IG-WRDRR Report 2010: Hong Kong

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ABSTRACT: This report gives an account of the wind conditions in Hong Kong and the corresponding wind related damages in Hong Kong throughout the years. Details are presented in the report under three different aspects. First, typhoon wind and related damages; second, thunderstorm wind and related damages; and third, flooding related to wind storms and damages. Measures taken by the Hong Kong Government to reduce the risk of damages and disaster mitigation are also presented.

KEYWORDS: Hong Kong, typhoon, thunderstorm, flooding, wind damages, disaster mitigation

1 INTRODUCTION

Hong Kong is situated on the southern coast of China facing the South China Sea. The wind climate of Hong Kong is such that there are two monsoon seasons with the northeast monsoon in the winter and the southwest monsoon in the summer. Hong Kong is also frequently subjected to the onslaught of typhoons. On the average there are about 6 to 7 tropical cyclones move close or across Hong Kong each year. Besides the monsoons and tropical cyclones, Hong Kong is also subjected to the squalls of thunderstorms which occur more often in spring and summer months. Thus, strong wind due to tropical cyclones and thunderstorms is quite a common experience in Hong Kong. Furthermore, flooding due to heavy rain and storm surge sometimes occurred as a result of these storms.

2 TROPICAL CYCLONES

Hong Kong is situated on the southern coast of China facing the South China Sea. Tropical cyclones frequently develop over the western North Pacific and some of them intensify to become typhoons and move into the South China Sea. On the average each year, there are about 12 tropical cyclones appear over the South China Sea and about 6 to 7 of them move close or across Hong Kong. Tropical cyclones in Hong Kong occur normally in the summer months from May to September; however some storms can occur as late as November or even December.

As typhoon is a common occurrence in Hong Kong, damages related to typhoon can be serious, especially in the early days 40, 50 years ago. In the pre-war years, it was reported that a typhoon in 1937 took away the lives of more than 10,000 people. A table of damages, deaths and injuries caused by typhoons is listed in Table 1 (HKO) in Appendix A. It can be seen that the casualties has been much reduced in recent years. Most of the deaths and injuries were due to flooding, tidal flow and mud slide. For example Typhoon Wanda in 1962 when the tidal water raised to more than 3m to 4m above the normal maximum high-tide level, damage and casualties were widespread throughout Hong Kong. 130 people were killed and 53 were missing. Approximately 72,000 people were registered as being homeless. Of a total of 20,287 small craft in Colony waters, 726 were wrecked, 571 were sunk and 756

damaged. Of a total of 132 oceangoing ships, many were beached and ran aground. The "Cronulla" capsized near West Point and the "Tung Feng" sank near Green Island (Report of Wanda, HKO). Pictures of the Cronulla capsized and ships ran aground are shown in Figures 1a & b.

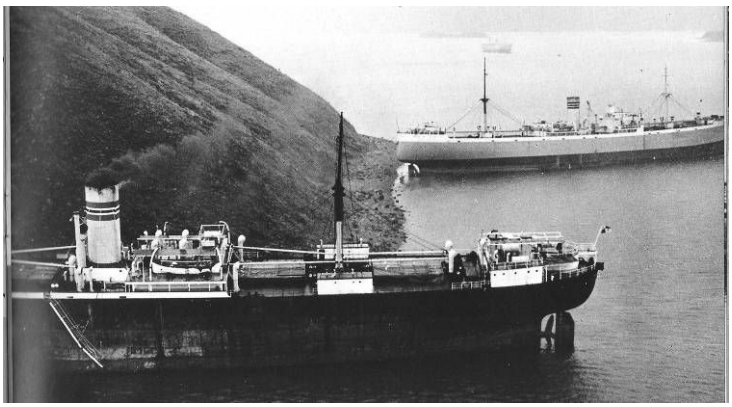
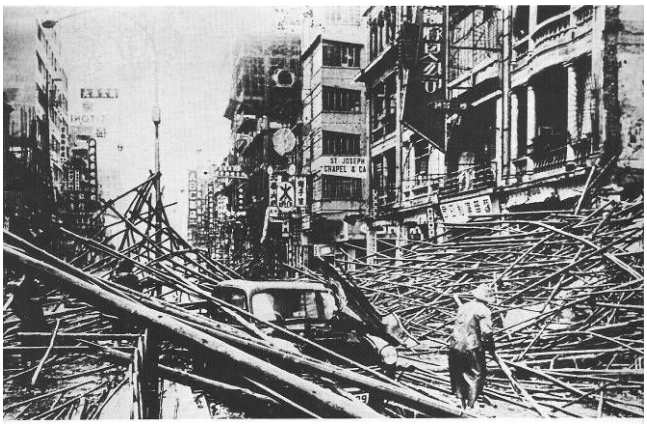


Figure 1a & b. The Capsized Cronulla and other ships ran aground during Typhoon Wanda 1962

Throughout the years although there had been substantial casualties, there were little catastrophe of building and structure collapse. There were many damages of temporary structures like scaffolding and minor structures like sign-boards, sheds, metal roofs and windows. Figures 2a & b show scaffolding damages. Damages to sign boards are shown in Figures 3a & b. Figure 4 shows damages on a curtain wall façade where many windows were broken during Typhoon York, 1999. This was found to be most likely the result of flying debris coupled with high wind pressure.



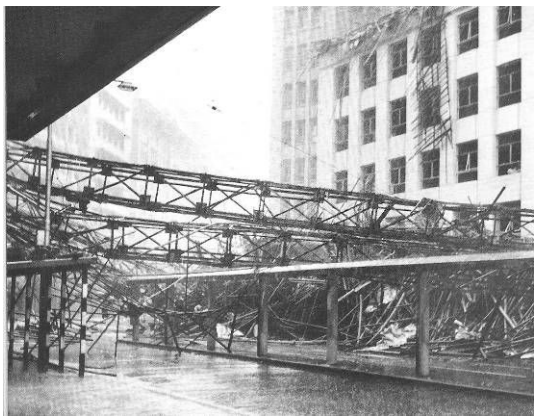


Figure 2a & b. Scaffolding damages Typhoon Wanda 1962, and Ruby 1964

Figure 3a & b. Damages to sign boards Typhoon Hope 1979 and Wanda 1962

Figure 4. Window damages during Typhoon York 1999

The relative minor damages suffered by buildings and structures in Hong Kong were partly due to the adequate provision stipulated in the Hong Kong Wind Code; and the relative small number of casualties (other than flooding and tidal surge) was the result of more accurate forecast of the movement and intensity of typhoons, a precise warning system and the prompt warning of the public by the Honk Kong Observatory (HKO) (www.hko.gov.hk). Furthermore, a standing committee is regularly looking into the Hong Kong Wind Code to update it with any necessary improvements.

In recent years with the advances in technology, the tracking and forecasting technique of typhoons is much refined and accurate. In Hong Kong, tropical cyclones are classified into six categories as given in Table 2. These classifications are in line with the recommendations of the World Meteorological Organization. The wind speed is the maximum sustained 10-minute mean wind speed near the centre of the cyclone.

Table 2. Tropical Cyclone Classifications

Classification	Max. 10-min mean speed
Tropical Depression	up to 62 km/h
Tropical storm	63 to 87 km/h
Severe Tropical Storm	88 to 117 km/h
Typhoon	118 to 149 km/h
Severe Typhoon	150 to 184 km/h
Super Typhoon	185 km/h and above

As a tropical cyclone moves near Hong Kong, tropical cyclone warning signals are isued. The wind strength referred to in the warning signals is tabulated below.

Table 3. Tropical Cyclone Warning Signal in Hong Kong

Signal	Indication
No. 1	Tropical cyclone centres within 800km of Hong Kong may affect the territory
No. 3	Sustained speed of 41-62km/h and gust may exceed 110km/h
No. 8*	Sustained speed of 63-117km/h and gust may exceed 180km/h
No. 9	Gale or storm force wind, is increasing or expected to increase significantly
No. 10	Hurricane force wind with sustained speed of 118km/h or Above and gust may exceed 220km/h

* There are the No. 8NW, 8SW, 8NE and 8SE for winds from the respective sectors

Besides the issuance of the warning signal, video-cast are given by HKO to inform the public of the movement of the oncoming tropical cyclone. Tropical cyclone warning bulletin is posted with the most updated information on the cyclone to the general public. There is also a separate tropical cyclone warning for shipping giving out the most updated information to shipping and fisherman. With the public well aware of the meaning and significance of the warning signal and adequate lead time given, casualties are expected to be reduced to a minimum.

3 TROPICAL THUNDERSTORM

Besides strong winds due to tropical cyclones, Hong Kong is also subjected to the squalls of thunderstorms which occur more often in spring and summer months. Over the years, significant damages to property and life caused by thunderstorm wind have been reported that aroused public attention. This report gives a summary of the thunderstorm activity as well as the thunderstorm monitoring and warning services in Hong Kong.

The wind speed of thunderstorm wind in Hong Kong is substantially lower than typhoon wind speed in Hong Kong; the extreme 50-year return gust wind speed (30 years of Waglan data at anemometer height) for thunderstorm is about 36m/s as compared with 65m/s for

typhoon (Choi 2007). The wind characteristics of thunderstorm wind are very different from those of the typhoon wind. A wind speed profile for thunderstorm wind is shown in Figure 5a and it can be noted that the peak wind speed is at a relatively low altitude of 50m to 200m which is very different from the typhoon wind speed profile show in Figure 5b. The time scale and space scale of thunderstorm wind are also much smaller. A thunderstorm is a local event with a time scale of less than an hour with the high wind speed portion occurring in about 10 minutes. It is also a very local event with area under immediate effect of about one to a few kilometers. Since squall lines can move very fast, strong thunderstorm wind can appear quite suddenly. Figure 6 shows the gust speed increased sharply from 10m/s to 29.7m/s in a matter of minutes at around 12:18 for thunderstorm 9/5/2005.

Thunderstorm occurs quite frequently in Hong Kong. On the average there are about 5 to 6 thunderstorms in a month. Damage caused by thunderstorm wind is mostly confined to below 100m altitude. Table 4 lists some damages in recent years. It can be seen that such damages were minor; but nevertheless, there were death and casualties. Photographs of some damages are shown in Figures 7a and b.

Table 4. Wind damages due to thunderstorm (Mok 2007)

Event Date	Damage and casualties
25 March 2001	A tree 7 metres tall collapsed in Repulse Bay
9 May 2001	- a window pane fell from a building in Tai Po and seriously injured a man. - a scaffolding collapsed in Tai Kok Tsui injuring a man about 50 containers fell to the ground in Kwai Chung
6 May 2005	- over 10 reports of fallen trees, including a 20m tree in Pokfulam. - damage of a signboard in Yau Ma Tei
9 May 2005	- some of the stacked containers in container terminals in Kwai Chung and Tsing Yi collapsed, resulting in one death and two other injured. - over 100 reports of fallen trees and scaffoldings. In particular, the fallen trees and scaffoldings respectively in Kowloon Tong and San Po Kong brought the traffic to a standstill in Kowloon.
9 June 2006	- about 20 trees were blown down at Ap Lei Chau
17 April 2007	- in Admiralty, three persons were injured when a sign board collapsed in gusty winds.
18 May 2007	- in Tin Shui Wai, four persons were injured when more than 20 stacked containers collapsed in gusty winds.

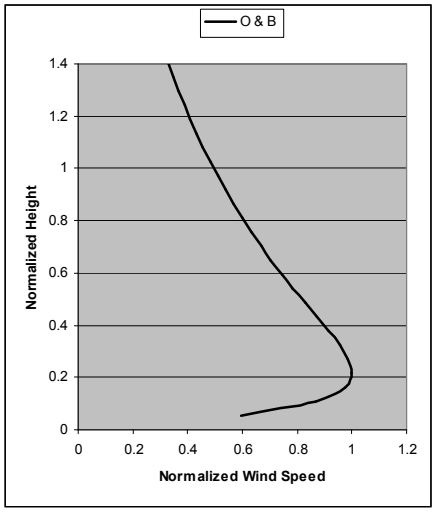


Figure 5a Wind profile (thunderstorm wind)

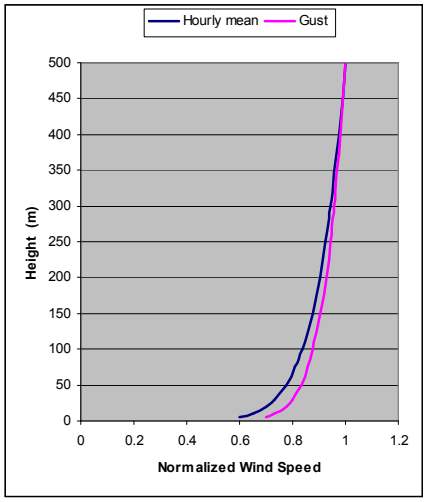


Figure 5b Wind profile (typhoon wind)

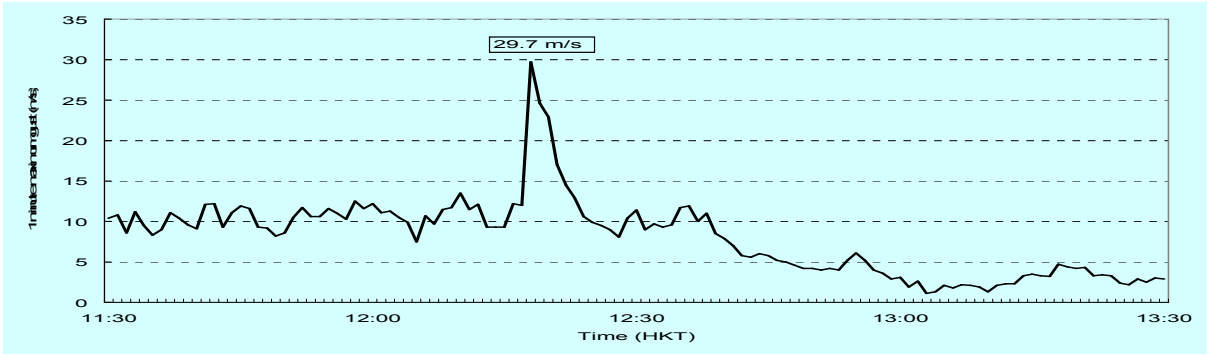


Figure 6 Gust speed record of thunderstorm 9/5/2005 at Lau Fau Shan, Hong Kong

Figure 7a & b Damages due to thunderstorm wind 2005 & 2007

To minimize damages caused by thunderstorm wind, it is important to deliver up-to-the-minute information to the public timely with the most accurate information. With the advances in technology, automatic weather stations, weather radars and lightning sensor stations are installed in many locations in Hong Kong by HKO. This makes possible the more accurate monitoring and forecasting of thunderstorm wind. To keep the public well informed, real time information on wind speed, wind direction and lightning are posted by HKO. Furthermore, different forms of information via different communication channels (e.g. TV, internet, PDA, mobile phone, data line, FTP and etc.) are communicated to the public and special clients (e.g. transport sector, construction companies) as shown in Figure 8 (Mok 2007).

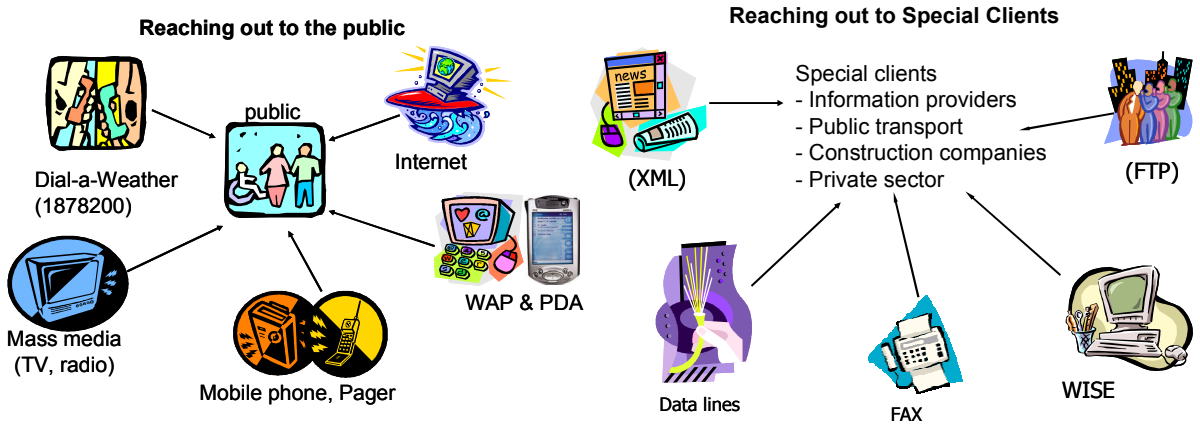


Figure 8a & b Efforts by the Hong Kong Observatory to convey information to the public

4 FLOODING DUE TO TYPHOONS AND RAIN STORMS

As mentioned in the earlier section, the majority of deaths and casualties during typhoons were the result of flooding due to storm surge and heavy rain. Figure 9 shows scene of flooding after Typhoon Wanda, 1962, where 150 people were killed, 100 injured and more than 100 missing. Heavy flooding was also recorded after other typhoons (e.g. Mary 1960, Rose 1971, Nuri 2008). Flooding caused by rain and thunderstorm was also common occurrence in Hong Kong.

In Hong Kong the long-term annual average rainfall is 2,382 mm but extreme rainfall events occur more frequent in recent years, probably caused by global climate change. For many years, the historical highest hourly rainfall record has been 109.9 mm which occurred on 8 May 1992. This record was broken on 16 July 2006 when the hourly rainfall was 115.1 mm. On 7 June 2008, an intensive storm resulted in extremely high rainfall in many parts of Hong Kong set the new record of 145.5 mm/hr.

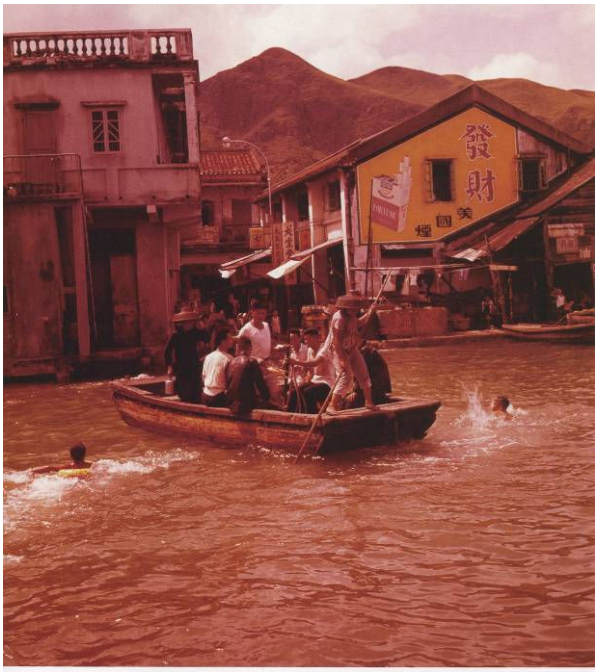


Figure 9 Flooding scene after Typhoon Wanda, 1962 (courtesy of Information Services Dept. HKSAR Government)

In the low-lying areas of Hong Kong, Kowloon and the flat land of New Territories, intensive rainfall often leads to flooding. Severe flooding, especially in the densely populated urban areas (Figure 10), causes traffic disruption and endangers lives. To alert the public, the Hong Kong Observatory issues a set of "rainstorm warning signals". The signals are based on recorded and predicted rainfall levels and recommend measures to minimize disasters related to flooding (Table 5).

Table 5. Hong Kong rainstorm warning signals.

Rainstorm warning signal	Expected or fallen rainfall	Flood risk, traffic disruption, precautions
AMBER	Heavy rain generally over Hong Kong, exceeding 30 mm/hr, and is likely to continue.	Flooding in some low-lying areas and poorly drained areas.
RED	Heavy rain generally over Hong Kong, exceeding 50 mm/hr, and is likely to continue.	All students are to remain at school unless there is a visible risk to staying in the building
BLACK	Very heavy rain generally over Hong Kong, exceeding 70 mm/hr, and is likely to continue	Schools will not dismiss students unless there is a visible risk to staying at school. Everyone is recommended to seek shelter immediately. Buses and other forms of public transport may be halted after some time. Mass Transit Railway services will be limited or suspended because of the risk of flooding

Figure 10 Flooding scene in the urban area (June 2008)

In view of the significant damages and casualties due to flooding, The Hong Kong Government is taking measures to mitigate the problem. The Drainage Services Department (DSD) has carried out a number of large flood prevention projects in Hong Kong. In the New Territories there have been provisions of new floodways and drainage channels, widening of existing channels and river courses, and installation of flood pumping schemes to villages (http://www.dsd.gov.hk).

Besides the widening and upgrading of storm drains, upstream diversion is another effect means to reduce flooding. Upstream diversion schemes can avoid numerous excavations and are often economical and environmental acceptance solutions for urban flood control in densely population cities (e.g., Lee et al., 2008; Yu and Lee, 2009). A number of underground flood storage tanks are in use or being constructed in the urban parts of Hong Kong. There are a few large-scale flood water transfer schemes employing tunnels to divert stormwater from a high runoff area into the harbour.

Upstream diversion is chosen by DSD to mitigate flooding in the urban areas of the northern part of Hong Kong Island including the business districts of Central and Wanchai. This choice is dictated by a number of factors including the steep topography of Hong Kong Island which brings rainfall runoff rapidly down the hills to the low-lying densely populated urban areas on the harbour front. In 2007, DSD commenced the flood prevention project "Hong Kong West Drainage Tunnel" for this part of Hong Kong. The project involves construction of a drainage tunnel at the Mid-Levels along the western part of Hong Kong Island to intercept stormwater from the upper catchment and discharge it directly to the sea (Figure 11).

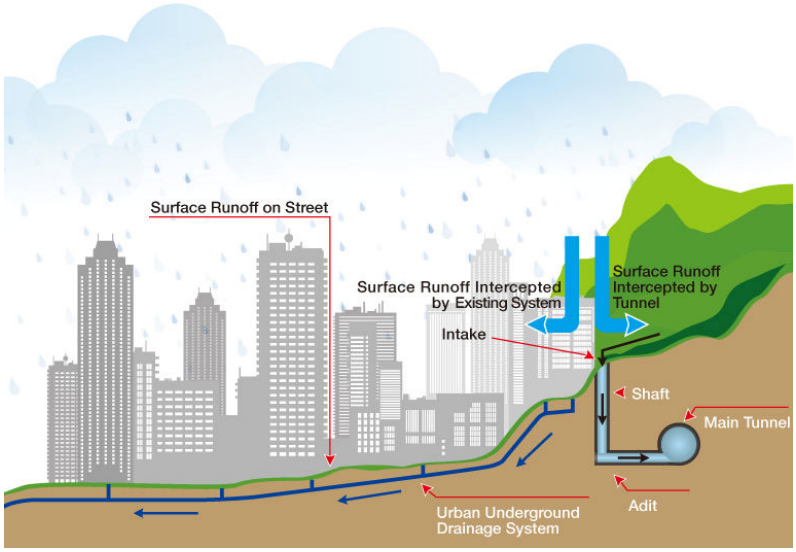


Figure 11. Hong Kong west drainage tunnel project (www.dsd.gov.hk).

The interception of stormwater from the existing steep open channels to the deep tunnel presents engineering difficulties and complicated hydraulic performance. In heavy rainfall, stormwater runs down the many steep channels in the supercritical state and it is required to catch the flow at 34 interception structures and diverse it into the deep underground tunnel safely, smoothly, and with means to dissipate the energy. The challenge of designing the structure is to transform the huge amount of energy and momentum into a desired amount and direction in as short a distance as possible. The huge amount of energy exhibited by storm water running down steep terrain can be seen from Figure 12 where motor cars were washed down hill by storm water

After careful hydraulic and engineering studies, the interception structure adopts the design consisting of (1) a bottom rack, (2) a bottom rack chamber, (3) a link channel, and (4) a vortex inlet (Figure 13). The hydraulic performance of the interception structure was studied in the Croucher Laboratory of Environmental Hydraulics at the University of Hong Kong. Different details of the vortex intake design were studied to obtain the most optimum design (Wong and Lee, 2010; Wong et al., 2010).

With the completion of these drainage mitigation measures, it is hopeful that damages and casualties due to flooding will be largely reduced.

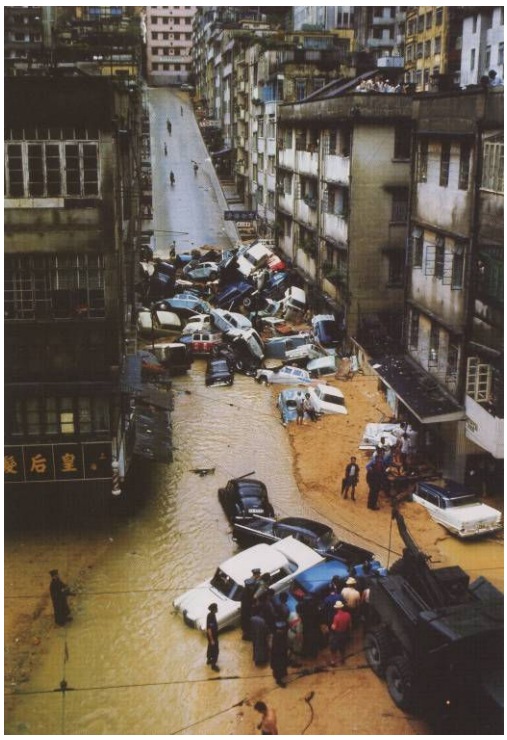


Figure 12 Motor cars washed down hill by rain storm June 1966 (courtesy of Information Services Dept. HKSAR Government)

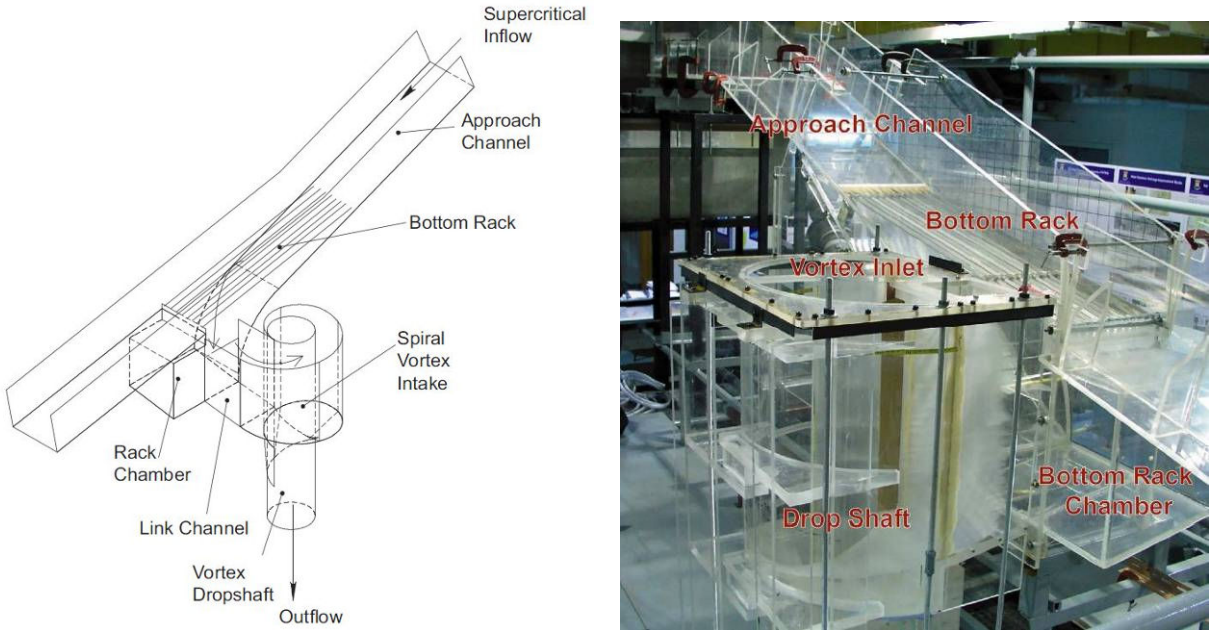


Figure 13. Interception structure: design (left) and hydraulic model (right).

Another disaster which cannot be ignored is landslide caused in-directly by typhoons, rain storms and thunderstorms. Landslide can occur as a result of too much rainfall on hill

slopes. The catastrophic landslide (Figure 14) in June 1972 induced by heavy rainfall killed 150 people and injured 93.

Since the 1972 landslide disaster, the Geotechnical Control Office has been setup by the Hong Kong Government. The office studies and stabilizes all major hill slopes in Hong Kong so as to reduce the risk of slope failure.

Figure 14 Landslide in Kwun Tong, Hong Kong in June 1972 (courtesy of Information Services Dept. HKSAR Government)

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ACKNOWLEDGEMENT

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Appendix A

Table 1 Casualties and Damage Caused by Tropical Cyclones in Hong Kong : 1960-2008 (HKO)

Year	Date / Month	Name of tropical cyclone	Persons dead	Persons missing	Persons injured	Ocean-going vessels in trouble	Small craft sunk or wrecked	Small craft damaged
1960	4 / 6 - 12 / 6	T. Mary	45	11	127	6	352	462
1961	17 / 5 - 21 / 5	T. Alice	4	0	20	*	*	*
	7 / 9 - 10 / 9	S.T.S. Olga	7	0	0	0	1	0
1962	28 / 8 - 2 / 9	T. Wanda	130	53	*	36	1 297	756
1963	1 / 9 - 9 / 9	T. Faye	3	0	51	0	2	0
1964	26 / 5 - 28 / 5	T. Viola	0	0	41	5	18	18
	2 / 8 - 9 / 8	T. Ida	5	4	56	3	7	60
	2 / 9 - 6 / 9	T. Ruby	38	6	300	20	32	282
	4 / 9 - 10 / 9	T. Sally	9	0	24	0	0	0
	7 /10 - 13 /10	T. Dot	26	10	85	2	31	59
1965	6 / 7 - 16 / 7	T. Freda	2	0	16	0	1	0
	25 / 9 - 28 / 9	T.S. Agnes	5	0	3	0	0	0
1966	12 / 7 - 14 / 7	S.T.S. Lola	1	0	6	0	*	6
1967	19 / 8 - 22 / 8	S.T.S. Kate	0	0	3	3	1	0
1968	17 / 8 - 22 / 8	T. Shirley	0	0	4	1	*	3
1969	22 / 7 - 29 / 7	T. Viola	0	0	0	0	3	0
1970	1 / 8 - 3 / 8	T.D. -	2+	0	0	0	0	0
	8 / 9 - 14 / 9	T. Georgia	0	0	0	2	0	*
1971	15 / 6 - 18 / 6	T. Freda	2	0	30	8	0	0
	16 / 7 - 22 / 7	T. Lucy	0	0	38	10	2	13
	10 / 8 - 17 / 8	T. Rose	110	5	286	34	303	*
1972	4 /11 - 9 /11	T. Pamela	1	0	8	3	0	0
1973	14 / 7 - 20 / 7	T. Dot	1	0	38	14	*	*
1974	7 / 6 - 14 / 6	T. Dinah	0	0	0	1	*	*
	18 / 7 - 22 / 7	T. Ivy	0	0	0	2	*	*
	15 /10 - 19 /10	T. Carmen	1	0	0	5	*	*
	21 /10 - 27 /10	T. Della	0	0	0	2	*	*
1975	10 / 8 - 14 / 8	T.D. -	2	1	0	3	1	*
	9 /10 - 14 /10	T. Elsie	0	0	46	7	2	1
	16 /10 - 23 /10	S.T.S. Flossie	0	0	0	1	*	*
1976	22 / 6 - 4 / 7	T. Ruby	3	2	2	0	0	0
	21 / 7 - 26 / 7	S.T.S. Violet	2	1	1	0	0	0
	5 / 8 - 6 / 8	S.T.S. Clara	0	0	4	0	0	0
	21 / 8 - 24 / 8	T.S. Ellen	27	3	65	0	4	7
	15 / 9 - 21 / 9	T. Iris	0	0	27	6	0	1
1977	4 / 7 - 6 / 7	T.D. -	0	0	2	0	0	0

	3	/ 9	-	5	/ 9	T.S.	Carla	0	0	1	1	0	0
	22	/ 9	-	25	/ 9	S.T.S.	Freda	1	0	37	2	0	0
1978	24	/ 7	-	30	/ 7	S.T.S.	Agnes	3	0	134	0	25	42
	9	/ 8	-	12	/ 8	T.S.	Bonnie	0	0	0	2	0	0
	23	/ 8	-	28	/ 8	S.T.S.	Elaine	1	0	51	8	5	8
	22	/ 9	-	26	/ 9	S.T.S.	Kit	0	7	0	0	1	0
	7	/10	-	16	/10	S.T.S.	Nina	0	0	2	0	0	0
	17	/10	-	29	/10	T.	Rita	0	0	3	1	5	0
1979	1	/ 7	-	6	/ 7	T.	Ellis	0	0	0	0	2	0
	26	/ 7	-	30	/ 7	T.S.	Gordon	0	0	0	0	2	0
	28	/ 7	-	3	/ 8	T.	Hope	12	0	260	29	167	207
	6	/ 8	-	9	/ 8	T.D.	-	0	0	0	0	3	0
	16	/ 9	-	24	/ 9	S.T.S.	Mac	1	0	67	2	12	0
1980	5	/ 7	-	12	/ 7	S.T.S.	Ida	0	0	0	1	0	0
	18	/ 7	-	23	/ 7	T.	Joe	2	1	59	4	0	1
	20	/ 7	-	28	/ 7	T.	Kim	0	0	0	0	2	1
	29	/10	-	2	/11	T.S.	Cary	0	0	0	0	0	2
1981	3	/ 7	-	7	/ 7	S.T.S.	Lynn	0	0	32	0	0	3
1982	27	/ 6	-	2	/ 7	T.S.	Tess	0	0	16	0	1	0
	22	/ 7	-	30	/ 7	T.	Andy	0	0	0	0	0	1
	5	/ 9	-	16	/ 9	T.	Irving	0	0	0	0	0	2
1983	12	/ 7	-	19	/ 7	T.	Vera	0	0	0	0	1	0
	29	/ 8	-	9	/ 9	T.	Ellen	10	12	333	44	135	225
	10	/10	-	14	/10	T.	Joe	0	0	58	2	0	3
	20	/10	-	26	/10	S.T.S.	Lex	0	0	0	0	0	1
1984	27	/ 8	-	7	/ 9	T.	Ike	0	0	1	0	0	0
1985	19	/ 6	-	25	/ 6	T.	Hal	0	1	13	0	4	2
	1	/ 9	-	7	/ 9	T.	Tess	2	0	12	6	1	3
	13	/10	-	22	/10	T.	Dot	0	0	1	0	0	0
1986	3	/ 7	-	12	/ 7	T.	Peggy	1	0	26	3	0	3
	9	/ 8	-	12	/ 8	T.D.	-	0	0	3	0	1	5
	18	/ 8	-	6	/ 9	T.	Wayne	3	1	15^{+}	0	3	0
	11	/10	-	19	/10	T.	Ellen	0	0	4	1	2	1
1987	16	/10	-	27	/10	T.	Lynn	0	0	1	0	0	0
1988	14	/ 7	-	20	/ 7	T.	Warren	0	1	12	1	2	1
	19	/ 9	-	22	/ 9	T.	Kit	0	0	0	0	0	1
	18	/10	-	23	/10	T.	Pat	2	0	1	0	0	0
	21	/10	-	29	/10	T.	Ruby	0	0	4	0	0	0

1989	16	/ 5	-	21	/ 5	T.	Brenda	6	1	119	0	3	5
	11	/ 7	-	19	/ 7	T.	Gordon	2	0	31	1	0	8
	8	/10	-	14	/10	T.	Dan	0	0	0	1	0	1
1990	15	/ 5	-	19	/ 5	T.	Marian	0	0	0	0	0	1
	15	/ 6	-	19	/ 6	S.T.S.	Nathan	5	1	1	1	0	2
	21	/ 6	-	30	/ 6	T.	Percy	1	0	0	0	0	0
	27	/ 7	-	31	/ 7	S.T.S.	Tasha	0	0	1	0	1	0
	25	/ 8	-	30	/ 8	T.	Becky	0	1	0	0	0	0
	10	/ 9	-	20	/ 9	T.	Ed	0	0	1	0	0	0
1991	15	/ 7	-	20	/ 7	T.	Amy	0	0	1	1	0	2
	20	/ 7	-	24	/ 7	S.T.S.	Brendan	0	0	17	1	1	13
	13	/ 8	-	18	/ 8	T.	Fred	0	0	0	0	1	0
1992	9	/ 7	-	14	/ 7	T.	Eli	0	0	23	0	0	1
	17	/ 7	-	18	/ 7	T.S.	Faye	2	0	24	1	0	3
	19	/ 7	-	23	/ 7	S.T.S.	Gary	0	0	18	2	0	0
1993	21	/ 6	-	28	/ 6	T.	Koryn	0	0	183	0	0	2
	16	/ 8	-	21	/ 8	T.	Tasha	0	0	35	0	0	7
	9	/ 9	-	14	/ 9	T.	Abe	1	0	0	0	0	0
	15	/ 9	-	17	/ 9	S.T.S.	Becky	1	0	130	0	0	10
	23	/ 9	-	27	/ 9	T.	Dot	0	1	48	0	1	0
	28	/10	-	5	/11	T.	Ira	2	0	30	0	1	0
1994	23	/ 6	-	25	/ 6	T.S.	Sharon	0	0	5	0	1	1
	25	/ 8	-	29	/ 8	S.T.S.	Harry	1	0	2	0	0	2
1995	7	/ 8	-	12	/ 8	S.T.S.	Helen	3	0	35	0	0	0
	25	/ 8	-	1	/ 9	T.	Kent	0	0	5	0	0	0
	28	/ 9	-	4	/10	T.	Sibyl	0	0	14	0	0	0
1996	5	/ 9	-	10	/ 9	T.	Sally	2	0	4	0	0	0
	18	/ 9	-	23	/ 9	S.T.S.	Willie	0	1	0	0	0	0
1997	31	/ 7	-	3	/ 8	T.	Victor	1	0	58	0	0	0
	20	/ 8	-	23	/ 8	T.	Zita	0	0	3	0	0	0
1998	7	/ 8	-	11	/ 8	S.T.S.	Penny	1	0	1	0	0	0
	12	/ 9	-	14	/ 9	T.D.	-	0	0	10	0	0	0
	15	/10	-	27	/10	T.	Babs	0	0	14	0	0	0
1999	28	/4	-	2	/ 5	T.	Leo	0	0	14	0	0	0
	2	/6	-	8	/ 6	T.	Maggie	0	0	5	0	2	0
	25	/7	-	28	/ 7	T.S.	-	0	0	18	0	0	0
	19	/8	-	23	/ 8	T.	Sam	4	0	328	0	0	0

	12	/9	-	17	/ 9	T.	York	2	0	500	3	*	*
	24	/9	-	26	/ 9	S.T.S.	Cam	1	0	23	0	0	0
2000	15	/7	-	16	/ 7	T.D.	-	0	1	6	0	0	0
	27	/8	-	1	/ 9	S.T.S.	Maria	2	0	0	0	0	0
	5	/9	-	10	/ 9	T.	Wukong	0	0	1	0	0	1
2001	30	/6	-	3	/ 7	T.	Durian	0	0	1	0	0	0
	1	/7	-	8	/ 7	T.	Utor	1	0	1	0	1	0
	23	/7	-	26	/ 7	T.	Yutu	0	0	10	0	0	0
	28	/8	-	1	/ 9	T.S.	Fitow	2	0	0	0	0	0
2002	15	/8	-	20	/ 8	S.T.S.	Vongfong	0	0	2	0	0	1
	10	/9	-	13	/ 9	S.T.S.	Hagupit	0	0	32	0	0	3
2003	16	/7	-	23	/ 7	S.T.S.	Koni	0	0	15	0	0	0
	17	/7	-	25	/ 7	T.	Imbudo	1	0	45	0	2	8
	17	/8	-	26	/ 8	T.	Krovanh	0	0	11	0	0	2
	29	/8	-	3	/ 9	T.	Dujuan	0	4	24	0	1	4
2004	14	/7	-	16	/ 7	T.S.	Kompasu	0	0	12	0	0	0
2005	10	/8	-	14	/ 8	S.T.S.	Sanvu	0	0	0	0	0	1
	16	/9	-	19	/ 9	T.S.	Vicente	2	0	0	0	0	0
	21	/9	-	28	/ 9	T.	Damrey	0	0	5	0	0	1
2006	9	/5	-	18	/ 5	T.	Chanchu	0	0	6	0	1	0
	27	/6	-	29	/ 6	T.S.	Jelawat	1	0	0	0	0	0
	31	/7	-	4	/ 8	T.	Prapiroon	0	0	8	0	1	4
	6	/8	-	10	/ 8	S.T.S.	Bopha	0	0	0	0	0	1
	23	/8	-	25	/ 8	T.D.	-	0	0	0	0	0	1
	12	/9	-	13	/ 9	T.D.	-	0	0	1	0	0	0
	2710	/	-	6	/11	T.	Cimaron	0	0	4	0	0	0
2007	5	/8	-	11	/8	S.T.S.	Pabuk	1	0	17	0	0	0
2008	15	/4	-	20	/4	T.	Neoguri	0	0	2	0	0	0
	18	/6	-	26	/6	T.	Fengshe n	0	0	17	0	0	0
	4	/8	-	8	/8	S.T.S.	Kammuri	0	0	37	0	0	0
	17	/8	-	23	/8	T.	Nuri	2	0	112	0	0	0
	19	/9	-	25	/9	T.	Hagupit	0	0	58	0	10	0