

Document	Rev.	Date	Remarks
N1641H-REP-DESG-007	A01	18.12.2013	FOURTH REVISION
N1641H-REP-DESG-007	A02	20.02.2014	FIFTH REVISION
N1641H-REP-DESG-007	A03	20.03.2014	SIXTH REVISION
N1641H-REP-DESG-007	A0 4	28.04.2014	FINAL SUBMISSION

Dennis Lau & Ng Chun Man Architects & Engineers (HK) Ltd Architect Aecom Asia Company Limited Structural & Geo-tehnical Engineer Traffic Consultant Environmental Consultant Landscape Consultant Langdon & Seah Hong Kong Limited Quantity Surveyor



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Executive Summary



Executive Summary

Dennis Lau & Ng Chun Man Architects & Engineers (HK) Ltd, in association with Aecom Asia Company Limited and Langdon & Seah Hong Kong Limited (hereinafter "the Consultants") were appointed in June 2013 to carry out a feasibility study of a proposed Landscape Deck over the existing Toll Plaza and the Tunnel Portal of Hung Hom Cross Harbour Tunnel with a view to:

- improve the air and noise quality of the Toll Plaza area;
- provide a green open space for the district and;
- enhance pedestrian connectivity between the Hong Kong Polytechnic University's Hung Hom campus and its surrounding neighbourhood.

The proposed Deck, as a District Park, is situated over the existing Hung Hom Cross Harbour Tunnel and its Toll Plaza, west of Hung Hom MTR Station Podium and South East to Hong Kong Polytechnic University Campus. The total Deck Area is approximately 43,000 sq. m. The design illustrates the possibility and potentials of this Green Deck and the vision and benefits for this development over the existing conditions. It demonstrates the improvements in Air Quality, the increase in Biomass and Vegetation for the reduction of Heat Island Effect, the enhancement of the pedestrian connectivity and additional provision of cycling connection to Harbourfront, Hung Hom Station, Tsim Sha Tsui, PolyU and other districts. It also shows how this Deck integrates with the existing podia of Hung Hom Station, the Coliseum and PolyU and reinforces the urban renewal.

The Deck comprises cultural, leisure and sports facilities and amenities located at different zones according to the neighbouring contexts, which serves for all walks of lifes, local communities, commuters and different stakeholders. At the south tip of the Deck is a viewing deck which offers fine dining with a backdrop of the Victoria harbour at scene. A new Art Gallery, Reflection Pools and the Willow Edge form a Cultural cluster that echoes the forecourt of the existing Coliseum. The middle part of the Deck is the main Landscape zone where the landscape gradually rises at the high point and bridges over the existing Chong Wan Road flyover. A variety of leisure park activities are offered in this zone like family time in the Kids Play, picnic in the Lawn and so on. Located further north is an Active zone where an Amphitheatre, Sports Complex and an outdoor exhibition area (Sculpure Garden and the Lantern) are accommodated.

Beneath the Landscape Deck an intermediate level is created for tunnel bus waiting lobby and mechanical plantroom spaces. The State-of-art air filtration and purification system including electrostatic precipitators is located at this level to filter and purify the polluted air underneath. Other environmental features are introduced such as photovoltaic cells, wind catchers, solar lighting, grey-water recycling and application of DeNOx agent. Zero carbon consumption and emisson will be targeted for the Deck development.

In terms of connectivity, through the enhanced pedestrian and cycling track network covering from Homantin, Hung Hom to Tsim Sha Tsui East harbourfront, the Deck reinforces a better and intimate inter-district relationship that will benefit the general public at large.

This proposal Deck will create a sustainable and green environment in this Precinct and be a major environmental improvement to the existing locale.

Please take note that this feasibility study was carried out in conceptual nature and separate detailed studies should be further required to verify the technical feasibility of the Landscape Deck which are not included in the scope of this report.





Introduction



1 Introduction

1.1 Purpose of the Report

This report is a proposal of a Green Deck Development over the existing Toll Plaza and the Tunnel Portal of Hung Hom Cross Harbour Tunnel. It illustrates the possibility and potential of this Green Deck and the vision and benefits for this development over the existing conditions. This briefly outlines the improvements in Air Quality, the increase in Biomass and Vegetation for the reduction of Heat Island Effect, the enhancement of the pedestrian connectivity and additional provision of cycling connection to Harbourfront, Hung Hom Station, Tsim Sha Tsui, PolyU and other districts. We also demonstrate how this Deck integrates with the existing podia of Hung Hom Station, the Coliseum and PolyU and upgrades the urban neighbourhood environmental qualities. This Deck will create a sustainable and green environment in this Precinct and be a major environmental improvement to a large segment of our city.

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Landscape Deck: Vision and Benefits



2 Landscape Deck : Vision and Benefits

Existing Condition





2 Landscape Deck : Vision and Benefits

2.1 Creation of District Park

2.1.1 Landscape Master Plan

This proposed District Park is located over the existing Hung Hom Cross Harbour Tunnel and its Toll Plaza, west of Hung Hom MTR Station Podium and South East to Hong Kong Polytechnic University Campus. The total Deck Area shown in red dotted line above toll plaza is 43,000 sq. m. and the Extended Deck area above MTR station and promenade shown in yellow dotted line is 60,000 sq. m.

Concept

This would be the dreams for many people to improve the area over the Toll Plaza and form a new hub to connect its neighbourhood.

This Deck is capable to contain a multitude of programs and uses for the needs of the locals and the neighbourhood in the provision of a sustainable green environment which is a scarcity for Hong Kong.

This Deck threads through these potential programs and provides networks to connect people and places by making the best use of the area over the Toll Plaza as well as improving the existing environment and air quality.

Connectivity is one of the major theme for this Deck in our vision to further enhance our existing infrastructure and provide enjoyment for the commuters, locals, PolyU students and staff and the general public.



KEYS:

- The Deck above toll plaza (43,000 sq. m.)
- The Extended Deck (60,000 sq. m.) showing potential new developments



2 Landscape Deck : Vision and Benefits

2.1 Creation of District Park

2.1.2 Deck Zoning Plan

The Deck is divided in different zones in relation to the proximity to its adjoining neighbourhood and the correlated level of activities to suit the surrounding context. Sports and Active Cultural zone are located at the north portion of the Deck which is close to the busy pedestrian traffic between PolyU and Hung Hom Station while the quiet Cultural zone is designated to the TST East Promenade and adjacent hotels. Harbour Vantage points are posited at high points of the Deck and close to the seafront promenade to capture the best views of Victoria Harbour and TST East. The rest are the majority for the enjoyment of the park and leisure.





2 Landscape Deck : Vision and Benefits

2.1 Creation of District Park

2.1.3 Mid-Level Walkway Plan

This Plan shows the extent of new Mid-Level Walkway network, the Cross Harbour Tunnel Bus Waiting Lobblies beneath the landscape deck and new connections to TST East, PolyU and TST East Seafront Promenade. This extension area shown in red dotted lines is approximately 13,732 sq.m. at +9.8mPD and +12.50mPD.





2 Landscape Deck : Vision and Benefits

2.1 Creation of District Park

2.1.4 Ground Level Plan

This Plan shows the glazed enclosure of bus lobbies and escalators/staircases to the Midlevel Walkway Bus Waiting Lobbies, which minimizes the ingress of the polluted air from traffic to the treated clear air in the interiors, and staying time of the bus commuters at this level.





2 Landscape Deck : Vision and Benefits

2.1 Creation of District Park

2.1.5 Section AA and BB

Section AA across the Deck along Cheong Wan Road Flyover shows the relationship of the proposed Deck, the flyover, existing elevated walkway and Cross Tunnel Bus Waiting Lobby and train concourse and platforms. Section BB along North Cross Harbour Tunnel Bus Waiting Lobby illustrates the pedestrian connection from PolyU through the widened covered walkway / Bus Waiting Lobby to MTR Hung Hom Station Mid-Level Station Entrance and ticketing concourse.





2 Landscape Deck : Vision and Benefits

2.1 Creation of District Park

2.1.6 Section CC

Section CC, a longitudinal section across the Deck from north to south shows the topography of the Deck and relationship of land form corresponding to the site constraints and various programs at different locations.





2 Landscape Deck : Vision and Benefits

2.1 Creation of District Park

2.1.7 Artist's Impression Perspectives

This is a bird's eye view overlooking the entire proposed landscape deck design showing deck amenities, facilities and development potentials. This also shows how the deck links to Polytechnic University Main Campus, TST East, integration and extension to the existing Hung Hom Station Podium and the Victoria Harbourfront.



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2 Landscape Deck : Vision and Benefits

2.1 Creation of District Park

2.1.8 Artist's Impression Perspectives

This bird's eye view angle illustrates the overall landscape design of the proposed deck.





2 Landscape Deck : Vision and Benefits

2.1 Creation of District Park

2.1.9 Artist's Impression Perspectives

The proposed buildings, innovation infrastructure and distinct landscape are the highlights of the deck, serving the local communities, PolyU students and staff, park users and visitors. This Deck could be one of the important and newest tourist attractions in Hong Kong.



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2 Landscape Deck : Vision and Benefits

2.1 Creation of District Park

2.1.10 Artist's Impression Perspectives

This image shows the relationship of the Art gallery with the Reflection Pool and the Willow Edge as well as the progression to the Viewing Deck, which is quiet portion of the Deck space for the users.



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2 Landscape Deck : Vision and Benefits

2.1 Creation of District Park

2.1.11 Artist's Impression Perspectives

The feature pavilion provides another vantage point to the entire deck and the PolyU Main Campus, Hung Hom Station, TST and Victoria harbourfront., which can be an attraction to visitors. The Boulevard, major circulation spine, provides Deck users enjoyment of leisure walk under a shady lush environment. Colourful floral Botanic Garden with the seasonal changes gives us delights and surprises in our leisure walk.





2 Landscape Deck : Vision and Benefits

2.1 Creation of District Park

2.1.12 Artist's Impression Perspectives

The north portion of the Deck belongs to Active Culturalt zone and the Sports Zone for the Deck users for sports, performance, events and pedestrian circulation.



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2 Landscape Deck : Vision and Benefits

2.2 Active System - Improvement in Air Quality

2.2.1 Improvement Plan and Strategy

Deck Enclosure

The Deck edges will form the enclosure wall around the area beneath, including the Tunnel Portal, Toll Plaza and part of Hong Chong Road for effective air treatment and the control of air quality. Deck enclosure is a combination of ventilation lourve walls for supply air and solid fire rated walls.

Air filtration

Exhaust air from vehicules in Toll Plaza, at the Hung Hom Entry / Exit of Cross Harbour Tunnel and part of Hong Chong Road is first sucked into the an air filtration system. This system includes pre-filter for removal of large particles in the air flow, electrostatic precipitator (EPS) and ioniser modules for removal of large proportion of very fine, respiratory and harmful particles (Suspended Particulate Matter). These filter modules are regularly cleaned by water spray nozzles shown in the picture on the right.

Air Purification

Then the air passes through an activated carbon filter to remove noxious gases in the exhaust air like nitrogen dioxide, unburned hydrocarbons, ozone and benzene. These filters are arranged in W form layout which was proven the most effective. The air will then be discharged at suitable altitudes and appropriate locations to atmosphere to statutory compliance.

Air Ventilation

The air at ground level beneath the Deck are constantly displaced and treated in the filtration and purification system creating a negative pressure within whereas the waiting lobbies, bus stands and toll booths are constantly supplied with fresh treated air creating a positive pressure.

Exploration of Biofiltration

The pollutants in the exhaust air may be filtered through the garden beds and planting medium on the Deck. Air purification capacities using this system may be further explored.

Notes: Technical info above is from http://www.filtrontec.de/index.php/en/ products/air-filters-for-road-tunnels



Air Purification Process

Electrostatic precipitator



Separation of particles in an electrostatic precipitator



2 Landscape Deck : Vision and Benefits

2.3

Increase in Biomass and Vegetation for Reduction of Heat Island Effect

2.3.1 Existing District Green / Open Space Distribution

The study diagram shows the different types of green areas within 500m walking distance from University Campus. This reveals the Cross Harbour Tunnel infrastructure and MTR Hung Hom Station precinct lack green coverage against the high volume of air pollutant generation.

The Open Space area below are from Outline Zoning Plan of different districts for reference:

- Homantin	13.08 Ha
- Hung Hom	13.04 Ha

- Tsim Sha Tsui 23.66 Ha

The Greenery space within the current PolyU Main Campus excluding Block X and new Block Z is approximately 20,742 sq. m.





2 Landscape Deck : Vision and Benefits

2.3

Increase in Biomass and Vegetation for Reduction of Heat Island Effect

2.3.2 Green Area on Proposed Deck

The Green and landscape area on the current deck design is approximately more than 70% of the area which greatly increases in biomass over the existing Toll Plaza and Hung Hom Station Podium and reduces the reflection of the Infra-red and heat energy absorption from the sun to concrete hard surfaces on roads and buildings.



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2 Landscape Deck : Vision and Benefits

2.4

Bicycle, Pedestrian and Vehicular Connectivity to Harbourfront, Hung Hom Station, Tsim Sha Tsui and Other Districts

2.4.1 Pedestrian Circulation on Deck Level

This Diagram shows the pedestrian connections from / to Deck, PolyU Main Campus, TST East, Hung Hom, MTR Hung Hom Station, Coliseum, Deck facilities, TST East and Hung Hom Seafront Promenade. The Deck will be a pedestrian connection hub for these areas.



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2

Landscape Deck : Vision and Benefits

2.4

Bicycle, Pedestrian and Vehicular Connectivity to Harbourfront, Hung Hom Station, Tsim Sha Tsui and Other Districts

2.4.2

Pedestrian Circulation on Midlevel Walkway : Departing from Deck

This Diagram shows the pedestrian network and flowpaths departing from the midlevel walkways and bus waiting lobbies to Hung Hom Station concourse, PolyU Main Campus, Bus stands beneath, TST East and Hung Hom. Bus Waiting Lobbies are provided for commuters queuing at this level till the bus arrives.





2

Landscape Deck : Vision and Benefits

2.4

Bicycle, Pedestrian and Vehicular Connectivity to Harbourfront, Hung Hom Station, Tsim Sha Tsui and Other Districts

2.4.3 Vehicular Circulation and Servicing on Deck

The Diagram shows the vehicular paths access to and from the proposed buildings on the Deck and the Podium Extensions, including hotels, office towers, apartment blocks, sports complex, art gallery and F&B / Viewing Deck.





2 Landscape Deck : Vision and Benefits

2.4

Bicycle, Pedestrian and Vehicular Connectivity to Harbourfront, Hung Hom Station, Tsim Sha Tsui and Other Districts

2.4.4 Cyclinig Tracks on Deck

This Diagram shows the main cycling track in dark purple on Deck from TST East Promenade to Deck Level and to PolyU Main Campus and further to Hung Hom and Homantin. The light purple routes are the leisure tracks for cyclists touring around on different themes of the landscape.





2

Landscape Deck : Vision and Benefits

2.4

Bicycle, Pedestrian and Vehicular Connectivity to Harbourfront, Hung Hom Station, Tsim Sha Tsui and Other Districts

2.4.5 Inter-District Cycling and Pedestrian Connection

This Diagram shows the Inter-District Cycling and Pedestrian Connection pathways through our Proposed Deck.





2 Landscape Deck : Vision and Benefits

2.4

Bicycle, Pedestrian and Vehicular Connectivity to Harbourfront, Hung Hom Station, Tsim Sha Tsui and Other Districts

2.4.6 Inter-District Cycling and Pedestrian Connection

An artist's impression shows the connectivity of the pedestrian and cycling route from the proposed Green Deck to Ho Man Tin slope site via Block Z.





2 Landscape Deck : Vision and Benefits

2.5 Sustainable Design

2.5.1 Sustainable Energy

The Deck aims at minimizing the energy consumption and lowering carbon emission while producing all, and hopefully more than, the energy required on-site to sustain the development.

Solar power is one of the option to be adopted. It is clean and renewable. No waste by-products are produced. Provision of up to 10,000 m² photovoltaic panels is expected to generate adequate electricity for the Deck. In detail design stage the scale of PV cell could be enlarged possibly to cover power consumption of adjacent development.

Wind turbine is not recommended due to its low performance.







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2 Landscape Deck : Vision and Benefits

2.5 Sustainable Design

2.5.2 Wind Catcher

Wind catcher is a passive self-sustainable device to create natural ventilation for interior spaces. Several wind catchers are located at optimum positions of the Deck to catch and guide the prevailing wind down to the bus waiting lobbies below. This not only facilitates natural ventilation, but also maintaining the interior space positively pressurized to prevent pollutants infill.

The wind catchers will be designed to blend into the surrounding environment.









2 Landscape Deck : Vision and Benefits

2.5 Sustainable Design

2.5.3 **Passive Air Purification**

The paving and paint chosen for the Deck would contain photocatalytic technology which helps for passive air purification.

The main ingredient of air-purifying paving and paint is titanium dioxide (TiO₂). It undergoes photocatalysis to convert the harmful nitrogen oxides (NO_x) in the air into harmless nitrates in the presence of sunlight and moisture. The nitrates will be rinsed away naturally. This process therefore also gives self-cleaning and anti-bacterial properties to the material itself.

The closer to the source of pollution, the better material performance will be. The photocatalytic material has being tested and used for roads, tunnels, sound walls, and buildings. This is by-far one of the latest innovation technology for passive air purification.









2 Landscape Deck : Vision and Benefits

2.5 Sustainable Design

2.5.4 Other Environmental Friendly Devices

1. Greywater Recycling & Rainwater Harvesting

Greywater and rainwater can be ready to use after simple treatments and replace the use of supplied water. Treated greywater can be beneficial for landscape irrigation and plant watering because greywater often contains nitrogen or phosphorus which are nutrients for plants. Treated rainwater can be stored and use for the replacement of landscape water features.

2. Biodiesel fuels

Biodiesel fuels refers to biological material that can be turned into fuel. Unlike fossil fuels, biodiesel fuels use plants or residue like grass dippings and fallen leaves to generate electricity. The resources are fully renewable. Plants on the Deck can be an endless source for biodiesel fuel and help to sustain the energy supply.

3. Solar lighting

Hybrid solar lighting system can be use for interior lighting. It combines the use of channelling natural sunlight during daylight hours to the interior through fibre optic cables, and artificial lighting, typically LED, to maintain a constant light level automatically even if the available sunlight decreases. For outdoor landscape lighting, LED lights powered by solar energy cells will be used. In addition, LED lights require little power, have long life span, and they do not attract flying insects.









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2

Landscape Deck : Vision and Benefits

2.6 **Structural Concept**

Column location

Columns are located strategically to minimize the impact to the traffic at road level below. Columns are placed either at Bus Stands, Pedestrian Islands, or center divider of road. They are spaced at 9000mm center to center.

Main Structural System

Due to the span of the structure, steel trusses system is by far the most economic system to adopt for the deck spanning across the wide road area. Primary steel space trusses will be installed at each column grids and with secondary steel space trusses at interval space to reduce the span of the structural floor girders. Steel girders will then be placed at suitable space on the main top chord of trusses to support the reinforced concrete composite slab with profile deck at Podium level. The column and the portal structure along traffic directions will be reinforced concrete beam-column system with pile foundation to sound rock.

Proposed Truss Type, Depth and Fire Rating Required

Steel trusses are in space truss arrangement so they will be stable during transportation as well as individually installed on supporting pier. Space truss is also efficient and suitable for long span structure while keeping the tonnage of steel at a minimum to ease hoisting and construction. Moreover, space truss can accommodate E/ M services to pass through without occupying additional space underneath the main structure.

Minimum of 240 minutes FRR is suggested to protect the steel truss. Spray protection of Vermiculite (Spray Cement Paste) is intended to be applied over steel truss

Landscape Podium Deck

The structural floor system will be a reinforced concrete composite slab with profile deck supported by the steel girders and eventually sit on top of the long span trusses.





Plant room level in between

In addition to the podium deck, a structural floor system will be installed in the middle of truss by connecting steel main beams to the verticals. The structural floor system will be a reinforced concrete composite slab with profile deck that is supported by the steel secondary beams on top of these main beams at mid level.

Low Rise Building on Deck

Due to the weight of the building, columns of the building will have to be aligned with node points (The intersection of vertical or diagonals strut to the top main chord) of trusses. The load from building will be transferred directly to the truss system and the reinforced concrete column of the deck and eventually down to the foundation system.



2 Landscape Deck : Vision and Benefits

2.6 Structural Concept

Structural Column Layout

The drawing at the right shows the possible locations of the structural columns for the support of the Deck.



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2 Landscape Deck : Vision and Benefits

2.7 Detailed Deck Programs

2.7.1 Vistas : Viewing Deck & Food & Beverage

The Viewing Deck will be the one of the most popular place for the Deck Users and provide a great vantage point to view our Victoria Harbour at daytime and nightime. Deck users can enjoy the panoramic view here while enjoying their coffee and snacks. This could also be a venue for special public events during festival seasons.











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2 Landscape Deck : Vision and Benefits

2.7 Detailed Deck Programs

2.7.2 Vistas : The Pavilion

The Pavilion provides a temporary shelter for Deck visitors to enjoy the views at this high vantage point to the entire Deck, PolyU Main Campus, TST East, Hung Hom and Victoria Harbour,









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2 Landscape Deck : Vision and Benefits

2.7 **Detailed Deck Programs**

2.7.3 **Cultural Programs:** Art Gallery

This will be one of the most popular art venue for PolyU students and staff and other well-established art organizations and instituations for its proximity to the mass transportation hub and its ease to reach within arm length, while it is well situated at a tranquil setting in the midst of a busy city. of a busy city.







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2 Landscape Deck : Vision and Benefits

2.7 **Detailed Deck Programs**

2.7.4 **Cultural Programs:** Willow Edge and Reflection Pool

Students and Deck visitors could take advantage on the tranquil side of the Deck and enjoy the quiet walk for this part of the Deck.







2 Landscape Deck : Vision and Benefits

2.7 Detailed Deck Programs

2.7.5 Cultural Programs: Amphitheatre / Arena

This could be a successful outdoor venue to engage the general public and the PolyU students, allowing them for their own form of expressions in performance and in speech for its proximity to the major pedestrian and transportation hub.







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2 Landscape Deck : Vision and Benefits

2.7 Detailed Deck Programs

2.7.6 Cultural Programs: The Lantern

This will be a home for the prominent temporary cultural artifacts and edifices, which extends the enjoyment for the general public while enriching the life and events on the Deck in different seasons of the year.









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2 Landscape Deck : Vision and Benefits

2.7 Detailed Deck Programs

2.7.7 Cultural Programs: Sculptural Garden

This could be another place for larger art piece display for our local artists and the PolyU students to communicate their ideas to the general public.









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2 Landscape Deck : Vision and Benefits

2.7 Detailed Deck Programs

2.7.8 Leisure Programs: Botanic Garden

This Botanic Garden owns the major part of the Deck for our enjoyment of the local Floral Species. This provides a nice short tour for Deck users in their visits at different seasons.







2 Landscape Deck : Vision and Benefits

2.7 Detailed Deck Programs

2.7.9 Leisure Programs: Kids Play

This Deck could be a great option for families and locals with kids to enjoy their family time.





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2 Landscape Deck : Vision and Benefits

2.7 Detailed Deck Programs

2.7.10 Leisure Programs: The Lawn

This place can offer Deck users to enjoy the sun and picnic time with their families and friends.







2 Landscape Deck : Vision and Benefits

2.7 **Detailed Deck Programs**

2.7.11 Leisure Programs: The Forest Green & Kiosk

This is a green extension to the existing Coliseum Podium from the proposed Green Deck to reduce the Heat Island Effect, to provide fresher air and visual delights without altering the existing use of the Podium. Addition of the Kiosk improves the amenities to both the Coliseum goers and the Deck users. This landscape and programmatic strategy help successfully integrate the proposed Deck with the existing adjoining podium.









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2 Landscape Deck : Vision and Benefits

2.7 Detailed Deck Programs

2.7.12 Leisure Programs: Seafront Promenade

Pedestrian and cyclist network of the Deck connects TST East Harbour Promenade, further extends and joins the Hung Hom Harbour Promenade in the overall long term Harbourfront Masterplan. This Deck development would form part of this overall Masterplan and provide better and enjoyable harbourfront environment for the general public and visitors.





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2 Landscape Deck : Vision and Benefits

2.7 Detailed Deck Programs

2.7.13 Sports Facilities: Sports Complex

Addition of this Sports Venues provides locals, commuters and PolyU students and staff a convenient way for leisure, keeping fit and healthy for its close location to the major transportation hub.





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2 Landscape Deck : Vision and Benefits

2.7 **Detailed Deck Programs**

2.7.14 **Sports Facilities:** . Soccer Pitch

This offers a handy venue for soccer training for the locals, general commuters and PolyU students and staff. A 16m x 30m soccer field occupies 497 sq. m. of the deck area.











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2 Landscape Deck : Vision and Benefits

2.8

Interface with Possible Urban Renewal of Hung Hom Station

2.8.1 Proposed Development on Existing Station & Coliseum Podium

This Diagram shows the proposed building development on this new Deck and on the existing Station and Coliseum Podium so as to capitalize the benefits of the Deck usages. Deck area: 43,000 sq.m.





2

Landscape Deck : Vision and Benefits

2.8

Interface with Potential Urban development over future Hung Hom Station

2.8.2

Garden Infusion into Existing Podiums This Diagram illustrates how our Deck extends up to the existing Station Podium at +21.8mPD with the gardens and amenities while the Forest Green stretches deep onto the Coliseum Podium for the improvement of the existing built environment with soft landscape strategies.







3 Landscape Deck : Local and International Precedents

3.1 Local Precedent : Central Kowloon Route

A proposed landscape deck was designed and will be constructed over the western tunnel portal of the CKR tunnel, Yaumatei. This deck covers a 250m long section of the mainline and the section of Hoi Wang Road between Yan Cheung Road and Waterloo Road. The size of the landscape deck is approximately 250 metres along east-west by 270 metres along north-south direction. This would mitigate the environmental impacts of the tunnel portal to the local neighbourhood. The CKR Project is currently at the detailed design stage and the image at the right is extracted from the Central Kowloon Route Phase 2 Public Engagement Digest in December 2012.



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3 Landscape Deck : Local and International Precedents

3.2

Precedents Elsewhere in Overseas : The Central Artery / Tunnel Project Big Dig, Boston, United States

Overall Length 3.5 miles (5.6 km) Tunnel

Rose Fitzgerald Kennedy Greenway 1.5 miles long (2.4 km)

The following is the excerpt from the Rose Fitzgerald Kennedy Greenway Conservancy website http://www. rosekennedygreenway.org/about-us/ greenway-history/ :

In 1991, after almost a decade of planning, construction began on the Central Artery/Tunnel Project, more widely known as the "Big Dig". The project, recognized as one of the largest, most complex, and technologically challenging in the history of the United States, would remove the elevated highway and create a tunnel system below the city.....

With the elevated highway to be relocated underground, community and political leaders seized the opportunity to enhance the city by creating the Greenway, a linear series of parks and gardens that would re-connect some of Boston's oldest, most diverse, and vibrant neighborhoods.....

Today, the Greenway encompasses gardens, plazas, and tree-lined promenades and is a key feature of the modern reinvention of Boston, the Harbor and the Waterfront.







3 Landscape Deck : Local and International Precedents

3.2 Precedents Elsewhere in Overseas : The Central Artery / Tunnel Project Big Dig, Boston, United States



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3 Landscape Deck : Local and International Precedents

3.2

Precedents Elsewhere in Overseas : The Central Artery / Tunnel Project Big Dig, Boston, United States

Overall Length 3.5 miles (5.6 km) Tunnel

Rose Fitzgerald Kennedy Greenway 1.5 miles long (2.4 km)

The immediate photos on the right show the changes before and after this project, from vehicular dominance infrastructure to a more pedestrianorientated urban space.

The Project designated different themes and characters for different portion of the parks corresponding to its adjoining historic and local contexts, which makes this Project a success.





3 Landscape Deck : Local and International Precedents

3.2 Precedents Elsewhere in Oversea: Elevated 'SkyCycle' bike routes in London

Plan for 220km network of bike paths suspended above railway lines could see commuters gliding to work over rooftops.

The project, which has the backing of Network Rail and Transport for London, would see over 220km of car-free routes installed above London's suburban rail network, suspended on pylons above the tracks and accessed at over 200 entrance points. At up to 15 metres wide, each of the ten routes would accommodate 12,000 cyclists per hour and improve journey times by up to 29 minutes, according to the designers.



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3 Landscape Deck : Local and International Precedents

3.2 Precedents Elsewhere in Oversea: New York High Line

wThe High Line is a public park built on an historic freight rail line elevated above the streets on Manhattan's West Side. It is owned by the City of New York, and maintained and operated by Friends of the High Line. Founded in 1999 by community residents, Friends of the High Line fought for the High Line's preservation and transformation at a time when the historic structure was under the threat of demolition. It is now the nonprofit conservancy working with the New York City Department of Parks & Recreation to make sure the High Line is maintained as an extraordinary public space for all visitors to enjoy.

The High Line is located on Manhattan's West Side. It runs from Gansevoort Street in the Meatpacking District to West 34th Street, between 10th and 11th Avenues. The first section of the High Line opened on June 9, 2009. It runs from Gansevoort Street to West 20th Street. The second section, which runs between West 20th and West 30th Streets, opened June 8, 2011.





Landscape Deck: Construction



4 Landscape Deck : Construction

4.1

Proposed Construction Methodology and Sequencing

4.1.1 Ground Condition

Site History

The study area is located at the reclaimed land near Hung Hom Bay. Reclamation was undertaken within the western portion of the study area in 1924. The eastern portion was reclaimed in 1964. This study area mainly comprises of Hong Kong Polytechnic University and Hong Chong Road connecting to the Cross Harbour Tunnel.



Fig. 4.1.1 Geological Map Sheet No.11

Geological Condition

Based on Sheet No. 11 of the Hong Kong Geological Survey (Scale 1:20000), the study area was formed by reclamation in 1924 and 1964. Before reclamation, the study area was under the sea and underlain by Marine Sand. Ground Investigation (GI) within or adjacent to the study area was carried out by Geotechnics, Bachy, Vibro, and Enpack in 1987, 1990, 1994, 1996 and 2010 respectively. The existing GI records revealed that this area is underlain by Fill followed by Marine Deposit, Alluvium, Completely/Highly Decomposed Granite and with Moderately to Slightly Decomposed Granite at the bottom. The geology of the site is interpreted as follows:

Fill

The Fill layer is described as loose to medium dense dark brown silty medium Sand with gravel. The thickness of the fill layer ranges from 5m to 15m.

Marine Deposit (MD Sand/MD Clay)

The Marine Deposit layer is described as medium dense to loose dark grey silty medium to coarse Sand or firm, dark grey, slightly sandy silty Clay. The thickness of the Marine Deposit layer varies from 0m to 6m.

Alluvium (ALL SAND/ALL CLAY)

The Alluvium layer is described as medium dense grayish white silty Sand, or soft white sandy Clay, or very stiff reddish brown and brown sandy Silt. The thickness of Alluvium layer ranges from 0m to 11m.

Completely/Highly Decomposed Granite (C/HDG)

The C/HDG layer is described as extremely weak, yellowish brown mottled reddish brown, completely decomposed, fine grained Granite, or very dense light brown silty coarse Sand with rock fragment. The thickness of this layer ranges from 5m to 28m.

Moderately/Slightly Decomposed Granite (M/SDG)

The Grade III/II bedrock is described as moderately weak to moderately strong, pinkish grey to yellowish grey, moderately decomposed, medium grained Granite, and black, slightly decomposed, medium grained Granite. The bedrock level ranged from -10mPD to -45mPD, which is around 15m to 50m below ground.



Fig. 4.1.2 Existing GI Layout Plan



4

Landscape Deck : Construction

4.1

Proposed Construction Methodology and Sequencing

10,

Geological Sections



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4.1

Proposed Construction Methodology and Sequencing

4.1.2 Foundation

Suitability of Pile Types to Geotechnical Conditions

Bored piles and Socketed H-piles are both considered as feasible foundation options for this project. For bored pile scheme, piles will found on grade III bedrock at envisaged depth of 15m to 50m below the existing ground level according to existing GI records. The tentative rock-head level and the corresponding tentative founding levels for the bored piles shall be determined by the proposed site specific GI works.

The load bearing capacity of the large diameter bored piles is generated from the end bearing capacity of the rock strata. According to the Code of Practice for Foundations, a safe rock bearing capacity of 5000kPa will be used for the design. No dewatering work is required for bored pile foundation and it has less vibration disturbance to the surrounding buildings.





Fig. 4.1.5 Typical Bored Piles Configuration

Fig. 4.1.6 Bored Pile Construction

For Socketed H-pile scheme, piles are embedded in a rock socket of Grade III rock, where shaft resistance is mobilized to support the foundation loads. The allowable working load is usually dictated by the structural capacity of the steel H-pile section. The socketed length is designed to match the structural requirement. Socketed H-piles is a common piling system which has less vibration and noise effect to the surroundings, it generally require a smaller working space when compared to bored piles.



Fig. 4.1.7 Socketed H-Pile Construction www.dln.com.hk



Fig. 4.1.8 Typical Socketed H-Pile Configuration

Exact foundation system to be adopted will be subjected to further review on the loading of the proposed development as well as the relationship between the proposed building columns and the boundary line.

4.1.3 Primary Structure

Design Load Intensity for the Green Deck

The usage of the Green Deck will be mainly for landscape/open space (outdoor sports facilities, park, outdoor amphi-theatre, passive recreational space for public. A portion of the deck may be used for community facilities like indoor sports & recreational facilities, pedestrian precinct, art gallery and commercial use. The design load intensity in accordance with Code of Practice for Dead and Imposed Loads 2011 are:

Design Load Intensity Table

	Superimposed Dea	Imposed Loads		
Description	Finishes	Soil	Ceiling & Services	Uniformly Distributed Load
	(kPa)	(kPa)	(kPa)	(kPa)
Landscape Deck	3.6 (100 mm protective slab + 50mm bedding/waterproofing)	24.0 (1.2m Thick Soil)	1.0	5.0
Plant Rooms	1.2 (50 mm Finishes)	-	1.0	7.5
Other Community Facilities	1.2 (50 mm Finishes)	-	0.5	5.0

Note: the above design load intensity shall be reviewed with the Landscape Plan and General Building Plan before carrying out detailed design.

Vertical Supporting Piers

Hung Hom Cross Harbour Tunnel is one of the busiest tunnels in Hong Kong. Traffic congestion often happens and continues until late at night.

The locations of new columns to support the green deck will be selected at locations that result in the least impact to the traffic. In addition, they are located in places so to avoid effect to the major tunnel structure during landscaped deck construction.

The most convenient places for column are at the perimeter of the toll plaza. However, this will result in clear span for the deck structure of more than 100 metres. Intermediate column supports are proposed in view of cost effectiveness and constructability. Intermediate column supports are located at the central divider or bus stand to achieve an effective span of main structure in 15m to 45m.



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Landscape Deck Over Cross Harbour Tunnel Toll Plaza N1641H-REP-DESG-007(A01)

4

Landscape Deck : Construction

4.1

Proposed Construction Methodology and Sequencing

Deck Structure

Structural Arrangement Ι.



Steel trusses are in space truss arrangement so they will be stabile during transportation as well as individually installed on supporting pier. Space truss is also efficient and suitable for long span structure while keeping the tonnage of steel at a minimum to ease hoisting and construction. Moreover, space truss can accommodate E/M services to pass through without occupying additional space underneath the main structure. Maximum space for steel trusses will be around 9 metres centre to centre. At the location of commercial/facilities areas, the steel trusses will be integrated with the steel frame of the commercial/facilities structures to form a mega frame structure.

Steel trusses will be supported by bearings and in turn be supported by the Reinforced Concrete pier structure below. Steel beams will be installed between two consecutive trusses to provide support for the Reinforced Concrete Landscape deck above.

Below are some typical sections of trusses designed with landscape deck usage.



^{•4.5} m depth • 4.5m load width



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4.1

Proposed Construction Methodology and Sequencing

Construction Considerations Π.

Some convenient spare spaces in the vicinity of the landscaped deck are selected to facilitate the construction work. They are located in the side and can be used for:

- Temporary Storage
- Maneuvering area
- Fabrication Yard



Fig. 4.1.14 Works Area

- Sequence of works III.
- 1. Columns are constructed along two side of the carriageway or at the centre dividing median
- Columns are spaced at approximately 9m centre to centre, refer to Fig. 3.2.12. 2.
- Beams are constructed to tie all columns and to give support to the trusses above 3.



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4. Steel truss segments will be delivered on site at the Temporary works area for further on-site fabrication



Fig. 4.1.16 Fabrication Site on the side

5. The main trusses are fabricated on site and lifted into position by heavy capacity cranes.





Fig. 4.1.17 Heavy Duty Tower Crane –Kroll K1400 used in Railway project(lifting capacity 30T to 60T)







4.1

Proposed Construction Methodology and Sequencing

6. Full length truss (35m to 50m span) will be hoisted to the position by heavy duty tower crane



Fig. 4.1.18 Delivery path of Trusses



Fig. 4.1.19a Hoisting Operation with cranes located at middle of roads

Fig. 4.1.19b Hoisting Operation with cranes located at one side of roads

- Repeat the operation until 5 trusses are installed on the pier
 Constructed the Future Landscape Deck slab for Temporary platform and site area. The Landscaped Deck will be used for temporary platform to facilitate future construction
- 9. Structural steel secondary beams are then erected and supported by the main truss. Concrete floor will be placed on profiled metal decking



Fig. 4.1.20 First Platform at Landscaped Deck Level



Fig. 4.1.21 Temporary Platform at High Level

The new constructed slab will provide:

- Area for temporary fabrication of trusses
- Temporary support platform for the Crawler Crane
- New trusses are advanced from the temporary platform by Crawler Crane





4.1

ology and Sequencing

10. Proceed with the fabrication of trusses at the temporary platform and hoist the trusses from the platform with Crawler Crane to the designated location



Fig. 4.1.22 Construction Sequence of Trusses from Temporary Platform

11. The temporary platform will advance to the next bay for further roof construction

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Figure References

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2.5.1	Sustainable En	ergy	27	
	Top Right Bottom Middle Bottom Right	Tyree Energy Technology Building, UNSW, Sydney Solar street lamp close up view Solar street lamps		http://www.crc.gov.au/ http://certified-lighting.com/ http://www.solar.anterbox.com/
2.5.2	Wind Catcher		28	
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	Top Middle Top Right Middle Bottom Middle Bottom Right	Viewing deck to Victoria Harbour Seafront seat at TST East Promenade Victoria Harbour Panorama view Sandwich and coffee Cafe Interior		http://mellor-online.co.uk/hong_kong_and_china_1.html http://www.urbanphoto.net/blog/2011/11/17/on-the-waterfront-tsim-sha-tsui/ http://carltonleisureblog.com/2012/11/08/hong-kong-asias-cruise-hub/ http://www.amica.fi/en/Partymeeting/Meetings-and-customer-events/ http://seoulinthecity.wordpress.com/category/seoul-brunch/
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	Top Right Bottom Right	Reflection Pool in Washington DC Willow Trees in DianChi Pool, Kunming		http://nikitasmits.com/2013/01/21/reflection-pool-washington-d-c/ Photo by Mr Cheung Kong Wing
2.7.5	Cultural Progr	ams : Amphitheatre / Arena	37	
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2.7.7	Cultural Progr	ams : Sculptural Garden	39	
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Bottom Left	High Line Park Deek level
Right	High Line Park between High rise neighbourhood

Ground Condition 4.1.1

Geological Map Sheet No. 11 Figure 4.1.1 Existing GI Layout Plan Figure 4.1.2

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6 Appendices

6.1 Academic Proposals

	Proposal Title / Field of Study	Professor in Charge
6.1.1	Study of pedestrian flow and traffic emission on the Green Deck	Hung, Wing-tat (CEE)
6.1.2	Effect of the Green Deck on the local real estate market	Hui, Eddie (BRE)
6.1.3	Effect on the Green Deck on the local noise level	Tang, Shiu-keung (BSE)
6.1.4	Effect of the Green Deck on local air quality	Lee, Shun-cheng (CEE)
6.1.5	Feasibility of installing solar and wind energy facilities on the Green Deck	Yang, Hong-xing (BSE)
6.1.6	Optimal public engagement processes for the Green Deck project	Chan, Edwin (BRE)
6.1.7	Maximise the use of recycled glass in construction materials for Green Deck	Poon, Chi-sun (CEE)
6.1.8	Effect of the Green Deck on the local thermal environment	Niu, Jian-lei (BSE)



6 **Appendices**

Assessment of Pedestrian Circulation and Traffic Emissions 6.1.1 - Dr Hung Wing-tat, Dept of Civil & Environmental Engineering





6 **Appendices**

Assessment of Pedestrian Circulation and Traffic Emissions 6.1.1 - Dr Hung Wing-tat, Dept of Civil & Environmental Engineering

- Traffic Emissions
 - Assumptions: No significant change in vehicular traffic flow
 - Findings:
 - Changes in total emission levels per day is not very significant
 - But Green Deck provides a potential to absorb tonnes of pollutants emitted as treatment systems can be incorporated underneath.

	2013	2015	2020
/OC (ton/day)	0.32871	0.07509	0.04160
CO (ton/day)	1.61212	0.76193	0.55592
NOx (ton/day)	1.29404	0.69710	0.36452
CO ₂ (ton/day)	0.27604	0.16885	0.17602
PM ₁₀ (ton/day)	0.05757	0.01980	0.01391





6 **Appendices**

The Effect of Green Deck on local real estate market 6.1.2 - Prof Eddie Hui, Dept of Building & Real Estate

General Benefits of the Green Deck

- Lessen Urban Heat Island Effect
- Increase biodiversity and green features
- Reduce sound transfer
- Increase amenity, livable space
- Enhance life style varieties
- Better landscape views
- Enhance urban sustainability

Specific Benefits of the Green Deck

- For existing [potential] nearby owners of flats/offices New landscape views improve property values
- For Public in Vicinity Addresses transport issues/ Improved air quality/ Provides new open space
- For Visitors (Tourists) Provides new tourist spot for visitors/ Offers platform for artists /Arouses public interests in Art



Appendices

Effect of Green Deck on local noise level 6.1.3 - Prof Tang Shiu-keung, Dept of Building Services Engineering

- Noise generated in the toll area will be trapped below the Green Deck, resulting in strong sound radiation at all potential openings
- Noise measurements were carried out at locations within PolyU facing the current toll area for a preliminary estimation of the acoustical effect of the Green Deck
 - Noise levels at high levels are likely to be reduced
 - Noise level at PolyU podium and the entrance area near the deck could be increased by more than 5 dBA
- Suggested acoustic treatment of mirco-perforated panels below the Green Deck







6 Appendices

6.1.4 Effect of Green Deck on local air quality - Prof Frank Lee, Dept of Civil and Environmental Engineering

- Hourly NO₂ concentration has **10%** sampling time exceed the HKAQO and WHO standard
- The 24-hr PM₁₀ and PM_{2.5} concentration has met the HKAQO level but ~50%-60% higher than WHO AQG value
- There is **~10% to 35% reduction** on PM₁₀, formaldehyde, acetaldehyde and benzene
- Chronic exposure on formaldehyde for PolyU staff is higher than risk acceptable level
- Estimated on the local NO₂ concentration and PM level could have 50% to 80% improved via green deck and pollutants control technology











6 Appendices

6.1.5 Potential of Renewable Energy on the Green Deck -Prof Yang Hong-Xing, Dept of Building Services Engineering

- Use of renewable energy resources to ensure a real "Green" deck project: zero-energy consumption and zero-greenhouse gas emission
- About HK\$1.0m electricity power has to be consumed per year for ventilation, lighting and air-conditioning by the deck
- Solar photovoltaic panels installed on new building roofs and facade can provide all the power needed on an annual basis
- A more economical design can be achieved using hybrid solar-wind systems, i.e. about 90% of power is supplied by PV and the rest covered by wind power generation.





6 **Appendices**

Public engagement process for the Green Deck Project 6.1.6 - By Prof Edwin Chan, Dept of Building & Real Estate

1. On-street and Online Survey Results

- 91 % favorable and highly favorable
- 7% unfavorable to highly unfavorable
- 2% neutral

Perceived Benefits of the project:

More green space and better use of space

Enhance air quality

Green feature

Make city beautiful with better scenery and view

Reduce carbon emission & absorb vehicular pollutants

Major issues/ concerns:

Overall environment

Project / construction cost and time

Social integration

Citizen's/ parties affected opinions and concerns **Construction impact and waste produced**

Preferred Stakeholder Engagement Activities:

Public Consultation

Collect opinion from community, government, etc.

Design competition

Public and stakeholder participation in workshops

Questionnaire and survey



6 **Appendices**

Public engagement process for the Green Deck Project 6.1.6 - By Prof Edwin Chan, Dept of Building & Real Estate



- Stage 1: Key Stakeholder Survey
- Stage 2: Round Table Meeting
- Stage 3: Data Analysis and Findings



6 **Appendices**

Build Green Deck with recycled glass 6.1.7

-By Prof Poon Chi-sun, Dept of Civil & Environmental Engineering



Eco-Architectural Glass Mortar Containing Recycled Glass & TiO₂

A nitrogen oxide reduction within the breathing zone from 0 to 20 %, depending on wind speed and pollutant concentration is estimated for the "Green Deck"

Approx. 143 tonnes of waste glass can be recycled through construction of "Green Deck"



6 Appendices

6.1.8 Effect of the Green Deck on local thermal environment - Prof Niu Jian-lei, Dept of Building Services Engineering

- An open space with open architectures to enhance airflow and wind for maximized thermal comfort (Xia et al 2013)
- Use of wind-catchers (Liu et al 2011) to reduce pollutant exposure of toll-gate workers and bus passengers
- Quantitative outdoor environment design based upon wind tunnel testing and state-of the-art computational flow dynamics (CFD) simulation





