

## Simulation of the Aratozawa Landslide using Ring Shear Tests and LS-RAPID model

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The deep large-scale landslide near Aratozawa Dam of Miyagi Prefecture in Japan was occurred due to main shock of the Iwate-Miyagi inland earthquake on 14 June 2008. The earthquake magnitude reached 7.2 which results a huge mass movement close to the Aratozawa reservoir. Study on the Aratozawa landslide is necessary in order to understand and clarify the initiation mechanism and motion behavior particularly when the seismic loading plays as a main triggering factor. This paper shows the newest version of the undrained dynamic ring shear apparatus which then integrated with the LS-RAPID as a landslide simulation model. In further, results of this research could be a significant step forward for the landslide hazard assessment efforts to reduce human casualties and public infrastructure damage.

The laboratory experiment for the Aratozawa samples was carried out by means of ring shear apparatus ICL-2 version. This version is the newest apparatus that has been built so far by Sassa and other colleagues started in 2012 for practical use. Still, the main purposes of this apparatus for landslides are to observe the pore water pressure generation in undrained condition, shear strength reduction and failure motion behavior of samples within a large shear displacement. The development of this ring shear apparatus also emphasizing the change of normal stress platform from pillar-beam based, to the single central axis-based. Several parameters resulted from experiment by ring shear tests then occupied for the LS-RAPID geotechnical simulation. Landslide simulation model using LS-RAPID aims to observe the overall process of landslide phenomena started from the initiation process by pore pressure increase and seismic loading up to the moving process which involving the volume enlargement and traveling process of the landslide mass.

The critical pore pressure ratio was obtained from ring shear tests. In addition, the friction coefficient, shear displacement at the start of shear strength reduction and steady state shear resistance of the Aratozawa samples were also produced from the tests. We brought the results from ring shear tests as an input parameter in the LS-RAPID. The results of LS-RAPID so far could explain the initiation mechanism and motion of Aratozawa landslide. However, further detailed study is still needed, particularly for the factors from reservoir catchment and relation of reservoir and groundwater condition before and when the earthquake takes place.

Keywords: Aratozawa landslide, Ring shear tests, Shear strength reduction, LS-RAPID