

Modelling landslide debris flow with entrainment: development and validation

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The volume and mobility of a debris flow could increase with distance travelled as it has the potential to entrain a substantial amount of channel-bed material along its travel path. This entrainment effect renders the debris flow more devastating to downslope populations and facilities. In modern landslide risk management, being able to predict the characteristics of debris flows is essential for the design of mitigation measures against landslide hazards. Such need has led to the development of a variety of debris mobility models around the world in recent times. There is a need for modelling methods which are capable of simulating entrainment effects in a rational but practical manner.

Over the past two decades, the Geotechnical Engineering Office (GEO) of Hong Kong has expended considerable effort to develop debris mobility modelling tools for use in routine engineering practice for forward prediction purposes. Recently, GEO has completed a study to enhance an in-house debris mobility code. Physical parameters which can be estimated from the field by engineers or geologists are incorporated in the code to predict entrainment effects in a simple and rational manner. This allows the modelling of varying entrainment potential along a debris flow path. The code has been checked against simplified analytical solutions and validated against field observations in a major historical landslide event involving high-mobility debris flows in Hong Kong. The numerical modelling results indicated that simulated entrainment volume and mobility characteristics are broadly consistent with geological field mapping records.