SLOPE FAILURES ALONG BRIL ROADS : QUANTITATIVE RISK ASSESSMENT AND RANKING

GEO REPORT No. 81

ERM-Hong Kong, Ltd

GEOTECHNICAL ENGINEERING OFFICE
CIVIL ENGINEERING DEPARTMENT
THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION

SLOPE FAILURES ALONG BRIL ROADS : QUANTITATIVE RISK ASSESSMENT AND RANKING

GEO REPORT No. 81

ERM-Hong Kong, Ltd

This report was originally produced in November 1997 under Consultancy Agreement No. GEO 6/97

First published, January 1999

Prepared by:

Geotechnical Engineering Office,
Civil Engineering Department,
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 Office,
Information Services Department,
4th Floor, Murray Building,
Garden Road, Central,
Hong Kong.

Price in Hong Kong: HK$76
Price overseas: US$15 (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.

Cheques, bank drafts or money orders must be made payable to
The Government of the Hong Kong Special Administrative Region

PREFACE

In keeping with our policy of releasing information which may be of general interest to the geotechnical profession and the public, we make available selected internal reports in a series of publications termed the GEO Report series. A charge is made to cover the cost of printing.

The Geotechnical Engineering Office also publishes guidance documents as GEO Publications. These publications and the GEO Reports may be obtained from the Government's Information Services Department. Information on how to purchase these documents is given on the last page of this report.

J.B. Massey
Ag. Principal Government Geotechnical Engineer
January 1999

FOREWORD

In 1993, the Geotechnical Engineering Office (GEO) embarked on a programme of research and development studies on landslide risk management under the R & D theme on Quantitative Risk Assessment (QRA).

This study was carried out by Mr Venkatesh Sourirajan of ERM-Hong Kong Ltd under the Consultancy Agreement No. GEO 6/97. The main objective of the study was to formulate a methodology for the ranking of selected roads with a history of landslips (referred to as BRIL roads) based on quantitative risk assessment of slope failures along such roads with due regard given to risk to life and economic losses. Mr K.K.S. Ho and Dr D.O.K. Lo of the Special Projects Division administered the consultancy and reviewed the Report.

In this Report, the results of the study are expressed in terms of risk to life (viz. potential loss of life per year) and economic loss per year due to road closure caused by landslips. The 41 BRIL road sections considered are ranked based on potential loss of life per year and economic loss per year (due to traffic disruption caused by landslips). The roads are also ranked in terms of the total economic loss considering both the cost of a statistical life and economic loss due to road closure.

P.L.R. Pang
Chief Geotechnical Engineer/Special Projects

EXECUTIVE SUMMARY

The technique of Quantitative Risk Assessment (QRA) has been adopted by the Geotechnical Engineering Office (GEO) to assist in the formulation of landslide risk management strategy. This study has been commissioned to apply QRA to evaluate the risk posed by slope failures along selected roads (called BRIL Roads), which have a high incidence of landslides and also have high traffic density.

Slope failures along busy roads not only have the potential to cause fatalities and injuries but also cause serious disruption to traffic. In order to evaluate the potential for disruption to traffic, the risk assessment technique has been applied in this study to evaluate the risk of economic loss caused by traffic disruption in addition to risk to life. The main purpose of this study is to provide information on the risks associated with slope failures to help prioritize and co-ordinate the slope and road improvement programmes.

The methodology developed in this study includes the determination of frequency of landslide incidents, assessment of the consequences of landslides in terms of fatalities and impact on road traffic and finally calculation of the risk levels in terms of Potential Loss of Life (PLL) and risk of economic loss.

The approach for frequency estimation, as described in *Section 3*, is summarised below:

- the frequency of landslides is estimated from historical data for slope failures along each BRIL road section for the period 1984 to 1996. Incidents reported as landslides, washouts, rockfalls and retaining wall failures are considered together as 'landslides' while those reported as boulder falls are considered separately;

- the proportion of upslope and downslope failures reported along each road section have been considered to model the consequences of failure as that from cut slope and fill slope respectively;

- the slope height-failure volume distribution is estimated for each road section based on the slope height-failure volume data reported in previous incidents for the given road section and the slope height-failure volume distribution derived from the Special Administrative Region (SAR)-wide study on slope failures from pre-GCO man-made slopes. Slope height information from the 1977/78 Slope Catalogue has been used. A modified volume distribution is evolved which attempts to best represent the road specific historical data while at the same time ensuring that certain high volume incidents for the corresponding slope heights, although may not have occurred, are nevertheless represented with a low probability;

- for upslope failures, the slope height-volume distribution is estimated for three slope height ranges, <10m, 10 to 20m and >20m and for five volume ranges, <20m^3, 20 to 50m^3, 50 to 500m^3, 500 to 2000m^3 and >2000m^3. For downslope failures, the volume distribution is estimated without any reference to slope height for five volume ranges, <20m^3, 20 to 50m^3, 50 to 200m^3, 200 to 1000m^3 and >1000m^3;

- the slopes along BRIL Roads are mainly pre-GCO slopes which are potentially sub-standard. A small percentage of these slopes have been improved to current geotechnical standards. In order to account for such improvements in the frequency analysis, a reduction factor equivalent to the proportion of total number of slopes along each road section that have been improved to current standards is applied. It is further assumed that the chance of failure of slopes designed to currently applicable standards is negligible in comparison with pre-GCO slopes;

The approach for consequence estimation, as described in *Section 4*, includes estimation of fatalities and estimation of economic loss due to road closure. The approach for estimation of fatalities from landslides and boulder falls is summarised below:

- the methodology for consequence assessment (ie, estimation of fatalities caused by landslides) is based on suitable adaptation of the approach evolved in previous studies by GEO on SAR-wide Pre-GCO Man-Made Slope Failures, Landslide Consequence Severity Classification of Roads, etc.

- the number of fatalities from landslides is expressed as a function of vulnerability factor, scale of failure and expected number of fatalities for a reference landslide affecting a facility which is road in this case;

- the vulnerability factors derived in the SAR-wide study as a function of runout angle and failure volume for cut slopes failures (ie, upslope failures) and as a function of crest distance and failure volume for fill slope failures (ie, downslope failures) are adopted. The proximity of the affected facility below a slope is expressed in terms of shadow angle, which is estimated considering three slope height ranges and the distance to the centre of each lane from the slope toe to determine the appropriate vulnerability factor. The average of vulnerability factors computed for each lane as the affected facility is then considered. Similar approach, but based on crest distance, is adopted for downslope failures;

- the scale factor which is the ratio of the width of actual landslide to the width of reference landslide is computed for different failure volumes as given in the SAR-wide study;

- the expected number of fatalities for a reference landslide (of $50m^3$ volume) is estimated from the nomograph which correlates fatalities with actual Annual Average Daily Traffic (AADT) and number of lanes for a given road;

- the estimation of fatalities from boulder fall is based on a model which evaluates the probability of boulder hitting a vehicle for various scenarios- falling boulder hitting a moving vehicle, moving vehicle hitting a fallen boulder etc. The probability of death of occupants in the road vehicle is considered for each of the scenarios.

The approach for computing economic loss due to landslides is summarised below:

- economic loss due to landslides is computed by considering the potential loss of life in terms of 'value of life' and the loss due to road closure resulting from landslides;

- the value of life, or the implied cost of averting a fatality is assumed as HK$ 24 million;

- road closure following landslips may result in increase in travelling time which may cause indirect effects on the economy due to lost time for productive work;

- the increase in travelling time due to congestion on the roads caused by lane/road closure is based on the initial suggestions by the Financial Services Bureau. The increase in travelling time is estimated for different class of roads (rural, urban, trunk roads etc) and for different proportion (or extent) of road closure;

- the time value for additional hours lost in commuting to work(which is higher than time value for non-working hours) is adopted from studies undertaken for the Transport Department in Hong Kong and in the UK;

- the increase in vehicle operating costs due to additional distance travelled as a result of congestion on roads due to road closure is considered;

- the duration and extent of lane closure caused by landslides is derived for various failure volumes based on data from past incidents provided by the Highways Department for the period 1994 to 1996. Data from past incidents on duration of closure of more than one lane is limited and therefore suitable assumptions have been made;

- the probability of different extent of closure (ie, one lane, two lanes, etc) is derived for various failure volumes from the GEO Annual Report on Rainfall and Landslides. Again, this data is adopted for estimating the probability of closure of the first lane while suitable assumptions have been made for the probability of closure of more than one lane.

Results

The results from the study are expressed in terms of both risk to life and risk of economic loss due to road closure. Risk to life is expressed in terms of PLL (Potential Loss of Life per year), which is a measure of societal risk.

The 41 BRIL Road sections considered under this study are ranked based on PLL per year and economic loss per year (due to traffic disruption caused by landslides; other costs such as cost of slope repair, etc. are not considered). The roads are also ranked based on total economic loss (considering both cost of life saved and economic loss due to lane/road closure caused by landslides), expressed in units of per kilometre per year, to provide a more uniform basis for comparison between roads given that their lengths are different.

The Castle Peak Road section ranks first both on PLL and on economic loss per year as a result of lane/ road closure. However, when the total economic loss is expressed in units of per km per year, the Kwun Tong Road section ranks first.

The results for PLL, economic loss and ranking are presented in the attached *Table.*

Table 6b

Summary Results Sheet II

Location	Road	Section	AADT 1995	Portion of	Frequency per year	PLL		Eco Loss/yr		Total Cost/yr		Total Cost/yr/km	
			Value	Slopes Upgraded	Value	Value	Rank	Value	Rank	Value	Rank	Value	Rank
HK	Cape Collinson Road	A	450	0%	8.46E-01	3.81E-03	36	$90,655	40	$182,068	39	$86,699	40
HK	Cape Collinson Road	B	450	0%	2.31E-01	4.05E-03	34	$61,661	41	$158,934	40	$1,324,453	27
HK	Chung Hom Kok Road	-	1300	6%	5.06E-01	2.82E-03	38	$138,085	38	$205,744	38	$205,744	38
HK	Island Road	-	16890	0%	4.62E-01	3.29E-02	20	$3,671,728	16	$4,461,134	16	$5,374,860	10
HK	Kennedy Road	-	10610	7%	9.30E-01	1.40E-01	7	$2,405,230	18	$5,753,412	13	$2,739,720	21
HK	Magazine Gap Road	-	14960	3%	1.27E+00	1.53E-01	6	$4,829,270	11	$8,511,418	11	$4,702,441	12
HK	Nam Fung Road	-	10110	20%	1.23E-01	3.96E-03	35	$441,636	34	$536,752	35	$1,789,174	23
HK	Peak Road	A	11170	10%	2.77E-01	6.36E-02	14	$943,354	26	$2,470,781	23	$1,647,188	25
HK	Peak Road	B	10120	0%	4.62E-01	3.27E-02	21	$881,478	29	$1,665,972	27	$4,164,930	16
HK	Pokfulam Road	A	36160	0%	5.38E-01	1.97E-02	26	$3,783,955	15	$4,255,719	18	$3,576,234	18
HK	Pokfulam Road	B	25050	8%	2.12E-01	1.78E-02	28	$1,597,113	23	$2,023,940	25	$1,190,553	29
HK	Repulse Bay Road	A	12300	0%	2.31E+00	2.47E-01	3	$7,449,498	6	$13,371,602	6	$4,610,897	14
HK	Repulse Bay Road	B	14370	0%	4.62E-01	2.60E-02	24	$2,354,381	19	$2,979,526	20	$4,655,509	13
HK	Stubbs Road	A	21070	16%	2.58E-01	3.91E-02	16	$1,668,117	21	$2,607,449	21	$2,005,730	22
HK	Stubbs Road	B	11270	0%	1.54E-01	3.61E-02	17	$604,920	33	$1,472,417	29	$12,270,142	3
HK	Tai Hang Road	-	14670	13%	2.48E+00	2.89E-01	2	$7,362,931	7	$14,293,038	5	$5,254,794	11
HK	Tai Tam Road	-	10900	0%	9.23E-01	6.72E-02	13	$4,201,882	13	$5,814,067	12	$842,618	31
HK	Victoria Road	A	5410	10%	7.62E-01	2.71E-02	23	$921,020	28	$1,570,986	28	$1,208,451	28
HK	Victoria Road	B	7860	0%	1.08E+00	1.30E-02	30	$1,628,442	22	$1,941,067	26	$1,078,371	30
HK	Yee King Road	-	14150	0%	6.15E-01	1.36E-01	8	$1,376,522	25	$4,629,910	15	$17,807,345	2
ME	Clear Water Bay Road	-	32950	0%	5.38E-01	1.16E-01	10	$6,645,836	10	$9,428,355	10	$7,036,086	7
ME	Kwun Tong Road	-	150120	33%	1.55E-01	1.85E-01	5	$28,505,163	2	$32,948,323	2	$122,030,827	1
ME	Sai Sha Road	-	5310	0%	1.00E+00	1.35E-01	9	$7,262,805	8	$10,501,665	8	$9,053,159	6
ME	Tai Mong Tsai Road	A	6000	0%	2.31E-01	3.55E-02	18	$1,755,182	20	$2,606,028	22	$10,858,452	5
ME	Tai Mong Tsai Road	B	6000	0%	6.15E-01	2.55E-02	25	$2,505,257	17	$3,116,500	19	$3,351,076	20
ME	Tai Mong Tsai Road	C	4120	0%	1.54E-01	1.76E-02	29	$326,009	36	$748,640	33	$1,559,666	26
ME	Tai Mong Tsai Road	D	4120	0%	1.54E-01	2.44E-03	39	$154,748	37	$213,419	37	$609,768	35
ME	Tai Po Road	A	9190	25%	1.15E-01	4.42E-04	41	$132,599	39	$143,214	41	$66,611	41
ME	Tai Po Road	B	5840	0%	6.15E-01	3.32E-02	19	$1,454,405	24	$2,252,297	24	$715,015	32
ME	Tai Po Road	C	5840	14%	3.97E-01	1.82E-02	27	$782,802	30	$1,219,444	30	$615,881	34
MW	Castle Peak Road	-	12980	5%	2.35E+00	9.85E-01	1	$32,938,275	1	$56,584,596	1	$4,041,757	17
MW	Route Twisk	A	6270	0%	1.00E+00	1.16E-01	11	$7,052,856	9	$9,831,120	9	$3,511,114	19
MW	Route Twisk	B	7250	0%	3.08E-01	6.42E-03	33	$935,882	27	$1,089,904	31	$247,706	37
MW	Route Twisk	C	7250	0%	3.08E-01	2.33E-03	40	$625,230	32	$681,047	34	$648,616	33
MW	South Lantau Road	A	2980	0%	1.31E+00	1.09E-02	31	$4,064,330	14	$4,325,979	17	$1,670,262	24
MW	South Lantau Road	B	1210	0%	4.62E-01	8.21E-03	32	$772,825	31	$969,822	32	$587,771	36
MW	South Lantau Road	C	1210	0%	3.85E-01	2.96E-03	37	$391,018	35	$462,008	36	$132,002	39
MW	Tuen Mun Road	A	96120	12%	2.71E-01	5.86E-02	15	$10,795,526	5	$12,201,033	7	$11,091,848	4
MW	Tuen Mun Road	B	96120	5%	1.46E-01	9.57E-02	12	$12,585,592	4	$14,882,052	4	$4,313,638	15
MW	Tuen Mun Road	C	85410	4%	3.69E-01	2.14E-01	4	$15,900,042	3	$21,024,174	3	$5,840,048	9
MW	Tuen Mun Road	D	95470	0%	7.69E-02	2.74E-02	22	$4,637,384	12	$5,295,649	14	$5,884,054	8
					Total	3.45E+00		$186,635,644		$269,431,207			

Note: Total Cost refers to implied cost for loss of life and economic loses due to traffic disruption caused by landslides.
Other costs such as cost of slope maintenance, repair, etc, are not included.

CONTENTS

		Page No.
	Title Page	1
	PREFACE	3
	FOREWORD	4
	EXECUTIVE SUMMARY	5
	CONTENTS	9
1.	***INTRODUCTION***	11
1.1	*BACKGROUND*	11
1.2	*OBJECTIVES OF THE STUDY*	11
1.3	*SCOPE OF WORK*	12
2.	***APPROACH TO THE STUDY***	16
3.	***FREQUENCY ESTIMATION***	21
3.1	*INCIDENTS ON BRIL ROADS*	21
3.2	*CATEGORISATION OF INCIDENTS BASED ON SLOPE FEATURE*	29
3.3	*DISTRIBUTION OF LANDSLIP INCIDENTS BASED ON VOLUME & SLOPE HEIGHT*	30
3.4	*COMPARISON WITH TERRITORY-WIDE STUDY*	32
3.5	*EFFECT OF SLOPE IMPROVEMENT WORKS ALONG BRIL ROADS*	34
4.	***CONSEQUENCE ESTIMATION***	38
4.1	*FATALITY ESTIMATION FOR LANDSLIDES*	38
4.2	*FATALITY ESTIMATION FOR BOULDER FALLS*	45
4.3	*ESTIMATION OF DURATION & EXTENT OF LANE/ROAD CLOSURE*	45
4.4	*ECONOMIC LOSS DUE TO ROAD CLOSURE*	57
5.	***ESTIMATION OF RISK TO LIFE & ECONOMIC LOSS***	61
5.1	*ESTIMATION OF PLL*	61
5.2	*ESTIMATION OF ECONOMIC LOSS*	66
6.	***RESULTS***	71
	ACKNOWLEDGEMENTS	75
	REFERENCES	76
Annex A	*Consequence Classification Method for BRIL Roads*	77
Annex B	*Incident Records & Analysis of Lane/Road Closure for BRIL & Non-BRIL Roads 1994 to 96*	81

		Page No.
Annex C	*Extracts from Workbooks for PLL/Economic Loss Estimation*	98
Annex D	*Data on Slope Features for Select BRIL Roads*	143
Annex E	*List of Slopes Along Select BRIL Roads Improved to Post-GEO Standards*	156
Annex F	*Incident Records for BRIL Roads 1984 to 96*	159
Annex G	*Grouping of Incidents on BRIL Roads Based on Simultaneous Occurrence*	166
Annex H	*Assessment of Consequences of Landslides*	169
Annex I	*Estimation of Failure Volume Distribution*	180
Annex J	*QRA Terminology*	198

1 INTRODUCTION

ERM-Hong Kong was commissioned by the Geotechnical Engineering Office (GEO) of the Civil Engineering Department (CED) to undertake a Quantitative Risk Assessment (QRA) of slope failures along BRIL roads.

This report presents the methodology, analysis and the findings of the study.

A set of road sections, total of 41, along 23 roads in different regions of Hong Kong have been identified by GEO as BRIL roads based on high frequency of occurrence of landslips on slopes along these roads along with considerations such as traffic and strategic importance of the road (in terms of those serving as primary routes or trunk routes). BRIL roads are therefore defined as 'Busy Roads with a hIstory of Landslips'.

1.1 BACKGROUND

This study had arisen due to the need to develop a comprehensive and integrated road and slope improvement programme.

The slope improvement programme along BRIL roads is necessitated by the presence of a number of sub-standard man-made slopes, referred to as pre-GCO slopes, which were constructed prior to the formation of GEO and may not meet the geotechnical standards evolved subsequent to GEO's establishment.

It is also understood that many of these roads also require to be upgraded (improved/ widened) to meet higher traffic needs.

While the Transport Department (TD) and the Highways Department (HyD) have their priorities for the road improvement programme based mainly on traffic and maintenance considerations, GEO's programme on slope improvement is based on risk of landslip hazards. In the absence of a joint strategy between TD/HyD and GEO, it is possible that slopes improved by GEO may later be reworked by TD for road improvement/ widening rendering the work done by GEO unnecessary. It is also possible that if the slope improvement programme is combined with the road improvement programme, it can save significant costs, reduce the time required for carrying out the works and minimise the disruption caused to the general public.

It is therefore under the consideration of the Works Bureau to prioritize the roadworks programme based on a combined consideration of slope safety and other needs. This study has been commissioned to aid decision making in this regard.

1.2 OBJECTIVES OF THE STUDY

The principal objective of this study is to formulate a methodology for ranking of BRIL roads based on QRA of landslips with due regard given to risk to life and economic losses. The methodology will then provide a basis for determining the priority for upgrading certain routes in road improvement/ reconstruction

schemes by adding the consideration of landslip risk to that of traffic and other needs.

The supplementary objectives of the study include:

- determining the probability of road closure for individual BRIL road sections for the likely range of duration and the combined probabilities of closure of the BRIL roads and respective diversion routes (which are also BRIL roads) due to landslip;
- refinement and application of the landslip economic loss model developed by the Financial Services Bureau; and
- benchmarking of different categories of road with respect to risk to life and economic losses.

The methodology is applied for all BRIL roads to determine their relative ranking.

1.3 *Scope of Work*

The scope of work includes the following:

- Review relevant literature;
- Collate data including information on the consequence classification of slopes along the uphill and downhill sides of BRIL roads and the characteristics of BRIL roads, such as the number of lanes and their widths and traffic volume;
- Compile relevant information on past landslips affecting BRIL roads, including types of slopes, mechanism and scale of failure, and number of lanes closed and duration of lane closure;
- Develop a QRA framework for quantification of landslip risk posed by slopes along BRIL roads;
- Determine the probabilities of road closure for individual BRIL road sections for the likely range of durations and the combined probabilities of closure of the BRIL roads and respective diversion routes (which are also BRIL roads) due to landslips and evaluate the corresponding economic losses;
- Formulate a methodology for ranking of BRIL roads based on the combined consideration of risk to life and risk of road closure of different extent and duration due to landslips.

1.3.1 *BRIL Roads*

41 road sections have been identified as BRIL roads by GEO, based on an initial assessment. There are 20 road sections in Hong Kong Island (HK), 10 road sections in the Eastern New Territories, categorised as Mainland East (ME), 11 road sections in the Western New Territories including one road section in Lantau island, categorised as Mainland West (MW).

The 41 road sections vary widely with respect to kilometres of road (from 120m of Stubbs Road Section B to 14km of Castle Peak Road), traffic (with Annual Average Daily Traffic (AADT) of 450 in Cape Collinson Road to 150,120 in Kwun Tong Road) and the frequency of reported landslips.

The details on the BRIL road sections are contained in the latter sections. The BRIL road sections considered for the study are listed below.

Hong Kong island (HK)

- Cape Collinson Road, section A & B;
- Chung Hom Kok Road;
- Island Road;
- Kennedy Road;
- Magazine Gap Road;
- Nam Fung Road;
- Peak Road, section A & B;
- Pokfulam Road, section A & B;
- Repulse Bay Road, section A & B;
- Stubbs Road, section A & B;
- Tai Hang Road;
- Tai Tam Road;
- Victoria Road, section A & B;
- Yee King Road.

Mainland East (ME)

- Clear Water Bay Road;
- Kwun Tong Road;
- Sai Sha Road;
- Tai Mong Tsai Road, section A to D;
- Tai Po Road, section A to C.

Mainland West (MW)

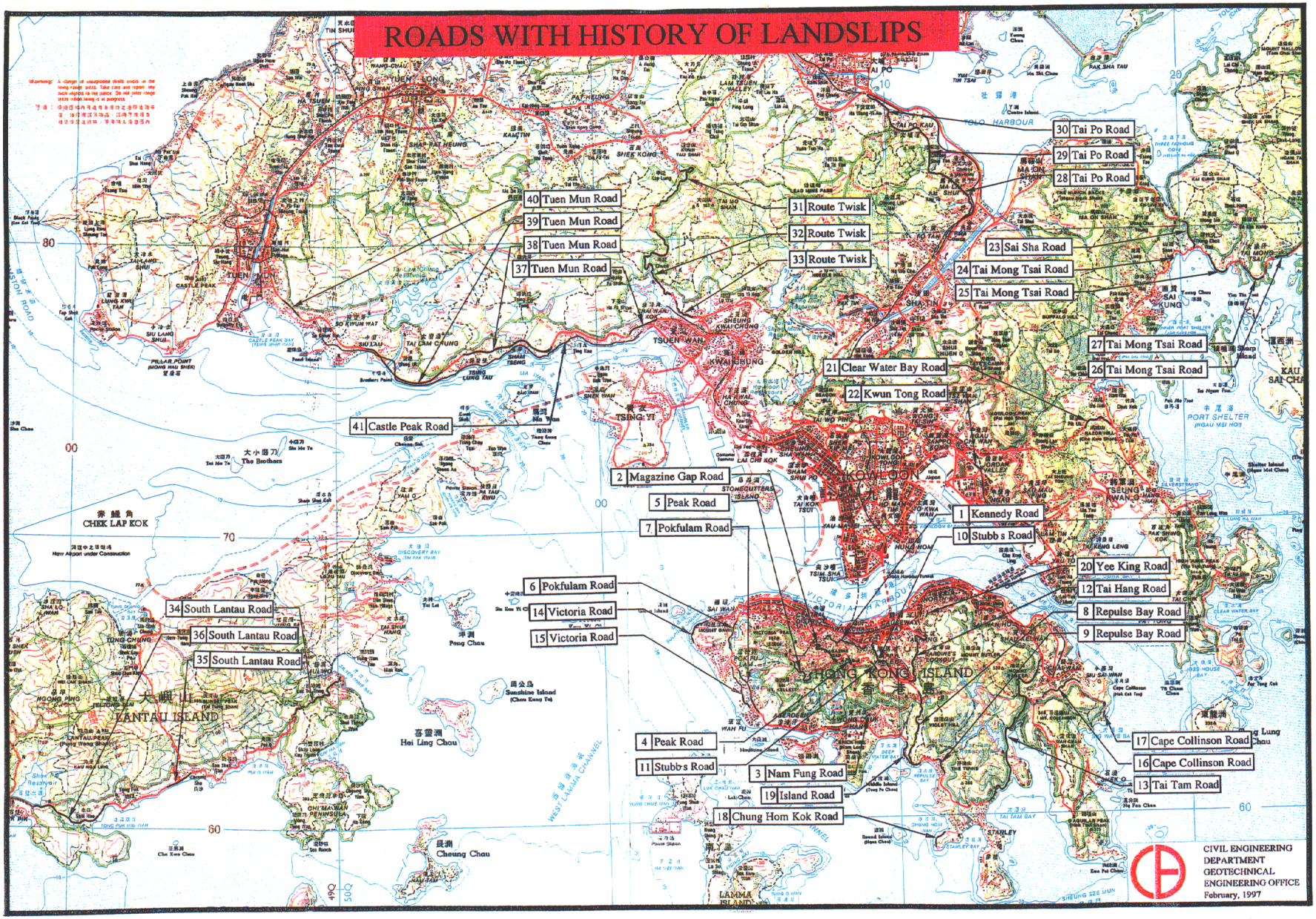
- Castle Peak Road;
- Route Twisk, section A to C;
- South Lantau Road, section A to C;
- Tuen Mun Road, section A to D.

Some of the roads have been divided into a number of sections and considered separately as noted above on the basis of their location along different slope ranges.

Figure 1.3a shows the location of BRIL road sections on a map of Hong Kong territory.

Road Name	Section	No. on Map
HK		
Cape Collinson Road	A	16
Cape Collinson Road	B	17
Chung Hum Kok Rd		18
Island Road		19
Kennedy Road		1
Magazine Gap Road		2
Nam Fung Road		3
Peak Road	A	4
Peak Road	B	5
Pokfulam Road	A	6
Pokfulam Road	B	7
Repulse Bay Road	A	8
Repulse Bay Road	B	9
Stubb's Road	A	10
Stubb's Road	B	11
Tai Hang Road		12
Tai Tam Road		13
Victoria Road	A	14
Victoria Road	B	15
Yee King Road		20
ME		
Clear Water Bay Road		21
Kwun Tong Road		22
Sai Sha Road		23
Ta Mong Tsai Road	A	24
Tai Mong Tsai Road	B	25
Tai Mong Tsai Road	C	26
Tai Mong Tsai Road	D	27
Tai Po Road	C	28
Tai Po Road	B	29
Tai Po Road	A	30
MW		
Castle Peak Road		41
Route Twisk	A	31
Route Twisk	B	32
Route Twisk	C	33
South Lantau Road	A	34
South Lantau Road	B	35
South Lantau Road	C	36
Tuen Mun Road	A	37
Tuen Mun Road	B	38
Tuen Mun Road	C	39
Tuen Mun Road	D	40

Figure 1.3a : Location of BRIL Roads


ROADS WITH HISTORY OF LANDSLIPS
30 Tai Po Road
29 Tai Po Road
28 Tai Po Road
31 Route Twisk
32 Route Twisk
33 Route Twisk
40 Tuen Mun Road
39 Tuen Mun Road
38 Tuen Mun Road
37 Tuen Mun Road
23 Sai Sha Road
24 Tai Mong Tsai Road
25 Tai Mong Tsai Road
27 Tai Mong Tsai Road
26 Tai Mong Tsai Road
21 Clear Water Bay Road
22 Kwun Tong Road
41 Castle Peak Road
2 Magazine Gap Road
5 Peak Road
7 Pokfulam Road
1 Kennedy Road
10 Stubb s Road
20 Yee King Road
12 Tai Hang Road
8 Repulse Bay Road
9 Repulse Bay Road
6 Pokfulam Road
14 Victoria Road
15 Victoria Road
34 South Lantau Road
36 South Lantau Road
35 South Lantau Road
4 Peak Road
11 Stubb s Road
3 Nam Fung Road
19 Island Road
18 Chung Hom Kok Road
17 Cape Collinson Road
16 Cape Collinson Road
13 Tai Tam Road
CIVIL ENGINEERING DEPARTMENT
GEOTECHNICAL ENGINEERING OFFICE
February, 1997

2 APPROACH TO THE STUDY

The approach to quantification of risks from landslides follows to a large extent the approaches developed in previous studies by GEO with respect to frequency estimation and consequence assessment.

This study has produced an integrated model for estimating risks from landslides, particularly for road sections. A number of assumptions and simplifications have been made in the development of the model. It has also extended the application of QRA to include economic loss considerations.

Previous Studies by GEO/ Literature Review

The previous studies carried out by GEO and which have been drawn upon for analysis in the present study are mainly:

- QRA of pre-GCO Man-made Slopes and Retaining Walls [1];
- Landslide Consequence Severity Classification of Roads and Footpaths [2].

The study on pre-GCO man-made slopes includes an analysis of Special Administrative Region (SAR)-wide historical data on man-made slopes. It provides a breakdown of incidents by slope type (cut slope, fill slope and retaining wall), failure mechanism (sliding failure, liquefaction and washout) and a distribution of volume ranges for different slope heights. The study also includes vulnerability factors for each of the above cases. The risk results for the entire population of man-made slopes in the territory are presented in terms of Potential Loss of Life (PLL).

The study on classification of roads and footpaths contains an approach for estimation of fatalities for roads and footpath users. This approach has been further modified by Wong et al [3] of GEO.

The main stages of QRA are as follows:

- Hazard identification;
- Frequency estimation;
- Consequence assessment and
- Risk summation.

Hazard Identification

The objective of this first stage of assessment is to identify all hazards and their failure modes. Hazard identification is based on a detailed analysis of historical incidents to identify the failure modes.

The hazards of landslips and their failure modes are considered in detail in [1] which is summarised below.

The hazards of landslips can be categorised with respect to type of slope feature and the mechanism of failure. There are 3 types of slope features - cut slope, fill slope, and retaining wall. Cut slopes may be soil cut or rock cut slope. A schematic of the slope types with respect to a road is given in *Figure 2a*.

The mechanism of failure for fill slopes may be sliding, washout (failure induced by the scouring action of surface water flow) and liquefaction. Cut slope failures are mainly sliding.

The causes of failure are mainly rain infiltration, leaking/ burst water mains, erosion etc.

Frequency Assessment

Failure frequencies may be estimated from historical failure data or from a detailed examination of the causes of failure due to a range of mechanisms.

The SAR-wide study on landslides from man-made slopes [4] has estimated the frequency of cut slope, fill slope and retaining wall failure as 1 in 100, 1 in 525 and 1 in 360 per year, based on an analysis of over 4500 incidents during the period 1982 to 1996.

The frequency of landslips along BRIL roads is estimated from historical data for BRIL roads for the period 1984 to 1996. The incident database for BRIL roads was analysed to determine the proportion of failures by slope type, up slope/ down slope features, volume range and slope heights.

A comparison of the data set for BRIL roads with the SAR-wide study has also been provided.

Consequence Assessment

The consequence assessment for landslips involves the estimation of runout distances for different slope heights and the estimation of the probability of fatality for various sizes of failure affecting the many types of facilities (such as buildings, roads etc) at different locations with respect to the runout distance.

The consequence assessment adopts the models derived in the previous studies by GEO for vulnerability factors (defined as the probability of fatality) and fatality estimates for road users. The vulnerability factors have been derived for failures from cut slopes and fill slopes for toe facilities and crest facilities.

The fatality estimates for road users are based on the grouping of facilities by GEO and the relationship derived between facility group number, actual Annual Average Daily Traffic (AADT) and the number of lanes.

Risk Estimation

It is common to estimate and express risk in terms of 'Individual Risk' and 'Societal Risk'.

Individual risk is, as the name suggests, the risk to specific individuals (for example, various categories of workers, the general public, road users, etc.). Individual risk is in fact a frequency with which individuals within the specified category are expected to suffer the harm (eg, to be fatally injured, or receive major injuries).

Societal risk is a measure of the overall risk associated with a situation or system. It accounts for the likely impact of all accidental events, not just on a particular type of individual, as in the case of individual risk, but on all individuals who

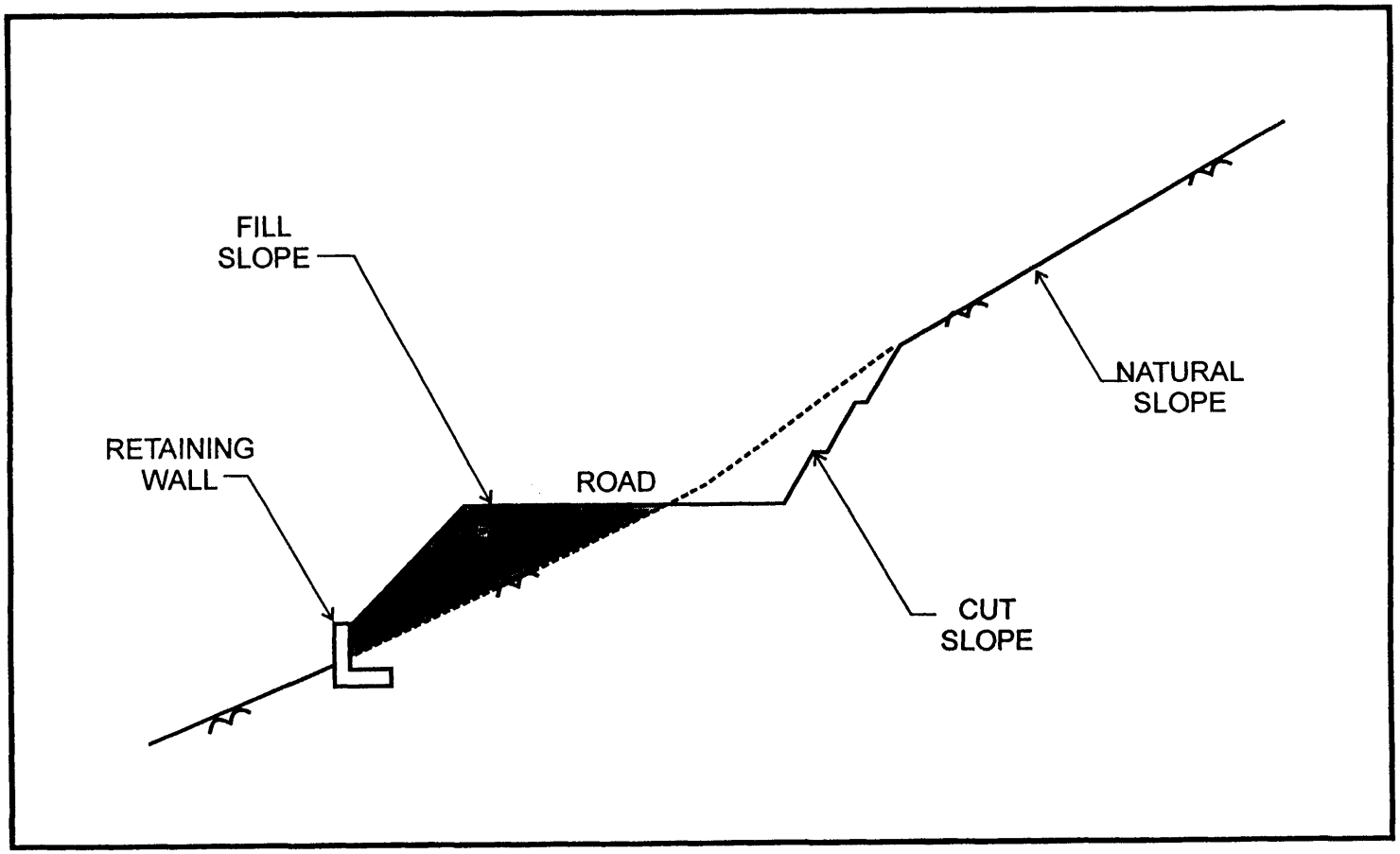


FIGURE 2a - TYPES OF SLOPE

may be exposed to the risk, and it reflects the number of people exposed.

The simplest measure of societal risk is the Rate of Death (RoD) or Potential Loss of Life (PLL) which is the average number of fatalities per year. Societal risk measures are required because decisions based on Cost-Benefit Analysis (CBA) depend on the aggregate risk to society due to an activity (as distinct from the risk to an individual, although CBA can be carried out for individuals also). In some cases the societal risk may be significant even though the risk to any one person may be insignificant.

For the present study, which requires estimation of risks to road users and ranking of roads, individual risk (ie Personal Individual Risk) is not an appropriate measure as any given individual is unlikely to travel on all the roads. Individual risk may also be estimated assuming that an hypothetical individual makes on an average 2 journeys per day through each of the given road sections. However, in relation to the overall traffic (assuming an AADT of 10,000 vehicles per day and an average of 3.6 persons per vehicle), two journeys per day by an individual constitutes a negligible fraction, it corresponds to an exposure probability of 5×10^{-5}.

PLL is therefore used as the measure to express risks and also for ranking. Such a measure also accounts for the total population exposed to the hazard.

Computation of Economic Consequences

A risk assessment approach can also be adopted to compute the economic consequences of failures. The computation of economic loss can be with respect to the implied cost of averting a fatality, which involves assigning a monetary value to life, or with respect to the cost of disruption. The results can be applied to perform a Cost Benefit Analysis (CBA) to determine if the cost of risk mitigation is justifiable.

Economic Loss due to Road Closure

A simplified approach for computing the economic consequences of landslips resulting from road/ lane closure has been suggested by the Financial Services Bureau of the Hong Kong Government based on the value of time corresponding to the increase in travelling time to the general road users. This model has been adopted in this study.

The model requires estimation of the number of days of lane/ road closure for different volumes of landslips and for different road types. Information provided by the Highways Department on the duration of lane closure and the number of lanes closed for different landslide incidents affecting roads SAR-wide for the period 1994 to 1996 have been used to derive a relationship between duration of closure and a range of volumes.

Cost of Life

The implied cost of averting fatality adopted for this study is HK$ 24 million per life lost. This figure is based on the 'cost of life' adopted in the ACDS study for UK [5] and has also been adopted for other studies in the SAR such as the GEO study on QRA of Boulder Falls in Hong Kong [6], EMSD study on QRA for LPG Storage and Transport [7, 8], WSD study on QRA for Water Treatment Works [9] and EPD study on QRA for transport of Chlorine in SAR [10].

Ranking of BRIL Roads

The ranking of BRIL roads has been carried out based on the following:

- risk of fatality per year (PLL) without assigning any cost for value of life;
- total annual economic loss per year;
- total economic loss per road km per year.

A brief description of the terminology used in QRA is given in *Annex J*.

3 FREQUENCY ESTIMATION

The estimation of frequency of landslips is mainly based on historical records of incidents on BRIL roads. Where necessary, reference to the SAR-wide study on landslips on pre-GCO man-made slopes [1] is also provided.

3.1 INCIDENTS ON BRIL ROADS

3.1.1 Overview

A list of incidents along BRIL roads for the period 1982 to 1996 from the SAR-wide incident database on man made slopes was provided to the Consultants for analysis required under this study.

In order to carry out a detailed analysis based on the type of failure, slope characteristics etc, the Consultants were provided access to the SAR-wide incident database to retrieve incident records pertaining to BRIL roads for the period 1982 to 1996.

The GEO incident database comprises incident reports which have been scanned and stored in computer diskette. This data is not amenable to analysis and therefore relevant details from the records for incidents on BRIL roads were entered in spreadsheet format and analysed using the relational database software, Microsoft Access version 7. A printout of the incident records for BRIL roads in spreadsheet format is included in *Annex F*. The analysis presented in the following pages are generated by suitable queries on the database.

The number of incidents corresponding to each year considering all BRIL roads together is given in *Table 3.1a.*

Of the 477 incident records, incidents during the years 1982 and 1983 (a total of 71 which is about 15%) are excluded from the analysis as sufficient information is not available. Also these records pertain to the period prior to or around the time when a systematic classification of incident reporting was initiated and therefore excluding these is not expected to affect the analysis. The average frequency of incidents (31.8 per year) over the period 1982 to 1996 is not significantly different from the average for the period 1984 to 1996 (31.2 incidents per year).

Of the 406 records for the period 1984 to 1996, information for 11 incidents are not available and hence these are also excluded from the analysis. The incident number and details for the 395 records are given in *Annex F.*

Table 3.1a *Number of Incidents Each Year for the Period 1982 to 1996*

Year	Total No. of Incidents	Incidents Considered for the Study
1982	45	
1983	26	
1984	3	2
1985	14	12
1986	18	11
1987	26	23
1988	13	10
1989	32	28
1990	9	9
1991	16	12
1992	90	79
1993	74	67
1994	54	46
1995	45	39
1996	12	12
Total	477	350

The incidents are then classified based on the type of failure - landslide, washout, boulder fall, rockfall and others as given in *Table 3.1b.*

Table 3.1b *Classification of Incidents based on Type of Failure (1984 to 1996)*

Type of Failure	Number of Incidents	Proportion
Landslide	237	60%
Washout	31	7.8%
Rockfall	49	12.4%
Boulder fall	28	7.1%
Retaining wall	5	1.3%
Others	45	11.4%
Total	395	100%

The classification 'others' include mainly, incidents for which volumes are not reported as it was considered not significant, incidents where falling trees causes displacement of soil, mud or rock carried by surface water flow and deposited on the roads, minor incidents that do not directly affect or likely to affect the roads, subsidence etc. These incidents do not strictly fall under the category of landslides.

The frequency of incidents of landslides (which includes landslides, washout, rockfall, and retaining wall failures) and boulder fall for each of the BRIL roads is estimated as given in *Table 3.1c*. The frequency of incidents is expressed both in terms of per year and per road km per year. It can be seen from the table that the ranking of roads based only on frequency of occurrence is different for the two cases.

For computation of risk of death or risk of economic loss due to landslides, it may be sufficient if the roads are ranked based only on frequency of occurrence per year. However, for cost-benefit analysis, it may be required to weigh the cost of slope improvement measures against economic consequences due to loss of life or road closure. Since the cost of slope improvement is a function of the total length of slopes along BRIL roads, the frequency of incidents is expressed in terms of road km per year assuming that the total slope length along the BRIL roads is approximately proportional to the total road length (as a further refinement to the cost-benefit analysis, only pre-GCO slopes along each road can be considered instead of the entire length of road).

Table 3.1d shows the number of incidents of landslides against different volume range for each BRIL Road.

The annual number of incidents on BRIL roads are plotted against rainfall (measured at the principal raingauge R01 at the Hong Kong Observatory Headquarters) for the period 1984 to 1996 in *Figure 3.1a* based on data given in *Table 3.1e*. It is beyond the scope of this study to examine the possible correlation between annual rainfall and incident frequency or alternatively between number of storms per year exceeding a certain intensity of rainfall and incident frequency. However, it may be noted that the average rainfall (at raingauge R01) for the period between 1984 to 1996 is close to the average rainfall since 1961 (which is 2200mm per year) and assuming a positive correlation between rainfall and incidents, the predicted frequency of incidents for BRIL roads based on historical data can be regarded as sufficiently representative for this study. An assessment of the possible effects of spatial distribution of intense rainstorms on landslide frequency merits detailed consideration in further studies.

Fig 3.1a: Incidents on BRIL Roads & Rainfall for the Period 1984 to 1996

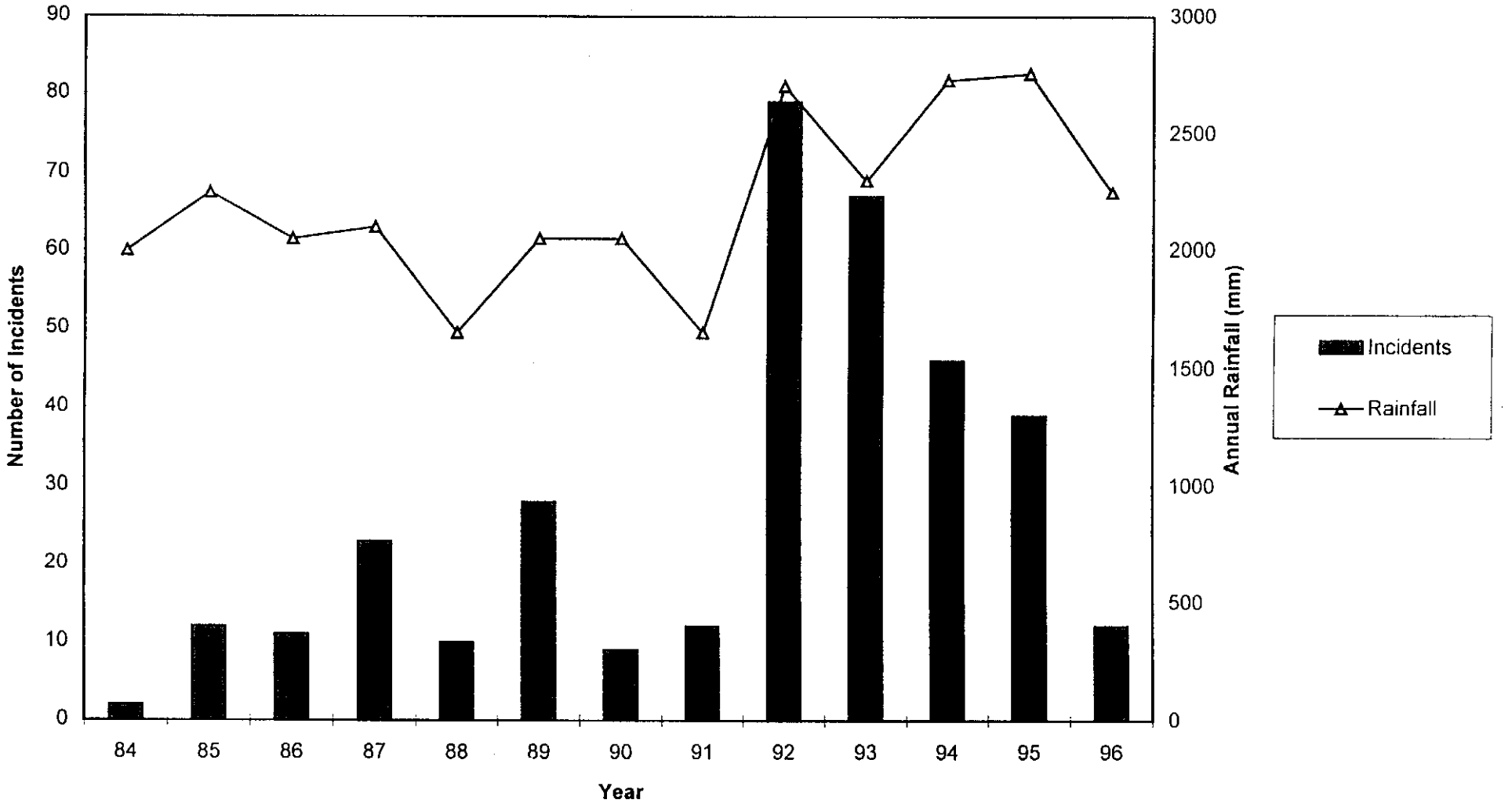


Table 3.1c : Frequency of Incidents (of Landslides and Boulder Fall) per year for BRIL Roads- 1984 to 1996

Roads	Section	Length (m)	No. of Incidents	Frequency per year		Frequency per km/year	
				Value	Rank	Value	Rank
Tai Hang Road	-	2720	37	2.85	1	1.05	5
Castle Peak Road	-	14000	32	2.46	2	0.18	33
Repulse Bay Road	A	2900	30	2.31	3	0.80	9
Magazine Gap Road	-	1810	17	1.31	4	0.72	10
South Lantau Road	A	2590	17	1.31	4	0.50	18
Victoria Road	B	1800	14	1.08	6	0.60	14
Sai Sha Road	-	1160	13	1.00	7	0.86	7
Kennedy Road	-	2100	13	1.00	7	0.48	19
Route Twisk	A	2800	13	1.00	7	0.36	24
Tai Tam Road	-	6900	12	0.92	10	0.13	35
Victoria Road	A	1300	11	0.85	11	0.65	13
Cape Collinson Road	A	2100	11	0.85	11	0.40	22
Yee King Road	-	260	8	0.62	13	2.37	1
Tai Mong Tsai Road	B	930	8	0.62	13	0.66	12
Tai Po Road	B	3150	8	0.62	13	0.20	32
Chung Hom Kok Road	-	1000	7	0.54	16	0.54	16
Pokfulam Road	A	1190	7	0.54	16	0.45	20
Clear Water Bay Road	-	1340	7	0.54	16	0.40	23
Peak Road	B	400	6	0.46	19	1.15	4
Repulse Bay Road	B	640	6	0.46	19	0.72	11
Island Road	-	830	6	0.46	19	0.56	15
South Lantau Road	B	1650	6	0.46	19	0.28	27
Tai Po Road	C	1980	6	0.46	19	0.23	30
South Lantau Road	C	3500	5	0.38	24	0.11	36
Tuen Mun Road	C	3600	5	0.38	24	0.11	37
Route Twisk	C	1050	4	0.31	26	0.29	26
Tuen Mun Road	A	1100	4	0.31	26	0.28	28
Stubbs Road	A	1300	4	0.31	26	0.24	29
Peak Road	A	1500	4	0.31	26	0.21	31
Route Twisk	B	4400	4	0.31	26	0.07	40
Cape Collinson Road	B	120	3	0.23	31	1.92	2
Tai Mong Tsai Road	A	240	3	0.23	31	0.96	6
Kwun Tong Road	-	270	3	0.23	31	0.85	8
Pokfulam Road	B	1700	3	0.23	31	0.14	34
Stubbs Road	B	120	2	0.15	35	1.28	3
Nam Fung Road	-	300	2	0.15	35	0.51	17
Tai Mong Tsai Road	D	350	2	0.15	35	0.44	21
Tai Mong Tsai Road	C	480	2	0.15	35	0.32	25
Tai Po Road	A	2150	2	0.15	35	0.07	39
Tuen Mun Road	B	3450	2	0.15	35	0.04	41
Tuen Mun Road	D	900	1	0.08	41	0.09	38
Total			350	26.92			

Table 3.1d : No. of Incidents of Landslide on BRIL Roads- 1984 to 1996

		No. of Landslide Incidents of Given Volume Range (m3)						Frequency
Road	Section	<20	20 to 50	50 to 500	500 to 2000	>2000	Total	per year
Cape Collinson Road	A	6	2				8	0.62
Cape Collinson Road	B	1	1		1		3	0.23
Chung Hom Kok Road	-	3	2				5	0.38
Island Road	-	4	2				6	0.46
Kennedy Road	-	12			1		13	1.00
Magazine Gap Road		14	3				17	1.31
Nam Fung Road	-	1	1				2	0.15
Peak Road	A	3		1			4	0.31
Peak Road	B	5					5	0.38
Pokfulam Road	A	6	1				7	0.54
Pokfulam Road	B	2	1				3	0.23
Repulse Bay Road	A	17	8	4			29	2.23
Repulse Bay Road	B	6					6	0.46
Stubbs Road	A	4					4	0.31
Stubbs Road	B	1		1			2	0.15
Tai Hang Road	-	24	3				27	2.08
Tai Tam Road	-	10	1				11	0.85
Victoria Road	A	8		1			9	0.69
Victoria Road	B	12	2				14	1.08
Yee King Road	-	3					3	0.23
Clear Water Bay Road	-	5	1	1			7	0.54
Kwun Tong Road	-		2	1			3	0.23
Sai Sha Road	-	4	5	1	2	1	13	1.00
Tai Mong Tsai Road	A	1	1		1		3	0.23
Tai Mong Tsai Road	B	6	2				8	0.62
Tai Mong Tsai Road	C	1		1			2	0.15
Tai Mong Tsai Road	D	2					2	0.15
Tai Po Road	A	1	1				2	0.15
Tai Po Road	B	4	2	2			8	0.62
Tai Po Road	C	4	1	1			6	0.46
Castle Peak Road	-	15	10	4	2		31	2.38
Route Twisk	A	6	1	5			12	0.92
Route Twisk	B	4					4	0.31
Route Twisk	C	3	1				4	0.31
South Lantau Road	A	4	11	2			17	1.31
South Lantau Road	B	1	3	1	1		6	0.46
South Lantau Road	C	3	1	1			5	0.38
Tuen Mun Road	A	4					4	0.31
Tuen Mun Road	B	1	1				2	0.15
Tuen Mun Road	C	2	2				4	0.31
Tuen Mun Road	D	1					1	0.08
Total							322	24.77

Table 3.1e *Rainfall Data for 1984 to 1996 versus No. of Annual Incidents*

Year	Rainfall (mm per year)	Difference from Average since 1961 (2200mm per year)	Annual No. of Incidents
1984	2000	-9%	2
1985	2250	2%	12
1986	2050	-7%	11
1987	2100	-5%	23
1988	1650	-25%	10
1989	2050	-7%	28
1990	2050	-7%	9
1991	1650	-25%	12
1992	2700	23%	79
1993	2300	5%	67
1994	2726	24%	46
1995	2754	25%	39
1996	2249	2%	12
Average	2194	-0.3%	26.9

3.1.2 *Consideration of Washout Failures*

It was thought that washout may need to be considered separately as major washout can result in much larger runout distances (for a given volume) as compared to sliding failures. However, incidents of washout reported in the database have been of minor volumes. The volume distribution for washout is given in *Table 3.1f.*

Table 3.1f *Volume Distribution for Washout*

Volume Range (m^3)	No. of Incidents	Proportion
< 5	19	61.3%
5 to 20	7	22.6%
20 to 50	5	16.1%
Total	31	100%

Since the volumes involved in washout are low, washouts are considered together with sliding failures for frequency and consequence assessment.

3.1.3 *Consideration of Rockfall*

Rockfalls are defined as failures from rock cut slopes, rock cliffs, etc which result in debris containing a mixture of rocks of various sizes. Boulders are characterised by a single or small number of rocks with significant dimension. Boulder fall and rockfall are therefore distinguished by the number and size

distribution of rock/boulders.

Where boulder volumes are noted or where the incident is identified as boulder fall in the landslide incident reports, such incidents are treated as boulder fall and its consequences assessed separately along with the frequency of its occurrence.

Rockfalls are considered together with landslides since the mechanism of failure of rock slopes and the nature of debris (consisting of rocks of various sizes) can be regarded as similar to soil slopes although the runout distances for rockfalls may be shorter while the corresponding vulnerability factor is expected to be higher in comparison to sliding failures. Also, given the proportion of rock falls (12%) and the relatively small volume of debris from rock falls, as given in *Table 3.1g*, such categorisation is considered adequate for this study.

Table 3.1g ***Volume Distribution for Rockfall***

Volume Range (m^3)	No. of Incidents	Proportion
< 5	37	75.5%
5 to 20	6	12.3%
20 to 50	5	10.2%
500 to 1000	1	2%
Total	49	100%

The incident MW 93/6/18 with a scale of 500 to 1000m^3 is reported as 'large amount of soil/rock washed down but no failure scar was observed'.

Hereafter, the term 'landslide' in this report shall include landslides, washout, retaining wall failure and rock fall.

3.1.4 Consideration of Boulder Fall

An analysis of the 28 boulder fall incidents indicates 18% originated from natural terrain (presumably from above the cut slopes) while the balance (82%) originated from soil cut, rock cut or soil/ rock cut slopes. The latter can be regarded as boulder outcrops or corestones exposed as part of soil/rock excavations during cutting.

Boulder volumes are reported for only 17 incidents. The volume distribution of these 17 incidents are given in *Table 3.1h.*

Table 3.1h ***Volume Distribution of Boulder Falls***

Volume Range (m^3)	No. of Incidents
<1	7 (41%)
1 to 8	6 (35%)
8 to 25	4 (24%)
Total	17

The incidents of boulder fall are limited to a few roads and these are given in *Table 3.1i.*

Table 3.1i ***Boulder Fall Frequency***

Road Section	No. of Incidents	Frequency (per year)
Tai Hang Road	10	0.77
Yee King Road	5	0.38
Cape Collinson Road A	3	0.23
Chung Hom Kok Road/ Victoria Road A	2 each	0.15 for each road
Peak Road B/ Repulse Bay Road A/ Tai Tam Road/ Castle Peak Road/ Route Twisk A/ Tuen Mun Road C	1 each	0.08 for each road
Total	28	2.16

3.2 *CATEGORISATION OF INCIDENTS BASED ON SLOPE FEATURE*

Man-made slopes are classified into three broad categories:

- Cut slope;
- Fill slope; and
- Retaining wall.

Some of the cut slopes and fill slopes could also incorporate a retaining wall. Cut slopes may be soil cut slopes, soil and rock cut slopes or only rock cut slopes.

Not all of the man-made slopes may be registered and catalogued as some of the older man-made slopes constructed prior to 1977 when GEO was formed may not be registered under the 1977/8 Slope Catalogue.

The categorisation of failures with respect to slope type is given in *Table 3.2a* for landslips and boulder falls.

Table 3.2a ***Categorisation of Failures based on Slope Type***

Slope Type	No. of Incidents of Landslips	No. of Incidents of Boulder falls
Cut	286 (88.8%)	23
Soil cut	175 (54.3%)	8
Soil/rock cut	76 (23.6%)	12
Rock cut	35 (10.9%)	3
Fill	27 (8.4%)	
Retaining wall	6 (1.9%)	
Natural	3 (0.9%)	5
Total	322	28

Up/Down Slope Feature

Slope failures can be broadly classified into upslope and downslope failures relative to road which is the main facility of concern in this analysis. The distinction between upslope and downslope failures is important for consequence analysis. Upslope failures could result in debris deposition on the road leading to lane/ road closure for debris removal and temporary or permanent slope improvement or rectification (in addition to the potential for fatalities/ injuries). The impact of downslope failures on the other hand could result in the collapse of part of the road (in addition to the potential for fatalities/ injuries) and therefore follow up work would primarily involve road reconstruction rather than debris removal.

The proportion of upslope and downslope failures are derived for each road based on historical data and these are given in *Annex I*. The information on up/down slope feature is obtained from the sketch given in the incident report identifying the failure scar relative to the road.

All incidents of upslope failures are assumed, for this study, as originating from cut slopes and all incidents of downslope failures are assumed as failure from fill slopes.

3.3 DISTRIBUTION OF LANDSLIDE INCIDENTS BASED ON VOLUME & SLOPE HEIGHT

3.3.1 *Overall Volume Distribution*

The volume distribution of landslides, from all BRIL roads is given in *Table 3.3a*.

It can be seen from *Table 3.3a*, that 41% of the incidents resulted in a landslip volume of less than 5 m^3 , 25% of incidents are of volumes 5 to 20 m^3, 21% of incidents are volumes of 20 to 50m^3, 9.2% resulted in volumes of 50 to 500m^3 while only 2.7% result in volumes larger than 500m^3.

Table 3.3a ***Distribution of Landslide Volumes***

Volume Range (m^3)	Total
<5	132 (41%)
5 to 20	82 (25.5%)
20 to 50	69 (21.4%)
50 to 200	19 (5.9%)
200 to 500	11 (3.4%)
500 to 1000	4 (1.2%)
1000 to 2000	4 (1.2%)
> 2000	1 (0.3%)
Total	322

3.3.2 *Slope Height Distribution*

In order to establish a correlation between landslide volumes and slope heights and also to determine potential runout distances of landslide debris, it is necessary to determine the range of slope heights along BRIL roads.

Map Data

A catalogue of man-made slopes along BRIL roads is available from slope location maps (scale of 1:1000). The slope numbers along BRIL road sections were identified and the slope features (including height and type of slope) were then noted from the catalogue. The exercise of identifying slope numbers and noting down the slope features is a time consuming exercise. Moreover, map records and records on slope heights are not complete. The slopes identified on maps include only slopes registered in the 1977/78 Slope Catalogue and therefore may not cover the entire length of slopes found along a road. A list of slope features along BRIL roads identified from maps is included in *Annex D*.

The New Slope Catalogue currently being compiled by GEO was not examined during the course of this study. This study may therefore be updated upon completion of the New Slope Catalogue.

Slope Heights from Incident Data

The information on slope height can also be obtained from the sketch contained in the incident reports which reports the height to the crest of the slope in addition to the height of the failure scar (this is not considered here). However, slope height information is available only for 236 records of which 210 records pertain to upslope failures. The slope height distribution for each road considering only upslope failures is given in *Annex I*.

3.3.3 *Volume Distribution for Upslope Failures*

The failure volume distribution has been derived on a road by road basis. The approach adopted for deriving probabilities corresponding to different failure sizes is explained below.

The incident data for each of the roads provides information on failure volume and also slope height. Where the number of incidents on a given road are few this distribution, however, may not represent the entire range of failures that are possible.

An alternate approach is to adopt the volume distribution derived in the SAR-wide study [1] for cut slope and fill slope failures. This provides for each slope height range, the probability distribution for various failure volumes. The information on slope height distribution is obtained from maps, although this information is not complete.

A more accurate information on slope features should be available once the new catalogue of slopes is completed. For the present, the Consultants were advised by GEO to undertake site visits to estimate the approximate distribution of various slope height ranges. This exercise was conducted for a few roads but is not satisfactory as it involves considerable level of judgement and familiarity with slope features.

It may be further noted that the SAR-wide volume distribution represents only an average distribution considering all slopes while the road specific volume distribution represents the actual historical distribution based on road specific slope characteristics. Therefore combining the SAR-wide volume distribution for different slope heights with the road specific slope height distribution may still not provide a road specific volume distribution that matches with the road specific historical data. Therefore, a modified volume distribution is evolved which attempts to best represent the road specific historical data while at the same time ensuring that certain high volume incidents for the corresponding slope heights, although may not have occurred, are nevertheless represented with a low probability.

Refer to *Annex I* for the volume distribution derived for each BRIL road section. A description of the approach adopted is also included in *Annex I*.

3.3.4 *Volume Distribution for Downslope Failures*

The volume distribution for downslope failures is derived for each road similar to the approach for upslope failures. The volume distribution based on SAR-wide data (estimated by considering slope height data from maps) and the incident data are both considered in deriving the modified volume distribution. Refer to *Annex I* for road specific distribution.

3.4 *COMPARISON WITH SAR-WIDE STUDY*

3.4.1 *Study on Pre-GCO Man-made Slopes*

GEO have carried out a SAR-wide study of landslides on pre-GCO man-made slopes based on historical data [1]. The study included a detailed analysis of over 4500 landslide incidents over the period 1982 to 1996 and also an analysis of the slope features for about 40,000 pre-GCO man-made slopes.

The SAR-wide study includes a detailed analysis of incidents by slope type - cut slope, fill slope and retaining wall.

A comparison between the SAR-wide study and the analysis for BRIL roads on frequency estimation, presented above is included in the following paragraphs:

- the proportion of small volume range failures (ie, <20m^3) is about 80% in the SAR-wide study while it is 67% for BRIL roads;

- the SAR-wide study considers 3 mechanisms of failure, sliding failure, liquefaction and washout for fill slopes contributing 90%, 3% and 7% respectively. Whilst liquefaction failures are considered rare, minor washout failures are considered together with sliding failures for BRIL roads;

- the frequency of annual landslides (the term landslides in the SAR-wide study does not include rockfall as considered here) for cut slopes, retaining walls and fill slopes are estimated as 1 in 100, 1 in 360 and 1 in 525 respectively while the average annual number of landslides in cut slopes, retaining walls and fill slopes is about 200, 20 and 20 respectively. The proportion of cut slope failures for BRIL roads is consistent with the proportion of cut slope failures SAR-wide (83%). However, the proportion of fill slope and retaining wall failures for BRIL roads are lower than SAR-wide estimates.

It may be noted that the frequency of landslides along BRIL roads is estimated primarily from the data for BRIL roads over a period of 13 years.

An alternative approach to deriving landslide frequency for BRIL roads is to apply the SAR-wide failure data since it covers a much larger data set of failures (over 4500) and slope features (about 35,000 x 15 slope years).

A count of the number of cut slopes, fill slopes and retaining walls was carried out from the slope maps and the frequency of landslide estimated for 3 roads, in each of the 3 regions, based on SAR-wide data. The results are given in *Table 3.4a*. The frequency of failure from cut slopes, retaining walls and fill slopes are estimated as 1 in 100, 1 in 360 and 1 in 525 per year respectively in the SAR-wide study. The frequency of landslide (excluding boulder fall) based on road specific historical data is also provided in *Table 3.4a*.

Table 3.4a ***Estimation of Failure Frequency based on SAR-wide Data***

Road	No. of Cut slopes	No. of Fill slopes	No. of Retaining Walls	Frequency based on SAR-wide data	Frequency based on Road specific Data
Repulse Bay Road A	32	11	11	0.37	2.23
Castle Peak Road	44	20	3	0.49	2.38
Tai Po Road B	3	1	3	0.04	0.62

It can be seen that the landslide frequency considering the number of slopes along each BRIL road and applying the SAR-wide average failure frequency per slope produces much lower values than the historical annual failures for BRIL roads.

This difference could possibly be explained by the fact that BRIL road slopes are more prone to failure than the SAR-wide average pre-GCO slopes and therefore constitute the higher end of the failure scale. In the SAR-wide study, the frequency of landslide is expressed in terms of 'per slope' rather than 'per slope metre'. The units of 'per slope metre' may better represent the failure rate for the given wide range of slope lengths. Another possible reason is that the catalogue of slopes is not complete and therefore the frequency derived based on a slope count from maps is on the lower side.

Although no definite conclusion can be drawn from the comparative analysis presented in *Table 3.4a*, it serves to demonstrate the relative slope failure rates on BRIL roads with respect to SAR-wide data.

3.4.2 Study on Boulder Fall From Natural Slopes

The SAR-wide study for boulder fall [6] was carried out separately for 3 regions, Western Hong Kong Island (WHKI), Eastern Hong Kong Island (EHKI) and Eastern Kowloon (DP_LYM). The boulder fall frequency for the 3 regions were estimated as 3×10^{-5} per metre per year for WHKI and DP_LYM and 4×10^{-5} per metre per year for EHKI.

Applying this historical frequency for Tai Hang Road in WHKI with a length of 2.72km (assuming that the entire road is threatened by boulder falls, although this may not be true) gives a frequency of 0.08 per year while the frequency of boulder fall based on historical data for Tai Hang Road is 0.77 per year. It may be noted that the boulder fall study considered only boulders from natural terrain while most of the incidents considered in this study have occurred from man-made slopes.

3.5 *Effect of Slope Improvement Works along BRIL Roads*

It was advised by GEO that where slopes along BRIL roads have now been upgraded to current geotechnical standards (as otherwise the slopes are of mostly pre-GCO standard), the data on frequency of landslides may need to be modified to reflect the contribution from slope improvement. The Consultants were provided the database containing a list of slopes upgraded (these represent the work carried out under the Landslip Preventive Measures (LPM) programme).

Match with Map Data

Slope numbers were identified from slope maps for 32 road sections out of the 41 BRIL road sections (the details on slope numbers and features are included in *Annex D).* The total number of slopes in these 32 road sections is 692 (the map data is not complete as it includes only registered slopes and data for some roads are only partially complete). A list of slope numbers that have been upgraded to current geotechnical standards were made available to the Consultants. Comparing the two datasets, it is found that 33 slopes (about 5%) have been upgraded. *Table E1* in *Annex E* contains the list of slopes along BRIL roads that match with GEO's database for slopes upgraded.

The proportion of slopes improved along each BRIL road is given in *Table 3.5a.*

Match with Incident Data

Slope numbers have also been noted from incident records. However, information on slope numbers is available for only 133 records out of 350. Of these 133 records, 112 pertain to unique slope numbers while the rest are incidents that occurred on the same slope as included within the total of 112. A comparison of these slope numbers with the list of slope numbers which have been upgraded reveals 11 incident records pertaining to 7 slopes (5 incidents occurred on the same slope). Of these 7 slopes, 5 match with the search described in the previous paragraph. The two remaining slopes are located on Sai Sha Road and Peak Road. *Table E2* in *Annex E* contains the list of slopes along BRIL roads with incident history that match with the database of slopes upgraded. The incident date and the date of completion of slope work are also included to identify if the failures were prior to the improvement work.

The effect of slope improvement on the frequency of incidents is estimated, as given in *Table 3.5b,* by excluding incidents that occurred on slopes that have been improved.

Table 3.5a : Proportion of Slopes along BRIL Roads Improved to Post-GEO Standard

Road	Section	No. of Slope Features	No. of Post-GEO Slopes	Proportion of Slopes Upgraded
Chung Hom Kok Road	-	16	1	6%
Kennedy Road	-	43	3	7%
Magazine Gap Road	-	32	1	3%
Nam Fung Road	-	5	1	20%
Peak Road	A	38	4	10%
Pokfulam Road	B	25	2	8%
Stubbs Road	A	19	3	16%
Tai Hang Road	-	37	5	13%
Victoria Road	A	29	3	10%
Kwun Tong Road	-	3	1	33%
Tai Po Road	A	8	2	25%
Tai Po Road	C	7	1	14%
Castle Peak Road	-	67	3	5%
Tuen Mun Road	A	8	1	12%
Tuen Mun Road	B	36	2	5%
Tuen Mun Road	C	23	1	4%

Table 3.5b : Modified Frequency of Incidents per year for Selected BRIL Roads where Some Slopes have been Improved

Roads	Section	Length (m)	Actual No. of Incidents	No. of Incidents not Considered	Actual Frequency per year	Modified Frequency per year	% Reduction
Tai Hang Road	-	2720	37	2	2.85	2.69	5.4
Castle Peak Road	-	14000	32	5	2.46	2.08	15.6
Sai Sha Road	-	1160	13	1	1.00	0.92	7.7
Peak Road	A	1500	4	1	0.31	0.23	25.0
Tuen Mun Road	A	1100	4	1	0.31	0.23	25.0
Tuen Mun Road	B	3450	2	1	0.15	0.08	50.0

An approach for deriving a reduction factor to the failure frequency to account for slope improvement works is discussed further here.

One approach is to consider reduction factors as given in *Table 3.5b* which is based on the premise that improvement in slopes that have failed more often in the past should bring about a corresponding reduction in the predicted failure frequency. For Tuen Mun Road B, this will lead to 50% reduction in failure frequency although only 5% of the slopes have been improved as can be seen from *Table 3.5a*. (The estimation of proportion of slopes improved along BRIL roads can be further refined by considering the length of slopes and also slopes that may not be registered). However, it needs to be established whether improvement of only slopes prone to failure is a sufficient measure to bring about corresponding reduction in the overall failure frequency for a given road or that the failure is equally likely on any of the remaining pre-GCO slopes. In the former case, slope improvement works can be limited to slopes prone to failure and for cost-benefit analysis only such costs may be considered instead of including the entire length of slopes along a given road.

The other approach is to consider the percentage of total slopes that have been improved to current geotechnical standards, as the corresponding frequency reduction factor. As given in *Table 3.5a*, the percentage of slopes improved in Tuen Mun Road B is 5% which is taken as the reduction factor for landslide frequency.

The latter approach (ie, reduction factors as given in *Table 3.5a*, based on percentage of total slopes improved) is adopted in deriving the modified frequency for landslides. A separate risk ranking based on the modified frequency is also produced. This approach can be regarded as conservative.

4 CONSEQUENCE ESTIMATION

The consequence assessment involves two parts : estimation of fatalities (for estimation of risk to life) and estimation of duration of road closure (for estimation of economic consequences).

4.1 FATALITY ESTIMATION FOR LANDSLIDES

The estimation of fatalities from landslides for a given facility is based on the generalised consequence model developed by GEO [3] and is expressed as a function of the following parameters:

- expected number of fatalities for a facility directly affected by the reference landslide;
- scale of failure;
- vulnerability factor (defined as the probability of death due to debris impact).

The model considers the consequence of a reference landslide directly affecting a given type of facility located at the worst possible position (ie, at the toe of a slope or near the edge of the slope crest) assuming occupation of the facility under average conditions. The consequence is then scaled with respect to the size of the actual failure relative to that of the reference landslide and the vulnerability of the facility given its actual location relative to the influence zone of the landslide. The reference landslide is taken to be a 10m wide failure of $50m^3$ volume.

Extracts from the paper by Wong, Ho and Chan [3] describing in detail the development of the generalised consequence model for landslides is attached in *Annex H*.

Facilities at Risk due to Slope Failure

The main facility for consideration in this study is the road and footpath at the toe or crest of the slope. The population at risk are the road users who are essentially vehicle users. The other facilities that may be at risk are footpaths and buildings. The present study considers slopes along roads and therefore buildings at the toe of slope are not expected. Buildings if any, may be found on the opposite side of the slope toe. However, such buildings are few and are not of main concern to the study.

Footpaths are found in almost all the roads. For the roads in HK, footpaths are mostly found on the opposite side from the slope toe and footpath users may therefore be vulnerable to both down slope failures and debris from upslope failures. Fatalities of pedestrians is considered along with adjacent roads as explained in *Annex A*.

4.1.1 *Vulnerability Factors*

The vulnerability factors, corresponding to different mechanisms of failure and to different types of facility at different proximity, have been derived by GEO [1], based on consideration of the worst credible limit of the debris mobility, an assumed range of variability of debris mobility and the probable degree of

Table 4.1a	**Vulnerability Factors for Roads at Toe of Cut Slopes**								
Failure Volume (m3)	Runout Angle of Debris (degrees)								
	20 to 25	25 to 30	30 to 35	35 to 40	40 to 45	45 to 50	50 to 55	55 to 60	>60
<20			0.0015	0.0065	0.019	0.042	0.072	0.095	0.1
20 to 50			0.03	0.1	0.23	0.37	0.47	0.5	0.5
50 to 500		0.0015	0.078	0.26	0.48	0.63	0.69	0.7	0.7
500 to 2000		0.01	0.15	0.48	0.83	0.95	0.95	0.95	0.95
> 2000	0.01	0.15	0.48	0.83	0.95	0.95	0.95	0.95	0.95
Table 4.1b	**Vulnerability Factors for Roads at Crest of Fill Slopes**								
Failure Volume (m3)	Crest Distance (m)								
	< 3m	3 to 6m	6 to 10m						
<20	0.0075	0.00025							
20 to 50	0.0375	0.00125							
50 to 200	0.15	0.005							
200 to 1000	0.4	0.04	0.002						
>1000	0.54	0.074	0.002						

damage for a particular facility at a given proximity.

The vulnerability factors for failures from cut slopes and fill slopes, are given in *Table 4.1a* and *4.1b* respectively.

The vulnerability factors for cut slopes (ie, upslopes) are expressed in terms of runout angle of debris for a range of failure volumes. The runout angle (or the shadow angle) is estimated for different slope heights and distances from the toe of the slope. For a given failure volume and slope height, vulnerability factors are estimated considering different lane sections separately as the affected facility and are then averaged. For example, if it is a two lane road, the vulnerability factor for a given failure volume and slope height is the average of vulnerability factors considering first lane and 2nd lane separately (see *Annex C*, sheet 'Up V factors' for details). This approach is adopted since fatality estimates are correlated to AADT and AADT represents traffic on all lanes in a given road.

The vulnerability factors for fill slope (downslope) failures are expressed in terms of crest distance (ie distance from the edge of the slope for facility at the crest which represents the depth of the landslide) for a range of failure volumes. The crest distances considered are 0 to 3m, 3 to 6m and 6 to 10m. *Figure 4.1a* depicts the influence zone for cut slope and fill slope failures

Estimation of Shadow Angle

The shadow angle, defined as the angle of the line that joins the toe facility to the slope crest, is estimated for different lane sections of the road for the three different slope heights based on simple geometry as shown in *Figure 4.1a*. It is assumed that the slope angle is 60^0 (based on the data on cut slope features from maps).

shadow angle = $\tan^{-1}$ (slope height/[distance from slope toe + {slope height/tan(slope angle)}])

Slope Heights

As discussed in the *Section 3* on Frequency Estimation, three slope height ranges are considered. These are <10m, 10 to 20m and >20m. For the purpose of estimating runout angle based on slope height, an equivalent height representative of the average for each range of slope heights is considered.

Table 4.1c *Slope Height Range*

Range	Average
<10m	7.5m
10 to 20m	15m
>20m	30m

It is further assumed that each lane section is about 3m wide for the first two lanes closest to the slope toe and 5m for lanes beyond it. This accounts for the narrow width of two lane roads and the increase in width as the number of lanes increases. The shadow angle is estimated by considering the distance from the slope toe to the centre of a given lane section.

Table 4.1d *Estimation of Shadow Angle for Lane Sections*

Lane Adjacent to Slope	Distance from Slope Toe	Shadow Angle for Slope Heights 7.5m	15m	30m
1	1.5m	52	56	58
2	4.5m	40	49	54
3	8m	31	42	50
4	12.5m	24	35	45
5	17.5m	19	30	41
6	22.5m	16	26	37

4.1.2 *Scale Factor*

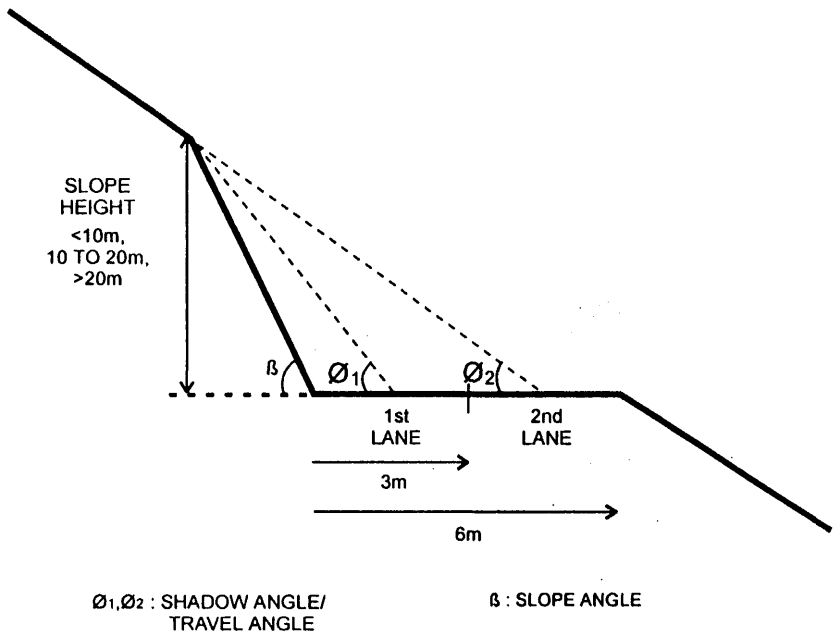
The scale of failure for an actual failure is expressed in terms of a scaling factor with respect to the reference landslide (which has a width of 10m). The scaling factor is derived as the ratio of the width of the actual landslide to the width of the reference landslide, taking due account of the width of the affected facility. For road sections, however, the width of the road section (which should be read as the length of the road section) is mostly higher than the landslide width. The width of landslide for different volume ranges is taken from the previous study by GEO as given in *Table 4.1e*. These are derived based on experience and analysis of historical landslide data.

An analysis of the incident data set for BRIL roads for a correlation between landslide width and volume could not be carried out due to inadequate data. Landslide widths are noted in very few records. It may be noted that any correlation between volume and width may require to consider slope height as the three are interrelated by geometry. However, derivation of such a correlation is beyond the scope of this study.

The scaling factors for different volume ranges are given in *Table 4.1e*. These are different for cut slope and fill slope failures.

Table 4.1e *Scale Factor for Landslide Widths*

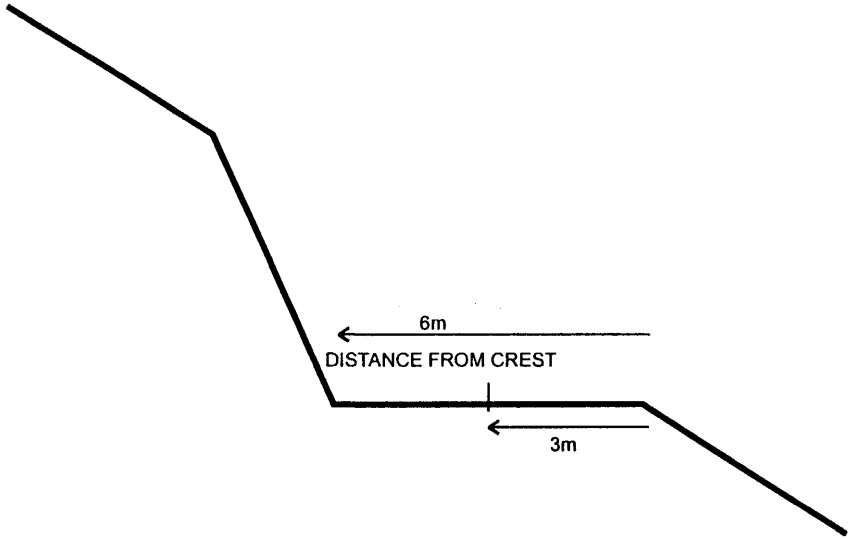
Volume Range (m3)	Average Width	Scale Factor
Cut slopes		
<20	4	0.4
20 to 50	7	0.7
50 to 500	15	1.5
500 to 2000	20	2
>2000	25	2.5
Fill Slopes		
<20	6	0.6
20 to 50	10	1
50 to 200	15	1.5
200 to 1000	20	2
> 1000	40	4



Ø1,Ø2 : SHADOW ANGLE/
TRAVEL ANGLE

ß : SLOPE ANGLE

INFLUENCE ZONE FOR UP SLOPE FAILURES



INFLUENCE ZONE FOR DOWN SLOPE FAILURES

FIGURE 4.1a - INFLUENCE ZONE FOR CUT SLOPE / FILL SLOPE FAILURES

4.1.3 *Expected Number of Fatalities for Reference Landslide*

The expected number of fatalities for a given BRIL road with certain traffic flow is derived from a previous study by GEO [2] which had produced a generalised consequence model for a reference landslide. GEO had subsequently improved on this to produce nomographs relating actual AADT (Annual Average Daily Traffic) and number of lanes of road to a facility group number. Each facility group number has an associated number of fatalities. The nomographs relating AADT and number of lanes to the facility group number is included in *Annex A*. The assumptions involved in the estimation are also included in *Annex A*. The fatalities corresponding to each facility group number are given in *Table 4.1f*.

Following the above approach, the expected number of fatalities for the reference landslide is estimated for all the BRIL roads as given in *Table 4.1g*.

Table 4.1f ***Fatalities Corresponding to Facility Group No.***

Facility Group No.	Expected No. of Fatalities
1	3
2	1
3	0.25
4	0.03
5	0.001

The AADT values for BRIL roads are based on actual traffic data for 1995. Actual AADT values for 1994 are also available and it is found that the growth/ decline in traffic are within a band of 5% for most of the roads except for a few which show a high increase such as Nam Fung Road (20%), Stubbs Road B (38%) and Castle Peak Road (35%), Tuen Mun Road D (8%). Since the facility group number corresponds to a range of AADT values (as can be seen from *Figure A1* in *Annex A*), increase in traffic by about 10% for 1996 or 1997 is not expected to affect the fatality estimates except for a few roads, listed below, which are on the borderline of two facility group numbers.

- Kennedy Road;
- Peak Road, section A &B;
- Repulse Bay Road A;
- Stubbs Road B;
- Tai Tam Road.

The above roads have been considered as facility group number 2 instead of 3 based on the expected increase in AADT. The expected number of fatalities will therefore increase from 0.25 to 1.

It may be noted that since the generalised consequence model for estimation of fatalities is derived for a reference landslide (of $50m^3$), scaling factors as described in *Table 4.1e* serves to scale up or down the actual landslide volume with respect to the reference landslide volume in terms of landslide width.

Table 4.1g : Estimation of Expected No. of Fatalities for BRIL Roads based on AADT and No. of Lanes

Road Name	Section	Class of Road	Category	No. of Lanes	Actual AADT (1995)	Facility Group No.	Expected No. of Fatality
HK							
Cape Collinson Road	A	LD	C	2	450	4	0.03
Cape Collinson Road	B	LD	C	2	450	4	0.03
Chung Hum Kok Rd		LD	C	2	1300	4	0.03
Island Road		PD	B	2	16890	2	1
Kennedy Road		DD	C	2	10610	2	1
Magazine Gap Road		DD	C	2	14960	2	1
Nam Fung Road		DD	B	4	10110	3	0.25
Peak Road	A	DD	C	2	11170	2	1
Peak Road	B	DD	C	2	10120	2	1
Pokfulam Road	A	PD	B	4	36160	2	1
Pokfulam Road	B	PD	B	4	25050	2	1
Repulse Bay Road	A	DD	C	2	12300	2	1
Repulse Bay Road	B	PD	B	2	14370	2	1
Stubb's Road	A	DD	C	2	21070	2	1
Stubb's Road	B	DD	C	2	11270	2	1
Tai Hang Road		DD	C	2	14670	2	1
Tai Tam Road		PD	B	2	10900	2	1
Victoria Road	A	DD	C	2	5410	3	0.25
Victoria Road	B	DD	C	2	7860	3	0.25
Yee King Road		DD	C	2	14150	2	1
ME							
Clear Water Bay Rd		RA	B	4	32950	2	1
Kwun Tong Road		UT	A	4	150120	1	3
Sai Sha Road		RA	B	2	5310	3	0.25
Tai Mong Tsai Road	A	RA	B	2	6000	2	0.25
Tai Mong Tsai Road	B	RA	B	2	6000	2	0.25
Tai Mong Tsai Road	C	LD	C	2	4120	3	0.25
Tai Mong Tsai Road	D	LD	C	2	4120	3	0.25
Tai Po Road	A	PD	B	4	9190	3	0.25
Tai Po Road	B	RA	B	4	5840	3	0.25
Tai Po Road	C	RA	B	4	5840	3	0.25
MW							
Castle Peak Road		RA	B	2	12980	2	1
Route Twisk	A	RA	B	2	6270	3	0.25
Route Twisk	B	RA	B	2	7250	3	0.25
Route Twisk	C	RA	B	2	7250	3	0.25
South Lantau Road	A	RA	B	2	2980	4	0.03
South Lantau Road	B	RA	B	2	1210	4	0.03
South Lantau Road	C	RA	B	2	1210	4	0.03
Tuen Mun Road	A	EX	A	6	96120	1	3
Tuen Mun Road	B	EX	A	6	96120	1	3
Tuen Mun Road	C	EX	A	6	85410	1	3
Tuen Mun Road	D	EX	A	6	95470	1	3

4.2 *FATALITY ESTIMATION FOR BOULDER FALLS*

The consequence of boulder fall is estimated from the methodology proposed by Bunce et al [11]. The model evaluates the probability of a falling rock of size greater than 150mm diameter hitting a moving vehicle based on the fraction of the road occupied by a vehicle which is defined as the probability of spatial impact given a rockfall,

P(S:H) = (AADT * Length of vehicle)/(average vehicle speed *24,000)

The average vehicle speed is taken as 70 km per hour while the length of the vehicle is assumed as 5m. AADT is the annual average daily traffic, ie the number of vehicles per day while 24,000 is the conversion factor for units.

The probability that a rock hits a vehicle is then given by,

$P(S) = 1-\{1-P(S:H)\}^{Nr}$

where, Nr is the frequency of rock fall per year.

The probability of loss of life of an occupant given a vehicle is hit by a rock is assumed as 0.2. Although this is a function of size of rock, the number of occupants in the vehicle, the location and nature of impact, the capability of the vehicle to protect the occupants etc, detailed modelling has not been included.

Similarly, the consequences of a moving vehicle hitting a fallen rock can be estimated [11]. The effective vehicle length is assumed to be half the driver's decision sight distance which is estimated as 250m at a vehicle speed of about 70km/hr. Substituting this value (which is 125m) for 'length of vehicle' in the equation for P(S:H), and assuming that the probability of loss of life of an occupant is 0.1 (following collision), the PLL due to moving vehicle hitting a fallen rock is estimated. This predicts a PLL of about one order of magnitude higher than for the case of a moving vehicle hit by a falling rock.

The effect of a falling rock on a stationary vehicle is not considered here as it is expected to have a much lower probability of occurrence. However, for roads more prone to congestion this may become significant.

4.3 *ESTIMATION OF DURATION & EXTENT OF LANE/ROAD CLOSURE*

4.3.1 *Overview*

Information on lane/ road closure following landslips was provided by the Highways Department for the years 1994 to 1996. The data however pertain to both BRIL and non-BRIL roads.

Information on landslide volumes corresponding to incidents of lane closure was obtained from the annual GEO reports on landslides. Lane closure data is available for 113 incidents while data on landslide volumes are available for only 102 of these incidents.

The number of incidents based on slope type and the number of incidents for different volumes ranges are summarised in *Table 4.3a* and *4.3b*.

Table 4.3a *Lane Closure Incidents by Slope Failure Type*

Slope Failure Type	No. of Incidents	Proportion
Cut	71	69.6%
Rock fall	11	10.8%
Fill	6	5.9%
Natural slope	6	5.9%
Boulder fall	4	3.9%
Retaining wall	1	1%
Others	3	2.9%
Total	102	

Table 4.3b *Volume Distribution for Lane Closure Incidents*

Volume Range (m^3)	No. of Incidents	Proportion
< 5	20	19.6%
5 to 20	33	32.3%
20 to 50	24	23.5%
50 to 500	20	19.6%
500 to 2000	4	3.9%
> 2000	1	1%
Total	102	

Since the number of incidents of failure volumes >500m^3 resulting in lane closure are very few, it is difficult to derive any correlation between type of slope failure and duration of lane closure for these high volume range failures. Similarly, there is only one incident in the range >2000m^3, which is of 14,000m^3 volume that resulted in 47 days of lane closure.

The section on Frequency Estimation has considered downslope failures (which are assumed as fill slopes) separately. One of the reasons is to account for possibly longer duration of closure following the damage to the stability of the road section. However, considering the limited amount of data on lane closure from fill slope failures, it is difficult to draw any conclusion on whether downslope failures result in extended lane closure.

The analysis therefore includes all incidents of slope failure. However, the duration of lane closure has been analysed separately for each volume range (similar to the approach on Frequency Estimation).

4.3.2 One Lane Closure

The data set for lane closure analysis is presented in *Annex B*. The number of days of closure of one lane and more than one lane have been combined to produce a cumulative value for closure of the first lane from the toe of slope.

The data set is plotted on graphs for each volume range (<20m^3, 20 to 50m^3, 50 to 500m^3, 500 to 2000m^3) to identify any trend between duration of closure and landslide volume. These are presented in *Annex B*.

It can be seen from the graphs in *Annex B* that there is no linear correlation between duration and volume. It is not necessary, however, that a linear correlation must exist since it can be expected that the duration of closure will reach a certain maximum value and remain the same for volumes higher than that corresponding to the maximum duration.

The data set is so widely distributed (that for a certain volume say 10m^3, the duration varies from 0.3 days to 50 days) that either there may not be any correlation at all or it requires a detailed multiple regression analysis or a detailed analysis of the factors involved in each incident of road closure .

It may be difficult to derive a correlation unless each of the incidents is analysed for reasons that resulted in closure. The requirement for closure may depend on a number of factors:

- volume of debris;
- whether slope remedial work is required following debris removal;
- nature of slope remedial work -temporary or permanent remedial measures;
- extraneous factors such as road repair work;
- possible demand on emergency services and/or geotechnical resources due to a number of simultaneous incidents;
- where the incident resulted in injury or death, duration may be extended to establish the cause of failure and carry out permanent remedial measures.

The volume of debris, therefore may not be the only parameter in the correlation although it appears to be the main deterministic parameter.

Considering the difficulties in establishing a correlation, a probabilistic approach to estimate the duration of closure may be appropriate. For each volume range, a range of duration can be considered with associated probability, as included in the tables in *Annex B*. However, for the analysis here, only values representative of the mean are adopted for each volume range, as given in *Table 4.3c*.

Table 4.3c *Duration of Closure for 1st Lane*

Volume Range (m^3)	Duration (days)
<20	10
20 to 50	20
50 to 500	30
500 to 2000	40
>2000	40

Similar values for duration of closure of 1st lane are adopted for upslope and downslope failures.

4.3.3 *Multiple Lane Closure*

The analysis presented above considered all incidents of lane closure irrespective of the number of lanes involved as each of these incidents would have caused minimum of one lane closure. Therefore the analysis could be regarded as pertaining to minimum one lane closure.

Of the 102 incidents for which duration of lane closure and number of lanes is available, the distribution of incidents with respect to number of lanes is given in *Table 4.3d.*

Table 4.3d ***Breakdown of Lane Closure Incidents by No. of Lanes***

No of Lanes Closed	No. of Incidents	Proportion
Only one lane closed	61	59.9%
Two lanes closed initially followed by one lane closure	18	17.6%
Two lanes closed throughout	19	18.6%
More than 2 lanes closed, 3 or 4 lanes initially followed by 2 lanes	4	3.9%
Total	102	

The incidents involving closure of 2 lanes followed by closure of 1 lane, incidents involving closure of 2 lanes throughout the period of closure and incidents involving closure of more than 2 lanes are analysed separately as given in *Table 4.3e, 4.3f and 4.3g.* It can be expected (for upslope failures) that closure of more than one lane is required primarily for clearing debris while closure of one lane is required for slope repair.

An analysis of incidents involving closure of 2 lanes initially followed by closure of one lane reveals that the duration of closure of 2 lanes has a mean of 5 and a standard deviation of 5. This is in line with the expectation that the closure relates to debris removal.

An analysis of incidents involving closure of 2 lanes throughout the period of closure reveals the same trend as the analysis for closure of single lane as explained in *Section* 4.3.2 in that there is no obvious correlation between closure of 2 lanes and landslide volume. If incidents involving less than 10 days of closure are excluded, there are 10 remaining incidents with duration range between 14 to 145 days. Further excluding the incident involving 145 days, gives an average closure time of 30 days. The reason for closure of 2 lanes for such a long period for incident volume ranging from 6 to 80m^3 may possibly be explained as due to specific slope repairs.

It is assumed that the duration of closure of the 2nd, 3rd or 4th lane from the slope toe is dependent only on the time taken to clear the debris for failures from cut slopes. Although closure of more than one lane is dependent on failure volume, in the absence of specific correlation some assumptions may be required. This is given in *Table 4.3h.*

The duration of closure of the first lane to the slope toe is, however, dependent on the time required for slope repair and therefore values as derived in *Section* 4.3.2 is adopted.

Table 4.3e	Incidents Involving 2 Lane Closure Followed by 1 Lane Closure				
Incident No	Duration (days)	No of lanes closed	Volume (m3)	Results	
MW95/10/2B	1.26	2	2	mean	4.95
HK94/8/12B	18	2	5	std_dev	5.12
ME94/8/6B	1	2	10		
MW94/8/25B	0.15	2	10		
K96/9/1B	0.25	2	20		
ME94/7/9B	11	2	30		
ME94/7/20B	5	2	40		
HK94/7/32B	2	2	40		
K94/7/4B	5	2	45		
ME94/6/2B	1	2	80		
ME95/8/19B	3	2	80		
K94/7/5B	1	2	140		
ME94/8/24B	12.23	2	150		
ME95/8/10B	8.29	2	240		
ME94/7/4B	0.79	2	260		
MW94/7/25B	1.69	2	275		
MW94/7/18B	9.07	2	700		
ME95/8/11B	8.29	2	2000		

Table 4.3f	Incidents Involving 2 Lane Closure				
Incident No	Duration (days)	No of lanes closed	Volume (m3)	Results	
HK94/7/3B	7	2	2	mean	24.39583
HK95/6/3B	3	2	2.5	std_dev	34.05145
HK94/7/15B	39	2	6		
HK95/8/17B	37	2	8		
HK94/7/36B	4	2	9		
K94/7/3B	28	2	10		
HK94/7/16B	22	2	15		
ME95/8/4B	0.71	2	15		
ME94/8/23B	5	2	20		
MW94/8/5B	145	2	20		
HK96/9/4	25	2	30		
HK95/8/77B	14	2	40		
MW94/7/16B	16	2	45		
ME95/10/1B	1	2	50		
HK95/8/16B	43	2	60		
ME94/7/31B	47	2	80		
ME94/8/32B	0	2	100		
ME94/8/22B	2.42	2	240		

Table 4.3g	Incidents Involving More than 2 Lane Closure		
Incident No	Duration (days)	No of lanes closed	Volume (m3)
MW95/8/21B	0.28	2	10
MW95/8/21C	9.23	3	10
HK95/8/15B	17.00	2	20
HK95/8/15D	19.00	4	20
HK95/8/2B	3.00	2	50
HK95/8/2D	6.00	4	50
K94/7/11B	22.00	2	150
K94/7/11D	39.00	4	150

Note:

The suffix B,C,D to the incident no. correspond to the same incident resulting in closure of 2, 3 and 4 lanes respectively for different periods.

Table 4.3h *Assumptions on Duration of Closure for 2nd, 3rd & 4th Lane*

Volume Range (m^3)	Duration of Closure (days) 2nd lane	3rd lane	4th lane
<20	1	0	0
20 to 50	3	0	0
50 to 500	5	1	0
500 to 2000	10	5	3
>2000	30	7	5

It is assumed that only 4 lanes are affected at most.

For downslope (ie, fill slope) failures, it is assumed that the 2nd lane from the crest of slope is affected only for large failures >1000 m^3 and that the duration of the 2nd lane closure is assumed to be the same as the duration for first lane closure.

It may be noted that closure of 2nd lane, for example, implies closure of 1st lane also. Therefore for estimating economic loss (see *Section 4.4.4*) due to lane closure, the duration of closure of each lane is estimated as illustrated below:

For volume > 2000m^3, affecting a 2 lane road,

duration of closure of 2 lanes = 30 days
duration of closure of one lane only = 40 - 30 = 10 days.

4.3.4 *Probability of Lane Closure*

Not all incidents of landslides may result in lane /road closure as it is dependent on the failure volume, debris run-out distance etc. The probability of lane/road closure is correlated with failure volume here. An analysis of all incidents of landslides affecting a road facility during the year 1995 [12] was carried out to determine the probability of an incident causing lane closure. This is summarised in *Table 4.3i.*

Table 4.3i *Probability of Closure of One or More Lanes (based on ref.[12])*

Volume Range (m^3)	No. of incidents affecting road facility	No. of incidents resulting in lane closure	Probability of incident causing 1 or more lane closure
<20	81	50	0.6
20 to 50	16	16	1
50 to 500	8	8	1
>500	3	3	1
Unknown	7	7	1

Incidents with volume less than 20m^3, which did not result in lane closure are reported as having affected the pedestrian pavement. For roads which do not have a pedestrian pavement at the toe of slope, the probability of incident

causing 1st lane closure can be considered as higher than 0.6. Also, 9 out of 50 incidents with volume less than $20m^3$ resulted in only partial closure of a lane. Therefore the probability value of 0.6 may be appropriate.

For downslope failures, the probability of incident causing one lane closure is assumed lower than that for upslope failures. The values assumed are 0, 0.2, 0.5, 0.7 and 1 for corresponding volumes of < 20 m^3, 20 to 50 m^3, 50 to 200 m^3, 200 to 1000 m^3 and > 1000 m^3 respectively.

The probability of incidents resulting in 2 or more lane closure is derived from two sources, from ref. [12] and from road closure data provided by Highways Department described in *Section 4.3.1 to 4.3.3.*

Based on ref. [12], the probability of incident resulting in 2 or more lane closure is derived as given in *Table* 4.3j. It is assumed that all roads have at least 2 lanes (information on number of lanes are not readily available and hence the probability of closure of 3rd and 4th lane cannot be derived from ref.[12]).

Table 4.3j ***Probability of Closure of Two or More Lanes (based on ref.[12])***

Volume Range (m^3)	No. of incidents affecting road facility	No. of incidents resulting in 2 or more lane closure	Probability of incident causing 2 or more lane closure
<20	81	4	0.05
20 to 50	16	6	0.38
50 to 500	8	7	0.88
>500	3	3	1

An alternate approach is to examine the road closure data provided by the Highways Department as described in *Section 4.3.1 to 4.3.3.* The number of incidents of lane closure that resulted in 2 or more lane closure can be derived as given in *Table 4.3k.*

Table 4.3k ***Proportion of Lane Closure Incidents Involving Two or More Lanes (based on data from HyD)***

Volume Range (m^3)	No. of incidents resulting in lane closure	No. of incidents resulting in 2 or more lane closure	Proportion of lane closures with 2 or more lane closed
<20	50	13	0.26
20 to 50	23	13	0.56
50 to 500	19	11	0.58
>500	4	2	0.5

Since the above data includes only incidents that resulted in lane closure, for landslide volumes < $20m^3$ (which do not always cause lane closure), the overall probability of 2 or more lane closure given a landslide should be lower than that derived in *Table 4.3k.* For landslides of higher volumes, which result in at least one lane closure, the probability values derived above can be regarded as the overall probability of 2 or more lane closure given a landslide.

Based on the discussion above, the following assumptions on 2nd, 3rd and 4th lane closure probability are derived. This is given in *Table 4.3l*.

Table 4.3l *Assumptions on Probability of Closure for 2nd, 3rd & 4th Lane*

Volume Range (m^3)	Probability of Closure		
	2 or more lanes	3 or more lanes	4 lanes
<20	0.05	0	0
20 to 50	0.3	0	0
50 to 500	0.5	0.1	0
500 to 2000	0.7	0.3	0.1
>2000	1	1	0.5

The values for probability of closure given in *Tables 4.3i* and *4.3l* are cumulative values. For example, in the event of an incident of volume > 2000 m^3 affecting a 4 lane road, the probability of closure of all 4 lanes is estimated as 0.5 and that of all 3 lanes is estimated as 0.5, (ie, 1 - 0.5).

The approach described above for estimation of duration and extent of lane/road closure is applied to landslides only. For boulder fall incidents, the following assumptions are made:

- road closure will be limited to a maximum of one lane;
- duration of closure will be for a maximum of 5 days;
- the proportion of boulder fall events leading to lane closure is assumed as 0.6.

4.3.5 *Simultaneous Closure of Adjoining BRIL Roads*

GEO have raised concerns that simultaneous closure of adjoining BRIL roads which may possibly serve as diversion routes may risk causing a great deal of inconvenience to the commuters than just an increase in travelling time.

It is possible that a localised extreme rainfall affecting adjoining BRIL roads will increase the chance of simultaneous occurrence of landslides resulting in closure of both the roads. An approach for estimating the probability of such an event is given below which is essentially based on interpretation of the historical data. This however, does not include a detailed analysis of the historical data to identify the cause of failure (ie, if it is rainfall induced) and correlate each incident with the rainfall data for that period.

Based on the location of BRIL roads and a limited understanding of the transport network, the following roads are identified as alternate routes:

- Castle Peak Road and Tuen Mun Road;
- Pokfulam Road and Victoria Road;
- Upper Stubbs Road (B) and Magazine Gap Road;
- Tai Tam Road and Repulse Bay Road.

The roads need to be considered by region, ie HK, ME and MW as firstly these routes serve a particular region and also since the rainfall may be region dependent.

The incident dates are available from incident reports for 350 incidents (it may be noted that analysis here is based on incident record dates for BRIL roads and has no relation to the road closure data presented in *Section 4.3.2 to 4.3.3)*.

Based on the incident dates, all incidents that occurred within 7 consecutive calendar days are grouped together as any two incidents within that period can be considered to affect the availability of the road taking into account the time required to clear the debris. The grouping of incidents period wise for all BRIL roads is given in *Annex G*.

It may be noted that there are no incidents of simultaneous occurrence on Magazine Gap Road and Stubbs Road B (Upper).

An estimate of the number of incidents that occurred on BRIL roads that serve as alternate routes during the same time period are summarised in *Table 4.3m*. The probability of incident occurring simultaneously as on alternate road is also given in *Table 4.3m*. However, this does not include the probability of road closure given an incident which is estimated separately.

Simultaneous Complete Closure of Adjoining BRIL Roads

Simultaneous occurrence of incidents on adjoining BRIL roads may result in a range of possibilities:

- partial closure of both the adjoining roads;
- partial closure of one road and complete closure of the other;
- complete closure of both the roads.

Tuen Mun Road is a 6 lane road while Castle Peak Road is a 2 lane road. As discussed in *Section 4.3.3*, closure up to 4 lanes only have been considered. Therefore simultaneous closure of Tuen Mun Road and Castle Peak Road are considered unlikely.

Pokfulam Road is a 4 lane road while Victoria Road is a 2 lane road. The probability of closure of 4th lane is considered only for volumes greater than $500m^3$, as given in *Table 4.3l*. The probability of an incident greater than $500m^3$ is considered unlikely based on the volume distribution for Pokfulam Road (both A and B) as given in *Annex I*. Therefore simultaneous closure of Pokfulam Road and Victoria Road is unlikely.

The only combination remaining is Repulse Bay Road (both A and B) and Tai Tam Road, both of which are two lane roads. The methodology for estimating the probability of simultaneous complete closure of both the roads is described below.

In order to estimate the probability of simultaneous closure of both roads, the incident data may require to be expressed as probability of incident occurring on both roads given an (intense) rainstorm assuming that only rainstorms can trigger simultaneous failures.

Based on data in *Annex G*, it can be seen there are about nine time periods when a large number of incidents have occurred on different roads during the same time period. Assuming that these pertain to the period of intense rain storm, there have been nine intense rainstorms over the 13 year period which caused failures in either Repulse Bay Road or Tai Tam Road. Among these 9 time

Table 4.3m : Probability of Simultaneous Occurrence of Incidents on BRIL Roads that serve as Alternate Routes

	Magazine Gap Road	Stubbs Road	Pokfulam Road	Victoria Road	Repulse Bay Road	Tai Tam Road	Castle Peak Road	Tuen Mun Road
	-	B	A&B	A&B	A&B	-	-	A,B&C
Total No. of incidents	17	2	10	25	36	12	32	11
No. of incidents during the same time period as the alternate road	0	0	8	14	4	3	3	3
No. of time periods when simultaneous occurrence of incidents on alternate roads reported	0	0	4	4	2	2	3	3
Probability of incident occurring simultaneously as on alternate road	0	0	0.8	0.56	0.11	0.25	0.09	0.27

periods only on two occasions, there have been simultaneous failures on Tai Tam Road and Repulse Bay Road.

An alternate approach for estimating the number of intense rainstorms per year is to consider the number of landslip warnings issued. The average number of landslip warnings issued is 3 per year for the period 1984 to 1995 [13]. The total number of intense rainstorms during the period 1984 to 1996 may therefore be taken as 39 and the probability of a simultaneous incident in Tai Tam Road and Repulse Bay Road is derived as 2/39.

P (of simultaneous occurrence of incidents given a rain storm) = 2/39 = 0.05
P (incident in Tai Tam Road causing road closure) = 0.08
(see *Table 4.3n*)
P (incident in Repulse Bay Road causing road closure) = 0.12
(see *Table 4.3n*)
P (simultaneous road closure) = 0.05x0.08x0.12
$= 4.8 \times 10^{-4}$

where,
P is probability.

However, this probability value needs to be expressed in terms of frequency for any meaningful application. The probability of simultaneous closure derived above is multiplied with the average number of intense rain-storms per year to derive the frequency of simultaneous closure.

The frequency of simultaneous closure of adjoining BRIL roads is therefore derived as $4.8 \times 10^{-4} \times 3$, which is 1.4×10^{-3} per year, ie, once in 694 years.

Table 4.3n ***Probability of Incident Resulting in Complete Road Closure***

Volume Range (m^3)	Volume Probability (refer Annex I)	Probability of 2nd lane closure given failure (refer Table 4.3l)	Overall probability of road closure
Tai Tam Road			
<20	0.87	0.05	0.04
20 to 50	0.11	0.3	0.03
50 to 500	0.02	0.5	0.01
Total			0.08
Repulse Bay Road			
<20	0.76	0.05	0.04
20 to 50	0.2	0.3	0.06
50 to 500	0.04	0.5	0.02
Total			0.12

Simultaneous Partial Closure of Adjoining BRIL Roads

Three cases of simultaneous partial closure are possible when both the roads are of two lanes, as in the case of Tai Tam Road and Repulse Bay Road:

- simultaneous partial closure of both Tai Tam Road and Repulse Bay Road;
- simultaneous complete closure of Tai Tam Road and partial closure of Repulse Bay Road;

- simultaneous complete closure of Repulse Bay Road and partial closure of Tai Tam Road.

Several other cases of partial closure may occur where the number of lanes is more than two. The approach for estimating the probabilities of various cases of simultaneous closure is however, similar.

The probability of closure of one lane only in Tai Tam Road and Repulse Bay Road is derived as given in *Table 4.3o* for different volume ranges. The probability of one lane closure only is the difference in probability of incident causing 1 or more lane closure (as given in *Table 4.3i*) and the probability of incident causing 2 or more lane closure (as given in *Table 4.3l*). The probability of simultaneous partial closure of both the roads is estimated as follows:

P(partial closure of both roads) = P(simultaneous incidents)*P(incident in Tai Tam Rd leading to one lane closure)* P(incident in Repulse Bay Rd leading to one lane closure)
= 0.05x0.57x0.58
= 0.017

The frequency of simultaneous partial closure of both roads is derived as 0.017 * 3 rainstorms per year, which is 0.05 per year, ie once in 20 years.

Table 4.3o ***Probability of Incident Resulting in Partial Road Closure***

Volume Range (m^3)	Volume Probability (refer Annex I)	Probability of one lane closure only given failure	Overall probability of lane closure
Tai Tam Road			
<20	0.87	0.55	0.48
20 to 50	0.11	0.7	0.08
50 to 500	0.02	0.5	0.01
Total			0.57
Repulse Bay Road			
<20	0.76	0.55	0.42
20 to 50	0.2	0.7	0.14
50 to 500	0.04	0.5	0.02
Total			0.58

The probability of simultaneous complete closure of Tai Tam Road and partial closure of Repulse Bay Road is estimated as follows:

P(partial closure of one & complete closure of other) = P(simultaneous incidents)*P(complete closure of Tai Tam Rd)* P(partial closure of Repulse Bay Rd)
= 0.05x0.08x0.58
= 0.002

The frequency of simultaneous complete closure of Tai Tam Road and partial closure of Repulse Bay Road is derived as 0.002 x 3 rainstorms per year, which is 0.006 per year, ie once in about 167 years.

The probability of simultaneous complete closure of Repulse Bay Road and partial closure of Tai Tam Road is estimated as follows:

P(partial closure of one & complete closure of other) = P(simultaneous incidents)*P(complete closure of Repulse Bay Rd)* P(partial closure of Tai Tam Rd)
= 0.05x0.12x0.57
= 0.003

The frequency of simultaneous complete closure of Repulse Bay Road and partial closure of Tai Tam Road is derived as 0.003 x 3 rainstorms per year, which is 0.009 per year, ie once in about 111 years.

The overall probability of simultaneous closure is the sum of the individual probabilities for various cases as derived above.

Overall P(simultaneous closure) $= 4.8 \times 10^{-4} + 0.017 + 0.002 + 0.003$
$= 0.022$

The overall frequency of simultaneous closure is estimated as 0.022 x 3 rainstorms per year, ie, 0.066 per year or once in about 15 years.

The probability of a localised extreme rainfall event affecting adjacent BRIL roads will increase the chance of simultaneous closure of roads. The forecasting of such events including the effects of spatial distribution of rainfall is fraught with difficulties because of the many uncertainties involved. The assessment presented above is essentially based on extrapolation from the available historical data.

4.4 *Economic Loss due to Road Closure*

The criteria for computation of economic loss due to road closure have been derived by the Financial Services Bureau which is described below. It may be noted that the economic losses considered in this study cover only those related to delay caused by road closure. Losses due to slope repairs, traffic accidents brought about by landslides etc have not been considered. As such, the assessed economic losses may be taken as lower bound estimates.

4.4.1 *Increase in Travelling Time*

The methodology for assessing the increase in travelling time due to road closure (partial and complete), as previously suggested by the Financial Services Bureau (FSB) is given in *Table 4.4a*. The increase in travelling time is estimated for different categories of road and for different proportion of road closure, 25%, 50%, 75% and complete closure of the road.

The values presented in *Table 4.4a* are based on the initial suggestions put forward by FSB. These have been revised subsequently by FSB whereby increase in travelling time is expressed as a function of number of days of lane/road closure. For ex., if increase in travelling time is about 5min for 1 to 3 days of closure, it reduces to about 3 min for 4 to 7 days closure and reduces further for more than 7 days closure. The implicit assumption in this approach is possibly that lane/road closure may dissuade some road users from driving on the affected road and therefore may either take alternate routes or alternate modes of

transport or possibly a better traffic management system will be in place. Opting for alternate routes may still lead to increase in travelling time while opting for alternate modes of transport may result in possible discomfort to passengers.

The values for increase in travelling time as given in *Table 4.4a* are therefore retained for computation of economic loss.

Table 4.4a *Assumptions on Increase in Travelling Time due to Road Closure*

Road Category	Category Description	Proportion of Lanes Closed	Increase in Travelling Time (minutes) for an Affected Vehicle per Day of Lane Closure	
			Suggested by FSB	Value assumed for this study
A	Urban trunk roads, rural trunk roads, expressways	25% or less	3 to 15	10
		50%	10 to30	20
		75%	20 to 60	30
		Total closure	30 to 120	60
B	Primary distributors, district distributors and local distributors with 4 lanes or above, and rural road types A	25% or less	3 to 5	5
		50%	5 to 15	10
		75%	15 to 45	20
		Total closure	20 to 60	40
C	District distributors and local distributors with 2 lanes and rural roads type B	25% or less	1 to 3	2
		50%	2 to 5	5
		75%	3 to 10	7
		Total closure	5 to 20	10
D	Rural feeder roads and other small roads not classified by TD	25% to total closure	0 to 5	3

4.4.2 *Time Value for Passengers*

The time value for passengers is assumed as HK$31 per hour per person (at 1995 prices) by the Financial Services Bureau, for the duration of increase in travelling time due to road closure. This is based on the 1992 'Travel Characteristics Survey' and adjusted for the rise in income of the road users.

The 'Travel Characteristics Survey' [14] report of May 1993 (which was made available to the Consultants) provides a time value of HK$ 57.91 and HK$ 39.89 per hour per person for car passengers travelling to work during congestion time and free flow time respectively. This has been derived based on 'route choice analysis'. This value is quoted at 1991 prices, which is equivalent to HK$ 77.6 (for congestion time) at current 1997 prices, assuming a 5% increase every year. The value (HK$31) suggested by the Financial Services Bureau, which is also based on the 'Travel Characteristics Survey' refers to the 'value for ride time' for car passengers to work.

The resource values of time per person used for economic appraisals by the Department of Transport in the UK is about £12.89 per hour for car drivers travelling to work [15]. This is expressed in 1994 values and at current values and prices, is about £13.88 per hour (ie, HK$ 174 @ 12.5 conversion rate), assuming a 2.5% increase each year. It may be noted that the time value for non-working

time is about one quarter of the value for working time.

Although the time value adopted in the UK is much higher than the value suggested for Hong Kong, the time value of HK$ 78 per hour per person in Hong Kong is adopted for this study.

4.4.3 *Additional Operating Costs*

The approach suggested by the Financial Services Bureau assumes that the vehicle has to travel longer distance at a slower speed of 30km/hr, due to the likely congestion in other roads. For each kilometre travelled, operating cost of HK$1.33 (at 1995 prices) was assumed based on the information contained in the 'Comprehensive Transport Study and Freight Transport Study' by the Transport Department of the Hong Kong Government. At current prices (1997), the operating cost is estimated as HK$1.47 per km, assuming 5% increase every year. The operating cost is then expressed as a function of travel time, ie, operating cost of HK$1.47/km x speed of 30km/hr is equal to HK$ 44 per hour of travel time.

4.4.4 *Computation of Economic Loss Due to Road Closure*

Based on the above, the economic loss of road closure per year is estimated as follows:

Time cost = AADT * duration of closure * increase in travelling time * average number of persons per vehicle * Time value

where,

AADT is the actual number of vehicles per day;
duration of closure is based on *Table 4.3c* and *4.3h* weighted for probabilities of closure as given in *Table 4.3i* and *4.3l* for each volume range;
increase in travelling time corresponding to proportion of lanes closed is from *Table 4.4a* (expressed in hours). The proportion of lanes closed is derived for each road considering the total number of lanes and the number of lanes closed;
average number of persons per vehicle is assumed as 3.6;
Time value is HK$ 78 per hour.

Operating Cost = AADT* duration of closure * increase in travelling time * operating cost per hour

where,

operating cost per hour is derived as HK$ 44 per hour per vehicle.

The total costs due to road closure given an incident is the sum of time cost and operating cost. The annual cost of road closure is obtained from the product of the frequency of occurrence of incidents for each road (see *Table 3.1c*), the probability of given volume range, the probability of upslope/ downslope, and the total cost due to lane closure considering weighted duration of closure (as explained in *Section 5.1.2*).

4.4.5 *Implied Cost of Averting Fatality*

The implied cost of averting fatality used in the ACDS study, 1992 [4] for the Health and Safety Executive (HSE) was £2 million. This value has been widely used in cost benefit analysis to determine the requirement of mitigation measures.

The equivalent cost in Hong Kong is taken as HK$ 24 million. This value is adopted in this study to determine the amount of justifiable investment to avert a single fatality. There is an aversion by society to events with multiple fatalities and therefore it is common in risk assessment to adopt an aversion factor for multiple fatalities. The aversion factor could range from 2 to 20 increasing the cost of averted fatality to HK$ 48 million to HK$ 480 million. However for the present study no aversion factor has been applied.

The total cost of averted fatality is derived for each road as follows:

Cost of averted fatality due to incidents on each road = PLL for the road (per year) * HK$ 24 million

5 ESTIMATION OF RISK TO LIFE & ECONOMIC LOSS

The results of QRA are presented in terms of risk to life and economic loss.

Risk to life is expressed in terms of Potential Loss of Life (PLL). PLL is a measure of societal risk which expresses the risk to the population as a whole and for each scenario and its location. The PLL is the sum of the outcome of multiplying the frequency of each incident with its associated number of fatalities as below:

$$PLL = \sum F_1N_1 + F_2N_2 + ... + F_nN_n$$

PLL is an integrated measure of societal risk and is used for performing cost-benefit analysis.

The PLL and the computation of economic loss are implemented in a workbook.

The Risk Assessment tool has been developed in Microsoft Excel v5.0 and consists of two workbooks:

- **pll.xls** which calculates the potential loss of life associated with incidents on each of the 41 BRIL roads; and
- **eco.xls** which computes the cost resulting from increased travelling time and vehicle maintenance. It also includes the computation for cost of averting fatality based on PLL.

In addition, the *eco.xls* workbook summarises data from both workbooks to present total values for PLL, and economic cost for each of the BRIL roads.

The workbook is designed to be easily modified and annotated with explanatory text for the users. The parameters can be changed and the results reworked. Each workbook contains a number of worksheets, each of them performing a specific task.

5.1 ESTIMATION OF PLL

5.1.1 *Workbook for PLL (pll.xls)*

The spreadsheets contained within the *pll.xls* workbook store data obtained from analysis of incident records, and use this historic data to estimate frequency of incidents of various scales on each of the BRIL roads. These values are used in conjunction with vulnerability factors to estimate the PLL associated with particular scenario (as listed on the "LS PLL" sheet). However, it should be noted that the PLL values for each road are summed and presented in the *eco.xls* workbook. The *pll.xls* workbook consists of the following sheets:

Road Specific Data

This sheet lists data specific to each of the BRIL roads, ie the number of lanes, length (in Km), AADT, etc. This information is used either directly in the "LS PLL" spreadsheet (in both pll.xls and eco.xls workbooks), and "Boulder Fall PLL" sheet, or serves to direct the selection of information from other data sheets (from either workbook).

For example the number of lanes and category is used to determine the delay resulting from lane closures, see sheets "Category Lane Time Delay" (which utilises the "Time Delay" data sheet).

Scale Factors

The width of landslide for a given volume range is obtained from previous GEO study. The scale factor is obtained by dividing this width by the width for the reference landslide of $50m^3$, which is 10m.

Up Vol vs Height

This sheet presents the distribution of failure volumes corresponding to each slope height range for upslope failures based on the modified volume distribution derived for each road as given in *Annex I*. This sheet therefore serves as a data source for the PLL computation.

Down Vol Distribution

This sheet presents the distribution of failure volumes for down slopes based on the modified volume distribution derived for each road as given in *Annex I*. The values given are divided by three to accommodate the distribution between the three slope heights as they appear in the "LS PLL" sheet.

Down V Factor

This sheet presents vulnerability factors for down slope failures for different volume ranges and at different crest distances.

Up V Factors Guide

This sheet stores the following defined tables "Shadow_Angle" and "Vulnerability_Factors" as they relate to up slopes. The first table is the "Shadow_Angle" table which presents the runout angle for debris (in degrees) for combinations of slope height and a given lane's position relative to the slope toe.

The "Vulnerability Factors" table presents values for particular failure volume ranges and runout angles, as derived by GEO. The runout angle values in the top row in fact each represent a range of values, where the lower limit is set by the cell to its left. ie 55 means 50 to 55. This table is used in conjunction with the above table by the "Up V Factors" sheet.

Up V Factors

This is a calculation only sheet which determines the appropriate vulnerability factor for particular combinations of:

- failure volume range;
- slope height range; and
- lane position relative to an up slope.

The sheet uses information from the "Shadow_Angle" table, and the "Vulnerability_Factors" table to select appropriate values.

LS PLL

This sheet lists all possible combinations of:

- slope feature (up/down);
- incident volume ranges (< 20, 20 to 50, 50 to 500, 500 to 2000, > 2000 for upslope failures and <20, 20 to 50, 50 to 200, 200 to 1000, > 1000 for downslope failures); and
- Slope height ranges (<=10, 10 to 20, >=20).

for landslip incidents along BRIL roads.

This sheet draws together the appropriate information from the data sheets and other calculation sheets to determine the PLL associated with each scenario.

Boulder Fall PLL

This sheet calculates the PLL associated with Boulder Falls on BRIL Roads. The sheet uses the "Road Specific Data" sheet to obtain relevant information.

5.1.2 *Example Calculation for PLL*

Castle Peak Road is considered for illustration. References to text and tables within the main body of the report and also to *Annex C* which contains the worksheets in excel is provided.

Frequency Estimation

Landslide frequency

The frequency of landslides is given in *Table 3.1d* as 2.38 per year. See also sheet 'Road Specific Data' in *Annex C* under the column heading 'LS Frequency per year'. The total number of incidents of landslides during the period 1984 to 1996 is also given in the same sheet under the column heading ' LS, RW, RF, WO'. The incident frequency is derived from incident records attached in *Annex F*. Incidents denoted as 'landslide', 'washout', 'rockfall' and 'retaining wall' under the column heading 'Type of Failure' in *Annex F* are included under 'landslides'.

Modification of Landslide frequency to account for slope improvement

The landslide frequency is modified to account for slope improvement works. The total number of slopes identified along Castle Peak Road from the 1977/78 Slope Catalogue is 67, as given in *Annex D*. The total number of slopes improved to current geotechnical standards is two as given in *Table E1* in *Annex E*. The proportion of slopes improved to current geotechnical standards is therefore 5%, as given in *Table 3.5a*. This value is used in the 'Summary Results Sheet II' in *Annex C* under the column heading 'Portion of slopes upgraded' as the reduction factor for frequency of landslides and boulder fall. The modified landslide frequency is 2.38 x (1-0.05) = 2.26 per year.

Boulder fall frequency

The frequency of boulder fall is given in *Table 3.1i* as 0.08 per year. See also sheet 'Road Specific Data' in *Annex C* under the column heading 'Boulder fall frequency per year'. The frequency is derived from incident records attached in *Annex F*. The value is transported into the PLL calculation sheet 'BF PLL' in

Annex C, under the column heading 'Boulder fall frequency per year'.

Up slope/ down slope failure distribution

The proportion of upslope and downslope failures is given in *Annex I*, last sheet, as 0.87 and 0.13 respectively. This is based on the data given in *Annex F* under the column heading 'Relative to road'. This is transported into the PLL calculation sheet 'LS PLL' in *Annex C* under the column heading 'slope'.

Slope height-volume distribution

Slope-height volume distribution for upslope failures and downslope failures is derived in *Annex I*. The proportion of slopes with height <10m, 10 to 20m and >20m is given as 0.22, 0.75 and 0.03 respectively in *Annex I*. This is based on slope height data from maps as given in Annex D, under the column 'Height'.

In *Annex I*, the proportion of incidents corresponding to various volume ranges (without reference to slope height) and corresponding to different slope height ranges are based on incident records in *Annex F*. The proportion of incidents corresponding to various volume ranges (without reference to slope heights) is also given in *Table 3.1d*.

The modified volume distribution given in *Annex I* is then adopted in sheet 'LS PLL' in *Annex C*, under the column heading 'height vol'. For ex., for Castle Peak Road, the probability of failure volume <20m^3, from slope height <10m is 0.23. A summary of the modified volume distribution for upslope failures is also provided in sheet 'up vol vs height' in *Annex C*.

Similarly, the volume distribution for downslope failures is derived in *Annex I*. This data is then transported to sheet 'LS PLL' in *Annex C*. A summary of the modified volume distribution for downslope failures is also provided in sheet 'Down vol distribution' in *Annex C*. It may be noted that probability for a given failure volume is divided into three, corresponding to three slope height ranges, while transporting the data into sheet 'LS PLL'. For ex., for Castle Peak Road, the probability of failure volume <20m^3 is 0.5, as given in *Annex I*. In the sheet 'LS PLL" in *Annex C*, under the column heading 'height vol', corresponding to row entry 'down' under the column heading slope, the value is 0.17 for all the 3 slope height ranges which adds up to 0.5.

Consequence Estimation - Fatalities

The details on BRIL road, such as number of lanes, class of road, road category and AADT are given in *Table 4.1g*. This is transported into sheet 'road specific data' in *Annex C*.

Vulnerability factors

Castle Peak Road is a two lane road, as given in *Table 4.1g*. The shadow angle is estimated, considering the centre-point of each lane as the affected facility, for three different slope heights, as shown in *Figure 4.1a* and as given in *Table 4.1d*. For ex., the shadow angle for lane 2, for slope height <10m is 40.3 degrees.

The vulnerability factors for various run-out angle of debris (from upslope failures) and for different failure volumes is obtained from the SAR-wide study and given in *Table 4.1a*. This is also reproduced in sheet 'Up V Factors Guide' in

Annex C. The vulnerability factor for a failure volume <20m^3 and a facility at a shadow angle of 40.3 degrees (which falls in the range 40 to 45 degrees) is given as 0.019.

The vulnerability factor for each lane of the road is estimated for various volume volumes and slope height range as given in sheet 'Up V Factors' in *Annex* C. The average vulnerability factor is also given based on the number of lanes in a given road. The vulnerability factor for lane 1 and lane 2 corresponding to failure volume <20m^3 and slope height <10m is 0.072 and 0.019 respectively. The average vulnerability factor for a 2 lane road is therefore 0.0455. This value is transported into sheet 'LS PLL' in *Annex* C under the column heading 'V Factor' corresponding to row entry 'up' under the column heading 'slope', '<20' under 'Failure vol range' and '<10' under 'Height range'.

The vulnerability factors for down slope failures corresponding to various failure volume ranges and crest distance is obtained from the SAR-wide data as given in *Table 4.1b* and in sheet 'Down V Factors' in *Annex* C. For a 2 lane road, the average of vulnerability factors considering crest distances of <3m and 3 to 6m, corresponding to failure volume <20m^3 is given as 0.0039 in sheet 'Down V Factors' in *Annex* C. This value is transported to sheet 'LS PLL' in *Annex* C under the column heading 'V Factor' corresponding to row entry 'down' under the column heading 'slope', <20 under 'Failure vol range' and <10 under 'Height range'.

Scale Factors

The scale factors are given in *Table 4.1e* and also in sheet 'Scale Factors' in *Annex* C. This is transported into sheet 'LS PLL' corresponding to each failure volume range.

Expected number of fatalities

The expected number of fatalities for a reference landslide is estimated for each road given its AADT and number of lanes, based on the relationship derived as shown in *Figure A1* in *Annex A*. The values are given in *Table 4.1g* and in sheet 'Road specific data' in *Annex* C. This is transported into sheet 'LS PLL'.

The column heading 'Consequence' in sheet 'LS PLL' provides the number of fatalities which is a product of values in columns 'V Factor', 'Expected Fatality' and 'Scale Factor'.

Landslide PLL

The column 'PLL' in sheet 'LS PLL' provides the PLL value due to landslides which is a product of values in columns 'LS Frequency per year', 'Slope', 'Height Vol' and 'Consequence'. The overall PLL for each road is summarised in sheet 'Total PLL' and is obtained by summing up the PLL corresponding to each failure volume range and slope height range.

Boulder Fall PLL

The PLL due to boulder fall is estimated based on the method described in *Section* 4.2 and is given in sheet 'BF PLL' in *Annex* C. The inputs required for estimation of PLL is AADT and boulder fall frequency.

5.2 ESTIMATION OF ECONOMIC LOSS

5.2.1 *Workbook for Economic Loss (eco.xls)*

This workbook contains the following worksheets.

LS Eco

This sheet lists all possible combinations of:
- slope feature (up/down); and
- incident volume ranges (< 20, 20 to 50, 50 to 500, 500 to 2000, > 2000 for upslope failures and <20, 20 to 50, 50 to 200, 200 to 1000, > 1000 for downslope failures).

for landslip incidents along BRIL roads.

This sheet draws together the appropriate information from the data sheets and calculation sheets to determining the economic loss associated with each scenario.

BF Eco

This sheet calculates the economic loss due to lane closure following boulder fall incidents.

Category Lane Time Delay

This sheet determines the expected delay (in minutes) that would result from the closure of a given number of lanes on a road of specified total lanes and road category. This sheet uses the Time Delay sheet to source information.

Up Volume Distribution

This sheets gives the volume distribution for upslope failures with no reference to height. This is based on data contained in sheet 'Up Volume vs Height' in pll.xls.

Closure Prob and Duration Guide

This table shows the cumulative probability of 1st, 2nd, 3rd and 4th lane closure in the event of an incident of a given scale and position relative to the road. The expected duration of the closure is also given (in minutes).

Weighted Closure

This table shows the weighted duration of closure for each lane considering the probability of closure and the duration of closure.

Time Delay

This presents the values for increased travelling time (in mins) for different proportion of road closure for each category of road.

Parameters

This sheet allows for variables such as value of life, passengers per vehicle, and time value of money to be varied.

Summary Result Sheet

This sheet sums values relating to economic loss and PLL values (obtained from the pll.xls workbook) for each of the BRIL roads. The values that are summed are from the "LS PLL" and "Boulder Fall PLL" spreadsheets. This sheet also ranks the roads on various basis (ie, PLL, Time Cost, and Total Cost).

5.2.2 *Example Calculation for Economic Loss*

Castle Peak Road is considered for illustration. References to text and tables within the main body of the report and also to *Annex C* which contains the worksheets in excel is provided.

Implied cost of averting fatality

A value of HK$24 million is adopted as explained in *Section 4.4.5* and given in sheet 'Parameters' in *Annex C*. This value is multiplied with PLL to derive the total cost of averting fatality as given in sheet 'Summary Results Sheet' in *Annex C*.

Economic Loss due to road closure

Duration of closure

The duration of closure of lane 1 is given in *Table 4.3c* for various volume ranges which is reproduced in sheet 'Closure Prob and Duration Guide' in *Annex C*. The duration of closure lane 2 to lane 4 is given in Table 4.3h which is also reproduced in the same sheet. The values in *Table 4.3c* and *4.3h* pertain to upslope failures. It is further assumed that only 4 lanes are affected at most.

For downslope failures, duration of closure lane 1 is considered to be the same as that for upslope failures. Closure of 2nd lane is considered only for failure volume >1000m^3 and the duration is assumed to be the same as that for lane 1 closure of corresponding failure volume.

Probability of Closure

For upslope failures, the probability of more than one lane closure is given in *Table 4.3i* while the probability of closure of 2 or more lanes up to 4 lanes is given in *Table 4.3l*.

For downslope failures, the probability of closure of lane 1 is assumed to be lower than that for upslope failures as described in the 2nd para of page 29. It is also assumed that, at most only 2 lanes will be affected and that too only for failure volume >1000m^3 . The probability of 2nd lane closure is taken as 1 as shown in the sheet 'Closure Prob and Duration Guide' in *Annex C*.

Weighted closure

The duration of closure and probability of closure data given above are

cumulative values. The weighted duration of closure for each lane is estimated considering the probability of closure and duration of closure. For example, the weighted duration of closure of a 2 lane road is derived as follows for a failure volume of < 20 m^3 and upslope failure.

2nd lane closure probability = 0.05 (see *Table 4.3l*)
Duration of closure of 2nd lane = 1 day (see *Table 4.3h*)
Duration of closure of 1st lane after 2nd lane is cleared = 10 - 1 = 9 days
(see *Table 4.3c & Table 4.3h*)
1st lane closure probability = 0.6 -0.05 = 0.55
(see *Table 4.3i & Table 4.3l*)
Duration of closure of 1st lane when only 1st lane is affected = 10 days
(see *Table 4.3c*)
Weighted duration of closure of 1st lane = 0.05 x 9 + 0.55 x 10 = 5.95
Weighted duration of closure of 2nd lane = 0.05 x 1 = 0.05

The values for weighted closure computed for various failure volumes and upslope and downslope failures are given in sheet 'Weighted Closure' in *Annex C*. These values are transported into sheet 'LS Eco' in *Annex C*.

Time delay

The time delay for different proportion of road closure for various categories of road are given in *Table 4.4a* and in sheet 'Time Delay' in *Annex C*. These values are transported into sheet 'LS Eco' under the column heading ' 1 lane closed', '2 lane closed' etc. For Castle Peak Road, which is a two lane road and 'B' road category, one lane closure corresponds to 50% closure of road. The resulting increase in travelling time for 'B' category road is 10 minutes, For 100% closure, it is 40min.

Time value

The time value considered for this study is described in *Section 4.4.2*. The value adopted for computation is given in the sheet 'parameter' in *Annex C*.

Vehicle operating costs

The vehicle operating costs considered for this study is described in *Section 4.4.3*. The value adopted for computation is given in the sheet 'parameter' in *Annex C*.

Computation of economic costs

The excel sheet for computation is found in sheet 'LS Eco' in *Annex C*.

Since the duration and probability of closure is computed for different failure volumes and separately for upslope and downslope failures, the probability of a given failure volume and the probability of upslope/ downslope failures is considered together with the frequency of landslide incident occurring as shown in the sheet 'LS Eco'. These values are derived as explained in PLL computation.

For PLL computation, the probability of failure volume is derived for various slope heights. For economic loss computation, however, only failure volume probability is required and therefore the values for different slope heights are summed up for a given failure volume as given in sheet 'Up Volume vs Location' in *Annex C*. For ex., for Castle Peak Road, the probability of failure volume <20m^3

is given as 0.43. This is the sum of values for different slope heights, 0.23+0.15+0.05 = 0.43, as given in sheet 'Up Vol vs Height' in *Annex C*.

The economic loss due to road closure is the sum of time cost and operating costs. This is estimated based on the formulae given in *Section 4.4.4*. For Castle Peak Road, for failure volume <20m^3 and upslope failure,

time cost for
one lane closure = LS Frequency x up prob x vol prob x 1st lane weighted closure x 1 lane closed (ie, increase in travel time) x AADT x Time cost x average no. of persons per vehicle

= 2.38 x 0.87 x 0.43 x 5.95 x (10/60) x 12980 x 78 x 3.6
= 3,218,120 (the value given in the spreadsheet is different from this due to rounding-off error)

The time cost computed separately for each of the 4 lanes is summed up. Similarly the vehicle operating cost is computed separately for each lane and summed up.

The economic loss due to road closure following boulder fall is computed separately as shown in sheet 'BF Eco' in *Annex C*. The assumptions for road closure are given in the 2nd para of page 30 and also in sheet 'parameter' in *Annex C*. The computation is similar to that described above.

5.2.3 *Estimation of Economic Loss for Simultaneous Closure*

An approach for estimating the economic loss due to simultaneous road closure is explained below:

The frequency of simultaneous complete closure of Tai Tam Road and Repulse Bay Road is estimated in *Section 4.3.5* as 1.4 x 10^{-3} per year. The weighted duration of complete road closure is estimated considering the volume probability as given in *Table 4.3n* and the duration of closure of both the lanes as given in *Table 4.3h.*

Duration of complete closure of Tai Tam Rd = (0.87 x 1)+ (0.11x3)+(0.02x5)
= 1.3 days

Duration of complete closure of Repulse Bay Rd = (0.76 x 1)+ (0.2x3)+(0.04x5)
= 1.6 days

The economic loss due to road closure is estimated for each of the roads based on *Section 4.4.4*. The duration of closure is taken as 1.3 days which is the minimum of the two values.

	Tai Tam Rd	*Repulse Bay Rd*
Time value costs (HK$)	2,652,624	3,497,083
Vehicle operating costs (HK$)	415,653	547,976
Total (HK$)	3,068,277	4,045,059

The economic costs due to simultaneous closure are not simply additive (although assumed here below for simplification) since it is expected that travelling time may be higher or people may not be able to travel at all and

therefore unable to reach workplace.

The total economic costs due to simultaneous closure of both the roads is HK$ 7,113,336. The annual costs are estimated as HK$ 9959 per year based on the frequency of simultaneous closure which is given as 1.4×10^{-3} per year.

Since the duration of closure of both the lanes is only a day, simultaneous complete closure of both the roads is expected to affect traffic only for a day. This will be followed by partial closure scenarios which will have lesser impact comparatively.

6 RESULTS

The ranking of BRIL roads has been carried out for all 41 BRIL road sections based on the following:

- PLL per year;
- Economic loss per year due to road closure;
- Total economic loss per year due to road closure and fatalities;
- Total economic loss per km per year due to road closure and fatalities.

Ranking based on economic loss per km per year is also provided for a direct comparison with the cost of slope improvement which will depend on kilometre of road.

The results are presented in *Table 6a and Table 6b.* While *Table 6a* presents the results without any credit for slope improvement works along some of the roads, *Table 6b* presents results considering a reduction factor to the frequency of landslides and boulder fall in proportion of the percentage of slopes improved to current geotechnical standards.

Summary of Results & Discussion

The results summary presented here for discussion are based on *Table 6b.*

Ranking

Based on PLL

	Rank	*Value (Potential Loss of Life per year)*
Castle Peak Road	1	0.99
Tai Hang Road	2	0.29
Repulse Bay Road A	3	0.25

Based on economic loss per year due to road closure

	Rank	*Value (HK$ million per year)*
Castle Peak Road	1	33
Kwun Tong Road	2	29
Tuen Mun Road C	3	16

Based on total economic loss per year due to landslides & boulder fall (includes cost of life considerations in addition to road closure)

	Rank	*Value (HK$ million per year)*
Castle Peak Road	1	57
Kwun Tong Road	2	33
Tuen Mun Road C	3	21

Based on total economic loss due to landslides & boulder fall (includes cost of life considerations in addition to road closure) expressed as per road km per year

	Rank	*Value (HK$ million per km per year)*
Kwun Tong Road	1	122
Yee King Road	2	18
Stubbs Road B	3	12

Total PLL considering all BRIL Road Sections

The total PLL considering all 41 BRIL road sections together is estimated as 3.5 (this includes the contribution from boulder fall incidents with a PLL of 0.37). The PLL (from landslides only) calculated for all roads in Hong Kong in the GEO's SAR-wide QRA study is about 5 [4] and the corresponding PLL for roads in consequence category nos. 1 and 2 is slightly over 3. The latter is comparable to the calculated PLL for all BRIL road sections, which covers a large proportion of category 1 and 2 roads.

The differences in PLL estimates may be attributed to the conservatism built into the assumptions on failure frequencies in respect of large scale failures for each individual BRIL road section which is derived based on extrapolation from limited historical failure records. However, such conservatism does not affect a risk ranking study.

Total Economic Loss due to Landslides & Boulder fall considering all BRIL Road Sections

The total economic loss due to landslides and boulder fall, considering the potential loss of life, in terms of 'cost of life saved' and the loss due to road closure resulting from landslides is estimated as HK$ 269 million per year. The economic loss due to road closure is estimated at HK$ 187 million per year while the cost of life saved is estimated at HK$ 82 million per year.

The approach for economic loss computation due to lane/road closure following landslides is based on the premise that it results in an increase in travelling time for the public with a corresponding value for time costs.

Table 6a

Summary Results Sheet I

Location	Road	Section	AADT 1995	Frequency per year	PLL		Eco Loss/yr		Total Cost/yr		Total Cost/yr/km	
			Value	Value	Value	Rank	Value	Rank	Value	Rank	Value	Rank
HK	Cape Collinson Road	A	450	8.46E-01	3.81E-03	36	$90,655	40	$182,068	40	$86,699	41
HK	Cape Collinson Road	B	450	2.31E-01	4.05E-03	35	$61,661	41	$158,934	41	$1,324,453	27
HK	Chung Hom Kok Road	-	1300	5.38E-01	2.89E-03	38	$145,862	39	$215,278	37	$215,278	38
HK	Island Road	-	16890	4.62E-01	3.29E-02	20	$3,671,728	16	$4,461,134	16	$5,374,860	11
HK	Kennedy Road	-	10610	1.00E+00	1.50E-01	7	$2,586,269	17	$6,186,464	12	$2,945,935	21
HK	Magazine Gap Road	-	14960	1.31E+00	1.58E-01	6	$4,978,629	11	$8,774,658	11	$4,847,877	12
HK	Nam Fung Road	-	10110	1.54E-01	4.95E-03	34	$552,045	34	$670,940	35	$2,236,468	23
HK	Peak Road	A	11170	3.08E-01	7.07E-02	13	$1,048,171	26	$2,745,313	22	$1,830,208	24
HK	Peak Road	B	10120	4.62E-01	3.27E-02	21	$881,478	30	$1,665,972	28	$4,164,930	17
HK	Pokfulam Road	A	36160	5.38E-01	1.97E-02	27	$3,783,955	15	$4,255,719	18	$3,576,234	18
HK	Pokfulam Road	B	25050	2.31E-01	1.93E-02	28	$1,735,992	22	$2,199,935	25	$1,294,079	29
HK	Repulse Bay Road	A	12300	2.31E+00	2.47E-01	4	$7,449,498	7	$13,371,602	7	$4,610,897	14
HK	Repulse Bay Road	B	14370	4.62E-01	2.60E-02	24	$2,354,381	19	$2,979,526	21	$4,655,509	13
HK	Stubbs Road	A	21070	3.08E-01	4.66E-02	16	$1,985,854	20	$3,104,106	20	$2,387,774	22
HK	Stubbs Road	B	11270	1.54E-01	3.61E-02	17	$604,920	33	$1,472,417	29	$12,270,142	4
HK	Tai Hang Road	-	14670	2.85E+00	3.16E-01	2	$8,326,219	6	$15,909,027	4	$5,848,907	10
HK	Tai Tam Road	-	10900	9.23E-01	6.72E-02	14	$4,201,882	13	$5,814,067	13	$842,618	31
HK	Victoria Road	A	5410	8.46E-01	2.92E-02	22	$1,015,846	27	$1,716,386	27	$1,320,297	28
HK	Victoria Road	B	7860	1.08E+00	1.30E-02	30	$1,628,442	23	$1,941,067	26	$1,078,371	30
HK	Yee King Road	-	14150	6.15E-01	1.36E-01	8	$1,376,522	25	$4,629,910	15	$17,807,345	2
ME	Clear Water Bay Road	-	32950	5.38E-01	1.16E-01	10	$6,645,836	10	$9,428,355	10	$7,036,086	7
ME	Kwun Tong Road	-	150120	2.31E-01	2.76E-01	3	$42,545,020	1	$49,176,602	2	$182,135,562	1
ME	Sai Sha Road	-	5310	1.00E+00	1.35E-01	9	$7,262,805	8	$10,501,665	8	$9,053,159	6
ME	Tai Mong Tsai Road	A	6000	2.31E-01	3.55E-02	18	$1,755,182	21	$2,606,028	23	$10,858,452	5
ME	Tai Mong Tsai Road	B	6000	6.15E-01	2.55E-02	25	$2,505,257	18	$3,116,500	19	$3,351,076	20
ME	Tai Mong Tsai Road	C	4120	1.54E-01	1.76E-02	29	$326,009	36	$748,640	33	$1,559,666	26
ME	Tai Mong Tsai Road	D	4120	1.54E-01	2.44E-03	39	$154,748	38	$213,419	38	$609,768	35
ME	Tai Po Road	A	9190	1.54E-01	5.90E-04	41	$176,799	37	$190,952	39	$88,815	40
ME	Tai Po Road	B	5840	6.15E-01	3.32E-02	19	$1,454,405	24	$2,252,297	24	$715,015	33
ME	Tai Po Road	C	5840	4.62E-01	2.12E-02	26	$910,235	29	$1,417,958	30	$716,140	32
MW	Castle Peak Road	-	12980	2.46E+00	1.03E+00	1	$34,482,700	2	$59,216,705	1	$4,229,765	16
MW	Route Twisk	A	6270	1.00E+00	1.16E-01	11	$7,052,856	9	$9,831,120	9	$3,511,114	19
MW	Route Twisk	B	7250	3.08E-01	6.42E-03	33	$935,882	28	$1,089,904	31	$247,706	37
MW	Route Twisk	C	7250	3.08E-01	2.33E-03	40	$625,230	32	$681,047	34	$648,616	34
MW	South Lantau Road	A	2980	1.31E+00	1.09E-02	31	$4,064,330	14	$4,325,979	17	$1,670,262	25
MW	South Lantau Road	B	1210	4.62E-01	8.21E-03	32	$772,825	31	$969,822	32	$587,771	36
MW	South Lantau Road	C	1210	3.85E-01	2.96E-03	37	$391,018	35	$462,008	36	$132,002	39
MW	Tuen Mun Road	A	96120	3.08E-01	6.65E-02	15	$12,267,643	5	$13,864,810	6	$12,604,372	3
MW	Tuen Mun Road	B	96120	1.54E-01	1.01E-01	12	$13,247,992	4	$15,665,318	5	$4,540,672	15
MW	Tuen Mun Road	C	85410	3.85E-01	2.18E-01	5	$16,518,087	3	$21,751,263	3	$6,042,017	8
MW	Tuen Mun Road	D	95470	7.69E-02	2.74E-02	23	$4,637,384	12	$5,295,649	14	$5,884,054	9
				TOTALS	3.67E+00		$207,212,250		$295,260,564			

Table 6b

Summary Results Sheet II

Location	Road	Section	AADT 1995	Portion of	Frequency per year	PLL		Eco Loss/yr		Total Cost/yr		Total Cost/yr/km	
			Value	Slopes Upgraded	Value	Value	*Rank*	Value	*Rank*	Value	*Rank*	Value	*Rank*
HK	Cape Collinson Road	A	450	0%	8.46E-01	3.81E-03	*36*	$90,655	*40*	$182,068	*39*	$86,699	*40*
HK	Cape Collinson Road	B	450	0%	2.31E-01	4.05E-03	*34*	$61,661	*41*	$158,934	*40*	$1,324,453	*27*
HK	Chung Hom Kok Road	-	1300	6%	5.06E-01	2.82E-03	*38*	$138,085	*38*	$205,744	*38*	$205,744	*38*
HK	Island Road	-	16890	0%	4.62E-01	3.29E-02	*20*	$3,671,728	*16*	$4,461,134	*16*	$5,374,860	*10*
HK	Kennedy Road	-	10610	7%	9.30E-01	1.40E-01	*7*	$2,405,230	*18*	$5,753,412	*13*	$2,739,720	*21*
HK	Magazine Gap Road	-	14960	3%	1.27E+00	1.53E-01	*6*	$4,829,270	*11*	$8,511,418	*11*	$4,702,441	*12*
HK	Nam Fung Road	-	10110	20%	1.23E-01	3.96E-03	*35*	$441,636	*34*	$536,752	*35*	$1,789,174	*23*
HK	Peak Road	A	11170	10%	2.77E-01	6.36E-02	*14*	$943,354	*26*	$2,470,781	*23*	$1,647,188	*25*
HK	Peak Road	B	10120	0%	4.62E-01	3.27E-02	*21*	$881,478	*29*	$1,665,972	*27*	$4,164,930	*16*
HK	Pokfulam Road	A	36160	0%	5.38E-01	1.97E-02	*26*	$3,783,955	*15*	$4,255,719	*18*	$3,576,234	*18*
HK	Pokfulam Road	B	25050	8%	2.12E-01	1.78E-02	*28*	$1,597,113	*23*	$2,023,940	*25*	$1,190,553	*29*
HK	Repulse Bay Road	A	12300	0%	2.31E+00	2.47E-01	*3*	$7,449,498	*6*	$13,371,602	*6*	$4,610,897	*14*
HK	Repulse Bay Road	B	14370	0%	4.62E-01	2.60E-02	*24*	$2,354,381	*19*	$2,979,526	*20*	$4,655,509	*13*
HK	Stubbs Road	A	21070	16%	2.58E-01	3.91E-02	*16*	$1,668,117	*21*	$2,607,449	*21*	$2,005,730	*22*
HK	Stubbs Road	B	11270	0%	1.54E-01	3.61E-02	*17*	$604,920	*33*	$1,472,417	*29*	$12,270,142	*3*
HK	Tai Hang Road	-	14670	13%	2.48E+00	2.89E-01	*2*	$7,362,931	*7*	$14,293,038	*5*	$5,254,794	*11*
HK	Tai Tam Road	-	10900	0%	9.23E-01	6.72E-02	*13*	$4,201,882	*13*	$5,814,067	*12*	$842,618	*31*
HK	Victoria Road	A	5410	10%	7.62E-01	2.71E-02	*23*	$921,020	*28*	$1,570,986	*28*	$1,208,451	*28*
HK	Victoria Road	B	7860	0%	1.08E+00	1.30E-02	*30*	$1,628,442	*22*	$1,941,067	*26*	$1,078,371	*30*
HK	Yee King Road	-	14150	0%	6.15E-01	1.36E-01	*8*	$1,376,522	*25*	$4,629,910	*15*	$17,807,345	*2*
ME	Clear Water Bay Road	-	32950	0%	5.38E-01	1.16E-01	*10*	$6,645,836	*10*	$9,428,355	*10*	$7,036,086	*7*
ME	Kwun Tong Road	-	150120	33%	1.55E-01	1.85E-01	*5*	$28,505,163	*2*	$32,948,323	*2*	$122,030,827	*1*
ME	Sai Sha Road	-	5310	0%	1.00E+00	1.35E-01	*9*	$7,262,805	*8*	$10,501,665	*8*	$9,053,159	*6*
ME	Tai Mong Tsai Road	A	6000	0%	2.31E-01	3.55E-02	*18*	$1,755,182	*20*	$2,606,028	*22*	$10,858,452	*5*
ME	Tai Mong Tsai Road	B	6000	0%	6.15E-01	2.55E-02	*25*	$2,505,257	*17*	$3,116,500	*19*	$3,351,076	*20*
ME	Tai Mong Tsai Road	C	4120	0%	1.54E-01	1.76E-02	*29*	$326,009	*36*	$748,640	*33*	$1,559,666	*26*
ME	Tai Mong Tsai Road	D	4120	0%	1.54E-01	2.44E-03	*39*	$154,748	*37*	$213,419	*37*	$609,768	*35*
ME	Tai Po Road	A	9190	25%	1.15E-01	4.42E-04	*41*	$132,599	*39*	$143,214	*41*	$66,611	*41*
ME	Tai Po Road	B	5840	0%	6.15E-01	3.32E-02	*19*	$1,454,405	*24*	$2,252,297	*24*	$715,015	*32*
ME	Tai Po Road	C	5840	14%	3.97E-01	1.82E-02	*27*	$782,802	*30*	$1,219,444	*30*	$615,881	*34*
MW	Castle Peak Road	-	12980	5%	2.35E+00	9.85E-01	*1*	$32,938,275	*1*	$56,584,596	*1*	$4,041,757	*17*
MW	Route Twisk	A	6270	0%	1.00E+00	1.16E-01	*11*	$7,052,856	*9*	$9,831,120	*9*	$3,511,114	*19*
MW	Route Twisk	B	7250	0%	3.08E-01	6.42E-03	*33*	$935,882	*27*	$1,089,904	*31*	$247,706	*37*
MW	Route Twisk	C	7250	0%	3.08E-01	2.33E-03	*40*	$625,230	*32*	$681,047	*34*	$648,616	*33*
MW	South Lantau Road	A	2980	0%	1.31E+00	1.09E-02	*31*	$4,064,330	*14*	$4,325,979	*17*	$1,670,262	*24*
MW	South Lantau Road	B	1210	0%	4.62E-01	8.21E-03	*32*	$772,825	*31*	$969,822	*32*	$587,771	*36*
MW	South Lantau Road	C	1210	0%	3.85E-01	2.96E-03	*37*	$391,018	*35*	$462,008	*36*	$132,002	*39*
MW	Tuen Mun Road	A	96120	12%	2.71E-01	5.86E-02	*15*	$10,795,526	*5*	$12,201,033	*7*	$11,091,848	*4*
MW	Tuen Mun Road	B	96120	5%	1.46E-01	9.57E-02	*12*	$12,585,592	*4*	$14,882,052	*4*	$4,313,638	*15*
MW	Tuen Mun Road	C	85410	4%	3.69E-01	2.14E-01	*4*	$15,900,042	*3*	$21,024,174	*3*	$5,840,048	*9*
MW	Tuen Mun Road	D	95470	0%	7.69E-02	2.74E-02	*22*	$4,637,384	*12*	$5,295,649	*14*	$5,884,054	*8*
					Total	**3.45E+00**		**$186,635,644**		**$269,431,207**			

Note: Total Cost refers to implied cost for loss of life and economic loses due to traffic disruption caused by landslides.
Other costs such as cost of slope maintenance, repair, etc, are not included.

ACKNOWLEDGEMENTS

ERM-Hong Kong wish to acknowledge the role and contribution of Mr Ken HO and Dr Dominic LO from GEO during the course of this study. GEO provided input on geotechnical engineering issues and contributed to the development of the methodology for the study. The Consultants also wish to acknowledge GEO's comments and suggestions on the report and the analysis.

REFERENCES

[1] Geotechnical Engineering Office (1996) **QRA of Pre-GCO Man-Made Slopes and Retaining Walls** DNV Technica

[2] Geotechnical Engineering Office (1995) **Landslide Consequence Severity Classification of Roads and Footpaths** ERM-Hong Kong, Ltd

[3] Wong H N et al **Assessment of Consequences of Landslides** Proceedings of the Workshop on Landslide Risk, IUGS Working Group on Landslides, Honolulu, Balkema, Pg 111-149

[4] Wong H N & Ho K K S **Overview of Risk of Old Man-made Slopes and Retaining Walls in Hong Kong** Proceedings of the Seminar on Slope Engineering in Hong Kong, Balkema (in press)

[5] Health & Safety Commission, Advisory Committee on Dangerous Substances (1991) **Major Hazard Aspects of the Transport of Dangerous Substances** HMSO, London

[6] Geotechnical Engineering Office (1996) **QRA of Boulder Fall Hazards in Hong Kong Phase 2 Study** ERM-Hong Kong, Ltd

[7] Gas Standards Office, EMSD (1996) **Risk Assessment of LPG Installations in Public Housing Estates- Methodology Report** ERM-Hong Kong, Ltd

[8] Gas Standards Office, EMSD (1995) **QRA of Transport of LPG and Naphtha in Hong Kong - Methodology Report** DNV Technica

[9] Water Supplies Department (1994) **Hazard Assessments for 5 Small Water Treatment Works - Methodology Report** ERM-Hong Kong, Ltd

[10] Environmental Protection Department (1996) **QRA of Transport of Chlorine in Hong Kong** DNV Technica

[11] Bunce C et al **Hazard Assessment for Rock Fall on a Highway**

[12] Geotechnical Engineering Office (1996) **Hong Kong Rainfall and Landslides in 1995** SPR 8/96

[13] Geotechnical Engineering Office **Rainfall and Landslides in 1984 to 1995** GEO Report No. 1 to 6, 14, 20, 35, 43, 54, SPR 8/96

[14] Territory Transport Planning Division, Transport Department (1993) **Travel Characteristics Survey** ***Final Report*** MVA Asia

[15] Department of Environment, Transport & the Regions, UK (1996) **Highways Economics Note 2, COBA Manual**

Annex A

Consequence Classification Method for Roads

GEO's Refined Landslide Consequence Classification System

A landslide consequence classification system was put forward by ERM [2]. The expected number of fatalities, N, in the event of a landslide is given by the following:

$$N = \sum \frac{W * F * P * E * A}{V}$$

where,

W is width of landslide plus adjustment for effective stopping distance;
F is frequency of passing passengers;
P is probability of death due to being caught in a landslide;
E is extent of the landslide (i.e. no. of lanes affected);
A is adjustment factor for proportion of normal road usage at time of landslide (i.e. accounting for the fact that the majority of the landslides take place at time of severe rainfall);
V is speed of vehicles.

The above system has been refined. The following is a summary of assumptions made in refining the system:

- Average speed of vehicles is taken to be 70 km/hour (note - the speed of the vehicles is not particularly sensitive to the calculation of N since the effect is largely compensated by the effective stopping distance);

- Using the equation given in the report by ERM [2] and assuming the effective stopping distance to be half of the "sight distance" calculated, the effective stopping distance may be taken as 15 m;

- Assuming a typical failure scar of 10 m high and 20 m wide and allowing for the effective stopping distance, W may be taken to be 35 m.

- F may be taken to be the product of AADT (annual average daily traffic) and N_p, where N_p is the average number of people in a vehicle and is taken to be 2;

- A major landslide which can affect the whole of the roadway up to 3 lanes is assumed.

- The following is assumed for the probability of death, P, affected by the landslide

Table A1 Probability of Death

Proximity to Slope	Probability of Death
Lane nearest to slope	0.8
2nd lane away from slope	0.6
3rd lane away from slope	0.4

- The parameter "A" may be taken to be 0.82 (see ERM report).

- To allow for the additional risk due to footpaths adjacent to urban roads other than major transportation routes, the calculated N is increased by 25%. No adjustment is made for major transportation route (e.g. Tuen Mun Road) as the risk to pedestrians is generally minimal compared with the risk to people in vehicles. Similarly, no adjustment is made for rural roads as pedestrian usage is generally not significant.

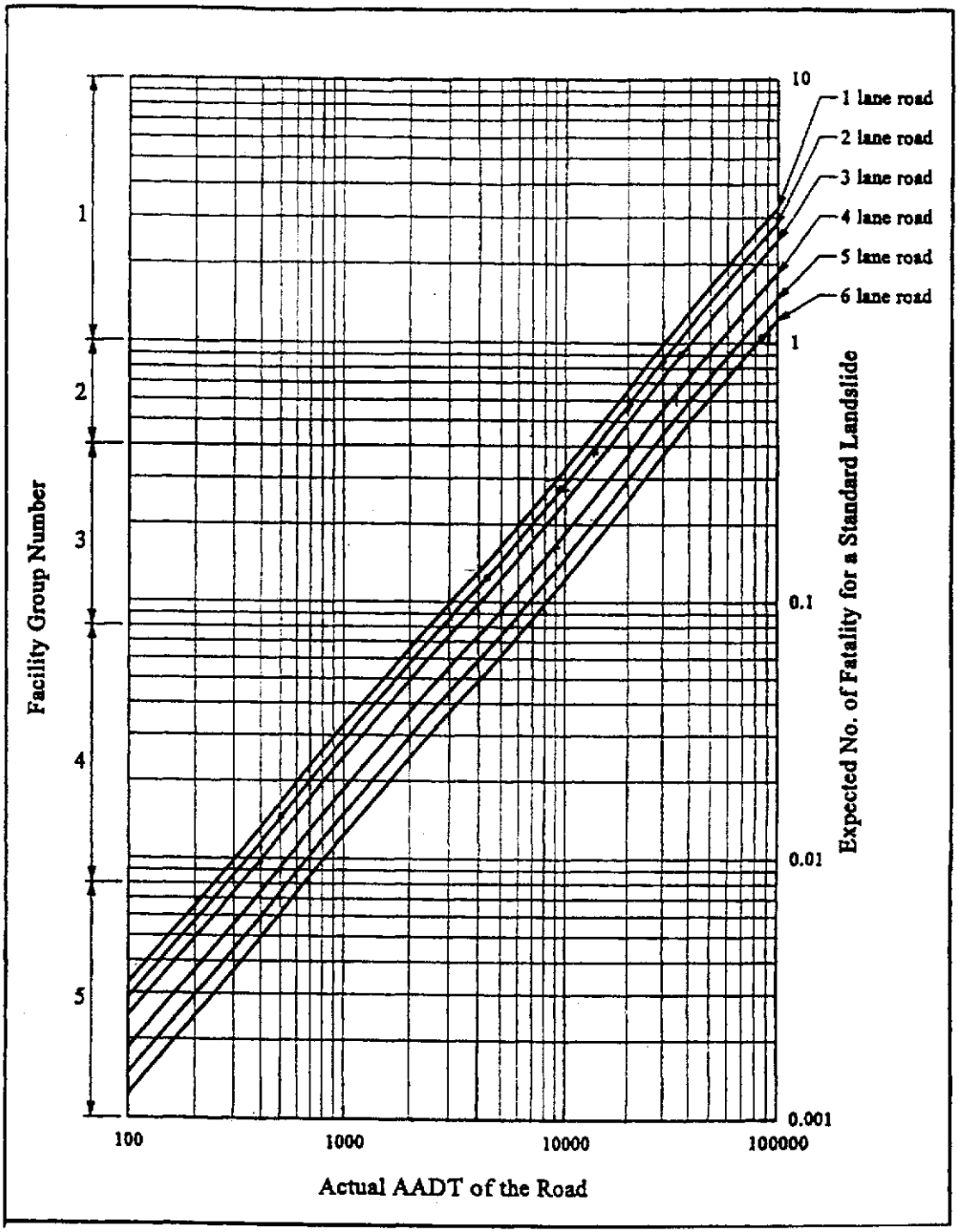


FIGURE A1 - RELATIONSHIP BETWEEN FACILITY GROUP NUMBER, ACTUAL AADT AND NUMBER OF LANES

Annex B

Incident Records & Analysis of Lane/Road Closure for BRIL & Non-BRIL Roads 1994 to 96

Table B1

Data on Duration of Lane/ Road Closure for Landslide Volumes up to 20 m3

Incidents in the ascending order of duration of closure		
Incident No.	Duration of Lane/Road Closure (days)	Landslide Volume (m^3)
ME94/8/8	0	0.5
HK95/7/12	0	1.5
HK95/8/46	0	12
MW94/8/25	0.3	10
ME95/8/4	0.7	15
HK96/3/3	1	0.5
HK94/7/30	1	2
ME94/8/11	1	6
HK94/7/31	1	10
ME94/8/10	1	10
HK94/7/42	1	13
HK95/8/41	1	15
HK96/9/7	2	0.2
HK94/7/1	2	3
HK95/8/25	2	10
HK95/8/33	2	12
HK96/6/1	3	2
HK95/6/3	3	2.5
ME95/8/1	3	3
MW95/10/2	3.3	2
ME96/6/5	4	2
HK94/7/36	4	9
ME94/8/17	4	10
MW95/9/1	4.6	5
ME95/8/6	5	10
K95/8/1	5	12
HK95/8/7	6	1
HK94/7/3	7	2
HK96/4/4	9	0.5
MW95/8/21	9.5	10
HK94/7/22	10	5
ME94/9/5	11	3
HK95/8/34	11	3
MW94/7/22	13	10
HK96/9/6	14	4
HK94/7/2	16	5
K94/7/10	18	5
ME94/7/42	18	18
ME95/6/3	22	3.5
HK94/7/16	22	15
ME94/8/6	24	10
ME95/8/3	26	8
K94/7/3	28	10
HK95/8/48	34	4.5
HK95/8/17	37	8
HK94/7/15	39	6
HK94/1/1	45	2
MW94/8/29	50	10
HK94/7/11	51	16
HK94/8/12	52	5
MW94/7/33	54	15
MW94/6/4	114	5
MW94/8/41	399	10

Results

	All incidents	Incidents excluding the 2 largest (of duration)
mean	22.5	13.4
std_dev	56.7	16.0
correl_coeff	0.122	0.204

Figure All incidents with volumes <20m^3

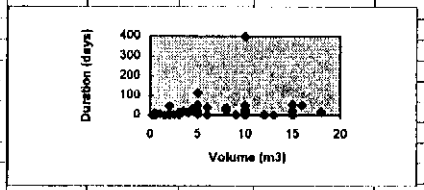
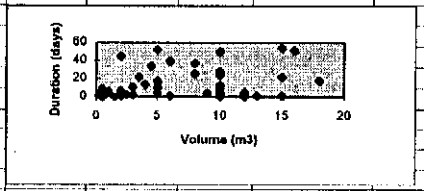


Figure All incidents with volumes <20m^3 excluding the two largest of duration



Results : Probability distribution of lane/road closure

Duration (range) days	Duration (mean) days	No. of incidents	Probability
0 to 2	1	16	0.30
2 to 10	6	15	0.28
10 to 30	20	12	0.23
>30	30	10	0.19
Total		53	1.00
Average Duration			12.19

Incidents in the ascending order of landslide volume		
Incident No	Duration of Lane/Road Closure (days)	Landslide Volume (m^3)
HK96/9/7	2	0.2
ME94/8/8	0	0.5
HK96/3/3	1	0.5
HK96/4/4	9	0.5
HK95/8/7	6	1
HK95/7/12	0	1.5
HK94/7/30	1	2
HK96/6/1	3	2
MW95/10/2	3.3	2
ME96/6/5	4	2
HK94/7/3	7	2
HK94/1/1	45	2
HK95/6/3	3	2.5
HK94/7/1	2	3
ME95/8/1	3	3
ME94/9/5	11	3
HK95/8/34	11	3
ME95/6/3	22	3.5
HK96/9/6	14	4
HK95/8/48	34	4.5
MW95/9/1	4.6	5
HK94/7/22	10	5
HK94/7/2	16	5
K94/7/10	18	5
HK94/8/12	52	5
MW94/6/4	114	5
ME94/8/11	1	6
HK94/7/15	39	6
ME95/8/3	26	8
HK95/8/17	37	8
HK94/7/36	4	9
MW94/8/25	0.3	10
HK94/7/31	1	10
ME94/8/10	1	10
HK95/8/25	2	10
ME94/8/17	4	10
ME95/8/6	5	10
MW95/8/21	9.5	10
MW94/7/22	13	10
ME94/8/6	24	10
K94/7/3	28	10
MW94/8/29	50	10
MW94/8/41	399	10
HK95/8/46	0	12
HK95/8/33	2	12
K95/8/1	5	12
HK94/7/42	1	13
ME95/8/4	0.7	15
HK95/8/41	1	15
HK94/7/16	22	15
MW94/7/33	54	15
HK94/7/11	51	16
ME94/7/42	18	18

Figure B1a

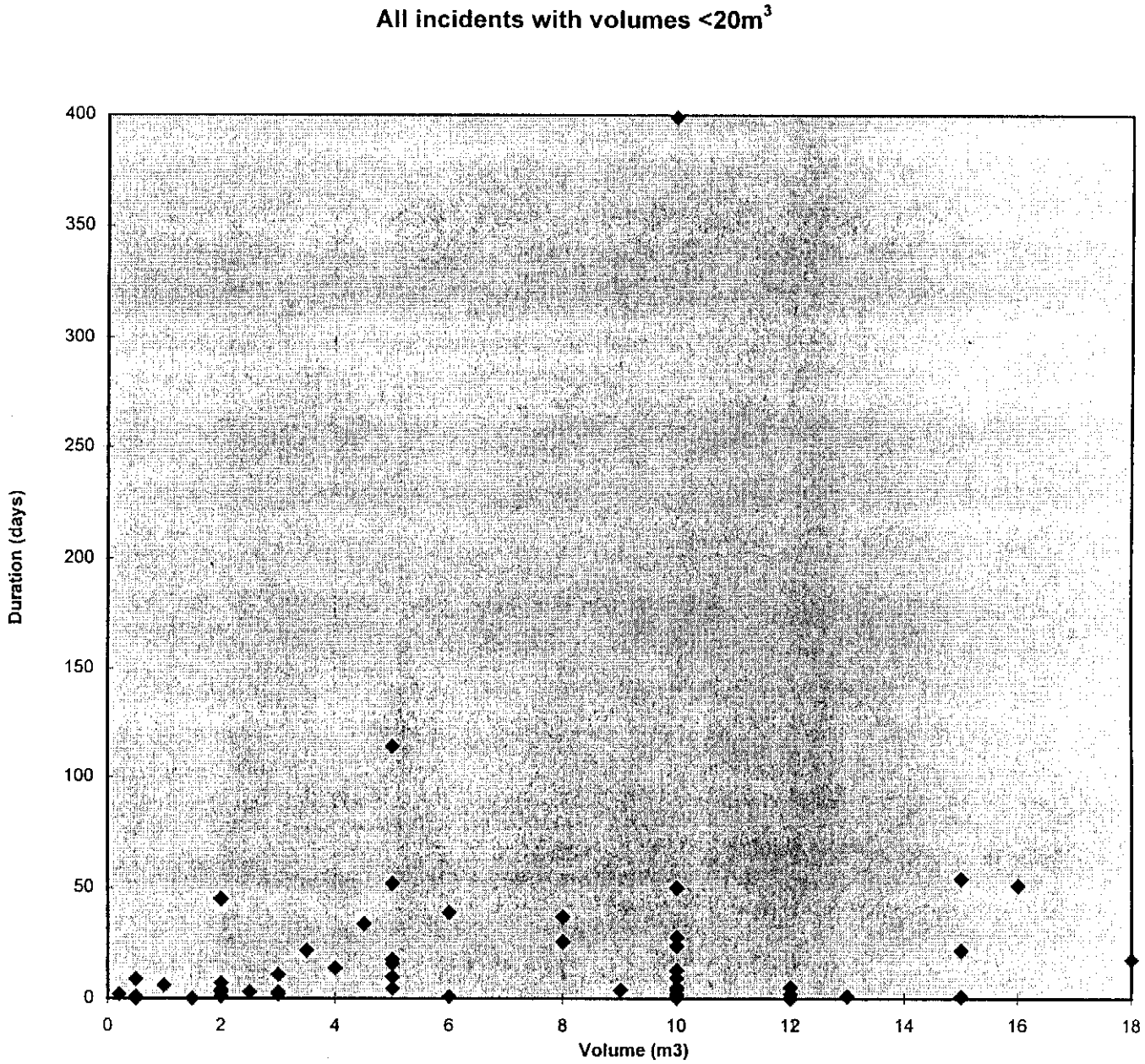

All incidents with volumes <20m3
Duration (days)
400
350
300
250
200
150
100
50
0
0
2
4
6
8
10
12
14
16
18
Volume (m3)

Figure B1b

All incidents with volumes <20m^3 excluding the two of largest duration

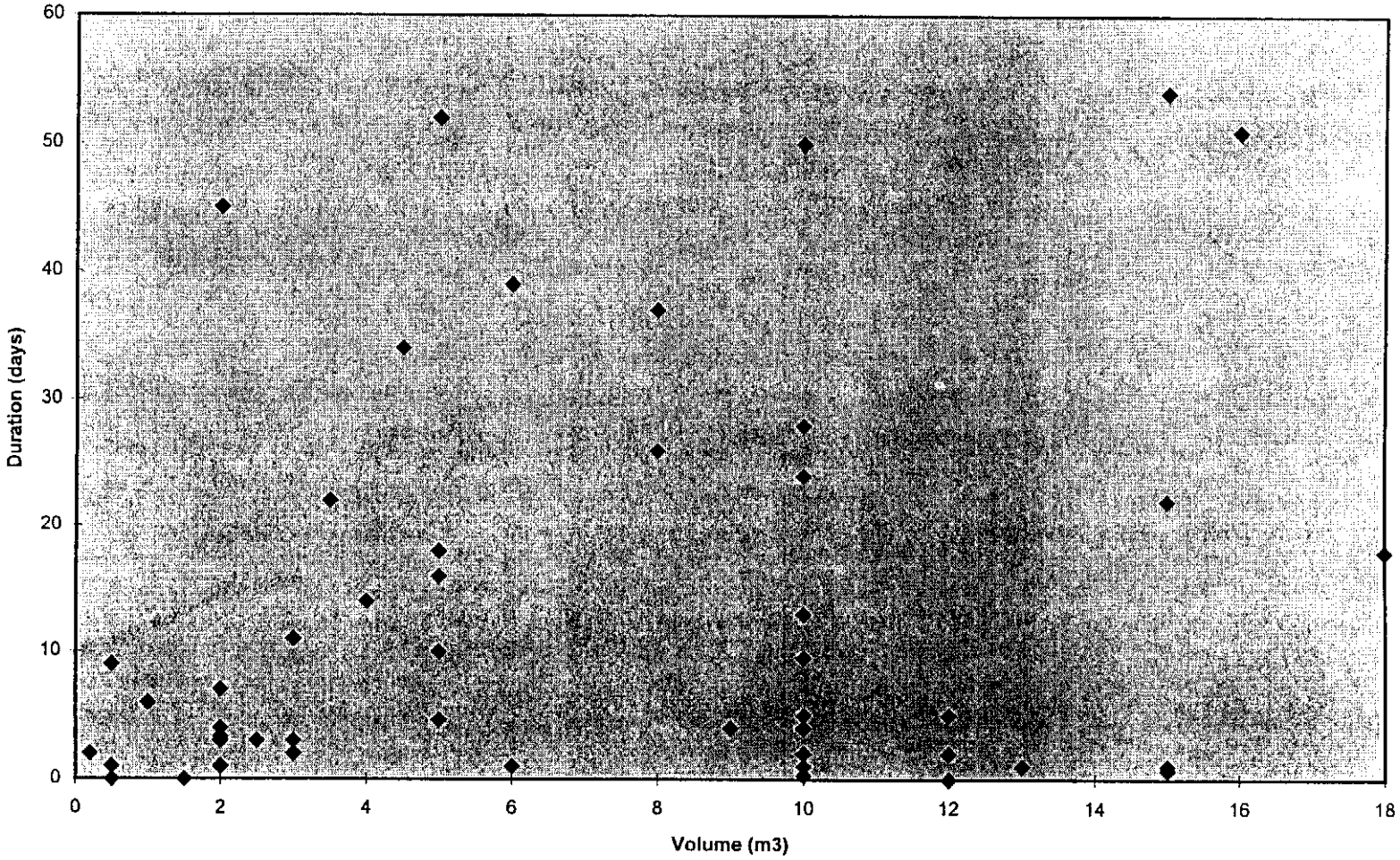
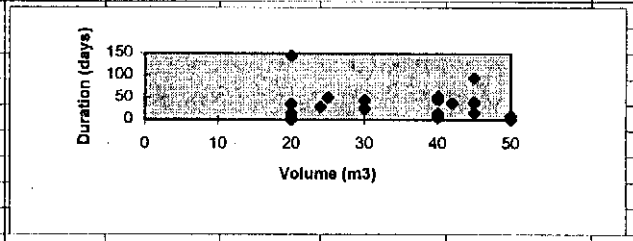
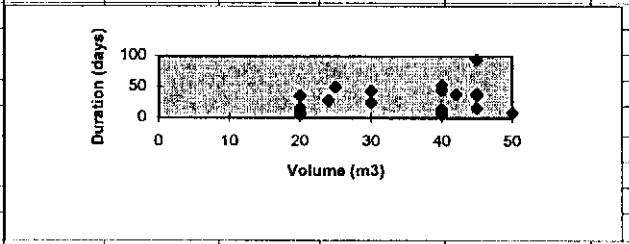


Table B2 **Data on Lane/ Road Closure for Landslide Volumes 20 to 50 m3**

Incidents in the ascending order of duration of closure					Results				Incidents in the ascending order of landslide volume			
Incident No.	Duration of Lane/Road Closure (days)	Landlside Volume (m^3)				All incidents	Incidents excluding the largest & 3 smallest (of duration)		Incident No.	Duration of Lane/Road Closure (days)	Landslide Volume (m^3)	
K96/9/1	0.5	20			mean	31.6	30.7		K96/9/1	0.5	20	
HK94/7/14	0	20			std_dev	32.9	21.8		HK94/7/14	0	20	
ME95/10/1	1	50			correl_coeff	-0.030	0.224		ME94/8/23	5	20	
ME94/8/23	5	20							MW94/8/40	8	20	
K94/7/13	6	40			Figure	All incidents with volumes of 20 to 50m^3			HK94/7/45	16	20	
MW94/8/40	8	20							HK95/8/15	36	20	
HK95/8/2	9	50							MW94/8/5	145	20	
HK94/7/32	10	40							MW95/8/20	29	24	
HK95/8/77	14	40							MW94/8/47	50	25	
HK94/7/45	16	20							HK96/9/4	25	30	
MW94/7/16	16	45							ME94/7/9	44	30	
HK96/9/4	25	30							K94/7/13	6	40	
MW95/8/20	29	24							HK94/7/32	10	40	
HK95/8/15	36	20							HK95/8/77	14	40	
MW94/7/9	37	45							ME94/7/20	45	40	
ME94/7/28	38	42							HK94/7/59	53	40	
ME94/7/25	38	45			Figure	All incidents with volumes of 20 to 50 m^3 excluding the largest &			ME94/7/28	38	42	
K94/7/4	39	45				the three smallest of duration			MW94/7/16	16	45	
ME94/7/9	44	30							MW94/7/9	37	45	
ME94/7/20	45	40							ME94/7/25	38	45	
MW94/8/47	50	25							K94/7/4	39	45	
HK94/7/59	53	40							MW94/7/34	95	45	
MW94/7/34	95	45							ME95/10/1	1	50	
MW94/8/5	145	20							HK95/8/2	9	50	





Results : Probability distribution of lane/road closure

Duration (range)	Duration (mean)	No. of incidents	Probability
days	*days*		
0 to 10	5	8	0.33
10 to 30	20	5	0.21
30 to 60	45	9	0.38
> 60	60	2	0.08
Total		24	1.00
Average Duration			27.71

Figure B2a

All Incidents with volumes of 20 to 50m^3

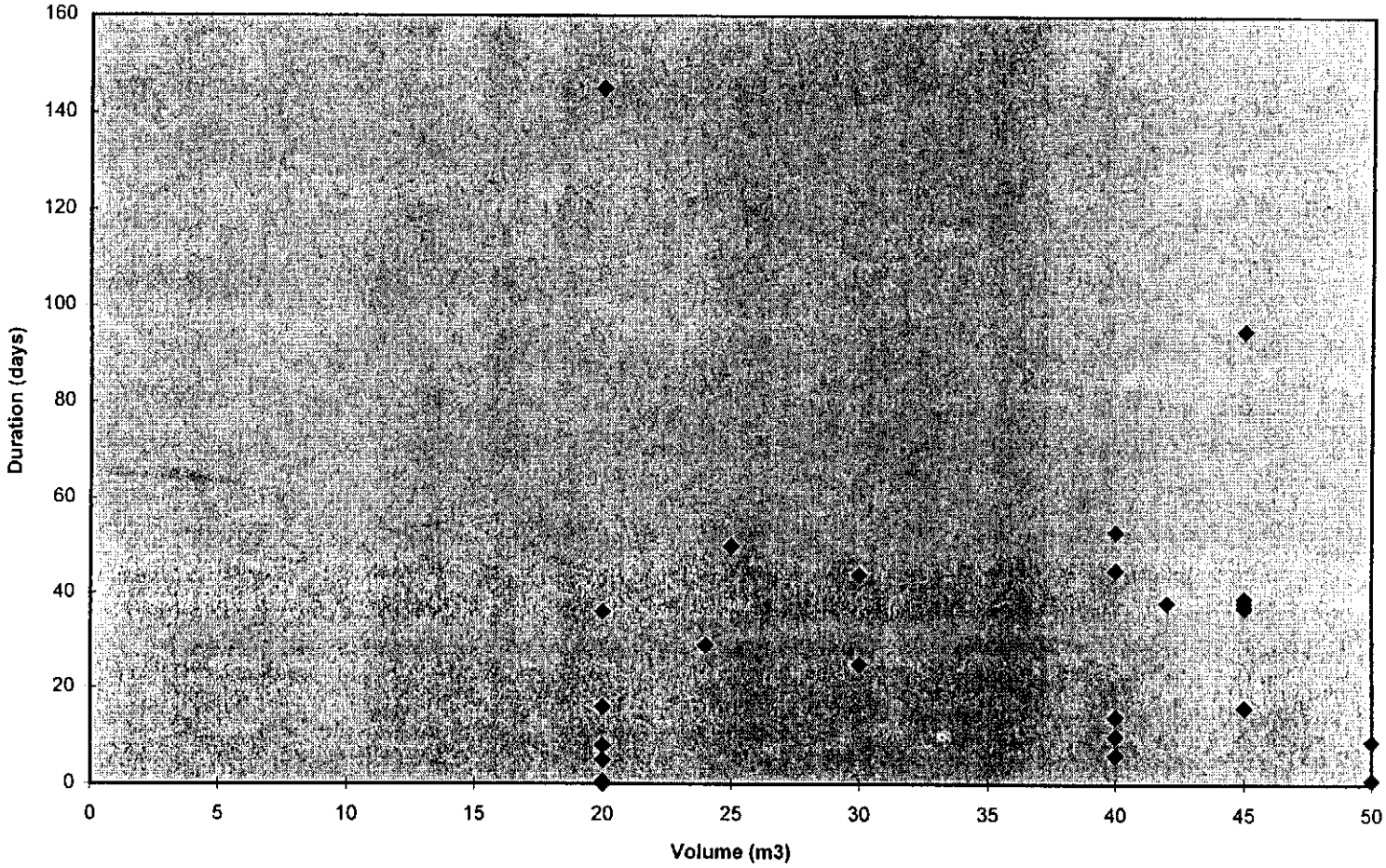


Figure B2b **All incidents with volumes of 20 to 50m^3 excluding the largest & the three smallest of duration**

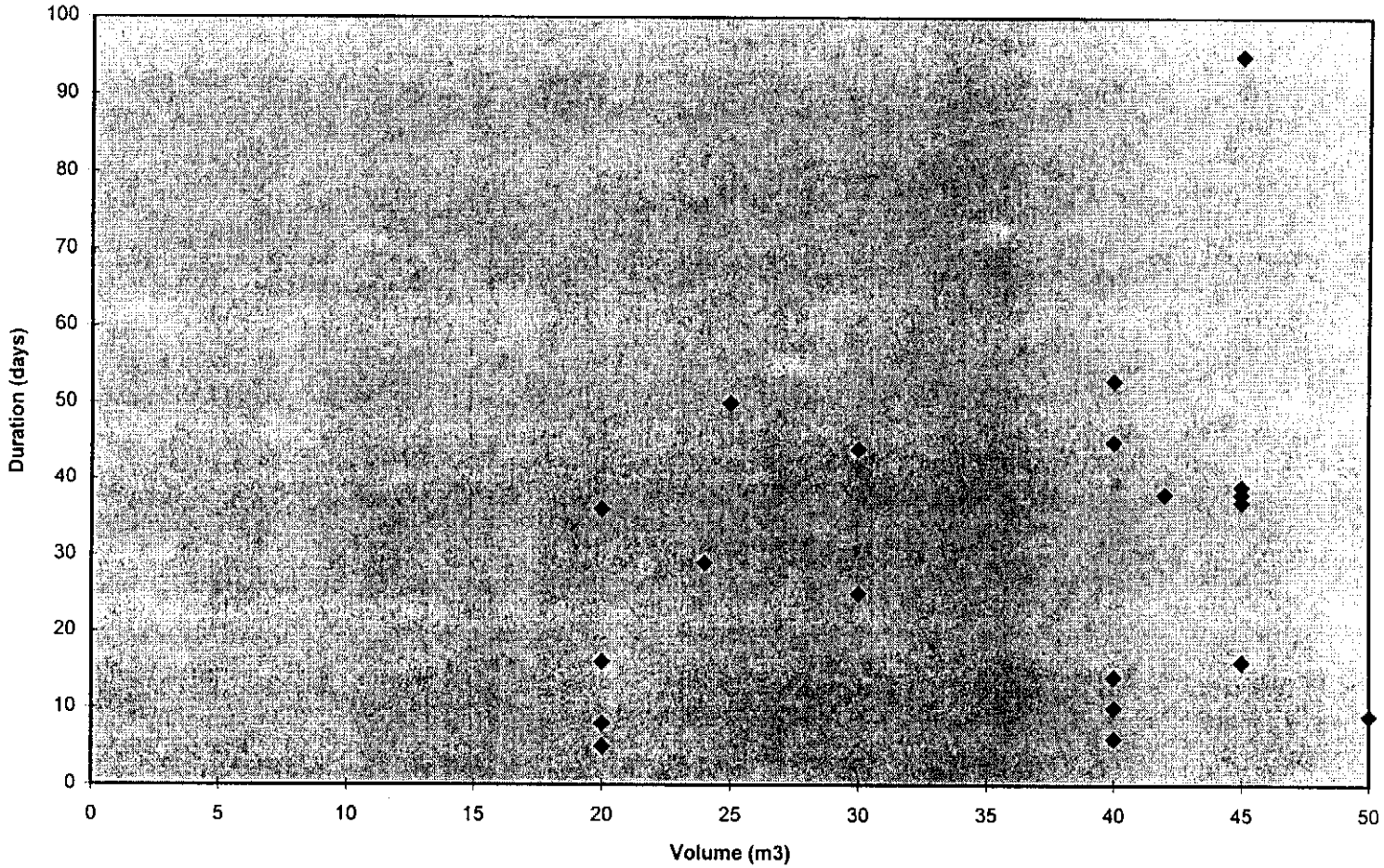


Table B3 Data on Lane/ Road Closure for Landslide Volumes 50 to 500m3

Incidents in the ascending order of duration of closure					Results			Incidents in the ascending order of landslide volume		
Incident No.	Duration of Lane/Road Closure (days)	Landslide Volume (m^3)				All incidents	Incidents excluding the 3 smallest (of duration)	Incident No.	Duration of Lane/Road Closure (days)	Landslide Volume (m^3)
ME94/8/32	0	100			mean	29.0	33.9	HK95/8/16	43	60
HK95/8/21	2	300			std_dev	24.4	23.2	HK94/5/1	26	65
ME94/8/22	2.4	240			correl_coeff	0.091	0.360	ME95/8/19	9	80
K94/7/5	6	140						ME94/6/2	15	80
ME95/8/19	9	80		Figure	All incidents with volumes of 50 to 500 m^3			ME94/7/19	31	80
HK95/8/31	10	120						ME94/7/31	47	80
K95/8/17	11	150						ME94/8/32	0	100
HK95/9/1	13	130						MW94/7/63	25	100
ME94/6/2	15	80						HK95/8/31	10	120
MW94/7/63	25	100						HK95/9/1	13	130
HK94/5/1	26	65						K94/7/5	6	140
ME94/7/19	31	80						K95/8/17	11	150
MW94/7/25	38	275						K94/7/11	61	150
HK95/8/16	43	60						ME94/8/24	90.5	150
HK94/6/1	44	200						HK94/6/1	44	200
ME94/7/31	47	80						ME94/8/22	2.4	240
ME95/8/10	47	240		Results : Probability distribution of lane/road closure				ME95/8/10	47	240
ME94/7/4	60	260						ME94/7/4	60	260
K94/7/11	61	150		Duration	Duration	No. of	Probability	MW94/7/25	38	275
ME94/8/24	90.5	150		(range)	(mean)	incidents		HK95/8/21	2	300
				days	*days*					
				0 to 10	5	6	0.30			
				10 to 30	20	5	0.25			
				30 to 60	45	7	0.35			
				60 to 90	75	1	0.05			
				> 60	60	1	0.05			
				Total		20	1.00			
				Average Duration			29.00			

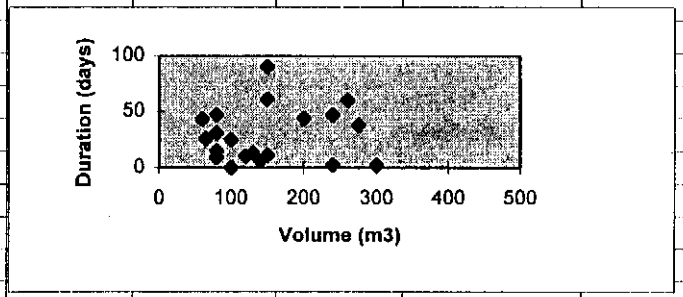


Figure B3a

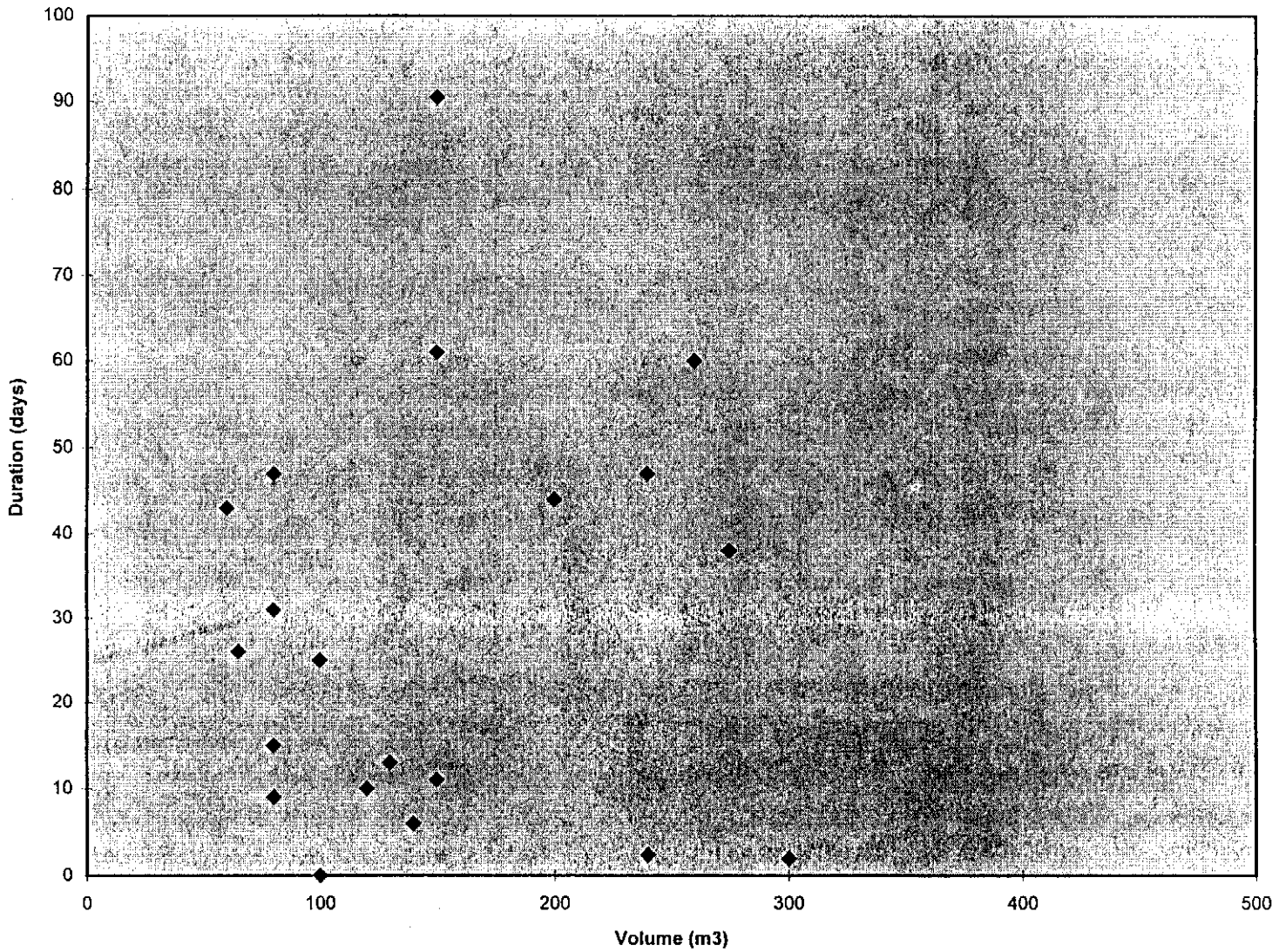

All incidents with volumes of 50 to 500 m3
Duration (days)
Volume (m3)
0
10
20
30
40
50
60
70
80
90
100
0
100
200
300
400
500

Table B4 **Data on Lane/Road Closure for Landslide Volumes 500 to 2000 m3**

Incident No.	Duration of Lane/Road Closure (days)	Landslide Volume (m^3)
MW94/7/18	15.2	700
K94/7/14	5	800
ME94/7/27	7	1000
ME95/8/11	78	2000

Results	
	All incidents
mean	26.3
std_dev	34.7
correl_coeff	0.954

Figure All incidents with volumes of 500 to 2000 m^3

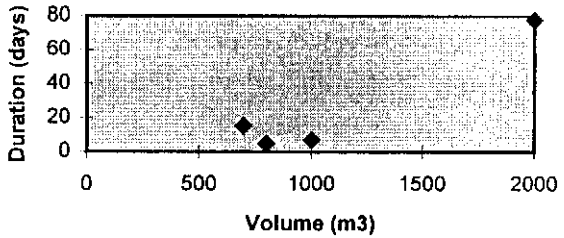


Figure B4a

All incidents with volumes of 500 to 2000m^3

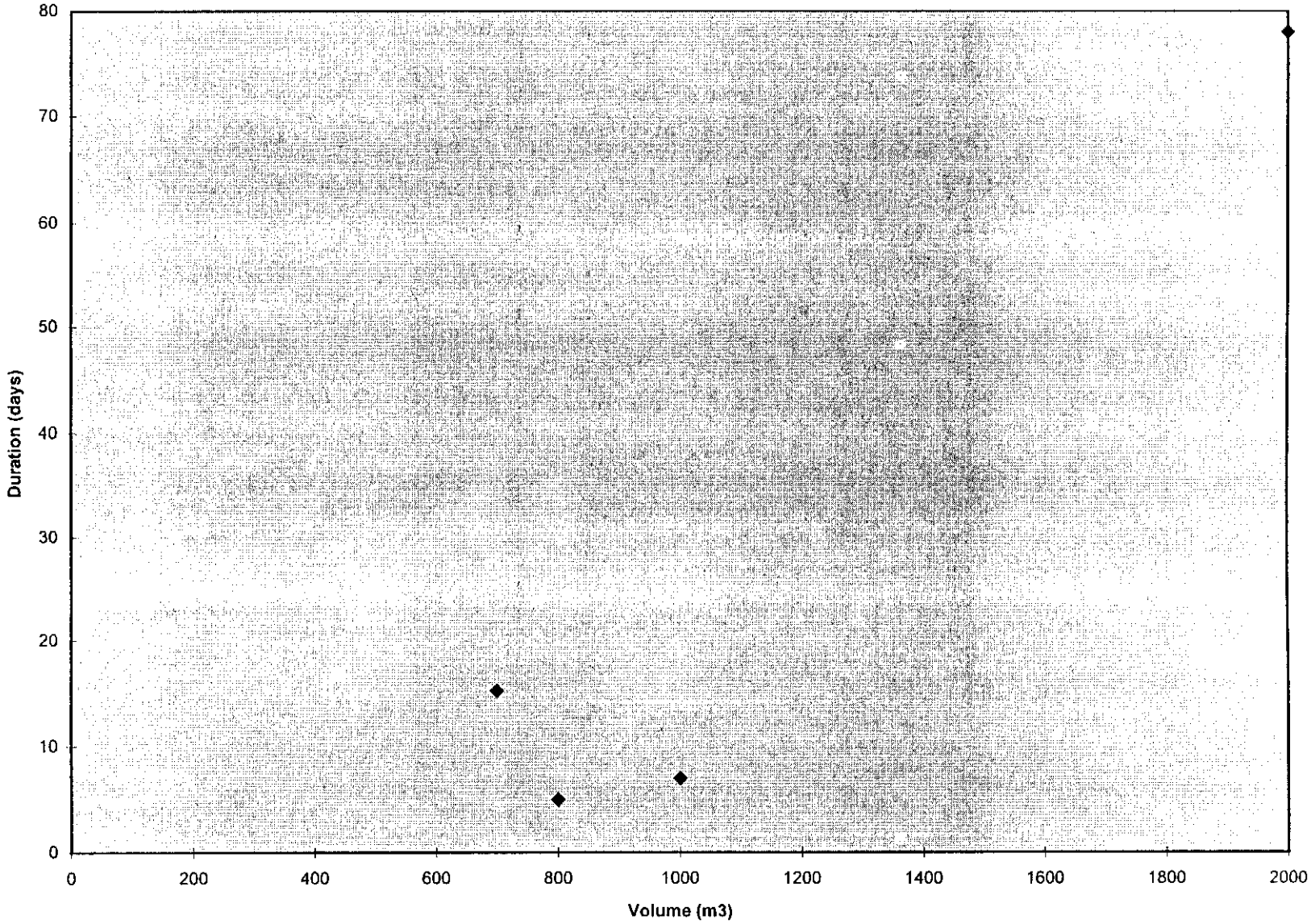


Table B5 **Lane/Road Closure - Raw Data (1994 & 1995)**

Landslide Incidents Involving Road Closure in 1994 and 1995									
Incident No	Location	Class of	Nos. of Lanes	Category	AADT	Road Closure (Information provided by Highways Department			
		Road	(Assumed)		(1995)	Start Date	End Date	Duration (Day)	No. of lanes closed
HK94/1/1	Black's Link, Mount Cameron		1	3		15-Jan-94	01-Mar-94	45	Whole section
HK94/5/1	Opposite 11 Repulse Bay Road, Repulse Bay	DD	4	2	12300	20-May-94	15-Jun-94	26	1
HK94/6/1	Cape Collinson Road near Correctional Institution, Chai Wan	LD	2	3	450	20-Jun-94	03-Aug-94	44	1
HK94/7/1	9 Tai Tam Road, Stanley	PD	2	2	10900	08-Jul-94	10-Jul-94	2	1
HK94/7/2	Opposite AIA Building, Stubbs Road, Wan Chai	DD	4	2	21070	12-Jul-94	28-Jul-94	16	1
HK94/7/3	Near the Fort, Chung Hom Kok Road, Chung Hom Kok	LD	2	3	1300	12-Jul-94	19-Jul-94	7	2
HK94/7/11	Near 42 opposite 41 Sassoon Road, Pokfulam	DD	2	3	6340	20-Jul-94	09-Sep-94	51	1
HK94/7/14	Access leading to 37 Conduit Road, Mid-levels		1	3		22-Jul-94	22-Jul-94	0	1
HK94/7/15	Opposite Shan Pin Terrace, A Kung Ngam Road, Shaukeiwan		1	3		22-Jul-94	30-Aug-94	39	2
HK94/7/16	Magazine Gap Road near May Road, The Peak	DD	4	2	14960	22-Jul-94	13-Aug-94	22	Uphill bound
HK94/7/22	Victoria Road, Wah Fu	DD	2	3	7340	22-Jul-94	01-Aug-94	10	1
HK94/7/30	45 Repulse Bay Road, Repulse Bay	DD	4	2	12300	24-Jul-94	25-Jul-94	1	1
HK94/7/31	73 Repulse Bay Road, Repulse Bay	PD	4	2	26700	24-Jul-94	25-Jul-94	1	1
HK94/7/32	Below 63 Repulse Bay Road, Repulse Bay	DD	4	2	12300	24-Jul-94	26-Jul-94	2	2
			4	2		26-Jul-94	03-Aug-94	8	1
HK94/7/36	42A Kennedy Road, Admiralty	DD	4	2	10610	23-Jul-94	27-Jul-94	4	West bound
HK94/7/42	South Bay Road, Repulse Bay		1	3		23-Jul-94	24-Jul-94	1	1
HK94/7/45	Victoria Road, Wah Fu	DD	2	3	7340	25-Jul-94	10-Aug-94	16	1
HK94/7/54	Towards Chesmire Home, Chung Hom Kok Road, Chung Hom Kok	LD	2	3	1300	25-Jul-94	27-Jul-94	2	1
HK94/7/59	Victoria Road, Pokfulam	DD	2	3	7860	24-Jul-94	15-Sep-94	53	1
HK94/8/12	Below Villa Helvetia, Repulse Bay Road		2	3		16-Aug-94	16-Aug-94	0	4
			2	3		16-Aug-94	16-Aug-94	0	3
			2	3		16-Aug-94	03-Sep-94	18	2
			2	3		03-Sep-94	07-Oct-94	34	1
K94/7/3	Ping Chi Street, Hung Hom	DD	2	3	1520	22-Jul-94	19-Aug-94	28	2
K94/7/4	Hau Man Street, Homantin		2	3		22-Jul-94	27-Jul-94	5	2
			2	3		27-Jul-94	30-Aug-94	34	1
K94/7/5	Opposite TVB, Lung Cheung Road	UT	4	1	79280	22-Jul-94	23-Jul-94	1	2
			4	1		23-Jul-94	28-Jul-94	5	1
K94/7/10	Fei Ngo Shan Road near Jat's Incline, Kowloon	LD	2	3	1460	25-Jul-94	12-Aug-94	18	1
K94/7/11	Opposite Blocks 35 & 40, Sau Mau Ping Road, Sau Mau Ping	DD	4	2	22470	23-Jul-94	02-Aug-94	10	4
			4	2		03-Aug-94	09-Aug-94	6	2
			4	2		10-Aug-94	08-Sep-94	29	4
			4	2		09-Sep-94	25-Sep-94	16	2
K94/7/13	Kwun Tong Road near St. Joseph's School at Choi Shek Lane	UT	4	1	89240	24-Jul-94	30-Jul-94	6	1
K94/7/14	Opposite Kai Fai House Choi Wan Estate, New Clear Water Bay Road	PD	4	2	44570	25-Jul-94	30-Jul-94	5	1
ME94/6/2	Pak Tam Road near Uk Tau, Sai Kung		1	3		20-Jun-94	21-Jun-94	1	2
			1	3		21-Jun-94	05-Jul-94	14	1
ME94/7/4	Kei Ling Ha Lo Wai, Sai Sha Road, Sai Kung	RA	2	2	5310	22-Jul-94	22-Jul-94	1	2
			2	2		22-Jul-94	20-Sep-94	59	1
ME94/7/5	Near Long Keng, Sai Sha Road	RA	2	2	5310	12-Aug-94	13-Aug-94	2	1
			2	2		13-Aug-94	15-Aug-94	2	2
ME94/7/9	Bride's Pool Road, Tai Po	LD	2	3	550	22-Jul-94	28-Jul-94	6	2
			2	3		29-Jul-94	09-Aug-94	11	1
			2	3		10-Aug-94	15-Aug-94	5	2
			2	3		16-Aug-94	07-Sep-94	22	1
ME94/7/19	Shek Lin Road, Tai Po		2	3		06-Sep-94	07-Oct-94	31	1
ME94/7/20	Bride's Pool Road between Chung Mei and Bride's Pool	LD	2	3	550	23-Jul-94	28-Jul-94	5	2
			2	3		29-Jul-94	07-Sep-94	40	1
ME94/7/25	Opposite Lot 248, Tso Wo Hang, Tai Mong Tsai Road	LD	2	3	4120	24-Jul-94	31-Aug-94	38	1
ME94/7/27	Hopes Villa, Tai Mong Tsai Road, Sai Kung	LD	2	3	4120	24-Jul-94	31-Jul-94	7	1
ME94/7/28	Hiram's Highway near Hong Kin Road, Sai Kung	RA	4	2	17240	24-Jul-94	31-Aug-94	38	1

Table B5

Lane/Road Closure - Raw Data (1994 & 1995)

Landslide Incidents involving Road Closure in 1994 and 1995									
Incident No	Location	Class of	Nos. of Lanes	Category	AADT	Road Closure (Information provided by Highways Department			
		Road	(Assumed)		(1995)	Start Date	End Date	Duration (Day)	No. of lanes closed
ME94/7/31	Near Anderson Road Quarry, Anderson Road, Sai Kung	DD	2	3	1200	25-Jul-94	10-Sep-94	47	2
ME94/7/42	Ting Kok Road, Tai Po	LD	2	3	740	14-Sep-94	02-Oct-94	18	1
ME94/8/6	Access road to Kau Lung Hang Shan, Tai Po		1	3		07-Aug-94	08-Aug-94	1	2
			1	3		08-Aug-94	31-Aug-94	23	1
ME94/8/7	House no. 244, Tai Po Tsai		1	3		07-Aug-94	08-Aug-94	1	2
			1	3		08-Aug-94	31-Aug-94	23	1
ME94/8/8	No. 31, Ling Yan Terrace, Tui Min Hoi, Sai Kung		1	3		07-Aug-94	07-Aug-94	0	1
ME94/8/10	Zone 243, Border Fence Road, San Kwai Tin		1	3		07-Aug-94	08-Aug-94	1	1
ME94/8/11	Zone 229, Border Fence Road, Wang Lek		1	3		07-Aug-94	08-Aug-94	1	1
ME94/8/17	Bride's Pool Road near Chung Mei, Tai Po	LD	2	3	550	12-Sep-94	16-Sep-94	4	1
ME94/8/22	Lot 227 in DD229, Ah Kung Wan Road, Sai Kung		1	3		16-Aug-94	18-Aug-94	2	2
ME94/8/23	Anderson Road, south of Clear Water Bay Road, Sai Kung	DD	2	3	1200	16-Aug-94	21-Aug-94	5	2
ME94/8/24	Sai Sha Road near Long Keng, Sai Kung	RA	2	2	5310	15-Aug-94	27-Aug-94	12	2
			2	2		27-Aug-94	14-Nov-94	78	1
ME94/8/32	Lin Ma Hang Road, Man Kam To		2	2		07-Aug-94	07-Aug-94	0	2
ME94/9/5	Tai Po Road - Tai Po Kau, Tsung Tsai Yuen	RA	2	2	5840	15-Sep-94	26-Sep-94	11	1
MW94/6/4	Near Fu Kong Shan, South Lantau Road, Mui Wo, Lantau Island	RA	2	2	2980	20-Jun-94	12-Oct-94	114	1
MW94/7/9	No. 69A, Kau Wa Keng San Tsuen, Kwai Chung		1	3		14-Jul-95	20-Aug-95	37	1
MW94/7/16	Greenview Terrace, Castle Peak Road, Tsuen Wan	RA	4	2	12040	22-Jul-94	07-Aug-94	16	2
MW94/7/18	MS 14 1/2, Castle Peak Road, Tsing Lung Tau	RA	4	2	12980	23-Jul-94	23-Jul-94	0	1
			4	2		23-Jul-94	01-Aug-94	9	2
			4	2		01-Aug-94	07-Aug-94	6	1
MW94/7/22	MS 10 3/4, South Lantau Road, Lantau Island	RA	2	2	1210	23-Jul-94	05-Aug-94	13	1
MW94/7/25	MS 6, South Lantau Road, Lantau Island	RA	2	2	1210	24-Jul-94	25-Jul-94	2	2
			2	2		25-Jul-94	31-Aug-94	36	1
MW94/7/33	Above Fu Yung Shan Road, Tsuen Wan		1	3		26-Jul-94	18-Sep-94	54	1
MW94/7/34	Opposite Route Twisk Towngas Station, Route Twisk, Tsuen Wan	RA	2	2	7250	26-Jul-94	29-Oct-94	95	1
MW94/7/63	Lion Rock Tunnel Road, Shatin	UT	4	1	92100	29-Jul-94	23-Aug-94	25	1
MW94/8/3	MS 14 1/2, Castle Peak Road, Tsing Lung Tau	RA	4	2	12980	07-Aug-94	24-Aug-94	17	2
			4	2		24-Aug-94	16-Dec-94	114	1
MW94/8/5	MS 10, Castle Peak Road, Yau Kom Tau	RA	4	2	12040	07-Aug-94	30-Dec-94	145	2
MW94/8/25	Castle Peak Road near Siu Lam Hospital, Siu Lam	RA	4	2	12980	10-Aug-94	10-Aug-94	0	2
			4	2		10-Aug-94	10-Aug-94	0	1
MW94/8/29	Ting Kau Beach, MS 11, Castle Peak Road, Ting Kau	RA	4	2	12040	10-Aug-94	29-Sep-94	50	1
MW94/8/40	Near Chung Shan Terrace, Castle Peak Road, Kwai Chung	PD	4	2	33550	16-Aug-94	24-Aug-94	8	1
MW94/8/41	Fan Kam Road, Pat Heung	RA	4	2	10130	15-Aug-94	18-Sep-95	399	1
MW94/8/47	Shing Mun Road, Tsuen Wan	LD	2	3	1110	16-Aug-94	05-Oct-94	50	1
HK95/6/3	42B Kennedy Road, Magazine Gap	DD	4	2	10610	10-Jun-95	13-Jun-95	3	West bound
HK95/7/12	Tai Hang Road, So Kon Po	DD	4	2	13070	28-Jul-95	28-Jul-95	0	1
HK95/8/2	Opposite 99 Peak Road, The Peak	DD	4	2	11170	03-Aug-95	09-Aug-95	6	Whole section
			4	2		09-Aug-95	12-Aug-95	3	Downhill bound
HK95/8/7	Near junction with Mount Butlar, Tai Hang Road, So Kon Po	DD	4	2	14670	03-Aug-95	09-Aug-95	6	1
HK95/8/15	Near May Road, Magazine Gap Road, The Peak	DD	4	2	14960	13-Aug-95	01-Sep-95	19	Whole section
			4	2		01-Sep-95	18-Sep-95	17	Downhill bound
HK95/8/16	Near 52 Peak Road, Magazine Gap	DD	4	2	11170	13-Aug-95	25-Sep-95	43	Downhill bound
HK95/8/17	92 Peak Road, The Peak	DD	4	2	11170	13-Aug-95	19-Sep-95	37	Downhill bound
HK95/8/21	73 to 91 Repulse Bay Road / Belleview Drive , Repulse Bay	PD	4	2	26700	13-Aug-95	15-Aug-95	2	1
HK95/8/24	119 Repulse Bay Road, Repulse Bay	PD	4	2	26700	13-Aug-95	15-Aug-95	2	1
HK95/8/25	43 Repulse Bay Road, Repulse Bay	DD	4	2	12300	13-Aug-95	15-Aug-95	2	1
HK95/8/31	Near Cape Collinson Road, Shek O Road, Tai Tam Gap	DD	2	3	4400	13-Aug-95	23-Aug-95	10	1
HK95/8/33	Near Reservoir Dam, Tai Tam Road, Tai Tam Gap	PD	2	2	7720	14-Aug-95	16-Aug-95	2	1
HK95/8/34	Adjacent to South-bound Lane near 555 Victoria Road, Pok Fu Lam	DD	2	3	7340	12-Aug-95	23-Aug-95	11	1

Table B5

Lane/Road Closure - Raw Data (1994 & 1995)

Landslide Incidents Involving Road Closure in 1994 and 1995									
Incident No.	Location	Class of Road	Nos. of Lanes (Assumed)	Category	AADT (1995)	Road Closure (Information provided by Highways Department			
						Start Date	End Date	Duration (Day)	No. of lanes closed
HK95/8/35	Opposit Fire Station, Ap Lei Chau Bridge Road, Ap Lei Chau	DD	4	2	38140	13-Aug-95	11-Sep-95	29	2
			4	2		11-Sep-95	15-Nov-95	65	1
HK95/8/36	100 m up from Ningnam College, Stubbs Road, Happy Valley	DD	4	2	21070	13-Aug-95	04-Sep-95	22	2
HK95/8/39	Near H.K. Electric House, Kennedy Road, Mid-Levels	DD	4	2	10610	13-Aug-95	16-Sep-95	34	West bound
HK95/8/41	19 Green Lane, Happy Valley	LD	2	3	940	12-Aug-95	13-Aug-95	1	1
HK95/8/43	Baptist Church, 30 Fei Tsui Road, Chai Wan		1	3		13-Aug-95	29-Sep-95	47	2
HK95/8/46	84 Pokfulam Road, Pokfulam	PD	4	2	36160	13-Aug-95	13-Aug-95	0	1
HK95/8/48	22 Aberdeen Reservoir Road, Aberdeen	LD	2	3	4400	13-Aug-95	16-Sep-95	34	1
HK95/8/77	Near 34 Stubbs Road, Happy Valley	DD	4	2	21070	14-Aug-95	28-Aug-95	14	Downhill bound
HK95/9/1	Adjacent to 47A Stubbs Road, Wan Chai Gap	DD	4	2	11270	31-Aug-95	13-Sep-95	13	1
K95/8/1	Jat's Incline, Ngau Chi Wan	LD	2	3	4390	03-Aug-95	08-Aug-95	5	1
K95/8/9	Near Kwun Tong Police Station, Junk Bay Road, Kwun Tong	PD	4	2	63690	13-Aug-95	14-Aug-95	1	3
			4	2		15-Aug-95	24-Aug-95	9	1
K95/8/11	Opposite Block 40 Sau Mau Ping Estate, Sau Mau Ping Road, Sau Mau Ping	DD	4	2	22470	13-Aug-95	15-Aug-95	2	1
			4	2		16-Aug-95	23-Aug-95	7	4
			4	2		23-Aug-95	29-Sep-95	37	2
K95/8/17	Opposite Lui Ming Choi Secondary School, Kwun Tong Road, Kwun Tong	UT	4	1	150120	13-Aug-95	24-Aug-95	11	1
ME95/6/3	Near Kwong Fuk Road, Wan Tau Kok Lane, Tai Po		1	3		18-Jun-95	18-Jun-95	0	1
			1	3		17-Jul-95	07-Aug-95	21	1
ME95/8/1	Kowloon Bound C.W.B.R. opposite Ta Kui Ling, Ta Kui Ling	RA	4	2	32950	03-Aug-95	06-Aug-95	3	1
ME95/8/3	Tai Mong Tsai Road, Tso Wo Hang, Sai Kung	LD	2	3	4120	03-Aug-95	29-Aug-95	26	1
ME95/8/4	Access Road of Hing Keng Shek Next to Hiram's Highway, Sai Kung		1	3		04-Aug-94	04-Aug-94	1	2
ME95/8/6	Next to Lamp Post N2633, Tai Mong Tsai Road, Sai Kung	LD	2	3	4120	03-Aug-95	08-Aug-95	5	1
ME95/8/10	Sai Sha Road, near circle to Pak Tam Chung, Sai Kung	RA	2	2	5310	13-Aug-95	21-Aug-95	8	2
			2	2		21-Aug-95	29-Sep-95	39	1
ME95/8/11	Junction of Sai Sha Road and Tai Mong Tsai Road, Sai Kung	RA	2	2	5310	13-Aug-95	21-Aug-95	8	2
			2	2		21-Aug-95	30-Oct-95	70	1
ME95/8/19	Near Ta Kin Ling San Tsuen, Clear Water Bay Road, Sai Kung	RA	4	2	32950	12-Aug-95	15-Aug-95	3	2
			4	2		16-Aug-95	23-Aug-95	7	1
ME95/10/1	Near Lamp Post No. EB1020-8, Brides Pool Road, Tai Po	LD	2	3	550	06-Oct-95	06-Oct-95	0	1
			2	3		06-Oct-95	07-Oct-95	1	2
MW95/8/20	Shatin Portal of Shing Mun Tunnel, at CH5.88, Shatin	UT	4	1	51220	14-Aug-95	12-Sep-95	29	1
MW95/8/21	Road Widening Project Site, Near Siu Lam at about CH21.4 on the Kowloon Bound Lane, Tuen Mun Highway	EX	4	1	85410	18-Aug-95	19-Aug-95	1	3
			4	1		24-Aug-95	24-Aug-95	0	2
			4	1		31-Aug-95	09-Sep-95	9	3
MW95/9/1	Above Ting Kau, Tuen Mun Road	EX	4	1	96120	31-Aug-95	04-Sep-95	5	1
MW95/10/2	Dragonville, 21-25 Castle Peak Road	RA	4	2	12980	06-Oct-95	06-Oct-95	0	2
			4	2		06-Oct-95	06-Oct-95	0	1
			4	2		06-Oct-95	07-Oct-95	0	2
			4	2		07-Oct-95	08-Oct-95	1	1
			4	2		08-Oct-95	08-Oct-95	1	2
			4	2		08-Oct-95	09-Oct-95	1	1
Note:	1. For the blank fields, no information had been provided by Highways Department								

Table B6 **Lane/ Road Closure - Raw Data 1996**

Incident No.	Location	Number of	Start Date	End Date	Duration
HK96/3/3	Uphill Roadside slope near no.1 Peak Road, Wan Chai Gap.	1	26-Mar-96	26-Mar-96	1
HK96/4/4	Lower portion of Feature No.15NE-A/C88, South Bay Road.	1	19-Apr-96	27-Apr-96	9
HK96/6/1	Slope No.11SW-D/C383, Stubbs Road.	1	22-Jun-96	24-Jun-96	3
HK96/6/3	Footpath between Blk 16-18 & Blk 45-48, Baguio Villa.				Private
HK96/9/1	Felix Villas, behind Mount Davis Road (Victoria Road Improvements).				PMO project
HK96/9/4	Opposite No.70 Tai Hang Road.	2	14-Sep-96	8-Oct-96	25
HK96/9/6	Junction with Big Wave Bay Road, Shek O Road.	1	14-Sep-96	27-Sep-96	14
HK96/9/7	Near No.9 Big Wave Bay Road, Shek O.	1	15-Sep-96	16-Sep-96	2
K96/9/1	Opposite Valley Road Estate Block No.6, Fat Kwong Street, Homantin, Kowloon.	1			0.5
ME96/6/5	Roadside slope opposite lamp post N37828, Tai Po Road - Tai Wo.	1	24-Jun-96	27-Jun-96	4
ME96/6/6	Leung Man Road leading to Ma On Shan Tsuen, Ma On Shan.				
MW96/3/2	Wing Cho Street, Cho Yiu Estate, Kwai Chung.				
MW96/3/4	Block 13, Pak Tin Estate, Shek Kip Mei.	1	16-Mar-96	25-Mar-96	9.5

Table B7

Slope Type Information for Lane/Road Closure Data (1994 to 1996)

Incident No.	Duration of Lane Closure (Days)	Landslide Volume (m^3)	Slope Type
HK96/9/7	2	0.2	cut
HK96/3/3	1	0.5	cut
HK96/4/4	9	0.5	cut
ME94/8/8	0	0.5	cut
HK95/8/7	6	1	cut
HK95/7/12	0	1.5	RF
HK96/6/1	3	2	cut
HK94/7/30	1	2	cut
MW95/10/2	3.3	2	cut
HK94/7/3	7	2	RF
HK94/1/1	45	2	RW
ME96/6/5	4	2	na
HK95/6/3	3	2.5	cut
HK94/7/1	2	3	cut
ME95/8/1	3	3	cut
ME94/9/5	11	3	RF
HK95/8/34	11	3	RF
ME95/6/3	22	3.5	cut
HK96/9/6	14	4	cut
HK95/8/48	34	4.5	cut
MW95/9/1	4.6	5	cut
HK94/7/22	10	5	cut
HK94/7/2	16	5	cut
K94/7/10	18	5	cut
HK94/8/12	52	5	cut
MW94/6/4	114	5	cut
HK94/7/15	39	6	cut
ME94/8/11	1	6	natural
ME95/8/3	26	8	cut
HK95/8/17	37	8	RF
HK94/7/36	4	9	cut
MW95/8/21	9.5	10	BF
MW94/8/25	0.3	10	cut
HK94/7/31	1	10	cut
ME94/8/10	1	10	cut
HK95/8/25	2	10	cut
ME94/8/6	24	10	cut
K94/7/3	28	10	cut
MW94/8/29	50	10	cut
MW94/8/41	399	10	cut
ME94/8/17	4	10	fill
MW94/7/22	13	10	natural
ME95/8/6	5	10	RF
HK95/8/46	0	12	cut
HK95/8/33	2	12	cut
K95/8/1	5	12	RF
HK94/7/42	1	13	cut
ME95/8/4	0.7	15	cut
HK95/8/41	1	15	cut
MW94/7/33	54	15	natural
HK94/7/16	22	15	RF
HK94/7/11	51	16	fill
ME94/7/42	18	18	cut
HK94/7/14	0	20	BF
ME94/8/23	5	20	cut
MW94/8/5	145	20	cut
MW94/8/40	8	20	cut
HK95/8/15	36	20	RF

Table B7 **Slope Type Information for Lane/Road Closure Data (1994 to 1996)**

Incident No.	Duration of Lane Closure (Days)	Landslide Volume (m^3)	Slope Type
HK94/7/45	16	20	subsidence
K96/9/1	0.5	20	na
MW95/8/20	29	24	cut
MW94/8/47	50	25	cut
HK96/9/4	25	30	cut
ME94/7/9	44	30	cut
ME94/7/20	45	40	BF
HK94/7/32	10	40	cut
K94/7/13	6	40	cut
HK95/8/77	14	40	cut
HK94/7/59	53	40	natural
ME94/7/28	38	42	cut
ME94/7/25	38	45	cut
MW94/7/9	37	45	cut
MW94/7/16	16	45	cut
MW94/7/34	95	45	fill
K94/7/4	39	45	RF
HK95/8/2	9	50	cut
ME95/10/1	1	50	RF
HK95/8/16	43	60	cut
HK94/5/1	26	65	fill
ME94/6/2	15	80	cut
ME94/7/19	31	80	cut
ME94/7/31	47	80	cut
ME95/8/19	9	80	cut
MW94/7/63	25	100	fill
ME94/8/32	0	100	natural
HK95/8/31	10	120	fill
HK95/9/1	13	130	cut
K94/7/5	6	140	cut
K95/8/17	11	150	BF
K94/7/11	61	150	cut
ME94/8/24	90.5	150	cut
HK94/6/1	44	200	cut
ME94/8/22	2.4	240	cut
ME95/8/10	47	240	cut
ME94/7/4	60	260	cut
MW94/7/25	38	275	cut
HK95/8/21	2	300	cut
MW94/7/18	15.2	700	cut
K94/7/14	5	800	cut
ME94/7/27	7	1000	natural
ME95/8/11	78	2000	cut
HK95/8/43	47	14000	cut
MW96/3/4	9.5	Not Available	
HK94/7/54	2	Not Available	
ME94/7/5	3.29	Not Available	
ME94/8/7	24	Not Available	
MW94/8/3	131	Not Available	
HK95/8/24	2	Not Available	
HK95/8/35	94	Not Available	
HK95/8/36	22	Not Available	
HK95/8/39	34	Not Available	
K95/8/9	10	Not Available	
K95/8/11	46	Not Available	

Annex C

Extracts from Workbooks for PLL/Economic Loss Estimation

Total PLL

Road	Section	AADT 1995	Frequency per year		PLL	
		Value	Value	Landslip	Boulderfall	Total
Cape Collinson Road	A	450	8.46E-01	2.96E-03	8.45E-04	3.81E-03
Cape Collinson Road	B	450	2.31E-01	4.05E-03	0.00E+00	4.05E-03
Chung Hom Kok Road	-	1300	5.38E-01	1.22E-03	1.67E-03	2.89E-03
Island Road	-	16890	4.62E-01	3.29E-02	0.00E+00	3.29E-02
Kennedy Road	-	10610	1.00E+00	1.50E-01	0.00E+00	1.50E-01
Magazine Gap Road	-	14960	1.31E+00	1.58E-01	0.00E+00	1.58E-01
Nam Fung Road	-	10110	1.54E-01	4.95E-03	0.00E+00	4.95E-03
Peak Road	A	11170	3.08E-01	7.07E-02	0.00E+00	7.07E-02
Peak Road	B	10120	4.62E-01	2.20E-02	1.07E-02	3.27E-02
Pokfulam Road	A	36160	5.38E-01	1.97E-02	0.00E+00	1.97E-02
Pokfulam Road	B	25050	2.31E-01	1.93E-02	0.00E+00	1.93E-02
Repulse Bay Road	A	12300	2.31E+00	2.29E-01	1.79E-02	2.47E-01
Repulse Bay Road	B	14370	4.62E-01	2.60E-02	0.00E+00	2.60E-02
Stubbs Road	A	21070	3.08E-01	4.66E-02	0.00E+00	4.66E-02
Stubbs Road	B	11270	1.54E-01	3.61E-02	0.00E+00	3.61E-02
Tai Hang Road	-	14670	2.85E+00	2.09E-01	1.07E-01	3.16E-01
Tai Tam Road	-	10900	9.23E-01	5.46E-02	1.25E-02	6.72E-02
Victoria Road	A	5410	8.46E-01	2.11E-02	8.12E-03	2.92E-02
Victoria Road	B	7860	1.08E+00	1.30E-02	0.00E+00	1.30E-02
Yee King Road	-	14150	6.15E-01	3.23E-02	1.03E-01	1.36E-01
Clear Water Bay Road	-	32950	5.38E-01	1.16E-01	0.00E+00	1.16E-01
Kwun Tong Road	-	150120	2.31E-01	2.76E-01	0.00E+00	2.76E-01
Sai Sha Road	-	5310	1.00E+00	1.35E-01	0.00E+00	1.35E-01
Tai Mong Tsai Road	A	6000	2.31E-01	3.55E-02	0.00E+00	3.55E-02
Tai Mong Tsai Road	B	6000	6.15E-01	2.55E-02	0.00E+00	2.55E-02
Tai Mong Tsai Road	C	4120	1.54E-01	1.76E-02	0.00E+00	1.76E-02
Tai Mong Tsai Road	D	4120	1.54E-01	2.44E-03	0.00E+00	2.44E-03
Tai Po Road	A	9190	1.54E-01	5.90E-04	0.00E+00	5.90E-04
Tai Po Road	B	5840	6.15E-01	3.32E-02	0.00E+00	3.32E-02
Tai Po Road	C	5840	4.62E-01	2.12E-02	0.00E+00	2.12E-02
Castle Peak Road	-	12980	2.46E+00	1.01E+00	2.35E-02	1.03E+00
Route Twisk	A	6270	1.00E+00	1.11E-01	5.01E-03	1.16E-01
Route Twisk	B	7250	3.08E-01	6.42E-03	0.00E+00	6.42E-03
Route Twisk	C	7250	3.08E-01	2.33E-03	0.00E+00	2.33E-03
South Lantau Road	A	2980	1.31E+00	1.09E-02	0.00E+00	1.09E-02
South Lantau Road	B	1210	4.62E-01	8.21E-03	0.00E+00	8.21E-03
South Lantau Road	C	1210	3.85E-01	2.96E-03	0.00E+00	2.96E-03
Tuen Mun Road	A	96120	3.08E-01	6.65E-02	0.00E+00	6.65E-02
Tuen Mun Road	B	96120	1.54E-01	1.01E-01	0.00E+00	1.01E-01
Tuen Mun Road	C	85410	3.85E-01	1.14E-01	1.04E-01	2.18E-01
Tuen Mun Road	D	95470	7.69E-02	2.74E-02	0.00E+00	2.74E-02
				3.27E+00	**3.95E-01**	**3.67E+00**

BF PLL

Road	Section	Boulder fall Frequency/yr	AADT 1995	PLL (falling)	PLL (fallen)	Total PLL
Cape Collinson Road	A	0.230769231	450	6.18E-05	7.83E-04	8.45E-04
Cape Collinson Road	B	0	450	0.00E+00	0.00E+00	0.00E+00
Chung Hom Kok Road	-	0.153846154	1300	1.19E-04	1.55E-03	1.67E-03
Island Road	-	0	16890	0.00E+00	0.00E+00	0.00E+00
Kennedy Road	-	0	10610	0.00E+00	0.00E+00	0.00E+00
Magazine Gap Road	-	0	14960	0.00E+00	0.00E+00	0.00E+00
Nam Fung Road	-	0	10110	0.00E+00	0.00E+00	0.00E+00
Peak Road	A	0	11170	0.00E+00	0.00E+00	0.00E+00
Peak Road	B	0.076923077	10120	4.70E-04	1.02E-02	1.07E-02
Pokfulam Road	A	0	36160	0.00E+00	0.00E+00	0.00E+00
Pokfulam Road	B	0	25050	0.00E+00	0.00E+00	0.00E+00
Repulse Bay Road	A	0.076923077	12300	5.73E-04	1.73E-02	1.79E-02
Repulse Bay Road	B	0	14370	0.00E+00	0.00E+00	0.00E+00
Stubbs Road	A	0	21070	0.00E+00	0.00E+00	0.00E+00
Stubbs Road	B	0	11270	0.00E+00	0.00E+00	0.00E+00
Tai Hang Road	-	0.769230769	14670	6.75E-03	1.00E-01	1.07E-01
Tai Tam Road	-	0.076923077	10900	5.07E-04	1.20E-02	1.25E-02
Victoria Road	A	0.153846154	5410	4.99E-04	7.62E-03	8.12E-03
Victoria Road	B	0	7860	0.00E+00	0.00E+00	0.00E+00
Yee King Road	-	0.384615385	14150	3.28E-03	1.00E-01	1.03E-01
Clear Water Bay Road	-	0	32950	0.00E+00	0.00E+00	0 00E+00
Kwun Tong Road	-	0	150120	0.00E+00	0.00E+00	0.00E+00
Sai Sha Road	-	0	5310	0.00E+00	0.00E+00	0.00E+00
Tai Mong Tsai Road	A	0	6000	0.00E+00	0.00E+00	0.00E+00
Tai Mong Tsai Road	B	0	6000	0.00E+00	0.00E+00	0.00E+00
Tai Mong Tsai Road	C	0	4120	0.00E+00	0.00E+00	0.00E+00
Tai Mong Tsai Road	D	0	4120	0.00E+00	0.00E+00	0.00E+00
Tai Po Road	A	0	9190	0.00E+00	0.00E+00	0.00E+00
Tai Po Road	B	0	5840	0.00E+00	0.00E+00	0.00E+00
Tai Po Road	C	0	5840	0.00E+00	0.00E+00	0.00E+00
Castle Peak Road	-	0.076923077	12980	5.05E-04	2.29E-02	2.35E-02
Route Twisk	A	0.076923077	6270	2.90E-04	4.72E-03	5.01E-03
Route Twisk	B	0	7250	0.00E+00	0.00E+00	0.00E+00
Route Twisk	C	0	7250	0.00E+00	0.00E+00	0.00E+00
South Lantau Road	A	0	2980	0.00E+00	0.00E+00	0.00E+00
South Lantau Road	B	0	1210	0.00E+00	0.00E+00	0.00E+00
South Lantau Road	C	0	1210	0.00E+00	0.00E+00	0.00E+00
Tuen Mun Road	A	0	96120	0.00E+00	0.00E+00	0.00E+00
Tuen Mun Road	B	0	96120	0.00E+00	0.00E+00	0.00E+00
Tuen Mun Road	C	0.076923077	85410	4.46E-03	1.00E-01	1.04E-01
Tuen Mun Road	D	0	95470	0.00E+00	0.00E+00	0.00E+00
Total				1.76E-02	3.77E-01	3.95E-01

LS PLL

Roads	Section	Slope	Failure Vol Range	Height Range	LS Frequency per year	Slope	Height Vol	V Factor	Expected Fatality	Scale Factor	Consequence	PLL
Cape Collinson Road	A	up	< 20	< 10	6.15E-01	0.88	0.65	0.0455	0.03	0.4	5.46E-04	1.92E-04
Cape Collinson Road	A	up	< 20	10 to 20	6.15E-01	0.88	0.10	0.0685	0.03	0.4	8.22E-04	4.45E-05
Cape Collinson Road	A	up	< 20	>= 20	6.15E-01	0.88	0.02	0.0835	0.03	0.4	1.00E-03	1.09E-05
Cape Collinson Road	A	up	20 to 50	< 10	6.15E-01	0.88	0.05	0.3500	0.03	0.7	7.35E-03	1.99E-04
Cape Collinson Road	A	up	20 to 50	10 to 20	6.15E-01	0.88	0.05	0.4350	0.03	0.7	9.14E-03	2.47E-04
Cape Collinson Road	A	up	20 to 50	>= 20	6.15E-01	0.88	0.02	0.4850	0.03	0.7	1.02E-02	1.10E-04
Cape Collinson Road	A	up	50 to 500	< 10	6.15E-01	0.88	0.01	0.5850	0.03	1.5	2.63E-02	1.43E-04
Cape Collinson Road	A	up	50 to 500	10 to 20	6.15E-01	0.88	0.02	0.6650	0.03	1.5	2.99E-02	3.24E-04
Cape Collinson Road	A	up	50 to 500	>= 20	6.15E-01	0.88	0.07	0.6950	0.03	1.5	3.13E-02	1.19E-03
Cape Collinson Road	A	up	500 to 2000	< 10	6.15E-01	0.88	0.00	0.8900	0.03	2	5.34E-02	0.00E+00
Cape Collinson Road	A	up	500 to 2000	10 to 20	6.15E-01	0.88	0.00	0.9500	0.03	2	5.70E-02	0.00E+00
Cape Collinson Road	A	up	500 to 2000	>= 20	6.15E-01	0.88	0.01	0.9500	0.03	2	5.70E-02	3.09E-04
Cape Collinson Road	A	up	> 2000	< 10	6.15E-01	0.88	0.00	0.9500	0.03	2.5	7.13E-02	0.00E+00
Cape Collinson Road	A	up	> 2000	10 to 20	6.15E-01	0.88	0.00	0.9500	0.03	2.5	7.13E-02	0.00E+00
Cape Collinson Road	A	up	> 2000	>= 20	6.15E-01	0.88	0.00	0.9500	0.03	2.5	7.13E-02	0.00E+00
Cape Collinson Road	A	down	< 20	< 10	6.15E-01	0.12	0.03	0.0039	0.03	0.6	6.98E-05	1.55E-07
Cape Collinson Road	A	down	< 20	10 to 20	6.15E-01	0.12	0.03	0.0039	0.03	0.6	6.98E-05	1.55E-07
Cape Collinson Road	A	down	< 20	>= 20	6.15E-01	0.12	0.03	0.0039	0.03	0.6	6.98E-05	1.55E-07
Cape Collinson Road	A	down	20 to 50	< 10	6.15E-01	0.12	0.07	0.0194	0.03	1	5.81E-04	2.86E-06
Cape Collinson Road	A	down	20 to 50	10 to 20	6.15E-01	0.12	0.07	0.0194	0.03	1	5.81E-04	2.86E-06
Cape Collinson Road	A	down	20 to 50	>= 20	6.15E-01	0.12	0.07	0.0194	0.03	1	5.81E-04	2.86E-06
Cape Collinson Road	A	down	50 to 200	< 10	6.15E-01	0.12	0.23	0.0775	0.03	1.5	3.49E-03	6.01E-05
Cape Collinson Road	A	down	50 to 200	10 to 20	6.15E-01	0.12	0.23	0.0775	0.03	1.5	3.49E-03	6.01E-05
Cape Collinson Road	A	down	50 to 200	>= 20	6.15E-01	0.12	0.23	0.0775	0.03	1.5	3.49E-03	6.01E-05
Cape Collinson Road	A	down	200 to 1000	< 10	6.15E-01	0.12	0.00	0.2200	0.03	2	1.32E-02	3.25E-06
Cape Collinson Road	A	down	200 to 1000	10 to 20	6.15E-01	0.12	0.00	0.2200	0.03	2	1.32E-02	3.25E-06
Cape Collinson Road	A	down	200 to 1000	>= 20	6.15E-01	0.12	0.00	0.2200	0.03	2	1.32E-02	3.25E-06
Cape Collinson Road	A	down	> 1000	< 10	6.15E-01	0.12	0.00	0.3070	0.03	4	3.68E-02	0.00E+00
Cape Collinson Road	A	down	> 1000	10 to 20	6.15E-01	0.12	0.00	0.3070	0.03	4	3.68E-02	0.00E+00
Cape Collinson Road	A	down	> 1000	>= 20	6.15E-01	0.12	0.00	0.3070	0.03	4	3.68E-02	0.00E+00
Cape Collinson Road	B	up	< 20	< 10	2.31E-01	1	0.00	0.0455	0.03	0.4	5.46E-04	0.00E+00
Cape Collinson Road	B	up	< 20	10 to 20	2.31E-01	1	0.35	0.0685	0.03	0.4	8.22E-04	6.64E-05
Cape Collinson Road	B	up	< 20	>= 20	2.31E-01	1	0.00	0.0835	0.03	0.4	1.00E-03	0.00E+00
Cape Collinson Road	B	up	20 to 50	< 10	2.31E-01	1	0.00	0.3500	0.03	0.7	7.35E-03	0.00E+00
Cape Collinson Road	B	up	20 to 50	10 to 20	2.31E-01	1	0.30	0.4350	0.03	0.7	9.14E-03	6.32E-04
Cape Collinson Road	B	up	20 to 50	>= 20	2.31E-01	1	0.00	0.4850	0.03	0.7	1.02E-02	0.00E+00
Cape Collinson Road	B	up	50 to 500	< 10	2.31E-01	1	0.00	0.5850	0.03	1.5	2.63E-02	0.00E+00
Cape Collinson Road	B	up	50 to 500	10 to 20	2.31E-01	1	0.20	0.6650	0.03	1.5	2.99E-02	1.38E-03
Cape Collinson Road	B	up	50 to 500	>= 20	2.31E-01	1	0.00	0.6950	0.03	1.5	3.13E-02	0.00E+00
Cape Collinson Road	B	up	500 to 2000	< 10	2.31E-01	1	0.00	0.8900	0.03	2	5.34E-02	0.00E+00
Cape Collinson Road	B	up	500 to 2000	10 to 20	2.31E-01	1	0.15	0.9500	0.03	2	5.70E-02	1.97E-03
Cape Collinson Road	B	up	500 to 2000	>= 20	2.31E-01	1	0.00	0.9500	0.03	2	5.70E-02	0.00E+00
Cape Collinson Road	B	up	> 2000	< 10	2.31E-01	1	0.00	0.9500	0.03	2.5	7.13E-02	0.00E+00
Cape Collinson Road	B	up	> 2000	10 to 20	2.31E-01	1	0.00	0.9500	0.03	2.5	7.13E-02	0.00E+00
Cape Collinson Road	B	up	> 2000	>= 20	2.31E-01	1	0.00	0.9500	0.03	2.5	7.13E-02	0.00E+00
Cape Collinson Road	B	down	< 20	< 10	2.31E-01	0	0.00	0.0039	0.03	0.6	6.98E-05	0.00E+00
Cape Collinson Road	B	down	< 20	10 to 20	2.31E-01	0	0.00	0.0039	0.03	0.6	6.98E-05	0.00E+00
Cape Collinson Road	B	down	< 20	>= 20	2.31E-01	0	0.00	0.0039	0.03	0.6	6.98E-05	0.00E+00
Cape Collinson Road	B	down	20 to 50	< 10	2.31E-01	0	0.00	0.0194	0.03	1	5.81E-04	0.00E+00
Cape Collinson Road	B	down	20 to 50	10 to 20	2.31E-01	0	0.00	0.0194	0.03	1	5.81E-04	0.00E+00
Cape Collinson Road	B	down	20 to 50	>= 20	2.31E-01	0	0.00	0.0194	0.03	1	5.81E-04	0.00E+00
Cape Collinson Road	B	down	50 to 200	< 10	2.31E-01	0	0.00	0.0775	0.03	1.5	3.49E-03	0.00E+00
Cape Collinson Road	B	down	50 to 200	10 to 20	2.31E-01	0	0.00	0.0775	0.03	1.5	3.49E-03	0.00E+00
Cape Collinson Road	B	down	50 to 200	>= 20	2.31E-01	0	0.00	0.0775	0.03	1.5	3.49E-03	0.00E+00
Cape Collinson Road	B	down	200 to 1000	< 10	2.31E-01	0	0.00	0.2200	0.03	2	1.32E-02	0.00E+00
Cape Collinson Road	B	down	200 to 1000	10 to 20	2.31E-01	0	0.00	0.2200	0.03	2	1.32E-02	0.00E+00
Cape Collinson Road	B	down	200 to 1000	>= 20	2.31E-01	0	0.00	0.2200	0.03	2	1.32E-02	0.00E+00
Cape Collinson Road	B	down	> 1000	< 10	2.31E-01	0	0.00	0.3070	0.03	4	3.68E-02	0.00E+00
Cape Collinson Road	B	down	> 1000	10 to 20	2.31E-01	0	0.00	0.3070	0.03	4	3.68E-02	0.00E+00
Cape Collinson Road	B	down	> 1000	>= 20	2.31E-01	0	0.00	0.3070	0.03	4	3.68E-02	0.00E+00
Castle Peak Road	-	up	< 20	< 10	2.38E+00	0.87	0.23	0.0455	1	0.4	1.82E-02	8.68E-03
Castle Peak Road	-	up	< 20	10 to 20	2.38E+00	0.87	0.15	0.0685	1	0.4	2.74E-02	8.53E-03
Castle Peak Road	-	up	< 20	>= 20	2.38E+00	0.87	0.05	0.0835	1	0.4	3.34E-02	3.46E-03
Castle Peak Road	-	up	20 to 50	< 10	2.38E+00	0.87	0.10	0.3500	1	0.7	2.45E-01	5.08E-02
Castle Peak Road	-	up	20 to 50	10 to 20	2.38E+00	0.87	0.10	0.4350	1	0.7	3.05E-01	6.32E-02
Castle Peak Road	-	up	20 to 50	>= 20	2.38E+00	0.87	0.08	0.4850	1	0.7	3.40E-01	5.63E-02
Castle Peak Road	-	up	50 to 500	< 10	2.38E+00	0.87	0.05	0.5850	1	1.5	8.78E-01	9.10E-02
Castle Peak Road	-	up	50 to 500	10 to 20	2.38E+00	0.87	0.05	0.6650	1	1.5	9.98E-01	1.03E-01
Castle Peak Road	-	up	50 to 500	>= 20	2.38E+00	0.87	0.08	0.6950	1	1.5	1.04E+00	1.73E-01
Castle Peak Road	-	up	500 to 2000	< 10	2.38E+00	0.87	0.05	0.8900	1	2	1.78E+00	1.85E-01
Castle Peak Road	-	up	500 to 2000	10 to 20	2.38E+00	0.87	0.01	0.9500	1	2	1.90E+00	3.94E-02
Castle Peak Road	-	up	500 to 2000	>= 20	2.38E+00	0.87	0.05	0.9500	1	2	1.90E+00	1.97E-01
Castle Peak Road	-	up	> 2000	< 10	2.38E+00	0.87	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Castle Peak Road	-	up	> 2000	10 to 20	2.38E+00	0.87	0.00	0.9500	1	2.5	2.38E+00	0.00E+00

LS PLL

Roads	Section	Slope	Failure Vol Range	Height Range	LS Frequency per year	Slope	Height Vol	V Factor	Expected Fatality	Scale Factor	Consequence	PLL
Castle Peak Road	-	up	> 2000	>= 20	2.38E+00	0.87	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Castle Peak Road	-	down	< 20	< 10	2.38E+00	0.13	0.17	0.0039	1	0.6	2.33E-03	1.20E-04
Castle Peak Road	-	down	< 20	10 to 20	2.38E+00	0.13	0.17	0.0039	1	0.6	2.33E-03	1.20E-04
Castle Peak Road	-	down	< 20	>= 20	2.38E+00	0.13	0.17	0.0039	1	0.6	2.33E-03	1.20E-04
Castle Peak Road	-	down	20 to 50	< 10	2.38E+00	0.13	0.07	0.0194	1	1	1.94E-02	4.00E-04
Castle Peak Road	-	down	20 to 50	10 to 20	2.38E+00	0.13	0.07	0.0194	1	1	1.94E-02	4.00E-04
Castle Peak Road	-	down	20 to 50	>= 20	2.38E+00	0.13	0.07	0.0194	1	1	1.94E-02	4.00E-04
Castle Peak Road	-	down	50 to 200	< 10	2.38E+00	0.13	0.05	0.0775	1	1.5	1.16E-01	1.80E-03
Castle Peak Road	-	down	50 to 200	10 to 20	2.38E+00	0.13	0.05	0.0775	1	1.5	1.16E-01	1.80E-03
Castle Peak Road	-	down	50 to 200	>= 20	2.38E+00	0.13	0.05	0.0775	1	1.5	1.16E-01	1.80E-03
Castle Peak Road	-	down	200 to 1000	< 10	2.38E+00	0.13	0.05	0.2200	1	2	4.40E-01	6.82E-03
Castle Peak Road	-	down	200 to 1000	10 to 20	2.38E+00	0.13	0.05	0.2200	1	2	4.40E-01	6.82E-03
Castle Peak Road	-	down	200 to 1000	>= 20	2.38E+00	0.13	0.05	0.2200	1	2	4.40E-01	6.82E-03
Castle Peak Road	-	down	> 1000	< 10	2.38E+00	0.13	0.00	0.3070	1	4	1.23E+00	0.00E+00
Castle Peak Road	-	down	> 1000	10 to 20	2.38E+00	0.13	0.00	0.3070	1	4	1.23E+00	0.00E+00
Castle Peak Road	-	down	> 1000	>= 20	2.38E+00	0.13	0.00	0.3070	1	4	1.23E+00	0.00E+00
Chung Hom Kok Road	-	up	< 20	< 10	3.85E-01	0.8	0.40	0.0455	0.03	0.4	5.46E-04	6.72E-05
Chung Hom Kok Road	-	up	< 20	10 to 20	3.85E-01	0.8	0.30	0.0685	0.03	0.4	8.22E-04	7.59E-05
Chung Hom Kok Road	-	up	< 20	>= 20	3.85E-01	0.8	0.00	0.0835	0.03	0.4	1.00E-03	0.00E+00
Chung Hom Kok Road	-	up	20 to 50	< 10	3.85E-01	0.8	0.20	0.3500	0.03	0.7	7.35E-03	4.52E-04
Chung Hom Kok Road	-	up	20 to 50	10 to 20	3.85E-01	0.8	0.05	0.4350	0.03	0.7	9.14E-03	1.41E-04
Chung Hom Kok Road	-	up	20 to 50	>= 20	3.85E-01	0.8	0.00	0.4850	0.03	0.7	1.02E-02	0.00E+00
Chung Hom Kok Road	-	up	50 to 500	< 10	3.85E-01	0.8	0.02	0.5850	0.03	1.5	2.63E-02	1.62E-04
Chung Hom Kok Road	-	up	50 to 500	10 to 20	3.85E-01	0.8	0.03	0.6650	0.03	1.5	2.99E-02	2.76E-04
Chung Hom Kok Road	-	up	50 to 500	>= 20	3.85E-01	0.8	0.00	0.6950	0.03	1.5	3.13E-02	0.00E+00
Chung Hom Kok Road	-	up	500 to 2000	< 10	3.85E-01	0.8	0.00	0.8900	0.03	2	5.34E-02	0.00E+00
Chung Hom Kok Road	-	up	500 to 2000	10 to 20	3.85E-01	0.8	0.00	0.9500	0.03	2	5.70E-02	0.00E+00
Chung Hom Kok Road	-	up	500 to 2000	>= 20	3.85E-01	0.8	0.00	0.9500	0.03	2	5.70E-02	0.00E+00
Chung Hom Kok Road	-	up	> 2000	< 10	3.85E-01	0.8	0.00	0.9500	0.03	2.5	7.13E-02	0.00E+00
Chung Hom Kok Road	-	up	> 2000	10 to 20	3.85E-01	0.8	0.00	0.9500	0.03	2.5	7.13E-02	0.00E+00
Chung Hom Kok Road	-	up	> 2000	>= 20	3.85E-01	0.8	0.00	0.9500	0.03	2.5	7.13E-02	0.00E+00
Chung Hom Kok Road	-	down	< 20	< 10	3.85E-01	0.2	0.08	0.0039	0.03	0.6	6.98E-05	4.47E-07
Chung Hom Kok Road	-	down	< 20	10 to 20	3.85E-01	0.2	0.08	0.0039	0.03	0.6	6.98E-05	4.47E-07
Chung Hom Kok Road	-	down	< 20	>= 20	3.85E-01	0.2	0.08	0.0039	0.03	0.6	6.98E-05	4.47E-07
Chung Hom Kok Road	-	down	20 to 50	< 10	3.85E-01	0.2	0.23	0.0194	0.03	1	5.81E-04	1.04E-05
Chung Hom Kok Road	-	down	20 to 50	10 to 20	3.85E-01	0.2	0.23	0.0194	0.03	1	5.81E-04	1.04E-05
Chung Hom Kok Road	-	down	20 to 50	>= 20	3.85E-01	0.2	0.23	0.0194	0.03	1	5.81E-04	1.04E-05
Chung Hom Kok Road	-	down	50 to 200	< 10	3.85E-01	0.2	0.02	0.0775	0.03	1.5	3.49E-03	4.47E-06
Chung Hom Kok Road	-	down	50 to 200	10 to 20	3.85E-01	0.2	0.02	0.0775	0.03	1.5	3.49E-03	4.47E-06
Chung Hom Kok Road	-	down	50 to 200	>= 20	3.85E-01	0.2	0.02	0.0775	0.03	1.5	3.49E-03	4.47E-06
Chung Hom Kok Road	-	down	200 to 1000	< 10	3.85E-01	0.2	0.00	0.2200	0.03	2	1.32E-02	0.00E+00
Chung Hom Kok Road	-	down	200 to 1000	10 to 20	3.85E-01	0.2	0.00	0.2200	0.03	2	1.32E-02	0.00E+00
Chung Hom Kok Road	-	down	200 to 1000	>= 20	3.85E-01	0.2	0.00	0.2200	0.03	2	1.32E-02	0.00E+00
Chung Hom Kok Road	-	down	> 1000	< 10	3.85E-01	0.2	0.00	0.3070	0.03	4	3.68E-02	0.00E+00
Chung Hom Kok Road	-	down	> 1000	10 to 20	3.85E-01	0.2	0.00	0.3070	0.03	4	3.68E-02	0.00E+00
Chung Hom Kok Road	-	down	> 1000	>= 20	3.85E-01	0.2	0.00	0.3070	0.03	4	3.68E-02	0.00E+00
Clear Water Bay Road	-	up	< 20	< 10	5.38E-01	1	0.55	0.0231	1	0.4	9.25E-03	2.74E-03
Clear Water Bay Road	-	up	< 20	10 to 20	5.38E-01	1	0.05	0.0406	1	0.4	1.63E-02	4.38E-04
Clear Water Bay Road	-	up	< 20	>= 20	5.38E-01	1	0.04	0.0628	1	0.4	2.51E-02	5.41E-04
Clear Water Bay Road	-	up	20 to 50	< 10	5.38E-01	1	0.10	0.1825	1	0.7	1.28E-01	6.88E-03
Clear Water Bay Road	-	up	20 to 50	10 to 20	5.38E-01	1	0.04	0.3000	1	0.7	2.10E-01	4.52E-03
Clear Water Bay Road	-	up	20 to 50	>= 20	5.38E-01	1	0.06	0.4275	1	0.7	2.99E-01	9.67E-03
Clear Water Bay Road	-	up	50 to 500	< 10	5.38E-01	1	0.01	0.3120	1	1.5	4.68E-01	2.52E-03
Clear Water Bay Road	-	up	50 to 500	10 to 20	5.38E-01	1	0.04	0.5175	1	1.5	7.76E-01	1.67E-02
Clear Water Bay Road	-	up	50 to 500	>= 20	5.38E-01	1	0.08	0.6625	1	1.5	9.94E-01	4.28E-02
Clear Water Bay Road	-	up	500 to 2000	< 10	5.38E-01	1	0.00	0.4825	1	2	9.65E-01	0.00E+00
Clear Water Bay Road	-	up	500 to 2000	10 to 20	5.38E-01	1	0.01	0.8025	1	2	1.61E+00	8.64E-03
Clear Water Bay Road	-	up	500 to 2000	>= 20	5.38E-01	1	0.02	0.9500	1	2	1.90E+00	2.05E-02
Clear Water Bay Road	-	up	> 2000	< 10	5.38E-01	1	0.00	0.5975	1	2.5	1.49E+00	0.00E+00
Clear Water Bay Road	-	up	> 2000	10 to 20	5.38E-01	1	0.00	0.9200	1	2.5	2.30E+00	0.00E+00
Clear Water Bay Road	-	up	> 2000	>= 20	5.38E-01	1	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Clear Water Bay Road	-	down	< 20	< 10	5.38E-01	0	0.00	0.0026	1	0.6	1.55E-03	0.00E+00
Clear Water Bay Road	-	down	< 20	10 to 20	5.38E-01	0	0.00	0.0026	1	0.6	1.55E-03	0.00E+00
Clear Water Bay Road	-	down	< 20	>= 20	5.38E-01	0	0.00	0.0026	1	0.6	1.55E-03	0.00E+00
Clear Water Bay Road	-	down	20 to 50	< 10	5.38E-01	0	0.00	0.0129	1	1	1.29E-02	0.00E+00
Clear Water Bay Road	-	down	20 to 50	10 to 20	5.38E-01	0	0.00	0.0129	1	1	1.29E-02	0.00E+00
Clear Water Bay Road	-	down	20 to 50	>= 20	5.38E-01	0	0.00	0.0129	1	1	1.29E-02	0.00E+00
Clear Water Bay Road	-	down	50 to 200	< 10	5.38E-01	0	0.00	0.0517	1	1.5	7.75E-02	0.00E+00
Clear Water Bay Road	-	down	50 to 200	10 to 20	5.38E-01	0	0.00	0.0517	1	1.5	7.75E-02	0.00E+00
Clear Water Bay Road	-	down	50 to 200	>= 20	5.38E-01	0	0.00	0.0517	1	1.5	7.75E-02	0.00E+00
Clear Water Bay Road	-	down	200 to 1000	< 10	5.38E-01	0	0.00	0.1473	1	2	2.95E-01	0.00E+00
Clear Water Bay Road	-	down	200 to 1000	10 to 20	5.38E-01	0	0.00	0.1473	1	2	2.95E-01	0.00E+00
Clear Water Bay Road	-	down	200 to 1000	>= 20	5.38E-01	0	0.00	0.1473	1	2	2.95E-01	0.00E+00
Clear Water Bay Road	-	down	> 1000	< 10	5.38E-01	0	0.00	0.2053	1	4	8.21E-01	0.00E+00

LS PLL

Roads	Section	Slope	Failure Vol Range	Height Range	LS Frequency per year	Slope	Height Vol	V Factor	Expected Fatality	Scale Factor	Consequence	PLL
Clear Water Bay Road	-	down	> 1000	10 to 20	5.38E-01	0	0.00	0.2053	1	4	8.21E-01	0.00E+00
Clear Water Bay Road	-	down	> 1000	>= 20	5.38E-01	0	0.00	0.2053	1	4	8.21E-01	0.00E+00
Island Road	-	up	< 20	< 10	4.62E-01	0.83	0.65	0.0455	1	0.4	1.82E-02	4.53E-03
Island Road	-	up	< 20	10 to 20	4.62E-01	0.83	0.15	0.0685	1	0.4	2.74E-02	1.57E-03
Island Road	-	up	< 20	>= 20	4.62E-01	0.83	0.00	0.0835	1	0.4	3.34E-02	0.00E+00
Island Road	-	up	20 to 50	< 10	4.62E-01	0.83	0.15	0.3500	1	0.7	2.45E-01	1.41E-02
Island Road	-	up	20 to 50	10 to 20	4.62E-01	0.83	0.03	0.4350	1	0.7	3.05E-01	3.50E-03
Island Road	-	up	20 to 50	>= 20	4.62E-01	0.83	0.00	0.4850	1	0.7	3.40E-01	0.00E+00
Island Road	-	up	50 to 500	< 10	4.62E-01	0.83	0.00	0.5850	1	1.5	8.78E-01	0.00E+00
Island Road	-	up	50 to 500	10 to 20	4.62E-01	0.83	0.02	0.6650	1	1.5	9.98E-01	7.64E-03
Island Road	-	up	50 to 500	>= 20	4.62E-01	0.83	0.00	0.6950	1	1.5	1.04E+00	0.00E+00
Island Road	-	up	500 to 2000	< 10	4.62E-01	0.83	0.00	0.8900	1	2	1.78E+00	0.00E+00
Island Road	-	up	500 to 2000	10 to 20	4.62E-01	0.83	0.00	0.9500	1	2	1.90E+00	0.00E+00
Island Road	-	up	500 to 2000	>= 20	4.62E-01	0.83	0.00	0.9500	1	2	1.90E+00	0.00E+00
Island Road	-	up	> 2000	< 10	4.62E-01	0.83	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Island Road	-	up	> 2000	10 to 20	4.62E-01	0.83	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Island Road	-	up	> 2000	>= 20	4.62E-01	0.83	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Island Road	-	down	< 20	< 10	4.62E-01	0.17	0.08	0.0039	1	0.6	2.33E-03	1.52E-05
Island Road	-	down	< 20	10 to 20	4.62E-01	0.17	0.08	0.0039	1	0.6	2.33E-03	1.52E-05
Island Road	-	down	< 20	>= 20	4.62E-01	0.17	0.08	0.0039	1	0.6	2.33E-03	1.52E-05
Island Road	-	down	20 to 50	< 10	4.62E-01	0.17	0.23	0.0194	1	1	1.94E-02	3.55E-04
Island Road	-	down	20 to 50	10 to 20	4.62E-01	0.17	0.23	0.0194	1	1	1.94E-02	3.55E-04
Island Road	-	down	20 to 50	>= 20	4.62E-01	0.17	0.23	0.0194	1	1	1.94E-02	3.55E-04
Island Road	-	down	50 to 200	< 10	4.62E-01	0.17	0.02	0.0775	1	1.5	1.16E-01	1.52E-04
Island Road	-	down	50 to 200	10 to 20	4.62E-01	0.17	0.02	0.0775	1	1.5	1.16E-01	1.52E-04
Island Road	-	down	50 to 200	>= 20	4.62E-01	0.17	0.02	0.0775	1	1.5	1.16E-01	1.52E-04
Island Road	-	down	200 to 1000	< 10	4.62E-01	0.17	0.00	0.2200	1	2	4.40E-01	0.00E+00
Island Road	-	down	200 to 1000	10 to 20	4.62E-01	0.17	0.00	0.2200	1	2	4.40E-01	0.00E+00
Island Road	-	down	200 to 1000	>= 20	4.62E-01	0.17	0.00	0.2200	1	2	4.40E-01	0.00E+00
Island Road	-	down	> 1000	< 10	4.62E-01	0.17	0.00	0.3070	1	4	1.23E+00	0.00E+00
Island Road	-	down	> 1000	10 to 20	4.62E-01	0.17	0.00	0.3070	1	4	1.23E+00	0.00E+00
Island Road	-	down	> 1000	>= 20	4.62E-01	0.17	0.00	0.3070	1	4	1.23E+00	0.00E+00
Kennedy Road	-	up	< 20	< 10	1.00E+00	0.85	0.60	0.0455	1	0.4	1.82E-02	9.28E-03
Kennedy Road	-	up	< 20	10 to 20	1.00E+00	0.85	0.20	0.0685	1	0.4	2.74E-02	4.66E-03
Kennedy Road	-	up	< 20	>= 20	1.00E+00	0.85	0.01	0.0835	1	0.4	3.34E-02	2.84E-04
Kennedy Road	-	up	20 to 50	< 10	1.00E+00	0.85	0.03	0.3500	1	0.7	2.45E-01	6.25E-03
Kennedy Road	-	up	20 to 50	10 to 20	1.00E+00	0.85	0.05	0.4350	1	0.7	3.05E-01	1.29E-02
Kennedy Road	-	up	20 to 50	>= 20	1.00E+00	0.85	0.03	0.4850	1	0.7	3.40E-01	8.66E-03
Kennedy Road	-	up	50 to 500	< 10	1.00E+00	0.85	0.00	0.5850	1	1.5	8.78E-01	0.00E+00
Kennedy Road	-	up	50 to 500	10 to 20	1.00E+00	0.85	0.00	0.6650	1	1.5	9.98E-01	0.00E+00
Kennedy Road	-	up	50 to 500	>= 20	1.00E+00	0.85	0.03	0.6950	1	1.5	1.04E+00	2.66E-02
Kennedy Road	-	up	500 to 2000	< 10	1.00E+00	0.85	0.00	0.8900	1	2	1.78E+00	0.00E+00
Kennedy Road	-	up	500 to 2000	10 to 20	1.00E+00	0.85	0.00	0.9500	1	2	1.90E+00	0.00E+00
Kennedy Road	-	up	500 to 2000	>= 20	1.00E+00	0.85	0.05	0.9500	1	2	1.90E+00	8.08E-02
Kennedy Road	-	up	> 2000	< 10	1.00E+00	0.85	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Kennedy Road	-	up	> 2000	10 to 20	1.00E+00	0.85	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Kennedy Road	-	up	> 2000	>= 20	1.00E+00	0.85	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Kennedy Road	-	down	< 20	< 10	1.00E+00	0.15	0.30	0.0039	1	0.6	2.33E-03	1.05E-04
Kennedy Road	-	down	< 20	10 to 20	1.00E+00	0.15	0.30	0.0039	1	0.6	2.33E-03	1.05E-04
Kennedy Road	-	down	< 20	>= 20	1.00E+00	0.15	0.30	0.0039	1	0.6	2.33E-03	1.05E-04
Kennedy Road	-	down	20 to 50	< 10	1.00E+00	0.15	0.03	0.0194	1	1	1.94E-02	9.69E-05
Kennedy Road	-	down	20 to 50	10 to 20	1.00E+00	0.15	0.03	0.0194	1	1	1.94E-02	9.69E-05
Kennedy Road	-	down	20 to 50	>= 20	1.00E+00	0.15	0.03	0.0194	1	1	1.94E-02	9.69E-05
Kennedy Road	-	down	50 to 200	< 10	1.00E+00	0.15	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Kennedy Road	-	down	50 to 200	10 to 20	1.00E+00	0.15	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Kennedy Road	-	down	50 to 200	>= 20	1.00E+00	0.15	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Kennedy Road	-	down	200 to 1000	< 10	1.00E+00	0.15	0.00	0.2200	1	2	4.40E-01	0.00E+00
Kennedy Road	-	down	200 to 1000	10 to 20	1.00E+00	0.15	0.00	0.2200	1	2	4.40E-01	0.00E+00
Kennedy Road	-	down	200 to 1000	>= 20	1.00E+00	0.15	0.00	0.2200	1	2	4.40E-01	0.00E+00
Kennedy Road	-	down	> 1000	< 10	1.00E+00	0.15	0.00	0.3070	1	4	1.23E+00	0.00E+00
Kennedy Road	-	down	> 1000	10 to 20	1.00E+00	0.15	0.00	0.3070	1	4	1.23E+00	0.00E+00
Kennedy Road	-	down	> 1000	>= 20	1.00E+00	0.15	0.00	0.3070	1	4	1.23E+00	0.00E+00
Kwun Tong Road	-	up	< 20	< 10	2.31E-01	1	0.07	0.0231	3	0.4	2.78E-02	4.48E-04
Kwun Tong Road	-	up	< 20	10 to 20	2.31E-01	1	0.05	0.0406	3	0.4	4.88E-02	5.63E-04
Kwun Tong Road	-	up	< 20	>= 20	2.31E-01	1	0.03	0.0628	3	0.4	7.53E-02	5.21E-04
Kwun Tong Road	-	up	20 to 50	< 10	2.31E-01	1	0.25	0.1825	3	0.7	3.83E-01	2.21E-02
Kwun Tong Road	-	up	20 to 50	10 to 20	2.31E-01	1	0.20	0.3000	3	0.7	6.30E-01	2.91E-02
Kwun Tong Road	-	up	20 to 50	>= 20	2.31E-01	1	0.10	0.4275	3	0.7	8.98E-01	2.07E-02
Kwun Tong Road	-	up	50 to 500	< 10	2.31E-01	1	0.02	0.3120	3	1.5	1.40E+00	6.48E-03
Kwun Tong Road	-	up	50 to 500	10 to 20	2.31E-01	1	0.10	0.5175	3	1.5	2.33E+00	5.37E-02
Kwun Tong Road	-	up	50 to 500	>= 20	2.31E-01	1	0.15	0.6625	3	1.5	2.98E+00	1.03E-01
Kwun Tong Road	-	up	500 to 2000	< 10	2.31E-01	1	0.00	0.4825	3	2	2.90E+00	0.00E+00
Kwun Tong Road	-	up	500 to 2000	10 to 20	2.31E-01	1	0.00	0.8025	3	2	4.82E+00	0.00E+00
Kwun Tong Road	-	up	500 to 2000	>= 20	2.31E-01	1	0.03	0.9500	3	2	5.70E+00	3.95E-02

LS PLL

Roads	Section	Slope	Failure Vol Range	Height Range	LS Frequency per year	Slope	Height Vol	V Factor	Expected Fatality	Scale Factor	Consequence	PLL
Kwun Tong Road	-	up	> 2000	< 10	2.31E-01	1	0.00	0.5975	3	2.5	4.48E+00	0.00E+00
Kwun Tong Road	-	up	> 2000	10 to 20	2.31E-01	1	0.00	0.9200	3	2.5	6.90E+00	0.00E+00
Kwun Tong Road	-	up	> 2000	>= 20	2.31E-01	1	0.00	0.9500	3	2.5	7.13E+00	0.00E+00
Kwun Tong Road	-	down	< 20	< 10	2.31E-01	0	0.00	0.0026	3	0.6	4.65E-03	0.00E+00
Kwun Tong Road	-	down	< 20	10 to 20	2.31E-01	0	0.00	0.0026	3	0.6	4.65E-03	0.00E+00
Kwun Tong Road	-	down	< 20	>= 20	2.31E-01	0	0.00	0.0026	3	0.6	4.65E-03	0.00E+00
Kwun Tong Road	-	down	20 to 50	< 10	2.31E-01	0	0.00	0.0129	3	1	3.88E-02	0.00E+00
Kwun Tong Road	-	down	20 to 50	10 to 20	2.31E-01	0	0.00	0.0129	3	1	3.88E-02	0.00E+00
Kwun Tong Road	-	down	20 to 50	>= 20	2.31E-01	0	0.00	0.0129	3	1	3.88E-02	0.00E+00
Kwun Tong Road	-	down	50 to 200	< 10	2.31E-01	0	0.00	0.0517	3	1.5	2.33E-01	0.00E+00
Kwun Tong Road	-	down	50 to 200	10 to 20	2.31E-01	0	0.00	0.0517	3	1.5	2.33E-01	0.00E+00
Kwun Tong Road	-	down	50 to 200	>= 20	2.31E-01	0	0.00	0.0517	3	1.5	2.33E-01	0.00E+00
Kwun Tong Road	-	down	200 to 1000	< 10	2.31E-01	0	0.00	0.1473	3	2	8.84E-01	0.00E+00
Kwun Tong Road	-	down	200 to 1000	10 to 20	2.31E-01	0	0.00	0.1473	3	2	8.84E-01	0.00E+00
Kwun Tong Road	-	down	200 to 1000	>= 20	2.31E-01	0	0.00	0.1473	3	2	8.84E-01	0.00E+00
Kwun Tong Road	-	down	> 1000	< 10	2.31E-01	0	0.00	0.2053	3	4	2.46E+00	0.00E+00
Kwun Tong Road	-	down	> 1000	10 to 20	2.31E-01	0	0.00	0.2053	3	4	2.46E+00	0.00E+00
Kwun Tong Road	-	down	> 1000	>= 20	2.31E-01	0	0.00	0.2053	3	4	2.46E+00	0.00E+00
Magazine Gap Road	-	up	< 20	< 10	1.31E+00	0.94	0.65	0.0455	1	0.4	1.82E-02	1.45E-02
Magazine Gap Road	-	up	< 20	10 to 20	1.31E+00	0.94	0.15	0.0685	1	0.4	2.74E-02	5.05E-03
Magazine Gap Road	-	up	< 20	>= 20	1.31E+00	0.94	0.00	0.0835	1	0.4	3.34E-02	0.00E+00
Magazine Gap Road	-	up	20 to 50	< 10	1.31E+00	0.94	0.08	0.3500	1	0.7	2.45E-01	2.41E-02
Magazine Gap Road	-	up	20 to 50	10 to 20	1.31E+00	0.94	0.05	0.4350	1	0.7	3.05E-01	1.87E-02
Magazine Gap Road	-	up	20 to 50	>= 20	1.31E+00	0.94	0.00	0.4850	1	0.7	3.40E-01	0.00E+00
Magazine Gap Road	-	up	50 to 500	< 10	1.31E+00	0.94	0.01	0.5850	1	1.5	8.78E-01	1.08E-02
Magazine Gap Road	-	up	50 to 500	10 to 20	1.31E+00	0.94	0.05	0.6650	1	1.5	9.98E-01	6.13E-02
Magazine Gap Road	-	up	50 to 500	>= 20	1.31E+00	0.94	0.00	0.6950	1	1.5	1.04E+00	0.00E+00
Magazine Gap Road	-	up	500 to 2000	< 10	1.31E+00	0.94	0.00	0.8900	1	2	1.78E+00	0.00E+00
Magazine Gap Road	-	up	500 to 2000	10 to 20	1.31E+00	0.94	0.01	0.9500	1	2	1.90E+00	2.34E-02
Magazine Gap Road	-	up	500 to 2000	>= 20	1.31E+00	0.94	0.00	0.9500	1	2	1.90E+00	0.00E+00
Magazine Gap Road	-	up	> 2000	< 10	1.31E+00	0.94	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Magazine Gap Road	-	up	> 2000	10 to 20	1.31E+00	0.94	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Magazine Gap Road	-	up	> 2000	>= 20	1.31E+00	0.94	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Magazine Gap Road	-	down	< 20	< 10	1.31E+00	0.06	0.30	0.0039	1	0.6	2.33E-03	5.47E-05
Magazine Gap Road	-	down	< 20	10 to 20	1.31E+00	0.06	0.30	0.0039	1	0.6	2.33E-03	5.47E-05
Magazine Gap Road	-	down	< 20	>= 20	1.31E+00	0.06	0.30	0.0039	1	0.6	2.33E-03	5.47E-05
Magazine Gap Road	-	down	20 to 50	< 10	1.31E+00	0.06	0.03	0.0194	1	1	1.94E-02	5.07E-05
Magazine Gap Road	-	down	20 to 50	10 to 20	1.31E+00	0.06	0.03	0.0194	1	1	1.94E-02	5.07E-05
Magazine Gap Road	-	down	20 to 50	>= 20	1.31E+00	0.06	0.03	0.0194	1	1	1.94E-02	5.07E-05
Magazine Gap Road	-	down	50 to 200	< 10	1.31E+00	0.06	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Magazine Gap Road	-	down	50 to 200	10 to 20	1.31E+00	0.06	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Magazine Gap Road	-	down	50 to 200	>= 20	1.31E+00	0.06	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Magazine Gap Road	-	down	200 to 1000	< 10	1.31E+00	0.06	0.00	0.2200	1	2	4.40E-01	0.00E+00
Magazine Gap Road	-	down	200 to 1000	10 to 20	1.31E+00	0.06	0.00	0.2200	1	2	4.40E-01	0.00E+00
Magazine Gap Road	-	down	200 to 1000	>= 20	1.31E+00	0.06	0.00	0.2200	1	2	4.40E-01	0.00E+00
Magazine Gap Road	-	down	> 1000	< 10	1.31E+00	0.06	0.00	0.3070	1	4	1.23E+00	0.00E+00
Magazine Gap Road	-	down	> 1000	10 to 20	1.31E+00	0.06	0.00	0.3070	1	4	1.23E+00	0.00E+00
Magazine Gap Road	-	down	> 1000	>= 20	1.31E+00	0.06	0.00	0.3070	1	4	1.23E+00	0.00E+00
Nam Fung Road	-	up	< 20	< 10	1.54E-01	1	0.50	0.0231	0.25	0.4	2.31E-03	1.78E-04
Nam Fung Road	-	up	< 20	10 to 20	1.54E-01	1	0.05	0.0406	0.25	0.4	4.06E-03	3.13E-05
Nam Fung Road	-	up	< 20	>= 20	1.54E-01	1	0.03	0.0628	0.25	0.4	6.28E-03	2.90E-05
Nam Fung Road	-	up	20 to 50	< 10	1.54E-01	1	0.25	0.1825	0.25	0.7	3.19E-02	1.23E-03
Nam Fung Road	-	up	20 to 50	10 to 20	1.54E-01	1	0.05	0.3000	0.25	0.7	5.25E-02	4.04E-04
Nam Fung Road	-	up	20 to 50	>= 20	1.54E-01	1	0.05	0.4275	0.25	0.7	7.48E-02	5.75E-04
Nam Fung Road	-	up	50 to 500	< 10	1.54E-01	1	0.00	0.3120	0.25	1.5	1.17E-01	0.00E+00
Nam Fung Road	-	up	50 to 500	10 to 20	1.54E-01	1	0.02	0.5175	0.25	1.5	1.94E-01	5.97E-04
Nam Fung Road	-	up	50 to 500	>= 20	1.54E-01	1	0.05	0.6625	0.25	1.5	2.48E-01	1.91E-03
Nam Fung Road	-	up	500 to 2000	< 10	1.54E-01	1	0.00	0.4825	0.25	2	2.41E-01	0.00E+00
Nam Fung Road	-	up	500 to 2000	10 to 20	1.54E-01	1	0.00	0.8025	0.25	2	4.01E-01	0.00E+00
Nam Fung Road	-	up	500 to 2000	>= 20	1.54E-01	1	0.00	0.9500	0.25	2	4.75E-01	0.00E+00
Nam Fung Road	-	up	> 2000	< 10	1.54E-01	1	0.00	0.5975	0.25	2.5	3.73E-01	0.00E+00
Nam Fung Road	-	up	> 2000	10 to 20	1.54E-01	1	0.00	0.9200	0.25	2.5	5.75E-01	0.00E+00
Nam Fung Road	-	up	> 2000	>= 20	1.54E-01	1	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Nam Fung Road	-	down	< 20	< 10	1.54E-01	0	0.00	0.0026	0.25	0.6	3.88E-04	0.00E+00
Nam Fung Road	-	down	< 20	10 to 20	1.54E-01	0	0.00	0.0026	0.25	0.6	3.88E-04	0.00E+00
Nam Fung Road	-	down	< 20	>= 20	1.54E-01	0	0.00	0.0026	0.25	0.6	3.88E-04	0.00E+00
Nam Fung Road	-	down	20 to 50	< 10	1.54E-01	0	0.00	0.0129	0.25	1	3.23E-03	0.00E+00
Nam Fung Road	-	down	20 to 50	10 to 20	1.54E-01	0	0.00	0.0129	0.25	1	3.23E-03	0.00E+00
Nam Fung Road	-	down	20 to 50	>= 20	1.54E-01	0	0.00	0.0129	0.25	1	3.23E-03	0.00E+00
Nam Fung Road	-	down	50 to 200	< 10	1.54E-01	0	0.00	0.0517	0.25	1.5	1.94E-02	0.00E+00
Nam Fung Road	-	down	50 to 200	10 to 20	1.54E-01	0	0.00	0.0517	0.25	1.5	1.94E-02	0.00E+00
Nam Fung Road	-	down	50 to 200	>= 20	1.54E-01	0	0.00	0.0517	0.25	1.5	1.94E-02	0.00E+00
Nam Fung Road	-	down	200 to 1000	< 10	1.54E-01	0	0.00	0.1473	0.25	2	7.37E-02	0.00E+00
Nam Fung Road	-	down	200 to 1000	10 to 20	1.54E-01	0	0.00	0.1473	0.25	2	7.37E-02	0.00E+00

LS PLL

Roads	Section	Slope	Failure Vol Range	Height Range	LS Frequency per year	Slope	Height Vol	V Factor	Expected Fatality	Scale Factor	Consequence	PLL
Nam Fung Road	-	down	200 to 1000	>= 20	1.54E-01	0	0.00	0.1473	0.25	2	7.37E-02	0.00E+00
Nam Fung Road	-	down	> 1000	< 10	1.54E-01	0	0.00	0.2053	0.25	4	2.05E-01	0.00E+00
Nam Fung Road	-	down	> 1000	10 to 20	1.54E-01	0	0.00	0.2053	0.25	4	2.05E-01	0.00E+00
Nam Fung Road	-	down	> 1000	>= 20	1.54E-01	0	0.00	0.2053	0.25	4	2.05E-01	0.00E+00
Peak Road	A	up	< 20	< 10	3.08E-01	0.75	0.40	0.0455	1	0.4	1.82E-02	1.68E-03
Peak Road	A	up	< 20	10 to 20	3.08E-01	0.75	0.20	0.0685	1	0.4	2.74E-02	1.26E-03
Peak Road	A	up	< 20	>= 20	3.08E-01	0.75	0.00	0.0835	1	0.4	3.34E-02	0.00E+00
Peak Road	A	up	20 to 50	< 10	3.08E-01	0.75	0.05	0.3500	1	0.7	2.45E-01	2.83E-03
Peak Road	A	up	20 to 50	10 to 20	3.08E-01	0.75	0.15	0.4350	1	0.7	3.05E-01	1.05E-02
Peak Road	A	up	20 to 50	>= 20	3.08E-01	0.75	0.00	0.4850	1	0.7	3.40E-01	0.00E+00
Peak Road	A	up	50 to 500	< 10	3.08E-01	0.75	0.01	0.5850	1	1.5	8.78E-01	2.03E-03
Peak Road	A	up	50 to 500	10 to 20	3.08E-01	0.75	0.15	0.6650	1	1.5	9.98E-01	3.45E-02
Peak Road	A	up	50 to 500	>= 20	3.08E-01	0.75	0.00	0.6950	1	1.5	1.04E+00	0.00E+00
Peak Road	A	up	500 to 2000	< 10	3.08E-01	0.75	0.00	0.8900	1	2	1.78E+00	0.00E+00
Peak Road	A	up	500 to 2000	10 to 20	3.08E-01	0.75	0.04	0.9500	1	2	1.90E+00	1.75E-02
Peak Road	A	up	500 to 2000	>= 20	3.08E-01	0.75	0.00	0.9500	1	2	1.90E+00	0.00E+00
Peak Road	A	up	> 2000	< 10	3.08E-01	0.75	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Peak Road	A	up	> 2000	10 to 20	3.08E-01	0.75	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Peak Road	A	up	> 2000	>= 20	3.08E-01	0.75	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Peak Road	A	down	< 20	< 10	3.08E-01	0.25	0.30	0.0039	1	0.6	2.33E-03	5.37E-05
Peak Road	A	down	< 20	10 to 20	3.08E-01	0.25	0.30	0.0039	1	0.6	2.33E-03	5.37E-05
Peak Road	A	down	< 20	>= 20	3.08E-01	0.25	0.30	0.0039	1	0.6	2.33E-03	5.37E-05
Peak Road	A	down	20 to 50	< 10	3.08E-01	0.25	0.03	0.0194	1	1	1.94E-02	4.97E-05
Peak Road	A	down	20 to 50	10 to 20	3.08E-01	0.25	0.03	0.0194	1	1	1.94E-02	4.97E-05
Peak Road	A	down	20 to 50	>= 20	3.08E-01	0.25	0.03	0.0194	1	1	1.94E-02	4.97E-05
Peak Road	A	down	50 to 200	< 10	3.08E-01	0.25	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Peak Road	A	down	50 to 200	10 to 20	3.08E-01	0.25	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Peak Road	A	down	50 to 200	>= 20	3.08E-01	0.25	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Peak Road	A	down	200 to 1000	< 10	3.08E-01	0.25	0.00	0.2200	1	2	4.40E-01	0.00E+00
Peak Road	A	down	200 to 1000	10 to 20	3.08E-01	0.25	0.00	0.2200	1	2	4.40E-01	0.00E+00
Peak Road	A	down	200 to 1000	>= 20	3.08E-01	0.25	0.00	0.2200	1	2	4.40E-01	0.00E+00
Peak Road	A	down	> 1000	< 10	3.08E-01	0.25	0.00	0.3070	1	4	1.23E+00	0.00E+00
Peak Road	A	down	> 1000	10 to 20	3.08E-01	0.25	0.00	0.3070	1	4	1.23E+00	0.00E+00
Peak Road	A	down	> 1000	>= 20	3.08E-01	0.25	0.00	0.3070	1	4	1.23E+00	0.00E+00
Peak Road	B	up	< 20	< 10	3.85E-01	1	0.82	0.0455	1	0.4	1.82E-02	5.74E-03
Peak Road	B	up	< 20	10 to 20	3.85E-01	1	0.08	0.0685	1	0.4	2.74E-02	8.43E-04
Peak Road	B	up	< 20	>= 20	3.85E-01	1	0.00	0.0835	1	0.4	3.34E-02	0.00E+00
Peak Road	B	up	20 to 50	< 10	3.85E-01	1	0.05	0.3500	1	0.7	2.45E-01	4.71E-03
Peak Road	B	up	20 to 50	10 to 20	3.85E-01	1	0.03	0.4350	1	0.7	3.05E-01	3.51E-03
Peak Road	B	up	20 to 50	>= 20	3.85E-01	1	0.00	0.4850	1	0.7	3.40E-01	0.00E+00
Peak Road	B	up	50 to 500	< 10	3.85E-01	1	0.01	0.5850	1	1.5	8.78E-01	3.38E-03
Peak Road	B	up	50 to 500	10 to 20	3.85E-01	1	0.01	0.6650	1	1.5	9.98E-01	3.84E-03
Peak Road	B	up	50 to 500	>= 20	3.85E-01	1	0.00	0.6950	1	1.5	1.04E+00	0.00E+00
Peak Road	B	up	500 to 2000	< 10	3.85E-01	1	0.00	0.8900	1	2	1.78E+00	0.00E+00
Peak Road	B	up	500 to 2000	10 to 20	3.85E-01	1	0.00	0.9500	1	2	1.90E+00	0.00E+00
Peak Road	B	up	500 to 2000	>= 20	3.85E-01	1	0.00	0.9500	1	2	1.90E+00	0.00E+00
Peak Road	B	up	> 2000	< 10	3.85E-01	1	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Peak Road	B	up	> 2000	10 to 20	3.85E-01	1	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Peak Road	B	up	> 2000	>= 20	3.85E-01	1	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Peak Road	B	down	< 20	< 10	3.85E-01	0	0.30	0.0039	1	0.6	2.33E-03	0.00E+00
Peak Road	B	down	< 20	10 to 20	3.85E-01	0	0.30	0.0039	1	0.6	2.33E-03	0.00E+00
Peak Road	B	down	< 20	>= 20	3.85E-01	0	0.30	0.0039	1	0.6	2.33E-03	0.00E+00
Peak Road	B	down	20 to 50	< 10	3.85E-01	0	0.03	0.0194	1	1	1.94E-02	0.00E+00
Peak Road	B	down	20 to 50	10 to 20	3.85E-01	0	0.03	0.0194	1	1	1.94E-02	0.00E+00
Peak Road	B	down	20 to 50	>= 20	3.85E-01	0	0.03	0.0194	1	1	1.94E-02	0.00E+00
Peak Road	B	down	50 to 200	< 10	3.85E-01	0	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Peak Road	B	down	50 to 200	10 to 20	3.85E-01	0	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Peak Road	B	down	50 to 200	>= 20	3.85E-01	0	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Peak Road	B	down	200 to 1000	< 10	3.85E-01	0	0.00	0.2200	1	2	4.40E-01	0.00E+00
Peak Road	B	down	200 to 1000	10 to 20	3.85E-01	0	0.00	0.2200	1	2	4.40E-01	0.00E+00
Peak Road	B	down	200 to 1000	>= 20	3.85E-01	0	0.00	0.2200	1	2	4.40E-01	0.00E+00
Peak Road	B	down	> 1000	< 10	3.85E-01	0	0.00	0.3070	1	4	1.23E+00	0.00E+00
Peak Road	B	down	> 1000	10 to 20	3.85E-01	0	0.00	0.3070	1	4	1.23E+00	0.00E+00
Peak Road	B	down	> 1000	>= 20	3.85E-01	0	0.00	0.3070	1	4	1.23E+00	0.00E+00
Pokfulam Road	A	up	< 20	< 10	5.38E-01	0.86	0.60	0.0231	1	0.4	9.25E-03	2.57E-03
Pokfulam Road	A	up	< 20	10 to 20	5.38E-01	0.86	0.30	0.0406	1	0.4	1.63E-02	2.26E-03
Pokfulam Road	A	up	< 20	>= 20	5.38E-01	0.86	0.00	0.0628	1	0.4	2.51E-02	0.00E+00
Pokfulam Road	A	up	20 to 50	< 10	5.38E-01	0.86	0.03	0.1825	1	0.7	1.28E-01	1.77E-03
Pokfulam Road	A	up	20 to 50	10 to 20	5.38E-01	0.86	0.05	0.3000	1	0.7	2.10E-01	4.86E-03
Pokfulam Road	A	up	20 to 50	>= 20	5.38E-01	0.86	0.00	0.4275	1	0.7	2.99E-01	0.00E+00
Pokfulam Road	A	up	50 to 500	< 10	5.38E-01	0.86	0.00	0.3120	1	1.5	4.68E-01	0.00E+00
Pokfulam Road	A	up	50 to 500	10 to 20	5.38E-01	0.86	0.02	0.5175	1	1.5	7.76E-01	7.19E-03
Pokfulam Road	A	up	50 to 500	>= 20	5.38E-01	0.86	0.00	0.6625	1	1.5	9.94E-01	0.00E+00
Pokfulam Road	A	up	500 to 2000	< 10	5.38E-01	0.86	0.00	0.4825	1	2	9.65E-01	0.00E+00

LS PLL

Roads	Section	Slope	Failure Vol Range	Height Range	LS Frequency per year	Slope	Height Vol	V Factor	Expected Fatality	Scale Factor	Consequence	PLL
Pokfulam Road	A	up	500 to 2000	10 to 20	5.38E-01	0.86	0.00	0.8025	1	2	1.61E+00	0.00E+00
Pokfulam Road	A	up	500 to 2000	>= 20	5.38E-01	0.86	0.00	0.9500	1	2	1.90E+00	0.00E+00
Pokfulam Road	A	up	> 2000	< 10	5.38E-01	0.86	0.00	0.5975	1	2.5	1.49E+00	0.00E+00
Pokfulam Road	A	up	> 2000	10 to 20	5.38E-01	0.86	0.00	0.9200	1	2.5	2.30E+00	0.00E+00
Pokfulam Road	A	up	> 2000	>= 20	5.38E-01	0.86	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Pokfulam Road	A	down	< 20	< 10	5.38E-01	0.14	0.08	0.0026	1	0.6	1.55E-03	9.74E-06
Pokfulam Road	A	down	< 20	10 to 20	5.38E-01	0.14	0.08	0.0026	1	0.6	1.55E-03	9.74E-06
Pokfulam Road	A	down	< 20	>= 20	5.38E-01	0.14	0.08	0.0026	1	0.6	1.55E-03	9.74E-06
Pokfulam Road	A	down	20 to 50	< 10	5.38E-01	0.14	0.23	0.0129	1	1	1.29E-02	2.27E-04
Pokfulam Road	A	down	20 to 50	10 to 20	5.38E-01	0.14	0.23	0.0129	1	1	1.29E-02	2.27E-04
Pokfulam Road	A	down	20 to 50	>= 20	5.38E-01	0.14	0.23	0.0129	1	1	1.29E-02	2.27E-04
Pokfulam Road	A	down	50 to 200	< 10	5.38E-01	0.14	0.02	0.0517	1	1.5	7.75E-02	9.74E-05
Pokfulam Road	A	down	50 to 200	10 to 20	5.38E-01	0.14	0.02	0.0517	1	1.5	7.75E-02	9.74E-05
Pokfulam Road	A	down	50 to 200	>= 20	5.38E-01	0.14	0.02	0.0517	1	1.5	7.75E-02	9.74E-05
Pokfulam Road	A	down	200 to 1000	< 10	5.38E-01	0.14	0.00	0.1473	1	2	2.95E-01	0.00E+00
Pokfulam Road	A	down	200 to 1000	10 to 20	5.38E-01	0.14	0.00	0.1473	1	2	2.95E-01	0.00E+00
Pokfulam Road	A	down	200 to 1000	>= 20	5.38E-01	0.14	0.00	0.1473	1	2	2.95E-01	0.00E+00
Pokfulam Road	A	down	> 1000	< 10	5.38E-01	0.14	0.00	0.2053	1	4	8.21E-01	0.00E+00
Pokfulam Road	A	down	> 1000	10 to 20	5.38E-01	0.14	0.00	0.2053	1	4	8.21E-01	0.00E+00
Pokfulam Road	A	down	> 1000	>= 20	5.38E-01	0.14	0.00	0.2053	1	4	8.21E-01	0.00E+00
Pokfulam Road	B	up	< 20	< 10	2.31E-01	1	0.50	0.0231	1	0.4	9.25E-03	1.07E-03
Pokfulam Road	B	up	< 20	10 to 20	2.31E-01	1	0.20	0.0406	1	0.4	1.63E-02	7.50E-04
Pokfulam Road	B	up	< 20	>= 20	2.31E-01	1	0.00	0.0628	1	0.4	2.51E-02	0.00E+00
Pokfulam Road	B	up	20 to 50	< 10	2.31E-01	1	0.15	0.1825	1	0.7	1.28E-01	4.42E-03
Pokfulam Road	B	up	20 to 50	10 to 20	2.31E-01	1	0.10	0.3000	1	0.7	2.10E-01	4.85E-03
Pokfulam Road	B	up	20 to 50	>= 20	2.31E-01	1	0.00	0.4275	1	0.7	2.99E-01	0.00E+00
Pokfulam Road	B	up	50 to 500	< 10	2.31E-01	1	0.01	0.3120	1	1.5	4.68E-01	1.08E-03
Pokfulam Road	B	up	50 to 500	10 to 20	2.31E-01	1	0.04	0.5175	1	1.5	7.76E-01	7.17E-03
Pokfulam Road	B	up	50 to 500	>= 20	2.31E-01	1	0.00	0.6625	1	1.5	9.94E-01	0.00E+00
Pokfulam Road	B	up	500 to 2000	< 10	2.31E-01	1	0.00	0.4825	1	2	9.65E-01	0.00E+00
Pokfulam Road	B	up	500 to 2000	10 to 20	2.31E-01	1	0.00	0.8025	1	2	1.61E+00	0.00E+00
Pokfulam Road	B	up	500 to 2000	>= 20	2.31E-01	1	0.00	0.9500	1	2	1.90E+00	0.00E+00
Pokfulam Road	B	up	> 2000	< 10	2.31E-01	1	0.00	0.5975	1	2.5	1.49E+00	0.00E+00
Pokfulam Road	B	up	> 2000	10 to 20	2.31E-01	1	0.00	0.9200	1	2.5	2.30E+00	0.00E+00
Pokfulam Road	B	up	> 2000	>= 20	2.31E-01	1	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Pokfulam Road	B	down	< 20	< 10	2.31E-01	0	0.30	0.0026	1	0.6	1.55E-03	0.00E+00
Pokfulam Road	B	down	< 20	10 to 20	2.31E-01	0	0.30	0.0026	1	0.6	1.55E-03	0.00E+00
Pokfulam Road	B	down	< 20	>= 20	2.31E-01	0	0.30	0.0026	1	0.6	1.55E-03	0.00E+00
Pokfulam Road	B	down	20 to 50	< 10	2.31E-01	0	0.03	0.0129	1	1	1.29E-02	0.00E+00
Pokfulam Road	B	down	20 to 50	10 to 20	2.31E-01	0	0.03	0.0129	1	1	1.29E-02	0.00E+00
Pokfulam Road	B	down	20 to 50	>= 20	2.31E-01	0	0.03	0.0129	1	1	1.29E-02	0.00E+00
Pokfulam Road	B	down	50 to 200	< 10	2.31E-01	0	0.00	0.0517	1	1.5	7.75E-02	0.00E+00
Pokfulam Road	B	down	50 to 200	10 to 20	2.31E-01	0	0.00	0.0517	1	1.5	7.75E-02	0.00E+00
Pokfulam Road	B	down	50 to 200	>= 20	2.31E-01	0	0.00	0.0517	1	1.5	7.75E-02	0.00E+00
Pokfulam Road	B	down	200 to 1000	< 10	2.31E-01	0	0.00	0.1473	1	2	2.95E-01	0.00E+00
Pokfulam Road	B	down	200 to 1000	10 to 20	2.31E-01	0	0.00	0.1473	1	2	2.95E-01	0.00E+00
Pokfulam Road	B	down	200 to 1000	>= 20	2.31E-01	0	0.00	0.1473	1	2	2.95E-01	0.00E+00
Pokfulam Road	B	down	> 1000	< 10	2.31E-01	0	0.00	0.2053	1	4	8.21E-01	0.00E+00
Pokfulam Road	B	down	> 1000	10 to 20	2.31E-01	0	0.00	0.2053	1	4	8.21E-01	0.00E+00
Pokfulam Road	B	down	> 1000	>= 20	2.31E-01	0	0.00	0.2053	1	4	8.21E-01	0.00E+00
Repulse Bay Road	A	up	< 20	< 10	2.23E+00	0.76	0.60	0.0455	1	0.4	1.82E-02	1.85E-02
Repulse Bay Road	A	up	< 20	10 to 20	2.23E+00	0.76	0.16	0.0685	1	0.4	2.74E-02	7.43E-03
Repulse Bay Road	A	up	< 20	>= 20	2.23E+00	0.76	0.00	0.0835	1	0.4	3.34E-02	0.00E+00
Repulse Bay Road	A	up	20 to 50	< 10	2.23E+00	0.76	0.15	0.3500	1	0.7	2.45E-01	6.23E-02
Repulse Bay Road	A	up	20 to 50	10 to 20	2.23E+00	0.76	0.05	0.4350	1	0.7	3.05E-01	2.58E-02
Repulse Bay Road	A	up	20 to 50	>= 20	2.23E+00	0.76	0.00	0.4850	1	0.7	3.40E-01	0.00E+00
Repulse Bay Road	A	up	50 to 500	< 10	2.23E+00	0.76	0.01	0.5850	1	1.5	8.78E-01	1.49E-02
Repulse Bay Road	A	up	50 to 500	10 to 20	2.23E+00	0.76	0.03	0.6650	1	1.5	9.98E-01	5.07E-02
Repulse Bay Road	A	up	50 to 500	>= 20	2.23E+00	0.76	0.00	0.6950	1	1.5	1.04E+00	0.00E+00
Repulse Bay Road	A	up	500 to 2000	< 10	2.23E+00	0.76	0.00	0.8900	1	2	1.78E+00	0.00E+00
Repulse Bay Road	A	up	500 to 2000	10 to 20	2.23E+00	0.76	0.00	0.9500	1	2	1.90E+00	0.00E+00
Repulse Bay Road	A	up	500 to 2000	>= 20	2.23E+00	0.76	0.00	0.9500	1	2	1.90E+00	0.00E+00
Repulse Bay Road	A	up	> 2000	< 10	2.23E+00	0.76	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Repulse Bay Road	A	up	> 2000	10 to 20	2.23E+00	0.76	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Repulse Bay Road	A	up	> 2000	>= 20	2.23E+00	0.76	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Repulse Bay Road	A	down	< 20	< 10	2.23E+00	0.24	0.07	0.0039	1	0.6	2.33E-03	8.30E-05
Repulse Bay Road	A	down	< 20	10 to 20	2.23E+00	0.24	0.07	0.0039	1	0.6	2.33E-03	8.30E-05
Repulse Bay Road	A	down	< 20	>= 20	2.23E+00	0.24	0.07	0.0039	1	0.6	2.33E-03	8.30E-05
Repulse Bay Road	A	down	20 to 50	< 10	2.23E+00	0.24	0.12	0.0194	1	1	1.94E-02	1.21E-03
Repulse Bay Road	A	down	20 to 50	10 to 20	2.23E+00	0.24	0.12	0.0194	1	1	1.94E-02	1.21E-03
Repulse Bay Road	A	down	20 to 50	>= 20	2.23E+00	0.24	0.12	0.0194	1	1	1.94E-02	1.21E-03
Repulse Bay Road	A	down	50 to 200	< 10	2.23E+00	0.24	0.12	0.0775	1	1.5	1.16E-01	7.26E-03
Repulse Bay Road	A	down	50 to 200	10 to 20	2.23E+00	0.24	0.12	0.0775	1	1.5	1.16E-01	7.26E-03
Repulse Bay Road	A	down	50 to 200	>= 20	2.23E+00	0.24	0.12	0.0775	1	1.5	1.16E-01	7.26E-03

LS PLL

Roads	Section	Slope	Failure Vol Range	Height Range	LS Frequency per year	Slope	Height Vol	V Factor	Expected Fatality	Scale Factor	Consequence	PLL
Repulse Bay Road	A	down	200 to 1000	< 10	2.23E+00	0.24	0.03	0.2200	1	2	4.40E-01	7.85E-03
Repulse Bay Road	A	down	200 to 1000	10 to 20	2.23E+00	0.24	0.03	0.2200	1	2	4.40E-01	7.85E-03
Repulse Bay Road	A	down	200 to 1000	>= 20	2.23E+00	0.24	0.03	0.2200	1	2	4.40E-01	7.85E-03
Repulse Bay Road	A	down	> 1000	< 10	2.23E+00	0.24	0.00	0.3070	1	4	1.23E+00	0.00E+00
Repulse Bay Road	A	down	> 1000	10 to 20	2.23E+00	0.24	0.00	0.3070	1	4	1.23E+00	0.00E+00
Repulse Bay Road	A	down	> 1000	>= 20	2.23E+00	0.24	0.00	0.3070	1	4	1.23E+00	0.00E+00
Repulse Bay Road	B	up	< 20	< 10	4.62E-01	0.67	0.70	0.0455	1	0.4	1.82E-02	3.94E-03
Repulse Bay Road	B	up	< 20	10 to 20	4.62E-01	0.67	0.10	0.0685	1	0.4	2.74E-02	8.47E-04
Repulse Bay Road	B	up	< 20	>= 20	4.62E-01	0.67	0.01	0.0835	1	0.4	3.34E-02	1.03E-04
Repulse Bay Road	B	up	20 to 50	< 10	4.62E-01	0.67	0.10	0.3500	1	0.7	2.45E-01	7.58E-03
Repulse Bay Road	B	up	20 to 50	10 to 20	4.62E-01	0.67	0.05	0.4350	1	0.7	3.05E-01	4.71E-03
Repulse Bay Road	B	up	20 to 50	>= 20	4.62E-01	0.67	0.02	0.4850	1	0.7	3.40E-01	2.10E-03
Repulse Bay Road	B	up	50 to 500	< 10	4.62E-01	0.67	0.00	0.5850	1	1.5	8.78E-01	1.09E-03
Repulse Bay Road	B	up	50 to 500	10 to 20	4.62E-01	0.67	0.01	0.6650	1	1.5	9.98E-01	1.85E-03
Repulse Bay Road	B	up	50 to 500	>= 20	4.62E-01	0.67	0.01	0.6950	1	1.5	1.04E+00	3.22E-03
Repulse Bay Road	B	up	500 to 2000	< 10	4.62E-01	0.67	0.00	0.8900	1	2	1.78E+00	0.00E+00
Repulse Bay Road	B	up	500 to 2000	10 to 20	4.62E-01	0.67	0.00	0.9500	1	2	1.90E+00	0.00E+00
Repulse Bay Road	B	up	500 to 2000	>= 20	4.62E-01	0.67	0.00	0.9500	1	2	1.90E+00	0.00E+00
Repulse Bay Road	B	up	> 2000	< 10	4.62E-01	0.67	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Repulse Bay Road	B	up	> 2000	10 to 20	4.62E-01	0.67	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Repulse Bay Road	B	up	> 2000	>= 20	4.62E-01	0.67	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Repulse Bay Road	B	down	< 20	< 10	4.62E-01	0.33	0.30	0.0039	1	0.6	2.33E-03	1.06E-04
Repulse Bay Road	B	down	< 20	10 to 20	4.62E-01	0.33	0.30	0.0039	1	0.6	2.33E-03	1.06E-04
Repulse Bay Road	B	down	< 20	>= 20	4.62E-01	0.33	0.30	0.0039	1	0.6	2.33E-03	1.06E-04
Repulse Bay Road	B	down	20 to 50	< 10	4.62E-01	0.33	0.03	0.0194	1	1	1.94E-02	9.84E-05
Repulse Bay Road	B	down	20 to 50	10 to 20	4.62E-01	0.33	0.03	0.0194	1	1	1.94E-02	9.84E-05
Repulse Bay Road	B	down	20 to 50	>= 20	4.62E-01	0.33	0.03	0.0194	1	1	1.94E-02	9.84E-05
Repulse Bay Road	B	down	50 to 200	< 10	4.62E-01	0.33	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Repulse Bay Road	B	down	50 to 200	10 to 20	4.62E-01	0.33	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Repulse Bay Road	B	down	50 to 200	>= 20	4.62E-01	0.33	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Repulse Bay Road	B	down	200 to 1000	< 10	4.62E-01	0.33	0.00	0.2200	1	2	4.40E-01	0.00E+00
Repulse Bay Road	B	down	200 to 1000	10 to 20	4.62E-01	0.33	0.00	0.2200	1	2	4.40E-01	0.00E+00
Repulse Bay Road	B	down	200 to 1000	>= 20	4.62E-01	0.33	0.00	0.2200	1	2	4.40E-01	0.00E+00
Repulse Bay Road	B	down	> 1000	< 10	4.62E-01	0.33	0.00	0.3070	1	4	1.23E+00	0.00E+00
Repulse Bay Road	B	down	> 1000	10 to 20	4.62E-01	0.33	0.00	0.3070	1	4	1.23E+00	0.00E+00
Repulse Bay Road	B	down	> 1000	>= 20	4.62E-01	0.33	0.00	0.3070	1	4	1.23E+00	0.00E+00
Route Twisk	A	up	< 20	< 10	9.23E-01	1	0.20	0.0455	0.25	0.4	4.55E-03	8.40E-04
Route Twisk	A	up	< 20	10 to 20	9.23E-01	1	0.15	0.0685	0.25	0.4	6.85E-03	9.48E-04
Route Twisk	A	up	< 20	>= 20	9.23E-01	1	0.05	0.0835	0.25	0.4	8.35E-03	3.85E-04
Route Twisk	A	up	20 to 50	< 10	9.23E-01	1	0.05	0.3500	0.25	0.7	6.13E-02	2.83E-03
Route Twisk	A	up	20 to 50	10 to 20	9.23E-01	1	0.10	0.4350	0.25	0.7	7.61E-02	7.03E-03
Route Twisk	A	up	20 to 50	>= 20	9.23E-01	1	0.08	0.4850	0.25	0.7	8.49E-02	6.27E-03
Route Twisk	A	up	50 to 500	< 10	9.23E-01	1	0.00	0.5850	0.25	1.5	2.19E-01	0.00E+00
Route Twisk	A	up	50 to 500	10 to 20	9.23E-01	1	0.24	0.6650	0.25	1.5	2.49E-01	5.52E-02
Route Twisk	A	up	50 to 500	>= 20	9.23E-01	1	0.10	0.6950	0.25	1.5	2.61E-01	2.41E-02
Route Twisk	A	up	500 to 2000	< 10	9.23E-01	1	0.00	0.8900	0.25	2	4.45E-01	0.00E+00
Route Twisk	A	up	500 to 2000	10 to 20	9.23E-01	1	0.01	0.9500	0.25	2	4.75E-01	4.38E-03
Route Twisk	A	up	500 to 2000	>= 20	9.23E-01	1	0.02	0.9500	0.25	2	4.75E-01	8.77E-03
Route Twisk	A	up	> 2000	< 10	9.23E-01	1	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Route Twisk	A	up	> 2000	10 to 20	9.23E-01	1	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Route Twisk	A	up	> 2000	>= 20	9.23E-01	1	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Route Twisk	A	down	< 20	< 10	9.23E-01	0	0.27	0.0039	0.25	0.6	5.81E-04	0.00E+00
Route Twisk	A	down	< 20	10 to 20	9.23E-01	0	0.27	0.0039	0.25	0.6	5.81E-04	0.00E+00
Route Twisk	A	down	< 20	>= 20	9.23E-01	0	0.27	0.0039	0.25	0.6	5.81E-04	0.00E+00
Route Twisk	A	down	20 to 50	< 10	9.23E-01	0	0.05	0.0194	0.25	1	4.84E-03	0.00E+00
Route Twisk	A	down	20 to 50	10 to 20	9.23E-01	0	0.05	0.0194	0.25	1	4.84E-03	0.00E+00
Route Twisk	A	down	20 to 50	>= 20	9.23E-01	0	0.05	0.0194	0.25	1	4.84E-03	0.00E+00
Route Twisk	A	down	50 to 200	< 10	9.23E-01	0	0.02	0.0775	0.25	1.5	2.91E-02	0.00E+00
Route Twisk	A	down	50 to 200	10 to 20	9.23E-01	0	0.02	0.0775	0.25	1.5	2.91E-02	0.00E+00
Route Twisk	A	down	50 to 200	>= 20	9.23E-01	0	0.02	0.0775	0.25	1.5	2.91E-02	0.00E+00
Route Twisk	A	down	200 to 1000	< 10	9.23E-01	0	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Route Twisk	A	down	200 to 1000	10 to 20	9.23E-01	0	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Route Twisk	A	down	200 to 1000	>= 20	9.23E-01	0	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Route Twisk	A	down	> 1000	< 10	9.23E-01	0	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Route Twisk	A	down	> 1000	10 to 20	9.23E-01	0	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Route Twisk	A	down	> 1000	>= 20	9.23E-01	0	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Route Twisk	B	up	< 20	< 10	3.08E-01	0.75	0.50	0.0455	0.25	0.4	4.55E-03	5.25E-04
Route Twisk	B	up	< 20	10 to 20	3.08E-01	0.75	0.30	0.0685	0.25	0.4	6.85E-03	4.74E-04
Route Twisk	B	up	< 20	>= 20	3.08E-01	0.75	0.00	0.0835	0.25	0.4	8.35E-03	0.00E+00
Route Twisk	B	up	20 to 50	< 10	3.08E-01	0.75	0.05	0.3500	0.25	0.7	6.13E-02	7.07E-04
Route Twisk	B	up	20 to 50	10 to 20	3.08E-01	0.75	0.10	0.4350	0.25	0.7	7.61E-02	1.76E-03
Route Twisk	B	up	20 to 50	>= 20	3.08E-01	0.75	0.00	0.4850	0.25	0.7	8.49E-02	0.00E+00
Route Twisk	B	up	50 to 500	< 10	3.08E-01	0.75	0.00	0.5850	0.25	1.5	2.19E-01	0.00E+00
Route Twisk	B	up	50 to 500	10 to 20	3.08E-01	0.75	0.05	0.6650	0.25	1.5	2.49E-01	2.88E-03

LS PLL

Roads	Section	Slope	Failure Vol Range	Height Range	LS Frequency per year	Slope	Height Vol	V Factor	Expected Fatality	Scale Factor	Consequence	PLL
Route Twisk	B	up	50 to 500	>= 20	3.08E-01	0.75	0.00	0.6950	0.25	1.5	2.61E-01	0.00E+00
Route Twisk	B	up	500 to 2000	< 10	3.08E-01	0.75	0.00	0.8900	0.25	2	4.45E-01	0.00E+00
Route Twisk	B	up	500 to 2000	10 to 20	3.08E-01	0.75	0.00	0.9500	0.25	2	4.75E-01	0.00E+00
Route Twisk	B	up	500 to 2000	>= 20	3.08E-01	0.75	0.00	0.9500	0.25	2	4.75E-01	0.00E+00
Route Twisk	B	up	> 2000	< 10	3.08E-01	0.75	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Route Twisk	B	up	> 2000	10 to 20	3.08E-01	0.75	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Route Twisk	B	up	> 2000	>= 20	3.08E-01	0.75	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Route Twisk	B	down	< 20	< 10	3.08E-01	0.25	0.30	0.0039	0.25	0.6	5.81E-04	1.34E-05
Route Twisk	B	down	< 20	10 to 20	3.08E-01	0.25	0.30	0.0039	0.25	0.6	5.81E-04	1.34E-05
Route Twisk	B	down	< 20	>= 20	3.08E-01	0.25	0.30	0.0039	0.25	0.6	5.81E-04	1.34E-05
Route Twisk	B	down	20 to 50	< 10	3.08E-01	0.25	0.03	0.0194	0.25	1	4.84E-03	1.24E-05
Route Twisk	B	down	20 to 50	10 to 20	3.08E-01	0.25	0.03	0.0194	0.25	1	4.84E-03	1.24E-05
Route Twisk	B	down	20 to 50	>= 20	3.08E-01	0.25	0.03	0.0194	0.25	1	4.84E-03	1.24E-05
Route Twisk	B	down	50 to 200	< 10	3.08E-01	0.25	0.00	0.0775	0.25	1.5	2.91E-02	0.00E+00
Route Twisk	B	down	50 to 200	10 to 20	3.08E-01	0.25	0.00	0.0775	0.25	1.5	2.91E-02	0.00E+00
Route Twisk	B	down	50 to 200	>= 20	3.08E-01	0.25	0.00	0.0775	0.25	1.5	2.91E-02	0.00E+00
Route Twisk	B	down	200 to 1000	< 10	3.08E-01	0.25	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Route Twisk	B	down	200 to 1000	10 to 20	3.08E-01	0.25	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Route Twisk	B	down	200 to 1000	>= 20	3.08E-01	0.25	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Route Twisk	B	down	> 1000	< 10	3.08E-01	0.25	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Route Twisk	B	down	> 1000	10 to 20	3.08E-01	0.25	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Route Twisk	B	down	> 1000	>= 20	3.08E-01	0.25	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Route Twisk	C	up	< 20	< 10	3.08E-01	0.5	0.80	0.0455	0.25	0.4	4.55E-03	5.60E-04
Route Twisk	C	up	< 20	10 to 20	3.08E-01	0.5	0.10	0.0685	0.25	0.4	6.85E-03	1.05E-04
Route Twisk	C	up	< 20	>= 20	3.08E-01	0.5	0.00	0.0835	0.25	0.4	8.35E-03	0.00E+00
Route Twisk	C	up	20 to 50	< 10	3.08E-01	0.5	0.05	0.3500	0.25	0.7	6.13E-02	4.71E-04
Route Twisk	C	up	20 to 50	10 to 20	3.08E-01	0.5	0.05	0.4350	0.25	0.7	7.61E-02	5.86E-04
Route Twisk	C	up	20 to 50	>= 20	3.08E-01	0.5	0.00	0.4850	0.25	0.7	8.49E-02	0.00E+00
Route Twisk	C	up	50 to 500	< 10	3.08E-01	0.5	0.00	0.5850	0.25	1.5	2.19E-01	0.00E+00
Route Twisk	C	up	50 to 500	10 to 20	3.08E-01	0.5	0.00	0.6650	0.25	1.5	2.49E-01	0.00E+00
Route Twisk	C	up	50 to 500	>= 20	3.08E-01	0.5	0.00	0.6950	0.25	1.5	2.61E-01	0.00E+00
Route Twisk	C	up	500 to 2000	< 10	3.08E-01	0.5	0.00	0.8900	0.25	2	4.45E-01	0.00E+00
Route Twisk	C	up	500 to 2000	10 to 20	3.08E-01	0.5	0.00	0.9500	0.25	2	4.75E-01	0.00E+00
Route Twisk	C	up	500 to 2000	>= 20	3.08E-01	0.5	0.00	0.9500	0.25	2	4.75E-01	0.00E+00
Route Twisk	C	up	> 2000	< 10	3.08E-01	0.5	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Route Twisk	C	up	> 2000	10 to 20	3.08E-01	0.5	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Route Twisk	C	up	> 2000	>= 20	3.08E-01	0.5	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Route Twisk	C	down	< 20	< 10	3.08E-01	0.5	0.17	0.0039	0.25	0.6	5.81E-04	1.49E-05
Route Twisk	C	down	< 20	10 to 20	3.08E-01	0.5	0.17	0.0039	0.25	0.6	5.81E-04	1.49E-05
Route Twisk	C	down	< 20	>= 20	3.08E-01	0.5	0.17	0.0039	0.25	0.6	5.81E-04	1.49E-05
Route Twisk	C	down	20 to 50	< 10	3.08E-01	0.5	0.15	0.0194	0.25	1	4.84E-03	1.12E-04
Route Twisk	C	down	20 to 50	10 to 20	3.08E-01	0.5	0.15	0.0194	0.25	1	4.84E-03	1.12E-04
Route Twisk	C	down	20 to 50	>= 20	3.08E-01	0.5	0.15	0.0194	0.25	1	4.84E-03	1.12E-04
Route Twisk	C	down	50 to 200	< 10	3.08E-01	0.5	0.02	0.0775	0.25	1.5	2.91E-02	7.45E-05
Route Twisk	C	down	50 to 200	10 to 20	3.08E-01	0.5	0.02	0.0775	0.25	1.5	2.91E-02	7.45E-05
Route Twisk	C	down	50 to 200	>= 20	3.08E-01	0.5	0.02	0.0775	0.25	1.5	2.91E-02	7.45E-05
Route Twisk	C	down	200 to 1000	< 10	3.08E-01	0.5	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Route Twisk	C	down	200 to 1000	10 to 20	3.08E-01	0.5	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Route Twisk	C	down	200 to 1000	>= 20	3.08E-01	0.5	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Route Twisk	C	down	> 1000	< 10	3.08E-01	0.5	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Route Twisk	C	down	> 1000	10 to 20	3.08E-01	0.5	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Route Twisk	C	down	> 1000	>= 20	3.08E-01	0.5	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Sai Sha Road	-	up	< 20	< 10	1.00E+00	1	0.10	0.0455	0.25	0.4	4.55E-03	4.55E-04
Sai Sha Road	-	up	< 20	10 to 20	1.00E+00	1	0.20	0.0685	0.25	0.4	6.85E-03	1.37E-03
Sai Sha Road	-	up	< 20	>= 20	1.00E+00	1	0.05	0.0835	0.25	0.4	8.35E-03	4.18E-04
Sai Sha Road	-	up	20 to 50	< 10	1.00E+00	1	0.10	0.3500	0.25	0.7	6.13E-02	6.13E-03
Sai Sha Road	-	up	20 to 50	10 to 20	1.00E+00	1	0.20	0.4350	0.25	0.7	7.61E-02	1.52E-02
Sai Sha Road	-	up	20 to 50	>= 20	1.00E+00	1	0.07	0.4850	0.25	0.7	8.49E-02	5.94E-03
Sai Sha Road	-	up	50 to 500	< 10	1.00E+00	1	0.00	0.5850	0.25	1.5	2.19E-01	0.00E+00
Sai Sha Road	-	up	50 to 500	10 to 20	1.00E+00	1	0.08	0.6650	0.25	1.5	2.49E-01	2.00E-02
Sai Sha Road	-	up	50 to 500	>= 20	1.00E+00	1	0.05	0.6950	0.25	1.5	2.61E-01	1.30E-02
Sai Sha Road	-	up	500 to 2000	< 10	1.00E+00	1	0.00	0.8900	0.25	2	4.45E-01	0.00E+00
Sai Sha Road	-	up	500 to 2000	10 to 20	1.00E+00	1	0.08	0.9500	0.25	2	4.75E-01	3.80E-02
Sai Sha Road	-	up	500 to 2000	>= 20	1.00E+00	1	0.06	0.9500	0.25	2	4.75E-01	2.85E-02
Sai Sha Road	-	up	> 2000	< 10	1.00E+00	1	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Sai Sha Road	-	up	> 2000	10 to 20	1.00E+00	1	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Sai Sha Road	-	up	> 2000	>= 20	1.00E+00	1	0.01	0.9500	0.25	2.5	5.94E-01	5.94E-03
Sai Sha Road	-	down	< 20	< 10	1.00E+00	0	0.00	0.0039	0.25	0.6	5.81E-04	0.00E+00
Sai Sha Road	-	down	< 20	10 to 20	1.00E+00	0	0.00	0.0039	0.25	0.6	5.81E-04	0.00E+00
Sai Sha Road	-	down	< 20	>= 20	1.00E+00	0	0.00	0.0039	0.25	0.6	5.81E-04	0.00E+00
Sai Sha Road	-	down	20 to 50	< 10	1.00E+00	0	0.00	0.0194	0.25	1	4.84E-03	0.00E+00
Sai Sha Road	-	down	20 to 50	10 to 20	1.00E+00	0	0.00	0.0194	0.25	1	4.84E-03	0.00E+00
Sai Sha Road	-	down	20 to 50	>= 20	1.00E+00	0	0.00	0.0194	0.25	1	4.84E-03	0.00E+00
Sai Sha Road	-	down	50 to 200	< 10	1.00E+00	0	0.00	0.0775	0.25	1.5	2.91E-02	0.00E+00

LS PLL

Roads	Section	Slope	Failure Vol Range	Height Range	LS Frequency per year	Slope	Height Vol	V Factor	Expected Fatality	Scale Factor	Consequence	PLL
Sai Sha Road	-	down	50 to 200	10 to 20	1.00E+00	0	0.00	0.0775	0.25	1.5	2.91E-02	0.00E+00
Sai Sha Road	-	down	50 to 200	>= 20	1.00E+00	0	0.00	0.0775	0.25	1.5	2.91E-02	0.00E+00
Sai Sha Road	-	down	200 to 1000	< 10	1.00E+00	0	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Sai Sha Road	-	down	200 to 1000	10 to 20	1.00E+00	0	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Sai Sha Road	-	down	200 to 1000	>= 20	1.00E+00	0	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Sai Sha Road	-	down	> 1000	< 10	1.00E+00	0	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Sai Sha Road	-	down	> 1000	10 to 20	1.00E+00	0	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Sai Sha Road	-	down	> 1000	>= 20	1.00E+00	0	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
South Lantau Road	A	up	< 20	< 10	1.31E+00	0.88	0.15	0.0455	0.03	0.4	5.46E-04	9.42E-05
South Lantau Road	A	up	< 20	10 to 20	1.31E+00	0.88	0.10	0.0685	0.03	0.4	8.22E-04	9.46E-05
South Lantau Road	A	up	< 20	>= 20	1.31E+00	0.88	0.05	0.0835	0.03	0.4	1.00E-03	5.77E-05
South Lantau Road	A	up	20 to 50	< 10	1.31E+00	0.88	0.35	0.3500	0.03	0.7	7.35E-03	2.96E-03
South Lantau Road	A	up	20 to 50	10 to 20	1.31E+00	0.88	0.20	0.4350	0.03	0.7	9.14E-03	2.10E-03
South Lantau Road	A	up	20 to 50	>= 20	1.31E+00	0.88	0.03	0.4850	0.03	0.7	1.02E-02	3.52E-04
South Lantau Road	A	up	50 to 500	< 10	1.31E+00	0.88	0.05	0.5850	0.03	1.5	2.63E-02	1.51E-03
South Lantau Road	A	up	50 to 500	10 to 20	1.31E+00	0.88	0.04	0.6650	0.03	1.5	2.99E-02	1.38E-03
South Lantau Road	A	up	50 to 500	>= 20	1.31E+00	0.88	0.02	0.6950	0.03	1.5	3.13E-02	7.20E-04
South Lantau Road	A	up	500 to 2000	< 10	1.31E+00	0.88	0.00	0.8900	0.03	2	5.34E-02	0.00E+00
South Lantau Road	A	up	500 to 2000	10 to 20	1.31E+00	0.88	0.01	0.9500	0.03	2	5.70E-02	6.56E-04
South Lantau Road	A	up	500 to 2000	>= 20	1.31E+00	0.88	0.00	0.9500	0.03	2	5.70E-02	0.00E+00
South Lantau Road	A	up	> 2000	< 10	1.31E+00	0.88	0.00	0.9500	0.03	2.5	7.13E-02	0.00E+00
South Lantau Road	A	up	> 2000	10 to 20	1.31E+00	0.88	0.00	0.9500	0.03	2.5	7.13E-02	0.00E+00
South Lantau Road	A	up	> 2000	>= 20	1.31E+00	0.88	0.00	0.9500	0.03	2.5	7.13E-02	0.00E+00
South Lantau Road	A	down	< 20	< 10	1.31E+00	0.12	0.03	0.0039	0.03	0.6	6.98E-05	3.65E-07
South Lantau Road	A	down	< 20	10 to 20	1.31E+00	0.12	0.03	0.0039	0.03	0.6	6.98E-05	3.65E-07
South Lantau Road	A	down	< 20	>= 20	1.31E+00	0.12	0.03	0.0039	0.03	0.6	6.98E-05	3.65E-07
South Lantau Road	A	down	20 to 50	< 10	1.31E+00	0.12	0.13	0.0194	0.03	1	5.81E-04	1.22E-05
South Lantau Road	A	down	20 to 50	10 to 20	1.31E+00	0.12	0.13	0.0194	0.03	1	5.81E-04	1.22E-05
South Lantau Road	A	down	20 to 50	>= 20	1.31E+00	0.12	0.13	0.0194	0.03	1	5.81E-04	1.22E-05
South Lantau Road	A	down	50 to 200	< 10	1.31E+00	0.12	0.03	0.0775	0.03	1.5	3.49E-03	1.64E-05
South Lantau Road	A	down	50 to 200	10 to 20	1.31E+00	0.12	0.03	0.0775	0.03	1.5	3.49E-03	1.64E-05
South Lantau Road	A	down	50 to 200	>= 20	1.31E+00	0.12	0.03	0.0775	0.03	1.5	3.49E-03	1.64E-05
South Lantau Road	A	down	200 to 1000	< 10	1.31E+00	0.12	0.13	0.2200	0.03	2	1.32E-02	2.76E-04
South Lantau Road	A	down	200 to 1000	10 to 20	1.31E+00	0.12	0.13	0.2200	0.03	2	1.32E-02	2.76E-04
South Lantau Road	A	down	200 to 1000	>= 20	1.31E+00	0.12	0.13	0.2200	0.03	2	1.32E-02	2.76E-04
South Lantau Road	A	down	> 1000	< 10	1.31E+00	0.12	0.00	0.3070	0.03	4	3.68E-02	1.93E-05
South Lantau Road	A	down	> 1000	10 to 20	1.31E+00	0.12	0.00	0.3070	0.03	4	3.68E-02	1.93E-05
South Lantau Road	A	down	> 1000	>= 20	1.31E+00	0.12	0.00	0.3070	0.03	4	3.68E-02	1.93E-05
South Lantau Road	B	up	< 20	< 10	4.62E-01	0.83	0.20	0.0455	0.03	0.4	5.46E-04	4.18E-05
South Lantau Road	B	up	< 20	10 to 20	4.62E-01	0.83	0.05	0.0685	0.03	0.4	8.22E-04	1.57E-05
South Lantau Road	B	up	< 20	>= 20	4.62E-01	0.83	0.02	0.0835	0.03	0.4	1.00E-03	7.68E-06
South Lantau Road	B	up	20 to 50	< 10	4.62E-01	0.83	0.10	0.3500	0.03	0.7	7.35E-03	2.82E-04
South Lantau Road	B	up	20 to 50	10 to 20	4.62E-01	0.83	0.16	0.4350	0.03	0.7	9.14E-03	5.60E-04
South Lantau Road	B	up	20 to 50	>= 20	4.62E-01	0.83	0.05	0.4850	0.03	0.7	1.02E-02	1.95E-04
South Lantau Road	B	up	50 to 500	< 10	4.62E-01	0.83	0.01	0.5850	0.03	1.5	2.63E-02	1.01E-04
South Lantau Road	B	up	50 to 500	10 to 20	4.62E-01	0.83	0.15	0.6650	0.03	1.5	2.99E-02	1.72E-03
South Lantau Road	B	up	50 to 500	>= 20	4.62E-01	0.83	0.05	0.6950	0.03	1.5	3.13E-02	5.99E-04
South Lantau Road	B	up	500 to 2000	< 10	4.62E-01	0.83	0.00	0.8900	0.03	2	5.34E-02	0.00E+00
South Lantau Road	B	up	500 to 2000	10 to 20	4.62E-01	0.83	0.15	0.9500	0.03	2	5.70E-02	3.28E-03
South Lantau Road	B	up	500 to 2000	>= 20	4.62E-01	0.83	0.05	0.9500	0.03	2	5.70E-02	1.09E-03
South Lantau Road	B	up	> 2000	< 10	4.62E-01	0.83	0.00	0.9500	0.03	2.5	7.13E-02	0.00E+00
South Lantau Road	B	up	> 2000	10 to 20	4.62E-01	0.83	0.00	0.9500	0.03	2.5	7.13E-02	0.00E+00
South Lantau Road	B	up	> 2000	>= 20	4.62E-01	0.83	0.01	0.9500	0.03	2.5	7.13E-02	2.73E-04
South Lantau Road	B	down	< 20	< 10	4.62E-01	0.17	0.08	0.0039	0.03	0.6	6.98E-05	4.56E-07
South Lantau Road	B	down	< 20	10 to 20	4.62E-01	0.17	0.08	0.0039	0.03	0.6	6.98E-05	4.56E-07
South Lantau Road	B	down	< 20	>= 20	4.62E-01	0.17	0.08	0.0039	0.03	0.6	6.98E-05	4.56E-07
South Lantau Road	B	down	20 to 50	< 10	4.62E-01	0.17	0.23	0.0194	0.03	1	5.81E-04	1.06E-05
South Lantau Road	B	down	20 to 50	10 to 20	4.62E-01	0.17	0.23	0.0194	0.03	1	5.81E-04	1.06E-05
South Lantau Road	B	down	20 to 50	>= 20	4.62E-01	0.17	0.23	0.0194	0.03	1	5.81E-04	1.06E-05
South Lantau Road	B	down	50 to 200	< 10	4.62E-01	0.17	0.02	0.0775	0.03	1.5	3.49E-03	4.56E-06
South Lantau Road	B	down	50 to 200	10 to 20	4.62E-01	0.17	0.02	0.0775	0.03	1.5	3.49E-03	4.56E-06
South Lantau Road	B	down	50 to 200	>= 20	4.62E-01	0.17	0.02	0.0775	0.03	1.5	3.49E-03	4.56E-06
South Lantau Road	B	down	200 to 1000	< 10	4.62E-01	0.17	0.00	0.2200	0.03	2	1.32E-02	0.00E+00
South Lantau Road	B	down	200 to 1000	10 to 20	4.62E-01	0.17	0.00	0.2200	0.03	2	1.32E-02	0.00E+00
South Lantau Road	B	down	200 to 1000	>= 20	4.62E-01	0.17	0.00	0.2200	0.03	2	1.32E-02	0.00E+00
South Lantau Road	B	down	> 1000	< 10	4.62E-01	0.17	0.00	0.3070	0.03	4	3.68E-02	0.00E+00
South Lantau Road	B	down	> 1000	10 to 20	4.62E-01	0.17	0.00	0.3070	0.03	4	3.68E-02	0.00E+00
South Lantau Road	B	down	> 1000	>= 20	4.62E-01	0.17	0.00	0.3070	0.03	4	3.68E-02	0.00E+00
South Lantau Road	C	up	< 20	< 10	3.85E-01	1	0.30	0.0455	0.03	0.4	5.46E-04	6.30E-05
South Lantau Road	C	up	< 20	10 to 20	3.85E-01	1	0.30	0.0685	0.03	0.4	8.22E-04	9.48E-05
South Lantau Road	C	up	< 20	>= 20	3.85E-01	1	0.00	0.0835	0.03	0.4	1.00E-03	0.00E+00
South Lantau Road	C	up	20 to 50	< 10	3.85E-01	1	0.08	0.3500	0.03	0.7	7.35E-03	2.26E-04
South Lantau Road	C	up	20 to 50	10 to 20	3.85E-01	1	0.15	0.4350	0.03	0.7	9.14E-03	5.27E-04
South Lantau Road	C	up	20 to 50	>= 20	3.85E-01	1	0.00	0.4850	0.03	0.7	1.02E-02	0.00E+00

LS PLL

Roads	Section	Slope	Failure Vol Range	Height Range	LS Frequency per year	Slope	Height Vol	V Factor	Expected Fatality	Scale Factor	Consequence	PLL
South Lantau Road	C	up	50 to 500	< 10	3.85E-01	1	0.01	0.5850	0.03	1.5	2.63E-02	1.01E-04
South Lantau Road	C	up	50 to 500	10 to 20	3.85E-01	1	0.15	0.6650	0.03	1.5	2.99E-02	1.73E-03
South Lantau Road	C	up	50 to 500	>= 20	3.85E-01	1	0.00	0.6950	0.03	1.5	3.13E-02	0.00E+00
South Lantau Road	C	up	500 to 2000	< 10	3.85E-01	1	0.00	0.8900	0.03	2	5.34E-02	0.00E+00
South Lantau Road	C	up	500 to 2000	10 to 20	3.85E-01	1	0.01	0.9500	0.03	2	5.70E-02	2.19E-04
South Lantau Road	C	up	500 to 2000	>= 20	3.85E-01	1	0.00	0.9500	0.03	2	5.70E-02	0.00E+00
South Lantau Road	C	up	> 2000	< 10	3.85E-01	1	0.00	0.9500	0.03	2.5	7.13E-02	0.00E+00
South Lantau Road	C	up	> 2000	10 to 20	3.85E-01	1	0.00	0.9500	0.03	2.5	7.13E-02	0.00E+00
South Lantau Road	C	up	> 2000	>= 20	3.85E-01	1	0.00	0.9500	0.03	2.5	7.13E-02	0.00E+00
South Lantau Road	C	down	< 20	< 10	3.85E-01	0	0.00	0.0039	0.03	0.6	6.98E-05	0.00E+00
South Lantau Road	C	down	< 20	10 to 20	3.85E-01	0	0.00	0.0039	0.03	0.6	6.98E-05	0.00E+00
South Lantau Road	C	down	< 20	>= 20	3.85E-01	0	0.00	0.0039	0.03	0.6	6.98E-05	0.00E+00
South Lantau Road	C	down	20 to 50	< 10	3.85E-01	0	0.00	0.0194	0.03	1	5.81E-04	0.00E+00
South Lantau Road	C	down	20 to 50	10 to 20	3.85E-01	0	0.00	0.0194	0.03	1	5.81E-04	0.00E+00
South Lantau Road	C	down	20 to 50	>= 20	3.85E-01	0	0.00	0.0194	0.03	1	5.81E-04	0.00E+00
South Lantau Road	C	down	50 to 200	< 10	3.85E-01	0	0.00	0.0775	0.03	1.5	3.49E-03	0.00E+00
South Lantau Road	C	down	50 to 200	10 to 20	3.85E-01	0	0.00	0.0775	0.03	1.5	3.49E-03	0.00E+00
South Lantau Road	C	down	50 to 200	>= 20	3.85E-01	0	0.00	0.0775	0.03	1.5	3.49E-03	0.00E+00
South Lantau Road	C	down	200 to 1000	< 10	3.85E-01	0	0.00	0.2200	0.03	2	1.32E-02	0.00E+00
South Lantau Road	C	down	200 to 1000	10 to 20	3.85E-01	0	0.00	0.2200	0.03	2	1.32E-02	0.00E+00
South Lantau Road	C	down	200 to 1000	>= 20	3.85E-01	0	0.00	0.2200	0.03	2	1.32E-02	0.00E+00
South Lantau Road	C	down	> 1000	< 10	3.85E-01	0	0.00	0.3070	0.03	4	3.68E-02	0.00E+00
South Lantau Road	C	down	> 1000	10 to 20	3.85E-01	0	0.00	0.3070	0.03	4	3.68E-02	0.00E+00
South Lantau Road	C	down	> 1000	>= 20	3.85E-01	0	0.00	0.3070	0.03	4	3.68E-02	0.00E+00
Stubbs Road	A	up	< 20	< 10	3.08E-01	1	0.50	0.0455	1	0.4	1.82E-02	2.80E-03
Stubbs Road	A	up	< 20	10 to 20	3.08E-01	1	0.15	0.0685	1	0.4	2.74E-02	1.26E-03
Stubbs Road	A	up	< 20	>= 20	3.08E-01	1	0.05	0.0835	1	0.4	3.34E-02	5.14E-04
Stubbs Road	A	up	20 to 50	< 10	3.08E-01	1	0.08	0.3500	1	0.7	2.45E-01	6.03E-03
Stubbs Road	A	up	20 to 50	10 to 20	3.08E-01	1	0.10	0.4350	1	0.7	3.05E-01	9.37E-03
Stubbs Road	A	up	20 to 50	>= 20	3.08E-01	1	0.05	0.4850	1	0.7	3.40E-01	5.22E-03
Stubbs Road	A	up	50 to 500	< 10	3.08E-01	1	0.01	0.5850	1	1.5	8.78E-01	2.70E-03
Stubbs Road	A	up	50 to 500	10 to 20	3.08E-01	1	0.04	0.6650	1	1.5	9.98E-01	1.23E-02
Stubbs Road	A	up	50 to 500	>= 20	3.08E-01	1	0.02	0.6950	1	1.5	1.04E+00	6.42E-03
Stubbs Road	A	up	500 to 2000	< 10	3.08E-01	1	0.00	0.8900	1	2	1.78E+00	0.00E+00
Stubbs Road	A	up	500 to 2000	10 to 20	3.08E-01	1	0.00	0.9500	1	2	1.90E+00	0.00E+00
Stubbs Road	A	up	500 to 2000	>= 20	3.08E-01	1	0.00	0.9500	1	2	1.90E+00	0.00E+00
Stubbs Road	A	up	> 2000	< 10	3.08E-01	1	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Stubbs Road	A	up	> 2000	10 to 20	3.08E-01	1	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Stubbs Road	A	up	> 2000	>= 20	3.08E-01	1	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Stubbs Road	A	down	< 20	< 10	3.08E-01	0	0.30	0.0039	1	0.6	2.33E-03	0.00E+00
Stubbs Road	A	down	< 20	10 to 20	3.08E-01	0	0.30	0.0039	1	0.6	2.33E-03	0.00E+00
Stubbs Road	A	down	< 20	>= 20	3.08E-01	0	0.30	0.0039	1	0.6	2.33E-03	0.00E+00
Stubbs Road	A	down	20 to 50	< 10	3.08E-01	0	0.03	0.0194	1	1	1.94E-02	0.00E+00
Stubbs Road	A	down	20 to 50	10 to 20	3.08E-01	0	0.03	0.0194	1	1	1.94E-02	0.00E+00
Stubbs Road	A	down	20 to 50	>= 20	3.08E-01	0	0.03	0.0194	1	1	1.94E-02	0.00E+00
Stubbs Road	A	down	50 to 200	< 10	3.08E-01	0	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Stubbs Road	A	down	50 to 200	10 to 20	3.08E-01	0	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Stubbs Road	A	down	50 to 200	>= 20	3.08E-01	0	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Stubbs Road	A	down	200 to 1000	< 10	3.08E-01	0	0.00	0.2200	1	2	4.40E-01	0.00E+00
Stubbs Road	A	down	200 to 1000	10 to 20	3.08E-01	0	0.00	0.2200	1	2	4.40E-01	0.00E+00
Stubbs Road	A	down	200 to 1000	>= 20	3.08E-01	0	0.00	0.2200	1	2	4.40E-01	0.00E+00
Stubbs Road	A	down	> 1000	< 10	3.08E-01	0	0.00	0.3070	1	4	1.23E+00	0.00E+00
Stubbs Road	A	down	> 1000	10 to 20	3.08E-01	0	0.00	0.3070	1	4	1.23E+00	0.00E+00
Stubbs Road	A	down	> 1000	>= 20	3.08E-01	0	0.00	0.3070	1	4	1.23E+00	0.00E+00
Stubbs Road	B	up	< 20	< 10	1.54E-01	1	0.60	0.0455	1	0.4	1.82E-02	1.68E-03
Stubbs Road	B	up	< 20	10 to 20	1.54E-01	1	0.05	0.0685	1	0.4	2.74E-02	2.11E-04
Stubbs Road	B	up	< 20	>= 20	1.54E-01	1	0.03	0.0835	1	0.4	3.34E-02	1.54E-04
Stubbs Road	B	up	20 to 50	< 10	1.54E-01	1	0.05	0.3500	1	0.7	2.45E-01	1.88E-03
Stubbs Road	B	up	20 to 50	10 to 20	1.54E-01	1	0.05	0.4350	1	0.7	3.05E-01	2.34E-03
Stubbs Road	B	up	20 to 50	>= 20	1.54E-01	1	0.04	0.4850	1	0.7	3.40E-01	2.09E-03
Stubbs Road	B	up	50 to 500	< 10	1.54E-01	1	0.01	0.5850	1	1.5	8.78E-01	1.35E-03
Stubbs Road	B	up	50 to 500	10 to 20	1.54E-01	1	0.12	0.6650	1	1.5	9.98E-01	1.84E-02
Stubbs Road	B	up	50 to 500	>= 20	1.54E-01	1	0.05	0.6950	1	1.5	1.04E+00	8.02E-03
Stubbs Road	B	up	500 to 2000	< 10	1.54E-01	1	0.00	0.8900	1	2	1.78E+00	0.00E+00
Stubbs Road	B	up	500 to 2000	10 to 20	1.54E-01	1	0.00	0.9500	1	2	1.90E+00	0.00E+00
Stubbs Road	B	up	500 to 2000	>= 20	1.54E-01	1	0.00	0.9500	1	2	1.90E+00	0.00E+00
Stubbs Road	B	up	> 2000	< 10	1.54E-01	1	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Stubbs Road	B	up	> 2000	10 to 20	1.54E-01	1	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Stubbs Road	B	up	> 2000	>= 20	1.54E-01	1	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Stubbs Road	B	down	< 20	< 10	1.54E-01	0	0.30	0.0039	1	0.6	2.33E-03	0.00E+00
Stubbs Road	B	down	< 20	10 to 20	1.54E-01	0	0.30	0.0039	1	0.6	2.33E-03	0.00E+00
Stubbs Road	B	down	< 20	>= 20	1.54E-01	0	0.30	0.0039	1	0.6	2.33E-03	0.00E+00
Stubbs Road	B	down	20 to 50	< 10	1.54E-01	0	0.03	0.0194	1	1	1.94E-02	0.00E+00
Stubbs Road	B	down	20 to 50	10 to 20	1.54E-01	0	0.03	0.0194	1	1	1.94E-02	0.00E+00

LS PLL

Roads	Section	Slope	Failure Vol Range	Height Range	LS Frequency per year	Slope	Height Vol	V Factor	Expected Fatality	Scale Factor	Consequence	PLL
Stubbs Road	B	down	20 to 50	>= 20	1.54E-01	0	0.03	0.0194	1	1	1.94E-02	0.00E+00
Stubbs Road	B	down	50 to 200	< 10	1.54E-01	0	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Stubbs Road	B	down	50 to 200	10 to 20	1.54E-01	0	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Stubbs Road	B	down	50 to 200	>= 20	1.54E-01	0	0.00	0.0775	1	1.5	1.16E-01	0.00E+00
Stubbs Road	B	down	200 to 1000	< 10	1.54E-01	0	0.00	0.2200	1	2	4.40E-01	0.00E+00
Stubbs Road	B	down	200 to 1000	10 to 20	1.54E-01	0	0.00	0.2200	1	2	4.40E-01	0.00E+00
Stubbs Road	B	down	200 to 1000	>= 20	1.54E-01	0	0.00	0.2200	1	2	4.40E-01	0.00E+00
Stubbs Road	B	down	> 1000	< 10	1.54E-01	0	0.00	0.3070	1	4	1.23E+00	0.00E+00
Stubbs Road	B	down	> 1000	10 to 20	1.54E-01	0	0.00	0.3070	1	4	1.23E+00	0.00E+00
Stubbs Road	B	down	> 1000	>= 20	1.54E-01	0	0.00	0.3070	1	4	1.23E+00	0.00E+00
Tai Hang Road	-	up	< 20	< 10	2.08E+00	0.93	0.60	0.0455	1	0.4	1.82E-02	2.11E-02
Tai Hang Road	-	up	< 20	10 to 20	2.08E+00	0.93	0.20	0.0685	1	0.4	2.74E-02	1.06E-02
Tai Hang Road	-	up	< 20	>= 20	2.08E+00	0.93	0.01	0.0835	1	0.4	3.34E-02	6.45E-04
Tai Hang Road	-	up	20 to 50	< 10	2.08E+00	0.93	0.04	0.3500	1	0.7	2.45E-01	1.89E-02
Tai Hang Road	-	up	20 to 50	10 to 20	2.08E+00	0.93	0.08	0.4350	1	0.7	3.05E-01	4.71E-02
Tai Hang Road	-	up	20 to 50	>= 20	2.08E+00	0.93	0.02	0.4850	1	0.7	3.40E-01	1.31E-02
Tai Hang Road	-	up	50 to 500	< 10	2.08E+00	0.93	0.01	0.5850	1	1.5	8.78E-01	1.69E-02
Tai Hang Road	-	up	50 to 500	10 to 20	2.08E+00	0.93	0.03	0.6650	1	1.5	9.98E-01	5.78E-02
Tai Hang Road	-	up	50 to 500	>= 20	2.08E+00	0.93	0.01	0.6950	1	1.5	1.04E+00	2.01E-02
Tai Hang Road	-	up	500 to 2000	< 10	2.08E+00	0.93	0.00	0.8900	1	2	1.78E+00	0.00E+00
Tai Hang Road	-	up	500 to 2000	10 to 20	2.08E+00	0.93	0.00	0.9500	1	2	1.90E+00	0.00E+00
Tai Hang Road	-	up	500 to 2000	>= 20	2.08E+00	0.93	0.00	0.9500	1	2	1.90E+00	0.00E+00
Tai Hang Road	-	up	> 2000	< 10	2.08E+00	0.93	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Tai Hang Road	-	up	> 2000	10 to 20	2.08E+00	0.93	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Tai Hang Road	-	up	> 2000	>= 20	2.08E+00	0.93	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Tai Hang Road	-	down	< 20	< 10	2.08E+00	0.07	0.17	0.0039	1	0.6	2.33E-03	5.63E-05
Tai Hang Road	-	down	< 20	10 to 20	2.08E+00	0.07	0.17	0.0039	1	0.6	2.33E-03	5.63E-05
Tai Hang Road	-	down	< 20	>= 20	2.08E+00	0.07	0.17	0.0039	1	0.6	2.33E-03	5.63E-05
Tai Hang Road	-	down	20 to 50	< 10	2.08E+00	0.07	0.15	0.0194	1	1	1.94E-02	4.13E-04
Tai Hang Road	-	down	20 to 50	10 to 20	2.08E+00	0.07	0.15	0.0194	1	1	1.94E-02	4.13E-04
Tai Hang Road	-	down	20 to 50	>= 20	2.08E+00	0.07	0.15	0.0194	1	1	1.94E-02	4.13E-04
Tai Hang Road	-	down	50 to 200	< 10	2.08E+00	0.07	0.02	0.0775	1	1.5	1.16E-01	2.82E-04
Tai Hang Road	-	down	50 to 200	10 to 20	2.08E+00	0.07	0.02	0.0775	1	1.5	1.16E-01	2.82E-04
Tai Hang Road	-	down	50 to 200	>= 20	2.08E+00	0.07	0.02	0.0775	1	1.5	1.16E-01	2.82E-04
Tai Hang Road	-	down	200 to 1000	< 10	2.08E+00	0.07	0.00	0.2200	1	2	4.40E-01	2.13E-04
Tai Hang Road	-	down	200 to 1000	10 to 20	2.08E+00	0.07	0.00	0.2200	1	2	4.40E-01	2.13E-04
Tai Hang Road	-	down	200 to 1000	>= 20	2.08E+00	0.07	0.00	0.2200	1	2	4.40E-01	2.13E-04
Tai Hang Road	-	down	> 1000	< 10	2.08E+00	0.07	0.00	0.3070	1	4	1.23E+00	0.00E+00
Tai Hang Road	-	down	> 1000	10 to 20	2.08E+00	0.07	0.00	0.3070	1	4	1.23E+00	0.00E+00
Tai Hang Road	-	down	> 1000	>= 20	2.08E+00	0.07	0.00	0.3070	1	4	1.23E+00	0.00E+00
Tai Mong Tsai Road	A	up	< 20	< 10	2.31E-01	0.67	0.35	0.0455	0.25	0.4	4.55E-03	2.46E-04
Tai Mong Tsai Road	A	up	< 20	10 to 20	2.31E-01	0.67	0.05	0.0685	0.25	0.4	6.85E-03	5.30E-05
Tai Mong Tsai Road	A	up	< 20	>= 20	2.31E-01	0.67	0.00	0.0835	0.25	0.4	8.35E-03	0.00E+00
Tai Mong Tsai Road	A	up	20 to 50	< 10	2.31E-01	0.67	0.05	0.3500	0.25	0.7	6.13E-02	4.74E-04
Tai Mong Tsai Road	A	up	20 to 50	10 to 20	2.31E-01	0.67	0.05	0.4350	0.25	0.7	7.61E-02	5.89E-04
Tai Mong Tsai Road	A	up	20 to 50	>= 20	2.31E-01	0.67	0.01	0.4850	0.25	0.7	8.49E-02	1.31E-04
Tai Mong Tsai Road	A	up	50 to 500	< 10	2.31E-01	0.67	0.00	0.5850	0.25	1.5	2.19E-01	0.00E+00
Tai Mong Tsai Road	A	up	50 to 500	10 to 20	2.31E-01	0.67	0.05	0.6650	0.25	1.5	2.49E-01	1.93E-03
Tai Mong Tsai Road	A	up	50 to 500	>= 20	2.31E-01	0.67	0.02	0.6950	0.25	1.5	2.61E-01	8.06E-04
Tai Mong Tsai Road	A	up	500 to 2000	< 10	2.31E-01	0.67	0.00	0.8900	0.25	2	4.45E-01	0.00E+00
Tai Mong Tsai Road	A	up	500 to 2000	10 to 20	2.31E-01	0.67	0.40	0.9500	0.25	2	4.75E-01	2.94E-02
Tai Mong Tsai Road	A	up	500 to 2000	>= 20	2.31E-01	0.67	0.02	0.9500	0.25	2	4.75E-01	1.47E-03
Tai Mong Tsai Road	A	up	> 2000	< 10	2.31E-01	0.67	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Tai Mong Tsai Road	A	up	> 2000	10 to 20	2.31E-01	0.67	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Tai Mong Tsai Road	A	up	> 2000	>= 20	2.31E-01	0.67	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Tai Mong Tsai Road	A	down	< 20	< 10	2.31E-01	0.33	0.08	0.0039	0.25	0.6	5.81E-04	3.69E-06
Tai Mong Tsai Road	A	down	< 20	10 to 20	2.31E-01	0.33	0.08	0.0039	0.25	0.6	5.81E-04	3.69E-06
Tai Mong Tsai Road	A	down	< 20	>= 20	2.31E-01	0.33	0.08	0.0039	0.25	0.6	5.81E-04	3.69E-06
Tai Mong Tsai Road	A	down	20 to 50	< 10	2.31E-01	0.33	0.23	0.0194	0.25	1	4.84E-03	8.61E-05
Tai Mong Tsai Road	A	down	20 to 50	10 to 20	2.31E-01	0.33	0.23	0.0194	0.25	1	4.84E-03	8.61E-05
Tai Mong Tsai Road	A	down	20 to 50	>= 20	2.31E-01	0.33	0.23	0.0194	0.25	1	4.84E-03	8.61E-05
Tai Mong Tsai Road	A	down	50 to 200	< 10	2.31E-01	0.33	0.02	0.0775	0.25	1.5	2.91E-02	3.69E-05
Tai Mong Tsai Road	A	down	50 to 200	10 to 20	2.31E-01	0.33	0.02	0.0775	0.25	1.5	2.91E-02	3.69E-05
Tai Mong Tsai Road	A	down	50 to 200	>= 20	2.31E-01	0.33	0.02	0.0775	0.25	1.5	2.91E-02	3.69E-05
Tai Mong Tsai Road	A	down	200 to 1000	< 10	2.31E-01	0.33	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Tai Mong Tsai Road	A	down	200 to 1000	10 to 20	2.31E-01	0.33	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Tai Mong Tsai Road	A	down	200 to 1000	>= 20	2.31E-01	0.33	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Tai Mong Tsai Road	A	down	> 1000	< 10	2.31E-01	0.33	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Tai Mong Tsai Road	A	down	> 1000	10 to 20	2.31E-01	0.33	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Tai Mong Tsai Road	A	down	> 1000	>= 20	2.31E-01	0.33	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Tai Mong Tsai Road	B	up	< 20	< 10	6.15E-01	1	0.25	0.0455	0.25	0.4	4.55E-03	7.00E-04
Tai Mong Tsai Road	B	up	< 20	10 to 20	6.15E-01	1	0.45	0.0685	0.25	0.4	6.85E-03	1.90E-03
Tai Mong Tsai Road	B	up	< 20	>= 20	6.15E-01	1	0.00	0.0835	0.25	0.4	8.35E-03	0.00E+00
Tai Mong Tsai Road	B	up	20 to 50	< 10	6.15E-01	1	0.10	0.3500	0.25	0.7	6.13E-02	3.77E-03

LS PLL

Roads	Section	Slope	Failure Vol Range	Height Range	LS Frequency per year	Slope	Height Vol	V Factor	Expected Fatality	Scale Factor	Consequence	PLL
Tai Mong Tsai Road	B	up	20 to 50	10 to 20	6.15E-01	1	0.12	0.4350	0.25	0.7	7.61E-02	5.62E-03
Tai Mong Tsai Road	B	up	20 to 50	>= 20	6.15E-01	1	0.00	0.4850	0.25	0.7	8.49E-02	0.00E+00
Tai Mong Tsai Road	B	up	50 to 500	< 10	6.15E-01	1	0.01	0.5850	0.25	1.5	2.19E-01	1.35E-03
Tai Mong Tsai Road	B	up	50 to 500	10 to 20	6.15E-01	1	0.06	0.6650	0.25	1.5	2.49E-01	9.21E-03
Tai Mong Tsai Road	B	up	50 to 500	>= 20	6.15E-01	1	0.00	0.6950	0.25	1.5	2.61E-01	0.00E+00
Tai Mong Tsai Road	B	up	500 to 2000	< 10	6.15E-01	1	0.00	0.8900	0.25	2	4.45E-01	0.00E+00
Tai Mong Tsai Road	B	up	500 to 2000	10 to 20	6.15E-01	1	0.01	0.9500	0.25	2	4.75E-01	2.92E-03
Tai Mong Tsai Road	B	up	500 to 2000	>= 20	6.15E-01	1	0.00	0.9500	0.25	2	4.75E-01	0.00E+00
Tai Mong Tsai Road	B	up	> 2000	< 10	6.15E-01	1	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Tai Mong Tsai Road	B	up	> 2000	10 to 20	6.15E-01	1	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Tai Mong Tsai Road	B	up	> 2000	>= 20	6.15E-01	1	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Tai Mong Tsai Road	B	down	< 20	< 10	6.15E-01	0	0.00	0.0039	0.25	0.6	5.81E-04	0.00E+00
Tai Mong Tsai Road	B	down	< 20	10 to 20	6.15E-01	0	0.00	0.0039	0.25	0.6	5.81E-04	0.00E+00
Tai Mong Tsai Road	B	down	< 20	>= 20	6.15E-01	0	0.00	0.0039	0.25	0.6	5.81E-04	0.00E+00
Tai Mong Tsai Road	B	down	20 to 50	< 10	6.15E-01	0	0.00	0.0194	0.25	1	4.84E-03	0.00E+00
Tai Mong Tsai Road	B	down	20 to 50	10 to 20	6.15E-01	0	0.00	0.0194	0.25	1	4.84E-03	0.00E+00
Tai Mong Tsai Road	B	down	20 to 50	>= 20	6.15E-01	0	0.00	0.0194	0.25	1	4.84E-03	0.00E+00
Tai Mong Tsai Road	B	down	50 to 200	< 10	6.15E-01	0	0.00	0.0775	0.25	1.5	2.91E-02	0.00E+00
Tai Mong Tsai Road	B	down	50 to 200	10 to 20	6.15E-01	0	0.00	0.0775	0.25	1.5	2.91E-02	0.00E+00
Tai Mong Tsai Road	B	down	50 to 200	>= 20	6.15E-01	0	0.00	0.0775	0.25	1.5	2.91E-02	0.00E+00
Tai Mong Tsai Road	B	down	200 to 1000	< 10	6.15E-01	0	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Tai Mong Tsai Road	B	down	200 to 1000	10 to 20	6.15E-01	0	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Tai Mong Tsai Road	B	down	200 to 1000	>= 20	6.15E-01	0	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Tai Mong Tsai Road	B	down	> 1000	< 10	6.15E-01	0	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Tai Mong Tsai Road	B	down	> 1000	10 to 20	6.15E-01	0	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Tai Mong Tsai Road	B	down	> 1000	>= 20	6.15E-01	0	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Tai Mong Tsai Road	C	up	< 20	< 10	1.54E-01	1	0.40	0.0455	0.25	0.4	4.55E-03	2.80E-04
Tai Mong Tsai Road	C	up	< 20	10 to 20	1.54E-01	1	0.05	0.0685	0.25	0.4	6.85E-03	5.27E-05
Tai Mong Tsai Road	C	up	< 20	>= 20	1.54E-01	1	0.00	0.0835	0.25	0.4	8.35E-03	0.00E+00
Tai Mong Tsai Road	C	up	20 to 50	< 10	1.54E-01	1	0.10	0.3500	0.25	0.7	6.13E-02	9.42E-04
Tai Mong Tsai Road	C	up	20 to 50	10 to 20	1.54E-01	1	0.10	0.4350	0.25	0.7	7.61E-02	1.17E-03
Tai Mong Tsai Road	C	up	20 to 50	>= 20	1.54E-01	1	0.00	0.4850	0.25	0.7	8.49E-02	0.00E+00
Tai Mong Tsai Road	C	up	50 to 500	< 10	1.54E-01	1	0.00	0.5850	0.25	1.5	2.19E-01	0.00E+00
Tai Mong Tsai Road	C	up	50 to 500	10 to 20	1.54E-01	1	0.30	0.6650	0.25	1.5	2.49E-01	1.15E-02
Tai Mong Tsai Road	C	up	50 to 500	>= 20	1.54E-01	1	0.00	0.6950	0.25	1.5	2.61E-01	0.00E+00
Tai Mong Tsai Road	C	up	500 to 2000	< 10	1.54E-01	1	0.00	0.8900	0.25	2	4.45E-01	0.00E+00
Tai Mong Tsai Road	C	up	500 to 2000	10 to 20	1.54E-01	1	0.05	0.9500	0.25	2	4.75E-01	3.65E-03
Tai Mong Tsai Road	C	up	500 to 2000	>= 20	1.54E-01	1	0.00	0.9500	0.25	2	4.75E-01	0.00E+00
Tai Mong Tsai Road	C	up	> 2000	< 10	1.54E-01	1	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Tai Mong Tsai Road	C	up	> 2000	10 to 20	1.54E-01	1	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Tai Mong Tsai Road	C	up	> 2000	>= 20	1.54E-01	1	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Tai Mong Tsai Road	C	down	< 20	< 10	1.54E-01	0	0.00	0.0039	0.25	0.6	5.81E-04	0.00E+00
Tai Mong Tsai Road	C	down	< 20	10 to 20	1.54E-01	0	0.00	0.0039	0.25	0.6	5.81E-04	0.00E+00
Tai Mong Tsai Road	C	down	< 20	>= 20	1.54E-01	0	0.00	0.0039	0.25	0.6	5.81E-04	0.00E+00
Tai Mong Tsai Road	C	down	20 to 50	< 10	1.54E-01	0	0.00	0.0194	0.25	1	4.84E-03	0.00E+00
Tai Mong Tsai Road	C	down	20 to 50	10 to 20	1.54E-01	0	0.00	0.0194	0.25	1	4.84E-03	0.00E+00
Tai Mong Tsai Road	C	down	20 to 50	>= 20	1.54E-01	0	0.00	0.0194	0.25	1	4.84E-03	0.00E+00
Tai Mong Tsai Road	C	down	50 to 200	< 10	1.54E-01	0	0.00	0.0775	0.25	1.5	2.91E-02	0.00E+00
Tai Mong Tsai Road	C	down	50 to 200	10 to 20	1.54E-01	0	0.00	0.0775	0.25	1.5	2.91E-02	0.00E+00
Tai Mong Tsai Road	C	down	50 to 200	>= 20	1.54E-01	0	0.00	0.0775	0.25	1.5	2.91E-02	0.00E+00
Tai Mong Tsai Road	C	down	200 to 1000	< 10	1.54E-01	0	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Tai Mong Tsai Road	C	down	200 to 1000	10 to 20	1.54E-01	0	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Tai Mong Tsai Road	C	down	200 to 1000	>= 20	1.54E-01	0	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Tai Mong Tsai Road	C	down	> 1000	< 10	1.54E-01	0	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Tai Mong Tsai Road	C	down	> 1000	10 to 20	1.54E-01	0	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Tai Mong Tsai Road	C	down	> 1000	>= 20	1.54E-01	0	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Tai Mong Tsai Road	D	up	< 20	< 10	1.54E-01	1	0.80	0.0455	0.25	0.4	4.55E-03	5.60E-04
Tai Mong Tsai Road	D	up	< 20	10 to 20	1.54E-01	1	0.00	0.0685	0.25	0.4	6.85E-03	0.00E+00
Tai Mong Tsai Road	D	up	< 20	>= 20	1.54E-01	1	0.00	0.0835	0.25	0.4	8.35E-03	0.00E+00
Tai Mong Tsai Road	D	up	20 to 50	< 10	1.54E-01	1	0.20	0.3500	0.25	0.7	6.13E-02	1.88E-03
Tai Mong Tsai Road	D	up	20 to 50	10 to 20	1.54E-01	1	0.00	0.4350	0.25	0.7	7.61E-02	0.00E+00
Tai Mong Tsai Road	D	up	20 to 50	>= 20	1.54E-01	1	0.00	0.4850	0.25	0.7	8.49E-02	0.00E+00
Tai Mong Tsai Road	D	up	50 to 500	< 10	1.54E-01	1	0.00	0.5850	0.25	1.5	2.19E-01	0.00E+00
Tai Mong Tsai Road	D	up	50 to 500	10 to 20	1.54E-01	1	0.00	0.6650	0.25	1.5	2.49E-01	0.00E+00
Tai Mong Tsai Road	D	up	50 to 500	>= 20	1.54E-01	1	0.00	0.6950	0.25	1.5	2.61E-01	0.00E+00
Tai Mong Tsai Road	D	up	500 to 2000	< 10	1.54E-01	1	0.00	0.8900	0.25	2	4.45E-01	0.00E+00
Tai Mong Tsai Road	D	up	500 to 2000	10 to 20	1.54E-01	1	0.00	0.9500	0.25	2	4.75E-01	0.00E+00
Tai Mong Tsai Road	D	up	500 to 2000	>= 20	1.54E-01	1	0.00	0.9500	0.25	2	4.75E-01	0.00E+00
Tai Mong Tsai Road	D	up	> 2000	< 10	1.54E-01	1	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Tai Mong Tsai Road	D	up	> 2000	10 to 20	1.54E-01	1	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Tai Mong Tsai Road	D	up	> 2000	>= 20	1.54E-01	1	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Tai Mong Tsai Road	D	down	< 20	< 10	1.54E-01	0	0.00	0.0039	0.25	0.6	5.81E-04	0.00E+00
Tai Mong Tsai Road	D	down	< 20	10 to 20	1.54E-01	0	0.00	0.0039	0.25	0.6	5.81E-04	0.00E+00
Tai Mong Tsai Road	D	down	< 20	>= 20	1.54E-01	0	0.00	0.0039	0.25	0.6	5.81E-04	0.00E+00

LS PLL

Roads	Section	Slope	Failure Vol Range	Height Range	LS Frequency per year	Slope	Height Vol	V Factor	Expected Fatality	Scale Factor	Consequence	PLL
Tai Mong Tsai Road	D	down	20 to 50	< 10	1.54E-01	0	0.00	0.0194	0.25	1	4.84E-03	0.00E+00
Tai Mong Tsai Road	D	down	20 to 50	10 to 20	1.54E-01	0	0.00	0.0194	0.25	1	4.84E-03	0.00E+00
Tai Mong Tsai Road	D	down	20 to 50	>= 20	1.54E-01	0	0.00	0.0194	0.25	1	4.84E-03	0.00E+00
Tai Mong Tsai Road	D	down	50 to 200	< 10	1.54E-01	0	0.00	0.0775	0.25	1.5	2.91E-02	0.00E+00
Tai Mong Tsai Road	D	down	50 to 200	10 to 20	1.54E-01	0	0.00	0.0775	0.25	1.5	2.91E-02	0.00E+00
Tai Mong Tsai Road	D	down	50 to 200	>= 20	1.54E-01	0	0.00	0.0775	0.25	1.5	2.91E-02	0.00E+00
Tai Mong Tsai Road	D	down	200 to 1000	< 10	1.54E-01	0	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Tai Mong Tsai Road	D	down	200 to 1000	10 to 20	1.54E-01	0	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Tai Mong Tsai Road	D	down	200 to 1000	>= 20	1.54E-01	0	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Tai Mong Tsai Road	D	down	> 1000	< 10	1.54E-01	0	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Tai Mong Tsai Road	D	down	> 1000	10 to 20	1.54E-01	0	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Tai Mong Tsai Road	D	down	> 1000	>= 20	1.54E-01	0	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Tai Po Road	A	up	< 20	< 10	1.54E-01	0.5	0.00	0.0231	0.25	0.4	2.31E-03	0.00E+00
Tai Po Road	A	up	< 20	10 to 20	1.54E-01	0.5	1.00	0.0406	0.25	0.4	4.06E-03	3.13E-04
Tai Po Road	A	up	< 20	>= 20	1.54E-01	0.5	0.00	0.0628	0.25	0.4	6.28E-03	0.00E+00
Tai Po Road	A	up	20 to 50	< 10	1.54E-01	0.5	0.00	0.1825	0.25	0.7	3.19E-02	0.00E+00
Tai Po Road	A	up	20 to 50	10 to 20	1.54E-01	0.5	0.00	0.3000	0.25	0.7	5.25E-02	0.00E+00
Tai Po Road	A	up	20 to 50	>= 20	1.54E-01	0.5	0.00	0.4275	0.25	0.7	7.48E-02	0.00E+00
Tai Po Road	A	up	50 to 500	< 10	1.54E-01	0.5	0.00	0.3120	0.25	1.5	1.17E-01	0.00E+00
Tai Po Road	A	up	50 to 500	10 to 20	1.54E-01	0.5	0.00	0.5175	0.25	1.5	1.94E-01	0.00E+00
Tai Po Road	A	up	50 to 500	>= 20	1.54E-01	0.5	0.00	0.6625	0.25	1.5	2.48E-01	0.00E+00
Tai Po Road	A	up	500 to 2000	< 10	1.54E-01	0.5	0.00	0.4825	0.25	2	2.41E-01	0.00E+00
Tai Po Road	A	up	500 to 2000	10 to 20	1.54E-01	0.5	0.00	0.8025	0.25	2	4.01E-01	0.00E+00
Tai Po Road	A	up	500 to 2000	>= 20	1.54E-01	0.5	0.00	0.9500	0.25	2	4.75E-01	0.00E+00
Tai Po Road	A	up	> 2000	< 10	1.54E-01	0.5	0.00	0.5975	0.25	2.5	3.73E-01	0.00E+00
Tai Po Road	A	up	> 2000	10 to 20	1.54E-01	0.5	0.00	0.9200	0.25	2.5	5.75E-01	0.00E+00
Tai Po Road	A	up	> 2000	>= 20	1.54E-01	0.5	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Tai Po Road	A	down	< 20	< 10	1.54E-01	0.5	0.13	0.0026	0.25	0.6	3.88E-04	3.97E-06
Tai Po Road	A	down	< 20	10 to 20	1.54E-01	0.5	0.13	0.0026	0.25	0.6	3.88E-04	3.97E-06
Tai Po Road	A	down	< 20	>= 20	1.54E-01	0.5	0.13	0.0026	0.25	0.6	3.88E-04	3.97E-06
Tai Po Road	A	down	20 to 50	< 10	1.54E-01	0.5	0.18	0.0129	0.25	1	3.23E-03	4.47E-05
Tai Po Road	A	down	20 to 50	10 to 20	1.54E-01	0.5	0.18	0.0129	0.25	1	3.23E-03	4.47E-05
Tai Po Road	A	down	20 to 50	>= 20	1.54E-01	0.5	0.18	0.0129	0.25	1	3.23E-03	4.47E-05
Tai Po Road	A	down	50 to 200	< 10	1.54E-01	0.5	0.02	0.0517	0.25	1.5	1.94E-02	2.48E-05
Tai Po Road	A	down	50 to 200	10 to 20	1.54E-01	0.5	0.02	0.0517	0.25	1.5	1.94E-02	2.48E-05
Tai Po Road	A	down	50 to 200	>= 20	1.54E-01	0.5	0.02	0.0517	0.25	1.5	1.94E-02	2.48E-05
Tai Po Road	A	down	200 to 1000	< 10	1.54E-01	0.5	0.00	0.1473	0.25	2	7.37E-02	1.89E-05
Tai Po Road	A	down	200 to 1000	10 to 20	1.54E-01	0.5	0.00	0.1473	0.25	2	7.37E-02	1.89E-05
Tai Po Road	A	down	200 to 1000	>= 20	1.54E-01	0.5	0.00	0.1473	0.25	2	7.37E-02	1.89E-05
Tai Po Road	A	down	> 1000	< 10	1.54E-01	0.5	0.00	0.2053	0.25	4	2.05E-01	0.00E+00
Tai Po Road	A	down	> 1000	10 to 20	1.54E-01	0.5	0.00	0.2053	0.25	4	2.05E-01	0.00E+00
Tai Po Road	A	down	> 1000	>= 20	1.54E-01	0.5	0.00	0.2053	0.25	4	2.05E-01	0.00E+00
Tai Po Road	B	up	< 20	< 10	6.15E-01	0.88	0.40	0.0231	0.25	0.4	2.31E-03	5.01E-04
Tai Po Road	B	up	< 20	10 to 20	6.15E-01	0.88	0.10	0.0406	0.25	0.4	4.06E-03	2.20E-04
Tai Po Road	B	up	< 20	>= 20	6.15E-01	0.88	0.05	0.0628	0.25	0.4	6.28E-03	1.70E-04
Tai Po Road	B	up	20 to 50	< 10	6.15E-01	0.88	0.10	0.1825	0.25	0.7	3.19E-02	1.73E-03
Tai Po Road	B	up	20 to 50	10 to 20	6.15E-01	0.88	0.09	0.3000	0.25	0.7	5.25E-02	2.56E-03
Tai Po Road	B	up	20 to 50	>= 20	6.15E-01	0.88	0.08	0.4275	0.25	0.7	7.48E-02	3.24E-03
Tai Po Road	B	up	50 to 500	< 10	6.15E-01	0.88	0.02	0.3120	0.25	1.5	1.17E-01	1.27E-03
Tai Po Road	B	up	50 to 500	10 to 20	6.15E-01	0.88	0.08	0.5175	0.25	1.5	1.94E-01	8.41E-03
Tai Po Road	B	up	50 to 500	>= 20	6.15E-01	0.88	0.05	0.6625	0.25	1.5	2.48E-01	6.73E-03
Tai Po Road	B	up	500 to 2000	< 10	6.15E-01	0.88	0.00	0.4825	0.25	2	2.41E-01	0.00E+00
Tai Po Road	B	up	500 to 2000	10 to 20	6.15E-01	0.88	0.01	0.8025	0.25	2	4.01E-01	2.17E-03
Tai Po Road	B	up	500 to 2000	>= 20	6.15E-01	0.88	0.02	0.9500	0.25	2	4.75E-01	5.14E-03
Tai Po Road	B	up	> 2000	< 10	6.15E-01	0.88	0.00	0.5975	0.25	2.5	3.73E-01	0.00E+00
Tai Po Road	B	up	> 2000	10 to 20	6.15E-01	0.88	0.00	0.9200	0.25	2.5	5.75E-01	0.00E+00
Tai Po Road	B	up	> 2000	>= 20	6.15E-01	0.88	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Tai Po Road	B	down	< 20	< 10	6.15E-01	0.12	0.03	0.0026	0.25	0.6	3.88E-04	8.58E-07
Tai Po Road	B	down	< 20	10 to 20	6.15E-01	0.12	0.03	0.0026	0.25	0.6	3.88E-04	8.58E-07
Tai Po Road	B	down	< 20	>= 20	6.15E-01	0.12	0.03	0.0026	0.25	0.6	3.88E-04	8.58E-07
Tai Po Road	B	down	20 to 50	< 10	6.15E-01	0.12	0.07	0.0129	0.25	1	3.23E-03	1.59E-05
Tai Po Road	B	down	20 to 50	10 to 20	6.15E-01	0.12	0.07	0.0129	0.25	1	3.23E-03	1.59E-05
Tai Po Road	B	down	20 to 50	>= 20	6.15E-01	0.12	0.07	0.0129	0.25	1	3.23E-03	1.59E-05
Tai Po Road	B	down	50 to 200	< 10	6.15E-01	0.12	0.23	0.0517	0.25	1.5	1.94E-02	3.34E-04
Tai Po Road	B	down	50 to 200	10 to 20	6.15E-01	0.12	0.23	0.0517	0.25	1.5	1.94E-02	3.34E-04
Tai Po Road	B	down	50 to 200	>= 20	6.15E-01	0.12	0.23	0.0517	0.25	1.5	1.94E-02	3.34E-04
Tai Po Road	B	down	200 to 1000	< 10	6.15E-01	0.12	0.00	0.1473	0.25	2	7.37E-02	1.81E-05
Tai Po Road	B	down	200 to 1000	10 to 20	6.15E-01	0.12	0.00	0.1473	0.25	2	7.37E-02	1.81E-05
Tai Po Road	B	down	200 to 1000	>= 20	6.15E-01	0.12	0.00	0.1473	0.25	2	7.37E-02	1.81E-05
Tai Po Road	B	down	> 1000	< 10	6.15E-01	0.12	0.00	0.2053	0.25	4	2.05E-01	0.00E+00
Tai Po Road	B	down	> 1000	10 to 20	6.15E-01	0.12	0.00	0.2053	0.25	4	2.05E-01	0.00E+00
Tai Po Road	B	down	> 1000	>= 20	6.15E-01	0.12	0.00	0.2053	0.25	4	2.05E-01	0.00E+00
Tai Po Road	C	up	< 20	< 10	4.62E-01	0.83	0.40	0.0231	0.25	0.4	2.31E-03	3.54E-04
Tai Po Road	C	up	< 20	10 to 20	4.62E-01	0.83	0.20	0.0406	0.25	0.4	4.06E-03	3.11E-04

LS PLL

Roads	Section	Slope	Failure Vol Range	Height Range	LS Frequency per year	Slope	Height Vol	V Factor	Expected Fatality	Scale Factor	Consequence	PLL
Tai Po Road	C	up	< 20	>= 20	4.62E-01	0.83	0.02	0.0628	0.25	0.4	6.28E-03	4.81E-05
Tai Po Road	C	up	20 to 50	< 10	4.62E-01	0.83	0.05	0.1825	0.25	0.7	3.19E-02	6.12E-04
Tai Po Road	C	up	20 to 50	10 to 20	4.62E-01	0.83	0.10	0.3000	0.25	0.7	5.25E-02	2.01E-03
Tai Po Road	C	up	20 to 50	>= 20	4.62E-01	0.83	0.04	0.4275	0.25	0.7	7.48E-02	1.15E-03
Tai Po Road	C	up	50 to 500	< 10	4.62E-01	0.83	0.00	0.3120	0.25	1.5	1.17E-01	0.00E+00
Tai Po Road	C	up	50 to 500	10 to 20	4.62E-01	0.83	0.15	0.5175	0.25	1.5	1.94E-01	1.12E-02
Tai Po Road	C	up	50 to 500	>= 20	4.62E-01	0.83	0.02	0.6625	0.25	1.5	2.48E-01	1.90E-03
Tai Po Road	C	up	500 to 2000	< 10	4.62E-01	0.83	0.00	0.4825	0.25	2	2.41E-01	0.00E+00
Tai Po Road	C	up	500 to 2000	10 to 20	4.62E-01	0.83	0.01	0.8025	0.25	2	4.01E-01	1.54E-03
Tai Po Road	C	up	500 to 2000	>= 20	4.62E-01	0.83	0.01	0.9500	0.25	2	4.75E-01	1.82E-03
Tai Po Road	C	up	> 2000	< 10	4.62E-01	0.83	0.00	0.5975	0.25	2.5	3.73E-01	0.00E+00
Tai Po Road	C	up	> 2000	10 to 20	4.62E-01	0.83	0.00	0.9200	0.25	2.5	5.75E-01	0.00E+00
Tai Po Road	C	up	> 2000	>= 20	4.62E-01	0.83	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Tai Po Road	C	down	< 20	< 10	4.62E-01	0.17	0.08	0.0026	0.25	0.6	3.88E-04	2.53E-06
Tai Po Road	C	down	< 20	10 to 20	4.62E-01	0.17	0.08	0.0026	0.25	0.6	3.88E-04	2.53E-06
Tai Po Road	C	down	< 20	>= 20	4.62E-01	0.17	0.08	0.0026	0.25	0.6	3.88E-04	2.53E-06
Tai Po Road	C	down	20 to 50	< 10	4.62E-01	0.17	0.23	0.0129	0.25	1	3.23E-03	5.91E-05
Tai Po Road	C	down	20 to 50	10 to 20	4.62E-01	0.17	0.23	0.0129	0.25	1	3.23E-03	5.91E-05
Tai Po Road	C	down	20 to 50	>= 20	4.62E-01	0.17	0.23	0.0129	0.25	1	3.23E-03	5.91E-05
Tai Po Road	C	down	50 to 200	< 10	4.62E-01	0.17	0.02	0.0517	0.25	1.5	1.94E-02	2.53E-05
Tai Po Road	C	down	50 to 200	10 to 20	4.62E-01	0.17	0.02	0.0517	0.25	1.5	1.94E-02	2.53E-05
Tai Po Road	C	down	50 to 200	>= 20	4.62E-01	0.17	0.02	0.0517	0.25	1.5	1.94E-02	2.53E-05
Tai Po Road	C	down	200 to 1000	< 10	4.62E-01	0.17	0.00	0.1473	0.25	2	7.37E-02	0.00E+00
Tai Po Road	C	down	200 to 1000	10 to 20	4.62E-01	0.17	0.00	0.1473	0.25	2	7.37E-02	0.00E+00
Tai Po Road	C	down	200 to 1000	>= 20	4.62E-01	0.17	0.00	0.1473	0.25	2	7.37E-02	0.00E+00
Tai Po Road	C	down	> 1000	< 10	4.62E-01	0.17	0.00	0.2053	0.25	4	2.05E-01	0.00E+00
Tai Po Road	C	down	> 1000	10 to 20	4.62E-01	0.17	0.00	0.2053	0.25	4	2.05E-01	0.00E+00
Tai Po Road	C	down	> 1000	>= 20	4.62E-01	0.17	0.00	0.2053	0.25	4	2.05E-01	0.00E+00
Tai Tam Road	-	up	< 20	< 10	8.46E-01	0.91	0.71	0.0455	1	0.4	1.82E-02	9.95E-03
Tai Tam Road	-	up	< 20	10 to 20	8.46E-01	0.91	0.15	0.0685	1	0.4	2.74E-02	3.16E-03
Tai Tam Road	-	up	< 20	>= 20	8.46E-01	0.91	0.01	0.0835	1	0.4	3.34E-02	2.57E-04
Tai Tam Road	-	up	20 to 50	< 10	8.46E-01	0.91	0.05	0.3500	1	0.7	2.45E-01	9.43E-03
Tai Tam Road	-	up	20 to 50	10 to 20	8.46E-01	0.91	0.04	0.4350	1	0.7	3.05E-01	9.38E-03
Tai Tam Road	-	up	20 to 50	>= 20	8.46E-01	0.91	0.02	0.4850	1	0.7	3.40E-01	5.23E-03
Tai Tam Road	-	up	50 to 500	< 10	8.46E-01	0.91	0.00	0.5850	1	1.5	8.78E-01	0.00E+00
Tai Tam Road	-	up	50 to 500	10 to 20	8.46E-01	0.91	0.01	0.6650	1	1.5	9.98E-01	7.68E-03
Tai Tam Road	-	up	50 to 500	>= 20	8.46E-01	0.91	0.01	0.6950	1	1.5	1.04E+00	8.03E-03
Tai Tam Road	-	up	500 to 2000	< 10	8.46E-01	0.91	0.00	0.8900	1	2	1.78E+00	0.00E+00
Tai Tam Road	-	up	500 to 2000	10 to 20	8.46E-01	0.91	0.00	0.9500	1	2	1.90E+00	0.00E+00
Tai Tam Road	-	up	500 to 2000	>= 20	8.46E-01	0.91	0.00	0.9500	1	2	1.90E+00	0.00E+00
Tai Tam Road	-	up	> 2000	< 10	8.46E-01	0.91	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Tai Tam Road	-	up	> 2000	10 to 20	8.46E-01	0.91	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Tai Tam Road	-	up	> 2000	>= 20	8.46E-01	0.91	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Tai Tam Road	-	down	< 20	< 10	8.46E-01	0.09	0.08	0.0039	1	0.6	2.33E-03	1.48E-05
Tai Tam Road	-	down	< 20	10 to 20	8.46E-01	0.09	0.08	0.0039	1	0.6	2.33E-03	1.48E-05
Tai Tam Road	-	down	< 20	>= 20	8.46E-01	0.09	0.08	0.0039	1	0.6	2.33E-03	1.48E-05
Tai Tam Road	-	down	20 to 50	< 10	8.46E-01	0.09	0.23	0.0194	1	1	1.94E-02	3.44E-04
Tai Tam Road	-	down	20 to 50	10 to 20	8.46E-01	0.09	0.23	0.0194	1	1	1.94E-02	3.44E-04
Tai Tam Road	-	down	20 to 50	>= 20	8.46E-01	0.09	0.23	0.0194	1	1	1.94E-02	3.44E-04
Tai Tam Road	-	down	50 to 200	< 10	8.46E-01	0.09	0.02	0.0775	1	1.5	1.16E-01	1.48E-04
Tai Tam Road	-	down	50 to 200	10 to 20	8.46E-01	0.09	0.02	0.0775	1	1.5	1.16E-01	1.48E-04
Tai Tam Road	-	down	50 to 200	>= 20	8.46E-01	0.09	0.02	0.0775	1	1.5	1.16E-01	1.48E-04
Tai Tam Road	-	down	200 to 1000	< 10	8.46E-01	0.09	0.00	0.2200	1	2	4.40E-01	0.00E+00
Tai Tam Road	-	down	200 to 1000	10 to 20	8.46E-01	0.09	0.00	0.2200	1	2	4.40E-01	0.00E+00
Tai Tam Road	-	down	200 to 1000	>= 20	8.46E-01	0.09	0.00	0.2200	1	2	4.40E-01	0.00E+00
Tai Tam Road	-	down	> 1000	< 10	8.46E-01	0.09	0.00	0.3070	1	4	1.23E+00	0.00E+00
Tai Tam Road	-	down	> 1000	10 to 20	8.46E-01	0.09	0.00	0.3070	1	4	1.23E+00	0.00E+00
Tai Tam Road	-	down	> 1000	>= 20	8.46E-01	0.09	0.00	0.3070	1	4	1.23E+00	0.00E+00
Tuen Mun Road	A	up	< 20	< 10	3.08E-01	0.67	0.00	0.0154	3	0.4	1.85E-02	0.00E+00
Tuen Mun Road	A	up	< 20	10 to 20	3.08E-01	0.67	0.65	0.0271	3	0.4	3.25E-02	4.36E-03
Tuen Mun Road	A	up	< 20	>= 20	3.08E-01	0.67	0.11	0.0461	3	0.4	5.53E-02	1.25E-03
Tuen Mun Road	A	up	20 to 50	< 10	3.08E-01	0.67	0.00	0.1217	3	0.7	2.56E-01	0.00E+00
Tuen Mun Road	A	up	20 to 50	10 to 20	3.08E-01	0.67	0.10	0.2000	3	0.7	4.20E-01	8.66E-03
Tuen Mun Road	A	up	20 to 50	>= 20	3.08E-01	0.67	0.05	0.3400	3	0.7	7.14E-01	7.36E-03
Tuen Mun Road	A	up	50 to 500	< 10	3.08E-01	0.67	0.00	0.2080	3	1.5	9.36E-01	0.00E+00
Tuen Mun Road	A	up	50 to 500	10 to 20	3.08E-01	0.67	0.05	0.3455	3	1.5	1.55E+00	1.60E-02
Tuen Mun Road	A	up	50 to 500	>= 20	3.08E-01	0.67	0.03	0.5650	3	1.5	2.54E+00	1.57E-02
Tuen Mun Road	A	up	500 to 2000	< 10	3.08E-01	0.67	0.00	0.3217	3	2	1.93E+00	0.00E+00
Tuen Mun Road	A	up	500 to 2000	10 to 20	3.08E-01	0.67	0.00	0.5383	3	2	3.23E+00	0.00E+00
Tuen Mun Road	A	up	500 to 2000	>= 20	3.08E-01	0.67	0.01	0.8517	3	2	5.11E+00	1.05E-02
Tuen Mun Road	A	up	> 2000	< 10	3.08E-01	0.67	0.00	0.3983	3	2.5	2.99E+00	0.00E+00
Tuen Mun Road	A	up	> 2000	10 to 20	3.08E-01	0.67	0.00	0.6633	3	2.5	4.98E+00	0.00E+00
Tuen Mun Road	A	up	> 2000	>= 20	3.08E-01	0.67	0.00	0.9300	3	2.5	6.98E+00	0.00E+00
Tuen Mun Road	A	down	< 20	< 10	3.08E-01	0.33	0.28	0.0026	3	0.6	4.65E-03	1.34E-04

LS PLL

Roads	Section	Slope	Failure Vol Range	Height Range	LS Frequency per year	Slope	Height Vol	V Factor	Expected Fatality	Scale Factor	Consequence	PLL
Tuen Mun Road	A	down	< 20	10 to 20	3.08E-01	0.33	0.28	0.0026	3	0.6	4.65E-03	1.34E-04
Tuen Mun Road	A	down	< 20	>= 20	3.08E-01	0.33	0.28	0.0026	3	0.6	4.65E-03	1.34E-04
Tuen Mun Road	A	down	20 to 50	< 10	3.08E-01	0.33	0.03	0.0129	3	1	3.88E-02	1.31E-04
Tuen Mun Road	A	down	20 to 50	10 to 20	3.08E-01	0.33	0.03	0.0129	3	1	3.88E-02	1.31E-04
Tuen Mun Road	A	down	20 to 50	>= 20	3.08E-01	0.33	0.03	0.0129	3	1	3.88E-02	1.31E-04
Tuen Mun Road	A	down	50 to 200	< 10	3.08E-01	0.33	0.01	0.0517	3	1.5	2.33E-01	3.15E-04
Tuen Mun Road	A	down	50 to 200	10 to 20	3.08E-01	0.33	0.01	0.0517	3	1.5	2.33E-01	3.15E-04
Tuen Mun Road	A	down	50 to 200	>= 20	3.08E-01	0.33	0.01	0.0517	3	1.5	2.33E-01	3.15E-04
Tuen Mun Road	A	down	200 to 1000	< 10	3.08E-01	0.33	0.00	0.1473	3	2	8.84E-01	2.99E-04
Tuen Mun Road	A	down	200 to 1000	10 to 20	3.08E-01	0.33	0.00	0.1473	3	2	8.84E-01	2.99E-04
Tuen Mun Road	A	down	200 to 1000	>= 20	3.08E-01	0.33	0.00	0.1473	3	2	8.84E-01	2.99E-04
Tuen Mun Road	A	down	> 1000	< 10	3.08E-01	0.33	0.00	0.2053	3	4	2.46E+00	0.00E+00
Tuen Mun Road	A	down	> 1000	10 to 20	3.08E-01	0.33	0.00	0.2053	3	4	2.46E+00	0.00E+00
Tuen Mun Road	A	down	> 1000	>= 20	3.08E-01	0.33	0.00	0.2053	3	4	2.46E+00	0.00E+00
Tuen Mun Road	B	up	< 20	< 10	1.54E-01	1	0.00	0.0154	3	0.4	1.85E-02	0.00E+00
Tuen Mun Road	B	up	< 20	10 to 20	1.54E-01	1	0.10	0.0271	3	0.4	3.25E-02	5.00E-04
Tuen Mun Road	B	up	< 20	>= 20	1.54E-01	1	0.35	0.0461	3	0.4	5.53E-02	2.98E-03
Tuen Mun Road	B	up	20 to 50	< 10	1.54E-01	1	0.00	0.1217	3	0.7	2.56E-01	0.00E+00
Tuen Mun Road	B	up	20 to 50	10 to 20	1.54E-01	1	0.30	0.2000	3	0.7	4.20E-01	1.94E-02
Tuen Mun Road	B	up	20 to 50	>= 20	1.54E-01	1	0.10	0.3400	3	0.7	7.14E-01	1.10E-02
Tuen Mun Road	B	up	50 to 500	< 10	1.54E-01	1	0.00	0.2080	3	1.5	9.36E-01	0.00E+00
Tuen Mun Road	B	up	50 to 500	10 to 20	1.54E-01	1	0.05	0.3455	3	1.5	1.55E+00	1.20E-02
Tuen Mun Road	B	up	50 to 500	>= 20	1.54E-01	1	0.06	0.5650	3	1.5	2.54E+00	2.35E-02
Tuen Mun Road	B	up	500 to 2000	< 10	1.54E-01	1	0.00	0.3217	3	2	1.93E+00	0.00E+00
Tuen Mun Road	B	up	500 to 2000	10 to 20	1.54E-01	1	0.00	0.5383	3	2	3.23E+00	0.00E+00
Tuen Mun Road	B	up	500 to 2000	>= 20	1.54E-01	1	0.04	0.8517	3	2	5.11E+00	3.14E-02
Tuen Mun Road	B	up	> 2000	< 10	1.54E-01	1	0.00	0.3983	3	2.5	2.99E+00	0.00E+00
Tuen Mun Road	B	up	> 2000	10 to 20	1.54E-01	1	0.00	0.6633	3	2.5	4.98E+00	0.00E+00
Tuen Mun Road	B	up	> 2000	>= 20	1.54E-01	1	0.00	0.9300	3	2.5	6.98E+00	0.00E+00
Tuen Mun Road	B	down	< 20	< 10	1.54E-01	0	0.30	0.0026	3	0.6	4.65E-03	0.00E+00
Tuen Mun Road	B	down	< 20	10 to 20	1.54E-01	0	0.30	0.0026	3	0.6	4.65E-03	0.00E+00
Tuen Mun Road	B	down	< 20	>= 20	1.54E-01	0	0.30	0.0026	3	0.6	4.65E-03	0.00E+00
Tuen Mun Road	B	down	20 to 50	< 10	1.54E-01	0	0.03	0.0129	3	1	3.88E-02	0.00E+00
Tuen Mun Road	B	down	20 to 50	10 to 20	1.54E-01	0	0.03	0.0129	3	1	3.88E-02	0.00E+00
Tuen Mun Road	B	down	20 to 50	>= 20	1.54E-01	0	0.03	0.0129	3	1	3.88E-02	0.00E+00
Tuen Mun Road	B	down	50 to 200	< 10	1.54E-01	0	0.01	0.0517	3	1.5	2.33E-01	0.00E+00
Tuen Mun Road	B	down	50 to 200	10 to 20	1.54E-01	0	0.01	0.0517	3	1.5	2.33E-01	0.00E+00
Tuen Mun Road	B	down	50 to 200	>= 20	1.54E-01	0	0.01	0.0517	3	1.5	2.33E-01	0.00E+00
Tuen Mun Road	B	down	200 to 1000	< 10	1.54E-01	0	0.00	0.1473	3	2	8.84E-01	0.00E+00
Tuen Mun Road	B	down	200 to 1000	10 to 20	1.54E-01	0	0.00	0.1473	3	2	8.84E-01	0.00E+00
Tuen Mun Road	B	down	200 to 1000	>= 20	1.54E-01	0	0.00	0.1473	3	2	8.84E-01	0.00E+00
Tuen Mun Road	B	down	> 1000	< 10	1.54E-01	0	0.00	0.2053	3	4	2.46E+00	0.00E+00
Tuen Mun Road	B	down	> 1000	10 to 20	1.54E-01	0	0.00	0.2053	3	4	2.46E+00	0.00E+00
Tuen Mun Road	B	down	> 1000	>= 20	1.54E-01	0	0.00	0.2053	3	4	2.46E+00	0.00E+00
Tuen Mun Road	C	up	< 20	< 10	3.08E-01	0.75	0.00	0.0154	3	0.4	1.85E-02	0.00E+00
Tuen Mun Road	C	up	< 20	10 to 20	3.08E-01	0.75	0.40	0.0271	3	0.4	3.25E-02	3.00E-03
Tuen Mun Road	C	up	< 20	>= 20	3.08E-01	0.75	0.20	0.0461	3	0.4	5.53E-02	2.55E-03
Tuen Mun Road	C	up	20 to 50	< 10	3.08E-01	0.75	0.00	0.1217	3	0.7	2.56E-01	0.00E+00
Tuen Mun Road	C	up	20 to 50	10 to 20	3.08E-01	0.75	0.10	0.2000	3	0.7	4.20E-01	9.69E-03
Tuen Mun Road	C	up	20 to 50	>= 20	3.08E-01	0.75	0.20	0.3400	3	0.7	7.14E-01	3.30E-02
Tuen Mun Road	C	up	50 to 500	< 10	3.08E-01	0.75	0.00	0.2080	3	1.5	9.36E-01	0.00E+00
Tuen Mun Road	C	up	50 to 500	10 to 20	3.08E-01	0.75	0.01	0.3455	3	1.5	1.55E+00	3.59E-03
Tuen Mun Road	C	up	50 to 500	>= 20	3.08E-01	0.75	0.08	0.5650	3	1.5	2.54E+00	4.69E-02
Tuen Mun Road	C	up	500 to 2000	< 10	3.08E-01	0.75	0.00	0.3217	3	2	1.93E+00	0.00E+00
Tuen Mun Road	C	up	500 to 2000	10 to 20	3.08E-01	0.75	0.00	0.5383	3	2	3.23E+00	0.00E+00
Tuen Mun Road	C	up	500 to 2000	>= 20	3.08E-01	0.75	0.01	0.8517	3	2	5.11E+00	1.18E-02
Tuen Mun Road	C	up	> 2000	< 10	3.08E-01	0.75	0.00	0.3983	3	2.5	2.99E+00	0.00E+00
Tuen Mun Road	C	up	> 2000	10 to 20	3.08E-01	0.75	0.00	0.6633	3	2.5	4.98E+00	0.00E+00
Tuen Mun Road	C	up	> 2000	>= 20	3.08E-01	0.75	0.00	0.9300	3	2.5	6.98E+00	0.00E+00
Tuen Mun Road	C	down	< 20	< 10	3.08E-01	0.25	0.08	0.0026	3	0.6	4.65E-03	2.98E-05
Tuen Mun Road	C	down	< 20	10 to 20	3.08E-01	0.25	0.08	0.0026	3	0.6	4.65E-03	2.98E-05
Tuen Mun Road	C	down	< 20	>= 20	3.08E-01	0.25	0.08	0.0026	3	0.6	4.65E-03	2.98E-05
Tuen Mun Road	C	down	20 to 50	< 10	3.08E-01	0.25	0.23	0.0129	3	1	3.88E-02	6.96E-04
Tuen Mun Road	C	down	20 to 50	10 to 20	3.08E-01	0.25	0.23	0.0129	3	1	3.88E-02	6.96E-04
Tuen Mun Road	C	down	20 to 50	>= 20	3.08E-01	0.25	0.23	0.0129	3	1	3.88E-02	6.96E-04
Tuen Mun Road	C	down	50 to 200	< 10	3.08E-01	0.25	0.02	0.0517	3	1.5	2.33E-01	2.98E-04
Tuen Mun Road	C	down	50 to 200	10 to 20	3.08E-01	0.25	0.02	0.0517	3	1.5	2.33E-01	2.98E-04
Tuen Mun Road	C	down	50 to 200	>= 20	3.08E-01	0.25	0.02	0.0517	3	1.5	2.33E-01	2.98E-04
Tuen Mun Road	C	down	200 to 1000	< 10	3.08E-01	0.25	0.00	0.1473	3	2	8.84E-01	0.00E+00
Tuen Mun Road	C	down	200 to 1000	10 to 20	3.08E-01	0.25	0.00	0.1473	3	2	8.84E-01	0.00E+00
Tuen Mun Road	C	down	200 to 1000	>= 20	3.08E-01	0.25	0.00	0.1473	3	2	8.84E-01	0.00E+00
Tuen Mun Road	C	down	> 1000	< 10	3.08E-01	0.25	0.00	0.2053	3	4	2.46E+00	0.00E+00
Tuen Mun Road	C	down	> 1000	10 to 20	3.08E-01	0.25	0.00	0.2053	3	4	2.46E+00	0.00E+00
Tuen Mun Road	C	down	> 1000	>= 20	3.08E-01	0.25	0.00	0.2053	3	4	2.46E+00	0.00E+00

LS PLL

Roads	Section	Slope	Failure Vol Range	Height Range	LS Frequency per year	Slope	Height Vol	V Factor	Expected Fatality	Scale Factor	Consequence	PLL
Tuen Mun Road	D	up	< 20	< 10	7.69E-02	1	0.50	0.0154	3	0.4	1.85E-02	7.12E-04
Tuen Mun Road	D	up	< 20	10 to 20	7.69E-02	1	0.15	0.0271	3	0.4	3.25E-02	3.75E-04
Tuen Mun Road	D	up	< 20	>= 20	7.69E-02	1	0.05	0.0461	3	0.4	5.53E-02	2.13E-04
Tuen Mun Road	D	up	20 to 50	< 10	7.69E-02	1	0.05	0.1217	3	0.7	2.56E-01	9.83E-04
Tuen Mun Road	D	up	20 to 50	10 to 20	7.69E-02	1	0.05	0.2000	3	0.7	4.20E-01	1.62E-03
Tuen Mun Road	D	up	20 to 50	>= 20	7.69E-02	1	0.10	0.3400	3	0.7	7.14E-01	5.49E-03
Tuen Mun Road	D	up	50 to 500	< 10	7.69E-02	1	0.00	0.2080	3	1.5	9.36E-01	0.00E+00
Tuen Mun Road	D	up	50 to 500	10 to 20	7.69E-02	1	0.02	0.3455	3	1.5	1.55E+00	2.39E-03
Tuen Mun Road	D	up	50 to 500	>= 20	7.69E-02	1	0.08	0.5650	3	1.5	2.54E+00	1.56E-02
Tuen Mun Road	D	up	500 to 2000	< 10	7.69E-02	1	0.00	0.3217	3	2	1.93E+00	0.00E+00
Tuen Mun Road	D	up	500 to 2000	10 to 20	7.69E-02	1	0.00	0.5383	3	2	3.23E+00	0.00E+00
Tuen Mun Road	D	up	500 to 2000	>= 20	7.69E-02	1	0.00	0.8517	3	2	5.11E+00	0.00E+00
Tuen Mun Road	D	up	> 2000	< 10	7.69E-02	1	0.00	0.3983	3	2.5	2.99E+00	0.00E+00
Tuen Mun Road	D	up	> 2000	10 to 20	7.69E-02	1	0.00	0.6633	3	2.5	4.98E+00	0.00E+00
Tuen Mun Road	D	up	> 2000	>= 20	7.69E-02	1	0.00	0.9300	3	2.5	6.98E+00	0.00E+00
Tuen Mun Road	D	down	< 20	< 10	7.69E-02	0	0.30	0.0026	3	0.6	4.65E-03	0.00E+00
Tuen Mun Road	D	down	< 20	10 to 20	7.69E-02	0	0.30	0.0026	3	0.6	4.65E-03	0.00E+00
Tuen Mun Road	D	down	< 20	>= 20	7.69E-02	0	0.30	0.0026	3	0.6	4.65E-03	0.00E+00
Tuen Mun Road	D	down	20 to 50	< 10	7.69E-02	0	0.03	0.0129	3	1	3.88E-02	0.00E+00
Tuen Mun Road	D	down	20 to 50	10 to 20	7.69E-02	0	0.03	0.0129	3	1	3.88E-02	0.00E+00
Tuen Mun Road	D	down	20 to 50	>= 20	7.69E-02	0	0.03	0.0129	3	1	3.88E-02	0.00E+00
Tuen Mun Road	D	down	50 to 200	< 10	7.69E-02	0	0.00	0.0517	3	1.5	2.33E-01	0.00E+00
Tuen Mun Road	D	down	50 to 200	10 to 20	7.69E-02	0	0.00	0.0517	3	1.5	2.33E-01	0.00E+00
Tuen Mun Road	D	down	50 to 200	>= 20	7.69E-02	0	0.00	0.0517	3	1.5	2.33E-01	0.00E+00
Tuen Mun Road	D	down	200 to 1000	< 10	7.69E-02	0	0.00	0.1473	3	2	8.84E-01	0.00E+00
Tuen Mun Road	D	down	200 to 1000	10 to 20	7.69E-02	0	0.00	0.1473	3	2	8.84E-01	0.00E+00
Tuen Mun Road	D	down	200 to 1000	>= 20	7.69E-02	0	0.00	0.1473	3	2	8.84E-01	0.00E+00
Tuen Mun Road	D	down	> 1000	< 10	7.69E-02	0	0.00	0.2053	3	4	2.46E+00	0.00E+00
Tuen Mun Road	D	down	> 1000	10 to 20	7.69E-02	0	0.00	0.2053	3	4	2.46E+00	0.00E+00
Tuen Mun Road	D	down	> 1000	>= 20	7.69E-02	0	0.00	0.2053	3	4	2.46E+00	0.00E+00
Victoria Road	A	up	< 20	< 10	6.92E-01	1	0.65	0.0455	0.25	0.4	4.55E-03	2.05E-03
Victoria Road	A	up	< 20	10 to 20	6.92E-01	1	0.15	0.0685	0.25	0.4	6.85E-03	7.11E-04
Victoria Road	A	up	< 20	>= 20	6.92E-01	1	0.04	0.0835	0.25	0.4	8.35E-03	2.31E-04
Victoria Road	A	up	20 to 50	< 10	6.92E-01	1	0.03	0.3500	0.25	0.7	6.13E-02	1.27E-03
Victoria Road	A	up	20 to 50	10 to 20	6.92E-01	1	0.02	0.4350	0.25	0.7	7.61E-02	1.05E-03
Victoria Road	A	up	20 to 50	>= 20	6.92E-01	1	0.03	0.4850	0.25	0.7	8.49E-02	1.76E-03
Victoria Road	A	up	50 to 500	< 10	6.92E-01	1	0.01	0.5850	0.25	1.5	2.19E-01	1.52E-03
Victoria Road	A	up	50 to 500	10 to 20	6.92E-01	1	0.02	0.6650	0.25	1.5	2.49E-01	3.45E-03
Victoria Road	A	up	50 to 500	>= 20	6.92E-01	1	0.05	0.6950	0.25	1.5	2.61E-01	9.02E-03
Victoria Road	A	up	500 to 2000	< 10	6.92E-01	1	0.00	0.8900	0.25	2	4.45E-01	0.00E+00
Victoria Road	A	up	500 to 2000	10 to 20	6.92E-01	1	0.00	0.9500	0.25	2	4.75E-01	0.00E+00
Victoria Road	A	up	500 to 2000	>= 20	6.92E-01	1	0.00	0.9500	0.25	2	4.75E-01	0.00E+00
Victoria Road	A	up	> 2000	< 10	6.92E-01	1	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Victoria Road	A	up	> 2000	10 to 20	6.92E-01	1	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Victoria Road	A	up	> 2000	>= 20	6.92E-01	1	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Victoria Road	A	down	< 20	< 10	6.92E-01	0	0.30	0.0039	0.25	0.6	5.81E-04	0.00E+00
Victoria Road	A	down	< 20	10 to 20	6.92E-01	0	0.30	0.0039	0.25	0.6	5.81E-04	0.00E+00
Victoria Road	A	down	< 20	>= 20	6.92E-01	0	0.30	0.0039	0.25	0.6	5.81E-04	0.00E+00
Victoria Road	A	down	20 to 50	< 10	6.92E-01	0	0.03	0.0194	0.25	1	4.84E-03	0.00E+00
Victoria Road	A	down	20 to 50	10 to 20	6.92E-01	0	0.03	0.0194	0.25	1	4.84E-03	0.00E+00
Victoria Road	A	down	20 to 50	>= 20	6.92E-01	0	0.03	0.0194	0.25	1	4.84E-03	0.00E+00
Victoria Road	A	down	50 to 200	< 10	6.92E-01	0	0.00	0.0775	0.25	1.5	2.91E-02	0.00E+00
Victoria Road	A	down	50 to 200	10 to 20	6.92E-01	0	0.00	0.0775	0.25	1.5	2.91E-02	0.00E+00
Victoria Road	A	down	50 to 200	>= 20	6.92E-01	0	0.00	0.0775	0.25	1.5	2.91E-02	0.00E+00
Victoria Road	A	down	200 to 1000	< 10	6.92E-01	0	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Victoria Road	A	down	200 to 1000	10 to 20	6.92E-01	0	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Victoria Road	A	down	200 to 1000	>= 20	6.92E-01	0	0.00	0.2200	0.25	2	1.10E-01	0.00E+00
Victoria Road	A	down	> 1000	< 10	6.92E-01	0	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Victoria Road	A	down	> 1000	10 to 20	6.92E-01	0	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Victoria Road	A	down	> 1000	>= 20	6.92E-01	0	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Victoria Road	B	up	< 20	< 10	1.08E+00	0.92	0.80	0.0455	0.25	0.4	4.55E-03	3.61E-03
Victoria Road	B	up	< 20	10 to 20	1.08E+00	0.92	0.10	0.0685	0.25	0.4	6.85E-03	6.79E-04
Victoria Road	B	up	< 20	>= 20	1.08E+00	0.92	0.00	0.0835	0.25	0.4	8.35E-03	0.00E+00
Victoria Road	B	up	20 to 50	< 10	1.08E+00	0.92	0.05	0.3500	0.25	0.7	6.13E-02	3.03E-03
Victoria Road	B	up	20 to 50	10 to 20	1.08E+00	0.92	0.04	0.4350	0.25	0.7	7.61E-02	3.02E-03
Victoria Road	B	up	20 to 50	>= 20	1.08E+00	0.92	0.00	0.4850	0.25	0.7	8.49E-02	0.00E+00
Victoria Road	B	up	50 to 500	< 10	1.08E+00	0.92	0.00	0.5850	0.25	1.5	2.19E-01	0.00E+00
Victoria Road	B	up	50 to 500	10 to 20	1.08E+00	0.92	0.01	0.6650	0.25	1.5	2.49E-01	2.47E-03
Victoria Road	B	up	50 to 500	>= 20	1.08E+00	0.92	0.00	0.6950	0.25	1.5	2.61E-01	0.00E+00
Victoria Road	B	up	500 to 2000	< 10	1.08E+00	0.92	0.00	0.8900	0.25	2	4.45E-01	0.00E+00
Victoria Road	B	up	500 to 2000	10 to 20	1.08E+00	0.92	0.00	0.9500	0.25	2	4.75E-01	0.00E+00
Victoria Road	B	up	500 to 2000	>= 20	1.08E+00	0.92	0.00	0.9500	0.25	2	4.75E-01	0.00E+00
Victoria Road	B	up	> 2000	< 10	1.08E+00	0.92	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Victoria Road	B	up	> 2000	10 to 20	1.08E+00	0.92	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00

LS PLL

Roads	Section	Slope	Failure Vol Range	Height Range	LS Frequency per year	Slope	Height Vol	V Factor	Expected Fatality	Scale Factor	Consequence	PLL
Victoria Road	B	up	> 2000	>= 20	1.08E+00	0.92	0.00	0.9500	0.25	2.5	5.94E-01	0.00E+00
Victoria Road	B	down	< 20	< 10	1.08E+00	0.08	0.30	0.0039	0.25	0.6	5.81E-04	1.50E-05
Victoria Road	B	down	< 20	10 to 20	1.08E+00	0.08	0.30	0.0039	0.25	0.6	5.81E-04	1.50E-05
Victoria Road	B	down	< 20	>= 20	1.08E+00	0.08	0.30	0.0039	0.25	0.6	5.81E-04	1.50E-05
Victoria Road	B	down	20 to 50	< 10	1.08E+00	0.08	0.02	0.0194	0.25	1	4.84E-03	9.74E-06
Victoria Road	B	down	20 to 50	10 to 20	1.08E+00	0.08	0.02	0.0194	0.25	1	4.84E-03	9.74E-06
Victoria Road	B	down	20 to 50	>= 20	1.08E+00	0.08	0.02	0.0194	0.25	1	4.84E-03	9.74E-06
Victoria Road	B	down	50 to 200	< 10	1.08E+00	0.08	0.01	0.0775	0.25	1.5	2.91E-02	1.67E-05
Victoria Road	B	down	50 to 200	10 to 20	1.08E+00	0.08	0.01	0.0775	0.25	1.5	2.91E-02	1.67E-05
Victoria Road	B	down	50 to 200	>= 20	1.08E+00	0.08	0.01	0.0775	0.25	1.5	2.91E-02	1.67E-05
Victoria Road	B	down	200 to 1000	< 10	1.08E+00	0.08	0.00	0.2200	0.25	2	1.10E-01	3.16E-05
Victoria Road	B	down	200 to 1000	10 to 20	1.08E+00	0.08	0.00	0.2200	0.25	2	1.10E-01	3.16E-05
Victoria Road	B	down	200 to 1000	>= 20	1.08E+00	0.08	0.00	0.2200	0.25	2	1.10E-01	3.16E-05
Victoria Road	B	down	> 1000	< 10	1.08E+00	0.08	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Victoria Road	B	down	> 1000	10 to 20	1.08E+00	0.08	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Victoria Road	B	down	> 1000	>= 20	1.08E+00	0.08	0.00	0.3070	0.25	4	3.07E-01	0.00E+00
Yee King Road	-	up	< 20	< 10	2.31E-01	1	0.50	0.0455	1	0.4	1.82E-02	2.10E-03
Yee King Road	-	up	< 20	10 to 20	2.31E-01	1	0.20	0.0685	1	0.4	2.74E-02	1.26E-03
Yee King Road	-	up	< 20	>= 20	2.31E-01	1	0.05	0.0835	1	0.4	3.34E-02	3.85E-04
Yee King Road	-	up	20 to 50	< 10	2.31E-01	1	0.05	0.3500	1	0.7	2.45E-01	2.83E-03
Yee King Road	-	up	20 to 50	10 to 20	2.31E-01	1	0.10	0.4350	1	0.7	3.05E-01	7.03E-03
Yee King Road	-	up	20 to 50	>= 20	2.31E-01	1	0.03	0.4850	1	0.7	3.40E-01	2.35E-03
Yee King Road	-	up	50 to 500	< 10	2.31E-01	1	0.00	0.5850	1	1.5	8.78E-01	0.00E+00
Yee King Road	-	up	50 to 500	10 to 20	2.31E-01	1	0.05	0.6650	1	1.5	9.98E-01	1.15E-02
Yee King Road	-	up	50 to 500	>= 20	2.31E-01	1	0.02	0.6950	1	1.5	1.04E+00	4.81E-03
Yee King Road	-	up	500 to 2000	< 10	2.31E-01	1	0.00	0.8900	1	2	1.78E+00	0.00E+00
Yee King Road	-	up	500 to 2000	10 to 20	2.31E-01	1	0.00	0.9500	1	2	1.90E+00	0.00E+00
Yee King Road	-	up	500 to 2000	>= 20	2.31E-01	1	0.00	0.9500	1	2	1.90E+00	0.00E+00
Yee King Road	-	up	> 2000	< 10	2.31E-01	1	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Yee King Road	-	up	> 2000	10 to 20	2.31E-01	1	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Yee King Road	-	up	> 2000	>= 20	2.31E-01	1	0.00	0.9500	1	2.5	2.38E+00	0.00E+00
Yee King Road	-	down	< 20	< 10	2.31E-01	0	0.30	0.0039	1	0.6	2.33E-03	0.00E+00
Yee King Road	-	down	< 20	10 to 20	2.31E-01	0	0.30	0.0039	1	0.6	2.33E-03	0.00E+00
Yee King Road	-	down	< 20	>= 20	2.31E-01	0	0.30	0.0039	1	0.6	2.33E-03	0.00E+00
Yee King Road	-	down	20 to 50	< 10	2.31E-01	0	0.02	0.0194	1	1	1.94E-02	0.00E+00
Yee King Road	-	down	20 to 50	10 to 20	2.31E-01	0	0.02	0.0194	1	1	1.94E-02	0.00E+00
Yee King Road	-	down	20 to 50	>= 20	2.31E-01	0	0.02	0.0194	1	1	1.94E-02	0.00E+00
Yee King Road	-	down	50 to 200	< 10	2.31E-01	0	0.01	0.0775	1	1.5	1.16E-01	0.00E+00
Yee King Road	-	down	50 to 200	10 to 20	2.31E-01	0	0.01	0.0775	1	1.5	1.16E-01	0.00E+00
Yee King Road	-	down	50 to 200	>= 20	2.31E-01	0	0.01	0.0775	1	1.5	1.16E-01	0.00E+00
Yee King Road	-	down	200 to 1000	< 10	2.31E-01	0	0.00	0.2200	1	2	4.40E-01	0.00E+00
Yee King Road	-	down	200 to 1000	10 to 20	2.31E-01	0	0.00	0.2200	1	2	4.40E-01	0.00E+00
Yee King Road	-	down	200 to 1000	>= 20	2.31E-01	0	0.00	0.2200	1	2	4.40E-01	0.00E+00
Yee King Road	-	down	> 1000	< 10	2.31E-01	0	0.00	0.3070	1	4	1.23E+00	0.00E+00
Yee King Road	-	down	> 1000	10 to 20	2.31E-01	0	0.00	0.3070	1	4	1.23E+00	0.00E+00
Yee King Road	-	down	> 1000	>= 20	2.31E-01	0	0.00	0.3070	1	4	1.23E+00	0.00E+00

Road Specific Data

Location	Roads	Section	Lanes	Length	Class of Road	Category	AADT 1995	Facility Group	Expected Fatality	Others	LS RF	RW WO	UpProb	Boulders	LS Frequency per year	Boulder fall Frequency/yr	Frequency per year
HK	Cape Collinson Road	A	2	2.1	LD	C	450	4	0.03			8	0.88	3	0.62	0.23	0.85
HK	Cape Collinson Road	B	2	0.12	LD	C	450	4	0.03			3	1		0.23	0.00	0.23
HK	Chung Hom Kok Road	-	2	1	LD	C	1300	4	0.03	1		5	0.8	2	0.38	0.15	0.54
HK	Island Road	-	2	0.83	PD	B	16890	2	1			6	0.83		0.46	0.00	0.46
HK	Kennedy Road	-	2	2.1	DD	C	10610	2	1	1		13	0.85		1.00	0.00	1.00
HK	Magazine Gap Road	-	2	1.81	DD	C	14960	2	1	1		17	0.94		1.31	0.00	1.31
HK	Nam Fung Road	-	4	0.3	DD	B	10110	3	0.25	1		2	1		0.15	0.00	0.15
HK	Peak Road	A	2	1.5	DD	C	11170	2	1			4	0.75		0.31	0.00	0.31
HK	Peak Road	B	2	0.4	DD	C	10120	2	1	1		5	1	1	0.38	0.08	0.46
HK	Pokfulam Road	A	4	1.19	PD	B	36160	2	1	4		7	0.86		0.54	0.00	0.54
HK	Pokfulam Road	B	4	1.7	PD	B	25050	2	1	1		3	1		0.23	0.00	0.23
HK	Repulse Bay Road	A	2	2.9	DD	C	12300	2	1	2		29	0.76	1	2.23	0.08	2.31
HK	Repulse Bay Road	B	2	0.64	PD	B	14370	2	1	1		6	0.67		0.46	0.00	0.46
HK	Stubbs Road	A	2	1.3	DD	C	21070	2	1	4		4	1		0.31	0.00	0.31
HK	Stubbs Road	B	2	0.12	DD	C	11270	2	1			2	1		0.15	0.00	0.15
HK	Tai Hang Road	-	2	2.72	DD	C	14670	2	1	7		27	0.93	10	2.08	0.77	2.85
HK	Tai Tam Road	-	2	6.9	PD	B	10900	2	1	2		11	0.91	1	0.85	0.08	0.92
HK	Victoria Road	A	2	1.3	DD	C	5410	3	0.25			9	1	2	0.69	0.15	0.85
HK	Victoria Road	B	2	1.8	DD	C	7860	3	0.25	3		14	0.92		1.08	0.00	1.08
HK	Yee King Road	-	2	0.26	DD	C	14150	2	1	2		3	1	5	0.23	0.38	0.62
ME	Clear Water Bay Road	-	4	1.34	RA	B	32950	2	1			7	1		0.54	0.00	0.54
ME	Kwun Tong Road	-	4	0.27	UT	A	150120	1	3			3	1		0.23	0.00	0.23
ME	Sai Sha Road	-	2	1.16	RA	B	5310	3	0.25			13	1		1.00	0.00	1.00
ME	Tai Mong Tsai Road	A	2	0.24	RA	B	6000	3	0.25	1		3	0.67		0.23	0.00	0.23
ME	Tai Mong Tsai Road	B	2	0.93	RA	B	6000	3	0.25			8	1		0.62	0.00	0.62
ME	Tai Mong Tsai Road	C	2	0.48	LD	C	4120	3	0.25			2	1		0.15	0.00	0.15
ME	Tai Mong Tsai Road	D	2	0.35	LD	C	4120	3	0.25			2	1		0.15	0.00	0.15
ME	Tai Po Road	A	4	2.15	PD	B	9190	3	0.25			2	0.5		0.15	0.00	0.15
ME	Tai Po Road	B	4	3.15	RA	B	5840	3	0.25			8	0.88		0.62	0.00	0.62
ME	Tai Po Road	C	4	1.98	RA	B	5840	3	0.25	1		6	0.83		0.46	0.00	0.46
MW	Castle Peak Road	-	2	14	RA	B	12980	2	1	6		31	0.87	1	2.38	0.08	2.46
MW	Route Twisk	A	2	2.8	RA	B	6270	3	0.25	2		12	1	1	0.92	0.08	1.00
MW	Route Twisk	B	2	4.4	RA	B	7250	3	0.25			4	0.75		0.31	0.00	0.31
MW	Route Twisk	C	2	1.05	RA	B	7250	3	0.25	1		4	0.5		0.31	0.00	0.31
MW	South Lantau Road	A	2	2.59	RA	B	2980	4	0.03			17	0.88		1.31	0.00	1.31
MW	South Lantau Road	B	2	1.65	RA	B	1210	4	0.03			6	0.83		0.46	0.00	0.46
MW	South Lantau Road	C	2	3.5	RA	B	1210	4	0.03	1		5	1		0.38	0.00	0.38
MW	Tuen Mun Road	A	6	1.1	EX	A	96120	1	3	1		4	0.67		0.31	0.00	0.31
MW	Tuen Mun Road	B	6	3.45	EX	A	96120	1	3			2	1		0.15	0.00	0.15
MW	Tuen Mun Road	C	6	3.6	EX	A	85410	1	3			4	0.75	1	0.31	0.08	0.38
MW	Tuen Mun Road	D	6	0.9	EX	A	95470	1	3			1	1		0.08	0.00	0.08
										44		**322**		**28**			

Scale Factors

		Volume Range (m3)	Width (m)	Scale Factor
up_< 20	up	< 20	4	0.4
up_20 to 50	up	20 to 50	7	0.7
up_50 to 500	up	50 to 500	15	1.5
up_500 to 2000	up	500 to 2000	20	2
up_> 2000	up	> 2000	25	2.5
down_< 20	down	< 20	6	0.6
down_20 to 50	down	20 to 50	10	1
down_50 to 200	down	50 to 200	15	1.5
down_200 to 1000	down	200 to 1000	20	2
down_> 1000	down	> 1000	40	4

Up Vol vs Height

Road	Section	Slope Height	< 20	20 to 50	50 to 500	500 to 2000	> 2000
Repulse Bay Road	A	< 10	0.6000	0.1500	0.01	0	0
Repulse Bay Road	A	10 to 20	0.1600	0.0500	0.03	0	0
Repulse Bay Road	A	>= 20	0.0000	0.0000	0	0	0
Repulse Bay Road	B	< 10	0.7000	0.1000	0.004	0	0
Repulse Bay Road	B	10 to 20	0.1000	0.0500	0.006	0	0
Repulse Bay Road	B	>= 20	0.0100	0.0200	0.01	0	0
Victoria Road	A	< 10	0.6500	0.0300	0.01	0	0
Victoria Road	A	10 to 20	0.1500	0.0200	0.02	0	0
Victoria Road	A	>= 20	0.0400	0.0300	0.05	0	0
Victoria Road	B	< 10	0.8000	0.0500	0	0	0
Victoria Road	B	10 to 20	0.1000	0.0400	0.01	0	0
Victoria Road	B	>= 20	0.0000	0.0000	0	0	0
Chung Hom Kok Road	-	< 10	0.4000	0.2000	0.02	0	0
Chung Hom Kok Road	-	10 to 20	0.3000	0.0500	0.03	0	0
Chung Hom Kok Road	-	>= 20	0.0000	0.0000	0	0	0
Kennedy Road	-	< 10	0.6000	0.0300	0	0	0
Kennedy Road	-	10 to 20	0.2000	0.0500	0	0	0
Kennedy Road	-	>= 20	0.01	0.03	0.03	0.05	0
Stubbs Road	A	< 10	0.50	0.08	0.01	0	0
Stubbs Road	A	10 to 20	0.15	0.10	0.04	0	0
Stubbs Road	A	>= 20	0.05	0.05	0.02	0	0
Stubbs Road	B	< 10	0.60	0.05	0.01	0	0
Stubbs Road	B	10 to 20	0.05	0.05	0.12	0	0
Stubbs Road	B	>= 20	0.03	0.04	0.05	0	0
Nam Fung Road	-	< 10	0.50	0.25	0	0	0
Nam Fung Road	-	10 to 20	0.05	0.05	0.02	0	0
Nam Fung Road	-	>= 20	0.03	0.05	0.05	0	0
Island Road	-	< 10	0.65	0.15	0	0	0
Island Road	-	10 to 20	0.15	0.03	0.02	0	0
Island Road	-	>= 20	0.00	0.00	0	0	0
Cape Collinson Road	A	< 10	0.65	0.05	0.01	0	0
Cape Collinson Road	A	10 to 20	0.10	0.05	0.02	0	0
Cape Collinson Road	A	>= 20	0.02	0.02	0.07	0.01	0
Cape Collinson Road	B	< 10	0.00	0.00	0	0	0
Cape Collinson Road	B	10 to 20	0.35	0.30	0.2	0.15	0
Cape Collinson Road	B	>= 20	0.00	0.00	0	0	0
Yee King Road	-	< 10	0.50	0.05	0	0	0
Yee King Road	-	10 to 20	0.20	0.10	0.05	0	0
Yee King Road	-	>= 20	0.05	0.03	0.02	0	0
Magazine Gap Road	-	< 10	0.65	0.08	0.01	0	0
Magazine Gap Road	-	10 to 20	0.15	0.05	0.05	0.01	0
Magazine Gap Road	-	>= 20	0.00	0.00	0	0	0
Peak Road	A	< 10	0.40	0.05	0.01	0	0
Peak Road	A	10 to 20	0.20	0.15	0.15	0.04	0
Peak Road	A	>= 20	0.00	0.00	0	0	0
Peak Road	B	< 10	0.82	0.05	0.01	0	0
Peak Road	B	10 to 20	0.08	0.03	0.01	0	0
Peak Road	B	>= 20	0.00	0.00	0	0	0
Pokfulam Road	A	< 10	0.60	0.03	0	0	0
Pokfulam Road	A	10 to 20	0.30	0.05	0.02	0	0
Pokfulam Road	A	>= 20	0.00	0.00	0	0	0
Pokfulam Road	B	< 10	0.50	0.15	0.01	0	0

Up Vol vs Height

Road	Section	Slope Height	< 20	20 to 50	50 to 500	500 to 2000	> 2000
Pokfulam Road	B	10 to 20	0.20	0.10	0.04	0	0
Pokfulam Road	B	>= 20	0.00	0.00	0	0	0
Tai Hang Road	-	< 10	0.60	0.04	0.01	0	0
Tai Hang Road	-	10 to 20	0.20	0.08	0.03	0	0
Tai Hang Road	-	>= 20	0.01	0.02	0.01	0	0
Tai Tam Road	-	< 10	0.71	0.05	0	0	0
Tai Tam Road	-	10 to 20	0.15	0.04	0.01	0	0
Tai Tam Road	-	>= 20	0.01	0.02	0.01	0	0
Tai Po Road	A	< 10	0.00	0.00	0	0	0
Tai Po Road	A	10 to 20	1.00	0.00	0	0	0
Tai Po Road	A	>= 20	0.00	0.00	0	0	0
Tai Po Road	B	< 10	0.40	0.10	0.02	0	0
Tai Po Road	B	10 to 20	0.10	0.09	0.08	0.01	0
Tai Po Road	B	>= 20	0.05	0.08	0.05	0.02	0
Tai Po Road	C	< 10	0.40	0.05	0	0	0
Tai Po Road	C	10 to 20	0.20	0.10	0.15	0.01	0
Tai Po Road	C	>= 20	0.02	0.04	0.02	0.01	0
Kwun Tong Road	-	< 10	0.07	0.25	0.02	0	0
Kwun Tong Road	-	10 to 20	0.05	0.20	0.1	0	0
Kwun Tong Road	-	>= 20	0.03	0.10	0.15	0.03	0
Clear Water Bay Road	-	< 10	0.55	0.10	0.01	0	0
Clear Water Bay Road	-	10 to 20	0.05	0.04	0.04	0.01	0
Clear Water Bay Road	-	>= 20	0.04	0.06	0.08	0.02	0
Sai Sha Road	-	< 10	0.10	0.10	0	0	0
Sai Sha Road	-	10 to 20	0.20	0.20	0.08	0.08	0
Sai Sha Road	-	>= 20	0.05	0.07	0.05	0.06	0.01
Tai Mong Tsai Road	A	< 10	0.35	0.05	0	0	0
Tai Mong Tsai Road	A	10 to 20	0.05	0.05	0.05	0.4	0
Tai Mong Tsai Road	A	>= 20	0.00	0.01	0.02	0.02	0
Tai Mong Tsai Road	B	< 10	0.25	0.10	0.01	0	0
Tai Mong Tsai Road	B	10 to 20	0.45	0.12	0.06	0.01	0
Tai Mong Tsai Road	B	>= 20	0.00	0.00	0	0	0
Tai Mong Tsai Road	C	< 10	0.40	0.10	0	0	0
Tai Mong Tsai Road	C	10 to 20	0.05	0.10	0.3	0.05	0
Tai Mong Tsai Road	C	>= 20	0.00	0.00	0	0	0
Tai Mong Tsai Road	D	< 10	0.80	0.20	0	0	0
Tai Mong Tsai Road	D	10 to 20	0.00	0.00	0	0	0
Tai Mong Tsai Road	D	>= 20	0.00	0.00	0	0	0
Castle Peak Road	-	< 10	0.23	0.10	0.05	0.05	0
Castle Peak Road	-	10 to 20	0.15	0.10	0.05	0.01	0
Castle Peak Road	-	>= 20	0.05	0.08	0.08	0.05	0
Tuen Mun Road	A	< 10	0.00	0.00	0	0	0
Tuen Mun Road	A	10 to 20	0.65	0.10	0.05	0	0
Tuen Mun Road	A	>= 20	0.11	0.05	0.03	0.01	0
Tuen Mun Road	B	< 10	0.00	0.00	0	0	0
Tuen Mun Road	B	10 to 20	0.10	0.30	0.05	0	0
Tuen Mun Road	B	>= 20	0.35	0.10	0.06	0.04	0
Tuen Mun Road	C	< 10	0.00	0.00	0	0	0
Tuen Mun Road	C	10 to 20	0.40	0.10	0.01	0	0
Tuen Mun Road	C	>= 20	0.20	0.20	0.08	0.01	0
Tuen Mun Road	D	< 10	0.50	0.05	0	0	0
Tuen Mun Road	D	10 to 20	0.15	0.05	0.02	0	0

Up Vol vs Height

Road	Section	Slope Height	< 20	20 to 50	50 to 500	500 to 2000	> 2000
Tuen Mun Road	D	>= 20	0.05	0.10	0.08	0	0
Route Twisk	A	< 10	0.20	0.05	0	0	0
Route Twisk	A	10 to 20	0.15	0.10	0.24	0.01	0
Route Twisk	A	>= 20	0.05	0.08	0.1	0.02	0
Route Twisk	B	< 10	0.50	0.05	0	0	0
Route Twisk	B	10 to 20	0.30	0.10	0.05	0	0
Route Twisk	B	>= 20	0.00	0.00	0	0	0
Route Twisk	C	< 10	0.80	0.05	0	0	0
Route Twisk	C	10 to 20	0.10	0.05	0	0	0
Route Twisk	C	>= 20	0.00	0.00	0	0	0
South Lantau Road	A	< 10	0.15	0.35	0.05	0	0
South Lantau Road	A	10 to 20	0.10	0.20	0.04	0.01	0
South Lantau Road	A	>= 20	0.05	0.03	0.02	0	0
South Lantau Road	B	< 10	0.20	0.10	0.01	0	0
South Lantau Road	B	10 to 20	0.05	0.16	0.15	0.15	0
South Lantau Road	B	>= 20	0.02	0.05	0.05	0.05	0.01
South Lantau Road	C	< 10	0.30	0.08	0.01	0	0
South Lantau Road	C	10 to 20	0.30	0.15	0.15	0.01	0
South Lantau Road	C	>= 20	0.00	0.00	0	0	0

Down Vol Distribution

		< 20	20 to 50	50 to 200	200 to 1000	> 1000
Cape Collinson Road	A	0.09	0.20	0.70	0.01	0.00
Cape Collinson Road	B	0.00	0.00	0.00	0.00	0.00
Chung Hom Kok Road	-	0.25	0.70	0.05	0.00	0.00
Island Road	-	0.25	0.70	0.05	0.00	0.00
Kennedy Road	-	0.90	0.10	0.00	0.00	0.00
Magazine Gap Road	-	0.90	0.10	0.00	0.00	0.00
Nam Fung Road	-	0.00	0.00	0.00	0.00	0.00
Peak Road	A	0.90	0.10	0.00	0.00	0.00
Peak Road	B	0.90	0.10	0.00	0.00	0.00
Pokfulam Road	A	0.25	0.70	0.05	0.00	0.00
Pokfulam Road	B	0.90	0.10	0.00	0.00	0.00
Repulse Bay Road	A	0.20	0.35	0.35	0.10	0.00
Repulse Bay Road	B	0.90	0.10	0.00	0.00	0.00
Stubbs Road	A	0.90	0.10	0.00	0.00	0.00
Stubbs Road	B	0.90	0.10	0.00	0.00	0.00
Tai Hang Road	-	0.50	0.44	0.05	0.01	0.00
Tai Tam Road	-	0.25	0.70	0.05	0.00	0.00
Victoria Road	A	0.90	0.10	0.00	0.00	0.00
Victoria Road	B	0.90	0.07	0.02	0.01	0.00
Yee King Road	-	0.90	0.07	0.02	0.01	0.00
Clear Water Bay Road	-	0.00	0.00	0.00	0.00	0.00
Kwun Tong Road	-	0.00	0.00	0.00	0.00	0.00
Sai Sha Road	-	0.00	0.00	0.00	0.00	0.00
Tai Mong Tsai Road	A	0.25	0.70	0.05	0.00	0.00
Tai Mong Tsai Road	B	0.00	0.00	0.00	0.00	0.00
Tai Mong Tsai Road	C	0.00	0.00	0.00	0.00	0.00
Tai Mong Tsai Road	D	0.00	0.00	0.00	0.00	0.00
Tai Po Road	A	0.40	0.54	0.05	0.01	0.00
Tai Po Road	B	0.09	0.20	0.70	0.01	0.00
Tai Po Road	C	0.25	0.70	0.05	0.00	0.00
Castle Peak Road	-	0.50	0.20	0.15	0.15	0.00
Route Twisk	A	0.80	0.15	0.05	0.00	0.00
Route Twisk	B	0.90	0.10	0.00	0.00	0.00
Route Twisk	C	0.50	0.45	0.05	0.00	0.00
South Lantau Road	A	0.10	0.40	0.09	0.40	0.01
South Lantau Road	B	0.25	0.70	0.05	0.00	0.00
South Lantau Road	C	0.00	0.00	0.00	0.00	0.00
Tuen Mun Road	A	0.85	0.10	0.04	0.01	0.00
Tuen Mun Road	B	0.90	0.08	0.02	0.00	0.00
Tuen Mun Road	C	0.25	0.70	0.05	0.00	0.00
Tuen Mun Road	D	0.90	0.09	0.01	0.00	0.00

Down V Factors

Vol/Lanes	1	2	3	<=1	<=2	<=3
< 20	0.0075	0.00025	0	0.0075	0.003875	0.00258333
20 to 50	0.0375	0.00125	0	0.0375	0.019375	0.01291667
50 to 200	0.15	0.005	0	0.15	0.0775	0.05166667
200 to 1000	0.4	0.04	0.002	0.4	0.22	0.14733333
> 1000	0.54	0.074	0.002	0.54	0.307	0.20533333

Up V Factors Guide

S. Height/Lane Pos.		1	2	3	4	5	6
distance from slope toe	Assumed height	1.5	4.5	8	12.5	17.5	22.5
< 10	7.5	52.1	40.3	31.3	24.0	19.0	15.6
10 to 20	15	55.9	48.7	42.0	35.3	29.8	25.7
>= 20	30	57.9	54.0	49.8	45.2	40.7	37.0

Vol/R. Out Angle	0	20	25	30	35	40	45	50	55	60
< 20	0	0	0	0.0015	0.0065	0.019	0.042	0.072	0.095	0.1
20 to 50	0	0	0	0.03	0.1	0.23	0.37	0.47	0.5	0.5
50 to 500	0	0	0.0015	0.078	0.26	0.48	0.63	0.69	0.7	0.7
500 to 2000	0	0	0.01	0.15	0.48	0.83	0.95	0.95	0.95	0.95
> 2000	0	0.01	0.15	0.48	0.83	0.95	0.95	0.95	0.95	0.95

Up V Factors

	Failure Vol.	Slope Height/Lanes	1	2	3	4	5	6	<=1	<=2	<=3	<=4	<=5	<=6
< 20_< 10	< 20	< 10	0.072	0.019	0.0015	0	0	0	0.072	0.0455	0.03083	0.02313	0.0185	0.01542
< 20_10 to 20	< 20	10 to 20	0.095	0.042	0.019	0.0065	0	0	0.095	0.0685	0.052	0.04063	0.0325	0.02708
< 20_>= 20	< 20	>= 20	0.095	0.072	0.042	0.042	0.019	0.0065	0.095	0.0835	0.06967	0.06275	0.054	0.04608
20 to 50_< 10	20 to 50	< 10	0.47	0.23	0.03	0	0	0	0.47	0.35	0.24333	0.1825	0.146	0.12167
20 to 50_10 to 20	20 to 50	10 to 20	0.5	0.37	0.23	0.1	0	0	0.5	0.435	0.36667	0.3	0.24	0.2
20 to 50_>= 20	20 to 50	>= 20	0.5	0.47	0.37	0.37	0.23	0.1	0.5	0.485	0.44667	0.4275	0.388	0.34
50 to 500_< 10	50 to 500	< 10	0.69	0.48	0.078	0	0	0	0.69	0.585	0.416	0.312	0.2496	0.208
50 to 500_10 to 20	50 to 500	10 to 20	0.7	0.63	0.48	0.26	0.0015	0.0015	0.7	0.665	0.60333	0.5175	0.4143	0.3455
50 to 500_>= 20	50 to 500	>= 20	0.7	0.69	0.63	0.63	0.48	0.26	0.7	0.695	0.67333	0.6625	0.626	0.565
500 to 2000_< 10	500 to 2000	< 10	0.95	0.83	0.15	0	0	0	0.95	0.89	0.64333	0.4825	0.386	0.32167
500 to 2000_10 to 20	500 to 2000	10 to 20	0.95	0.95	0.83	0.48	0.01	0.01	0.95	0.95	0.91	0.8025	0.644	0.53833
500 to 2000_>= 20	500 to 2000	>= 20	0.95	0.95	0.95	0.95	0.83	0.48	0.95	0.95	0.95	0.95	0.926	0.85167
> 2000_< 10	> 2000	< 10	0.95	0.95	0.48	0.01	0	0	0.95	0.95	0.79333	0.5975	0.478	0.39833
> 2000_10 to 20	> 2000	10 to 20	0.95	0.95	0.95	0.83	0.15	0.15	0.95	0.95	0.95	0.92	0.766	0.66333
> 2000_>= 20	> 2000	>= 20	0.95	0.95	0.95	0.95	0.95	0.83	0.95	0.95	0.95	0.95	0.95	0.93

Table 6a

Summary Results Sheet I

Location	Road	Section	AADT 1995	Frequency per year	PLL		Eco Loss/yr		Total Cost/yr		Total Cost/yr/km	
			Value	Value	Value	*Rank*	Value	*Rank*	Value	*Rank*	Value	*Rank*
HK	Cape Collinson Road	A	450	8.46E-01	3.81E-03	*36*	$90,655	*40*	$182,068	*40*	$86,699	*41*
HK	Cape Collinson Road	B	450	2.31E-01	4.05E-03	*35*	$61,661	*41*	$158,934	*41*	$1,324,453	*27*
HK	Chung Hom Kok Road	-	1300	5.38E-01	2.89E-03	*38*	$145,862	*39*	$215,278	*37*	$215,278	*38*
HK	Island Road	-	16890	4.62E-01	3.29E-02	*20*	$3,671,728	*16*	$4,461,134	*16*	$5,374,860	*11*
HK	Kennedy Road	-	10610	1.00E+00	1.50E-01	*7*	$2,586,269	*17*	$6,186,464	*12*	$2,945,935	*21*
HK	Magazine Gap Road	-	14960	1.31E+00	1.58E-01	*6*	$4,978,629	*11*	$8,774,658	*11*	$4,847,877	*12*
HK	Nam Fung Road	-	10110	1.54E-01	4.95E-03	*34*	$552,045	*34*	$670,940	*35*	$2,236,468	*23*
HK	Peak Road	A	11170	3.08E-01	7.07E-02	*13*	$1,048,171	*26*	$2,745,313	*22*	$1,830,208	*24*
HK	Peak Road	B	10120	4.62E-01	3.27E-02	*21*	$881,478	*30*	$1,665,972	*28*	$4,164,930	*17*
HK	Pokfulam Road	A	36160	5.38E-01	1.97E-02	*27*	$3,783,955	*15*	$4,255,719	*18*	$3,576,234	*18*
HK	Pokfulam Road	B	25050	2.31E-01	1.93E-02	*28*	$1,735,992	*22*	$2,199,935	*25*	$1,294,079	*29*
HK	Repulse Bay Road	A	12300	2.31E+00	2.47E-01	*4*	$7,449,498	*7*	$13,371,602	*7*	$4,610,897	*14*
HK	Repulse Bay Road	B	14370	4.62E-01	2.60E-02	*24*	$2,354,381	*19*	$2,979,526	*21*	$4,655,509	*13*
HK	Stubbs Road	A	21070	3.08E-01	4.66E-02	*16*	$1,985,854	*20*	$3,104,106	*20*	$2,387,774	*22*
HK	Stubbs Road	B	11270	1.54E-01	3.61E-02	*17*	$604,920	*33*	$1,472,417	*29*	$12,270,142	*4*
HK	Tai Hang Road	-	14670	2.85E+00	3.16E-01	*2*	$8,326,219	*6*	$15,909,027	*4*	$5,848,907	*10*
HK	Tai Tam Road	-	10900	9.23E-01	6.72E-02	*14*	$4,201,882	*13*	$5,814,067	*13*	$842,618	*31*
HK	Victoria Road	A	5410	8.46E-01	2.92E-02	*22*	$1,015,846	*27*	$1,716,386	*27*	$1,320,297	*28*
HK	Victoria Road	B	7860	1.08E+00	1.30E-02	*30*	$1,628,442	*23*	$1,941,067	*26*	$1,078,371	*30*
HK	Yee King Road	-	14150	6.15E-01	1.36E-01	*8*	$1,376,522	*25*	$4,629,910	*15*	$17,807,345	*2*
ME	Clear Water Bay Road	-	32950	5.38E-01	1.16E-01	*10*	$6,645,836	*10*	$9,428,355	*10*	$7,036,086	*7*
ME	Kwun Tong Road	-	150120	2.31E-01	2.76E-01	*3*	$42,545,020	*1*	$49,176,602	*2*	$182,135,562	*1*
ME	Sai Sha Road	-	5310	1.00E+00	1.35E-01	*9*	$7,262,805	*8*	$10,501,665	*8*	$9,053,159	*6*
ME	Tai Mong Tsai Road	A	6000	2.31E-01	3.55E-02	*18*	$1,755,182	*21*	$2,606,028	*23*	$10,858,452	*5*
ME	Tai Mong Tsai Road	B	6000	6.15E-01	2.55E-02	*25*	$2,505,257	*18*	$3,116,500	*19*	$3,351,076	*20*
ME	Tai Mong Tsai Road	C	4120	1.54E-01	1.76E-02	*29*	$326,009	*36*	$748,640	*33*	$1,559,666	*26*
ME	Tai Mong Tsai Road	D	4120	1.54E-01	2.44E-03	*39*	$154,748	*38*	$213,419	*38*	$609,768	*35*
ME	Tai Po Road	A	9190	1.54E-01	5.90E-04	*41*	$176,799	*37*	$190,952	*39*	$88,815	*40*
ME	Tai Po Road	B	5840	6.15E-01	3.32E-02	*19*	$1,454,405	*24*	$2,252,297	*24*	$715,015	*33*
ME	Tai Po Road	C	5840	4.62E-01	2.12E-02	*26*	$910,235	*29*	$1,417,958	*30*	$716,140	*32*
MW	Castle Peak Road	-	12980	2.46E+00	1.03E+00	*1*	$34,482,700	*2*	$59,216,705	*1*	$4,229,765	*16*
MW	Route Twisk	A	6270	1.00E+00	1.16E-01	*11*	$7,052,856	*9*	$9,831,120	*9*	$3,511,114	*19*
MW	Route Twisk	B	7250	3.08E-01	6.42E-03	*33*	$935,882	*28*	$1,089,904	*31*	$247,706	*37*
MW	Route Twisk	C	7250	3.08E-01	2.33E-03	*40*	$625,230	*32*	$681,047	*34*	$648,616	*34*
MW	South Lantau Road	A	2980	1.31E+00	1.09E-02	*31*	$4,064,330	*14*	$4,325,979	*17*	$1,670,262	*25*
MW	South Lantau Road	B	1210	4.62E-01	8.21E-03	*32*	$772,825	*31*	$969,822	*32*	$587,771	*36*
MW	South Lantau Road	C	1210	3.85E-01	2.96E-03	*37*	$391,018	*35*	$462,008	*36*	$132,002	*39*
MW	Tuen Mun Road	A	96120	3.08E-01	6.65E-02	*15*	$12,267,643	*5*	$13,864,810	*6*	$12,604,372	*3*
MW	Tuen Mun Road	B	96120	1.54E-01	1.01E-01	*12*	$13,247,992	*4*	$15,665,318	*5*	$4,540,672	*15*
MW	Tuen Mun Road	C	85410	3.85E-01	2.18E-01	*5*	$16,518,087	*3*	$21,751,263	*3*	$6,042,017	*8*
MW	Tuen Mun Road	D	95470	7.69E-02	2.74E-02	*23*	$4,637,384	*12*	$5,295,649	*14*	$5,884,054	*9*
				TOTALS	**3.67E+00**		**$207,212,250**		**$295,260,564**			

Table 6b

Summary Results Sheet II

Location	Road	Section	AADT 1995	Portion of	Frequency per year	PLL		Eco Loss/yr		Total Cost/yr		Total Cost/yr/km	
			Value	Slopes Upgraded	Value	Value	*Rank*	Value	*Rank*	Value	*Rank*	Value	*Rank*
HK	Cape Collinson Road	A	450	0%	8.46E-01	3.81E-03	*36*	$90,655	*40*	$182,068	*39*	$86,699	*40*
HK	Cape Collinson Road	B	450	0%	2.31E-01	4.05E-03	*34*	$61,661	*41*	$158,934	*40*	$1,324,453	*27*
HK	Chung Hom Kok Road	-	1300	6%	5.06E-01	2.82E-03	*38*	$138,085	*38*	$205,744	*38*	$205,744	*38*
HK	Island Road	-	16890	0%	4.62E-01	3.29E-02	*20*	$3,671,728	*16*	$4,461,134	*16*	$5,374,860	*10*
HK	Kennedy Road	-	10610	7%	9.30E-01	1.40E-01	*7*	$2,405,230	*18*	$5,753,412	*13*	$2,739,720	*21*
HK	Magazine Gap Road	-	14960	3%	1.27E+00	1.53E-01	*6*	$4,829,270	*11*	$8,511,418	*11*	$4,702,441	*12*
HK	Nam Fung Road	-	10110	20%	1.23E-01	3.96E-03	*35*	$441,636	*34*	$536,752	*35*	$1,789,174	*23*
HK	Peak Road	A	11170	10%	2.77E-01	6.36E-02	*14*	$943,354	*26*	$2,470,781	*23*	$1,647,188	*25*
HK	Peak Road	B	10120	0%	4.62E-01	3.27E-02	*21*	$881,478	*29*	$1,665,972	*27*	$4,164,930	*16*
HK	Pokfulam Road	A	36160	0%	5.38E-01	1.97E-02	*26*	$3,783,955	*15*	$4,255,719	*18*	$3,576,234	*18*
HK	Pokfulam Road	B	25050	8%	2.12E-01	1.78E-02	*28*	$1,597,113	*23*	$2,023,940	*25*	$1,190,553	*29*
HK	Repulse Bay Road	A	12300	0%	2.31E+00	2.47E-01	*3*	$7,449,498	*6*	$13,371,602	*6*	$4,610,897	*14*
HK	Repulse Bay Road	B	14370	0%	4.62E-01	2.60E-02	*24*	$2,354,381	*19*	$2,979,526	*20*	$4,655,509	*13*
HK	Stubbs Road	A	21070	16%	2.58E-01	3.91E-02	*16*	$1,668,117	*21*	$2,607,449	*21*	$2,005,730	*22*
HK	Stubbs Road	B	11270	0%	1.54E-01	3.61E-02	*17*	$604,920	*33*	$1,472,417	*29*	$12,270,142	*3*
HK	Tai Hang Road	-	14670	13%	2.48E+00	2.89E-01	*2*	$7,362,931	*7*	$14,293,038	*5*	$5,254,794	*11*
HK	Tai Tam Road	-	10900	0%	9.23E-01	6.72E-02	*13*	$4,201,882	*13*	$5,814,067	*12*	$842,618	*31*
HK	Victoria Road	A	5410	10%	7.62E-01	2.71E-02	*23*	$921,020	*28*	$1,570,986	*28*	$1,208,451	*28*
HK	Victoria Road	B	7860	0%	1.08E+00	1.30E-02	*30*	$1,628,442	*22*	$1,941,067	*26*	$1,078,371	*30*
HK	Yee King Road	-	14150	0%	6.15E-01	1.36E-01	*8*	$1,376,522	*25*	$4,629,910	*15*	$17,807,345	*2*
ME	Clear Water Bay Road	-	32950	0%	5.38E-01	1.16E-01	*10*	$6,645,836	*10*	$9,428,355	*10*	$7,036,086	*7*
ME	Kwun Tong Road	-	150120	33%	1.55E-01	1.85E-01	*5*	$28,505,163	*2*	$32,948,323	*2*	$122,030,827	*1*
ME	Sai Sha Road	-	5310	0%	1.00E+00	1.35E-01	*9*	$7,262,805	*8*	$10,501,665	*8*	$9,053,159	*6*
ME	Tai Mong Tsai Road	A	6000	0%	2.31E-01	3.55E-02	*18*	$1,755,182	*20*	$2,606,028	*22*	$10,858,452	*5*
ME	Tai Mong Tsai Road	B	6000	0%	6.15E-01	2.55E-02	*25*	$2,505,257	*17*	$3,116,500	*19*	$3,351,076	*20*
ME	Tai Mong Tsai Road	C	4120	0%	1.54E-01	1.76E-02	*29*	$326,009	*36*	$748,640	*33*	$1,559,666	*26*
ME	Tai Mong Tsai Road	D	4120	0%	1.54E-01	2.44E-03	*39*	$154,748	*37*	$213,419	*37*	$609,768	*35*
ME	Tai Po Road	A	9190	25%	1.15E-01	4.42E-04	*41*	$132,599	*39*	$143,214	*41*	$66,611	*41*
ME	Tai Po Road	B	5840	0%	6.15E-01	3.32E-02	*19*	$1,454,405	*24*	$2,252,297	*24*	$715,015	*32*
ME	Tai Po Road	C	5840	14%	3.97E-01	1.82E-02	*27*	$782,802	*30*	$1,219,444	*30*	$615,881	*34*
MW	Castle Peak Road	-	12980	5%	2.35E+00	9.85E-01	*1*	$32,938,275	*1*	$56,584,596	*1*	$4,041,757	*17*
MW	Route Twisk	A	6270	0%	1.00E+00	1.16E-01	*11*	$7,052,856	*9*	$9,831,120	*9*	$3,511,114	*19*
MW	Route Twisk	B	7250	0%	3.08E-01	6.42E-03	*33*	$935,882	*27*	$1,089,904	*31*	$247,706	*37*
MW	Route Twisk	C	7250	0%	3.08E-01	2.33E-03	*40*	$625,230	*32*	$681,047	*34*	$648,616	*33*
MW	South Lantau Road	A	2980	0%	1.31E+00	1.09E-02	*31*	$4,064,330	*14*	$4,325,979	*17*	$1,670,262	*24*
MW	South Lantau Road	B	1210	0%	4.62E-01	8.21E-03	*32*	$772,825	*31*	$969,822	*32*	$587,771	*36*
MW	South Lantau Road	C	1210	0%	3.85E-01	2.96E-03	*37*	$391,018	*35*	$462,008	*36*	$132,002	*39*
MW	Tuen Mun Road	A	96120	12%	2.71E-01	5.86E-02	*15*	$10,795,526	*5*	$12,201,033	*7*	$11,091,848	*4*
MW	Tuen Mun Road	B	96120	5%	1.46E-01	9.57E-02	*12*	$12,585,592	*4*	$14,882,052	*4*	$4,313,638	*15*
MW	Tuen Mun Road	C	85410	4%	3.69E-01	2.14E-01	*4*	$15,900,042	*3*	$21,024,174	*3*	$5,840,048	*9*
MW	Tuen Mun Road	D	95470	0%	7.69E-02	2.74E-02	*22*	$4,637,384	*12*	$5,295,649	*14*	$5,884,054	*8*
					Total	**3.45E+00**		**$186,635,644**		**$269,431,207**			

Note: Total Cost refers to implied cost for loss of life and economic loses due to traffic disruption caused by landslides.
Other costs such as cost of slope maintenance, repair, etc, are not included.

Parameters

Value of Life	$24,000,000
Passengers per vehicle	3.6
Passenger time cost (per hr)	$78
Vehicle running cost (per hr)	$44
Probability of single lane closure in the event of a boulder fall	0.6
Duration of single lane closure due to boulder fall (days)	5

Time Delay

Category/Lanes Closed	100%	75%	50%	25%
A	60	30	20	10
B	40	20	10	5
C	10	7	5	2
D	0	0	0	3

Weighted Closure

	Max Lanes	Slope	Failure Vol	1st Lane Weighted Closure	2nd Lane Weighted Closure	3rd Lane Weighted Closure	4th Lane Weighted Closure
2Lane_up_< 20	2Lane	up	< 20	5.95	0.05	0	0
2Lane_up_20 to 50	2Lane	up	20 to 50	19.1	0.9	0	0
2Lane_up_50 to 500	2Lane	up	50 to 500	27.5	2.5	0	0
2Lane_up_500 to 2000	2Lane	up	500 to 2000	33	7	0	0
2Lane_up_> 2000	2Lane	up	> 2000	10	30	0	0
2Lane_down_< 20	2Lane	down	< 20	0	0	0	0
2Lane_down_20 to 50	2Lane	down	20 to 50	4	0	0	0
2Lane_down_50 to 200	2Lane	down	50 to 200	15	0	0	0
2Lane_down_200 to 100	2Lane	down	200 to 1000	28	0	0	0
2Lane_down_> 1000	2Lane	down	> 1000	0	40	0	0
4Lane_up_< 20	4Lane	up	< 20	5.95	0.05	0	0
4Lane_up_20 to 50	4Lane	up	20 to 50	19.1	0.9	0	0
4Lane_up_50 to 500	4Lane	up	50 to 500	27.5	2.4	0.1	0
4Lane_up_500 to 2000	4Lane	up	500 to 2000	33	5.5	1.2	0.3
4Lane_up_> 2000	4Lane	up	> 2000	10	20	7.5	2.5
4Lane_down_< 20	4Lane	down	< 20	0	0	0	0
4Lane_down_20 to 50	4Lane	down	20 to 50	4	0	0	0
4Lane_down_50 to 200	4Lane	down	50 to 200	15	0	0	0
4Lane_down_200 to 100	4Lane	down	200 to 1000	28	0	0	0
4Lane_down_> 1000	4Lane	down	> 1000	0	40	0	0
6Lane_up_< 20	6Lane	up	< 20	5.95	0.05	0	0
6Lane_up_20 to 50	6Lane	up	20 to 50	19.1	0.9	0	0
6Lane_up_50 to 500	6Lane	up	50 to 500	27.5	2.4	0.1	0
6Lane_up_500 to 2000	6Lane	up	500 to 2000	33	5.5	1.2	0.3
6Lane_up_> 2000	6Lane	up	> 2000	10	20	7.5	2.5
6Lane_down_< 20	6Lane	down	< 20	0	0	0	0
6Lane_down_20 to 50	6Lane	down	20 to 50	4	0	0	0
6Lane_down_50 to 200	6Lane	down	50 to 200	15	0	0	0
6Lane_down_200 to 100	6Lane	down	200 to 1000	28	0	0	0
6Lane_down_> 1000	6Lane	down	> 1000	0	40	0	0

Closure Prob and Duration Guide

	Slope	Failure Vol	1st Lane Prob	2nd Lane Prob	3rd Lane Prob	4th Lane Prob	1st Lane Duration	2nd Lane Duration	3rd Lane Duration	4th Lane Duration
up_< 20	up	< 20	0.6	0.05	0	0	10	1	0	0
up_20 to 50	up	20 to 50	1	0.3	0	0	20	3	0	0
up_50 to 500	up	50 to 500	1	0.5	0.1	0	30	5	1	0
up_500 to 2000	up	500 to 2000	1	0.7	0.3	0.1	40	10	5	3
up_> 2000	up	> 2000	1	1	1	0.5	40	30	10	5
down_< 20	down	< 20	0	0	0	0	10	0	0	0
down_20 to 50	down	20 to 50	0.2	0	0	0	20	0	0	0
down_50 to 200	down	50 to 200	0.5	0	0	0	30	0	0	0
down_200 to 1000	down	200 to 1000	0.7	0	0	0	40	0	0	0
down_> 1000	down	> 1000	1	1	0	0	40	40	0	0

Up Volume vs Location

Road	Section	< 20	20 to 50	50 to 500	500 to 2000	> 2000
Cape Collinson Road	A	0.77	0.12	0.1	0.01	0
Cape Collinson Road	B	0.35	0.3	0.2	0.15	0
Chung Hom Kok Road	-	0.7	0.25	0.05	0	0
Island Road	-	0.8	0.18	0.02	0	0
Kennedy Road	-	0.81	0.11	0.03	0.05	0
Magazine Gap Road	-	0.8	0.13	0.06	0.01	0
Nam Fung Road	-	0.58	0.35	0.07	0	0
Peak Road	A	0.6	0.2	0.16	0.04	0
Peak Road	B	0.9	0.08	0.02	0	0
Pokfulam Road	A	0.9	0.08	0.02	0	0
Pokfulam Road	B	0.7	0.25	0.05	0	0
Repulse Bay Road	A	0.76	0.2	0.04	0	0
Repulse Bay Road	B	0.81	0.17	0.02	0	0
Stubbs Road	A	0.7	0.23	0.07	0	0
Stubbs Road	B	0.68	0.14	0.18	0	0
Tai Hang Road	-	0.81	0.14	0.05	0	0
Tai Tam Road	-	0.87	0.11	0.02	0	0
Victoria Road	A	0.84	0.08	0.08	0	0
Victoria Road	B	0.9	0.09	0.01	0	0
Yee King Road	-	0.75	0.18	0.07	0	0
Clear Water Bay Road	-	0.64	0.2	0.13	0.03	0
Kwun Tong Road	-	0.15	0.55	0.27	0.03	0
Sai Sha Road	-	0.35	0.37	0.13	0.14	0.01
Tai Mong Tsai Road	A	0.4	0.11	0.07	0.42	0
Tai Mong Tsai Road	B	0.7	0.22	0.07	0.01	0
Tai Mong Tsai Road	C	0.45	0.2	0.3	0.05	0
Tai Mong Tsai Road	D	0.8	0.2	0	0	0
Tai Po Road	A	1	0	0	0	0
Tai Po Road	B	0.55	0.27	0.15	0.03	0
Tai Po Road	C	0.62	0.19	0.17	0.02	0
Castle Peak Road	-	0.43	0.28	0.18	0.11	0
Route Twisk	A	0.4	0.23	0.34	0.03	0
Route Twisk	B	0.8	0.15	0.05	0	0
Route Twisk	C	0.9	0.1	0	0	0
South Lantau Road	A	0.3	0.58	0.11	0.01	0
South Lantau Road	B	0.27	0.31	0.21	0.2	0.01
South Lantau Road	C	0.6	0.23	0.16	0.01	0
Tuen Mun Road	A	0.76	0.15	0.08	0.01	0
Tuen Mun Road	B	0.45	0.4	0.11	0.04	0
Tuen Mun Road	C	0.6	0.3	0.09	0.01	0
Tuen Mun Road	D	0.7	0.2	0.1	0	0

Category Lane Time Delay

	Category	Total Lanes	1	2	3	4	5	6
A_1	A	1	60					
A_2	A	2	20	60				
A_3	A	3	20	30	60			
A_4	A	4	10	20	30	60		
A_5	A	5	10	20	30	60	60	
A_6	A	6	10	20	20	30	60	60
B_1	B	1	40					
B_2	B	2	10	40				
B_3	B	3	10	20	40			
B_4	B	4	5	10	20	40		
B_5	B	5	5	10	20	40	40	
B_6	B	6	5	10	10	20	40	40
C_1	C	1	10					
C_2	C	2	5	10				
C_3	C	3	5	7	10			
C_4	C	4	2	5	7	10		
C_5	C	5	2	5	7	10	10	
C_6	C	6	2	5	5	7	10	10

LS Eco

Roads	Section	Slope	Failure Vol.	LS Frequency per year	up/down prob	Vol Prob	1st Lane Weighted Closure	2nd Lane Weighted Closure	3rd Lane Weighted Closure	4th Lane Weighted Closure	1 Lane Closed	2 Lanes Closed	3 Lanes Closed	4 Lanes Closed	1st Lane time cost/yr	2nd Lane time cost/yr	3rd Lane time cost/yr	4th Lane time cost/yr	1st Lane opr cost/yr	2nd Lane opr cost/yr	3rd Lane opr cost/yr	4th Lane opr cost/yr	Eco Loss/yr
Cape Collinson Road	A	up	< 20	6.15E-01	0.88	0.770	5.95	0.05	0	0	5	10	0	0	26126	439	0	0	4094	69	0	0	30727
Cape Collinson Road	A	up	20 to 50	6.15E-01	0.88	0.120	19.1	0.9	0	0	5	10	0	0	13070	1232	0	0	2048	193	0	0	16543
Cape Collinson Road	A	up	50 to 500	6.15E-01	0.88	0.100	27.5	2.5	0	0	5	10	0	0	15682	2851	0	0	2457	447	0	0	21437
Cape Collinson Road	A	up	500 to 2000	6.15E-01	0.88	0.010	33	7	0	0	5	10	0	0	1882	798	0	0	295	125	0	0	3100
Cape Collinson Road	A	up	> 2000	6.15E-01	0.88	0.000	10	30	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Cape Collinson Road	A	down	< 20	6.15E-01	0.12	0.090	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Cape Collinson Road	A	down	20 to 50	6.15E-01	0.12	0.200	4	0	0	0	5	10	0	0	622	0	0	0	97	0	0	0	720
Cape Collinson Road	A	down	50 to 200	6.15E-01	0.12	0.700	15	0	0	0	5	10	0	0	8165	0	0	0	1279	0	0	0	9444
Cape Collinson Road	A	down	200 to 1000	6.15E-01	0.12	0.010	28	0	0	0	5	10	0	0	218	0	0	0	34	0	0	0	252
Cape Collinson Road	A	down	> 1000	6.15E-01	0.12	0.000	0	40	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Cape Collinson Road	B	up	< 20	2.31E-01	1.00	0.350	5.95	0.05	0	0	5	10	0	0	5060	85	0	0	793	13	0	0	5952
Cape Collinson Road	B	up	20 to 50	2.31E-01	1.00	0.300	19.1	0.9	0	0	5	10	0	0	13924	1312	0	0	2182	206	0	0	17624
Cape Collinson Road	B	up	50 to 500	2.31E-01	1.00	0.200	27.5	2.5	0	0	5	10	0	0	13365	2430	0	0	2094	381	0	0	18270
Cape Collinson Road	B	up	500 to 2000	2.31E-01	1.00	0.150	33	7	0	0	5	10	0	0	12029	5103	0	0	1885	800	0	0	19816
Cape Collinson Road	B	up	> 2000	2.31E-01	1.00	0.000	10	30	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Cape Collinson Road	B	down	< 20	2.31E-01	0.00	0.000	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Cape Collinson Road	B	down	20 to 50	2.31E-01	0.00	0.000	4	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Cape Collinson Road	B	down	50 to 200	2.31E-01	0.00	0.000	15	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Cape Collinson Road	B	down	200 to 1000	2.31E-01	0.00	0.000	28	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Cape Collinson Road	B	down	> 1000	2.31E-01	0.00	0.000	0	40	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Castle Peak Road	-	up	< 20	2.38E+00	0.87	0.430	5.95	0.05	0	0	10	40	0	0	3224360	108382	0	0	505242	16983	0	0	3854967
Castle Peak Road	-	up	20 to 50	2.38E+00	0.87	0.280	19.1	0.9	0	0	10	40	0	0	6739839	1270336	0	0	1056100	199056	0	0	9265331
Castle Peak Road	-	up	50 to 500	2.38E+00	0.87	0.180	27.5	2.5	0	0	10	40	0	0	6238258	2268457	0	0	977505	355456	0	0	9839677
Castle Peak Road	-	up	500 to 2000	2.38E+00	0.87	0.110	33	7	0	0	10	40	0	0	4574723	3881583	0	0	716837	608225	0	0	9781368
Castle Peak Road	-	up	> 2000	2.38E+00	0.87	0.000	10	30	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Castle Peak Road	-	down	< 20	2.38E+00	0.13	0.500	0	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Castle Peak Road	-	down	20 to 50	2.38E+00	0.13	0.200	4	0	0	0	10	40	0	0	150651	0	0	0	23606	0	0	0	174257
Castle Peak Road	-	down	50 to 200	2.38E+00	0.13	0.150	15	0	0	0	10	40	0	0	423706	0	0	0	66393	0	0	0	490099
Castle Peak Road	-	down	200 to 1000	2.38E+00	0.13	0.150	28	0	0	0	10	40	0	0	790918	0	0	0	123933	0	0	0	914851
Castle Peak Road	-	down	> 1000	2.38E+00	0.13	0.000	0	40	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Chung Hom Kok Road	-	up	< 20	3.85E-01	0.80	0.700	5.95	0.05	0	0	5	10	0	0	38984	655	0	0	6109	103	0	0	45851
Chung Hom Kok Road	-	up	20 to 50	3.85E-01	0.80	0.250	19.1	0.9	0	0	5	10	0	0	44694	4212	0	0	7003	660	0	0	56569
Chung Hom Kok Road	-	up	50 to 500	3.85E-01	0.80	0.050	27.5	2.5	0	0	5	10	0	0	12870	2340	0	0	2017	367	0	0	17593
Chung Hom Kok Road	-	up	500 to 2000	3.85E-01	0.80	0.000	33	7	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Chung Hom Kok Road	-	up	> 2000	3.85E-01	0.80	0.000	10	30	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Chung Hom Kok Road	-	down	< 20	3.85E-01	0.20	0.250	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Chung Hom Kok Road	-	down	20 to 50	3.85E-01	0.20	0.700	4	0	0	0	5	10	0	0	6552	0	0	0	1027	0	0	0	7579
Chung Hom Kok Road	-	down	50 to 200	3.85E-01	0.20	0.050	15	0	0	0	5	10	0	0	1755	0	0	0	275	0	0	0	2030
Chung Hom Kok Road	-	down	200 to 1000	3.85E-01	0.20	0.000	28	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Chung Hom Kok Road	-	down	> 1000	3.85E-01	0.20	0.000	0	40	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Clear Water Bay Road	-	up	< 20	5.38E-01	1.00	0.640	5.95	0.05	0	0	5	10	20	40	1580967	26571	0	0	247730	4164	0	0	1859432
Clear Water Bay Road	-	up	20 to 50	5.38E-01	1.00	0.200	19.1	0.9	0	0	5	10	20	40	1585949	149461	0	0	248511	23420	0	0	2007341
Clear Water Bay Road	-	up	50 to 500	5.38E-01	1.00	0.130	27.5	2.4	0.1	0	5	10	20	40	1484233	259066	21589	0	232572	40594	3383	0	2041437
Clear Water Bay Road	-	up	500 to 2000	5.38E-01	1.00	0.030	33	5.5	1.2	0.3	5	10	20	40	411018	137006	59784	29892	64405	21468	9368	4684	737626
Clear Water Bay Road	-	up	> 2000	5.38E-01	1.00	0.000	10	20	7.5	2.5	5	10	20	40	0	0	0	0	0	0	0	0	0
Clear Water Bay Road	-	down	< 20	5.38E-01	0.00	0.000	0	0	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Clear Water Bay Road	-	down	20 to 50	5.38E-01	0.00	0.000	4	0	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Clear Water Bay Road	-	down	50 to 200	5.38E-01	0.00	0.000	15	0	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Clear Water Bay Road	-	down	200 to 1000	5.38E-01	0.00	0.000	28	0	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Clear Water Bay Road	-	down	> 1000	5.38E-01	0.00	0.000	0	40	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Island Road	-	up	< 20	4.62E-01	0.83	0.800	5.95	0.05	0	0	10	40	0	0	1441347	48449	0	0	225852	7592	0	0	1723239
Island Road	-	up	20 to 50	4.62E-01	0.83	0.180	19.1	0.9	0	0	10	40	0	0	1041040	196217	0	0	163126	30746	0	0	1431129
Island Road	-	up	50 to 500	4.62E-01	0.83	0.020	27.5	2.5	0	0	10	40	0	0	166542	60561	0	0	26096	9490	0	0	262689
Island Road	-	up	500 to 2000	4.62E-01	0.83	0.000	33	7	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Island Road	-	up	> 2000	4.62E-01	0.83	0.000	10	30	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Island Road	-	down	< 20	4.62E-01	0.17	0.250	0	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Island Road	-	down	20 to 50	4.62E-01	0.17	0.700	4	0	0	0	10	40	0	0	173656	0	0	0	27211	0	0	0	200867
Island Road	-	down	50 to 200	4.62E-01	0.17	0.050	15	0	0	0	10	40	0	0	46515	0	0	0	7289	0	0	0	53804
Island Road	-	down	200 to 1000	4.62E-01	0.17	0.000	28	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0

LS Eco

Roads	Section	Slope	Failure Vol.	LS Frequency per year	up/down prob	Vol Prob	1st Lane Weighted Closure	2nd Lane Weighted Closure	3rd Lane Weighted Closure	4th Lane Weighted Closure	1 Lane Closed	2 Lanes Closed	3 Lanes Closed	4 Lanes Closed	1st Lane time cost/yr	2nd Lane time cost/yr	3rd Lane time cost/yr	4th Lane time cost/yr	1st Lane opr cost/yr	2nd Lane opr cost/yr	3rd Lane opr cost/yr	4th Lane opr cost/yr	Eco Loss/yr
Island Road	-	down	> 1000	4.62E-01	0.17	0.000	0	40	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Kennedy Road	-	up	< 20	1.00E+00	0.85	0.810	5.95	0.05	0	0	5	10	0	0	1017073	17094	0	0	159370	2678	0	0	1196216
Kennedy Road	-	up	20 to 50	1.00E+00	0.85	0.110	19.1	0.9	0	0	5	10	0	0	443380	41785	0	0	69476	6547	0	0	561188
Kennedy Road	-	up	50 to 500	1.00E+00	0.85	0.030	27.5	2.5	0	0	5	10	0	0	174102	31655	0	0	27281	4960	0	0	237998
Kennedy Road	-	up	500 to 2000	1.00E+00	0.85	0.050	33	7	0	0	5	10	0	0	348204	147723	0	0	54562	23147	0	0	573637
Kennedy Road	-	up	> 2000	1.00E+00	0.85	0.000	10	30	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Kennedy Road	-	down	< 20	1.00E+00	0.15	0.900	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Kennedy Road	-	down	20 to 50	1.00E+00	0.15	0.100	4	0	0	0	5	10	0	0	14896	0	0	0	2334	0	0	0	17231
Kennedy Road	-	down	50 to 200	1.00E+00	0.15	0.000	15	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Kennedy Road	-	down	200 to 1000	1.00E+00	0.15	0.000	28	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Kennedy Road	-	down	> 1000	1.00E+00	0.15	0.000	0	40	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Kwun Tong Road	-	up	< 20	2.31E-01	1.00	0.150	5.95	0.05	0	0	10	20	30	60	1447007	24319	0	0	226739	3811	0	0	1701676
Kwun Tong Road	-	up	20 to 50	2.31E-01	1.00	0.550	19.1	0.9	0	0	10	20	30	60	#######	1605083	0	0	2668787	251509	0	0	21557093
Kwun Tong Road	-	up	50 to 500	2.31E-01	1.00	0.270	27.5	2.4	0.1	0	10	20	30	60	#######	2101200	131325	0	1886316	329248	20578	0	16506789
Kwun Tong Road	-	up	500 to 2000	2.31E-01	1.00	0.030	33	5.5	1.2	0.3	10	20	30	60	1605083	535028	175100	87550	251509	83836	27437	13719	2779262
Kwun Tong Road	-	up	> 2000	2.31E-01	1.00	0.000	10	20	7.5	2.5	10	20	30	60	0	0	0	0	0	0	0	0	0
Kwun Tong Road	-	down	< 20	2.31E-01	0.00	0.000	0	0	0	0	10	20	30	60	0	0	0	0	0	0	0	0	0
Kwun Tong Road	-	down	20 to 50	2.31E-01	0.00	0.000	4	0	0	0	10	20	30	60	0	0	0	0	0	0	0	0	0
Kwun Tong Road	-	down	50 to 200	2.31E-01	0.00	0.000	15	0	0	0	10	20	30	60	0	0	0	0	0	0	0	0	0
Kwun Tong Road	-	down	200 to 1000	2.31E-01	0.00	0.000	28	0	0	0	10	20	30	60	0	0	0	0	0	0	0	0	0
Kwun Tong Road	-	down	> 1000	2.31E-01	0.00	0.000	0	40	0	0	10	20	30	60	0	0	0	0	0	0	0	0	0
Magazine Gap Road	-	up	< 20	1.31E+00	0.94	0.800	5.95	0.05	0	0	5	10	0	0	2048273	34425	0	0	320954	5394	0	0	2409046
Magazine Gap Road	-	up	20 to 50	1.31E+00	0.94	0.130	19.1	0.9	0	0	5	10	0	0	1068458	100692	0	0	167422	15778	0	0	1352351
Magazine Gap Road	-	up	50 to 500	1.31E+00	0.94	0.060	27.5	2.5	0	0	5	10	0	0	710011	129093	0	0	111255	20228	0	0	970587
Magazine Gap Road	-	up	500 to 2000	1.31E+00	0.94	0.010	33	7	0	0	5	10	0	0	142002	60243	0	0	22251	9440	0	0	233936
Magazine Gap Road	-	up	> 2000	1.31E+00	0.94	0.000	10	30	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Magazine Gap Road	-	down	< 20	1.31E+00	0.06	0.900	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Magazine Gap Road	-	down	20 to 50	1.31E+00	0.06	0.100	4	0	0	0	5	10	0	0	10987	0	0	0	1722	0	0	0	12708
Magazine Gap Road	-	down	50 to 200	1.31E+00	0.06	0.000	15	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Magazine Gap Road	-	down	200 to 1000	1.31E+00	0.06	0.000	28	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Magazine Gap Road	-	down	> 1000	1.31E+00	0.06	0.000	0	40	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Nam Fung Road	-	up	< 20	1.54E-01	1.00	0.580	5.95	0.05	0	0	5	10	20	40	125603	2111	0	0	19681	331	0	0	147726
Nam Fung Road	-	up	20 to 50	1.54E-01	1.00	0.350	19.1	0.9	0	0	5	10	20	40	243307	22929	0	0	38125	3593	0	0	307955
Nam Fung Road	-	up	50 to 500	1.54E-01	1.00	0.070	27.5	2.4	0.1	0	5	10	20	40	70062	12229	1019	0	10978	1916	160	0	96365
Nam Fung Road	-	up	500 to 2000	1.54E-01	1.00	0.000	33	5.5	1.2	0.3	5	10	20	40	0	0	0	0	0	0	0	0	0
Nam Fung Road	-	up	> 2000	1.54E-01	1.00	0.000	10	20	7.5	2.5	5	10	20	40	0	0	0	0	0	0	0	0	0
Nam Fung Road	-	down	< 20	1.54E-01	0.00	0.000	0	0	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Nam Fung Road	-	down	20 to 50	1.54E-01	0.00	0.000	4	0	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Nam Fung Road	-	down	50 to 200	1.54E-01	0.00	0.000	15	0	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Nam Fung Road	-	down	200 to 1000	1.54E-01	0.00	0.000	28	0	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Nam Fung Road	-	down	> 1000	1.54E-01	0.00	0.000	0	40	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Peak Road	A	up	< 20	3.08E-01	0.75	0.600	5.95	0.05	0	0	5	10	0	0	215335	3619	0	0	33742	567	0	0	253263
Peak Road	A	up	20 to 50	3.08E-01	0.75	0.200	19.1	0.9	0	0	5	10	0	0	230415	21714	0	0	36105	3403	0	0	291637
Peak Road	A	up	50 to 500	3.08E-01	0.75	0.160	27.5	2.5	0	0	5	10	0	0	265399	48254	0	0	41587	7561	0	0	362802
Peak Road	A	up	500 to 2000	3.08E-01	0.75	0.040	33	7	0	0	5	10	0	0	79620	33778	0	0	12476	5293	0	0	131167
Peak Road	A	up	> 2000	3.08E-01	0.75	0.000	10	30	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Peak Road	A	down	< 20	3.08E-01	0.25	0.900	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Peak Road	A	down	20 to 50	3.08E-01	0.25	0.100	4	0	0	0	5	10	0	0	8042	0	0	0	1260	0	0	0	9303
Peak Road	A	down	50 to 200	3.08E-01	0.25	0.000	15	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Peak Road	A	down	200 to 1000	3.08E-01	0.25	0.000	28	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Peak Road	A	down	> 1000	3.08E-01	0.25	0.000	0	40	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Peak Road	B	up	< 20	3.85E-01	1.00	0.900	5.95	0.05	0	0	5	10	0	0	487733	8197	0	0	76425	1284	0	0	573641
Peak Road	B	up	20 to 50	3.85E-01	1.00	0.080	19.1	0.9	0	0	5	10	0	0	139170	13116	0	0	21807	2055	0	0	176148
Peak Road	B	up	50 to 500	3.85E-01	1.00	0.020	27.5	2.5	0	0	5	10	0	0	50094	9108	0	0	7849	1427	0	0	68479
Peak Road	B	up	500 to 2000	3.85E-01	1.00	0.000	33	7	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Peak Road	B	up	> 2000	3.85E-01	1.00	0.000	10	30	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Peak Road	B	down	< 20	3.85E-01	0.00	0.900	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Peak Road	B	down	20 to 50	3.85E-01	0.00	0.100	4	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Peak Road	B	down	50 to 200	3.85E-01	0.00	0.000	15	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0

LS Eco

Roads	Section	Slope	Failure Vol.	LS Frequency per year	up/down prob	Vol Prob	1st Lane Weighted Closure	2nd Lane Weighted Closure	3rd Lane Weighted Closure	4th Lane Weighted Closure	1 Lane Closed	2 Lanes Closed	3 Lanes Closed	4 Lanes Closed	1st Lane time cost/yr	2nd Lane time cost/yr	3rd Lane time cost/yr	4th Lane time cost/yr	1st Lane opr cost/yr	2nd Lane opr cost/yr	3rd Lane opr cost/yr	4th Lane opr cost/yr	Eco Loss/yr
Peak Road	B	down	200 to 1000	3.85E-01	0.00	0.000	28	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Peak Road	B	down	> 1000	3.85E-01	0.00	0.000	0	40	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Pokfulam Road	A	up	< 20	5.38E-01	0.86	0.900	5.95	0.05	0	0	5	10	20	40	2098248	35265	0	0	328785	5526	0	0	2467824
Pokfulam Road	A	up	20 to 50	5.38E-01	0.86	0.080	19.1	0.9	0	0	5	10	20	40	598716	56423	0	0	93815	8841	0	0	757797
Pokfulam Road	A	up	50 to 500	5.38E-01	0.86	0.020	27.5	2.4	0.1	0	5	10	20	40	215506	37616	3135	0	33769	5894	491	0	296411
Pokfulam Road	A	up	500 to 2000	5.38E-01	0.86	0.000	33	5.5	1.2	0.3	5	10	20	40	0	0	0	0	0	0	0	0	0
Pokfulam Road	A	up	> 2000	5.38E-01	0.86	0.000	10	20	7.5	2.5	5	10	20	40	0	0	0	0	0	0	0	0	0
Pokfulam Road	A	down	< 20	5.38E-01	0.14	0.250	0	0	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Pokfulam Road	A	down	20 to 50	5.38E-01	0.14	0.700	4	0	0	0	5	10	20	40	178601	0	0	0	27986	0	0	0	206587
Pokfulam Road	A	down	50 to 200	5.38E-01	0.14	0.050	15	0	0	0	5	10	20	40	47840	0	0	0	7496	0	0	0	55336
Pokfulam Road	A	down	200 to 1000	5.38E-01	0.14	0.000	28	0	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Pokfulam Road	A	down	> 1000	5.38E-01	0.14	0.000	0	40	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Pokfulam Road	B	up	< 20	2.31E-01	1.00	0.700	5.95	0.05	0	0	5	10	20	40	563400	9469	0	0	88282	1484	0	0	662634
Pokfulam Road	B	up	20 to 50	2.31E-01	1.00	0.250	19.1	0.9	0	0	5	10	20	40	645914	60872	0	0	101212	9538	0	0	817536
Pokfulam Road	B	up	50 to 500	2.31E-01	1.00	0.050	27.5	2.4	0.1	0	5	10	20	40	185996	32465	2705	0	29145	5087	424	0	255822
Pokfulam Road	B	up	500 to 2000	2.31E-01	1.00	0.000	33	5.5	1.2	0.3	5	10	20	40	0	0	0	0	0	0	0	0	0
Pokfulam Road	B	up	> 2000	2.31E-01	1.00	0.000	10	20	7.5	2.5	5	10	20	40	0	0	0	0	0	0	0	0	0
Pokfulam Road	B	down	< 20	2.31E-01	0.00	0.900	0	0	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Pokfulam Road	B	down	20 to 50	2.31E-01	0.00	0.100	4	0	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Pokfulam Road	B	down	50 to 200	2.31E-01	0.00	0.000	15	0	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Pokfulam Road	B	down	200 to 1000	2.31E-01	0.00	0.000	28	0	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Pokfulam Road	B	down	> 1000	2.31E-01	0.00	0.000	0	40	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Repulse Bay Road	A	up	< 20	2.23E+00	0.76	0.760	5.95	0.05	0	0	5	10	0	0	2206580	37085	0	0	345760	5811	0	0	2595237
Repulse Bay Road	A	up	20 to 50	2.23E+00	0.76	0.200	19.1	0.9	0	0	5	10	0	0	1864029	175668	0	0	292084	27526	0	0	2359307
Repulse Bay Road	A	up	50 to 500	2.23E+00	0.76	0.040	27.5	2.5	0	0	5	10	0	0	536762	97593	0	0	84108	15292	0	0	733756
Repulse Bay Road	A	up	500 to 2000	2.23E+00	0.76	0.000	33	7	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Repulse Bay Road	A	up	> 2000	2.23E+00	0.76	0.000	10	30	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Repulse Bay Road	A	down	< 20	2.23E+00	0.24	0.200	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Repulse Bay Road	A	down	20 to 50	2.23E+00	0.24	0.350	4	0	0	0	5	10	0	0	215732	0	0	0	33804	0	0	0	249536
Repulse Bay Road	A	down	50 to 200	2.23E+00	0.24	0.350	15	0	0	0	5	10	0	0	808996	0	0	0	126766	0	0	0	935761
Repulse Bay Road	A	down	200 to 1000	2.23E+00	0.24	0.100	28	0	0	0	5	10	0	0	431464	0	0	0	67608	0	0	0	499073
Repulse Bay Road	A	down	> 1000	2.23E+00	0.24	0.000	0	40	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Repulse Bay Road	B	up	< 20	4.62E-01	0.67	0.810	5.95	0.05	0	0	10	40	0	0	1002278	33690	0	0	157052	5279	0	0	1198297
Repulse Bay Road	B	up	20 to 50	4.62E-01	0.67	0.170	19.1	0.9	0	0	10	40	0	0	675255	127273	0	0	105809	19943	0	0	928280
Repulse Bay Road	B	up	50 to 500	4.62E-01	0.67	0.020	27.5	2.5	0	0	10	40	0	0	114379	41593	0	0	17923	6517	0	0	180412
Repulse Bay Road	B	up	500 to 2000	4.62E-01	0.67	0.000	33	7	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Repulse Bay Road	B	up	> 2000	4.62E-01	0.67	0.000	10	30	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Repulse Bay Road	B	down	< 20	4.62E-01	0.33	0.900	0	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Repulse Bay Road	B	down	20 to 50	4.62E-01	0.33	0.100	4	0	0	0	10	40	0	0	40972	0	0	0	6420	0	0	0	47392
Repulse Bay Road	B	down	50 to 200	4.62E-01	0.33	0.000	15	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Repulse Bay Road	B	down	200 to 1000	4.62E-01	0.33	0.000	28	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Repulse Bay Road	B	down	> 1000	4.62E-01	0.33	0.000	0	40	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Route Twisk	A	up	< 20	9.23E-01	1.00	0.400	5.95	0.05	0	0	10	40	0	0	644656	21669	0	0	101015	3395	0	0	770735
Route Twisk	A	up	20 to 50	9.23E-01	1.00	0.230	19.1	0.9	0	0	10	40	0	0	1189906	224275	0	0	186452	35143	0	0	1635776
Route Twisk	A	up	50 to 500	9.23E-01	1.00	0.340	27.5	2.5	0	0	10	40	0	0	2532578	920938	0	0	396843	144306	0	0	3994665
Route Twisk	A	up	500 to 2000	9.23E-01	1.00	0.030	33	7	0	0	10	40	0	0	268155	227526	0	0	42019	35652	0	0	573352
Route Twisk	A	up	> 2000	9.23E-01	1.00	0.000	10	30	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Route Twisk	A	down	< 20	9.23E-01	0.00	0.800	0	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Route Twisk	A	down	20 to 50	9.23E-01	0.00	0.150	4	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Route Twisk	A	down	50 to 200	9.23E-01	0.00	0.050	15	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Route Twisk	A	down	200 to 1000	9.23E-01	0.00	0.000	28	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Route Twisk	A	down	> 1000	9.23E-01	0.00	0.000	0	40	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Route Twisk	B	up	< 20	3.08E-01	0.75	0.800	5.95	0.05	0	0	10	40	0	0	372708	12528	0	0	58402	1963	0	0	445601
Route Twisk	B	up	20 to 50	3.08E-01	0.75	0.150	19.1	0.9	0	0	10	40	0	0	224330	42282	0	0	35151	6625	0	0	308388
Route Twisk	B	up	50 to 500	3.08E-01	0.75	0.050	27.5	2.5	0	0	10	40	0	0	107663	39150	0	0	16870	6135	0	0	169817
Route Twisk	B	up	500 to 2000	3.08E-01	0.75	0.000	33	7	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Route Twisk	B	up	> 2000	3.08E-01	0.75	0.000	10	30	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Route Twisk	B	down	< 20	3.08E-01	0.25	0.900	0	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Route Twisk	B	down	20 to 50	3.08E-01	0.25	0.100	4	0	0	0	10	40	0	0	10440	0	0	0	1636	0	0	0	12076

LS Eco

Roads	Section	Slope	Failure Vol.	LS Frequency per year	up/down prob	Vot Prob	1st Lane Weighted Closure	2nd Lane Weighted Closure	3rd Lane Weighted Closure	4th Lane Weighted Closure	1 Lane Closed	2 Lanes Closed	3 Lanes Closed	4 Lanes Closed	1st Lane time cost/yr	2nd Lane time cost/yr	3rd Lane time cost/yr	4th Lane time cost/yr	1st Lane opr cost/yr	2nd Lane opr cost/yr	3rd Lane opr cost/yr	4th Lane opr cost/yr	Eco Loss/yr
Route Twisk	B	down	50 to 200	3.08E-01	0.25	0.000	15	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Route Twisk	B	down	200 to 1000	3.08E-01	0.25	0.000	28	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Route Twisk	B	down	> 1000	3.08E-01	0.25	0.000	0	40	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Route Twisk	C	up	< 20	3.08E-01	0.50	0.900	5.95	0.05	0	0	10	40	0	0	279531	9396	0	0	43801	1472	0	0	334200
Route Twisk	C	up	20 to 50	3.08E-01	0.50	0.100	19.1	0.9	0	0	10	40	0	0	99702	18792	0	0	15623	2945	0	0	137061
Route Twisk	C	up	50 to 500	3.08E-01	0.50	0.000	27.5	2.5	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Route Twisk	C	up	500 to 2000	3.08E-01	0.50	0.000	33	7	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Route Twisk	C	up	> 2000	3.08E-01	0.50	0.000	10	30	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Route Twisk	C	down	< 20	3.08E-01	0.50	0.500	0	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Route Twisk	C	down	20 to 50	3.08E-01	0.50	0.450	4	0	0	0	10	40	0	0	93960	0	0	0	14723	0	0	0	108683
Route Twisk	C	down	50 to 200	3.08E-01	0.50	0.050	15	0	0	0	10	40	0	0	39150	0	0	0	6135	0	0	0	45285
Route Twisk	C	down	200 to 1000	3.08E-01	0.50	0.000	28	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Route Twisk	C	down	> 1000	3.08E-01	0.50	0.000	0	40	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Sai Sha Road	-	up	< 20	1.00E+00	1.00	0.350	5.95	0.05	0	0	10	40	0	0	517518	17396	0	0	81093	2726	0	0	618732
Sai Sha Road	-	up	20 to 50	1.00E+00	1.00	0.370	19.1	0.9	0	0	10	40	0	0	1756206	331013	0	0	275189	51868	0	0	2414276
Sai Sha Road	-	up	50 to 500	1.00E+00	1.00	0.130	27.5	2.5	0	0	10	40	0	0	888416	323060	0	0	139211	50622	0	0	1401309
Sai Sha Road	-	up	500 to 2000	1.00E+00	1.00	0.140	33	7	0	0	10	40	0	0	1148107	974151	0	0	179903	152645	0	0	2454806
Sai Sha Road	-	up	> 2000	1.00E+00	1.00	0.010	10	30	0	0	10	40	0	0	24851	298210	0	0	3894	46728	0	0	373682
Sai Sha Road	-	down	< 20	1.00E+00	0.00	0.000	0	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Sai Sha Road	-	down	20 to 50	1.00E+00	0.00	0.000	4	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Sai Sha Road	-	down	50 to 200	1.00E+00	0.00	0.000	15	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Sai Sha Road	-	down	200 to 1000	1.00E+00	0.00	0.000	28	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Sai Sha Road	-	down	> 1000	1.00E+00	0.00	0.000	0	40	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
South Lantau Road	A	up	< 20	1.31E+00	0.88	0.300	5.95	0.05	0	0	10	40	0	0	286476	9629	0	0	44889	1509	0	0	342504
South Lantau Road	A	up	20 to 50	1.31E+00	0.88	0.580	19.1	0.9	0	0	10	40	0	0	1777918	335105	0	0	278591	52509	0	0	2444123
South Lantau Road	A	up	50 to 500	1.31E+00	0.88	0.110	27.5	2.5	0	0	10	40	0	0	485485	176540	0	0	76073	27663	0	0	765761
South Lantau Road	A	up	500 to 2000	1.31E+00	0.88	0.010	33	7	0	0	10	40	0	0	52962	44937	0	0	8299	7041	0	0	113240
South Lantau Road	A	up	> 2000	1.31E+00	0.88	0.000	10	30	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
South Lantau Road	A	down	< 20	1.31E+00	0.12	0.100	0	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
South Lantau Road	A	down	20 to 50	1.31E+00	0.12	0.400	4	0	0	0	10	40	0	0	35016	0	0	0	5487	0	0	0	40503
South Lantau Road	A	down	50 to 200	1.31E+00	0.12	0.090	15	0	0	0	10	40	0	0	29545	0	0	0	4630	0	0	0	34174
South Lantau Road	A	down	200 to 1000	1.31E+00	0.12	0.400	28	0	0	0	10	40	0	0	245113	0	0	0	38408	0	0	0	283521
South Lantau Road	A	down	> 1000	1.31E+00	0.12	0.010	0	40	0	0	10	40	0	0	0	35016	0	0	0	5487	0	0	40503
South Lantau Road	B	up	< 20	4.62E-01	0.83	0.270	5.95	0.05	0	0	10	40	0	0	34850	1171	0	0	5461	184	0	0	41665
South Lantau Road	B	up	20 to 50	4.62E-01	0.83	0.310	19.1	0.9	0	0	10	40	0	0	128444	24209	0	0	20126	3793	0	0	176573
South Lantau Road	B	up	50 to 500	4.62E-01	0.83	0.210	27.5	2.5	0	0	10	40	0	0	125276	45555	0	0	19630	7138	0	0	197600
South Lantau Road	B	up	500 to 2000	4.62E-01	0.83	0.200	33	7	0	0	10	40	0	0	143173	121480	0	0	22435	19035	0	0	306123
South Lantau Road	B	up	> 2000	4.62E-01	0.83	0.010	10	30	0	0	10	40	0	0	2169	26031	0	0	340	4079	0	0	32620
South Lantau Road	B	down	< 20	4.62E-01	0.17	0.250	0	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
South Lantau Road	B	down	20 to 50	4.62E-01	0.17	0.700	4	0	0	0	10	40	0	0	12441	0	0	0	1949	0	0	0	14390
South Lantau Road	B	down	50 to 200	4.62E-01	0.17	0.050	15	0	0	0	10	40	0	0	3332	0	0	0	522	0	0	0	3855
South Lantau Road	B	down	200 to 1000	4.62E-01	0.17	0.000	28	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
South Lantau Road	B	down	> 1000	4.62E-01	0.17	0.000	0	40	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
South Lantau Road	C	up	< 20	3.85E-01	1.00	0.600	5.95	0.05	0	0	10	40	0	0	77755	2614	0	0	12184	410	0	0	92962
South Lantau Road	C	up	20 to 50	3.85E-01	1.00	0.230	19.1	0.9	0	0	10	40	0	0	95680	18034	0	0	14993	2826	0	0	131532
South Lantau Road	C	up	50 to 500	3.85E-01	1.00	0.160	27.5	2.5	0	0	10	40	0	0	95832	34848	0	0	15016	5461	0	0	151157
South Lantau Road	C	up	500 to 2000	3.85E-01	1.00	0.010	33	7	0	0	10	40	0	0	7187	6098	0	0	1126	956	0	0	15368
South Lantau Road	C	up	> 2000	3.85E-01	1.00	0.000	10	30	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
South Lantau Road	C	down	< 20	3.85E-01	0.00	0.000	0	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
South Lantau Road	C	down	20 to 50	3.85E-01	0.00	0.000	4	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
South Lantau Road	C	down	50 to 200	3.85E-01	0.00	0.000	15	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
South Lantau Road	C	down	200 to 1000	3.85E-01	0.00	0.000	28	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
South Lantau Road	C	down	> 1000	3.85E-01	0.00	0.000	0	40	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Stubbs Road	A	up	< 20	3.08E-01	1.00	0.700	5.95	0.05	0	0	5	10	0	0	631847	10619	0	0	99007	1664	0	0	743138
Stubbs Road	A	up	20 to 50	3.08E-01	1.00	0.230	19.1	0.9	0	0	5	10	0	0	666436	62805	0	0	104427	9841	0	0	843510
Stubbs Road	A	up	50 to 500	3.08E-01	1.00	0.070	27.5	2.5	0	0	5	10	0	0	292030	53096	0	0	45760	8320	0	0	399206
Stubbs Road	A	up	500 to 2000	3.08E-01	1.00	0.000	33	7	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Stubbs Road	A	up	> 2000	3.08E-01	1.00	0.000	10	30	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Stubbs Road	A	down	< 20	3.08E-01	0.00	0.900	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0

LS Eco

Roads	Section	Slope	Failure Vol.	LS Frequency per year	up/down prob	Vol Prob	1st Lane Weighted Closure	2nd Lane Weighted Closure	3rd Lane Weighted Closure	4th Lane Weighted Closure	1 Lane Closed	2 Lanes Closed	3 Lanes Closed	4 Lanes Closed	1st Lane time cost/yr	2nd Lane time cost/yr	3rd Lane time cost/yr	4th Lane time cost/yr	1st Lane opr cost/yr	2nd Lane opr cost/yr	3rd Lane opr cost/yr	4th Lane opr cost/yr	Eco Loss/yr
Stubbs Road	A	down	20 to 50	3.08E-01	0.00	0.100	4	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Stubbs Road	A	down	50 to 200	3.08E-01	0.00	0.000	15	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Stubbs Road	A	down	200 to 1000	3.08E-01	0.00	0.000	28	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Stubbs Road	A	down	> 1000	3.08E-01	0.00	0.000	0	40	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Stubbs Road	B	up	< 20	1.54E-01	1.00	0.680	5.95	0.05	0	0	5	10	0	0	164154	2759	0	0	25722	432	0	0	193068
Stubbs Road	B	up	20 to 50	1.54E-01	1.00	0.140	19.1	0.9	0	0	5	10	0	0	108490	10224	0	0	17000	1602	0	0	137316
Stubbs Road	B	up	50 to 500	1.54E-01	1.00	0.160	27.5	2.5	0	0	5	10	0	0	200831	36515	0	0	31469	5722	0	0	274537
Stubbs Road	B	up	500 to 2000	1.54E-01	1.00	0.000	33	7	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Stubbs Road	B	up	> 2000	1.54E-01	1.00	0.000	10	30	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Stubbs Road	B	down	< 20	1.54E-01	0.00	0.900	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Stubbs Road	B	down	20 to 50	1.54E-01	0.00	0.100	4	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Stubbs Road	B	down	50 to 200	1.54E-01	0.00	0.000	15	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Stubbs Road	B	down	200 to 1000	1.54E-01	0.00	0.000	28	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Stubbs Road	B	down	> 1000	1.54E-01	0.00	0.000	0	40	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Tai Hang Road	-	up	< 20	2.08E+00	0.93	0.810	5.95	0.05	0	0	5	10	0	0	3195592	53707	0	0	500734	8416	0	0	3758449
Tai Hang Road	-	up	20 to 50	2.08E+00	0.93	0.140	19.1	0.9	0	0	5	10	0	0	1773008	167090	0	0	277822	26182	0	0	2244102
Tai Hang Road	-	up	50 to 500	2.08E+00	0.93	0.050	27.5	2.5	0	0	5	10	0	0	911700	165764	0	0	142859	25974	0	0	1246297
Tai Hang Road	-	up	500 to 2000	2.08E+00	0.93	0.000	33	7	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Tai Hang Road	-	up	> 2000	2.08E+00	0.93	0.000	10	30	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Tai Hang Road	-	down	< 20	2.08E+00	0.07	0.500	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Tai Hang Road	-	down	20 to 50	2.08E+00	0.07	0.440	4	0	0	0	5	10	0	0	87837	0	0	0	13764	0	0	0	101601
Tai Hang Road	-	down	50 to 200	2.08E+00	0.07	0.050	15	0	0	0	5	10	0	0	37431	0	0	0	5865	0	0	0	43296
Tai Hang Road	-	down	200 to 1000	2.08E+00	0.07	0.010	28	0	0	0	5	10	0	0	13974	0	0	0	2190	0	0	0	16164
Tai Hang Road	-	down	> 1000	2.08E+00	0.07	0.000	0	40	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	A	up	< 20	2.31E-01	0.67	0.400	5.95	0.05	0	0	10	40	0	0	103330	3473	0	0	16191	544	0	0	123539
Tai Mong Tsai Road	A	up	20 to 50	2.31E-01	0.67	0.110	19.1	0.9	0	0	10	40	0	0	91217	17193	0	0	14293	2694	0	0	125397
Tai Mong Tsai Road	A	up	50 to 500	2.31E-01	0.67	0.070	27.5	2.5	0	0	10	40	0	0	83576	30391	0	0	13096	4762	0	0	131825
Tai Mong Tsai Road	A	up	500 to 2000	2.31E-01	0.67	0.420	33	7	0	0	10	40	0	0	601746	510572	0	0	94291	80004	0	0	1286613
Tai Mong Tsai Road	A	up	> 2000	2.31E-01	0.67	0.000	10	30	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	A	down	< 20	2.31E-01	0.33	0.250	0	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	A	down	20 to 50	2.31E-01	0.33	0.700	4	0	0	0	10	40	0	0	59875	0	0	0	9382	0	0	0	69257
Tai Mong Tsai Road	A	down	50 to 200	2.31E-01	0.33	0.050	15	0	0	0	10	40	0	0	16038	0	0	0	2513	0	0	0	18551
Tai Mong Tsai Road	A	down	200 to 1000	2.31E-01	0.33	0.000	28	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	A	down	> 1000	2.31E-01	0.33	0.000	0	40	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	B	up	< 20	6.15E-01	1.00	0.700	5.95	0.05	0	0	10	40	0	0	719712	24192	0	0	112775	3791	0	0	860470
Tai Mong Tsai Road	B	up	20 to 50	6.15E-01	1.00	0.220	19.1	0.9	0	0	10	40	0	0	726106	136858	0	0	113777	21445	0	0	998185
Tai Mong Tsai Road	B	up	50 to 500	6.15E-01	1.00	0.070	27.5	2.5	0	0	10	40	0	0	332640	120960	0	0	52123	18954	0	0	524677
Tai Mong Tsai Road	B	up	500 to 2000	6.15E-01	1.00	0.010	33	7	0	0	10	40	0	0	57024	48384	0	0	8935	7582	0	0	121925
Tai Mong Tsai Road	B	up	> 2000	6.15E-01	1.00	0.000	10	30	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	B	down	< 20	6.15E-01	0.00	0.000	0	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	B	down	20 to 50	6.15E-01	0.00	0.000	4	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	B	down	50 to 200	6.15E-01	0.00	0.000	15	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	B	down	200 to 1000	6.15E-01	0.00	0.000	28	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	B	down	> 1000	6.15E-01	0.00	0.000	0	40	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	C	up	< 20	1.54E-01	1.00	0.450	5.95	0.05	0	0	5	10	0	0	39713	667	0	0	6223	105	0	0	46707
Tai Mong Tsai Road	C	up	20 to 50	1.54E-01	1.00	0.200	19.1	0.9	0	0	5	10	0	0	56658	5340	0	0	8878	837	0	0	71713
Tai Mong Tsai Road	C	up	50 to 500	1.54E-01	1.00	0.300	27.5	2.5	0	0	5	10	0	0	122364	22248	0	0	19174	3486	0	0	167272
Tai Mong Tsai Road	C	up	500 to 2000	1.54E-01	1.00	0.050	33	7	0	0	5	10	0	0	24473	10382	0	0	3835	1627	0	0	40317
Tai Mong Tsai Road	C	up	> 2000	1.54E-01	1.00	0.000	10	30	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	C	down	< 20	1.54E-01	0.00	0.000	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	C	down	20 to 50	1.54E-01	0.00	0.000	4	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	C	down	50 to 200	1.54E-01	0.00	0.000	15	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	C	down	200 to 1000	1.54E-01	0.00	0.000	28	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	C	down	> 1000	1.54E-01	0.00	0.000	0	40	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	D	up	< 20	1.54E-01	1.00	0.800	5.95	0.05	0	0	5	10	0	0	70600	1187	0	0	11063	186	0	0	83036
Tai Mong Tsai Road	D	up	20 to 50	1.54E-01	1.00	0.200	19.1	0.9	0	0	5	10	0	0	56658	5340	0	0	8878	837	0	0	71713
Tai Mong Tsai Road	D	up	50 to 500	1.54E-01	1.00	0.000	27.5	2.5	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	D	up	500 to 2000	1.54E-01	1.00	0.000	33	7	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	D	up	> 2000	1.54E-01	1.00	0.000	10	30	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0

LS Eco

Roads	Section	Slope	Failure Vol.	LS Frequency per year	up/down prob	Vol Prob	1st Lane Weighted Closure	2nd Lane Weighted Closure	3rd Lane Weighted Closure	4th Lane Weighted Closure	1 Lane Closed	2 Lanes Closed	3 Lanes Closed	4 Lanes Closed	1st Lane time cost/yr	2nd Lane time cost/yr	3rd Lane time cost/yr	4th Lane time cost/yr	1st Lane opr cost/yr	2nd Lane opr cost/yr	3rd Lane opr cost/yr	4th Lane opr cost/yr	Eco Loss/yr
Tai Mong Tsai Road	D	down	< 20	1.54E-01	0.00	0.000	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	D	down	20 to 50	1.54E-01	0.00	0.000	4	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	D	down	50 to 200	1.54E-01	0.00	0.000	15	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	D	down	200 to 1000	1.54E-01	0.00	0.000	28	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Tai Mong Tsai Road	D	down	> 1000	1.54E-01	0.00	0.000	0	40	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Tai Po Road	A	up	< 20	1.54E-01	0.50	1.000	5.95	0.05	0	0	5	10	20	40	98425	1654	0	0	15423	259	0	0	115761
Tai Po Road	A	up	20 to 50	1.54E-01	0.50	0.000	19.1	0.9	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Tai Po Road	A	up	50 to 500	1.54E-01	0.50	0.000	27.5	2.4	0.1	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Tai Po Road	A	up	500 to 2000	1.54E-01	0.50	0.000	33	5.5	1.2	0.3	5	10	20	40	0	0	0	0	0	0	0	0	0
Tai Po Road	A	up	> 2000	1.54E-01	0.50	0.000	10	20	7.5	2.5	5	10	20	40	0	0	0	0	0	0	0	0	0
Tai Po Road	A	down	< 20	1.54E-01	0.50	0.400	0	0	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Tai Po Road	A	down	20 to 50	1.54E-01	0.50	0.540	4	0	0	0	5	10	20	40	35731	0	0	0	5599	0	0	0	41330
Tai Po Road	A	down	50 to 200	1.54E-01	0.50	0.050	15	0	0	0	5	10	20	40	12407	0	0	0	1944	0	0	0	14351
Tai Po Road	A	down	200 to 1000	1.54E-01	0.50	0.010	28	0	0	0	5	10	20	40	4632	0	0	0	726	0	0	0	5358
Tai Po Road	A	down	> 1000	1.54E-01	0.50	0.000	0	40	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Tai Po Road	B	up	< 20	6.15E-01	0.88	0.550	5.95	0.05	0	0	5	10	20	40	242180	4070	0	0	37948	638	0	0	284836
Tai Po Road	B	up	20 to 50	6.15E-01	0.88	0.270	19.1	0.9	0	0	5	10	20	40	381641	35966	0	0	59801	5636	0	0	483044
Tai Po Road	B	up	50 to 500	6.15E-01	0.88	0.150	27.5	2.4	0.1	0	5	10	20	40	305268	53283	4440	0	47834	8349	696	0	419871
Tai Po Road	B	up	500 to 2000	6.15E-01	0.88	0.030	33	5.5	1.2	0.3	5	10	20	40	73264	24421	10657	5328	11480	3827	1670	835	131483
Tai Po Road	B	up	> 2000	6.15E-01	0.88	0.000	10	20	7.5	2.5	5	10	20	40	0	0	0	0	0	0	0	0	0
Tai Po Road	B	down	< 20	6.15E-01	0.12	0.090	0	0	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Tai Po Road	B	down	20 to 50	6.15E-01	0.12	0.200	4	0	0	0	5	10	20	40	8073	0	0	0	1265	0	0	0	9338
Tai Po Road	B	down	50 to 200	6.15E-01	0.12	0.700	15	0	0	0	5	10	20	40	105961	0	0	0	16604	0	0	0	122565
Tai Po Road	B	down	200 to 1000	6.15E-01	0.12	0.010	28	0	0	0	5	10	20	40	2826	0	0	0	443	0	0	0	3268
Tai Po Road	B	down	> 1000	6.15E-01	0.12	0.000	0	40	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Tai Po Road	C	up	< 20	4.62E-01	0.83	0.620	5.95	0.05	0	0	5	10	20	40	193118	3246	0	0	30261	509	0	0	227133
Tai Po Road	C	up	20 to 50	4.62E-01	0.83	0.190	19.1	0.9	0	0	5	10	20	40	189977	17904	0	0	29769	2805	0	0	240455
Tai Po Road	C	up	50 to 500	4.62E-01	0.83	0.170	27.5	2.4	0.1	0	5	10	20	40	244735	42717	3560	0	38349	6694	558	0	336613
Tai Po Road	C	up	500 to 2000	4.62E-01	0.83	0.020	33	5.5	1.2	0.3	5	10	20	40	34551	11517	5026	2513	5414	1805	787	394	62006
Tai Po Road	C	up	> 2000	4.62E-01	0.83	0.000	10	20	7.5	2.5	5	10	20	40	0	0	0	0	0	0	0	0	0
Tai Po Road	C	down	< 20	4.62E-01	0.17	0.250	0	0	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Tai Po Road	C	down	20 to 50	4.62E-01	0.17	0.700	4	0	0	0	5	10	20	40	30022	0	0	0	4704	0	0	0	34727
Tai Po Road	C	down	50 to 200	4.62E-01	0.17	0.050	15	0	0	0	5	10	20	40	8042	0	0	0	1260	0	0	0	9302
Tai Po Road	C	down	200 to 1000	4.62E-01	0.17	0.000	28	0	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Tai Po Road	C	down	> 1000	4.62E-01	0.17	0.000	0	40	0	0	5	10	20	40	0	0	0	0	0	0	0	0	0
Tai Tam Road	-	up	< 20	8.46E-01	0.91	0.870	5.95	0.05	0	0	10	40	0	0	2033290	66346	0	0	318607	10709	0	0	2430952
Tai Tam Road	-	up	20 to 50	8.46E-01	0.91	0.110	19.1	0.9	0	0	10	40	0	0	825257	155546	0	0	129314	24373	0	0	1134490
Tai Tam Road	-	up	50 to 500	8.46E-01	0.91	0.020	27.5	2.5	0	0	10	40	0	0	216036	78558	0	0	33852	12310	0	0	340756
Tai Tam Road	-	up	500 to 2000	8.46E-01	0.91	0.000	33	7	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Tai Tam Road	-	up	> 2000	8.46E-01	0.91	0.000	10	30	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Tai Tam Road	-	down	< 20	8.46E-01	0.09	0.250	0	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Tai Tam Road	-	down	20 to 50	8.46E-01	0.09	0.700	4	0	0	0	10	40	0	0	108773	0	0	0	17044	0	0	0	125818
Tai Tam Road	-	down	50 to 200	8.46E-01	0.09	0.050	15	0	0	0	10	40	0	0	29136	0	0	0	4565	0	0	0	33701
Tai Tam Road	-	down	200 to 1000	8.46E-01	0.09	0.000	28	0	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Tai Tam Road	-	down	> 1000	8.46E-01	0.09	0.000	0	40	0	0	10	40	0	0	0	0	0	0	0	0	0	0	0
Tuen Mun Road	A	up	< 20	3.08E-01	0.67	0.760	5.95	0.05	0	0	10	20	20	30	4193548	70480	0	0	657109	11044	0	0	4932180
Tuen Mun Road	A	up	20 to 50	3.08E-01	0.67	0.150	19.1	0.9	0	0	10	20	20	30	2656903	250389	0	0	416324	39235	0	0	3362850
Tuen Mun Road	A	up	50 to 500	3.08E-01	0.67	0.080	27.5	2.4	0.1	0	10	20	20	30	2040205	356108	14838	0	319690	55800	2325	0	2788967
Tuen Mun Road	A	up	500 to 2000	3.08E-01	0.67	0.010	33	5.5	1.2	0.3	10	20	20	30	306031	102010	22257	8346	47954	15985	3488	1308	507377
Tuen Mun Road	A	up	> 2000	3.08E-01	0.67	0.000	10	20	7.5	2.5	10	20	20	30	0	0	0	0	0	0	0	0	0
Tuen Mun Road	A	down	< 20	3.08E-01	0.33	0.850	0	0	0	0	10	20	20	30	0	0	0	0	0	0	0	0	0
Tuen Mun Road	A	down	20 to 50	3.08E-01	0.33	0.100	4	0	0	0	10	20	20	30	182705	0	0	0	28629	0	0	0	211334
Tuen Mun Road	A	down	50 to 200	3.08E-01	0.33	0.040	15	0	0	0	10	20	20	30	274057	0	0	0	42943	0	0	0	317001
Tuen Mun Road	A	down	200 to 1000	3.08E-01	0.33	0.010	28	0	0	0	10	20	20	30	127893	0	0	0	20040	0	0	0	147934
Tuen Mun Road	A	down	> 1000	3.08E-01	0.33	0.000	0	40	0	0	10	20	20	30	0	0	0	0	0	0	0	0	0
Tuen Mun Road	B	up	< 20	1.54E-01	1.00	0.450	5.95	0.05	0	0	10	20	20	30	1853001	31143	0	0	290356	4880	0	0	2179381
Tuen Mun Road	B	up	20 to 50	1.54E-01	1.00	0.400	19.1	0.9	0	0	10	20	20	30	5287369	498286	0	0	828505	78079	0	0	6692239
Tuen Mun Road	B	up	50 to 500	1.54E-01	1.00	0.110	27.5	2.4	0.1	0	10	20	20	30	2093494	365410	15225	0	328040	57258	2386	0	2861813
Tuen Mun Road	B	up	500 to 2000	1.54E-01	1.00	0.040	33	5.5	1.2	0.3	10	20	20	30	913524	304508	66438	24914	143145	47715	10411	3904	1514559

LS Eco

Roads	Section	Slope	Failure Vol.	LS Frequency per year	up/down prob	Vol Prob	1st Lane Weighted Closure	2nd Lane Weighted Closure	3rd Lane Weighted Closure	4th Lane Weighted Closure	1 Lane Closed	2 Lanes Closed	3 Lanes Closed	4 Lanes Closed	1st Lane time cost/yr	2nd Lane time cost/yr	3rd Lane time cost/yr	4th Lane time cost/yr	1st Lane opr cost/yr	2nd Lane opr cost/yr	3rd Lane opr cost/yr	4th Lane opr cost/yr	Eco Loss/yr
Tuen Mun Road	B	up	> 2000	1.54E-01	1.00	0.000	10	20	7.5	2.5	10	20	20	30	0	0	0	0	0	0	0	0	0
Tuen Mun Road	B	down	< 20	1.54E-01	0.00	0.900	0	0	0	0	10	20	20	30	0	0	0	0	0	0	0	0	0
Tuen Mun Road	B	down	20 to 50	1.54E-01	0.00	0.080	4	0	0	0	10	20	20	30	0	0	0	0	0	0	0	0	0
Tuen Mun Road	B	down	50 to 200	1.54E-01	0.00	0.020	15	0	0	0	10	20	20	30	0	0	0	0	0	0	0	0	0
Tuen Mun Road	B	down	200 to 1000	1.54E-01	0.00	0.000	28	0	0	0	10	20	20	30	0	0	0	0	0	0	0	0	0
Tuen Mun Road	B	down	> 1000	1.54E-01	0.00	0.000	0	40	0	0	10	20	20	30	0	0	0	0	0	0	0	0	0
Tuen Mun Road	C	up	< 20	3.08E-01	0.75	0.600	5.95	0.05	0	0	10	20	20	30	3293068	55346	0	0	516008	8672	0	0	3873094
Tuen Mun Road	C	up	20 to 50	3.08E-01	0.75	0.300	19.1	0.9	0	0	10	20	20	30	5285512	498111	0	0	828214	78052	0	0	6669889
Tuen Mun Road	C	up	50 to 500	3.08E-01	0.75	0.090	27.5	2.4	0.1	0	10	20	20	30	2283009	398489	16604	0	357737	62441	2602	0	3120681
Tuen Mun Road	C	up	500 to 2000	3.08E-01	0.75	0.010	33	5.5	1.2	0.3	10	20	20	30	304401	101467	22138	8302	47698	15899	3469	1301	504676
Tuen Mun Road	C	up	> 2000	3.08E-01	0.75	0.000	10	20	7.5	2.5	10	20	20	30	0	0	0	0	0	0	0	0	0
Tuen Mun Road	C	down	< 20	3.08E-01	0.25	0.250	0	0	0	0	10	20	20	30	0	0	0	0	0	0	0	0	0
Tuen Mun Road	C	down	20 to 50	3.08E-01	0.25	0.700	4	0	0	0	10	20	20	30	860933	0	0	0	134904	0	0	0	995837
Tuen Mun Road	C	down	50 to 200	3.08E-01	0.25	0.050	15	0	0	0	10	20	20	30	230607	0	0	0	36135	0	0	0	266742
Tuen Mun Road	C	down	200 to 1000	3.08E-01	0.25	0.000	28	0	0	0	10	20	20	30	0	0	0	0	0	0	0	0	0
Tuen Mun Road	C	down	> 1000	3.08E-01	0.25	0.000	0	40	0	0	10	20	20	30	0	0	0	0	0	0	0	0	0
Tuen Mun Road	D	up	< 20	7.69E-02	1.00	0.700	5.95	0.05	0	0	10	20	20	30	1431477	24058	0	0	224306	3770	0	0	1663611
Tuen Mun Road	D	up	20 to 50	7.69E-02	1.00	0.200	19.1	0.9	0	0	10	20	20	30	1312903	123729	0	0	205726	19388	0	0	1661746
Tuen Mun Road	D	up	50 to 500	7.69E-02	1.00	0.100	27.5	2.4	0.1	0	10	20	20	30	945153	164972	6874	0	148101	25850	1077	0	1292027
Tuen Mun Road	D	up	500 to 2000	7.69E-02	1.00	0.000	33	5.5	1.2	0.3	10	20	20	30	0	0	0	0	0	0	0	0	0
Tuen Mun Road	D	up	> 2000	7.69E-02	1.00	0.000	10	20	7.5	2.5	10	20	20	30	0	0	0	0	0	0	0	0	0
Tuen Mun Road	D	down	< 20	7.69E-02	0.00	0.900	0	0	0	0	10	20	20	30	0	0	0	0	0	0	0	0	0
Tuen Mun Road	D	down	20 to 50	7.69E-02	0.00	0.090	4	0	0	0	10	20	20	30	0	0	0	0	0	0	0	0	0
Tuen Mun Road	D	down	50 to 200	7.69E-02	0.00	0.010	15	0	0	0	10	20	20	30	0	0	0	0	0	0	0	0	0
Tuen Mun Road	D	down	200 to 1000	7.69E-02	0.00	0.000	28	0	0	0	10	20	20	30	0	0	0	0	0	0	0	0	0
Tuen Mun Road	D	down	> 1000	7.69E-02	0.00	0.000	0	40	0	0	10	20	20	30	0	0	0	0	0	0	0	0	0
Victoria Road	A	up	< 20	6.92E-01	1.00	0.840	5.95	0.05	0	0	5	10	0	0	438035	7362	0	0	68638	1154	0	0	515188
Victoria Road	A	up	20 to 50	6.92E-01	1.00	0.080	19.1	0.9	0	0	5	10	0	0	133917	12620	0	0	20984	1978	0	0	169499
Victoria Road	A	up	50 to 500	6.92E-01	1.00	0.080	27.5	2.5	0	0	5	10	0	0	192812	35057	0	0	30213	5493	0	0	263575
Victoria Road	A	up	500 to 2000	6.92E-01	1.00	0.000	33	7	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Victoria Road	A	up	> 2000	6.92E-01	1.00	0.000	10	30	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Victoria Road	A	down	< 20	6.92E-01	0.00	0.900	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Victoria Road	A	down	20 to 50	6.92E-01	0.00	0.100	4	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Victoria Road	A	down	50 to 200	6.92E-01	0.00	0.000	15	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Victoria Road	A	down	200 to 1000	6.92E-01	0.00	0.000	28	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Victoria Road	A	down	> 1000	6.92E-01	0.00	0.000	0	40	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Victoria Road	B	up	< 20	1.08E+00	0.92	0.900	5.95	0.05	0	0	5	10	0	0	975822	16400	0	0	152907	2570	0	0	1147698
Victoria Road	B	up	20 to 50	1.08E+00	0.92	0.090	19.1	0.9	0	0	5	10	0	0	313247	29521	0	0	49084	4626	0	0	396478
Victoria Road	B	up	50 to 500	1.08E+00	0.92	0.010	27.5	2.5	0	0	5	10	0	0	50112	9111	0	0	7852	1428	0	0	68504
Victoria Road	B	up	500 to 2000	1.08E+00	0.92	0.000	33	7	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Victoria Road	B	up	> 2000	1.08E+00	0.92	0.000	10	30	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Victoria Road	B	down	< 20	1.08E+00	0.08	0.900	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Victoria Road	B	down	20 to 50	1.08E+00	0.08	0.070	4	0	0	0	5	10	0	0	4437	0	0	0	695	0	0	0	5132
Victoria Road	B	down	50 to 200	1.08E+00	0.08	0.020	15	0	0	0	5	10	0	0	4754	0	0	0	745	0	0	0	5499
Victoria Road	B	down	200 to 1000	1.08E+00	0.08	0.010	28	0	0	0	5	10	0	0	4437	0	0	0	695	0	0	0	5132
Victoria Road	B	down	> 1000	1.08E+00	0.08	0.000	0	40	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Yee King Road	-	up	< 20	2.31E-01	1.00	0.750	5.95	0.05	0	0	5	10	0	0	340980	5731	0	0	53430	898	0	0	401038
Yee King Road	-	up	20 to 50	2.31E-01	1.00	0.160	19.1	0.9	0	0	5	10	0	0	262698	24757	0	0	41163	3879	0	0	332497
Yee King Road	-	up	50 to 500	2.31E-01	1.00	0.070	27.5	2.5	0	0	5	10	0	0	147089	26744	0	0	23048	4191	0	0	201072
Yee King Road	-	up	500 to 2000	2.31E-01	1.00	0.000	33	7	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Yee King Road	-	up	> 2000	2.31E-01	1.00	0.000	10	30	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Yee King Road	-	down	< 20	2.31E-01	0.00	0.900	0	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Yee King Road	-	down	20 to 50	2.31E-01	0.00	0.070	4	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Yee King Road	-	down	50 to 200	2.31E-01	0.00	0.020	15	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Yee King Road	-	down	200 to 1000	2.31E-01	0.00	0.010	28	0	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0
Yee King Road	-	down	> 1000	2.31E-01	0.00	0.000	0	40	0	0	5	10	0	0	0	0	0	0	0	0	0	0	0

BF Eco

Road	Section	Boulder fall Frequency/yr	AADT 1995	1 Lane Closed	1st Lane time cost	1st Lane opr cost	Eco Loss/yr
Cape Collinson Road	A	0.230769231	450	5	52,650	8,250	8,432
Cape Collinson Road	B	0	450	5	52,650	8,250	0
Chung Hom Kok Road	-	0.153846154	1300	5	152,100	23,833	16,240
Island Road	-	0	16890	10	3,952,260	619,300	0
Kennedy Road	-	0	10610	5	1,241,370	194,517	0
Magazine Gap Road	-	0	14960	5	1,750,320	274,267	0
Nam Fung Road	-	0	10110	5	1,182,870	185,350	0
Peak Road	A	0	11170	5	1,306,890	204,783	0
Peak Road	B	0.076923077	10120	5	1,184,040	185,533	63,211
Pokfulam Road	A	0	36160	5	4,230,720	662,933	0
Pokfulam Road	B	0	25050	5	2,930,850	459,250	0
Repulse Bay Road	A	0.076923077	12300	5	1,439,100	225,500	76,828
Repulse Bay Road	B	0	14370	10	3,362,580	526,900	0
Stubbs Road	A	0	21070	5	2,465,190	386,283	0
Stubbs Road	B	0	11270	5	1,318,590	206,617	0
Tai Hang Road	-	0.769230769	14670	5	1,716,390	268,950	916,311
Tai Tam Road	-	0.076923077	10900	10	2,550,600	399,667	136,166
Victoria Road	A	0.153846154	5410	5	632,970	99,183	67,583
Victoria Road	B	0	7860	5	919,620	144,100	0
Yee King Road	-	0.384615385	14150	5	1,655,550	259,417	441,915
Clear Water Bay Road	-	0	32950	5	3,855,150	604,083	0
Kwun Tong Road	-	0	150120	10	35,128,080	5,504,400	0
Sai Sha Road	-	0	5310	10	1,242,540	194,700	0
Tai Mong Tsai Road	A	0	6000	10	1,404,000	220,000	0
Tai Mong Tsai Road	B	0	6000	10	1,404,000	220,000	0
Tai Mong Tsai Road	C	0	4120	5	482,040	75,533	0
Tai Mong Tsai Road	D	0	4120	5	482,040	75,533	0
Tai Po Road	A	0	9190	5	1,075,230	168,483	0
Tai Po Road	B	0	5840	5	683,280	107,067	0
Tai Po Road	C	0	5840	5	683,280	107,067	0
Castle Peak Road	-	0.076923077	12980	10	3,037,320	475,933	162,150
Route Twisk	A	0.076923077	6270	10	1,467,180	229,900	78,327
Route Twisk	B	0	7250	10	1,696,500	265,833	0
Route Twisk	C	0	7250	10	1,696,500	265,833	0
South Lantau Road	A	0	2980	10	697,320	109,267	0
South Lantau Road	B	0	1210	10	283,140	44,367	0
South Lantau Road	C	0	1210	10	283,140	44,367	0
Tuen Mun Road	A	0	96120	10	22,492,080	3,524,400	0
Tuen Mun Road	B	0	96120	10	22,492,080	3,524,400	0
Tuen Mun Road	C	0.076923077	85410	10	19,985,940	3,131,700	1,066,968
Tuen Mun Road	D	0	95470	10	22,339,980	3,500,567	0
Total							

Annex D

Data on Slope Features for Select BRIL Roads

ANNEX D SLOPE FEATURES DATA FOR SELECT BRIL ROADS

ROAD	SECTION	MAP	SLOPE	UP OR DOWN	HEIGHT	LENGTH	TYPE
Cape Collinson Road	A		11SE-D/C199	up			
Cape Collinson Road	A		11SE-D/F74	down			
Cape Collinson Road	A	11-SE-19B					
Cape Collinson Road	A	11-SE-19C	11SE-D/C100	up	13	80	Soil cut slope
Cape Collinson Road	A	11-SE-19C	11SE-D/C124	up	8	60	Soil cut slope
Cape Collinson Road	A	11-SE-19C	11SE-D/C125	up	8	50	Soil/rock cut slope
Cape Collinson Road	A	11-SE-19C	11SE-D/C126	up	12	50	Soil cut slope
Cape Collinson Road	A	11-SE-19C	11SE-D/C129	up	16	40	Soil cut slope
Cape Collinson Road	A	11-SE-19C	11SE-D/C99	up	13	50	Soil/rock cut slope
Cape Collinson Road	A	11-SE-19C	11SE-D/CR127	up	7.5	50	Soil cut slope
Cape Collinson Road	A	11-SE-19C	11SE-D/CR128	up	9	50	Rock slope
Cape Collinson Road	A	11-SE-19C	11SE-D/F8	down	5	45	Soil cut slope
Cape Collinson Road	A	11-SE-19D	11SE-D/C101	up	8	70	Soil/rock cut slope
Cape Collinson Road	A	11-SE-19D	11SE-D/C88		5	115	Soil/rock cut slope
Cape Collinson Road	A	11-SE-19D	11SE-D/C89	up	21	70	Soil/rock cut slope
Cape Collinson Road	A	11-SE-19D	11SE-D/C90	up	15	65	Soil/rock cut slope
Cape Collinson Road	A	11-SE-19D	11SE-D/F1	down	7	100	Soil/rock cut slope
Cape Collinson Road	A	11-SE-19D	11SE-D/F11	down	6	20	Soil/rock cut slope
Cape Collinson Road	A	11-SE-19D	11SE-D/F67	down			
Cape Collinson Road	A	11-SE-19D	11SE-D/F68	down			
Cape Collinson Road	A	11-SE-19D	11SE-D/F69	down	6		
Cape Collinson Road	A	11-SE-19D	11SE-D/FR18	down	5	30	Soil cut slope
Cape Collinson Road	A	11-SE-23B	11SE-D/C114	up	7	60	Rock slope
Cape Collinson Road	A	11-SE-23B	11SE-D/C115	up	6	60	Soil/rock cut slope
Cape Collinson Road	A	11-SE-23B	11SE-D/C121	up	12	110	Soil cut slope
Cape Collinson Road	A	11-SE-23B	11SE-D/CR122	up	8	40	Soil cut slope
Cape Collinson Road	A	11-SE-24A	11SE-D/C123	up	8	90	Soil cut slope
Cape Collinson Road	B	11-SE-25A	11SE-D/C206	up			
Cape Collinson Road	B	11-SE-25C	11SE-D/C152	up	14	170	Soil/rock cut slope
Castle Peak Road	-	6-SE-17D+18C	6SE-C/C12	up	10	145	Soil cut slope
Castle Peak Road	-	6-SE-17D+22B	6SE-C/C13	up	12	70	Rock slope
Castle Peak Road	-	6-SE-18C	6SE-C/C118	up			
Castle Peak Road	-	6-SE-18C	6SE-C/C123	up			
Castle Peak Road	-	6-SE-18C	6SE-C/C3	up	10	70	Soil/rock cut slope
Castle Peak Road	-	6-SE-18C	6SE-C/C7	down	7	35	Soil cut slope
Castle Peak Road	-	6-SE-18C	6SE-C/C8	up	10	60	Soil cut slope
Castle Peak Road	-	6-SE-18C	6SE-C/CR4	up	6	20	Soil cut slope
Castle Peak Road	-	6-SE-18C	6SE-C/F25	down	10	40	Fill slope
Castle Peak Road	-	6-SE-18C	6SE-C/FR2	down			
Castle Peak Road	-	6-SE-18C	6SE-C/R2	up	7	22	Retaining wall
Castle Peak Road	-	6-SE-18C	6SE-D/C88	up			
Castle Peak Road	-	6-SE-18C/D	6SE-C/C1	up	10	110	Soil cut slope
Castle Peak Road	-	6-SE-18D	6SE-C/C117	up			
Castle Peak Road	-	6-SE-18D	6SE-C/CR45	down			
Castle Peak Road	-	6-SE-18D	6SE-C/CR46	down			
Castle Peak Road	-	6-SE-18D	6SE-C/R15	down			
Castle Peak Road	-	6-SE-21A	6SE-C/C25	up	10	50	Soil/rock cut slope
Castle Peak Road	-	6-SE-21A	6SE-C/C26	up	15	80	Soil/rock cut slope
Castle Peak Road	-	6-SE-21A	6SE-C/C27	up	18	85	Soil/rock cut slope
Castle Peak Road	-	6-SE-21A	6SE-C/F30	down	8	20	Fill slope
Castle Peak Road	-	6-SE-21A	6SE-C/FR7	down	5	170	Fill slope
Castle Peak Road	-	6-SE-21B	6SE-C/C106	up			
Castle Peak Road	-	6-SE-21B	6SE-C/C115	up			
Castle Peak Road	-	6-SE-21B	6SE-C/C22	up	14	70	Soil/rock cut slope
Castle Peak Road	-	6-SE-21B	6SE-C/C23	up	15	60	Soil/rock cut slope
Castle Peak Road	-	6-SE-21B	6SE-C/C24	up	12	90	Soil cut slope
Castle Peak Road	-	6-SE-21B	6SE-C/F41	down			
Castle Peak Road	-	6-SE-21B	6SE-C/F42	down			
Castle Peak Road	-	6-SE-21B	6SE-C/F6	down	3	120	Fill slope
Castle Peak Road	-	6-SE-22B	6SE-C/C14	up	14	100	Soil cut slope
Castle Peak Road	-	6-SE-22B	6SE-C/C15	up	10	60	Soil/rock cut slope
Castle Peak Road	-	6-SE-22B	6SE-C/C17	up	12	70	Soil/rock cut slope
Castle Peak Road	-	6-SE-22B	6SE-C/C81	up			

ANNEX D SLOPE FEATURES DATA FOR SELECT BRIL ROADS

ROAD	SECTION	MAP	SLOPE	UP OR DOWN	HEIGHT	LENGTH	TYPE	
Castle Peak Road	-	6-SE-22B	6SE-C/CR16	up	9	40	Soil cut slope	
Castle Peak Road	-	6-SE-22B	6SE-C/F4	down	4	60	Fill slope	
Castle Peak Road	-	6-SE-22B	6SE-C/FR31	down	13	30	Fill slope	
Castle Peak Road	-	6-SE-22B	6SE-D/F29	down	9	25	Fill slope	
Castle Peak Road	-	6-SE-22B	6SE-D/FR26	down	5	15	Fill slope	
Castle Peak Road	-	6-SE-22B	6SE-D/FR27	down	11	35	Fill slope	
Castle Peak Road	-	6-SE-22B	6SE-D/FR28	down	3	10	Fill slope	
Castle Peak Road	-	6-SE-D	6SE-D/C117	up				
Castle Peak Road	-	6-SE-D	6SE-D/C33	up	6	45	Soil/rock cut slope	
Castle Peak Road	-	6-SE-D	6SE-D/C40	up	5	65	Soil/rock cut slope	
Castle Peak Road	-	6-SE-D	6SE-D/C41	down	10	180	Soil cut slope	
Castle Peak Road	-	6-SE-D	6SE-D/C42	up	8	90	Soil/rock cut slope	
Castle Peak Road	-	6-SE-D	6SE-D/CR34	up	6	45	Soil/rock cut slope	
Castle Peak Road	-	6-SE-D	6SE-D/CR43	up	14	50	Soil/rock cut slope	
Castle Peak Road	-	6-SN-17A	6SW-C/R2	up	6	15	Retaining wall	
Castle Peak Road	-	6-SW-18C	6SW-C/C2	up	12	25	Soil/rock cut slope	
Castle Peak Road	-	6-SW-18C	6SW-C/C3	up	10	20	Soil/rock cut slope	
Castle Peak Road	-	6-SW-18C	6SW-C/F2	down	5	30	Fill slope	
Castle Peak Road	-	6-SW-18C	6SW-D/C13	up	10	20	Rock slope	
Castle Peak Road	-	6-SW-18D	6SW-D/C12	up	9	20	Soil cut slope	
Castle Peak Road	-	6-SW-18D	6SW-D/F20	down	10	160	Fill slope	
Castle Peak Road	-	6-SW-23B	6SW-D/C10	up	11	40	Soil/rock cut slope	
Castle Peak Road	-	6-SW-23B	6SW-D/F18	down	7	65	Fill slope	
Castle Peak Road	-	6-SW-24A	6SW-D/C7	up	25	70	Rock slope	
Castle Peak Road	-	6-SW-24A	6SW-D/C8	up	14	60	Rock slope	
Castle Peak Road	-	6-SW-24A	6SW-D/F16	up	7	120	Fill slope	
Castle Peak Road	-	6-SW-24A	6SW-D/F3	down	5	7	Fill slope	
Castle Peak Road	-	6-SW-24C	6SW-D/C6	up	12	25	Soil/rock cut slope	
Castle Peak Road	-	6-SW-24D	6SW-D/F1	up	8	50	Fill slope	
Castle Peak Road	-	6-SW-24D	6SW-D/F14	up	15	180	Fill slope	
Castle Peak Road	-	6-SW-25C	6SW-D/C4	up	10	20	Rock slope	
Castle Peak Road	-	6-SW-25C	6SW-D/C5	up	10	30	Soil/rock cut slope	
Castle Peak Road	-	6-SW-25D	6SW-D/C1	up	10	35	Soil/rock cut slope	
Chung Hom Kok Road	-	15-NE-11D	15NE-C/C100	up	4.5	30	Soil/rock cut slope	
Chung Hom Kok Road	-	15-NE-11D	15NE-C/C92	up	10	50	Soil/rock cut slope	
Chung Hom Kok Road	-	15-NE-11D	15NE-C/C93	up	7.5	70	Rock slope	
Chung Hom Kok Road	-	15-NE-11D	15NE-C/C94	up	4	30	Soil/rock cut slope	
Chung Hom Kok Road	-	15-NE-11D	15NE-C/C95	up	4	20	Rock slope	
Chung Hom Kok Road	-	15-NE-11D	15NE-C/C96	up	4	15	Soil/rock cut slope	
Chung Hom Kok Road	-	15-NE-11D	15NE-C/C97	up	10	80	Rock slope	
Chung Hom Kok Road	-	15-NE-11D	15NE-C/C98	up	3	15	Soil/rock cut slope	
Chung Hom Kok Road	-	15-NE-11D	15NE-C/C99	up	7.5	40	Soil/rock cut slope	
Chung Hom Kok Road	-	15-NE-16B	15NE-C/C75	up	14	100	Rock slope	
Chung Hom Kok Road	-	15-NE-16B	15NE-C/C76	up	5	40	Rock slope	
Chung Hom Kok Road	-	15-NE-16B	15NE-C/C77	up	8	90	Soil cut slope	
Chung Hom Kok Road	-	15-NE-16B	15NE-C/C78	up	12	90	Soil/rock cut slope	
Chung Hom Kok Road	-	15-NE-16B	15NE-C/C79	up	9	60	Soil/rock cut slope	
Chung Hom Kok Road	-	15-NE-16B	15NE-C/C82	up	10.5	45	Rock slope	
Chung Hom Kok Road	-	15-NE-16B	15NE-C/C83	up	6	80	Rock slope	
Clear Water Bay Road	-	11-NE-10A						
Clear Water Bay Road	-	11-NE-10B						
Island Road	-	15-NE-1C	15NW-A/C43	up	6	25	Soil cut slope	
Island Road	-	15-NE-1C	15NW-A/FR49	up				
Island Road	-	15-NE-1C	15NW-A/R9	up	4	10	Retaining wall	
Island Road	-	15-NW-5B	15NW-B/C97	up	55			*
Island Road	-	15-NW-5B	15NW-B/C98	up	31			*
Island Road	-	15-NW-5B	15NW-B/FR36	up	3.3			*
Island Road	-	15-NW-6D	15NW-B/C53	up	4	20	Rock slope	
Island Road	-	15-NW-6D	15NW-B/C54	up	6	10	unknown	
Island Road	-	15-NW-6D	15NW-B/C55	up	4	40	Soil/rock cut slope	
Island Road	-	15-NW-6D	15NW-B/C56	down	7	40	Soil/rock cut slope	
Island Road	-	15-NW-6D	15NW-B/C60	up	5	10	Soil/rock cut slope	
Island Road	-	15-NW-6D	15NW-B/FR23	up				

ANNEX D SLOPE FEATURES DATA FOR SELECT BRIL ROADS

ROAD	SECTION	MAP	SLOPE	UP OR DOWN	HEIGHT	LENGTH	TYPE
Island Road	-	15-NW-6D	15NW-B/R10	down	3	16	Retaining wall
Island Road	-	15-NW-6D	15NW-B/R19	down			
Kennedy Road	-	11-SW-14A	11SW-B/C138	down	8	10	Soil cut slope
Kennedy Road	-	11-SW-14A	11SW-B/C139	down	8	40	Soil cut slope
Kennedy Road	-	11-SW-14A	11SW-B/C159	up	4	20	Soil/rock cut slope
Kennedy Road	-	11-SW-14A	11SW-B/C160	up	4	40	Soil/rock cut slope
Kennedy Road	-	11-SW-14A	11SW-B/C196	up	5	60	Soil cut slope
Kennedy Road	-	11-SW-14A	11SW-B/C200	up	6	50	Soil/rock cut slope
Kennedy Road	-	11-SW-14A	11SW-B/C201	up	4		Soil/rock cut slope
Kennedy Road	-	11-SW-14A	11SW-B/C205	up	8	100	Soil cut slope
Kennedy Road	-	11-SW-14A	11SW-B/C206	up	8	80	Soil cut slope
Kennedy Road	-	11-SW-14A	11SW-B/CR107	up	3.5	5	Soil cut slope
Kennedy Road	-	11-SW-14A	11SW-B/CR118	down	8	50	Soil/rock cut slope
Kennedy Road	-	11-SW-14A	11SW-B/CR199	up	2.5	90	Soil/rock cut slope
Kennedy Road	-	11-SW-14A	11SW-B/CR294	up			
Kennedy Road	-	11-SW-14A	11SW-B/F68	down	5	10	Fill slope
Kennedy Road	-	11-SW-14A	11SW-B/F74	down	8	30	Fill slope
Kennedy Road	-	11-SW-14A	11SW-B/F99	down			
Kennedy Road	-	11-SW-14A	11SW-B/FR56	up	20	35	Retaining wall
Kennedy Road	-	11-SW-14A	11SW-B/FR57	down	4		Unknown
Kennedy Road	-	11-SW-14A	11SW-B/FR73	down	5	100	Fill slope
Kennedy Road	-	11-SW-14A	11SW-B/R415	down	6	40	Retaining wall
Kennedy Road	-	11-SW-14A	11SW-B/R427	down	6	20	Retaining wall
Kennedy Road	-	11-SW-14A	11SW-B/R539	up	3.5	30	Retaining wall
Kennedy Road	-	11-SW-14A	11SW-B/R543	down	4	35	Retaining wall
Kennedy Road	-	11-SW-14B	11SW-B/C217	up	8	25	Soil/rock cut slope
Kennedy Road	-	11-SW-14B	11SW-B/C225	up	4	50	Soil/rock cut slope
Kennedy Road	-	11-SW-14B	11SW-B/C229	up	5	25	Soil cut slope
Kennedy Road	-	11-SW-14B	11SW-B/R557	down	4	25	Retaining wall
Kennedy Road	-	11-SW-14B	11SW-B/R558	down	4	70	Retaining wall
Kennedy Road	-	11-SW-14D	11SW-D/CR409	up	5	35	Soil/rock cut slope
Kennedy Road	-	11-SW-14D	11SW-D/FR114	up	8	25	Fill slope
Kennedy Road	-	11-SW-14D	11SW-D/FR5	down	8	30	Fill slope
Kennedy Road	-	11-SW-14D	11SW-D/R185	up	5	20	Retaining wall
Kennedy Road	-	11-SW-14D	11SW-D/R189	up	6	45	Retaining wall
Kennedy Road	-	11-SW-14D	11SW-D/R190	up	5	60	Retaining wall
Kennedy Road	-	11-SW-14D	11SW-D/R192	down	12	95	Retaining wall
Kennedy Road	-	11-SW-14D	11SW-D/R194	down	7	15	Retaining wall
Kennedy Road	-	11-SW-14D	11SW-D/R195	down	7	20	Retaining wall
Kennedy Road	-	11-SW-15A	11SW-B/CR29	up	24	40	Soil cut slope
Kennedy Road	-	11-SW-15A	11SW-B/CR403	up	26	100	Soil/rock cut slope
Kennedy Road	-	11-SW-15C	11SW-D/C412	down	6	60	Soil/rock cut slope
Kennedy Road	-	11-SW-15C	11SW-D/CR404	up	23	65	Soil/rock cut slope
Kennedy Road	-	11-SW-15C	11SW-D/CR624	down	6.6	27.7	Retaining wall
Kennedy Road	-	11-SW-15C	11SW-D/R184	up	35	10	Retaining wall
Kwun Tong Road	-	11-NE-12B	11NE-A/C35	up	45	160	Rock slope
Kwun Tong Road	-	11-NE-12B	11NE-A/C72	up	45	16	Rock slope
Kwun Tong Road	-	11-NE-12B	11NE-C/C2	up	22	90	Soil/rock cut slope
Magazine Gap Road	-	11-SE-13B	11SW-D/C605	up			
Magazine Gap Road	-	11-SE-13B	11SW-D/C99	up	6	80	Soil/rock cut slope
Magazine Gap Road	-	11-SE-13B	11SW-D/R344	down	3	30	Retaining wall
Magazine Gap Road	-	11-SE-13B	11SW-D/R345	down	6	60	Retaining wall
Magazine Gap Road	-	11-SE-13B	11SW-D/R346	down	8	30	Retaining wall
Magazine Gap Road	-	11-SW-13D	11SW-D/CR316	up	10	45	Soil/rock cut slope
Magazine Gap Road	-	11-SW-13D	11SW-D/CR317	up	15	45	Soil/rock cut slope
Magazine Gap Road	-	11-SW-13D	11SW-D/CR330	up	8	40	Soil/rock cut slope
Magazine Gap Road	-	11-SW-13D	11SW-D/R110	up	3.5	20	Retaining wall
Magazine Gap Road	-	11-SW-14C	11SW-D/C296	up	6	60	Soil/rock cut slope
Magazine Gap Road	-	11-SW-14C	11SW-D/C298	up	8	70	Soil/rock cut slope
Magazine Gap Road	-	11-SW-14C	11SW-D/C300	up	11	30	Soil/rock cut slope
Magazine Gap Road	-	11-SW-14C	11SW-D/C301	up	6.5	35	Soil/rock cut slope
Magazine Gap Road	-	11-SW-14C	11SW-D/C524	up			
Magazine Gap Road	-	11-SW-14C	11SW-D/CR295	up	2.5	50	Rock cut slope

ANNEX D SLOPE FEATURES DATA FOR SELECT BRIL ROADS

ROAD	SECTION	MAP	SLOPE	UP OR DOWN	HEIGHT	LENGTH	TYPE
Magazine Gap Road	-	11-SW-14C	11SW-D/CR299	up	6	60	Soil/rock cut slope
Magazine Gap Road	-	11-SW-14C	11SW-D/CR302	up	15	65	Soil/rock cut slope
Magazine Gap Road	-	11-SW-14C	11SW-D/F110	down			
Magazine Gap Road	-	11-SW-14C	11SW-D/F111	down			
Magazine Gap Road	-	11-SW-14C	11SW-D/FR112	down			
Magazine Gap Road	-	11-SW-14C	11SW-D/R100	up	6	58	Retaining wall
Magazine Gap Road	-	11-SW-14C	11SW-D/R103	up	3	19.5	Retaining wall
Magazine Gap Road	-	11-SW-14C	11SW-D/R105	down	7.5	64	Retaining wall
Magazine Gap Road	-	11-SW-14C	11SW-D/R106	up	6.5	57	Retaining wall
Magazine Gap Road	-	11-SW-14C	11SW-D/R108	up	7.5	116	Retaining wall
Magazine Gap Road	-	11-SW-14C	11SW-D/R109	up	13	198	Retaining wall
Magazine Gap Road	-	11-SW-14C	11SW-D/R252	up	2		
Magazine Gap Road	-	11-SW-14D	11SW-D/C526	up	3.5	95	Soil/rock cut slope
Magazine Gap Road	-	11-SW-14D	11SW-D/F174	down	4	21	Fill slope
Magazine Gap Road	-	11-SW-14D	11SW-D/FR104	down	4	12	Fill slope
Magazine Gap Road	-	11-SW-14D	11SW-D/R257	up	3.5	68	Retaining wall
Magazine Gap Road	-	11-SW-14D	11SW-D/R258	up	8	50	Retaining wall
Nam Fung Road	-	11-SW-25A	11SW-D/C115	up	22	90	Soil/rock cut slope
Nam Fung Road	-	11-SW-25A	11SW-D/C117	up	3.5	60	Soil/rock cut slope
Nam Fung Road	-	11-SW-25A	11SW-D/CR116	up	4	50	Soil/rock cut slope
Nam Fung Road	-	11-SW-25A	11SW-D/F80	down	12	300	Fill slope
Nam Fung Road	-	11-SW-25C	11SW-D/C118	up	7	110	Soil/rock cut slope
Peak Road	A	11-SW-13C	11SW-D/C225	up	3	100	Soil/rock cut slope
Peak Road	A	11-SW-13C	11SW-D/F50	down	25	45	Soil cut slope
Peak Road	A	11-SW-13C	11SW-D/F75	down			
Peak Road	A	11-SW-13C	11SW-D/R118	down			
Peak Road	A	11-SW-13C	11SW-D/R60	up	2.4	60	Retaining wall
Peak Road	A	11-SW-13C	11SW-D/R99	up	6	35	Retaining wall
Peak Road	A	11-SW-18A	11SW-D/CR228	up	3.5	60	Soil/rock cut slope
Peak Road	A	11-SW-18A	11SW-D/CR229	up	18	65	Rock cut slope
Peak Road	A	11-SW-18A	11SW-D/F57	down	10	130	Soil cut slope
Peak Road	A	11-SW-18A	11SW-D/R62	up	2.75	90	Retaining wall
Peak Road	A	11-SW-18A	11SW-D/R63	up	5	40	Retaining wall
Peak Road	A	11-SW-18A	11SW-D/R64	up	5	90	Retaining wall
Peak Road	A	11-SW-18B	11SW-D/C238	up	8	30	Soil/rock cut slope
Peak Road	A	11-SW-18B	11SW-D/C242	up	8	80	Soil/rock cut slope
Peak Road	A	11-SW-18B	11SW-D/C249	up	8	80	Soil/rock cut slope
Peak Road	A	11-SW-18B	11SW-D/C250	up	10	40	Soil cut slope
Peak Road	A	11-SW-18B	11SW-D/C251	up	8	30	Soil/rock cut slope
Peak Road	A	11-SW-18B	11SW-D/C253	up	15	100	Soil/rock cut slope
Peak Road	A	11-SW-18B	11SW-D/C254	up	13	100	Soil/rock cut slope
Peak Road	A	11-SW-18B	11SW-D/C257	up	15	30	Soil/rock cut slope
Peak Road	A	11-SW-18B	11SW-D/C258	up	10	80	Soil/rock cut slope
Peak Road	A	11-SW-18B	11SW-D/C259	up	4	60	Rock cut slope
Peak Road	A	11-SW-18B	11SW-D/C260	up	10	60	Soil/rock cut slope
Peak Road	A	11-SW-18B	11SW-D/CR237	up	12	70	Soil/rock cut slope
Peak Road	A	11-SW-18B	11SW-D/CR239	up	8	35	Soil/rock cut slope
Peak Road	A	11-SW-18B	11SW-D/CR241	down	4	40	Soil/rock cut slope
Peak Road	A	11-SW-18B	11SW-D/CR243	up	2.5	40	Soil/rock cut slope
Peak Road	A	11-SW-18B	11SW-D/CR245	up	8	60	Soil/rock cut slope
Peak Road	A	11-SW-18B	11SW-D/CR480	up	6	40	Soil/rock cut slope
Peak Road	A	11-SW-18B	11SW-D/CR647	up			
Peak Road	A	11-SW-18B	11SW-D/F32	down	6	30	Soil cut slope
Peak Road	A	11-SW-18B	11SW-D/F33	down	5		Soil cut slope
Peak Road	A	11-SW-18B	11SW-D/F34	down	6		Soil cut slope
Peak Road	A	11-SW-18B	11SW-D/F35	down	5	30	Soil cut slope
Peak Road	A	11-SW-18B	11SW-D/F36	up	5	20	Soil cut slope
Peak Road	A	11-SW-18B	11SW-D/R286	down	4.5	30.2	Retaining wall
Peak Road	A	11-SW-18B	11SW-D/R83	down	3.5	90	Retaining wall
Peak Road	A	11-SW-18B	11SW-D/R84	up	3.5	30	Retaining wall
Peak Road	B	11-SW-14D	11SW-D/C589	up	9	25	Soil/rock cut slope
Peak Road	B	11-SW-14D	11SW-D/C592	up	6	35	Soil/rock cut slope
Peak Road	B	11-SW-14D	11SW-D/C595	up	4	25	Soil/rock cut slope

ANNEX D SLOPE FEATURES DATA FOR SELECT BRIL ROADS

ROAD	SECTION	MAP	SLOPE	UP OR DOWN	HEIGHT	LENGTH	TYPE
Peak Road	B	11-SW-14D	11SW-D/C599	up	10	80	Soil/rock cut slope
Peak Road	B	11-SW-14D	11SW-D/F102	down	6	30	Soil cut slope
Peak Road	B	11-SW-19B	11SW-D/C600	up	8	90	Soil/rock cut slope
Peak Road	B	11-SW-19B	11SW-D/C601	up	8	50	Soil/rock cut slope
Peak Road	B	11-SW-19B	11SW-D/F98	down	6	35	Soil/rock cut slope
Pokfulam Road	A	11-SW-11B	11SW-A/C332	up	18	26	Soil cut slope
Pokfulam Road	A	11-SW-11B	11SW-C331	up	6	65	Soil cut slope
Pokfulam Road	A	11-SW-11B	11SW-FR1	down	15		
Pokfulam Road	A	11-SW-11B	11SW-FR95	down			
Pokfulam Road	A	11-SW-11B	11SW-R808	down			
Pokfulam Road	A	11-SW-11D	11SW-C/R11	down	8	150	Rataining Wall
Pokfulam Road	A	11-SW-11D	11SW-C78	up	17	60	Soil/rock cut slope
Pokfulam Road	A	11-SW-11D	11SW-C79	up	20	160	rock slope
Pokfulam Road	A	11-SW-12A	11SW-C137	up	12	65	Soil cut slope
Pokfulam Road	A	11-SW-12C	11SW-FR4	up	4	120	Soil cut slope
Pokfulam Road	A	11-SW-7C	11SW-C135	up	12	40	Soil/rock cut slope
Pokfulam Road	A	11-SW-7C	11SW-C138	up	8	55	Soil/rock cut slope
Pokfulam Road	A	11-SW-7C	11SW-C139	up	10	35	Rock slope
Pokfulam Road	A	11-SW-7C	11SW-CR134	up	8	40	Soil/rock cut slope
Pokfulam Road	A	11-SW-7C	11SW-R325	down			
Pokfulam Road	A	11-SW-7C	11SW-R32A	down			
Pokfulam Road	B	11-SW-17A	11SW-C/C94	up	6	50	Soil/rock cut slope
Pokfulam Road	B	11-SW-17A	11SW-C/C95	up	13	80	Soil/rock cut slope
Pokfulam Road	B	11-SW-17A	11SW-C/CR117	up	8	25	Soil/rock cut slope
Pokfulam Road	B	11-SW-17A	11SW-C/F104	down			
Pokfulam Road	B	11-SW-17A	11SW-C/F106	down	6		
Pokfulam Road	B	11-SW-17A	11SW-C/FR88	down			
Pokfulam Road	B	11-SW-17A	11SW-C/R24	up	8	30	Retaining wall
Pokfulam Road	B	11-SW-17A	11SW-C/R26	up	8	30	Retaining wall
Pokfulam Road	B	11-SW-17C	11SW-C/C119	up	5	30	Soil/rock cut slope
Pokfulam Road	B	11-SW-17C	11SW-C/C123	up	10	109	Rock cut slope
Pokfulam Road	B	11-SW-17C	11SW-C/CR118	up	8	60	Soil/rock cut slope
Pokfulam Road	B	11-SW-17C	11SW-C/CR120	up	10	110	Soil/rock cut slope
Pokfulam Road	B	11-SW-17C	11SW-C/CR124	up	8	35	Soil/rock cut slope
Pokfulam Road	B	11-SW-17C	11SW-C/FR40	down	4	15	Soil cut slope
Pokfulam Road	B	11-SW-17C	11SW-C/FR41	down	5	180	Soil cut slope
Pokfulam Road	B	11-SW-17C	11SW-C/FR78	down	6	90	
Pokfulam Road	B	11-SW-17C	11SW-C/FR87	down			
Pokfulam Road	B	11-SW-17C	11SW-C/R28	up	9	190	Retaining wall
Pokfulam Road	B	11-SW-17C	11SW-C/R37	down	8	150	Retaining wall
Pokfulam Road	B	11-SW-17C	11SW-C/R38	down	5	190	Retaining wall
Pokfulam Road	B	11-SW-22A	11SW-C/125	up	12	62	Soil/rock cut slope
Pokfulam Road	B	11-SW-22B	11SW-C/C126	up	15	85	Soil/rock cut slope
Pokfulam Road	B	11-SW-22B	11SW-C/C127	up	12	70	Soil/rock cut slope
Pokfulam Road	B	11-SW-22B	11SW-C/C128	up	6	35	Rock cut slope
Pokfulam Road	B	11-SW-22B	11SW-C/C98	up	8	90	Soil/rock cut slope
Repulse Bay Road	A	11-SE-21A	11SE-C/C14	up	12	85	Soil cut slope
Repulse Bay Road	A	11-SE-21A	11SE-C/C15	up	7	50	Soil cut slope
Repulse Bay Road	A	11-SE-21A	11SE-C/C16	up	8	20	Soil cut slope
Repulse Bay Road	A	11-SE-21A	11SE-C/C168	up			
Repulse Bay Road	A	11-SE-21A	11SE-C/R2	down	5	20	Retaining wall
Repulse Bay Road	A	11-SE-21A	11SE-C/R3	down	8	45	Retaining wall
Repulse Bay Road	A	11-SE-21A	11SE-C/R7	down	5	70	Retaining wall
Repulse Bay Road	A	11-SE-21A	11SE-C/R9	down	8	30	Retaining wall
Repulse Bay Road	A	11-SE-21A	11SE-C/RS6	up	8	30	Retaining wall
Repulse Bay Road	A	11-SE-21A	11SE-D/F32	down	5	30	Fill slope
Repulse Bay Road	A	11-SE-21A	11SE-D/F33	down	10	15	Fill slope
Repulse Bay Road	A	11-SE-21A	11SE-D/F34	down	8	15	Fill slope
Repulse Bay Road	A	11-SE-21A	11SE-D/FR26	up	5	15	Fill slope
Repulse Bay Road	A	11-SE-21A	11SE-D/FR27	down	5	160	Fill slope
Repulse Bay Road	A	11-SE-21A	11SE-D/FR42	down			
Repulse Bay Road	A	11-SE-21C	11SE-C/C1	up	8	80	Soil/rock cut slope
Repulse Bay Road	A	11-SE-21C	11SE-C/C10	up	6	50	Soil cut slope

ANNEX D SLOPE FEATURES DATA FOR SELECT BRIL ROADS

ROAD	SECTION	MAP	SLOPE	UP OR DOWN	HEIGHT	LENGTH	TYPE
Repulse Bay Road	A	11-SE-21C	11SE-C/C11	up	6	45	Soil cut slope
Repulse Bay Road	A	11-SE-21C	11SE-C/C2	up	12	70	Soil/rock cut slope
Repulse Bay Road	A	11-SE-21C	11SE-C/C3	up	10	100	Rock slope
Repulse Bay Road	A	11-SE-21C	11SE-C/C4	up	8	45	Soil/rock cut slope
Repulse Bay Road	A	11-SE-21C	11SE-C/C5	up	10	50	Soil/rock cut slope
Repulse Bay Road	A	11-SE-21C	11SE-C/C6	up	12	70	Soil/rock cut slope
Repulse Bay Road	A	11-SE-21C	11SE-C/C7	up	7	45	Soil/rock cut slope
Repulse Bay Road	A	11-SE-21C	11SE-C/C9	up	7	60	Soil cut slope
Repulse Bay Road	A	11-SE-21C	11SE-C/F35	down	5	16	Fill slope
Repulse Bay Road	A	11-SE-21C	11SE-C/F36	down	7	10	Fill slope
Repulse Bay Road	A	11-SE-21C	11SE-C/F57	down			
Repulse Bay Road	A	11-SE-21C	11SE-C/F8	up	10	70	Soil/rock cut slope
Repulse Bay Road	A	15-NE-1A	15NE-A/C13	up	6	80	Soil/rock cut slope
Repulse Bay Road	A	15-NE-1A	15NE-A/C18	up	5	70	Soil/rock cut slope
Repulse Bay Road	A	15-NE-1A	15NE-A/C20	up	1	0.5	Soil/rock cut slope
Repulse Bay Road	A	15-NE-1A	15NE-A/C22	up	4	130	Soil/rock cut slope
Repulse Bay Road	A	15-NE-1A	15NE-A/C23	up	4	50	Soil/rock cut slope
Repulse Bay Road	A	15-NE-1A	15NE-A/C24	up	5	30	Soil/rock cut slope
Repulse Bay Road	A	15-NE-1A	15NE-A/C25	up	8	20	Soil/rock cut slope
Repulse Bay Road	A	15-NE-1A	15NE-A/CR16	up	6	55	Soil cut slope
Repulse Bay Road	A	15-NE-1A	15NE-A/F1	down	10	10	Fill slope
Repulse Bay Road	A	15-NE-1A	15NE-A/F2	down	5	20	Fill slope
Repulse Bay Road	A	15-NE-1A	15NE-A/F52	down	15	90	Fill slope
Repulse Bay Road	A	15-NE-1A	15NE-A/F54	down			
Repulse Bay Road	A	15-NE-1C	15NE-A/C232	up	6	26	Rock slope
Repulse Bay Road	A	15-NE-1C	15NE-A/C26	up	10	80	Soil/rock cut slope
Repulse Bay Road	A	15-NE-1C	15NE-A/C27	up	5	20	Soil/rock cut slope
Repulse Bay Road	A	15-NE-1C	15NE-A/C30	up	6	110	Soil/rock cut slope
Repulse Bay Road	A	15-NE-1C	15NE-A/C42	up	10	75	Soil/rock cut slope
Repulse Bay Road	A	15-NE-1C	15NE-A/C44	up	10	150	Soil/rock cut slope
Repulse Bay Road	A	15-NE-1C	15NE-A/C45	up	6	30	Soil/rock cut slope
Repulse Bay Road	A	15-NE-1C	15NE-A/C47	up	6	80	Soil/rock cut slope
Repulse Bay Road	A	15-NE-1C	15NE-A/CR29	up	12	16	Retaining wall
Repulse Bay Road	A	15-NE-1C	15NE-A/F29	down	8	40	Fill slope
Repulse Bay Road	A	15-NE-1C	15NE-A/FR32	up	5	15	Fill slope
Repulse Bay Road	A	15-NE-1C	15NE-A/FR49	down			
Repulse Bay Road	A	15-NE-1C	15NE-A/R79	up	6.5	55	Retaining wall
Repulse Bay Road	B	15-NE-1D	15NE-A/C104	up	3	70	Soil/rock cut slope
Repulse Bay Road	B	15-NE-1D	15NE-A/C106	up	5	80	Soil/rock cut slope
Repulse Bay Road	B	15-NE-1D	15NE-A/C61	up	6	20	Soil/rock cut slope
Repulse Bay Road	B	15-NE-1D	15NE-A/C71	up	5	160	Soil/rock cut slope
Repulse Bay Road	B	15-NE-1D	15NE-A/C78	down	5	100	Soil/rock cut slope
Repulse Bay Road	B	15-NE-1D	15NE-A/C86	down	8	80	unknown
Repulse Bay Road	B	15-NE-1D	15NE-A/C87	down	10	70	Soil/rock cut slope
Repulse Bay Road	B	15-NE-1D	15NE-A/CR79	down	5	35	Soil/rock cut slope
Repulse Bay Road	B	15-NE-1D	15NE-A/CR93	down	4	30	Soil/rock cut slope
Repulse Bay Road	B	15-NE-1D	15NE-A/F11	down	6	50	Fill slope
Repulse Bay Road	B	15-NE-6B	15NE-A/C107	up	70	80	Soil/rock cut slope
Repulse Bay Road	B	15-NE-6B	15NE-A/C108	up	10	100	Soil/rock cut slope
Repulse Bay Road	B	15-NE-6B	15NE-A/C110	up	7	10	Soil/rock cut slope
Repulse Bay Road	B	15-NE-6B	15NE-A/R27	down	3	50	Retaining wall
Route Twisk	A	6-NE-20D	6NE-D/C5	up	12	200	Soil cut slope
Route Twisk	A	6-NE-20D	6NE-D/F8	down	5	220	Fill slope
Route Twisk	A	6-NE-20D	6NW-C/C6	down	12	15	Soil cut slope
Route Twisk	A	6-NE-25B	6NE-D/C10	up	15	50	Soil/rock cut slope
Route Twisk	A	6-NE-25B	6NE-D/C24	up			
Route Twisk	A	6-NE-25B	6NE-D/C8	up	12	40	Soil/rock cut slope
Route Twisk	A	6-NE-25B	6NE-D/C9	up	12	50	Soil cut slope
Route Twisk	A	6-NE-25B	6NE-D/F6	down	7	200	Fill slope
Route Twisk	A	6-NE-25B	6NE-D/F7	down	7	120	Fill slope
Route Twisk	A	6-NE-25C	6NE-D/C14	up	20	60	Soil/rock cut slope
Route Twisk	A	6-NE-25D	6NE-D/C21	up			
Route Twisk	A	6-NE-25D	6NE-D/F2	down	5	50	Fill slope

ANNEX D SLOPE FEATURES DATA FOR SELECT BRIL ROADS

ROAD	SECTION	MAP	SLOPE	UP OR DOWN	HEIGHT	LENGTH	TYPE
Route Twisk	A	6-NE-25D	6NE-D/F3	down	5	90	Fill slope
Route Twisk	A	6-NE-25D	6NE-D/F4	down	18	60	Fill slope
Route Twisk	A	6-NE-25D	6NE-D/F5	down	20	40	Fill slope
Route Twisk	A	7-NW-16C	6NE-D/C6	up	12	40	Soil/rock cut slope
Route Twisk	A	7-NW-16C	6NE-D/C7	up	12	40	Soil/rock cut slope
Route Twisk	A	7-NW-16C	6NW-C/C7	up	54	120	Soil cut slope
Route Twisk	B	6-SE-10A	6SE-B/C5	up	15	60	Soil cut slope
Route Twisk	B	6-SE-10A	6SE-B/C6	up	12	50	Soil cut slope
Route Twisk	B	6-SE-10A	6SE-B/F4	down	5	140	Fill slope
Route Twisk	B	6-SE-10B	6SE-B/C4	up	12	30	Soil/rock cut slope
Route Twisk	B	6-SE-10B	6SE-B/F5	down	5	130	Fill slope
Route Twisk	B	6-SE-10C	6SE-B/C7	up	14	35	Soil/rock cut slope
Route Twisk	B	6-SE-10C	6SE-B/C8	up	12	85	Soil cut slope
Route Twisk	B	6-SE-10C	6SE-B/F1	down	5	60	Fill slope
Route Twisk	B	6-SE-10C	6SE-B/F10	down	10	35	Fill slope
Route Twisk	B	6-SE-10C	6SE-B/F2	down	6	30	Fill slope
Route Twisk	B	6-SE-10C	6SE-B/F3	down	6	320	Fill slope
Route Twisk	B	6-SE-5C	6SE-B/C3	up	15	40	Soil/rock cut slope
South Lantau Road	A	10-SW-18A					
South Lantau Road	B	10-SW-17C	10SW-C/C21	up	10	110	Soil/rock cut slope
South Lantau Road	B	10-SW-21B					
South Lantau Road	B	10-SW-21D					
South Lantau Road	B	13-NE-5C					
South Lantau Road	B	13-NE-5D					
South Lantau Road	B	13-NE-8B					
South Lantau Road	B	13-NE-8C					
South Lantau Road	B	13-NE-8D					
South Lantau Road	B	13-NE-9A					
South Lantau Road	B	13-NE-9B					
South Lantau Road	B	14-NE-5B					
South Lantau Road	B	14-SW-1A					
South Lantau Road	B	14-SW-1B					
South Lantau Road	C	13-NE-11B					
South Lantau Road	C	13-NE-12A					
South Lantau Road	C	13-NE-12B					
South Lantau Road	C	13-NE-6C					
Stubbs Road	A	11-SW-15C	11SW-D/C211	up	4	60	Soil/rock cut slope
Stubbs Road	A	11-SW-15C	11SW-D/C27	up	15	130	Soil/rock cut slope
Stubbs Road	A	11-SW-15C	11SW-D/C371	up	5	25	Soil/rock cut slope
Stubbs Road	A	11-SW-15C	11SW-D/C386	up	9	60	Soil/rock cut slope
Stubbs Road	A	11-SW-15C	11SW-D/C387	up	10	50	Soil/rock cut slope
Stubbs Road	A	11-SW-15C	11SW-D/C389	up	10	30	Soil/rock cut slope
Stubbs Road	A	11-SW-15C	11SW-D/C435	up	3	30	Soil/rock cut slope
Stubbs Road	A	11-SW-15C	11SW-D/C436	up	10	35	Soil/rock cut slope
Stubbs Road	A	11-SW-15C	11SW-D/C438	down	5	40	Soil/rock cut slope
Stubbs Road	A	11-SW-15C	11SW-D/C440	up	7	35	Soil/rock cut slope
Stubbs Road	A	11-SW-15C	11SW-D/CR388	up	12	40	Soil/rock cut slope
Stubbs Road	A	11-SW-15C	11SW-D/CR434	up	6	80	Soil/rock cut slope
Stubbs Road	A	11-SW-15C	11SW-D/CR439	up	8	70	Soil/rock cut slope
Stubbs Road	A	11-SW-15C	11SW-D/CR44	down	12	55	Soil/rock cut slope
Stubbs Road	A	11-SW-15C	11SW-D/F72	down	15	50	Fill slope
Stubbs Road	A	11-SW-15C	11SW-D/FR71	down	6	30	Soil/rock cut slope
Stubbs Road	A	11-SW-15C	11SW-D/R165	down	4	25	Retaining wall
Stubbs Road	A	11-SW-15C	11SW-D/R166	down	5	70	Retaining wall
Stubbs Road	A	11-SW-20B	11SW-D/F69	down	12	40	Fill slope
Stubbs Road	B	11-SW-15C	11SW-D/C391	up	5	25	Soil/rock cut slope
Stubbs Road	B	11-SW-15C	11SW-D/C437	up	8	40	Soil/rock cut slope
Stubbs Road	B	11-SW-15C	11SW-D/CR649	up	35	72	Soil/rock cut slope
Stubbs Road	B	11-SW-15C	11SW-D/FR2	down	15	70	Soil cut slope
Stubbs Road	B	11-SW-20B	11SW-D/CR25	up	10	30	Soil/rock cut slope
Stubbs Road	B	11-SW-20B	11SW-D/CR384	up	6	10	Soil cut slope
Stubbs Road	B	11-SW-20B	11SW-D/R149	up	8	50	Retaining wall
Stubbs Road	B	11-SW-20B	11SW-D/R151	up	7	80	Retaining wall

ANNEX D SLOPE FEATURES DATA FOR SELECT BRIL ROADS

ROAD	SECTION	MAP	SLOPE	UP OR DOWN	HEIGHT	LENGTH	TYPE
Stubbs Road	B	11-SW-20B	11SW-D/R292	up	5	31	Retaining wall
Tai Hang Road	-	11-SE-16A	11SE-A/C114	up	8	40	Soil/rock cut slope
Tai Hang Road	-	11-SE-16A	11SE-A/C123	up	9	220	Soil/rock cut slope
Tai Hang Road	-	11-SE-16A	11SE-A/C124	up	9	100	Soil/rock cut slope
Tai Hang Road	-	11-SE-16A	11SE-A/C128	up	11	40	Soil/rock cut slope
Tai Hang Road	-	11-SE-16A	11SE-A/C129	up	12	35	Soil/rock cut slope
Tai Hang Road	-	11-SE-16A	11SE-A/CR159	up	9	35	Soil/rock cut slope
Tai Hang Road	-	11-SE-16A	11SE-A/F1	down	8	14	Soil cut slope
Tai Hang Road	-	11-SE-16A	11SE-A/F62	down	25	58	Soil cut slope
Tai Hang Road	-	11-SE-16A	11SE-A/R33	up	7	75	Retaining wall
Tai Hang Road	-	11-SE-16A	11SE-A/R34	up	6	70	Retaining wall
Tai Hang Road	-	11-SE-16A	11SE-A/R35	down	4	25	Retaining wall
Tai Hang Road	-	11-SE-16A	11SE-A/R52	up	4	20	Retaining wall
Tai Hang Road	-	11-SE-16A	11SE-C/C153	down	44	60	Soil cut slope
Tai Hang Road	-	11-SE-16A	11SE-C/C173	up			
Tai Hang Road	-	11-SE-16A	11SE-C/C174	up			
Tai Hang Road	-	11-SE-16A	11SE-C/C54	up	15	160	Soil/rock cut slope
Tai Hang Road	-	11-SE-16A	11SE-C/C55	up	9	30	Soil/rock cut slope
Tai Hang Road	-	11-SE-16A	11SE-C/C56	up	7	40	Soil cut slope
Tai Hang Road	-	11-SE-16A	11SE-C/C57	up	9	15	Soil cut slope
Tai Hang Road	-	11-SE-16A	11SE-C/C58	up	9	30	Soil cut slope
Tai Hang Road	-	11-SE-16A	11SE-C/C59	up	18	80	Soil cut slope
Tai Hang Road	-	11-SE-16A	11SE-C/C61	up	16	50	Soil cut slope
Tai Hang Road	-	11-SE-16A	11SE-C/C62	up	24	60	Soil cut slope
Tai Hang Road	-	11-SE-16A	11SE-C/C63	up	10	80	Soil cut slope
Tai Hang Road	-	11-SE-16A	11SE-C/C64	up	12	40	Soil cut slope
Tai Hang Road	-	11-SE-16A	11SE-C/C68	up	10	45	Soil cut slope
Tai Hang Road	-	11-SE-16A	11SE-C/C70	down	8	40	Soil cut slope
Tai Hang Road	-	11-SE-16A	11SE-C/C87	up	10	150	Soil cut slope
Tai Hang Road	-	11-SE-16A	11SE-C/FR22	down	4	6	Soil cut slope
Tai Hang Road	-	11-SE-16A	11SE-C/FR49	down	28	100	Soil cut slope
Tai Hang Road	-	11-SE-16A	11SE-C/R21	down	4	35	Retaining wall
Tai Hang Road	-	11-SE-16A	11SE-C/R24	down	3	20	Retaining wall
Tai Hang Road	-	11-SE-16C	11SE-C/C48	up	10	40	Soil cut slope
Tai Hang Road	-	11-SE-16C	11SE-C/C60	up	12	100	Soil/rock cut slope
Tai Hang Road	-	11-SE-16C	11SE-C/F21	down	5	7	Soil cut slope
Tai Hang Road	-	11-SE-16C	11SE-C/F23	down	7	20	Soil/rock cut slope
Tai Hang Road	-	11-SE-16C	11SE-C/F4	down	7	20	Soil cut slope
Tai Po Road	A	7-NE-22A	7NE-C/FR24	down	20	100	Fill slope
Tai Po Road	A	7-NE-22C	7NE-C/C106	down	20	50	Soil cut slope
Tai Po Road	A	7-NE-22C	7NE-C/F79	down	15		Fill slope
Tai Po Road	A	7-NE-22C	7NE-C/F80	down	20		Fill slope
Tai Po Road	A	7-NE-22C	7NE-C/F81	down			Fill slope
Tai Po Road	A	7-SE-2A	7SE-A/C54	down			Fill slope
Tai Po Road	A	7-SE-2A	7SE-A/R1	down			Fill slope
Tai Po Road	A	7-SE-2B	7NE-C/C108	down			Fill slope
Tai Po Road	B	7-NE-11C	7NE-C/C90	up	12	200	Soil/rock cut slope
Tai Po Road	B	7-NE-11C	7NE-C/C92	up	12	200	Soil/rock cut slope
Tai Po Road	B	7-NE-11C	7NE-C/C93	up	12	80	Soil/rock cut slope
Tai Po Road	B	7-NE-11C	7NE-C/F31	down	15	15	Fill slope
Tai Po Road	B	7-NE-11C	7NE-C/FR29	down	5	20	Fill slope
Tai Po Road	B	7-NE-11C	7NE-C/FR30	down	8	15	Fill slope
Tai Po Road	B	7-NW-D/R2	7NW-D/R2	down	4.5	45	Retaining wall
Tai Po Road	C	7-NW-10C	7NW-B/C12	up	10	100	Soil/rock cut slope
Tai Po Road	C	7-NW-15A	7NW-B/C13	up	15	80	Soil/rock cut slope
Tai Po Road	C	7-NW-15A	7NW-B/FR3	down	10	50	Fill slope
Tai Po Road	C	7-NW-D/R3	7NW-D/FR1	down	15	200	Fill slope
Tai Po Road	C	7-NW-D/R4	7NW-D/R1	up	7	15	Retaining wall
Tai Po Road	C	7-NW-D/R5	7NW-D/C1	up	20	100	Soil/rock cut slope
Tai Po Road	C	7-NW-D/R6	7NW-D/F2	down	6	100	Fill slope
Tai Tam Road	-	11-SE-18D	11SE-D/C132	up	6	30	Soil cut slope
Tai Tam Road	-	11-SE-18D	11SE-D/C133	up	7	150	Soil/rock cut slope
Tai Tam Road	-	11-SE-18D	11SE-D/C174	up	19	64	Soil/rock cut slope

ANNEX D SLOPE FEATURES DATA FOR SELECT BRIL ROADS

ROAD	SECTION	MAP	SLOPE	UP OR DOWN	HEIGHT	LENGTH	TYPE
Tai Tam Road	-	11-SE-18D	11SE-D/C175	up	25	135	Soil/rock cut slope
Tai Tam Road	-	11-SE-18D	11SE-D/C176	up	17	55	Soil cut slope
Tai Tam Road	-	11-SE-18D	11SE-D/C56	up	9	1.5	Soil/rock cut slope
Tai Tam Road	-	11-SE-18D	11SE-D/C59	up	6	60	Soil/rock cut slope
Tai Tam Road	-	11-SE-18D	11SE-D/C60	up	8	45	Soil/rock cut slope
Tai Tam Road	-	11-SE-18D	11SE-D/F17	down	10	30	Soil cut slope
Tai Tam Road	-	11-SE-18D	11SE-D/F18	down			
Tai Tam Road	-	11-SE-18D	11SE-D/F49	down	8	50	Soil cut slope
Tai Tam Road	-	11-SE-18D	11SE-D/F50	down	5	80	Soil cut slope
Tai Tam Road	-	11-SE-18D	11SE-D/F54	up	4	25	Soil cut slope
Tai Tam Road	-	11-SE-18D	11SE-D/FR28	down	10	30	Soil cut slope
Tai Tam Road	-	11-SE-18D	11SE-D/FR29	down	10	30	Soil cut slope
Tai Tam Road	-	11-SE-18D	11SE-D/R32	up	3.2	7	Retaining wall
Tai Tam Road	-	11-SE-23B	11SE-D/C141	up	12	30	Soil/rock cut slope
Tai Tam Road	-	11-SE-23B	11SE-D/C142	up	5	50	Soil/rock cut slope
Tai Tam Road	-	11-SE-23B	11SE-D/C143	down	10	40	Soil/rock cut slope
Tai Tam Road	-	11-SE-23B	11SE-D/C144	up	8	40	Soil/rock cut slope
Tai Tam Road	-	11-SE-23B	11SE-D/C145	up	8	40	Soil/rock cut slope
Tai Tam Road	-	11-SE-23B	11SE-D/C146	up	9	50	Soil/rock cut slope
Tai Tam Road	-	11-SE-23B	11SE-D/C147	up	8	40	Soil/rock cut slope
Tai Tam Road	-	11-SE-23B	11SE-D/C148	up	8	50	Soil/rock cut slope
Tai Tam Road	-	11-SE-23B	11SE-D/C165	up	3.7	15.7	Soil cut slope
Tai Tam Road	-	11-SE-23B	11SE-D/C64	up	9	80	Soil/rock cut slope
Tai Tam Road	-	11-SE-23B	11SE-D/F35	down	10	40	Soil cut slope
Tai Tam Road	-	11-SE-23B	11SE-D/F36	down	8	40	Soil cut slope
Tai Tam Road	-	11-SE-23B	11SE-D/F37	down	10	30	Soil cut slope
Tai Tam Road	-	11-SE-23B	11SE-D/F38	down	8	30	Soil cut slope
Tai Tam Road	-	11-SE-23B	11SE-D/F39	down	8	25	Soil cut slope
Tai Tam Road	-	11-SE-23B	11SE-D/R19	down	3	20	Retaining wall
Tai Tam Road	-	11-SE-23C	11SE-C/C143	up	3	45	Soil cut slope
Tai Tam Road	-	11-SE-23C	11SE-C/C144	up	3	40	Soil/rock cut slope
Tai Tam Road	-	11-SE-23C	11SE-C/C145	up	5	50	Soil/rock cut slope
Tai Tam Road	-	11-SE-23C	11SE-C/C146	up	3	60	Soil/rock cut slope
Tai Tam Road	-	11-SE-23C	11SE-C/C147	up	5	40	Soil/rock cut slope
Tai Tam Road	-	11-SE-23C	11SE-C/C148	up	9	60	Soil/rock cut slope
Tai Tam Road	-	11-SE-23C	11SE-C/C149	down	6	50	Soil cut slope
Tai Tam Road	-	11-SE-23D	11SE-D/F40	down	8	30	Soil cut slope
Tai Tam Road	-	15-NE-3A	15NE-A/C195	up	20	50	Soil/rock cut slope
Tai Tam Road	-	15-NE-3A	15NE-A/C196	down	4	10	Soil cut slope
Tai Tam Road	-	15-NE-3A	15NE-A/C197	up	8	20	Soil/rock cut slope
Tai Tam Road	-	15-NE-3A	15NE-A/C198	down	5	20	Soil/rock cut slope
Tai Tam Road	-	15-NE-3C	15NE-A/C190	up	12	80	Soil/rock cut slope
Tai Tam Road	-	15-NE-3C	15NE-A/C191	up	7	20	Soil/rock cut slope
Tai Tam Road	-	15-NE-3C	15NE-A/C192	up	15	120	Soil/rock cut slope
Tai Tam Road	-	15-NE-3C	15NE-A/C193	up	15	170	Rock cut slope
Tai Tam Road	-	15-NE-3C	15NE-A/C194	down	5	20	Rock cut slope
Tai Tam Road	-	15-NE-3C	15NE-A/C199	down	10	70	Soil/rock cut slope
Tai Tam Road	-	15-NE-7D	15NE-A/C170	up	8	30	Soil/rock cut slope
Tai Tam Road	-	15-NE-8A	15NE-A/C179	up	5	20	Rock cut slope
Tai Tam Road	-	15-NE-8A	15NE-A/C180	up	20	170	Rock cut slope
Tai Tam Road	-	15-NE-8A	15NE-A/C181	up	6	20	Rock cut slope
Tai Tam Road	-	15-NE-8A	15NE-A/C182	up	8	40	Rock cut slope
Tai Tam Road	-	15-NE-8A	15NE-A/C183	up	8	70	Rock cut slope
Tai Tam Road	-	15-NE-8A	15NE-A/F21	up			
Tai Tam Road	-	15-NE-8C	15NE-A/C176	up	5	150	Soil cut slope
Tai Tam Road	-	15-NE-8C	15NE-A/C177	up	7	150	Rock cut slope
Tai Tam Road	-	15-NE-8C	15NE-A/C178	up	25	240	Rock cut slope
Tai Tam Road	-	15-NE-8C	15NE-A/FR45	down			
Tuen Mun Road	A		6SE-D/C61	up	12	150	Rock slope
Tuen Mun Road	A		6SE-D/C62	up	12	230	Soil/rock cut slope
Tuen Mun Road	A		6SE-D/C63	up	35	250	Soil/rock cut slope
Tuen Mun Road	A		6SE-D/C64	up	15	350	Soil/rock cut slope
Tuen Mun Road	A		6SE-D/F16	down	6	20	Soil cut slope

ANNEX D SLOPE FEATURES DATA FOR SELECT BRIL ROADS

ROAD	SECTION	MAP	SLOPE	UP OR DOWN	HEIGHT	LENGTH	TYPE
Tuen Mun Road	A		6SE-D/F17	down	8	30	Soil cut slope
Tuen Mun Road	A		6SE-D/F18	down	22	140	Soil cut slope
Tuen Mun Road	A		6SE-D/F47	up			
Tuen Mun Road	B	6-SE-16D	6SE-C/C39	up	15	110	Soil/rock cut slope
Tuen Mun Road	B	6-SE-16D	6SE-C/C40	up	35	300	Soil/rock cut slope
Tuen Mun Road	B	6-SE-16D	6SE-C/C41	up	28	150	Soil/rock cut slope
Tuen Mun Road	B	6-SE-17C	6SE-C/C43	up	45	240	Soil/rock cut slope
Tuen Mun Road	B	6-SE-17C	6SE-C/C44	up	10	240	Soil/rock cut slope
Tuen Mun Road	B	6-SE-17C	6SE-C/C47	up	26	130	Soil/rock cut slope
Tuen Mun Road	B	6-SE-17C	6SE-C/C50	down	14	80	Soil cut slope
Tuen Mun Road	B	6-SE-17C	6SE-C/C64	down	12	40	Soil/rock cut slope
Tuen Mun Road	B	6-SE-17C	6SE-C/F20	down	20	170	Fill slope
Tuen Mun Road	B	6-SE-17C	6SE-C/F21	down	22	200	Fill slope
Tuen Mun Road	B	6-SE-17D	6SE-C/C46	up	20	150	Soil/rock cut slope
Tuen Mun Road	B	6-SE-17D	6SE-C/C48	up	16	60	Soil/rock cut slope
Tuen Mun Road	B	6-SE-17D	6SE-C/C49	up	35	160	Soil/rock cut slope
Tuen Mun Road	B	6-SE-17D	6SE-C/C51	up	18	100	Soil cut slope
Tuen Mun Road	B	6-SE-17D	6SE-C/C52	up	42	380	Soil/rock cut slope
Tuen Mun Road	B	6-SE-17D	6SE-C/C53	up	10	80	Soil cut slope
Tuen Mun Road	B	6-SE-17D	6SE-C/C54	up	28	110	Soil/rock cut slope
Tuen Mun Road	B	6-SE-17D	6SE-C/C55	down	20	65	Soil/rock cut slope
Tuen Mun Road	B	6-SE-17D	6SE-C/C56	up	45	240	Soil/rock cut slope
Tuen Mun Road	B	6-SE-17D	6SE-C/F13	down	16	60	Fill slope
Tuen Mun Road	B	6-SE-17D	6SE-C/F14	down	22	60	Fill slope
Tuen Mun Road	B	6-SE-17D	6SE-C/F15	down	22	55	Fill slope
Tuen Mun Road	B	6-SE-17D	6SE-C/F16	down	10	20	Fill slope
Tuen Mun Road	B	6-SE-17D	6SE-C/F19	down	34	170	Fill slope
Tuen Mun Road	B	6-SE-18C	6SE-C/C59	up	15	120	Soil/rock cut slope
Tuen Mun Road	B	6-SE-21A	6SE-C/C23	down	15	60	Soil/rock cut slope
Tuen Mun Road	B	6-SE-21A	6SE-C/C34	down	35	350	Soil/rock cut slope
Tuen Mun Road	B	6-SE-21A	6SE-C/C35	up	28	160	Soil/rock cut slope
Tuen Mun Road	B	6-SE-21A	6SE-C/C36	up	22	150	Soil/rock cut slope
Tuen Mun Road	B	6-SE-21A	6SE-C/FR45	down			
Tuen Mun Road	B	6-SE-21A	6SE-D/F6	down	8	50	Fill slope
Tuen Mun Road	B	6-SE-21B	6SE-C/C37	up	45	600	Soil/rock cut slope
Tuen Mun Road	B	6-SE-21B	6SE-C/C38	up	30	180	Soil/rock cut slope
Tuen Mun Road	B	6-SE-22B	6SE-C/C83	up			
Tuen Mun Road	B	6-SE-22B	6SE-C/F17	down	24	90	Fill slope
Tuen Mun Road	B	6-SE-22B	6SE-C/F18	down	18	60	Fill slope
Tuen Mun Road	C	6-SW-18D	6SW-D/C15	up	18	180	Soil/rock cut slope
Tuen Mun Road	C	6-SW-18D	6SW-D/F19	down	12	270	Fill slope
Tuen Mun Road	C	6-SW-18D	6SW-D/F20	down	10	160	Fill slope
Tuen Mun Road	C	6-SW-23B	6SW-D/C9	up	35	120	Soil/rock cut slope
Tuen Mun Road	C	6-SW-24A	6SW-D/F3	up	5	7	Fill slope
Tuen Mun Road	C	6-SW-24A	6SW-D/FR17	down	6	20	Fill slope
Tuen Mun Road	C	6-SW-24C	6SW-D/C16	up	35	250	Soil/rock cut slope
Tuen Mun Road	C	6-SW-24C	6SW-D/F1	down	8	50	Fill slope
Tuen Mun Road	C	6-SW-24D	6SW-D/C17	up	30	470	Rock slope
Tuen Mun Road	C	6-SW-24D	6SW-D/C18	up	30	500	Rock slope
Tuen Mun Road	C	6-SW-24D	6SW-D/F13	down	8	85	Fill slope
Tuen Mun Road	C	6-SW-24D	6SW-D/F15	down	6	35	Fill slope
Tuen Mun Road	C	6-SW-25B	6SW-D/C24	up	28	100	Soil/rock cut slope
Tuen Mun Road	C	6-SW-25B	6SW-D/C25	up	16	120	Soil/rock cut slope
Tuen Mun Road	C	6-SW-25B	6SW-D/C49	up			
Tuen Mun Road	C	6-SW-25C	6SW-D/C19	up	26	100	Soil/rock cut slope
Tuen Mun Road	C	6-SW-25C	6SW-D/C20	up	12	100	Soil/rock cut slope
Tuen Mun Road	C	6-SW-25C	6SW-D/C21	up	12	100	Soil cut slope
Tuen Mun Road	C	6-SW-25C	6SW-D/C22	up	12	100	Soil/rock cut slope
Tuen Mun Road	C	6-SW-25C	6SW-D/C23	up	25	100	Soil/rock cut slope
Tuen Mun Road	C	6-SW-25C	6SW-D/F10	down	8	25	Fill slope
Tuen Mun Road	C	6-SW-25C	6SW-D/F11	down	12	75	Fill slope
Tuen Mun Road	C	6-SW-25C	6SW-D/F12	down	18	240	Fill slope
Tuen Mun Road	D	6-SW-11D	6SW-A/C9	up	9		

ANNEX D SLOPE FEATURES DATA FOR SELECT BRIL ROADS

ROAD	SECTION	MAP	SLOPE	UP OR DOWN	HEIGHT	LENGTH	TYPE
Tuen Mun Road	D	6-SW-11D	6SW-A/F9	up	9	50	Soil/rock cut slope
Tuen Mun Road	D	6-SW-11D	6SW-C/C12	up	16	150	Soil/rock cut slope
Tuen Mun Road	D	6-SW-11D	6SW-C/C13	up	40	300	Soil/rock cut slope
Tuen Mun Road	D	6-SW-11D	6SW-C/C14	up	16	100	Soil/rock cut slope
Tuen Mun Road	D	6-SW-12C	6SW-C/F27	down	24	120	Soil cut slope
Tuen Mun Road	D	6-SW-12C	6SW-C/F28	down	18	180	Soil cut slope
Tuen Mun Road	D	6-SW-12C	6SW-C/F29	down	6	80	Soil cut slope
Tuen Mun Road	D	6-SW-17A	6SW-C/C16	up	24	150	Soil/rock cut slope
Tuen Mun Road	D	6-SW-17A	6SW-C/F24	down	12	180	Soil cut slope
Tuen Mun Road	D	6-SW-17A	6SW-C/F25	down	10	140	Soil cut slope
Tuen Mun Road	D	6-SW-17A	6SW-C/F26	down	24	180	Soil cut slope
Victoria Road	A	11-SW-11A	11SW-A/C289	up	6	15	Soil cut slope
Victoria Road	A	11-SW-11A	11SW-A/C292	up	6	70	Soil/rock cut slope
Victoria Road	A	11-SW-11A	11SW-A/C293	up	15		Soil/rock cut slope
Victoria Road	A	11-SW-11A	11SW-A/C294	up	7	30	Soil/rock cut slope
Victoria Road	A	11-SW-11A	11SW-A/F75	down	18	30	Fill slope
Victoria Road	A	11-SW-11A	11SW-A/R781	down	4	30	Retaining wall
Victoria Road	A	11-SW-11A	11SW-A/R782	down	5	15	Retaining wall
Victoria Road	A	11-SW-11A	11SW-A/R783	up	4.5	12	Retaining wall
Victoria Road	A	11-SW-6C	11SW-A/C251	up	12	30	Soil cut slope
Victoria Road	A	11-SW-6C	11SW-A/C254	up	10	60	Soil/rock cut slope
Victoria Road	A	11-SW-6C	11SW-A/C261	up	7	45	Soil cut slope
Victoria Road	A	11-SW-6C	11SW-A/C268	up	5	40	Soil cut slope
Victoria Road	A	11-SW-6C	11SW-A/C273	up	14	70	Soil/rock cut slope
Victoria Road	A	11-SW-6C	11SW-A/C274	up	8	50	Soil cut slope
Victoria Road	A	11-SW-6C	11SW-A/C286	up	0.12	30	Soil cut slope
Victoria Road	A	11-SW-6C	11SW-A/C287	up	8	30	Soil cut slope
Victoria Road	A	11-SW-6C	11SW-A/C376	down			
Victoria Road	A	11-SW-6C	11SW-A/CR253	up	7	15	Soil cut slope
Victoria Road	A	11-SW-6C	11SW-A/CR267	up	3	15	Soil cut slope
Victoria Road	A	11-SW-6C	11SW-A/R768	up	4	20	Retaining wall
Victoria Road	A	11-SW-6C	11SW-A/R769	down	5	30	Retaining wall
Victoria Road	A	11-SW-6C	11SW-A/R770	down	10	25	Retaining wall
Victoria Road	A	11-SW-6C	11SW-A/R771	down	6	18	Retaining wall
Victoria Road	A	11-SW-6C	11SW-A/R772	down	6	40	Retaining wall
Victoria Road	A	11-SW-6C	11SW-A/R775	up	6	15	Retaining wall
Victoria Road	A	11-SW-6C	11SW-A/R779	down	4.5	20	Retaining wall
Victoria Road	A	11-SW-6C	11SW-A/R780	down	5	20	Retaining wall
Victoria Road	A	11-SW-6D	11SW-A/C102	up	8	110	Soil/rock cut slope
Victoria Road	A	11-SW-6D	11SW-A/C103	up	10	20	Soil/rock cut slope
Victoria Road	B	11-SW-17A	11SW-C/C150	down	27	65	
Victoria Road	B	11-SW-17A	11SW-C/C152	up	13	70	Rock cut slope
Victoria Road	B	11-SW-17A	11SW-C/C153	up	10	30	Rock cut slope
Victoria Road	B	11-SW-17A	11SW-C/C154	up	6	50	Soil/rock cut slope
Victoria Road	B	11-SW-17A	11SW-C/C155	up	8	65	Soil/rock cut slope
Victoria Road	B	11-SW-17A	11SW-C/C156	up	10	25	Soil/rock cut slope
Victoria Road	B	11-SW-17C	11SW-C/C125	up	12	62	Soil/rock cut slope
Victoria Road	B	11-SW-17C	11SW-C/C138	up	16	55	Soil/rock cut slope
Victoria Road	B	11-SW-17C	11SW-C/C139	up	10	35	rock cut slope
Victoria Road	B	11-SW-17C	11SW-C/C140	up	12	40	Soil/rock cut slope
Victoria Road	B	11-SW-17C	11SW-C/C141	up	12	40	Soil/rock cut slope
Victoria Road	B	11-SW-17C	11SW-C/C143	up	14	50	Soil/rock cut slope
Victoria Road	B	11-SW-17C	11SW-C/C146	down	17	40	
Victoria Road	B	11-SW-17C	11SW-C/CR137	up	12	65	Soil cut slope
Victoria Road	B	11-SW-17C	11SW-C/CR142	up	6	25	Soil/rock cut slope
Victoria Road	B	11-SW-17C	11SW-C/CR144	up	10	55	rock cut slope
Victoria Road	B	11-SW-17C	11SW-C/CR145	down	45	50	
Victoria Road	B	11-SW-17C	11SW-C/CR147	down	25	50	
Victoria Road	B	11-SW-17C	11SW-C/R42	up	6	15	
Victoria Road	B	11-SW-17C	11SW-C/R44	down	6	110	
Victoria Road	B	11-SW-22A	11SW-C/C131	up	12	60	Soil/rock cut slope
Victoria Road	B	11-SW-22A	11SW-C/C132	up	10	40	Soil/rock cut slope
Victoria Road	B	11-SW-22A	11SW-C/C133	up	6	30	rock cut slope

ANNEX D SLOPE FEATURES DATA FOR SELECT BRIL ROADS

ROAD	SECTION	MAP	SLOPE	UP OR DOWN	HEIGHT	LENGTH	TYPE
Victoria Road	B	11-SW-22A	11SW-C/C134	up	8	40	Soil/rock cut slope
Victoria Road	B	11-SW-22A	11SW-C/C135	up	12	40	Soil/rock cut slope
Victoria Road	B	11-SW-22A	11SW-C/C136	up	12	50	Soil/rock cut slope
Victoria Road	B	11-SW-22A	11SW-C/R41	down	3	45	
Yee King Road	-	11-SE-6C	11SE-A/C208	up	10	40	Soil cut slope
Yee King Road	-	11-SE-6C	11SE-A/C209	up	7	25	Soil cut slope
Yee King Road	-	11-SE-6C	11SE-A/C210	up	6	55	Soil/rock cut slope
Yee King Road	-	11-SE-6C	11SE-A/C211	up	15	135	Soil/rock cut slope
Yee King Road	-	11-SE-6C	11SE-A/C212	up	12	150	Rock cut slope
Yee King Road	-	11-SE-6C	11SE-A/C213	up	50	105	Soil/rock cut slope
Yee King Road	-	11-SE-6C	11SE-A/C214	up	7	55	Soil cut slope
Yee King Road	-	11-SE-6C	11SE-A/C215	up	18	105	Soil/rock cut slope
Yee King Road	-	11-SE-6C	11SE-A/C262	down	25	43	Rock cut slope

* The heights as indicated by these records were determined subsequent to issue of the draft report.

Annex E

List of Slopes Along Select BRIL Roads Improved to Post-GEO Standards

Table E1 : Slopes on BRIL Roads (from Map data) that Match with post-GEO Slope Database

Slope No.	Road	Section
15NE-C/C82	Chung Hom Kok Road	-
11SW-B/CR29	Kennedy Road	-
11SW-B/FR56	Kennedy Road	-
11SW-D/FR5	Kennedy Road	-
11SW-D/FR112	Magazine Gap Road	-
11SW-D/F80	Nam Fung Road	-
11SW-D/CR228	Peak Road	A
11SW-D/CR237	Peak Road	A
11SW-D/F32	Peak Road	A
11SW-D/F33	Peak Road	A
11SW-C/FR87	Pokfulam Road	B
11SW-C/FR88	Pokfulam Road	B
11SW-D/C27	Stubbs Road	A
11SW-D/CR388	Stubbs Road	A
11SW-D/F69	Stubbs Road	A
11SE-A/C123	Tai Hang Road	-
11SE-C/C57	Tai Hang Road	-
11SE-C/C58	Tai Hang Road	-
11SE-C/C87	Tai Hang Road	-
11SE-C/F21	Tai Hang Road	-
11SW-A/C103	Victoria Road	A
11SW-A/C251	Victoria Road	A
11SW-A/CR253	Victoria Road	A
11NE-C/C2	Kwun Tong Road	-
7NE-C/FR24	Tai Po Road	A
7SE-A/C54	Tai Po Road	A
7NW-D/FR1	Tai Po Road	C
6SE-C/C118	Castle Peak Road	-
6SE-C/C23	Castle Peak Road	-
6SE-D/F47	Tuen Mun Road	A
6SE-C/C23	Tuen Mun Road	B
6SE-C/C34	Tuen Mun Road	B
6SW-D/C9	Tuen Mun Road	C
6SE-D/C25 in Castle Peak Road although not included in Annex D		
has been improved to current geotechnical standards and also		
has an incident history as reported in the landslide incident database.		

Table E2 : Slopes on BRIL Roads with Incident History that Match with post-GEO Slope Database

Slope Number	Date Slope Improvement Completed	Incident Date	Incident No.	Road	Section
11SE-C/C87	30-Jun-97	20-Sep-91	HK91/9/4	Tai Hang Road	-
11SW-D/CR237	6-Feb-95	8-Mar-95	HK95/8/2	Peak Road	A
11SE-C/C57	1-Dec-96	8-Mar-95	HK95/8/7	Tai Hang Road	-
8SW-A/C4	15-Jan-95	16-Aug-94	ME94/8/24	Sai Sha Road	-
6SE-C/C34	2-May-94	17-Nov-88	MW88/11/1	Tuen Mun Road	B
6SE-D/F47	16-Oct-90	20-Jul-88	MW88/7/15	Tuen Mun Road	A
6SE-D/C25	15-Jan-95	16-Jun-92	MW92/6/12	Castle Peak Road	-
6SE-D/C25	15-Jan-95	16-Jun-93	MW93/6/20	Castle Peak Road	-
6SE-D/C25	15-Jan-95	22-Jul-94	MW94/7/16a	Castle Peak Road	-
6SE-D/C25	15-Jan-95	8-Jul-94	MW94/8/5	Castle Peak Road	-
6SE-D/C25	15-Jan-95	23-Jul-94	MW94/7/16b	Castle Peak Road	-

Annex F

Incident Records for BRIL Roads 1984 to 96

ANNEX F INCIDENT RECORDS FOR BRIL ROADS (1984 TO 1996)

Incident No.	Incident Reported	Road	Section	Slope Type	Relative to Road	Type of Failure	Scale of Failure (m3)	Slope Height (m)	Slope No.
HK85/9/11	26-Aug-85	Cape Collinson Road	A	Soil/rock cut slope	up	Landslide	10	10	
HK92/1/1	08-Jan-92	Cape Collinson Road	A	Soil/rock cut slope	up	Boulders	0.02		11SE-D/C124
HK92/5/159	08-May-92	Cape Collinson Road	A	Soil/rock cut slope	up	Landslide	3	3.5	11SD-D/C114
HK92/5/107	08-May-92	Cape Collinson Road	A	Soil/rock cut slope	up	Boulders	1	2.5	11SE-D/C88
HK92/5/41	09-May-92	Cape Collinson Road	A	Fill slope	down	Retaining wall	120	4	
HK92/5/108	11-May-92	Cape Collinson Road	A	Soil cut slope	up	Boulders	0.5		11SE-D/C89
HK92/5/109	11-May-92	Cape Collinson Road	A	Soil cut slope	up	Landslide	2	2.5	11SE-D/C154
HK93/6/9	16-Jun-93	Cape Collinson Road	A	Soil cut slope	up	Landslide	150	65	11SE-D/SSW2
HK93/6/23	17-Jun-93	Cape Collinson Road	A	Soil/rock cut slope	up	Landslide	10	9	11SE-D/C124
HK93/9/13	27-Sep-93	Cape Collinson Road	A	Soil cut slope	up	Landslide	5	6	11SE-D/C100
HK94/8/23	29-Aug-94	Cape Collinson Road	A	Soil/rock cut slope	up	Landslide	2	8	11SE-D/C90
HK92/4/8	08-Apr-92	Cape Collinson Road	B	Rock slope	up	Rock fall	3	13	
HK93/6/10	16-Jun-93	Cape Collinson Road	B	Soil/rock cut slope	up	Rock fall	30	10	11SE-D/C152
HK94/6/1	20-Jun-94	Cape Collinson Road	B	Soil/rock cut slope	up	Landslide	600	15	11SE-D/C206
MW85/4/3	10-Apr-85	Castle Peak Road	-	Soil cut slope	up	Boulders	0.5		
MW85/8/6	30-Aug-85	Castle Peak Road	-	Retaining wall	down	Negligible			
MW86/5/4	11-May-86	Castle Peak Road	-	Soil cut slope	up	Landslide	40		
MW87/8/23	30-Jul-87	Castle Peak Road	-	Soil cut slope	up	Landslide	10		
MW88/7/2	08-Jul-88	Castle Peak Road	-	Soil/rock cut slope	NotNearBrilRoad	Negligible			
MW88/7/8	20-Jul-88	Castle Peak Road	-	Fill slope	up	Landslide	5	15	
MW89/5/16	20-May-89	Castle Peak Road	-	Soil cut slope	up	Landslide	60	9	
MW89/5/11	20-May-89	Castle Peak Road	-	Soil/rock cut slope	up	Landslide	100		
MW89/5/86	21-May-89	Castle Peak Road	-	Fill slope	down	Landslide	200	13	
MW89/5/64	21-May-89	Castle Peak Road	-	Soil cut slope	up	Landslide	3		
MW89/5/63	21-May-89	Castle Peak Road	-	Soil cut slope	up	Landslide	2.5		
MW89/7/3	21-May-89	Castle Peak Road	-	Soil cut slope	up	Landslide	45	15	
MW89/8/1	01-Aug-89	Castle Peak Road	-	Rock slope	up	Rock fall	0.25	20	
MW91/6/4	10-Jun-91	Castle Peak Road	-	Soil/rock cut slope	up	Negligible	1		
MW91/6/3	10-Jun-91	Castle Peak Road	-	Retaining wall	up	Others	8		
MW92/6/12	16-Jun-92	Castle Peak Road	-	Soil/rock cut slope	up	Landslide	20	8	6SE-D/C25
MW92/7/11	18-Jul-92	Castle Peak Road	-	Soil/rock cut slope	up	Landslide	10		
MW92/7/18	20-Jul-92	Castle Peak Road	-	Soil cut slope	up	Landslide	5	6	
MW93/6/18	16-Jun-93	Castle Peak Road	-	Soil/rock cut slope	up	Rock fall	750	0	
MW93/6/20	16-Jun-93	Castle Peak Road	-	Soil cut slope	up	Landslide	10	12	6SE-D/C25
MW93/6/77	25-Jun-93	Castle Peak Road	-	Fill slope	down	Landslide	20	4	6SE-D/CR45
MW93/9/1	07-Sep-93	Castle Peak Road	-	Rock slope	down	Rock fall	2	5.5	
MW93/9/4	17-Sep-93	Castle Peak Road	-	Soil/rock cut slope	up	Rock fall	5	0	
MW93/11/79	09-Nov-93	Castle Peak Road	-	Soil cut slope	up	Landslide	20	2.5	
MW93/11/77	11-Nov-93	Castle Peak Road	-	Rock slope	up	Rock fall	0.5	4	
MW93/11/118	15-Nov-93	Castle Peak Road	-	Fill slope	up	Landslide	30	30	
MW94/8/5	08-Jul-94	Castle Peak Road	-	Soil cut slope	up	Landslide	20	15	6SE-D/C25
MW94/8/4	08-Jul-94	Castle Peak Road	-	Fill slope	down	Landslide	7.5	6	
MW94/8/3	08-Jul-94	Castle Peak Road	-	Soil cut slope	up	Landslide	250	15	
MW94/7/16a	22-Jul-94	Castle Peak Road	-	Soil cut slope	up	Landslide	45	20	6SE-D/C25
MW94/7/16b	23-Jul-94	Castle Peak Road	-	Soil cut slope	up	Washout	45	20	6SE-D/C25
MW94/7/18	23-Jul-94	Castle Peak Road	-	soil/rock cut slope	up	Landslide	1200	36	
MW94/7/62	27-Jul-94	Castle Peak Road	-	Soil cut slope	down	Landslide	10	5	
MW94/8/12	08-Aug-94	Castle Peak Road	-	Soil cut slope	up	Washout	1	10	6SE-C/C26
MW94/8/29	10-Aug-94	Castle Peak Road	-	Soil cut slope	up	Landslide	10	6	6SE-C/C1
MW95/8/6	14-Aug-95	Castle Peak Road	-	Soil cut slope	up	Landslide	10	5	
MW96/6/2	18-Jun-96	Castle Peak Road	-	Fill slope	up	Landslide	30	8	
MW96/9/6	17-Sep-96	Castle Peak Road	-	Soil cut slope	up	Landslide	1		
HK91/6/6	12-Jun-91	Chung Hom Kok Road	-	Soil/rock cut slope	up	Rock fall	1	10	
HK92/4/13	08-Apr-92	Chung Hom Kok Road	-	Soil/rock cut slope	up	Boulders	0.5	10	
HK92/4/11	08-Apr-92	Chung Hom Kok Road	-	Soil/rock cut slope	up	Boulders	8	10	
HK93/6/17	17-Jun-93	Chung Hom Kok Road	-	Rock slope	up	Rock fall	2	5	15NE-C/C75
HK94/7/3	12-Jul-94	Chung Hom Kok Road	-	Rock slope	up	Rock fall	2	14	15NE-C/C75
HK94/7/54	25-Jul-94	Chung Hom Kok Road	-	Fill slope	down	Landslide			
HK94/7/55	26-Jul-94	Chung Hom Kok Road	-	Retaining wall	down	Landslide	40	4	
HK95/8/101	15-Aug-95	Chung Hom Kok Road	-	Soil/rock cut slope	up	Landslide	35	8	15NE-C/C78
ME89/5/11	02-May-89	Clear Water Bay Road	-	Soil cut slope	up	Landslide	1		
ME89/5/9	02-May-89	Clear Water Bay Road	-	Soil cut slope	up	Landslide	8	4	
ME90/6/4	11-Jun-90	Clear Water Bay Road	-	Soil cut slope	up	Washout	0.5	0.5	
ME94/8/1	08-Jan-94	Clear Water Bay Road	-	Fill slope	up	Landslide	20	8	
ME94/7/32	25-Jul-94	Clear Water Bay Road	-	Soil cut slope	up	Landslide	60	25.5	11NE-BC/C144
ME95/8/1	08-Mar-95	Clear Water Bay Road	-	Soil cut slope	up	Landslide	3	3	11NE-B/C143
ME95/8/42	23-Aug-95	Clear Water Bay Road	-	Soil cut slope	up	Landslide	2.5	4	
HK86/4/3	21-Apr-86	Island Road	-	Rock slope	down	Negligible			
HK92/4/5	07-Apr-92	Island Road	-	Soil/rock cut slope	up	Landslide	4.8	13	
HK92/5/86	12-May-92	Island Road	-	Soil cut slope	up	Landslide	33		
HK92/6/25	11-Jun-92	Island Road	-	Soil cut slope	up	Washout	0.5		
HK93/5/4	26-May-93	Island Road	-	Rock slope	up	Rock fall	1.5	3	
HK93/10/7	14-Oct-93	Island Road	-	Soil/rock cut slope	up	Landslide	1.3	9	15NW-B/C53

ANNEX F INCIDENT RECORDS FOR BRIL ROADS (1984 TO 1996)

Incident No.	Incident Reported	Road	Section	Slope Type	Relative to Road	Type of Failure	Scale of Failure (m3)	Slope Height (m)	Slope No.
HK96/3/4	13-Aug-96	Island Road	-	Soil/rock cut slope	down	Landslide	40	12	15NW-B/C56
HK94/4/19		Kennedy Road	-						
HK92/3/3	09-Mar-92	Kennedy Road	-	Retaining wall	up	Retaining wall	0.04	10	
HK92/4/44	27-Apr-92	Kennedy Road	-	Soil cut slope	up	Washout	5		
HK92/5/38	08-May-92	Kennedy Road	-	Fill slope	up	Landslide	500		11SW-B/CR403
HK92/6/47	08-Jun-92	Kennedy Road	-	Soil cut slope	up	Landslide	6	0	
HK92/6/45	19-Jun-92	Kennedy Road	-	Soil cut slope	down	Washout	0.1		
HK93/4/1	22-Apr-93	Kennedy Road	-	Soil cut slope	up	Others	5	20	11SW-D/C404
HK93/9/2	23-Sep-93	Kennedy Road	-	Rock slope	up	Rock fall	0.1	11	
HK93/9/19	26-Sep-93	Kennedy Road	-	Rock slope	up	Rock fall	0.5	10	
HK93/12/1	16-Dec-93	Kennedy Road	-	Soil cut slope	up	Washout	3.5	5.5	11SW-B/C156
HK94/7/4	12-Jul-94	Kennedy Road	-	Soil cut slope	down	Landslide	17.5		
HK94/7/27	23-Jul-94	Kennedy Road	-	Soil cut slope	up	Landslide	5	5	11SW-B/C196
HK94/7/36	23-Jul-94	Kennedy Road	-	Soil cut slope	up	Landslide	9	6	11SW-B/C196
HK95/6/3	06-Oct-95	Kennedy Road	-	Soil/rock cut slope	up	Washout	2.5	9	11SW-B/C196
HK96/4/3	01-Apr-96	Kennedy Road	-	Rock slope	up	Rock fall	0.03		11SW-D/C668
K89/5/102		Kwun Tong Road	-	Soil cut slope			0		
K93/9/4	29-Sep-93	Kwun Tong Road	-	Soil/rock cut slope	up	Rock fall	20	8	11NE-A/C72
K94/7/13	24-Jul-94	Kwun Tong Road	-	Soil/rock cut slope	up	Washout	40	15	11NE-A/C35
K95/8/17	13-Aug-95	Kwun Tong Road	-	Soil/rock cut slope	up	Landslide	150		
HK84/9/2		Magazine Gap Road	-	-		Rock fall	2		
HK85/8/13	26-Aug-85	Magazine Gap Road	-	Soil cut slope	up	Landslide	3	8	
HK86/7/6	12-Jul-86	Magazine Gap Road	-	Soil/rock cut slope	up	Landslide	20	6	
HK88/7/7	20-Jul-88	Magazine Gap Road	-	Soil cut slope	up	Landslide	3.5	8	
HK89/5/37	21-May-89	Magazine Gap Road	-	Soil cut slope	up	Landslide	3	6	
HK92/4/23	11-Apr-92	Magazine Gap Road	-	Soil cut slope	up	Landslide	6	9	
HK92/5/32	08-May-92	Magazine Gap Road	-	Soil cut slope	up	Landslide	15		11SW-D/C298
HK92/5/44	09-May-92	Magazine Gap Road	-	Soil cut slope	up	Landslide	50		11SW-D/C526
HK92/5/145	15-May-92	Magazine Gap Road	-	-	up	Negligible		8	
HK93/3/1	15-Mar-93	Magazine Gap Road	-	Soil/rock cut slope	up	Landslide	2	7	11SW-D/C325
HK93/9/37	26-Sep-93	Magazine Gap Road	-	Soil cut slope	up	Landslide	8	16	11SW-D/CR302
HK93/9/43	29-Sep-93	Magazine Gap Road	-	Soil cut slope	up	Landslide	1	5	11SW-D/C526
HK94/7/34	24-Jul-94	Magazine Gap Road	-	Fill slope	up	Landslide	3	4	11SW-D/CR295
HK94/7/35	24-Jul-94	Magazine Gap Road	-	Soil cut slope	up	Landslide	2	15	11SW-D/C296
HK94/7/73	03-Aug-94	Magazine Gap Road	-	Soil cut slope	up	Landslide	10	7	
HK94/8/20	20-Aug-94	Magazine Gap Road	-	Soil/rock cut slope	up	Washout	7		
HK95/6/2	09-Jun-95	Magazine Gap Road	-	Retaining wall	down	Retaining wall	7		
HK95/8/15	13-Aug-95	Magazine Gap Road	-	Rock slope	up	Rock fall	20	8	11SW-D/CR316
HK95/10/2	06-Oct-95	Magazine Gap Road	-	Soil/rock cut slope	up	Rock fall	1.5	2.5	
HK87/5/7	23-May-87	Nam Fung Road	-	Retaining wall	NotNearBrilRoad	Others	2.5		
HK87/7/11	30-Jul-87	Nam Fung Road	-	Soil cut slope	up	Landslide	7		
HK92/5/166	19-May-92	Nam Fung Road	-	Soil cut slope	up	Washout	31.5	7	
HK93/6/12	16-Jun-93	Peak Road	A	Soil/rock cut slope	up	Washout	2.4	10	
HK95/8/2	08-Mar-95	Peak Road	A	Soil/rock cut slope	up	Landslide	50	11	11SW-D/CR237
HK95/8/17	13-Aug-95	Peak Road	A	Rock slope	up	Rock fall	8	9	11SW-D/C249
HK95/9/2	24-Aug-95	Peak Road	A	Soil/rock cut slope	down	Rock fall	1	6	
HK85/8/17	29-Aug-85	Peak Road	B	Rock slope	up	Rock fall	3		
HK89/5/49	22-May-89	Peak Road	B	Soil cut slope	up	Landslide	2		
HK91/10/1	16-Oct-91	Peak Road	B	Soil/rock cut slope	unknown	Negligible			
HK92/4/3	06-Apr-92	Peak Road	B	Rock slope	up	Rock fall	1	6	
HK92/5/33	08-May-92	Peak Road	B	Fill slope	up	Landslide	7.5		11SW-D/C601
HK92/5/200	28-May-92	Peak Road	B	Soil cut slope	up	Landslide	2	5	11SW-DC/592
HK96/3/3	26-Mar-96	Peak Road	B	Natural slope	up	Boulders	1		11SW-D/C599
HK89/5/53	24-May-89	Pokfulam Road	A	Soil cut slope	up	Landslide	3	6	
HK92/4/39	23-Apr-92	Pokfulam Road	A	Soil cut slope	up	Negligible			
HK92/5/25	08-May-92	Pokfulam Road	A	Soil cut slope	up	Negligible	3		
HK92/5/97	09-May-92	Pokfulam Road	A	Soil cut slope	down	Landslide	42.5	6	
HK92/5/76	10-May-92	Pokfulam Road	A	Soil cut slope	up	Negligible		8	
HK92/5/111	11-May-92	Pokfulam Road	A	Soil cut slope	up	Landslide	4.5		
HK92/6/10	14-May-92	Pokfulam Road	A	Soil/rock cut slope	up	Negligible	15	5	
HK92/5/183	18-May-92	Pokfulam Road	A	Soil cut slope	up	Landslide	4		
HK94/7/17	22-Jul-94	Pokfulam Road	A	Soil cut slope	up	Landslide	15	12	11SW-A/C139
HK95/8/46	13-Aug-95	Pokfulam Road	A	Soil/rock cut slope	up	Landslide	12		
HK95/12/1	29-Nov-95	Pokfulam Road	A	Soil/rock cut slope	up	Rock fall	0.2	4	11SW-A/C138
HK92/5/37	08-May-92	Pokfulam Road	B	Soil/rock cut slope	up	Landslide	40		
HK92/5/35	08-May-92	Pokfulam Road	B	Rock slope	up	Rock fall	7.5		
HK92/5/112	11-May-92	Pokfulam Road	B	Soil cut slope	up	Landslide	3	4	
HK92/5/150	15-May-92	Pokfulam Road	B	unknown	unknown	Subsidence			
HK92/5/87		Repulse Bay Road	A	Soil cut slope			0		
HK84/5/9	30-May-84	Repulse Bay Road	A	Retaining wall	down	Landslide	30	3	
HK95/8/27	14-Aug-85	Repulse Bay Road	A	Soil/rock cut slope	NotNearBrilRoad	-	0		15NE-A/C28
HK85/9/4	06-Sep-85	Repulse Bay Road	A	Soil cut slope	up	Landslide	1	3	
HK87/7/4	28-Jul-87	Repulse Bay Road	A	Soil/rock cut slope	up	Landslide	7.5		

ANNEX F INCIDENT RECORDS FOR BRIL ROADS (1984 TO 1996)

Incident No.	Incident Reported	Road	Section	Slope Type	Relative to Road	Type of Failure	Scale of Failure (m3)	Slope Height (m)	Slope No.
HK87/7/14	30-Jul-87	Repulse Bay Road	A	Soil cut slope	up	Landslide	4		
HK90/7/1	23-Jul-90	Repulse Bay Road	A	Fill slope	down	Landslide	150		
HK90/9/3	20-Sep-90	Repulse Bay Road	A	Soil cut slope	up	Landslide	3	7	11SE-C/C10
HK91/8/1	16-Aug-91	Repulse Bay Road	A	Retaining wall	up	Negligible			11SE-21A-8
HK91/8/3	16-Aug-91	Repulse Bay Road	A	Soil cut slope	up	Landslide	40		
HK91/8/4	16-Aug-91	Repulse Bay Road	A	Soil/rock cut slope	up	Rock fall	1.5	3	
HK92/5/4	08-May-92	Repulse Bay Road	A	Rock slope	up	Boulders	2		
HK92/5/95	12-May-92	Repulse Bay Road	A	Soil/rock cut slope	up	Landslide	5	8	
HK92/5/147	15-May-92	Repulse Bay Road	A	Fill slope	down	Landslide	45		
HK92/5/157	18-May-92	Repulse Bay Road	A	Soil/rock cut slope	up	Landslide	1.2	7.5	
HK92/6/31	13-Jun-92	Repulse Bay Road	A	Soil/rock cut slope	up	Landslide	0.5	5	
HK92/6/32	13-Jun-92	Repulse Bay Road	A	Soil/rock cut slope	up	Landslide	25	6	
HK92/6/30	13-Jun-92	Repulse Bay Road	A	Soil/rock cut slope	up	Landslide	0.3	10	
HK92/10/3	19-Oct-92	Repulse Bay Road	A	Retaining wall	down	Retaining wall	45	6.3	
HK92/11/1	17-Nov-92	Repulse Bay Road	A	Soil cut slope	up	Landslide	2	10	11SE-C/C168
HK93/6/3	06-Feb-93	Repulse Bay Road	A	Fill slope	down	Landslide	150	0	
HK93/6/4	06-Apr-93	Repulse Bay Road	A	Fill slope	down	Landslide	100	9	
HK93/9/21	26-Sep-93	Repulse Bay Road	A	Soil/rock cut slope	up	Landslide	8	10	15NE-A/C18
HK93/9/20	27-Sep-93	Repulse Bay Road	A	Soil cut slope	up	Landslide	7	6	11SE-C/C9
HK93/9/22	27-Sep-93	Repulse Bay Road	A	Soil cut slope	up	Landslide	2	5.5	15NE-A/C45
HK93/9/39	28-Sep-93	Repulse Bay Road	A	Soil cut slope	up	Landslide	1	4.5	11SE-C/C168
HK94/5/1	20-May-94	Repulse Bay Road	A	Fill slope	down	Landslide	45		
HK94/7/41	23-Jul-94	Repulse Bay Road	A	Soil cut slope	up	Landslide	2.5		
HK94/7/32	24-Jul-94	Repulse Bay Road	A	Soil/rock cut slope	up	Landslide	40	6	18NE-A/C30
HK94/8/12	10-Aug-94	Repulse Bay Road	A	Soil/rock cut slope	up	Landslide	5		15NE-A/C42
HK95/8/25	13-Aug-95	Repulse Bay Road	A	Soil cut slope	up	Washout	10	5	15NE-A/C20
HK95/8/20	13-Aug-95	Repulse Bay Road	A	Soil cut slope	down	Landslide	250	10	
HK95/8/26	13-Aug-95	Repulse Bay Road	A	Soil cut slope	up	Washout	20	8	15NE-A/C22
HK91/8/6	17-Aug-91	Repulse Bay Road	B	Rock slope	up	Rock fall	3	5	
HK92/5/148	15-May-92	Repulse Bay Road	B	Soil/rock cut slope	up	Rock fall	2.5	9	
HK92/5/142	15-May-92	Repulse Bay Road	B	Soil cut slope	down	Washout	0.3	8	15NE-A/CR79
HK93/6/31	22-Jun-93	Repulse Bay Road	B	Soil cut slope	down	Landslide	7	8.5	15NE-A/CR79
HK93/9/7	26-Sep-93	Repulse Bay Road	B	Soil/rock cut slope	up	Rock fall	2.3	4	15NE-A/C107
HK93/9/40	28-Sep-93	Repulse Bay Road	B	Soil cut slope	up	Landslide	5	5	15NE-A/C76
HK94/9/1	09-Nov-94	Repulse Bay Road	B	Soil cut slope	down	Negligible	0.25	4.5	15NE-A/CR93
MW86/5/2	12-May-86	Route Twisk	A	Rock slope		Negligible	0		
MW86/7/1	12-Jul-86	Route Twisk	A	Soil cut slope	up	Landslide	80		
MW86/7/10	12-Jul-86	Route Twisk	A	Rock slope	up	Rock fall	1		
MW86/7/11	15-Jul-86	Route Twisk	A	Soil/rock cut slope	up	Negligible	1		
MW86/9/1	05-Sep-86	Route Twisk	A	Soil/rock cut slope	up	Landslide	3		
MW88/7/16	22-Jul-88	Route Twisk	A	Soil/rock cut slope	up	Boulders	1.6	3.5	
MW88/7/17	22-Jul-88	Route Twisk	A	Soil/rock cut slope	up	Landslide	10	12	6NE-D/C10
MW89/5/50	21-May-89	Route Twisk	A	Soil cut slope	up	Landslide	400	12	
MW89/5/9a	21-May-89	Route Twisk	A	soil cut slope	up	Landslide	400	15	
MW89/5/51	21-May-89	Route Twisk	A	Soil cut slope	up	Landslide	300		
MW89/5/9b	21-May-89	Route Twisk	A	soil cut slope	up	Landslide	450	20	
MW93/9/8	26-Sep-93	Route Twisk	A	Soil/rock cut slope	up	Landslide	17.5	6	
MW93/9/7	27-Sep-93	Route Twisk	A	Soil/rock cut slope	up	Landslide	40	14	6NE-D/C6
MW95/7/10	14-Jul-95	Route Twisk	A	Soil/rock cut slope	up	Rock fall	0.8		6NE-D/C10
MW95/8/3	04-Aug-95	Route Twisk	A	Soil cut slope	up	Rock fall	0.02	3	
MW87/4/3	04-Apr-87	Route Twisk	B	Soil cut slope	up	Landslide	4	2.5	
MW88/7/10	20-Jul-88	Route Twisk	B	Soil cut slope	up	Landslide	1	2	
MW89/5/59	20-May-89	Route Twisk	B	Soil cut slope	up	Landslide	2		
MW96/4/6	13-Apr-96	Route Twisk	B	Soil cut slope	down	Landslide	1		
MW86/4/1	21-Apr-86	Route Twisk	C	Soil cut slope	up	Landslide	2	2	
MW88/7/1	06-Jul-88	Route Twisk	C	Fill slope	up	Subsidence		10	
MW89/5/6	04-May-89	Route Twisk	C	Soil cut slope	up	Landslide	1	7	
MW93/6/16	16-Jun-93	Route Twisk	C	Soil cut slope	down	Landslide	2	0	
MW94/7/34	26-Jul-94	Route Twisk	C	Fill slope	down	Landslide	45		6SE-D/F32
ME93/7/6		Sai Sha Road	-						
ME94/7/5		Sai Sha Road	-	Soil cut slope			0	0	
ME85/6/1	04-Jun-85	Sai Sha Road	-	Soil cut slope	up	Landslide	5	14	
ME87/4/2	06-Apr-87	Sai Sha Road	-	Soil cut slope	up	Landslide	30	13	
ME87/7/16	29-Jul-87	Sai Sha Road	-	Soil cut slope	up	Landslide	20	3	
ME87/7/15	30-Jul-87	Sai Sha Road	-	Soil cut slope	up	Landslide	40	8	
ME92/6/4b	13-Jun-92	Sai Sha Road	-	Soil cut slope	up	Landslide	15	15	
ME92/6/4c	14-Jun-92	Sai Sha Road	-	Soil cut slope	up	Landslide	500	15	
ME92/6/4d	14-Jun-92	Sai Sha Road	-	Soil cut slope	up	Landslide	1700	35	
ME92/6/4a	15-Jun-92	Sai Sha Road	-	Soil cut slope	up	Landslide	10	30	
ME93/6/11	16-Jun-93	Sai Sha Road	-	Soil/rock cut slope	up	Landslide	20	14	8SW-A/C3
ME94/6/10	20-Jun-94	Sai Sha Road	-	Soil cut slope	up	Washout	35	19	8SW-A/C2
ME94/8/24	16-Aug-94	Sai Sha Road	-	Soil cut slope	up	Landslide	200	12	8SW-A/C4
ME95/8/11	13-Aug-95	Sai Sha Road	-	Soil cut slope	up	Landslide	2000		8SW-A/C8

ANNEX F INCIDENT RECORDS FOR BRIL ROADS (1984 TO 1996)

Incident No.	Incident Reported	Road	Section	Slope Type	Relative to Road	Type of Failure	Scale of Failure (m3)	Slope Height (m)	Slope No.
ME96/3/1	13-Mar-96	Sai Sha Road	-	Soil cut slope	up	Washout	9	15	8SW-A/C3
MW90/9/2	11-Sep-90	South Lantau Road	A	Soil cut slope	up	Landslide	29	9	
MW92/4/4	11-Apr-92	South Lantau Road	A	Soil cut slope	up	Landslide	30		
MW92/5/10	08-May-92	South Lantau Road	A	Soil cut slope	up	Landslide	6	14	
MW92/5/11	08-May-92	South Lantau Road	A	Rock slope	up	Rock fall	2	5	
MW92/6/37	13-Jun-92	South Lantau Road	A	Soil cut slope	up	Landslide	50	6	
MW92/6/35	23-Jun-92	South Lantau Road	A	Soil cut slope	up	Landslide	3	3	
MW92/6/34	23-Jun-92	South Lantau Road	A	Soil cut slope	up	Landslide	30	10	
MW93/11/27	11-May-93	South Lantau Road	A	Fill slope	down	Landslide	30	4	10SW-C/F11
MW93/11/28	11-May-93	South Lantau Road	A	Soil cut slope	up	Landslide	30	13	
MW93/11/29	11-May-93	South Lantau Road	A	Soil cut slope	up	Landslide	20	12	
MW93/11/26b	11-May-93	South Lantau Road	A	soil/rock cut slope	up	Landslide	30		10SW-C/C21
MW93/11/26a	11-May-93	South Lantau Road	A	soil/rock cut slope	down	Landslide	200	6	
MW93/11/30	11-May-93	South Lantau Road	A	Soil cut slope	up	Landslide	20	9	
MW93/11/31	05-Nov-93	South Lantau Road	A	Soil cut slope	up	Landslide	30	9	
MW93/11/60	08-Nov-93	South Lantau Road	A	Soil cut slope	up	Landslide	40	6	10SW-C/C12
MW93/11/61	08-Nov-93	South Lantau Road	A	Soil cut slope	up	Landslide	20	6	10SW-C/C12
MW94/6/4	21-Jun-94	South Lantau Road	A	Soil cut slope	up	Landslide	5	23	
MW92/1/1	21-Jan-92	South Lantau Road	B	Soil cut slope	up	Landslide	1000	15	
MW93/9/10	24-Sep-93	South Lantau Road	B	Retaining wall	down	Retaining wall	30	3.5	
MW93/11/58	08-Nov-93	South Lantau Road	B	Soil cut slope	up	Landslide	30	6	13NE-B/CR5
MW93/11/59	08-Nov-93	South Lantau Road	B	Soil cut slope	up	Landslide	30	15	
MW94/7/25	24-Jul-94	South Lantau Road	B	Soil/rock cut slope	up	Landslide	275	12	13NE-B/C9
MW95/8/17	15-Aug-95	South Lantau Road	B	Rock slope	up	Rock fall	5	9	13NE-B/C6
MW87/8/2	30-Jul-87	South Lantau Road	C	Soil cut slope	up	Landslide	100	10	
MW87/8/21	30-Jul-87	South Lantau Road	C	Soil cut slope	up	Landslide	20	14	
MW92/4/9	13-Apr-92	South Lantau Road	C	Soil cut slope	up	Landslide	5		
MW92/7/46	20-Jul-92	South Lantau Road	C	Soil cut slope	up	Others	3		
MW93/11/55	08-Nov-93	South Lantau Road	C	Soil cut slope	up	Landslide	10	10	13NE-A/C25
MW93/11/56	08-Nov-93	South Lantau Road	C	Soil cut slope	up	Landslide	10	5	
HK85/8/9	27-Aug-85	Stubbs Road	A	Soil cut slope	up	Landslide	5		
HK88/8/3	17-Aug-88	Stubbs Road	A	-	down	-			
HK90/4/2	30-Mar-90	Stubbs Road	A	Soil cut slope	up	Washout	10		
HK92/4/32	10-Apr-92	Stubbs Road	A	Soil/rock cut slope	up	Landslide	4.5	40	
HK92/5/184	08-May-92	Stubbs Road	A	Soil cut slope	up	Landslide	7	6.5	11SW-D/CR439
HK93/9/1	17-Sep-93	Stubbs Road	A	Retaining wall	up	Others			
HK93/9/32	27-Sep-93	Stubbs Road	A	Soil cut slope	up	Negligible			11SW-B/C24
HK95/8/36	13-Aug-95	Stubbs Road	A	Retaining wall	down	Retaining wall			
HK87/5/1	16-May-87	Stubbs Road	B	Rock slope	up	Rock fall	0.8	6	
HK95/9/1	09-Jan-95	Stubbs Road	B	Soil cut slope	up	Landslide	130	12	11SW-D/C340
HK95/7/12		Tai Hang Road	-	Soil/rock cut slope			1.5		
HK86/1/1	30-Jan-86	Tai Hang Road	-	-	up	Washout	15		
HK86/7/18	28-Jul-86	Tai Hang Road	-	-	NotNearBrilRoad	-			
HK86/9/6	05-Sep-86	Tai Hang Road	-	unknown	NotNearBrilRoad	Negligible			
HK87/4/1	06-Apr-87	Tai Hang Road	-	Soil cut slope	up	Landslide	10	4.5	
HK87/6/2	05-Jun-87	Tai Hang Road	-	Soil/rock cut slope	up	Boulders	5	10	
HK87/7/8	30-Jul-87	Tai Hang Road	-	Soil cut slope	up	Landslide	7	10	
HK87/10/1	19-Oct-87	Tai Hang Road	-	Natural slope	up	Boulders	1	8	
HK88/1/1	21-Jan-88	Tai Hang Road	-	Fill slope	down	Washout	3		
HK88/7/3	19-Jul-88	Tai Hang Road	-	Natural slope	up	Boulders	1		
HK88/7/10	21-Jul-88	Tai Hang Road	-	Soil cut slope	up	Boulders	1	10	
HK89/5/1	02-May-89	Tai Hang Road	-	Soil cut slope	up	Landslide	3		
HK89/5/5	20-May-89	Tai Hang Road	-	Soil/rock cut slope	up	Landslide	30	13	
HK89/5/6	20-May-89	Tai Hang Road	-	Fill slope	down	Landslide	20	16	
HK89/5/41	22-May-89	Tai Hang Road	-	Soil cut slope	up	Landslide	3	10	
HK89/5/40	22-May-89	Tai Hang Road	-	Soil cut slope	up	Landslide	3	6	
HK90/2/3	26-Feb-90	Tai Hang Road	-	Soil/rock cut slope	up	Rock fall	0.5	6	
HK90/6/5	19-Jun-90	Tai Hang Road	-	Soil cut slope	up	Landslide	2	9	
HK91/6/11	27-Jun-91	Tai Hang Road	-	Soil cut slope	up	Boulders	0.5	4	11SE-C/C54
HK91/9/4	20-Sep-91	Tai Hang Road	-	Soil cut slope	up	Landslide	0.5	6	11SE-C/C87
HK92/4/25	13-Apr-92	Tai Hang Road	-	Soil/rock cut slope	up	Washout	1	8	
HK92/5/13	08-May-92	Tai Hang Road	-	Soil cut slope	up	Negligible	2		11SE-C/C56
HK92/5/55	08-May-92	Tai Hang Road	-	Soil/rock cut slope	up	Boulders	4		
HK92/5/161	18-May-92	Tai Hang Road	-	Fill slope	up	Washout	1	3.5	
HK92/7/5	08-Jul-92	Tai Hang Road	-	-		Negligible			
HK93/6/27	18-Jun-93	Tai Hang Road	-	Soil cut slope	up	Landslide	10	3	11SW-D/C551
HK93/8/1	27-Jul-93	Tai Hang Road	-	Soil cut slope	up	Boulders	8	0	
HK93/8/3	13-Aug-93	Tai Hang Road	-	Soil cut slope	up	Boulders	3.4	0	
HK93/9/5	26-Sep-93	Tai Hang Road	-	Soil cut slope	up	Landslide	5	5	11SE-C/C54
HK93/9/14	27-Sep-93	Tai Hang Road	-	Natural slope	up	Others	6	0	
HK93/9/17	27-Sep-93	Tai Hang Road	-	Natural slope	up	Boulders	10	0	
HK93/10/5	15-Oct-93	Tai Hang Road	-	Retaining wall	up	Negligible	0.45		11SE-C/C66
HK94/7/6	13-Jul-94	Tai Hang Road	-	Soil cut slope	up	Washout	2		

ANNEX F INCIDENT RECORDS FOR BRIL ROADS (1984 TO 1996)

Incident No.	Incident Reported	Road	Section	Slope Type	Relative to Road	Type of Failure	Scale of Failure (m3)	Slope Height (m)	Slope No.
HK94/7/5	13-Jul-94	Tai Hang Road	-	Soil/rock cut slope	up	Landslide	0.2		
HK94/7/10	16-Jul-94	Tai Hang Road	-	Rock slope	up	Rock fall	0.5		11SE-A/C130
HK94/8/14	16-Aug-94	Tai Hang Road	-	Soil cut slope	up	Landslide	2	6	11SE-A/C114
HK95/8/8	08-Mar-95	Tai Hang Road	-	Soil/rock cut slope	up	Landslide	0.5	11	11SE-C/C63
HK95/8/7	08-Mar-95	Tai Hang Road	-	Soil cut slope	up	Washout	1	6	11SE-C/CS7
HK95/7/9	15-Jul-95	Tai Hang Road	-	Soil/rock cut slope	up	Rock fall	0.1	15	
HK95/8/18	13-Aug-95	Tai Hang Road	-	Soil cut slope	up	Washout	1		
HK95/8/69	14-Aug-95	Tai Hang Road	-	Rock slope	up	Washout			
HK95/8/99	14-Aug-95	Tai Hang Road	-	Natural slope	up	Landslide	15		
HK95/8/98	14-Aug-95	Tai Hang Road	-	Natural slope	up	Landslide	1		
HK95/8/28	08-Dec-95	Tai Hang Road	-	Soil/rock cut slope	up	Boulders	3	12	11SE-C/C63
HK96/9/4	14-Sep-96	Tai Hang Road	-	Soil cut slope	up	Landslide	30	15	11SE-A/C24
ME85/7/12	30-Jul-85	Tai Mong Tsai Road	A	Soil cut slope	up	Negligible		8	
ME93/6/15	16-Jun-93	Tai Mong Tsai Road	A	Fill slope	down	Landslide	45	0	
ME94/7/27	25-Jul-94	Tai Mong Tsai Road	A	Soil cut slope	up	Landslide	1500	16	8SW-A/C20
ME96/7/4	23-Jul-96	Tai Mong Tsai Road	A	Soil cut slope	up	Landslide	8	4	
ME87/4/3	07-Apr-87	Tai Mong Tsai Road	B	Soil cut slope	up	Landslide	2	16	
ME92/6/31a	13-Jun-92	Tai Mong Tsai Road	B	Soil cut slope	up	Landslide	3	3	
ME92/6/31b	13-Jun-92	Tai Mong Tsai Road	B	Soil cut slope	up	Landslide	15	13	
ME93/6/41	16-Jun-93	Tai Mong Tsai Road	B	Soil/rock cut slope	up	Landslide	45	18	8SW-A/C11
ME94/7/25	25-Jul-94	Tai Mong Tsai Road	B	Soil cut slope	up	Landslide	45	6	8SWA/C11
ME95/8/3	08-Mar-95	Tai Mong Tsai Road	B	Soil cut slope	up	Landslide	8	11	8SW-A/C11
ME95/9/4	09-Jul-95	Tai Mong Tsai Road	B	Soil cut slope	up	Landslide	3	7	8SW-A/C10
ME96/5/7	24-May-96	Tai Mong Tsai Road	B	Soil/rock cut slope	up	Landslide	15	19	8SW-A/C11
ME93/6/12	16-Jun-93	Tai Mong Tsai Road	C	Soil cut slope	up	Landslide	250	10	8SW-B/C22
ME95/8/2	08-Mar-95	Tai Mong Tsai Road	C	Soil cut slope	up	Washout	1	2	
ME93/6/35	17-Jun-93	Tai Mong Tsai Road	D	Soil cut slope	up	Landslide	7.2	3	
ME95/8/6	08-Mar-95	Tai Mong Tsai Road	D	Rock slope	up	Landslide	10	7	8SW-B/C26
ME87/7/30	30-Jul-87	Tai Po Road	A	Soil cut slope	up	Landslide	5	10	
ME90/4/2	24-Apr-90	Tai Po Road	A	Rock slope	down	Rock fall	20	5	
ME86/7/4	11-Jul-86	Tai Po Road	B	Fill slope	down	Landslide	50	22	
ME87/5/4	28-May-87	Tai Po Road	B	Rock slope	up	Landslide	20	20	
ME87/7/10	30-Jul-87	Tai Po Road	B	Soil cut slope	up	Landslide	10	10	
ME93/6/33	18-Jun-93	Tai Po Road	B	Soil cut slope	up	Landslide	3	8	
ME93/9/6	27-Sep-93	Tai Po Road	B	Soil cut slope	up	Landslide	3	7	7NE-C/C84
ME93/9/22	27-Sep-93	Tai Po Road	B	Soil cut slope	up	Landslide	25	7	
ME93/9/4	27-Sep-93	Tai Po Road	B	Soil cut slope	up	Landslide	80	10	
ME93/9/7	27-Sep-93	Tai Po Road	B	Soil cut slope	up	Landslide	6	8.2	7NE-C/C82
ME85/9/7	07-Sep-85	Tai Po Road	C	Soil cut slope	up	Landslide	3	12	
ME86/7/5	12-Jul-86	Tai Po Road	C	Soil/rock cut slope	up	Washout	3	8	
ME87/7/9	30-Jul-87	Tai Po Road	C	Soil cut slope	up	Negligible		9	
ME93/6/32	18-Jun-93	Tai Po Road	C	Soil/rock cut slope	up	Landslide	2	10	
ME93/9/3	27-Sep-93	Tai Po Road	C	Soil cut slope	up	Landslide	100	12	7NW-D/C1
ME94/9/5	09-Jul-94	Tai Po Road	C	Rock slope	up	Rock fall	3	9	7NW-D/C1
ME96/4/3	23-Apr-96	Tai Po Road	C	Fill slope	down	Landslide	25		7NW-B/F1
HK89/3/1		Tai Tam Road	-	Soil cut slope	down	Landslide	10		
HK89/4/1		Tai Tam Road	-	Fill slope	down		300		
HK94/4/1		Tai Tam Road	-						
HK87/4/3	06-Apr-87	Tai Tam Road	-	Soil/rock cut slope	up	Landslide	4.9		
HK87/4/8	15-Apr-87	Tai Tam Road	-	-	down	Subsidence	0		
HK87/7/5	29-Jul-87	Tai Tam Road	-	Soil/rock cut slope	up	Landslide	3.2	8	
HK91/7/1	30-Jun-91	Tai Tam Road	-	Soil cut slope	up	Landslide	0.05	5	
HK91/10/2	16-Oct-91	Tai Tam Road	-	Soil cut slope	up	Boulders	0.1		
HK91/12/1	09-Dec-91	Tai Tam Road	-	Soil cut slope	up	Landslide	6	4	15NE-A/C209
HK92/3/1	04-Mar-92	Tai Tam Road	-	Rock slope	up	Rock fall	17	5	
HK92/5/19a	08-May-92	Tai Tam Road	-	Soil cut slope	up	Landslide	10		
HK92/5/19b	10-May-92	Tai Tam Road	-	Soil cut slope	up	Landslide	10	5	11SE-DC/133
HK93/12/2	20-Dec-93	Tai Tam Road	-	Fill slope	down	Landslide	45		
HK94/7/1	08-Jul-94	Tai Tam Road	-	Soil cut slope	up	Landslide	3	10	
HK94/9/2	14-Sep-94	Tai Tam Road	-	Fill slope	up	Landslide	10		
HK95/8/3	08-Mar-95	Tai Tam Road	-	Soil/rock cut slope	up	Washout			
HK96/4/1	04-Apr-96	Tai Tam Road	-	Rock slope	up	Rock fall	1		
MW85/4/1	09-Apr-85	Tuen Mun Road	A	Soil cut slope	NotNearBrilRoad	Washout	1		
MW85/8/3	19-Aug-85	Tuen Mun Road	A	Soil cut slope	up	Landslide	5		
MW88/7/15	20-Jul-88	Tuen Mun Road	A	Fill slope	down	Landslide	10		6SE-D/F47
MW90/9/4	11-Sep-90	Tuen Mun Road	A	Rock slope	up	Rock fall	3		
MW93/6/56	18-Jun-93	Tuen Mun Road	A	-	up	-	5		
MW88/11/1	17-Nov-88	Tuen Mun Road	B	Rock slope	up	Rock fall	20	11	6SE-C/C34
MW95/9/1	09-Jan-95	Tuen Mun Road	B	Soil/rock cut slope	up	Washout	5	24	6SE-C/C54
MW85/2/1	05-Feb-85	Tuen Mun Road	C	Rock slope	up	Rock fall	0.5		
MW85/2/2	11-Feb-85	Tuen Mun Road	C	Rock slope	up	Rock fall	0.2		
MW89/5/87	01-May-89	Tuen Mun Road	C	Soil cut slope	up	Landslide	35		
MW89/7/6	12-Jul-89	Tuen Mun Road	C	Soil cut slope	down	Landslide	30	7	

ANNEX F INCIDENT RECORDS FOR BRIL ROADS (1984 TO 1996)

Incident No.	Incident Reported	Road	Section	Slope Type	Relative to Road	Type of Failure	Scale of Failure (m3)	Slope Height (m)	Slope No.
MW95/8/21	18-Aug-95	Tuen Mun Road	C	Soil/rock cut slope	up	Boulders	10	30	6SW-D/C18
MW89/5/28		Tuen Mun Road	D	Soil cut slope			120		
MW94/8/30	08-Oct-94	Tuen Mun Road	D	Rock slope	up	Rock fall	3	6	6SWC-C/13
HK87/4/9	14-Apr-87	Victoria Road	A	Rock slope	up	Boulders	0.02		
HK87/7/18	31-Jul-87	Victoria Road	A	Soil cut slope	up	Landslide	70		
HK89/5/45	21-May-89	Victoria Road	A	Soil cut slope	up	Landslide	3		
HK92/4/37	21-Apr-92	Victoria Road	A	Soil cut slope	up	Landslide	1	2	
HK92/5/73b	08-May-92	Victoria Road	A	Soil/rock cut slope	up	Boulders	1		
HK92/5/29	08-May-92	Victoria Road	A	Soil/rock cut slope	up	Landslide	2.3		
HK92/5/73a	10-May-92	Victoria Road	A	Soil cut slope	up	Landslide	4		11SW-A/C254
HK92/5/204	29-May-92	Victoria Road	A	Soil cut slope	up	Landslide	4.5	20	11SW-A/CR260
HK94/7/38	23-Jul-94	Victoria Road	A	Soil cut slope	up	Landslide	2	9	11SW-A/C287
HK94/7/39	23-Jul-94	Victoria Road	A	Soil cut slope	up	Landslide	5		11SW-A/C294
HK96/9/15	18-Sep-96	Victoria Road	A	Soil cut slope	up	Washout	1		11SW-A/C290
HK86/8/9	24-Aug-86	Victoria Road	B	Soil/rock cut slope	up	Landslide	15		
HK89/5/62	20-May-89	Victoria Road	B	Soil cut slope	NotNearBrilRoad	Landslide	20		
HK89/5/21	20-May-89	Victoria Road	B	Soil cut slope	up	Landslide	1		
HK92/5/117	08-May-92	Victoria Road	B	Rock slope	up	Rock fall	4	6	
HK92/5/115	11-May-92	Victoria Road	B	Rock slope	up	Rock fall	8.5	5	
HK92/5/114	11-May-92	Victoria Road	B	Soil/rock cut slope	up	Landslide	12.5	3	
HK92/5/116	11-May-92	Victoria Road	B	Soil/rock cut slope	up	Landslide	40	4	
HK92/6/44	19-Jun-92	Victoria Road	B	Soil/rock cut slope	up	Landslide	3	5	
HK92/7/4	09-Jul-92	Victoria Road	B	Soil/rock cut slope	up	Landslide	3	8.5	
HK94/7/22	22-Jul-94	Victoria Road	B	Soil cut slope	up	Landslide	5	4	11SW-C/C132
HK94/7/59	24-Jul-94	Victoria Road	B	unknown	up	Others	40		
HK94/7/45	25-Jul-94	Victoria Road	B	Soil cut slope	down	Subsidence	20		
HK94/8/17	16-Aug-94	Victoria Road	B	Soil/rock cut slope	up	Washout	1		11SW-C/C153
HK95/7/4	07-May-95	Victoria Road	B	Soil/rock cut slope	up	Landslide	3	4	11SW-C/CR137
HK95/8/55	13-Aug-95	Victoria Road	B	Soil cut slope	down	Landslide	10	5	
HK95/8/37	08-Dec-95	Victoria Road	B	Rock slope	up	Rock fall			11SW-C/C131
HK95/8/34	08-Dec-95	Victoria Road	B	Soil/rock cut slope	up	Rock fall	3		11SW-C/C143
HK84/8/3	11-Aug-84	Yee King Road	-	Soil cut slope	up	Landslide	3		
HK86/7/20	28-Jul-86	Yee King Road	-	-	unknown	-	0		
HK86/7/19	28-Jul-86	Yee King Road	-	-	unknown	-	0		
HK91/6/2	10-Jun-91	Yee King Road	-	Soil/rock cut slope	down	Boulders	0.25		
HK91/6/10	25-Jun-91	Yee King Road	-	Natural slope	up	Boulders	0.5	7	11SE-A/C214
HK91/10/3	16-Oct-91	Yee King Road	-	Rock slope	up	Rock fall	1.8	6	
HK92/4/21	11-Apr-92	Yee King Road	-	Soil cut slope	up	Boulders	20	8	
HK92/5/21	08-May-92	Yee King Road	-	Soil/rock cut slope	up	Landslide	10	5	11SE-A/C214
HK92/5/9	08-May-92	Yee King Road	-	Rock slope	up	Boulders	1	5	11SE-A/C212
HK95/8/29	14-Aug-95	Yee King Road	-	Soil/rock cut slope	up	Boulders	5	6	11SE-A/C212

To arrive at the 350 incidents which were analysed, the following records from the above 406 were excluded:

- where 'incident reported' is blank; or
- where 'scale of failure' is blank; or
- where 'type of failure' is '-' or 'negligible' or 'others' or 'subsidence'.

Annex G

Grouping of Incidents on BRIL Roads Based on Simultaneous Occurrence

Annex G

Incident Records for BRIL Roads 1984 to 96 - Grouping Based on Simultaneous Occurrence

Location	HK 16	HK 17	HK 18	HK 19	HK 1	HK 2	HK 3	HK 4	HK 5	HK 6	HK 7	HK 8	HK 9	HK 10	HK 11	HK 12	HK 13	HK 14	HK 15	HK 20	HK 21	ME 22	ME 23	ME 24	ME 25	ME 26	ME 27	ME 28	ME 29	ME 30	MW 41	MW 51	MW 52	MW 53	MW 54	MW 35	MW 36	MW 37	MW 38	MW 39	MW 40	
ROAD	Cape Collinson Road	Cape Collinson Road	Chung Hom Kok Road	Island Road	Kennedy Road	Magazine Gap Road	Nam Fung Road	Peak Road	Peak Road	Pok Kilam Road	Pok Kilam Road	Repulse Bay Road	Repulse Bay Road	Shubbs Road	Shubbs Road	Tai Hang Road	Tai Tam Road	Victoria Road	Victoria Road	Yee Kng Road	Clear Water Bay Road	Kwun Tong Road	Sai Sha Road	Tai Mong Tsai Road	Tai Mong Tsai Road	Tai Mong Tsai Road	Tai Mong Tsai Road	Tai Po Road	Tai Po Road	Tai Po Road	Castle Peak Road	Route Twisk	Route Twisk	Route Twisk	South Lantau Road	South Lantau Road	South Lantau Road	Tuen Mun Road	Tuen Mun Road	Tuen Mun Road	Tuen Mun Road	TOTAL
SECT	A	B	-	-	-	-	-	A	B	A	B	A	B	A	B	-	-	A	B	-	-	-	-	A	B	C	D	A	B	C	-	A	B	C	A	B	C	A	B	C	D	
01/04/96 to 04/04/96						1																																				2
01/05/89 to 04/05/89																1		1			2												1									5
01/08/89																							1																			1
03/08/94							1																																			1
04/03/92																	1																									1
04/04/87																																1										1
04/06/85																							1																			1
05/02/85																																										1
05/06/87																1																										1
05/09/86																																1										1
05/11/93 to 15/11/93																							3												3		2	2					10
06/02/93													1																														1
06/04/87 to 07/04/87																1	1						1		1																		4
06/04/92 to 13/04/92		1	2	1			1			1					1	1				1															1								11
06/04/93													1																														1
06/09/85													1																														1
06/09/95						1																																				1
06/10/95					1																																					1
07/05/95																			1																								1
07/09/85																														1												1
07/09/93																							1																				1
08/01/92	1																														1												1
08/01/94																					1																						1
08/03/95									1							2					1				1		1	1															7
08/04/95																								1																			1
08/05/92 to 12/05/92	5			1	1	2			1	2	3	2		1		1	2	3	4	2			4			2					1			2								32
08/06/92 to 16/06/92				1	1							3																			1			1								13
08/07/94																	1														2											3
08/08/94																															1											1
08/10/94																															1										1	2
08/12/95																1				1																							2
09/01/95															1																									1			2
09/03/92					1																																					1
09/04/85 to 10/04/85																							1																1				2
09/07/92																			1																								1
09/07/94																						1									1												2
09/07/95																									1																		1
09/12/91																	1																										1
10/06/91 to 12/06/91			1														1																										2
10/06/95							1																																			1
10/08/94													1																														1
11/02/85																																										1	1
11/05/86																							1																				1
11/05/93																																			6								6
11/06/90																					1																						1
11/07/86 to 12/07/88							1																						1	1		2										5
11/08/84																				1																							1
11/09/90																																			1				1				2
12/07/89																																									1		1
12/07/94 to 16/07/94			1		1											3																											5
13/03/96																							1																				1
13/04/96																																1											1
13/08/93																1																											1
13/08/95 to 18/08/95			1				1		1		1		3			3				1	1		1	1							1					1				1			17
13/08/96				1																																						1
14/04/87																		1																										1
14/07/95																								1																				1
14/09/94																	1																											1
14/09/96																1																												1
14/10/93				1																																							1
15/03/93							1																																				1
15/05/92 to 19/05/92								1			1		2	2		1																											7
15/07/95																1																												1
16/05/87															1																													1
16/06/93 to 22/06/93	2	1	1						1				1			1							1	1	1	1					2			1									17
16/08/91 to 17/08/91												2	1																															3

Incident Records for BRIL Roads 1984 to 96 - Grouping Based on Simultaneous Occurrence

Location		HK	HK	HK	HK	HK	HK	HK	HK	HK	HK	HK	HK	HK	HK	HK	HK	HK	HK	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	
ROAD		A Cape Collinson Road	B Cape Collinson Road	- Chung Hom Kok Road	- Island Road	Kennedy Road	- Magazine Gap Road	- Nam Fung Road	A Peak Road	B Peak Road	A Pokfulam Road	B Pokfulam Road	A Repulse Bay Road	B Repulse Bay Road	A Stubbs Road	B Stubbs Road	Tai Hang Road	- Tai Tam Road	A Victoria Road	B Victoria Road	- Yee Kng Road	- Clear Water Bay Road	- Kwun Tong Road	- Sai Sha Road	A Tai Mong Tsai Road	B Tai Mong Tsai Road	C Tai Mong Tsai Road	D Tai Mong Tsai Road	A Tai Po Road	B Tai Po Road	C Tai Po Road	- Castle Peak Road	A Route Twisk	B Route Twisk	C Route Twisk	A South Lantau Road	B South Lantau Road	C South Lantau Road	A Tuen Mun Road	B Tuen Mun Road	C Tuen Mun Road	D Tuen Mun Road	TOTAL
SECT		16	17	18	19	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	20	21	22	23	24	25	26	27	28	29	30	41	31	32	33	34	35	36	37	38	39	40	
16/08/94 to 20/08/94							1										1			1					1																		4
16/10/91																		1			1																					2
16/12/93 to 20/12/93						1												1																								2
17/09/93																															1											1
17/09/96																															1											1
17/11/88																																							1			1
17/11/92													1																													1
18/06/96																															1											1
18/09/96																				1																							1
19/06/90																	1																										1
19/06/92						1														1																							2
19/07/88 to 22/07/88							1										2															1		2	1				1				8
19/08/85																																							1				1
19/10/87																	1																										1
19/10/92													1																													1
20/05/89 to 24/05/89							1				1	1					4			1	2											6	4	1								21
20/05/94													1																													1
20/06/94 to 21/06/94			1																					1											1							3
20/07/92																																1										1
20/09/90													1																													1
20/09/91																	1																										1
21/01/88																	1																										1
21/01/92																																										1
21/04/86																																			1							1
21/04/92																			1																								1
22/07/94 to 27/07/94				1			2	2				1		2						2	1		1	1		1	1					4			1		1					21
23/04/96																															1											1
23/06/92																																				2						2
23/07/90													1																													1
23/07/96																									1																	1
23/08/95																						1																					1
23/09/93 to 29/09/93		1					2	2					4	2			2						1							4	1		2			1						22
24/04/90																													1													1
24/05/96																										1																	1
24/08/86																				1																							1
24/08/95									1																																		1
25/06/91 to 30/06/91																	1	1			1																							3
25/06/93																																1											1
26/02/90																	1																											1
26/03/96											1																																1
26/05/93					1																																					1
26/08/85 to 29/08/85		1						1			1					1																											4
27/04/92							1																																				1
27/07/93																	1																											1
28/05/87																														1													1
28/05/92 to 29/05/92										1										1																								2
28/07/87 to 31/07/87								1					2				1	1	1					2					1	1		1					2					13
29/08/94		1																																									1
29/11/95											1																																1
30/01/86																	1																											1
30/03/90															1																													1
30/05/84													1															1																1
Total of Incidents		11	3	7	6	13	17	2	4	6	7	3	30	6	4	2	37	12	11	14	8	7	3	13	3	8	2	2	2	8	6	32	13	4	4	17	6	5	4	2	5	1	350

Annex H

Assessment of Consequences of Landslides

Assessment of Consequence of Landslides

H.N.Wong
K.K.S. Ho
Y.C. Chan
Geotechnical Engineering Office, Hong Kong Government

ABSTRACT: Consequence assessment is an important but less developed component of quantitative landslide risk assessment. This paper examines the factors affecting landslide consequence, discusses usual methods for assessing consequence scenarios and reviews tools for quantifying the likelihood of occurrence of the scenarios. It reviews examples of the methods and describes the generalised consequence model developed in Hong Kong to assess landslide consequence. The paper then illustrates the application of the model for both global and site-specific risk assessment, including the construction of an example F-N curve.

1 INTRODUCTION

Consideration of landslide consequences is important in slope assessment and forms one of the fundamental components in the quantification of landslide risk. Traditionally, the main emphasis has often been placed on the evaluation of the likelihood of slope failure. The nature of damage that can be caused by landslides is complex and diffuse because of the many interacting factors that are involved and it may involve loss of life and injury or economic loss. A rational assessment of the consequences of a slope failure, including the consideration of potential travel distance of debris, spatial and temporal distribution of the vulnerable population, potential loss of life, etc. is rarely carried out, and landslide consequences are commonly gauged only on the basis of engineering judgement.

Many practical slope problems are best tackled by adopting a risk-based approach. These may include the selection of appropriate design standards (e.g. factors of safety or probability of failure), quantitative risk assessment (QRA), determination of priority ranking of substandard slopes for retrofitting, delineation of unsafe landslide zones, etc.

Advances have been made in addressing salient aspects of consequence assessments. For instance, simplified analytical approaches have been developed to predict the travel distance of landslide debris and computer algorithms have been developed to simulate boulder trajectories. However, in comparison with the fairly advanced methodology that has been developed and applied in the QRA field of the chemical and hazardous process industries, there seems to be, on the whole, a lack of a systematic and practicable framework for assessing the factors that affect the quantification of landslide consequences.

This paper provides an overview of the factors that need to be considered in a landslide consequence assessment, and the approaches that could be adopted in quantifying consequences. The different approaches are classified and examples are given to illustrate how they may be applied in practice.

A new consequence model for QRA of landslides is described in this paper. The derivation of the model is explained and its application is illustrated by means of a selection of examples.

The *event tree* approach has been applied to landslide QRA. This approach is generally favoured by risk analysts as they are more accustomed to applying such techniques in formal QRA. It will be useful for very complex landslides or hazards of little prior knowledge, or very important facilities are at stake, generally for site-specific assessments.

The collective *consequence model* suggested by Leone et al (1996) is flexible and can cater for a wide range of situations. Not enough is known from the literature to appreciate the full details of the scheme and the adequacy of scenario components considered. For example, there may be scope for a more refined classification of the different types of landslide hazards, particularly those that can result in different debris mobility. The scale of the failure and the downslope gradient can also significantly affect the travel distance of debris. The range of damage processes considered is extensive but some of the input data may be difficult to obtain directly from historical data (e.g. air blow effects and lateral pressure from debris). Also, the way in which debris runout of each landslide hazard is taken into account is not clear.

Bunce et al (1995) demonstrates the power of a simplified, specific consequence model in experienced hands. The specific consequence model presented is neat and rational although refinement is probably desirable by taking into account the size distribution of the rock fragments involved.

The *influence diagram approach* described by Roberds & Ho (1997) includes the use of analytical tools to explicitly incorporate probabilistic assessment of uncertainties in the key factors considered in the consequence assessment.

7 DEVELOPMENT OF A CONSEQUENCE MODEL

7.1 Basic framework

A rational framework for landslide consequence assessment with respect to different facilities has been developed that takes the key factors into account. For the purposes of this paper, it will be referred to as the generalised consequence model.

In this approach, the consequence of a given hazard (that corresponds to a specific mechanism and scale of failure for a certain feature), expressed in terms of PLL, is a function of the following key parameters :

$$\begin{array}{l}\text{Expected no. of}\\ \text{landslide fatalities}\\ \text{for a given facility}\end{array} = f\left\{\begin{array}{c}\text{Expected no. of fatalities for}\\ \text{facility directly affected actual}\\ \text{by the reference landslide}\end{array}\right\}\left\{\begin{array}{c}\text{Scale of}\\ \text{failure}\end{array}\right\}\left\{\begin{array}{c}\text{Vulnerability}\\ \text{factor}\end{array}\right\}$$

The concept of the generalised consequence model involves the consideration of the consequence of a reference landslide of a standard size directly affecting a given type of facility located at the worst possible spot (i.e. right at the toe of a slope or near the edge of the slope crest) assuming occupation of the facility under average conditions. The consequence is then scaled with respect to the size of the actual failure relative to that of the reference landslide and the vulnerability of the facility given its actual location relative to the influence zone of the landslide.

The first term relates to the type of facility that is directly affected by a reference landslide (taken to be a 10 m-wide failure of 50 m^3 in volume). The expected numbers of fatalities for the different facilities directly affected by the reference landslide are shown in Table 3.

The size of the actual failure serves to scale up, or down, the consequence with respect to that expected of the reference landslide. The scaling is based on the ratio of the width of the actual landslide to the width of the reference landslide, taking due account of the width of the affected facility (e.g. consideration of spatial impact). For instance, if a given landslide measures 40 m in width, the scaling factor will be 4 for a road in front of the landslide. On the other hand, for the same landslide, if the affected facility is a building that measures only 20 m, the appropriate scaling factor as far as consequence in respect of the building is concerned becomes 2 even though the landslide itself measures 40 m.

Table 3 - Grouping of Facilities and Expected Number of Fatalities Used for Hong Kong Study

Group No.	Facilities	Expected No. of Fatality
1	(a) Buildings with a high density of occupation or heavily used - residential building, commercial office, store and shop, hotel, factory, school, power station, ambulance depot, market, hospital/polyclinic/clinic, welfare centre.	3
	(b) Others - bus shelter, railway platform and other sheltered public waiting area - cottage, licensed and squatter area - dangerous goods storage site (e.g. petrol station) - road with very heavy vehicular or pedestrian traffic density	3
2	(a) Buildings with a low density of occupation or lightly used - built-up area (e.g. indoor car park, building within barracks, abattoir, incinerator, indoor games's sport hall, sewage treatment plant, refuse transfer station, church, temple, monastery, civic centre, manned substation)	2
	(b) Others - road with heavy vehicular or pedestrian traffic density - major infrastructure facility (e.g. railway, tramway, flyover, subway, tunnel portal, service reservoir) - construction sites	1
3	Roads and Open Space - densely-used open space and public waiting area (e.g. densely-used playground, open car park, densely-used sitting out area, horticulture garden) - quarry - road with moderate vehicular or pedestrian traffic density	0.25
4	Roads and Open Space - lightly-used open-aired recreation area (e.g. district open space, lightly-used playground, cemetery, columbarium) - non-dangerous goods storage site - road with low vehicular or pedestrian traffic density	0.03
5	Roads and Open Space - remote area (e.g. country park, undeveloped green belt, abandoned quarry) - road with very low vehicular or pedestrian traffic density	0.001

Notes :
(1) To account for the different types of building structure with different detailing of window and other perforations etc, a multiple fatality factor ranging from 1 to 5 is considered appropriate for Group No. 1(a) facilities to account for the possibility that some incidents may result in a disproportionately larger number of fatalities than that envisaged. For global QRA, an average value of 3 is taken for the multiple fatality factor.
(2) For incidents that involve the collapse of a building, it is assumed that the expected number of fatalities is 100.

The vulnerability factor as defined above is in effect the probability of loss of life, i.e. v_l in equation (1). Its value is influenced by a number of factors including :

(a) the nature, proximity and spatial distribution of the facilities,
(b) mobility of debris and likely extent of the upslope influence zone,
(c) scale of failure, and
(d) degree of protection offered to persons by the facility.

The generalised consequence model can also consider the vulnerability to building collapse in the event of impact by a large-scale landslide having regard to factors (a) to (c) above.

It should be noted that the above framework is for consequence assessment with respect to fatalities. The framework can however be extended to consider injuries, economic losses and other social disruptions.

7.2 Expected number of fatalities for the reference landslide

The generalised consequence model involves assessing the expected number of fatalities for facilities directly affected by a reference landslide. The reference landslide has been taken to be a 10 m-wide failure of 50 m^3 in volume, which is a typical "major" failure for conditions pertaining in Hong Kong. Other suitable definitions of the standard landslide may be taken as appropriate for local conditions. It is important, however, that the assessment of the expected number of fatalities for the reference landslide is compatible with the specific definition of the reference landslide.

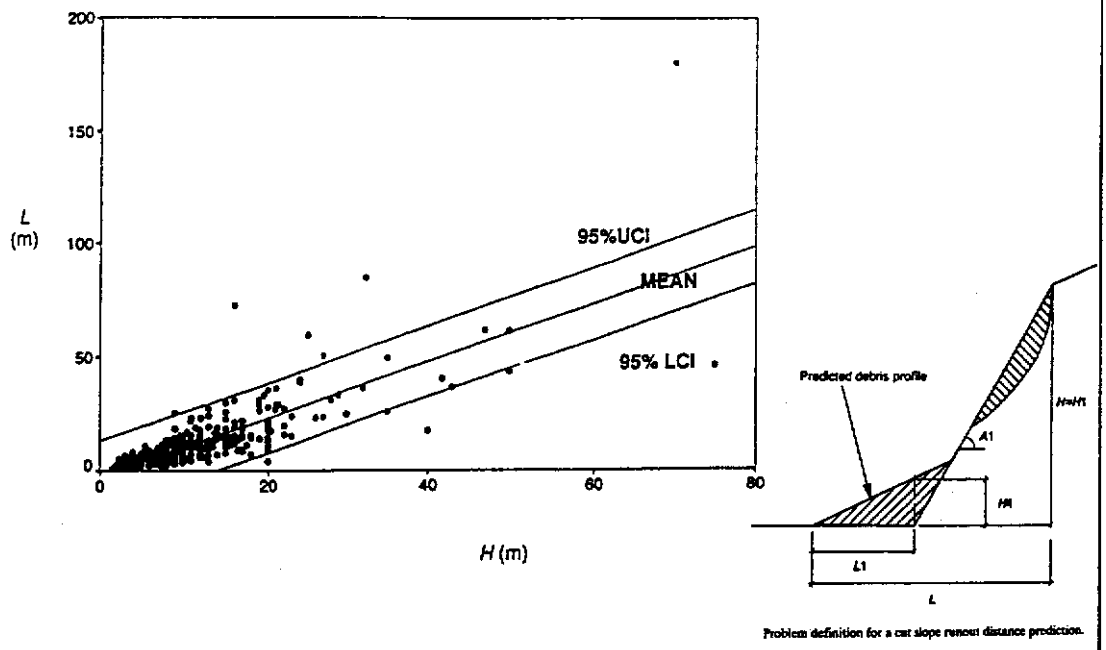
In assessing the expected number of fatalities for the reference landslide, the type of the facility, density of occupation and degree of usage and the vulnerability to death under direct impact are taken into consideration. The expected number of fatalities for different road types with specific traffic flow characteristics are assessed explicitly to classify roads using a 5-tier classification system. The way this has been done will be described in a later section.

Other types of facility are aligned with respect to the respective road classes in terms of the expected number of fatalities by means of expert judgement (Table 3). The main factors that influence the judgement are the nature of the facility (i.e. likely population density and degree of protection) and its likely degree of occupation at the time of a landslide (i.e. temporal presence).

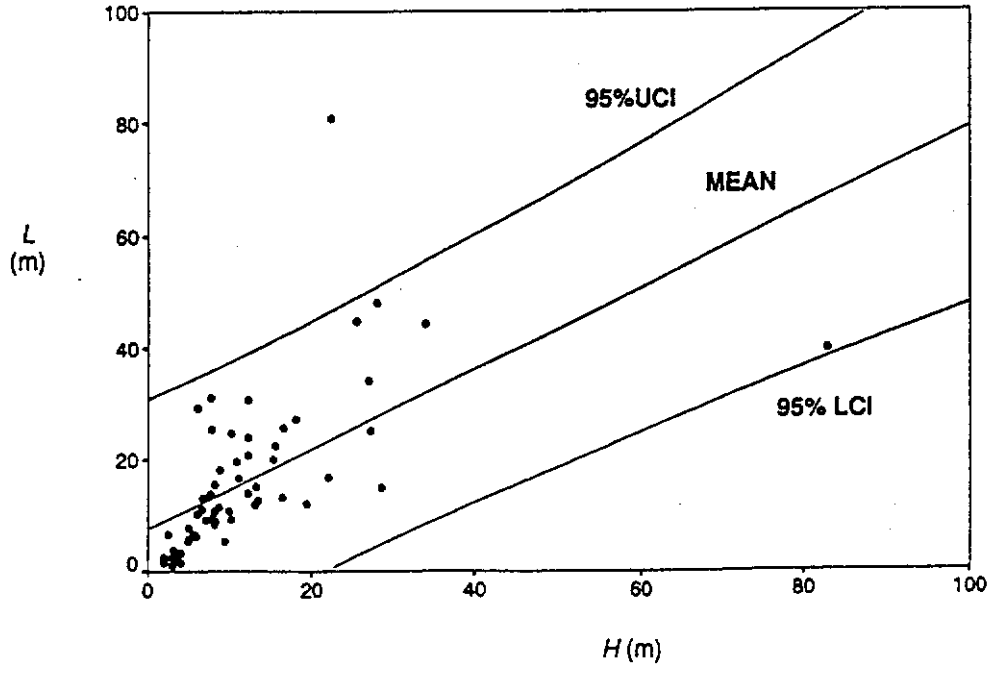
7.3 Travel distance of landslide debris

The assessment of the travel of debris from landslides of different mechanisms and scales in Hong Kong is discussed by Wong & Ho (1996). The landslides involved weathered volcanics and granite as well as colluvial deposits which originated from these materials. Based on a systematic study of reliable data obtained from field inspections and a critical review of other selected case histories with sufficiently reliable information, the following findings were reported :

(a) the travel of the landslide debris can be profoundly influenced by the mechanism of failure (viz. typical rain-induced 'sliding' failure, liquefaction of loose fill and wash-out by convergent surface water flow),
(b) the travel angle (defined as the inclination of the line joining the tip of the debris to the crest of the landslide scarp) for typical rain-induced landslides involving small to medium-scale failure (viz. landslide volume <2000 m^3), generally ranges from 30° to 40°,
(c) for landslides involving liquefaction of loose fill or wash-out action, the apparent angle of friction reduces to 15° to 30°,
(d) the apparent angle of friction reduces with increase in landslide volume, irrespective of the mode of failure, and
(e) the travel of landslide debris may be affected significantly by the gradient of the downslope topography; the use of apparent angle of friction will better account for such effects than L-H relationships (Figure 4).



(a) Correlation between H and L for Hong Kong Cuts, R^2 = 0.64



(b) Correlation between H and L for Hong Kong Fills, R^2 = 0.36

Figure 4 - Empirical Correlations for Travel Distance of Debris
(Extracted from Finlay et al, 1997)

More data have been compiled since the completion of the above pilot work and the available information is summarised in Figure 5.

For a given slope type, the failure (even for a specific mechanism and failure volume) can result in a range of debris runout distance because of differences in geomorphology, slope-forming materials, etc. Given the relationship between debris travel distance and failure volume for different failure mechanisms, the worst credible value for apparent angles of friction may be assessed. It should be noted that the smaller the apparent angle of friction, the more mobile is the debris.

For realistic vulnerability assessments, it is not sufficient to make reference only to the worst credible limit of debris runout. Instead, the distribution (or frequency of occurrence) of landslides having different travels needs to be taken into account. For practical purposes, the mobility of the debris is taken to be reflected by the travel angle, α, which is defined as the inclination of the line joining the far end of the debris to the crest of the slope. For shallow failures, α is practically the same as the apparent angle of friction. The use of travel angle as defined in this way simplifies the assessment procedure.

Given the information on the type and spatial location of the affected facility, the degree of protection offered to person and debris travel, the likely probability of death or vulnerability may be assessed systematically using a risk-based framework.

The extent of the retrogression is determined empirically from the database of more than 4000 landslides.

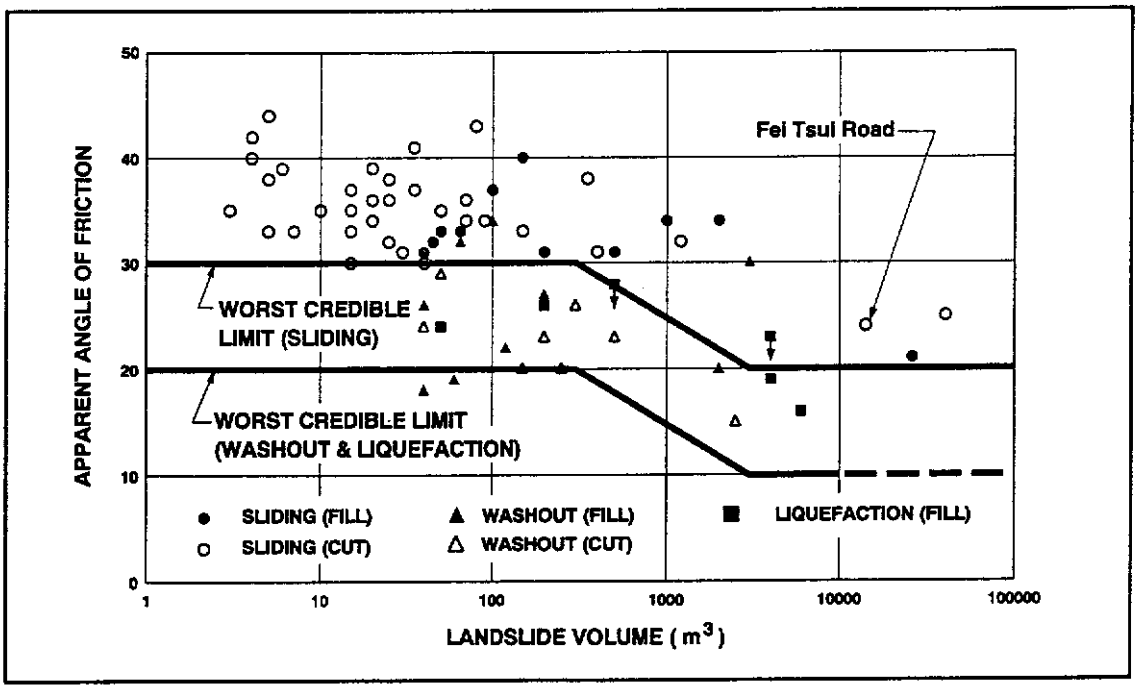


Figure 5 - Data on Debris Mobility for Different Mechanisms and Scales of Landslides in Hong Kong

7.4 Derivation of vulnerability factors

Factors to be considered in assessing vulnerability is explained above. The derivation of the suggested vulnerability factors is best explained by means of an example.

The following example illustrates the derivation of vulnerability factors for toe facilities threatened by potential landslides arising from 'sliding' failure of a cut slope with a landslide volume ranging from 500 m^3 to 2000 m^3.

For the above landslide hazard, the limit of debris travel is taken to correspond to an α value ranging between 25° and 40°. The assumed distribution, based on extrapolation of the presently available database, is as follows :

(a) 5% of cases with $\alpha = 27.5° (\pm 2.5°)$,
(b) 60% of cases with $\alpha = 32.5° (\pm 2.5°)$, and
(c) 35% of cases with $\alpha = 37.5° (\pm 2.5°)$.

Thus, based on the available database and previous experience, it is judged that in the majority of the cases, a landslide with the above characteristics in terms of scale and failure mechanism is most likely to result in debris deposition with α of between 30° and 35° and only in rare cases will the debris be expected to be so mobile as to have a runout distance corresponding to an α of between 25° and 30°.

The shadow angle made by the facility with respect to slope crest (i.e. the angle of the line that joins the toe facility to slope crest) defines its proximity. The nature of the affected facility (e.g. building or road) will affect the degree of protection.

The spatial location of the facility also needs to be considered. For toe facilities, debris runout is relevant whereas for crest facilities, the influence zone is important. In the case of buildings located on the slope crest, the nature of the foundation (e.g. on piles or footings) is also taken into account because this will affect the degree of damage that can be caused and hence the vulnerability to loss of life.

Given a particular facility type and the probable depth of debris at the facility location, the appropriate vulnerability factors (i.e. probability of death) may be assessed systematically by expert judgement. This framework allows the important factors to be considered systematically and hence greatly facilitates more consistent judgement to be made of the vulnerability factors and how they relate to one other in a relative sense.

For example, in the case of an α of 25°, the average probability of death for a road user located at a shadow angle of between 25° and 30° is judged to be 20% given that the affected facility is near the limit of debris runout. On the other hand, if the road user is located at a shadow angle of between 30° and 35° (i.e. closer to the slope), the corresponding probability is judged to be 60%. In making the above judgement, due regard is given to the likely depth of debris at the location of the facility. The likely depth of debris at a given location may be gauged relatively easily given the information on the location of the facility, scale of failure and the travel distance of the debris.

The corresponding vulnerability factors for people inside a building are taken as 5% and 20% respectively, having regard to the protection afforded by the structure whereupon some of the debris may enter the building via openings such as windows. It should be noted that the above assessment relates to average values. In practice, there may be a range of vulnerability factors depending on the details of the structure and the precise location of the people, e.g. different vulnerability factors may be applicable for people on different areas of the ground floor and for people on different floors. The framework may be refined but it should be noted that much more data will be required and more guesswork in one way or another will be unavoidable if an unnecessarily complicated framework is used.

The different vulnerability factors assessed for the above specific landslide hazard are summarised in Table 4. It should be noted that the vulnerability values given in this Table have duly taken into consideration the potential uncertainties associated with the runout distance of debris.

In the present example, for a person travelling on a certain road lane that is located at the slope toe with a shadow angle of between 35° and 40°, the corresponding vulnerability factor is given by the following :

$$(0.95 \times 0.05) + (0.6 \times 0.6) + (0.2 \times 0.35) \approx 0.48$$

This means that should the above landslide occur, a given person at that location will have a 48% chance of dying, or that 48% of the population density present at that location is expected to perish.

Table 4 - Example Calculation of Vulnerability Factors Used for Hong Kong Study

Likely Probability of Death for Different Ranges of Shadow Angle (β) of Affected Person with Respect to Slope Crest								Frequency of occurrence of landslides (of a given slope type) having different ranges of debris travel distances measured in terms of debris mobility angle, α
>60°	55° - 60°	50° - 55°	45° - 50°	40° - 45°	35° - 40°	30° - 35°	25° - 30°	
0.95 (0.95)	0.95 (0.95)	0.95 (0.95)	0.95 (0.95)	0.95 (0.95)	0.60 (0.95)	0.20 (0.60)	0.05 (0.20)	5% of cases with α = 27.5° (±2.5°)
0.95 (0.95)	0.95 (0.95)	0.95 (0.95)	0.95 (0.95)	0.60 (0.95)	0.20 (0.60)	0.05 (0.20)		60% of cases with α = 32.5° (±2.5°)
0.95 (0.95)	0.95 (0.95)	0.95 (0.95)	0.60 (0.95)	0.20 (0.60)	0.05 (0.20)			35% of cases with α = 37.5° (±2.5°)

0.95 (0.95)	0.95 (0.95)	0.95 (0.95)	0.83 (0.95)	0.48 (0.83)	0.17 (0.48)	0.04 (0.15)	0.0025 (0.01)	Vulnerability Factor Calculated

Legend :

0.2	← likely probability of death for a person in a building given the impact of the landslide, at a given range of α and β.
(0.6)	← likely probability of death for a person on a road given the impact of the landslide, at a given range of α and β.

Note : The above tables are applicable for toe facilities of a cut slope with an estimated failure volume ranging from 500m³ to 2000 m³. The figures in the top table are based on judgement, having regard to the type of facility, its proximity to the feature and whether it is a toe or crest feature, its location in relation to the reach of the debris (hence accounting for the likely depth of debris at the affected facility) and the degree of protection afforded to persons by the facility.

The corresponding vulnerability of a person inside a building at the same location in front of the slope is given by the following :

$$(0.6 \times 0.05) + (0.2 \times 0.6) + (0.05 \times 0.35) \approx 0.17$$

The above illustrates the effect of the different degree of protection afforded to persons by different types of facility. In the above example, the vulnerability of a person within a building to loss of life given the above landslide is more than 50% less than a person on a road at the same location.

This example corresponds to one of the hazards for the slope. In practical cases, different tables need to be prepared for the crest and toe facilities for each of the landslide hazards considered in the present hazard model. The degree of refinement is related to the complexity of the hazard model adopted.

7.5 Discussion

Although the consequence framework as illustrated in this paper has been developed for Hong Kong conditions, the basic concepts are, in principle, applicable to different conditions in other countries and the framework can be extended as appropriate.

In evaluating the results of consequence assessments using the proposed framework, it is instructive to consider whether the assessment errs on the conservative side or not. The following simplifying assumptions made in the generalised consequence model in its present format are known to be conservative :

(a) The travel distance of landslide debris has been assessed assuming the failure involves the slope crest (this represents the worst case; in reality, some landslides are partial failures that involve the slope body below the crest with a smaller influence zone on toe facilities and little effect on crest facilities and the available data in Hong Kong suggests that some 70% of the failures involve the portion of the slope near its crest.

(b) The mobility angle of the debris is calculated with respect to the crest of the slope rather than the crest of the failure scarp (as in the case of apparent friction angle) - this is a conservative assumption, particularly for large-scale or deep failures, because the travel distance will have been over-estimated. However, it is an expedient assumption as the influence zone is more readily defined with respect to the slope crest without the need to predict the depth of failure. In Hong Kong, the vast majority of landslides involve shallow failures and the degree of conservatism implied by the above simplifying assumption is not excessive.

Although the somewhat conservative assumptions will result in a slight overestimate of the consequence and hence the risk, it is considered that the relative ratio and distribution of the total risk is unlikely to be greatly affected.

8 LANDSLIDE CONSEQUENCE CLASSIFICATION SYSTEM FOR ROADS

Prior to the development of the generalised consequence model as described previously, the authors took part in formulating a landslide consequence classification system for roads based on quantified risk considerations. This classification system was further extended in the course of developing the generalised landslide consequence model as described above. A brief description of the salient aspects of the consequence classification system for roads is given below.

Before formulating the landslide consequence classification system for roads, reference was made to the available historical landslide data to see if a simple system can be derived. One of the main observations is that the limited data available are very sensitive to "near-misses" and other factors that affect the casualty figures, such as changes in traffic density over the years. In view of this, it was concluded that historical data cannot be relied upon and recourse needs to be made to a more analytical approach based on a risk framework.

The method for assessing the consequence of landslides affecting roads involves the consideration of the relative likelihood of fatalities with respect to a 5-tier facility grouping system. The expected number of fatalities given a reference landslide is assessed with due account taken of the temporal presence of population within the influence zone. The consideration of a reference landslide allows a realistic comparison of the different types of road with different degree of usage in terms of landslide consequence.

The expected number of fatalities (i.e. PLL) in the event of a reference landslide is given by the following equation :

$$N = \Sigma \frac{W * F * P * E * A}{v} \quad \ldots\ldots\ldots\ldots \quad (3)$$

where W = width of landslide plus adjustment for effective stopping distance
F = frequency of passing passengers (taken to be the product of average daily traffic and average number of people inside a vehicle)
P = probability of death due to being caught in the reference landslide
E = extent of the landslide (i.e. number of lanes affected)
A = adjustment factor for actual proportion of normal road usage at the time of a landslide
v = speed of vehicles

In considering the influence zone of the reference landslide, the extent of the reference landslide is taken to affect up to three road lanes and that the effective width of the landslide is increased to allow for the sight distance and stopping distance of vehicles. Thus, the area of the influence zone is defined.

In assessing the temporal presence of population at the time of occurrence of the reference landslide, the frequency of the passing passengers being within the influence zone is considered having regard to :

(a) average traffic flow (in Hong Kong, information on the annual average daily traffic, AADT, is readily available; alternatively, traffic survey may be carried out to determine the frequency of road usage at different times),
(b) the split of different modes of transport (i.e. relative distribution of cars and buses),
(c) average number of people in a vehicle, and
(d) average speed of the vehicles.

An adjustment is also made for the likely proportion of traffic density relative to normal road usage at the time of a landslide. This accounts for the fact that the majority of landslides take place at times of severe rainfall during which time the overall degree of usage of the roads may be less than average.

Suitable assumptions also need to be made regarding the likely probability of death for people in a vehicle located on different road lanes. In doing so, reference is made to historical information. Suitable allowance has also been made for the additional risk arising from users of footpaths adjacent to roads.

The final format of the consequence classification system relates the type of road in terms of facility group number to the actual average traffic conditions, taking into account the degree of saturation relative to the design capacity of the road and the number of lanes of a road. Each of the facility group has a corresponding expected number of fatalities for the reference landslide, as calculated using equation (3).

9 APPLICATION OF GENERALISED CONSEQUENCE MODEL TO GLOBAL QRA

The generalised consequence model as described above has been applied to a pilot territory-wide QRA of man-made slope features (i.e. slopes and retaining walls) that were constructed prior to the implementation of geotechnical control by the Hong Kong Government. These slope features, which are potentially substandard, amount to a total of about 35,000. Some salient aspects of the approach taken and the key findings are described below in order to put the application of the generalised consequence model into context.

In the global QRA, the landslide hazard model adopted (Figure 6) has the following components :

(a) *Types of Feature* - namely, cut slope, fill slope and retaining wall (Figure 7).
(b) *Mechanisms of failure* - failure may take place via different mechanisms, each posing a differing degree of hazard. In fill slopes, for instance, the landslide records show that the dominant failure mechanisms are sliding, 'wash out' (viz. failure induced by the scouring action of running surface water) and liquefaction with the relative likelihood in the ratio of 45% : 45% : 10%.
(c) *Size of failure* - for a given failure mechanism, the hazard may be classified according to the size of failure, taking into account the height of the slope. For example, in the case of fill slopes, the following classification has been adopted : $<20\ m^3$, $20\ m^3$ - $50m^3$, $50m^3$ - $200m^3$, $200m^3$ - $1000m^3$ and $>1000m^3$. In addition, the possibility of knock-on effects, such as scenarios involving escalation of failure consequences (e.g. small sliding failure developing into a major 'wash out'), have also been considered.

Thus, a multitude of landslide hazards are considered (Figure 8). For instance, a fill slope that is disposed to liquefaction failure with a volume in the range $200\ m^3$ to $1000\ m^3$ will constitute a specific hazard, whilst a cut slope disposed to typical rain-induced sliding failure with a volume in the range of $50\ m^3$ to $200\ m^3$ is another hazard. Each hazard will have its corresponding frequency of occurrence and consequence. The likely maximum size of failure is related to the height of the slope feature. In other words, the hazards posed by some of the larger-scale failures are not credible for a relatively small slope and hence are not considered for such slopes.

Each hazard has its corresponding consequence, taking into account the characteristics of the

Annex I

Estimation of Failure Volume Distribution

Guide to Estimation of Failure Volume Distribution

General

The data preceding those for Repulse Bay Road A are from the SAR-wide study [1]. This serves as a guide for deriving road specific values.

The first column on slope heights (ie the 2nd column overall) is based on map data (ie, the 1977/78 Slope Catalogue). Therefore entries in this column are given under the row sub-heading 'map data'. The second column on slope heights (ie the 9th column overall) is based on field visits undertaken by the Consultants to selected roads.

The entries in the 8th column overall (ie Probability Sum) is the slope height distribution, estimated from volume distribution.

The entries in the last column overall (Total Sum), gives the size of the distribution. For ex., for Repulse Bay Road A, the total sum 30 under 'map data' refers to the number of slopes identified in maps whose height distribution is given in the 2nd column. The total sum 22 under 'all incidents data' refers to the total number of incidents (of upslope failures) reported and whose volume distribution is given. The total sum 16 under 'incidents with height data' refers to the number of incidents for which both failure volume and slope height are reported.

Approach

The approach for deriving the volume distribution is as follows:

- where data was available from the 1977/78 Slope Catalogue, the distribution of slope height ranges were estimated. Based on the slope height distribution (for the given road), the volume distribution (for the given road) is estimated using SAR-wide volume distribution data;

  For ex., for Repulse Bay Road A, proportion of slopes with height <10m is 0.7 based on map data. The percentage of failures < 20 m^3 from slopes of height <10m is 81.5% based on the SAR-wide distribution. Therefore the proportion of failures < 20m^3 for Repulse Bay Road A is 0.7 x 0.815 = 0.571.

- considering all incidents of upslope failures, the failure volume distribution for each road is estimated. This is given under 'all incidents';

- where slope height is recorded for incidents, the volume distribution corresponding to each slope height range is estimated. This is given under 'incidents with height data';

  The data given under 'all incidents' and 'incidents with height data' refer to road specific data;

- the modified volume distribution is derived as explained below. The approach attempts to best represent the road specific historical data while at the same time ensuring that certain high volume incidents for the corresponding slope heights, although may not have occurred, are nevertheless represented with a low probability.

Basis

- The volume distribution shall reflect the historical incident data for the given road to the extent possible;

- Where the incidents do not cover the complete range of volume distribution, the volume distribution based on slope heights from map data and the SAR-wide study shall guide the allocation of probabilities.

  For ex., there are no incidents with failure volumes >50m^3 reported in Repulse Bay Road A. However, the volume distribution derived from map data and SAR-wide distribution indicates 7.5% probability of 50 to 500m^3 failure volume and 0.6% probability of 500 to 2000 m^3. These values are used as a guide to arrive at probabilities for higher volume ranges;

- While allocating probabilities for higher volume ranges, this has been limited to mostly one higher volume range or at most two higher volume ranges only. All volume ranges on the lower side are considered.

  For ex., for Repulse bay Road A, probability for one higher volume range, ie., 50 to 500 m^3 has been derived;

- Where both 'map data' and 'incidents with height data' does not include say, data corresponding to slope height range >20m, the modified volume distribution also does not contain any entry corresponding to this slope height;

- Where 'map data' does not include slope height range say <10m, for ex., for Tai Po Road B while the incident report data points to the existence of such a slope height, the modified data includes entries on volume distribution corresponding to slope height less than 10m. The volume distribution based on 'incidents with height data' is used as guide to derive modified volume distribution.

  This approach has also been adopted for roads for which slope height information is not available from maps, for ex., for Tai Po Road A. Therefore volume distribution based on 'incidents with height data' was adopted.

Volume Distribution for Up Slope Failures along BRIL Roads

Cut Slopes : SAR-wide Slope Height- Volume Distribution									
height/ volume	Proportion of slopes of corresponding height	<20 m3	20 to 50 m3	50 to 500 m3	500 to 2000 m3	>2000 m3	Probability Sum	Proportion of slopes of corresponding height based on field data	Total Sum
<10m		0.815	0.160	0.023	0.002	0.000			
10 to 20m		0.460	0.330	0.195	0.015	0.000			
>20m		0.200	0.450	0.270	0.065	0.015			
Repulse Bay Road A									
Slope height proportion based on map data & volume distribution based on global incident data									
<10m	0.7	0.571	0.112	0.016	0.001	0.000			
10 to 20m	0.3	0.138	0.099	0.059	0.005	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.709	0.211	0.075	0.006	0.000	1.000		30
All incidents (road specific)		0.770	0.230	0.000	0.000	0.000	1.000		22
Volume distribution based on incidents where slope height recorded									
<10m		0.625	0.188	0.000	0.000	0.000	0.813		
10 to 20m		0.188	0.000	0.000	0.000	0.000	0.188		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.813	0.188	0.000	0.000	0.000	1.000		16
Modified volume distribution									
<10m		0.600	0.150	0.010	0.000	0.000	0.760		
10 to 20m		0.160	0.050	0.030	0.000	0.000	0.240		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.760	0.200	0.040	0.000	0.000	1.000		
Repulse Bay Road B									
Map data									
<10m	0.71	0.579	0.114	0.016	0.001	0.000			
10 to 20m	0.15	0.069	0.050	0.029	0.002	0.000			
>20m	0.14	0.028	0.063	0.038	0.009	0.002			
All ht		0.676	0.226	0.083	0.013	0.002	1.000		7
All incidents		1.000	0.000	0.000	0.000	0.000	1.000		4
Incidents with ht data									
<10m		1.000	0.000	0.000	0.000	0.000	1.000		
10 to 20m		0.000	0.000	0.000	0.000	0.000	0.000		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		1.000	0.000	0.000	0.000	0.000	1.000		4
Modified data									
<10m		0.700	0.100	0.004	0.000	0.000	0.804		
10 to 20m		0.100	0.050	0.006	0.000	0.000	0.156		
>20m		0.010	0.020	0.010	0.000	0.000	0.040		
All ht		0.810	0.170	0.020	0.000	0.000	1.000		
Victoria Road A									
Map data									
<10m	0.69	0.562	0.110	0.016	0.001	0.000			
10 to 20m	0.31	0.143	0.102	0.060	0.005	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.705	0.213	0.076	0.006	0.000	1.000		16
All incidents		0.890	0.000	0.110	0.000	0.000	1.000		9
Incidents with ht data									
<10m		0.670	0.000	0.000	0.000	0.000	0.670		
10 to 20m		0.000	0.000	0.000	0.000	0.000	0.000		
>20m		0.330	0.000	0.000	0.000	0.000	0.330		
All ht		1.000	0.000	0.000	0.000	0.000	1.000		3
Modified data									
<10m		0.650	0.030	0.010	0.000	0.000	0.690		
10 to 20m		0.150	0.020	0.020	0.000	0.000	0.190		
>20m		0.040	0.030	0.050	0.000	0.000	0.120		
All ht		0.840	0.080	0.080	0.000	0.000	1.000		
Victoria Road B									
Map data									
<10m	0.29	0.236	0.046	0.007	0.001	0.000			

Volume Distribution for Up Slope Failures along BRIL Roads

height/ volume	Proportion of slopes of corresponding height	<20 m3	20 to 50 m3	50 to 500 m3	500 to 2000 m3	>2000 m3	Probability Sum	Proportion of slopes of corresponding height based on field data	Total Sum
10 to 20m	0.71	0.327	0.234	0.138	0.011	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.563	0.281	0.145	0.011	0.000	1.000		21
All incidents		0.920	0.080	0.000	0.000	0.000	1.000		12
Incidents with ht data									
<10m		0.890	0.110	0.000	0.000	0.000	1.000		
10 to 20m		0.000	0.000	0.000	0.000	0.000	0.000		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.890	0.110	0.000	0.000	0.000	1.000		8
Modified data									
<10m		0.800	0.050	0.000	0.000	0.000	0.850		
10 to 20m		0.100	0.040	0.010	0.000	0.000	0.150		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.900	0.090	0.010	0.000	0.000	1.000		
Chung Hom Kok Rd									
Map data									
<10m	0.69	0.562	0.110	0.016	0.001	0.000			
10 to 20m	0.31	0.143	0.102	0.060	0.005	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.705	0.213	0.076	0.006	0.000	1.000		16
All incidents		0.750	0.250	0.000	0.000	0.000	1.000		4
Incidents with ht data									
<10m		0.250	0.250	0.000	0.000	0.000	0.500		
10 to 20m		0.500	0.000	0.000	0.000	0.000	0.500		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.750	0.250	0.000	0.000	0.000	1.000		4
Modified data									
<10m		0.400	0.200	0.020	0.000	0.000	0.620		
10 to 20m		0.300	0.050	0.030	0.000	0.000	0.380		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.700	0.250	0.050	0.000	0.000	1.000		
Kennedy Road									
Map data									
<10m	0.81	0.660	0.130	0.019	0.002	0.000			
10 to 20m	0	0.000	0.000	0.000	0.000	0.000			
>20m	0.19	0.038	0.086	0.051	0.012	0.003			
All ht		0.698	0.215	0.070	0.014	0.003	1.000		16
All incidents		0.910	0.000	0.000	0.090	0.000	1.000		11
Incidents with ht data									
<10m		0.620	0.000	0.000	0.000	0.000	0.620		
10 to 20m		0.380	0.000	0.000	0.000	0.000	0.380		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		1.000	0.000	0.000	0.000	0.000	1.000		8
Modified data									
<10m		0.600	0.030	0.000	0.000	0.000	0.630		
10 to 20m		0.200	0.050	0.000	0.000	0.000	0.250		
>20m		0.010	0.030	0.030	0.050	0.000	0.120		
All ht		0.810	0.110	0.030	0.050	0.000	1.000		
Stubbs Road A									
Map data									
<10m	0.58	0.473	0.093	0.013	0.001	0.000			
10 to 20m	0.42	0.193	0.139	0.082	0.006	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.666	0.231	0.095	0.007	0.000	1.000		12
All incidents		1.000	0.000	0.000	0.000	0.000	1.000		4
Incidents with ht data									
<10m		0.500	0.000	0.000	0.000	0.000	0.500		

Volume Distribution for Up Slope Failures along BRIL Roads

height/ volume	Proportion of slopes of corresponding height	<20 m3	20 to 50 m3	50 to 500 m3	500 to 2000 m3	>2000 m3	Probability Sum	Proportion of slopes of corresponding height based on field data	Total Sum
10 to 20m		0.000	0.000	0.000	0.000	0.000	0.000		
>20m		0.500	0.000	0.000	0.000	0.000	0.500		
All ht		1.000	0.000	0.000	0.000	0.000	1.000		2
Modified data									
<10m		0.500	0.080	0.010	0.000	0.000	0.590		
10 to 20m		0.150	0.100	0.040	0.000	0.000	0.290		
>20m		0.050	0.050	0.020	0.000	0.000	0.120		
All ht		0.700	0.230	0.070	0.000	0.000	1.000		
Stubbs Road B									
Map data									
<10m	0.75	0.611	0.120	0.017	0.002	0.000			
10 to 20m	0.13	0.060	0.043	0.025	0.002	0.000			
>20m	0.12	0.024	0.054	0.032	0.008	0.002			
All ht		0.695	0.217	0.075	0.011	0.002	1.000		8
All incidents		0.500	0.000	0.500	0.000	0.000	1.000		2
Incidents with ht data									
<10m		0.500	0.000	0.000	0.000	0.000	0.500		
10 to 20m		0.000	0.000	0.500	0.000	0.000	0.500		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.500	0.000	0.500	0.000	0.000	1.000		2
Modified data									
<10m		0.600	0.050	0.010	0.000	0.000	0.660		
10 to 20m		0.050	0.050	0.120	0.000	0.000	0.220		
>20m		0.030	0.040	0.050	0.000	0.000	0.120		
All ht		0.680	0.140	0.180	0.000	0.000	1.000		
Nam Fung Rd									
Map data									
<10m	0.75	0.611	0.120	0.017	0.002	0.000			
10 to 20m	0	0.000	0.000	0.000	0.000	0.000			
>20m	0.25	0.050	0.113	0.068	0.016	0.004			
All ht		0.661	0.233	0.085	0.018	0.004	1.000		4
All incidents		0.500	0.500	0.000	0.000	0.000	1.000		2
Incidents with ht data									
<10m		0.000	1.000	0.000	0.000	0.000	1		
10 to 20m		0.000	0.000	0.000	0.000	0.000	0		
>20m		0.000	0.000	0.000	0.000	0.000	0		
All ht		0.000	1.000	0.000	0.000	0.000	1		1
Modified data									
<10m		0.500	0.250	0.000	0.000	0.000	0.750		
10 to 20m		0.050	0.050	0.020	0.000	0.000	0.120		
>20m		0.030	0.050	0.050	0.000	0.000	0.130		
All ht		0.580	0.350	0.070	0.000	0.000	1.000		
Island Road									
Map data									
<10m	1	0.815	0.160	0.023	0.002	0.000			
10 to 20m	0	0.000	0.000	0.000	0.000	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.815	0.160	0.023	0.002	0.000	1.000		4
All incidents		0.800	0.200	0.000	0.000	0.000	1.000		5
Incidents with ht data									
<10m		0.670	0.000	0.000	0.000	0.000	0.67		
10 to 20m		0.330	0.000	0.000	0.000	0.000	0.33		
>20m		0.000	0.000	0.000	0.000	0.000	0		
All ht		1.000	0.000	0.000	0.000	0.000	1		3
Modified data									
<10m		0.650	0.150	0.000	0.000	0.000	0.800		
10 to 20m		0.150	0.030	0.020	0.000	0.000	0.200		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		

Volume Distribution for Up Slope Failures along BRIL Roads

height/ volume	Proportion of slopes of corresponding height	<20 m3	20 to 50 m3	50 to 500 m3	500 to 2000 m3	>2000 m3	Probability Sum	Proportion of slopes of corresponding height based on field data	Total Sum
All ht		0.800	0.180	0.020	0.000	0.000	1.000		
Cape Collinson Rd A									
Map data									
<10m	0.59	0.481	0.094	0.014	0.001	0.000			
10 to 20m	0.35	0.161	0.116	0.068	0.005	0.000			
>20m	0.06	0.012	0.027	0.016	0.004	0.001			
All ht		0.654	0.237	0.098	0.010	0.001	1.000		17
All incidents		0.860	0.000	0.140	0.000	0.000	1.000		7
Incidents with ht data									
<10m		0.710	0.000	0.000	0.000	0.000	0.71		
10 to 20m		0.150	0.000	0.000	0.000	0.000	0.15		
>20m		0.000	0.000	0.140	0.000	0.000	0.14		
All ht		0.860	0.000	0.140	0.000	0.000	1		7
Modified data									
<10m		0.650	0.050	0.010	0.000	0.000	0.710		
10 to 20m		0.100	0.050	0.020	0.000	0.000	0.170		
>20m		0.020	0.020	0.070	0.010	0.000	0.120		
All ht		0.770	0.120	0.100	0.010	0.000	1.000		
Cape Collinson Rd B									
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000			
10 to 20m	1	0.460	0.330	0.195	0.015	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.460	0.330	0.195	0.015	0.000	1.000		1
All incidents		0.340	0.330	0.000	0.330	0.000	1.000		3
Incidents with ht data									
<10m		0.000	0.000	0.000	0.000	0.000	0		
10 to 20m		0.340	0.330	0.000	0.330	0.000	1		
>20m		0.000	0.000	0.000	0.000	0.000	0		
All ht		0.340	0.330	0.000	0.330	0.000	1		3
Modified data									
<10m		0.000	0.000	0.000	0.000	0.000	0.000		
10 to 20m		0.350	0.300	0.200	0.150	0.000	1.000		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.350	0.300	0.200	0.150	0.000	1.000		
Yee King Rd									
Map data									
<10m	0.38	0.310	0.061	0.009	0.001	0.000			
10 to 20m	0.5	0.230	0.165	0.098	0.008	0.000			
>20m	0.12	0.024	0.054	0.032	0.008	0.002			
All ht		0.564	0.280	0.139	0.016	0.002	1.000		8
All incidents		1.000	0.000	0.000	0.000	0.000	1.000		3
Incidents with ht data									
<10m		1.000	0.000	0.000	0.000	0.000	1		
10 to 20m		0.000	0.000	0.000	0.000	0.000	0		
>20m		0.000	0.000	0.000	0.000	0.000	0		
All ht		1.000	0.000	0.000	0.000	0.000	1		2
Modified data									
<10m		0.500	0.050	0.000	0.000	0.000	0.550		
10 to 20m		0.200	0.100	0.050	0.000	0.000	0.350		
>20m		0.050	0.030	0.020	0.000	0.000	0.100		
All ht		0.750	0.180	0.070	0.000	0.000	1.000		
Magazine Gap Road									
Map data									
<10m	0.8	0.652	0.128	0.018	0.002	0.000			
10 to 20m	0.2	0.092	0.066	0.039	0.003	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.744	0.194	0.057	0.005	0.000	1.000		20

Volume Distribution for Up Slope Failures along BRIL Roads

height/ volume	Proportion of slopes of corresponding height	<20 m3	20 to 50 m3	50 to 500 m3	500 to 2000 m3	>2000 m3	Probability Sum	Proportion of slopes of corresponding height based on field data	Total Sum
All incidents		0.810	0.130	0.060	0.000	0.000	1.000		16
Incidents with ht data									
<10m		0.690	0.160	0.000	0.000	0.000	0.85		
10 to 20m		0.150	0.000	0.000	0.000	0.000	0.15		
>20m		0.000	0.000	0.000	0.000	0.000	0		
All ht		0.840	0.160	0.000	0.000	0.000	1		13
Modified data									
<10m		0.650	0.080	0.010	0.000	0.000	0.740		
10 to 20m		0.150	0.050	0.050	0.010	0.000	0.260		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.800	0.130	0.060	0.010	0.000	1.000		
Peak Road A									
Map data									
<10m	0.69	0.562	0.110	0.016	0.001	0.000			
10 to 20m	0.31	0.143	0.102	0.060	0.005	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.705	0.213	0.076	0.006	0.000	1.000		26
All incidents		0.670	0.000	0.330	0.000	0.000	1.000		3
Incidents with ht data									
<10m		0.340	0.000	0.000	0.000	0.000	0.34		
10 to 20m		0.330	0.000	0.330	0.000	0.000	0.66		
>20m		0.000	0.000	0.000	0.000	0.000	0		
All ht		0.670	0.000	0.330	0.000	0.000	1		3
Modified data									
<10m		0.400	0.050	0.010	0.000	0.000	0.460		
10 to 20m		0.200	0.150	0.150	0.040	0.000	0.540		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.600	0.200	0.160	0.040	0.000	1.000		
Peak Road B									
Map data									
<10m	0.83	0.676	0.133	0.019	0.002	0.000			
10 to 20m	0.17	0.078	0.056	0.033	0.003	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.755	0.189	0.052	0.004	0.000	1.000		6
All incidents		1.000	0.000	0.000	0.000	0.000	1.000		5
Incidents with ht data									
<10m		1.000	0.000	0.000	0.000	0.000	1		
10 to 20m		0.000	0.000	0.000	0.000	0.000	0		
>20m		0.000	0.000	0.000	0.000	0.000	0		
All ht		1.000	0.000	0.000	0.000	0.000	1		2
Modified data									
<10m		0.820	0.050	0.010	0.000	0.000	0.880		
10 to 20m		0.080	0.030	0.010	0.000	0.000	0.120		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.900	0.080	0.020	0.000	0.000	1.000		
Pokfulam Road A									
Map data									
<10m	0.4	0.326	0.064	0.009	0.001	0.000			
10 to 20m	0.6	0.276	0.198	0.117	0.009	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.602	0.262	0.126	0.010	0.000	1.000		10
All incidents		1.000	0.000	0.000	0.000	0.000	1.000		6
Incidents with ht data									
<10m		0.670	0.000	0.000	0.000	0.000	0.67		
10 to 20m		0.330	0.000	0.000	0.000	0.000	0.33		
>20m		0.000	0.000	0.000	0.000	0.000	0		
All ht		1.000	0.000	0.000	0.000	0.000	1		3

Volume Distribution for Up Slope Failures along BRIL Roads

height/ volume	Proportion of slopes of corresponding height	<20 m3	20 to 50 m3	50 to 500 m3	500 to 2000 m3	>2000 m3	Probability Sum	Proportion of slopes of corresponding height based on field data	Total Sum
Modified data									
<10m		0.600	0.030	0.000	0.000	0.000	0.630		
10 to 20m		0.300	0.050	0.020	0.000	0.000	0.370		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.900	0.080	0.020	0.000	0.000	1.000		
Pokfulam Road B									
Map data									
<10m	0.6	0.489	0.096	0.014	0.001	0.000			
10 to 20m	0.4	0.184	0.132	0.078	0.006	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.673	0.228	0.092	0.007	0.000	1.000		15
All incidents		0.670	0.330	0.000	0.000	0.000	1.000		3
Incidents with ht data									
<10m		1.000	0.000	0.000	0.000	0.000	1		
10 to 20m		0.000	0.000	0.000	0.000	0.000	0		
>20m		0.000	0.000	0.000	0.000	0.000	0		
All ht		1.000	0.000	0.000	0.000	0.000	1		1
Modified data									
<10m		0.500	0.150	0.010	0.000	0.000	0.660		
10 to 20m		0.200	0.100	0.040	0.000	0.000	0.340		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.700	0.250	0.050	0.000	0.000	1.000		
Tai Hang Rd									
Map data									
<10m	0.48	0.391	0.077	0.011	0.001	0.000			
10 to 20m	0.48	0.221	0.158	0.094	0.007	0.000			
>20m	0.04	0.008	0.018	0.011	0.003	0.001			
All ht		0.620	0.253	0.115	0.011	0.001	1.000		23
All incidents		0.920	0.080	0.000	0.000	0.000	1.000		25
Incidents with ht data									
<10m		0.630	0.000	0.000	0.000	0.000	0.63		
10 to 20m		0.250	0.120	0.000	0.000	0.000	0.37		
>20m		0.000	0.000	0.000	0.000	0.000	0		
All ht		0.880	0.120	0.000	0.000	0.000	1		16
Modified data									
<10m		0.600	0.040	0.010	0.000	0.000	0.650		
10 to 20m		0.200	0.080	0.030	0.000	0.000	0.310		
>20m		0.010	0.020	0.010	0.000	0.000	0.040		
All ht		0.810	0.140	0.050	0.000	0.000	1.000		
Tai Tam Rd									
Map data									
<10m	0.73	0.595	0.117	0.017	0.001	0.000			
10 to 20m	0.22	0.101	0.073	0.043	0.003	0.000			
>20m	0.05	0.010	0.023	0.014	0.003	0.001			
All ht		0.706	0.212	0.073	0.008	0.001	1.000		41
All incidents		1.000	0.000	0.000	0.000	0.000	1.000		10
Incidents with ht data									
<10m		0.830	0.000	0.000	0.000	0.000	0.83		
10 to 20m		0.170	0.000	0.000	0.000	0.000	0.17		
>20m		0.000	0.000	0.000	0.000	0.000	0		
All ht		1.000	0.000	0.000	0.000	0.000	1		6
Modified data									
<10m		0.710	0.050	0.000	0.000	0.000	0.760		
10 to 20m		0.150	0.040	0.010	0.000	0.000	0.200		
>20m		0.010	0.020	0.010	0.000	0.000	0.040		
All ht		0.870	0.110	0.020	0.000	0.000	1.000		
Tai Po Road A									

Volume Distribution for Up Slope Failures along BRIL Roads

height/ volume	Proportion of slopes of corresponding height	<20 m3	20 to 50 m3	50 to 500 m3	500 to 2000 m3	>2000 m3	Probability Sum	Proportion of slopes of corresponding height based on field data	Total Sum
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000			
10 to 20m	0	0.000	0.000	0.000	0.000	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.000	0.000	0.000	0.000	0.000	0.000		0
All incidents		1.000	0.000	0.000	0.000	0.000	1.000		1
Incidents with ht data									
<10m		0.000	0.000	0.000	0.000	0.000	0.000		
10 to 20m		1.000	0.000	0.000	0.000	0.000	1.000		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		1.000	0.000	0.000	0.000	0.000	1.000		1
Modified data									
<10m		0.000	0.000	0.000	0.000	0.000	0.000		
10 to 20m		1.000	0.000	0.000	0.000	0.000	1.000		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		1.000	0.000	0.000	0.000	0.000	1.000		
Tai Po Road B									
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000			
10 to 20m	1	0.460	0.330	0.195	0.015	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.460	0.330	0.195	0.015	0.000	1.000		3
All incidents		0.570	0.290	0.140	0.000	0.000	1.000		7
Incidents with ht data									
<10m		0.430	0.140	0.000	0.000	0.000	0.570		
10 to 20m		0.140	0.000	0.150	0.000	0.000	0.290		
>20m		0.000	0.140	0.000	0.000	0.000	0.140		
All ht		0.570	0.280	0.150	0.000	0.000	1.000		7
Modified data									
<10m		0.400	0.100	0.020	0.000	0.000	0.520		
10 to 20m		0.100	0.090	0.080	0.010	0.000	0.280		
>20m		0.050	0.080	0.050	0.020	0.000	0.200		
All ht		0.550	0.270	0.150	0.030	0.000	1.000		
Tai Po Road C									
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000			
10 to 20m	0.67	0.308	0.221	0.131	0.010	0.000			
>20m	0.33	0.066	0.149	0.089	0.021	0.005			
All ht		0.374	0.370	0.220	0.032	0.005	1.000		3
All incidents		0.800	0.000	0.200	0.000	0.000	1.000		5
Incidents with ht data									
<10m		0.400	0.000	0.000	0.000	0.000	0.400		
10 to 20m		0.400	0.000	0.200	0.000	0.000	0.600		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.800	0.000	0.200	0.000	0.000	1.000		5
Modified data									
<10m		0.400	0.050	0.000	0.000	0.000	0.450		
10 to 20m		0.200	0.100	0.150	0.010	0.000	0.460		
>20m		0.020	0.040	0.020	0.010	0.000	0.090		
All ht		0.620	0.190	0.170	0.020	0.000	1.000		
Kwun Tong Rd									
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000			
10 to 20m	0	0.000	0.000	0.000	0.000	0.000			
>20m	1	0.200	0.450	0.270	0.065	0.015			
All ht		0.200	0.450	0.270	0.065	0.015	1.000		1
All incidents		0.000	0.670	0.330	0.000	0.000	1.000		3

Volume Distribution for Up Slope Failures along BRIL Roads

height/ volume	Proportion of slopes of corresponding height	<20 m3	20 to 50 m3	50 to 500 m3	500 to 2000 m3	>2000 m3	Probability Sum	Proportion of slopes of corresponding height based on field data	Total Sum
Incidents with ht data									
<10m		0.000	0.500	0.000	0.000	0.000	0.5		
10 to 20m		0.000	0.500	0.000	0.000	0.000	0.5		
>20m		0.000	0.000	0.000	0.000	0.000	0		
All ht		0.000	1.000	0.000	0.000	0.000	1		2
Modified data									
<10m		0.070	0.250	0.020	0.000	0.000	0.340		
10 to 20m		0.050	0.200	0.100	0.000	0.000	0.350		
>20m		0.030	0.100	0.150	0.030	0.000	0.310		
All ht		0.150	0.550	0.270	0.030	0.000	1.000		
Clear Water Bay Rd									
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000			
10 to 20m	0	0.000	0.000	0.000	0.000	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.000	0.000	0.000	0.000	0.000	0.000		0
All incidents		0.710	0.150	0.140	0.000	0.000	1.000		7
Incidents with ht data									
<10m		0.670	0.170	0.000	0.000	0.000	0.84		
10 to 20m		0.000	0.000	0.000	0.000	0.000	0		
>20m		0.000	0.000	0.160	0.000	0.000	0.16		
All ht		0.670	0.170	0.160	0.000	0.000	1		6
Modified data									
<10m		0.550	0.100	0.010	0.000	0.000	0.660		
10 to 20m		0.050	0.040	0.040	0.010	0.000	0.140		
>20m		0.040	0.060	0.080	0.020	0.000	0.200		
All ht		0.640	0.200	0.130	0.030	0.000	1.000		
Sai Sha Rd									
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000			
10 to 20m	0	0.000	0.000	0.000	0.000	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.000	0.000	0.000	0.000	0.000	0.000		0
All incidents		0.310	0.380	0.080	0.150	0.080	1		13
Incidents with ht data									
<10m		0.000	0.170	0.000	0.000	0.000	0.17		
10 to 20m		0.250	0.250	0.080	0.090	0.000	0.67		
>20m		0.080	0.000	0.000	0.080	0.000	0.16		
All ht		0.330	0.420	0.080	0.170	0.000	1		12
Modified data									
<10m		0.100	0.100	0.000	0.000	0.000	0.200		
10 to 20m		0.200	0.200	0.080	0.080	0.000	0.560		
>20m		0.050	0.070	0.050	0.060	0.010	0.240		
All ht		0.350	0.370	0.130	0.140	0.010	1.000		
Tai Mong Sai Rd A									
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000			
10 to 20m	0	0.000	0.000	0.000	0.000	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.000	0.000	0.000	0.000	0.000	0.000		0
All incidents		0.500	0.000	0.000	0.500	0.000	1		2
Incidents with ht data									
<10m		0.500	0.000	0.000	0.000	0.000	0.5		
10 to 20m		0.000	0.000	0.000	0.500	0.000	0.5		
>20m		0.000	0.000	0.000	0.000	0.000	0		
All ht		0.500	0.000	0.000	0.500	0.000	1		2
Modified data									
<10m		0.350	0.050	0.000	0.000	0.000	0.400		

Volume Distribution for Up Slope Failures along BRIL Roads

height/ volume	Proportion of slopes of corresponding height	<20 m3	20 to 50 m3	50 to 500 m3	500 to 2000 m3	>2000 m3	Probability Sum	Proportion of slopes of corresponding height based on field data	Total Sum
10 to 20m		0.050	0.050	0.050	0.400	0.000	0.550		
>20m		0.000	0.010	0.020	0.020	0.000	0.050		
All ht		0.400	0.110	0.070	0.420	0.000	1.000		
Tai Mong Sai Rd B									
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000			
10 to 20m	0	0.000	0.000	0.000	0.000	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.000	0.000	0.000	0.000	0.000	0.000		0
All incidents		0.750	0.250	0.000	0.000	0.000	1		8
Incidents with ht data									
<10m		0.250	0.130	0.000	0.000	0.000	0.38		
10 to 20m		0.500	0.120	0.000	0.000	0.000	0.62		
>20m		0.000	0.000	0.000	0.000	0.000	0		
All ht		0.750	0.250	0.000	0.000	0.000	1		8
Modified data									
<10m		0.250	0.100	0.010	0.000	0.000	0.360		
10 to 20m		0.450	0.120	0.060	0.010	0.000	0.640		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.700	0.220	0.070	0.010	0.000	1.000		
Tai Mong Sai Rd C									
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000			
10 to 20m	0	0.000	0.000	0.000	0.000	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.000	0.000	0.000	0.000	0.000	0.000		0
All incidents		0.500	0.000	0.500	0.000	0.000	1		2
Incidents with ht data									
<10m		0.500	0.000	0.000	0.000	0.000	0.5		
10 to 20m		0.000	0.000	0.500	0.000	0.000	0.5		
>20m		0.000	0.000	0.000	0.000	0.000	0		
All ht		0.500	0.000	0.500	0.000	0.000	1		2
Modified data									
<10m		0.400	0.100	0.000	0.000	0.000	0.500		
10 to 20m		0.050	0.100	0.300	0.050	0.000	0.500		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.450	0.200	0.300	0.050	0.000	1.000		
Tai Mong Sai Rd D									
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000			
10 to 20m	0	0.000	0.000	0.000	0.000	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.000	0.000	0.000	0.000	0.000	0.000		0
All incidents		1.000	0.000	0.000	0.000	0.000	1		2
Incidents with ht data									
<10m		1.000	0.000	0.000	0.000	0.000	1		
10 to 20m		0.000	0.000	0.000	0.000	0.000	0		
>20m		0.000	0.000	0.000	0.000	0.000	0		
All ht		1.000	0.000	0.000	0.000	0.000	1		2
Modified data									
<10m		0.800	0.200	0.000	0.000	0.000	1.000		
10 to 20m		0.000	0.000	0.000	0.000	0.000	0.000		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.800	0.200	0.000	0.000	0.000	1.000		
Castle Peak Road									
Map data									
<10m	0.22	0.179	0.035	0.005	0.000	0.000		0.5	
10 to 20m	0.75	0.345	0.248	0.146	0.011	0.000		0.4	

Volume Distribution for Up Slope Failures along BRIL Roads

height/ volume	Proportion of slopes of corresponding height	<20 m3	20 to 50 m3	50 to 500 m3	500 to 2000 m3	>2000 m3	Probability Sum	Proportion of slopes of corresponding height based on field data	Total Sum
>20m	0.03	0.006	0.014	0.008	0.002	0.000		0.1	
All ht		0.530	0.296	0.159	0.014	0.000	1.000		32
All incidents		0.481	0.333	0.111	0.075	0.000	1.000		27
Incidents with ht data									
<10m		0.250	0.100	0.050	0.050	0.000	0.45		
10 to 20m		0.150	0.100	0.050	0.000	0.000	0.3		
>20m		0.050	0.150	0.000	0.050	0.000	0.25		
All ht		0.450	0.350	0.100	0.100	0.000	1		20
Modified data									
<10m		0.230	0.100	0.050	0.050	0.000	0.430		
10 to 20m		0.150	0.100	0.050	0.010	0.000	0.310		
>20m		0.050	0.080	0.080	0.050	0.000	0.260		
All ht		0.430	0.280	0.180	0.110	0.000	1.000		
Tuen Mun Road A									
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000		0.1	
10 to 20m	0.75	0.345	0.248	0.146	0.011	0.000		0.4	
>20m	0.25	0.050	0.113	0.068	0.016	0.004		0.5	
All ht		0.395	0.360	0.214	0.028	0.004	1.000		4
All incidents		1.000	0.000	0.000	0.000	0.000	1.000		2
Incidents with ht data									
<10m		0.000	0.000	0.000	0.000	0.000	0.000		
10 to 20m		0.000	0.000	0.000	0.000	0.000	0.000		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.000	0.000	0.000	0.000	0.000	0.000		0
Modified data									
<10m		0.000	0.000	0.000	0.000	0.000	0.000		
10 to 20m		0.650	0.100	0.050	0.000	0.000	0.800		
>20m		0.110	0.050	0.030	0.010	0.000	0.200		
All ht		0.760	0.150	0.080	0.010	0.000	1.000		
Tuen Mun Road B									
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000		0.1	
10 to 20m	0.32	0.147	0.106	0.062	0.005	0.000		0.4	
>20m	0.68	0.136	0.306	0.184	0.044	0.010		0.5	
All ht		0.283	0.412	0.246	0.049	0.010	1.000		19
All incidents		0.500	0.500	0.000	0.000	0.000	1.000		2
Incidents with ht data									
<10m		0.000	0.000	0.000	0.000	0.000	0.000		
10 to 20m		0.000	0.500	0.000	0.000	0.000	0.500		
>20m		0.500	0.000	0.000	0.000	0.000	0.500		
All ht		0.500	0.500	0.000	0.000	0.000	1.000		2
Modified data									
<10m		0.000	0.000	0.000	0.000	0.000	0.000		
10 to 20m		0.100	0.300	0.050	0.000	0.000	0.450		
>20m		0.350	0.100	0.060	0.040	0.000	0.550		
All ht		0.450	0.400	0.110	0.040	0.000	1.000		
Tuen Mun Road C									
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000		0.1	
10 to 20m	0.42	0.193	0.139	0.082	0.006	0.000		0.4	
>20m	0.58	0.116	0.261	0.157	0.038	0.009		0.5	
All ht		0.309	0.400	0.239	0.044	0.009	1.000		12
All incidents		0.670	0.330	0.000	0.000	0.000	1.000		3
Incidents with ht data									
<10m		0.000	0.000	0.000	0.000	0.000	0.000		
10 to 20m		0.000	0.000	0.000	0.000	0.000	0.000		

Volume Distribution for Up Slope Failures along BRIL Roads

height/ volume	Proportion of slopes of corresponding height	<20 m3	20 to 50 m3	50 to 500 m3	500 to 2000 m3	>2000 m3	Probability Sum	Proportion of slopes of corresponding height based on field data	Total Sum
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.000	0.000	0.000	0.000	0.000	0.000		0
Modified data									
<10m		0.000	0.000	0.000	0.000	0.000	0.000		
10 to 20m		0.400	0.100	0.010	0.000	0.000	0.510		
>20m		0.200	0.200	0.080	0.010	0.000	0.490		
All ht		0.600	0.300	0.090	0.010	0.000	1.000		
Tuen Mun Road D									
Map data									
<10m	0.2	0.163	0.032	0.005	0.000	0.000		0.1	
10 to 20m	0.4	0.184	0.132	0.078	0.006	0.000		0.4	
>20m	0.4	0.080	0.180	0.108	0.026	0.006		0.5	
All ht		0.427	0.344	0.191	0.032	0.006	1.000		5
All incidents		1.000	0.000	0.000	0.000	0.000	1.000		1
Incidents with ht data									
<10m		1.000	0.000	0.000	0.000	0.000	1.000		
10 to 20m		0.000	0.000	0.000	0.000	0.000	0.000		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		1.000	0.000	0.000	0.000	0.000	1.000		1
Modified data									
<10m		0.500	0.050	0.000	0.000	0.000	0.550		
10 to 20m		0.150	0.050	0.020	0.000	0.000	0.220		
>20m		0.050	0.100	0.080	0.000	0.000	0.230		
All ht		0.700	0.200	0.100	0.000	0.000	1.000		
Route Twisk A									
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000		0.5	
10 to 20m	0.75	0.345	0.248	0.146	0.011	0.000		0.5	
>20m	0.25	0.050	0.113	0.068	0.016	0.004		0	
All ht		0.395	0.360	0.214	0.028	0.004	1.000		8
All incidents		0.500	0.080	0.420	0.000	0.000	1.000		12
Incidents with ht data									
<10m		0.290	0.000	0.000	0.000	0.000	0.290		
10 to 20m		0.140	0.140	0.290	0.000	0.000	0.570		
>20m		0.000	0.000	0.140	0.000	0.000	0.140		
All ht		0.430	0.140	0.430	0.000	0.000	1.000		7
Modified data									
<10m		0.200	0.050	0.000	0.000	0.000	0.250		
10 to 20m		0.150	0.100	0.240	0.010	0.000	0.500		
>20m		0.050	0.080	0.100	0.020	0.000	0.250		
All ht		0.400	0.230	0.340	0.030	0.000	1.000		
Route Twisk B									
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000		0.5	
10 to 20m	1	0.460	0.330	0.195	0.015	0.000		0.5	
>20m	0	0.000	0.000	0.000	0.000	0.000		0	
All ht		0.460	0.330	0.195	0.015	0.000	1.000		6
All incidents		1.000	0.000	0.000	0.000	0.000	1.000		3
Incidents with ht data									
<10m		1.000	0.000	0.000	0.000	0.000	1.000		
10 to 20m		0.000	0.000	0.000	0.000	0.000	0.000		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		1.000	0.000	0.000	0.000	0.000	1.000		2
Modified data									
<10m		0.500	0.050	0.000	0.000	0.000	0.550		
10 to 20m		0.300	0.100	0.050	0.000	0.000	0.450		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.800	0.150	0.050	0.000	0.000	1.000		

Volume Distribution for Up Slope Failures along BRIL Roads

height/ volume	Proportion of slopes of corresponding height	<20 m3	20 to 50 m3	50 to 500 m3	500 to 2000 m3	>2000 m3	Probability Sum	Proportion of slopes of corresponding height based on field data	Total Sum
Route Twisk C									
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000		0.5	
10 to 20m	0	0.000	0.000	0.000	0.000	0.000		0.5	
>20m	0	0.000	0.000	0.000	0.000	0.000		0	
All ht		0.000	0.000	0.000	0.000	0.000	0.000		0
All incidents		1.000	0.000	0.000	0.000	0.000	1.000		2
Incidents with ht data									
<10m		1.000	0.000	0.000	0.000	0.000	1.000		
10 to 20m		0.000	0.000	0.000	0.000	0.000	0.000		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		1.000	0.000	0.000	0.000	0.000	1.000		2
Modified data									
<10m		0.800	0.050	0.000	0.000	0.000	0.850		
10 to 20m		0.100	0.050	0.000	0.000	0.000	0.150		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.900	0.100	0.000	0.000	0.000	1.000		
South Lantau Road A									
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000			
10 to 20m	0	0.000	0.000	0.000	0.000	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.000	0.000	0.000	0.000	0.000	0.000		0
All incidents		0.270	0.670	0.060	0.000	0.000	1.000		15
Incidents with ht data									
<10m		0.150	0.380	0.080	0.000	0.000	0.61		
10 to 20m		0.080	0.230	0.000	0.000	0.000	0.31		
>20m		0.080	0.000	0.000	0.000	0.000	0.08		
All ht		0.310	0.610	0.080	0.000	0.000	1		13
Modified data									
<10m		0.150	0.350	0.050	0.000	0.000	0.550		
10 to 20m		0.100	0.200	0.040	0.010	0.000	0.350		
>20m		0.050	0.030	0.020	0.000	0.000	0.100		
All ht		0.300	0.580	0.110	0.010	0.000	1.000		
South Lantau Road B									
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000			
10 to 20m	0	0.000	0.000	0.000	0.000	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.000	0.000	0.000	0.000	0.000	0.000		0
All incidents		0.200	0.400	0.200	0.200	0.000	1.000		5
Incidents with ht data									
<10m		0.250	0.000	0.000	0.000	0.000	0.25		
10 to 20m		0.250	0.000	0.250	0.250	0.000	0.75		
>20m		0.000	0.000	0.000	0.000	0.000	0		
All ht		0.500	0.000	0.250	0.250	0.000	1		4
Modified data									
<10m		0.200	0.100	0.010	0.000	0.000	0.310		
10 to 20m		0.050	0.160	0.150	0.150	0.000	0.510		
>20m		0.020	0.050	0.050	0.050	0.010	0.180		
All ht		0.270	0.310	0.210	0.200	0.010	1.000		
South Lantau Road C									
Map data									
<10m	0	0.000	0.000	0.000	0.000	0.000			
10 to 20m	1	0.460	0.330	0.195	0.015	0.000			
>20m	0	0.000	0.000	0.000	0.000	0.000			
All ht		0.460	0.330	0.195	0.015	0.000	1.000		1

Volume Distribution for Up Slope Failures along BRIL Roads

height/ volume	Proportion of slopes of corresponding height	<20 m3	20 to 50 m3	50 to 500 m3	500 to 2000 m3	>2000 m3	Probability Sum	Proportion of slopes of corresponding height based on field data	Total Sum
All incidents		0.600	0.200	0.200	0.000	0.000	1.000		5
Incidents with ht data									
<10m		0.250	0.000	0.000	0.000	0.000	0.25		
10 to 20m		0.250	0.250	0.250	0.000	0.000	0.75		
>20m		0.000	0.000	0.000	0.000	0.000	0		
All ht		0.500	0.250	0.250	0.000	0.000	1		4
Modified data									
<10m		0.300	0.080	0.010	0.000	0.000	0.390		
10 to 20m		0.300	0.150	0.150	0.010	0.000	0.610		
>20m		0.000	0.000	0.000	0.000	0.000	0.000		
All ht		0.600	0.230	0.160	0.010	0.000	1.000		

Volume Distribution for Down Slope Failures Along BRIL Roads

												Territory-wide volume distribution for fill slope failures										
											height/vol	<20	20 to 50	50 to 200	200 to 1000	>1000					
											<20 m	0.8	0.14	0.05	0.01						
											>20 m	0.77	0.14	0.05	0.01	0.03					
Location	Road	Section	Proportion of incidents for each volume range						Proportion of slopes with height			Volume distribution based on territory-wide data considering slope height proportion					Volume distribution (modified)				
			<20	20 to 50	50 to 200	200 to 1000	>1000	Total No.	<20m	>20m	Total no.	<20	20 to 50	50 to 200	200 to 1000	>1000	<20	20 to 50	50 to 200	200 to 1000	>1000
HK	Cape Collinson Road	A			1			1	1	0	4	0.80	0.14	0.05	0.01	0.00	0.09	0.20	0.70	0.01	0.00
HK	Cape Collinson Road	B						0									0.00	0.00	0.00	0.00	0.00
HK	Chung Hom Kok Road	-		1				1									0.25	0.70	0.05	0.00	0.00
HK	Island Road	-		1				1	1	0	2	0.80	0.14	0.05	0.01	0.00	0.25	0.70	0.05	0.00	0.00
HK	Kennedy Road	-	1					2	1	0	18	0.80	0.14	0.05	0.01	0.00	0.90	0.10	0.00	0.00	0.00
HK	Magazine Gap Road	-	1					1	1	0	6	0.80	0.14	0.05	0.01	0.00	0.90	0.10	0.00	0.00	0.00
HK	Nam Fung Road	-						0									0.00	0.00	0.00	0.00	0.00
HK	Peak Road	A	1					1	0.89	0.11	9	0.80	0.14	0.05	0.01	0.00	0.90	0.10	0.00	0.00	0.00
HK	Peak Road	B						0	1	0	2	0.80	0.14	0.05	0.01	0.00	0.90	0.10	0.00	0.00	0.00
HK	Pokfulam Road	A		1				1	1	0	2	0.80	0.14	0.05	0.01	0.00	0.25	0.70	0.05	0.00	0.00
HK	Pokfulam Road	B						0	1	0		0.80	0.14	0.05	0.01	0.00	0.90	0.10	0.00	0.00	0.00
HK	Repulse Bay Road	A		0.43	0.43	0.14		7	1	0	14	0.80	0.14	0.05	0.01	0.00	0.20	0.35	0.35	0.10	0.00
HK	Repulse Bay Road	B	1					2	1	0	7	0.80	0.14	0.05	0.01	0.00	0.90	0.10	0.00	0.00	0.00
HK	Stubbs Road	A						0	1	0	7	0.80	0.14	0.05	0.01	0.00	0.90	0.10	0.00	0.00	0.00
HK	Stubbs Road	B						0	1	0	1	0.80	0.14	0.05	0.01	0.00	0.90	0.10	0.00	0.00	0.00
HK	Tai Hang Road	-	0.5	0.5				2	0.75	0.25	12	0.79	0.14	0.05	0.01	0.01	0.50	0.44	0.05	0.01	0.00
HK	Tai Tam Road	-		1				1	0.95	0.05	19	0.80	0.14	0.05	0.01	0.00	0.25	0.70	0.05	0.00	0.00
HK	Victoria Road	A						0	1	0	9	0.80	0.14	0.05	0.01	0.00	0.90	0.10	0.00	0.00	0.00
HK	Victoria Road	B	1					1	0.67	0.33	6	0.79	0.14	0.05	0.01	0.01	0.90	0.07	0.02	0.01	0.00
HK	Yee King Road	-						0	0	1	1	0.77	0.14	0.05	0.01	0.03	0.90	0.07	0.02	0.01	0.00
ME	Clear Water Bay Road	-						0									0.00	0.00	0.00	0.00	0.00
ME	Kwun Tong Road	-						0									0.00	0.00	0.00	0.00	0.00
ME	Sai Sha Road	-						0									0.00	0.00	0.00	0.00	0.00
ME	Tai Mong Tsai Road	A		1				1									0.25	0.70	0.05	0.00	0.00
ME	Tai Mong Tsai Road	B						0									0.00	0.00	0.00	0.00	0.00
ME	Tai Mong Tsai Road	C						0									0.00	0.00	0.00	0.00	0.00
ME	Tai Mong Tsai Road	D						0									0.00	0.00	0.00	0.00	0.00
ME	Tai Po Road	A		1				1	0	1	2	0.77	0.14	0.05	0.01	0.03	0.40	0.54	0.05	0.01	0.00
ME	Tai Po Road	B			1			1	1	0	4	0.80	0.14	0.05	0.01	0.00	0.09	0.20	0.70	0.01	0.00
ME	Tai Po Road	C		1				1	1	0	3	0.80	0.14	0.05	0.01	0.00	0.25	0.70	0.05	0.00	0.00
MW	Castle Peak Road	-	0.5	0.25		0.25		4	1	0	15	0.80	0.14	0.05	0.01	0.00	0.50	0.20	0.15	0.15	0.00
MW	Route Twisk	A						0	0.88	0.12	8	0.80	0.14	0.05	0.01	0.00	0.80	0.15	0.05	0.00	0.00
MW	Route Twisk	B	1					1	1	0	6	0.80	0.14	0.05	0.01	0.00	0.90	0.10	0.00	0.00	0.00
MW	Route Twisk	C	0.5	0.5				2									0.50	0.45	0.05	0.00	0.00
MW	South Lantau Road	A		0.5		0.5		2									0.10	0.40	0.09	0.40	0.01
MW	South Lantau Road	B		1				1									0.25	0.70	0.05	0.00	0.00
MW	South Lantau Road	C						0									0.00	0.00	0.00	0.00	0.00
MW	Tuen Mun Road	A	1					1	0.67	0.33	3	0.79	0.14	0.05	0.01	0.01	0.85	0.10	0.04	0.01	0.00
MW	Tuen Mun Road	B						0	0.6	0.4	15	0.79	0.14	0.05	0.01	0.01	0.90	0.08	0.02	0.00	0.00
MW	Tuen Mun Road	C		1				1	1	0	9	0.80	0.14	0.05	0.01	0.00	0.25	0.70	0.05	0.00	0.00
MW	Tuen Mun Road	D						0	0.67	0.33	6	0.79	0.14	0.05	0.01	0.01	0.90	0.09	0.01	0.00	0.00
	Total							37													

Proportion of Up Slope/ Down Slope Failures along BRIL Roads

Road	Section	Proportion of failures		
		Upslope	Downslope	Total no.
Cape Collinson Road	A	0.88	0.12	8
Cape Collinson Road	B	1	0	3
Chung Hom Kok Road	-	0.8	0.2	5
Island Road	-	0.83	0.17	6
Kennedy Road	-	0.85	0.15	13
Magazine Gap Road	-	0.94	0.06	17
Nam Fung Road	-	1	0	2
Peak Road	A	0.75	0.25	4
Peak Road	B	1	0	5
Pokfulam Road	A	0.86	0.14	7
Pokfulam Road	B	1	0	3
Repulse Bay Road	A	0.76	0.24	29
Repulse Bay Road	B	0.67	0.33	6
Stubbs Road	A	1	0	4
Stubbs Road	B	1	0	2
Tai Hang Road	-	0.93	0.07	27
Tai Tam Road	-	0.91	0.09	11
Victoria Road	A	1	0	9
Victoria Road	B	0.92	0.08	13
Yee King Road	-	1	0	3
Clear Water Bay Road	-	1	0	7
Kwun Tong Road	-	1	0	3
Sai Sha Road	-	1	0	13
Tai Mong Tsai Road	A	0.67	0.33	3
Tai Mong Tsai Road	B	1	0	8
Tai Mong Tsai Road	C	1	0	2
Tai Mong Tsai Road	D	1	0	2
Tai Po Road	A	0.5	0.5	2
Tai Po Road	B	0.88	0.12	8
Tai Po Road	C	0.83	0.17	6
Castle Peak Road	-	0.87	0.13	31
Route Twisk	A	1	0	12
Route Twisk	B	0.75	0.25	4
Route Twisk	C	0.5	0.5	4
South Lantau Road	A	0.88	0.12	17
South Lantau Road	B	0.83	0.17	6
South Lantau Road	C	1	0	5
Tuen Mun Road	A	0.67	0.33	3
Tuen Mun Road	B	1	0	2
Tuen Mun Road	C	0.75	0.25	4
Tuen Mun Road	D	1	0	1
Total				320

Annex J

QRA Terminology

Quantitative Risk Assessment (QRA) Terminology

Consequence Analysis is the quantification of the impact of the consequences of an accident.

Event Tree Analysis a method for illustrating the intermediate and final outcomes which may arise after the occurrence of a selected initial event.

Fault Tree Analysis a method for representing the logical combinations of various system states which lead to a particular outcome (top event).

BS 4778 specifies " an analysis to determine which fault modes of the subitems or external events, or combinations thereof, may result in a stated fault mode of the item, presented in the form of a fault tree".

The fault tree technique adopts a top down approach for identification of causes which result in the top event, which is boulder fall herein, shown in Figure 2.1a. The immediate causes of boulder fall are identified as external forces, loss of boulder support and boulder weathering. These are further investigated to identify the root causes as shown in the fault tree diagram. A fault tree can be used to simply identify the root causes or additionally it can be used to determine the frequency of the top event if the frequency or probability of base events are known or can be synthesised. Simple logic gates (usually AND and OR gates) are used to represent the failure logic. The output for an AND gate occurs if all the inputs to the gate exist simultaneously. The output for an OR gate occurs if one or more of the inputs to the gate exists. The tree shown in this report only represents the causes for boulder fall, based on the brainstorming session with CED. No attempt has been made to synthesise frequencies.

FN curve a plot showing, for a specified hazard or range of hazards, the frequency of all events causing a stated degree of harm to N or more people.

Hazard a physical situation with a potential for human injury, damage to property, damage to the environment or some combination of these.

Individual Risk the frequency at which an individual may be expected to sustain a given level of harm from the realisation of specified hazards.

PLL Potential Loss of Life is another measure of societal risk also referred to as Rate of Death (RoD) and is the statistically expected number of fatalities (usually per year) from a given hazard.

Risk	the likelihood of a specified undesired event occurring within a specified period or in specified circumstances (ie, per year or per severe weather condition). It may be either a frequency (the number of specified events occurring in unit time) or a probability (the probability of a specified event following a prior event), depending on the circumstances.
Societal Risk	the relationship between frequency and the number of people suffering from a specified level of harm in a given population from the realisation of specified hazards. FN curves and PLL are risk parameters used for societal risk.