（ 続紙 1 ）

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論文題目	Mitigation of dip slope collapse due to groundwater infiltration using counterweight fill and slope stability analysis considering lateral confinement （押え盛土を用いた地下水浸透による斜面崩壊の軽減と側方拘束を考慮した安定性解析）		

A slope lying on bedding, often referred to as a dip slope, is a geological formation where the slope surface parallels or closely follows the orientation of underlying sedimentary rock layers or bedding planes. Dip slopes have a potential for landslides, as evidenced by past incidents where landslides have caused damage to infrastructure and posed risks to human safety. This thesis focuses on the stability analysis of dip slopes under varying conditions, with an emphasis on groundwater infiltration and seismic activity. The primary objective is to develop theoretical models and conduct physical experiments to understand the failure mechanisms and improve the assessment of dip slope stability.

A physical model of a dip slope was designed and utilized to investigate failure mechanisms under controlled conditions. Experiments employed both 1g and centrifuge setups to simulate realistic scenarios and evaluate the impact of different factors on slope stability. The reverse toe angle emerged as a critical factor influencing failure modes, with distinct behaviors such as toe sliding and thrust failure identified and analyzed using Particle Image Velocimetry (PIV) techniques. Additionally, a novel minimum coefficient of variation method was developed to analyze PIV results and detect slip line formations. The centrifugal model was newly designed to incorporate the effect of groundwater infiltration.

Theoretical analyses were developed to complement experimental findings, focusing on assessing dip slope stability under groundwater infiltration. Analysis of dip slope stability was enhanced through considerations of lateral confinement, transitioning from 2 dimensional to 3-dimensional analyses. Results indicated a strong correlation between dip slope stability analyses with lateral confinement and experimental outcomes.

Furthermore, counterweight fill was investigated as an effective measure to mitigate slope instability. Theoretical predictions and experimental observations affirmed that counterweight fill shifts failure modes from toe sliding to thrust failure, thereby enhancing slope stability across varied conditions. Moreover, dip slope stability analysis with lateral confinement was utilized to assess failure modes post-counterweight fill.

Chapter 1 introduces the study, outlining the background, challenges, and in Chapter 2, through comprehensive literature reviews on dip slope, the scope of this study is clarified: Study the reverse toe effect on failure mechanisms of dip slope by physical modelling; Development of PIV analysis with statistical approach to evaluate dip slope failure mechanisms Investigate the effect of groundwater infiltration on dip slopes by centrifugal modelling; Explore counterweight mitigation for dip slope stabilization by centrifugal modelling; Study effect of dynamic loading on dip slope by centrifugal modelling; Development and validation of slope stability analysis formula.

Chapter 3 details the methodology used to achieve the research objectives. An introduction to the 1g and centrifuge experiments is introduced, followed by a detailed description of the model apparatus and instrumentation used in the centrifuge tests. The geotechnical properties of the sand are thoroughly detailed, along with the sand preparation process. Two advanced techniques for measuring earth pressures and sand deformations are then introduced.

In Chapter 4, a total of 12 tests were conducted under 1g conditions to investigate passive thrust near the slope toe in laterally confined slopes on an inclined bedding plane. Additionally, the failure mechanism related to a reverse toe angle was observed in these experiments. PIV analysis with statistical approaches was applied to analyze the failure mode. Additionally, a newly developed minimum coefficient of variation method was utilized to detect slip lines and determine the time of slope failure. Due to the failure mechanism of dip slopes investigated in Chapter 4, the study will continue to explore the effect of groundwater infiltration on dip slope stability using centrifugal model.

In Chapter 5, six centrifuge tests were carried out to study slope failure subjected to groundwater infiltration on an impermeable bedding plane. A surcharge load cart acted as a moving boundary, triggering the loading in these 24 experiments. Moreover, theoretical calculations of slope stability are provided and compared with the experimental results.

In Chapter 6, five centrifuge tests focused on counterweight mitigation for dip slope failure due to groundwater infiltration on an impermeable bedding plane. Furthermore, theoretical calculations of slope stability with counterweight fill are provided to analyze stability changes subjected to counterweight fill.

In Chapter 7, the behavior of slopes on permeable bedding planes with lateral confinements and toe support was examined through six centrifuge tests, which included two dip slopes without countermeasures and four with countermeasures.

In Chapter 8, one centrifuge test investigated the effect of seismic loading on dip slopes. One test applied four seismic waves to determine the impact of seismic loading on slope failure. In this chapter, a combination of pseudo-static and dip slope stability analysis was performed to compare with experimental results.

The final chapter provides the conclusion of this dissertation and outlines future work.

This thesis advances the understanding of dip slope stability through integrated theoretical analyses and physical modeling. The insights gained contribute to mitigating risks associated with dip slope landslides, thereby supporting more informed geotechnical engineering practices.