Review of Landslides in 2021

GEO Report No. 366

C. Lam, V.S.F. Kong & R.W.H. Lee

Geotechnical Engineering Office
Civil Engineering and Development Department
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Special Administrative Region

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Preface

In keeping with our policy of releasing information which may be of general interest to the geotechnical profession and the public, we make available selected internal reports in a series of publications termed the GEO Report series. The GEO Reports can be downloaded from the website of the Civil Engineering and Development Department (http://www.cedd.gov.hk) on the Internet.

Raymond W M Cheung
Head, Geotechnical Engineering Office
February 2024

Foreword

This report presents the findings of a detailed diagnosis of the landslides in 2021 that were reported to the Government. It serves to review the performance of the Government's slope safety system and identify areas for improvement, as well as to further enhance the slope engineering practice in Hong Kong.

The review was carried out by Dr C. Lam, Mr V.S.F. Kong and Mr R.W.H. Lee of Landslip Preventive Measures Division 2 under the supervision of Ms F.W.Y. Ko. Assistance was provided by the landslide investigation consultants engaged by the Geotechnical Engineering Office, namely AECOM Asia Company Limited and Fugro (Hong Kong) Limited respectively. Technical support provided by Mr C.M. Leung, Mr S.Y. Tse and Mr H.S. Mak is gratefully acknowledged.

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Abstract

This report presents the findings of a diagnostic review of the landslides in 2021 that were reported to the Government. The review forms part of the systematic landslide investigation programme, which is an integral component of the Government's slope safety system. The aims of this report are to review the performance of the Government's slope safety system and identify areas for improvement, as well as to further enhance the slope engineering practice in Hong Kong.

Altogether, 146 genuine landslides in 2021 were reported to the Government of which 13 were major landslides (viz. failure volume of 50 m^3 or more), including one that occurred on an engineered man-made slope. There were also seven minor landslides (i.e. failure volume less than 50 m^3) occurring on engineered man-made slopes. The corresponding annual failure rate of engineered slopes is about 0.021% on a slope number basis (i.e. number of landslides relative to the total number of engineered slopes).

Overall, 99.98% of the engineered man-made slopes performed satisfactorily without occurrence of landslides in 2021.

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1 Introduction

This report presents the findings of a diagnostic review of the landslides in 2021 that were reported to the Geotechnical Engineering Office (GEO) of the Civil Engineering and Development Department (CEDD) or other government departments. The review forms part of the GEO's systematic landslide investigation (LI) programme, which is an integral component of the Government's slope safety system. The LI programme has the following two principal objectives:

(a) to identify, through studies of landslides, slopes that are affected by inherent instability problems so that appropriate follow-up actions can be taken for integrated slope assessment and upgrading works; and

(b) to review the performance of the Government's slope safety system and identify areas for improvement in slope engineering practice.

The present diagnostic review considers all the available landslide data in 2021. The review has been carried out by the Landslip Preventive Measures Division 2 (LPM2) of the GEO, with assistance provided by the GEO's landslide investigation consultants, namely AECOM Asia Company Limited and Fugro (Hong Kong) Limited under Agreements Nos. CE 29/2018 (GE) and CE 28/2018 (GE) respectively.

2 Rainfall and Landslides in 2021

The factual information, together with the relevant statistics on rainfall and landslides in 2021, has been documented by Lam et al (2022).

In 2021, the annual rainfall recorded at the Principal Raingauge of the Hong Kong Observatory (HKO) in Tsim Sha Tsui was 2307.1 mm, which is about 5% lower than the annual normal of 2431.2 mm between 1991 and 2020. Two Black Rainstorm Warnings were issued on 28 June and 8 October 2021 respectively. Six Red Rainstorm Warnings and 27 Amber Rainstorm Warnings were issued in 2021. Two Landslip Warnings were issued on 28 June and 8 October 2021 respectively.

Landslides are classified as follows:

(a) minor (i.e. failure volume < 50 m^3), and

(b) major (i.e. failure volume ≥ 50 m^3 or where one or more fatalities occurred).

In the present context, a failure volume refers to the total sum of the volume of detached materials and the volume of any deformed materials remaining on the slope that may, or may not, have displaced significantly.

Of the 170 incidents reported in 2021, 146 were genuine landslides, discounting those non-landslide incidents (e.g. tree falls). There were 13 major landslides, corresponding to about 8.9% of the number of genuine cases. None of the landslides reported in 2021 involved any fatalities.

The distribution of the landslides, as classified by the types of slope failures, is given in Table 2.1. The types of facilities affected by the landslides are summarised in Table 2.2. The consequences of the landslides in relation to the types of slope failures are summarised in Table 2.3. The distribution of the different facility groups affected by different types of major landslides is presented in Table 2.4. The distribution of the scale of failures, as classified by the types of slopes involved, is given in Table 2.5.

Table 2.1 Breakdown of Landslides by Types of Slope Failures

Types of Slope Failures		Number	Percentage (%)
Fill slopes		14 (2)	9.6
Cut slopes	Soil	69 (4)	47.3
	Soil/rock	10 (0)	6.8
	Rock	12 (0)	8.2
Retaining walls		12 (0)	8.2
Natural hillsides		29 (7)	19.9
Total		146 (13)	100

Legend:

14 (2) Fourteen landslides, two of which were major

Note: Where a landslide involved more than one type of failure, the predominant type of failure is considered in the above classification.

Table 2.2 Breakdown of Landslides by Types of Affected Facilities

Types of Affected Facilities [1]	Hong Kong Island	Kowloon	New Territories and Outlying Islands	All
Buildings (including village houses)	0	0	7 (0)	7 (0)
Registered squatter dwellings	0	0	6 (0)	6 (0)
Roads	21 (1)	2 (0)	21 (4)	44 (5)
Transportation facilities (e.g. railways, tramways)	0	0	0	0
Pedestrian pavements/footways	1 (0)	0	0	1 (0)
Minor footpaths/access paths/ access roads	18 (1)	2 (0)	30 (1)	50 (2)
Construction sites	0	1 (0)	0	1 (0)
Open Areas	0	3 (1)	10 (1)	13 (2)
Catchwaters	0	0	2 (1)	2 (1)
Others (e.g. carparks, parks, playgrounds, gardens, backyards)	3 (1)	2 (0)	4 (0)	9 (1)
Nil [2]	5 (0)	2 (0)	9 (2)	16 (2)
Total	48 (3)	12 (1)	89 (9)	149 (13)

Legend:

21 (1) Twenty-one landslides, one of which was major

Notes:
(1) A given landslide may affect more than one type of facility. In 2021, 146 genuine landslides affected 149 facilities.
(2) 'Nil' refers to incidents where the landslide debris came to rest on the slopes, not affecting any facilities.

Table 2.3 Breakdown of Landslide Consequences by Types of Slope Failures

Types of Slope Failures		Number of Squatter Dwellings (1) Evacuated		Number of Floors, Houses or Flats Evacuated or Partially Closed	Number of Incidents Involving Closures			Deaths	Injuries Reported to the GEO
		Permanent	Temporary		Roads	Pedestrian Pavements	Footpaths, Alleyways or Private Access Paths		
Fill slopes		0	0	0	1	0	0	0	0
Cut slopes	Soil	0	0	0	8	0	4	0	0
	Soil/rock	0	0	0	0	0	0	0	0
	Rock	0	0	0	1	0	0	0	0
Retaining walls		0	0	0	0	0	0	0	0
Natural hillsides		0	0	1 (2)	2	0	1	0	0
Total		0	0	1	12	0	5	0	0

Legend:

1 (1) Number of squatter dwellings evacuated, with the number of tolerated squatter structures evacuated shown in brackets

Notes:

(1) A squatter dwelling is defined as a place of residence that contains one or more tolerated squatter structures, i.e. all structures registered in 1982 Housing Department's Squatter Structure Survey (GEO, 2018).

(2) One person was temporarily evacuated from a village house as a result of the natural hillside failure (Incident No. 2021/06/2995).

Table 2.4 Breakdown of Facility Groups Affected by Different Types of Major Landslides

Types of Major Landslides	Facility Groups Affected by Major Landslides (Group No.)						
	1a	1b	2a	2b	3	4	5
All Major Landslides	0	0	0	0	2	4	5
Major Landslides on Man-made Slopes	0	0	0	0	1	2	3
Major Landslides on Natural Hillsides	0	0	0	0	1	2	2

Notes: (1) Facility groups are classified in accordance with GEO Technical Guidance Note No. 15 (GEO, 2007).
(2) Among the 13 major landslides, the landslide debris of two cases came to rest on the slopes, not affecting any facilities.

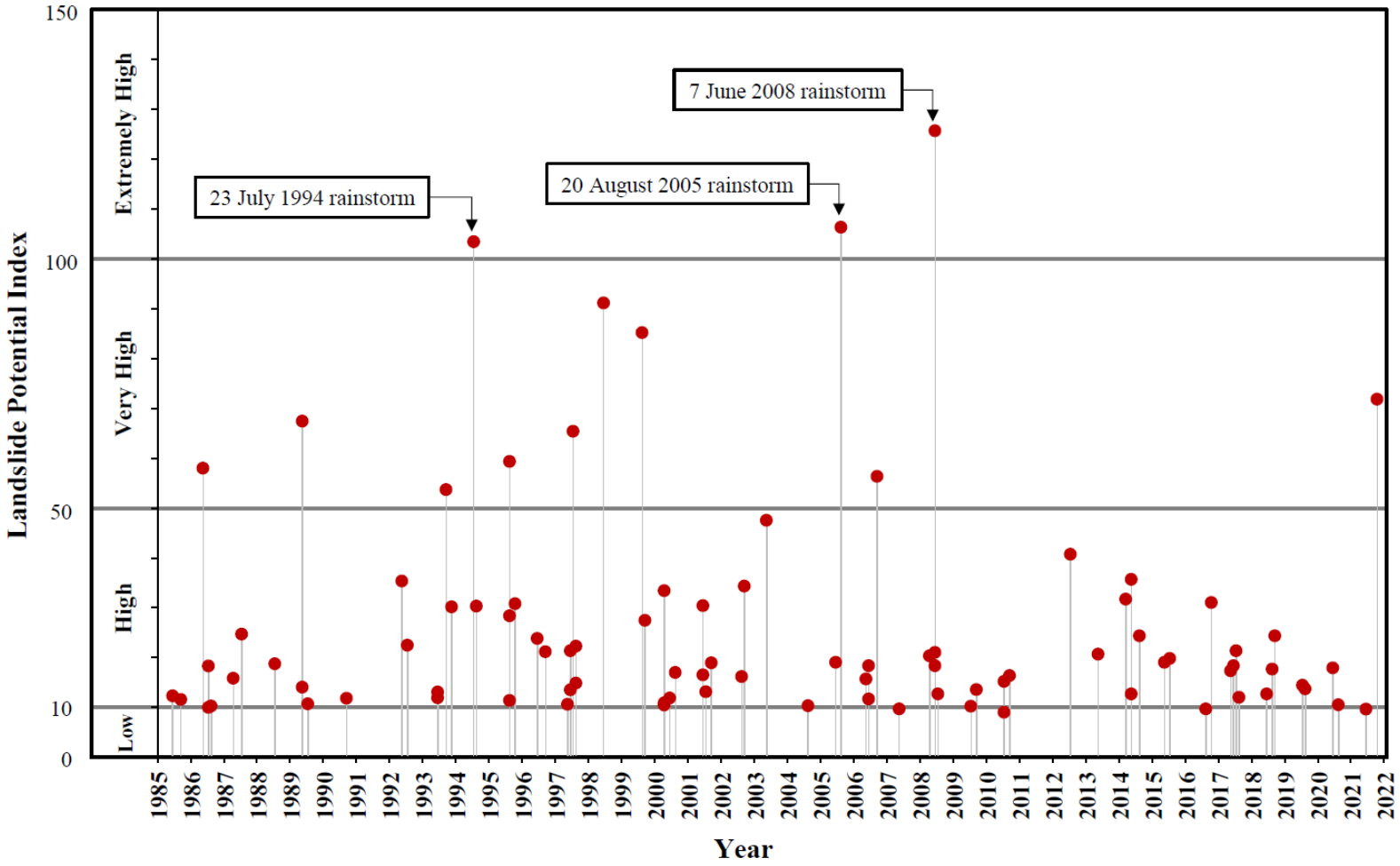
Table 2.5 Breakdown of Scale of Failures by Types of Slopes

Types of Slopes	Number of Minor Landslides (< 50 m^3)	Number of Major Landslides		Total
		(50 m^3 to < 500 m^3)	(≥ 500 m^3)	
Registered man-made slopes	73	5	1	79
Unregistrable man-made slopes	33	0	0	33
Registrable man-made slopes not yet registered at time of failure	5	0	0	5
Natural hillsides	22	6	1	29
Total	133	11	2	146

3 Severity of Rainstorms as Reflected by Landslide Potential Index

Experience has shown that the annual rainfall alone is not a good measure of the severity of rainstorms in a year in terms of their potential to trigger landslides. A more direct measure of the severity of an individual rainstorm in the context of landslides is the Landslide Potential Index (LPI) (GEO, 2021a). LPIs for rainstorms that prompted Landslip Warnings have been determined and are used to depict the relative severity of the rainstorms with respect to their potential to cause landslides. The LPI, which is not a predictive index, is based on the maximum rolling 24-hour rainfall of a rainstorm. The LPIs for rainstorms that prompted Landslip Warnings from 1985 to 2021 are shown in Figure 3.1.

Two Landslip Warnings were issued in 2021, each on 28 June and 8 October 2021, and the corresponding LPIs were 10 and 72 respectively. In terms of the potential to trigger landslides, the rainstorm of 8 October 2021 was about two-third of the severity of the rainstorms of 23 July 1994 and 20 August 2005, both of which had an LPI of about 100 and had triggered landslides resulting in fatalities (viz. the 23 July 1994 landslide at Kwun Lung Lau and the 20 August 2005 landslide at Fu Yung Shan Tsuen).



Legend:

Each red dot represents a rainstorm that prompted a Landslip Warning.

Figure 3.1 Landslide Potential Indices for Rainstorms That Prompted Landslip Warnings from 1985 to 2021

4 Overall Diagnostic Review of Landslides

4.1 General

An overall diagnostic review of the available 2021 landslide data has been carried out to appraise the performance of slopes and facilitate the identification of areas in the Government's slope safety system for further improvement, if any.

The diagnostic review mainly focuses on the following aspects:

(a) coverage of the Catalogue of Slopes,

(b) performance of registered man-made slopes,

(c) observations from natural terrain landslides, and

(d) other areas of technical interest.

4.2 Coverage of the Catalogue of Slopes

4.2.1 General

Sizeable man-made slopes and retaining walls, including those compiled under the GEO's project entitled "Systematic Identification and Registration of Slopes in the Territory" (SIRST) that was completed in September 1998, together with the newly formed or identified slope features after 1998, are registered in the Catalogue of Slopes. Any unregistered man-made slopes identified during slope maintenance inspections, landslide inspections and other geotechnical inspections or studies will also be registered in the Catalogue of Slopes (GEO, 2021b) should they satisfy the slope registration criteria.

4.2.2 Diagnosis

Of the 146 genuine landslides, 79 occurred on registered man-made slopes and the other 67 occurred on slopes not registered in the Catalogue of Slopes (Table 2.5).

Among the 67 landslides on slopes that were not registered, 29 occurred on natural hillsides and 33 occurred on small man-made slopes that did not meet the slope registration criteria (DEVB, 2018). The remaining five landslides, corresponding to 3.4% of the total number of genuine landslides in 2021, involved slopes that satisfied the registration criteria but not yet registered in the Catalogue of Slopes at the time of failures. A breakdown of these 67 landslides is given in Figure 4.1.

The 33 landslides involving unregistrable man-made slopes were all minor with failure volumes up to about 7 m^3. One incident resulted in the temporary closure of an access road and one caused damage of a temporary storage structure.

The five landslides involving registrable slopes were all minor with failure volumes up

to about 5 m^3 (refer to Appendix A for details). Amongst these five minor incidents, one resulted in the temporary closure of a minor footpath and the others did not cause any significant impact on the community. Following the landslides, arrangements have been made to register these slopes in the Catalogue of Slopes.

4.3 Performance of Registered Man-made Slopes

4.3.1 General

The man-made slopes registered in the Catalogue of Slopes can be broadly classified into engineered and non-engineered slopes.

Engineered slopes include:

(a) slopes formed after 1977 (i.e. after the Geotechnical Control Office (renamed the GEO in 1991) was established) that were designed, checked and accepted under the slope safety system as being up to the required geotechnical standards;

(b) slopes formed before 1977 that were subsequently assessed, checked and accepted under the slope safety system as being up to the required geotechnical standards;

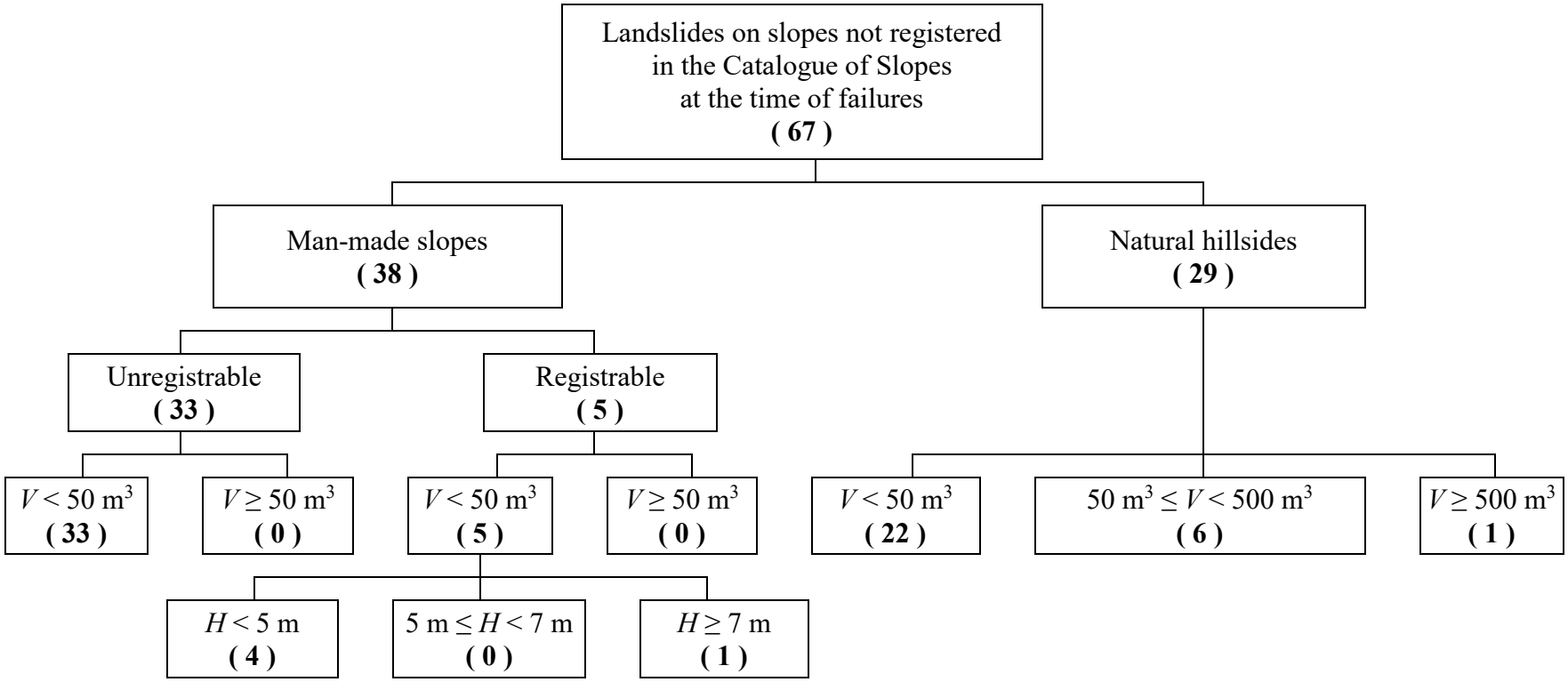
(c) slopes formed before 1977 that were subsequently upgraded, checked and accepted under the slope safety system as being up to the required geotechnical standards; and

(d) slopes upgraded to the required geotechnical standards using Type 3 prescriptive measures (GEO, 2009) under an adequate quality system satisfying the requirements of the Project Administration Handbook for Civil Engineering Works (HKSARG, 2020) whereby checking of the design by the GEO has been waived.

For the present diagnosis, slopes that were not accepted under the slope safety system (e.g. no geotechnical submissions made to the GEO for checking) are considered as non-engineered slopes.

Of the 146 genuine landslides in 2021, a total of 79 landslides (54.1%) occurred on registered man-made slopes (Table 2.5) and six of them were major. Of these 79 landslides, eight (about 10.1%) occurred on engineered slopes and the remaining 71 occurred on non-engineered slopes. A breakdown of the consequence-to-life (CTL) categories of the registered man-made slopes involved in the landslides is given in Table 4.1.

Discussions of the landslides on engineered and non-engineered slopes are given in Sections 4.3.2 and 4.3.3 respectively.



Legend:

V	Failure volume
H	Height of man-made slope before failure
(67)	Number of landslides equals 67

Note: 'Unregistrable' slopes are slopes that do not satisfy the height criteria for registration in the Catalogue of Slopes (DEVB, 2018) at the time of failures.

Figure 4.1 Breakdown of Landslides on Unregistered Slopes

Table 4.1 Breakdown of Consequence-to-life Categories of Registered Man-made Slopes

Types of Slopes	Number of Landslides			Total
	CTL Cat. 1	CTL Cat. 2	CTL Cat. 3	
Engineered Slopes	6 (0)	2 (1)	0 (0)	8 (1)
Non-engineered Slopes	20 (0)	22 (1)	29 (4)	71 (5)

Legend:

2 (1) Two landslides, one of which was major

4.3.2 Landslides on Engineered Slopes

Brief descriptions with photographs of the eight landslides that occurred on engineered slopes in 2021 are given in this section and in Appendix B. A breakdown of these landslides in terms of types of slope failures and scales of failures is given in Table 4.2. The corresponding breakdown of landslides on slopes previously treated under the Landslip Preventive Measures Programme (LPMP) or Landslip Prevention and Mitigation Programme (LPMitP) is given in Table 4.3. Among these landslides, three involved slopes previously treated under the LPMP and one involved a slope previously treated under the LPMitP.

Table 4.2 Breakdown of Landslides on Engineered Slopes

Scales of Failures (m^3)	Fill Slopes	Cut Slopes			Retaining Walls	Total
		Soil	Soil/Rock	Rock		
> 500 m^3	1	0	0	0	0	1
50 m^3 to 500 m^3	0	0	0	0	0	0
> 5 m^3 to < 50 m^3	1	2 (1)	0	1	0	4
≤ 5 m^3	0	0	0	3	0	3
Total	2	2 (1)	0	4	0	8

Legend:

2 (1) Of the two landslides, one occurred within the soil-nailed portion of the slope

Table 4.3 Breakdown of Landslides on Slopes Previously Treated under the LPMP/LPMitP

Scales of Failures (m^3)	Fill Slopes	Cut Slopes			Retaining Walls	Total
		Soil	Soil/Rock	Rock		
> 500 m^3	1	0	0	0	0	1
50 m^3 to 500 m^3	0	0	0	0	0	0
> 5 m^3 to < 50 m^3	0	2 (1)	0	0	0	2
≤ 5 m^3	0	0	0	1	0	1
Total	1	2 (1)	0	1	0	4

Legend:

2 (1) Of the two landslides, one occurred within the soil-nailed portion of the slope

One landslide involved a sizeable failure of the upper portion of a recompacted fill slope below Peak Road (Lam et al, 2022). The failure volume was about 1,600 m^3. The incident involved a flowslide that occurred under dry weather. The landslide investigation revealed that the landslide was triggered by the bursting of a buried 250 mm diameter pressurised water main running along the west-bound lane of Peak Road. Water from the burst main probably saturated the uncompacted fill layer underlying the compacted fill cap of 3 m thick, rendering liquefaction of the uncompacted fill which initiated the flowslide. The landslide debris travelled downhill and entered into a natural drainage line. The debris travel distance was over 300 m.

One landslide involved a sliding failure (volume of about 34 m^3) within a local fill pocket at the crest of a slope immediately below the toe of a retaining wall. Post-landslide inspections and desk study findings revealed that the fill materials were possibly disturbed as a result of the clearance of a fallen sizeable tree about two months before the incident. Direct infiltration of rainwater through the bare ground surface leading to instability of the disturbed fill materials is considered to be one of the probable causes of the failure.

One landslide involved a sliding failure (volume of about 26 m^3) on the topmost unsupported batter of a soil cut slope which had been trimmed to 50° in Grade V materials. Post-landslide inspections revealed defects in the surface drainage channels on the platform beyond the slope crest and immediately above the landslide scar. Water ingress through holes in the channel invert into the slope could have rendered saturation of the groundmass causing the failure.

One landslide involved a local washout failure (volume of about 15 m^3) within the soil-nailed portion of a soil cut slope. Two soil nails were exposed on the scar face and had bent downwards under their self-weight and the weight of the nail heads. The grout sleeves of the soil nails had fractured while the steel reinforcing bars and the nail heads remained intact. This landslide was probably caused by progressive erosion due to overflow from the partially

blocked surface drainage channel and catchpit on the slope berm immediately above the landslide scar.

One landslide involved a rockslide (volume of about 15 m^3) on the rock portion of a soil and rock cut slope inclined at about 55° and covered by wire mesh. The rockslide involved planar sliding with the scar delineated by a subvertical joint and a 45° daylighted joint forming the back release and sliding surfaces respectively. The failed portion was surrounded by trees and dense vegetation, and a number of roots were noted to have penetrated into the said joints and extended over the scar. The rockslide was probably triggered by rainfall and caused by the development of cleft water pressure within the adversely orientated rock joints, which were opened up by root wedging action.

The remaining three landslides involved minor rockfalls (volumes $\leq$ 2 m^3), which all occurred under dry weather and were primarily due to the root wedging action of vegetation. One involved detachment of rock blocks from the bare rock cut face. The other two involved detachment from rock faces covered with rock mesh in which the rockfall debris was fully retained.

The two incidents with rockfall debris fully retained by the rock mesh were not regarded as failures in accordance with GEO Technical Guidance Note No. 10 (GEO, 2020) and have been discarded from the compilation of the annual failure rates as presented in Section 4.3.5. These landslides demonstrate that minor rockfalls from rock slopes are hard to assess and be prevented. The provision of surface protective measures such as rock mesh could be a pragmatic approach to mitigate the consequence and hence reduce the risk of minor rockfalls (GEO, 2020).

Two of the eight landslides on engineered slopes resulted in temporary closure of roads. The remaining cases did not result in any significant consequence.

4.3.3 Landslides on Non-engineered Slopes

There were 71 landslides on non-engineered slopes in 2021, among which five were major and 66 were minor. The five major landslides involved failure volumes ranging from 65 m^3 to 147 m^3. Among them, one incident that occurred on a CTL Category 3 slope resulted in the blockage of a catchwater near Upper Cheung Sha Beach on the Lantau Island, and the overflow consequently caused washout failures of three geotechnical features downslope, including a fill slope immediately below the catchwater, a natural slope above South Lantau Road and a cut slope abutting South Lantau Road. The eroded materials were deposited on the road and this resulted in the temporary closure of both two lanes of the road. Two other incidents that occurred on CTL Category 3 slopes also resulted in temporary road closures. The remaining two incidents, one on a CTL Category 2 slope and one on a CTL Category 3 slope, did not have any notable consequence.

Of the 66 minor landslides, 49 were relatively small in scale with failure volumes less than 5 m^3. Six incidents resulted in temporary road closures and one caused minor damage of a brick column at the entrance corridor of a house. The rest did not result in any notable consequence.

There was also a rockfall incident where the fallen debris was retained by the rock mesh on the slope. This incident was not regarded as a failure according to GEO (2020) and thus has been discarded from the compilation of the annual failure rates as presented in Section 4.3.5.

4.3.4 Landslides Occurring in the Vicinity of Registered Squatter Structures

Six landslides occurred on slopes located in the vicinity of registered squatter structures, two of which occurred on registered slopes, three on unregistrable man-made slopes and one on a registrable man-made slope but not yet registered at time of failure. All six landslides were minor in scale, with failure volumes up to about 5 m^3. The two registered slopes involved in the landslides were both non-engineered.

In one of the six landslides, the nearby squatter structures were not affected by the landslide debris. The debris reached the squatter structures in the other five landslides. In these five cases, one involved a Category 2 Non-development Clearance (NDC)[1] recommendation previously made on the affected squatter structure. No NDC recommendations were made for the other four cases after the 2021 landslides as the failures were very minor in scale (volume $\leq$ 4 m^3) and did not cause any damage to the squatter structures.

4.3.5 Annual Failure Rates

The performance of registered man-made slopes is reviewed in terms of their annual failure rates. The annual failure rates of registered man-made slopes are presented in Table 4.4. The annual failure rates have been assessed in terms of:

(a) the number of landslides divided by the total number of slopes under a given category (e.g. slope type, engineering status),

(b) the surface area of landslides divided by the total surface area of slopes under a given category, and

(c) the number of landslides divided by the total surface area of slopes under a given category.

By considering (b) above in terms of surface areas, it would have taken into account that a large slope is more susceptible to having 'defects' than a small slope. It is however noteworthy that the annual failure rates could be influenced by other factors, such as rainfall characteristics and the prevailing slope maintenance condition.

The annual failure rates for all genuine landslides on registered man-made slopes in 2021 correspond to about 0.127% (number of landslides divided by number of registered man-made slopes), 0.0099% (total surface area of landslides divided by total surface area of registered

[1] Category 2 NDC recommendations are issued to squatter structures that are considered especially vulnerable to landslides due to their close proximity to potentially unstable slopes; the clearance is through advice and persuasion.

man-made slopes), and about 1.272×10^{-6} (number of landslides divided by total surface area of registered man-made slopes in m^2) respectively. Further details are summarised in Table 4.4.

Based on the landslide data in 2021 (Table 4.4), the annual failure rates of engineered slopes are lower than those of non-engineered slopes by a factor of about 11 on a slope number basis, and about 14 on a slope surface area basis. In terms of the number of landslides per total slope surface area, the corresponding failure rate of engineered slopes is about 26 times lower than that of non-engineered slopes.

In 2021, three landslides involved slopes treated under the LPMP and one involved a slope treated under the LPMitP. The annual failure rates of slopes previously treated under the LPMP or LPMitP correspond to 0.051% (number of landslides divided by number of registered man-made slopes treated under the LPMP or LPMitP), 0.0071% (total surface area of landslides divided by total surface area of registered man-made slopes treated under the LPMP or LPMitP), and about 3.289×10^{-7} (number of landslides divided by total surface area of registered man-made slopes treated under the LPMP or LPMitP in m^2) respectively, as summarised in Table 4.4. The annual failure rate of slopes previously treated under the LPMP or LPMitP is lower than that of non-engineered slopes by a factor ranging from about 4 to 12, comparable to that of other engineered slopes.

The GEO's target annual success rates (where success rate = 1 - failure rate) for engineered slopes are 99.8% and 99.5% against major and minor failures respectively, on the basis of the number of landslides per total number of slopes. In 2021, the corresponding annual success rates were 99.99% and 99.98% respectively. Hence, the targets were satisfactorily achieved. The trend of the annual success rates of engineered slopes against major and minor failures for the period from 1997 to 2021 are shown in Table 4.5 and Figure 4.2.

4.4 Natural Terrain Landslides

A total of 29 natural terrain landslides were reported in 2021, among which seven were major and 22 were minor in scale. Of the seven major landslides, one occurring on the natural hillside near Upper Cheung Sha Beach on Lantau Island involved a washout failure with a failure volume of about 2,000 m^3. The incident resulted in the temporary closure of a section of South Lantau Road and was widely reported in the media (Lam et al, 2022). The other six major landslides had no notable consequence.

The 22 minor incidents involved open hillslope failures (up to about 40 m^3), washout failures or surface erosion of the hillsides (up to about 20 m^3), boulder falls/rockfalls (up to about 2 m^3) originating from natural hillsides and distress of the hillsides (about 2 m^3). One incident resulted in the temporary evacuation of a village house and one resulted in temporary road closure.

Among the 29 reported natural terrain landslides, eight of which were located within existing Historical Landslide Catchments (HLC) (Ho & Roberts, 2016). These incidents appear to be isolated cases which were not clustered around the previous natural terrain landslides as recorded in the Enhanced Natural Terrain Landslide Inventory (ENTLI) (Ho & Roberts, 2016). Eleven other landslides were located within 50 m from the existing HLC, none of which with

debris trails close to any important downslope facilities. Together, these 19 cases involved five major landslides and 14 minor landslides. These landslides did not result in any significant consequence except that one major landslide resulted in temporary road closure. The remaining 10 cases are located more than 50 m from the existing HLC and did not result in any significant consequence.

Among the 29 reported natural terrain landslides, the landslide debris in two cases reached the defence measures previously installed on hillsides under the LPMitP, i.e. a steel flexible barrier above Ma Wan New Village in Tung Chung and a reinforced concrete rigid barrier above Middleton Towers in Pok Fu Lam. In both cases, the landslide debris was fully retained by the barriers without affecting any downslope facilities. No obvious damage was observed on the barriers.

4.5 Landslides with Inadequate Slope Maintenance Diagnosed as a Key Contributory Factor to Failure

All the 79 landslides on registered man-made slopes were reviewed to assess whether inadequate slope maintenance was likely to have been a key contributory factor to the failures. Reference has been made to the records of emergency inspections by the GEO or other government departments, inspections or follow-up studies by the LI consultants.

Inadequate slope maintenance such as blockage of surface drainage channels and inadequate hard surface protection was assessed to be a key contributory factor in 19 landslides, one of which was a major failure. These constituted about 24% (i.e. 19 out of 79) of the landslides on registered man-made slopes. Among these 19 landslides, six occurred on engineered slopes.

Of these 19 landslides involving inadequate slope maintenance, 12 affected government slopes and four affected private slopes. Another three affected slopes of mixed government/private maintenance responsibility, one of which occurred on the government portion and two occurred on the private portion of the slopes. The relevant maintenance parties have been informed of the incidents and advised to take appropriate follow-up action. The above diagnosis reiterates the importance of regular slope maintenance to the performance of slopes. It also serves as a reminder that even an engineered slope is liable to failure if it is not adequately maintained.

Table 4.4 Annual Failure Rates of Registered Man-made Slopes (Sheet 1 of 2)

Annual Failure Rates		Non-engineered Slopes			Engineered Slopes		
		Fill/Retaining Wall	Soil/Rock Cut	Overall	Fill/Retaining Wall	Soil/Rock Cut	Overall
Slopes Involved in Landslides in 2021	Number of Slopes	12	58	70	2	4	6
	Surface Area of Landslides (m^2)	175	4,940	5,115	730	99	829
Slopes Involved in Major Landslides in 2021	Number of Slopes	1	4	5	1	0	1
	Surface Area of Landslides (m^2)	50	522	572	600	0	600
Slopes Involved in Minor Landslides in 2021	Number of Slopes	11	54	65	1	4	5
	Surface Area of Landslides (m^2)	125	4,418	4,543	130	99	229
Total Number of Registered Slopes		11,750	18,700	30,450	12,800	16,450	29,250
Total Surface Area of Registered Slopes (m^2)		7,415,010	11,106,190	18,521,200	14,026,030	27,198,770	41,224,800
Annual Failure Rates (All Landslides)	On Slope Number Basis	0.102%	0.310%	0.230%	0.016%	0.024%	0.021%
	On Slope Surface Area Basis	0.0024%	0.0445%	0.0276%	0.0052%	0.0004%	0.0020%
	Number of Landslides Divided by Slope Surface Area (no./m^2)	1.618×10^{-6}	5.222×10^{-6}	3.779×10^{-6}	1.426×10^{-7}	1.471×10^{-7}	1.455×10^{-7}
Annual Failure Rates (Major Landslides)	On Slope Number Basis	0.009%	0.021%	0.016%	0.008%	0%	0.003%
	On Slope Surface Area Basis	0.0007%	0.0047%	0.0031%	0.0043%	0%	0.0015%
	Number of Landslides Divided by Slope Surface Area (no./m^2)	1.349×10^{-7}	3.602×10^{-7}	2.700×10^{-7}	7.130×10^{-8}	0	2.426×10^{-8}

Note: Three incidents involving fallen rock blocks fully retained by rock mesh netting have been excluded from this calculation.

Table 4.4 Annual Failure Rates of Registered Man-made Slopes (Sheet 2 of 2)

Categories of Slopes		Failure Rates on Slope Number Basis (i.e. number of landslides divided by total number of slopes)	Failure Rates on Slope Surface Area Basis (i.e. surface area of landslides divided by total surface area of slopes)	Failure Rates in Terms of Number of Landslides Divided by Total Surface Area of Slopes (no./m^2)
Registered Man-made Slopes	All Landslides	0.127%	0.0099%	1.272×10^{-6}
	Major Landslides	0.010%	0.0020%	1.004×10^{-7}
	Minor Landslides	0.117%	0.0080%	1.172×10^{-6}
Engineered Slopes	All Landslides	0.021% (0.051%)	0.0020% (0.0071%)	1.455×10^{-7} (3.289×10^{-7})
	Major Landslides	0.003% (0.017%)	0.0015% (0.0066%)	2.426×10^{-8} (1.096×10^{-7})
	Minor Landslides	0.017% (0.034%)	0.0006% (0.0006%)	1.213×10^{-7} (2.192×10^{-7})
Non-engineered Slopes	All Landslides	0.230% [11.0/4.5]	0.0276% [13.8/3.9]	3.779×10^{-6} [26.0/11.5]
	Major Landslides	0.016%	0.0031%	2.700×10^{-7}
	Minor Landslides	0.213%	0.0245%	3.509×10^{-6}

Legend:

0.021% (0.051%)	Annual failure rate of engineered slopes (considering all landslides) is 0.021% and that for slopes previously treated under the LPMP or LPMitP is 0.051%
0.230% [11.0/4.5]	Annual failure rate of non-engineered slopes (considering all landslides) is 0.230%, which is 11 times and 4.5 times higher than those of engineered slopes and slopes previously treated under the LPMP or LPMitP respectively

Table 4.5 Annual Success Rates of Engineered Slopes from 1997 to 2021

Year	Annual Success Rates on Slope Number Basis (i.e. number of landslides divided by total number of slopes)	
	Engineered Slopes Processed under the Slope Safety System (Scale of Failure ≥ 50 m^3)	Engineered Slopes Processed under the Slope Safety System (Scale of Failure < 50 m^3)
1997	99.97%	99.89%
1998	99.98%	99.92%
1999	99.97%	99.92%
2000	99.98%	99.91%
2001	99.98%	99.93%
2002	100%	99.95%
2003	99.99%	99.95%
2004	100%	99.97%
2005	99.98%	99.89%
2006	100%	99.95%
2007	100%	99.97%
2008	99.99%	99.89%
2009	100%	99.95%
2010	100%	99.97%
2011	100%	99.97%
2012	100%	99.95%
2013	99.99%	99.95%
2014	99.99%	99.97%
2015	99.99%	99.97%
2016	100%	99.95%
2017	99.99%	99.97%
2018	100%	99.96%
2019	100%	99.97%
2020	100%	99.96%
2021	99.99%	99.98%

Note: See Figure 4.2 for a plot of annual success rates of engineered slopes against the target annual success rates from 1997 to 2021.

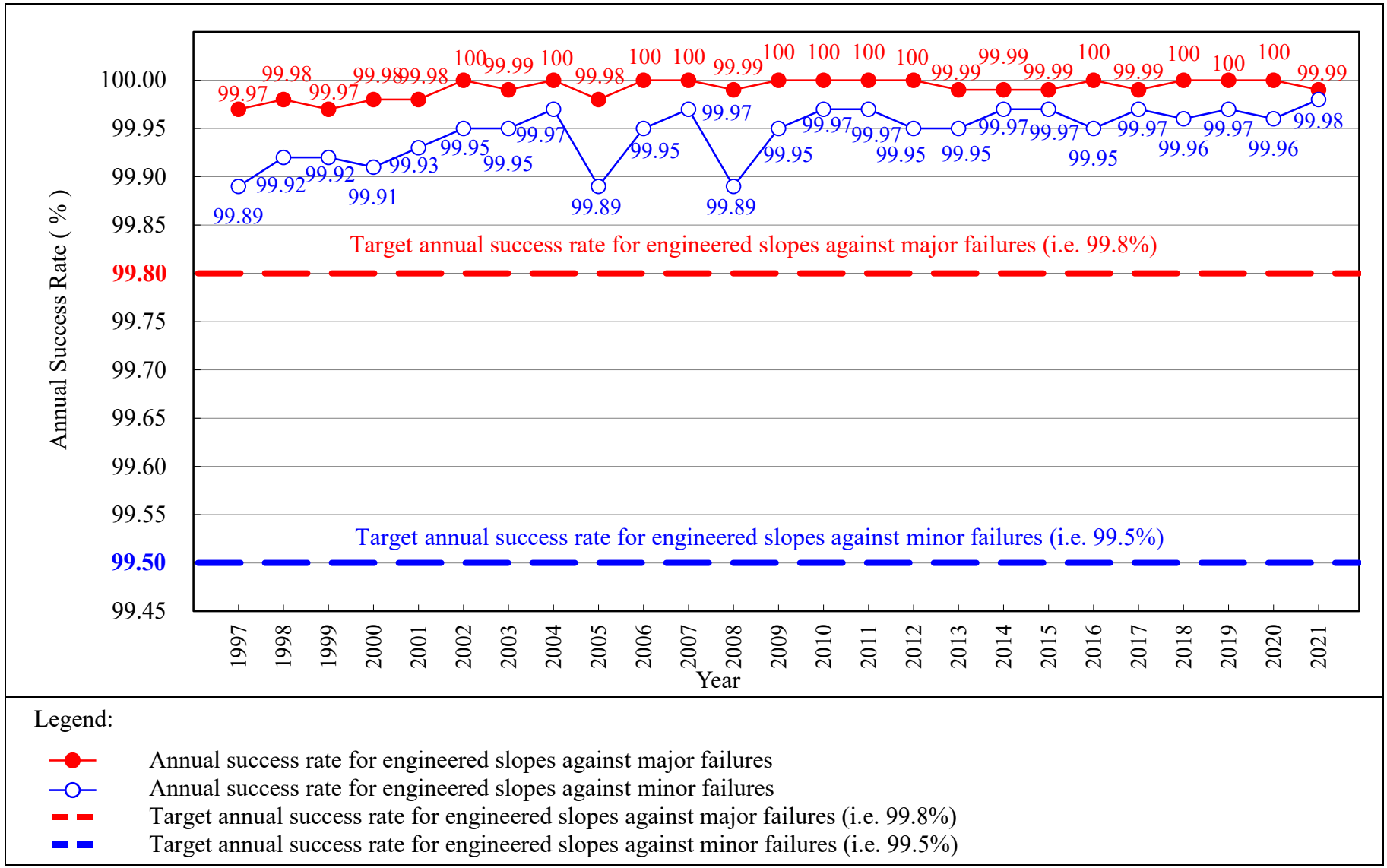


Figure 4.2 Annual Success Rates of Engineered Slopes from 1997 to 2021

5 Conclusions

Overall, 99.98% of the engineered man-made slopes performed satisfactorily without occurrence of landslides in 2021. There was one major landslide on an engineered slope in 2021.

The annual failure rates of major and minor landslides on engineered slopes, on a slope number basis, are 0.003% and 0.017% respectively in 2021. These correspond to annual success rates of 99.99% and 99.98% with respect to major and minor landslides, which are above the pledged annual success rates of 99.8% and 99.5% respectively.

6 References

DEVB (2018). *Registration and Upgrading of the Catalogue of Slopes (DEVB Technical Circular (Works) No. 2/2018)*. Development Bureau, Hong Kong, 3 p.

GEO (2007). *Guidelines for Classification of Consequence-to-Life Category for Slope Features (GEO Technical Guidance Note No. 15).* Geotechnical Engineering Office, Civil Engineering and Development Department, Hong Kong, 14 p.

GEO (2009). *Prescriptive Measures for Man-made Slopes and Retaining Walls (GEO Publication No. 1/2009)*. Geotechnical Engineering Office, Civil Engineering and Development Department, Hong Kong, 76 p.

GEO (2018). *Non Development Clearance (Slope Safety) of Squatters (GEO Circular No. 3)*. Geotechnical Engineering Office, Civil Engineering and Development Department, Hong Kong, 19 p.

GEO (2020). *Enhancement of Rock Slope Engineering Practice Based on Findings of Landslide Studies (GEO Technical Guidance Note No. 10)*. Geotechnical Engineering Office, Civil Engineering and Development Department, Hong Kong, 7 p.

GEO (2021a). *Landslide Potential Index (GEO Information Note No. 15/2021)*. Geotechnical Engineering Office, Civil Engineering and Development Department, Hong Kong, 3 p.

GEO (2021b). *Catalogue of Slopes (GEO Information Note No. 27/2021)*. Geotechnical Engineering Office, Civil Engineering and Development Department, Hong Kong, 3 p.

HKSARG (2020). *Project Administration Handbook for Civil Engineering Works (2020 Edition)*. The Government of the Hong Kong Special Administrative Region, Hong Kong. (https://www.cedd.gov.hk/eng/publications/standards-spec-handbooks-cost/stan-pah/index.html).

Ho, H.Y. & Roberts, K.J. (2016). *Guidelines for Natural Terrain Hazard Studies (GEO Report No. 138) (2nd Edition)*. Geotechnical Engineering Office, Civil Engineering and Development Department, Hong Kong, 176 p.

Lam, C., Kong, V.S.F. & Chu, E.K.H. (2022). *Factual Report on Hong Kong Rainfall and Landslides in 2021 (Special Project Report No. SPR 1/2022)*. Geotechnical Engineering Office, Civil Engineering and Development Department, Hong Kong, 58 p.

Appendix A

Landslides Involving Unregistered Man-made Slopes but Registrable at the Time of Failures

List of Table

Table A1 Landslides Involving Unregistered Man-made Slopes but Registrable at the Time of Failures

Incident No.	Location	Maximum Slope Height [(1)]	Reported		Failure			Facility Affected	Consequence
			Date	By	Date (Time)	Feature Type	Scale (m^3)		
2021/02/2867	Below Feature No. 7NE-C/F163, Kon Hang, Tai Po	7 m	3/2	DLO	Unknown	Soil cut	1.5	Access road	-
2021/06/2985	Sui Wo Road, Sha Tin (near Lamp Post No. VE4448)	3.5 m	21/6	DLO	Unknown	Soil cut	0.5	Minor footpath	-
2021/06/2989	No. 28 Self Help Care Village, Cheung Chau	4 m	28/6	DO	28/6	Soil cut	1	Minor footpath	Minor footpath temporarily closed
2021/10/3057	House No. 22, Tai Shan East, Yung Shue Wan, Lamma	3 m	9/10	Police	Unknown	Fill	4.8	Registered squatter dwelling	-
2021/11/3096	Opposite to Feature No.11SE-D/C385, Sai Wan Fort Morning Trail, Chai Wan	3.5 m	23/11	GEO	2/11 (15:00)	Soil cut	0.06	Minor footpath	-

Note: [(1)] The height of the man-made slope before failure is used for determining the maximum slope height.

Appendix B

Landslides Involving Slopes Processed under the Slope Safety System

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Table B1 Landslides Involving Slopes Processed under the Slope Safety System (Sheet 1 of 8)

Incident No.	Slope No.	Location	Failure Volume (m^3)	Feature Type	Remarks
1. Slopes Upgraded Under the LPMP/LPMitP ($\sum$ = 4 nos.)					
2021/07/3005	11NW-D/C44	Behind Lok Fung Lau (Block D), Lok Man Sun Chuen, No. 156 Kau Pui Lung Road, To Kwa Wan	1.7 (Rockfall)	Rock cut	This landslide occurred on a 70° inclined rock cut slope upgraded under the LPMP in 2004. This incident involved a rockfall under dry weather and was primarily due to the presence of adversely orientated rock joints and root wedging action (Figure B1). The rockfall debris was fully retained by a rock mesh.
2021/10/3045	11NW-A/C179	Near Jao Tsung-I Academy, No. 800 Castle Peak Road, Mei Foo	26	Soil cut	This landslide occurred on a soil cut slope upgraded under the LPMP in 1991 by slope cutting, installation of soil nails and provision of surface drainage channels. This incident involved a sliding failure of the topmost unsupported batter which had been cut back to 50° in Grade V materials (Figure B2). Post-landslide inspections revealed defects in the surface drainage channel on the platform beyond the slope crest and immediately above the landslide scar. Water ingress through holes in the channel invert into the slope could have rendered saturation of the groundmass causing the failure.

Table B1 Landslides Involving Slopes Processed under the Slope Safety System (Sheet 2 of 8)

Incident No.	Slope No.	Location	Failure Volume (m^3)	Feature Type	Remarks
2021/11/3089	11SW-D/FR135	Peak Road	1,600	Fill	This landslide occurred on a fill slope below Peak Road. The slope was upgraded under the LPMP in 1988 and the works included recompaction of the top 3 m of soil fill to a slope angle of 30º, construction of a cantilevered reinforced concrete crest retaining wall, construction of a row of hand-dug caissons for supporting the retaining wall and Peak Road, and provision of a vegetated slope surface cover. This landslide involved a sizeable failure of the upper portion of the slope with a scar depth of up to about 6 m (Figure B3). Some of the caissons were exposed after the landslide. The landslide investigation revealed that the failure involved a flowslide triggered by the bursting of a buried 250 mm diameter pressurised water main running along Peak Road. Water from the burst main probably saturated the uncompacted fill layer underlying the compacted fill cap, rendering liquefaction of the uncompacted fill followed by a flowslide. The landslide debris travelled downhill and entered into a natural drainage line. The debris travel distance was over 300 m.

Table B1 Landslides Involving Slopes Processed under the Slope Safety System (Sheet 3 of 8)

Incident No.	Slope No.	Location	Failure Volume (m^3)	Feature Type	Remarks
2022/02/3107	11SW-A/C313	Above Kennedy Town Fresh Water Service Reservoir	15	Soil cut	This landslide occurred on a soil cut slope upgraded under the LPMitP in 2020 mainly by soil nails and placement of compacted rockfill in local areas of the slope. This incident involved a local washout failure within the soil-nailed portion of the slope inclined at about 45° (Figure B4). The slope surface at the failure location was covered with erosion control mat and wire mesh. Two 100 mm diameter soil nails were exposed on the scar face and had bent downwards under their self-weight and the weight of the nail heads measuring 600 mm by 600 mm. The grout sleeves of the soil nails had fractured while the steel reinforcing bars and the nail heads remained intact. This incident was probably caused by progressive erosion due to overflow from the partially blocked surface drainage channel and catchpit on the slope berm immediately above the landslide scar.

Table B1 Landslides Involving Slopes Processed under the Slope Safety System (Sheet 4 of 8)

Incident No.	Slope No.	Location	Failure Volume (m^3)	Feature Type	Remarks
2.	Slopes Assessed under the LPMP/LPMitP with No Upgrading Works Required (∑ = 0 no.)0 Nil.				
3.	Slopes Assessed by Studies in the late 1970's to mid-1980's with No Upgrading Works/Further Study Required (∑ = 0 no.) Nil.				
4.	Slopes Assessed by Government Departments and Checked by the GEO with No Upgrading Works Required (∑ = 0 no.) Nil.				
5.	Slopes Assessed by Private Owners and Checked by the GEO with No Upgrading Works Required (∑ = 0 no.) Nil.				

Table B1 Landslides Involving Slopes Processed under the Slope Safety System (Sheet 5 of 8)

Incident No.	Slope No.	Location	Failure Volume (m^3)	Feature Type	Remarks
6. Slopes Formed or Upgraded by Government Departments and Checked by the GEO ($\sum$ = 2 nos.)					
2021/03/2869	15NE-A/CR44	Repulse Bay Road (opposite to Lamp Post No. 31628)	0.5 (Rockfall)	Rock cut	The slope was upgraded in 2009 under HyD's Project "Upgrading/Improvement of Roadside Slopes/Retaining Walls on Hong Kong Island (2005 to 2008 Programme)" with the design checked and accepted by the GEO. The landslide occurred under dry weather and involved a rockfall originated from the rock portion of the slope inclined at about 85° and covered with rock mesh (Figure B5). Root wedging action on adversely orientated rock joints could be the key contributing factor to the rockfall. The fallen debris was fully trapped inside the rock mesh and sitting within the road kerb area.

Table B1 Landslides Involving Slopes Processed under the Slope Safety System (Sheet 6 of 8)

Incident No.	Slope No.	Location	Failure Volume (m^3)	Feature Type	Remarks
2021/07/3010	7NE-C/C207	Lai Ping Road, Sha Tin	15 (Rockslide)	Rock cut	The slope was upgraded during the site formation works under the "Shatin New Town Stage II" project in 2011. The landslide involved a rockslide on the rock cut portion of a soil and rock cut slope inclined at about 55° and covered with rock mesh (Figure B6). The rockslide involved a planar sliding with the scar delineated by a subvertical joint and a 45° daylighted joint forming the back release and sliding surfaces respectively. The failed portion was surrounded by trees and dense vegetation, and a number of roots were noted to have penetrated into the said joints and extended over the scar. The rockslide was probably triggered by rainfall and caused by the development of cleft water pressure within the adversely orientated rock joints, which were opened up by root wedging action.

Table B1 Landslides Involving Slopes Processed under the Slope Safety System (Sheet 7 of 8)

Incident No.	Slope No.	Location	Failure Volume (m^3)	Feature Type	Remarks
7. Slopes Formed or Upgraded by Private Owners and Checked by the GEO ($\sum$ = 1 no.)					
2021/10/3066	11SW-D/C1836	Manderly Garden, Deep Water Bay	34	Fill	The slope was constructed between 1984 and 1986 during the site formation works for the construction of Manderly Garden. The slope was formed mainly by cutting with some local fill pockets. The landslide involved a sliding failure of a local fill pocket inclined at 30º at the crest of the slope immediately below the toe of a retaining wall (Figure B7). Post-landslide inspections and desk study findings revealed that the fill materials were possibly disturbed as a result of the clearance of a fallen sizeable tree about two months before the incident. Direct infiltration of rainwater through the bare ground surface leading to instability of the disturbed fill materials is considered to be one of the probable causes of the failure.
8. Slopes Upgraded Following Service of DH Orders and Checked by the GEO ($\sum$ = 1 no.)					
2021/03/2868	11SW-D/CR36	Nos. 19-25, Village Terrace, Happy Valley	0.45 (Rockfall)	Rock cut	The slope was assessed and upgraded to the required standard by the default action for discharging of a Dangerous Hillside Order in 2005. The landslide involved a rockfall from the rock cut portion of the slope inclined at about 80° under dry weather (Figure B8). It involved detachment of rock blocks from the bare rock face due to the presence of adversely orientated rock joints and root wedging action.

Table B1 Landslides Involving Slopes Processed under the Slope Safety System (Sheet 8 of 8)

Incident No.	Slope No.	Location	Failure Volume (m^3)	Feature Type	Remarks
9.	Slopes Assessed as Not Requiring Upgrading Works But with Outstanding GEO's Comments ($\sum$ = 0 no.)				
	Nil.				
10.	Slopes Assessed as Requiring Upgrading Works But with Outstanding GEO's Comments ($\sum$ = 0 no.)				
	Nil.				

Legend:

Landslide occurred within the soil-nailed portion of a cut slope ($\sum$ = 1 no.)

Landslide involved an unsupported cut ($\sum$ = 1 no.)

Notes:
(1) Slopes under Categories 1 to 8 are classified as engineered slopes.
(2) Slopes under Categories 9 and 10 are post-1977 features but are not regarded as engineered slopes for the purpose of this report.

Figure B1 Rockfall in To Kwa Wan (Incident No. 2021/07/3005)

Figure B2 Sliding Failure at Castle Peak Road (Incident No. 2021/10/3045)

Figure B3 Flowslide at Peak Road (Incident No. 2021/11/3089)

Figure B4 Washout Failure below Kennedy Town Fresh Water Service Reservoir (Incident No. 2022/02/3107)

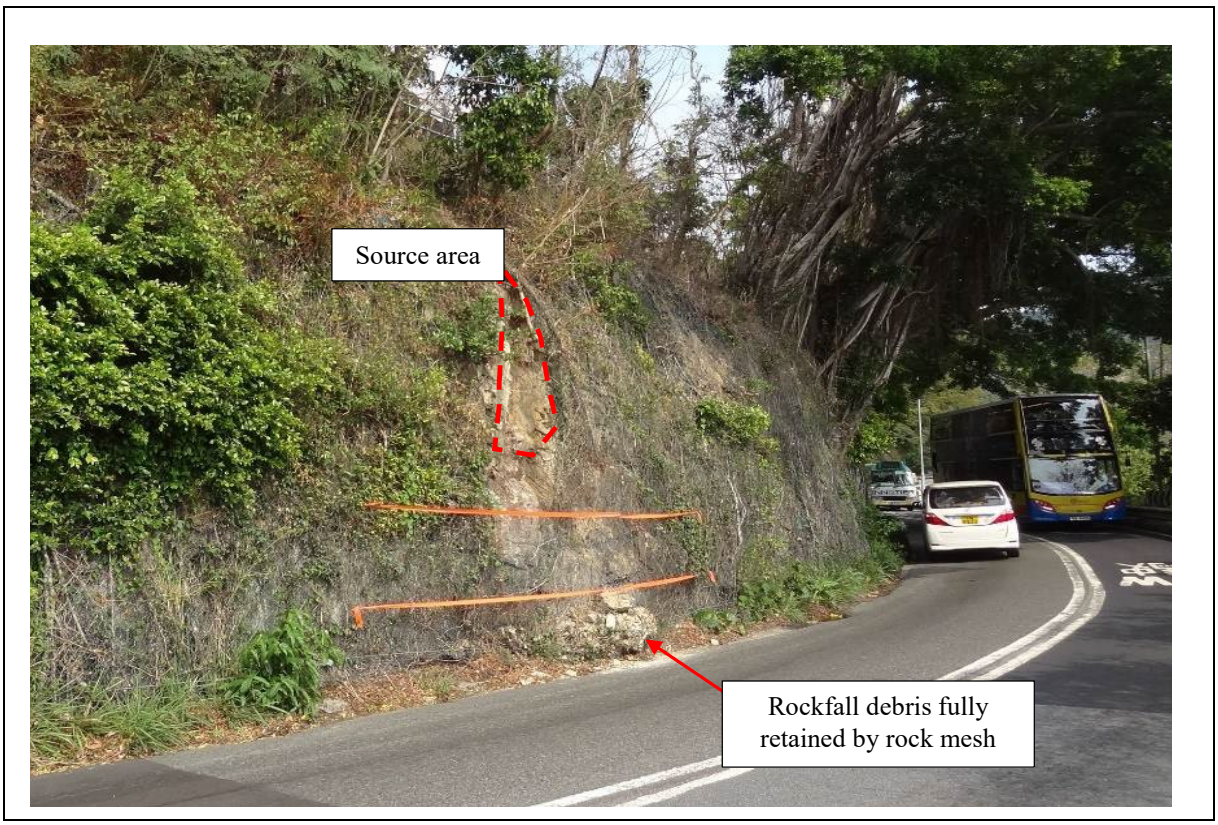

Figure B5 Rockfall at Repulse Bay Road (Incident No. 2021/03/2869)

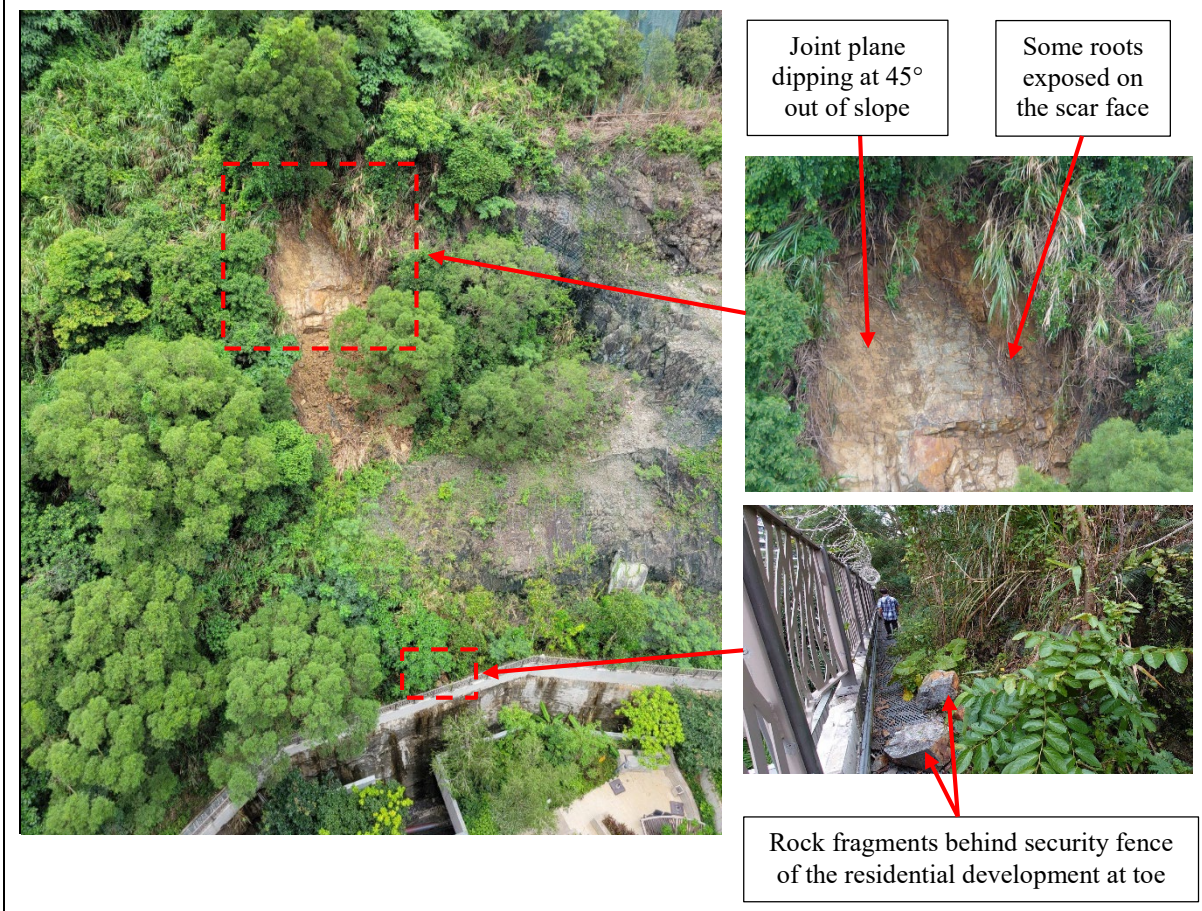

Figure B6 Rockslide above Lai Ping Road (Incident No. 2021/07/3010)

Figure B7 Sliding Failure at Manderly Garden (Incident No. 2021/10/3066)

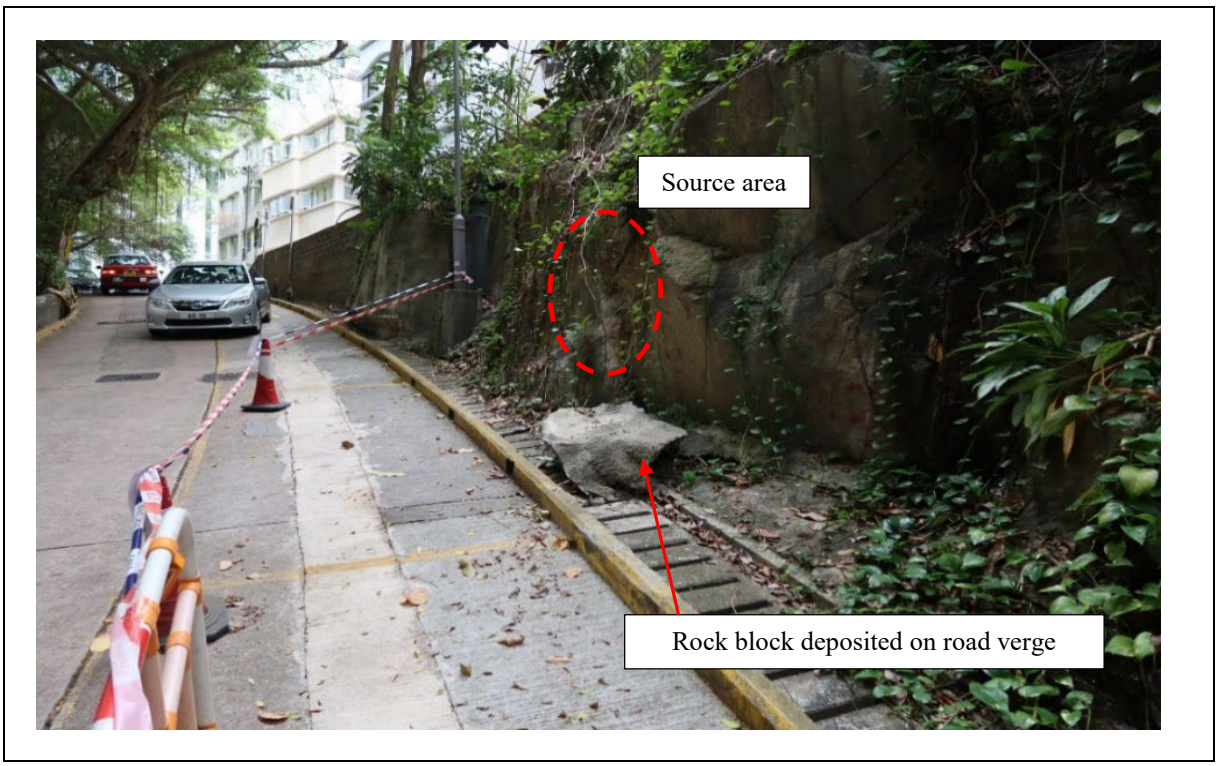

Figure B8 Rockfall in Happy Valley (Incident No. 2021/03/2868)

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