# Environmental Management

Environmental considerations are at the heart of our day-to-day activities. We systematically manage impacts that our work may have on the environment and ensure that all our operations are carried out in an environmentally responsible manner.

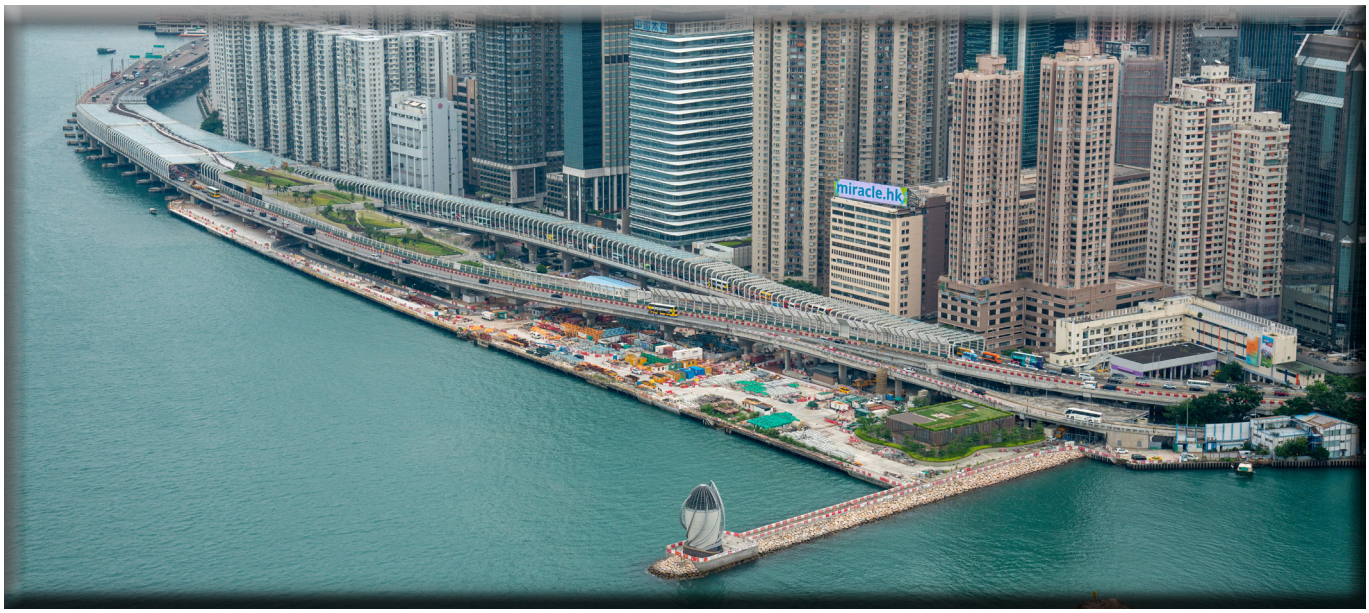
## Greening Design of the Central–Wan Chai Bypass and Island Eastern Corridor Link

### Background

The Central–Wan Chai Bypass (CWB) and Island Eastern Corridor Link (IECL) commissioned in late February 2019 is a strategic highway running along the north shore of Hong Kong Island connecting the existing Rumsey Street Flyover in Central and the Island Eastern Corridor in North Point to alleviate the traffic congestion along Gloucester Road–Harcourt Road–Connaught Road Central corridor.

### Environmental Benefits

Apart from shortening the travel time between the eastern end and the western end of Hong Kong Island, the project is strategically planned to bring environmental benefits such as lower noise level by noise barriers constructed at North Point and along the IECL; better air quality by enhanced traffic efficiency and removal of respirable suspended particulates and nitrogen dioxide from vehicle exhaust by an air purification system; enhanced water quality by removal of contaminated marine sediment in the Causeway Bay Typhoon Shelter; and more green space and open space for sustainable development by incorporating extensive greening elements in CWB structures and buildings. Benefits associated with this major infrastructure, in terms of traffic efficiency and environmental quality, have been brought to Hong Kong as a whole and surely will not go unnoticed.




Noise enclosures and noise barriers on IECL

## Noise Mitigation Measures

A package of noise mitigation measures comprising noise barriers and noise semi-enclosures have been implementing progressively under the CWB project to mitigate traffic noise at the CWB North Point Tunnel Portal and IECL in North Point. These noise mitigation measures include the provision of a 270 m long at-grade section of noise semi-enclosure with landscape deck above the North Point Tunnel Portal, a 580 m long section of noise barriers on the eastbound slip road bridge and another section of 730 m long noise semi-enclosures on the elevated bridge structure of the IECL. These measures can significantly reduce the noise nuisance caused by the through traffic running along the IECL to the nearby residential areas.


**Artist's impression showing an aerial view of the landscape deck and green roof at the CWB North Point Tunnel Portal and IECL in North Point**

## Aesthetic Considerations and Greening Design

Since the noise barriers and noise semi-enclosures are located near the harbourfront, they would become significant eye-appealing visual elements to the sea view. We therefore took the opportunity to provide greening design to these noise mitigation measures with a view to softening the rigid forms and bulkiness of the structures thereby mitigating the visual impacts.

Inspired by the form of ocean waves in the Victoria Harbour, we have developed an innovative concept of "Urban Floating Oasis" and introduced through the planting of trees, shrubs and groundcovers on the cover of the at-grade noise semi-enclosure above the North Point Tunnel Portal. The concept would take the form of an integrated landscape deck climbing up in steps from the CWB tunnel in the west to merge with the green roof of the elevated semi-noise enclosure on the IECL in the east. That said, the wavy pattern formed by various plants together with the other landscape hardwork features carry the conceptual design of the landscape deck and green roof as if a weaving ribbon of greeneries floating on the sky and the "Urban Floating Oasis" hovering above the Victoria Harbour.

## Landscape Deck Design and Implementation

Different varieties of trees, shrubs and groundcovers are purposely selected for the proposed greening works, and these plants are capable of tolerating strong wind, salt-spray and drought condition on the landscape deck and green roof. Spectacular visual interest and abundant ornamental scenery are offered through attractive blossom, colorful foliage and characteristic form of the plants.

Through the plantation of trees and palms on the landscape deck, the visual interests of vertical variations among the plants and seasonal changing scenery would enrich the local context in the community and could be enjoyed by the adjacent visual receivers.

**Planting palettes will offer spectacular visual interest and abundant ornamental scenery**

All in all, the greening on the landscape deck and the green roof of the elevated semi-noise enclosure responds to the public aspirations for a vibrant harbourfront, softens the rigid forms and bulkiness of the structures and allows a smooth integration with the future harbourfront open space development. The greening works are expected to complete in the second quarter of 2021 for public enjoyment.

**Dynamic planting pattern embraces waves of the Victoria Harbour**

**Lush planting providing pleasant scenery view**

# Reducing Traffic Noise Impact on Existing Roads

## Retrofitting of Noise Barriers on Tuen Mun Road (Town Centre and Fu Tei Sections)

To mitigate the traffic noise impact of existing roads on neighbouring residents, we have implemented direct noise mitigation measures, where practicable, on existing roads with a traffic noise level exceeding 70 dB(A). Mitigation measures include retrofitting noise barriers and enclosures, and constructing road pavement using low noise road surfacing materials. Up to now, we have retrofitted noise barriers on 19 existing road sections, benefitting about 62,000 neighbouring residents.

The noise barrier retrofitting projects on Tuen Mun Road (Town Centre and Fu Tei Sections) comprise construction of noise barriers and enclosures of 1,400 m total in length along a section of Tuen Mun Road (Town Centre Section) between Rose Dale Garden and Lakeshore Building, and another section of Tuen Mun Road (Fu Tei Section) between Fung Tei Station and Lam Tei Raw Water Pumping Station. The works on Tuen Mun Road (Fu Tei Section) and Tuen Mun Road (Town Centre Section) were substantially completed in December 2019 and March 2020 respectively. Upon completion of both projects, about 2,600 dwellings amounted to 6,500 people in the neighbourhood of the concerned road sections will be benefitted with reduction in traffic noise levels of about 1 to 25 dB(A).

**Noise barriers and enclosures on Tuen Mun Road (Town Centre Section)**

**Noise barriers and enclosures on Tuen Mun Road (Fu Tei Section)**

## Noise Mitigation Measures for Night Works on Tuen Mun Road

Tuen Mun Road (Town Centre and Fu Tei Sections) is a very busy highway and closure of any traffic lane during daytime for construction of the proposed noise barriers and enclosures would cause significant adverse impact on road traffic. In view of such constraint, we scheduled most of steelwork erection and noise panel installation works for the proposed noise barriers and enclosures to be carried out at night time. To mitigate the noise impact arising from the construction works at night time, adequate noise mitigation measures have been implemented on site. In addition, the construction sequence has been effectively programmed for completing noise panel installation works before road resurfacing works in order to minimise noise impact.

**Erection of steelworks and installation of noise panels at night time**

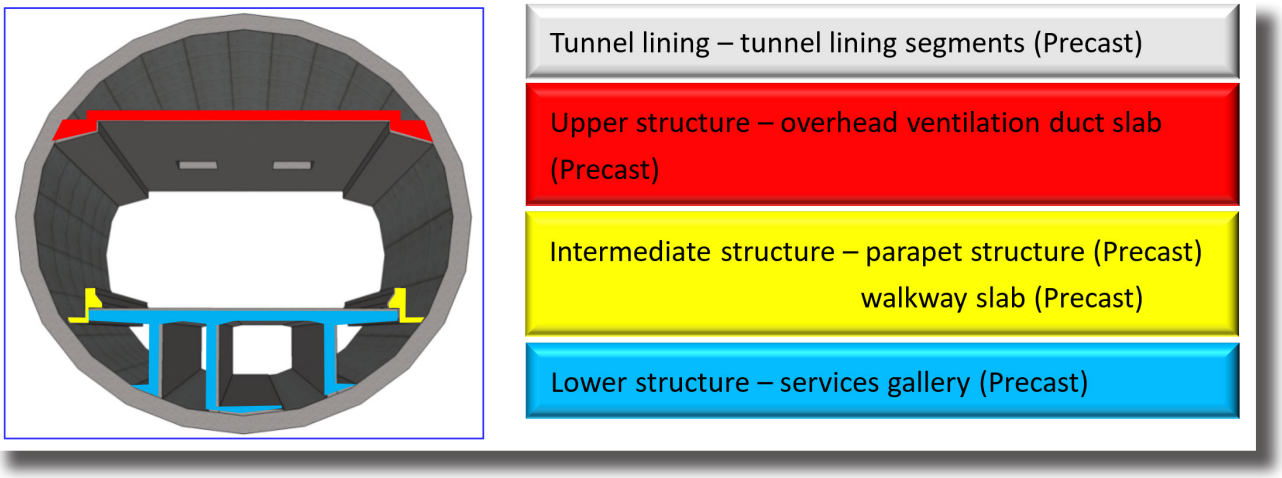
# Modular Construction in Tuen Mun-Chek Lap Kok Link Northern Connection Sub-sea Tunnel

Tuen Mun–Chek Lap Kok Link (TM-CLKL) provides a strategic link connecting the Northwest New Territories with the Hong Kong–Zhuhai–Macao Bridge Hong Kong Port (HZMB Hong Kong Port), North Lantau and the Hong Kong International Airport. The TM-CLKL comprises a 9 km long dual 2-lane carriageway between Tuen Mun South and North Lantau. It is divided into two major sections: Southern Connection and Northern Connection. Southern Connection connects North Lantau Highway at Tai Ho and HZMB Hong Kong Port. Northern Connection links HZMB Hong Kong Port and Tuen Mun Area 40 by a sub-sea tunnel of about 5 km long crossing the Urmston Road and daylighting at Tuen Mun.


Layout of TM-CLKL

Modular construction makes use of readily-assembled standardised components which are prefabricated off site, and connects these components on site into a permanent structure in a convenient manner. In comparison to the traditional cast in-situ method, modular construction greatly reduces the amount of in-situ concrete construction and hence the volume of timber formwork and falsework. Moreover, the on-site formation works and the off-site prefabrication works can commence concurrently. With such significant improvement in construction schedule and less wastage of construction materials such as formwork and falsework, the carbon footprint for the whole project is greatly reduced. Furthermore, since the structural elements are prefabricated in off-site fabrication yards, better on-site air quality as well as less noise generated from construction plants are achieved as exhaust gas emissions from concrete lorry mixers and the time of on-site operation are both greatly reduced. Thus, this would provide a healthier working environment inside the congested tunnel construction area to the workers. Overall speaking, modular construction not only produces higher quality structural elements efficiently but also helps promote green construction.

Under the TM-CLKL Northern Connection project, contractors have adopted modular construction for different structural elements in the contracts. For instance, a number of structural elements including tunnel lining segments (42,756 nos.), overhead ventilation duct slabs (5,115 nos.), parapet structures with walkway slabs (9,357 nos.) and services galleries (3,995 nos.) have employed modular construction to reduce the amount of in-situ concrete construction and to ensure the quality of the precast structural elements. These precast structural elements were prefabricated in Anhui and Dongguan in the Mainland.




Schematic diagram showing the internal tunnel structures

Installation of services galleries

Installation of overhead ventilation duct slabs

Segmental tunnel linings for use with tunnel boring machines


Installation of precast parapets

The cross passages for the TM-CLKL sub-sea tunnel also adopted modular construction. Precast jacking pipes (476 nos.) were prefabricated off site in Mainland China. In addition, board type of thermal barrier was adopted instead of the spray-type to facilitate the construction programme as well as future maintenance.

**Precast jacking pipes for cross passages**

**Installation of board-type thermal barrier**

Two ventilation buildings were built at the Northern Landfall and Southern Landfall using modular construction. Precast beams (1,043 nos.), precast slabs (1,810 nos.) and precast columns (134 nos.) were prefabricated in Mainland China under controlled plant conditions.

**Ventilation building**

**Installation of precast beams**

**Installation of precast columns**

**Installation of precast slabs**

Apart from the concrete structural elements, modular construction for the pipework and cable containment installation was also adopted inside the services galleries. Total 6,387 nos. of modules were first fabricated in an off-site fabrication factory in Tsing Yi and then delivered to site for installation.

Production of electrical and mechanical modules

General view of completed services

# Typical Environmental Measures Taken on Construction Sites

## Air Quality Control

Cover bare slope by tarpaulin

Suppress dust on haul road with water mist cannon

Use concrete plank as vehicle access for dust control

## Noise Mitigation


Use quality powered mechanical equipment

Cover plant with acoustic enclosure

Erect acoustic fabric barriers

## Water Pollution Control

Implement marine water quality monitoring


Use wasterwater treatment facilities

Deploy silt curtains during marine works

## Waste Management

Adopt food waste decomposer

Adopt recycling bins

Collect scrap metal from piling works for recycling

## Site Cleanliness

Apply rat bait

Provide wheel washing machine at site entrance

Apply pesticides for mosquito control

## Sustainable Measures


Use renewable energy in site office, lighting and mosquito killing devices for energy saving

# Development of Environmentally Friendly Railway System

Railway is a safe, efficient and environmentally friendly mass carrier. It is the Government's policy to utilize railway as the backbone of public passenger transport. We adhere to this policy and aim at planning and implementing the railway system to world-class standard.

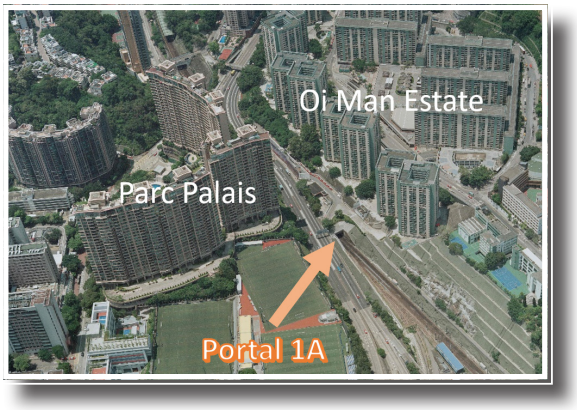
## Environmentally Friendly Measures for Shatin-to-Central Link

The Shatin-to-Central Link (SCL) is a 17 km strategic rail line connecting several existing lines to form two railway corridors, namely the "East West Corridor" and the "North South Corridor". On 14 February 2020, the "Tai Wai to Hung Hom Section" was partially commissioned involving three new stations, namely Hin Keng Station, Diamond Hill Station Extension and Kai Tak Station. The section from Wu Kai Sha Station to Kai Tak Station is now named as Tuen Ma Line Phase 1.

Since the commencement of construction works for the SCL in 2012, the project team has continued to implement good practice on site in order to comply with statutory environmental requirements and minimize potential environmental impacts to the community. Effective mitigation measures and initiatives have been put in place to protect the environment in different aspects.

## Noise Mitigation

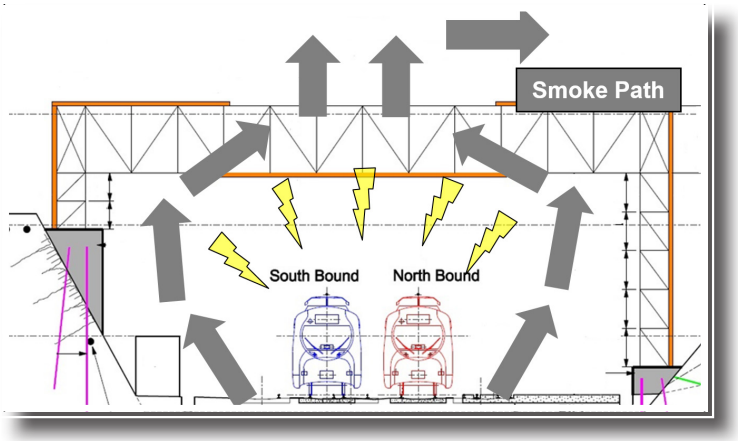
To mitigate the noise impacts arising from the construction and operational phases of the SCL project, a 150m long naturally ventilated absorptive noise enclosure extending from the East Rail Line tunnel portal 1A near Oi Man Estate was constructed, following the recommendation in the Environmental Impact Assessment report for the SCL project.




Location of tunnel portal 1A

## Green Design for Noise Enclosure

The structural form of the noise enclosure at tunnel portal 1A is different from the conventional one. It is formed by structural steel trusses spanning over the existing railway lines with acoustic panels fixed to the trusses and natural ventilation system introduced. It is generally designed to serve two main purposes, viz. noise abatement and allow smoke to escape in the event of fire. The natural ventilation system complies with the Fire Services Department's requirement of 45% opening on the top of the proposed noise enclosure.




Typical cross section showing how natural ventilation works

In comparison to traditional noise enclosure design which is normally a tunnel-like structure with extensive mechanical smoke extraction system, the green design of the noise enclosure for the SCL project is of different structural form which is more conducive to protecting the environment. With the adoption of natural ventilation concept, it achieves sustainability by reducing the use of construction materials and electricity consumption. Since the use of mechanical smoke extraction system is no longer required, it does not only help save energy, but also provides a lighter and more pleasant appearance. Moreover, disruption to train services due to maintenance and repair of smoke extraction system can also be eliminated.

**The completed noise enclosure at tunnel portal 1A near Oi Man Estate**

The visual impact of the noise enclosure on the surrounding environment has also been considered. The design concept is based on a cutaway bamboo, with a tapered profile integrated with a chromatic colour scheme, which makes the structure visually less intrusive and blend into the surroundings.

# Acacia and Beyond | Reconnecting Community with Trees

## Slope Enhancement Programme of Vegetated Slope

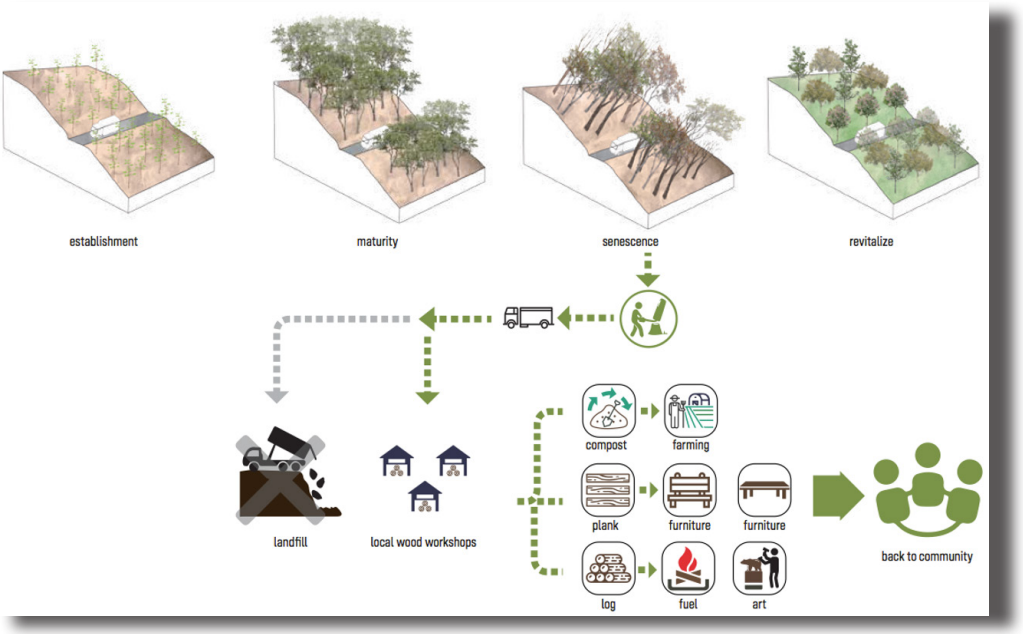

The urban forestry and habitat restoration scheme of Senescent Acacia Slopes launched by the Highways Department is the first of its kind in Hong Kong which aims to restore the natural habitats on slopes in a territory-wide scale as many of them had been planted by pioneer exotic species that gradually reached a senescent stage.

Over the past half century, Acacia confusa (Acacia), one of the few tree species that can establish rapidly on poor soil and in turn improve soil fertility was chosen as a pioneer species for extensive planting in the newly formed slopes along the roadsides in Hong Kong. With an average life expectancy of approximately fifty years only, majority of the Acacia trees planted in the past decades have been gradually reaching their senescent stage with deteriorating structure and health. Their declined structural stability has been posing a significant threat to public safety with breakage/collapse occurring from time to time. Moreover, due to allelopathy, the Acacia slopes support a poor community of other flora and fauna.

The Slope Enhancement Programme of Vegetated Slopes (the Programme) has been implemented with the objectives to:

- better safeguard public safety;
- promote long-term sustainable tree management; and
- enrich bio-diversity along highway landscape.

## Background - Tree Life Cycle Management




Overview of tree life cycle under the Programme

Acacia trees with poor health and structure are removed under the Programme, and native and localised species will be replanted subsequently. In face of the yard waste generated that will increase the burden of landfill sites, we have been exploring opportunities to recycle and upcycle the felled trees proactively.

## Process - Collaboration with Local Tree Recycling Workshops

By collaborating with local wood workshops/artists, trees felled will be collected, cut and dried, and upcycled to wood planks, mulches and sawdust. The collaboration also rekindles the interest of people in general and craftsmen/artists in the use of wood and helps successful building up of the network and the re-establishment of the wood working trade gradually.


**Process and machinery required for wood upcycling**

## Outcome

Over 100 tonnes of raw (green) wood collected under the Programme have been upcycled into over ten types of products. More than 1,600 pieces of upcycled wood products have been distributed to more than 15 interest groups. So far, we have collaborated with 15 partners from government bodies, non-government ogranisations, academia and artists/designers on the upcycling/recycling of wood.

**Types of wood products generated from local wood workshop under collaboration**

The Programme does not only carry out slope vegetation regeneration but also provides opportunities to create a useful network of engaging individuals and organisations interested in wood upcycling and recycling, and thus catalysing environmental stewardship in waste reduction.

# Green Office Management

## Resources Saving: Water, Paper and Waste Recycling

In support of the Government's drive to save natural resources, we are committed to making every endeavour to make our green office management a greater success. In addition to energy saving as mentioned in the previous chapter titled Clear Air Charter, we have been making our best effort to save other resources.

### *Paper Saving*

To align with the green office initiative, we would continue with the following measures on paper saving:

1. Minimise photocopying paper consumption;
2. use both sides of paper for printing and photocopying;
3. Use the blank side of used paper for drafting/photocopying for internal document/ correspondence/fax document;
4. Use electronic means extensively for communication (for instance, use electronic files and keep the use of hard copies to the minimum);
5. Reuse envelopes and file covers;
6. Encourage the use of recycled paper; and
7. Exclude leader page for outgoing fax document.

In 2019, we consumed 19,265 reams of paper and 100% of which were recycled paper.

### *Water Saving*

To maximise water conservation, we have adopted the use of dual-flush toilets, automatic low flow water taps and sensor type urinals. These components can effectively control the duration of water flow and keep the water flow at low level.

### *Waste Recycling*

We treasure waste with recycle value by taking the following measures over the years:

1. Put up green boxes to collect reusable envelopes and papers;
2. Collect computer printer toners and ink cartridges for refilling and recycling; and
3. Put up recycling boxes to collect used paper, CDs, plastic bottles, aluminium cans and rechargeable batteries for recycling.

## Auditing: Environmental and Carbon

### *Annual Environmental Audit*

We conduct annual environmental audits in all 23 offices located in different premises with a view to maintaining the impetus of green measures in housekeeping. The objectives of conducting annual environmental audits are:

1. To assess compliance with the green housekeeping guidelines;
2. To identify non-compliance and recommend remedial actions;
3. To promote good environmental management; and
4. To increase staff awareness of green management and occupational safety and health initiatives.

Our offices have continued to comply with the green housekeeping guidelines. We have also taken the opportunity to share among the offices the green management best practices.

### *Carbon Audit*

Carbon audit was conducted for Ho Man Tin Government Offices by the Building Management Office in 2019 to monitor the effectiveness of greenhouse gas emission reduction effort. The relevant data are being studied by Building Management Office.