

# The construction of the MTR West Island Line, Hong Kong highlight on the design, construction and environmental features that meet Sustainability & Urban Habitat concerns

Presented by  
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On “Challenges Of Global Mega Projects  
- Sustainability & Human Habitat For Project Excellence

## Background

For the over 200,000 population working and living in the Western District of Hong Kong, only buses and mini-buses are served as means of public transport. It is particularly inconvenient for commuters who are suffering from the frequent traffic jam during peak hours. As a result, residents of the Western District, members of the Central & Western District Council and the Legislative Council have urged strongly for the construction of the West Island Line.

In response to this, the Government decided to proceed with detailed planning and preparations for the West Island Line in June 2005. The MTR Corporation submitted an updated proposal for the West Island Line to the Government in August 2006, setting out the detailed scope, cost and implementation program for the project for government's review.

After a detail study of the scheme as well as conducting a number of consultation to incorporate public views, in October 2007, the Government invited MTRC to proceed with further planning and detailed design of the West Island Line.

In May 2009, the Executive Council endorsed the funding arrangement of the MTR West Island Line (WIL) Project. With that endorsement, funding approval was obtained from the Legislative Council on 3 July 2009 which signified the official commencement of this US\$2 billion project.

## Highlights of the West Island Line Projects:

### Design features

The 3.5km track for the mass transit railway is running underground with 3 buried stations.

The alignment will merge into the existing 15km-Island Line with further provision for future extension to the 12km-South Island Line.

Along the alignment of the line it covers a population of 0.2 million. In order to improve the public flow, a series of pedestrian subway system with an escalator network will be provided especially for users on elevated uphill levels.

In order to acquire very limited land for station entrances and other operation accesses, a number of existing public facilities are to be relocated (including a swimming pool and a community centre). New facilities will be constructed at the same time to replace such existing services before their removal.

## Highlights of the West Island Line Projects:

### Application of green and state-of-the-art technology

No reclamation work is required in the design (In Hong Kong reclamation is concerned jeopardizing natural environment)

Tunneling method employs traditional drill-and-blast process with stringent monitoring control including the use of environment assessment and case-by-case work permit system, 24-hour monitoring on emission of waste water, noise and dust etc.

Similar principle also applies to ensure no nuisance cause to general public that may be living within 20m away from the work site.

Most of the stations are constructed using rock cavern technology within solid rock. This is a highly challenging engineering work especially when the size of the cavern is gigantic (station volume approx. 240m x 80m x 20m)

## Highlights of the West Island Line Projects:

### Sustainable and user-friendly inputs for human habitat.

Very detail environment impact assessment (EIA) is conducted, followed by a detail consultation and reviewing process before approval can be issued for the design and construction of all works.

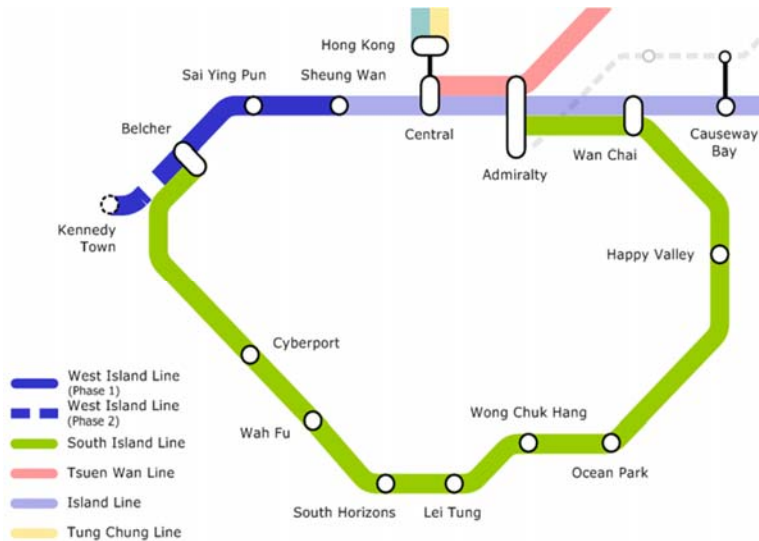
All measures as proposed in the EIA are required to set up for inspection before the issue of work permit.

Continual monitoring by site team and independent checker is required throughout the entire construction period.

Waste disposal measures especially to dispose more than 5 million cubic meter of excavated materials is to be handled in a safe, efficient and non-contaminated manner.

Feedback from general public, liaison groups, local residence or district council representatives forming part of the monitoring structures to ensure no unacceptable disturbance is generated at any time.

The project also involves the preservation of a few heritage buildings for the Island West projects is located within the historic district of Hong Kong the development of which can be dated back to mid 19th Century.



The original scheme alignment as proposed in Railway Development Strategy 2000, released in 1996.

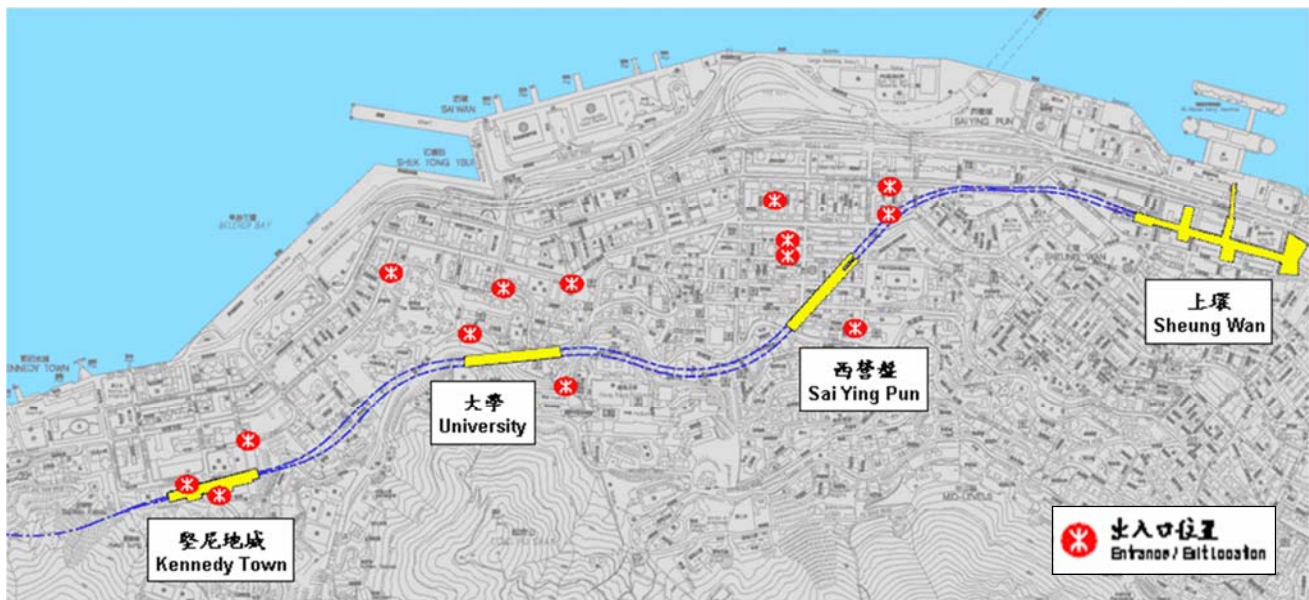
The present status is that:

West Island Line is under a schedule of construction from 2009 to 2014

South Island Line will be construction from 2011 to 2016

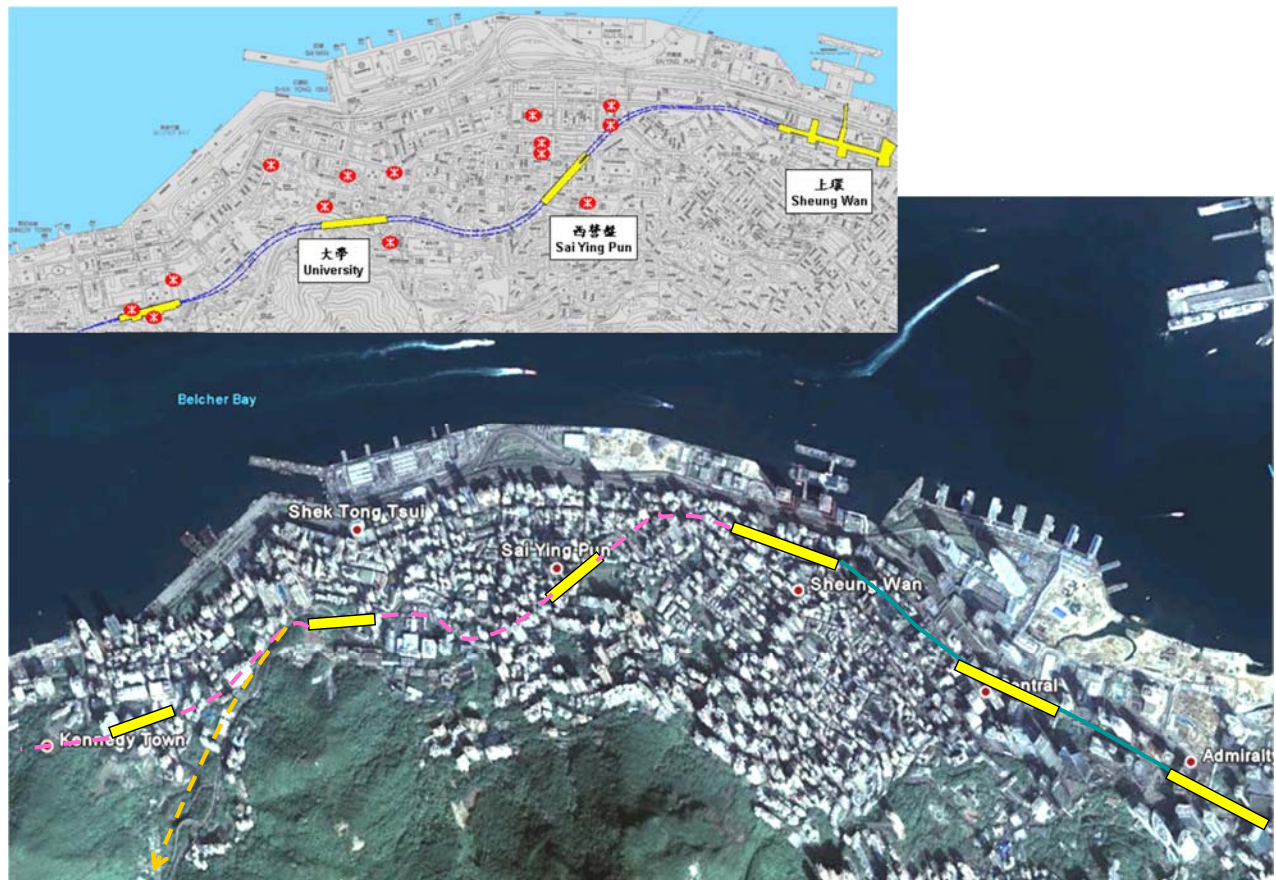
## Design features of the West Island Line

The 3.4 km double-track mass transit railway is running underground with 3 buried stations. Namely the Sai Ying Pun, University and Kennedy Town Stations. The line will be merging into the Sheung Wan Station of the Island Line when completed. The University Station will have extension provision for the future South Island Line. Kennedy Town Station will have a track over-run as well as for possible future extension.









## The Western District of Hong Kong from satellite map



West Island Line runs across the densely populated areas of Western District on the Hong Kong Island. It is so designed that over 90% of the residents can access to the new railway stations on foot when the line being completed.



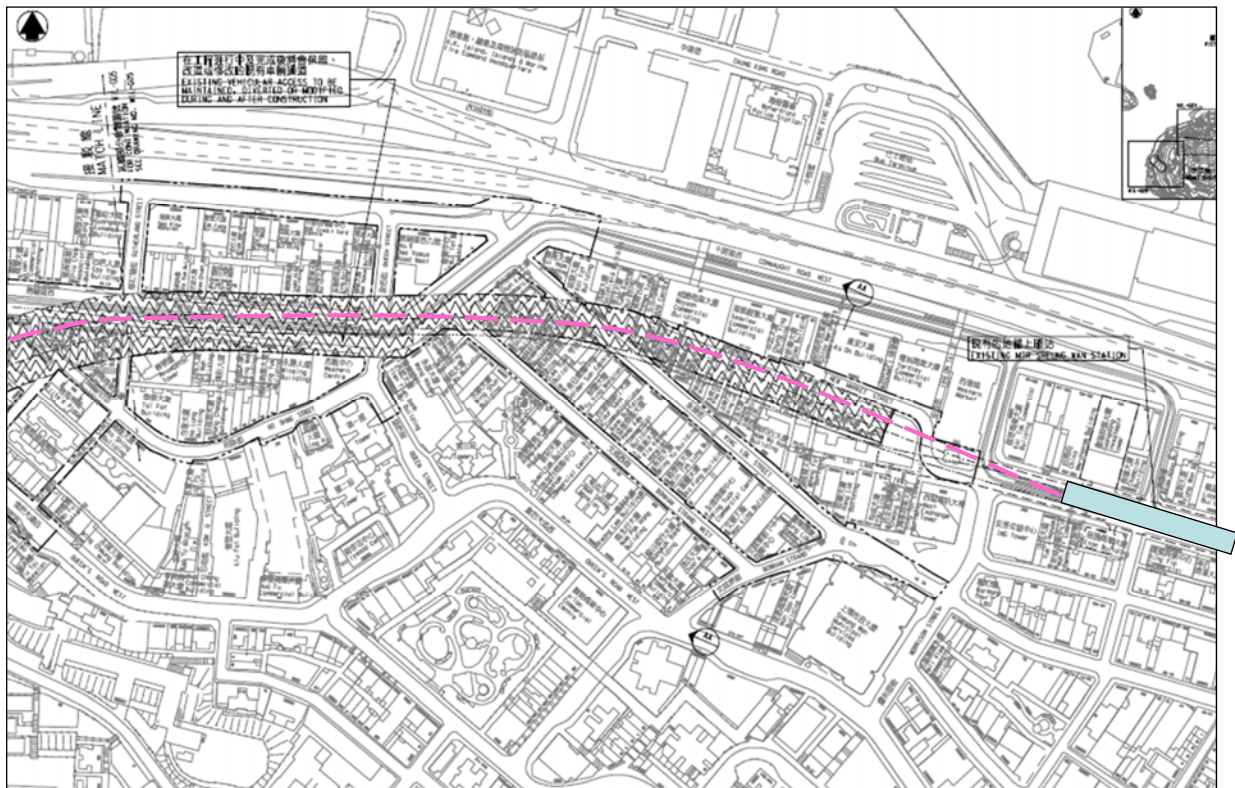
-  Future connection of the South Island Line (at the rear of Victoria Peak)
-  Existing Island Line
-  The approximate alignment of the West Island Line
-  The approximate location of the underground stations (from left to right, the connecting station, Sai Ying Pun, University and Kennedy Town stations)



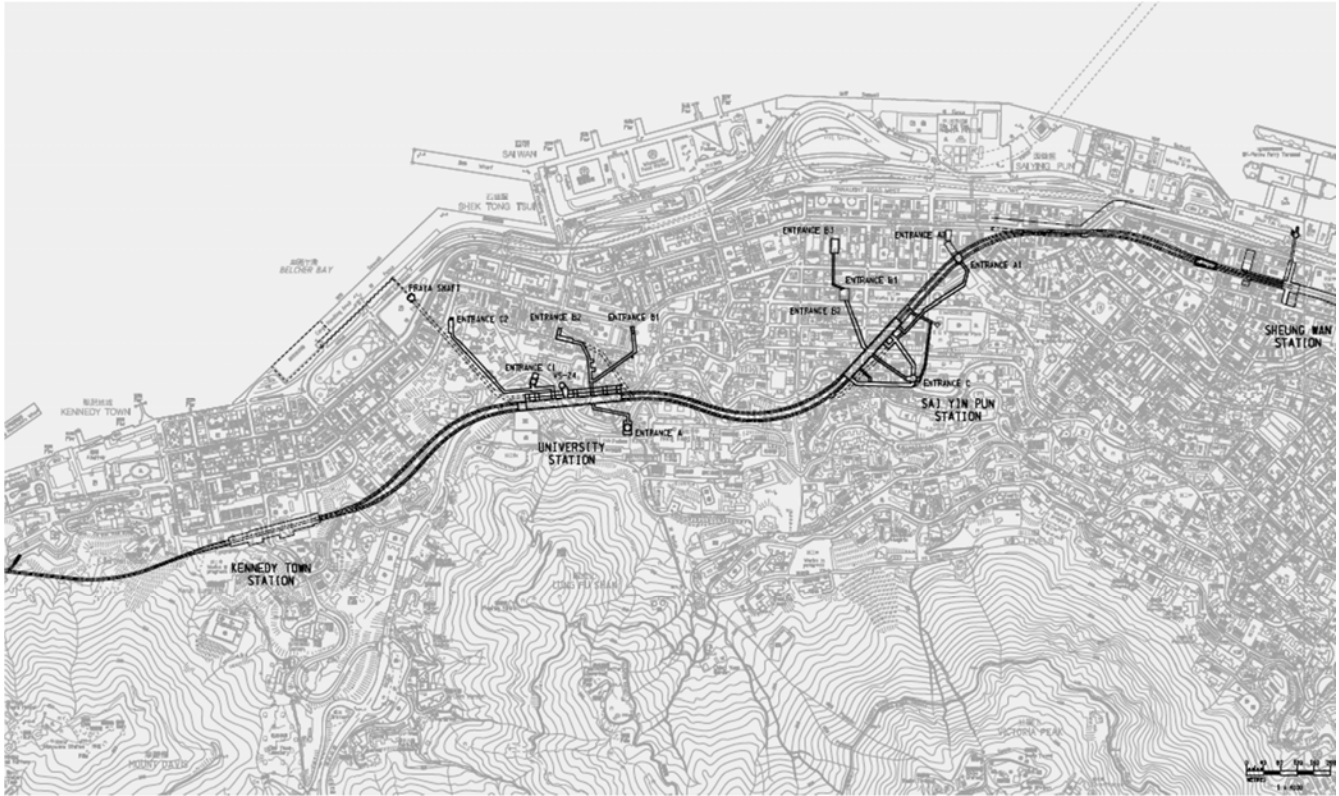


Typical urban environment where the West Island Line cutting through

Design features of the West Island Line - The alignment will merge into the existing 15km-Island Line from Sheung Wan Station. Provision for future extension to the 12km-South Island Line is also provided at the University Station.

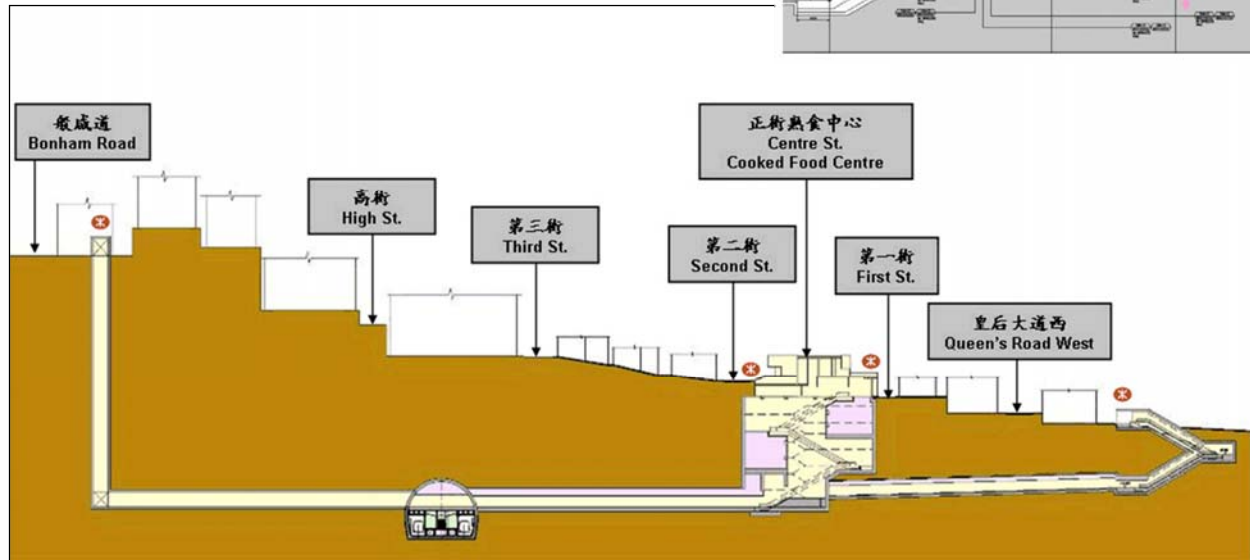
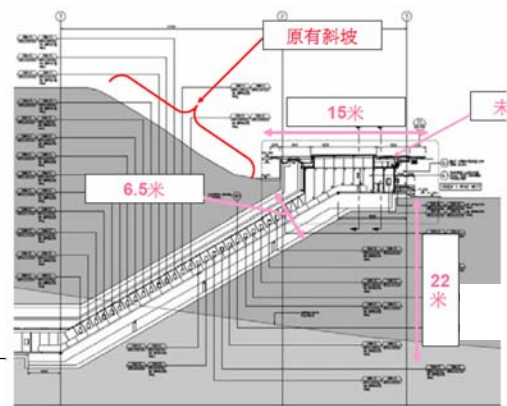


Layout showing the pedestrian access subway linking to each underground station.

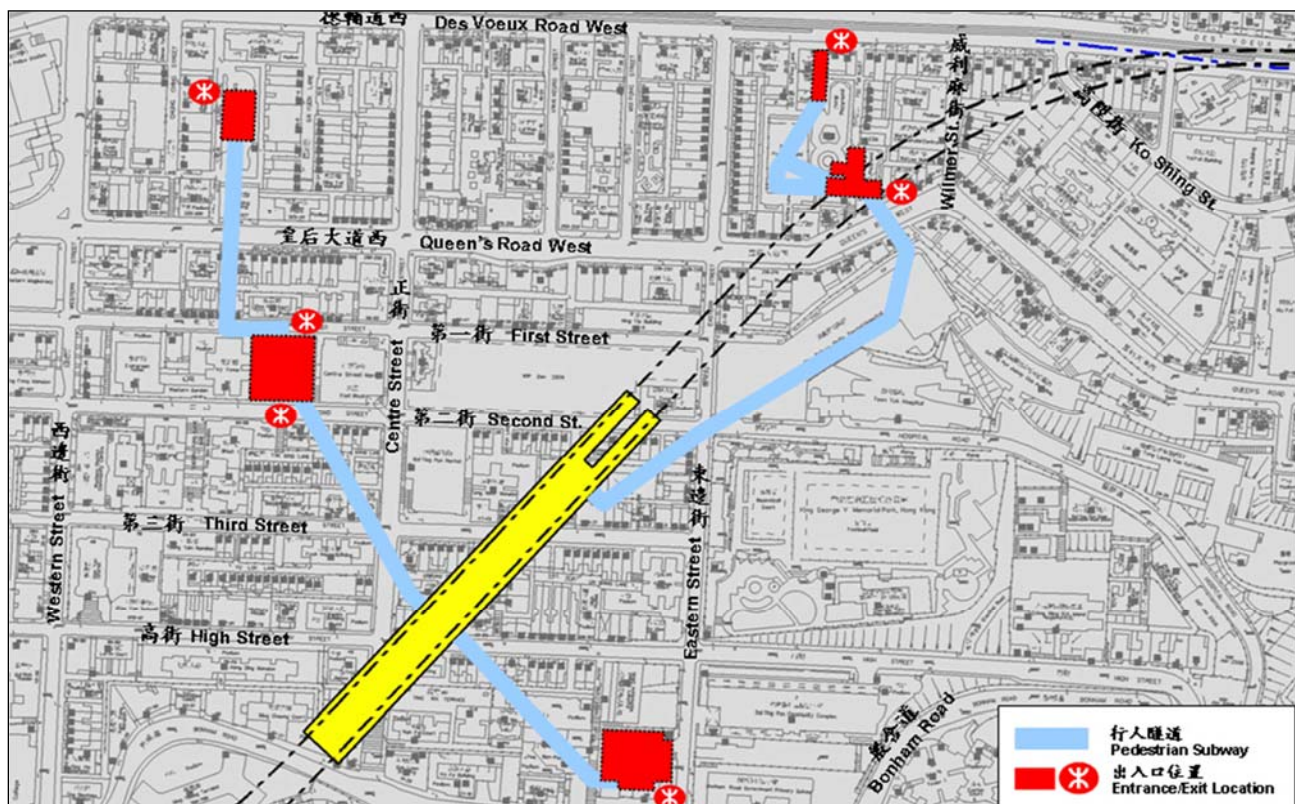




Sections showing the complicated layout of the underground station constructed in the form of a rock cavern and its pedestrian access system

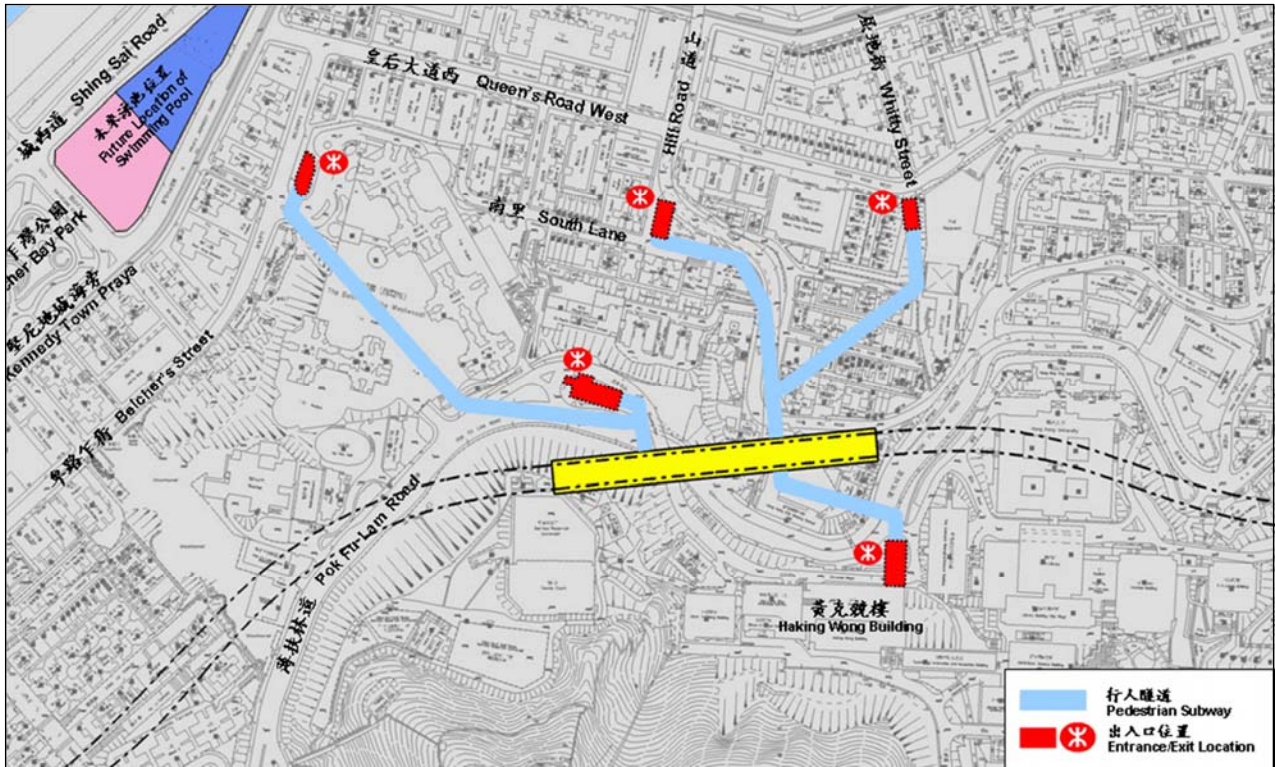


Pedestrian subway system leading from the underground station concourse up to the street level for the Sai Ying Pun Station

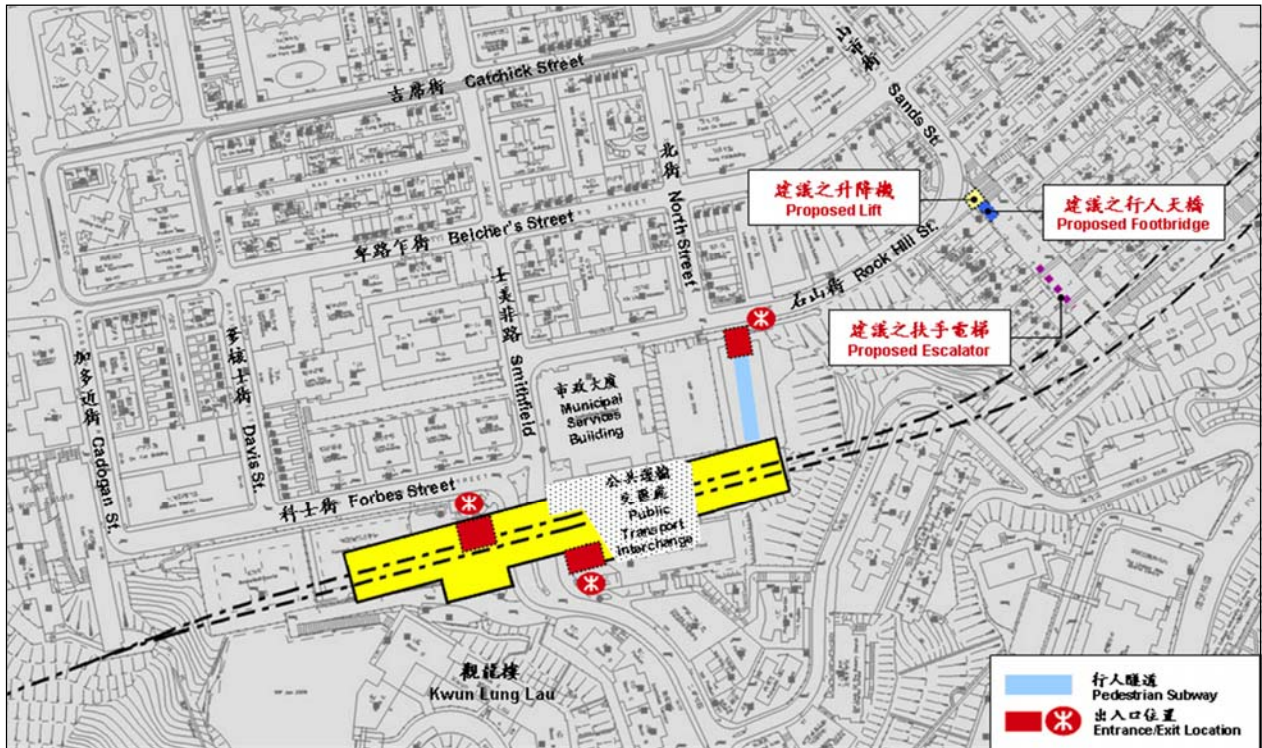




Pedestrian subway system leading from the underground station concourse up to the street level for the University Station



Pedestrian subway system leading from the underground station concourse up to the street level for the Kennedy Town Station







Alignment of track from University Station to Kennedy Town Station

## Construction of the Kennedy Town Station

The Kennedy Town Station will have two levels with a length of 240 meters and to be constructed using cut-and-cover method. The lower level will be the rail platform and the upper level as the station concourse.





Further close-up of the Kennedy Town Station layout

Station located below the open space previously used as playground and swimming pool



The playground and swimming pool as seen in 2008 before their removal for the construction of the Kennedy Town Station







↙ Tunnel coming from University Station



Swimming pool being removed and handed over for construction works in early 2011





Previous playground becomes the work site using semi open-cut method to construct the underground station. The working ground is only a deck platform supported by temporary post to maximize disturbance to the neighborhood as well as serving as a work platform

Temporary platform deck



View of the working deck with the access opening and the excavation works underneath in progress





Congested urban environment in close proximity of the working site



Overview of the station portion on the previous swimming pool site



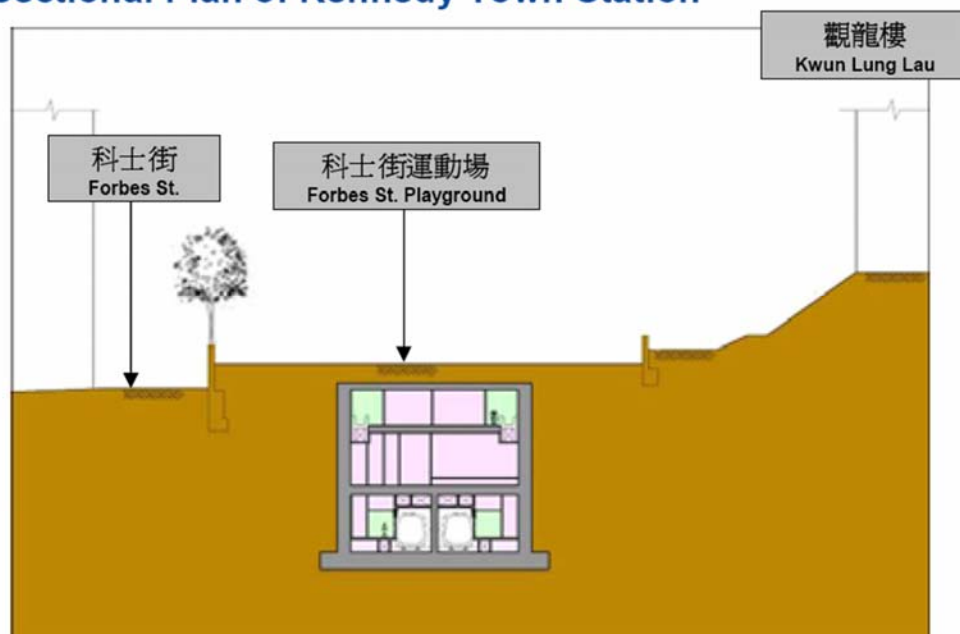




Physical constraints of the site includes a significant amount of slope stabilization before the carrying out of work in full scale.

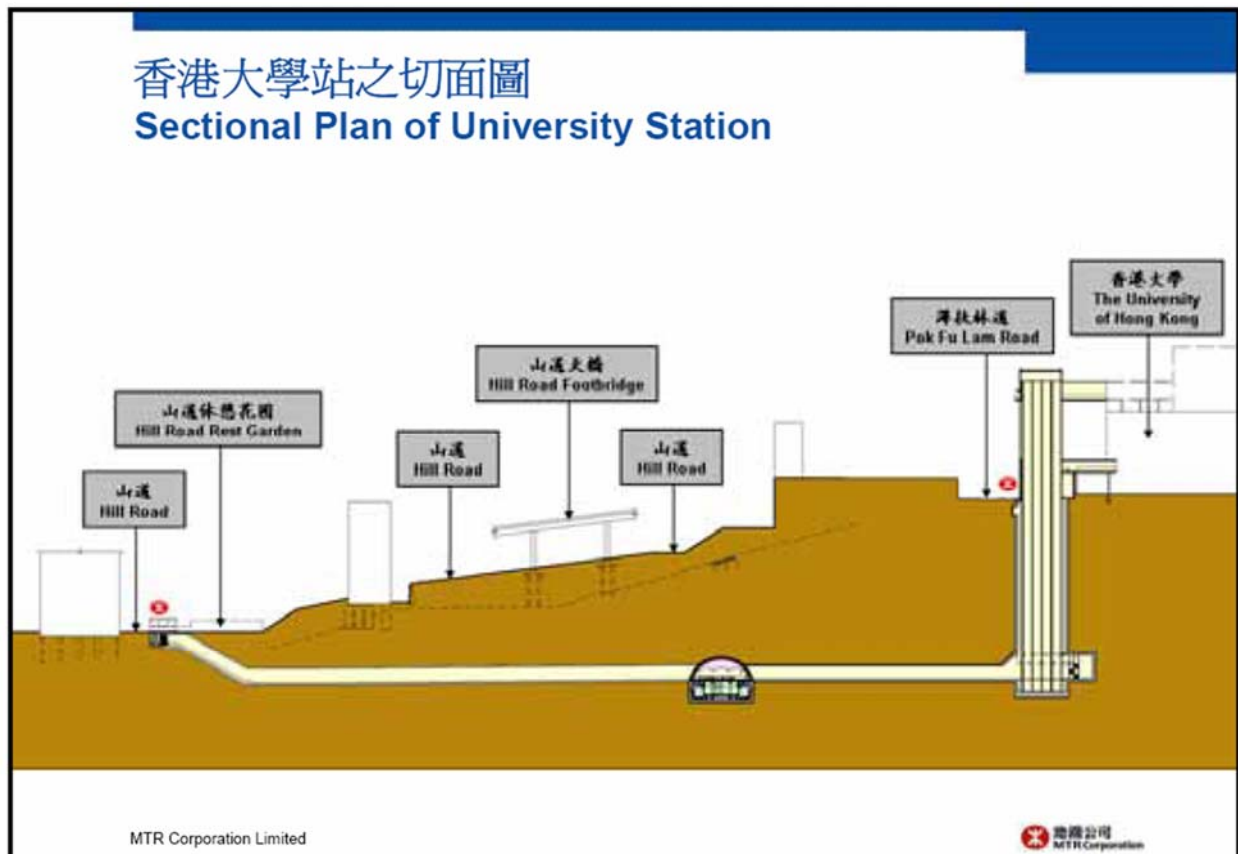
## 堅尼地城站之切面圖

## Sectional Plan of Kennedy Town Station



## Construction of the University Station

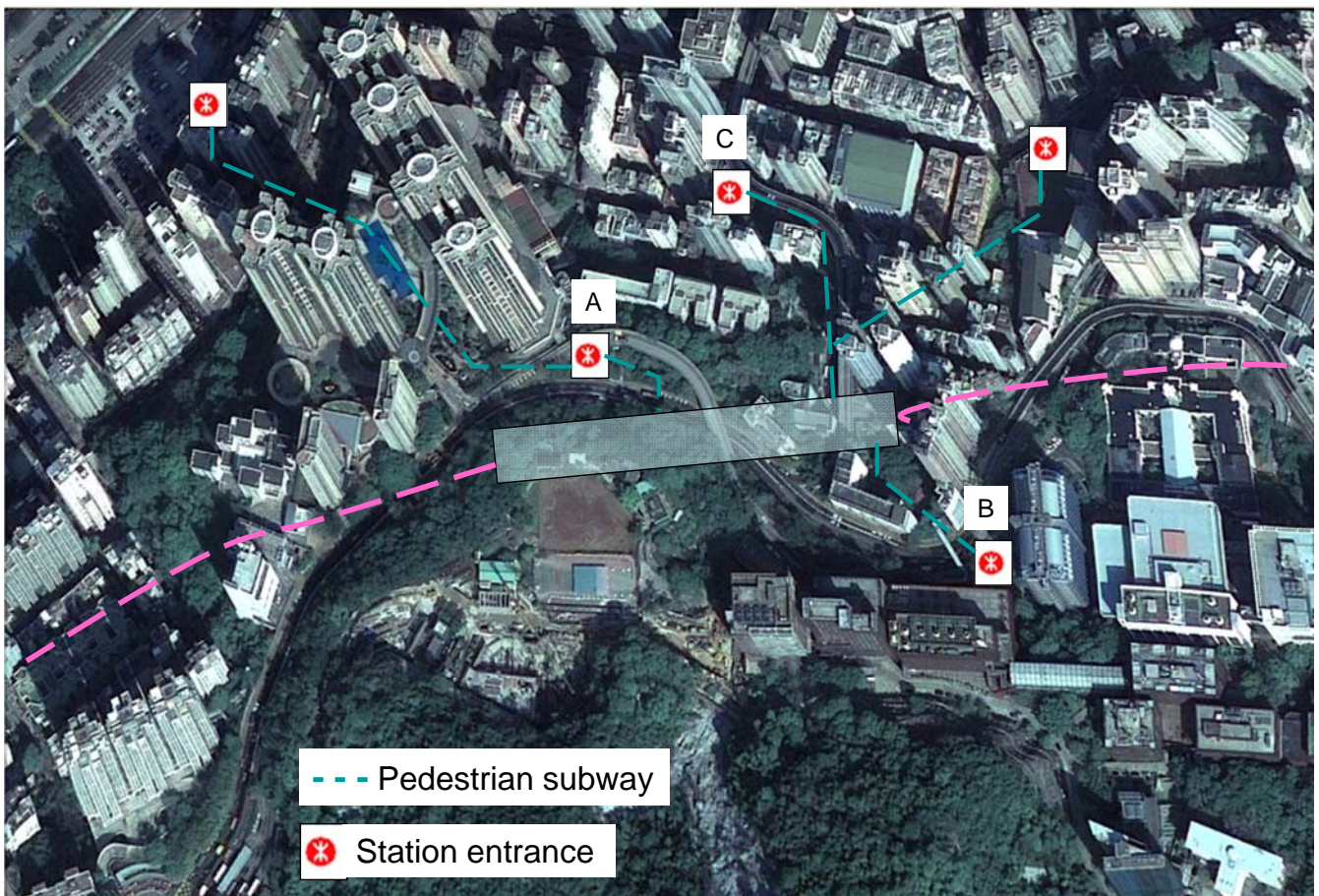
Both the University Station and Sai Ying Pun Station are 22 meters in span, 20 meters high and up to 240 meters long constructed using drill-and-blast in benches approach finally forming a gigantic underground rock cavern.







Alignment of track from University Station to Kennedy Town Station

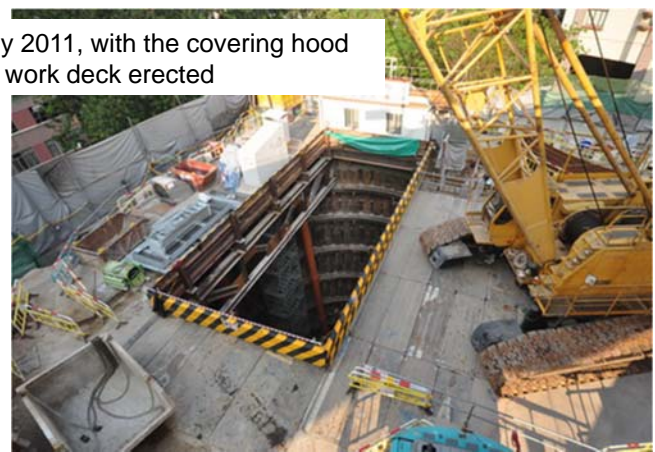






End 2010

Early 2011, with the covering hood and work deck erected



Forming an vertical shaft for the station entrance at entrance A



Semi-underground storm water discharge to be diverted to allow for the placing of the pedestrian subway (near entrance B)







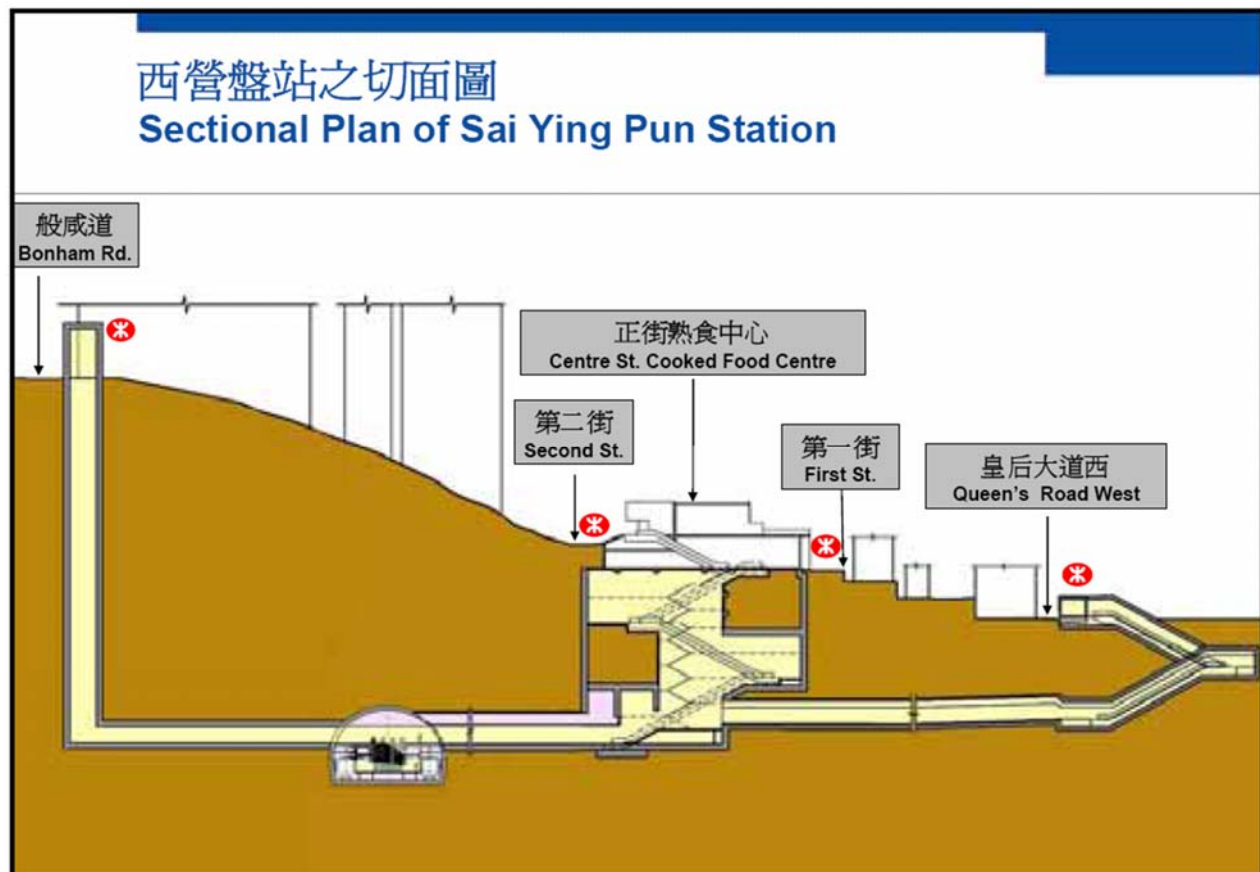
Forming an vertical shaft for the station entrance at entrance C.

Extremely challenging work environment at spot can be seen.

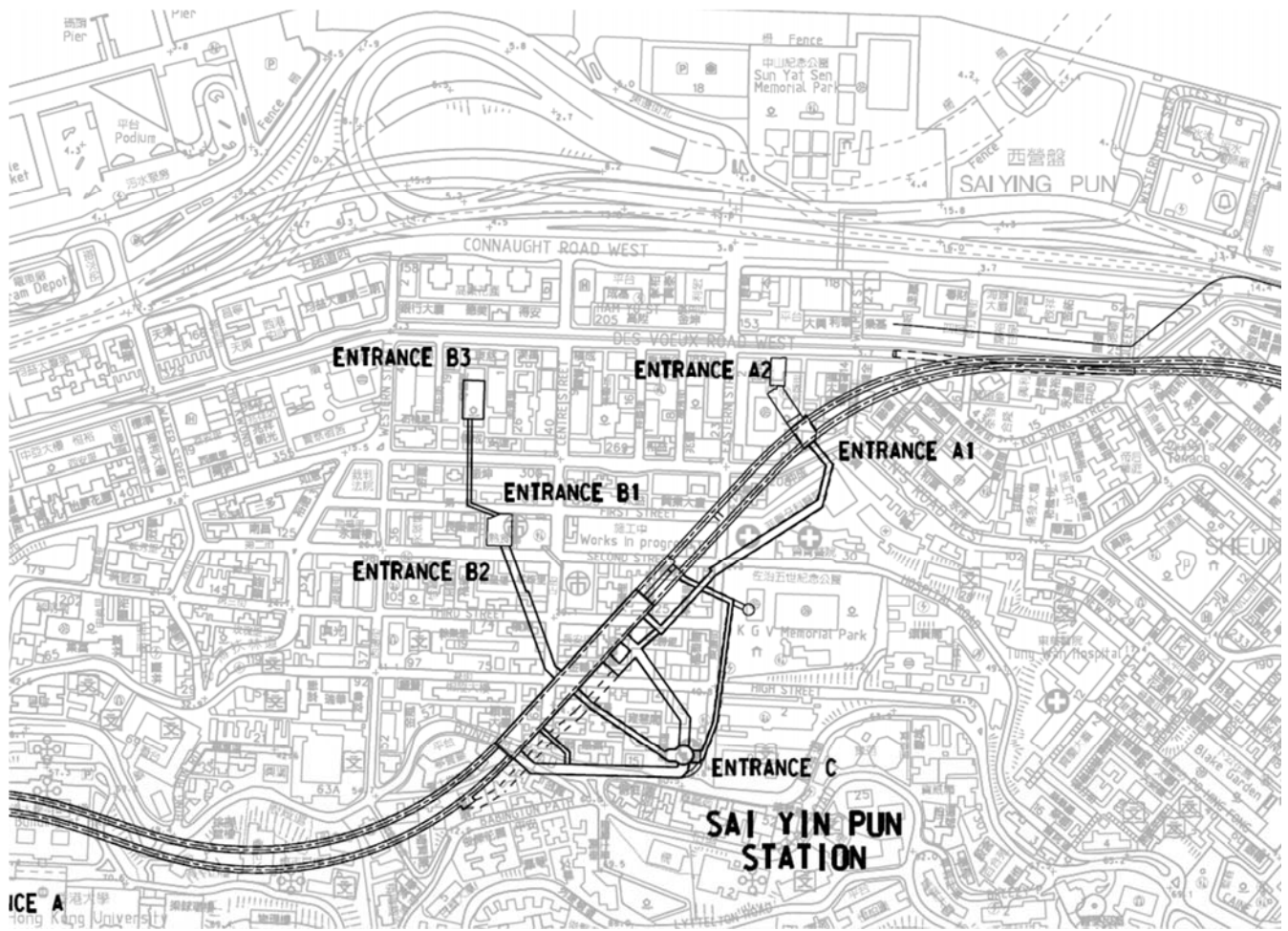


Forming an vertical shaft for the station entrance at entrance C.  
A covering deck has been erected to minimize public disturbance.

## Construction of the Sai Ying Pun Station







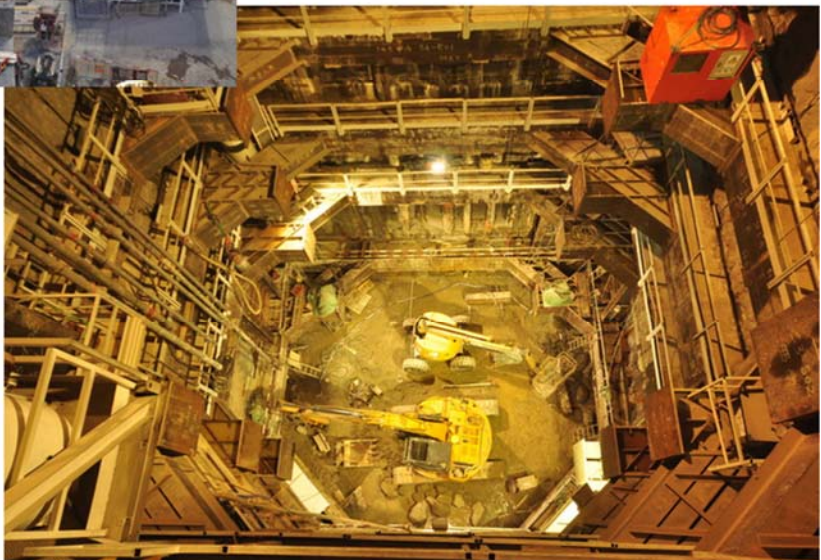




Forming an vertical shaft for the station entrance at entrance A. This vacated open area also forms an service access for the launching of a tunnel boring machine.



Closer view of the access shaft.







Other vacated spaces at Entrance B and C preparing for the forming of the vertical shaft

## Tunneling work

The tunnel tube for the West Island Line is formed using 2 different methods. Most of the line is within solid rock stratum.

The tunnel between SYP and SW Station is constructed using Tunnel Boring Machine (TBM).

The tunnel between SYP to Kennedy Town Station, tunnel tube is formed using drill-and-blast method. This method is suitable for excavating hard rocks and can shorten construction time. It allows the contractor to construct 24-hours a day at multiple ends concurrently.

The entire run of the tunnel is in a parallel twin-tube configuration with safety access linking in between as emergency route at approximate 300m interval.



General setting-up of the tunnel access shaft

Tunnel tube formed by drill-and-blast before the forming of tunnel lining

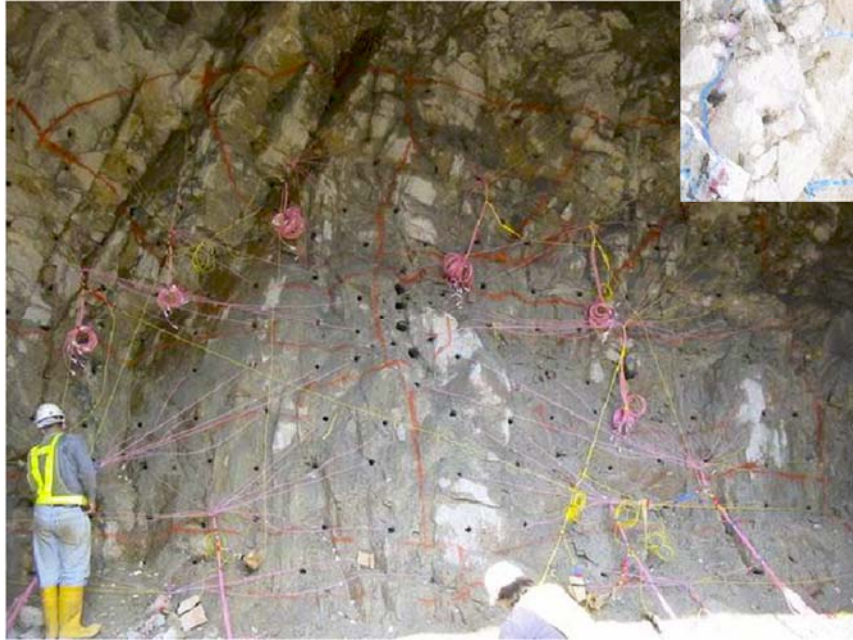


Drilling of holes for inserting emulsion explosive before blasting





Placing explosive into the blast hole



Excavating, Scaling and removing of the blasted section at tunnel end







Other safety and environmental provisions inside the tunnel at work, which include the temporary ventilation duct, blast protection gate, dust filter and service pipework etc.



Typical views inside a work shaft

## Construction of the tunnel using Tunnel Boring Machine (TBM)

TBM is suitable to be used in soft ground. The TBM produces less vibration, noise and pollution than Drill and Blast or Cut and Cover approach, and brings less impact to nearby buildings and disturbance to the residents. It will be used mainly to excavate mixed and soft ground in the project. Besides, some shafts and tunnels are located very deeply underground and TBM can effectively withstand the extremely high water pressure of such areas. In addition, the use of TBM can also obviate the complicated land resumption procedures and avoid clearance and demolition works along the area.



Similar service shaft for the erection and launching of the tunnel boring machine (Kowloon Southern Link project in 2006)

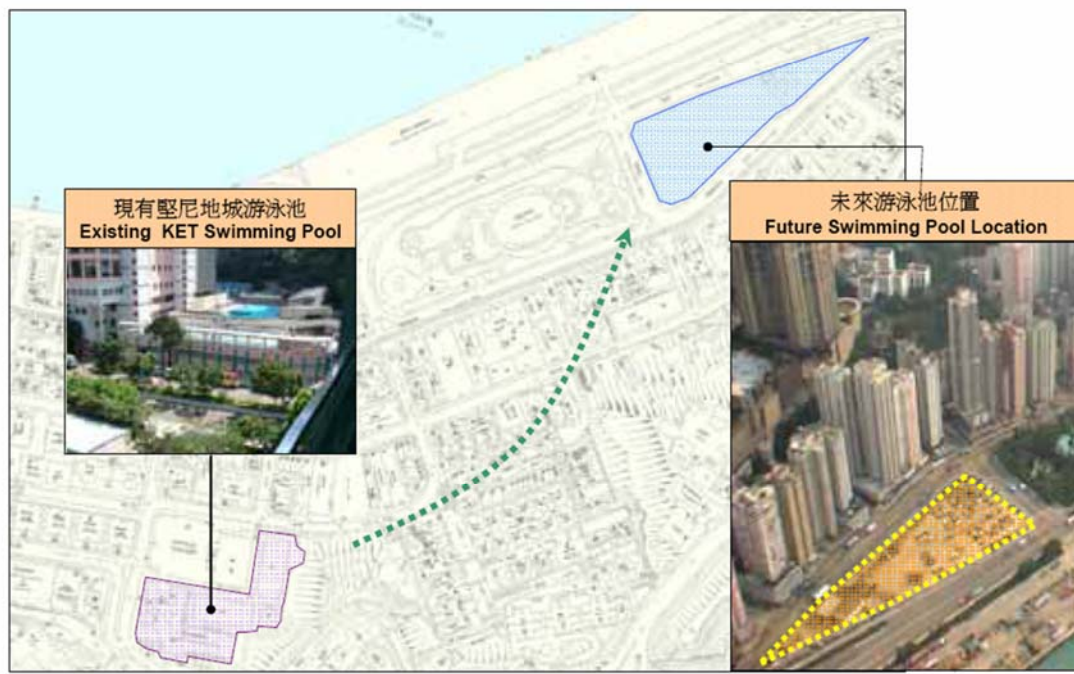




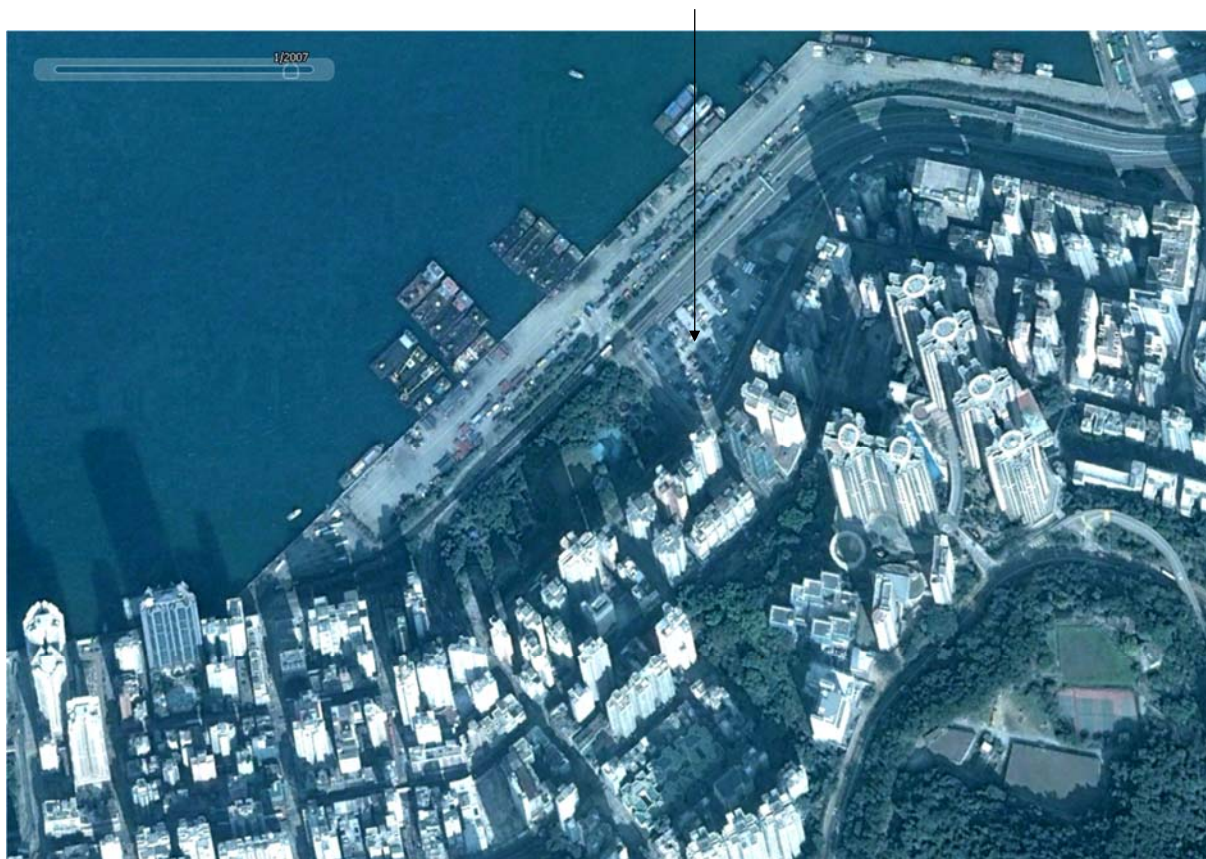
In order to acquire very limited land for station entrances and other operation accesses, a number of existing public facilities are to be relocated. These facilities included a numbers of public playground, rest-gardens and green parks. Besides, there is a swimming pool and a rehabilitation centre are also required to relocate to give way for the construction of the station and access shaft respectively. New facilities will be constructed at the same time to replace such existing services before their removal.



## 重置堅尼地城游泳池 Re-provisioning of KET Swimming Pool



Previous lorry parking area to be used as the new site for the swimming pool





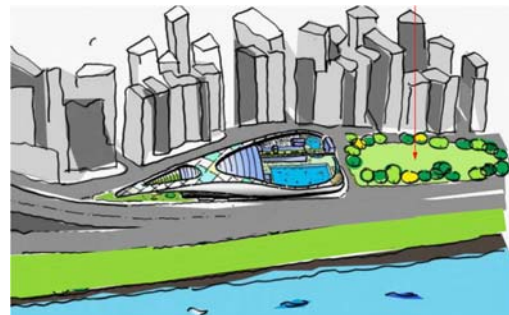


Construction of a new swimming pool to replace the existing one at the new Kennedy Town Station site.

Previous lorry parking area to be used as the new site for the swimming pool



New swimming pool completed for operation in early 2011. Upon the changing over, the one in Kennedy Town started the demolition.





Previous David Trench Rehabilitation Centre at Bonham Road to be re-provisioned using the ex upper-level police Station at High Street





The ex upper-level police Station at High Street as viewed before the commencement of conversion work in late 2009.



Site formation and slope stabilization work for the ex-Upper Level Police Station at High Street



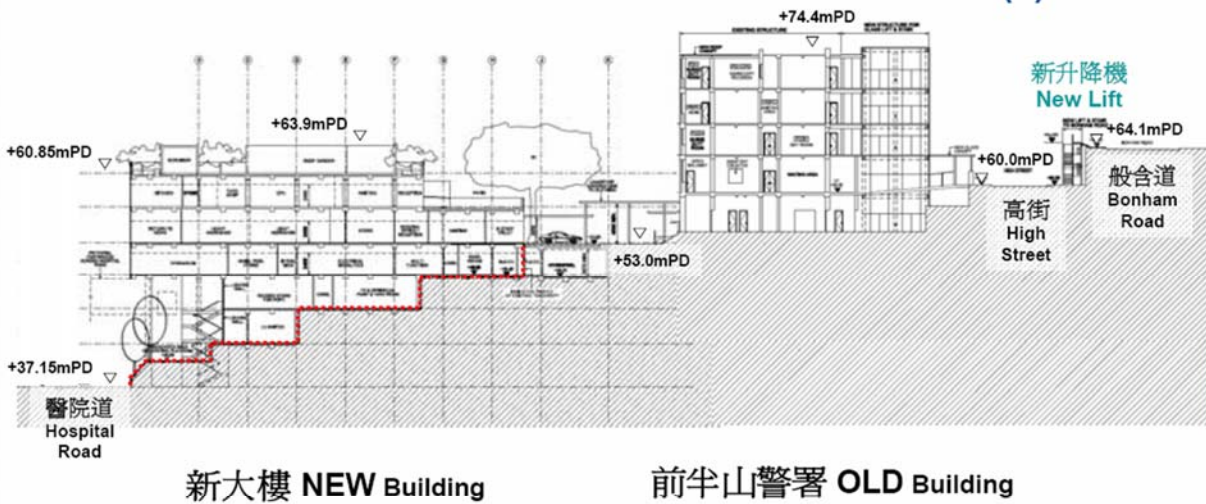


Conversion work for the ex-Upper Level Police Station at High Street





## 重置戴麟趾康復中心 (2) Relocation of David Trench Rehabilitation Centre (2)



In order to minimize disturbance to local traffic, temporary barging points are set up at the previous incinerator site and Western District Public Cargo Works Areas for the removal of excavated spoil by sea. Covered conveyor belts are temporary erected to carry the excavated materials directly from the tunnel drilling/excavation points for disposal.







Covered conveyor

Western District Public Cargo Works Area served as a spoil disposal point during the work period



the majority of the construction waste will be removed through a fully enclosed conveyor belt to barges for further disposal at appropriate areas. This is to prevent loud noise when dumping waste. And minimize the number of trucks on the busy narrow streets around the construction sites







Facilities and set-up for the spoil disposal arrangement

Examples showing the complexity of the West Island Line Projects



Large areas of work locations involving complicated slope cutting and stabilization works



## Examples showing the complexity of the West Island Line Projects

The approx.  
alignment of track



Large areas of work locations  
involving complicated slope  
cutting and stabilization works

Locations in close proximity of the  
work areas where land-slide  
occurred shortly before the  
commencement of the WIL projects



堅尼地城警察宿舍附近斜坡鞏固工程





## Examples showing the complexity of the West Island Line Projects



Difficult location for the forming of pedestrian access point



Access to be provided from underground pedestrian subway leading to elevated location (HK University access)

## Examples showing the complexity of the West Island Line Projects

The cut-opening is formed and covered with a noise and dust hood to minimize public disturbance

The same site viewed from rooftop nearby



Work site for one of the station entrance access situated in extremely congested urban corner.



Work access covered with a noise and dust hood



## The management and consultation system for the West Island Line projects

### **Chairman**

Deputy Secretary for Development (Works)1

### **Membership**

*Representatives at D1/D2 level from :*

Development Bureau (Planning and Lands Branch)  
Agriculture, Fisheries and Conservation Department  
Architectural Services Department  
Civil Engineering and Development Department  
Drainage Services Department  
Highways Department  
Home Affairs Department  
Lands Department  
Leisure and Cultural Services Department  
Planning Department  
Transport Department  
Water Supplies Department  
Plus a Senior Landscape Architect from CEDD (ad hoc)  
Plus a Senior Landscape Architect from HyD (ad hoc)

### **Ad hoc members**

Buildings Department  
Housing Department

### **Non-Official Members**

Senior Manager, Flora Conservation Department, Kadoorie Farm and Botanic Garden  
Landscaping Manager of Ocean Park Corporation  
Corporate Environmental Manager of Airport Authority  
Director of Team 73 Hong Kong  
Director of Conservancy Association  
Chairman of Green Fun  
Program Director, Moral Education Concern Group  
Chair Professor of Geography, University of Hong Kong

### **Representatives from Professional Institutes**

Hong Kong Institute of Architect  
Association of Landscape Consultants  
Institute of Horticulture (Hong Kong)

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Regular meetings and public forum held between various Liaison groups



Community Centre set up in convenient location for public enquiry and coordination (the photo is a similar facility for the Central-Wanchai Bypass projects)

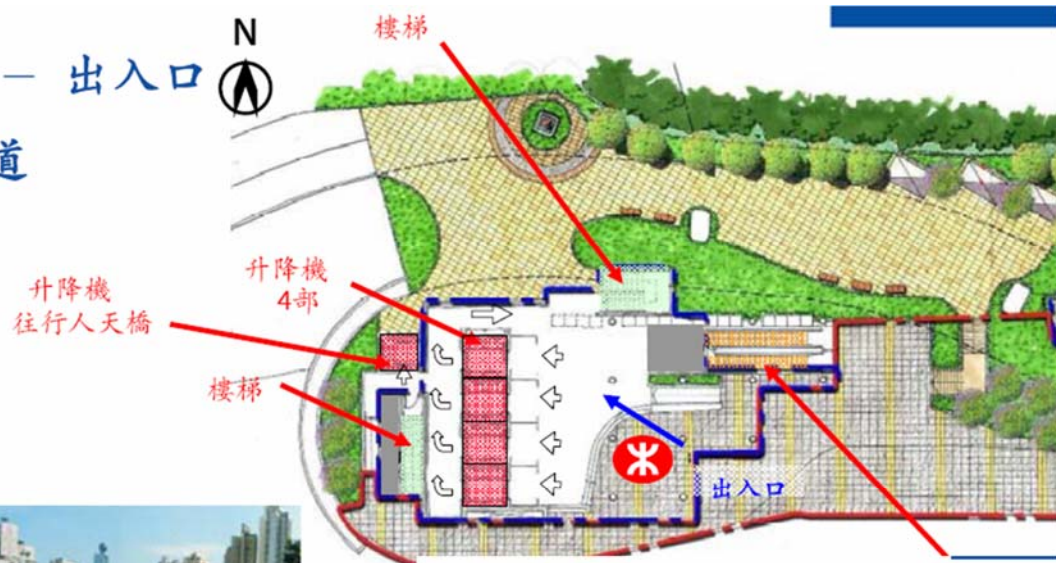
Green plan to re-instate the communal environment after the completion of the West Island Line projects



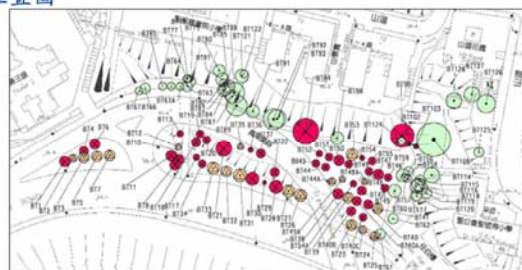
# 大學站 — 出入口 山道休憩公園 — 重置方案



## 大學站 — 出入口 薄扶林道



樹木位置圖



圖例

	建議移植的樹木	20 棵
	建議砍伐的樹木	41 棵
	建議保留的樹木	43 棵

(另發現3棵已枯死的樹木)



## 堅尼地城士美菲路休憩區方案

杜鵑徑



紅杜鵑 *Rhododendron simsii Planch.*  
開花時節：二月至三月



杜鵑徑將動態區與靜態區連結



沿途展示所種植本土灌木的資料  
例如品種描述、種植小貼士、及  
花朵形態



Areas will be re-instate and upgraded to provide a high-quality environment with enhanced public facilities and green space (similar experiences are common in MTRC projects such as for the West Rail, Tseung Kwan O Line and Ma On Shan Line)





Similar upgrading scheme will also applies to other disturbed areas such as the site for the ex-Abattoir and Incinerator facilities



Preserving of old tree in historic retaining structure



West Island Line will create value in monetary and non-monetary terms, to society and the Government. The benefits include:

Time savings in travelling generated by a fast and reliable railway service;

Environmental benefits (air & noise) brought about by a reduction in road traffic;

Renewal of older districts with poor quality buildings;

New employment opportunities from potential new tourism and commercial developments;

Increase in value of properties along the railway corridor.

The project is targeted to be completed for operation in late 2014. At the present moment it is about 30% being completed for the civil works.

This presentation thus only serves as an highlight so that a world-class project with the input of a highly professional team in Hong Kong's construction sector can be further show-cased to international community.

If further information about this project or other large-scale buildings and infrastructure development of Hong Kong is required, please visit the homepage of Raymond Wong using the following links:

<http://personal.cityu.edu.hk/~bswmwong/pl.html>

<http://personal.cityu.edu.hk/~bswmwong/contents/studies.html>

Thank you.