Session 7
Global Approach to Slope Safety in Hong Kong (Part 1)

[1:00 – 3:00 pm, 19 February 2009]

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Geotechnical Engineering Office

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Objective of this session:

- Slope safety in Hong Kong in early years
- Set up of the geotechnical control mechanism
- The Key Result Areas of the Hong Kong Slope Safety System
- Aesthetic treatment of slopes
- The landslip prevention programmes

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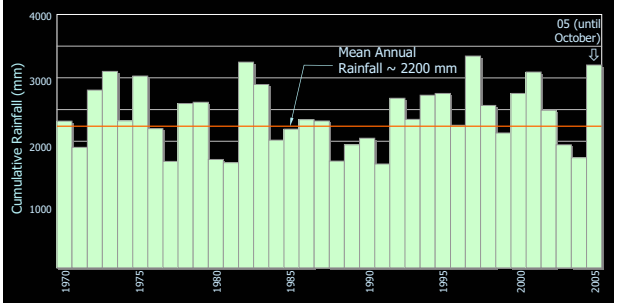
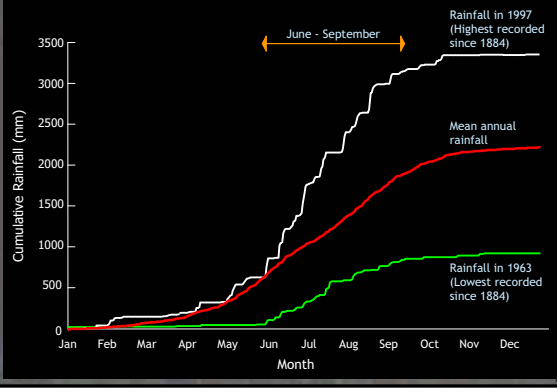
ANNUAL RAINFALL (1970-2005)



YEARLY RAINFALL DISTRIBUTION



Urban slope engineering and landslide risk management

1900

2000

… essential to sustainable urban development on Hong Kong's hilly terrain

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Evolution of Slope Engineering and Landslide Risk Management in Hong Kong

Enhanced Landslide Risk Management

Mid-1990s

Fatal Landslide 1994

Geotechnical Slope Engineering

1977

GEO set up

Fatal Landslides 1972 & 1976

Empirical Slope Engineering

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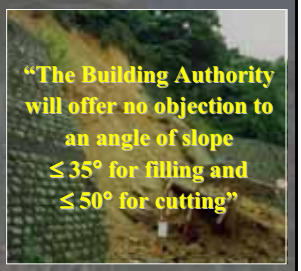
Pre-1977: Empirical Slope Engineering (Prescription based on Rule-of-thumb)

Rapid urban development after WWII, with little geotechnical input and construction control



"The Building Authority will offer no objection to an angle of slope ≤ 35° for filling and ≤ 50° for cutting"

... although it works in some cases, it fails where the ground is 'atypical', and when heavy rain comes

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Many landslides in the old days

… part of Hong Kong people's struggle for living

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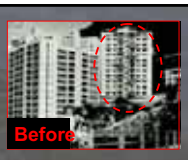
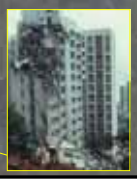
1972 Po Shan Landslide

(Vol. = 20,000 m³ ; 67 fatalities)





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1972 Sau Mau Ping Landslide

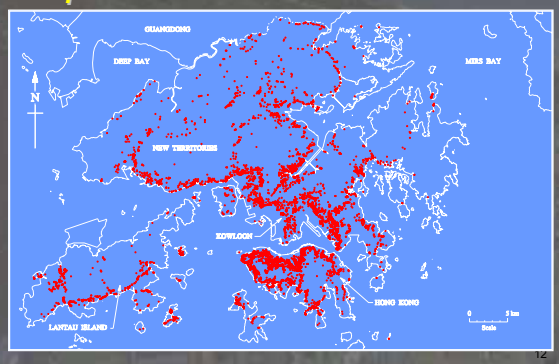
(Vol. = 6,000 m³ ; 71 fatalities)

Fill slope mobile failure

1976 Sau Mau Ping Landslide

(Vol = 5,000 m³ ; 18 fatalities)

Spatial Distribution of Landslides Reported to GEO in the Period 1982-2004



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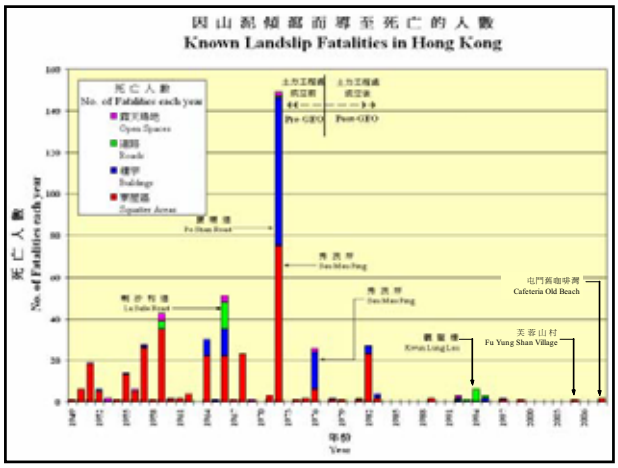

Set up of Geotechnical Engineering Office in 1977

- On the recommendation of an independent review panel, the Geotechnical Engineering Office (GEO) was established in 1977 to regulate slope safety in Hong Kong.
- The key issue is how to ensure the safety of new slopes and to reduce landslide danger of existing slopes.

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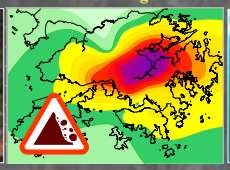
Strategies of GEO in 1977


Geotechnical Control


Landslip Preventive Measures Programme


Setting Standards


Squatter Clearance


Landslip Warning


Land Use Planning

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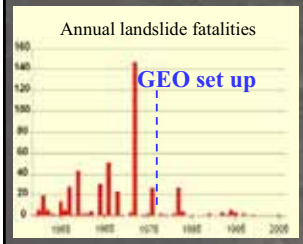
Annual Landslide Fatalities in Hong Kong



Number of fatalities have been much reduced since the setting up of the GEO in 1977

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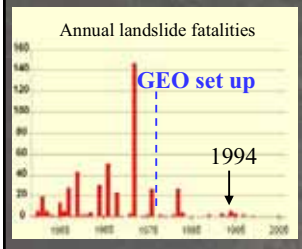
1994 Kwun Lung Lau Landslide

(Vol. = 1,000 m^3 ; 5 fatalities & 3 injuries)



- Collapse of an >100-yr old masonry wall, owned by NGO
- Affect a footpath (temporal users)
- Much smaller in scale of failure, occurred during landslip warning

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Great outcry from the public, politicians and Administration


Slope safety criticised
Separate inquiry on landslide demanded
Faults revealed in monitoring of dangerous slopes
Slopes still a big risk

Underlying reasons

- Reduced awareness of potential landslide risk after many uneventful years
- Increased expectation
- Aversion to multiple-fatality
- Geotechnical process not 100% robust *(technological limitations and human errors)*

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Enhancement of Slope Safety System

Risk assessment and management

Slope maintenance

Landslip warning system

More than 2,700 landslides examined and more than 200 landslides selected for detailed study since 1997

Systematic landslide investigation

Public education

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Roving Exhibition

Public Advisory Services

School Talk

Slope Safety Seminar

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Systematic Landslide Investigation

200 - 800 landslides reported per year

All landslides

(1) Examination

~10%

(2) Landslide study/review

~1%

(3) Forensic study

Aims :

1. Improve understanding of slope behaviour
2. Enhance slope engineering practice
3. Audit slope safety system

+ external review by Slope Safety Technical Review Board

US$ 4 Million per year

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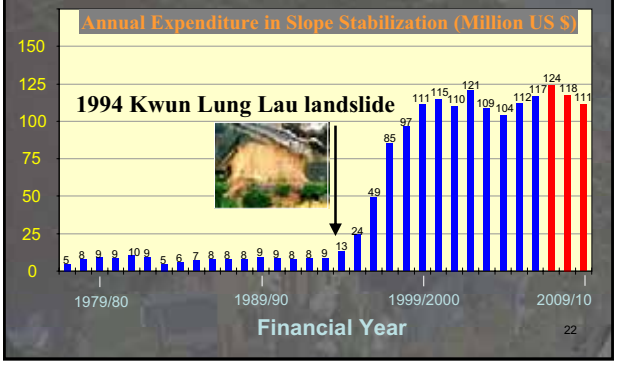
Acceleration of Landslip Preventive Measures Programme (LPMP)



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Enhancement of Slope Appearance

Establishment & Consolidation — Development & Advancement

1970 — GCO — 1980 — 1990 — Renamed as GEO — 2000 — 2005

Slope Safety Framework

- IT
- Advanced equipment
- QRA
- Public education
- Landslide investigation
- Advanced testing
- Natural terrain
- Soil nailing technology
- Slope appearance
- Prescriptive design
- Continued slope maintenance

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Hong Kong Slope Safety System

- System improvement through the formation of a comprehensive framework of the Slope Safety System by the HKSAR Government. – Seven key results areas
- Key tasks undertaken in the Slope Safety System are described

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Hong Kong Slope Safety System

- Seven Key Result Areas

1. Improve slope safety standards, technology, and administrative and regulatory frameworks
2. Ensure safety standards of new slopes
3. Rectify substandard government slopes
4. Maintain all government man-made slopes
5. Ensure that owners take responsibility for slope safety
6. Promote public awareness and response in slope safety through public education, publicity, information services and public warning
7. Enhance the appearance and aesthetics of engineered slopes

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Ensure that New Slopes Meet Safety Standards

❖ Improve slope safety standards, administrative and regulatory frameworks

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Ensure that New Slopes Meet Safety Standards

❖ Improve slope safety standards, administrative and regulatory frameworks

- Systematic investigation of landslides has brought improved understanding of the mechanism of landsliding.
- Areas for improvement identified as feedback to enhance the elements in the Slope Safety System.

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Goals of Systematic Landslide Investigations

Safety-net : identify slopes requiring action

Technical development : enhance slope engineering practice

System review : identify areas for improvement

Forensic investigation

Ensure that New Slopes Meet Safety Standards

❖ Through systematic landslide investigations, we have:

- Improved reliability of engineered slopes.
- Improved slope safety risk management system.
- Enhanced public safety

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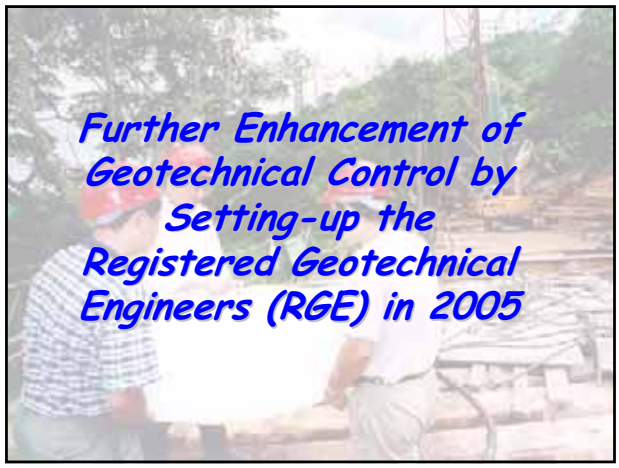

Enhancement of Geotechnical Control

- The Buildings (Amendment) Ordinance 2004 establishes a register of geotechnical engineers and introduces the requirement for the appointment of a RGE for the geotechnical elements of building works
- The registration system has commenced operation since 31.12.2004
- With effect from 31.12.2005, a RGE is required to be appointed for the geotechnical elements of building works

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Enhancement of Geotechnical Control

- The duties and functions of a RGE are classified into "executive role" and "advisory role"

Executive tasks:
•Prepare and sign the prescribed geotechnical plans and reports
•Certify that the works have been carried out in accordance with the approved plans, and that the works completed are geotechnically safe

Advisory tasks:
Prepare and sign the geotechnical report/supporting documentation

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Enhancement of Geotechnical Control

Executive Role – Geotechnical Tasks
Ground Investigation in Scheduled Areas
Ground Investigation in Non-scheduled Areas
Site Formation
Groundwater Drainage Works in Scheduled Area 1
Water Supply and Wells
Remedial Works to Dangerous Hillsides
Long Term Monitoring (Post Occupation Permit)

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Enhancement of Geotechnical Control

Advisory Role – Geotechnical Tasks
Demolition Affecting Slopes and Retaining Walls
Geotechnical Assessment for General Building Plan where required
Foundation in Scheduled Areas Nos. 1, 2 & 4 and Designated Area of Northshore Lantau
Foundation Affecting Slope and Retaining Wall
Excavation and Lateral Support
Superstructure (Report on geotechnical design parameters)

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Ensure that New Slopes Meet Safety Standards

❖ Checking new slopes

- Dedicated team of geotechnical engineers
- Audit of designs of new geotechnical works (private and public)
- Audit of standard of site supervisions of geotechnical works (private and public)

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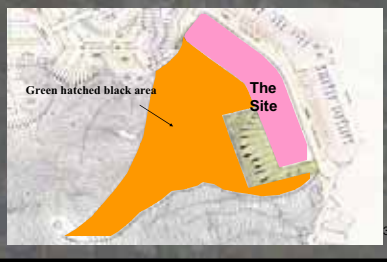
Ensure that New Slopes Meet Safety Standards

❖ Enhancing land use planning

- Providing geotechnical advice on new developments to ensure that slope safety is duly considered at the early planning stage



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Ensure that New Slopes Meet Safety Standards

❖ Enhancing land use planning

- Where it is difficult to develop due to geotechnical limitations, we may recommend a change in the land use.

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Enhance the Stability of Old Man-made Slopes

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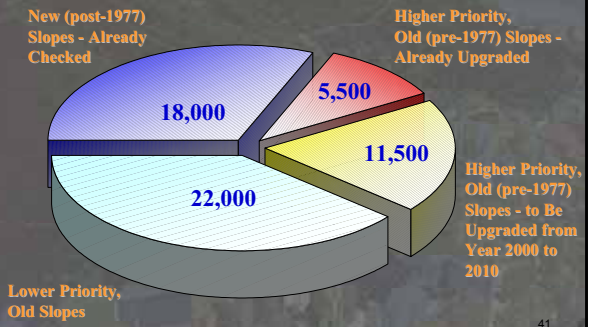
Distribution of Man-made Slopes in the Slope Catalogue



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Enhance the Stability of Old Man-made Slopes

❖ Upgrading of old government man-made slopes

- 57,000 registered man-made slopes (39,000 Government and 18,000 private)
- **For the old government man-made slopes,**
  - Implemented the 5-year Accelerated Landslip Preventive Measures (LPM) Project (1995-2000)
  - Implementing the 10-year Extended LPM Project (2000 - 2010)

Before LPM

After LPM

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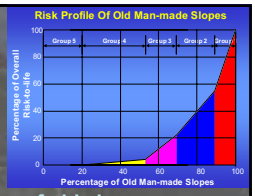
Enhance the Stability of Old Man-made Slopes

❖ Upgrading of old private man-made slopes

- Safety screening of private slopes and issue Dangerous Hillside Orders where needed
- Proactive advisory service to private owners

Risk from Old Slopes

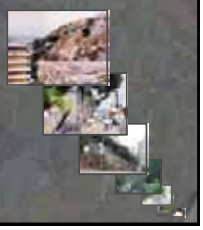
About half of the risk derives from 10% of the slope population



➔ Upgrading a small proportion of old slopes would result in a major risk reduction

➔ Point to the importance of a risk-based ranking system for prioritising landslide preventive actions

➔ Formulate risk reduction target (by 2010, half the risk in 2000)



TARGETS OF REDUCING LANDSLIDE RISK FROM OLD MAN-MADE SLOPES

Landslide Risk

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Enhance the Stability of Old Man-made Slopes

❖ Promote slope maintenance

- Encourage private owners to maintain their slopes
  - Model Slope Maintenance Plan and training video
  - Layman's Guide to Slope Maintenance
  - Leaflets on slope maintenance

Enhance the Stability of Old Man-made Slopes

❖ Promote slope maintenance

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Enhance the Stability of Old Man-made Slopes

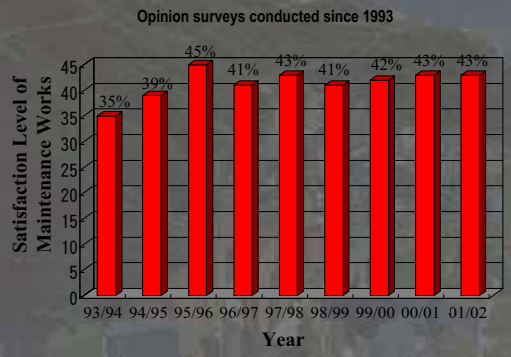
❖ Promote slope maintenance

Enhance the Stability of Old Man-made Slopes

❖Promote slope maintenance

- Encourage private owners to maintain their slopes
  - **Seminars**
  - **Internet training course**

Slope Maintenance Works by Private Owners



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Enhance the Stability of Old Man-made Slopes

❖Providing information services

- **Provide comprehensive slope information for free public access on the Internet (http://hkss.cedd.gov.hk)**

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Enhance the Stability of Old Man-made Slopes

❖Providing information services

- **Provide information on slope maintenance responsibility by Lands Department from their Systematic Identification of Maintenance Responsibility of Slopes (SMRIS) on the Internet (http://www.slope.landsd.gov.hk/smris/)**

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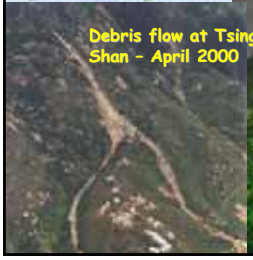
Natural Terrain Landslide Risk Management

Mitigate Natural Terrain Landslide Risk

>60% area - Natural terrain

Debris flow at Tsing Shan - April 2000



Natural terrain landslide at Lei Pui Street, Kwai Tsing - September 2001

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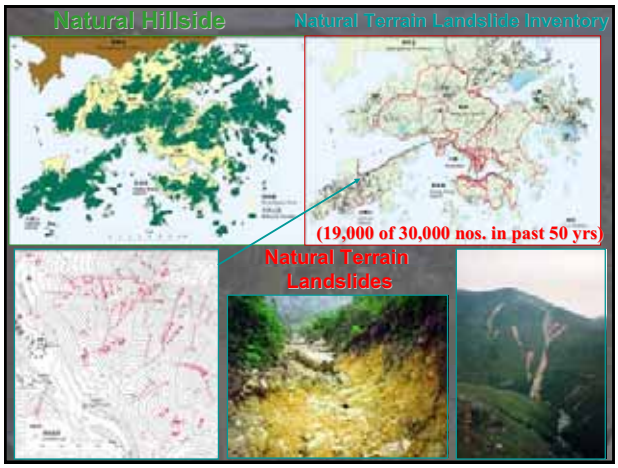

Recent Advances in Natural Terrain Risk Management

- Enhanced understanding of failure mechanisms
- Rationalisation of natural terrain risk management strategy
- Development of new tools for natural terrain hazard studies
- Availability of practical solution for risk mitigation

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Risk Management Strategy

	New development (control risk increase)	Existing development (reduce risk; fix it before too late)
Man-made slopes (1970's)	Design and check new slopes	Retro-fitting (e.g. LPM)
Natural hillside (2000's)	NTHS for new development	React to 'known' hazards

NTHS = natural terrain hazard study

Current Practice in Managing Natural Terrain Risk to As Low As Practically Achievable

Existing development

... 'react-to-known-hazard'

New development

... contain overall risk increase

Continuing development of practice from experience gained and technical advances

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Approaches of NTHS (SPR 5/2000)

Approach	Design Concept	Guidance
Factor of Safety (FOS)	Study stability of hillside and design any slope stabilization measures to meet the required FOS (prevent failure)	Geotechnical Manual for Slopes
Quantitative Risk Assessment (QRA)	Assess risk to development site and determine any risk mitigation measures based on risk guidelines (control risk)	GEO Report No. 75
Design Event Approach (DEA)	Study landslide hazards and determine the design event and any mitigation measures (control risk)	SPR 1/2002 NTHS guidelines

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Screening for New Developments (Planning and Land Disposal Stage)

'In-principle objection' to new development subject to severe hazard

35°

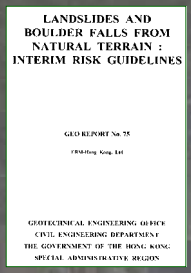
'Alert' Natural Terrain Hazard Study required for new development that may be affected by NT hazard

20°

and ≤ 50 m from ground ≤ 15° steep

* with case-by-case consideration/judgement

Technical Guidelines & Professional Practice

Natural Terrain Hazard Study	Risk Guidelines	Design of Debris Barriers
	 LANDSLIDES AND BOULDER FALLS FROM NATURAL TERRAIN : INTERIM RISK GUIDELINES	 REVIEW OF NATURAL TERRAIN LANDSLIDE DEBRIS-RESISTING BARRIER DESIGN
SPR 1/2002 (GEO Rpt No. 138)	GEO Rpt No. 75	GEO Rpt No. 104

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Advances in Digital Technologies Open up Opportunities in Systematic Management of Natural Terrain Landslide Hazards

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Minimise Damage Caused by Landslides

❖Improving the safety of squatters

- Clear squatters on slope safety grounds
  - some 75,000 squatters cleared and rehoused

Landslides Affecting Squatters

Before Clearance

After Clearance

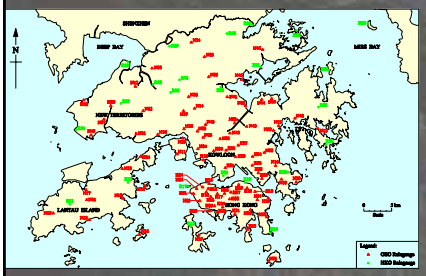
Landslides Affecting Squatters at Lei Yue Mun Village

Minimise Damage Caused by Landslides

- Issue Landslip Warnings in times of heavy rain and post warning signs

- Provide Landslide Emergency Service

Automatic Raingauges



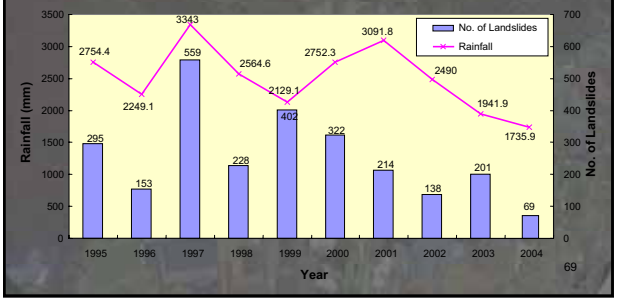
Locations of 110 Nos. of Raingauges

Automatic Raingauges

Communication of Severity of Rainstorms

Annual rainfall does not reflect the true picture of landslide potential - Misleading message to the public !

Rainfall and Landslides from 1995 to 2004



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Communication of Severity of Rainstorms

Landslide Potential Index (LPI) may help us to communicate with the public about the severity of a rainstorm in terms of its potential to cause landslides.

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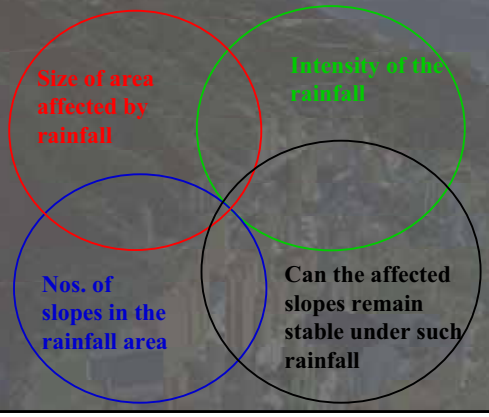
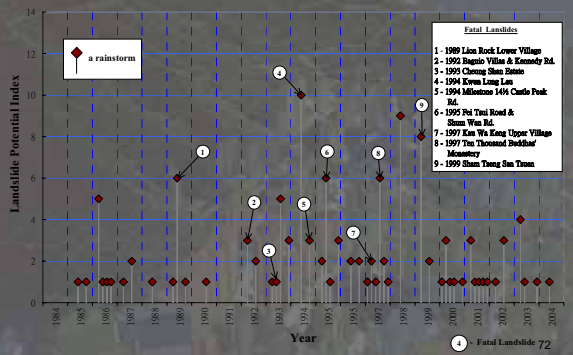
Landslide Potential is a Function of 4 Factors



Communication of Severity of Rainstorms – Landslide Potential Index



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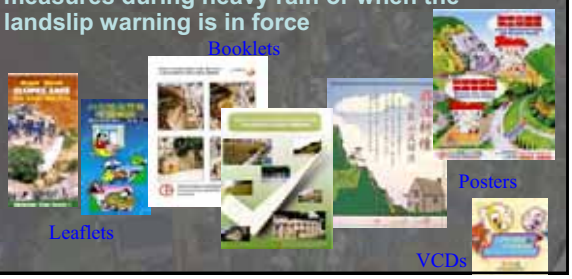
Launch Public Education & Publicity on Slope Safety

- To remind slope owners their responsibility of slope maintenance
- To educate the public on proper precautionary measures during heavy rain or when the landslip warning is in force



Launch Public Education & Publicity on Slope Safety

Public Education on Slope Safety – Exhibitions


Roving Exhibition


Landslide History Exhibition

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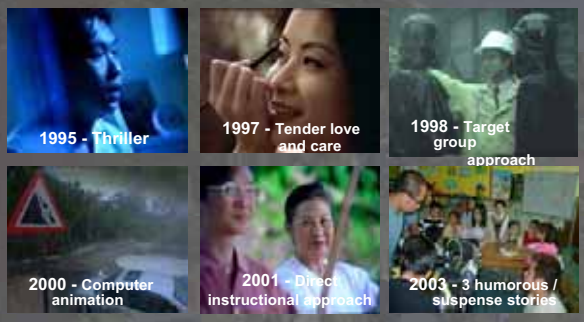
Publicity of Landslide Risk & Importance of Slope Maintenance through TV - API



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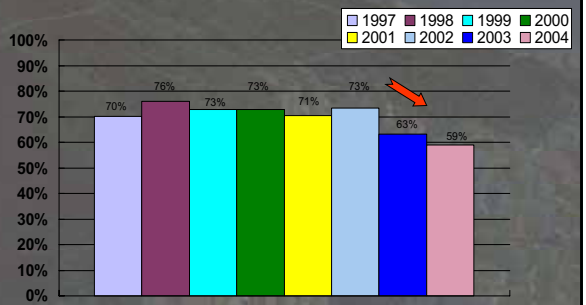
Concern on Slope Safety



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Rolling Annual Public Education Campaign "Safer Living – Reducing Natural Disasters"

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"Safer Living – Reducing Natural Disasters"
Exhibition of Natural Disasters to Raise Awareness

Enhance the Appearance of Slopes

Enhance the Appearance of Slopes

Examples of Shotcreted Slopes

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Newspaper Articles on Slope Appearance in Late 1990s

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Government Policy

To make man-made slopes look as natural as possible to reduce their visual impact and improve the environment.

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Works Bureau Technical Circulars

- WBTC No. 25/93 - Control of Visual Impact of Slopes
  - Contain policy guidance and design principles of slope works on control of visual impact of man-made slopes
- WBTC No. 17/2000 - Improvement to the Appearance of Slopes
  - Outlines the principles and procedures for improving slope appearance
  - Government departments involved in slope works are required to set up Vetting Committees on Slope appearance to control the use of shotcrete
- WBTC No. 14/2002 - Management and Maintenance of Natural Vegetation and Landscape Works, and Tree Preservation
  - Defines the management and maintenance responsibilities for natural vegetation and landscape works on slopes amongst others

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Initiatives

- Technical and administrative guidelines
- Promoting studies of greening technology
- LPM slopes - Targets and Measures

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Technical and Administrative Guidelines

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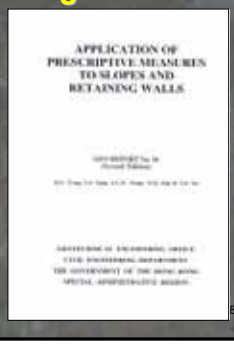
GEO Report No. 56, 2nd Edition (1999) - Application of Prescriptive Measures to Slopes and Retaining Walls

- Contain guidelines on prescriptive use of vegetation cover to soil cut slopes up to 55°



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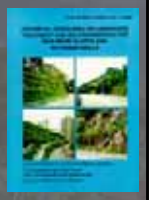
Changes in Local Practice

- ❑ Engagement of landscape specialists at design/construction stages of slope works
- ❑ A comprehensive technical guidelines published
- ❑ Policy Pledge to landscape Government slopes
- ❑ Layman's Guide to Landscape Treatment published

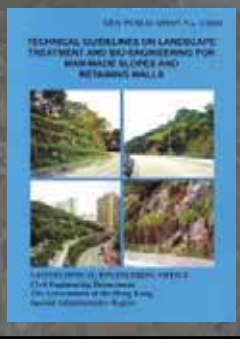
ADHOC → SYSTEMATIC INPUT



GEO Publication No. 1/2000

Technical Guidelines on Landscape Treatment and Bio-engineering for Man-made Slopes and Retaining Walls

- Provide guidance on good practice for landscape treatment and bio-engineering for man-made slopes and retaining walls
  - design process
  - landscape design principles
  - worked examples
  - technical details
- Aim for use by professionals



Technical Guidelines

GEO Publication No. 1/2000

Technical Guidelines on Landscape Treatment and Bio-engineering for Man-made Slopes and Retaining Walls

- Won a Silver Award under "Planning/Research" category and the Grand Award in the "Outstanding Green Project Awards 2000"

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Layman's Guide to Landscape Treatment

93

Common Methods of Vegetating Slopes

- 0 - 35°
- 35 - 45°
- 45 - 55°
- 55 - 60°
- 60 - 90°
- 90°

Highway Slope Manual (2000)

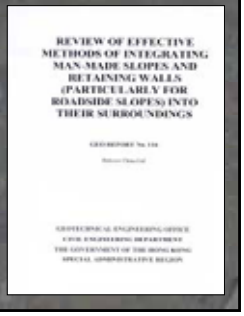
- Give guidance on good practice on planning, investigation, design, construction and maintenance of highway slopes
- Cover not only engineering aspects but also landscape aspects of slope design

95

GEO Report No. 116 (2001)

Review of Effective Methods of Integrating Man-made Slopes and Retaining Walls (Particularly for Roadside Slopes) into Their Surroundings

- Present a review of local and international practice into reduction of visual impact of slopes
- Give administrative and technical recommendations and proposals for further research



Special Project Report SPR 4/2002
Guidelines on Safe Access for Slope Maintenance

- Present guidelines on the design of safe access for slope maintenance, taking into consideration visual quality amongst other aspects

(GEO Rpt No. 136)

97

Various New Planting Techniques Are Used for Greening Steep Slopes

- Erosion control mat with steel wire mesh
- Mulching
- Grass in holes on shotcreted slope
- Soil-filled panels
- Fibrous soil
- Planter-grillage system, etc.

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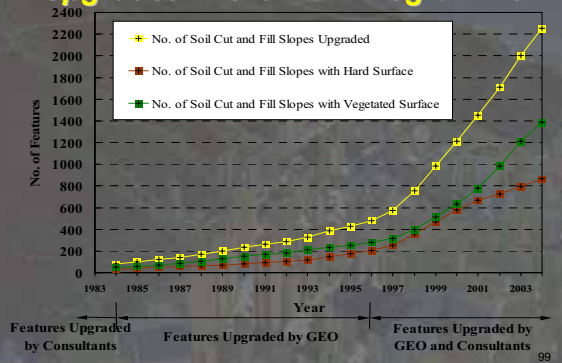
Surface Cover of Soil Cut & Fill Slopes Upgraded in the LPM Programme



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Media and Public Appreciation of Improvement in Greening Slopes

Public Opinion

- Public opinion survey in 2004
  - 65% satisfied with slope appearance
- Survey with District Councils (July 2002)
  - 63% neither satisfied nor dissatisfied with slope appearance
  - 31% quite satisfied with slope appearance
  - Slope greening should be further promoted

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Promoting Studies in Greening Technology

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Greening Technology

- Performance Assessment of Greening Techniques and Vegetation Species on Slopes
- Trial Planting of Native Shrubs on Steep Slopes

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Performance Assessment of Greening Techniques and Vegetation Species on Slopes

(August 2002 - December 2003)

- **Task 1 - Assessing the performance of greening techniques**
  - Common Database on Greening Techniques
  - Inspect 100 slope features
  - Assess the performance
- **Task 2 - Assessing the performance of vegetation species**
  - Inspect 20 slope features
  - Assess the performance of both planned species and unplanned species, aiming to identify a list of vegetation species that are self-sustaining on steep slopes

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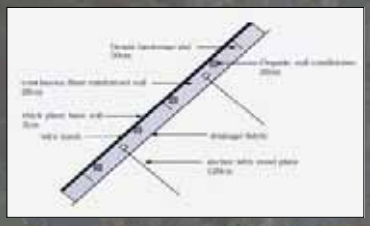
Performance Assessment of Greening Techniques on Slopes

Greening product : Geofiber

- A kind of Fiber Reinforced Soil method based on continuous fiber soil reinforcement technology
- Can be applied to slopes with gradient up to 70°



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Performance Assessment of Greening Techniques on Slopes

Greening product : Geofiber

Feature 11SW-B/C 24 at Stubb's Road

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Performance Assessment of Vegetation Species on Slopes

A well-vegetated slope

Feature 11NW-A/C56 at Ching Cheung Road

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Performance Assessment of Vegetation Species on Slopes

108

Trial Planting of Native Shrubs on Steep Slopes (July 2001 - July 2006)

- Undertake trial planting of 8 native shrub species on 2 steep (55°) soil slopes in collaboration with the Kadoorie Farm and Botanic Garden
- Aim to study
  - Growth of native shrubs
  - Natural succession of plants
  - Effect of surface protection provided by native shrubs
- Shrubs having a lower risk of uprooting are more suitable for planting on steep slopes
- Native species are beneficial for ecological enhancement
- Species selected are hardy
- The survival and growth rate of the shrubs are satisfactory so far

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Trial Planting of Native Shrubs on Steep Slopes

Trial site : Yuen Tun at Tai Lam Country Park

Condition in August 2001

Condition in 2005

Trial Planting of Native Shrubs on Steep Slopes

Shrub planting

Vegetation monitoring

Trial site : Yuen Tun at Tai Lam Country Park

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Trial Planting of Native Shrubs on Steep Slopes


Psychotria asiatica
(Wild Coffee 山大刀)


Melicope pteleifolia
(Evodia 三桠苦)


Litsea rotundifolia
(Long-leaf Litsea 豺皮樟)


Schefflera octophylla
(Ivy Tree 鵝掌木)

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Trial Planting of Native Shrubs on Steep Slopes


Gordonia axillaris
(Gordonia 大頭茶)


Zanthoxylum avicennae
(Prickly Ash 簕欓)


Ardisia crenata
(Hilo Holly 大羅傘)


Rhaphiolepis indica
(Hong Kong Hawthorn 車輪梅)

113

Special Project Report SPR 6/2004
Performance Assessment of Greening Techniques on Slopes

- Present findings on performance of various greening techniques applied on 100 slopes.
- Recommend improvements to different areas on the application of the greening techniques.

(GEO Rpt No. 183)

Special Project Report SPR 7/2004

Identification of Suitable Vegetation Species for Use on Man-made Slopes

- Present findings on the planting trial of 8 native small tree and shrub species at Yuen Tun.
- Present findings of the performance assessment of vegetation species on 20 well-vegetated cut slopes.
- Recommend a list of native vegetation species that have been proven successful and reliable.

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GEO Technical Guidance Note No. 20

Updating of GEO Publication No. 1/2000 – Technical Guidelines on Landscape Treatment and Bio-engineering for Man-made Slopes and Retaining Walls

- **Supplement the guidelines given in the GEO Publication No. 1/2000 in respect of the use of new greening techniques and selection of suitable vegetation species.**

LPM Slopes - Targets and Measures

117

Annual Targets since 2002

- **To landscape all the 250 slopes upgraded under the LPM Programme**
- **At least 70% of the LPM slopes upgraded to have vegetation cover**

118

Measures

- **Include landscape treatment as an integral part of slope upgrading works**
  - Cost of landscape works is 10-20% of cost of slope upgrading works
  - Cost of greening works is comparable to cost of hard surfacing covers
- **Engage landscape consultants**
- **Establish the posts of a Landscape Architect and a Field Officer**
- **Organise training courses for professional staff and site staff**
- **Publicise the best landscaped feature of the month**

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Examples of Good Landscaped Features

- **Cut slopes**
  - 11NW-B/C 121 at Lung Ping Road, Sham Shui Po
- **Fill slopes**
  - 11NE-D/FR 284 at Ma Yau Tong, Sai Kung
- **Rock slopes**
  - 11SE-C/C 161 at Mt. Parker Road
- **Retaining walls**
  - 11SW-A/R 159 at Conduit Road
  - 7SE-C/R 88 at Ngau Pei Sha New Village, Shatin

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Cut Slopes

Before works

After works
- Cutting back
- Soil nails
- Hydroseeding and shrub planting
- Toe planter

Feature 11NW-B/C121 at Lung Ping Road, Sham Shui Po

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Fill Slopes

Before works

After works
- Retaining wall
- Rock fill compaction
- Hydroseeding and shrub planting

Feature 11NE-D/FR284 at Ma Yau Tong, Sai Kung

122

Rock Slopes

Before works

After works
- Rock slope stabilisation
- Buttress wall
- Artificial rock

Feature 11SE-C/C161at Mt. Parker Road

123

Retaining Walls

Before works

After works
- Soil nails
- Preservation of wall tree
- Retention of original wall appearance

Feature 11SW-A/R 159 at Conduit Road

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Retaining Walls

Before works

After works
- Skin wall and masonry facing
- Toe planters of varying heights

Feature 7SE-C/R88 at Ngau Pei Sha New Village, Shatin

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Ecological Consideration

- A biodiversified vegetation cover is ecologically stable and hence more sustainable.
- Efforts are devoted to achieve ecological enhancement on slopes by:
  - Adopting native species for restoring vegetation covers as far as possible
  - Protecting any rare plant species found on or in close proximity to the slopes to be upgraded under the LPM Programme

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Projects Demonstrating Efforts on Ecological Considerations

127

Project 1
Slope Upgrading Works along South Lantau Road between Mui Wo and Pui O, Lantau (December 2001 - Early 2004)

- Involved 24 slope features
- Ecological survey carried out for 12 slope features within Lantau South and Lantau North Country Parks according to EIAO
- Wild orchids classified as locally protected species found on 2 slope features
  - Cages installed to protect the orchids during slope upgrading works
- Original hard surface covers on all slope features replaced by vegetation
- Native species planted to enhance the ecological value of vegetation covers

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Slope upgrading works along South Lantau Road between Mui Wo and Pui O, Lantau

Locations of 24 Slope Features at South Lantau Road

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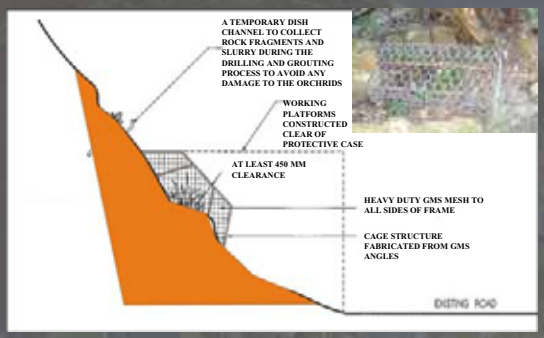
Slope upgrading works along South Lantau Road between Mui Wo and Pui O, Lantau



Measures for Protecting Wild Orchids

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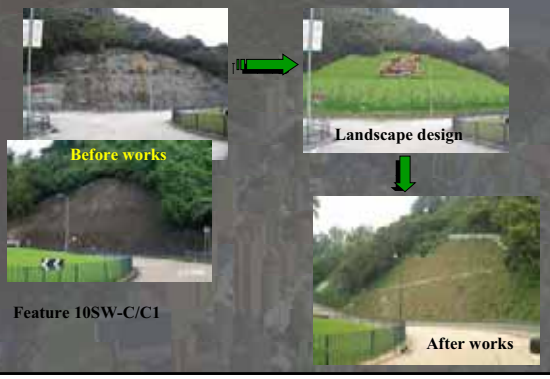
Slope Upgrading Works along South Lantau Road between Mui Wo and Pui O, Lantau



Feature 10SW-C/C1

Slope Upgrading Works along South Lantau Road between Mui Wo and Pui O, Lantau

Feature 10SW-C/FR70

Slope Upgrading Works along South Lantau Road between Mui Wo and Pui O, Lantau

Feature 10SW-C/C165

After works

Project 2

Slope Upgrading Works along Keung Shan Road and South Lantau Road near Shek Pik Reservoir, Lantau

(March 2003 - Early 2005)

- Involved 9 slope features
- Ecological survey carried out for these 9 slope features, all within Lantau South Country Park, according to EIAO
- Chinese New Year flower (*Enkianthus quinqueflorus*) classified as locally protected species found on a slope feature at Keung Shan Road
  - Those not affected to be protected by chain link fence
  - Those affected to be transplanted by specialist landscape contractor
- Original hard surface covers on 5 slope features replaced by vegetation
- Native species planted to enhance the ecological value of vegetation covers

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Slope Upgrading Works along Keung Shan Road and South Lantau Road near Shek Pik Reservoir, Lantau

Locations of 7 Slope Features at South Lantau Road

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Slope Upgrading Works along Keung Shan Road and South Lantau Road near Shek Pik Reservoir, Lantau

Locations of 2 Slope Features at Keung Shan Road

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Slope Upgrading Works along Keung Shan Road and South Lantau Road near Shek Pik Reservoir, Lantau

Chinese New Year Flower (*Enkianthus quinqueflorus*)

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Slope upgrading works along Keung Shan Road and South Lantau Road near Shek Pik Reservoir, Lantau

Feature 13NE-A/C108 at South Lantau Road

Landscape design

After works


Questions?
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