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学位論文の要旨（論文の内容の要旨）
Summary of the Dissertation (Summary of Dissertation Contents)

論　文　題　目
Behavior of Ground Displacement Caused by Groundwater Seepage Force

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Underground stores, basement parking and subways are concentrated in the downtown of the city because the underground space is very commonly exploited to optimize high land cost in urban development. Constructions are often accompanied with dewatering engineering, which causes ground deformation in a large affected area. Roads, structures, underground pipelines and etc. are usually crowded around the excavation pit, therefore, the environment conditions around sites are growing severe. In view of the recent catastrophes associated with ground subsidence due to dewatering project, there is an urgent need to provide vital guidelines on the design of the construction processes.

It is hard to estimate the ground behaviors around the construction sites due to complex situations of construction and many influencing factors in the crowded cities. In consequence of ground behaviors due to groundwater remain a challenging geotechnical engineering problem with difficulties.

In addition to the effect of underwater, the influence of maintenance structures and interaction between structure and soil are key points, as well as difficulties in the practical engineering.

Simulating the ground behaviors due to seepage by considering structure interaction with soil and maintenance structures could provide insight understanding of deformation process around construction sites. The numerical results will make valuable to disaster predication in practical engineering.

To investigate the mechanical behaviors around the dewatering projects, numerical research of single pumping well and dewatering of foundation pit are conducted respectively. An unsteady saturated-unsaturated model for seepage and a non-linear model for deformation are employed to represent the mechanical behavior of ground in numerical analysis. The finite element method and finite different method are used to study the space problem and time dimension respectively, and the numerical simulation code implemented by FORTRAN is applied to predict the flow velocity distribution and the results of ground displacement.

This study presents a hydro-mechanical model to analysis ground behaviors around the dewatering projects incorporating excavating theory and spring element. The interaction between the structure and the soil was characterized with the Goodman's zero thickness elements. It is found that the settlement of ground will become larger if the effect of unsaturated zone is considered, which is encouraging that the effect of capillary zone should be considerable in both seepage and displacement field. The numerical values of displacement in excavation case are compared with the field observed data. Three numerical cases have been compared, the prediction accuracy by the external load and joint element is more agreeable with the field observed data. It is found that external load has a great impact on the deformation behind the SMW, but it has small influence on the heave inner pit. Relative movements between the SMW and soil mass should not be ignored in displacement analysis.

Consequently, it is vital to integrate various factors in numerical analysis to model as closely as possible the true ground behaviors in the field and hydro-mechanical model analysis is necessary to present useful reference to the excavation stability and excavation disaster predication.

備考　論文の要旨はＡ４判用紙を使用し，4, 000字以内とする。ただし，英文の場合は1, 500語以内とする。
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