MONITORING OF SOLID WASTE IN HONG KONG 1998

Environmental Protection Department

Mui Wo

Hei Ling Chau

Cheung Chau

Peng Chau

The North Lantau Transfer Station (front cover) and the Outlying Islands Transfer Facilities (inside cover) came into operation in 1998.

Monitoring of Solid Waste in Hong Kong

1998

Facilities Planning Group
Environmental Protection Department

1999

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Abbreviations

C&D - Construction and Demolition

C&I - Commercial and Industrial

CED - Civil Engineering Department

CWTC - Chemical Waste Treatment Centre

EMSD - Electrical and Mechanical Services Department

EPD - Environmental Protection Department

EPS - Expanded polystyrene

GDP - Gross Domestic Product

IETS - Island East Refuse Transfer Station

IWTS - Island West Refuse Transfer Station

KBTS - Kowloon Bay Refuse Transfer Station

KCIP - Kwai Chung Incineration Plant

MSW - Municipal Solid Waste

NENT - North East New Territories Landfill

NLTS - North Lantau Refuse Transfer Station

NT - New Territories

OITF - Outlying Islands Refuse Transfer Facilities

PET - Polyethylene terephthalate

RSD - Regional Services Department

RTS - Refuse Transfer Stations

SENT - South East New Territories Landfill

STTS - Sha Tin Refuse Transfer Station

tpd - tonnes per day

USD - Urban Services Department

WENT - West New Territories Landfill

WKTS - West Kowloon Refuse Transfer Stat

Executive Summary

The monitoring of solid waste in 1998 was a continuation of previous work. The latest findings were recorded under similar headings and formats of previous reports in the same series.

The solid waste quantities disposed of in 1998 were the actual quantities recorded at all the waste facilities throughout the year. The characteristics of various types of waste in the municipal solid waste stream, including domestic waste, commercial waste and industrial waste, were determined through an annual waste survey at refuse transfer stations and landfills using sampling techniques. The projected waste quantities were estimated from the projection of past waste data and the predicted figures on population and employment size.

In the 1998 waste survey, a total of 140 samples, each with volume of one cubic metre, were taken from three refuse transfer stations and two landfills for analysis. For each sample, sorting was carried out on site for its composition and a small portion of which was taken out randomly before sorting for moisture content determination.

In 1998, Hong Kong generated 46,510 tonnes of solid waste and reusable materials daily. The net intake quantity of solid waste in 1998 at all waste facilities was 16,560 tonnes per day; an increase by 5% from 1997. The major types of solid waste disposed of at waste facilities were municipal solid waste (8,730 tonnes per day) and construction & demolition waste (7,030 tonnes per day). Landfilled municipal solid waste was made up of 6,820 tonnes of domestic waste, 1,290 tonnes of commercial waste and 620 tonnes of industrial waste. As regards waste recovery, 4,270 tonnes of recyclable materials in the municipal solid waste were recovered daily for recycling and 25,680 tonnes of inert construction & demolition materials were reused for land formation.

1.56 million tonnes (i.e. 33% of the total municipal solid waste generated in Hong Kong) were recovered in 1998, of which 0.38 million tonnes were recycled locally and 1.18 million tonnes were exported for recycling. The other municipal solid waste was disposed of at the three strategic landfills, namely West New Territories Landfill (WENT), North East New Territories Landfill (NENT) and South East New Territories Landfill (SENT); WENT had the daily intake of 4,090 tonnes, NENT 2,480 tonnes and SENT 2,160 tonnes.

Upon the opening of the additional refuse transfer station at North Lantau and four refuse transfer facilities at Outlying Islands (Cheung Chau, Peng Chau, Mui Wo and Hei Ling Chau) in 1998, all refuse transfer stations and facilities transferred daily 4,800 tonnes of municipal solid waste in bulk containers to WENT and NENT by means of marine and land transport respectively. This quantity represented 55% of the total municipal solid waste disposed of at landfills.

For C&D waste disposed of at landfills, SENT had the highest daily intake of 5,400 tonnes, WENT 910 tonnes and NENT 720 tonnes. The overall intake of construction & demolition waste at all landfills was 42% of the total waste landfilled in 1998, as a result of continued diversion of inert construction & demolition material to public filling areas and the provision of new barging points and public filling areas. The total quantity of construction & demolition material delivered to landfills and public filling areas in 1998 was 15% higher than that of 1997.

Paper and putrescibles were the major components constituting more than half of the landfilled municipal solid waste, representing about 27% and 31% respectively. Paper waste was the most popular item for recycling in 1998 and non-ferrous metals had the greatest financial value for recovery despite their relatively small percentage by weight.

Domestic waste refers to household waste(1), waste generated from institutional premises (e.g. government offices and schools) and refuse collected from public cleansing services such as litter collected by the two Provisional Municipal Councils, marine refuse and waste from country parks. The generation rate of domestic waste in 1998 was about 1.02 kg per person per day. The annual generation rates over the last six years since 1993 fluctuated over a small range of 1.00 to 1.04 kg per person per day. However, the generation rate of commercial & industrial waste increased by 10% to 1.21 kg per employee per day in 1998, compared to 1.10 kg per employee per day in 1997.

If the current growing trend in the quantity of municipal solid waste continues, per capita generation rates of domestic waste and commercial & industrial waste would be 1.16 kg per day and 1.61 kg per day respectively in year 2016. The predicted quantity of municipal solid waste requiring final disposal in year 2016 would be 14,200 tonnes daily; making up of about 10,400 tonnes of domestic waste and 3,800 tonnes of commercial & industrial waste.

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(1) In 1998, it was found from a household waste survey at public and private housing estates that the average waste generation rate of a household member was 0.79 kg per person per day.

1 Introduction

1.1 Background

1.1.1 Following the growth in population and economy in Hong Kong since the 1980s when the monitoring of solid waste started, the total quantity of waste discarded from households, commercial and industrial activities has generally increased over the years. Figure 1 portrays the wasteloads requiring disposal at waste facilities over the last decade by type.

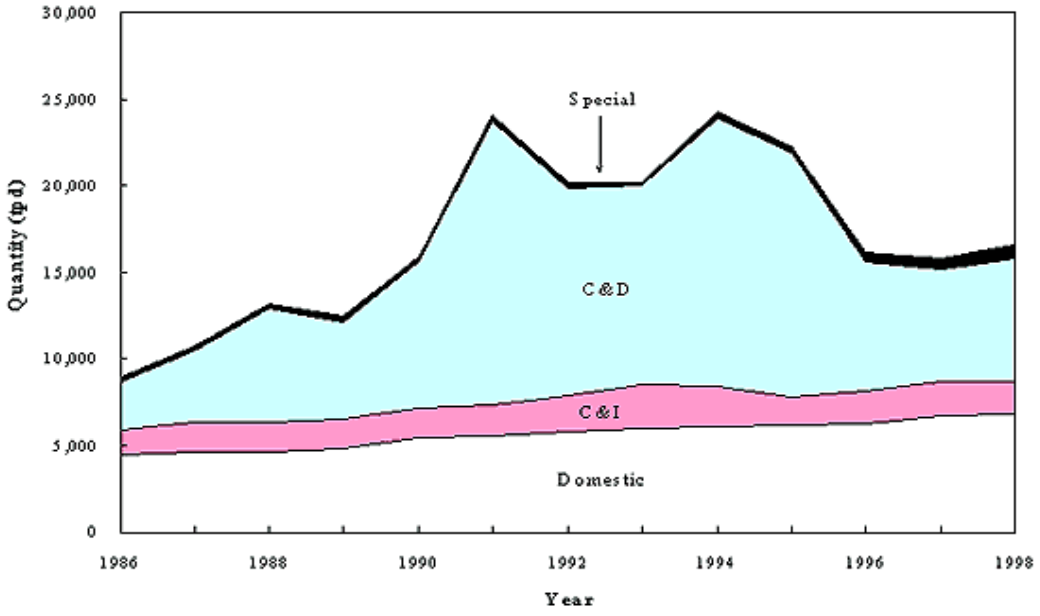


Figure 1 : Quantity of the major types of solid waste disposed of at solid waste facilities 1986 - 1998
(Note : Please refer to section 2.1 for detailed interpretation of waste terminology)

1.1.2 In 1981, the Environmental Protection Agency, the predecessor of the Environmental Protection Department (EPD), launched a waste monitoring programme to gather information related to the design needs of the waste management system. The objectives of this programme include establishing geographical distribution of solid waste and their major constituents as well as identifying socio-economic parameters that can be used for forecasting future waste management needs and planning for appropriate waste facilities. Since then, subsequent waste monitoring has been conducted annually.

1.1.3 The information collected from the monitoring work has been used in various aspects of waste management planning which include in particular the development of the Waste Disposal Plan (1989) and the Waste Reduction Framework Plan (1998).

1.1.4 The Waste Disposal Plan published in 1989 sets out the disposal strategy for solid waste and includes the development of cost-effective new waste facilities of high environmental standards. In 1998, these facilities include the Chemical Waste Treatment Centre, three specially-built landfills and a network of six refuse transfer stations and four outlying islands refuse transfer facilities under the management of the EPD.

1.2 Importance of the Waste Monitoring Programme

1.2.1 Waste monitoring is important for keeping track of waste statistics and relevant development. The existing database of waste information has been compiled since 1981. The latest waste disposal records and data collected each year from the waste monitoring programme enable the EPD to fine-tune projection of waste and take account of the best estimates for strategic waste management and planning such as:-

(a) projecting quantities of waste and their geographical distribution;
(b) forecasting future utilization of waste disposal facilities;
(c) planning for new waste disposal facilities;
(d) planning for waste reduction measures;
(e) establishing waste management models for development of cost-effective waste management plans;
(f) identifying new waste management initiatives; and
(g) monitoring of waste reduction.

1.3 Scope of this Report

1.3.1 This annual report for calendar year 1998 is the fifteenth in a series of reports on the solid waste monitoring work carried out by the EPD.

1.3.2 Chapter 2 covers the classification and terminology of different types of solid waste used in this report and describes the approaches in monitoring waste information in 1998 together with relevant sources of reference.

1.3.3 The latest findings of waste monitoring survey and records of waste handled at all waste facilities are compiled under various tables and figures in Chapters 3 to 5

and appendices in similar structure and headings as in recent reports.

1.3.4 Chapter 3 summarizes the records of waste intake at various waste facilities such as landfills, refuse transfer stations and the Chemical Waste Treatment Centre.

1.3.5 Chapter 4 presents the updated information on recovery and recycling of municipal solid waste and financial values of various recovered waste materials.

1.3.6 Chapter 5 provides per capita generation rates of domestic waste and commercial & industrial waste in 1998 and their projections up to 2016. This chapter also presents the projected quantities of municipal solid waste and construction & demolition waste up to 2016, and briefly describes the waste reduction targets set out in the Waste Reduction Framework Plan.

2 Classification of Solid Waste and Waste Monitoring Methodology

2.1 Waste Classification and Terminology

2.1.1 In this report, solid waste is classified into five main types by making reference to the sources of waste and the institutional arrangements for waste collection and disposal. These five types of solid waste are municipal solid waste, construction & demolition (C&D) waste, chemical waste, special waste and other solid waste. The current classification system of solid waste is depicted in Figure 2. The detailed interpretations of some commonly used terms are described below.

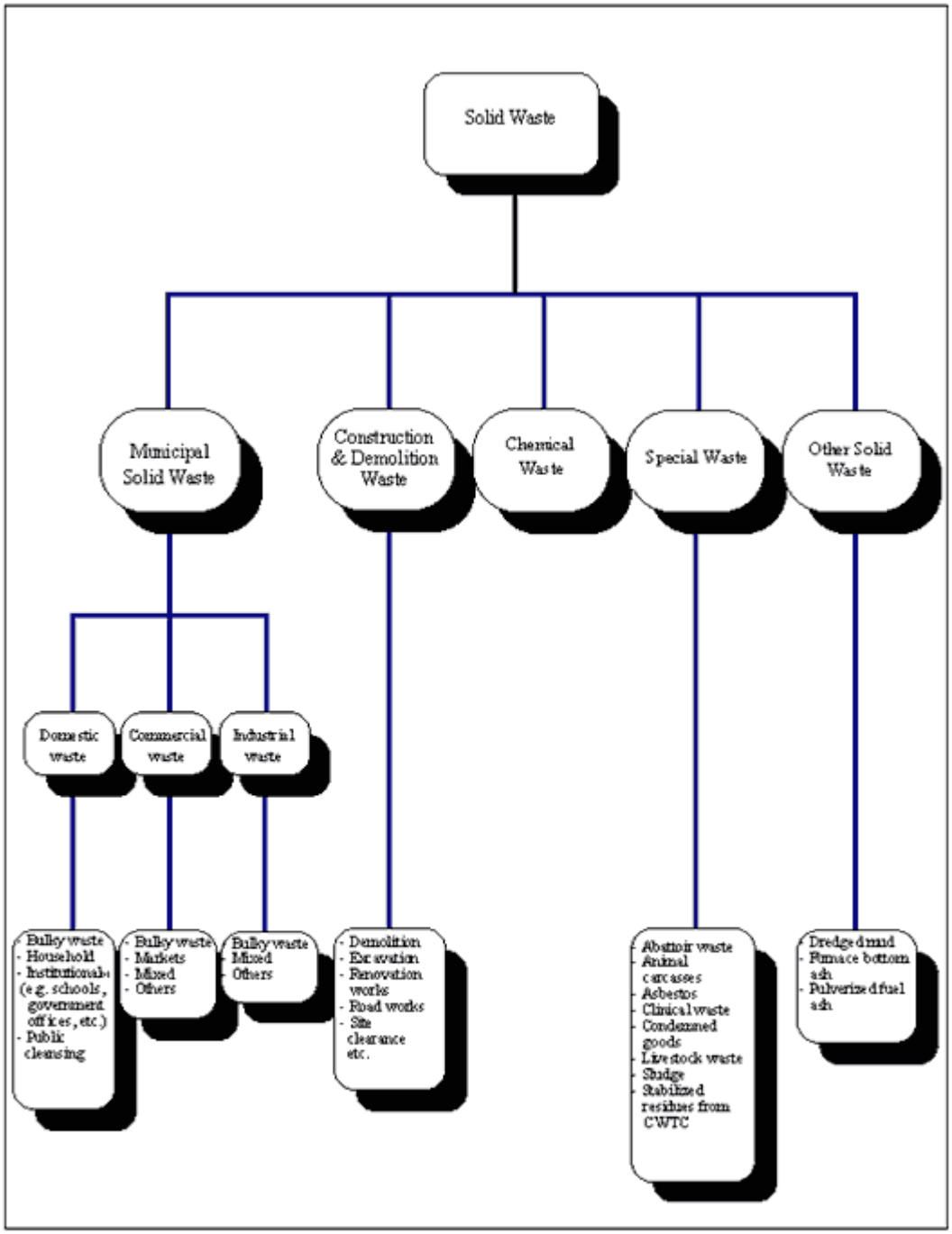
2.1.2 **Municipal solid waste** includes domestic waste, commercial waste and industrial waste.

- **Domestic waste** refers to household waste, waste generated from daily activities in institutional premises and refuse collected from public cleansing services. Public cleansing waste includes dirt and litter collected by the two Provisional Municipal Councils, marine refuse collected by the Marine Department and waste from country parks collected by the Agriculture and Fisheries Department.

- **Commercial waste** is waste arising from commercial activities taking place in markets, shops, restaurants, hotels and offices etc. It is collected mainly by private waste collectors. However, some commercial waste is mixed with domestic waste and collected by the Provisional Municipal Councils. Some not mixed is also collected by the Provisional Municipal Councils for historical reasons.

- **Industrial waste** is waste arising from industrial activities and does not include C&D waste and chemical waste. It is usually collected by private waste collectors. However, some industries may deliver their industrial waste directly to landfills for disposal.

It should be noted that there are bulky items like furniture and domestic appliances which cannot be handled by conventional compactor type refuse collection vehicles. These items are regarded as bulky waste and are usually collected separately. They may come from residential premises, commercial and industrial activities.



Notes :

(1) Waste generated from schools, government offices, etc. was usually mixed with household waste and/or public cleansing refuse during the process of collection carried out by RSD/USD.

Figure 2 : Current classification of solid waste

2.1.3 **Construction & Demolition (C&D) waste** includes waste arising from any land excavation or formation, civil/building construction, site clearance, demolition activities, roadworks and building renovation. It includes various types of building debris, rubble, earth, concrete, timber and mixed site clearance materials. Type I C&D waste, as stated in the landfill contracts, is defined as C&D waste containing not more than 20% by volume (or 30% by weight) of inert materials. Inert materials comprise dirt/soil/mud, concrete, reinforced concrete, asphalt, brick/sand, cement plaster/mortar, aggregate, inert building debris, and rock/rubble. Type II C&D waste, which is not normally accepted by landfills, consists of more than 20% by volume (or 30% by weight) of inert material content.

2.1.4 **Chemical waste** is defined in the Waste Disposal (Chemical Waste) (General) Regulation under the Waste Disposal Ordinance (Cap. 354). Chemical waste can be any substance arising from any process or trade activity which contains chemical in such form, quantity or concentration that can cause pollution to the environment or become a risk to health.

2.1.5 **Special waste** includes abattoir waste, animal carcasses, asbestos, clinical waste, condemned goods, livestock waste, sewage treatment and waterworks treatment sludge, sewage works screenings and stabilized residues from Chemical Waste Treatment Centre.

2.1.6 **Other solid waste** refers to solid waste types not covered by the above descriptions. These include coal ash, dredged mud and excavated materials disposed of at marine dumps.

2.2 Methodology

2.2.1 Solid waste data are mainly collected by two approaches : weighing exercise at all waste facilities throughout the year and waste characterization using sampling techniques. All solid waste facilities in Hong Kong are now managed by the Environmental Protection Department (EPD) whereas public filling areas and barging points accepting inert C&D material are managed by the Civil Engineering Department (CED). Whilst the wasteload of each intake is recorded immediately at each waste facility, waste composition is characterized through sampling exercises in a separate survey. Other departments, such as the CED, Regional Services Department (RSD), Urban Services Department (USD), Census and Statistics Department and Planning Department, provide the EPD with relevant statistics

regularly.

2.2.2 The following data were collected from various sources throughout the year and compiled into various tables, figures and appendices in this report :-

- waste intake records taken at weighbridges of landfills and refuse transfer stations (RTS);
- results of survey on waste composition characterization conducted in October/November 1998 at landfills and RTS;
- results of quarterly exercises of weighing waste from various districts conducted by the RSD, USD and EPD;
- annual figures of total gross domestic product (GDP), population and employment provided by the Census and Statistics Department;
- figures of population and employment in 2001, 2006 , 2011 and 2016 predicted by the Planning Department under Scenario B of the Territorial Development Strategic Review; and
- quantities of special waste and other solid waste from relevant specialist groups in the EPD and concerned government departments.

3. Waste Quantities and Characteristics

3.1 Waste Disposal Statistics

3.1.1 In 1998, a daily average of 16,560 tonnes of solid waste were disposed of at the landfills. Compared with the 15,780 tpd disposed of at waste facilities in 1997, there was an overall increase of about 5%.

3.1.2 The three specially-built landfills at the west, south east and north New Territories, abbreviated as WENT, SENT and NENT, were supported by a network of six refuse transfer stations at Kowloon Bay (KBTS), Island East (IETS), Sha Tin (STTS), West Kowloon (WKTS), Island West (IWTS) and North Lantau (NLTS) and four outlying islands refuse transfer facilities (OITF) at Cheung Chau, Peng Chau, Mui Wo and Hei Ling Chau.

3.1.3 Table 1 summarizes by waste type the quantities of solid waste disposed of at the above facilities and its percentage change from 1997. Domestic waste and construction & demolition (C&D) waste were the major components summing up to 84% of all solid waste. Compared with 1997, the C&D waste had the highest increase in terms of quantity by 552 tonnes per day (tpd) whilst the industrial waste had the highest reduction by 77 tpd. There was a net overall increase in the quantity of solid waste requiring disposal. The increased intake of C&D waste at landfills was a result of the increase of total C&D material arising in 1998 by 15%.

3.1.4 The domestic waste intake at the waste facilities slightly increased by 1% to 6,822 tpd. Commercial waste intake increased by 5% to 1,286 tpd but industrial waste intake decreased by 11% to 624 tpd. Hence, there is a net slight increase of municipal solid waste (MSW) intake by 1% to 8,732 tpd. Special waste intake increased by 28% to 794 tpd, mainly due to the increase of dewatered sludge attributed to the gradual implementation of Hong Kong's Strategic Sewage Disposal Scheme.

3.1.5 Table 1 also presents the breakdown of solid waste collected by the public and private sectors. In general, C&D waste and commercial & industrial (C&I) waste were collected by private waste collectors whereas domestic waste was collected by the Regional Services Department (RSD) and Urban Services Department (USD). However, publicly collected domestic waste included some C&I waste owing to (i) mixing of C&I waste with domestic waste prior to delivery to refuse collection points in

some old urban areas, (ii) historical reason that the Provisional Municipal Councils have been collecting C&I waste from some commercial establishments and commercial districts, and (iii) the current practice that the Provisional Municipal Councils collect some market waste, i.e. waste from the markets managed by RSD/USD.

Waste type	Quantity (tpd)			Change from 1997	
	Public[1]	Private[2]	Total	Quantity (tpd)	Percentage
a. Domestic waste					
- household mixed/ public cleansing	5,597	1,046	6,643		
- bulky waste	157	22	179		
Sub-total	5,754[3]	1,068	6,822	+ 67	+ 1%
b. Commercial waste					
- commercial mixed	-	1,154	1,154		
- bulky waste	-	68	68		
- markets	-	60	60		
- others	-	4	4		
Sub-total		1,286	1,286	+ 66	+ 5%
c. Industrial waste					
- manufacturing mixed	-	265	265		
- bulky waste	-	11	11		
- others	-	348	348		
Sub-total		624	624	- 77	-11%
d. Municipal solid waste received at disposal facilities (a+ b+ c)	**5,754**	**2,978**	**8,732**	**+ 56**	**+ 1%**
e. Construction & demolition waste (landfilled)	**-**	**7,033**	**7,033**	**+ 552**	**+ 9%**
f. Special waste (landfilled)	**453**	**341**	**794**	**+ 176**	**+ 28%**
g. All waste received at waste facilities (d+ e+ f)	**6,210[4]**	**10,350[4]**	**16,560[4]**	**+ 780[4]**	**+ 5%**

Notes:
(1) Waste collected by RSD and USD, RSD/USD contractors and other government vehicles.
(2) Waste collected by private waste collectors.
(3) Publicly collected domestic waste included some commercial and industrial waste.
(4) Figures are rounded off to the nearest 10 tpd.

Table 1 : Quantities of solid waste disposed of at refuse transfer stations and landfills in 1998

3.1.6 The average daily waste intake at each facility by waste type in 1998 is given in Appendix 1.

3.1.7 The past disposal records of solid waste from 1986 to 1998 at all waste facilities are compiled by waste type in Table 2 and by facility in Appendix 2. Only domestic waste showed a continued increasing disposal trend over the last decade. Its quantity was primarily dependent on population which also increased steadily during that period. For the other waste types, their quantities were affected by the territory's economic and construction activities. The substantial reduction of C&D waste intake at landfills after 1995 was a result of (i) joint effort amongst government departments in providing new barging points and public filling outlets for inert C&D material and promoting their re-utilization, and (ii) support from the construction trade.

Year	Quantity of waste by type (tpd)						
	Municipal solid waste				C&D (landfilled)	Special (landfilled)	TOTAL
	Domestic (a)	Commercial (b)	Industrial (c)	Sub-total (d)= (a)+ (b)+ (c)	(e)	(f)	(g)= (d)+ (e)+ (f)
1986	4,420	370	1,080	5,870	2,850	240	8,960
1987	4,630	430	1,240	6,300	4,220	250	10,770
1988	4,580	420	1,410	6,410	6,520	260	13,190
1989	4,870	450	1,270	6,580	5,580	310	12,480
1990	5,460	380	1,270	7,100	8,450	360	15,920
1991	5,560	400	1,430	7,390	16,380	340	24,110
1992	5,760	460	1,710	7,930	11,960	320	20,210
1993	6,000	570	1,880	8,450	11,520	250	20,220
1994	6,070	700	1,660	8,430	15,480	390	24,300
1995	6,210	520	1,060	7,790	14,120	350	22,260
1996	6,260	1,090	800	8,140	7,520	490	16,150
1997	6,760	1,220	700	8,680	6,480	620	15,780
1998	6,820	1,290	620	8,730	7,030	790	16,560

Remark: Figures are rounded off to the nearest 10 tpd and may not add up to total due to rounding-off.

Table 2 : Summary of the major types of solid waste disposed of at waste facilities 1986 - 1998

3.1.8 There was seasonal fluctuation of municipal solid waste in 1998, with a maximum of 4% surge in the summer months from the annual average. The surge might be explained by the increased production of domestic waste during the summer time, for instance, soft drink containers and fruit waste.

3.1.9 The quantities and disposal methods of special waste and other solid waste are summarized in Table 3. About 109 tpd of grease trap waste were accepted for treatment at the Interim Grease Trap Waste Treatment Facility located at WENT prior to co-disposal. This waste is not included in Table 3 as it is regarded as special aqueous waste due to its high water content.

Waste type	Disposal method	Quantity disposed of (tpd)
Abattoir waste	Landfilling	25
Animal carcasses	Landfilling	26
	Crematories, Kennedy Town By-Product Plant	4
Asbestos waste	Co-disposal at landfills	20
Chemical waste other than asbestos waste	CWTC	205
	Co-disposal at landfills	5
Clinical waste	Co-disposal at landfills	3
Condemned goods	Landfilling	23
CWTC stabilised residue	Landfilling	45
Dewatered waterworks and sewage sludge	Landfilling	356
Dredged mud and excavated materials (1)	Marine dumping	10,979
Furnace bottom ash	Concrete manufacturing, stored in lagoon	213
Livestock waste	Composting and other environmentally acceptable means (2)	586
Pulverised fuel ash	Concrete manufacturing, stored in lagoon	1,848
Sewage works screenings	Landfilling	46

Notes :
(1) Assuming the density of the dredged mud and excavated materials to be one tonne per cubic metre.
(2) Examples of environmentally acceptable means include on-site composting, aerobic treatment, dry muck-out, etc.

Table 3 : Quantities of different kinds of special and other solid wastes disposed of in 1998

3.2 Geographical Distribution of Major Solid Waste

3.2.1 The quantity of each type of solid waste disposed of at waste facilities is attributed to 18 waste arising districts identical to that of the District Board districts. In order to facilitate waste data capturing and recording, these 18 waste arising districts are sub-divided into 54 waste arising areas. The list of waste arising districts and waste arising areas is provided in Appendix 3. The geographical distribution of the major types of solid waste disposed of at waste facilities in 1998 by waste arising districts is shown in Table 4. The geographical breakdown should be regarded as indicative reference only as the information was provided by drivers who generally stated the last pick up location at the weighbridges of waste facilities although each waste collection vehicle might have collected waste from a number of locations.

3.2.2 Figure 3 depicts the bulk containerized transfer routings of solid waste by road and sea from refuse transfer stations and facilities to landfills. Figure 3 also portrays in bar-charts the quantities of domestic waste and C&I waste collected and disposed of at waste facilities within four geographical regions, namely Islands & West NT, North East NT, Kowloon & HK Island and South East NT. Kowloon & Hong Kong Island had the highest collected quantity of MSW in the territory in 1998. Since there was no final disposal outlet in this region, the domestic waste collected was delivered to the refuse transfer stations for containerized bulk transfer to landfills in other regions for final disposal. Waste collected from a particular geographical region may not end up in a final waste disposal outlet in its vicinity. The flexibility of the waste transfer system is that its destiny can be changed to where the new disposal facility will be, without disrupting the waste collection services in any region.

3.3 Utilization of Waste Facilities

3.3.1 Appendix 1 summarizes the waste intake by type at each waste facility in 1998. All refuse transfer stations and facilities accepted publicly collected MSW. Starting from mid-1998, IETS, WKTS, NLTS and OITF also accepted privately collected MSW. Among the three strategic landfills, SENT received the majority of C&D waste and privately collected MSW in 1998. It also received the greatest amount of waste in 1998. At both WENT and NENT, more than 75% of solid waste intake was MSW. WENT and NENT each accepted about 60% and 40% of RTS processed MSW respectively for final disposal.

Waste Arising District	Quantity[1] (tpd)					
	Domestic waste		C&I waste	Municipal solid waste	C&D waste (Landfilled)	All solid waste[3]
	Publicly collected[2] (a)	Privately collected (b)	(c)	(d) = (a)+ (b)+ (c)	(e)	(f) = (d)+ (e)
Central & Western	339	70	93	502	615	1,117
Wanchai	252	66	80	398	265	663
Eastern	436	113	118	667	261	928
Southern	268	17	35	320	72	392
Hong Kong Island Sub-total	**1,295**	**266**	**326**	**1,887**	**1,213**	**3,100**
Yau Tsim Mong	496	103	127	726	720	1,446
Sham Shui Po	330	67	120	517	312	829
Kowloon City	306	85	115	506	366	872
Wong Tai Sin	322	17	33	372	250	622
Kwun Tong	454	78	213	745	984	1,729
Kowloon Sub-total	**1,908**	**350**	**608**	**2,866**	**2,632**	**5,498**
Kwai Tsing	324	34	103	461	300	761
Tsuen Wan	221	101	164	486	328	814
Tuen Mun	412	40	145	597	448	1,045
Yuen Long	375	22	158	555	334	889
North	229	122	86	437	508	945
Tai Po	259	59	63	381	159	540
Sha Tin	414	60	156	630	311	941
Sai Kung	185	14	63	262	666	928
NT - Mainland Sub-total	**2,419**	**452**	**938**	**3,809**	**3,054**	**6,863**
Cheung Chau[4]	41	-	-	-	-	-
Mui Wo[4]	28	-	-	-	-	-
Peng Chau[4]	11	-	-	-	-	-
Discovery Bay[4]	15	-	-	-	-	-
Lamma Island[4]	25	-	-	-	-	-
Hei Ling Chau[4]	4	-	-	-	-	-
North Lantau[4]	8	-	-	-	-	-
NT - Outlying Islands Sub-total	**132**	**-**	**38** [5]	**170**	**134** [5]	**304**
Territorial Total	**5,754**	**1,068**	**1,910**	**8,732**	**7,033**	**15,765**

Notes :

(1) The geographical distribution of solid waste arisings is based on weighbridge records and should be regarded as indicative reference only.

(2) Publicly collected domestic waste included public cleansing waste as well as some commercial and industrial waste.

(3) Special waste is not included in this table.

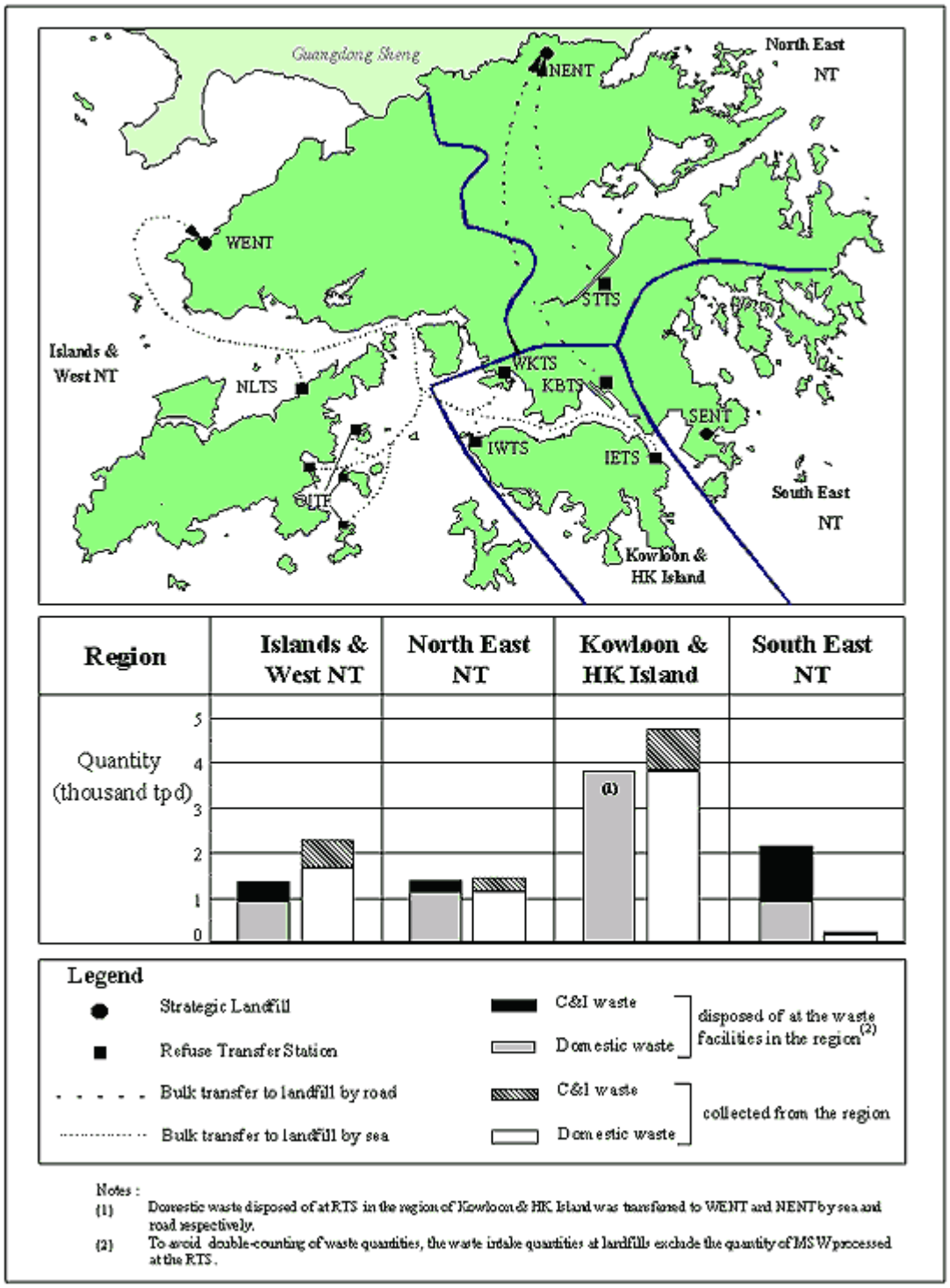
(4) These islands /areas are aggregated to form the waste arising district "Outlying Islands".

(5) Data are collected from OITF and NLTS.

(6) Breakdown into individual islands /areas is not available.

Table 4 : Geographical distribution of major solid waste disposed of at landfills in 1998

3.3.2 Figure 4 presents the provision of waste facilities in 1998, the average daily waste intake at each waste facility in 1998 and its percentage change over the previous year 1997. Upon the commissioning of the four OITF and the NLTS in 1998, an increase by 30% of waste intake at WENT was recorded. The change was mainly due to bulk transfer of containerized MSW by sea to WENT from the new waste facilities.

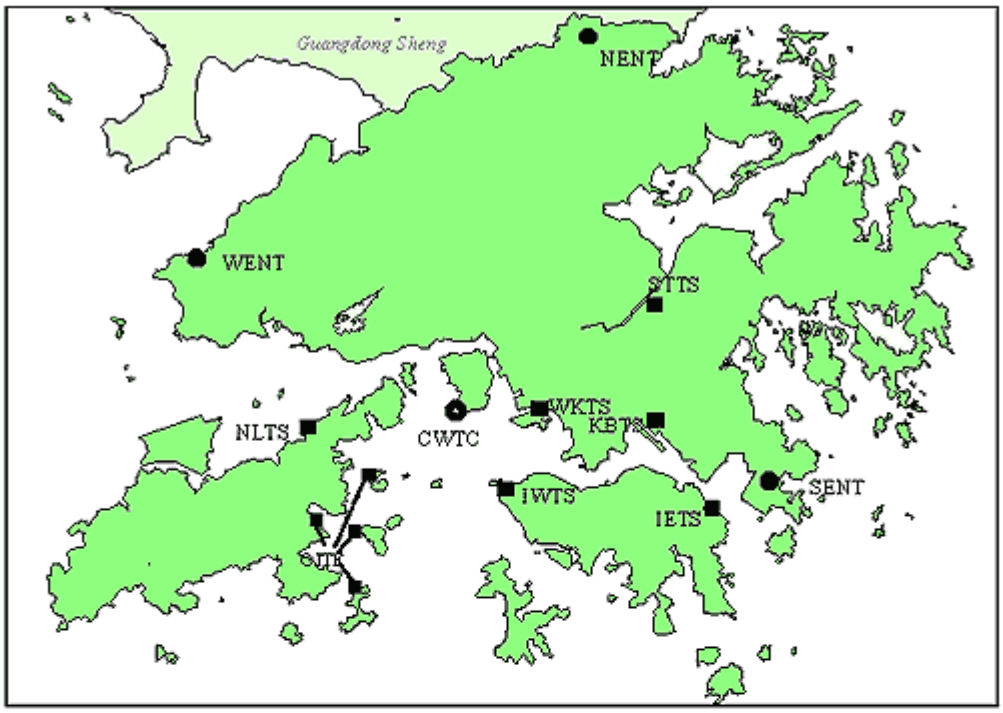


Notes :

(1) Domestic waste disposed of at RTS in the region of Kowloon & HK Island was transferred to WENT and NENT by sea and road respectively.

(2) To avoid double-counting of waste quantities, the waste intake quantities at landfills exclude the quantity of MSW processed at the RTS.

Figure 3 : Quantities of municipal solid waste collected and disposed of at waste facilities in 1998 by geographical region



Landfill	●	WENT 5,415 tpd (+29.6%)	SENT 7,842 tpd (+0.2%)	NENT 3,302 tpd (-5.5%)		
RTS	■	IETS (1) 835 tpd (-11.5%) KBTS (2) 1,079 tpd (-22.9%)	IWTS (1) 463 tpd (+1.1%) STTS (2) 902 tpd (-1.8%)	WKTS (1) 1,448 tpd (+0.2%)	OITF (1)(3) 118 tpd	NLTS (1)(3) 75 tpd
CWTC	◘	205 tpd (+8.5%)				

Remark :
Percentage increase/decrease of waste quantity over previous year is shown in brackets.

Notes:
(1) Waste from IETS, IWTS, WKTS, OITF and NLTS was transferred to WENT by sea.
(2) Waste from KBTS and STTS was transferred to NENT by road.
(3) Waste intake since commissioning of the waste facilities. Amongst the Outlying Islands Transfer Facilities, the facilities at at Cheung Chau, Mui Wo and Peng Chau were commissioned in March 1998 and the facility at Hei Ling Chau was commissioned in July 1998. NLTS was commissioned in June 1998.

Figure 4 : Waste intake at waste facilities in 1998

3.4 Disposal of Construction & Demolition Waste

3.4.1 Public filling areas are proper disposal outlets for inert C&D material (commonly known as public fill) which can be reused beneficially for land formation. Public filling areas and public filling barging points are managed by the Civil Engineering Department (CED).

3.4.2 The quantities of inert C&D material delivered to public filling areas and C&D waste disposed of at landfills in 1997 and 1998 are shown in Figure 5. The total C&D material arisings, i.e. inert C&D material delivered to public filling areas and C&D waste disposed of at landfills, increased by 15% from 28,430 tpd in 1997 to 32,710 tpd in 1998. The quantity of inert C&D material delivered to public filling areas increased by 17% from 21,950 tpd in 1997 to 25,680 tpd in 1998. During the same period, the quantity of C&D waste disposed of at landfills increased by 8.5% from 6,480 tpd to 7,030 tpd. The C&D waste disposed of at landfills in 1998 represents 21% of total C&D material arisings as a result of continued diversion of inert material to public filling areas.

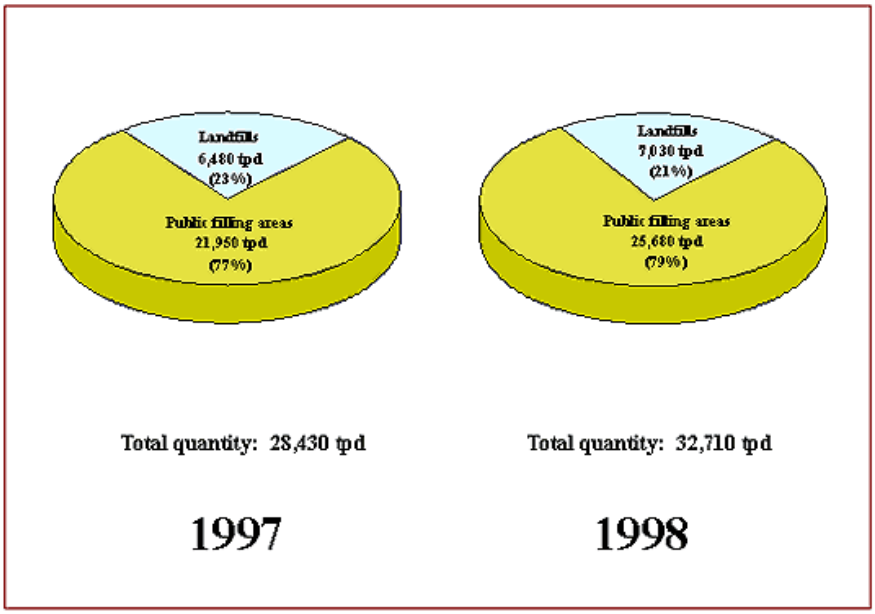
3.4.3 Figure 6 presents the proportion of C&D waste out of the total waste intake at landfills in 1997 and 1998. Percentage of C&D waste intake at landfills was 42% in 1998, remaining the same as that in 1997. As C&D waste taken to the landfills still consists of certain amount of inert material, some void space at landfills will be saved if more inert material can be sorted for beneficial reuse at public filling areas.

3.5 Waste Characteristics

3.5.1 The characteristics of MSW were identified through annual waste survey conducted at refuse transfer stations and landfills. The determined compositions of domestic waste, C&I waste and MSW in the years 1986 to 1998 are summarized in Appendices 4, 5 and 6 respectively. The proportions of major waste components have remained fairly constant.

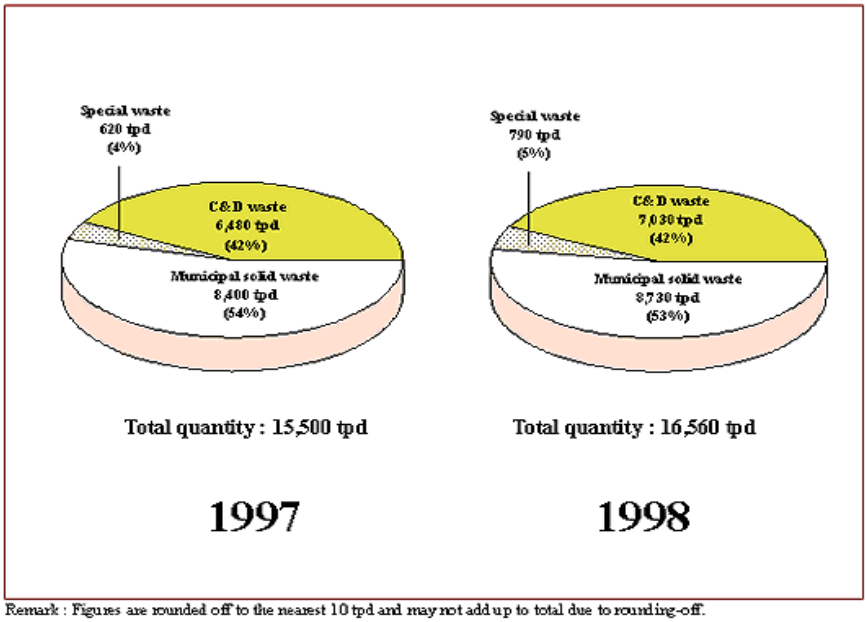
3.5.2 In the annual waste survey for 1998, about 70 samples of domestic waste were taken from STTS, IWTS and WKTS and another 70 samples of C&I waste were taken from WENT and SENT for composition and moisture content analyses during the survey period between mid-October and late-November. The samples, each with volume of one cubic metre, were sorted manually on site. A small portion of

about one kilogram was taken out randomly from each sample before sorting and sent to laboratory for moisture content determination.



Remark : Figures are rounded off to the nearest 10 tpd.

Figure 5 : Quantities of inert C&D material delivered to public filling areas and C&D waste disposed of at landfills in 1997 and 1998



Remark : Figures are rounded off to the nearest 10 tpd and may not add up to total due to rounding-off.

Figure 6 : Proportion of C&D waste out of the total waste intake at landfills in 1997 and 1998

3.5.3 The average moisture contents for domestic waste and C&I waste were estimated to be 31% and 28% respectively based on the representative number of samples taken during the survey in 1998. The estimated bulk densities of domestic waste and C&I waste were 188 and 125 kilograms per cubic metre respectively.

3.5.4 The three major components of domestic waste were again putrescibles (35.1%), paper (26.2%) and plastics (18.5%). Other minor components included metals (3.6%), glass (3.1%), textiles (3.1%), bulky waste (2.6%) and wood/rattan (0.8%).

3.5.5 Likewise, the major components of C&I waste were paper (30.3%), putrescibles (16.0%), wood/rattan (14.1%) and plastics (14.0%). Other minor components included bulky waste (4.1%), glass (3.3%), textiles (3.0%) and metals (2.7%). In line with the diminishing textile and garment manufacturing industry in Hong Kong, the quantity as well as the relative proportion of textile waste has dropped in recent years.

3.5.6 The composition of MSW in 1998, i.e. a summation of its components in domestic waste and C&I waste, is summarized in Table 5. The major components of MSW were putrescibles (30.9%), paper (27.1%) and plastics (17.5%). Other components included wood/rattan (3.7%), metals (3.4%), textiles (3.1%), glass (3.1%) and bulky waste (3.0%).

3.5.7 In addition to identifying the quantities of the above waste components, the quantities of sub-components of recyclable materials were also estimated through sample weighing during survey. Recyclable content determination is useful for the investigation of further opportunities to increase the level of recycling. Breakdown of the major recyclable materials in domestic waste and C&I waste disposed of at waste facilities in 1998 is compiled in Table 6. It should be noted that the actual amount of waste which could be recovered for recycling depends mainly on the extent of contamination, practicality in separating recyclable materials and financial incentive.

3.5.8 In 1998, the major recyclable materials in either domestic waste or C&I waste were still paper and plastics, constituting together more than 40% by weight of the MSW disposed of at waste facilities. In domestic waste, newsprint and colour bags were the main recyclable sub-components of paper and plastics respectively. This standout phenomenon was not obvious in C&I waste where recyclable sub-components were more evenly spread. For instance, newsprint, cardboard

and writing paper constituted 8.6%, 6.5% and 5.3% by weight of C&I waste respectively in 1998.

Component	Quantity (tpd) and percentage by weight		
	Domestic Waste (a)	Commercial & Industrial Waste (b)	Municipal Solid Waste (c)= (a)+ (b)
Bulky waste	179 (2.6%)	79 (4.1%)	258 (3.0%)
Glass	212 (3.1%)	64 (3.3%)	276 (3.1%)
Metals	244 (3.6%)	52 (2.7%)	296 (3.4%)
Paper	1,790 (26.2%)	578 (30.3%)	2,368 (27.1%)
Plastics	1,263 (18.5%)	267 (14.0%)	1,530 (17.5%)
Putrescibles	2,394 (35.1%)	305 (16.0%)	2,699 (30.9%)
Textiles	211 (3.1%)	57 (3.0%)	268 (3.1%)
Wood/rattan	54 (0.8%)	270 (14.1%)	324 (3.7%)
Others	475 (7.0%)	238 (12.5%)	713 (8.2%)
Total	6,822 (100%)	1,910 (100%)	8,732 (100%)

Remark: Figures may not add up to total due to rounding-off.

Table 5 : Estimated composition of municipal solid waste in 1998

Component	Domestic Waste		C&I Waste	
	Quantity (tpd)	% by weight	Quantity (tpd)	% by weight
Glass bottles				
- Brown	44	(0.6%)	7	(0.4%)
- Clear	120	(1.8%)	26	(1.4%)
- Green	47	(0.7%)	13	(0.7%)
(Glass bottles) Sub-total	**211**	**(3.1%)**	**46**	**(2.5%)**
Metals				
- Ferrous metals	182	(2.7%)	41	(2.1%)
- Non-ferrous metals	62	(0.9%)	11	(0.6%)
(Metals) Sub-total	**244**	**(3.6%)**	**52**	**(2.7%)**
Paper				
- Cardboard	240	(3.5%)	123	(6.5%)
- Newsprint	996	(14.5%)	165	(8.6%)
- Writing	134	(2.0%)	101	(5.3%)
- Others (1)	420	(6.2%)	189	(9.9%)
(Paper) Sub-total	**1,790**	**(26.2%)**	**578**	**(30.3%)**
Plastics				
- Clear bags	104	(1.5%)	52	(2.7%)
- Colour bags (white, red, yellow, etc)	751	(11.0%)	79	(4.1%)
- EPS food/drink containers	82	(1.2%)	16	(0.8%)
- Other Polyfoams	18	(0.3%)	5	(0.3%)
- PET bottles	62	(0.9%)	9	(0.5%)
- Other beverage bottles	78	(1.1%)	10	(0.5%)
- Trim-off & scraps	0	(0.0%)	43	(2.3%)
- Others (2)	168	(2.5%)	53	(2.8%)
(Plastics) Sub-total	**1,263**	**(18.5%)**	**267**	**(14.0%)**
Total	**3,508**	**(51.4%)**	**943**	**(49.5%)**

Notes :
(1) Other paper sub-components are drink pack (tetrapak), tissue paper, etc.
(2) Other plastics sub-components are household utensils, packaging materials, toys, etc.

Table 6 : Major recyclable materials in domestic waste and commercial & industrial waste disposed of at waste facilities in 1998

4. Waste Recovery and Recycling

4.1 Recovery and Recycling of Municipal Solid Waste

4.1.1 In 1998, about 1.56 million tonnes of municipal solid waste (MSW) generated in Hong Kong were recovered for recycling. This represents about 33% of the total MSW arisings, amongst which 0.38 million tonnes (24%) were recycled locally and 1.18 million tonnes (76%) were exported for recycling overseas (see Figure 7). The composition of recovered MSW for recycling locally and overseas is tabulated in Appendix 7 and the relative proportion of major recyclable materials recovered is presented in Figure 8. The major recyclable materials were paper (44%), ferrous metals (33%), plastics (14%) and non-ferrous metals (7%). The remaining 2% included glass bottles, wood, rubber tyres and textiles.

4.1.2 Paper was the most popular item for recycling in 1998. Its actual volume handled in 1998 was substantially larger than that of metals which have much higher density than paper but lower recovered amount by weight. The recycling of plastics was considerable in view of their low density. Plastics recovered in Hong Kong mainly consisted of relatively clean scraps and rejects from manufacturing sources and there was very little reprocessing of post-consumer plastic packaging waste such as polyethylene terephthalate (PET) bottles and plastic bags. The reasons and practical constraints might be as follows:-

- Recycling of paper was relatively more popular, convenient and well publicized. Recycling bins or boxes for paper waste were available in many housing estates, railway stations and offices. In contrast, similar facilities for plastics were less common.
- There was extensive paper recycling due to the presence of relatively greater market demand for recycled paper.
- Most plastics found in waste was packaging materials (like plastic bags and beverage bottles) which were usually contaminated. In addition, the cost of transporting plastics per unit weight was high and hence profit margin of recycling plastics was usually low.

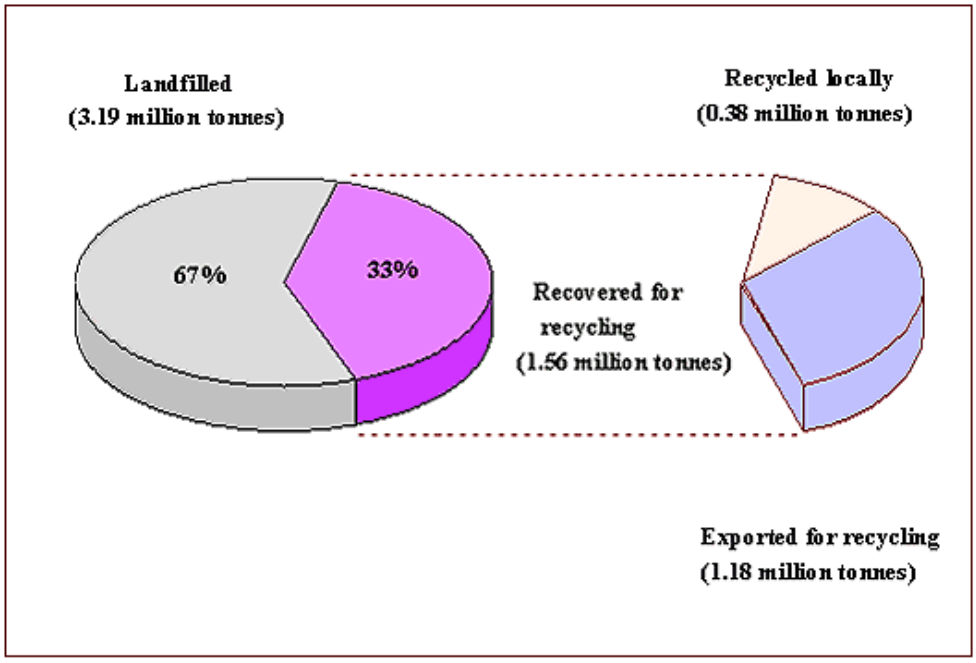


Figure 7 : Recovery of municipal solid waste in 1998

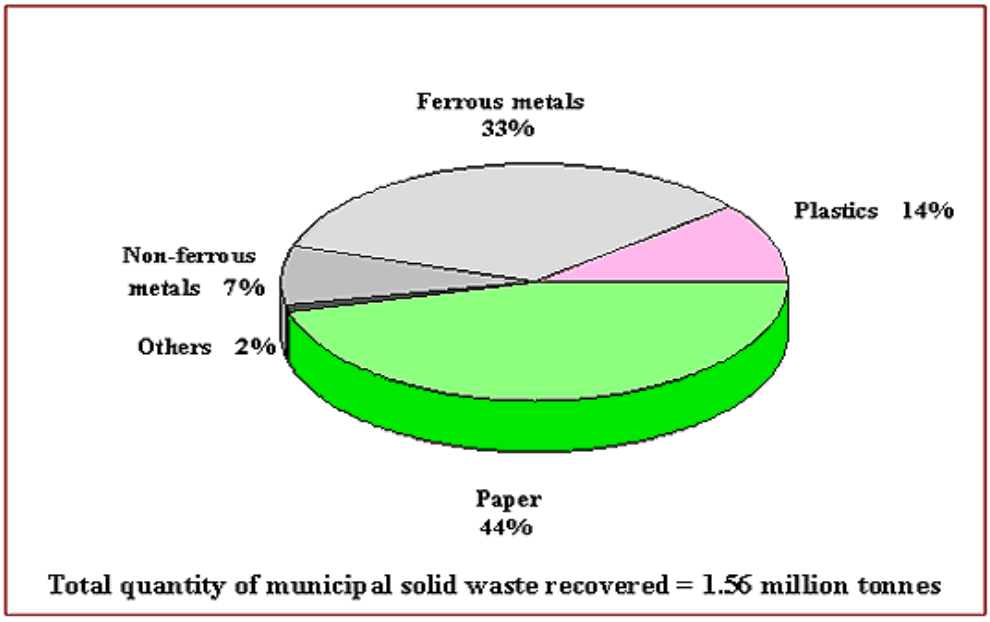


Figure 8 : Proportion of major recyclable materials recovered from municipal solid waste in 1998

4.1.3 Opportunities of making profit through recycling depend on the prices of competing raw materials, the market demand for recycled products, and to a lesser extent the prevailing prices for the disposal alternative. The government will therefore gradually implement appropriate initiatives under the Waste Reduction Framework Plan to promote recycling and to render assistance to the recycling industries. As recycling activities in Hong Kong are dominantly market driven, the extent of recycling may be reflected by the market values of different types of recyclable material. Table 7 provides in details the quantities and values of various exported recyclable materials and their values per unit weight in 1998.

4.1.4 The relative exported values of the four major recyclable materials, i.e. paper, ferrous metals, plastics and non-ferrous metals, are shown in Figure 9. The export value of non-ferrous metals, including aluminium and copper & alloys, was the greatest in 1998.

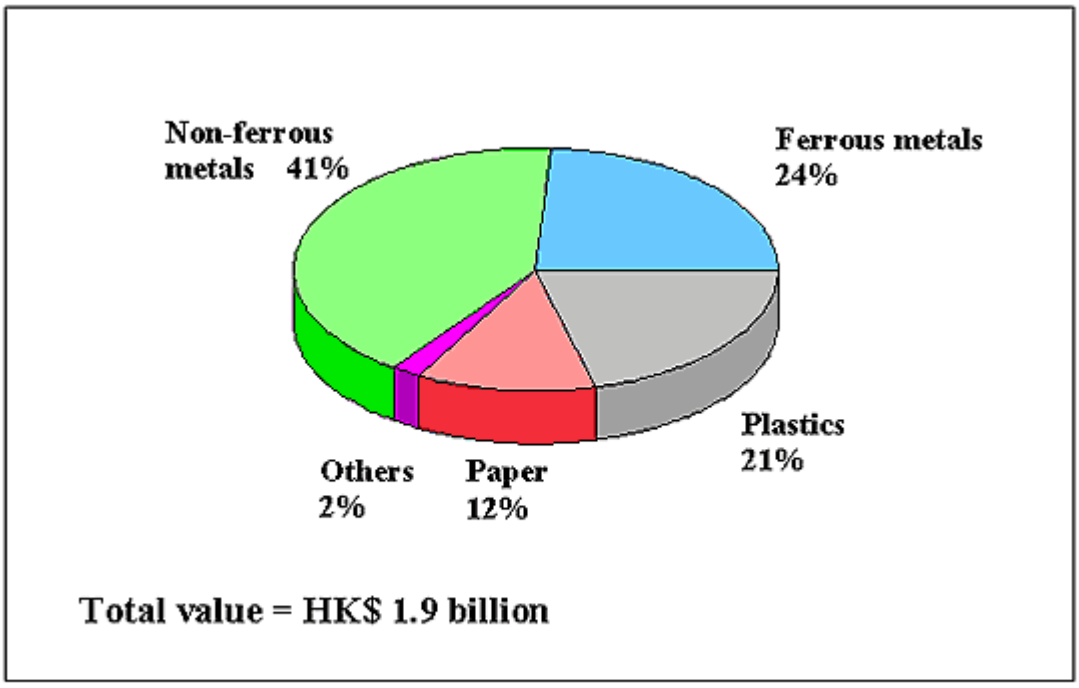


Figure 9 : Values of exported recyclable materials in 1998

4.2 Recovery and Recycling of Construction & Demolition Waste

4.2.1 In 1998, totally about 11.9 million tonnes of construction & demolition (C&D) material was delivered to landfills and public filling areas, of which, about 79% was inert C&D material reused as fill material for reclamation and earth filling projects whilst the rest was C&D waste disposed of at landfills (see Figure 5). C&D waste, usually containing a mixture of inert and non-inert substances, arises from site clearance, excavation, construction, refurbishment, renovation, demolition and roadworks. The non-inert portion of C&D waste disposed of at landfills, comprising bamboo, plastics, timber, vegetation and other organic materials, was often mixed with inert substances, e.g. concrete, asphalt, brick/sand, rock/rubble etc. As shown in Figure 6, an average of 7,030 tonnes of C&D waste were disposed of at landfills everyday in 1998, representing about 42% of total waste intake at landfills. If separation of inert materials at source is more effective, more void space of landfills can be saved.

4.2.2 The government is implementing a C&D waste management strategy which is essentially to avoid, minimize, recycle and dispose of waste (in order of desirability). The target is to reduce the generation of C&D waste and hence its intake at landfills, and to reuse and recycle as much C&D material as possible.

Category of recyclable materials		Quantity[1] (tonnes)	Value[1] ($ thousand)	Value per Unit weight ($ / tonne)
a. Ferrous metals & steel				
- alloy steel scrap		39,699	100,542	2,533
- pig or cast iron		34,418	28,526	829
- tinplate		58,249	. [2]	. [2]
- other scraps		372,490	342,211	919
	Sub-total	**504,856**	**471,279**	**1,055**
b. Glass[3]				
	Sub-total	**17**	**30**	**1,765**
c. Non-ferrous metals				
- aluminium		20,612	112,037	5,436
- copper & alloys		66,594	490,638	7,368
- lead		221	4,529	20,493
- magnesium		0	0	-
- metal ash & residues		331	6,946	20,985
- nickel		166	2,724	16,410
- precious metal		53	165,427	3,121,246
- tin		49	711	14,510
- zinc		308	1,277	4,146
- other base metals		0	0	-
	Sub-total	**88,334**	**784,289**	**8,879**
d. Plastics				
- polyethylene		24,694	54,693	2,215
- polystyrene & copolymers		58,634	155,749	2,656
- polyvinyl chloride		16,894	37,496	2,219
- others		81,759	158,694	1,941
	Sub-total	**181,981**	**406,632**	**2,234**
e. Textile fibre				
- cotton		8,682	18,557	2,137
- man-made fibres		473	1,982	4,190
- silk		0	7	70,000
- wool/other animal hair (not pulled)		115	1,782	15,496
- wool/other animal hair (pulled)		0	0	-
- old clothing & other old textile articles, rags, etc.		2,006	10,163	5,066
	Sub-total	**11,276**	**32,491**	**2,881**
f. Wood & paper				
- paper		392,157	235,636	601
- wood (include sawdust)		987	1,645	1,667
	Sub-total	**393,144**	**237,281**	**604**
	Total	**1,179,608**	**1,932,002**	**1,638**

Notes :

(1) Figures provided by the Census & Statistics Department and rounded off to the nearest 1.
(2) Reliable data not available.
(3) This category includes cullet, scrap of glass and glass in the mass.

Table 7 : Quantities and values of exported recyclable materials by type in 1998

5. Waste Generation Rates and Forecasts

5.1 Generation Rates of Municipal Solid Waste

5.1.1 Waste generation per capita, expressed in kilograms per head per day, is the basis for comparison of the historical trend of municipal solid waste (MSW) disposal. Per capita generation rates of domestic waste and commercial & industrial (C&I) waste that have been considered separately since previous monitoring work on waste disposal revealed close relationships between population and domestic waste quantity, and between economic activities and C&I waste quantity. Economic activities were indirectly measured in terms of employee size of all sectors grouped under Divisions 3, 6 and 8 of the Hong Kong Standard Industrial Classification. These commercial and industrial sectors include manufacturing, wholesale, retail, import and export trades, restaurants, hotels, finance, insurance, real estate and business services.

5.1.2 In working out the waste generation rates in 1998 by district, the population and employment data and their geographical distribution into 18 waste arising districts adopted in the calculation are based on Census & Statistics Department's consolidated information. Per capita generation rates of domestic waste and C&I waste of various districts in 1997 and 1998 are shown in Table 8.

5.1.3 A point of interest is the small fluctuation of the territorial average per capita generation rates of domestic waste in the 1990s. Whilst there was a trend of growth in general from 1986 to 1992, the generation rate of 1.02 kg per person per day in 1998 was similar to that in the previous six years from 1992 to 1997 (in the range of 1.00 to 1.04 kg per person per day). The relatively steady generation rate in the recent years might be attributed to factors such as changes in economy, lifestyle and throw-away habits being adopted by the community as a result of increasing environmental consciousness.

5.1.4 From the generation rates of domestic waste in 1998, the following major observations are noted :

- The territorial average per capita generation rate (1.02 kg per person per day) dropped slightly by 2% as compared with 1997.
- The largest deviations from the territorial average are observed in outlying islands (1.58 kg per person per day) and commercial districts, such as Yau Tsim Mong (1.99 kg per person per day), Wanchai (1.72 kg per person per

day) and Central & Western (1.47 kg per person per day). Owing to the existing practice of disposing unsegregated waste, particularly in the above districts, C&I waste has been mixed to various degrees with domestic waste prior to collection by the Regional Services Department and Urban Services Department. The amount of C&I waste added to domestic waste was most significant in the commercial districts (Yau Tsim Mong, Wanchai, Central & Western) having a large employee size of more than 604,000 which was about 38% of total employment figure of the selected sectors.

- Waste arising districts having more than 10% variation of per capita generation rate as compared to the 1997 figures include the Kwai Tsing (+14%), Sai Kung (-12%) and Yuen Long (-11%).

5.1.5 It has been noted that the sources of commercial waste and industrial waste are always very close and the wastes are often mixed together, e.g. fast food restaurants, offices and factories may locate at the same building. For the purpose of waste projection, it is considered more practical to combine these wastes into a single waste type, i.e. C&I waste. From the generation rates of C&I waste in 1998, the following major observations are noted :

- The territorial average generation rate of 1.21 kg per employee per day in 1998 is 10% higher than that in 1997. This might be due to the substantial decrease in the employee size of the selected sectors by 9.5% whereas only 5.1% reduction in the total gross domestic product (GDP) of Hong Kong as compared with 1997.
- The districts with greatest deviations of per capita generation rate from the territorial average are found in the New Territories such as Yuen Long (4.18 kg per employee per day), Sai Kung (4.17 kg per employee per day) and North NT (3.79 kg per employee per day) where the subtotal employee size of these districts (75,000) constituted only 5% of the total for the selected sectors.
- Per capita generation rate of the New Territories Mainland (2.22 kg per employee per day) was higher than the territorial average (1.21 kg per employee per day). As regards the urban areas, the average per capita generation rate (0.82 kg per employee per day) was smaller than the territorial average.
- The lowest per capita generation rates are found in Central & Western (0.41 kg per employee per day), Wanchai (0.51 kg per employee per day)

and Yau Tsim Mong (0.58 kg per employee per day). As discussed in Section 5.1.4, the mixing of a considerable amount of C&I waste with domestic waste in these districts had caused an apparent reduced quantity of C&I waste for collection by private waste collectors.

- For the outlying islands, virtually all C&I waste was delivered to refuse collection points and then mixed with domestic waste before collection by the Regional Services Department; hence per capita generation rate of C&I waste for the outlying islands could not be determined.
- The average per capita generation rates of both the Hong Kong Island and Kowloon in 1998 increased by 12% from that of 1997 but the average of the New Territories Mainland increased slightly by only 2% from 1997.

5.2 Correlation of Quantity of Municipal Solid Waste with Gross Domestic Product

5.2.1 It has been established in previous reports that the quantity of MSW disposed of correlates well with the economic activities as measured by the total gross domestic product (GDP). Figure 10 shows three best-plotted straight lines of total GDP against quantity of MSW and its individual constituents disposed of at waste facilities from 1979 to 1998.

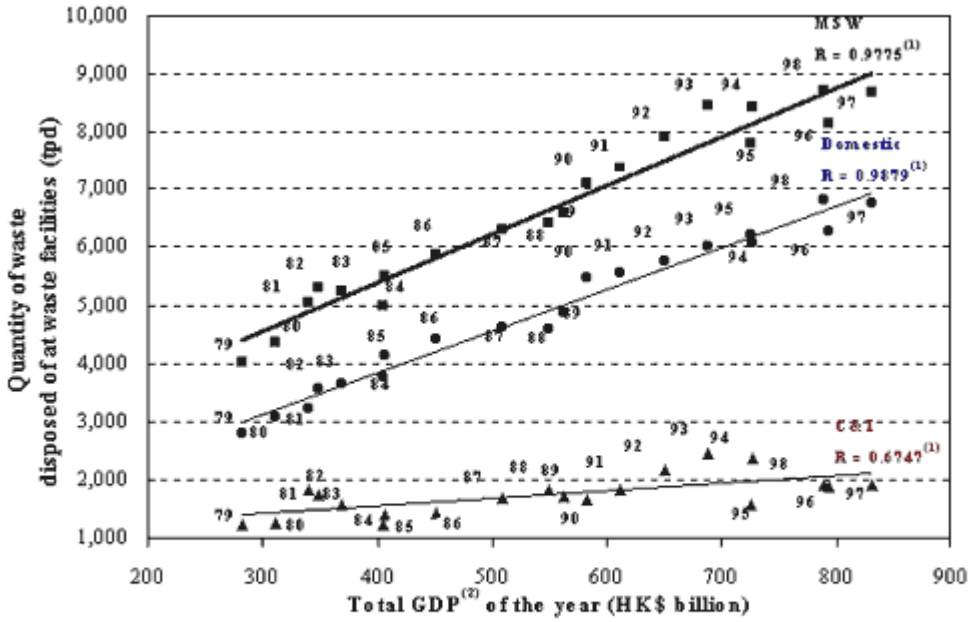
5.2.2 Domestic waste has an almost straight-line relationship with the total GDP in Hong Kong whereas C&I waste has a weaker linear correlation. Due to the large contribution of domestic waste to MSW, the linear relationship of MSW to total GDP is strong.

District	Domestic waste (kg/person/day)			C&I waste (kg/employee/day)		
	1997	1998	*Variation*	1997	1998	*Variation*
Central & Western	1.42	1.47	*+3.5%*	0.35	0.41	*+17.1%*
Wanchai	1.79	1.72	*-3.9%*	0.48	0.51	*+6.3%*
Eastern	0.88	0.85	*-3.4%*	0.68	0.90	*+32.4%*
Southern	0.96	0.99	*+3.1%*	1.55	1.13	*-27.1%*
Hong Kong Island Average	**1.12**	**1.11**	*-0.9%*	**0.54**	**0.60**	*+11.1%*
Yau Tsim Mong	2.12	1.99	*-6.1%*	0.52	0.58	*+11.5%*
Sham Shui Po	1.09	1.05	*-3.7%*	0.95	1.20	*+26.3%*
Kowloon City	1.01	1.00	*-1.0%*	1.12	1.44	*+28.6%*
Wong Tai Sin	0.74	0.79	*+6.8%*	0.73	0.70	*-4.1%*
Kwun Tong	0.86	0.88	*+2.3%*	1.36	1.39	*+2.2%*
Kowloon Average	**1.08**	**1.07**	*-0.9%*	**0.90**	**1.01**	*+12.2%*
Kwai Tsing	0.66	0.75	*+13.6%*	0.73	0.87	*+19.2%*
Tsuen Wan	1.11	1.12	*+0.9%*	1.81	1.93	*+6.6%*
Tuen Mun	0.95	0.94	*-1.1%*	3.63	3.60	*-0.8%*
Yuen Long	1.14	1.02	*-10.5%*	4.29	4.18	*-2.6%*
North	1.38	1.31	*-5.1%*	5.43	3.79	*-30.2%*
Tai Po	1.10	1.02	*-7.3%*	1.75	1.92	*+9.7%*
Sha Tin	0.80	0.75	*-6.3%*	2.05	2.24	*+9.3%*
Sai Kung	0.91	0.80	*-12.1%*	4.63	4.17	*-9.9%*
NT - Mainland Average	**0.96**	**0.93**	*-3.1%*	**2.17**	**2.22**	*+2.3%*
NT - Outlying Islands Average	**1.92**	**1.58**	*-17.7%*	- (1)	- (1)	- (1)
Urban Areas (HK & Kln) Average	**1.10**	**1.09**	*-0.9%*	**0.73**	**0.82**	*+12.3%*
Territorial Average	**1.04**	**1.02**	*-1.9%*	**1.10**	**1.21**	*+10.0%*

Notes :

(1) On Outlying Islands, C&I waste is usually mixed with domestic waste.

Table 8 : Per capita generation rates of domestic waste and commercial & industrial waste in 1997 and 1998



Year	Domestic waste ●	C&I waste ▲	Municipal solid waste ■	Total GDP(2)
	Quantity (tpd)			(HK $ billion)
1979	2,790	1,240	4,030	282
1980	3,080	1,270	4,350	310
1981	3,220	1,820	5,030	339
1982	3,570	1,730	5,300	348
1983	3,650	1,580	5,230	368
1984	3,770	1,220	4,990	405
1985	4,120	1,400	5,510	407
1986	4,420	1,440	5,870	450
1987	4,630	1,680	6,300	509
1988	4,580	1,820	6,410	549
1989	4,870	1,720	6,580	563
1990	5,460	1,650	7,100	583
1991	5,560	1,830	7,390	612
1992	5,760	2,170	7,930	650
1993	6,000	2,450	8,450	690
1994	6,070	2,360	8,430	727
1995	6,210	1,580	7,790	726
1996	6,260	1,880	8,140	794
1997	6,760	1,920	8,680	831 (3)
1998	6,820	1,910	8,730	789 (3)

Remark : Figures on waste quantities are rounded off to the nearest 10 tpd and may not add up to total due to rounding-off.

Notes :

(1) R = 1 shows best fitted regression line.

(2) GDP at constant (1990) market prices.

(3) Preliminary estimate provided by Census & Statistics Department.

Figure 10 : Correlation of municipal solid waste with total GDP 1979 - 1998

5.3 Municipal Solid Waste Projection

5.3.1 The existing methodology of projecting the quantity of MSW requiring disposal, which is made up of domestic waste and C&I waste, is based on two sets of parameters, viz. projected waste generation rates and predicted figures on population and employment size. Both parameters are regularly updated and easily accessible; the former by the EPD and the latter by the Planning Department. More importantly, they provide a reliable and simple method in projecting future solid waste requiring disposal. Quantities of solid waste requiring disposal can be worked out easily by multiplying the projected waste generation rate per capita with predicted population or number of employees.

5.3.2 Statistical trend analysis was applied to determine the underlying pattern of growth for municipal solid waste requiring disposal in the future years. The historical territorial average per capita generation rates of both domestic waste and C&I waste from 1986 to 1998 are provided in Figure 11. It is noted that the average annual growth of the per capita generation rates of domestic waste and C&I waste are about 0.007 and 0.021 kg per person per day respectively. The linear regression expressions for the projection of future generation rates of domestic waste and C&I waste are as follows: -

- per capita generation rate of domestic waste : $y_t = 0.006934t - 12.820026$
- per capita generation rate of C&I waste : $y_t = 0.021464t - 41.6624$
  here y_t = per capita waste generation rate at year t (kg per person per day)
  t = year in four figures (e.g. 2000)

5.3.3 Based on the above projection method, the per capita generation rates of domestic waste and C&I waste would be increased to 1.16 and 1.61 kg per person per day respectively in 2016.

5.3.4 The quantity of domestic waste requiring disposal is then worked out by multiplying its projected generation rate by the predicted population. Similarly, the quantity of C&I waste is worked out by multiplying its projected generation rate by the predicted employment size. A graphical presentation of the projected waste quantities by waste type up to 2016 is depicted in Figure 11.

5.3.5 The quantities of domestic waste and C&I waste requiring disposal for each of the 18 waste arising districts in the years 2001, 2006, 2011 and 2016 are presented in

Table 9. The quantities of the wastes for each waste arising district are derived by multiplying the projected waste generation rate for each type of waste in the district by the respective population/employment size obtained from the Planning Department.

5.3.6 It should be noted that besides population and employment size, the projected generation rates and quantities of MSW would also be affected by a number of factors such as: -

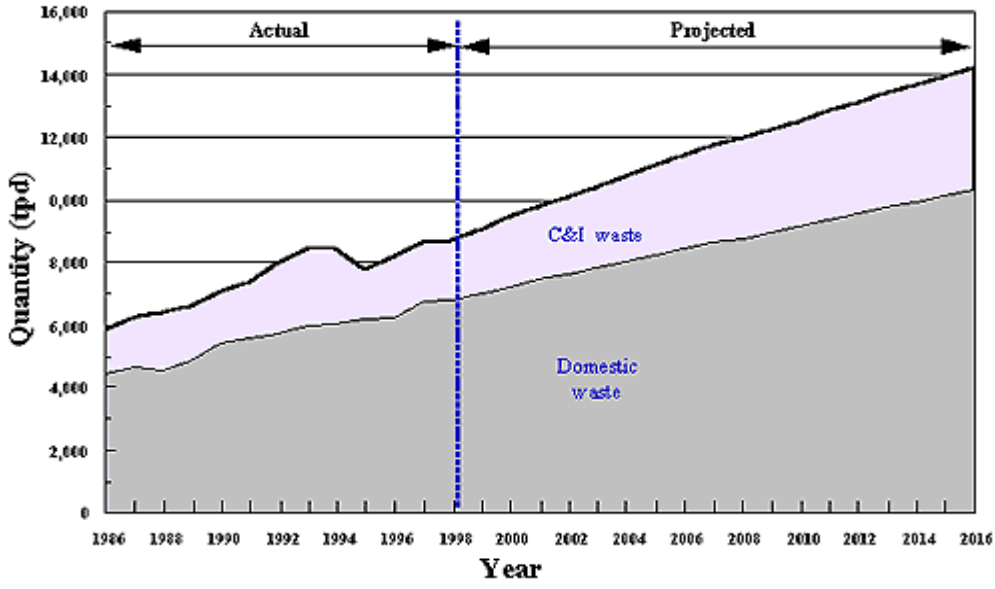
- the implementation of the waste reduction measures in the Waste Reduction Framework Plan, such as Landfill Charging Scheme which would be an incentive for the public to reduce waste generation;
- extent of recycling activities;
- changes in environmental awareness, lifestyle, consumers behaviour, economic activities, manufacturing and product packaging technology;
- progress on the development of new towns and redevelopment of urban areas; and
- changes in the predicted figures of future population and employment size.

5.3.7 A comparison of the MSW projections in the previous "Monitoring of Solid Waste in Hong Kong" reports with the actual MSW quantities in the recent years indicated that the average deviation of projections for 5 years from the actual quantities was within 5%. The accuracy dropped with the length of projection period. The projections for short periods were hence more reliable than those for longer periods.

5.4 Forecast of Construction & Demolition Waste

5.4.1 Since 1998, the forecast of construction & demolition (C&D) material has been carried out by the Civil Engineering Department (CED) which oversees the management of public fill (i.e. inert C&D materials) through its Fill Management Committee. The public fill planning model, one of the key elements of the public filling strategy set out by the Committee, has been developed by CED. The planning model, amongst other things, forecasts the quantity of C&D material arisings. Based on the information generated from the planning model, the forecast quantities of C&D material arising in 2001, 2006, 2011 and 2016 are provided in Figure 12. The forecast quantities of C&D waste to be disposed of at landfills are based on the current situation that about 80% of the total C&D material arising

being diverted to public filling areas. The actual quantities of public fill and C&D waste disposed of at public filling areas and landfills respectively since 1986 are also tabulated in Figure 12.



Year	Domestic waste		Commercial & industrial waste		Municipal solid waste
	Quantity (tpd)	Per capita generation rate (kg/person/day)	Quantity (tpd)	Per capita generation rate (kg/employee/day)	Quantity (tpd)
1986	4,420	0.80	1,440	0.86	5,870
1987	4,630	0.83	1,680	0.97	6,300
1988	4,580	0.82	1,820	1.03	6,410
1989	4,870	0.86	1,720	0.96	6,580
1990	5,460	0.95	1,650	0.92	7,100
1991	5,560	0.98	1,830	1.09	7,390
1992	5,760	1.01	2,170	1.29	7,930
1993	6,000	1.02	2,450	1.44	8,450
1994	6,070	1.04	2,360	1.38	8,430
1995	6,210	1.01	1,580	0.88	7,790
1996	6,260	1.00	1,880	1.07	8,140
1997	6,760	1.04	1,920	1.10	8,680
1998	6,820	1.02	1,910	1.21	8,730
2001	7,460	1.06 (1)	2,310	1.29 (2)	9,770
2006	8,430	1.09 (1)	2,990	1.39 (2)	11,420
2011	9,380	1.12 (1)	3,440	1.50 (2)	12,820
2016	10,360	1.16 (1)	3,840	1.61 (2)	14,200

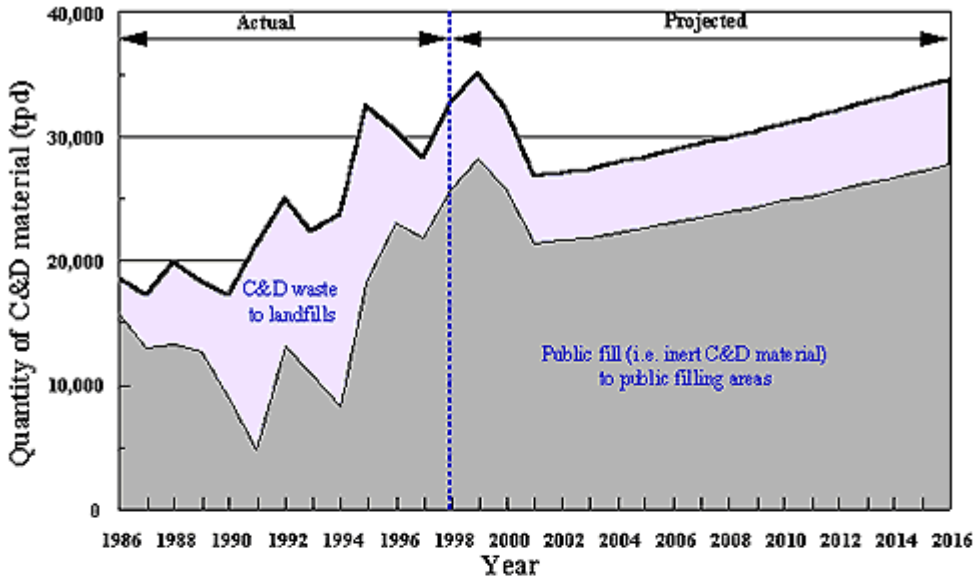
Remark: Figures on waste quantities are rounded off to the nearest 10 tpd and may not add up to total due to rounding-off.

Notes :
(1) Figures are estimated by linear projection from 1990 onwards.
(2) Figures are estimated by linear projection from 1986 onwards.

Figure 11 : Per capita generation rates and quantities of municipal solid waste disposed of at waste facilities 1986 - 2016

	Domestic waste (tpd)								Commercial & Industrial waste (tpd)				Total MSW (tpd)			
	Public				Private											
Year	2001	2006	2011	2016	2001	2006	2011		2001	2006	2011	2016	2001	2006	2011	2016
District																
Central & Western	350	360	470	580	70	70	100	120	120	180	180	210	540	610	750	910
Wanchai	260	260	270	280	70	70	70	70	100	120	130	140	430	450	470	490
Eastern	440	440	440	450	110	110	110	120	140	180	180	180	690	730	730	750
Southern	270	280	300	320	20	20	20	20	40	50	50	60	330	350	370	400
Hong Kong Island	**1,320**	**1,340**	**1,480**	**1,630**	**270**	**270**	**300**	**330**	**400**	**530**	**540**	**590**	**1,990**	**2,140**	**2,320**	**2,550**
Yau Tsim Mong	540	600	620	630	110	130	130	130	160	220	230	250	810	950	980	1010
Sham Shui Po	370	440	460	480	80	90	90	100	150	210	250	270	600	740	800	850
Kowloon City	340	400	460	570	100	110	130	160	130	150	150	210	570	660	740	940
Wong Tai Sin	360	410	420	420	20	20	20	20	40	40	50	50	420	470	490	490
Kwun Tong	490	530	560	580	80	90	100	100	240	310	330	360	810	930	990	1040
Kowloon	**2,100**	**2,380**	**2,520**	**2,680**	**390**	**440**	**470**	**510**	**720**	**930**	**1,010**	**1,140**	**3,210**	**3,750**	**4,000**	**4,330**
Kwai Tsing	360	430	420	420	40	40	40	40	130	170	180	180	530	640	640	640
Tsuen Wan	220	220	260	280	100	100	120	130	180	200	250	260	500	520	630	670
Tuen Mun	450	510	550	570	40	50	60	60	150	160	200	210	640	720	810	840
Yuen Long	480	660	710	980	30	40	40	60	160	180	220	280	670	880	970	1,320
North	250	260	320	400	130	140	170	210	90	100	100	160	470	500	590	770
Tai Po	260	260	270	270	60	60	60	60	60	70	70	80	380	390	400	410
Sha Tin	440	470	480	480	60	70	70	70	180	210	220	240	680	750	770	790
Sai Kung	250	360	430	470	20	30	30	30	130	250	300	330	400	640	760	830
NT - Mainland	**2,710**	**3,170**	**3,440**	**3,870**	**480**	**530**	**590**	**660**	**1,080**	**1,340**	**1,540**	**1,740**	**4,270**	**5,040**	**5,570**	**6,270**
NT - Outlying Islands	**190**	**300**	**580**	**680**	**-**	**-**	**-**		**110**	**190**	**350**	**370**	**300**	**490**	**930**	**1,050**
Territorial Total	**6,320**	**7,190**	**8,020**	**8,860**	**1,140**	**1,240**	**1,360**	**1,500**	**2,310**	**2,990**	**3,440**	**3,840**	**9,770**	**11,420**	**12,820**	**14,200**

Table 9 : Projected quantities of municipal solid waste by waste arising district in 2001, 2006, 2011 and 2016



Year	C&D waste to landfills		Public fill to Public Filling Areas		Total C&D material
	Quantity (tpd)	% of total C&D material	Quantity (tpd)	% of total C&D material	Quantity (tpd)
1986	2,850	15.3	15,780	84.7	18,630
1987	4,220	24.4	13,070	75.6	17,290
1988	6,520	32.9	13,320	67.1	19,840
1989	5,580	30.3	12,820	69.7	18,410
1990	8,450	48.7	8,900	51.3	17,350
1991	16,380	77.0	4,880	23.0	21,260
1992	11,960	47.6	13,170	52.4	25,130
1993	11,520	51.4	10,880	48.6	22,400
1994	15,480	64.9	8,370	35.1	23,850
1995	14,120	43.6	18,280	56.4	32,400
1996	7,520	24.6	22,990	75.4	30,510
1997	6,480	22.8	21,950	77.2	28,430
1998	7,030	21.5	25,680	78.5	32,710
2001 (1)	5,360	20.0	21,460	80.0	26,820
2006 (1)	5,770	20.0	23,080	80.0	28,850
2011 (1)	6,310	20.0	25,220	80.0	31,530
2016 (1)	6,930	20.0	27,730	80.0	34,660

Remark : Figures on waste quantities are rounded off to the nearest 10 tpd and may not add up to total due to rounding-off.

Notes :

(1) Forecast figures on total C&D material are provided by the Civil Engineering Department.

Figure 12 : Quantity of construction and demolition material

5.5 Waste Reduction Targets

5.5.1 The target waste reduction levels for MSW for the future years 2001, 2003, 2005 and 2007 are 10%, 14%, 22% and 40% respectively as set out in the Waste Reduction Framework Plan which was launched in November 1998. Both the anticipated MSW quantities with the above target levels achieved and the latest projected quantities of MSW requiring disposal up to 2007, using the methodology in Section 5.3, are shown in Figure 13. It is expected that with successful implementation of various waste reduction measures, the projected waste quantity curve in Figure 13 will gradually move closer to the anticipated waste quantity curve.

5.5.2 For the management of C&D material, the Waste Reduction Framework Plan sets out the target that, in addition to the 80% of the total C&D material arising already diverted to public filling areas, a further 20% reduction of the remaining C&D waste (i.e. 4% of total C&D material arising) to be disposed of at landfills is to be achieved.

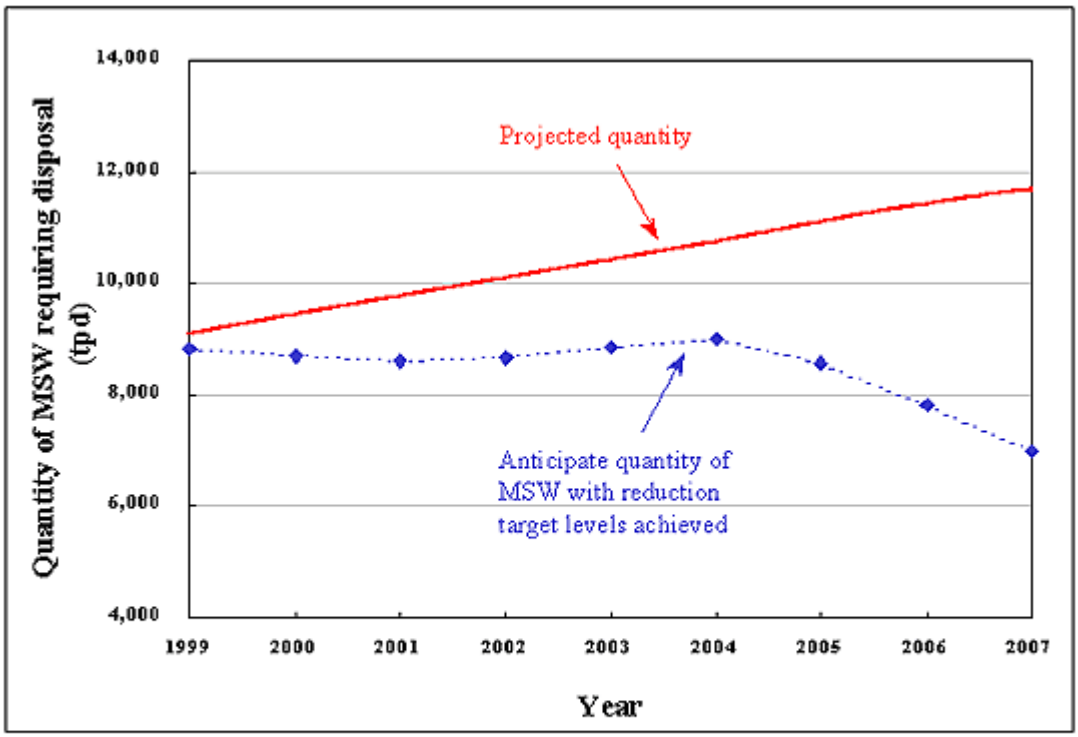


Figure 13 : Anticipated quantities of municipal solid waste requiring disposal with reduction target levels achieved (from the Waste Reduction Framework Plan, November 1998)

Appendix 1

Breakdown of solid waste delivered to refuse transfer stations and landfills in 1998

Disposal facilities	Average daily waste intake[1] by waste type in 1998 (tpd)				
	MSW		Construction & demolition	Special	Total
	Public	Private			
KBTS - Kowloon Bay Refuse Transfer Station [2]	1,079	-	-	-	1,079
IETS - Island East Refuse Transfer Station [3]	832	3	-	-	835
STTS - Sha Tin Refuse Transfer Station [2]	902	-	-	-	902
IWTS - Island West Refuse Transfer Station [3]	463	-	-	-	463
WKTS - West Kowloon Refuse Transfer Station [3]	1,434	14	-	-	1,448
OITF - Outlying Islands Refuse Transfer Facilities [3][4]	64	2	-	1	67[5]
NLTS - North Lantau Refuse Transfer Station [3][6]	8	36	-	0	44
WENT - West New Territories Landfill	787[7]	444	912	415[7]	2,558[7]
SENT - South East New Territories Landfill	185	1,981	5,398	278	7,842
NENT - North East New Territories Landfill	0[7]	498	723	100	1,321[7]
Sub-total	**5,754**	**2,978**			
Total	**8,732**		**7,033**	**794**	**16,559**

Notes :

(1) Average daily intake shown here is based on the whole calendar year irrespective of the operational period of the facilities.

(2) Waste from KBTS and STTS was delivered to NENT by road.

(3) Waste from IETS, IWTS, WKTS, OITF and NLTS was delivered to WENT by sea.

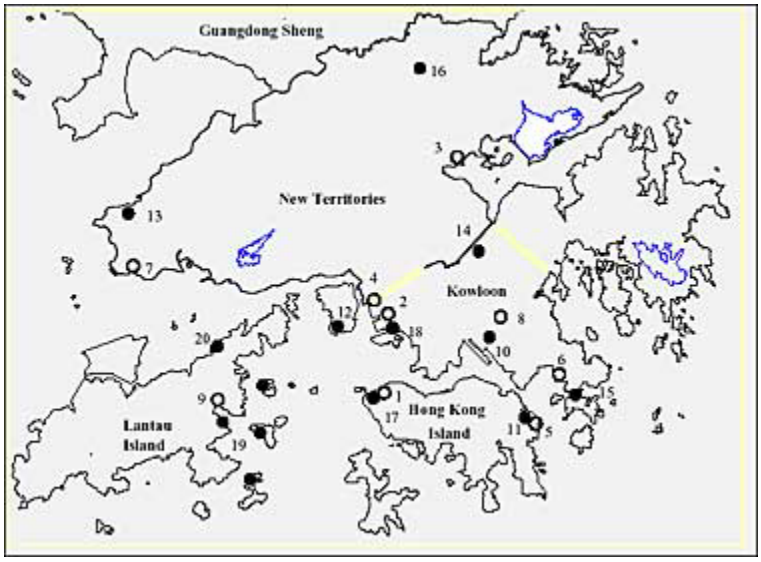
(4) OITF at Cheung Chau, Mui Wo and Peng Chau were commissioned in March 1998 and that at Hei Ling Chau was commissioned in July 1998. The average daily intake of OITF since commissioning was 118 tpd.

(5) The quantity shown here does not include inert C&D material received by OITF (41 tpd).

(6) NLTS was commissioned in June 1998 and its average daily intake since commissioning was 75 tpd.

(7) The quantity shown here does not include waste transferred from the RTS and OITF.

Appendix 2: Review of solid waste intake at waste facilities



- Decommissioned
- In operation

Appendix 2

Review of solid waste intake at waste facilities

	Waste facilities	Year commissioned	Average daily intake (tpd) (2)													Year decommissioned
			1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	
1	○ Kennedy Town Incineration Plant	1967	630	550	580	780	820	780	680	*420*	-	-	-	-	-	1993
2	○ Lai Chi Kok Incineration Plant	1969	1010	480	470	500	*380*	-	-	-	-	-	-	-	-	1990
3	○ Shuen Wan Landfill	1974	1,240	1,360	1,950	2,450	3,750	7,000	5,670	6,410	7,570	*6,230*	-	-	-	1995
4	○ Kwai Chung Incineration Plant	1978	820	880	860	800	820	790	760	750	710	720	710	*760*	-	1997
5	○ Chai Wan Composting/ Pulverisation Plant	1979	350	420	490	390	390	*430*	-	-	-	-	-	-	-	1991
6	○ Tseung Kwan O Landfill	1979	2,200	4,560	6,050	4,730	6,330	13,150	9,890	10,660	10,490	*4,830*	-	-	-	1995
7	○ Pillar Point Valley Landfill	1983	1,330	1,560	1,790	1,920	2,070	2,640	3,410	2,130	2,430	4,690	*2,800*	-	-	1996
8	○ Jordon Valley Landfill	1986	*380*	970	1,010	930	*370*	-	-	-	-	-	-	-	-	1990
9	○ Mui Wo Incineration Plant	1987	-	*10*	10	10	10	10	10	10	*10*	-	-	-	-	1994
10	• Kowloon Bay Transfer Station	1990	-	-	-	-	*980*	1,530	1,600	1,720	1,760	1,690	1,740	1,400	1,080	
11	• Island East Transfer Station	1992	-	-	-	-	-	-	*40*	1,140	1,250	1,200	1,220	940	840	
12	• Chemical Waste Treatment Centre	1993	-	-	-	-	-	-	-	*90*	220	240	180	190	200	
13	• WENT Landfill	1993	-	-	-	-	-	-	-	*1,170*	2,700	2,810	1,970	4,180	5,420	
14	• Sha Tin Transfer Station	1994	-	-	-	-	-	-	-	-	*650*	800	850	920	900	
15	• SENT Landfill	1994	-	-	-	-	-	-	-	-	*1,160*	7,070	7,230	7,830	7,840	
16	• NENT Landfill	1995	-	-	-	-	-	-	-	-	-	*2,620*	3,440	3,500	3,300	
17	• Island West Transfer Station	1997	-	-	-	-	-	-	-	-	-	-	-	*460*	460	
18	• West Kowloon Transfer Station	1997	-	-	-	-	-	-	-	-	-	-	-	*1,450*	1,450	
19	• Outlying Islands Transfer Facilities (1)	1998													*120*	
20	• North Lantau Transfer Station	1998													*80*	

Remark: Figures are rounded off to the nearest 10 tpd.

Notes:
(1) The Outlying Islands Transfer Facilities commissioned in 1998 include the facilities at Cheung Chau, Mui Wo, Peng Chau and Hei Ling Chau.
(2) Italic figures are average of actual operation days rather than 365 days during the year of commissioning and decommissioning.

Appendix 3

Waste arising districts and waste arising areas

District name	Area name	District name	Area name
Central & Western	Central Sheung Wan Mid Levels Peak Kennedy Town	*Kwun Tong*	Kwun Tong East Kwun Tong West Sau Mau Ping Lam Tin
Wanchai	Wanchai Tai Hang / Happy Valley	*Kwai Tsing*	Kwai Chung Tsing Yi
Eastern	North Point Quarry Bay Shau Kei Wan Chai Wan	*Tsuen Wan*	Tsuen Wan
Southern	Pok Fu Lam Aberdeen Stanley	*Tuen Mun*	Tuen Mun Lam Tei
Yau Tsim (1)	Tsim Sha Tsui East Tsim Sha Tsui West Yau Ma Tei	*Yuen Long*	Yuen Long Tin Shui Wai Kam Tin / Shek Kong San Tin
Mongkok (1)	Mongkok North Mongkok South	*North*	Sheung Shui / Fanling Shau Tau Kok
Sham Shui Po	Sham Shui Po Shek Kip Mei Cheung Sha Wan Lai Chi Kok	*Tai Po*	Tai Po Shuen Wan Tai Po Rural Sai Kung North
Kowloon City	Hung Hom Ho Man Tin Kowloon Tong	*Sha Tin*	Sha Tin West Sha Tin East Sha Tin South Ma On Shan
Wong Tai Sin	Wong Tai Sin Ngau Chi Wan	*Sai Kung*	Sai Kung South Clear Water Bay Junk Bay
		Outlying Islands	

Notes :

(1) Yau Tsim and Mongkok districts are amalgamated into one waste arising district in accordance with the merging of the District Board Districts of Yau Tsim and Mongkok.

Appendix 4

Review of composition of domestic waste

Year	Quantity (tpd) and its percentage by weight [1]									
	Bulky waste	Glass	Metals	Paper	Plastics	Putrescibles	Textiles	Wood/ rattan	Others	Total
1986	320 (7.2%)	110 (2.5%)	150 (3.4%)	970 (22.0%)	630 (14.3%)	1,340 (30.4%)	190 (4.2%)	190 (4.2%)	520 (11.8%)	4,420
1987	250 (5.5%)	130 (2.7%)	160 (3.4%)	1,000 (21.7%)	680 (14.8%)	1,450 (31.4%)	210 (4.5%)	190 (4.1%)	550 (11.9%)	4,630
1988	280 (6.1%)	180 (3.9%)	190 (4.1%)	870 (19.1%)	720 (15.6%)	1,190 (26.1%)	240 (5.2%)	130 (2.8%)	780 (17.1%)	4,580
1989	220 (4.6%)	170 (3.4%)	210 (4.3%)	1,040 (21.4%)	740 (15.3%)	1,390 (28.6%)	290 (5.9%)	70 (1.4%)	730 (15.1%)	4,870
1990	240 (4.4%)	130 (2.4%)	130 (2.5%)	1,040 (19.1%)	810 (14.9%)	2,070 (38.0%)	220 (4.0%)	70 (1.4%)	730 (13.3%)	5,460
1991	320 (5.8%)	140 (2.5%)	170 (3.0%)	1,010 (18.2%)	870 (15.7%)	1,740 (31.4%)	270 (4.8%)	130 (2.4%)	900 (16.2%)	5,560
1992	490 (8.5%)	110 (2.0%)	170 (3.0%)	1,080 (18.7%)	790 (13.8%)	1,910 (33.1%)	230 (3.9%)	130 (2.2%)	860 (14.8%)	5,760
1993	770 (12.8%)	150 (2.5%)	150 (2.5%)	1,210 (20.2%)	890 (14.8%)	1,600 (26.7%)	240 (4.0%)	130 (2.2%)	860 (14.3%)	6,000
1994	640 (10.3%)	140 (2.3%)	150 (2.5%)	1,150 (18.9%)	750 (12.4%)	1,920 (31.7%)	290 (4.8%)	20 (0.3%)	1,010 (16.6%)	6,070
1995	480 (7.8%)	180 (2.8%)	210 (3.4%)	1,250 (20.1%)	950 (15.3%)	1,930 (31.0%)	200 (3.2%)	200 (3.3%)	820 (13.1%)	6,210
1996 [2]	250 (4.0%)	160 (2.5%)	190 (3.0%)	1,270 (20.3%)	950 (15.2%)	2,030 (32.5%)	270 (4.4%)	140 (2.2%)	990 (15.9%)	6,260
1997	290 (4.3%)	240 (3.5%)	240 (3.5%)	1,740 (25.8%)	1,160 (17.2%)	2,050 (30.4%)	230 (3.4%)	100 (1.4%)	710 (10.5%)	6,760
1998	180 (2.6%)	210 (3.1%)	240 (3.6%)	1,790 (26.2%)	1,260 (18.5%)	2,390 (35.1%)	210 (3.1%)	50 (0.8%)	480 (7.0%)	6,820

Remark:

Figures on waste quantities are rounded off to the nearest 10 tpd and may not add up to total due to rounding-off.

Notes :

(1) The estimated quantity of each waste component shown here is based on results of sampling exercise for domestic waste.

(2) 1996 data were estimates based on the trends in previous years as sampling exercise was not conducted.

Appendix 5

Review of composition of commercial & industrial waste

Year	Quantity (tpd) and its percentage by weight [1]									
	Bulky waste	Glass	Metals	Paper	Plastics	Putrescibles	Textiles	Wood/ rattan	Others	Total
1986	N.A.	50 (3.2%)	60 (4.0%)	280 (19.3%)	240 (16.9%)	240 (16.9%)	290 (20.2%)	150 (10.7%)	130 (8.8%)	1,440
1987	N.A.	70 (3.9%)	60 (3.8%)	340 (20.2%)	300 (17.8%)	260 (15.7%)	280 (16.4%)	210 (12.5%)	160 (9.7%)	1,680
1988	N.A.	60 (3.5%)	80 (4.2%)	290 (16.1%)	290 (16.0%)	270 (15.1%)	290 (16.0%)	250 (13.6%)	280 (15.5%)	1,820
1989	20 (1.3%)	40 (2.6%)	90 (5.0%)	330 (19.4%)	310 (17.9%)	180 (10.2%)	290 (17.0%)	170 (10.0%)	290 (16.6%)	1,720
1990	20 (0.9%)	30 (1.9%)	90 (5.7%)	330 (20.3%)	300 (18.0%)	150 (9.0%)	420 (25.5%)	160 (9.7%)	150 (9.0%)	1,650
1991	30 (1.8%)	50 (2.6%)	70 (4.0%)	340 (18.4%)	320 (17.7%)	240 (12.9%)	350 (19.0%)	180 (9.9%)	250 (13.7%)	1,830
1992	50 (2.5%)	50 (2.2%)	60 (2.9%)	430 (19.8%)	460 (21.4%)	160 (7.5%)	400 (18.5%)	190 (9.0%)	350 (16.2%)	2,170
1993	40 (1.6%)	20 (0.9%)	80 (3.2%)	780 (31.7%)	430 (17.3%)	130 (5.3%)	280 (11.6%)	260 (10.4%)	440 (18.0%)	2,450
1994	180 (7.7%)	40 (1.8%)	60 (2.5%)	690 (29.3%)	400 (16.9%)	140 (5.8%)	200 (8.4%)	280 (11.8%)	370 (15.8%)	2,360
1995	50 (3.0%)	40 (2.4%)	80 (5.0%)	500 (31.3%)	280 (17.4%)	50 (2.9%)	120 (7.3%)	250 (16.1%)	230 (14.6%)	1,580
1996[2]	80 (4.1%)	30 (1.8%)	70 (3.5%)	570 (30.1%)	310 (16.2%)	90 (4.7%)	130 (6.8%)	320 (16.9%)	300 (15.9%)	1,880
1997	90 (4.8%)	40 (2.1%)	80 (4.0%)	490 (25.5%)	320 (16.4%)	160 (8.3%)	140 (7.0%)	340 (17.6%)	280 (14.3%)	1,920
1998	80 (4.1%)	60 (3.3%)	50 (2.7%)	580 (30.3%)	270 (14.0%)	310 (16.0%)	60 (3.0%)	270 (14.1%)	240 (12.5%)	1,910

Remarks:
Figures on waste quantities are rounded off to the nearest 10 tpd and may not add up to total due to rounding-off.
N.A. = Not available.

Notes :
(1) The estimated quantity of each waste component shown here is based on results of sampling exercise for commercial and industrial waste.
(2) 1996 data were estimates based on the trends in previous years as sampling exercise was not conducted.

Review of composition of municipal solid waste

Year	Quantity (tpd) and its percentage by weight [1]									
	Bulky waste	Glass	Metals	Paper	Plastics	Putrescibles	Textiles	Wood/ rattan	Others	Total
1986	320 (5.4%)	160 (2.7%)	210 (3.5%)	1,250 (21.3%)	880 (15.0%)	1,590 (27.1%)	480 (8.1%)	340 (5.8%)	650 (11.1%)	5,870
1987	250 (4.0%)	190 (3.0%)	220 (3.5%)	1,340 (21.3%)	980 (15.6%)	1,720 (27.2%)	490 (7.7%)	400 (6.3%)	710 (11.4%)	6,300
1988	280 (4.4%)	240 (3.8%)	270 (4.1%)	1,170 (18.2%)	1,010 (15.7%)	1,470 (22.9%)	530 (8.3%)	380 (5.9%)	1,070 (16.7%)	6,410
1989	250 (3.7%)	210 (3.2%)	300 (4.5%)	1,370 (20.9%)	1,050 (16.0%)	1,570 (23.8%)	580 (8.7%)	240 (3.7%)	1,020 (15.5%)	6,580
1990	260 (3.6%)	160 (2.3%)	230 (3.2%)	1,380 (19.4%)	1,110 (15.6%)	2,220 (31.3%)	640 (9.0%)	230 (3.3%)	880 (12.3%)	7,100
1991	350 (4.8%)	180 (2.5%)	240 (3.2%)	1,350 (18.3%)	1,200 (16.2%)	1,980 (26.8%)	610 (8.3%)	320 (4.3%)	1,150 (15.6%)	7,390
1992	540 (6.8%)	160 (2.1%)	230 (3.0%)	1,510 (19.0%)	1,260 (15.9%)	2,070 (26.1%)	630 (7.9%)	320 (4.0%)	1,210 (15.2%)	7,930
1993	810 (9.5%)	170 (2.0%)	230 (2.7%)	1,990 (23.6%)	1,320 (15.6%)	1,730 (20.5%)	520 (6.2%)	380 (4.5%)	1,300 (15.4%)	8,450
1994	820 (9.7%)	180 (2.2%)	210 (2.5%)	1,840 (21.8%)	1,150 (13.6%)	2,060 (24.5%)	490 (5.9%)	300 (3.5%)	1,380 (16.3%)	8,430
1995	530 (6.8%)	210 (2.8%)	290 (3.7%)	1,740 (22.3%)	1,230 (15.8%)	1,970 (25.3%)	310 (4.0%)	460 (5.9%)	1,050 (13.4%)	7,790
1996[2]	330 (4.0%)	190 (2.4%)	260 (3.1%)	1,840 (22.6%)	1,260 (15.4%)	2,120 (26.1%)	400 (4.9%)	450 (5.6%)	1,290 (15.9%)	8,140
1997	380 (4.4%)	280 (3.2%)	310 (3.6%)	2,230 (25.7%)	1,480 (17.1%)	2,210 (25.5%)	370 (4.2%)	440 (5.0%)	980 (11.3%)	8,680
1998	260 (3.0%)	280 (3.1%)	300 (3.4%)	2,370 (27.1%)	1,530 (17.5%)	2,700 (30.9%)	270 (3.1%)	320 (3.7%)	710 (8.2%)	8,730

Remark:

Figures on waste quantities are rounded off to the nearest 10 tpd and may not add up to total due to rounding-off.

Notes :

(1) The estimated quantity of each waste component shown here is based on results of sampling exercises for domestic waste and commercial & industrial waste.

(2) 1996 data were estimates based on the trends in previous years as sampling exercise was not conducted.

Appendix 7

Recovery of major recyclable materials in 1998

Waste type	Quantity of recyclables recovered in 1998 (thousand tonnes)		
	Exported for recycling [1] (a)	Recycled locally (b)	Total recovered for recycling (c) = (a) + (b)
Ferrous metals	505	3.8	509
Glass[2]	less than 0.1	3.9	3.9
Non-ferrous metals	88	21	109
Paper	392	292	684
Plastics	182	32	214
Rubber tyre	0	8.7	8.7
Textiles	11	2	13
Wood	1	20	21
Total [3]	**1,180**	**380**	**1,560**

Notes :

(1) Figures are based on records of the Census and Statistics Department.

(2) Excluding glass beverage bottles recovered through deposit-and-refund system operated by local beverage manufacturers.

(3) Figures are rounded off to the nearest 10 thousand tonnes.