Class A Prediction Symposium on Debris flow impact forces on single and dual barriers

Hong Kong SAR, 8-9 May 2022

1. BACKGROUND

Predicting debris flow impact force on rigid and flexible barriers is a significant challenge faced by geotechnical engineers and geohazards experts. Existing design guidelines provide limited guidance, and analysis approaches vary among guidelines. Debris flow and flow like landslides prediction and benchmarking exercises have largely been focused on runout prediction without any emphasis on flow-structure interaction. The Centre for Slope Safety in conjunction with the Institute of Mountain Hazards and Environment of the Chinese Academy of Sciences, the Norwegian University of Science and Technology and the Geotechnical Engineering Office of the Civil Engineering and Development Department, Government of Hong Kong SAR invite geotechnical and engineering geology academics and practitioners from around the world to participate in the class A prediction symposium on "Debris flow impact forces on single and dual barriers".

The objective of this event is to provide insights into the dynamic response of debris resisting barriers under debris flow impact loading. Capabilities of current prediction methods will be assessed on capturing the dynamic flow-barrier interaction.

A series of physical flume model tests have been performed, along with supporting laboratory tests (similar to what is available to a designer). Participants interested in the prediction exercise will be asked to predict the dynamic impact response of the barriers and submit the results to the organizing committee. This document outlines the scope of the Class A prediction event.

2. PROBLEM STATEMENT

2.1 Prediction problems

Two test configurations are provided: (1) dual rigid barrier impact and (2) dual flexible barrier impact. Using those configurations predictors can submit their results for the following 4 scenarios.

Debris flow impact on
I. Single rigid barrier
II. Single flexible barrier
III. Dual rigid barriers
IV. Dual flexible barriers

The impact forces and the kinematics for scenarios (I) and (II), refer to the first barrier configuration in the provided test cases (Section 4.5).

The tests are conducted in a 28 m-long flume facility in Hong Kong SAR (Figure 1)

Figure 1. Top view image of the 28 m-long flume with debris material in the storage container

3. FLUME, DEBRIS AND BARRIER DATASET

The 28 m-long flume is made of galvanized steel bed. One of the flume side walls is made of transparent acrylic plates to capture the impact kinematics. The runout zone is founded on a reinforced concrete pad. The flume dimensions with necessary details about the position of the gate and barriers, locations of basal instrumentation cells along the flume and barrier load cells required are available in the dataset.

The debris material used in the tests are representative of debris materials found in East Asia. The debris material is composed of gravel (31%), sand (53%), clay (2%) and water (14%) by mass. The volumetric water content is 30%. The density of the mixture is 2130 ± 100 kg/m^3. The grain size distribution of debris material is shown in Figure 2. The internal friction angle of debris material as well as the interface friction angle with the base and side walls are also available in the dataset.

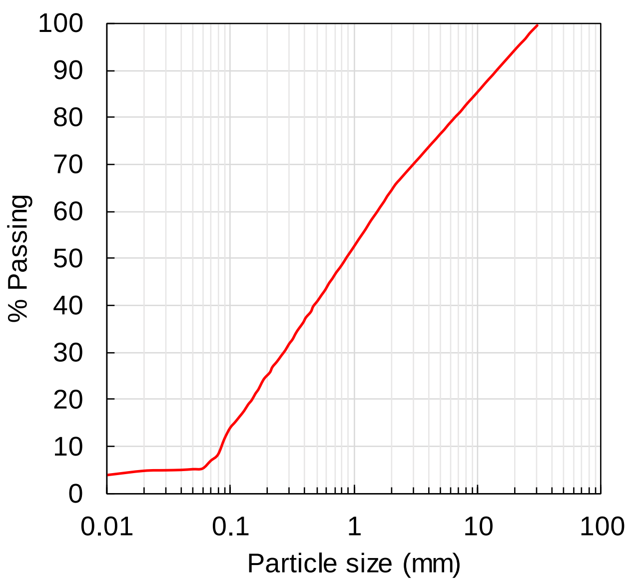

Figure 2. Grain size distribution of debris material

Debris resisting barrier material properties, geometry and boundary conditions necessary for the numerical model are provided in the dataset. A single flexible barrier impacted by debris flow during a test is shown in Figure 3.

Figure 3. Debris flow run up during impact against a flexible barrier

4. GUIDELINES FOR PREDICTION

4.1 Prediction methods

Participants are free to choose any prediction method of their choice. Participants are encouraged to provide details on the methods used to make their predictions. The goal is to benefit the entire geohazards community and improve the overall knowledge on the prediction of debris flow impact against single and multiple barriers.

4.2 Submitting predictions

MS word and Excel templates are provided on the symposium website (https://slope-aoe.hkust.edu.hk/claps-download). Participants are required to use this template to submit their prediction results.

Predictions can be submitted via email haimingliu@ust.hk

4.3 Timeframe

Predictions will be accepted until 20th April 2022.
Please contact us at haimingliu@ust.hk if you have specific requirements.

4.4 Summary and presentation of results

Submitted prediction results will be compared with experimental tests and presented during the symposium on 8th May 2022.

A round-table discussion will be held to summarize lessons learnt form the prediction exercise.

4.5 Communication and support platform

Participants are encouraged to register and access the dataset for the prediction exercise from the symposium website.

The predictors can refer to "Prediction submission template" and "Test cases" in the guidelines for prediction (https://slope-aoe.hkust.edu.hk/claps-download) for specific details.

Notifications and updates about the event will be posted on the symposium website and emailed to registered participants..

Questions can be directed to haimingliu@ust.hk. A list of frequently asked questions (FAQs) will be created and kept up-to-date on the symposium website.

5. REGISTRATION

To register for the class A prediction symposium, please visit (https://slope-aoe.hkust.edu.hk/CLAPS-REG). The opening dates for registration will be updated on the website.