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Recent Development of the Hong Kong Landslip Warning System

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Hong Kong is situated at the south-eastern tip of China. It has a sub-tropical climate, with a rainy season from April to October each year. Rainfall intensities can be high, with 50 mm to 100 mm per hour and 250 mm to 350 mm in 24 hours being not uncommon. Because of its mountainous terrain, Hong Kong is susceptible to landsliding during the periods of heavy rainfall. As part of the Slope Safety System, the Geotechnical Engineering Office (GEO) of the Hong Kong Special Administrative Region Government has been operating a territory-wide Landslip Warning System for over 40 years. The primary objective of the Landslip Warning is to forewarn the public of possible landslide risk during periods of heavy rainfall. This paper summarises the major components of the current GEO Landslip Warning System as a landslide risk management tool. Hong Kong has an extensive network of automatic raingauges and comprehensive records of landslides. With this, rainfall-landslide correlation models have been established and updated regularly through statistical means to facilitate the prediction of the severity of landslide based on real-time rainfall recorded in the raingauge network and the rainfall forecast by the Hong Kong Observatory (HKO). The System has been continuously enhanced and upgraded along with the development of novel technology and analytical techniques. Currently, Internet of Things (IoT) technology are used in the automatic raingauge network jointly operated by the GEO and the HKO to ensure reliable data transmission. The collected rainfall data are stored and processed using cloud computing service that predicts the severity of landslide at every five-minute intervals. The prediction allows the GEO and the HKO to determine the necessity of issuing a Landslip Warning. Apart from technology, the effectiveness of the Landslip Warning also depends on the actions taken by the public when it is in force. The GEO has ongoing public education campaigns to raise the public awareness and preparedness to reduce vulnerability to landslide hazards. In recent years, occurrence of severe landslides and casualties in landslide have been significantly reduced, which is attributed largely to the successful implementation of the Slope Safety System and partly to the absence of extreme rainfall events. As a result, there is a genuine concern that the public is becoming complacent to the potential landslide hazards. The GEO has enhanced the efforts in maintaining public participation in combating landslide hazards and improved the public perception of the landslide risk of a rainstorm by using a quantitative Landslide Potential Index. Besides providing public warning, the GEO also endeavours to enhance the emergency response to landslide incidents through innovative solutions. Selected debris barriers are installed with IoT

sensors for providing immediate alert of the occurrence of sizable landslides and quadrupled robots are being studied and tested for inspecting landslide sites. It is anticipated that innovation and technology have great potential in improving the GEO's capability in emergency management, in particular in the case of extreme rainfall events that are expected be more frequent and intense in future.