

LANDSLIPS CAUSED BY THE JUNE 1983 RAINSTORM

GEO REPORT No. 27

E.B. Choot

**GEOTECHNICAL ENGINEERING OFFICE
CIVIL ENGINEERING DEPARTMENT
HONG KONG**

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**This report was originally produced in August 1984
as GCO Special Project Report No. SPR 1/84**

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First published, August 1993
First Reprint, April 1995

Prepared by:

Geotechnical Engineering Office,
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Civil Engineering Building,
101 Princess Margaret Road,
Homantin, Kowloon,
Hong Kong.

This publication is available from:

Government Publications Centre,
Ground Floor, Low Block,
Queensway Government Offices,
66 Queensway,
Hong Kong.

Overseas orders should be placed with:

Publications (Sales) Section,
Information Services Department,
28th Floor, Siu On Centre,
188 Lockhart Road, Wan Chai,
Hong Kong.

Price in Hong Kong: HK\$83

Price overseas: US\$13 (including surface postage)

An additional bank charge of **HK\$50** or **US\$6.50** is required per cheque made in currencies other than Hong Kong dollars.

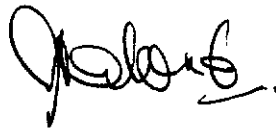
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PREFACE

In keeping with our policy of releasing information of general technical interest, we make available some of our internal reports in a series of publications termed the GEO Report series. The reports in this series, of which this is one, are selected from a wide range of reports produced by the staff of the Office and our consultants.

Copies of GEO Reports have previously been made available free of charge in limited numbers. The demand for the reports in this series has increased greatly, necessitating new arrangements for supply. In future a charge will be made to cover the cost of printing.

The Geotechnical Engineering Office also publishes guidance documents and presents the results of research work of general interest in GEO Publications. These publications and the GEO Reports are disseminated through the Government's Information Services Department. Information on how to purchase them is given on the last page of this report.



A. W. Malone
Principal Government Geotechnical Engineer
April 1995

FOREWORD

This report presents brief details of the intense rainstorm of 17 June 1983 and of the resulting landslip incidents. The document is intended to be factual rather than interpretative.

Many engineers within the GCO have contributed to the report by providing details of landslip incidents which they inspected during or shortly after the rainstorm. The cooperation of other Government offices and Departments in supplying statistics and other relevant information is gratefully acknowledged.

K.K. Wong, now of BDD, contributed considerably to this report in carrying out much of the initial data collection and preparing an initial draft.

S.R. Hencher

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Senior Geotechnical Engineer/Special Projects Division

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1. INTRODUCTION

The June 1983 rainstorm was the most severe rainstorm of 1983. Within a 5-hour period in the morning of 17 June, 274.4 mm of rainfall, the most intense 5-hour rainfall on record since June 1966, was recorded at the Royal Observatory in Tsim Sha Tsui. As a result of the particularly intense rainfall, numerous landslips, flooding and other incidents occurred throughout the Territory leading to the death of 1 person, injuries to 12, and the evacuation of at least 600 people from their homes. The estimated direct cost of clean up and repair associated with landslip incidents alone amounted to HK\$12 million, not to mention the far greater indirect cost of disruptions, evacuations etc.

During the deluge, various Government Offices and Departments received reports and requests for assistance regarding landslips, flooding and other incidents. Many of these reports came from District Offices and the Police Department which received numerous complaints from the public during the rainstorm. The records available at the Offices and Departments concerned showed that there were approximately 409 reports of landslip incidents and 407 reports of flooding incidents related to the rainstorm. 160 of those landslip incidents were reported to and inspected by the Geotechnical Control Office (GCO).

The purpose of this report is to serve as a permanent factual documentation of the effect of the June 83 rainstorm on slopes in Hong Kong and the associated damages and disruptions caused by landslip incidents. In this report, the definition of a landslip incident has been broadened to include not only failures of slopes but also boulder falls and the failures of retaining walls. Slopes, boulders and retaining walls which showed signs of distress or obvious instability were also considered as failures. This report will concentrate on the 160 landslip incidents reported to and inspected by the GCO as more detailed information is available for those incidents.

As a factual document, subjective interpretation in the report has been deliberately kept to a minimum. Aside from acknowledging that the landslip incidents presented herein were all related to the intense rainstorms, this report does not endeavour to explain the failures or how the failures could have been predicted. It is hoped, however, that sufficient information is presented for readers to draw their own conclusions and that the information presented herein can serve as a useful starting point for furthering our understanding of rain-induced slope failures in Hong Kong.

The structure of this report is similar to that for the previous rainstorm reports on the May and August rainstorms of 1982 (GCO, 1982a & b). Section 2 gives a summary of facts and figures related to the rainstorm. These facts and figures are then expanded upon in Section 3 which presents the details of rainfall data and Section 4 the details of landslip incidents. Several notable and interesting landslip incidents caused by the rainstorm are described in Section 5.

2. SUMMARY FACTS AND FIGURES

2.1 Incidents and Death

Table 1 shows the number of incident reports received by various

Government Offices and Departments during the June 83 rainstorm. A breakdown of the types, number and territorial distribution of these reported incidents is shown in Table 2. The information presented was compiled from information available in the following Government Offices and Departments, namely :

- (a) Geotechnical Control Office (GCO)*
- (b) Highway Office
 - (i) Hong Kong Division (H/HK)
 - (ii) Kowloon Division (H/K)
 - (iii) New Territories Division (H/NT)
- (c) Housing Department (HD),
- (d) Water Supplies Department (WSD),
- (e) Agricultural and Fisheries Department (AFD),
- (f) Architectural Office, Maintenance Branch (AOM), and
- (g) Fire Service Department (FSD).

The tables show that during the rainstorm the above Government Offices and Departments received a total of 409 reports of landslip incidents, 407 reports of flooding incidents and 42 reports of other incidents. These reports were related to 487 incidents on Hong Kong Island, 125 in Kowloon and 145 in the New Territories. It should be noted that the total number of incidents is less than the total number of reports received because of duplicated reports i.e. reports which were made to more than one office or department. It should also be noted that the number of incidents shown on the table is less than the actual number of incidents that actually occurred during the rainstorm as it is conceivable that many minor incidents of little consequence and those that occurred in the remote and open areas were not reported.

The only confirmed fatality during the rainstorm occurred at South Bay Close. The body of a man was found trapped underneath a parked car shortly before 8 am on 17 June 1983. He was believed to have been swept there by floodwater. At Tin Wan Hill Road in Aberdeen, there was a report of a woman and child inside a parked car being buried by the debris of a major landslip incident. Fortunately, it was only a false report.

2.2 Rainfall

The main characteristic of the June 83 rainstorm was that it was very short and intense. The 274.4 mm of rainfall recorded at the Royal Observatory in Tsim Sha Tsui between 5 am and 10 am on 17 June alone accounted for 80% of the total rainfall for the day (346.7 mm) and 60%

* As the June 83 rainstorm occurred before the reorganization of the GCO in November, 1983, the GCO then was only responsible for checking slopes on Crown Lands and squatter areas. Slopes in private lots were checked by the Geotechnical Control Branch (GCB) of the Building Ordinance Office. However, for the purpose of this report, unless specifically mentioned otherwise, the GCO being referred to in the report includes GCB as well.

of the total rainfall for the month of June. Similar rainfall patterns were observed at other raingauges in the Territory with most of the rainfall occurring between 5 and 12 am, a lesser amount of rainfall between 3 to 6 pm and very little rainfall during other periods of the day. The rainstorm was essentially a one day event with very little rainfall recorded for the days prior and subsequent to the day of the rainstorm.

Due to the intense rainfall, a flood warning was issued at 5:40 am, followed by a landslip warning at 7:45 am.

As is typical for Hong Kong, there was a considerable variation in the rainfall distribution throughout the Territory during the rainstorm event. The hardest hit areas during the rainstorm were on the Hong Kong Island and in East Kowloon.

The maximum daily rainfall recorded at GCO raingauges during the rainstorm was at H15 in Stanley (546.0 mm) and that daily rainfall was about three times the lowest rainfall recorded at NO1 in Shatin (133.5 mm). In fact, there was such large variation in rainfall that even areas at approximately the same elevation and only a few kilometres apart experienced more than 200 mm difference in rainfall, such as that for HO8 in Happy Valley (462.5 mm) and HO5 in Wong Chuk Hang (225.0 mm).

The maximum hourly rainfall for GCO raingauges was 181.0 mm recorded between 3 to 4 pm at H15 in Stanley. This rather high hourly rainfall was exceptional as elsewhere in the Territory, the maximum hourly rainfall during the same period was only 45 mm. It was believed that this exceptionally high hourly rainfall was due to a localized low pressure trough that had only affected the Stanley Peninsula at that time. Aside from at H15, the maximum hourly rainfall recorded at GCO raingauges were 136.5 mm, 101.0 mm, and 96.0 mm at KO3 in Sau Man Ping, HO8 in Happy Valley, and H20 in Ap Lei Chau respectively, all of which were recorded between 7 to 8 am.

It is very difficult to calculate the return period for the June 83 rainstorm as it was such an uncharacteristically short and intense rainstorm for Hong Kong. The estimated return period for the rainstorm is equally a function of its intensity and duration considered. According to Peterson and Kwong (1981), a maximum 5-hour rainfall of 274.4 mm has a return period of 50 years using Gumbel's method of probability distribution for extreme values and based on the data available at the Royal Observatory. The estimated return period however reduces drastically to about 3 years if a 3-day storm duration is considered. While a unique and representative return period for the June 83 rainstorm cannot be calculated, however, it can generally be concluded that the rainstorm was less severe than those of May and August, 1982.

2.3 Landslip Incidents

160 of the 307 landslip incidents reported during the June 83 rainstorm, were reported to and inspected by the GCO. 37 of these landslip incidents inspected were classified as major failures where a major failure is one whose volume of slide debris exceeded 50 m³ or one whose potential failure mass exceeded 50 m³ in the case of a partial failure. While in most instances, it was the major landslip incidents that caused the worst damage, there were cases where minor landslip incidents, such as

small boulder falls in densely populated squatter areas, caused major disruption.

The more notable and interesting landslip incidents that occurred were located at Tin Wan Hill Road (GCO Incident No. HK 6/27); Peak Road (GCO Incident No. HK 6/12); Rennie's Mill Cottage Area (GCO Incident No. N 6/13), Tai Hang Road (GCO Incident No. HK 6/45); 61 Blue Pool Road (GCO Incident No. HK 6/6); Po Toi Island (GCO Incident No. N 6/42); 11 Blue Pool Road (GCO Incident No. HK 6/11); 1-2 New Eastern Terrace (GCB Incident No. 20/11SE-A); Hing Man Estate (GCO Incident No. HK 6/20); and 14 Headland Road (GCO Incident No. HK 6/35). Details of these incidents are available in Section 5 on "Notable and Interesting Incidents".

In Table 3 the 160 landslip incidents inspected by the GCO are classified into the following principal slope types, namely

- (a) Fill slope,
- (b) Cut slope (soil, soil/rock, rock),
- (c) Natural slope,
- (d) Retaining wall, and
- (e) Boulder or rock fall.

It can be seen that cut slope failures were very common and had accounted for 53% of the number of failures inspected. Approximately half of the landslip incidents occurred on Hong Kong Island, the area hardest hit by the rainstorm.

In Table 4, the 160 landslip incidents inspected were classified based on the area affected by the incidents. The following classification was adopted :

- (a) Squatter area,
- (b) Permanent Building (Houses, apartment blocks, cottages etc.),
- (c) Road,
- (d) Footpath, catchwater, country path,
- (e) Remote, open and other areas.

It should be noted that some landslip incidents affected more than one area, for example an incident that affected both the squatter area above and the road below.

The table shows that about 35% of the landslip incidents had affected permanent structures which is a rather broad category encompassing all types of buildings which are licensed, as opposed to squatters which are unlicensed. About 30% of the incidents were noted as incidents affecting squatter areas and another 30% as incidents affecting road.

Table 5 shows the number of squatter huts and permanent buildings that were temporarily or permanently evacuated and the number of instances where a road had to be partially or totally closed due to landslip incidents. The table shows that 149 squatter huts and 21 permanent buildings were evacuated due to landslip incidents. There were 30 instances where a section of road had to be partially or totally closed due to landslip incidents.

It needs be emphasized that the above discussions are strictly based only on those incidents reported to and inspected by the GCO. Besides those, there were landslip incidents attended by other Offices and Departments, and landslip incidents which were not reported at all. The unreported incidents were however mostly very minor landslip incidents, or inconsequential failures of natural slopes in remote areas. Had those unreported incidents been included in the summary tables, there would have been proportionately far more failures of natural slopes in remote and open areas.

The figures presented in this section are only summaries. More detailed information regarding landslip incidents will be presented in Sections 4 and 5. Lists of incidents in Hong Kong Island, Kowloon and New Territories reported to the GCO and brief details of those incidents are given in Tables 6, 7 and 8 respectively.

2.4 Flooding Incidents

According to the information available, there were a total of 407 flooding incidents reported during the June 83 rainstorm. These reported incidents were mostly on Hong Kong Island where the rainfall was most intense. Apart from inconvenience, most of the flooding incidents caused very little damages and were dealt with by Highway Office maintenance crews. Most of the flooding incidents were related to blocked drains and occurred during the period of heavy downpour between 5 to 10 am.

While flooding incident reports concentrated in Hong Kong Island, flooding did the most damage in the low-lying areas of the New Territories causing death of livestock and damage to crops. During the June rainstorm, over 24 hectares of farmland were inundated. The Yuen Long area of flat land which is generally regarded as the most flood-prone area in the New Territories was however relatively unaffected by flooding due to low rainfall. The area only received about 90 mm of rainfall as opposed to the 300 mm plus rainfall received in the urban areas.

As noted earlier, a death was caused by flooding at South Bay Close on Hong Kong Island.

Since the emphasis of this report is on landslip incidents, no further details will be presented for flooding incidents.

3. RAINFALL INFORMATION

3.1 Introduction

In Hong Kong, the distribution of rainfall can vary drastically across the Territory during a rainstorm event and the June 83 rainstorm was of this type. At GCO gauge no. HO8 in Happy Valley for instance, the daily rainfall recorded was 462.5 mm while at only 3 km away and approximately the same elevation in Wong Chuk Hang (HO5), the daily rainfall was only 225.0 mm.

In order to measure this widely varying rainfall pattern, the Royal Observatory has installed 165 raingauges at strategic locations around the Territory. The type of rainauge installed ranges from very advanced

and accurate automatic raingauges such as the 'principal' rain gauge which is located outside the Royal Observatory headquarters in Tsim Sha Tsui to manual raingauges in remote areas which are only read once a day at 3 pm. Weather summaries and rainfall statistics prepared by the Royal Observatory are usually based on the measurements made at the 'principal' gauge which has continuous readings dating back to January 1884 with the exception of an eight year period during the Second World War.

A few years ago, the GCO with the help of the Royal Observatory began to install additional raingauges throughout the Territories to supplement rainfall information from the Royal Observatory and to provide specific information in areas where slopes were under observation. These raingauges are automatic 'tipping bucket' raingauges which are capable of recording rainfall every 15 minutes and are connected by telephone lines to an automatic recorder in the Emergency Control room of the GCO. By the June 83 rainstorm, 39 automatic raingauges had been installed and 33 of them were fully operational throughout the rainstorm.

This network of Royal Observatory and GCO raingauges have provided a fairly detailed picture of the rainfall distribution during the June 83 rainstorm.

3.2 Royal Observatory Records

The Royal Observatory routinely publishes monthly summaries of the weather situation in Hong Kong and the following is an excerpt from Royal Observatory monthly weather summary for June 1983 (Royal Observatory, 1983) :

" The Weather of June 1983

The total rainfall of the month, 445.8 mm, was slightly above the normal figure. 346.7 mm of rain, that is, about three quarters of the month's total, were recorded on 17 June. This amount was the second highest daily rainfall record for June. The accumulated rainfall for the first six months of the year, 1 734.7 mm, was the highest rainfall amount for the corresponding period since 1889 and was about 75 per cent above normal. The month was also hotter and less humid than normal. The mean minimum temperature of 27.0°C was the highest record for June while the relative humidity of 79 per cent was the second lowest for the month.....

Fine weather set in on 11 June and persisted until 14 June. There were a few isolated showers on 15 June and the weather became increasingly unsettled with scattered showers on 16 June.

A trough of low pressure moved southwards to south China on 17 June, resulting in frequent heavy showers and widespread thunderstorms in Hong Kong. The downpour was heaviest during the five hours between 5 am and 10 am when 274.4 mm of rain were recorded at the Royal Observatory. This five-

hourly rainfall was the second highest on record for June and the fourth highest for any month.... rain was heaviest on Hong Kong Island where amounts exceeding 400 mm were recorded.....

There were occasional light showers on 18 June as the trough of low pressure gradually moved northwards away from Hong Kong. During the following two days, the weather remained cloudy with scattered showers. Sunny periods developed on 21 and 22 June but there were also some isolated showers.

Apart from some light showers from time to time, the weather continued fine for the rest of the month....

Thunderstorm Warnings were issued on 3, 16, 17 and 19 June while a Flood Warning and a Landslip Warning were in effect on 17 June. No fire Danger Warnings were issued. The Strong Monsoon Signal and Tropical Cyclone Warning Signals were not displayed. "

Figure 1 is a histogram of the hourly rainfall recorded at the 'principal' gauge at Tsim Sha Tsui and Table 9 tabulates the daily rainfall recorded from Wednesday, June 15 to Sunday, June 19.

3.3 Geotechnical Control Office Records

The same general rainfall pattern was depicted by the 33 GCO raingauges throughout the Territories and Figure 2 shows the hourly rainfall histograms at those raingauges.

From the rainfall record, it can be seen that the most intense rainfall during the June 83 rainstorm occurred between 5 am and 10 am on 17 June with lesser amounts falling between 3 pm and 6 pm and very little rainfall at other times of the day. The three highest daily rainfalls were recorded at raingauge no. H15 in Stanley (546.0 mm), H08 at Eastern Treatment Work in Happy Valley (462.5 mm) and H20 in Ap Lei Chau (458.0 mm). The minimum daily rainfall recorded by the GCO was at N01 in Shatin (133.5 mm). Lower daily rainfall of the order of 60 mm were recorded at the Royal Observatory raingauges near the Hong Kong - China border.

The maximum hourly(clock hour) rainfall was 181.0 mm at H15 in Stanley from 4 to 5 pm with 54.0 mm of the hourly rainfall recorded in the 15 minute period from 4 to 4:15 pm. This record was rather exceptional because elsewhere in the Territory, the maximum hourly rainfall recorded was only about 45 mm during the same period. As H15 at Stanley is located at the southermost tip of Hong Kong Island, this intense rainfall was probably localized due to the passage of a low pressure trough which had only affected the Stanley Peninsula at that time. Other than at H15, the maximum hourly rainfall recorded were at K03 in Sau Mau Ping (138.5 mm), H08 in Happy Valley (101.0) and H20 in Ap Lei Chau (96.0 mm), all of which were recorded from 7 to 8 am.

3.4 Geographical Distribution of Rainfall

Figure 3 is a rainfall distribution map produced by the Royal Observatory showing the rainfall isohyets for the 24 hour period ending at 3 pm on 17 June 1983. This is probably a representative rainfall distribution map for the June 83 rainstorm as it brackets the most intensive rainfall period which was from 5 to 10 am. The map shows that the whole of Hong Kong Island, the eastern part of Kowloon Peninsula, and the southern part of Lantau Island all received over 300 mm of rainfall for the 24 hour period. For some areas in Hong Kong Island, over 400 mm of rainfall was recorded during the same period.

3.5 Comparison with Past Rainstorms

3.5.1 Historic Ranking of June 83 Rainstorm

3.5.1.1 5-hour Total Rainfall

With a maximum 5-hour total rainfall of 274.4 mm, the June 83 rainstorm ranks fourth in terms of maximum 5-hour total rainfall when compared to other rainstorms in the past. The highest 5-hour rainfall of 349.3 mm was recorded between 4 - 8 am on 19 July 1926. In Table 10 the details of the four most intense 5-hour rainfall recorded at the Royal Observatory are shown. It should be noted that the above comparison is only valid for the 'principal' raingauge in Tsim Sha Tsui.

3.5.1.2 24-hour Total Rainfall

The June 83 rainstorm, with a maximum 24-hour total rainfall of 246.7 mm, ranks thirteenth in terms of maximum 24-hour rainfall, the highest being 697.1 mm for the 24 hour period ending at 6 am on 30 May 1982. Table 11 is a tabulation of the thirteen highest 24-hour total rainfall to date.

3.5.1.3 3-day Total Rainfall

In terms of maximum 3-day rainfall, June 83 rainstorm with a 3-day total of 352.1 mm is not very significant compared to other past rainstorms. There are at least 30 known rainstorms in the past with 3-day total rainfall exceeding 350 mm.

3.5.2 Return Period

The June 83 rainstorm is atypical for Hong Kong in that it was extremely short and intense. Because it is an unusual rainstorm, it is very difficult to determine from past rainstorm records its return period which will equally be a function of its intensity and the duration considered.

According to Peterson & Kwong (1981) who presented statistical information on rainstorms in Hong Kong based on the Royal Observatory raingauge in Tsim Sha Tsui, a maximum 5-hour total rainfall of 274.4 mm has a return period of about 50 years using Gumbel's method of probability distribution for extreme values. The return period decreases to 7.5 years

for the 24-hour total rainfall of 346.7 mm and to only about 3 years for the 3-day total rainfall of 352.1 mm.

3.5.3 Comparison with the May and August Rainstorms of 1982 and Other Significant Rainstorms in the Past

Table 12 compares the maximum 1 hour to 4 day rainfall for June 83 rainstorm with those for the May and August rainstorms of 1982 for which the two previous rainstorm reports have been prepared (GCO, 1982a & b). Generally speaking, June 83 rainstorm was less severe than the two rainstorms in 1982 although it was definitely more severe in the short term.

Figure 4 shows a comparison of the cumulative rainfall for June 83 rainstorm with those for the rainstorms in June 1966, June 1972, August 1976, and, May and August 1982.

4. LANDSLIP INCIDENTS

4.1 Introduction

According to the records kept by the GCO, a total of 160 landslip incidents that took place as a result of June 83 rainstorm were reported to and inspected by the GCO. The approximate locations of those incidents are plotted on the map of the Territory in Figure 5. Brief details regarding the location, type, and consequence for each of those incidents are presented in Tables 6,7 and 8 for incidents in Hong Kong Island, Kowloon, and the New Territories respectively.

Information in the summary tables came from various sources. For major incidents, the information was readily available from landslip record cards which were routinely prepared for landslips whose volume of slide debris exceeded 50 m³. An example of the landslip record card is shown in Figure 6. Information regarding other landslip incidents came from field notes kept by the engineers who attended the incidents, records of any follow up actions and recommendations, and for very minor incidents, recollection of the engineers who inspected the incidents.

There are no firm rules regarding the type of landslip incidents that should be referred to the GCO for advice. In many cases, minor incidents of little consequence were referred to the office while other comparatively more severe incidents went unreported. It is likely however that the list of 160 incidents has included all the major, severe incidents in the rainstorm that required specialist geotechnical advice.

In the following subsections, details of some of the landslip incidents will be presented. The incidents will firstly be discussed in terms of types of slope failure and then in terms of the areas affected by the incidents. Specific examples will be cited and illustrated by photographs annotated with brief notes. Summary statistics regarding the type of slope failed, area affected and failure consequence as discussed in Section 2 are given in Tables 3,4, and 5 respectively. The last subsection will briefly mention those landslip incidents inspected by other offices and departments.

4.2 Type of Slope Failures

4.2.1 Cut Slope Failures

It can be seen from Table 3 that over 50% of the landslip incidents reported to and inspected by the GCO were classified as cut slope failures. The majority, 72 cases, occurred in soil cut slopes. Only 4 occurred in soil/rock cut slopes and 8 in rock cut slopes.

22 cases, i.e. approximately 25% of the cut slope failures, were classified as major failures. The most notable example is Incident No. HK 6/27 in Tin Wan Hill Road which involved the failure of the upper part of a 30 m high soil/rock outcrops (Plates 1 and 2). 6 parked vehicles were buried by the slide debris. Details of this failure will be presented later in Section 5.1. Other examples of major cut slope failures are Incident No. HK 6/22 at Stubbs Road near Lingnam College (Plate 3); Incident No. HK 6/24 at 11 Shouson Hill Road East (Plate 4); Incident No. HK 6/43 at Ap Lei Chau (Plate 5); Incident No. N 6/5 at Tsing Yi Road (Plate 6); and Incident No. K 6/8 at Cheung Lung Tin Village (Plate 7).

The remaining 57 cases were minor cut slope failures. Examples of minor outslope failures are Incident No. HK 6/26 at Tai Hang Road (Plate 8); Incident No. HK 6/41 at Repulse Bay Road (Plate 9); Incident No. HK 6/55 at Chung Hom Kok Road (Plate 10); Incident No. HK 6/61 at King's Road opposite to Pan Hoi Street (Plate 11); and Incident No. HK 6/66 at Ma Shan Village (Plate 12).

4.2.2. Fill Slope Failures

There were a total of 19 landslip incidents inspected by the GCO which were classified as fill slope failures. Of these, only one was a major failure.

The major fill slope failure at the Peak Road, Incident No. HK 6/12, caused major disruptions in the Peak area (Plates 15 and 16). Peak Road was closed for a week following the collapse of the section near Magazine and Guilford Roads until a temporary steel bridge was constructed. Section 5.2 will discuss some details of the failure.

Other fill slope failures were minor, and are typified by Incident No. K 6/10 at Tai Shing Village (Plate 15); Incident No. K 6/22 at Ngau Chi Wai Village (Plate 16); and Incident No. K 6/25 at Fuk Tak Sun Tsuen (Plate 17). Type of fill material was variable and in one case, Incident No. HK 6/54 at Tin Pui Tsuen in Tin Wan, it consisted entirely of building debris (Plate 18). A number of cases which were classified as fill slope failures could be more appropriately designated as fill embankment failures. Examples of such failures are Incident No. HK 6/25 at Tai Tam Road (Plate 19); Incident No. HK 6/46 at the junction of Kennedy Road and Mammoth Path (Plate 20); and Incident No. HK 6/59 at Wong Ma Kok Road (Plate 21). Erosion of fill platforms underneath squatter huts were also considered as fill slope failures. An example is Incident No. HK 6/47 at Hoi Pong Village (Plate 24).

4.2.3 Natural Slope Failures

The record available in the GCO showed that 28 of those landslip incidents inspected could be classified as natural slope failure. 11 of these, i.e. approximately 40%, were major failures.

Notable and interesting major natural slope failures are Incident No. N 6/13 at Rennie's Mill Cottage Area (Plate 23) and Incident No. HK 6/45 at Tai Hang Road (Plate 24). Details of these failures will be presented in Section 5. Examples of other major natural slope failures are Incident No. HK 6/21(i) at Stubbs Road (Plate 25); Incident No. N 6/31 at Chung Mei in Lamma Island (Plate 26); and Incident No. K 6/15 at Tai Shing Village (Plate 27).

Examples of minor natural slope failures are Incident No. HK 6/53 at Bowen Road (Plate 28); and Incident No. K 6/4 at Sau On Village (Plate 29).

As mentioned earlier, the actual number of natural slope failures during the rainstorm was probably far greater than those inspected as it is reasonable to assume that many natural slope failures in remote and open areas were not reported.

4.2.4 Retaining Wall Failures

There were 21 retaining wall failures of which only 3 were classified as major failures.

The 3 major failures were Incident No. N 6/14 at Pak Shek San Tsuen (Plate 30); Incident No. N 6/23 at Section 4 of Pak Tin in Shatin (Plate 31); and Incident N 7/7 at Cheung Hang Village (Plate 32).

Examples of minor retaining wall failures are Incident No. N 6/25 at Pak Shek Terrace in Sai Kung (Plate 33); and Incident No. K 6/18 at Chung Luen Tsuen (Plate 34). Some of the retaining wall failures were only partial. An example is Incident No. N 6/30 at Hung Shing Yeh in Lamma Island (Plate 35).

4.2.5 Boulder and Rock Fall

There were 8 cases of boulder and rock fall incidents during the rainstorm of which only 3, such as the rockfall in Incident No. HK 6/31 at Pak Fuk Garden in North Point (Plate 36), were complete failures. The rest of the cases were only partial where boulders and rocks showed signs of instability or movement after the rainstorm.

The most notable case of boulder movement was Incident No. HK 6/36 at 61 Blue Pool Road (Plates 37 and 38). Details of this incident will be presented in Section 5.5. Other examples of boulder movements are Incident No. HK 6/62 at Ma Shan Village in Causeway Bay (Plate 39) and Incident No. HK 6/65 at Holy Cross Village (Plate 40).

4.3 Areas Affected by Landslip Incidents

4.3.1 Squatter Area

The record available in the GCO showed that a total of 48 landslip incidents during June 83 rainstorm had affected squatter areas. The hardest hit areas were at Lam Tin, Cheung Lung Tin and Tai Shing Villages in East Kowloon, due to a combination of high rainfall and high squatter density in those areas.

One of the notable squatter area incidents was Incident No. HK 6/36 at 61 Blue Pool Road mentioned in section 4.2.5 where boulder instability in the squatter area necessitated the evacuation of over 50 huts on the slope. Another notable incident was Incident No. N 6/42 at Po Toi Island (Plates 41 & 42). Details of the above incidents will be given in Section 5. Other examples of squatter area incidents are Incident No. HK 6/68 at Tsin Shiu Ma Tau Village (Plate 43) and Incident No. N 6/9 at Chung Lung Tin Village (Plate 44).

It was noted by inspecting engineers that most cases of squatter incidents were the result of random cut and fill typical of uncontrolled squatter development and such incidents are exemplified by Incident No. K 6/11 and K 6/12, both at Tai Shing Village (Plates 45 and 46). Others were caused by uncontrolled water/sewer discharge as in the case of Incident No. N 6/10 at Cheung Hang Squatter (Plate 47). Certain incidents such as Incident No. HK 6/62 at Ma Shan Village in Causeway Bay (Plate 39) were due to squatter huts being founded on unstable boulders. There were also squatter area incidents such as Incident No. K 6/19 and K 6/20 which were due to poor hut construction and unrelated to landslip.

4.3.2 Permanent Buildings

During the rainstorm, 62 landslip incidents were noted as incidents which affected permanent buildings. The type of buildings affected varied from housing estates, apartment buildings and schools to huts, pigsties and public toilets.

Examples of notable incidents are Incident No. HK 6/11 at 11 Blue Pool Road (Plate 48); Incident No. GCB 20/11SE-A at 1-2 New Eastern Terrace (Plate 49); and Incident No. HK 6/20 at Chai Wan Road near Hing Man Estate (Plate 50). Details of these incidents will be presented in Section 5. Examples of other incidents are Incident No. N 6/7 at Tai Hang Hau in Sai Kung (Plate 51), and Incident No. N 7/9 at Lo Uk Village in Lantau (Plate 52).

4.3.3 Roads

There were altogether 48 landslip incidents that affected roads, with most of the road landslip incidents occurring on Hong Kong Island.

Notable landslip incidents affecting roads included the Peak Road failure and the Tin Wan Hill Road failure which were described in the preceding sections, and Incident No. HK 6/35 at 14 Headland Road (Plate 53). Details of these incidents are available in Section 5.

A number of failures occurred in old cut slopes along roads such as Incident No. HK 6/40 at Repulse Bay Road (Plate 54) and Incident No. HK 7/1 at Chung Hom Kok Road (Plate 55). Further examples of landslip incidents affecting roads are Incident No. HK 6/56 at Nam Long Shan Road (Plate 56); Incident No. HK 6/58 at Big Wave Bay Road (Plate 57); and Incident No. N 6/41 at Peak Road in Cheung Chau (Plate 58).

4.3.4 Footpath, Catchwater, etc.

Ten incidents reported to GCO affected structures in this category, and examples are Incident No. N 6/19 and N 6/20 along the country path between Yung Che Wan, Sun Tsuen and Tai Ping Tsuen in Lamma Island (Plates 59 and 60).

The Water Supplies Department has records of more than 50 landslip incidents along their catchwaters but these incidents were not inspected by the GCO.

4.3.5 Remote, Open and Other Areas

There were 5 landslip incidents in remote, open and other areas. Examples are Incident No. HK 6/21 (ii) at Stubbs Road (Plate 61); Incident No. HK 6/33 at Mt. Collinson and Lin Shing Road (Plate 62); and Incident No. HK 7/5 at Tai Tam Reservoir (Plate 63).

4.4 Landslip Incidents Reported to Other Government Offices and Departments

During the rainstorm, the Highway Office received a total of 146 reports concerning landslip incidents. The records in the GCO showed that 93 of these incidents were referred to the GCO while those remaining were attended to directly by the Highway Office without assistance from the GCO.

The Housing Department attended 4 landslip incidents within public housing estates. Two of the incidents at Rennies Mill and Hing Man Estate will be discussed in Section 5.

The Water Supplies Department record showed that 51 landslips occurred along their catchwaters during the rainstorm. These incidents were minor incidents and none of the incidents were referred to the GCO for advice.

The Agricultural and Fisheries Department attended 23 landslip incidents during the rainstorm, all of which occurred on Hong Kong Island and Lantau Island.

23 landslip incidents were attended by the Maintenance Branch of the Architectural Office. These landslip incidents affected government buildings under their maintenance responsibility. Four of the more significant incidents were referred to the GCO for advice.

The Fire Service Department received 7 special service calls related to landslip incidents during the rainstorm. All these incidents were later attended by other relevant Government Departments and Offices including GCO.

5. NOTABLE AND INTERESTING LANDSLIP INCIDENTS

5.1 Tin Wan Hill Road

(Major soil/rock cut slope failure affecting road and old folks home, Plates 1 and 2)

The failure occurred at around 6 pm on 17.6.83. Large volume of decomposed rock of volcanic origin collapsed and the resultant debris buried 6 parked vehicles, and totally blocked Tin Wan Hill Road and the rear entrance to the old folks home opposite the slope. At the time of inspection, the debris was noted to be saturated and the slide debris extended over an area of approximately 400 m². Witnesses reported that a woman and child were trapped inside one of the buried vehicles although the report proved false following the removal of debris by the Fire Service Department.

The original cut slope was about 30 m high and was comprised of a thin mantle of soil overlying less weathered rock at the lower 20 m of the slope. The slope was formed in 1963 and aerial photographs of the slope showed that the upper portion of the slope had previously failed sometime between 1973 and 1977.

The present failure can be considered as an enlargement of the previous failure and occurred along a very persistent sheeting joint which separates the completely decomposed volcanic rock above from the moderately and slightly decomposed rock below. Inflow from small scale biotic piping above the failure was believed to have been the source of water for pore pressure build up along the sheeting joint sliding plane. The high pore pressure along the sliding plane may also have been due in part to a damming effect behind the chunam surfacing placed after the previous failure.

5.2 Peak Road

(Major fill slope failure affecting road, Plates 13 and 14)

The slope (GCO phase 1A reference no. 11SW-D/FR133) failed in the morning of 17.6.83 during intensive rain. According to eyewitnesses' accounts, the failure occurred in stages. The failure was initially a local failure of the footpath and a small width of the carriageway. It then became a wider failure, before finally developing into a large failure. The final failure removed a mass of soil measuring approximately 35 m in width, 40 m long with a maximum depth of 5 metres, with the slide debris travelled downslope by a maximum of 300 m. The whole western section of the road collapsed and the eastern section was left in a precarious condition.

A detailed programme of investigation was carried out by the GCO to aid remedial work design and comprised drillholes, trial pits, and GCO probings. The investigation revealed decomposed volcanic fill overlying completely decomposed volcanic rock to a depth of 20 metres. In some areas, fill had been placed on a thin veneer of colluvium.

Various sources of water for the failure were considered and it was concluded that the failure was most likely initiated by infiltration into a depression, left open at the top of the slope in connection with the repair of a lamppost.

Temporary remedial measures for the slope included water diversion to minimize direct infiltration, rock fill to stabilize portions of the slope and a temporary steel bridge for Peak Road traffic. The permanent remedial measure that was adopted was a cantilever deck supported by 1.8 m diameter caissons at 3.2 to 3.5 metres centre to centre and taken to bedrock at depths of 20 m. The remedial work cost some HK\$2 million.

Details of this failure are given in a GCO design report (GCO, 1983).

5.3 Rennie's Mill Cottage Area

(Major natural slope failure affecting a cottage area, Plate 23)

The natural slope failure, which occurred in the morning of 17.6.83 may have resulted from rapid infiltration due to concentration of runoff at the bend of an access road above the slope.

The natural slope which failed was about 20 metre high, densely vegetated, and was inclined at an angle of about 40 degrees. A small failure occurred previously at the toe of the slope during the rainstorm of May 1982.

The failure of 1983 was shallow and was mainly confined to the colluvium mantle of the slope. The failure scar is long and narrow and the failure had undermined a retaining wall that supported the fill for the access road above the slope resulting in the partial collapse of the access road. Three endangered cottages were evacuated as a result.

5.4 Tai Hang Road

(Major natural slope failure affecting road, Plate 24)

The failure occurred below a section of Tai Hang Road supported by a 4 to 5 m high foundation wall crossing a natural stream course.

When the failure was first noted, it was only very minor but when it was reinspected again on 18.6.84, the failure had progressively developed into a major failure about 15 m wide. The wall supporting the road was undermined and 3 to 4 m of vertical soil face was exposed.

The failure was believed to have been caused by overflow concentration from the road above. Temporary means to stabilize the slope included diversion of water flow, chunam patching and covering of the slip area with plastic sheets to minimize infiltration. A programme of site investigation which consisted of borings, piezometer installations, GCO probings and laboratory testing was carried out to aid the design of permanent remedial measures. Two alternative remedial measures were recommended to the Highway Office. The first and permanent solution which involved caisson wall was estimated at HK\$500,000 and the second and temporary solution which involved backfilling was estimated to cost HK\$62,000. The cheaper alternative was chosen as Tai Hang Road was planned to be widened in the future.

5.5 61 Blue Pool Road

(Major boulder instability affecting squatter area, Plates 37 and 38)

The incident occurred on a large boulder strewn natural slope above Blue Pool Road (phase 1A reference no. 11SE-C/N3). The slope is about 50 m high and 500 m wide and is covered with trees and dense vegetation. The natural slope angle is on average approximately 35 degrees although at places the slope is almost vertical.

Unstable boulders were noted during the inspection of a cut slope failure nearby on 18.6.84. It was noted that extensive gullying and erosion had destabilized many of the large boulders, some of which showed signs of movement.

A study of the possible trajectories of those unstable boulders revealed potential danger and as a consequence, an immediate evacuation order involving the permanent evacuation of 28 squatter huts and temporary evacuation of 29 squatter huts was issued.

5.6 Po Toi Island

(Major natural slope failure in squatter area, Plates 41 & 42)

Po Toi Island is a small island off the southern coast of Hong Kong Island. The incident occurred on 17.6.83 but it was not inspected until a few days later due to its remote location.

The incident involved the failure of 10 metre high natural soil and rock slope behind a squatter area which caused the collapse of 6 squatter huts. One of the collapsed squatter huts as shown on Plate 42 was carried by debris into the sea. As a result of the natural slope failure, 10 squatter huts were permanently evacuated. There were also other huts in the island which were evacuated. These huts had partially collapsed due to high wind, rather than due to landslide incidents.

For remedial measures, the slide debris was removed and a retaining bund was constructed to contain any further failure. Unstable boulders in the squatter area were also buttressed to improve their stability.

5.7 11 Blue Pool Road

(Major soil cut slope failure affecting apartment buildings, Plate 48)

The failure occurred in a 45° - 50° , 30 m high, vegetated cut slope behind four four-storey apartment buildings on Blue Pool Road. The failure was believed to have occurred in two stages with the lower portion of the slope failing at about 8 am on 17.6.83, followed later by the failure of a much larger section cut slope. The volume of slide debris was estimated at around 200 m³. As a result of the failure two buildings and the ground floor of a third buildings were evacuated until remedial works were completed. Other buildings were also temporarily evacuated.

Remedial work on the slope consisted of double layer spray mortar protection of the failed area after the removal of loose debris. Several loose boulders on the slope were dowelled.

5.8 1-2 New Eastern Terrace

(Major soil cut slope failure affecting apartment buildings, Plate 49)

A 6 m high and very steep (75°) cut slope above a masonry retaining wall behind the buildings failed at about 8 am on 17.6.83. The cut slope may have failed due to rapid infiltration and the lack of any provision for surface drainage.

The 6 m high retaining wall below the slope showed no signs of distress. The two apartment buildings in front of the wall however were temporarily evacuated because they are only about 3 metres in front of the wall and were at risk if further deterioration were to have occurred.

5.9 Hing Man Estate

(Major soil cut slope failure affecting road and housing estate, Plate 50)

Hing Man Estate is a Housing Department project which consists of several 44 storey housing blocks under construction in a lot between Tai Tam Road above and Chai Wan Road below. The failure occurred beneath the estate community centre and car park podium in a slope which is basically colluvium overlying decomposed in-situ materials of volcanic origin. Several failures occurred in the slope previously and the present failure during the June 83 rainstorm occurred before the completion of reconstruction work for an earlier failure. As a result of the failure, the foundation of the carpark podium was undermined and Chai Wan Road, below was partially blocked by slide debris which was estimated to be 1 200 m³ in volume. The Housing Department believed that the source of water for the failure came from a network of pipes in the rather permeable colluvial valley.

Remedial measures implemented on the slope included redirecting of water flow away from the slope, placement of rock to stabilize the slope and horizontal drain installation. Several piezometers were installed on the slope to monitor the water level for checking the effectiveness of the remedial measures.

5.10 14 Headland Road

(Major soil cut slope failure affecting private driveway, Plate 53)

The failure occurred in the morning of 17.6.83. Heavy water discharge was noted at the boundary between fill and highly decomposed volcanic rock on the slope. The source of water was traced to a temporary depression on Headland Road which was formed by a roadwork contractor.

The contractor had limited success in diverting flow away from the depression. An extremely heavy downpour (an indirect confirmation of the heavy rainfall recorded in the afternoon at H15 in Stanley) in the afternoon damaged the water diversion bund that had been constructed. Infiltration into the slope below, resulted in further deterioration of the slopes.

On 18.6.83 a row of temporary sheet piles were installed to stabilize the slope as noted on Plate 53.

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Table 1 - No. of Incident Reports Received by Various Government Offices and Departments

Government Office/Department		No. of Reports Received	Type of Incident		
			Landslip	Flooding	Other
Geotechnical Control Office		159	155	2	2
Highway Office	HK Division	406	98	300	8
	Kln Division	109	23	68	18
	NT Division	50	25*	25*	-
Housing Department		4	4	-	-
Water Supplies Department		60	51	-	9
Agricultural & Fisheries Department		23	23	-**	-**
Architectural Office, Maintenance Branch		31	23	4	4
Fire Service Department		16	7	8	1
Total		858	409	407	42
Legend :					
* Approximate breakdown					
** Figure not available					

Table 2 - Type, Number and Territorial Distribution of Incidents Reported to Government Offices and Departments

Type of Incident	No. Reported (due to June, 83 rainstorm)	Territorial Distribution		
		Hong Kong	Kowloon	New Territories
Landslip	* 307 (160 inspected by the GCO)	160	32	115
Flooding	407	309	73	25
Others (horse collapse broken drains etc.)	42	18	20	4

Legend :

* Duplicated and multiple incident reports were accounted for in arriving of this figure

Table 3 - Types of Landslip Incidents Inspected by the GCO during June, 1983 Rainstorm

Type of Slope		Number of Failures				Territorial Distribution		
		Major	Minor	Total	% of Total	Hong Kong	Kowloon	New Territories
Cut Slope	Soil	18	54	72	45%	46	4	22
	Soil/Rock	3	1	4	3%	4	-	-
	Rock	1	7	8	5%	6	1	1
Fill Slope		1	18	19	12%	11	7	1
Natural Slope		11	17	28	17%	7	7	14
Retaining Wall		3	18	21	13%	4	2	15
Boulder or Rock Fall		-	8	8	5%	6	1	1

Note : Total number of landslip incidents inspected = 160.

Table 4 - Areas Affected by those Landslip Incidents Inspected by the GCO

Area Affected	No. of Landslip Incidents Affecting the Area				Territorial Distribution		
	Major	Minor	Total	% of Total	Hong Kong	Kowloon	New Territories
Squatter Area	8	40	48	28%	19	23	6
Permanent Structure (Houses, Apartments, Cottages etc.)	13	49	62	35%	24	2	36
Road	17	31	48	28%	42	-	6
Footpath, Catchwater Minor Road, Country Path etc.	3	8	11	6%	-	-	11
Remote, Open and Other Area	1	4	5	3%	4	-	1

Table 5 - Failure Consequence of those Landslip Incidents Inspected by the GCO

	Failure Consequence					
	No. of Squatter Huts		No. of Permanent Structure		No. of Sections of Road	
	Permanently Evacuated	Temporarily Evacuated	Permanently Evacuated	Temporarily Evacuated	Totally Closed	Partially Closed
Hong Kong Island	51	38	-	4	6	20
Kowloon	26	11	-	-	-	-
New Territories	23	0	8	9	3	1
Total	100	49	8	13	9	21

Table 6 - List of Incidents on Hong Kong Island Reported to GCO (Sheet 1 of 7)

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		Date	From	Date	Type	Scale			
HK 6/4	Link Road/Broadwood Road	17/6	Public	17/6	Soil out slope	Major	Road	Road partially blocked	
HK 6/5	21-23 Borrett Road, Opp. Island School	17/6	Public	17/6	Flooding and accumulation of mud (not related to landslip)	-	Apartments	Carpark temporarily closed	
HK 6/6	Peak Road between Wanchai Gap and Magazine Gap	17/6	G.C.O.	17/6	Rockfall	Minor	Road	Road partially blocked	
HK 6/7	Hoi Pang Village Area 5	17/6	C.D.O.	17/6	Natural slope	Major	Squatter	4 huts permanently evacuated	
HK 6/8	Hoi Pang Village Area 4 No. 88 near Tsang Kee Stone	17/6	C.D.O.	17/6	Flooding (not related to landslip)	-	Squatter	1 hut temporarily evacuated	
HK 6/9	Smithfield Cottage Area Section 5814 near Telephone Exchange Building	17/6	C.D.O.	17/6	Soil out slope	Major	Squatter	1 hut temporarily evacuated	
HK 6/10	200 Victoria Road (57 Mt. Davis Road)	17/6	H/HK	17/6	Brick retaining wall	Minor	Apartments (construction site) and road	Road totally blocked Foundation of building exposed	OCB 10/11 SW-C
HK 6/11	11 Blue Pool Road	17/6	H/HK	17/6	Soil out slope	Major	Duplexes	2 duplexes evacuated	OCB 24/11SW-D
HK 6/12	Peak Road, near Magazine Gap Road and Guilford Road	17/6	G.C.O.	17/6	Fill slope	Major	Road	Road collapsed and closed	
HK 6/13	Maryknoll Sisters School, Blue Pool Road	17/6	Public	17/6	Chunam spalled off soil out slope	Minor	School	Part of school playground temporarily closed	
HK 6/14	Chung Ngai Village, Aberdeen	17/6	H/HK	17/6	(Landslip inspected by H/HK)		Squatter	16 huts permanently evacuated	
HK 6/15	62, Leighton Hill Road	17/6	G.C.O.	17/6	Soil out slope	Minor	Private apartment	Backlane of building temporarily closed	OCB 31/11SW-B
HK 6/16	Mount Davis Road, near No.52 (2 incidents)	17/6	G.C.O.	17/6	(i) Soil out slope (ii) Soil out slope	Minor	Road	Bus bay closed	

Table 6 (Cont.) - List of Incidents on Hong Kong Island Reported to GCO (Sheet 2 of 7)

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		Date	From	Date	Type	Scale			
HK 6/17	Stubbs Road/Mt. Nicholson Road	17/6	G.C.O.	17/6	Washout of chunam on soil cut slope	Minor	Road	-	
HK 6/18	Ma Hang Village, Causeway Bay	17/6	H/HK	17/6	Boulder movement	Minor	Squatter	Permanent evacuation of 2 huts	
HK 6/19	Ka Wai Man Road	17/6	Private	17/6	Distressed soil out slope (slope seepage)	Major	Building (clinic)	Ground floor of clinic evacuated	
HK 6/20	Chai Wan Road near Hing Man Village	17/6	H/HK	17/6	Soil out slope	Major	Road	Road partially blocked	Case followed up by HD
HK 6/21	Stubbs Road, Shiu Fai Terrace (2 failures)	17/6	H/HK	17/6	(i) Natural slope (ii) Soil out slope	Major Minor	(i) Road (ii) Cemetery	(i) Catchpit blocked surface channel broken (ii) Several tombs buried	
HK 6/22	Stubb Road, near Ling Nam College	17/6	H/HK	17/6	Soil out slope	Major	Road	Road partially blocked	GCB 25/11SW-D
HK 6/23	Scenic Villa, Victoria Road	17/6	H/HK	17/6	Soil out slope	Minor	Road (private)	Road partially blocked	GCB 11/11SW-C
HK 6/24	11 Shouson Hill Road East	17/6	H/HK	17/6	Soil out slope	Major	Apartment (carpark podium) and road	Road partially blocked	GCB 28/11SW-D
HK 6/25	Tai Tam Road (Catchpit No. TT 76)	17/6	H/HK	17/6	Erosion of surfacing and subgrade of road	Minor	Road	Catchpit blocked	
HK 6/26	Tai Hang Road, 100 m up from Junction of Mt. Butler Road	17/6	G.C.O.	17/6	Soil out slope	Minor	Road	Road partially blocked	
HK 6/27	Tin Wan Hill Road, Tai Wan Tsuen Block 1	17/6	F.S.D.	17/6	Soil/rock out slope	Major	Road & Old folks home	Road totally blocked 6 vehicles buried	
HK 6/28	Hoi Pong Village Section 4 No 103 and 104	17/6	H/HK	17/6	Rubble retaining wall	Minor	Squatter	2 huts permanently evacuated	
HK 6/29	8 Illumination Terrace at the end of Wun Sha Street 5 beneath Tai Hung Road	17/6	H/HK	17/6	Erosion of soil out slope	Minor	Apartments	Lane behind buildings blocked	
HK 6/30	Village 82, Victoria Road, structure RH21A, 45-49	18/6	D.O.	17/6	Soil out slope	Minor	Village house	Minor damage to the house	

Table 6 (Cont.) - List of Incidents on Hong Kong Island Reported to GCO (Sheet 3 of 7)

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		Date	From	Date	Type	Scale			
HK 6/31	Pak Fok Garden near Block L, North Point	18/6	H/HK	17/6	Rockfall from natural slope	Minor	Apartments	Staircase damaged	GCB 19/11SE-A
HK 6/32	Hatton Road/Po Shan Road	18/6	H/HK	17/6	Soil out slope	Minor	Road	Road partially blocked	
HK 6/33	Mt. Collinson/Lin Shing Road	18/6	H/HK	17/6	Soil out slope	Major	Road and cemetery	Road partially blocked Footpath at the top collapsed	GCB 5/11SE-D
HK 6/34	Nam Long Shan Road	18/6	H/HK	17/6	(Landslip inspected by H/HK)		Road	Road partially blocked	
HK 6/35	14 Headland Road, Repulse Bay	18/6	H/HK	17/6	Soil out slope with stone pitched protection at the lower portion	Major	Road (private driveway)	Driveway blocked	GCB 15/15WE-A
HK 6/37	Telegraph Bay Village No.82	18/6	H/HK	17/6	Natural Slope	Minor	Squatter	4 huts permanently evacuated	GCB 12/11SW-C
HK 6/38	Below Bowen Drive & Kennedy Road 11SW-B/FR59	18/6	H/HK	17/6	Erosion of ohuman (inspected by H/HK)	Minor	Road		
HK 6/39	20 Repulse Bay Road	18/6	H/HK	18/6 (probably)	Rock cut slope	Major	Road	Road partially blocked	
HK 6/40	32 Repulse Bay Road (2 incidents)	18/6	H/HK	17/6	(i) Soil/rock out slope (ii) Rock out slope	Minor	Road	Road partially blocked	
HK 6/41	45 Repulse Bay Road	18/6	H/HK	17/6	Soil out slope	Minor	Road	Road partially blocked	
HK 6/42	Repulse Bay/Island Road Junction (2 incidents)	18/6	H/HK	17/6	(i) Rock out slope (ii) Soil out slope	Minor	Road	Road partially blocked	
HK 6/43	Ap Lei Chau near Power Station	18/6	H/HK	17/6	Soil/rock out slope	Major	Road (construction site)	Backhoe carried down by and buried in the slide debris	
HK 6/44	South Bay Road/Repulse Bay	18/6	H/HK	17/6	Subsidence of pavement fill	Minor	Grocery store and road	-	

Table 6 (Cont.) - List of Incidents on Hong Kong Island Reported to GCO (Sheet 4 of 7)

Incident No.	Location	Call Received		Failure		Area Affected	Consequence	Remarks
		Date	From	Date	Type			
HK 6/45	Tai Hang Road near Bridge 17	18/6	G.C.O.	17/6	Natural slope below retaining wall	Major	Road	Retaining Wall undermined
HK 6/46	Kennedy Road/Mammoth Path adjacent to petrol station	18/6	H/HK	17/6	Fill embankment for road	Minor	Road	Road partially closed
HK 6/47	Hoi Fong Village, Tin Wan	20/6	H/HK	17/6	Erosion of fill platform underneath hut	Minor	Squatter	1 hut permanently evacuated 4 huts temporarily evacuated Footpath blocked
HK 6/48	Opp. 27 Shun Wan Road	20/6	H/HK	17/6	Erosion of natural slope	Minor	Squatter	2 huts permanently evacuated
HK 6/49	Kau Yor Yuen, Wong Chuk Hang Upper Road	20/6	H/HK	17/6	Soil cut slope	Minor	Squatter	1 hut permanently evacuated
HK 6/50	Nam Long Shan Road Squatters	20/6	H/HK	17/6	Erosion of fill platform	Minor	Squatter	4 huts permanently evacuated
HK 6/51	Hut No. 20, Wong Chuk Hang Path	20/6	H/HK		(Landslip inspected by H/HK)			
HK 6/52	Stanley Gap Road	20/6	H/HK		(Landslip inspected by H/HK)			
HK 6/53	Bowen Road Catchpit No. B28 & 29	20/6	H/HK	17/6	Natural slope	Minor	Road	-
HK 6/54	Tin Pui Tsuen, Tin Wan	21/6	H/HK	17/6	Building debris fill slope	Minor	Squatter	-
HK 6/55	Chung Hom Kok Road	21/6	H/HK	17/6	Rock out slope	Minor	Road	Road partially blocked
HK 6/56	Nam Long Shan Road near catchpit No. 24	21/6	H/HK	17/6	Soil cut slope	Minor	Road	Road partially blocked
HK 6/57	Tong Bin Lane, Wong Chuk Hang	21/6	H/HK	17/6	Rock out slope	Minor	Road	Footpath blocked
HK 6/58	No. 8 Big Wave Road, near catchpit B49	21/6	H/HK	17/6	Soil cut slope	Minor	Road	Road partially blocked
HK 6/59	Wong Ma Kok Road, near junction to sports ground	21/6	H/HK	17/6	Fill embankment	Minor	Road	Footpath collapsed and closed

Table 6 (Cont.) - List of Incidents on Hong Kong Island Reported to GCO (Sheet 5 of 7)

Incident No.	Location	Call Received		Failure			Area Affected	Consequences	Remarks
		Date	From	Date	Type	Scale			
HK 6/60	Ma Hang 'A' Village	21/6	H/HK	17/6	Soil out slope	Minor	Squatter	-	
HK 6/61	King's Road opp. Fan Hoi Street, Quarry Bay	22/6	H/HK	17/6	Rock out slope	Minor	Road	Footpath partially blocked	
HK 6/62	Ma Shan Village, Causeway Bay	21/6	H/HK	17/6	Boulder movement	Minor	Squatter	3 huts permanently evacuated 1 hut temporarily evacuated	
HK 6/63	Cheung Hong Street, North Point, slope above retaining wall	23/6	H/HK	17/6	Erosion of fill slope above retaining wall	Minor	School	Backland between school and retaining wall temporary closed	
HK 6/64	O Pui Loon Village, footpath adjacent to RE/7D/81-83	21/6	H/HK	17/6	Soil out slope	Minor	Squatter	-	
HK 6/65	Holy Cross Path Village	21/6	H/HK	17/6	Loose rocks from previous failure in dangerous position (No actual failure)	Minor	Squatter	3 huts temporarily evacuated	
HK 6/66	Ma Shan Village upper level footpath near XE/BD/01/154	21/6	H/HK	17/6	Soil out slope	Minor	Squatter	Footpath blocked	
HK 6/67	Tsin Shiu Ma Tau Village RE/10C/184-189	21/6	H/HK	17/6	Soil out slope	Minor	Squatter	-	
HK 6/68	Tsin Shiu Ma Tau Village YE/Y12/7	21/6	H/HK	17/6	Soil out slope	Minor	Squatter	Kitchen of 1 hut relocated	
HK 7/1	Chung Hom Kok Road, No.3 Failure	1/7	H/HK	17/6	Soil out slope	Major	Minor road	Road blocked	
HK 7/2	Chung Hom Kok Road, No.2 Failure	1/7	H/HK	17/6	Soil/rock out slope	Major	Minor road	Road blocked	
HK 7/3	Hoi Fong Village, Tin Wan				(Same failure as Case 6/47)				
HK 7/4	Repulse Bay Road near oahopit No. RB8	25/7	H/HK	17/6	Fill slope	Minor	Road	Pedestrian pavement slightly undermined	
HK 7/5	Tai Tam Reservoir Road	25/7	H/HK	17/6	Fill slope	Minor	Open area	-	

Table 6 (Cont.) - List of Incidents on Hong Kong Island Reported to GCO (Sheet 6 of 7)

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		Date	From	Date	Type	Scale			
GCB 14/15NE-A	5-11 South Bay Close (Kingly Court)	29/6	-	17/6	Soil out slope above retaining wall	Minor	Apartments	-	
GCB	15 Ventris Road	17/6	-	17/6	Soil out slope	Major	Apartments	Flats temporarily evacuated	File ref.: DH92/76/HK
GCB	RBL 1044 South Bay Close (2 incidents)	17/6	-	17/6	Soil out slope	Minor	Construction site for apartments		File ref.: 6/3/07/80
GCB 20/11SE-A	1-2 New Eastern Terrace	24/6	-	17/6	Soil out slope above retaining wall	Major	Apartments	Building evacuated	
GCB	St. Lukes College, Ship Street	17/6	-	17/6	Soil out slope	Minor	School	-	File ref.: 6/1152/78 Slope no. 115W-B/C 253
GCB	63 Repulse Bay Road	17/6	-	17/6	Distressed chunam on soil out slope	Minor	Houses	-	File ref.: D365/79/ HK
GCB 23/11SW-D	11 Plantation Road	18/6	-	18/6	Cracked retaining Wall	Minor	Apartments	-	
GCB 28/11SW-D	Tree Nursery, Shouson Hill Road West	29/6	-	17/6	Soil out slope	Minor	USD Tree Nursery	-	Case followed up by AO(M)
GCB	St. Francis Canossian College, Kwong Ming Street	17/6	-	17/6	Rubble retaining wall	Minor	School	-	File ref.: DH 365/75/ HK
GCB	12 Villa Verde, Guilford Road	17/6	-	17/6	Soil out slope	Minor	Apartments	-	File Ref.: DH 377/72/ HK
GCB 13/11SW-C	555 Victoria Road, Baguio Villa	12/7	-	17/6	Soil out slope above a retaining wall	Minor	Apartments	-	
GCB 33/11SW-D & 34/11SW-D	Access Road to 66 Deep Water Bay Road (2 incidents)	12/7	-	17/6	Soil out slope Natural slope	Minor Minor	Road(Private)	Road partially -	
GCB 13/15NE-A	Petrol Station, South Bay Close	29/6	-	17/6	Soil out slope	Minor	Petrol station	-	

Table 6 (Cont.) - List of Incidents on Hong Kong Island Reported to GCO (Sheet 7 of 7)

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		Date	From	Date	Type	Scale			
OCB 7/11SE-C	Cooper Road	8/7	-	17/6	Soil out slope	Minor	Road	-	

Table 7 - List of Incidents in Kowloon Reported to GCO (Sheet 1 of 2)

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		Date	From	Date	Type	Scale			
K 6/2	Lam Tin 1st Village	17/6	D.O.	17/6	Natural slope	Minor	Squatter	6 huts permanently evacuated	
K 6/3	Lam Tin 3rd Village (Section 1)	17/6	D.O.	17/6	Natural slope	Minor	Squatter	1 hut permanently evacuated 2 huts temporarily evacuated Footpath collapsed	
K 6/4	Sau On Village	17/6	D.O.	17/6	Erosion of natural slope	Minor	Squatter	2 huts permanently evacuated	
K 6/5	Kam Shek Village	17/6	D.O.	17/6	Natural slope	Minor	Squatter	2 huts permanently evacuated	
K 6/6	Kam Shek Village	17/6	D.O.	17/6	Soil cut slope	Minor	Squatter	1 hut permanently evacuated 1 hut temporarily evacuated	
K 6/7	Cheung Lung Tin Village	17/6	D.O.	17/6	Soil cut slope	Minor	Squatter	2 huts temporarily evacuated 1 hut flooded	
K 6/8	Cheung Lung Tin Village	17/6	D.O.	17/6	Soil cut slope	Major	Squatter	1 hut permanently evacuated Footpath blocked	Deterioration of previous failure in 1980. Many huts were evacuated previously
K 6/9	Cheung Lung Tin Village	17/6	D.O.	17/6	Fill slope movement	Minor	Squatter	Concrete landing cracked	
K 6/10	Tai Shing Village	18/6	H/K	17/6	Fill slope	Minor	Squatter	1 hut permanently evacuated 2 huts temporarily evacuated	
K 6/11	Tai Shing Village	18/6	H/K	17/6	Fill plantation	Minor	Squatter	2 huts permanently evacuated	
K 6/12	Tai Shing Village	18/6	H/K	17/6	Erosion of fill platform on natural gully	Minor	Squatter	2 huts permanently evacuated	
K 6/13	Tai Shing Village	18/6	H/K	17/6	Natural slope	Minor	Squatter	2 huts permanently evacuated	

Table 7 (Cont.) - List of Incidents in Kowloon Reported to GCO (Sheet 2 of 2)

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		Date	From	Date	Type	Scale			
K 6/14	Tai Shing Village	18/6	H/K	17/6	Soil out slope	Minor	Squatter	1 hut damaged slightly	Previous failure in the same area
K 6/15	Tai Shing Village	18/6	D.O.	18/6	Natural slope	Major	Squatter	1 hut permanently evacuated 3 huts temporarily evacuated	
K 6/16	Tai Shing Village	18/6	H/K	17/6	Natural slope	Minor	Squatter	Pigsty damaged	Permanent evacuation order lifted later on
K 6/17	Sau On Village	18/6	H/K	17/6	Boulder fall	Minor	Squatter	2 huts permanently evacuated Footpath collapsed Power distribution board dislocated	
K 6/18	Chung Luen Tsuen	20/6	H/K	20/6	Concrete retaining wall	Minor	Squatter	1 hut permanently evacuated 1 hut temporarily evacuated	
K 6/19	Ling Nam Village	20/6	H/K	20/6	Hut collapse due to poor construction, not related to landslide	-	Squatter	-	
K 6/20	Ling Nam Village	20/6	H/K	?	Progressive of hut due to rotting timber support, not related to landslide	-	Squatter	-	
K 6/21	2C Anderson Road near Wo Ping Village	20/6	Police	?	Timber retaining wall	Minor	House and factory	-	
K 6/22	Ngau Chi Wan Village (Upper East)	20/6	H/K	18/6	Fill Slope	Minor	Squatter and home for the aged	2 huts permanently evacuated	
K 6/23	Lam Tin 1st Village	20/6	H/K	20/6	Chunam spalled off the face of rock out slope	Minor	Squatter	-	
K 6/24	Lam Tin 2nd Village	17/6	D.C.	17/6	Fill platform	Minor	Squatter	Foundation of electric substation undermined	
K 6/25	Fuk Tak San Tsuen	22/6	H.D.	17/6	Fill slope	Minor	Squatter	-	

Table 8 - List of Incidents in the New Territories Reported to GCO (Sheet 1 of 4)

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Reports
		Date	From	Date	Type	Scale			
N 6/5	Tsing Yi Road (FEPCO)	17/6	Police	17/6	Soil cut slope	Major	Road	Road totally blocked	Deterioration of previous failure in Aug. 1982 Incident No. NT 8/44, 1982
N 6/6	Heung Fan Liu, Shatin	17/6	H/NT	17/6	Soil cut slope	Minor	Squatter	1 hut permanently evacuated	
N 6/7	Lot 657, DD 230 Tai Hang Hau, Sai Kung	17/6	D.O.	17/6	Concrete retaining wall	Minor	House	-	GCB 2/12
N 6/8	House No. 6, Ma Nam Wat, Sai Kung	17/6	D.O.	17/6	Masonry retaining wall	Minor	Footpath	Footpath blocked	
N 6/9	Cheung Hang Road, Kwai Chung	17/6	Police	17/6	Natural slope with very minor cut at the toe	Major	Squatter and road	6 huts permanently evacuated Road totally blocked	
N 6/10	Cheung Hang Squatter	17/6	H/NT	17/6	Erosion of natural slope	Minor	Squatter	6 huts permanently evacuated	
N 6/11	Lot 816, Hortus, Ko Shan Tsuen, Cheung Chau	17/6	H/NT	17/6	Random rubble retaining wall	Minor	House	1 house temporarily evacuated Footpath partially blocked	
N 6/12	Nam Wan San Tsuen, Ping Chau	17/6	H/NT	17/6	(Landslip inspected by H/NT)				
N 6/13	Rennies Mill Cottage Area, Section 4 near Po Lan Road	17/6	H.D.	17/6	Natural slope with minor fill above	Major	Cottages and road	3 cottages permanently evacuated Road collapsed and closed	Case followed up by HD GCB 3/LINE-D
N 6/14	64, Pak She San Tsuen, Cheung Chau	17/6	H/NT	17/6	Masonry retaining wall	Major	Houses	3 houses permanently evacuated	
N 6/15	95A, 95B, 96 Tai Ping San Tsuen, Yung She Wan, Lamma Island (2 incidents)	17/6	H/NT	17/6	(i) Soil cut slope (ii) Soil cut slope	Major Minor	Houses	Ground floors of 2 houses temporarily evacuated	
N 6/16	3B & 4B Tai Yuen Tsuen, Lamma Island	17/6	H/NT	17/6	Soil cut slope	Major	Houses	-	
N 6/17	108 Main Street, Lamma Island	17/6	H/NT	17/6	Soil cut slope	Minor	House	1 house temporarily evacuated	

Table 8 (Cont.) - List of Incidents in the New Territories Reported to GCO (Sheet 2 of 4)

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		Date	From	Date	Type	Scale			
N 6/18	Lot 1596 DD3, 51 Main Road, Lamma Island	17/6	E/NT	17/6	Soil cut slope	Major	House	-	
N 6/19	Country path between Yung Che Wan	17/6	E/NT	17/6			Country path	Country path blocked	Numerous other (about 10)
N 6/20	San Tsuen and Tai Ping Tsuen, Lamma Island (4 incidents)				(i),(ii)&(iii) Soil cut slope (iv) rock out slope	(i) Major (ii) (iii) &(iv) Minor		At 4 locations	Very minor failures of no consequence along the path were not inspected
N 6/21	Waglan Island	18/6	Marine Dept.	17/6	3 Landslips (inspected by Government Maintenance Surveyor)		Supply trolley	Supply trolley alignment	
N 6/22	Nga Kau Wan, Shek Li Ka Nam, Lamma Island (2 incidents)	21/6	D.L.O.	17/6	(i) Soil cut slope (ii) Retaining wall	Minor	Village hut	1 hut temporarily evacuated	
N 6/23	142-148 Pak Tin Section 4 Shatin	22/6	D.L.O.	17/6	Masonry retaining wall	Major	Squatter and WSD access road	WSD access road partially blocked	
N 6/24	D.D. 177 Lot 451 Lok Lo Ha, Shatin	22/6	D.L.O.	17/6	Concrete retaining wall	Minor	Garden of private house and footpath	Footpath partially blocked	
N 6/25	24 Pak Shek Terrace, Pak Shek Wo, Sai Kung	23/6	D.L.O.	17/6	Masonry retaining wall	Minor	Garden of private house	-	GCB 5/11
N 6/26	CLL. S. 7052, Pak Shek Wo San Tsuen, Sai Kung	23/6	D.L.O.	17/6	Rubble retaining wall	Minor	Pigsty	Crown Land license cancelled pigsty demolished	
N 6/27	Minor road near Sam Cheung Restaurant Ma Yau Tong, Sai Kung	23/6	D.L.O.	17/6	Erosion of fill embankment	Minor	Road	-	
N 6/28	Lot 676 DD1, Tai Peng Village, Lamma Island	21/6	D.L.O.	17/6	Soil cut slope	Minor	House	-	
N 6/29	Yung Shu Long Tsuen, Lamma Island (2 incidents)	21/6	D.L.O.	17/6	(i) Natural slope (ii) Natural slope	Minor	Footpath	Footpath blocked	
N 6/30	No. 12, 12A & 13A DD4 Hung Shung Yeh, Lamma Island	21/6	D.L.O.	17/6	Building of retaining wall	Minor	Houses	Concrete landing/platform cracked	

Table 8 (Cont.) - List of Incidents in the New Territories Reported to GCO (Sheet 3 of 4)

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		Date	From	Date	Type	Scale			
N 6/31	No. 26 Chung Mei, Lamma Island	21/6	D.L.O.	17/6	Natural slope	Major	Footpath and house	Footpath blocked 1 house permanently evacuated	
N 6/32	No. 8 & 9, Third Street Sok Kwa Wan, Lamma Island	21/6	D.L.O.	17/6	Rubble wall	Minor	House	-	
N 6/33	Behind No. 15, Third Street Sok Kwa Wan, Lamma Island	21/6	D.L.O.	17/6	Natural slope	Minor	Squatter	-	
N 6/34	No. 25B Peak Road, Lot 944, Cheung Chau	20/6	D.L.O.	17/6	Retaining wall	Minor	House	-	
N 6/35	Lot 12, Ying Sin Leung Care Village Cheung Chau	20/6	D.L.O.	17/6	Rubble retaining wall	Minor	House and playground	-	
N 6/36	Purple Bamboo (Chi Chuk) Temple, Cheung Chau	20/6	H/NT	17/6	Soil cut slope	Minor	Staircase of temple	Kitchen area of temple temporarily evacuated	
N 6/37	Tsau Tuen Road, Sai Wan, Cheung Chau	20/6	D.L.O.	17/6	Boulder instability	Minor	Houses	-	
N 6/38	Pa Chong, Cheung Chau	20/6	D.L.O.	17/6	Soil cut slope	Minor	Factory	-	
N 6/39	61 Pak She Sun Tsuen, Cheung Chau	20/6	H/NT	17/6	Soil cut slope	Minor	Houses	-	
N 6/40	No. 1,2, & 3 Round Table Third Village, Cheung Chau	20/6	D.L.O.	17/6	Soil cut slope	Minor	Village houses	-	
N 6/41	Access Road, near 26 Peak Road, Cheung Chau	20/6	D.L.O.	17/6	Natural slope	Major	Road	-	
N 6/42	Po Toi Island	24/6	D.L.O.	17/6	Natural slope	Major	Squatter	10 huts permanently evacuated	
N 7/1	Footpath from Tin Hau Temple to Kan Tso Long, Lamma Island	30/6	D.L.O.	17/6	Soil cut slope	Minor	Footpath	-	
N 7/2	Tung O Village at the back of HK Electric High Voltage Station, Lamma Island	30/6	D.L.O.	17/6	Natural slope	Minor	Electric substation	-	
N 7/3	19 Mo Tat Village Lamma Island	30/6	D.L.O.	17/6	Masonry wall	Minor	Houses	-	

Table 8 (Cont.) - List of Incidents in the New Territories Reported to GCO (Sheet 4 of 4)

Incident No.	Location	Call Received		Failure			Area Affected	Consequence	Remarks
		Date	From	Date	Type	Scale			
N 7/4	Kwun Yum Wan, Cheung Chau	5/7	D.L.O.	17/6	Natural slope	Minor	Storage hut	1 storage hut temporarily evacuated	
N 7/5	Don Bosco Road, Cheung Chau	5/7	D.L.O.	17/6	Natural slope (Landslip inspected by H/NT)	Minor	Access Road		
N 7/6	Near Ming Fai Youth Centre, Cheung Chau	5/7	D.L.O.	17/6	Natural slope (Landslip inspected by H/NT)	Minor	Footpath		
N 7/7	Cheung Hang Village	17/6	H/NT	17/6	Retaining wall	Major	Public toilet	Toilet closed temporarily stream partially blocked	
N 7/9	Lo Uk Village, DD 316, Lantau	27/7	D.L.O.	17/6	Natural slope	Major	Houses	-	
N 7/10	Ngong Ping Road near Shelter, Lantau	27/7	H/NT	17/6	Natural slope	Major	Road	-	
GCB 7/14	Lot 16/3 DD3, Yung Shue Wan Lamma Island North	23/6	D.L.O.	17/6	Soil cut slope	Minor	House	Concrete platform cracked 1 house temporarily evacuated	
GCB 1/9 & 2/9	Tai O Police Station (1) (2 incidents)	28/6	Police	17/6	Soil cut slope	Minor	Police station	-	
GCB 3/13	Ma Po Ping Correctional Institute, Lantau (2 incidents)	27/6	Correctional Service Dept.	17/6	(i) Soil cut slope (ii) Natural slope	Minor	Correctional institute	-	
GCB 3/10	Green Island Marine Post	1/7	Police	17/6	Soil cut slope	Major	Marine post	-	

Table 9 - Daily Rainfall Recorded at the Royal Observatory from
15th to 19th June, 1983

Date	Day	Total Rainfall
15th June, 1983	Wednesday	trace
16th June, 1983	Thursday	1.6 mm
17th June, 1983	Friday	346.7 mm
18th June, 1983	Saturday	3.8 mm
19th June, 1983	Sunday	trace

Table 10 - List of Highest 5-hour Total Rainfall Recorded at the Royal Observatory

Rank	Ending Hour of 5-hour Period	Total Rainfall (mm)
1	8 a.m. 19th July, 1926	349.3
2	5 a.m. 30th May, 1889	348.0
3	10 a.m. 12th June, 1966	303.3
④	10 a.m. 17th June, 1983	274.4

Table 11 - List of Highest 24 - hour Total Rainfall Recorded at the Royal Observatory

Rank	Ending Hour of 24-hour Period	Total Rainfall (mm)
1	6 a.m. 30th May, 1889	697.1
2	3 p.m. 19th July, 1926	552.2
3	11 a.m. 25th Aug., 1926	416.2
4	9 a.m. 31st Oct., 1923	408.8
5	12 noon 12th Jun., 1966	401.2
6	10 a.m. 29th May, 1982	394.3
7	4 p.m. 17th Oct., 1978	379.8
8	3 p.m. 9th Jun., 1960	368.4
9	8 p.m. 15th Jul., 1866	363.8
10	9 p.m. 16th Aug., 1962	362.4
11	3 p.m. 28th Jun., 1903	350.8
12	10 a.m. 6th Aug., 1911	346.4
⑬	12 Midnight 17th Jun., 1983	346.7

Table 12 - Comparison of June, 83 Rainstorm with May and August Rainstorms of 1982

Rainfall	June, 83 Rainstorm (17th June, 1983)	May, 82 Rainstorm (28th May - 1st June, 1982)	August, 82 Rainstorm (15th - 19th August, 1982)
Max. 1 hour	69.4 mm	43.9 mm	68.3 mm
Max. 2 hour	128.3 mm	83.8 mm	95.1 mm
Max. 4 hour	236.6 mm	135.0 mm	134.5 mm
Max. 6 hour	280.7 mm	182.2 mm	196.8 mm
Max. 8 hour	291.2 mm	208.2 mm	238.3 mm
Max. 12 hour	317.4 mm	225.7 mm	250.7 mm
Max. 24 hour	346.7 mm	394.3 mm	362.4 mm
Max. 36 hour	349.2 mm	431.4 mm	413.3 mm
Max. 1 day	346.7 mm (17 June)	258.4 mm (29 May)	334.2 mm (16 Aug.)
Max. 2 day	350.5 mm (17 - 18 June)	437.4 mm (28 - 29 May)	414.6 mm (16 - 17 Aug.)
Max. 3 day	352.1 mm (16 - 18 June)	474.9 mm (29 - 31 May)	462.2 mm (16 - 18 Aug.)
Max. 4 day	361.9 mm (17 - 19 June)	653.9 mm (28 - 31 May)	493.4 mm (16 - 19 Aug.)
Max. 5 day	364.3 mm (17 - 20 June)	655.2 mm (28 May - 1 June)	522.8 mm (15 - 19 Aug.)

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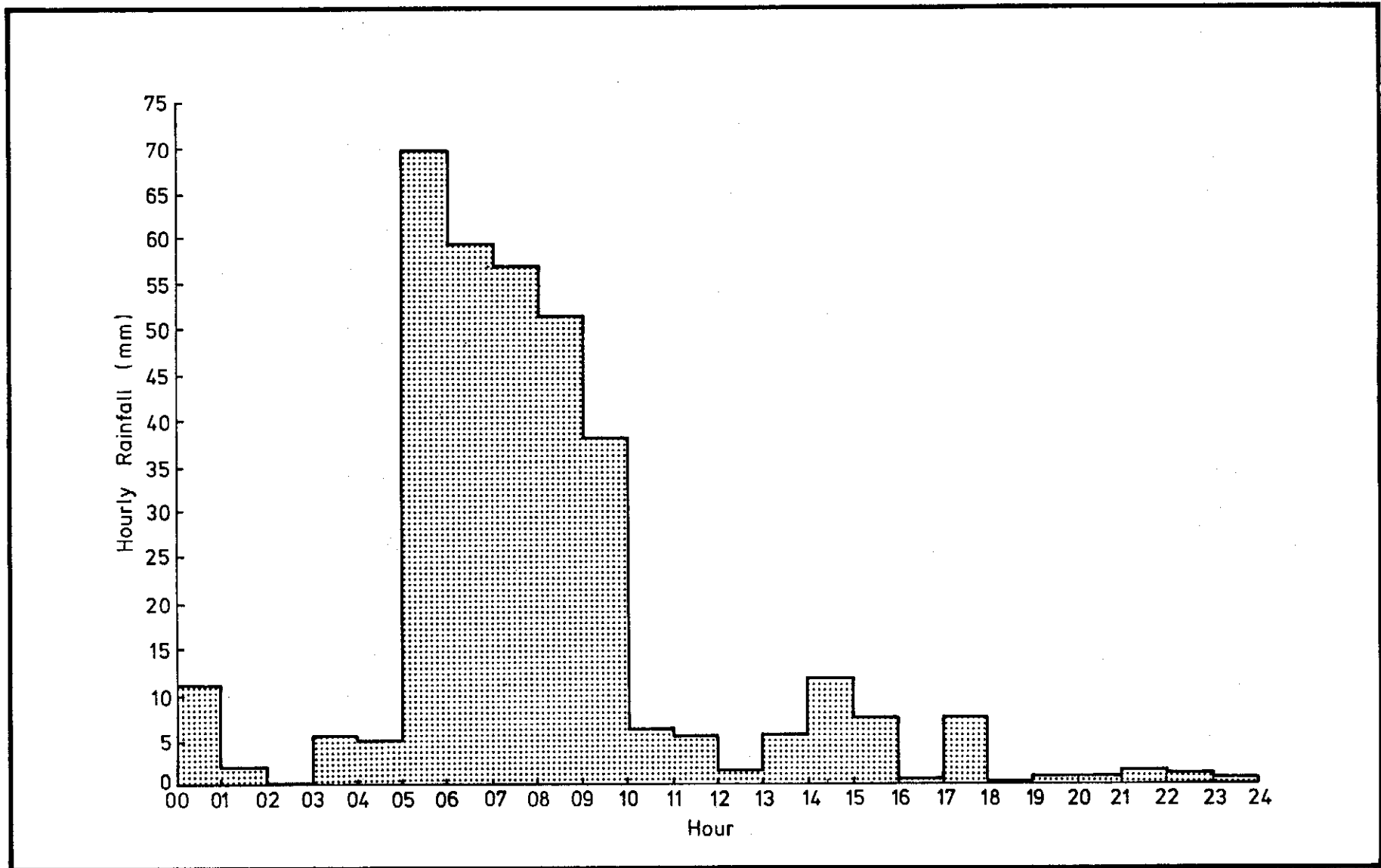


Figure 1 - Histogram of Hourly Rainfall at the Royal Observatory on 17th June, 1983

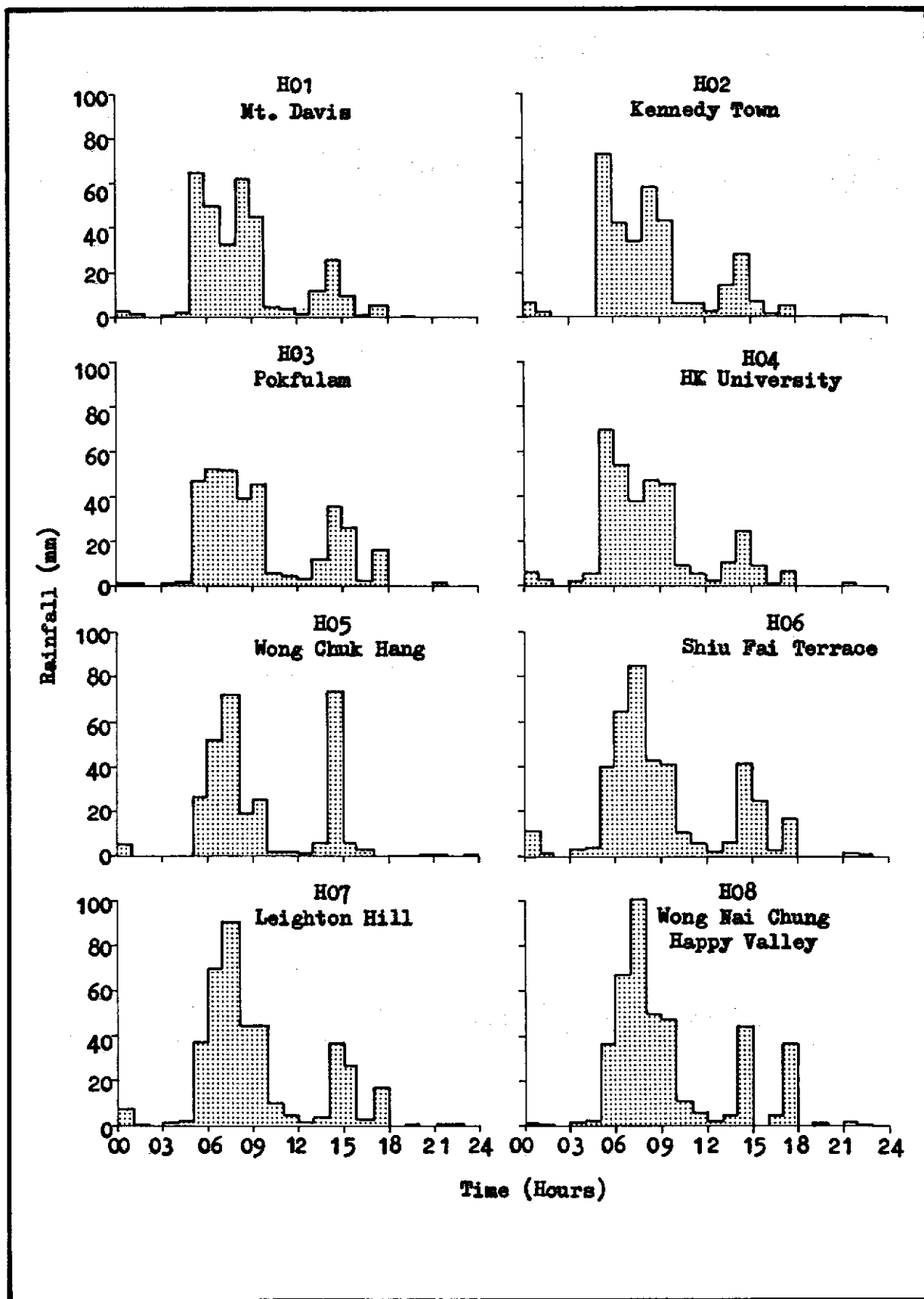


Figure 2 - Histograms of Hourly Rainfall Recorded by GCO Raingauges on 17th June, 1983 (Sheet 1 of 5)

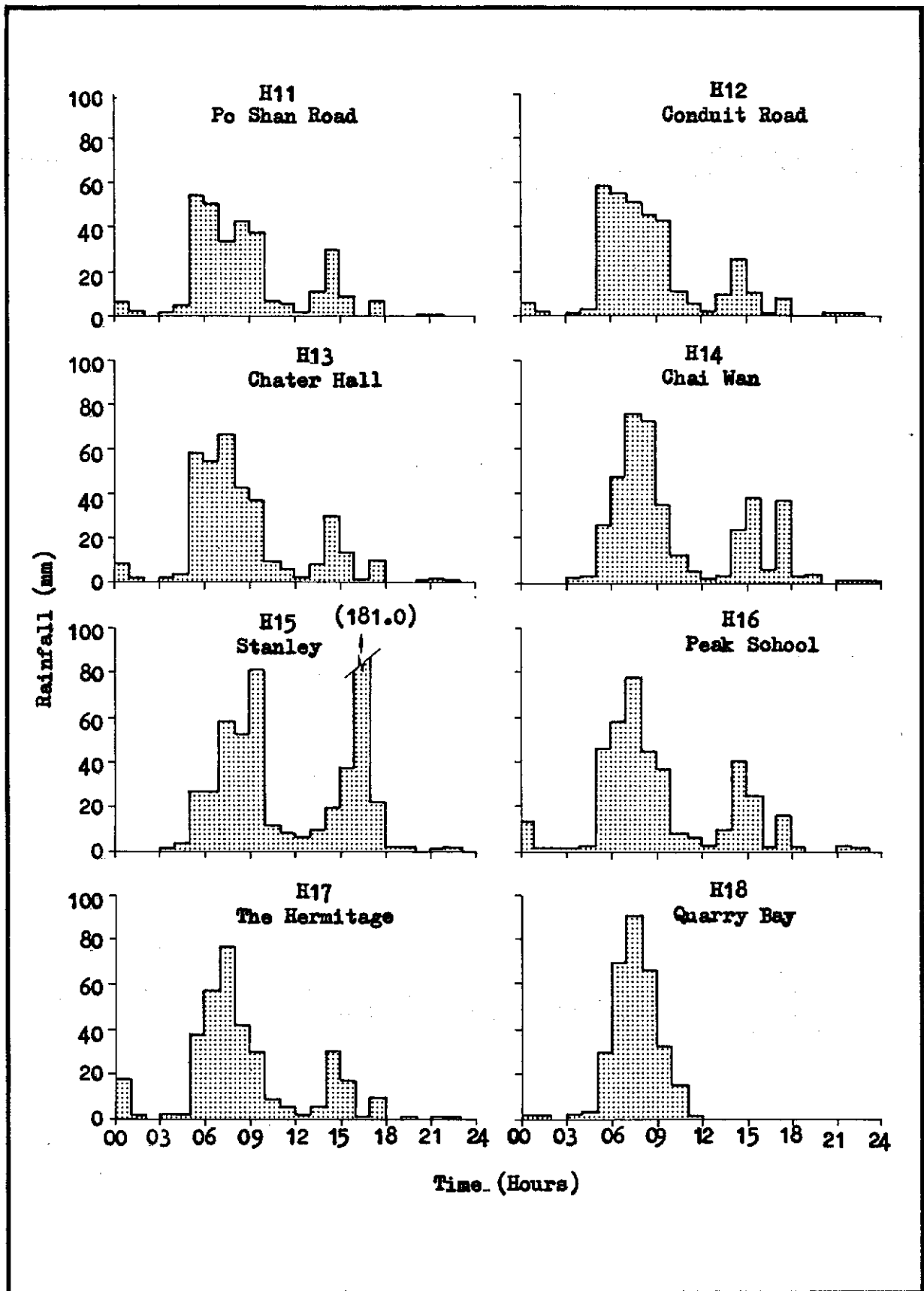


Figure 2 (Contd.) - Histograms of Hourly Rainfall Recorded by GCO Raingauges on 17th June 1983 (Sheet 2 of 5)

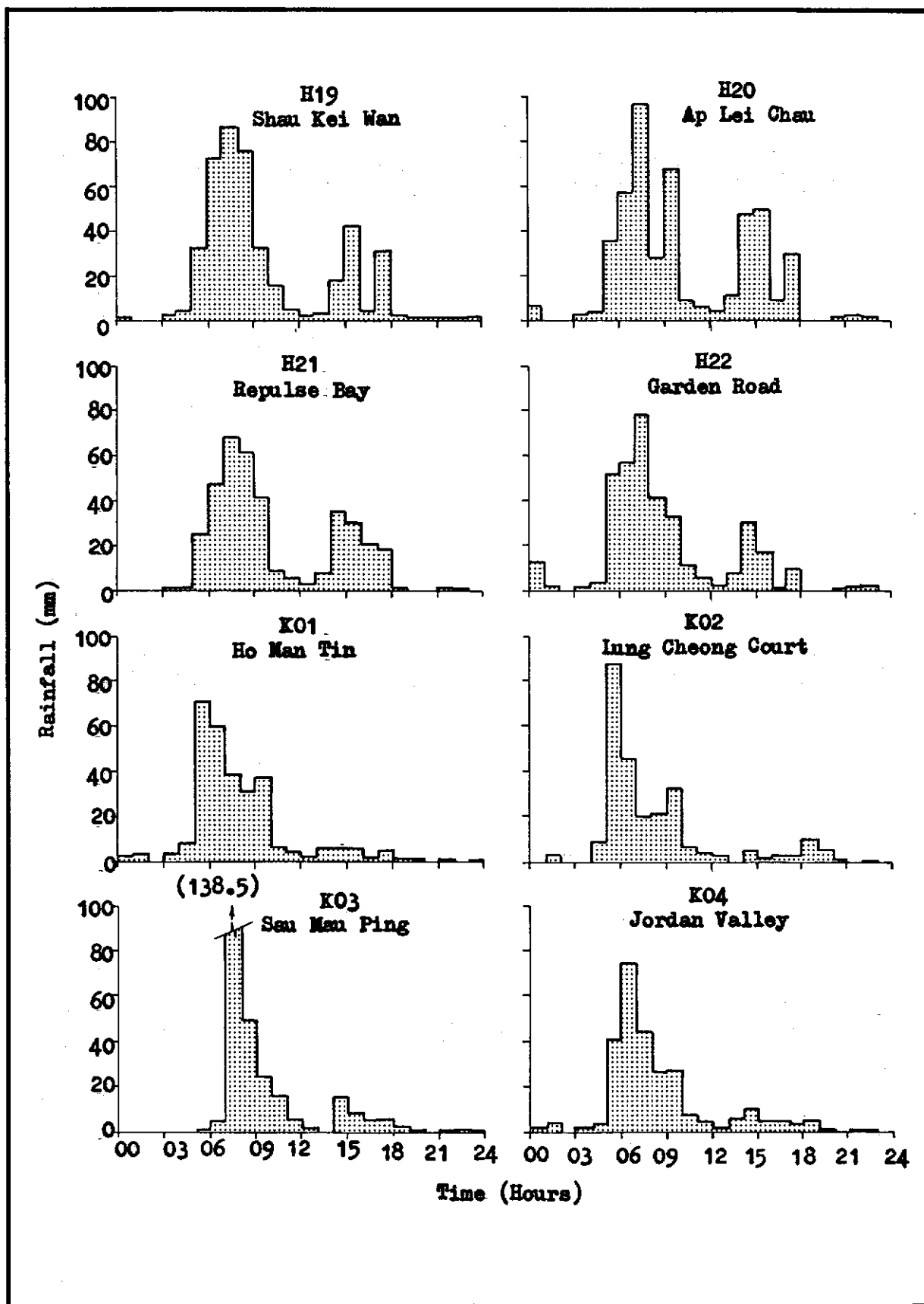


Figure 2 (Contd.) - Histograms of Hourly Rainfall Recorded by GCO Raingauges on 17th June 1983 (Sheet 3 of 5)

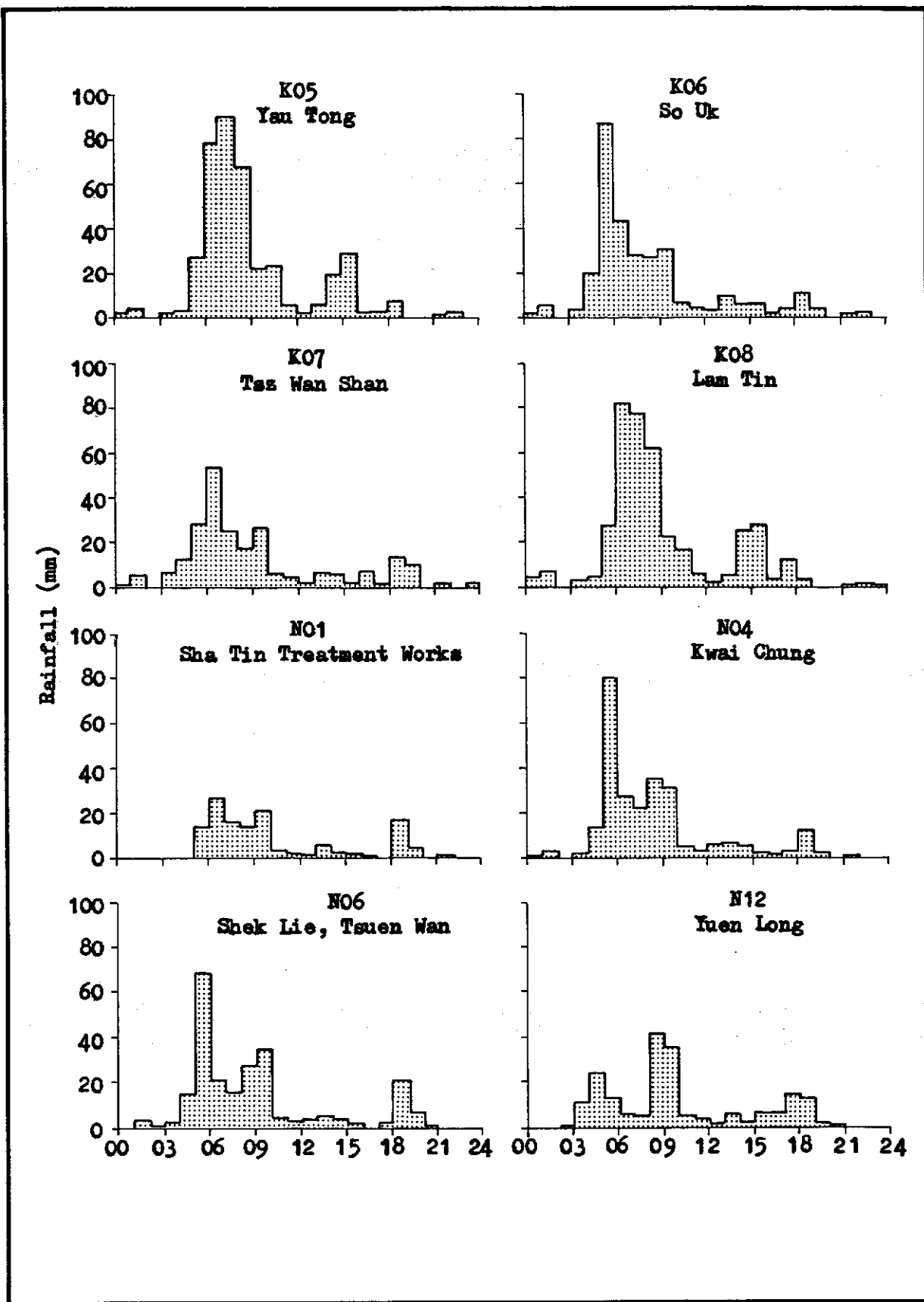


Figure 2 (Contd.) - Histograms of Hourly Rainfall Recorded by GCO Raingauges on 17th June 1983 (Sheet 4 of 5)

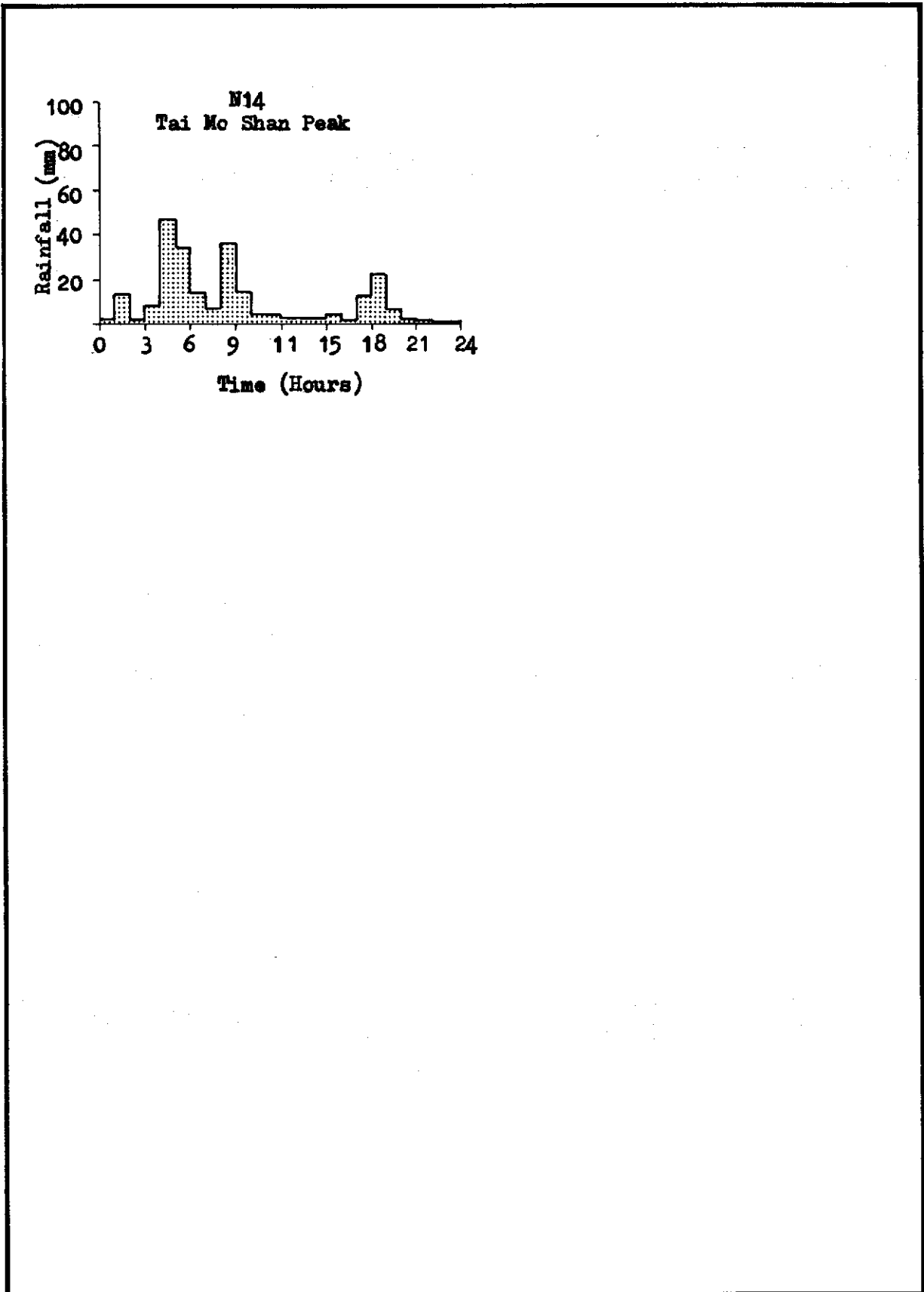


Figure 2 (Contd.) - Histograms of Hourly Rainfall Recorded by GGO Raingauges on 17th June 1983 (Sheet 5 of 5)

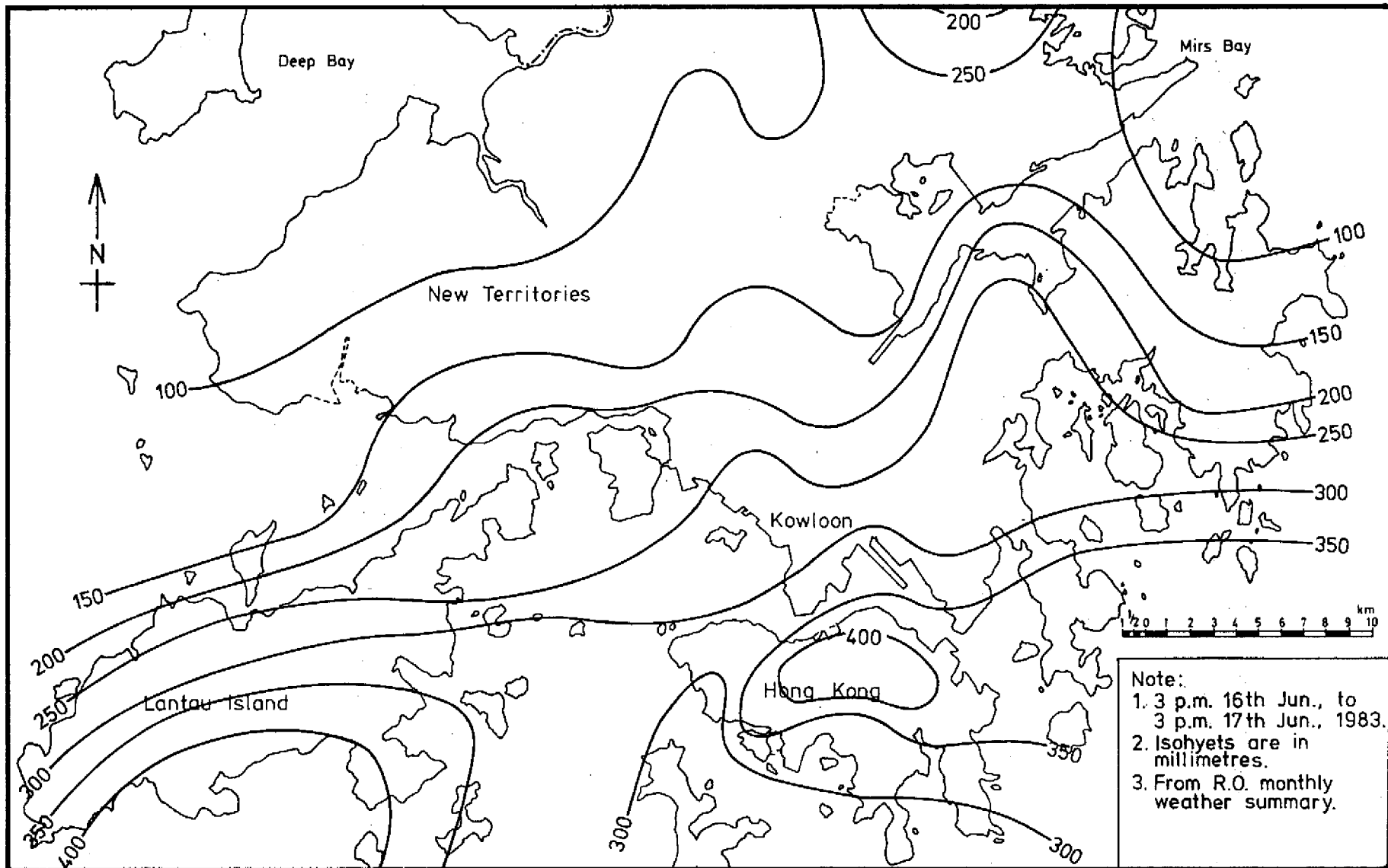
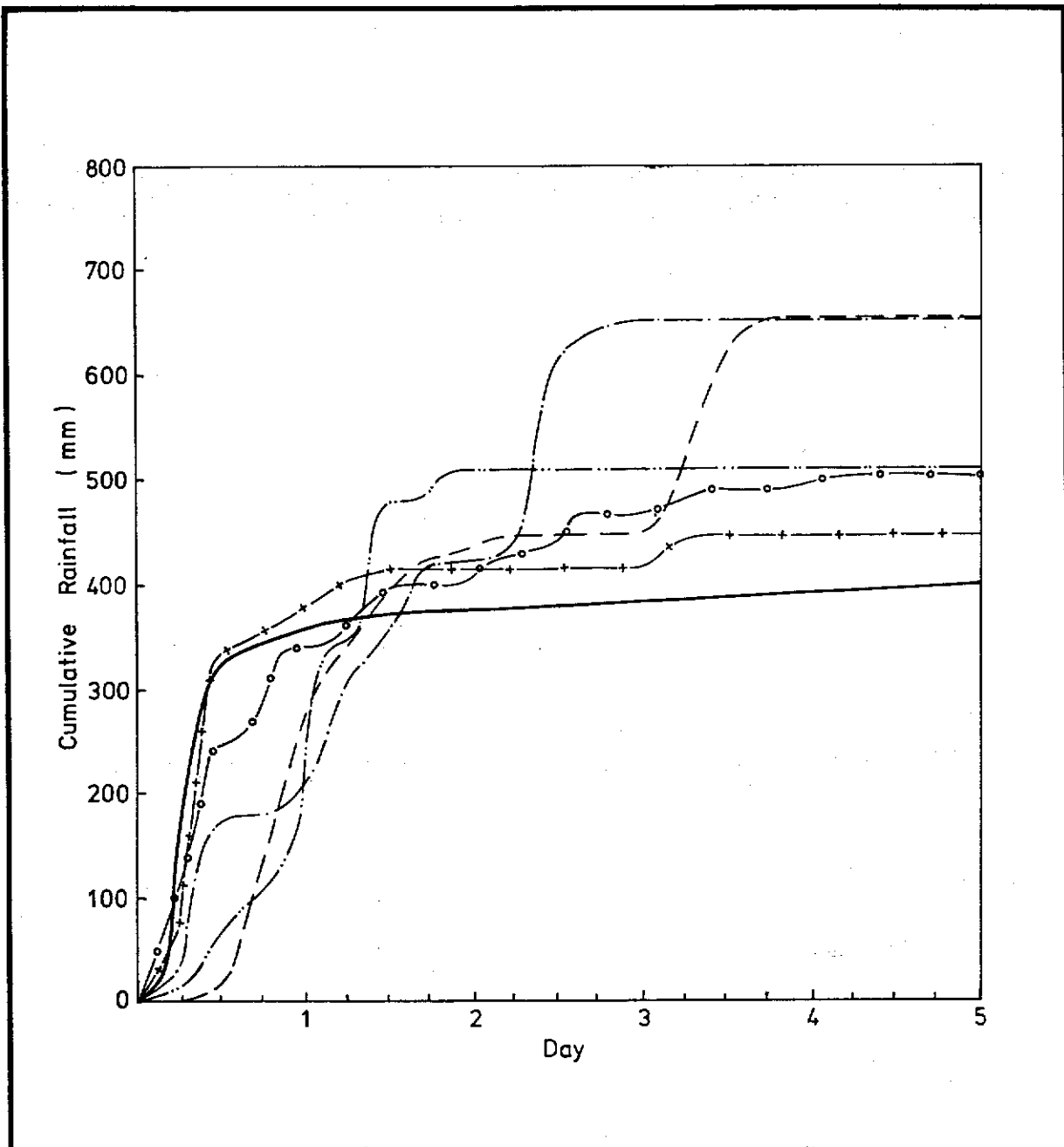


Figure 3 - Rainfall Distribution Map during the June, 83 Rainstorm



Year	Month	Symbol	Day (Rainfall in mm)					Previous 15 days
			1	2	3	4	5	
1966	June	—+—	382.6	33.7	0.7	31.4	-	416.4
1972	June	—·—·—	205.9	213.8	232.6	0.6	0.1	141.6
1976	August	—·—·—	250.3	261.3	4.5	NIL	1.4	78.5
1982	May	—·—·—	179.0	258.4	11.0	205.5	1.3	9.8
1982	August	—○—	334.2	80.4	47.6	31.2	2.3	376.7
1983	June	—	346.7	3.8	Tr.	9.8	2.4	76.6

Figure 4 - Comparison of June, 83 Rainstorms with Past Rainstorms

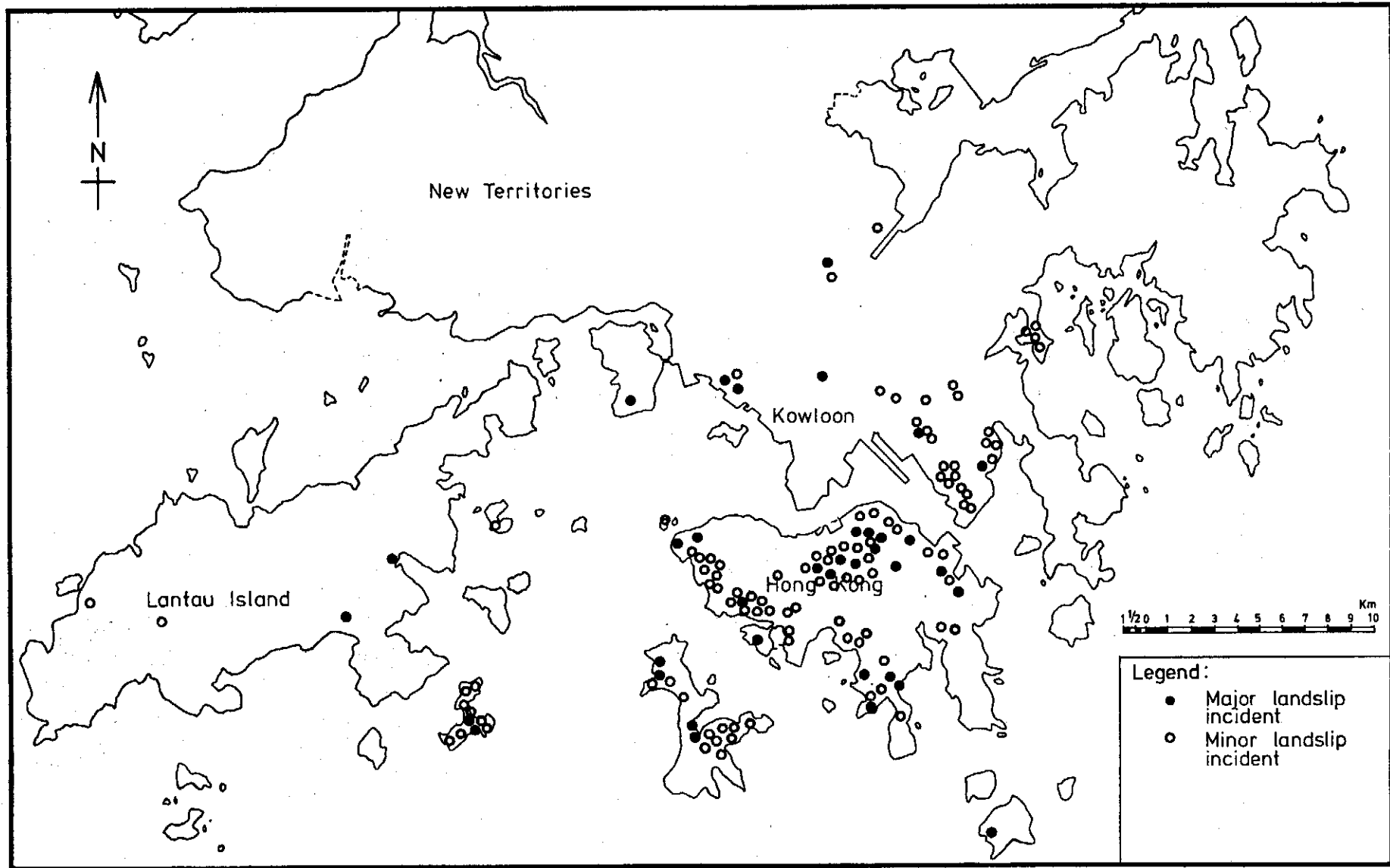


Figure 5 - Locations of Landslip Incidents Reported to the CGO

<p>1 Photograph/Sketch of failure relative to buildings, roads etc. 1:5000</p>	2 Inspected by S.J. Kennedy (SGE)		3 Failure Number 15/15NE-A					
	4 Ownership Private		5 Lot No. RBL 693					
	6 Location 14, Headland Rd		7 Active Construction Site. <input type="checkbox"/> Yes/No					
	Date and Time		10 File No.					
	8 Failure: 0900/17.6.83		9 Inspected: 1000/22.6.83					
	Retaining Wall	Natural	Cut	Fill	Chunam/Concrete	Grass	Trees/Bushes	Stone Pitching
	11	12	13	14	20	21	22	23
	Possible Cause				Rainfall in preceding			
	Ground Water	Infiltration	Pipe Failure	Excavation	15 days	1 day	1 hour	
	30	31	32	33	40	41	42	
Material				60 Remaining Danger				
D.V.	D.G.	Soil	Rock	Colluvium	Continuing Erosion			
50	51	52	53	54				
70 Description of Failure Shallow failure of soil/fill on top of rock probably caused by infiltration into soil from road opening at top of slope.						71 Joint controlled	80 Back Analysis Yes/No	

Detail of Failure		105 C.S.	106 I.S.	107 Vol. Slip	108 Vol. Debris	109 \bar{c} .	110 $\bar{\phi}$
90 Cut height: 4.4 m	91 breadth: 80 m	92 angle: 70°	93 depth: 1.5 m	94 scarp distance: 4.5 m			
95 failure height: 4.8 m	96 toe height: 1.2 m	101 debris breadth:	102 debris angle:	103 debris max. thickness:	104 debris length:		
Section 1:300				Plan 1:300			
Refer to Notes on Completion of Landslip Card							
N.B. - CCD Survey section will undertake survey of important failures							
water conditions (show on drawing) PWD 800 114	water seeping from				154 fluidity of debris REMOVED PRIOR TO INSPECTION. 1981		
	drain	main	debris	scarp (give depth BGL)			
	150	151	152	153			

Figure 6 - An Example of a Landslip Record Card

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PHOTOGRAPH



Negative No. 83/122/21A

DESCRIPTIONS

1. Major soil/rock cut slope failure.
2. Upper portion of the slope failed previously and was chunamed.
3. Present failure probably due to pore pressure build-up along sheeting joint sliding plane.
4. See Section 5.1 for further details.

PHOTOGRAPH



Negative No. 83/122/20A

DESCRIPTIONS

1. Slide debris buried the road, 6 parked vehicles and blocked the rear entrance to an old folks home under construction.

Plate 2 - Tin Wan Hill Road (Incident No. HK 6/27)

PHOTOGRAPH



Negative No. 83/126/17A

DESCRIPTIONS

1. Major soil cut slope failure.
2. Probably caused by intense infiltration at the top of the slope.
3. Slope was approximately 45° and 10 m high.
4. Stubbs Road was partially blocked by slide debris.

Plate 3 - Stubbs Road near Lingnam College (Incident No. HK 6/22)

PHOTOGRAPH



Negative No. 83/121/02

DESCRIPTIONS

1. Major soil cut slope failure.
2. Heavy runoff from the car park podium infiltrated the slope from above and caused the failure.
3. Foundation of car park podium was slightly undermined and the road below was partially blocked.

PHOTOGRAPH



Negative No. 83/125/13A

DESCRIPTIONS

1. Major soil/rock cut slope failure.
2. Slope adjacent to WSD access road was under construction and temporarily unprotected.
3. Rainwater infiltrated into the slope via the unlined drainage channels on the slope.
4. A backhoe on the 2nd berm was brought down by the slide debris.

Plate 5 - Ap Lei Chau near Power Station (Incident No. HK 6/43)

PHOTOGRAPH



Negative No. 83/124/06

DESCRIPTIONS

1. Major soil cut slope failure.
2. Enlargement of a previous failure.
3. Slide debris very fluid and travelled several hundred metres along Tsing Yi Road and collected in the foreground of the picture.
4. PEPCO slope is in the background.
5. Tsing Yi Road was totally blocked.

Plate 6 - Tsing Yi Road - PEPCO slope (Incident No. N 6/5)

PHOTOGRAPH



Negative No. 83/129/22

DESCRIPTIONS

1. Major soil cut slope failure.
2. Slope failed previously and the present failure was an enlargement of the previous failure.
3. Previous failure was not well protected and the slope was open to infiltration during the June 83 rainstorm.
4. Many squatter huts were damaged and evacuated as a result of the previous failure.

Plate 7 - Chung Ling Tin Village (Incident No. K 6/8)

PHOTOGRAPH



Negative No. 83/126/19A

DESCRIPTIONS

1. Minor failure of a steep old soil cut slope.
2. Slope partly chunamed and near vertical at certain areas.
3. Slope situated adjacent to a slope under the LPM (Landslide Preventive Measure) programme whose boundary was extended to include this slope following the failure.
4. Road was partially blocked by the failure debris.

Plate 8 - Tai Hang Road, 100 m up from Junction of Mt. Butler Road
(Incident No. HK 6/26)

PHOTOGRAPH



Negative No. 83/124/17

DESCRIPTIONS

1. Minor soil cut slope failure.
2. Slope old and steep, approximately 60° .
3. Slope failed previously and chunamed as indicated by its concave profile.
4. Road partially blocked.

Plate 9 - 45 Repulse Bay Road (Incident No. HK 6/41)

PHOTOGRAPH



Negative No. 83/152/16

DESCRIPTIONS

1. Minor rock cut slope failure.
2. Joint-controlled.
3. Road partially blocked.

Plate 10 - Chung Hom Kok Road, No. 1 Failure (Incident No. HK 6/55)

PHOTOGRAPH



Negative No. 83/140/19A

DESCRIPTIONS

1. Minor rock slope failure.
2. Blocks of intact Grade II rocks dislodged by roots allowing rainwater penetration and pore-pressure build-up.
3. Footpath adjacent to King's Road blocked by slide debris.

Plate 11 - King's Road opposite to Pan Hoi Street, Quarry Bay
(Incident No. HK 6/61)

PHOTOGRAPH



Negative No. 83/142/14A

DESCRIPTIONS

1. Minor soil cut slope failure.
2. Slope comprised predominantly of Grade II materials with one large boulder.
3. Soil debris which blocked the access footpath was removed by the villager immediately after failure, leaving the heavy boulder behind.

PHOTOGRAPH



Negative No. 83/122/12A

DESCRIPTIONS

1. Major fill slope failure.
2. Caused by infiltration from the road.
3. See Section 5.2 for details.
4. Road collapsed and closed for 1 week until the erection of a temporary steel bridge.

PHOTOGRAPH



Negative No. API 362-10

DESCRIPTIONS

1. API photo of elongated slip scar.

PHOTOGRAPH



Negative No. 83/129/05

DESCRIPTIONS

1. Minor erosion of fill slope/platform underneath squatter huts.
2. 1 hut permanently evacuated and 2 huts temporarily evacuated.

PHOTOGRAPH



Negative No. 83/149/04

DESCRIPTIONS

1. Erosion of backfill around pipe.
2. Caused by preferential seepage around the pipe in poorly compacted backfill.
3. Affected both squatter huts above the slope and the backyard of the home for the aged.

PHOTOGRAPH



Negative No. 83/149/13

DESCRIPTIONS

1. Minor fill slope failure in squatter area.
2. Probably due to discharge from the squatter hut above.
3. No evacuation necessary as the hut was not in immediate danger.

PHOTOGRAPH



Negative No. 83/130/21

DESCRIPTIONS

1. Failure of a fill slope consisting of loose randomly placed building debris in squatter area.
2. No major consequence.

PHOTOGRAPH



Negative No. 83/126/23

DESCRIPTIONS

1. Very minor erosion of fill embankment at Tai Tam Road.
2. Eroded fill washed down along a step channel and blocked a catchpit below the road.

Plate 19 - Tai Tam Road (Incident No. HK 6/25)

PHOTOGRAPH



Negative No. 83/125/6A

DESCRIPTIONS

1. Erosion of fill embankment due to heavy runoff from the road possibly infiltrating into a small excavation on the footpath.

Plate 20 - Junction of Kennedy Road and Mammoth Path
(Incident No. HK 6/46)

PHOTOGRAPH



Negative No. 83/152/13

DESCRIPTIONS

1. Minor erosion of fill embankment due to runoff from the road.
2. Picture shows remedial works underway.
3. The remedial work consisted of backfilling, recompaction and a small retaining wall at the toe to contain the backfill.

PHOTOGRAPH



Negative No. 83/130/06

DESCRIPTIONS

1. Erosion of fill platform underneath squatter huts.
2. Resulted in the tilting forward of squatter huts.
3. 1 hut was permanently evacuated and 4 temporarily evacuated.

PHOTOGRAPH



Negative No. 83/150/06

DESCRIPTIONS

1. Major natural slope failure above a cottage area.
2. Due to concentration of overflow from the access road.
3. Details of failure available in Section 5.3.

Plate 23 - Rennie's Mill Cottage Area (Incident No. N 6/13)

PHOTOGRAPH



Negative No. 83/131/20

DESCRIPTIONS

1. Major failure of a natural slope which undermined the foundation for the road.
2. Began as a minor failure but progressively deteriorated to become a major one a few days later.
3. See Section 5.4 for further details.

Plate 24 - Tai Hang Road near Bridge 17 (Incident No. HK 6/45)

PHOTOGRAPH



Negative No. 83/122/4A

DESCRIPTIONS

1. Major natural slope failure below Stubbs Road.
2. Caused by overflow from Stubbs Road and inadequate surface drainage.
3. See Plate 61 for an adjacent minor failure in cemetery area.

**Plate 25 - Stubbs Road across from Shui Fai Terrace
(Incident No. HK 6/21(i))**

PHOTOGRAPH



Negative No. 83/198/23A

DESCRIPTIONS

1. Major natural slope failure above a footpath.
2. Slide debris travelled downslope a considerable distance and affected the houses below.
3. 1 house permanently evacuated.

PHOTOGRAPH



Negative No. 83/129/07

DESCRIPTIONS

1. Major failure of a natural slope in squatter area.
2. Slope had failed previously.
3. Caused by discharge from the squatter huts above the slope.
4. 4 huts evacuated.

PHOTOGRAPH



Negative No. 83/140/5A

DESCRIPTIONS

1. Minor erosion of a natural slope below Bowen Road.
2. Caused by overflow from the road above.

PHOTOGRAPH



Negative No. 83/129/23

DESCRIPTIONS

1. Minor erosion of natural slope below squatter huts.
2. Foundations of huts undermined.
3. 2 squatter huts evacuated.

PHOTOGRAPH



Negative No. 83/132/02

DESCRIPTIONS

1. Major retaining wall failure which affected houses.
2. Water pressure built-up behind the wall which has no drainage failures.
3. Signs of distress were observed in the wall a year previously.
4. 3 houses were evacuated.

PHOTOGRAPH



Negative No. 83/150/13

DESCRIPTIONS

1. Collapse of a 5 m high masonry retaining wall at edge of platform.
2. Slide debris blocked a WSD access road below.
3. Caused by water pressure build up due to infiltration.

Plate 31 - Pak Tin Section 4, Shatin (Incident No. N 6/23)

PHOTOGRAPH



Negative No. 83/157/20

DESCRIPTIONS

1. Major rubble retaining wall failure.
2. Debris blocked a stream below.
3. Foundation for a public toilet above the wall undermined.

PHOTOGRAPH



Negative No. 83/150/18

DESCRIPTIONS

1. Minor masonry retaining wall failure which affected the garden area of a house.

Plate 33 - Pak Shek Terrace, Sai Kung (Incident No. N 6/25)

PHOTOGRAPH



Negative No. 83/129/16

DESCRIPTIONS

1. Minor concrete retaining wall failure in squatter area.
2. No weepholes or proper drainage layer.
3. Failed 3 days after rainstorm probably following pore pressure build-up.
4. Upper part of retaining wall very clean indicating that a crack or separation opened up at the top and filled with water which slowly infiltrated.
5. Bearing type failure.
6. 1 hut evacuated.

PHOTOGRAPH



Negative No. 83/132/18

DESCRIPTIONS

1. **Partial failure of small rubble retaining wall.**
2. **Retaining wall bulged and platform of the house above cracked as a result.**

PHOTOGRAPH

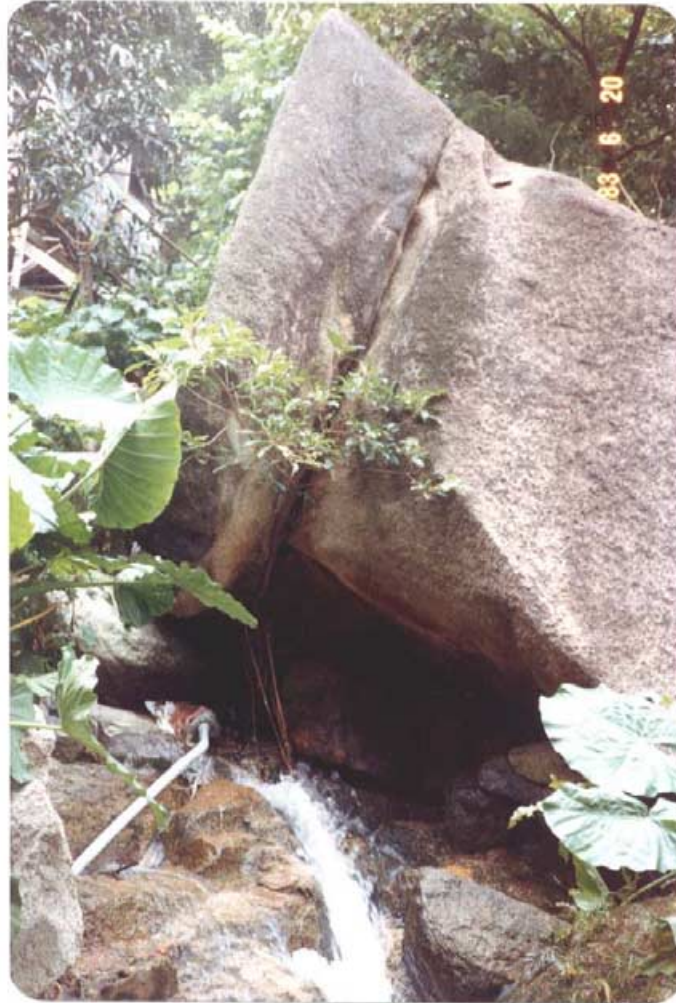


Negative No. 83/125/08

DESCRIPTIONS

1. Minor rock fall from natural slope which damaged part of the staircase to private apartments.

PHOTOGRAPH



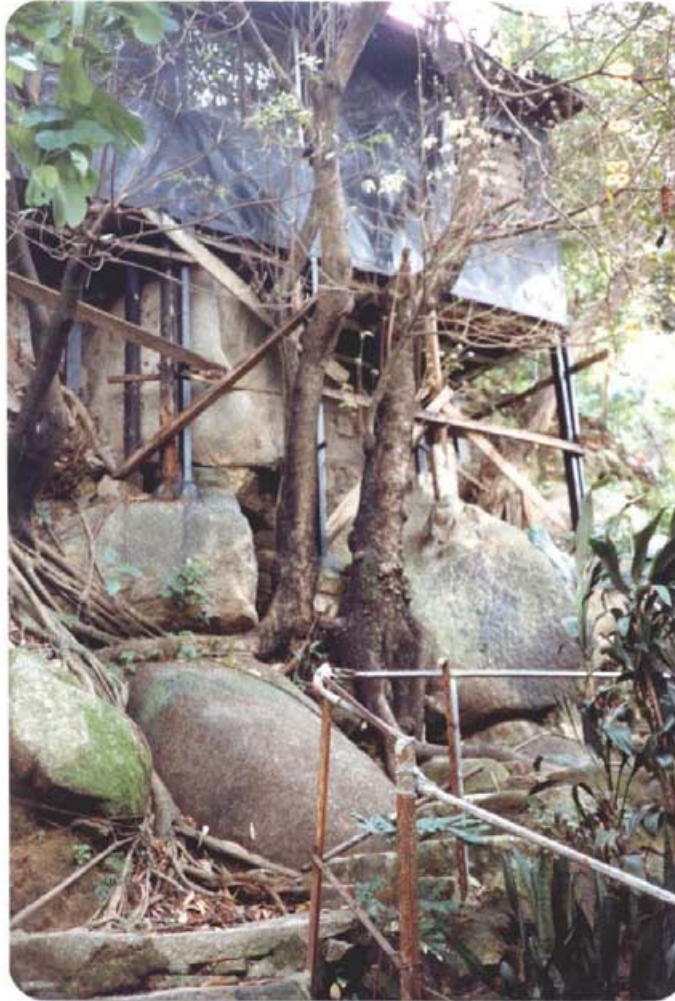
Negative No. 83/131/06

DESCRIPTIONS

1. Major boulder instability affecting squatter areas.
2. Many boulders in the squatter area showed signs of movement after the rainstorm.
3. Heavy discharge and temporary streamflow promoted erosion around boulders.

Plate 37 - 61 Blue Pool Road (Incident HK 6/36)

PHOTOGRAPH



Negative No. 83/131/11

DESCRIPTIONS

1. Squatter huts founded on unstable boulders.
2. Extensive evacuation of over 50 huts in the area.
3. See Section 5.5 for further details.

PHOTOGRAPH



Negative No. 83/140/15A

DESCRIPTIONS

1. Huts founded on unstable boulders.
2. 3 huts evacuated.

PHOTOGRAPH



Negative No. 83/142/10A

DESCRIPTIONS

1. Loose rocks from an earlier failure showed signs of movement due to the rainstorms.
2. 3 huts evacuated.

Plate 40 - Holy Cross Path Village (Incident No. HK 6/65)

PHOTOGRAPH



Negative No. 83/147/11

DESCRIPTIONS

1. Major natural slope failure in squatter area in a remote island.
2. 10 huts evacuated.

Plate 41 - Po Toi Island (Incident No. 6/42)

PHOTOGRAPH



Negative No. 83/147/22

DESCRIPTIONS

1. One hut carried down by the slide debris to the sea.
2. See Section 5.6 for details.

Plate 42 - Po Toi Island (Incident No. N 6/42)

PHOTOGRAPH



Negative No. 83/142/22A

DESCRIPTIONS

1. Squatter area incident.
2. Minor cut slope failure.
3. Failure affected the kitchen area of the hut.

Plate 43 - Tsin Shiu Ma Tau Village (Incident No. HK 6/68)

PHOTOGRAPH



Negative No. 83/129/19

DESCRIPTIONS

1. Major failure of a 6 m high soil cut slope in squatter area.
2. Removal of huts previously, had left an open platform susceptible to infiltration.
3. Drainage channel blocked by slide debris caused flooding of huts at the toe.
4. 2 huts evacuated.

Plate 44 - Chung Lung Tin Village (Incident No. K 6/7)

PHOTOGRAPH



Negative No. 83/129/02

DESCRIPTIONS

1. Erosion of fill platform underneath a squatter hut.
2. Foundation partly exposed and huts tilted.
3. 2 huts evacuated.

PHOTOGRAPH



Negative No. 83/129/04

DESCRIPTIONS

1. Erosion of a fill platform over a natural gully underneath a squatter hut.
2. The small diameter by-pass pipe buried in the fill was under capacity for the storm discharge and the fill platform was therefore eroded.
3. Foundation of the hut was undermined and the hut evacuated.

PHOTOGRAPH



Negative No. 83/124/05

DESCRIPTIONS

1. Natural slope below squatter hut eroded due to direct discharge onto the slope and channeling of water.
2. Slope in the area failed before in August 1982.

PHOTOGRAPH



Negative No. API 360/8

DESCRIPTIONS

1. Major soil cut slope failure which affected buildings below the slope.
2. See Section 57 for details.

Plate 48 - 11 Blue Pool Road (Incident No. HK 6/11)

PHOTOGRAPH



Negative No. GCB11.7.83/6

DESCRIPTIONS

1. Major soil cut slope failure affecting apartment buildings.
2. See Section 5.8 for further details.

Plate 49 - 1-2 New Eastern Terrace (Incident No. GCB 20/11SE-A)

PHOTOGRAPH



Negative No. 83/121/21

DESCRIPTIONS

1. Failure of a colluvium slope beneath the carpark podium of a housing estate under construction.
2. Foundation undermined.
3. Many failures in the area previously.
4. Section 59 contains more detail of this failure.

PHOTOGRAPH



Negative No. 83/150/15

DESCRIPTIONS

1. Failure of a thin lightly reinforced 4 metre high concrete retaining wall affecting a private residential area.

Plate 51 - Tai Hang Hau, Sai Kung (Incident No. N 6/7)

PHOTOGRAPH



Negative No. 83/181/14

DESCRIPTIONS

1. Major natural slope failure behind a house in Lantau.

PHOTOGRAPH



Negative No. 83/121/10

DESCRIPTIONS

1. Major soil cut slope failure which affected private driveway.
2. Started as a small failure in the morning and progressively became bigger.
3. Caused by infiltration into a small temporary excavation in the road above.
4. Picture shows sheet piles being driven to stabilize the slope.
5. More details in Section 5.10.

Plate 53 - 14 Headland Road, Repulse Bay (Incident No. HK 6/35)

PHOTOGRAPH



Negative No. 83/124/19

DESCRIPTIONS

1. Failure of a very steep old rock cut slope adjacent to Repulse Bay Road.
2. Probably due to root action and pore pressure build-up along steep jointing.
3. Second failure was a short distance away.

Plate 54 - 32 Repulse Bay Road (Incident No. HK 6/40)

PHOTOGRAPH



Negative No. 83/152/20

DESCRIPTIONS

1. Major soil cut slope failure affecting road.
2. One of 3 failures in the area.
3. Chung Hom Kok Road blocked by debris.

PHOTOGRAPH



Negative No. 83/130/24

DESCRIPTIONS

1. Soil cut slope failure affecting road.
2. Probably caused by infiltration from surface channel at the top of the slope which was blocked and cracked by vegetation.

Plate 56 - Nam Long Shan Road (Incident No. HK 6/56)

PHOTOGRAPH



Negative No. 83/130/12

DESCRIPTIONS

1. Soil cut slope failure adjacent to road.

Plate 57 - Big Wave Bay Road (Incident No. HK 6/58)

PHOTOGRAPH



Negative No. 83/132/24

DESCRIPTIONS

1. Natural slope failure below road.
2. Caused by broken sewer.

Plate 58 - Peak Road, Cheung Chau (Incident No. N 6/41)

PHOTOGRAPH



Negative No. 83/221/04

DESCRIPTIONS

1. Major soil cut slope failure adjacent to country path.
2. One of numerous failures along the country path.

Plate 59 - Country Path between Yueng Che Wan, San Tsuen, and Tai Ping Tsuen in Lamma Island (Incident Nos. N 6/19 and N 6/20)

PHOTOGRAPH



Negative No. 83/221/07

DESCRIPTIONS

1. Minor failure through closely jointed decomposed granite along country path.

Plate 60 - Country Path between Yung Che Wan, San Tsuen, and Tai Ping Tsuen in Lamma Island (Incident Nos. N 6/19 and N 6/20)

PHOTOGRAPH



Negative No. 83/126/11

DESCRIPTIONS

1. Minor soil cut slope failure in cemetery area.

**Plate 61 - Stubbs Road across from Shui Fai Terrace
(Incident No. HK 6/21 (ii))**

PHOTOGRAPH



Negative No. 83/121/12

DESCRIPTIONS

1. Failure in cemetery area.
2. Soil cut slope failure and collapse of small retaining wall supporting a footpath.

Plate 62 - Mount Collinson and Lin Shing Road (Incident No. HK 6/33)

PHOTOGRAPH



Negative No. 83/173/7A

DESCRIPTIONS

1. Failure of a fill slope in open area.