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ZERO WASTE DESIGN

FOR BUILDINGS IN HONG KONG

October 2022

Executive Summary

Hong Kong has for years battled monumental waste crisis, with enormous amount of municipal solid waste (MSW) generated and prolonged underperformance of resource recovery. To gradually develop a circular economy and reduce over-reliance on landfilling, more efforts need to be put to reduce waste at source together with a more comprehensive transformation of waste into resources. Waste reduction is also of great importance in achieving our climate goals.

Currently, more attention has been paid to the circular design of products and materials for waste reduction, whereas the significance of a good and circular design for buildings is seldom discussed. With a stock of more than 41,000 existing private buildings and many more are under construction and planning, Hong Kong has a huge potential to incorporate circular economy principles into building designs to facilitate local waste management and drive behavioural change in waste reduction. Recognising such importance, BEC sees the need to identify different building typologies in terms of waste management in Hong Kong and study the best practices for achieving a circular and zero-waste economy.

This report is developed with reference to the *Zero Waste Design Guidelines NYC* (the Guidelines) published by the Centre for Zero Waste Design for New York City in 2017, which called on designers to envision how the role of design can encourage better waste management, and ultimately achieve waste reduction and circular economy. Research findings and recommendations are mainly based on interviews with pertinent stakeholders in the local building value chain, and site visits to various types of buildings.

Key findings include the identification of local good practices and strategies that can possibly be widely adopted by existing buildings to enhance current waste management system. For instance, offering reusable items, providing resource sharing platforms and other facilities such as water refill stations help avoid waste generation. Well-managed collection facilities for different recyclables, such as recycling bins and reverse vending machines, help facilitate waste diversion. Moreover, a comprehensive waste management plan for buildings can be developed to streamline the processes of waste collection, transfer and storage, as well as to enhance recyclable collection and resource recovery.

Follow up with the research findings, BEC hopes to scale up the application of zero waste design principles in buildings through potential pilot projects or trials of best practices in different buildings to explore the associated challenges and opportunities. Engagement activities may also be organised to raise relevant stakeholders' awareness of achieving a circular economy through building designs.

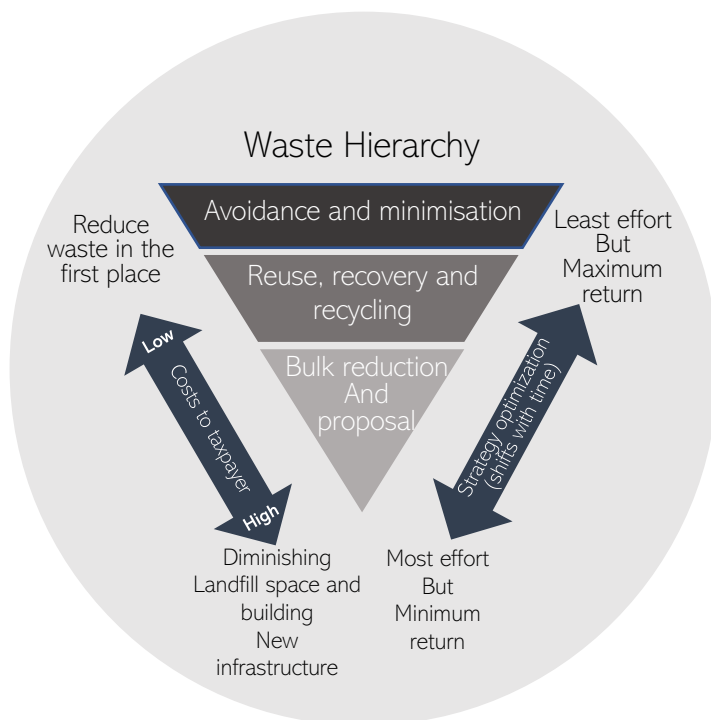
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1. Background

Hong Kong has long been facing an acute waste crisis for years, with a huge quantity of municipal solid waste (MSW) generated and a low resource recovery rate. In 2020, 10,809¹ tonnes of MSW were disposed of at landfills every day. Among the 5.49 million tonnes of MSW generated in the year, only 28% was recovered for recycling. Since waste accounts for about 7% of Hong Kong's total carbon emissions in 2019, waste reduction plays an essential role in achieving our climate targets. The Waste Blueprint for Hong Kong 2035 released by the Government in 2021 has set out the vision of 'Waste reduction, Resources circulation and Zero landfill'. While these are crucial components in a circular economy, the importance of good and circular design, especially for buildings, to influence human behaviour and incorporate both economic and social incentives for facilitating waste reduction and recycling is often neglected in the discussion.

Traditionally, waste avoidance and minimisation were at the top of the waste hierarchy,² followed by reuse, recovery and recycling and bulk reduction and disposal.



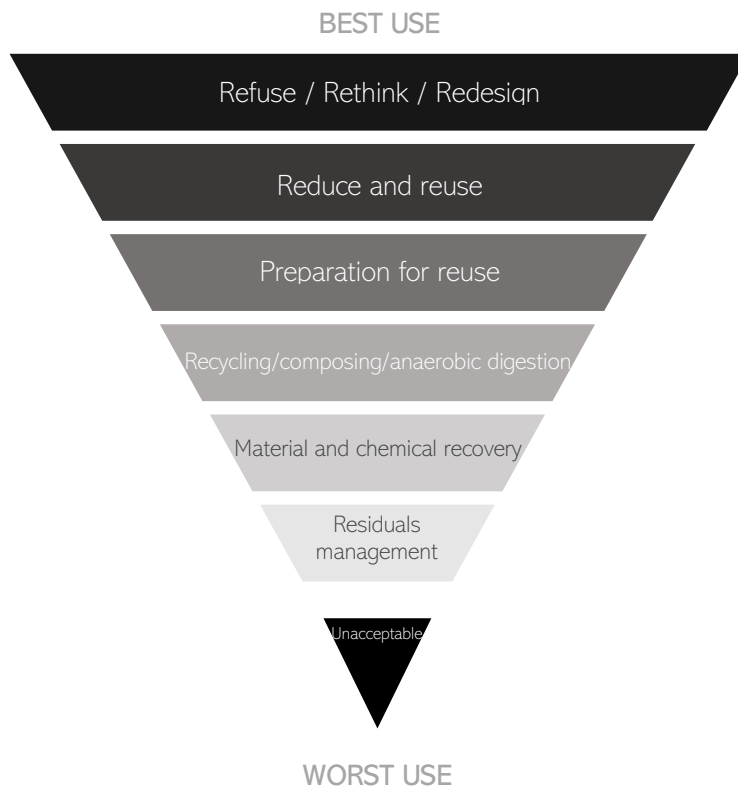
The term of waste hierarchy was first introduced by the EU's Waste Framework Directive of 1975 as European waste policy and formalised into a hierarchy of management options in the European Commission's Community Strategy for Waste Management and further endorsed in the Commission's review of this strategy in 1996.

However, the concept is not in line with the circular economy and a new hierarchy is needed to change the mindset from waste management to resource management. Waste prevention at the first place can only be achieved via designing waste out of the system, with refuse, rethink and redesign at top of the agenda.

¹ <https://www.wastereduction.gov.hk/sites/default/files/msw2020.pdf>

² https://www.epd.gov.hk/epd/msw/htm_en/ch03/main.htm

Zero Waste Hierarchy



The Zero Waste Hierarchy developed by the Zero Waste Europe.³

Adopting a circular design is critical to prevent products and materials from becoming waste and improve resource efficiency. It often refers to applying circular economy principles at the design stage of everything. To achieve circular economy, products, buildings or cities need to be designed in a way that allows the regeneration of natural systems, elimination of waste and pollution, and retention of usable products and materials within the system.⁴

In Hong Kong, most products are imported, and many businesses are close to the end of the value chain, as importers and retailers who have limited influence over the upstream processes involving product design. However, a huge opportunity lies for the city to design and rethink the role of buildings – with a stock of more than 41,000⁵ existing private buildings and many more are under construction and planning – in facilitating waste management and driving behavioural change. The planning for separation, movement and storage of waste in our buildings should be done at the building design stage, in a way to reduce the ongoing waste that is generated and managed within them, as well as to facilitate the separation of discarded materials for reuse and recycling.

³ <https://zerowasteurope.eu/press-release/press-release-a-zero-waste-hierarchy-for-europe/>

⁴ [Circular Design \(ellenmacarthurfoundation.org\)](https://ellenmacarthurfoundation.org/circular-design/)

⁵ https://www.legco.gov.hk/research-publications/english/2021_iss08-building-management-in-hong-kong-20201123-e.pdf

1.1. Zero Waste

Zero waste refers to the prevention of waste generated, by conserving resources through responsible production, consumption, reuse and recovery of products and materials. It is an approach which discourages waste to be landfilled or burned and to avoid any discharge of waste that might harm physical and human health.

The Zero Waste International Alliance (ZWIA) defines Zero Waste as follows⁶:

“Zero Waste is a goal that is ethical, economical, efficient and visionary, to guide people in changing their lifestyles and practices to emulate sustainable natural cycles, where all discarded materials are designed to become resources for others to use. Zero Waste means designing and managing products and processes to systematically avoid and eliminate the volume and toxicity of waste and materials, conserve and recover all resources, and not burn or bury them.”

1.2. Zero Waste Design Guidelines

This project is based on the *Zero Waste Design Guidelines NYC* (the Guidelines) published by the Centre for Zero Waste Design for New York City (NYC) in 2017, which called on designers to envision how the role of design can encourage better waste management, and ultimately achieve waste reduction and circular economy. The Guidelines were produced by engaging and discussing with over 100 collaborators, as well as conducting site visits to understand waste collection practices and issues in different buildings in NYC.

It was found that existing building designs created friction and inefficiencies, sometimes even impossible situations, for waste collection staff and operations. The Guidelines provided recommendations to architects, building operators and planners to better design and/or manage buildings and streetscapes to facilitate easy waste separation, recovery and recycling, as well as efficient waste transportation and storage. It examines the common building typologies among residential, commercial and institutional buildings, and describes the relevant policies to facilitate zero waste and best practices of each type of buildings, as well as for construction and demolition waste. It also analyses the best practice strategies for community waste collection and urban design, which is not the main focus of this report.

1.3. Objectives

Besides referring to the Guidelines, this report is developed mainly based on interviews conducted with relevant stakeholders in the local building value chain, such as property developers and property managers, as well as site visits conducted in different types of buildings. This research has the following objectives:

- To summarise the relevant regulations and guidelines in Hong Kong

⁶ <https://zwia.org/zero-waste-definition/>

- To provide an overview of the key building typologies in Hong Kong, in terms of waste collection and management practices, among existing and new buildings as well as among residential and commercial buildings
- To discuss the applicability and relevance of Zero Waste Design Guidelines in different types of buildings
- To compile the opportunities identified for future research and potential collaboration with relevant key stakeholders

2. Relevant regulations and guidelines in Hong Kong

In August 2021, the Legislative Council approved the Waste Disposal (Charging for Municipal Solid Waste) (Amendment) Ordinance 2021, commencing a preparatory period of 18 months which allows the Government, the public, and different stakeholders to get ready for its enactment. This is one of the important measures taken by the Government to drive behavioral changes and promote waste reduction at source through policies and legislation, as the effectiveness of MSW charging in reducing the overall amount of waste disposal has been proven by the experiences of other major cities.

Buildings play a crucial role in supporting the implementation of the MSW charging. It is also a good opportunity for property developers and property management companies (PMCs) to improve and streamline current waste management practices in buildings. Following the "polluter-pays" principle, the MSW charges will be based on the quantity of waste disposed of with two charging modes: charging by designated bags/ designated labels and charging by weight (gate-fee), with the former charging method covering most residential buildings, commercial and industrial (C&I) buildings, village houses, street-level shops and institutional premises in Hong Kong. Individual households and occupants of these premises must properly wrap their waste in a designated bag or stick a designated label to it before disposal. Cleansing workers will need to carefully check the garbage bags disposed of by the households and occupants to ensure that they have followed the regulations.

Besides the upcoming MSW charging, there are several regulations and voluntary guidelines in place in Hong Kong providing rules or recommendations on waste management in existing and/or new buildings. They can be categorised into four key areas including design, operations, construction and demolition, and community and urban planning. Key areas were identified to better categorise all relevant building regulations and guidelines:

1. Building design for
 - waste management/ collection
 - construction of waste treatment facilities
 - less construction waste/ demolition waste
2. Building operations
3. Building construction and demolition
4. City-wide waste collection and urban planning
 - Hong Kong's refuse collection system
 - Waste management planning for neighbourhood and cities/ communities

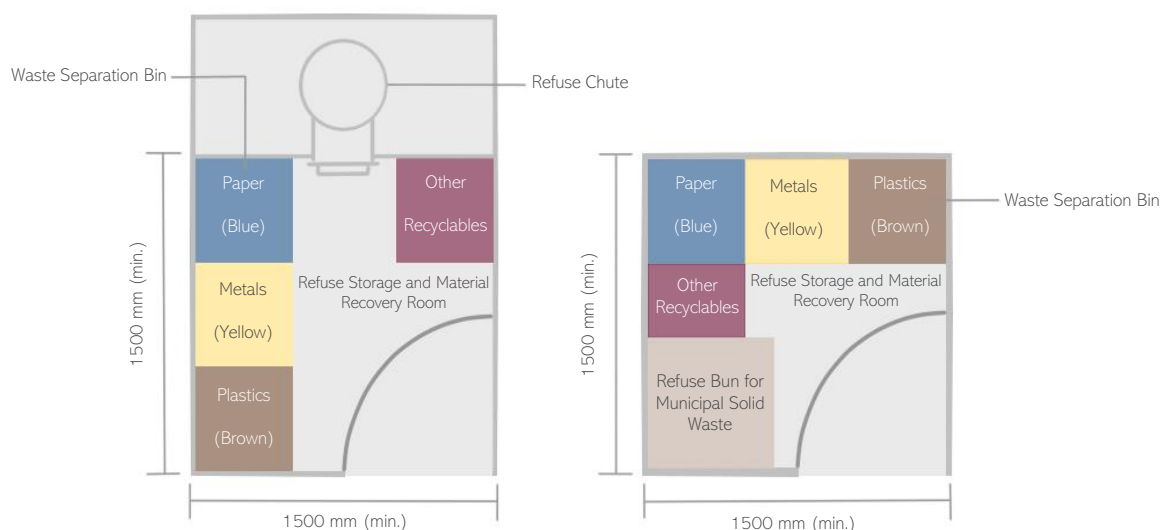
A detailed summary can be found in Appendix A.

Being part of Hong Kong's legislation, the 'Building (Refuse Storage and Material Recovery Chambers and Refuse Chutes) Regulations'⁷ (Regulations) is the only mandatory rule applicable

⁷ [Cap. 123H Building \(Refuse Storage and Material Recovery Chambers and Refuse Chutes\) Regulations \(elegislation.gov.hk\)](https://www.elegislation.gov.hk)

to all new buildings. To ensure the provision of more convenient waste separation facilities in buildings and facilitate occupants' participation in source separation of waste for material recovery, the Regulations specifies the requirements on the provision and design for refuse storage or material recovery rooms in domestic, non-domestic, industrial and composite buildings, such as the minimum area and types of construction materials used. Some of the regulations include:

- Every plan relating to a domestic building⁸ or the domestic⁹ part of a composite building shall show provision for a refuse storage and material recovery room on every floor.
- Every refuse storage and material recovery room shall always be readily accessible by any occupier of the building.
- Every refuse storage and material recovery chamber shall be constructed of brickwork, concrete or other approved material; the whole of the internal faces of the walls shall be lined with glazed bricks, glazed tiles or other approved material; the ceiling shall be rendered in cement and finished with a smooth surface.
- Minimum requirements for a refuse storage and material recovery room are:
 - Having any dimensions of minimum 1.5m
 - Having a 2-hour fire resisting period (FRP) for walls and 1-hour FRP for the access doors
 - Having an access door that is closed at all times and is equipped with a self-closing mechanism
 - Providing a proper receptacle, with cover, for each type of recyclable



Examples of Layout Plan for Refuse Storage and Materials Recovery Chamber, subject to modifications to suit any other suitable waste separation systems.¹⁰

⁸ Domestic building means a building constructed or intended to be used for habitation and the expression domestic purpose (住用用途) shall be construed accordingly.

⁹ Domestic, when used in relation to a part of a composite building, means a part that is constructed or intended for habitation.

¹⁰ [Guidebook on Source Separation of Waste in Residential Buildings | Environmental Protection Department \(epd.gov.hk\)](#)

Other government departments and administrative bodies that issue building regulations and guidelines include the Buildings Department, Environmental Protection Department, Planning Department, Home Affairs Department, Hong Kong Fire Services Department and the Environmental Protection Department, with most of the relevant guidelines issued by the Buildings Department and the Environmental Protection Department.

Buildings Department (BD)

The BD mainly introduces guidelines on the design and operational requirements of refuse storage or material recovery rooms. A Building Maintenance Guidebook¹¹ is in place, providing general management approaches on environmental issues in Chapter 4 Miscellaneous Issues in Management:

- Sharp bends of the common refuse chutes should be lined with damping materials in order to minimise noise nuisance arising from the disposal of rubbish from upper floors.
- Common refuse chute and refuse collection chambers in buildings should be regularly cleaned and maintained.
- Objects with pointed or sharp edges or of a hazardous nature (such as inflammable or corrosive materials) should be separately packed and disposed of.
- Refuse like newspapers, plastics, metal cans and glass bottles should be separated from other kind of rubbish for recycling as far as practical.

The BD also issued the Code of Practice for Demolition of Buildings Year 2004¹², providing guidance on safe and good practices for demolition works. Under the Debris and Waste Handling section:

- The method of 'selective demolition' should be adopted as far as practicable. It involves demolition and removal of waste of the same category one at a time, allowing sorting and recycling of building materials.
- In general, domestic waste such as furniture, household appliances, etc., metal components such as window frames, pipes, etc., timber components such as doors, wooden floors, etc., other waste such as tiles, asphaltic materials, ceramic products should be removed first. Most of these materials may be recycled. The building demolition shall begin after all the above non-structural materials have been stripped and removed.
- Broken concrete may be disposed of at construction and demolition (C&D) materials recycling facilities for processing into recycled products and aggregates for beneficial reuse. In case of mixing with some other waste, broken concrete should be sorted out on site from the mixture of waste before disposal at a C&D materials recycling facility.
- All construction and demolition materials arising from or in connection with demolition work shall be sorted on-site and be separated into different groups for disposal at landfills.

¹¹ <https://www.bd.gov.hk/en/resources/codes-and-references/codes-and-design-manuals/bmg.html>

¹² [Code of Practice for DEMOLITION OF BUILDINGS YEAR 2004 \(bd.gov.hk\)](#)

public filling areas, in filling areas provided by the Registered Specialist Contractor (Demolition), or recycling as appropriate.

Environmental Protection Department (EPD)

The EPD mainly develops guidelines on waste management and recycling measures in residential buildings. The Guidebook on Source Separation of Waste in Residential Buildings¹³ provides suggestions on selecting waste separation locations and options for waste recovery:

- Floor refuse storage & Material recovery room
- Floor refuse storage room/ Refuse chute Room
- Floor cleaner room/ Water meter room
- Refuse chute
- Integration of lobby with floor refuse storage room
- Staircase landing
- Service lift lobby

Regarding waste handling and refuse room under green property management, the EPD states two rules as general guidelines¹⁴:

- The refuse room/ station should be used solely for refuse collection operation and no illegal occupation/ misuse should be allowed.
- Proper bulk storage containers/ areas should be allocated at central refuse station for storage of recycling materials.

Some examples of other relevant guidelines include the Daily Operation of Building Management Waste Separation and Recovery¹⁵ issued by the Home Affairs Department, providing general guidelines on waste collection and the maintenance of waste separation and recovery facilities; the Hong Kong Planning Standards and Guidelines¹⁶ issued by the Planning Department, providing guidelines for a broader perspective of waste management planning for neighbourhood and communities; as well as the Guidelines on Placing Rubbish Bins in Common Areas and Staircases of Domestic or Composite Buildings¹⁷ issued by the Hong Kong Fire Services Department, specifying recommendations on placing trash bins to ensure fire safety.

Mostly being voluntary, the majority of the above building regulations and guidelines are applicable to existing buildings, focusing mainly on the design and operational aspect of waste management which include the provision and location requirements of refuse storage and material recovery room and waste handling facility and equipment, strategies on reducing C&D waste, as well as guidelines on the daily operations and maintenance of the refuse storage and material recovery room etc. They are mainly applicable to more than one specific building types and commonly

¹³ [Guidebook on Source Separation of Waste in Residential Buildings | Environmental Protection Department \(epd.gov.hk\)](http://epd.gov.hk)

¹⁴ [Waste Handling & Refuse Room | Environmental Protection Department \(epd.gov.hk\)](http://epd.gov.hk)

¹⁵ [Home Affairs Department - Building Management - Daily Operation of Building Management \(buildingmgt.gov.hk\)](http://buildingmgt.gov.hk)

¹⁶ [ch9.pdf \(pland.gov.hk\)](http://pland.gov.hk)

¹⁷ [Guidelines on Placing Rubbish Bins in Common Areas and Staircases of Domestic or Composite Buildings \(hkfsd.gov.hk\)](http://hkfsd.gov.hk)

pertain to residential buildings. No rules requiring source separation or regulating waste management operations in place specifically for commercial buildings.

Other than relevant government departments, non-governmental organisations (NGOs) such as Hong Kong Green Building Council, US Green Building Council, and the International WELL Building Institute also issue waste-related building guidelines. They mainly cover waste management strategies from waste collection and storage to the planning of waste management for neighbourhood, communities or cities.

Hong Kong Green Building Council (HKGBC)

The BEAM Plus is a set of comprehensive and independent environmental assessment schemes for buildings developed by HKGBC. It sets out a series of best practice criteria for a range of sustainability issues across the whole lifecycle of all types of buildings, covering building management, operation, maintenance and improvement, with four sets of schemes in place including BEAM Plus Neighbourhood (ND), BEAM Plus New Building (NB), BEAM Plus Existing Buildings (EB) and BEAM Plus Interiors (BI).

U.S. Green Building Council (USGBC)

The LEED certification is a set of rating systems developed by the USGBC. It specifies various green building strategies, covering all building types and all building phases including new construction, interior fit outs, sustainable operations and maintenance upgrades, and core and shell.

International WELL Building Institute (IWBI)

The WELL Building Standard version 2 is the updated rating system, providing performance standards for various policy, design and operational strategies that make spaces better for human health and well-being. The system is designed to accommodate all project types and sectors, which measures, certifies and monitors features of the built environment that impact human health and well-being, through parameters such as air, water, light and comfort.

Among all the voluntary certification schemes, the provision of space and facilities for the collection and storage of waste and specific types of recyclables is always the pre-requisite for the design and operation stage of buildings. Requirements are slightly different for different building types such as new buildings or existing buildings. Some also require minimum waste recycling facilities. The storage or recycling facilities shall be placed in prominent location which is easily accessible to waste haulers and building occupants. It is also recommended that the collection and storage bins should be located close to the source of recyclable waste. For recyclables such as batteries, mercury-containing lamps and electronic waste, appropriate measures should be taken for safe collection, storage and disposal. More credits can be obtained by undertaking other sustainable waste management practices. For example, by installing waste treatment equipment, developing waste management plan and taking actions to reduce waste.

For building C&D, a C&D waste management plan is required by some of the certification schemes, with a waste diversion goal established to identify materials targeted for diversion. The diversion strategies for targeted materials should be included in the plan, with description on where the material will be taken and how the recycling facility will process the material. Bonus credits are offered to various building designs for less C&D waste. For example, design for durability and resilience by taking measures to minimise necessary refurbishment or renewal and prevent excessive material use, design for easy dismantling, separation and collection of the construction elements, reuse major elements of existing building structures and use recycled materials for construction.

3. Building typologies in Hong Kong

Hong Kong is one of the most densely populated cities in the world, with a population density of around 7,242¹⁸ people per square kilometre. Some of the districts have a population density even much higher than that of other international cities. For example, Kwun Tong had a population density of around 59,700¹⁹ people per square kilometre in 2021, which is more than two-fold of the figure in Manhattan, New York City of around 27,346²⁰ people per square kilometre. Around 88%²¹ of Hong Kong people live in multi-tenant buildings over 10 storeys, mostly served by PMCs on waste collection and management. There are also around 6% of households located in buildings without proper building management, mainly single block buildings (SBBs) in older districts and village houses scattered across the New Territories and suburban areas. The diverse urban form has led to the development of a complex MSW collection system in the city, with the ultimate aim of ensuring environmental hygiene.



A private residential estate with high-rise, multi-tenant building blocks (left);²² Single block buildings, Tong-laus, in older districts (right).²³

3.1. Current MSW Collection System

The city's waste collection services are provided by both the Food and Environmental Hygiene Department (FEHD) and private waste collectors (PWCs). About 85% of MSW from domestic source is covered by FEHD's services, including waste collected from residential and institutional premises, public trash bins, streets, marine areas and country parks. FEHD has a total of 164, 8 and 878²⁴ permanent off-street public refuse collection points (RCPs), temporary RCPs and village-type RCPs/ RCPs with temporary structures respectively, of different design and sizes to meet actual needs and site constraints. C&I establishment would need to hire their own collection

¹⁸ <https://worldpopulationreview.com/countries/hong-kong-population>

¹⁹ <https://www.censtatd.gov.hk/en/EIIndexbySubject.html?scode=150&pcode=D5320189#section1>

²⁰ <https://worldpopulationreview.com/boroughs/manhattan-population>

²¹ https://www.epd.gov.hk/epd/msw_consult/file/MSW_ENG_ch5.pdf

²² brown high rise buildings during daytime photo – Free Hong kong Image on Unsplash

²³ yellow concrete building photo – Free Hong kong Image on Unsplash

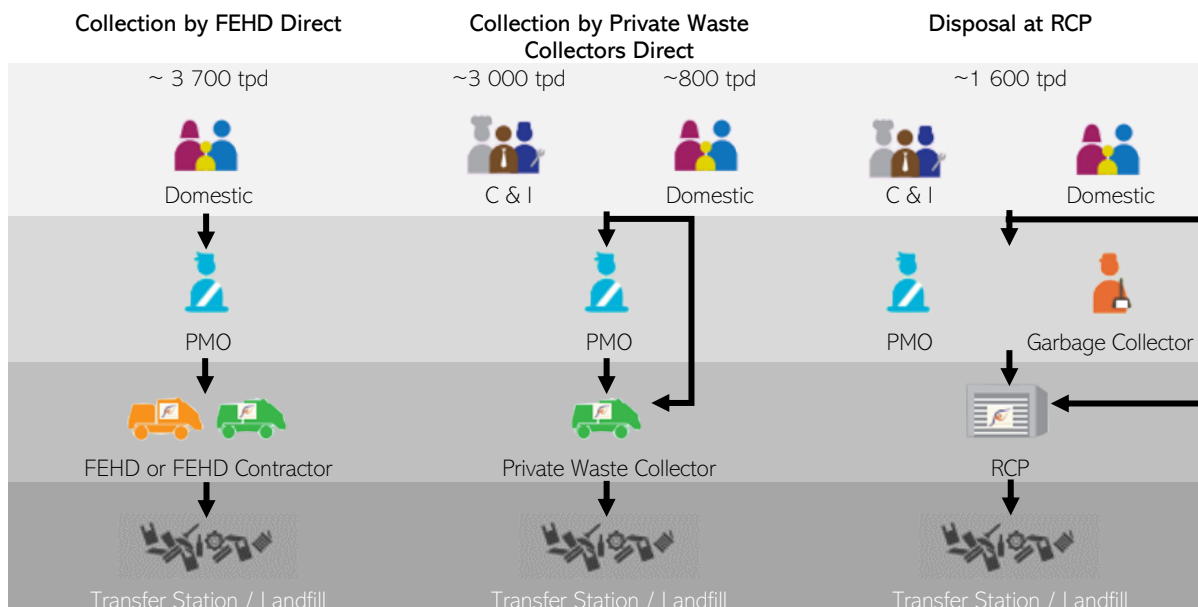
²⁴ https://www.fehd.gov.hk/english/pleasant_environment/cleansing/clean1.html#

services i.e. PWCs to collect and deliver the waste to refuse transfer station or directly to landfills for disposal.

There are three main types of waste collection modes operating in Hong Kong:²⁵

1. Direct collection by FEHD – Collection fleet of FEHD provides a direct, daily and free waste collection service to residential buildings, covering nearly all public and private housing estates as well as newly built SBBs.
2. Direct collection by PWCs – PWCs mainly provide waste collection services in C&I buildings at a charge. These buildings have to engage cleansing contractors to collect and send the waste to transfer stations or directly to landfills. There are also cases of waste disposal through RCPs in the C&I sector, such as street-level shops. They also collect a small portion of domestic waste mainly from private housing estates and newly developed SBBs, which are not accessible by FEHD's refuse collection vehicles (RCVs) or do not fit it with FEHD's waste collection schedules.
3. Disposal at RCPs directly or through garbage collectors – There are about 1.5 million people using public RCPs for household waste disposal, who mainly live in buildings located in old districts or village houses scattered across suburban or rural areas. Most old SBBs in some older districts at the city centre have no management body to coordinate waste collection activities. It is also not possible to accommodate FEHD's RCVs for direct waste collection. Therefore, domestic waste generated in these buildings is delivered to the nearby RCPs by the waste producers or through the paid waste collection service provided by garbage collectors. Residents can also dispose of their waste into public litter bins which will eventually end up in an RCP. For village houses in the suburban or rural areas, residents dispose of their waste at village-type RCPs or bin sites operated by FEHD. Refuse in the RCPs will be collected by FEHD's RCVs or its cleansing contractors at least once a day, and transported to refuse transfer stations or directly to landfills for disposal.

²⁵ https://www.epd.gov.hk/epd/msw_consult/file/MSW_ENG_ch5.pdf



~ 5.5M population

- Public and private housing estates
- New single block buildings
- Government buildings
- Institutional buildings

- Public and private housing estates
- New single block buildings
- Commercial buildings
- Industrial buildings
- Shopping Malls
- Institutional buildings

~ 1.5M population

- Old single block buildings
- Village houses
- Street level shops
- Small trades in composites buildings

Existing MSW collection system in Hong Kong.²⁵

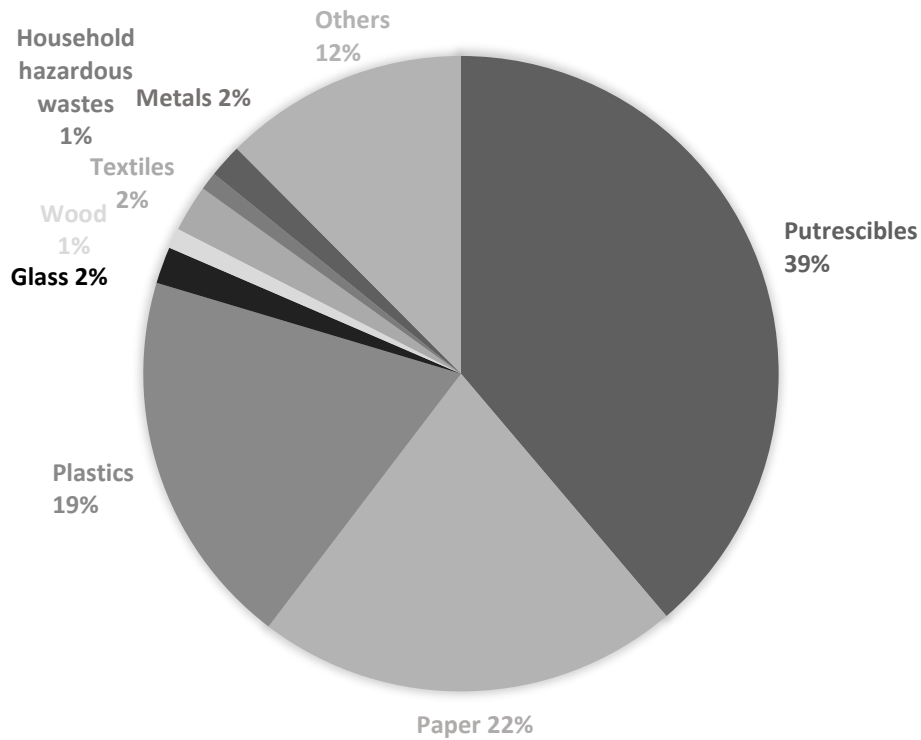
3.2. Residential Building Context

In Hong Kong, residential flats in public rental housing estates, private housing and subsidised home ownership housing constituted over 98%²⁶ of all occupied quarters, with about 45% are private residential units. Each public housing and subsidised home ownership housing estate usually comprises several high-rise blocks with flats of different sizes. Building stock for private housing varies physically in many ways, from typical private housing estates containing high-rise to low- or mid-rise building blocks to older street-side, mixed-used residential buildings Tong-laus or village houses.

Due to limited availability of official waste data solely for residential buildings, the data of domestic waste is used as a reference in identifying key residential waste streams. According to the latest waste statistics²⁷, domestic waste accounted for 63% of the MSW disposed at landfills in 2020. The largest constituent of domestic waste was putrescibles, followed by wastepaper and waste plastics.

²⁶ https://www.census2021.gov.hk/en/main_tables.html

²⁷ <https://www.wastereduction.gov.hk/sites/default/files/msw2020.pdf>



Waste composition of domestic waste disposed of at landfills in 2020.

With reference to the *Zero Waste Design Guidelines NYC*, each residential typology is described and assessed in terms of the below four interrelated factors:

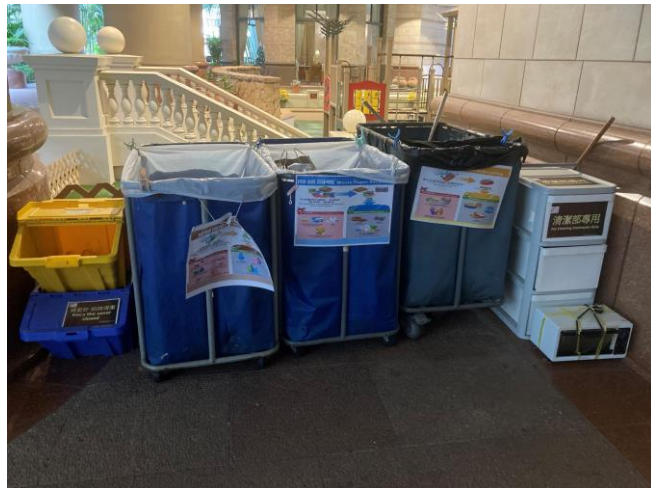
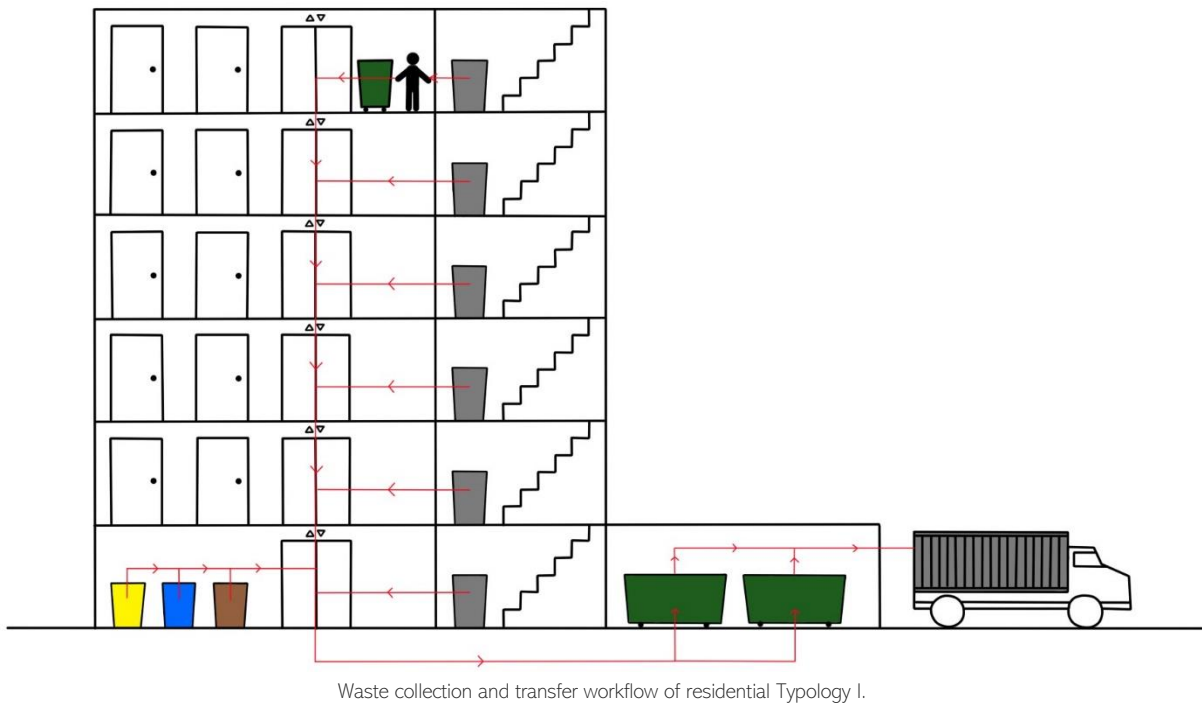
- Space required: Space efficiency is desirable to building owners
- Labour required: Additional labour cost is required for waste collection and handling
- Convenience to resident: One of the most important elements in facilitating waste recycling as most residents want convenience
- Cost and maintenance: Capital costs and additional maintenance requirements for waste collection and handling equipment

The below table summarises the characteristics of the three residential typologies identified in terms of the above-mentioned factors:

<i>Factors</i>	Typology I: Trash bins with central recycling	Typology II: Trash and recycling bins in service corridor/ refuse room	Typology III: Central refuse collection outside buildings
<i>Space required</i>	Limited space is required due to the lack of recyclable collection facilities on every floor.	More space is required on each floor and in common areas for placing waste and recyclable collection facilities.	No space is needed in the building for the collection and storage of waste and recyclables.
<i>Labour required</i>	Labour is required to collect waste from each floor and collect recyclables from only a few locations.	More labour is required to collect waste and recyclables from a number of locations.	No labour is needed for the collection and transfer of waste and recyclables.
<i>Convenience to resident</i>	Waste disposal is convenient, but disposal of recyclables is not.	Both waste and recyclable disposal are convenient. The co-location of waste and recyclable collection facilities supports equal convenience disposal.	Disposal of both waste and recyclables is not convenient for building occupants, as no or only limited collection facilities or services are available inside the building block.
<i>Cost and maintenance</i>	Low capital cost and no additional maintenance requirements are needed for facilities related to waste and recyclable collection, transfer and storage, as mainly ordinary trash containers are used and waste transfer is completely manual. Capital costs and regular maintenance may be required for additional on-site waste treatment facilities such as waste compactor and food waste composter.		No capital cost and no maintenance requirements are needed for facilities related to waste and recyclable collection, transfer and storage.

Typology I: Trash bins with central recycling

This is one of the most common waste collection practices in private, multi-storey residential blocks in Hong Kong. Waste collection bins are in place at the corner of staircase landing each floor. Residents should put the household garbage inside plastic bags and place them inside the designated bins. Collection bins or boxes for different recyclables are usually placed at the ground floor at each block or in a common area where accessible to all the residents in the estate.



A trash bin located at staircase landing (left); A central location for recyclable collection (right).

Cleaning staff collect the waste from each floor by using a wheel bin and transport them via passenger lift, either to the refuse room located at the ground floor of the building block for temporary storage or transfer the waste directly to the central refuse storage and material recovery room which is mainly located at the parking lot of the residential estate for storage before collected by FEHD or its contractors.

Recyclables collected from the collection facilities located in common areas are also stored and sorted in the central refuse storage and material recovery room before collected by the private collectors who are hired to provide recycling collection service to the estate. Collection arrangement for recyclables is usually less frequent than daily waste collection, depending on the amount of recyclable collected and the storage capacity.

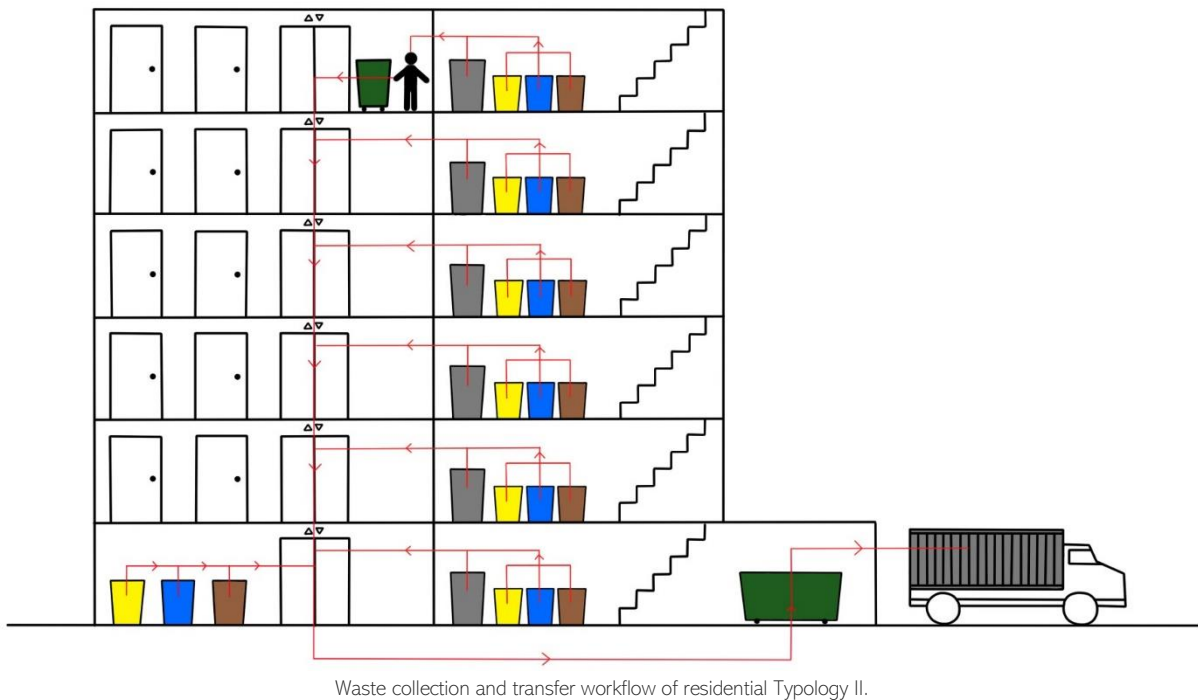


Waste is transferred via a passenger lift at a designated time period.

In this residential typology, waste disposal is convenient for building occupants as there are waste collection facilities on each floor. However, lacking collection facilities for different recyclables on each floor makes recyclable disposal not as convenient as waste disposal. Less space is required for simply placing a collection bin for general waste. Labour is required to collect waste from each floor and collect recyclables from only a few locations.

Typology II: Trash and recycling bins in service corridor/ refuse room

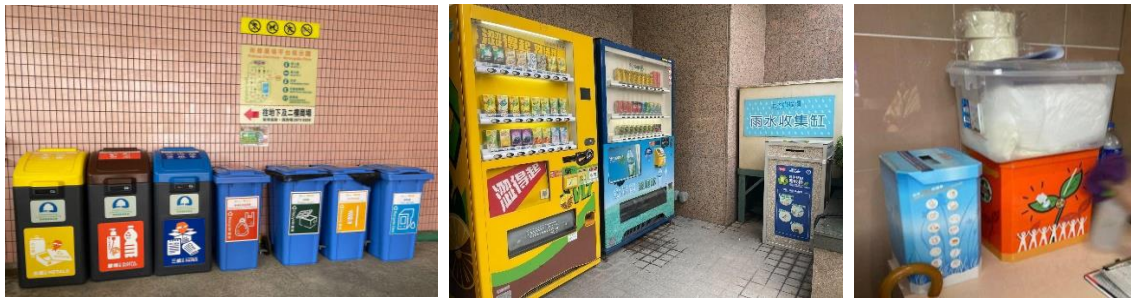
The second typology is very similar to the previous one in terms of waste collection and transfer, with differences over the provision and location of recyclable collection facilities. In some residential buildings, a small area in existing service spaces each floor is dedicated to waste and recyclable collection. Examples include a small, unventilated refuse storage room at stairwell and collection bins at service lift lobby. Separate collection bins or containers for waste and different types of recyclables are in place. Several sets of recycling bins for recyclables may also be in place in the common areas, such as by the garden or next to the main exits of the housing estate. Collection boxes for recyclables of smaller sizes such as rechargeable battery and fluorescent lamp may be placed at the security counter of each building block.



A small waste room with separate collection bins and trays for waste and recyclables respectively.



A refuse storage and material recovery room with separate collection bins for different waste streams.



A set of recycling bins for metals, paper, different types of plastics, fluorescent lamps and toner cartridge located in the common areas (left); A beverage carton collection box located next to the vending machines (middle); Collection boxes for used rechargeable battery and fluorescent lamps located at the security counter at the lobby of the block (right).

Similar to Typology I, cleaning staff collect the waste and recyclables from each floor and transport them via passenger lift. Collection time and frequency vary among different housing estates, depending on the property management practices. The materials are then transferred either to the refuse room located at the ground floor of the building block for temporary storage or directly to the central refuse storage and material recovery area which is mainly located at the parking lot of the residential estate. Waste collected from all the blocks is stored in this area before collected by FEHD or its contractors.

Recyclables collected from all the blocks and collection facilities located in common areas are also stored and sorted in the central refuse storage and materials recovery area before collected by private collectors. Collection frequency for recyclables may vary depending on the amount of recyclable collected and the storage capacity.

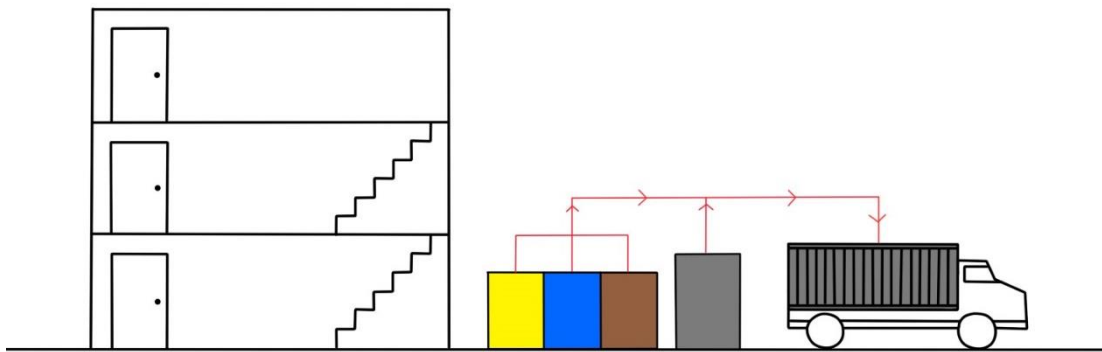


A central refuse storage and materials recovery room located at the parking lot of the housing estate.

In this residential typology, high convenience is offered to building occupants on disposal of general waste and different recyclables as there are collection facilities in place on each floor. At the same time, more space, both on each floor and in common areas, is required for placing different collection facilities. More labour is also required to collect waste and recyclables from a number of locations.

Typology III: Central refuse collection outside buildings

For smaller or single block residential buildings, including Tong-laus and village houses, often no standardised procedures nor a centralised system is in place for waste collection, transfer and storage. There are about 5300²⁸ "three-nil" buildings in Hong Kong, which are those having no owners' corporations (OCs) or any form of residents' organisation or do not engage PMCs. More than 89%²⁹ of village houses do not have property management services. These buildings are typically up to 4 to 10 storeys high and often without an elevator. If there is no waste collection service provided, residents will need to deliver household waste and recyclables to the nearest public refuse collection points managed by the FEHD for disposal.



Waste collection and transfer workflow of residential Typology III.



Public refuse collection points managed by the FEHD.³⁰

In this residential typology, disposal of both waste and recyclables is not convenient for building occupants. As no or only limited collection facilities or services are available inside the building block, residents need to carry all the materials to the nearest public refuse collection points for disposal. No space and labour are needed for the collection, transfer and storage of different waste streams.

²⁸ <https://www.info.gov.hk/gia/general/202001/15/P2020011400595.htm>

²⁹ <https://medium.com/@makingonloft/%E7%B6%AO%E5%9C%A8%E5%8D%80%E5%8D%80-%E5%A6%82%E4%BD%95%E8%AE%8A%E5%8C%96%E5%89%B5%E6%96%B0-%E5%9B%9E%E6%87%89%E5%9E%83%E5%9C%BE%E6%A3%84%E7%BD%AE%E6%8C%81%E7%BA%8C%E6%94%80%E5%8D%87%E7%9A%84%E7%8B%80%E6%B3%81-3-3%E7%AF%87-8c3b4242797f>

³⁰ https://hk.on.cc/hk/bkn/cnt/news/20180903/bkn-20180903033029335-0903_00822_001.html

The collection of recyclables for this building typology relies mainly on the roadside recycling bins and community recycling services. Three-colour recycling bins are in place in the public refuse collection points to collect paper, metal and plastic bottles, which will then be delivered to local recyclers for proper handling and recycling. This is usually not an efficient and effective way of recycling, with poor maintenance of recycling facilities and high contamination rate of recyclables.

The Community Recycling Network (CRN)³¹ established by the government, including the GREEN@COMMUNITY and Community Recycling Centres (CRC) provides additional options, especially for older districts, for the disposal of different types of recyclables. By providing easy access to convenient disposal of different recyclables, these drop-off locations in public space help address the issue of inadequate storage in single building blocks.



Recycling stations and recycling stores under the GREEN@COMMUNITY CRN.³²

For all the above residential typologies, capital costs and additional maintenance requirements are low as mainly ordinary trash containers are used and waste transfer is completely manual. Capital costs and regular maintenance may be required for additional on-site waste treatment facilities such as waste compactor and food waste composter.

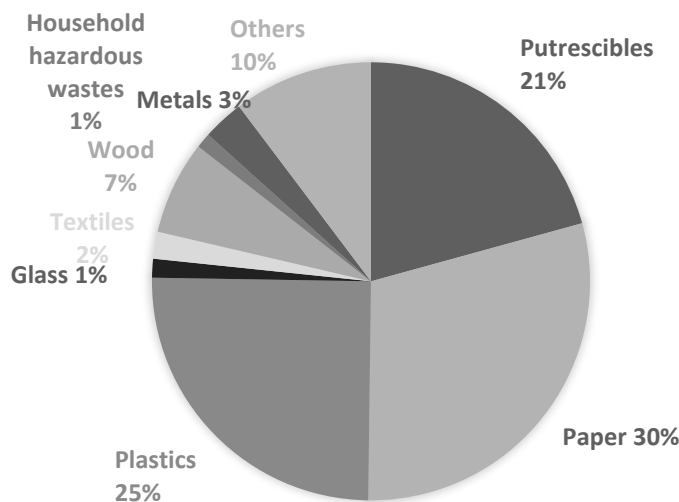
³¹ https://www.wastereduction.gov.hk/sites/default/files/CRN_Locations.pdf

³² https://www.wastereduction.gov.hk/en/community/crn_intro.htm

3.3. Commercial Building Context

In Hong Kong, there are many types of commercial buildings with a wide range of uses. They range from office buildings, shopping malls, hotels or mixed used premises, accounting for 0.5%³³ of urban or built-up land in the city. For commercial buildings, typologies vary among buildings of different size and usage.

With limited statistics for the exact amount of waste generated solely from commercial buildings, data comprising both commercial and industrial waste is used as a reference to commercial waste composition. Commercial and industrial waste accounted for 37%³⁴ of the MSW disposed at landfills in 2020, with largest constituent being wastepaper, followed by waste plastics and putrescibles. Information collected from interviews with property developers and PMCs is generally consistent with the waste statistics, with paper waste being the major composition of waste generated from shopping malls and office buildings. Other key waste streams include plastic waste and food waste.



Waste composition of commercial and industrial waste disposed of at landfills in 2020.

Similar to the residential typologies and with reference to the *Zero Waste Design Guidelines NYC*, each commercial typology is described separately and assessed in terms of the below four interrelated factors:

- Space required: Space efficiency is desirable to building owners
- Labour required: Additional labour cost is required for waste collection and handling
- Convenience to staff: Staff are more likely to follow a convenient and safe waste management system
- Cost and maintenance: Capital costs and additional maintenance requirements for waste collection and handling equipment

³³ https://www.pland.gov.hk/pland_en/info_serv/statistic/landu.html

³⁴ <https://www.wastereduction.gov.hk/sites/default/files/msw2020.pdf>

The below table summarises the characteristics of the three commercial typologies identified in terms of the above-mentioned factors:

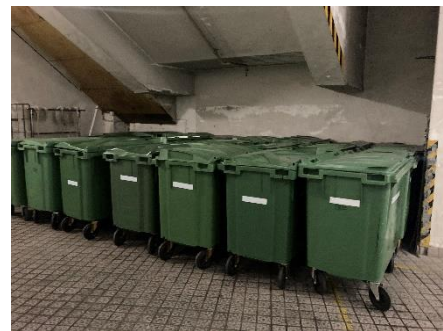
<i>Factors</i>	Typology I: Trash and recycling bins in service corridor	Typology II: Door-to-door collection	Typology III: Hotels
<i>Space required</i>	More space is required on each floor and in common areas for placing waste and recyclable collection facilities.	No/ limited floor space is needed on each floor.	
<i>Labour required</i>	More labour is required to collect and transfer waste from multiple locations.	High labour demand for collecting waste from every office/ shop.	Hotel cleaning staff is responsible for the collection and disposal of different waste streams during the room cleaning process.
<i>Convenience to staff</i>	Both waste and recyclable disposal are convenient. The co-location of waste and recyclable collection facilities supports equal convenience disposal.	High convenience for tenants, but they may need to hold waste materials until the set collection time.	-
<i>Cost and maintenance</i>	Low capital cost and no additional maintenance requirements are needed for facilities related to waste and recyclable collection, transfer and storage, as mainly ordinary trash containers are used and waste transfer is completely manual. Capital costs and regular maintenance may be required for additional on-site waste treatment facilities such as waste compactor and food waste composter.		

Typology I: Trash and recycling bins in service corridor

This typology is commonly found in typical, multi-tenant office buildings in Hong Kong. Separate collection bins for waste and common recyclables are in place at the common space each floor, usually near the staircase, service or passenger lift. Tenants directly bring and place the waste materials inside the bins. Cleaning staff collect the materials from each floor and transfer them via cargo lift to the central refuse storage and material recovery area mainly located in the parking lot at the ground floor of the building block for temporary storage and sorting.



Waste collection and transfer workflow of commercial Typology I.



Separate collection bins for general waste and recyclables are located next to the service lift (left); Waste and recyclables are transported to the central refuse storage and material recovery area via service lift (middle and right).

Usually, more bins are available in central refuse storage and material recovery area to collect more types of recyclables. Tenants need to go down and dispose of these recyclables. For larger recyclables such as electrical appliances and furniture, tenants may contact the management company for collection arrangement.

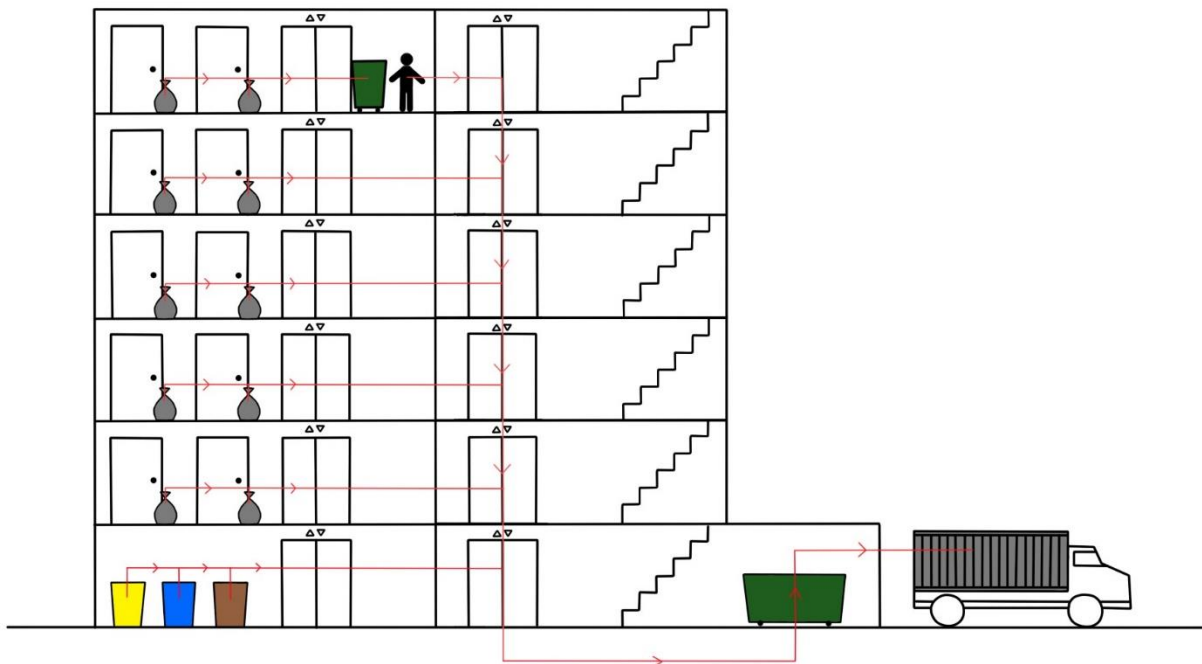


Collection bins for more types of recyclables are located in the central refuse storage and material recovery area.

In this commercial typology, high convenience is offered to tenants on disposal of certain waste streams as there are collection facilities in place on each floor. The co-location of waste and common recyclables provides building occupants with equal convenient disposal. Space in each floor and common areas needs to be allocated for placing waste collection and storage facilities. More labour is required to collect and transfer waste from multiple locations.

Typology II: Door-to-door collection

This is another common type of waste management practice in office buildings and shopping malls. Tenants store waste materials with or without sorting in the tenant area. Then leave them right outside the door or at the corridors for cleaning staff to collect. In some cases, cleaning staff may also enter the office or shop to collect waste. Collection time and frequency vary among types of buildings and property management practices.



Waste collection and transfer workflow of commercial Typology II.



Tenants leave the waste at the corridor for collection (left); Cleaning staff may collect the waste directly from the office (middle); Additional recycling bins placed at each floor (right).

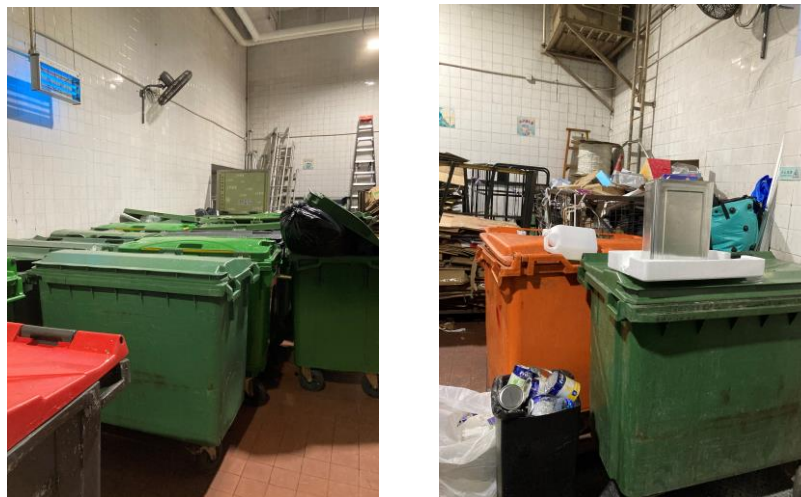
Recycling bins may also be found at the common space of each floor, such as area next to the service lift for separation collection. More sets of three-colour recycling bins are placed in public areas mainly for building users other than tenants, such as guests or customers. There are also

other initiatives which can be taken to encourage and facilitate waste reduction and separation at source. More details can be found in the next section.



Recycling bins for multi-waste streams are in place in the common areas of office buildings and shopping malls.

Cleaning staff collect all the waste materials door-to-door from all floors. Together with the waste and recyclables collected from the bins in public areas, all the waste materials are transported to the central refuse collection and storage point by using wheeled bins and via service lift. PWCs appointed by the management company will collect and handle both waste and recyclables. Tenants may contact the management company for collection arrangement of larger recyclables, such as electrical appliances and furniture.



A central refuse collection and storage point in a mixed-used commercial building comprising a shopping mall and office towers.

In this commercial typology, high convenience is offered to tenants on both general waste and recyclables disposal. Waste is collected by the cleaning staff directly from tenant area, then transferred to the central refuse collection and storage area for sorting and storage. While more labour is required to collect, transfer and sort the waste materials, less floor space is required for placing waste collection facilities.

Typology III: Hotels

The waste management practice in hotel buildings is unique and a bit different from usual commercial buildings, in which building users and occupants are mainly hotel guests with short term stay. Waste is managed by hotel's steward department instead of PMCs. Waste from hotel rooms is collected by hotel cleaning staff during room cleaning, with a frequency of once a day after the standard check-out time or upon request by hotel guests. Waste from in-house restaurants is separately collected and transferred to the waste storage area at hotel basement. Food waste is transferred at a higher frequency of 2 to 3 times a day under normal business operation.



Waste collection and transfer workflow of commercial Typology III.



A two-compartment waste collection bin in hotel rooms (left) and recyclables collection bins in one of the in-house restaurant kitchens (right).

The waste collection bin in guest room consists of two boxes for general waste and recyclables respectively. The provision of a 2-compartment trash bin with clear labels allows hotel guests to separate general waste and recyclables. Cleaning staff then sort and put the waste materials into different plastic bags, in terms of paper, glass, aluminium and food waste etc. Waste collected from rooms at the same floor is temporarily stored at the pantry of each floor. Waste and recyclables generated from in-house restaurants are sorted and temporarily stored in designated bins in kitchen areas. All waste is then transferred to the waste storage area at hotel basement via service lift.



A central refuse collection and storage point at a hotel basement, with collection bins for different waste streams (left and middle) and a waste compactor (right) in place.

In this commercial typology, hotel cleaning staff is responsible for the collection and disposal of different waste streams during the room cleaning process. Waste is collected directly from guest rooms and sorted at each floor, then transferred to the central refuse collection and storage areas for storage. While limited floor space is required for placing waste collection facilities in public areas, workload of cleaning staff can be increased as additional time is needed for waste separation and transfer.

Similar to residential typologies, capital costs and additional maintenance requirements for all the above commercial typologies are low as mainly ordinary trash containers are used with manual waste transfer. Capital costs and regular maintenance may be required for additional on-site waste treatment facilities, for example, waste compactor and food waste composter, as well as advance systems installed for waste reduction initiatives, such as the water bottling system which will be introduced in the next section.

4. Discussions

4.1. Best Practices in Hong Kong

Design strategies can be applied to buildings to facilitate waste reduction and waste separation at source. With reference to the *Zero Waste Design Guidelines NYC*, strategies to reduce ongoing waste generated and streamline material flow within buildings fall into the following categories:

- I. Planning for material flow through a building
- II. Making waste separation easier
- III. Reducing material consumption through programming decisions
- IV. Reducing the volume of waste

Through our site visits to some local residential and commercial buildings, we see local good practices and initiatives which can possibly be widely adopted by other buildings to improve the waste management system. Possibilities for existing buildings to reduce waste and increase recycling mainly lie on facilitating waste separation and reducing material consumption.

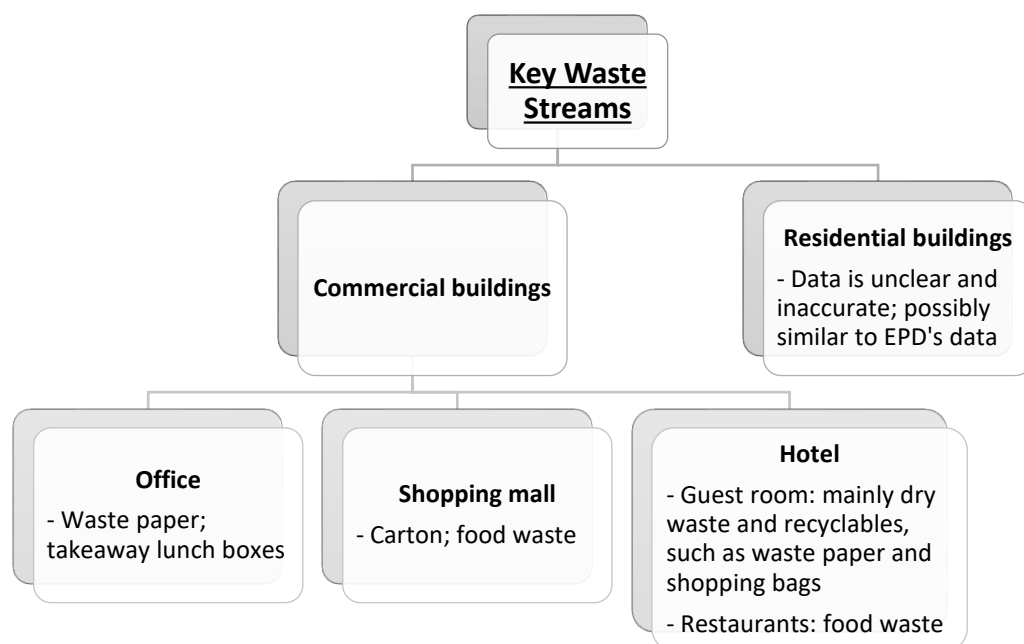
4.1.1. Design for material flow

A comprehensive and efficient waste management plan for a building should cover tenant disposal and separation, movement of recyclables and waste to central storage, waste storage and waste collection.

Tracking of waste statistics

“You can’t manage what you don’t measure.” Information and knowledge of waste types and quantities is the key foundation for waste planning. The collection of accurate waste data allows property developers or PMCs to benchmark and understand the waste performance in their buildings. Progress of waste reduction strategies and targets can therefore be assessed, with the possibility of identifying ways to streamline waste management systems and processes.

Based on the interview and site visit results, most commercial buildings do collect waste data to track different waste streams. Data collection methods vary among different buildings. For general waste, data is commonly collected and managed by installing scales on site, taking records in terms of the number of waste containers being filled and using web-based platforms. Data of recyclables, on the other hand, is usually provided by recycling contractors on a regular basis. Waste audit is conducted in some commercial buildings, with certification of ISO 14001 Environmental Management Systems. Waste data collection is sometimes less common for private residential buildings, as issues related to waste management have to go through the owner’s committee for decision making. Key waste compositions are identified as follows:



Waste transfer routes and storage space

Common types of waste collection operations in Hong Kong include manual collection using passenger or service lift, manual collection using refuse chute and refuse extraction using Automatic Refuse Collection System (ARCS).³⁵ Among all the residential and commercial buildings visited, the first approach of manual collection and transfer is adopted, requiring greater labour input and limited equipment maintenance cost and effort. Other two types of waste collection operations are more commonly found in public housing estates, which are not covered in this study.

Waste is either gathered in the collection bins at each floor or collected door-to-door, then transported manually by cleaning staff to the central refuse collection and storage point at the ground floor or basement via passenger (mainly residential buildings) or service lift (mainly commercial buildings). Containers in different size are used for the collection, transfer and storage of waste and recyclables, which can be located in the refuse collection corner or room at each floor, public areas and the central refuse collection and storage area. Standard Operating Procedures (SOPs) are in place in some buildings, providing operational and cleaning staff with clear steps and instructions for moving waste and recyclables through the buildings.

The size of the central refuse collection and storage area varies among buildings. While well-designed storage space can help increase waste diversion, many buildings in Hong Kong, both commercial and residential, are facing the challenge of space limitation. Some property developers expanded the size of refuse rooms or converted a proportion of carpark space beyond the requirements specified in the city's building codes, for their own waste-related initiatives or waste treatment equipment installation.

³⁵ https://www.epd.gov.hk/epd/english/greenproperty/poll_pro/poll_pro_whrr.html

4.1.2. Design for waste diversion

While waste prevention is always the top priority in the waste hierarchy for managing MSW, the provision of well-managed waste separation facilities and services in buildings is necessary to facilitate and maximise recycling and recovery of waste materials when it is not possible to avoid waste generation in the first place. It is one of the key elements in a circular economy in which recyclable materials generated in economic activities are returned to the consumption loop through reuse, recycling and recovery, enabling the most efficient use of resources and materials at the same time producing as little waste as possible.

Provision of well-managed collection facilities for different waste streams

To promote waste collection and sorting, it is essential to provide adequate collection facilities for different waste streams i.e. having recycling bins next to the general waste bin, and place them in prominent locations with good signage. When designing waste disposal locations, accessibility and convenience are two crucial factors that need to be considered. It is important to provide equal convenience disposal, so that it is equally convenient to dispose of recyclables in the recycling bins. Regardless of the underlying attitudes and culture of the residents, a mere change in physical convenience, for example, the provision of collection facilities for different waste streams on each floor to reduce the distance of carrying waste materials from the flat to the collection bins can lead to an increase in recycling rate.³⁶

Clear visual cues and signage for different waste types at all bins and storage locations can provide clear instructions to buildings occupants on waste disposal and avoid confusion. In some buildings, posters or notice containing green messages are in place next to the waste bins to encourage recycling. Efforts have also been put in designing more aesthetically pleasing recycling bins. Both equal convenience and the provision of visual cues and signage can help reduce contamination of different waste streams.



Co-location of trash and recyclable collection (left and middle); A single bin only for general waste collection (right).

³⁶ Alessandra DiGiacomo, David W.-L. Wu, Peter Lenkic, Bud Fraser, Jiaying Zhao & Alan Kingstone (2018) Convenience improves composting and recycling rates in highdensity residential buildings. *Journal of Environmental Planning and Management*, 61:2, 309-331, DOI: 10.1080/09640568.2017.1305332, https://zhaolab.psych.ubc.ca/pdfs/Convenience_JEPM_2018.pdf

Except for the collection of common recyclables such as paper, plastics and metals, collection facilities for other recyclables are sometimes in place, including clothes, rechargeable batteries and beverage cartons etc. The provision of collection facilities and services of different types of recyclables in buildings allows easy and convenient recycling, hence facilitates public participation and enhances resource recovery.



Collection bins or boxes for used clothes (left), rechargeable batteries (middle) and leaflets (right).

Some PMCs of buildings offer additional services that residents or tenants are welcomed to bring the recyclables to the security counter at the lobby of each building block or contact the management services office for recycling. While additional workload is given to property management staff, this makes recycling process easier and more convenient and is likely to encourage more building occupants to recycle.



Notice stating the contact information of the management services office for recycling.

- Reverse Vending Machines (RVMs)

The provision of RVMs also helps increase convenience of collecting certain types of recyclables, such as plastic bottles and glass bottles. In most cases, there are systems in place which allow the service providers to track and monitor the status of the machines. Collection service will be arranged when the machine is fully filled.

RVMs offer an alternative recycling option in an efficient, convenient and incentivising way. Mobile phone apps are sometimes available for displaying the locations of the RVMs and earning reward points. With incentives such as cash rebate and donation to charity, people are likely more motivated to recycle.



RVMs installed in a residential estate (left) and shopping malls (middle and right).

- Food waste recycling

Other than facilitating waste sorting and recyclable collection, the provision of on-site waste recycling facilities allows direct waste treatment at source. Around 85%³⁷ of the recovered recyclables in Hong Kong are exported to other countries for recycling, which is definitely not a long-term solution for creating a circular economy. The remaining is mainly transported to local off-site and centralised plants for treatment and recycling. To reduce the city's reliance on waste export, it is necessary to support local green industry and expand the manufacturing capacity for recycled products. Buildings can also play a role in supporting resource circulation, with possibilities lying mainly on small scaled, on-site food waste treatment facilities due to limited space availability.

Food waste accounts for about 30% of MSW disposed of at landfills in Hong Kong, constituting the largest MSW category being landfilled. Some local residential and commercial buildings are taking initiatives to manage food waste generated with mainly three approaches:

- Arranging collection service for tenants or residents and sending food waste collected to the O·PARK for recycling;
- Installing food waste decomposers in the central refuse storage area of the building for on-site treatment, with possibility of receiving support from the Government;
- Donating food surplus to local NGOs
- Selling pre-packaged food items which have passed the "best before" date or are short dated to local social-driven retail chain.

³⁷<https://www.wastereduction.gov.hk/sites/default/files/msw2020.pdf>

Case study on food waste recycling – Residential building

A food waste recycling programme has been launched in a local residential estate. The management office announced and promoted the programme by putting up notices on the noticeboard by the lift lobby. With registration, residents can request for a cleaned bucket from the management office (the security counter at the lobby of each block) at any time. They can then return the buckets with food waste to the security counter before evening, in return of a cleaned and empty one. Filled buckets are stored temporarily at the corner of staircase landing next to the security counter. Grinded coffee is added to reduce odour nuisance.



Buckets for food waste collection.

The buckets are collected by cleaners twice a day, then transported to the central waste storage area located in the parking lot via wheeled bins. The food waste is then sorted and treated with a food waste composter, with ventilators installed to reduce odour. Finished compost is then used at the podium garden and donated to residents and schools as fertilisers for farming.



A food waste composter installed in the central waste storage area (left and middle) and the farming area in the podium garden of the estate.

Not all kinds of food waste are recyclable, for example, shellfish shells and oversized bones. While these materials would normally go into landfills, some local initiatives can actually help turning some of these waste into values.

Hotel restaurants serving buffets usually generate huge amounts of discarded shellfish shells such as oysters and mussels. Other than treating them as waste and sending them to landfill, some restaurants have partnered with a local environmental organisation in a shell recycling programme "Save Our Shells" which supports the restoration of Hong Kong's lost shellfish reefs.



Notice displayed at the seafood corner of a buffet restaurant (left); Shells collection bin at the kitchen (middle and right).

Supports from customers have marked the success of the programme. By displaying notice at the seafood corner to introduce the shell recycling programme, customers are reminded and encouraged to separate the shells from other waste on their plates. The shells are collected and stored temporarily in a dedicated bin located in the kitchen area. Hotel staff will be responsible for pre-treatment and sorting of the collected shells. Selected and washed shells will be transferred and stored at the loading bay at hotel basement. The shells will then be transported to the recycling site, with direct and flexible arrangements with the organisation. Collection frequency is roughly once a week, depending on business needs. Since August 2021, the hotel has collected and recycled more than 20 tonnes of shellfish shells.

4.1.3. Design for waste reduction

Sharing and reuse of materials are key to circular economy. In some local buildings, various environmental campaigns have been launched to promote reuse behaviours and raise awareness of the building users on waste reduction.

Offering reusable items

Reusable tableware lending services are provided in an office building for large-scale events, such as company parties and celebration activities. Lending services of individual reusable tableware for takeaway meals, such as lunch boxes and utensils, are also available for office and shopping mall tenants. By promoting and facilitating the use of reusable items, waste avoidance and elimination can be achieved in the first place.



Lending services of reusable tableware.

Providing platforms for sharing

In some residential and office buildings, sharing facilities and platforms are in place to facilitate resources exchange. Unwanted materials or "waste" from building occupants are collected, allowing others to take them for free and preventing waste generation.

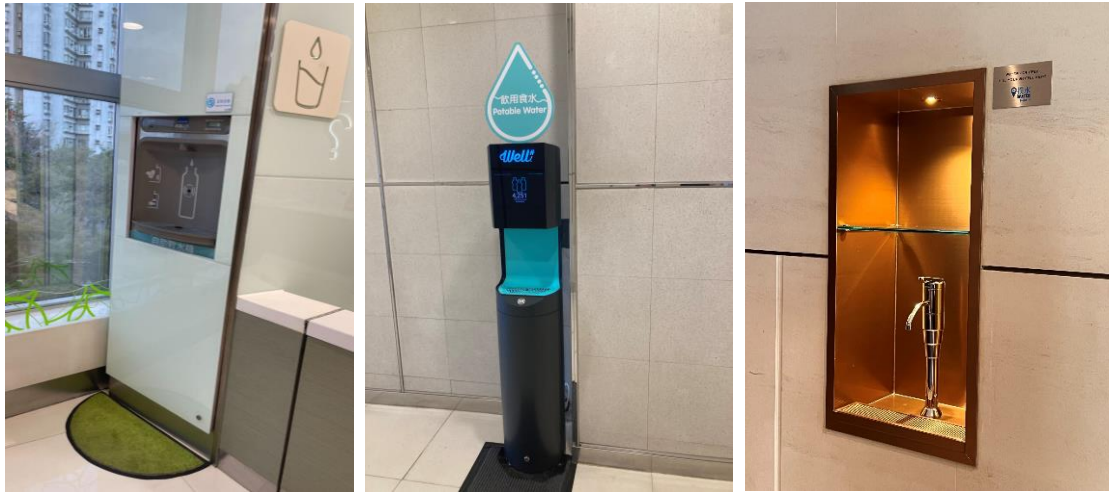


Sharing facilities for books (left) and shopping bags (middle); Unwanted plants (right), for example tangerine shrubs after the Lunar New Year, are collected and replanted in the garden areas. Residents can take them home upon request.

Provision of various facilities to reduce waste generation

The provision of drinking water stations is one of the examples of supporting waste avoidance at source. In some local shopping malls and hotel lobbies, drinking water stations are in place for customers to fill cups or reusable containers for free. It helps encourage the refill culture and reduce peoples' needs of buying single-use plastic bottles.

Extensive and reliable networks of water stations throughout the city are extremely important in advocating and supporting the concept of "bringing your own bottle". Besides having a water refilling station installed at the lobby, a local hotel has been a part of the "Water for Free" initiative, a mobile phone app mapping the locations of water fountains or dispensers around Hong Kong.



Water refill stations in shopping malls (left and middle) and at a hotel lobby (right).

Another example is the provision of umbrella drying facilities. In Hong Kong, it is estimated that around 14 million³⁸ disposable plastic umbrella covers are disposed of during the wet season from June to September annually. To avoid the use of single-use plastic umbrella bags and prevent dripping umbrellas, some local premises provide customers with alternative environmentally-friendly options such as umbrella dryers, umbrella racks and floor mats.



An umbrella dryer in a shopping mall.

³⁸ <https://www.scmp.com/yp/discover/news/environment/article/3065727/14-million-disposable-plastic-umbrella-covers-used>

Case study on waste reduction initiatives – hotel

To provide high quality services to guests, hotel operations unavoidably generate a large amount of waste. While it can be challenging for the hotel and hospitality sector to fulfil the needs of guests and minimise the environmental impacts at the same time, some local hotels have stepped up efforts to reduce waste.

To reduce the usage of single-use plastic bottles for drinking water, some hotels have started to supply guest rooms with refillable water bottles or installed filtered water taps.



A filtered drinking water tap (left) and refillable glass water bottles (middle and right) in hotel rooms.

A site visit to a local hotel was conducted to study the actual operation of adopting refillable water bottles. Drinking water is bottled on-site using local tap water, after being filtered and purified by a patented filtering system. The whole process is fully automatic, including glass bottle disinfection, water refilling and bottle sealing. Laboratory test has been conducted and showed that the filtered water is safe for drinking for 3 months. The expiry date is set as 2 months since the date of bottling and is lasered on the cap.

To accommodate the water filtering system, a part of the hotel kitchen areas originally designed for food production has been released and converted, with some modifications made on drainage and ventilation. The hotel manager shared that currently the total cost of supplying drinking water in glass bottles is a bit higher than purchasing plastic water bottles, with a satisfactory payback period of about 5 years.



A water filter system (left), plastic crates for water bottle storage and transfer (middle) and a refillable glass water bottle (right).

Other initiatives for hotels to reduce plastic consumption and waste generation include:

- Replacing single-use miniatures, for example, shampoo, shower gel and conditioner, with large-format bathroom amenities
- Reducing the provision of other plastic-wrapped toiletries such as hairbrush and shower cap and only offer them upon request
- Purchasing toiletries that are packaged with and made of environmentally friendly materials such as bamboo toothbrush with paper packaging
- Offering toiletries with individual packaging to reduce resource wastage, for example, separating toothbrush and toothpaste, and shaving cream and shaver
- Donating used hotel soap to a local NGO, Soap Cycling for recycling
- Simplifying mini bar at room by keeping only popular items and those with a longer shelf life. Items that have not been purchased for a period will be transferred to the banquet department for usage to avoid food wastage



Large-format bathroom amenities.

Embracing digitalisation

Embracing digitalisation also allows buildings to avoid waste generation and support recycling. In some local shopping malls, electronic guides with interactive maps are installed in areas with high traffic flow, providing guests with information on and guidance to where RVMs, recycling bins and water refill stations are located. The locations of these facilities are also available on shopping mall's website and mobile phone app.



An electronic guide in the shopping mall (left) and a QR code used for hotel room cleaning record tracking (right).

To reduce paper consumption and save resources, PressReader is available for hotel guests and can be accessed unlimitedly by scanning the QR code. Paperless worksheet is also used for hotel room cleaning track log. Cleaning staff is required to scan the QR code stuck beneath the doorknob of each room to record the in and out time of room cleaning and the cleaning status.

Organising awareness raising and educational activities

Active engagement with tenants and building occupants are of great importance in driving behavioural changes and achieving waste reduction. Various educational and promotional programmes have been launched in different buildings, including workshops, meetings and competitions etc. on sustainability related topics such as waste sorting and clean recycling. Other initiatives include:

- Providing posters, notice and news announcements on waste reduction and separation and information regarding waste reduction or recycling programmes as promotional materials and communication tools
- Providing guidelines on different environmental issues, for example on green retrofitting to encourage tenants to keep original design to reduce construction waste
- Organising trips and site visits to local recycling facilities such as the Mil Mill beverage cartons recycling plant, aiming to enhance residents' knowledge and understanding on how local recycling facilities work and to increase their awareness on waste reduction and recycling
- Setting up educational centres which are open for school visits and community engagement activities

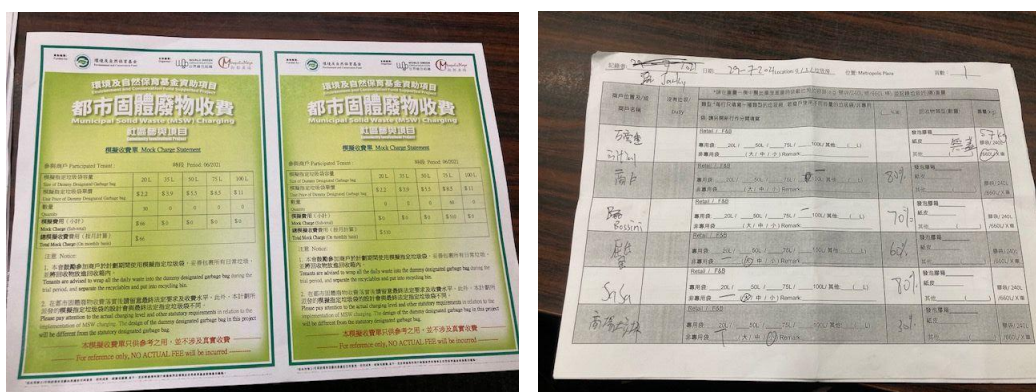


Posters (left), notice on digital screen (middle) and display board (right) to promote waste reduction and recycling programmes.

Collaboration with NGOs is a common practice in launching awareness raising and educational campaigns. A shopping mall was partnered with a local NGO in launching a 6-months MSW Charging Scheme Trial. The participation rate was about 70%, with around 30 tenants joined the programme. Green plastic bags in different sizes were distributed by EPD. Tenants who participated in the trial were required to put their waste into designated bags according to the amount of waste, and carry the bags to the waste storage area in the parking lot every day for weighting. Mock charging statements were sent to tenants for reference and awareness raising.

Evaluation forms were also distributed to tenants for feedback and to identify areas for improvement. Some observations from the trial scheme include:

- Around 70% - 80% of waste collected was from food and beverage outlets, others were mainly packaging waste such as carton and expanded polystyrene
- More waste was generated at the end of month due to stock-taking, especially in pharmacies
- Since most of the tenants are chain retail stores, longer response time was required for paperwork and approval from head office
- Staff from some shops were unwilling to take the waste bags to the designated disposal area as they might get complaints from shop managers for leaving the store unattended



Notice (left) and waste record sheet (right) for the MSW trial programme.

Waste reduction strategies in restaurants

Buffet restaurants in hotel have tried to avoid food waste generation by limiting the food portion taken by customers. To prevent customers from inadvertently taking large portions that they will not finish and reduce excessive plate waste, staff is assigned to serve and provide food instead of allowing customers to take the food freely. Smaller plates and bowls are also provided to encourage customers to claim less food.

To reduce packaging waste, efforts have also been put in green procurement. For example, a local hotel restaurant sources alcohol from ecoSPIRITS, an innovative closed-loop distribution system that nearly eliminates packaging waste in the alcohol supply chain. The adoption of a reusable and refillable spirits vessel system helps minimise the need of excess packaging and eliminate the generation of single-use glass waste. Carbon footprint associated with the production and transportation of glass bottles and other secondary packaging can also be reduced significantly. Purchasing in bulk for raw materials can also eliminate unnecessary packaging, such as serving butter by cutting appropriate portion instead of serving it with small, individual packing.



Alcohol containers as reusable and refillable square metal pail.

4.1.4. Design for waste volume reduction

To increase waste collection and handling efficiency and reduce space required for waste storage, especially in high density city such as Hong Kong where land is limited and extremely valuable, it is essential for buildings to have waste handling equipment that reduces the volume of general waste and recyclables installed. Various volume reduction equipment types are available in the market, with different functions and characteristics. Property developers and PMCs will need to consider factors such as waste stream suitability and cost and maintenance requirement for adopting suitable volume reduction strategies.



Waste compactors located at the central refuse collection and storage point of some commercial buildings.

5. Conclusions

5.1. Major Challenges in Waste Management for Buildings

1. Space limitation

A prominent issue in existing buildings faced by PMCs and operation staff is the lack of space allocated for refuse rooms, waste collection facilities and other waste handling facilities such as waste compactors and on-site composters for food waste treatment, especially in old, single-block buildings. Due to high property price and operational cost, it is not easy for property developers or owners to dedicate space to waste related facilities and internal waste storage. Even basement areas and parking space are valuable as they can serve many purposes. Small refuse rooms usually require more efforts and time put in by operational and cleaning staff as waste and recyclables collected must be cleared more frequently to avoid the piling up of waste and maintain good hygiene condition.

Outdated government policies have further created frictions and inefficiencies, leading to the lack of building designs that support effective waste collection and management to enable circular flow. For example, some existing building codes and regulations are dated, with the current size requirement of refuse rooms being too small for the installation of waste treatment facilities.

To address the spatial concerns, incentives are necessary to encourage and support property developers to allocate more space for better waste management equipment and facilities, and to reduce waste through building design.

2. Perception of waste collection facilities as nuisance

Besides space limitation, the perception of considering waste collection facilities as nuisance also hinders the efficiency of recyclable collection. During the site visits, some PMCs, especially of shopping malls, expressed that collection bins for general waste and recyclables, as well as RVMs are bulky in size and do not look good in appearance. Therefore, they are placed in somewhere that are more hidden instead of prominent spots, for example, in the passenger lift lobby or at the car park entrance in the basement. This makes the disposal of recyclables inconvenient and deters peoples' willingness to separate waste and recycle.

Also, some waste treatment facilities, such as food waste composters, are not welcomed by building occupants due to odour and hygiene concerns. It can therefore be difficult for property developers or PMCs to execute their waste management plans that incorporate the principles of zero waste design.

To address the issue, additional efforts are required to control and minimise odour and dirt associated with the waste collection facilities, as well as to enhance public education and raise public awareness on proper waste separation and recycling, and on the importance and urgency of achieving zero waste and circular economy.

3. Lack of knowledge and education

The lack of recycling knowledge has hindered citizens' willingness to separate recyclables during waste disposal. They may have insufficient knowledge and information on identifying recyclable materials, clean recycling procedures and locations of recycling points, leading to confusions and thus barriers to successful and effective recycling. Besides, some may not understand the benefits and recognise the needs of recycling, putting all waste including recyclables into trash bins which ends up in the landfills is the free and convenient option for them. Thus, more efforts need to be put on education and awareness raising to enhance citizens' recycling knowledge and ensure they understand the importance of doing so.

Public distrust towards the handling of recyclables has also contributed to the city's low recycling rate, mainly due to the scandal broke of some waste collection companies dumping recyclables collected from the three-coloured bins into the landfills. To restore public confidence and increase recycling rate, there is a need to improve current MSW management system, with a clearer and more transparent recycling process in Hong Kong.

5.2. The Next Steps

Good design of buildings is essential in supporting waste reduction and achieving circular economy, by influencing behavioural and physical changes in managing waste and rethinking the role of buildings.

After identifying the key building typologies in Hong Kong, BEC hopes to work on awareness raising and the application of zero waste design principles to real world cases. The next steps of the study may potentially lead to pilot projects or trials in relation to the role of building designs in achieving a circular economy, focusing on examples of best practices and case studies to further address and explore the associated challenges and opportunities. Potential engagement exercises, such as training and education, can also be conducted to relevant stakeholders in the building value chain, including architects, developers and property management companies, on the topic.

Glossary

ARCS	Automatic Refuse Collection System
BD	Building Department
C&D	Construction and Demolition
C&I	Commercial and Industrial
CRCs	Community Recycling Centres
CRN	Community Recycling Network
EPD	Environmental Protection Department
EU	European Union
FEHD	Food and Environmental Hygiene Department
FRP	Fire Resisting Period
HKGBC	Hong Kong Green Building Council
IWBI	International WELL Building Institute
MSW	Municipal Solid Waste
NGOs	Non-governmental Organisations
NYC	New York City
OCs	Owner's Corporations
PMCs	Property Management Companies
PWCs	Private Waste Collectors
RCPs	Refuse Collection Points
RCVs	Refuse Collection Vehicles
RVMs	Reverse Vending Machines
SBBs	Single Block Buildings
SOPs	Standard Operating Procedures
USGBC	U.S. Green Building Council
ZWIA	Zero Waste International Alliance

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Interviewees and site visit partners (by organisation name, in alphabetical order)

Cordis, Hong Kong

Great Eagle Holdings Limited

Henderson Land Development Company Limited

Hongkong Land Limited

Kai Shing Management Services Limited

Landmark North

Metropolis Plaza

Millennium City 2

MOSTown

Sino Group

Sun Hung Kai Properties Limited

Swire Properties

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Mr Merlin Lao Head – Policy & Research

Ms Danice Wong Senior Officer – Policy & Research

Ms Ming Cai Chung Officer – Policy & Research (Former)

Appendix A

Summary of waste-related building regulations and guidelines in Hong Kong

Table 1: Existing building design regulations and guidelines in Hong Kong

Key Areas	Title of regulations/ guidelines	Description	Issuer	Applicability	Mandatory (M)/ Voluntary (V)
Design for waste management/ collection	Daily Operation of Building Management: Waste Separation and Recovery ³⁹	Appropriate and sufficient waste separation and recovery facilities should be provided at common area convenient to the residents, such as floor refuse storage room and staircase landing	Home Affairs Department	-Existing buildings -Residential buildings	V
	Building (Refuse Storage and Material Recovery Chambers and Refuse Chutes) Regulations	Requires the provision of refuse storage and material recovery room on every floor of new domestic buildings and the domestic ⁴¹ part of new composite buildings.	Legislative Council of the HKSAR	-Existing buildings -Domestic, non-domestic (except industrial buildings), Industrial, and composite buildings	M
		In relation to the multi-floor unit or any of the multi-floor units, the plan shall show provision for a refuse storage and material recovery room on at least one of those floors on which that unit is located.			
Cap. 123, section 38 of Hong Kong Legislation ⁴⁰	Access to refuse storage and material recovery chambers for emptying refuse containers and recovered materials -Every refuse storage and material recovery chamber shall be approved by the Building Authority and in such location approved by the Building Authority as to provide ready access thereto for the purpose of removing any refuse container and recovered materials stored in such refuse storage and material recovery chamber.	-Not applied to church, school or a car park			

³⁹ https://www.buildingmgt.gov.hk/en/Daily_Operation_of_Building_Management/6_2.html

⁴⁰ https://www.epd.gov.hk/epd/english/laws_regulations/envir_legislation/leg_waste.html

⁴¹ Domestic (住用), when used in relation to a part of a composite building, means a part that is constructed or intended for habitation; (Added 73 of 1983 s. 2)

Domestic building (住用建築物) means a building constructed or intended to be used for habitation and the expression domestic purposes (住用用途) shall be construed accordingly; (Added 73 of 1983 s. 2)

		-Where access to any refuse storage and material recovery chamber other than a refuse storage and material recovery chamber with vehicular access is obtained along a passage or alley or similar way, the passage, alley or other way shall be not less than 1.5 m in width, shall be without steps and paved and shall have a longitudinal gradient not greater than 1 in 20.			
		Refuse storage and material recovery rooms to be readily accessible.			
		Allows the Building Authority to require adequate waste treatment facilities in any new building. Provides for control over the design of refuse chutes within buildings and oil storage facilities.			
	Guidebook on Source Separation of Waste in Residential Buildings ⁴²	Suggestions of Source Separation of Waste locations + Options for waste recovery (1) Floor refuse storage & material recovery room (2) Floor refuse storage room/ refuse chute room (3) Floor cleaner room/ water meter room (4) Refuse chute (5) Integration of lobby with floor refuse storage room (6) Staircase landing (7) Floor service lift lobby	Environmental Protection Department	-Existing buildings -Residential buildings	V
	BEAM Plus Existing Buildings Version 2.0 ⁴³	(Pre-requisite) Providing spaces for the collection, sorting, storage and disposal of waste and recovered materials	Hong Kong Green Building Council	-Existing buildings -No specific building types	V

⁴² https://www.epd.gov.hk/epd/mobile/english/environmentinhk/waste/prob_solutions/guidebook2006/ENG-Ch03-1.htm

⁴³ https://www.beamsociety.org.hk/files/download/BEAM%20Plus%20Existing%20Buildings%20v2_0_Comprehensive%20Scheme.pdf

	<p>Building (Refuse Storage and Material Recovery Chambers and Refuse Chutes) Regulations</p> <p>Cap. 123, section 38 of Hong Kong Legislation</p>	<p>Minimum dimensions of refuse storage and material recovery chamber (1.5m x 1.5m)</p>	<p>Legislative Council of the HKSAR</p>	<p>-Existing buildings</p> <p>-Domestic, Non-domestic (except industrial buildings), Industrial, and composite buildings</p> <p>-Not applied to church, school or a car park</p>	<p>M</p>
	<p>Practice Note for Authorized Persons, Registered Structural Engineers and Registered Geotechnical Engineers</p> <p>(PNAP APP- 151)⁴⁴</p>	<p>Under Building (Planning) Regulation 23(3)(b), the area of refuse storage chamber and material recovery room can be excluded from measurement in the Gross Floor Area (GFA) calculation (i.e. not counted for plot ratio calculation).</p>	<p>Buildings Department</p>	<p>-Existing buildings</p> <p>-No specific building types</p>	<p>V</p>
	<p>Guidelines for Using Building Information Modelling in General Building Plans Submission 2019⁴⁵</p>	<p>Refuse Storage and Material Recovery Chamber Calculation – total Usable Floor Space (UFS) required/actual refuse storage and material recovery chamber should be provided</p>	<p>Buildings Department</p>	<p>-Existing buildings</p> <p>-No specific building types</p>	<p>V</p>
	<p>BEAM Plus Existing Buildings Version 2.0</p>	<p>Recycling Facilities for Different Waste Stream – 4 credits</p> <p>-The recycling facilities shall be located at prominent location(s).</p>	<p>Hong Kong Green Building Council</p>	<p>-Existing buildings</p> <p>-No specific building types</p>	<p>V</p>

⁴⁴ <https://www.bd.gov.hk/doc/en/resources/codes-and-references/practice-notes-and-circular-letters/pnap/APP/APP151.pdf>

⁴⁵ https://www.bd.gov.hk/doc/en/resources/codes-and-references/code-and-design-manuals/BIMGBPS_e.pdf

	BEAM Plus New Buildings Version 2.0 ⁴⁶	(Pre-requisite) Provide storage facilities at prominent location for the collection and recycling of paper, plastic and metal waste	Hong Kong Green Building Council	New buildings -No specific building types - Specific instructions will be shown in each requirement's "extent of application"	V
	BEAM Plus Interiors Version 1.0 ⁴⁷	(Pre-requisite) Minimum Waste Recycling Facilities -Provide at least one storage facility with capacity for paper, plastic and metal materials. -The facility shall be placed in prominent location but not necessary within the project space. Waste Recycling Facilities – 2 credits -Providing storage and collection for any one or any two of the following: recycling of glass, used small electrical appliance, food waste	Hong Kong Green Building Council	-New and existing buildings - Commercial, retail and institutional buildings	V
	LEED 4.1 Interior Design and Construction (ID+C) ⁴⁸	(Pre-requisite) Storage and Collection of Recyclables (provide areas) For new construction, core and shell, data centres, warehouses and distribution centres, hospitality new construction, healthcare -Provide dedicated areas accessible to waste haulers and building occupants for collection and storage of recyclable materials for the entire building	US Green Building Council	-Complete interior fit-out projects. -Includes commercial interiors, Retail and Hospitality	V

⁴⁶ https://www.beamsociety.org.hk/files/download/NBv2.0_FinalVersion_v2.2_20190904.pdf

⁴⁷ <https://www.beamsociety.org.hk/files/Manual/BEAM%20Plus%20Interiors%20Manual.pdf7>

⁴⁸ https://build.usgbc.org/ID+C_Guide

		<p>-Collection and storage areas may be separate locations</p> <p>For retail new construction</p> <p>(2) Provide dedicated areas accessible to waste haulers and building occupants for the separation, collection, and storage of recyclable materials for at least the top four recyclable waste streams identified by the waste study.</p>			
	LEED 4.1 Building Design and Construction (BD+C) ⁴⁹	<p>(Pre-requisite) Storage and Collection of Recyclables</p> <p>-Provide dedicated areas accessible to waste haulers and building occupants for collection and storage of recyclable materials for the entire building</p> <p>-Collection and storage areas may be separate locations</p> <p>For retail new construction</p> <p>-Provide dedicated areas accessible to waste haulers and building occupants for the separation, collection, and storage of recyclable materials for at least the top four recyclable waste streams identified by the waste study.</p> <p>-Locate the collection and storage bins close the source of recyclable waste. If any of the top four waste streams are batteries, mercury-containing lamps, or electronic waste, take appropriate measures for safe collection, storage, and disposal</p>	US Green Building Council	<p>-New construction or major renovations that</p> <p>-Do not primarily serve residential, educational, retail, data centres, warehouses and distribution centres, hospitality or health care uses.</p>	V
	LEED v4.1 Residential BD+C Multifamily Homes	<p>(Pre-requisite) Storage and Collections of Recyclables</p> <p>-Provide dedicated areas accessible to waste haulers and building occupants for the collection and storage of recyclable materials for the entire building.</p> <p>-Collection and storage areas may be separate locations.</p>	US Green Building Council	<p>-New construction or major renovation</p> <p>-Residential buildings</p>	V

⁴⁹ https://www.usgbc.org/sites/default/files/LEED%20v4%20BDC_07.25.19_current.pdf

Design for construction of waste treatment facilities	Building (Refuse Storage and Material Recovery Chambers and Refuse Chutes) Regulations Cap. 123, section 38 of Hong Kong Legislation	Construction of refuse storage and material recovery chambers -Every refuse storage and material recovery chamber shall be constructed of brickwork, concrete or other approved material. -The whole of the internal faces of the walls of every refuse storage and material recovery chamber shall be lined with glazed bricks, glazed tiles or other approved material. -The ceiling of every refuse storage and material recovery chamber shall be rendered in cement and finished with a smooth surface.	Legislative Council of the HKSAR	-Existing buildings -Domestic, Non-domestic (except industrial buildings), Industrial, and composite buildings -Not applied to church, school or a car park	M
	Building Maintenance Guidebook ⁵⁰	Sharp bends of the common refuse chutes should be lined with damping materials in order to minimize noise nuisance arising from the disposal of rubbish from upper floors	Buildings Department	-Existing buildings -No specific building types	V
Design for less construction waste/ demolition waste	BEAM Plus New Buildings Version 2.0	Adaptability and Deconstruction – 1 + 1 additional bonus credits -Encourage the design of building interior elements and building services components that allow modifications to space layout, and to reduce waste during churning, refurbishment and deconstruction Spatial Adaptability -Designs providing spatial flexibility that can adapt spaces for different uses and allows for expansion to permit additional spatial requirements to be accommodated. Flexible Engineering Services -Flexible design of services that can adapt to changes of layout and use.	Hong Kong Green Building Council	-New buildings -No specific building types -Specific instructions will be shown in each requirement's "extent of application"	V

⁵⁰ https://www.bd.gov.hk/doc/en/resources/codes-and-references/code-and-design-manuals/bmg/BDG_ENG.pdf

		<p>Structural Adaptability</p> <p>-Using of building structural systems which allow for change in future use and is coordinated with interior planning modules.</p>			
		<p>Design for Durability and Resilience – 1 + 2 bonus credits</p> <p>-Encourage material selection and adequate protection of exposed building elements to minimize the frequency of replacement and maximize materials optimization</p> <p>-Conduct an appraisal report demonstrating a proactive approach to explain the details in building material selection with suitable durability that minimizes the necessary refurbishment or renewal and prevents excessive material use.</p> <p>-Report covers at least three items of the following; Timber door sets (fire rated doors), Panel wall for partitions, Cement products (for architectural uses), Tile adhesives, Ceramic tiles (floor tiles and wall tiles), Aluminium windows, Heat-soaked tempered glass, Drainage uPVC pipe and fittings, Other items may be proposed at discretion of the applicant</p>			
	BEAM Plus Interiors Version 1.0	<p>Designed for Disassembly – 1 credit</p> <p>-Encourage forward looking planning, design, and installation to permit easy dismantling, separation and collection of the construction elements.</p> <p>-Installed construction elements and fixings that are easy to dismantle, and disassemble at the end of serviceable life, and contributed at least 50% by area of the newly installed elements.</p>	Hong Kong Green Building Council	<p>-New and existing buildings</p> <p>- Commercial, retail and institutional buildings</p>	V
	BEAM Plus Neighbourhood Version 1.0 ⁵¹	<p>Building Reuse – 2 + 1 bonus credits</p> <p>-The project reuses 30% or more of existing sub-structure and superstructure.</p>	Hong Kong Green Building Council	-New or planned neighbourhood developments	V

⁵¹ <https://www.beamsociety.org.hk/files/Manual/BEAMPlusNDManualWithCorrigendumNo1.pdf>

		<p>-The Project reuses 60% or more of existing sub-structure and superstructure.</p> <p>-The project reuses 90% or more of existing sub-structure and superstructure</p>			
	BEAM Plus New Buildings Version 2.0	<p>Buildings Re-use – 2B + 1 additional bonus credits</p> <p>-Reuse of major elements of existing building structures, to reduce demolition waste</p> <hr/> <p>Recycled Materials – 1 + 2 additional bonus credits</p> <p>(1) Outside Surface Works and Structures:</p> <p>-At least 10% of all materials used for site exterior surface works, structures and features with recycled content.</p> <p>(2) Building Façade and Structural Components</p> <p>-At least 10% of all materials used for © and structural components are materials with recycled content;</p> <p>-OR the use of Pulverized Fuel Ash (PFA) as a partial cement replacement in concrete that the PFA content is not less than 25%</p> <p>-OR the use of Ground Granulated Blast-furnace Slag (GGBS) as a partial cement replacement in concrete that the GGBS content is not less than 40%.</p> <p>(3) Interior Non-structural Components</p> <p>-At least 10% of all materials used for interior non-structural components are materials with recycled content.</p> <p>-1 additional bonus credit for compliance with the requirements listed in sub-item (a) Outside Surface Works and Structures, (b) Building Façade and Structural Components, and (c) Interior Non-structural Components.</p> <p>-50% or more of all materials used for sub-item are materials with recycled content.</p>	Hong Kong Green Building Council	<p>-New buildings</p> <p>-No specific building types</p> <p>-Specific instructions will be shown in each requirement's "extent of application"</p>	V

	LEED 4.1 Building Design and Construction (BD+C)	<p>Building Life-Cycle Impact Reduction – 2-6 points</p> <p>-Historic building reuse; renovation of abandoned or blighted building; building and material reuse; whole building life-cycle assessment</p>	US Green Building Council	<p>-New construction or major renovations that</p> <p>-Do not primarily serve residential, educational, retail, data centres, warehouses and distribution centres, hospitality or health care uses.</p>	V
	LEED 4.1 Interior Design and Construction (ID+C)	<p>Interiors Life-Cycle Impact Reduction (1-5 points)</p> <p>(1) Interior Reuse: Reuse or salvage interior non-structural elements for at least 50% of the surface area</p> <p>(2) Furniture reuse: Reuse, salvage, or refurbish furniture and furnishings for at least 30% of the total furniture and furnishings cost</p> <p>(3) Design for flexibility: Increase project space flexibility, ease of adaptive use, and recycling of building materials while considering differential durability and premature obsolescence over building design life and individual component service lives.</p> <p>(4) Use at least three of the following strategies:</p> <ul style="list-style-type: none"> -Install accessible systems -Design interior non-structural walls -Ensure there are integral labels on non-structural materials -Include major component or system purchase contract -Use of recyclable or reusable non-structural materials 	US Green Building Council	<p>-Complete interior fit-out projects.</p> <p>-Includes commercial interiors, Retail and Hospitality</p>	V

		<p>Building Product Disclosure and Optimization – Sourcing of Raw Materials – 1-2 points</p> <p>(1) Responsible sourcing of raw materials: Use products sourced from at least three or five manufacturers that meet at least one of the responsible sourcing and extraction criteria below for at least 20% or 40% of total value:</p> <p>(2) Extended producer responsibility/ bio-based materials/ wood products/ materials reuse/ recycled content/ US Green Building Council approved program</p>			
	LEED v.4 Neighbourhood Development (ND) ⁵²	<p>Building Reuse – 1 point</p> <p>-For projects with five or fewer buildings undergoing major renovations, reuse 50% of one such building (20% for five or more buildings), based on surface area. Calculations must include structural elements (e.g., floors, roof decking) and enclosure materials (e.g., skin, framing).</p>	US Green Building Council	<p>-New land development projects or redevelopment projects</p> <p>-Residential uses, non-residential uses or a mix.</p>	V
		<p>Recycle and Reused Infrastructure – 1 point</p> <p>-Use materials for new infrastructure such that the sum of the postconsumer recycled content, on-site reused materials, and one-half of the pre-consumer recycled content constitutes at least 50% of the total mass of infrastructure materials</p> <p>-Recycled content is defined in accordance with ISO/IEC 14021, Environmental Labels and Declaration, Self-Declared Environmental Claims (Type II environmental labelling).</p>			
	LEED v4.1 Cities and Communities ⁵³	<p>Responsible Sourcing for Infrastructure - 2 points</p> <p>(1) Option 1 and 2: Purchased 20%/ 40% by cost of permanently installed top three/ top five infrastructure materials</p> <p>(2) Sourcing and extraction requirements:</p>	US Green Building Council	-New cities and communities that are in the planning/designing stage	V

⁵² <https://www.usgbc.org/resources/leed-v4-neighborhood-development-current-version>

⁵³ <https://build.usgbc.org/lfcplandesignbeta41>

		<p>-Material reuse: Reuse includes salvaged, refurbished or reused materials/products</p> <p>-Recycled content: the sum of postconsumer recycled content plus one half of pre-consumer recycled content, based on weight</p>		-Cities and communities that are more than 75% built out	
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Table 2: Existing building operations regulations and guidelines in Hong Kong

Key Areas	Title of regulations/ guidelines	Description	Issuer	Applicability	Mandatory (M)/ Voluntary (V)
Operations	Building Maintenance Guidebook	Common refuse chutes and refuse collection chambers in buildings should be regularly cleaned and maintained.	Buildings Department	-Existing buildings -No specific building types	V
		Objects with pointed or sharp edges or of a hazardous nature (such as inflammable or corrosive materials) should be separately packed and disposed of.			
		Refuse like newspapers, plastics, metal cans and glass bottles should be separated from other kind of rubbish for recycling as far as practical.			
		Refuse accumulated in the surface channels of corridors, rooftops, podiums and courtyards should be immediately cleared to avoid blockage. Blockage should be cleared at once.			
		Furniture and other bulky items should not be left to cause obstruction to fire escapes.			
		Accumulated refuse on the canopies of flats should be cleared by the relevant occupiers. Alternatively, the Management Office may regularly arrange a special clearance service			
	Daily Operation of Building Management:	The types of recyclable materials collected include all wastepaper, plastics, metals, old clothing, computers, electrical and electronic appliances and rechargeable batteries.	Home Affairs Department	-Existing buildings	V

	Waste Separation and Recovery ⁵⁴	Recyclable materials recovered from the waste separation and recovery facilities should be collected regularly. The recyclable materials should be stored at suitable locations such as refuse storage and material recovery chambers properly before sending for reuse/recycling.		-Residential buildings	
		The collected recyclable materials should be sent for reuse/recycling with proper record of the quantities of recyclable materials collected and all collection and transfer transactions.			
	Green Property Management, Waste Handling and Refuse Room ⁵⁵	The refuse room/station should be used solely for refuse collection operation and no illegal occupation/misuse should be allowed Proper bulk storage containers/areas should be allocated at central refuse station for storage of recycling materials Common refuse collection methods: (1) Manual collection using passenger lift (2) Manual collection using refuse chute (3) Refuse extraction using Automatic Refuse Collection System (ARCS)	Environmental Protection Department	-Existing buildings -No specific building types	V
Guidelines on Placing Rubbish Bins in Common Areas and Staircases of Domestic or Composite Buildings ⁵⁶	(1) Single staircase buildings -Rubbish bins of individual households containing the to-be-collected household garbage are allowed to be placed outside the unit only during the specified garbage collection time and should be retrieved immediately afterwards; -Rubbish bins should be small in size, and should not cause serious obstruction to the passageway or render emergency escapes impossible or difficult; and	Hong Kong Fire Service Department	-New or existing buildings -No specific building types	V	

⁵⁴ https://www.buildingmgt.gov.hk/en/Daily_Operation_of_Building_Management/6_2.html

⁵⁵ https://www.epd.gov.hk/epd/english/greenproperty/poll_pro/poll_pro_whrr.html

⁵⁶ https://www.hkfsd.gov.hk/eng/source/safety/rubbish_bins.pdf

		<p>-Rubbish bins should be of metal type of made of non-combustible/ fire resisting material, and be properly covered by lids at all times.</p> <p>(2) Buildings with two or more staircases without hopper rooms/ refuse chutes</p> <p>-Rubbish bins for shared use of households should be places inside recommended areas i.e. at the corner portion of the staircase landing so as not to cause obstruction to means of escape;</p> <p>-The size of the rubbish bins should be restricted to a diameter less than 50% of the effective staircase width so as to avoid obstruction of the means of escape;</p> <p>-The rubbish bins should preferably be of metal type of made of non-combustible/ fire resisting material, and be properly covered by lids at all times; and</p> <p>-The to-be-collected household garbage should be put inside plastic bags and be placed inside rubbish bins.</p> <p>(3) Buildings with two or more staircases with hopper rooms/ refuse chutes</p> <p>-Hopper rooms/ refuse chutes, where provided in buildings, should be utilized as far as possible.</p>			
	BEAM Plus Existing Buildings Version 2.0	<p>Recycling Facilities for Different Waste Stream – 4 credits</p> <p>-For each waste stream, provide at least one storage bin/storage area for recycling.</p> <p>-The size and collection frequency are not regulated</p>	Hong Kong Green Building Council	<p>-Existing buildings</p> <p>-No specific building types</p>	V
		<p>Waste Treatment Equipment – 1 bonus credit</p> <p>-Provide at least one set of waste treatment equipment</p>			
	BEAM Plus New Buildings Version 2.0	<p>(Pre-requisite) Minimum Waste Handling Facilities - Waste Recycling Facilities</p> <p>-Refuse storage and material recovery chambers (RS&MRC) Provision</p>	Hong Kong Green Building Council	-New buildings	V

		<p>-Refuse storage and material recovery room (RS&MRR) Provision</p> <p>-Minimum types of recyclables to be collected: Metal, Plastics, Paper/ Cardboard/ Glass</p>		<p>-No specific building types</p> <p>- Specific instructions will be shown in each requirement's "extent of application"</p>	
		<p>Enhanced Waste Handling Facilities – 2 + 2 bonus credits</p> <p>-Additional recyclables collection (aside from the ones mentioned in MWP1 - Minimum Waste Handling Facilities)</p> <p>-Additional facility provisions to enable enhanced municipal solid waste charging scheme</p> <p>-Providing at least one set of waste treatment equipment (E.g., Static waste compactors or balers)</p> <p>-Alternative means of waste collection systems</p>			
	BEAM Plus Interiors Version 1.0	<p>(Pre-requisite) Minimum Waste Recycling Facilities</p> <p>-The storage facility size and collection frequency are not regulated.</p>	Hong Kong Green Building Council	<p>-New and existing buildings</p> <p>- Commercial, retail and institutional buildings</p>	V
	LEED 4.1 Interior Design and Construction (ID+C)	<p>(Pre-requisite) Storage and Collection of Recyclables</p> <p>For new construction, core and shell, data centres, warehouses and distribution centres, hospitality new construction, healthcare</p> <p>-Recyclable materials must include mixed paper, corrugated cardboard, glass, plastics, and metals</p> <p>-Take appropriate measures for the safe collection, storage, and disposal of two of the following: batteries, mercury-containing lamps, and electronic waste</p>	US Green Building Council	<p>-Complete interior fit-out projects.</p> <p>-Includes commercial interiors, Retail and Hospitality</p>	V

		<p>For retail new construction</p> <p>-Conduct a waste stream study to identify the retail project's top five recyclable waste streams, by either weight or volume, using consistent metrics. List the top four waste streams for which collection and storage space will be provided. If no information is available on waste streams for the project, use data from similar operations to make projections.</p> <p>-Locate the collection and storage bins close the source of recyclable waste. If any of the top four waste streams are batteries, mercury-containing lamps, or electronic waste, take appropriate measures for safe collection, storage, and disposal</p>			
	LEED 4.1 Building Design and Construction (BD+C)	<p>(Pre-requisite) Storage and Collection of Recyclables</p> <p>-Recyclable materials must include mixed paper, corrugated cardboard, glass, plastics, and metals</p> <p>-Take appropriate measures for the safe collection, storage, and disposal of two of the following: batteries, mercury-containing lamps, and electronic waste</p> <p>For retail new construction</p> <p>-Conduct a waste stream study to identify the retail project's top five recyclable waste streams, by either weight or volume, using consistent metrics. List the top four waste streams for which collection and storage space will be provided. If no information is available on waste streams for the project, use data from similar operations to make projections. Retailers with existing stores of similar size and function can use historical information from their other locations</p>	US Green Building Council	<p>-New construction or major renovations that</p> <p>-Do not primarily serve residential, educational, retail, data centres, warehouses and distribution centres, hospitality or health care uses.</p>	V
	LEED v4.1 Residential BD+C Multifamily Homes	<p>(Pre-requisite) Storage and Collections of Recyclables</p> <p>-Research local recycling programs and determine which materials will be stored separately on site, which may be reused via donation, which may be commingled into a single stream and separated off site.</p>	US Green Building Council	<p>-New construction or major renovation</p> <p>-Residential buildings</p>	V

		-Recyclable materials separated on and off site can include mixed paper, corrugated cardboard, glass, plastics, metals and organic waste.			
	BEAM Plus Existing Buildings Version 2.0	<p>Developing a waste management plan - 1 credit</p> <p>The Applicant shall provide a waste management plan including but not limited to the following items:</p> <ul style="list-style-type: none"> -Objectives -Responsibility -Waste minimization program -Waste recycle/ reuse program -Waste data collection system -Influence on building users (e.g. training/ workshop/ campaign) -Resource allocation; viii. Training for staff -Reporting to top management 	Hong Kong Green Building Council	<ul style="list-style-type: none"> -Existing buildings -No specific building types 	V
		<p>Action to Waste Reduction – 3 + 2 bonus credit</p> <ul style="list-style-type: none"> -Demonstrate the implementation of the waste management plan -Undertake a waste stream audit -Collection of the waste and recycling records for the past 12 months -Collection of waste and recycling records for the past 24 months -Providing new targets on the waste recycle items, recycle rate and reduction rate based on the performance of the past 12 months 			

		<p>Food Waste Management – 1 + 1 bonus credits</p> <p>-Signing the Food Wise Charter and demonstrating the implementation of food waste reduction good practice guide as per Hong Kong Food Wise Campaign</p> <p>-Provide on-site used cooking oil collection facility and implementing the collection arrangement</p>			
	BEAM Plus New Buildings Version 2.0	<p>(Pre-requisite) Recycle & Waste Management Strategy Plan</p> <p>-Identify and estimate the quantities of expected waste streams (organic, recyclable and non-recyclable) of the development</p> <p>-Demonstrate compliance with the space requirement of waste recycling facilities (for waste storage, sorting and recycling)</p> <p>-Demonstrate storage for recycling</p> <p>-Demonstrate management plan, accessibility and hygiene. It includes the outlines of how the municipal solid waste disposal rate can be reduced by the waste management hierarchy - prevention, reuse, recycling, recovery and disposal; what is the collection and separation methodology of waste and recyclables; and how the building users dispose refuses and recyclables and janitorial staffs collect and deliver to refuse storage and material recovery chambers (RS&MRC) & Refuse Chutes.</p>	Hong Kong Green Building Council	<p>-New buildings</p> <p>-No specific building types</p> <p>-Specific instructions will be shown in each requirement's "extent of application"</p>	V
	BEAM Plus Neighbourhood Version 1.0	<p>Integrated Waste Management – 3 credits</p> <p>-Integrated waste management plan is put in place and sufficient waste facilities are provided to promote the reduction, reuse and recycling of waste within the Site</p> <p>-Waste processing facilities provided on site</p> <p>- Commitment to engage on-site personnel to oversee and facilitate the effective operation of the waste management facilities</p>	Hong Kong Green Building Council	-New or planned neighbourhood developments	V
		(Pre-requisite) Facility Maintenance and Renovation Policy			V

	<p>LEED 4.1 Operations and Maintenance (O+M)⁵⁷</p>	<p>Waste Management Policy for maintenance and renovation</p> <ul style="list-style-type: none"> -Facility maintenance waste: Address safe storage and recycling and diversion of waste associated with maintenance activities -Renovation waste: Describe the procedure for creating an individual plan for each renovation project. Each renovation project should establish waste diversion goals, target five materials for diversion, approximate the volume of waste anticipated, and identify waste diversion strategies to be used -Separation of facility maintenance and renovation waste from ongoing waste: The policy should indicate that facility maintenance and renovation waste are handled separately from ongoing waste -Furniture waste (Multifamily only): Address storage locations for furniture and reuse or recycling of furniture waste. 	<p>US Green Building Council</p>	<p>-Existing buildings and interior spaces</p> <p>- Schools, Retail, Hospitality, Data Centre, and Warehouses and Distribution Centre</p>	
		<p>Waste Performance - 3-8 points</p> <ul style="list-style-type: none"> (1) Have storage locations for recyclable materials, including mixed paper, corrugated cardboard, glass, plastics, and metals. Safely store and dispose of batteries and all lamps (indoor and outdoor, hardwired and portable fixtures) (2) Track and measure all ongoing waste and durable goods waste (3) Measure the total weight of waste (in lbs., kg, or tons) that is generated, and the total weight that is diverted from landfills and incineration facilities for one full year or from a waste analysis. Exclude any facility renovations waste. (4) Input generated and diverted waste totals and calculate a Waste Performance Score for the project; obtain a minimum score of 40 			

⁵⁷ <https://www.usgbc.org/resources/leed-v41-om-beta-guide>

		(5) Waste Performance Score: rates the resource consumption and resource use efficiency of the building (waste generated and diverted) against the consumption and efficiency of comparable high performing buildings.			
	WELL v2 Materials- Feature X09-Waste management ⁵⁸	<p>- Implement a waste management plan for all batteries, pesticides, lamps that may contain mercury, other mercury-containing equipment (including thermostats and thermometers), and electrical and electronic equipment⁶ present or expected to be present within the project during the building operations</p> <p>A waste management plan that contains the following is developed and implemented:</p> <ul style="list-style-type: none"> -Identification of roles, responsibilities and vendors for implementing the plan. -Identification of the sources of waste, estimation of rates of generation and strategies to minimize waste generation. -Strategies for waste collection. Each of the categorized wastes is separately contained in clearly labelled receptacles and removed from the building within one year. -Protocols for cleaning spills of mercury (including broken fluorescent lamp tubes), pesticides and battery electrolyte fluid, including sealed containment of residues, as applicable. -Protocols to track, measure and report waste stream flows. -Protocols for off-site shipment of wastes. 	The International WELL Building Institute	<p>-During the construction, remodelling, furnishing and operation of buildings.</p> <p>-No specific building types</p>	V
	3R campaign housing estates	3-coloured waste separation bins are usually placed at the ground floor lobby or a common area of a building	Environmental Protection Department	<p>-Existing buildings</p> <p>-Residential buildings</p>	V

⁵⁸ <https://v2.wellcertified.com/wellv2/en/materials/feature/9>

	SSW (Source Separation of Source) Program ⁵⁹	Encourage and assist property management companies and resident organizations for provision of waste separation facilities on each building floor to facilitate source separation of waste by residents	Environmental Protection Department	-Existing buildings -Residential, commercial, industrial buildings	V
		-Tailor made waste separation facilities for each estate: E.g. waste separation facilities, in compliance with relevant building and fire safety requirements, can be set up at such locations as refuse rooms or staircase landings on each floor.			
		-In a refuse room, property managers may install a wall-mounted shelf for collecting wastepaper and separate bins for metals and plastics, or they may provide a bin with compartments for different types of recyclables. -In staircase landings, they may install metal collection bins. Collection times can also be adapted to suit needs.			
		Participating housing estates are also encouraged to organize periodic collection programmes for collection of other types of recyclables such as old clothes, old computers, waste electronic and electrical equipment, and rechargeable batteries.			

Table 3: Existing construction and demolition regulations and guidelines in Hong Kong

Key Areas	Title of regulations/ guidelines	Description	Issuer	Applicability	Mandatory (M)/ Voluntary (V)
Construction and demolition	LEED 4.1 Building Design and Construction (BD+C)	Develop and implement a construction and demolition waste management plan: (1) Establish waste diversion goals for the project by identifying at least five materials targeted for diversion	US Green Building Council	-New construction or major renovations that	V

⁵⁹ https://www.wastereduction.gov.hk/en/household/source_detail.htm

		<p>(2) Specify whether materials will be separated or comingled and describe the diversion strategies planned for the project. Describe where the material will be taken and how the recycling facility will process the material</p> <p>(3) Each source separated material sent to an individual recycler who processes that single material is considered one material stream; materials sent to comingled facilities for mixed-recyclable processing are considered one stream.</p>		-Do not primarily serve residential, educational, retail, data centres, warehouses and distribution centres, hospitality or health care uses.	
		<p>Construction and Demolition Waste Management - 1-2 points</p> <p>(1) Recycle and/or salvage non-hazardous construction and demolition materials. Calculations can be by weight or volume but must be consistent throughout</p> <p>(2) Exclude excavated soil, land-clearing debris from calculations. Include materials destined for alternative daily cover (ADC) in the calculations as waste (not diversion). Include wood waste converted to fuel (biofuel) in the calculations; other types of waste-to-energy are not considered diversion for this credit.</p> <p>Option 1: Diversion</p> <p>-Divert material streams and use certified comingled recycling facility</p> <p>Option 2: Reduction of Total (Construct and Demolition) Waste material</p> <p>-Salvage or recycle renovation and demolition debris and utilize on-site waste minimizing design strategies for new construction activities</p> <p>-For waste from renovation and demolition activities, salvage or recycle at least 75%, not including ADC (Alternative Daily Cover)</p>			
	LEED 4.1 Interior Design and Construction (ID+C)	<p>(Pre-requisite) Construction and Demolition Waste Management Planning</p> <p>(1) Establish waste diversion goals for the project by identifying at least five materials targeted for diversion</p>	US Green Building Council	-Complete interior fit-out projects.	V

		<p>(2) Specify whether materials will be separated or comingled and describe the diversion strategies planned for the project. Describe where the material will be taken and how the recycling facility will process the material</p>		-Includes commercial interiors, Retail and Hospitality	
		<p>Construction and Demolition Waste Management (1-2 points)</p> <p>For new construction, retail, hospitality</p> <p>(1) Recycle and/or salvage non-hazardous construction and demolition materials. Calculations can be by weight or volume but must be consistent throughout.</p> <p>(2) Exclude excavated soil, land-clearing debris from calculations. Include materials destined for alternative daily cover (ADC) in the calculations as waste (not diversion). Include wood waste converted to fuel (biofuel) in the calculations; other types of waste-to-energy are not considered diversion for this credit</p> <p>Option 1: Diversion</p> <p>-Divert material streams and using certified comingled recycling facility</p> <p>Option 2: Reduction of total (construction and demolition) waste material</p> <p>-Salvage or recycle at least 75% of all demolition and renovation debris (not including ADC) and utilize on-site waste minimizing design strategies for new construction activities.</p> <p>-Create a narrative describing how the project is addressing waste prevention and/or achieving waste generation thresholds via design strategies and on-site waste minimization practices. Do not generate more than 2.5 pounds of construction waste per square foot (12.2 kilograms of waste per square meter) of the building's floor area for all commercial interiors (CI) projects.</p>			
	LEED v4.1 Residential BD+C Multifamily Homes	<p>(Pre-requisite) Construction and Demolition Waste Management</p> <p>(1) Develop and implement a construction and demolition waste management plan:</p>	US Green Building Council	-New construction or major renovation	V

		<p>-Establish waste diversion goals for the project by identifying at least five materials (both structural and non-structural) targeted for diversion</p> <p>-Specify whether materials will be separated or comingled and describe the diversion strategies planned for the project. Describe where the material will be taken and how the recycling facility will process the material including expected diversion rates for each material stream.</p> <p>(2) Provide a final report detailing all major waste streams generated, including disposal and diversion rates</p>		-Residential buildings	
		<p>Construction and Demolition Waste Management (1-2 points)</p> <p>(1) Recycle and/or salvage non-hazardous construction and demolition materials. Calculations can be by weight or volume but must be consistent throughout</p> <p>(2) Exclude excavated soil, land-clearing debris from calculations. Include materials destined for alternative daily cover (ADC) in the calculations as waste (not diversion). Include wood waste converted to fuel (biofuel) in the calculations</p> <p>(3) For international projects that cannot meet credit requirements using reuse and recycling methods, waste-to-energy systems may be considered waste diversion if the European Commission Waste Framework Directive 2008/98/EC and Waste Incineration Directive 2000/76/EC are followed and Waste to Energy facilities meet applicable European Committee for Standardization (CEN) EN 303 standards</p> <p>-Option 1: Diversion</p> <p>-Option 2: Reduction of total (Construction and Demolition) waste material</p>			
	LEED v.4 Home Design and Construction ⁶⁰	<p>Construction waste management</p> <p>-Reduce total construction waste or divert from landfills and incinerators a large proportion of the waste generated from new construction.</p>	US Green Building Council	<p>-New or existing buildings</p> <p>-Applied to single family homes, low-</p>	V

⁶⁰ <https://www.usgbc.org/resources/leed-v4-homes-and-midrise-ballot-version>

				rise multi-family (one to three stories) or mid-rise multi-family (four to six stories).	
	Code of practice for demolition of buildings year 2004 ⁶¹	<p>Waste management</p> <p>-All construction and demolition materials arising from or in connection with demolition work shall be sorted on-site and be separated into different groups for disposal at landfills, public filling areas, in filling areas provided by the Registered Specialist Contractor (Demolition), or recycling as appropriate.</p>	Buildings Department	<p>-Existing buildings for the planning and implementation of demolition works</p> <p>-No specific building types</p>	V
	LEED v4.1 Cities and Communities	<p>(Pre-requisite) Construction and Demolition waste management</p> <p>-Develop a detailed construction and demolition (C&D) waste management plan and commit to divert minimum of 35% of C&D waste from all infrastructure works and construction undertaken by the city development authority. This includes but is not limited to roads and highways, transits, water supply and wastewater treatment plants, public spaces and parks and buildings owned by the development authorities.</p> <p>-The plan must include an overall project waste diversion goal and identify the strategies for waste diversion.</p> <p>-Provide a C&D facility within or outside the city boundary to treat C&D waste generated from all infrastructure works and construction undertaken by the city development authority.</p> <p>-Ensure that waste from city/ community is treated by the assigned facility. For cities, where C&D waste management services are undertaken by the subcontractors, ensure all above requirements are met.</p>	US Green Building Council	<p>-New cities and communities that are in the planning/designing stage</p> <p>-Cities and communities that are more than 75% built out</p>	V

⁶¹ https://www.bd.gov.hk/doc/en/resources/codes-and-references/code-and-design-manuals/Demolition_e2004.pdf

Demolition	BEAM Plus New Buildings Version 2.0	<p>Demolition Waste Recycling 2 + 4 bonus credits</p> <p>(1) Demonstrating compliance with the Waste Management Plan and the application of proactive waste management provisions during demolition; and recycling at least 15% of demolition waste</p> <p>-Demonstration of recycling at least 30% of demolition waste; or at least 60% of demolition waste</p> <p>(2) Demonstrating compliance with the waste management plan and the application of proactive waste management provisions during construction (foundation waste to be included, if any)</p> <p>-Demonstration of recycling at least 30% of construction waste (foundation waste to be included, if any); or at least 60% of construction waste (foundation waste to be included, if any)</p> <p>-The related credits encourage best practices in the management of construction resources consumption, including waste reduction</p>	Hong Kong Green Building Council	<p>-New buildings</p> <p>-No specific building types</p> <p>-Specific instructions will be shown in each requirement's "extent of application"</p>	V
	BEAM Plus Interiors Version 1.0	<p>Interior Components Reuse – 3 credits</p> <p>-Reusing prior walls, glazing, doors, ceilings and floorings</p>	Hong Kong Green Building Council	<p>-New and existing buildings</p> <p>-Commercial, retail and institutional buildings</p>	V
		<p>Demolition and Construction Waste Reduction – 2 credits</p> <p>-Demonstrating that demolition and construction waste was recycled</p>			
	Code of practice for demolition of buildings year 2004	<p>Debris Recycling</p> <p>-The method of 'selective demolition' should be adopted as far as practicable. Domestic wastes such as furniture, household appliances, etc., metal components such as window frames, pipes, etc., timber components such as doors, wooden floors, etc., other wastes such as tiles, asphaltic materials, ceramic products should be removed first. Most of these materials may be recycled. The building demolition</p>	Buildings Department	<p>-Existing buildings for the planning and implementation of demolition works</p> <p>-No specific building types</p>	V

		<p>shall begin after all the above non-structural materials have been stripped and removed.</p> <p>- Broken concrete may be disposed of at construction and demolition (C&D) materials recycling facilities for processing into recycled 38 products and aggregates for beneficial reuse.</p>			
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Table 4: Existing city-wide waste collection and urban planning regulations and guidelines in Hong Kong

Key Areas	Title of regulations/ guidelines	Description	Issuer	Applicability	Mandatory (M)/ Voluntary (V)
Hong Kong's refuse collection system	Refuse Collection System in Hong Kong ⁶²	<p>-Food and Environmental Hygiene Department are responsible for collecting waste generated in residential buildings and government venues</p> <p>-Refuse collection vehicles will attend to several designated collection points according to schedule then transport the waste to a designated refuse transfer station or landfill for disposal.</p> <p>-In some cases, property management company will hire private waste collectors to collect household wastes in residential buildings then deliver it to the nearby refuse collection points (RCPs) manually by handcarts/ property management company from other commercial and industrial establishments would also hire private waste collectors to collect and deliver their waste to refuse transfer station or landfills by refuse collecting vehicles' direct.</p> <p>-FEHD's in-house and contracted refuse collection fleets provide daily collection service to some 4 000 collection points, including RCPs and refuse storage chambers. The remainder is collected by departmental RCVs. Some collection points with a high waste yield will be visited by RCVs two or three times a day.</p>	Panel on Environmental Affairs Subcommittee on Refuse Collection and Resource Recovery	NA	V

⁶² https://www.legco.gov.hk/yr16-17/english/panels/ea/ea_rrcrr/papers/ea_rrcrr20170411cb1-787-1-e.pdf

		<p>-Existing MSW collection system in Hong Kong</p> <p style="text-align: center;"><i>Exhibit 5: Existing MSW Collection System in Hong Kong</i></p>			
<p>Waste Management planning for neighbourhood and cities/communities</p>	<p>Hong Kong Planning Standards and Guidelines (HKPSG)⁶³</p>	<p>Refuse Transfer Station (RTS)</p> <p>-Consideration should be given to providing a refuse transfer station (RTS) for handling 500 - 2 000 tonnes a day of waste in the Urban Area, equivalent to 500 000 - 2 million population, or 100 - 1 000 tonnes in the NT, equivalent to 100 000 -1 million population. A site area of between 1 and 2 hectares is required for each such facility.</p> <p>-A RTS should be centrally located in the waste catchment it serves, preferably on the waterfront, with barge access.</p> <p>-A RTS should be sited in an industrial or other non-sensitive area or, if possible, underground.</p>	<p>Planning Department</p>	<p>-Planning studies, preparation/revision of town plans and development control.</p> <p>-Multiple land uses such as industry, residential, government institution, slaughterhouses, commercial, open space.</p>	<p>V</p>

⁶³ https://www.pland.gov.hk/pland_en/tech_doc/hkpsg/full/pdf/ch9.pdf

		<p>-Sufficient space should be provided for reception and queuing of refuse collection vehicles (RCVs).</p> <p>-Short vehicular access from and to major transport routes is preferred. The adequacy of adjoining road capacities for the RCVs should be determined.</p> <p>-Considerations should be given to the provision of fully enclosed stations and/or suitable barriers for odour and dust control.</p> <p>-Adequate control measures should be provided to minimise the impacts and may include provisions for noise control of the machinery and the structure, leachate treatment/disposal systems and installation of air/exhaust cleaning systems</p>			
	Hong Kong Planning Standards and Guidelines (HKPSG)	<p>(1) Refuse Storage and Material Recovery Chamber (RS & MRC) shall be provided in each domestic block to meet sufficient daily operational requirements for the total number of flats in the block pursuant to Building Regulations, Chapter 123H of Buildings Ordinance for the minimum floor space of RS & MRC.</p> <p>-Refuse Collection Point: an enclosed structure to provide sufficient daily storage for the total number of flats in the estate where refuse is collected by the Food and Environmental Hygiene Department (FEHD).</p> <p>-Junk Collection Points: a separate storage area for those items which cannot be handled by the normal refuse collection services</p> <p>(2) All refuse storage and material recovery facilities should be sheltered from weather.</p> <p>(3) A Refuse Storage & Material Recovery Chamber (RS & MRC) should be provided at ground floor or basement for refuse storage and material recovery activities including sorting and storage of recovered materials</p> <p>-Waste reception and transfer facilities should be sited so that any adjacent development is very well buffered.</p>	Planning Department	<p>-Planning studies, preparation/revision of town plans and development control.</p> <p>-Multiple land uses such as industry, residential, government institution, slaughterhouses, commercial, open space.</p>	V

		-Provisions should be made in the building configuration to allow for the separation and recovery of recyclables.			
	LEED v.4 Neighbourhood Development (ND)	<p>Solid Waste Management (1 point)</p> <p>-Meet at least four out of five of the below requirements</p> <p>(1) Include at least one recycling or reuse station, available to all project occupants, dedicated to the separation, collection, and storage of materials for recycling; or locate the project in a local government jurisdiction that provides recycling services. The recycling must cover at least paper, corrugated cardboard, glass, plastics, and metals.</p> <p>(2) Include at least one drop-off point, available to all project occupants, for potentially hazardous office or household wastes and establish a plan for post collection disposal or use; or locate the project in a local government jurisdiction that provides collection services</p> <p>(3) Include at least one compost station or location, available to all project occupants, dedicated to the collection and composting of food and yard wastes, and establish a plan for post collection use; or locate the project in a local government jurisdiction that provides composting services.</p> <p>(4) Include recycling containers either adjacent to or integrated into the design of other receptacles, on every mixed-use or non-residential block or at least every 800 feet (245 meters), whichever is shorter.</p> <p>(5) Recycle, reuse, or salvage at least 50% of non-hazardous construction, demolition, and renovation debris. Develop and implement a construction waste management plan that identifies the materials to be diverted from disposal and specifies whether the materials will be stored on site or commingled.</p>	US Green Building Council	<p>-New land development projects or redevelopment projects</p> <p>-Residential uses, non-residential uses or a mix</p>	V

	LEED v4.1 Cities and Communities ⁶⁴	<p>Solid Waste Management</p> <p>-Waste collection services: 100% coverage of all buildings for segregated waste collection services including but not limited to recyclables and organics</p> <p>-Waste Generation and Diversion: Estimate the annual municipal solid waste generation and municipal solid waste diversion rate from landfill for the city.</p> <p>-City must also estimate the total waste generated (in metric tons per year) and waste diverted (percentage diverted) from special waste streams. Special wastes are defined as non-municipal solid waste generated within the city including industrial waste, agricultural, biomedical waste, hazardous waste or any other as specific to the city</p> <p>-The project performance should meet the following criteria in: waste generation; Waste Diversion; Waste disposal</p>	US Green Building Council	<p>-New cities and communities that are in the planning/designing stage</p> <p>-Cities and communities that are more than 75% built out</p>	V
		<p>Organic Waste Management (1-2 points)</p> <p>(1) To encourage diversion of organic matter away from landfill and move towards creation of valuable nutrient rich soil and clean power</p> <p>For cities</p> <p>(2) Incorporate decentralized and /or centralized waste management systems to treat 75% to 100% of organic waste estimated as per Material & Resources prerequisite Waste Management generated within the city</p> <p>For communities</p> <p>(3) Incorporate waste management systems to treat organic waste estimated as per Material & Resources prerequisite Waste Management generated within the community</p>			

⁶⁴ <https://build.usgbc.org/lfcplandesignbeta41>

		<p>-Option 1: Decentralized organic waste management;</p> <p>-Option 2: Centralized organic waste management</p>			
		<p>Smart Waste Management Systems (1-2 points)</p> <p>Option 1: Pneumatic Transport Systems</p> <p>-Loading stations: Design public and private areas with hatches, called loading stations. Two pipes, one for compostable and other for recyclable waste should run parallel underground</p> <p>Transport network: Design underground transport network with appropriate diameter (500mm) 3layer Polyethylene pipes. Polyvinyl chloride (PVC) conduits (compressed air and system communication) should run parallel to waste pipes</p> <p>-Waste handling and processing facility: All pipes shall be designed to transfer waste for compaction. Through automated software this waste shall then be directed to proper container, further trucked for recycling</p> <p>Option 2: Smart Bin & Route Optimization</p> <p>-Sensor Bins: Ultrasonic sensors installed in trash bins to guide fill level of waste and a communication system will transfer this information to the cloud for further processing and analysis</p> <p>-Route Optimization: Information analysed at the cloud will be processed further and sent to waste vehicle operators to optimize the fleet routing for waste collection.</p>			
		<p>Recycling Infrastructure</p> <p>(1) Inorganic Waste Collection and Processing (2 points)</p> <p>-Collection centres must be provided and equipped with facilities to collect and store the waste products including (i) Electronics and Electrical Equipment (e-waste) and (ii) Packaging or metal cans to transfer these to the manufacturers. Collection centres must be within or outside the city boundary and may be operated by the</p>			

		<p>municipality or other organizations such as Producer Responsible Organizations (PRO)</p> <p>-Mandate a Manufacturers or Producer's Extended Producer Responsibility (EPR) policy for companies within the city's jurisdiction to encourage refurbishment, remanufacturing and recycling of the products collected</p> <p>-Or identify suitable market for all the waste products collected from consumers. Vendors may be within the city or outside the city boundary.</p> <p>(2) Material Recovery Facility (MRF) (3 points)</p> <p>-Waste Collection and Storage: Comply with the 'Requirement' sections of US. Code of Federal Regulations, Title 40, Volume 26, Part 243 on Storage, Safety and Collection (or local, state or national equivalent) for storage and collection of recyclables</p> <p>-Design a Material Recovery Facility (MRF) to recycle the inorganic waste such as paper/ corrugated cardboard, glass, plastic and metal generated within the city. Facility must be designed and operated in accordance with local/ national regulations including design features for sorting to specialization, bailing, shredding, crushing and compaction to prepare recyclables for end user manufacturer</p> <p>-Identify suitable markets to collect MRF output for paper/ corrugated cardboard, glass, plastic and metal. Vendors may be within the city or outside the city boundary</p> <p>-Recycling infrastructure should be planned and designed to cater to the phase-wise development of the city to ensure that the requirements are met at each phase</p>			
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About BEC

Business Environment Council Limited ('BEC') is an independent, charitable membership organisation, established by the business sector in Hong Kong. Since its establishment in 1992, BEC has been at the forefront of promoting environmental excellence by advocating the uptake of clean technologies and practices which reduce waste, conserve resources, prevent pollution and improve corporate environmental and social responsibility. BEC offers sustainable solutions and professional services covering advisory, research, assessment, training and award programs for government, business and the community, thus enabling environmental protection and contributing to the transition to a low carbon economy.

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