論文 / 著書情報
Article / Book Information

題目(和文)	浸透流に起因する盛土内の細粒土の移動に関する実験的研究
Title(English)	An experimental study of seepage-induced transport of fines in embankments
著者(和文)	堀越一輝
Author(English)	Kazuki Horikoshi
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（博士課程）
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論 文 要 旨

THESIS SUMMARY

専攻： Department of	土木工学　専攻	申請学位（専攻分野）： Academic Degree Requested	博士 Doctor of　（　工学　）
学生氏名： Student's Name	堀越　一輝	指導教員（主）： Academic Advisor(main)	高橋　章浩
		指導教員（副）： Academic Advisor(sub)	

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

Progress of suffusion may cause deterioration of the hydraulic structure. In this dissertation, to examine the seepage-induced suffusion process in an embankment, a series of physical model tests on seepage-induced suffusion on small-scale model embankment is firstly performed. Secondly, the physical model is numerically simulated. From comparison between experimental and numerical results, it is pointed out the importance of fines redeposition-induced clogging at the bottom of foundation. Finally, to investigate the cause of redeposition of fines, a series of physical model tests on the small-scale model embankment on foundation ground with different fines content is performed. This dissertation is composed of 8 chapters.

Chapter 1 is the current chapter which introduces the background of the research. Chapter 2 summarizes previous studies on internal erosion (suffusion). Chapter 3 presents reviews existing scaling laws and states limitations of small-scaled physical model tests. Chapter 4 explores ways to reproduce suffusion in small model and determines experimental conditions for tests in Chapters 5 and 7.

In Chapter 5, the suffusion process under the transient and steady seepage conditions in embankments are presented. Based on the finding in Chapter 4, test apparatus was improved and a series of physical model test were conducted on a homogenous embankment with the foundation. The spatial extent of erosion-induced fines content variation is discussed through sieve analyses on subdivided areas of the model embankment after seepage testing. The obtained conclusions are (1) Sieve analyses in each area of the embankment allow to observe the spatial distribution of fines with in the model embankment. (2) Under the transient seepage in the first permeation, major fines erosion takes place due to rising phreatic surface. Disappearance of suction and the transportation of fines with the seepage flow change the fines content distribution in the embankment. (3) After a certain elapsed time, suffusion develops backward along the phreatic surface from downstream in the embankments. Below the phreatic surface, the erodible fines not only move laterally by seepage flow but also move vertically due to the gravitational force and are deposited in the foundation. This deposition of the fines results in the expansion of the fine-rich region in the foundation and causes decrease in the permeability of the whole embankment. In addition, it is confirmed that the repeated permeation leads to the prominent vertical transportation of fines from the slope zone to the foundation zone.

Chapter 6 presents numerically simulation of the physical model tests described in Chapter 5 and points out the applicability and limitations of existing erosion models. The applicability and limitations of the numerical model used are discussed by comparison results of the physical model tests and numerical simulation and these are summarized as (1) The numerical simulation can reproduce overall erosion response of the embankment, i.e. backward decrease in fines from the downstream. (2) Since the fines redeposition-induced clogging has considerable effects on flow field change as demonstrated in the physical model tests and previous studies, this should be considered if detailed modeling of erosion process is required.

To elaborate the cause of redeposition of fines in the seepage-induced suffusion, further physical model tests were also conducted with embankment built on the foundation ground with different fines content to investigate the cause of redeposition of fines in Chapter 7. To examine temporal and spatial variation of the fines content, sieve analyses on subdivided areas of the model embankment and particle analyses on (a) outflow particles and (b) remaining particles in the subdivided areas were also conducted after seepage testing. The following conclusions are (1) The larger the void at the bottom of the foundation ground, the more the downward fines transport by gravitation across the embankment. (2) Marked downward transport of the fines is observed in the upstream because of relatively small seepage force. (3) Fines migrate actively in the area where the hydraulic gradient or velocity is large. (4) Erosion of internally instable material occurs independent from particle size of fines if the tractive force by seepage flow is sufficiently large.

Finally, conclusions and recommendations of this dissertation are presented in Chapter 8. The recommendations of this dissertation is that if the performance of an eroded hydraulic structure is of interest, detailed modeling of the erosion process is required and increase in fines in a certain area of interest should be properly considered.

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).