Information Note 20/2025 **September 2025**

Understanding Natural Terrain Landslide Risk

Key Messages: Natural terrain landslide hazard is dealt with mainly by means of mitigation measures as large scale landslide preventive works on natural hillsides would be costly and environmentally unacceptable. The objective of these mitigation measures is to reduce the consequence of landslides, not the likelihood of failure.

Introduction

In 2010, the Geotechnical Engineering Office (GEO) completed the Landslip Preventive Measures (LPM) Programme. The overall landslide risk level arising from man-made slopes had been reduced to less than 25% of the 1977 risk level. This corresponds to an "as low as reasonably practicable" (ALARP) level that is commensurate with the international best practice in risk management.

A rolling Landslip Prevention and Mitigation Programme (LPMitP) was launched in 2010 to dovetail with the LPM Programme to contain the landslide risk in Hong Kong within the ALARP level. Under the LPMitP, natural hillside catchments are for the first time systematically selected for detailed studies and subsequent implementation of risk mitigation works if found necessary.

Mitigating Natural Terrain Landslide Risk

Substandard man-made slopes are in general dealt with by preventive works, such as soil nailing or construction of retaining walls. Such works, being carried out on man-made features, would not usually affect the natural environment. Slopes with such preventive works generally have a much lower chance of failure.

A hillside catchment is hundreds of times the area of a man-made slope and any preventive works carried out on hillsides will intrude into the natural environment. Preventive works, if relied upon solely to deal with natural hillside and hence of large-scale, would be costly and environmentally unacceptable. Instead, a much preferred approach is to contain the natural terrain landslide hazard through mitigation measures, e.g., concrete check dams and steel flexible barriers.

Such mitigation measures aim at reducing consequences, but not the number or scale of landslides.

"As Low As Reasonably Practicable" Level of Risk

Following the "react-to-known-hazard" principle, the LPMitP focuses on natural hillsides with a history of failure posing a known hazard to existing buildings or major transportation corridors. Deterioration and failure of natural hillsides is a natural phenomenon. Landslides may also occur on hillsides that do not have a history of failure.

The mitigation measures will reduce the consequences of failure. Two natural terrain

landslides occurring in 2021 can illustrate this. Both hillsides in concern have a history of landslides and had been identified as requiring attention under the LPMitP. Mitigation measures mainly consisting of rigid and flexible barriers were constructed on both hillsides in early 2010s. The debris of the two landslides in 2021 struck the barriers and was entirely retained. Facilities at the toe of the hillsides could be safely protected from the landslides. Similarly, the debris of two natural terrain landslides occurred during the rainstorm in September 2023 was successfully intercepted by the rigid barriers constructed previously, and hence protected the facilities at the toe of the hillsides. These examples illustrate that the GEO's "react-to known-hazard" principle is effective and the mitigation measures constructed have functioned as intended when needed.

However, mitigation measures may not stop the nuisance of mud and water over-spilling the mitigation measures during a landslide. Buildings and roads may have to be closed temporarily in the interest of public safety due to risks remaining from the landslide scar and the adjacent ground.

The GEO employs international best practice and state-of-the-art technology in mitigating natural terrain landslide risk. Because of the variable nature of natural terrain and limitations in the current technology, the mitigation measures could be overwhelmed under very severe or extreme rainstorms, as evidenced by recent experience in other countries.

Climate Change

There appears to be a trend of increasing extreme rainfall. The GEO will continue to strive to better understand the possible effect of this apparent trend and enhance the natural terrain landslide risk management system.

Personal Precaution

Warning signs are erected near the natural terrain landslide mitigation measures that are under construction, completed or planned to be commenced soon. The public should keep clear of the areas during heavy rainfall.

Effect on the Environment

During construction of the mitigation measures, the natural environment will inevitably be disturbed. Suitable planting and landscaping works will be implemented to restore the natural scenery in due course.

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