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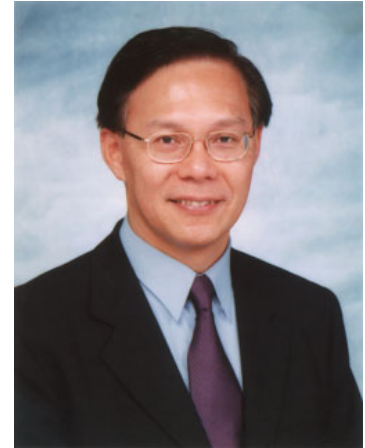
Achievement of environmental objectives & targets

Looking Ahead

Director's Message

I am pleased to present here our second Environmental Report - the report for the year of 2004.

We have in 2004 enhanced the environmental control measures of our work. Road openings are now carried out in a more co-ordinated manner with better lighting, signing and guarding. Additional environmental requirements have been incorporated into our new maintenance term contracts. We continued to improve our environment and streetscapes through implementing pedestrian schemes, planting, painting of bridges, adoption of new street furniture and the use of gully inlet to trap odour and prevent mosquitoes breeding at selected streets. We have also introduced community planting in our construction projects, which were received with enthusiastic support and participation from local residents.



Our research on re-use of waste construction and noise reducing pavement materials in roadwork has resulted in the development of more durable materials which we will test on our roads. We are also exploring further means to save the electricity consumption of our street lighting and other installations.

In the year under review, we had taken every opportunity to enhance our performance in the protection and improvement of the environment through our Environment Management System. We will continue to strive for improvement in all aspects of our work in the years ahead.

I hope you will find this second report interesting.

A handwritten signature in black ink, appearing to read 'MAK Chai-kwong'. The signature is fluid and cursive, with a large initial 'M' and 'C'.

MAK Chai-kwong
Director of Highways
July 2005



Introduction

Highways Department is responsible for developing and upkeeping the road network as well as the planning and monitoring of railway development in the Hong Kong SAR. We have a staff establishment of over 400 professionals and nearly 1,600 other staff in different grades.

In planning and implementing our road projects, we carry out environmental impact assessments and monitoring to ensure that highway infrastructures are built with the least disturbance to the surroundings. In planning our railway projects, we give due regard to environmental considerations.

We maintain about 1,930km of roads and 12,000 roadside slopes. We ensure that the roads are safe and defects are readily rectified, and that road lighting and street furniture are properly functioning.

In 2004, our Department worked on the following initiatives to achieve a more sustainable form of development:

- implementation of a new excavation permit system;
- recycling construction waste for use in road pavement and concrete paver construction;
- employing modern technology on low noise surfacing, common utility enclosure, energy saving for public lighting and public transport interchange;
- replacement of existing street name plates;
- trial installation of gully inlet traps;
- enhancement of greenery in the Urban area and along North Lantau Highway; and
- ecological preservation and mitigation in mega projects.

The content of the report is grouped under 5 headings, viz., Environmental Management, Research, Technology, Greening and Streetscape Enhancement, and Green Office Management. The final chapter summarizes what we have achieved in 2004 and lists out our targets for 2005.

Our Environmental Policy

Our policy on environmental protection has been integrated with our Management Policy under the departmental Quality Management System (QMS). The QMS was developed to comply with both the requirements of the International Standards ISO 9001 and ISO 14001. We act on the Management Policy under the QMS.

We are committed to providing high quality services to our clients and protecting the environment as far as practicable in all stages of our work. We seek to conform to the statutory requirements for environmental aspects and ensure that all our activities are conducted in an environmentally responsible manner.

Our commitments are reflected through our attention to the implementation of the environmental management system including various environmental protection measures taken on site, in researches and technologies adopted, as well as our initiatives in greening and landscape enhancement.



Environmental Management

Implementation of Environmental Management System (EMS)

Highways Department has been implementing an EMS certified to ISO 14001 since 2004. The global EMS standard sets out the requirements to enable the Department to formulate policy and objectives taking into account legislative requirements and significant environmental impact information.



ISO 14001 : 1996
Certificate No : CC2634

The EMS is a management tool that aims at balancing environmental protection and prevention of pollution with socio-economic needs. It also provides a useful means to encourage consultants, contractors and suppliers, who are our business partners, to operate in line with our green policy.

Under the EMS, we identify and evaluate during the planning stage the environmental impacts of our projects. We set up operational control requirements on the significant aspects for inclusion into the project documents. During construction, the contractors' environmental performance is checked and monitored regularly for compliance with the control requirements. Some of the key environmental measures taken on site by our capital works contractors are illustrated under the topic "Environmental Measures taken on site by contractors".

At the beginning of each financial year, we review existing environmental objectives and targets and formulate new ones for continual improvement. Depending on their functions, the offices of our Department are divided into four groups and each has its own Quality Management Committee. The committees monitor and review the respective targets in pursuit of continually improving our performance.





We also conduct internal audits to verify the effectiveness of our EMS. The audit covers checking of project activities against established operation procedures. Results of audits conducted in October 2004 indicated that our EMS had been effectively implemented. For the period under review, all the measures and techniques employed to protect the environment and to minimize disturbance had consistently achieved their intended results.

As a rule, our EMS is subject to regular surveillance by the ISO certification body, Hong Kong Quality Assurance Agency (HKQAA). Comments of the last surveillance visit conducted by HKQAA in December 2004 were encouraging. HKQAA appreciated our proactive approach in identifying environmentally friendly methods for road construction as well as the robust site activities control and monitor mechanism.

Regular training is one of the EMS policies. In 2004, we had conducted 15 classes of training courses to equip our staff with the necessary knowledge for system implementation and maintenance. We also organized 3 workshops on Green Construction Practices, and 3 courses related to environmental impact assessments.



Environmental protection measures taken on site by contractors

On site, we ensure that our contractors will establish and implement measures to mitigate the environmental impacts arising from the works. The photographs below show some of the general measures taken by our contractors to mitigate air, water and noise pollution, as well as to manage the waste on site.

Measures to control air pollution

- 1 Cover for grout mixing
- 2 Dust monitoring equipment
- 3 Covering construction and demolition (C&D) materials on truck
- 4 Wheel washing facilities
- 5 Water spraying for excavation
- 6 Water spraying on haul roads



Measures to mitigate water pollution and consumption

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2



3



1 Silt curtain (to mitigate pollution to surrounding sea)

2 Sludge separation tank

3 Sedimentation tank

4 Tunnel Water Recycling System

Freshwater is one of the major resources consumed during tunnel drilling operation. In order to reduce consumption, a dedicated tunnel water recycling system has been implemented in our tunnel projects.

The system included the pipework, primary settlement tanks, chemical enhanced sedimentation tanks (Wetsep system), a pH regulator, water storage tanks, and a pumping and water sprinklers system with 10 water sprinklers.

4



Water from the tunneling drilling work are collected in the primary sedimentation tanks for primary settlement i.e. to remove any large particulates. The effluent will then be diverted into two Wetseps for secondary treatment to remove the fine particulates with chemical precipitation. The resulting effluent will be neutralized by pH adjustment and then stored at water storage tanks.

The treated water will be re-used for tunnel drilling work, and for dust suppression at haul roads with manual spraying and at the stockpiling area using a water sprinklers system.



Measures to control construction noise emission

- 1 Temporary noise barrier – front view
- 2 Temporary noise barrier – back view
- 3 Noise enclosure for noisy operation
- 4 Ventilation fan equipped with silencers

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2



3



4



Waste management on work site

- 1 Waste separation to enhance re-use or recycling
- 2 Drip tray underneath containers
- 3 Waste storage skip
- 4 Chemical waste storage
- 5 Chemical waste collected by licensed collector.

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Study on good EIA measures

In delivering a new road or a new railway project, it is necessary to undertake an environmental impact assessment (EIA) to identify impacts that the project may have on the environment and to devise proper control and mitigation measures. During the process, we have to comply with the requirements in the Technical Memorandum of the Environmental Impact Assessment Ordinance (EIAO).

To build up our knowledge gained in HyD projects since implementation of the EIAO six years ago, we commissioned a consultant in November 2004 to undertake the design and production of an EIA Knowledge Transfer Platform. Three of our major projects, namely, "Improvement to Tung Chung Road between Lung Tseng Tau and Cheung Sha", "Deep Bay Link" and "Hong Kong - Shenzhen Western Corridor" were selected for detailed evaluation. The assignment has the following objectives:

- capture information and experiences gained in EIA process;
- provide comprehensive information on the procedures and guidelines relating to the EIA process;
- evaluate good management skills and mitigation measures deployed; and
- provide suggestions on good EIA practices

The Platform will be categorized as (i) EIA Process Guidelines & Procedures, (ii) EIA Study Outcome, (iii) Case Studies, (iv) Good EIA Practices, (v) Information & Knowledge Search and (vi) Helpful Link.

We anticipate that this assignment will be completed in 2005 and the results will be uploaded onto our departmental intranet. A web system will be developed, and CD-ROMs will be prepared for use by those who do not have access to the web system.

Road Opening Control

In April 2004, the Department started to implement the fee charging permit system under the Land (Miscellaneous Provisions) Ordinance to control excavations on public roads. Applicants for excavation permits had to pay a fee for processing the permit and a daily fee for the duration of the permit. We would also charge economic costs if permits involving carriageways were extended. Apart from carrying out audit inspections as in the past, we had set up an enforcement team to collect evidence on contravention of permit conditions. The Department of Justice would consider the evidence and give advice on whether prosecutions should proceed.

In processing permit applications, we make use of our computerized Utility Management System (UMS) to determine an optimum road opening period and to minimize repeated opening at the same location within a short period of time. Database of the UMS is replicated into a web server which permits external users to plan, coordinate and apply their permits or extensions. External users can digitize the proposed excavation location and generate online works coordination programmes.

To promote the publicity of the excavation permit requirements, we published and distributed to the public a Q&A pamphlet in 2004. It provides answers to general questions, such as:

- Why do we need to open up the road?
- Who and how do we control excavations?
- Why do we need to amend the Ordinance?
- What's new in the amended Ordinance for excavations in streets and footpaths?
- How to apply for a permit?
- How long do I need to register and place an application for excavation work before work commencement?
- Who should I contact if I have problems with permit application?
- What are the main contents of permit conditions?
- What will Highways Department do in monitoring the excavation works?
- What likely advantages will the amended Ordinance bring to the Public?
- How should I lodge complaints on road excavation work?

(For answers to the above, please visit our website at <http://www.hyd.gov.hk>)



With the new permit system, we are hopeful that disturbance to the environment due to road excavation works can be greatly minimized. The new system has been put in operation for one year. Our initial assessment confirms that the environmental performances of excavation sites have continued to improve. Both the number and duration of excavation permits were substantially reduced in the past year.



Research

Recycled Pavement Materials

Hong Kong is facing a challenge to handle over 20 million tonnes of construction and demolition (C&D) waste materials each year generated from local construction activities. To prevent waste accumulation from becoming a problem, the Government is trying to find ways to reuse and recycle the C&D waste material.

To contribute to the effort, we continued in the year to investigate the use of recycled aggregates for road sub-base and for precast block pavers, and also on the reuse of asphalt reclaimed from routine road maintenance milling work.

Sub-base

On Fo Tan Road we have laid part of the pavement with sub-base constructed with recycled aggregates. Non-destructive tests using the Falling Weight Deflectometer were regularly conducted to determine the sub-base layer stiffness after use of the road by traffic. Also, use of recycled aggregates was extended to the sub-base for the adjoining footpaths. The monitoring programme will be completed in mid 2005 and the specifications of recycled sub-base will be refined taking into account the monitoring results.

Reclaimed Asphalt Pavement

Hong Kong produces about 1 million tonnes of asphalt materials each year for paving our road network. At the same time, about 0.2 million tonne of asphalt pavement is scarified and removed from roads due to resurfacing work for improvement of riding quality. Based on our research work, we have allowed the use of up to 15% of reclaimed asphalt pavement (RAP) as road base material in new pavements. With a view to further use RAP, we collaborated with the Hong Kong Polytechnic University to evaluate the use of RAP in the wearing course and the base course of our roads. The study started in November 2004 and is expected to last for one year. If the results are promising, we shall promote use of RAP in more pavement layers by the end of 2005.

Block Paver

Precast block pavers are now the preferred paving material for public footpaths. They are more environmentally friendly than in-situ concrete, and more durable than tiles or similar materials. Approximately 186,000 square metres of public footpaths were paved with precast block pavers in 2004. Such widespread use of block pavers can form an outlet for part of the C&D waste material if the latter could be processed as materials for making pavers.

Based on the results of field trials carried out by the Hong Kong Polytechnic University on precast concrete block pavers made with recycled aggregates from C&D waste materials, we refined the specifications of precast concrete block pavers to incorporate recycled fine aggregates. In October 2004, we provided assistance to the Environment, Transport and Works Bureau in preparing and promulgating a technical circular that stipulated the use of recycled aggregates in precast concrete pavers for public works contracts.



Paving blocks made of recycled aggregates

Low Noise Surfacing

In Hong Kong, low noise surfacing is used as a standard on expressways and roads with speed limit of 70 km/h and above. Its use on low speed roads is not recommended due to high maintenance cost. However, due to aspiration of the public to reduce noise pollution and the difficulty of installing noise barriers in existing roads, low noise surfacing has been adopted in selected road sections to reduce traffic noise. In 2004, we completed resurfacing 11 low speed road sections with low noise surfacing.

The application of low noise surfacing on low speed roads will require more frequent maintenance due to earlier deterioration of the surfacing material under heavy, slow moving traffic. In early 2004, in collaboration with the Hong Kong Polytechnic University, we developed a more durable type of low noise surfacing material. The research project was completed in December 2004 and we are now liaising with the asphalt suppliers to introduce the new material into our works in 2005.

New Street Name Plates

Existing street name plates show street names in both English and Chinese on the signface facing the carriageway. Pedestrians cannot see the names and may become annoyed if they cannot see the same on the buildings they are passing by. In 2004, we introduced a new, improved street name plate design with building numbers added together with direction arrows. The new street name plates have two signfaces, one facing the carriageway and the other facing the footway.

The new design has the following advantages over the old one:

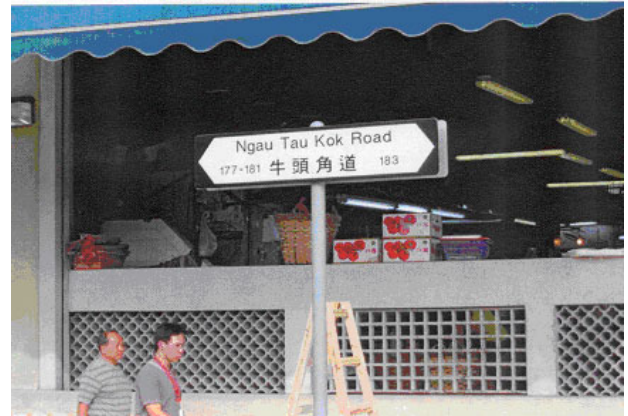
- It solves the problem above;
- the aesthetic design has been improved; and
- the public can identify their locations more easily.

A pilot scheme of this new design was implemented in Mong Kok in August 2004 and was generally well received by the public. We then started in late 2004 to replace all existing street name plates over the territory with the new design, and aimed at completing the replacement programme within 2005.

To minimize obstruction to pedestrian flow, we have also developed a one-post support for newly planted street name plates instead of using the two-post support in the past, and started to develop a multi-function post to house also traffic signs.



Replacement street name plates on existing two-post support



Newly planted street name plates on new one-post support

Common Utility Enclosure

In 2004 we have completed the investigation into the feasibility of implementing Common Utility Enclosures (CUE) in both new developments and built-up areas. CUE are underground structures that provide a common passage for utility services. With CUE, the need for road excavations during installation and maintenance of utilities will be greatly reduced. We are carrying out a trial CUE installation at the junction of Horizon Drive and Chung Hom Kok Road. A culvert type design is adopted to house power cables and telecommunication cables in this trial. Construction is expected to commence in February 2005 and to complete by the end of 2005.



Common utility enclosure

Technology

Energy Saving for Public Lighting

Highways Department has a mission to maintain road infrastructure in the most environmental friendly manner. In view of the significant electricity consumption of the Public Lighting System illuminating our roads, bridges, underpasses, footbridges, subways and public transport interchanges, we need to constantly investigate the use of new technology to reduce electricity consumption. In 2004, we have adopted the following measures:

- We replaced some 2,000 nos. of less efficient lamps and its associated obsolete lanterns with lower wattage energy efficient lamps and modern lanterns having more efficient light distribution to maintain same lighting levels. This resulted in annual saving of electricity consumption of about 860,000 kWh.
- We replaced some 10,900 nos. of conventional electromagnetic ballasts with electronic ballasts at footbridges and subways to reduce energy loss. This resulted in annual saving of electricity consumption of about 510,000 kWh.

Energy Saving for Public Transport Interchange Ventilation

Many of the covered Public Transport Interchanges (PTIs) in Hong Kong have been built under enclosed building developments. Mechanical ventilation systems are in place in order to keep the air quality in the PTI to acceptable standard. Their electricity consumption is high and is expected to grow further when more PTIs come into operation in future.

Under our request, air quality measurements have been made since 2002-2003 in 30 PTIs by the Electrical and Mechanical Services Department. Based on the results of these measurements, those PTIs with potential energy saving were identified and the ventilation fan operation in the selected PTIs were rescheduled to achieve saving in electricity consumption. Fan operation adjustment was made to 3 PTIs in 2004 and another 6 PTIs have been selected for adjustment. It is expected that the annual electricity consumption for the PTIs will be reduced by about 2,000,000 kWh.

Further air quality measurements will be conducted at the remaining PTIs with a view to identifying more suitable PTIs for fan operation adjustment to save energy.

Painting of Bridges/Footbridges

Background

Our past inspections revealed that the surface of some concrete vehicular bridges and footbridges in the territory were in unsatisfactory and deteriorating conditions. The main cause was due to aggressive pollutants emitted from vehicles (such as hydrogen sulphide) weakening the protective alkaline environment to the reinforcement inside the concrete. The conditions cannot be restored with washing. Moreover, water stains and dirt marks on the bridge surfaces, especially those at movement joints, induced adverse visual impacts to the public. In order to improve the durability and appearance of the concrete structures, application of painting on concrete vehicular bridges and footbridges, in addition to those built of steel, was suggested and included in our general structure maintenance works.

Painting Materials

The painting applied to the concrete surfaces is a kind of acrylate co-polymer paint and serves as a protective layer to the concrete surfaces. The painting will also prevent mould growth on concrete surface but will allow water to escape from the concrete structure. These properties are beneficial in maintaining the durability of concrete and in safeguarding the painting from flaking, blistering and chalking. Furthermore, the painting can seal up hairline cracks on concrete surfaces, thus further protecting the structure from attacks by aggressive agents, such as hydrogen sulphide.

The painting materials commonly adopted for concrete surfaces are Chemrex Acrylate 120 Concrete Stain and Dekguard S Aliphatic Coating or other materials with equivalent properties. The colour adopted is normally grey or light grey as it will generally match with the natural colour of concrete.

The painting applied on steel structure is different from those on concrete surface. As stipulated in the Structures Design Manual for Highways and Railways (SDM), there are three paint systems for steelworks, namely, Paint System I & II for galvanized steelworks, and Paint System III for metal-sprayed steelworks. The paint systems generally comprise several layers, i.e. pre-treatment, primer, undercoat and finish as per Section 18.4 of the SDM.

Painting Works

Painting works on bridges and footbridges commenced in about 1997. In 2004, we have completed painting works for 245 bridges in the territory, of which 132 are vehicular bridges and 113 are footbridges. About 180 bridges/footbridges have been selected for painting in 2005.

In addition, some painting works of special patterns were implemented by other Departments, such as the Home Affairs Department, for enhancing the appearance of the bridges and promoting activities in local community. An example is the footbridge across Leighton Road near Irving Street in Causeway Bay, which was painted with information of Olympic Games, with background painting done by us.

Photos of Bridges before and after Painting

BEFORE



Vehicular bridge near Aberdeen Tunnel, Wong Chuk Hang

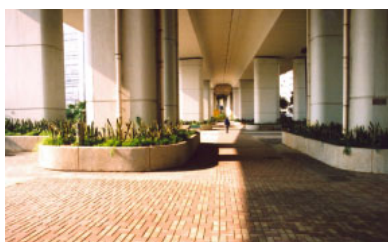


AFTER

BEFORE



Tsuen Wan Road Flyover



AFTER

BEFORE



Po Lam Road Footbridge



AFTER

BEFORE



Hung Mui Kok Road, Tai Wai



AFTER

Trial Installation of Gully Inlet Trap

Background

There have been complaints about odour originating from our roadside gullies, and the stagnant water and debris inside the gullies, which are potential grounds for mosquito breeding, are unsightly. As part of the Team Clean follow-up effort, our department has been trying out a new product, viz. gully inlet trap (GIT), to tackle the problems. GIT is specially designed for simple installation underneath the standard gully grating. It is made of fiberglass, which has the characteristics of lightweight, non-hazardous to health, non-corrosive, inert and capable of operating under severe temperatures.

The GIT has been tested by the Hong Kong Polytechnic University for its hydraulic performance and the results were found to be satisfactory. Without affecting the drainage function of the roadside gully, the GIT is specifically designed to achieve the following functions: -

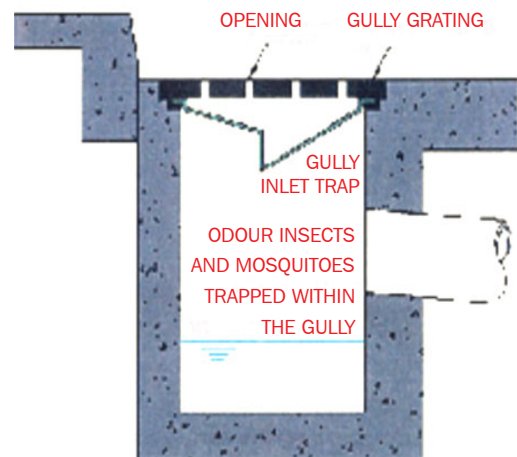
- (i) Trapping odour;
- (ii) Preventing mosquitoes breeding inside the gully;
- (iii) Aesthetically pleasant – by covering up the inlet of the gully, the visual impacts of debris/water inside the gully are eliminated.

Trial Application

Starting from September 2003, joint operations with Food and Environmental Hygiene Department (FEHD) have been conducted for the trial installation of GIT in various hygiene black spots in the territory, including Cheung Chau, Shatin, Mongkok and Kennedy Town. FEHD colleagues in Cheung Chau have remarked that these traps are effective in alleviating the emission of odour from the gullies. FEHD has then identified some more locations of hygiene black spots and proposed to our Department for carrying out further and more extensive trial installation of the GIT. There are about 1000 nos. of GITs to be installed in the territory.

At the same time, Drainage Services Department (DSD) has also conducted trial installation of similar GIT product.

After the first round of site trial, FEHD opined that the GIT would complicate their gully cleaning operation and asked for improvement. Taking into account FEHD's concern and advice, the prototype GIT was revised and a further demonstration on the installation of the revised GIT was conducted in November 2004 with the participation of the departments concerned, including FEHD and DSD.



Subsequently, FEHD agreed that the GIT could reduce the risk of mosquito breeding and did not object to the installation of the proposed GIT. In addition, FEHD stated that their pest control staff would continue to apply larvicidal oil to gullies installed with GIT. In consideration of the potential fire hazard caused by the flammable larvicidal oil trapped in gullies with GIT installed, expert advice from the appropriate department (e.g. Fire Services Department) is being sought to assess the risk.

Progress of Trial Installation of GIT

As mentioned above, trial installation of GIT has been carried out in various districts in the territory. Taking Mongkok district as an example, the trial has been completed recently. A total number of 40 sets of GIT were installed in road sections including Nathan Road, Fa Yuen Street, Nelson Street, Dundas Street, Soy Street, Portland Street, Shangtung Street and Shanghai Street.

The trial installation in Yau Tsim district is still in progress. According to FEHD's request, there will be 15 sets of GIT to be installed in the district. Besides, in response to a complaint on bad odour from roadside gullies, additional GITs (97 sets) will be installed in the areas around Peninsula Hotel at Tsim Sha Tsui. A total of 66 out of the 97 sets have been installed up to the end of 2004 and it is expected that installation of the remaining GITs (46 sets) will be completed in early 2005.

Interim Observation

It is noted that the odour at the locations where the gully inlet traps are installed has been alleviated. Whereas, since the mosquito breeding activity is not significant in dry season, the function of the gully inlet trap in such respect has yet to be tested to its full potential in the coming wet season.

Site photos showing the trial gully inlet trap installation:

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Location : Dundas Street

- 1 Remove the grating cover
- 2 Clearing the frame of grit and dirt
- 3 Putting the gully inlet trap on the frame
- 4 Reinstate the grating

Greening and Streetscape Enhancement

Greening Our Environment

Highways Department's greening objectives are to bring noticeable improvements in urban greening, improve the quality of existing green areas and maximise greening opportunities at all stages of its works undertaken by the Department.

Urban Greening

In 2004, two pilot greening schemes were implanted, one in Nathan Road of Mong Kok and one in Sheung Wan. The schemes are under monitoring and the successful techniques will be applied in other urban districts.

Nathan Road

We had taken up the detail design and implementation of thematic planting along the central median of Nathan Road in Mong Kok District on a trial basis. The installation of fibreglass portable planters and planting of *Duranta repens yellow* were completed on 30 April 2004. The following were observed during the establishment period from April 2004 to December 2004:

1. April 2004 to September 2004 – fair in health condition, major damage of shrubs was due to jaywalking.
2. September 2004 to November – most of the shrubs died due to lack of water though watering was maintained once a week even with rain.
3. Plants, planters and soil were stained and coated with dust.
4. Contamination caused by dust and exhaust by heavy vehicular traffic.
5. Jaywalking damages the plants.
6. The planters and plants trap rubbish thrown by drivers. Approx. 300 nos out of 1,300 nos of plant had died and been replaced.



Furthermore, the following maintenance difficulties have been encountered:

1. Access to carry out establishment work is difficult. Lane closure and assistance by Slow Moving Works Vehicle are required.
2. Higher cost and longer working period resulting from limited working time for alternate closure of the carriageway.



Following the observations, the following improvement works had been carried out in December 2004:

1. Use more drought resistant species. 100 nos of *Kalanchoe laciniata* replaced part of the *Duranta repens yellow* in December 2004.
2. More frequent watering arranged.
3. For a section of the central divider, double rows planters were rearranged to an alternate single row to discourage jaywalking.



Sheung Wan

To introduce more greening to the area around Shun Tak Centre, we added trees along the footpath and planter boxes along the footbridge at the centre.



BEFORE

◀ Planters on footbridge between Western Market and Shun Tak Centre



AFTER

▼ Enhancement Planting along Connaught Road, Sheung Wan



BEFORE



AFTER

Large Trees Planting at North Lantau Highways (NLH)

To further enhance the aesthetic quality of NLH, our department in collaboration with the Leisure and Cultural Services Department (LCSD) have planted about 120 large trees along NLH in 2004. They were of 5m or more in height to ensure that the greening effect could be readily appreciated.

Sites with grass cover and free from utilities at Tsing Ma Control Areas and Siu Ho Wan were chosen. With their exposed expressway microclimate and the constraint of planting in the dry month of December, evergreen tree species including *Ficus spp.* and *Syzygium spp.* were selected for their relatively high resistant to drought, wind and air pollution.

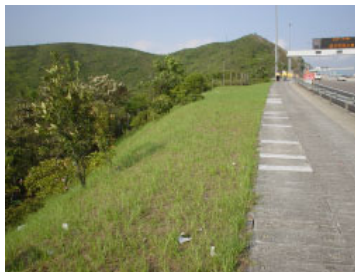
Large Trees (5m high) Planted near Toll Plaza along Kowloon Bound Carriageway – View Looking East



BEFORE AFTER



BEFORE AFTER



BEFORE AFTER



Large Trees (5m to 7m high) Planted near Toll Plaza along Kowloon Bound Carriageway – View Looking East



Large Trees (5m to 7m high) Planted near Toll Plaza along Kowloon Bound Carriageway – View Looking West



Site investigation, laboratory testing on soil samples, planter walls construction, tree selection in plant nursery, tree guying system development, etc., were undertaken well in advance to create a pleasant and safe new 'home' for these large trees. Meanwhile, we are conducting further site investigations with LCSD to plant more large trees in 2005 at strategic locations of this transport corridor for the enjoyment of the commuters as well as the visitors to Hong Kong.



BEFORE  AFTER



Large Trees (5m high) Planted along Airport Bound Carriageway at Siu Ho Wan –View Looking East

Community Planting

In order to promote involvement of the community in our landscape works so as to raise public awareness of the importance of greening and to development a sense of ownership among local residents, we have successfully organized four community planting days in Kam Tin, Chuk Yuen Tsuen and Ha San Wai in May and June 2004. Approximate 250 participants including Village Representatives, villagers, headmasters, teachers, students and their parents took part, all showed keen interests in greening up their environment.



Community Planting at Chuk Yuen Tsuen



Community Planting at Ha San Wai



Community Planting along Kam Tin By-pass



The Department will continue to consult District Councils on the greening proposals of its projects and to invite local communities to participate in the planting works.

Greening and Ecological Mitigation Measure of Projects

Greening

We continued to incorporate landscape works in both road and railway projects at every opportunity to enhance their aesthetic appearance. In 2004, we spent about \$70 million in various road and rail projects and in maintenance works by planting over 1.18 million trees, shrubs, climbers and groundcovers to green the environment of which about 560,000 nos are planted in the urban areas.



Sai Sha Road Widening



Reinstatement of Middle Road Playground by East Rail Extension from Tsim Sha Tsui to Hung Hom



Hiram's Highway



Wah King Street Reconstruction



The Kam Tin Bypass is a typical illustration on how to incorporate landscape works to achieve the greening objectives. The 1.3km dual 2-lane project is a new road running through rural and natural habitat areas located in the Kam Tin Valley. It bypasses the Kam Tin Town by connecting the outskirt areas of the Town at its two ends.



Various settings such as woodland, wetland, suburban and amenity habitats have been implemented under this project to create a greener environment and enhanced landscape. Some of the salient features of the landscaping works of this project include planting of trees along the central divider, colour patterns formed by shrubs and groundcover of different colours and textures at the roundabouts, and extensive planting of flowering shrubs at the roadside amenities. *Melaleuca quinquenervia* was chosen as the theme tree planted along the central median in view of its upright habit and low maintenance. This species together with *Calliandra* species will help absorbing the pollutants generated by the vehicles and reducing glare at night. Considerable native species such as *Bridelia tomentosa*, *Celtis sinensis*, *Cinnamomum camphora*, *Cleistocalyx operculata*, *Ficus hispida*, *Litsea glutinosa*, *Schefflera octophylla* were planted to provide food source and roosting sites for wildlife.



BEFORE



AFTER

Ecological Mitigation Measure

Whilst every practical step has been taken to avoid ecological impacts of projects, there may be situations where ecological impacts are unavoidable.

Hong Kong - Shenzhen Western Corridor

Numerous challenges were encountered in the Environmental Impact Assessment (EIA) Study for Hong Kong - Shenzhen Western Corridor (HK-SWC) as it will span across the environmentally sensitive areas and pass over an ecologically valuable mudflat in Deep Bay. For example, the inner Deep Bay coastline is the feeding ground for a large population of migratory birds, especially the Mai Po wetland (a Ramsar site protected by international convention) located on the northern side of HK-SWC. There were also serious concern on the increased sedimentation rate in Deep Bay due to the HK-SWC construction. To alleviate the concerns, both mitigation and enhancement measures have been proposed and implemented under the Project.

Temporary Access Bridge

In the HK-SWC contract, about 1.6km of the alignment is located within the shallow water region where the maximum water depth is less than 3m. Such depth is unable to accommodate barges for the construction of the bridge. A temporary access bridge was therefore constructed along the future bridge alignment between each pair of the pile-caps in the shallow water region.

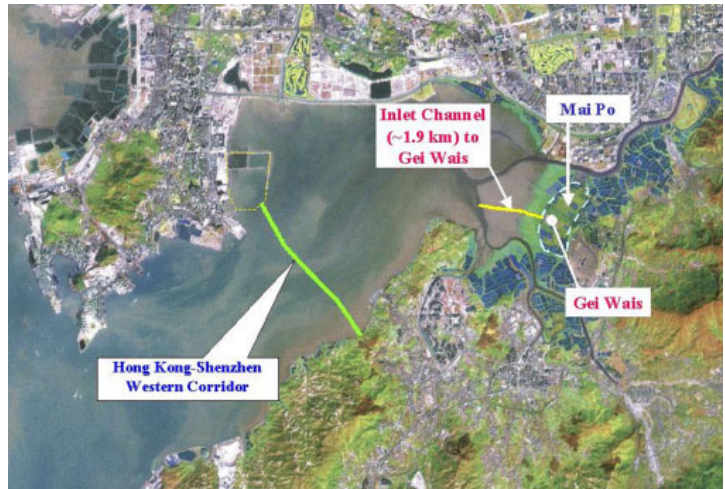


The bridge was a pre-fabricated modular steel structure of 1.8 km length and 9m width. It traversed the shallow water area with the seaward side functioning as a berthing point for marine access. Its construction provided an access route of plants and materials and avoided otherwise necessary marine traffic causing disturbance to the mudflat area.



Dredging at Mai Po

The sediment deposition rate in Deep Bay near the mouth of Shenzhen River is rather high. This natural sediment deposition phenomenon has caused a rise of the channel bed levels and obstructed the tidal flows from Deep Bay into Gei Wais in Mai Po. As seawater exchange could bring fish and shrimp into Gei Wais, the decreasing seawater exchange would exhaust the food resources inside Gei Wais and thus jeopardizing its function as feeding ground for birds. Although based on the EIA study, HK-SWC would only slightly increase the sedimentation rate (0.5 mm/yr) at Mai Po after completion of the Project, a small scale dredging in a 1.9km long water channel at Mai Po was carried out to revitalize two numbers of Gei Wais.



To minimize disturbance to migratory birds, the dredging works had to be completed before the start of the winter period. To overcome the site constraints and tight programme, the contractor manufactured an amphibious dredger to carry out dredging in area where the water depth was extremely shallow, and the dredged sediments were transported for disposal by self-propelled spoil barges. Silt curtain was installed to confine the dredging areas to avoid spreading of dredged sediments. A 24-hour shift working hour was adopted.

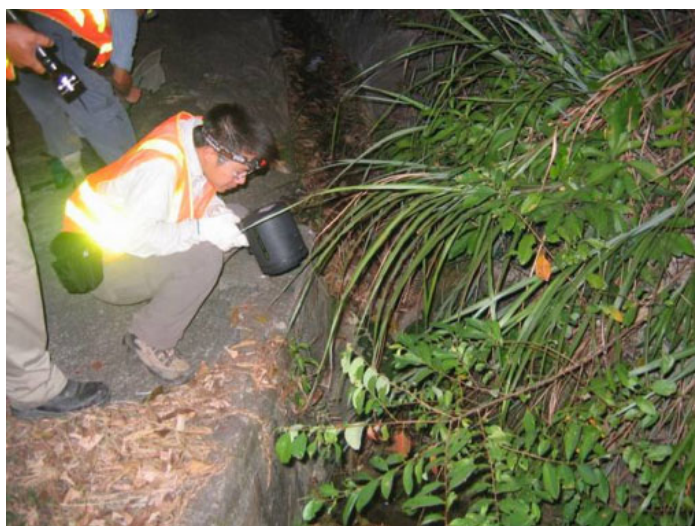


Dredging at Inlet Channel to Gei Wais

With close collaboration amongst concerned parties, the works were finally completed satisfactorily. Upon completion of the dredging works, the tidal influx into the two Gei Wais was restored and 24.3 ha of feeding ground for the birds was reinstated, which had far more than offsetting any effect due to construction of HK-SWC.

Tung Chung Road

Under the Tung Chung Road Improvement project, protected species including Hong Kong Newt, Lesser Spiny Frog, Romer's Tree Frog and Beijiang Thick-lipped Barb were identified. Pre-translocation surveys including the identification of the most suitable receptor sites for the release of the captured individuals were carried out. The actual translocation was undertaken by ecologists with relevant expertise before the commencement of construction works. Ecological audit confirmed that the translocation works satisfied the relevant requirements under the Environmental Permit of the project.



Translocation of the Romer's Tree Frog being carried out at night



Romer's Tree Frog

Slope Vegetation Maintenance

Under a new arrangement of maintenance responsibility, we have taken over for maintenance about 12,000 roadside slopes with approximately 1,500 hectares of vegetation. In 2004 we started regular maintenance operations of slope vegetation in Tai Po and North districts, Kowloon and Northwest areas of Hong Kong Island, and along expressways in NT West. The routine maintenance operations will expand to the remaining districts in 2005 to cover all roadside slopes in the Territory. We aim to upkeep the vegetation in a natural and self-sustainable condition, to provide a green backdrop to roads, and to maintain an urban habitat for fauna and flora. Of course, safety to the road system and stability of our slopes caused by the vegetation is also our concern.

During the maintenance operations, about 15 hectares of invasive exotic vines and weeds, such as *Mikania micrantha*, has been removed, allowing the natural vegetation to recover.



Removal of invasive exotic vines and weeds

For the efficient management of slope vegetation a Slope Vegetation Inventory was completed in 2004 and in order to identify trees requiring special preservation or maintenance measures a survey of wall trees was conducted.



Wall Tree

Streetscape Enhancement

Highways Department is keen to provide a better pedestrian environment by enhancing the streetscape, especially in built-up areas. We aim to provide comfortable surroundings for pedestrians; to encourage walking and the use of public transport. During 2004, we continued to implement pedestrian schemes with the streetscape of Chiu Lung Street and Theatre Lane in Central, Apliu Street in Sham Shui Po, Yuen Long New Street, and Soy Street in Mong Kok upgraded.



Chiu Lung Street



Soy street



Theatre Lane



Streetscape Enhancement in Sai Kung

Sai Kung has recently taken on a new look with an overall upgrading on the streetscape in the town centre, raising the town's profile as the 'backyard' of Hong Kong. The comprehensive upgrading of the urban environment of Sheung Wan around Wing Lok Street and the Western Market is currently underway with completion due in mid 2005. This pilot scheme utilizes new street furniture standards. Elements of street furniture, such as railings, bollards, and street nameplates were purposely designed to be manufactured locally, using replaceable panels and components to enhance maintenance and environmental efficiency.

Awards

The excellence of our Landscape Unit in providing professional services in the design and implementation aspects and in the research has been well recognized.

Research on Wetland Planting

Our Landscape Unit not only provides landscape design services but also pioneers in the research on wetland plants. This includes a study on wetland planting at Chau Tau Tsuen Flood Storage Pond.



Species	Adapted Water Depth	Plant Spread Sideway	Regenerate Ability	Tolerance (< 1 month)	
				Flood	Dry
<i>Paspalum paspoides</i> 雙穗雀稗	< 300 mm	✓✓	✓✓	✓	✓
<i>Panicum repens</i> 枯骨草	< 300 mm	✓✓	✓✓	✓	✓
<i>Cyperus malaccensis</i> 荳芩	300 - 400mm	✗	✓✓	✓	✓
<i>Lepidosperma chinense</i> 抱仗草	< 150 mm	✗	✓	✓	✓
<i>Fimbristylis subspicata</i> 雙穗飄拂草	< 150 mm	✗	✓	✓	✓
<i>Paspalum orbiculare</i> 圓果雀稗	< 150 mm	✓	✓	✓	✓
<i>Bacopa monnieri</i> 假馬齒莧	< 5 mm	✓✓	✓	✗	✗
<i>Isachne globosa</i> 柳葉箬	✗	✗	✗	✗	✗

Comparison of performance of each species

The report of this study provides a summary of the observation for 12 months and a preliminary assessment on the adaptation of the selected wetland species which were planted in the weep holes of the concrete base of the flood storage pond. Wetland planting in such environment was at the first time of its kind in Hong Kong.

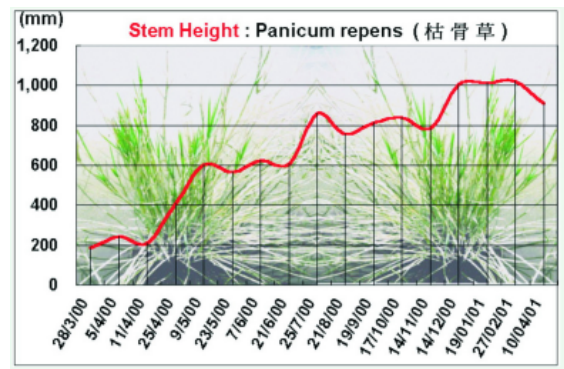


Sample zone



Measuring the foliage density

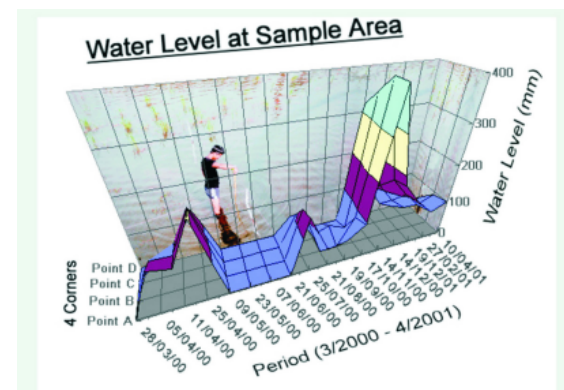
Lepidosperma chinense - Monostand form



Variation of Stem Height over the observation period

One of the main criteria for selecting of suitable species for trial was that the selected species should not be woody in nature so as not to cause blockage to the screw pumps when the dead tissues were sucked into the pumps.

It was found that only one species could not survive under such harsh environment. The other seven species demonstrated their respective degrees of adaptation, depending on the depth of water above the concrete base and their duration of planting.



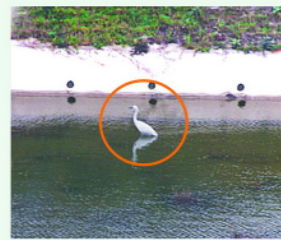
▼ Survival rate of each species

Code	Species (Chinese Name)	Survival %	Performance
Pp	<i>Paspalum paspoides</i> (雙穗雀稗)	100%	Very good
Pr	<i>Panicum repens</i> (枯骨草)	100%	Very good
Cm	<i>Cyperus malaccensis</i> (茭草)	100%	Very good
Lc	<i>Lepidosperma chinense</i> (炮仗草)	90%	Good
Fs	<i>Fimbristylis subspicata</i> (雙穗飄拂草)	90%	Good
Po	<i>Paspalum orbiculare</i> (圓果雀稗)	50%	Fair
Bm	<i>Bacopa monnieri</i> (假馬齒莧)	40%	Fair
Ig	<i>Isachne globosa</i> (柳葉箬)	0%	Poor

▼ Summer scene with vigorous wetland plants



▲ Various species of fish ▶



▲ Bird ▶



The hard surface of the concrete pond was softened substantially after wetland planting, resulting in tremendous improvement of the landscape. Moreover, wildlife such as fish, snail, bird, dragonfly were attracted to the flood pond.

The evidence of the successful adaptation of wetland plants planted in the weep holes of the concrete base of the flood storage pond is a milestone in the history of landscape design in Hong Kong. This environmental friendly approach not only improves the landscape character in floodwater storage ponds but also enhances the ecological interests of the rural setting.

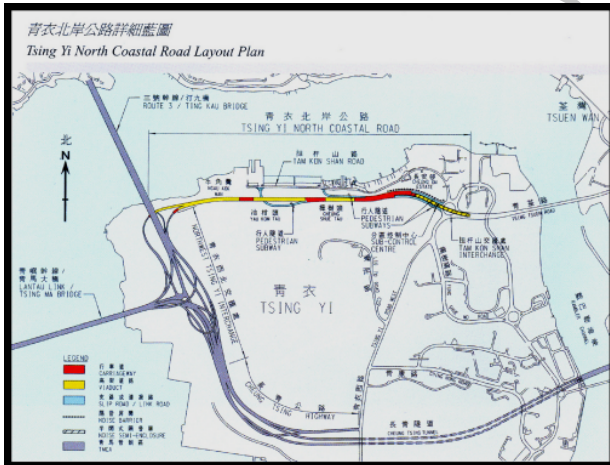
In July 2004, the study “Report on Trial of Wetland Plants at Chau Tau Tsuen Flood Pond” obtained Merit Award under the category of Landscape Planning / Research of the HKILA Professional Awards.



▲ Just after planting



▲ 3 years after planting



Tsing Yi North Coastal Road Project

In 2004, the project won the Merit Award under the category of Landscape Design Project in the Hong Kong Institute of Landscape Architects Professional Awards competition.

Design Concepts

The 2.2km long dual 2-lane Tsing Yi North Coastal Road (TYNCR) comprises of a series of elevated viaducts stretching along the foothills and over the valleys of the north Tsing Yi Coast. The major portions of road are designed as viaducts consisting of precast concrete elements manufactured off-site, aiming to minimize earthworks and disturbance to the natural terrain.

The main objective of the landscape works is to create a unique landscape setting that ties in with the road alignment and at the same time softens and screens its visual impact. The total landscape areas under the project are about 76,000 square metres.

Theme trees, ornamental shrubs and groundcovers were planted in the roadside verges/amenity strips along the new carriageway, in front of bridge abutments and noise barriers, and at retaining walls and roadside/toe wall planters to introduce a continuous linear corridor of planting. Total numbers of 814 trees, 24,364 shrubs and 22,867 groundcovers were planted in these amenity areas.



Implementation Details

The viaducts were designed with a curved, shallow profile to minimize the concrete cross-section and shadow lines. Columns were rounded to reduce shadow and to have a more natural form. Transparent noise reflective panels of tinted green colour were adopted for the upper portion of the noise semi-enclosure and noise barriers near Cheung On Estate.



Naturalistic chromatic schemes or pastel colour ceramic wall/floor tiles were applied to the finishes of other highway structures including the noise semi-enclosure and pedestrian subways as the mitigating measures to reduce their visual intrusiveness.

Hydroseeding and woodland mix plantings were used on the newly formed cut slopes. Combination of 12 exotic and native plant species were adopted for the woodland mix planting in order to achieve the biodiversity, fast establishment and natural succession in future. More than 66,900 numbers of tree whips were planted on those slopes.



In addition, a pilot vegetation trial that employs the technique of fibre-reinforced soil had been implemented in the project on a rock cut slope. A mixture of continuous filaments of polymeric fibres and 200mm thick sandy soil with suitable grass seeds were sprayed under hydraulic pressure onto the 55° rock slope surface about 20m in height. Shrubs seedlings were then pit planted on the slope for the establishment of a long term self-sustainable vegetative cover and assurance of greening in all seasons. With the introduction of this technique, the visual impact of the rock slopes or shotcrete surfaces could be greatly reduced.



Hong Kong Flower Show 2004 Departmental Exhibit

The Highways Department's display for the Hong Kong Flower Show 2004 illustrates the strong commitment of the Department in providing suitable landscape works in our projects to enhance the environment. The exhibit demonstrates the seamless integration of various landscape works in association with highway projects in different environmental settings. Examples include the provision of slope planting and wetland planting for enhancement of the appearance of slopes and to compensate for loss of wetland habitat respectively; the provision of landscape planting for screening and creation of a view corridor; and the provision of high quality streetscape in urban area for the enjoyment of the public.

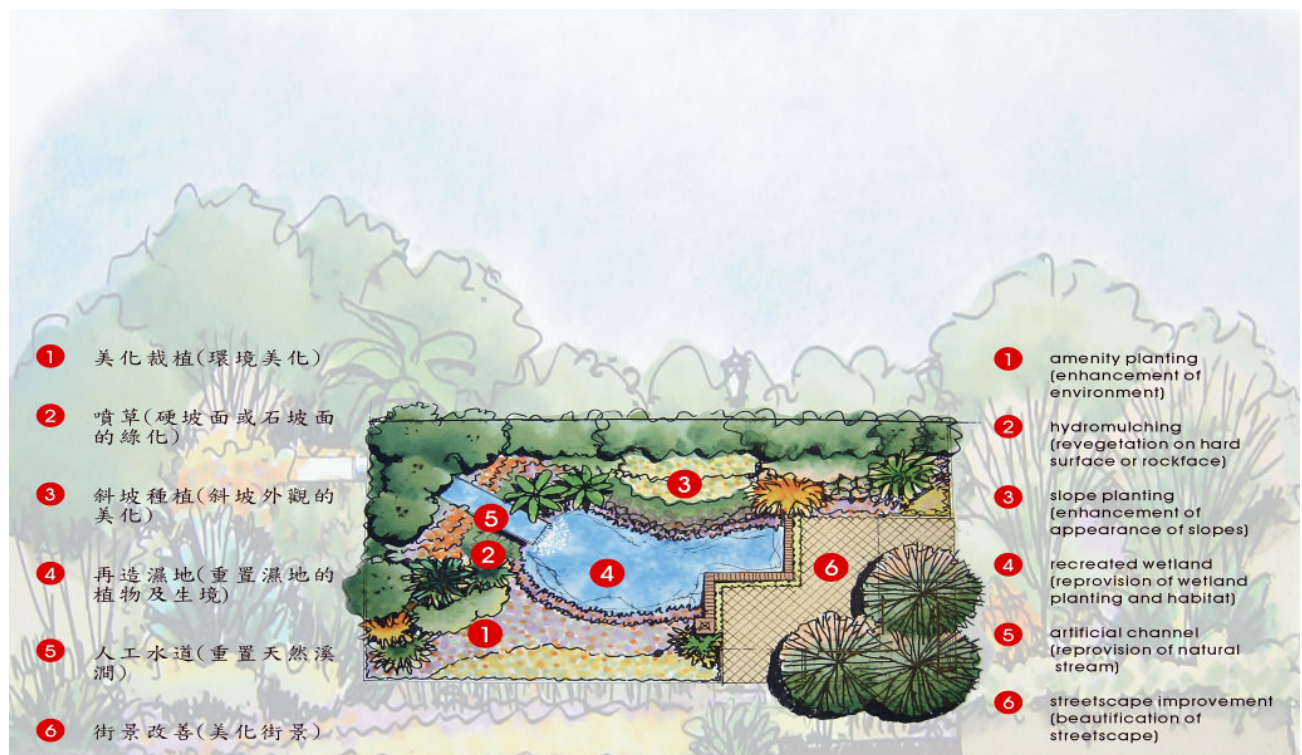


The focus of the Garden is a spectacular waterfall fed by water in an artificial channel. The water plunges into a "recreated wetland". The green backdrop with flowering mass on a man-made slope with hydro-mulching symbolizes greening works carried out on HyD's slopes.

The viewing area is a typical street with streetscape works. It is also a photo spot with pleasant walking experience.

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The Exhibit won the Award for Unique Feature under the category of Display Section (Local).

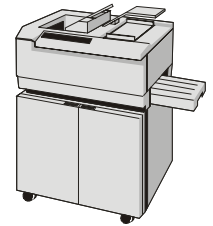
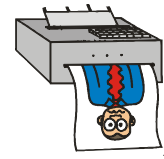


Green Office Management

The Highways Department Green Committee was first formed in 1994 to develop, implement and monitor green office practices. We adopt various green measures in housekeeping to economize the use of natural resources. In 2004, a Green Officer was appointed in every Office / Division to oversee and co-ordinate the implementation of the measures. The main features of the green measures are summarised as follows:

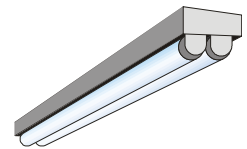
Paper Saving

- Minimize photocopying paper consumption
- Use both sides of paper for printing and photocopying
- Use blank side of used paper for drafting/photocopying for internal reference
- Use electronic means extensively for communication, including the sending of electronic files instead of hard copies
- Reuse envelopes and file covers
- Increase the use of recycle paper to 70%



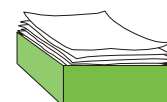
Energy Saving

- Appoint Energy Wardens in every Office / Division to monitor lighting
- Maintain air-conditioning not lower than 25.5 °C in summer
- Switch off lights during lunch or when away for long hours
- Switch off computer equipment and electric appliances not in use
- Increase the use of energy efficient fluorescent tubes for lighting
- Review lighting level arising from change of room use
- Monitor electricity consumption
- Encourage use of staircase for interfloor traffic
- Use timer water taps in toilets

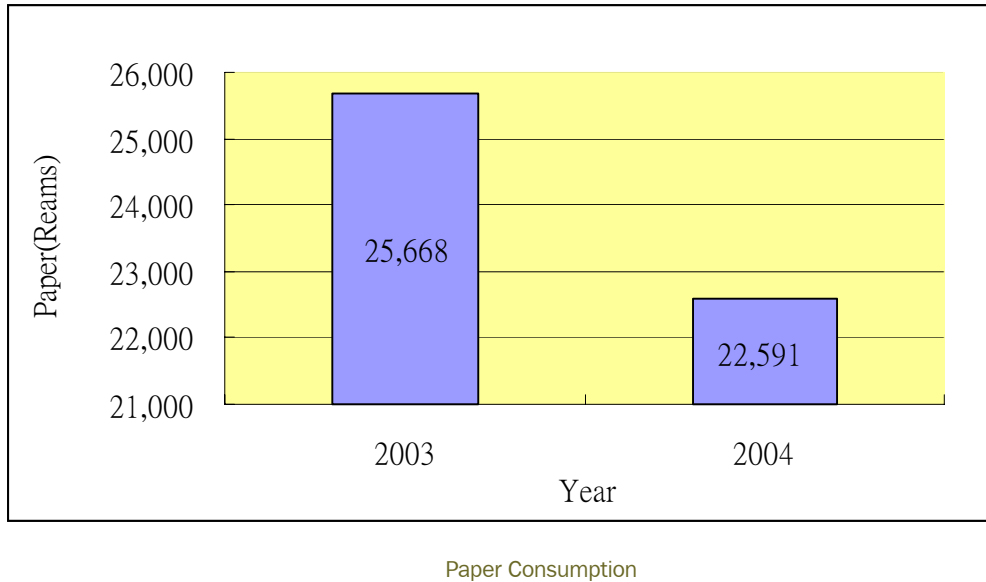


Waste collection for Recycling

- Put up green boxes to collect reusable envelopes and papers for reuse
- Collect computer printer toner and ink cartridges for refill and recycling
- Put up recycling boxes to collect paper for recycling



With the concerted efforts of our staff, the Department achieved a saving of 11.99% in paper consumption in 2004 when compared with 2003.



To maintain impetus of green measures in housekeeping, we conduct annual environmental audits in all the 14 offices located in different premises. The objectives of conducting the annual environmental audits are:

- (i) to assess compliance with the green housekeeping guidelines;
- (ii) to identify non-compliances and recommend remedial actions;
- (iii) to promote good environmental management; and
- (iv) to increase staff awareness of green management and occupational safety and health initiatives.

Achievement of environmental objectives and targets

We set clear environmental management plans with yearly objectives and targets to improve our environmental performance. We have made satisfactory progress in meeting our objectives and targets of 2004. The achievements are summarized as follows:

Objectives	Targets	Achievement
Improve Environmental Performance of term contractors	<ul style="list-style-type: none"> To incorporate additional environmental requirements in our term contracts commencing in 2004 	Additional particular specification clauses for improvement on environmental aspects were incorporated into the standard term contract document (2004 edition) for all maintenance term contracts commencing on 1.4. 2004
Use of recycled materials in road construction	<ul style="list-style-type: none"> To promulgate the use of recycled asphalt pavement in road construction 	Departmental Technical Circular on the use of recycled asphalt pavement in road construction promulgated
	<ul style="list-style-type: none"> To study the use of recycled aggregates produced from C&D waste as road sub-base 	A report on the trial use of recycled aggregates produced from C&D waste as road sub-base issued
Save energy consumption	<ul style="list-style-type: none"> To maintain the room temperature of offices at an average not lower than 24°C during office hours in summer 	No report on room temperature of offices in the government offices building deviating from the target received
	<ul style="list-style-type: none"> To increase the office area having energy saving fluorescent tubes installed from 20% in 2003 to 25% in 2004 	34.1% of the office area of the department was installed with energy saving fluorescent tubes
	<ul style="list-style-type: none"> To explore further electricity consumption reduction measures in public lighting and Public Transport Interchanges (further annual saving of 700,000 kWh) 	Further annual saving of 700,000 kWh in electricity consumption was achieved



Objectives	Targets	Achievement
Save photocopying paper consumption in the Department	<ul style="list-style-type: none"> To reduce the consumption of photocopying paper by 1% in 2004 comparing with that in 2003 	Consumption of photocopying paper in 2004 was reduced by 11.99% when compared with that in 2003
Waste reduction	<ul style="list-style-type: none"> To incorporate additional environmental requirements into specifications of the capital works contracts 	Three new particular specification clauses in respect of waste reduction were drafted for incorporation into the capital works contracts



Looking Ahead

With the encouraging results achieved in 2004, we look forward to further research initiatives and greening measures in the protection of the environment.

We aim at achieving the following environmental objectives and targets set for 2005:

Objectives	Targets
Continuous replacement of obsolete lanterns with a view to saving energy	<ul style="list-style-type: none"> To replace 1,300 obsolete lanterns by modern lanterns of lower lamp wattage
Continuous replacement of electromagnetic ballasts with a view to saving energy	<ul style="list-style-type: none"> To replace 9,000 electromagnetic ballasts by electronic ballasts at footbridges and subways
Increase recycled paper consumption in the Department	<ul style="list-style-type: none"> To increase the consumption rate of recycled paper from 58% in 2004 to 70% in 2005
Incorporation of Reclaimed Asphalt Pavement (RAP) in producing wearing course and base course materials	<ul style="list-style-type: none"> In collaboration with a local tertiary institute, complete the evaluation of using RAP in the wearing course and base course materials with a view to increasing the usage of RAP
Waste reduction	<ul style="list-style-type: none"> To incorporate additional environmental requirements into Specifications of the capital works contracts in 2005

We will make every endeavour to achieve these targets to make Hong Kong a better place for our children. If you have any comments or suggestions on our work, please send us your views through our homepage on the Internet (address: <http://www.hyd.gov.hk>). We welcome your valuable feedback.