading to smaller resistance to liquefaction.

#### **Chapter 6: Internal erosion and its impact on undrained mechanical response of well-graded soils**

This chapter discusses the experimental investigation of internal erosion and its impact on undrained mechanical responses of well-graded soils. The effects of particle size distribution curve, density, and applied hydraulic loading are discussed. It is found that the amount of eroded mass tends to decrease with larger density, narrower gradation, and smaller hydraulic loading. The hydraulic gradient initiating erosion increases with increased density and narrower particle size distribution for well-graded soils, but this is not the case for gap-graded

soils. Factor influencing the internal erosion of gap-graded and well-graded soils is also explored. The constriction-size distribution of the soils appears to be one of the primary factors affecting erosion characteristics. Initial hydraulic conductivity increases while hydraulic gradient initiating erosion decreases considerably with increasing constriction diameters.

## **Chapter 7: Conclusions and recommendations**

Conclusions and recommendations of the thesis are given in this chapter.

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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