

# Layman's Guide to Slope Maintenance



Geotechnical Engineering Office  
Civil Engineering and Development Department

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# **Layman's Guide to Slope Maintenance**

**Geotechnical Engineering Office  
Civil Engineering and Development Department  
The Government of the Hong Kong  
Special Administrative Region**

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In Hong Kong, copies may be directly obtained from **District Offices**.

## Foreword

All man-made slopes, retaining walls and natural terrain hazard mitigation measures (hereafter referred to as “mitigation measures”, e.g. rigid barriers and flexible barriers) need regular maintenance, including those designed and constructed to acceptable standards. Under the climatic conditions of Hong Kong, slopes, retaining walls or mitigation measures that are not properly maintained will deteriorate with time and may become unstable and prone to collapse, causing injuries to persons, damages to properties and disruptions to normal life. These incidents will cause suffering to the public, and property owners may also incur significant expenses to repair the collapsed slopes, retaining walls or mitigation measures.

The Code of Practice on Building Management and Safety produced in accordance with Section 44(1)(b) of the Building Management Ordinance (Chapter 344) stipulates that any slope, retaining wall or mitigation measure for which owners of the building are responsible shall be maintained in a state of good condition in accordance with “Geoguide 5 – Guide to Slope Maintenance” (hereafter referred to as “Geoguide 5”) published by the Geotechnical Engineering Office of the Civil Engineering and Development Department. This Layman’s Guide (an abridged version of Geoguide 5) advises the general public on how to maintain slopes, retaining walls and mitigation measures, and provides very useful information and guidelines for property owners, owners’ associations and property managers to discharge their slope maintenance duties as stipulated under the Code of Practice.

This document and the more comprehensive Geoguide 5 were first published in 1995. Since promulgation of both documents, slope maintenance has been implemented in a more systematic manner for slopes, retaining walls and mitigation measures. We will regularly review the standards and requirements for slope maintenance and periodically update the content of Geoguide 5 with accumulation of our experiences. In response to the newly added guidelines on maintaining mitigation measures published in Geoguide 5, we have made the corresponding revisions to this edition of Layman’s Guide.

For more detailed guidance on slope maintenance, readers may refer to Geoguide 5.



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March 2026

## Contents

	Page No.
Foreword	3
Contents	4
List of Tables	7
List of Figures	8
List of Plates	9
1 Introduction	10
1.1 Purpose and Scope	10
1.2 Maintenance Responsibility	10
2 Maintenance Management	12
2.1 Maintenance Management Actions	12
2.2 Maintenance Manuals	17
2.3 Maintenance Records	17
3 Maintenance Requirements for Man-made Slopes and Retaining Walls	18
3.1 Routine Maintenance	18
3.1.1 Routine Maintenance Inspections	18
3.1.2 Frequency and Timing of Routine Maintenance Inspections	20
3.1.3 Personnel for Routine Maintenance Inspections	20
3.1.4 Routine Maintenance Works	20
3.1.5 Need for Immediate Engineer Inspections for Maintenance	20
3.1.6 Records of Routine Maintenance	21
3.2 Engineer Inspections for Maintenance	24
3.2.1 General	24
3.2.2 Frequency of Engineer Inspections	24
3.2.3 Personnel for Engineer Inspections	24

	Page No.	
3.3	Regular Checks of Buried Water-carrying Services	24
3.3.1	General	24
3.3.2	Frequency for Regular Checks of Buried Water-carrying Services	25
3.3.3	Methods for Checking Buried Water-carrying Services	25
3.3.4	Repairs of Services	25
3.3.5	Records of the Checks	25
3.4	Access and Safety Precautions	25
3.5	Regular Monitoring of Special Measures	26
3.5.1	Need for the Monitoring	26
4	Maintenance Requirements for Natural Terrain Hazard Mitigation Measures	28
4.1	General	28
4.2	Routine Maintenance Inspections for Mitigation Measures	29
4.3	Frequency of Routine Maintenance Inspections	30
4.4	Engineer Inspections for Maintenance of Mitigation Measures	30
4.5	Special Follow-up Review for Mitigation Measures Involving Flexible Barriers	31
4.6	Other Measures	34
5	Technical Aspects of Maintenance for Natural Terrain Hazard Mitigation Measures	35
5.1	Clearance of Landslide Debris Accumulated behind Mitigation Measures	35
5.2	Provision of Drainage Works for Natural Terrain Hazard Mitigation Measures	35
5.3	Effect of Trees on Flexible Barriers	36
5.4	Corrosion of Steel Components in Flexible Barriers	37
6	Sources of Information	39
6.1	Information Providers	39
6.2	Documents	40
7	References	42

	Page No.
Appendix A: Record Sheet Templates for Routine Maintenance Inspections and Works	43
Appendix B: Model Brief for Engineer Inspections for Maintenance for Private Slopes	49
Appendix C: Record Sheet Templates for Routine Maintenance Inspections and Works for Natural Terrain Hazard Mitigation Measures	56

**List of Tables**

Table No.		Page No.
3.1	Typical Routine Maintenance Works for Slopes and Retaining Walls	22

**List of Figures**

Figure No.		Page No.
3.1	Typical Man-made Items on Slopes and Retaining Walls that Require Maintenance	19

**List of Plates**

Plate No.		Page No.
2.1	Well-maintained Slope Surface Cover	13
2.2	Poorly-maintained Slope Surface Cover	14
2.3	Well-maintained Surface Drainage Measures	15
2.4	Poorly-maintained Surface Drainage Measures	16
3.1	Abnormal Features	23
3.2	Examples of Access for Slope Inspection and Maintenance	27
4.1	Examples of Natural Terrain Hazard Mitigation Measures	29
4.2	Examples of Major Defects and Anomalies Requiring Special Follow-up Review for Flexible Barriers	32
4.3	Examples of Severely Rusted Components Requiring Special Follow-up Review for Flexible Barriers	33
5.1	Examples of Landslide Debris Accumulated behind Mitigation Measures	35
5.2	Tree Intermingling with Principal Net of Flexible Barrier	36
5.3	Examples of Minor Rusting without Implication to Structural Performance of Flexible Barriers	38

# 1 Introduction

## 1.1 Purpose and Scope

To prevent deterioration caused by prolonged lack of maintenance of slopes, retaining walls and natural terrain hazard mitigation measures (hereafter referred to as “mitigation measures”, e.g. rigid barriers and flexible barriers), and to maintain their functions, owners are required to arrange regular inspections and maintenance for these facilities. This guide, an abridged version of Geoguide 5 – Guide to Slope Maintenance (hereinafter referred to as “Geoguide 5”) (GEO, 2023), aims to help private owners and property management personnel understand how to carry out maintenance inspections for these facilities, so that they can better fulfil their maintenance responsibilities. It also outlines the necessary maintenance inspections and works for keeping these facilities in good condition.

Maintenance inspections are sub-divided into five categories:

- (a) Routine Maintenance Inspections – carried out by any responsible person with no professional geotechnical knowledge;
- (b) Engineer Inspections for Maintenance – carried out by a professionally qualified geotechnical engineer;
- (c) Regular Checks of Buried Water-carrying Services – carried out by a specialist leakage detection contractor;
- (d) Regular Monitoring of Special Measures – carried out by a firm with special expertise in the particular type of monitoring service. Such monitoring is only necessary where long-term slope stability relies on specific measures that become less effective with time; and
- (e) Special Follow-up Review for Flexible Barriers – carried out by a professionally qualified geotechnical engineer. This review is only necessary when major defects or anomalies are identified.

This document provides general guidance on the requirements for the above five types of maintenance inspections. Reference should be made to Geoguide 5 for detailed recommendations and technical guidance on maintenance inspections and works carried out by professionally qualified geotechnical engineers, specialist leakage detection contractors, or other specialist firms.

## 1.2 Maintenance Responsibility

According to the Code of Practice on Building Management and Safety (HAD, 2018) produced in accordance with the Building Management Ordinance, owners are responsible for properly maintaining the slopes, retaining walls or mitigation measures under their

responsibility in accordance with Geoguide 5 published by the Geotechnical Engineering Office of the Civil Engineering and Development Department, to ensure they remain in good condition.

Ownership is granted by a lease document issued by the Lands Department, such as a government lease or conditions of grant, conditions of sale, and conditions of exchange. These lease documents and records of owners are available to the public at the Land Registry. It should be noted that the lease document may include a clause (with a site plan attached) relating to maintenance responsibility for an area outside the lot boundary. Sometimes, owners may also be accountable for maintenance of land adjoining their lot even if it is not stated in the lease document as they have previously carried out some works in that nearby area. For example, their action of cutting into the adjoining land to create flat ground or a path could make them liable for maintaining the slopes under common law. There may also be a Natural Terrain Clause in the lease document, which requires the owners to study the landslide hazards originating from natural terrain outside the lot boundary, construct and maintain mitigation and stabilisation measures protecting the development. Details of the mitigation measures constructed and their maintenance requirements are usually documented in the Natural Terrain Hazard Mitigation and Stabilisation Works Plan registered in the Land Registry by the developer.

Private owners, including flat owners in multi-storey buildings, should carefully examine the lease documents when purchasing property to confirm their maintenance responsibilities. Where needed, legal or professional advice should be sought from lawyers or estate surveyors on the interpretation of maintenance responsibilities in the lease.

The Geotechnical Engineering Office keeps a Catalogue of Slopes that registers sizeable slopes, retaining walls and mitigation measures in Hong Kong. Up-to-date information is available in the Slope Information System on the “Hong Kong Slope Safety” website (<https://hkss.cedd.gov.hk>).

The Lands Department also provides a Slope Maintenance Responsibility Information System (SMRIS), an online tool that helps the public quickly identify the owner or party responsible for maintenance of registered slopes, retaining walls and mitigation measures. The SMRIS can be accessed at <https://www.slope.landsd.gov.hk/smrisk/>.

## **2 Maintenance Management**

### **2.1 Maintenance Management Actions**

A slope or retaining wall that is not properly maintained will deteriorate with time and may become unstable and prone to collapse, causing injuries to persons, damages to properties and disruptions to normal life. If a landslide occurs, owner or party responsible for maintenance may have to pay substantial repair cost. Examples of well-maintained and poorly-maintained slopes and retaining walls are shown in Plates 2.1 to 2.4. Similarly, maintenance of mitigation measures is necessary to ensure their performance.

Owners or parties responsible for maintenance should arrange regular maintenance inspections and works. This can be done either by the owners themselves or through an agent. For single owner, arranging such maintenance is fairly straightforward. For owners of individual flats in a multi-storey building, maintenance action should be arranged by the Owners' Corporation, on behalf of the individual owners, usually through a property management company. The Building Management Ordinance requires the Owners' Corporation to properly maintain the common parts of a building, which include slopes, retaining walls and mitigation measures. The Deed of Mutual Covenant, which is registered in the Land Registry, defines the rights, interests and obligations of owners among themselves, including the obligations of the owners, property managers and other parties towards maintenance of man-made slopes.

If slopes, retaining walls or mitigation measures have not been properly maintained previously, the owner or party responsible for maintenance should take the following actions:

- (a) Start Routine Maintenance Inspections and then carry out the necessary maintenance works;
- (b) Arrange the first Engineer Inspection for Maintenance for slopes and retaining walls as soon as possible, particularly for those without Maintenance Manuals.

The Government has set up a loan scheme (administered by the Buildings Department) that provides loans to individual owners of private buildings for reinstating or improving safety of their slopes, no matter if the loans are applied for works carried out voluntarily or in compliance with statutory orders including slope repairs, regular slope maintenance or removal of unauthorised building works. Further information about the loan scheme can be obtained from the Buildings Department.



(a) Vegetated Surface



(b) Shotcreted Surface



(c) Chunam Surface

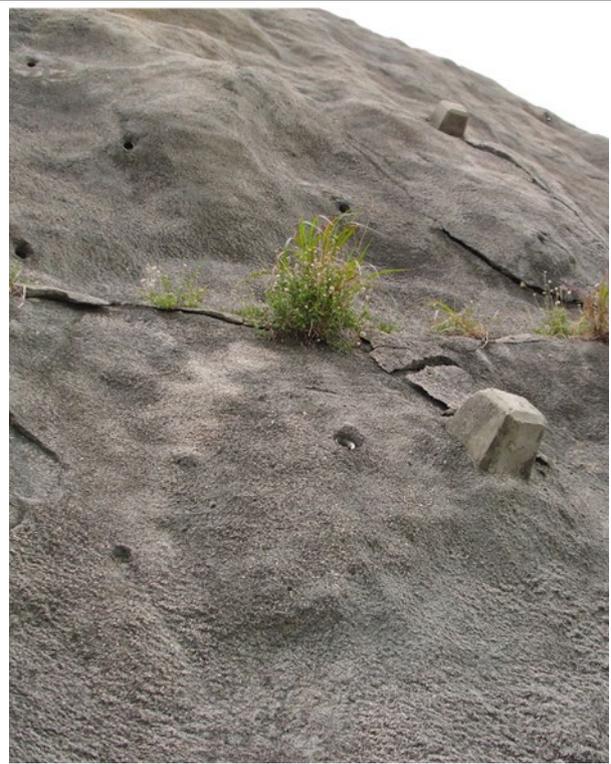


(d) Stone-pitched Surface

**Plate 2.1 Well-maintained Slope Surface Cover**



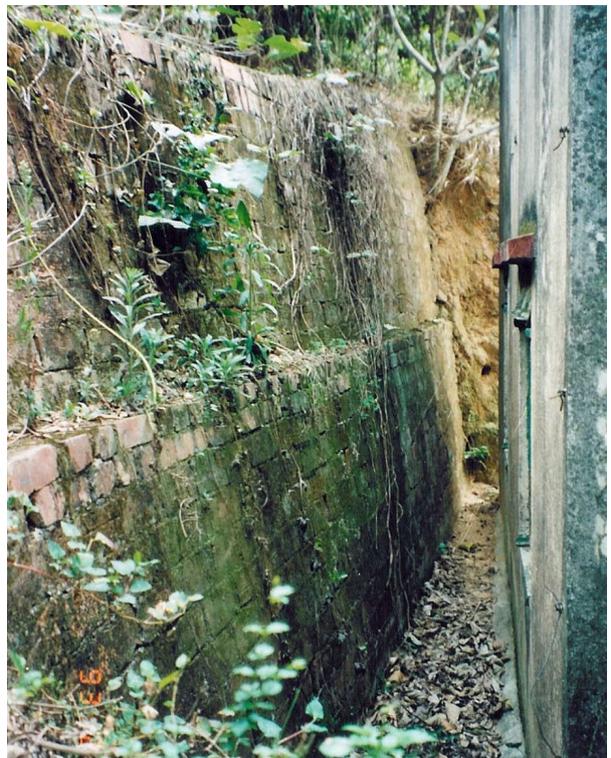
(a) Vegetated Surface



(b) Shotcreted Surface



(c) Chunam Surface



(d) Masonry Facing

**Plate 2.2 Poorly-maintained Slope Surface Cover**



(a) Exposed Down Pipe on Retaining Wall

(b) U-channel along Toe of Slope



(c) U-channel and Catchpit

(d) Stepped Channel

**Plate 2.3 Well-maintained Surface Drainage Measures**



(a) U-channel along Crest of Slope



(b) U-channel along Berm of Slope



(c) Catchpit at Toe of Slope



(d) Catchpit at Crest of Slope

**Plate 2.4 Poorly-maintained Surface Drainage Measures**

## **2.2 Maintenance Manuals**

A Maintenance Manual should be prepared by the engineer who designs the slopes, retaining walls or mitigation measures. If an existing slope, retaining wall or mitigation measure does not have a Maintenance Manual, the engineer responsible for Engineer Inspection for Maintenance or upgrading works should prepare one. Even a Maintenance Manual is available, the engineer should update it as necessary in each Engineer Inspection for Maintenance.

The owner or the party responsible for maintenance needs to carry out regular maintenance inspections and the necessary works as recommended in the Maintenance Manual.

## **2.3 Maintenance Records**

Comprehensive and accurate record-keeping is important for good maintenance management. Maintenance manuals and all records of maintenance inspections and works should be properly kept. It is advisable to keep backup copies of all records apart from the originals. Digitising such records is encouraged to ensure effective record management.

### **3 Maintenance Requirements for Man-made Slopes and Retaining Walls**

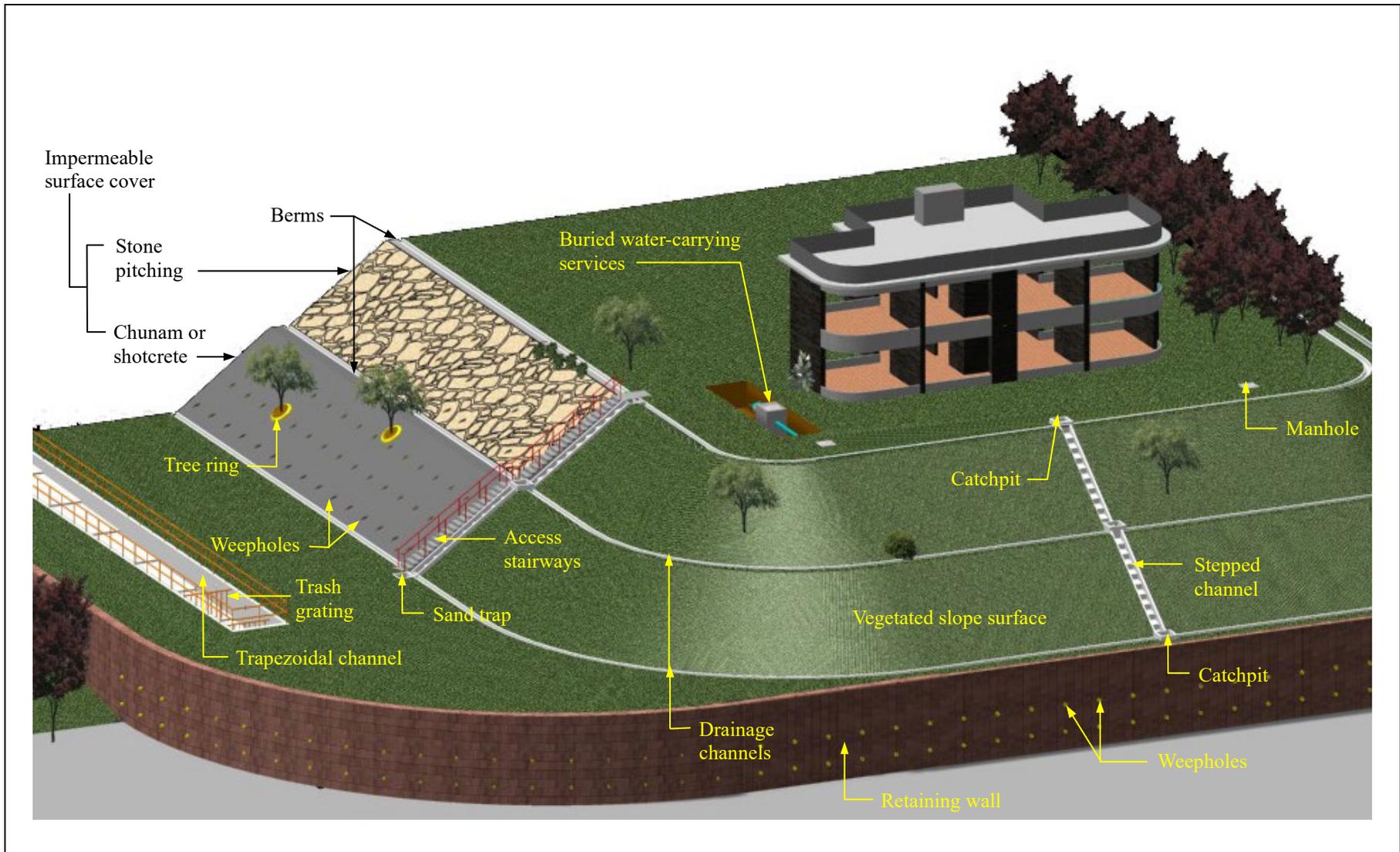
#### **3.1 Routine Maintenance**

##### **3.1.1 Routine Maintenance Inspections**

Typical man-made items on slopes and retaining walls that require maintenance are illustrated in Figure 3.1. Annual Routine Maintenance Inspections for these man-made items are required to ascertain the need for the following repair works:

- (a) clearance of accumulated debris on drainage channels and slope surface;
- (b) repair of cracked or damaged drainage channels or pavement;
- (c) repair or replacement of cracked or damaged slope surface cover;
- (d) unblocking of weepholes and outlet drainpipes;
- (e) removal of vegetation that has caused severe cracking of slope surface cover and drainage channels;
- (f) re-grassing of bare soil slope surface areas;
- (g) repair of missing or deteriorated pointing in masonry walls;
- (h) removal of loose rock fragments and undesirable vegetation on rock slopes or around boulders;
- (i) checking for signs of leakage of buried and exposed water-carrying services and alerting relevant services' owners, maintenance parties or relevant authorities to take prompt actions if signs of leakage are identified (Section 3.3);
- (j) repair or replacement of rusted steel slope furniture; and
- (k) maintenance of landscape items on the slope.

An immediate Engineer Inspection for Maintenance should be arranged if abnormal features on slopes or retaining walls are spotted (Section 3.1.5). If repeated maintenance works are found to be required for a particular aspect, such as repair of cracked drainage channels or surface cover, clearance of severely silted-up drainage channels, or reinstatement of areas with serious erosion, causes of problems should be investigated by a professionally qualified geotechnical engineer.



**Figure 3.1 Typical Man-made Items on Slopes and Retaining Walls that Require Maintenance**

### **3.1.2 Frequency and Timing of Routine Maintenance Inspections**

In general, Routine Maintenance Inspections should be carried out at least once every year for slopes or retaining walls affecting residential buildings/cottages, car parks or roads with heavy vehicular/pedestrian traffic density, etc., and at least once every two years for those affecting lightly used open-air recreation areas, non-dangerous goods storage sites or roads with low vehicular/pedestrian traffic density, etc. Designers or engineers undertaking Engineer Inspections for Maintenance may, where appropriate, specify an inspection frequency different from the above general rules for a slope or retaining wall taking into account its size, stabilisation measures adopted, indirect consequences anticipated in the event of failure and the cost-benefit considerations of the maintenance inspections. Slope owners should follow the recommended frequency to arrange Routine Maintenance Inspections.

It is preferable to carry out Routine Maintenance Inspections between October and February, and complete any required maintenance works before the onset of the wet season in April. In addition, it is a good practice to inspect drainage channels and clear any blockage after a heavy rainstorm.

### **3.1.3 Personnel for Routine Maintenance Inspections**

No professional geotechnical knowledge is required for persons carrying out Routine Maintenance Inspections, therefore property management staff or maintenance personnel can perform such inspections.

### **3.1.4 Routine Maintenance Works**

Typical routine maintenance works are listed in Table 3.1. Most of these works can be carried out by general building or civil engineering contractors. The Buildings Department and District Offices hold a list of Registered Contractors who have indicated their willingness to carry out slope maintenance works for public reference.

Vegetation used for landscaping slopes and retaining walls can usually grow naturally and continuously after the initial establishment period. Therefore, routine maintenance works should be carried out to prevent overgrown vegetation from adversely affecting drainage channels. These works include clearing litter and trimming overgrown vegetation near drainage channels or slope access. For pest and disease control, and tree surgery works, advice from arborists or specialist contractors should be sought. Guidance on the maintenance requirements for landscape items and bioengineering works is given in GEO Publication No. 1/2011: “Technical Guidelines on Landscape Treatment for Slopes” (GEO, 2011) and Layman’s Guide to Landscape Treatment of Slopes (GEO, 2012).

### **3.1.5 Need for Immediate Engineer Inspections for Maintenance**

Particular attention should be given to unusual or abnormal situations such as signs of leakage, spillage or overflow of drainage channels, widening of cracks, settling ground, bulging or distortion of masonry walls, or settlement of the crest platforms during Routine Maintenance

Inspections. Examples of such defects are shown in Plate 3.1. These defects must be reported promptly to the owner or the party responsible for maintenance, who should then appoint a professionally qualified geotechnical engineer to carry out an immediate Engineer Inspection for Maintenance and recommend the necessary actions.

For any change in land use near a slope or retaining wall, the inspection personnel should notify the owner or the party responsible for maintenance, so that they can review whether to change the consequence-to-life category of the slope or retaining wall and also the required frequency of maintenance inspections. Advice should be sought from a professionally qualified geotechnical engineer when needed.

### **3.1.6 Records of Routine Maintenance**

Record sheet templates for Routine Maintenance Inspections and works are shown in Appendix A. The record sheets should be filled out in two stages: after the Routine Maintenance Inspection and after the maintenance works are finished.

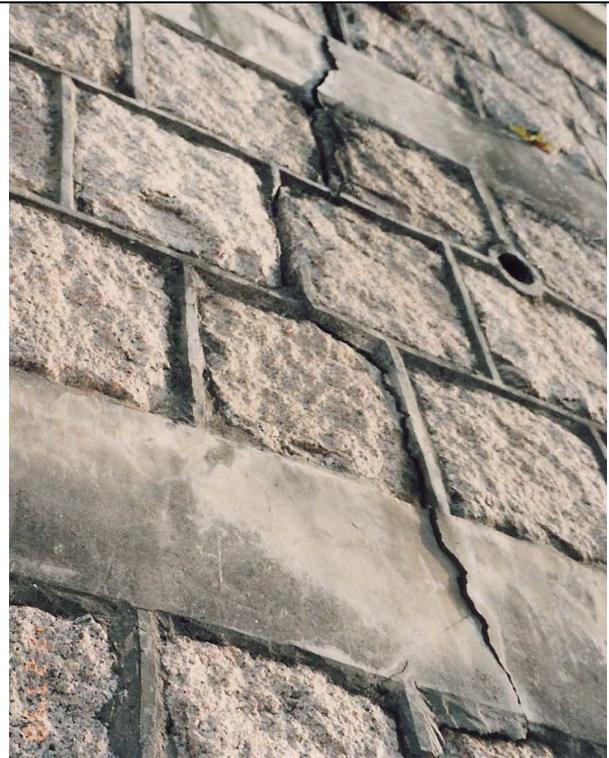
**Table 3.1 Typical Routine Maintenance Works for Slopes and Retaining Walls**

Man-made Item	Typical Maintenance Works Required	Guidance
Surface Drainage Channels, Catchpits and Sand Traps	<ul style="list-style-type: none"> <li>(a) Clear debris, undesirable vegetation and other obstructions.</li> <li>(b) Repair minor cracks with cement mortar or flexible sealing compound.</li> <li>(c) Rebuild severely cracked channels.</li> <li>(d) Replace missing or deteriorated joint fillers and sealant.</li> </ul>	<ul style="list-style-type: none"> <li>(a) Works may be required outside site boundaries to prevent debris from blocking the drainage system.</li> <li>(b) Where large tree roots have damaged drainage channels, appropriate portions of the roots should be removed, taking care not to make the tree unstable. Alternatively, the channels may be realigned.</li> </ul>
Weepholes and Drainage Pipes	<ul style="list-style-type: none"> <li>(a) Clear obstructions (e.g. weeds and debris) in weepholes and pipe ends.</li> <li>(b) Probe with rods for deeper obstructions.</li> </ul>	<ul style="list-style-type: none"> <li>(a) Pipes are prone to being blocked. Leaky or severely blocked pipes should be replaced with drainage channels where possible.</li> </ul>
Impermeable Surface Cover (e.g. chunam and shotcrete)	<ul style="list-style-type: none"> <li>(a) Remove undesirable vegetation.</li> <li>(b) Repair cracks or spalling.</li> <li>(c) Restore and repair eroded areas.</li> <li>(d) Replace surface cover that has detached from the underlying soil.</li> <li>(e) Replace missing or deteriorated joint fillers and sealant.</li> <li>(f) Remove dead, decaying or unstable trees.</li> </ul>	<ul style="list-style-type: none"> <li>(a) Cracked impermeable surface cover should be repaired by cutting a groove along the crack before filling it with a similar slope cover material or a flexible sealant.</li> <li>(b) Surface cover damaged by large tree roots should be replaced with provision of tree rings.</li> <li>(c) Specialist advice may be sought for treating trees. Approval for tree felling should be obtained from relevant authority where necessary.</li> </ul>
Vegetated Surface Cover	<ul style="list-style-type: none"> <li>(a) Restore eroded areas with compacted soil followed by re-planting.</li> <li>(b) Replant vegetation in areas of dead or withered vegetation.</li> <li>(c) Trim overgrown vegetation.</li> <li>(d) Remove dead, decaying or unstable trees.</li> </ul>	<ul style="list-style-type: none"> <li>(a) For shallow erosion that does not affect the function of existing surface drainage channels, the eroded area may be restored without backfilling.</li> <li>(b) Surface erosion may indicate an inadequate drainage system (e.g. Inadequate diversion of concentrated flow on slope surface). Possible sources of concentrated flow should be identified and rectified.</li> <li>(c) Specialist advice may be sought on types of cover or plant species in areas with insufficient sunlight for growing vegetation.</li> </ul>
Rock Slopes and Boulders	<ul style="list-style-type: none"> <li>(a) Repair cracked or spalled concrete surface and support.</li> <li>(b) Remove loose rock fragments.</li> <li>(c) Remove undesirable vegetation.</li> </ul>	<ul style="list-style-type: none"> <li>(a) If tree roots crack the rock along its joints, the tree and its entire stump should be removed. Regrowing of roots should also be prevented by using appropriate methods.</li> </ul>
Facing	<ul style="list-style-type: none"> <li>(a) Re-point deteriorated mortar joints on masonry face.</li> <li>(b) Repair cracked or spalled concrete surface and replace missing or deteriorated joint fillers and sealant.</li> </ul>	<ul style="list-style-type: none"> <li>(a) Continual distress (e.g. widening cracks) of a wall should be reported to the owner or the party responsible for maintenance.</li> </ul>

Note: Safe and efficient access is important for maintenance works.



(a) Tension Crack on Slope



(b) Crack in Retaining Wall



(c) Cracked Chunam Surface



(d) Cracked Surfacing and Wall

**Plate 3.1 Abnormal Features**

## **3.2 Engineer Inspections for Maintenance**

### **3.2.1 General**

A model brief for an Engineer Inspection for Maintenance is provided in Appendix B to help private owners hire such a service. An Engineer Inspection for Maintenance aims to assess the maintenance condition of a slope or retaining wall, evaluate changes in the surrounding environment, review and revise the maintenance action items, and recommend the necessary maintenance works, but not determine if it meets the geotechnical standards specified in the Geotechnical Manual for Slopes (GCO, 1984).

### **3.2.2 Frequency of Engineer Inspections**

The frequency of Engineer Inspections for Maintenance should normally be recommended by the designer in the Maintenance Manual, or as considered appropriate by the engineer appointed to carry out the Engineer Inspections. An Engineer Inspection for Maintenance may also be requested by those who carry out the Routine Maintenance Inspection. In general, the frequency of Engineer Inspections should be once every five years for slopes or retaining walls affecting residential buildings or cottages, car parks or roads with heavy vehicular/pedestrian traffic density, etc., and once every ten years for those affecting lightly used open-air recreation areas, non-dangerous goods storage sites or roads with low vehicular/pedestrian traffic density, etc.

Designers or engineers undertaking the Engineer Inspections may, where appropriate, specify a more or less frequent inspection cycle, taking into account the size of the slope or retaining wall, stabilisation measures adopted and cost-benefit considerations of the Engineer Inspections. Slope owners or the parties responsible for maintenance should arrange Engineer Inspections following the recommended frequency.

### **3.2.3 Personnel for Engineer Inspections**

An Engineer Inspection for Maintenance should be carried out by a professionally qualified geotechnical engineer in Hong Kong. A suitable qualification is Registered Professional Engineer (Geotechnical), information on which can be obtained from the Engineers Registration Board. Where considered necessary, the inspecting engineer should advise the owner or party responsible for maintenance to consult a professionally qualified structural engineer, e.g. a Registered Professional Engineer (Structural), for any suspected structural problems identified during the inspection.

## **3.3 Regular Checks of Buried Water-carrying Services**

### **3.3.1 General**

Leakage from buried water-carrying services (e.g. water supply mains and stormwater drains) not visible on the surface of a slope or retaining wall may adversely affect its stability. Therefore, owners or parties responsible for maintaining these services should arrange Regular Checks of Buried Water-carrying Services, even without observable signs of leakage. If a

ducting system has been provided, regular checks of the ducting system should also be carried out to detect any water ingress or leakage.

Occasionally, water-carrying services owned or maintained by other parties may cross a private lot. The owner of the private lot should grant access to the services' owners to carry out the Regular Checks of Buried Water-carrying Services. Such requirements are sometimes stated clearly in the lease or grant document, such as areas designated as drainage reserves in the lease.

### **3.3.2 Frequency for Regular Checks of Buried Water-carrying Services**

The owners or parties responsible for maintaining water-carrying services should follow the frequency for Regular Checks of Buried Water-carrying Services as recommended in the "Code of Practice on Monitoring and Maintenance of Water-Carrying Services Affecting Slopes" (ETWB, 2006).

### **3.3.3 Methods for Checking Buried Water-carrying Services**

Checking of buried drains, sewers, water pipes, water mains and ducting systems should be carried out by specialist leakage detection contractors. Guidance on methods for checking buried water-carrying services is given in the "Code of Practice on Monitoring and Maintenance of Water-Carrying Services Affecting Slopes" (ETWB, 2006).

### **3.3.4 Repairs of Services**

Any damaged or leaky buried water-carrying services should be repaired without delay. Care should be taken to ensure that any repair works do not impair the hydraulic performance of the pipes.

### **3.3.5 Records of the Checks**

Forms and records for Regular Checks of Buried Water-carrying Services should be designed by the engineer who recommends the regular checks, or by the specialist leakage detection contractor who conducts the regular checks.

## **3.4 Access and Safety Precautions**

Many slopes and retaining walls are both high and steep, and personal safety must be prioritized during inspections. It is a good practice to have at least two people to carry out the maintenance inspections at the same time.

Owners or parties responsible for slope maintenance must provide safe access for maintenance personnel. Guidance on providing safe and visually pleasing access routes that prevent the public from trespassing is given in GEO Report No. 136 titled "Guidelines on Safe

Access for Slope Maintenance” (Lam et al., 2003). Examples of typical access arrangements for the inspection and maintenance of slopes and retaining walls are given in Plate 3.2.

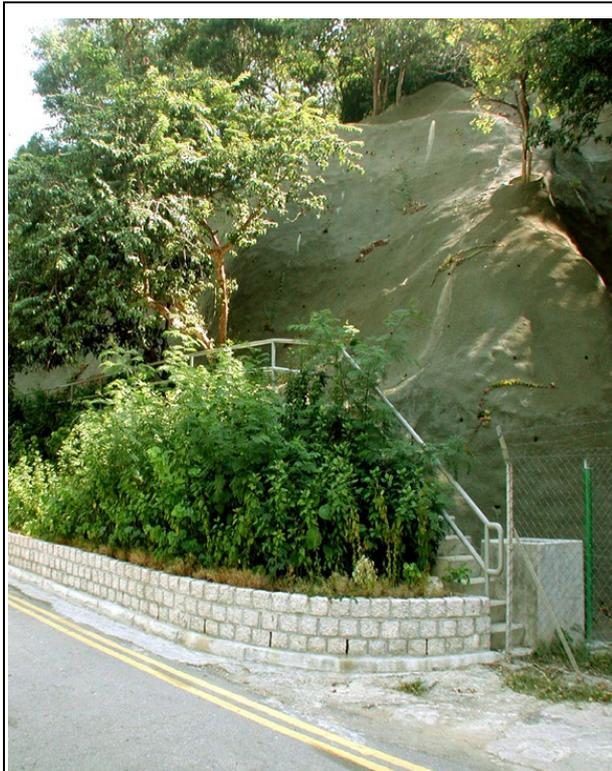
### **3.5 Regular Monitoring of Special Measures**

#### **3.5.1 Need for the Monitoring**

Regular Monitoring of Special Measures is necessary when special measures (e.g. prestressed ground anchors or designed raking drains) are present on slopes or retaining walls. Such requirements are normally established by the designer. Details of the monitoring are specified in a Monitoring Schedule that forms part of the Maintenance Manual. If there is no such Monitoring Schedule in the Maintenance Manual, the owner or party responsible for maintenance should request the engineer undertaking the Engineer Inspections for Maintenance to prepare one.

Regular Monitoring of Special Measures is required to be carried out by specialist firms at the recommended frequency, or more frequently as required. Where the monitoring results exceed the ‘alert levels’ given in the Monitoring Schedule, the owner or the party responsible for maintenance should promptly appoint a professionally qualified geotechnical engineer to implement the stipulated contingency actions and determine whether upgrading works are required. Such events should also be brought to the attention of engineers undertaking subsequent Engineer Inspections for Maintenance.

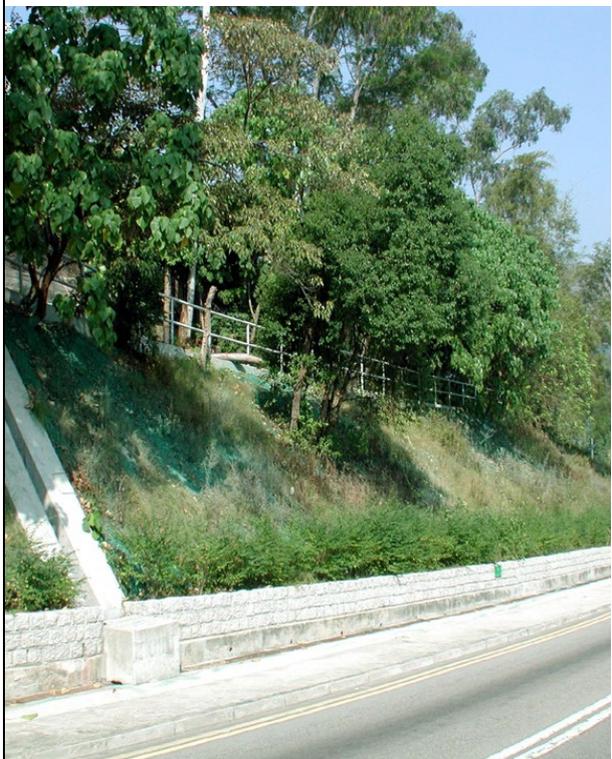
The forms and records for Regular Monitoring of Special Measures should be designed by the designer or the specialist firm that conducts the inspection.



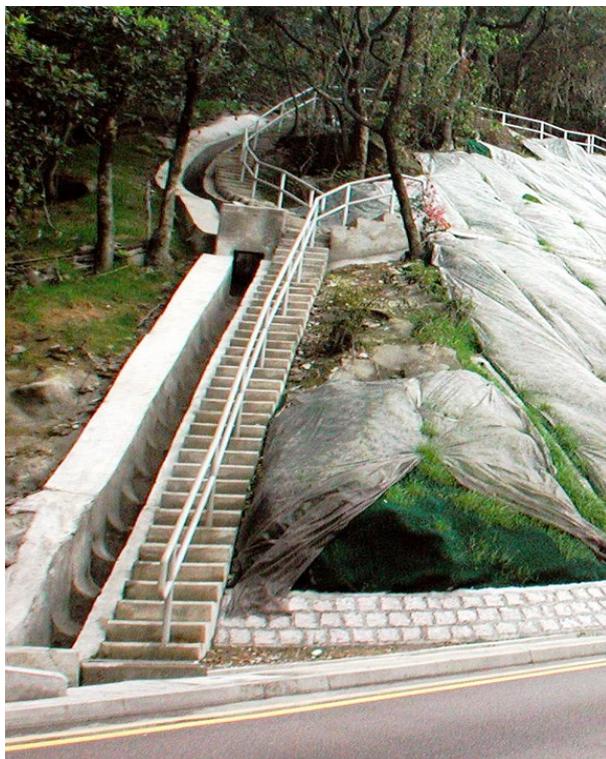
(a) Concealed Access to Stairway



(b) Ladders with Safety Hoops



(c) Fencing Recessed into Vegetated Land



(d) Combined Stepped Channel and Stairway

**Plate 3.2 Examples of Access for Slope Inspection and Maintenance**

## **4 Maintenance Requirements for Natural Terrain Hazard Mitigation Measures**

### **4.1 General**

Natural hillsides do not require maintenance in general, and mitigation measures do not normally result in substantial modification to the geometry and condition of the natural hillsides. If a hillside has been substantially modified by earthworks (e.g. cutting into the hillside), it should be regarded as a man-made slope or retaining wall which should be maintained in accordance with the guidelines given in Chapter 3 for man-made slopes and retaining walls.

The purpose of maintenance for mitigation measures is to ensure their physical integrity and satisfactory performance. The owner or the party responsible for maintaining the mitigation measures is not required to maintain the natural hillsides or review the adequacy of the measures provided.

Common examples of natural terrain hazard mitigation measures include:

- (a) concrete buttresses, soil nails, rock dowels/bolts to prevent failure of a natural hillside (named as Stabilisation Measures in Geoguide 5);
- (b) check dams, earth bunds, concrete baffles, debris/boulders straining structures, rigid barriers and flexible barriers (including boulder fences) to contain landslide debris or boulder fall from the hillside (Plate 4.1) (named as Defence Measures in Geoguide 5).



**Plate 4.1 Examples of Natural Terrain Hazard Mitigation Measures**

#### **4.2 Routine Maintenance Inspections for Mitigation Measures**

Routine Maintenance Inspections of the following mitigation measures to prevent failure of a natural hillside are normally not required unless specified by the designer:

- (a) soil nails,
- (b) rock dowels/bolts, and
- (c) concrete buttresses (excluding those  $\geq 3$  m high affecting and in close proximity to Consequence-to-life Category 1 facilities).

The general principles given for the maintenance of man-made slopes and retaining walls in Chapter 3, and the recommended good practice given in respect of the maintenance management, personnel requirements, attention to safe access and precautions, are also applicable to the maintenance of natural terrain hazard mitigation measures.

Routine Maintenance Inspections for mitigation measures should cover the measures, as

well as the surrounding area and adjoining ground. In general, the inspection should assess the need for carrying out the following maintenance works for man-made items:

- (a) clearing debris from drainage channels, catch trenches and pits, containment basins and straining structures,
- (b) repairing or replacing damaged sections,
- (c) unblocking weepholes and drainage outlets,
- (d) removing any vegetation that has caused severe cracking of channels or hard surfaces,
- (e) repairing or reinstating the ground adjoining the mitigation measures if affected by severe erosion,
- (f) other routine maintenance works to upkeep the integrity and function of the mitigation measures,
- (g) removal of accumulated debris behind mitigation measures (e.g. rigid barriers, flexible barriers and gabion walls), and
- (h) trimming or removal of trees affecting flexible barriers.

Record sheet templates for Routine Maintenance Inspections and works specific to mitigation measures are shown in Appendix C.

### **4.3 Frequency of Routine Maintenance Inspections**

Routine Maintenance Inspections should be carried out at least once every year, and should preferably be completed well before the wet season. In addition, it is a good practice to inspect the mitigation measures and clear any debris accumulated behind them after a heavy rainstorm.

If the facilities protected by the mitigation measures have changed or no longer exist, the owner or party responsible for maintenance may consult the designer or a professionally qualified geotechnical engineer on the frequency of Routine Maintenance Inspections, taking into account the change in land use and the consequence of failure in natural terrain.

### **4.4 Engineer Inspections for Maintenance of Mitigation Measures**

The maintenance works required for mitigation measures are relatively simple and normally do not require input from a professionally qualified geotechnical engineer. Engineer Inspections for Maintenance are not required unless specified by the designer or in special provisions (e.g. the requirements under the Natural Terrain Clause or delineation of “Green hatched-black” area in the lease document). If unusual conditions or problems are observed (e.g. a check dam filled with a large volume of landslide debris or significant movement of

boulders supported by buttresses), the owner or the party responsible for maintenance should seek advice from a professionally qualified geotechnical engineer.

#### **4.5 Special Follow-up Review for Mitigation Measures Involving Flexible Barrier**

A Special Follow-up Review for flexible barriers should be initiated when the following major defects or anomalies are observed:

- (a) barriers severely damaged by landslides, hill fires, super typhoons, etc.,
- (b) overturning of posts upslope due to wind or other factors (Plate 4.2),
- (c) slackening of upslope wire ropes (Plate 4.2),
- (d) reduction of height of principal net due to sagging of wire ropes or tilting of posts (Plate 4.2), and
- (e) severe rusting of main components (Plate 4.3).

The review should be undertaken by a professionally qualified geotechnical engineer. When necessary, specialist advice from professionally qualified engineers of other appropriate disciplines, barrier manufacturers or suppliers should be sought. The review should examine the causes and assess the implications of the observed anomalies or defects. If required, recommendations for rectification should be made to restore the retaining function of the flexible barriers.



(c) Reduced Net Height

**Plate 4.2 Examples of Major Defects and Anomalies Requiring Special Follow-up Review for Flexible Barriers**



(a) Wire Rope Clips



(b) Shackles



(c) Energy Dissipating Devices

**Plate 4.3 Examples of Severely Rusted Components Requiring Special Follow-up Review for Flexible Barriers**

## 4.6 Other Measures

There are other means of dealing with natural terrain landslide hazards, such as:

- (a) provision of a buffer zone (e.g. an open space) between the hillside and developments or facilities, and
- (b) incorporation of debris basins, sand traps, etc. as part of the drainage facilities.

Unless specified by the designer, the above measures require no maintenance except regular clearance of debris.

If special bio-engineering measures are adopted for the mitigation of natural terrain hazards, the vegetation surfaces should be maintained as specified by the designer. Otherwise, re-vegetation may be carried out in a prescriptive manner to repair hillsides that are affected by landslides, hill fires, etc. The re-vegetation species should be maintenance-free.

## 5 Technical Aspects of Maintenance for Natural Terrain Hazard Mitigation Measures

### 5.1 Clearance of Landslide Debris Accumulated behind Mitigation Measures

The owner or party responsible for maintenance should arrange inspections of the condition of mitigation measures and clear any landslide debris accumulated behind the mitigation measures (Plate 5.1) soon after a heavy rainstorm in order to restore their debris retaining functions (particularly for those constructed at the crest of sloping ground). Timely removal of the accumulated debris is important to prevent instability downslope.



**Plate 5.1 Examples of Landslide Debris Accumulated behind Mitigation Measures**

### 5.2 Provision of Drainage Works for Natural Terrain Hazard Mitigation Measures

The maintenance requirements of drainage works on natural hillsides as stipulated in Sections 4.3 and 4.4 should be followed.

### 5.3 Effect of Trees on Flexible Barriers

Routine Maintenance Inspections for flexible barriers should identify whether any trees are pushing against or intermingling with the barriers (e.g. trees passing through the principal nets of barriers), as this hinders the barrier's ability to deflect upon impact and compromises its proper function (Plate 5.2). Such trees should be trimmed or, as a last resort, removed. However, indiscriminate removal of other vegetation on the barriers should be avoided.



**Plate 5.2 Tree Intermingling with Principal Net of Flexible Barrier**

#### **5.4 Corrosion of Steel Components in Flexible Barriers**

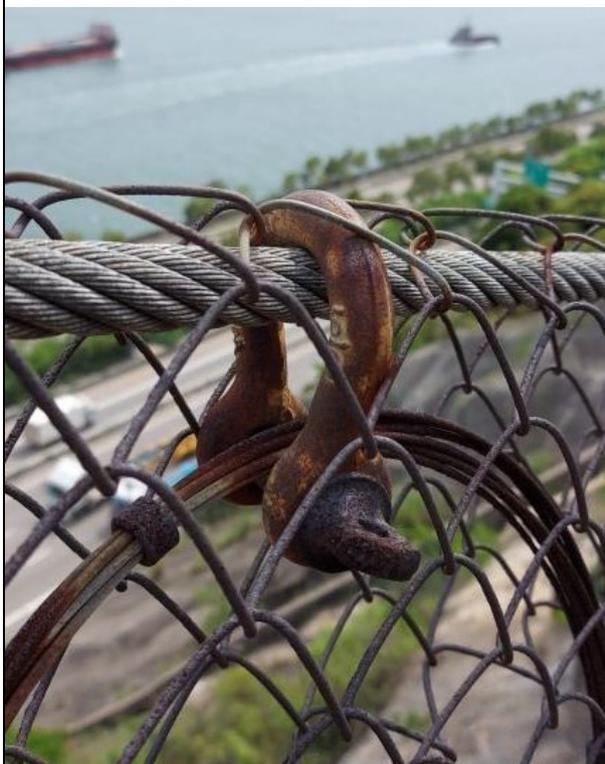
In general, a certain degree of minor rusting (e.g. surface rusting without affecting structural performance) (Plate 5.3) may be tolerated as long as the barriers' functions are sufficiently maintained. However, the rusting condition should be properly documented in the Records of Routine Maintenance Inspection and reviewed in subsequent Routine Maintenance Inspections. It is useful to take sufficient photographic records for comparison and assessment of the rusting condition in the future. These records will later assist the engineer conducting the Special Follow-up Review, where necessary, in determining whether repair and replacement works are required.



(a) Principal and Secondary Nets



(b) Wire Rope Clips



(c) Shackles



(d) Nuts and Bolts

**Plate 5.3 Examples of Minor Rusting without Implication to Structural Performance of Flexible Barriers**

## 6 Sources of Information

### 6.1 Information Providers

Useful information relating to the maintenance of slopes, retaining walls and mitigation measures can be obtained from the following government departments or organisations:

- (a) Geotechnical Engineering Office:
  - (i) The Slope Information System can be accessed from the “Hong Kong Slope Safety” website (<https://hkss.cedd.gov.hk>). This system contains up-to-date information on registered man-made slopes, retaining walls and mitigation measures within Hong Kong;
  - (ii) The Geotechnical Information Unit in the Civil Engineering Library contains records of previous ground investigations and landslides, as well as reports on Stability Assessments and upgrading works carried out under the Landslip Preventive Measures Programme and Landslip Prevention and Mitigation Programme, and other records of existing slopes, retaining walls and mitigation measures.
- (b) Government Hotline 1823:

Advice can be sought on matters relating to maintenance of slopes and retaining walls, and the sources of more specific information.
- (c) Engineers Registration Board:

A list of Registered Professional Engineers (Geotechnical) can be obtained.
- (d) Buildings Department and District Offices of Home Affairs Department:

A list of Registered Contractors who have indicated their willingness to carry out maintenance works for slopes and retaining walls can be obtained.
- (e) Building Management Resource Centres under Home Affairs Department:

The Centres assist building owners, residents, owners’ corporations, mutual aid committees and management bodies in improving the standards of management, safety and maintenance of their buildings.
- (f) The Hong Kong Association of Property Management Companies Limited:

General information about property management and a list of property management companies in Hong Kong can be obtained.

- (g) Lands Department:  
Information about land records, land boundaries, lease conditions and slope maintenance responsibility can be sought, while large-scale plans and topographic maps can be purchased. The Slope Maintenance Responsibility Information System (SMRIS) containing information on the maintenance responsibility for registered man-made slopes, retaining walls and mitigation measures can be accessed from the SMRIS website (<https://www.slope.landsd.gov.hk/smrisk/>).
- (h) Land Registry:  
Records of property owners, lease documents and Deeds of Mutual Covenant can be searched.
- (i) Water Supplies Department:  
Information on the location of water supply mains can be obtained upon request.
- (j) Drainage Services Department:  
As-built records of public stormwater drains and foul sewers are available.
- (k) Buildings Department:  
As-built records of stormwater drains and foul sewers for private lots can be obtained.
- (l) Private companies supplying the services:  
Information on gas, electricity, telephone and similar services (including both the locations and details of existing facilities and the provision of future services) is available.
- (m) GovHK Website:  
Further information regarding the services provided by the relevant government departments and their contact details can be found at the website of the Government of the Hong Kong Special Administrative Region (<https://www.gov.hk>).

## 6.2 Documents

More comprehensive guidance on the technical aspects of slope maintenance is given in the “Guide to Slope Maintenance” (Geoguide 5) published by the Geotechnical Engineering Office. In addition, a “Layman’s Guide to Landscape Treatment of Slopes” (GEO, 2012) has been prepared to provide guidelines to owners and encourage them to adopt landscape treatment to slopes and retaining walls when planning for the maintenance or upgrading works. Both

guides can be downloaded from the website of the Civil Engineering and Development Department (<https://www.cedd.gov.hk/eng/publications/geo/index.html>).

The Government of the Hong Kong Special Administrative Region has also prepared a code of practice titled “Code of Practice on Monitoring and Maintenance of Water-Carrying Services Affecting Slopes” (ETWB, 2006), which can be downloaded from the website of the Development Bureau.

## 7 References

- ETWB (2006). *Code of Practice on Monitoring and Maintenance of Water-Carrying Services Affecting Slopes. (Second edition)*. Environment, Transport and Works Bureau, Hong Kong, 93 p.
- GCO (1984). *Geotechnical Manual for Slopes. (Second edition)*. Geotechnical Control Office, Hong Kong, 302 p.
- GEO (2011). *Technical Guidelines on Landscape Treatment for Slopes (GEO Publication No. 1/2011)*. Geotechnical Engineering Office, Hong Kong, 217 p.
- GEO (2012). *Layman's Guide to Landscape Treatment of Slopes*. Geotechnical Engineering Office, Hong Kong, 29 p.
- GEO (2023). *Geoguide 5 - Guide to Slope Maintenance. (Fourth edition)*. Geotechnical Engineering Office, Hong Kong, 130 p.
- HAD (2018). *Code of Practice on Building Management and Safety*. Home Affairs Department, Hong Kong, 25 p.
- Lam, J.S., Siu, C.K. & Chan, Y.C. (2003). *Guidelines on Safe Access for Slope Maintenance (GEO Report No. 136)*. Geotechnical Engineering Office, Hong Kong, 77 p.

## Appendix A

### Record Sheet Templates for Routine Maintenance Inspections and Works

<b>RECORD OF ROUTINE MAINTENANCE INSPECTION</b>				<b>(SHEET 1 OF 4)</b>
<b>SLOPE/RETAINING WALL REFERENCE NO.<sup>(1)</sup></b>				
Location of Slope/Retaining Wall (address)				
Date of Inspection:				
Date of Last Engineer Inspection for Maintenance:				
Due Date of Next Engineer Inspection for Maintenance:				
Weather Condition at Time of Inspection:				
Maintenance Action Item	Location Reference	Action Required		Works Completion Date
		No	Yes	
Clear drainage channels of accumulated debris				
Repair cracked/damaged drainage channels or pavements along crest and toe of slope or retaining wall				
Repair or replace cracked or damaged impermeable slope surface cover				
Remove surface debris and vegetation that has caused severe cracking of slope surface cover and drainage channels				
Remove loose rock debris and undesirable vegetation from rock slopes or boulders				
Re-vegetate bare soil slope surface				
Repair pointings in masonry walls				
Unblock weepholes and outlet drainpipes				
Repair leaky exposed water-carrying services				
Repair or replace rusted slope furniture (e.g. steel gates, boundary fences and stairs)				
Remove debris from defence measures				
Others (specify works and give details)				
Recommended Date for Completion of Above Works:				
Note: (1) Upon request, the Geotechnical Engineering Office can provide a slope or retaining wall reference number if applicable.				

**RECORD OF ROUTINE MAINTENANCE INSPECTION (SHEET 2 OF 4)**

**SLOPE/RETAINING WALL REFERENCE NO.**

SITE PLAN (Reference numbers should be assigned to locations of man-made items for which maintenance works are required. The corresponding reference numbers should be quoted in the photographic records.)

Note: Add additional record sheets for site plan as necessary.



**RECORD OF ROUTINE MAINTENANCE INSPECTION****(SHEET 4 OF 4)****SLOPE/RETAINING WALL REFERENCE NO.**

RECORD PHOTOGRAPHS (with descriptions, date, and reference numbers as given on the site plan)

- Notes:
- (1) Add additional record sheets for photographs as necessary.
  - (2) Record photographs should show in detail areas where maintenance works are required, signs of distress observed (e.g. tension cracks, bulging of wall), and be annotated with descriptions.



## Appendix B

### Model Brief for Engineer Inspections for Maintenance for Private Slopes

## 1. Objective of the Assignment

The objective of this Assignment is to carry out an Engineer Inspection for Maintenance, including the preparation of an Engineer Inspection Report and the preparation/updating\* of a Maintenance Manual, and, if required, the design, management and supervision of works, for slope/retaining wall\* number \_\_\_\_\_, the location and extent of which are shown on the attached plan.

## 2. Description of the Assignment

The Assignment shall consist of the following items of work:

- (a) to assess the state of maintenance and condition of the slope/retaining wall\*,
- (b) to establish if Stability Assessments of the slope/retaining wall\* have previously been carried out and, if so, to carry out a review of these previous Stability Assessments,
- (c) to determine whether a Stability Assessment and/or preventive maintenance or urgent repair works or access provision are necessary,
- (d) to recommend, arrange, supervise and certify the satisfactory completion of any necessary works\*, and
- (e) to prepare/update\* the maintenance documentation and recommend improvement for the maintenance process.

The review of previous Stability Assessments required in (b) above is not intended to certify or endorse any part or the whole of the previous Stability Assessments. It only aims to identify whether the previous Stability Assessments contains any obvious deficiencies in engineering approach or assumptions in the light of current local geotechnical engineering practice and safety standards, any monitoring records indicating deficiency in the design assumptions, and to judge whether the stability of the slope/retaining wall would be affected by any visible changes in conditions identified during the site inspection.

## 3. Deliverables

The Engineer shall submit \_\_\_\_\_ copies of the Engineer Inspection Report covering the tasks listed in Section 4 below and enclosing the Records of Engineer Inspection for Maintenance /and \_\_\_\_\_ copies of the Maintenance Manual to the Employer.

#### 4. Services to be Provided by the Engineer

This Assignment shall be carried out by a professionally qualified geotechnical engineer in Hong Kong. A suitable qualification is Registered Professional Engineer (Geotechnical). As the inspecting engineer, the geotechnical engineer shall prepare and sign the Records of Engineer Inspection for Maintenance. The geotechnical engineer shall also prepare and sign the Engineer Inspection Report.

##### Part 1 - Information Collection

- (a) Starting from the sample checklist in Appendix I of Geoguide 5, prepare a checklist for the agreement of the Employer indicating the types of documents to be collected under this Assignment.
- (b) Collect available documentary information pertaining to the slope/retaining wall\* and the nearby areas which could have implications on its stability, including all relevant slope maintenance records.

##### Part 2 - Site Inspection

- (a) Carry out an inspection of the slope/retaining wall\* and the nearby areas and prepare Records of Engineer Inspection for Maintenance according to the Indicative Record Sheets given in Appendix F of Geoguide 5. In particular,
  - (i) evaluate the adequacy of access to the slope/retaining wall for maintenance inspections taking into account the requirements of safety regulations and provide recommendations in accordance with Part 4(b) below,
  - (ii) identify visually any discrepancies between the records of previous engineer inspections for maintenance, maintenance manuals, the works as constructed, actual site conditions and the plans in the Stability Assessment Reports, design reports, drawings or as-built records,
  - (iii) identify all visible changes including landslides, unauthorised constructions, formation of unauthorised cultivation areas, appearance of tension cracks, or other signs of distress, that have taken place at or in the vicinity of the slope/retaining wall\*, in particular any changes since the last Stability Assessment and Engineer Inspection, which could have implications on its stability, and to judge whether these might be significant,
  - (iv) identify the presence of buried and exposed water-carrying services (including any ducting systems housing the services) and unauthorised services, on or in the vicinity of the slope/retaining wall\* (including relevant areas outside the lot boundary), both visually and with reference to the record plans for the services,

- (v) check for signs of leakage of any exposed and buried water-carrying services (including any ducting systems housing the services) and identify the source of any leaky water-carrying services where possible, and
- (vi) look for and consider the implications of problems that are not explicitly included in the list of maintenance for man-made items, and bring to the attention of the Employer any immediate and obvious danger noted and provide recommendations in accordance with Part 4(d) below.

### Part 3 - Assessment

Based on the tasks of Parts 1 and 2 above, carry out the following tasks:

- (a) Evaluate the relevance and completeness of all information collected with reference to the checklist agreed by the Employer (see Part 1(a)). Determine whether Stability Assessments covering parts or the entirety of the slope/retaining wall\* have previously been carried out. If so, review the previous Stability Assessment reports to check whether the engineering approach used, the assumptions and the conclusions made in these reports are reasonable in the light of current practice and safety standards.
- (b) Re-assess the consequence-to-life category of the slope/retaining wall\*, as set out in the standards and guidance documents promulgated by the Geotechnical Engineering Office.
- (c) Check that Routine Maintenance Inspections and the recommendations for routine maintenance works have been carried out and documented satisfactorily.
- (d) Check that Regular Checks of Buried Water-carrying Services (including any ducting systems housing the services) (see Note (1)) and/or Regular Monitoring of Special Measures (if required) and the recommendations arising from the checks have been carried out and documented satisfactorily.
- (e) Assess the adequacy of routine maintenance works and supplement the list of basic maintenance works items, as necessary.
- (f) Re-assess the required frequency of Routine Maintenance Inspections, Engineer Inspections for Maintenance, and Regular Checks of Buried Water-carrying Services (including any ducting systems housing the services) (see Note (1)).

(Note (1): For the above actions under items (d) and (f) pertaining to Regular Checks of Buried Water-carrying Services, they apply only to those services belonging to the owner of or the party required to maintain the slope/retaining wall.)

#### Part 4 - Recommendations

- (a) Recommend any necessary preventive maintenance works.
- (b) Based on the task of Part 2(a)(i), recommend any necessary access to be provided for maintenance inspections and works.
- (c) Based on the task of Part 2(a)(v), where leaky water-carrying services are found, advise the relevant services' owners/maintenance parties or relevant authorities for actions in accordance with ETWB (2006). Update the Maintenance Manual to include a provision to initiate an out-of-turn Engineer Inspection for Maintenance whenever anomalies due to leaky services are observed.
- (d) Based on the work of Part 2(a)(iii) & (vi), recommend any necessary emergency measures (e.g. cordoning off works), urgent repair or investigations.
- (e) Advise whether a Stability Assessment of the slope/retaining wall\* is needed taking into consideration the results of the tasks in Parts 2 and 3 and the results of the previous Stability Assessment(s), if any.

#### Part 5 - Reporting

- (a) Prepare an Engineer Inspection Report covering the above tasks and enclosing the Records of Engineer Inspection for Maintenance for submission to the Employer.
- (b) Explain the findings and recommendations of the Engineer Inspection to the Employer, in particular whether Stability Assessment or works are required to be carried out, with justifications and cost estimates including any site supervision costs, and answering any queries.

#### Part 6 - Preparation/Updating\* of the Maintenance Manual

- (a) Prepare/update\* the Maintenance Manual to include all relevant information extracted from the previous Stability Assessment(s), and the desk study, records and details of any previous landslides and subsequent repair works, and site inspection(s) under this Assignment, with traceability to all source documents used.
- (b) Prepare/update\* the Maintenance Manual to include a statement of landscape design highlighting the rationale for the choice of the landscape items for the slope/retaining wall.

#### Part 7 - Design, Management and Supervision of Works (Optional Items)

- (a) Prepare specifications and plans for the necessary routine and preventive maintenance works, urgent repair, and access provision based on the tasks of Part 4(a), (b) & (d) above.
- (b) Recommend the requirements of a construction design review for the works in Part 7(a) above.

- (c) Obtain or arrange to obtain all statutory approvals (e.g. from Building Authority) and agreements from any parties, as appropriate, required for the execution of the necessary maintenance works.
- (d) Seek approval/agreement from the relevant authorities (e.g. Transport Department, Police, and District Lands Offices) and any affected parties (e.g. utility companies), if necessary, for the execution of the items of works on the slopes/retaining walls.
- (e) Prepare the works contract, invite tenders, and provide recommendations for the Employer to appoint the most suitable Contractor to undertake the works.
- (f) Undertake supervision of the items of works and all contract administration. Check whether the works have been carried out in accordance with the works contract requirements and if so certify payment for works that are satisfactorily completed.
- (g) Carry out any necessary construction design reviews and liaise with the Contractor and the Employer as necessary.
- (h) Prepare and certify the as-built construction records, including any design reviews carried out, and update the Maintenance Manual to document the works done, based on site inspections and the as-built records of the works. Submit relevant documents to statutory authorities certifying the completion of works.

## **5. Programme of Implementation**

The due date for the commencement of the Assignment shall be \_\_\_\_\_.

The due date(s) for the completion of Parts 1 to 6 of Section 4 of the Assignment, including the submission of Record of Engineer Inspection for Maintenance and any relevant documents and reports, shall be \_\_\_\_\_.

## **6. Standards and Specifications**

The Engineer shall adopt such technical and design standards and specifications as are applicable to and in current use by the Government of the Hong Kong Special Administrative Region or, if non-existent, international Codes of Practice and Specifications. Reference can be made to Technical Guidance Note (TGN) No. 1 which contains a list of guidance documents being used by the Geotechnical Engineering Office as the de facto geotechnical standards. The TGN can be found at the Civil Engineering and Development Department website at <https://www.cedd.gov.hk>.

## 7. Information Provided by the Employer

All available information held by the Employer and relevant to the Assignment will be provided to the Engineer.

- 
- Notes:
- (1) \* Deleted if not applicable.
  - (2) The agreement should be priced on the basis of all the tasks included in Parts 1 to 6 of Section 4 only. The fee for the tasks in Part 7 of Section 4, if found necessary, should be negotiated separately.
  - (3) The programme for the tasks in Part 7 of Section 4 should be agreed after completion of the tasks in Parts 1 to 6 of Section 4.

Appendix C

Record Sheet Templates for  
Routine Maintenance Inspections and Works  
for Natural Terrain Hazard Mitigation Measures

<b>RECORD OF ROUTINE MAINTENANCE INSPECTION</b>	<b>(SHEET 1 OF 4)</b>
<b>DEFENCE MEASURE REFERENCE NO.</b>	
Location of Defence Measures (address):	
Types of Defence Measures: Steel Flexible Barrier / Rigid Barrier / Gabion Structure	
Date of Inspection:	
Weather Condition at Time of Inspection:	
<p>LOCATION PLAN AND SITE PLAN (Reference numbers should be assigned to locations where (i) general maintenance action items and/or (ii) observations triggering Special Follow-up Review are identified. The corresponding reference numbers should be quoted in the photographic records.)</p>	
<p>Notes: (1) Add additional record sheets as necessary.  (2) The plan scale and access should be indicated.  (3) Specific number should be assigned for each bay (i.e. between two posts) of the flexible barrier.</p>	

<b>RECORD OF ROUTINE MAINTENANCE INSPECTION</b>			<b>(SHEET 2 OF 4)</b>	
<b>DEFENCE MEASURE REFERENCE NO.</b>				
<b>GENERAL MAINTENANCE ACTION ITEMS</b>				
Maintenance Action Items	Action Required		Location Reference	Remarks (e.g. Works Completion Date)
	No	Yes		
A1. Trim/remove undesirable trees from the barrier				
A2. Remove accumulated debris from the barrier (e.g. behind principal net and around base plates of posts of flexible barriers)				
A3. Clear accumulated debris from drainage channels				
A4. Repair cracked/damaged drainage channels or maintenance access				
A5. Repair/replace rusted steel furniture (e.g. steel gates, hand railings, boundary fences and stairs)				
A6. Repair/reinstate the ground adjoining the measures affected by severe erosion				
A7. Repair/reinstate the pavement of the vehicular maintenance access				
A8. Repair, or notify relevant parties of, leaky exposed water-carrying services				
A9. Repair cracked/damaged baffles				
A10. Others (specify works and give details)				
Recommended Date for Completion of Above Works:				
<b>OBSERVATIONS REQUIRING ADVICE OF PROFESSIONAL ENGINEER</b>				
B1. Accumulation of large quantity of landslide debris at the rear of Defence Measures				
B2. Excessive deformation of Defence Measures				
OTHER OBSERVATIONS / RECOMMENDATIONS (continue on separate sheets if necessary).....				
Inspected by: ..... (Name of person undertaking inspection)				
of ..... (Organisation)				
Signature : ..... Date : .....				
Due date of next inspection:.....				
Received by : ..... (Name of owner or his authorised representative)				
of ..... (Organisation)				
Signature : ..... Date : .....				

<b>RECORD OF ROUTINE MAINTENANCE INSPECTION</b>				<b>(SHEET 3 OF 4)</b>	
<b>DEFENCE MEASURE REFERENCE NO.</b>					
<b>ADDITIONAL MAINTENANCE ACTION ITEMS SPECIFIC TO STEEL FLEXIBLE BARRIER</b>					
Maintenance Action Items	Action Required		Location Reference	Remarks (e.g. Works Completion Date)	
	No	Yes			
C1. Trim/remove undesirable trees from the barrier					
C2. Remove obstructions in energy dissipating device					
C3. Repair cracked concrete structures (e.g. concrete pad of anchor or foundation)					
<b>MAJOR DEFECTS AND ANOMALIES OBSERVED</b>					
Major Defects and Anomalies Triggering Special Follow-up Review	No	Yes	Location Reference	Remarks	
D1. Barrier affected by landslide/rockfall					
D2. Barrier affected by hill fire					
<i>Items specific to steel flexible barrier</i>					
D3. Severe rusting observed at main components of steel flexible barrier					
D4. Posts overturning upslope					
D5. Suspected missing barrier components					
D6. Upslope wire ropes slackened					
D7. Height of principal net less than Minimum Retaining Height (as specified in Maintenance Manual) due to excessive sagging of wire ropes or tilting of posts					
D8. Others					
OTHER OBSERVATIONS / RECOMMENDATIONS (continue on separate sheets if necessary)..... ..... .....					
Inspected by: ..... (Name of person undertaking inspection) of ..... (Organisation) Signature : ..... Date : .....					
Due date of next inspection:.....					
Received by : ..... (Name of owner or his authorised representative) of ..... (Organisation) Signature : ..... Date : .....					

<b>RECORD OF ROUTINE MAINTENANCE INSPECTION</b>		<b>(SHEET 4 OF 4)</b>
<b>DEFENCE MEASURE REFERENCE NO.</b>		
RECORD PHOTOGRAPHS (with descriptions, date and reference numbers as given on the site plan)		
Photo Ref.:	Description:	
Date:		
<p>Notes:</p> <ul style="list-style-type: none"> <li>(1) Add additional record sheets for photographs as necessary.</li> <li>(2) Record photographs showing the general view of each individual bay of the barrier (taken from the same vantage points as the last Routine Maintenance Inspection) should be provided.</li> <li>(3) Record photographs should show in detail areas where (i) general maintenance action items and/or (ii) observations triggering Special Follow-up Review are identified, and these should be annotated with descriptions.</li> </ul>		



