



**“From Grey to Green”
A Green Deck in Hung Hom for Social Innovation**

Existing Scenario



THE HONG KONG
POLYTECHNIC UNIVERSITY
香港理工大學



campus development office

Issues: Poor air quality and safety concern with the overloaded footbridge

The Cross Harbour Tunnel is the most congested tunnel plaza in the world (daily usage in Jan 2014: 117,554)



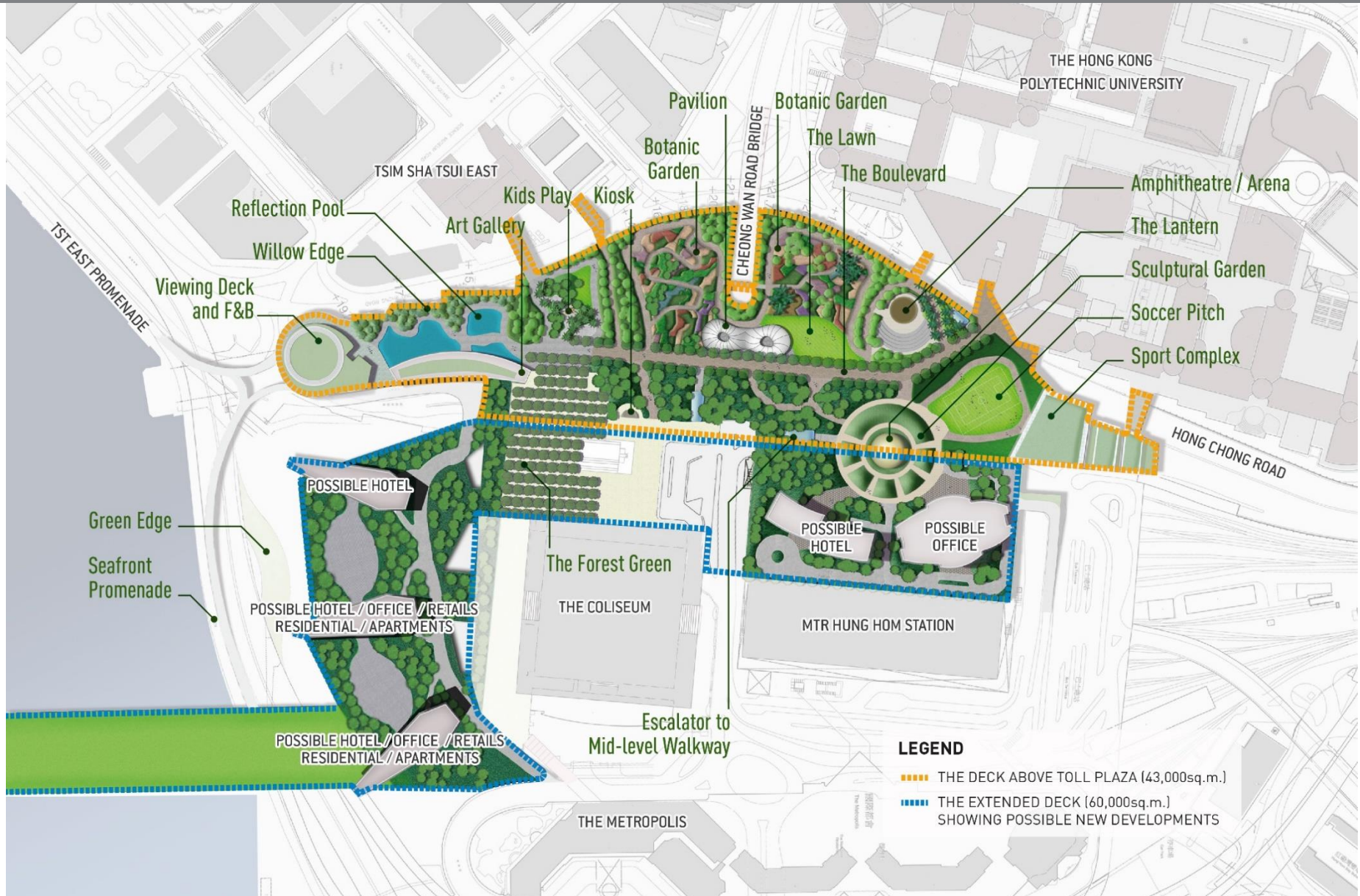
Issues: Poor connection within the district



Overview of the district with the Green Deck



Preliminary Concept Plan



Green Deck Benefits (I) – Enhanced neighborhood quality



Green Deck Benefits (I) – Enhanced neighborhood quality



Green Deck Benefits (I) – Enhanced neighborhood quality

Proposed Art Gallery



Green Deck Benefits (I) – Enhanced neighborhood quality

District Park



Green Deck Benefits (I) – Enhanced neighborhood quality

District Park





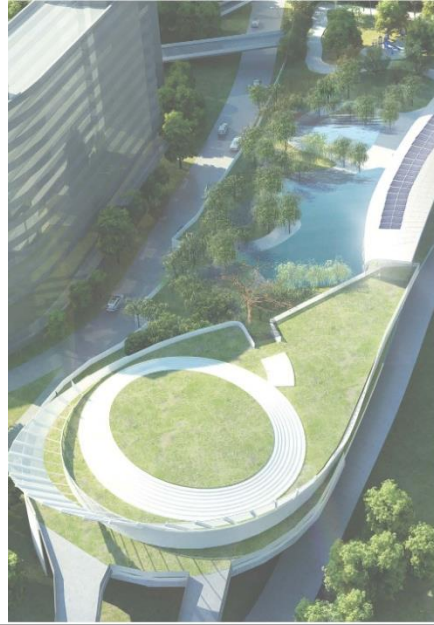
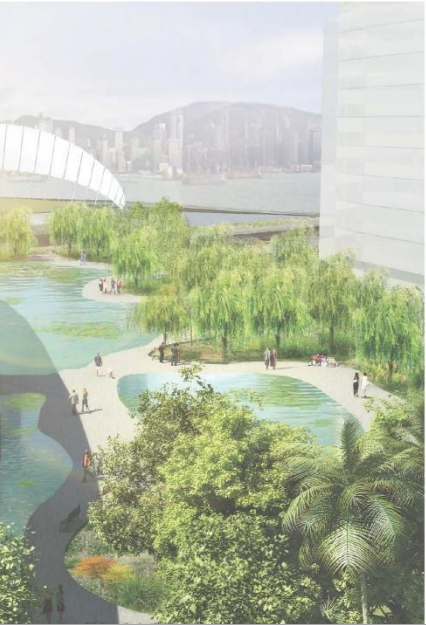
The Forest Green & Kiosk

Seafront Promenade



Sports Complex

Soccer Pitch



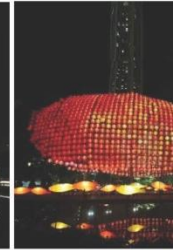
Willow Edge & Reflection Pool

Viewing Deck and Food & Beverage



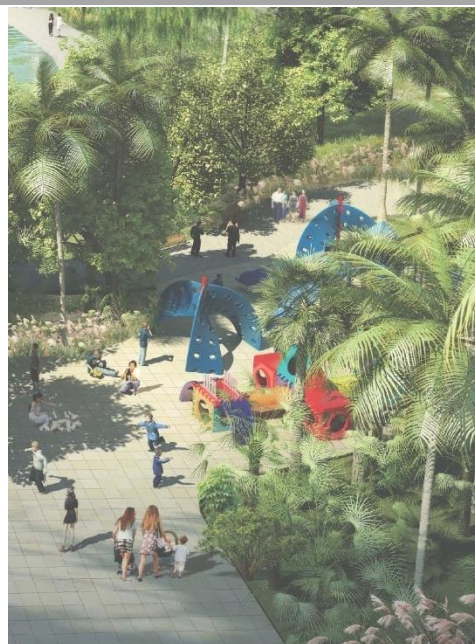
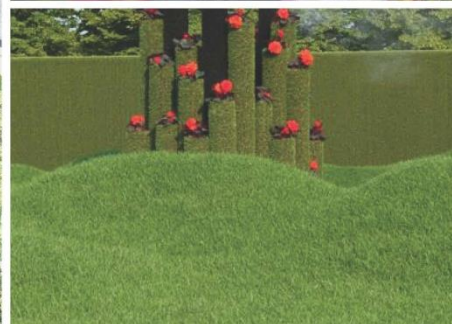
The Pavilion

Amphiatre / Arena



Botanic Garden

The Lantern

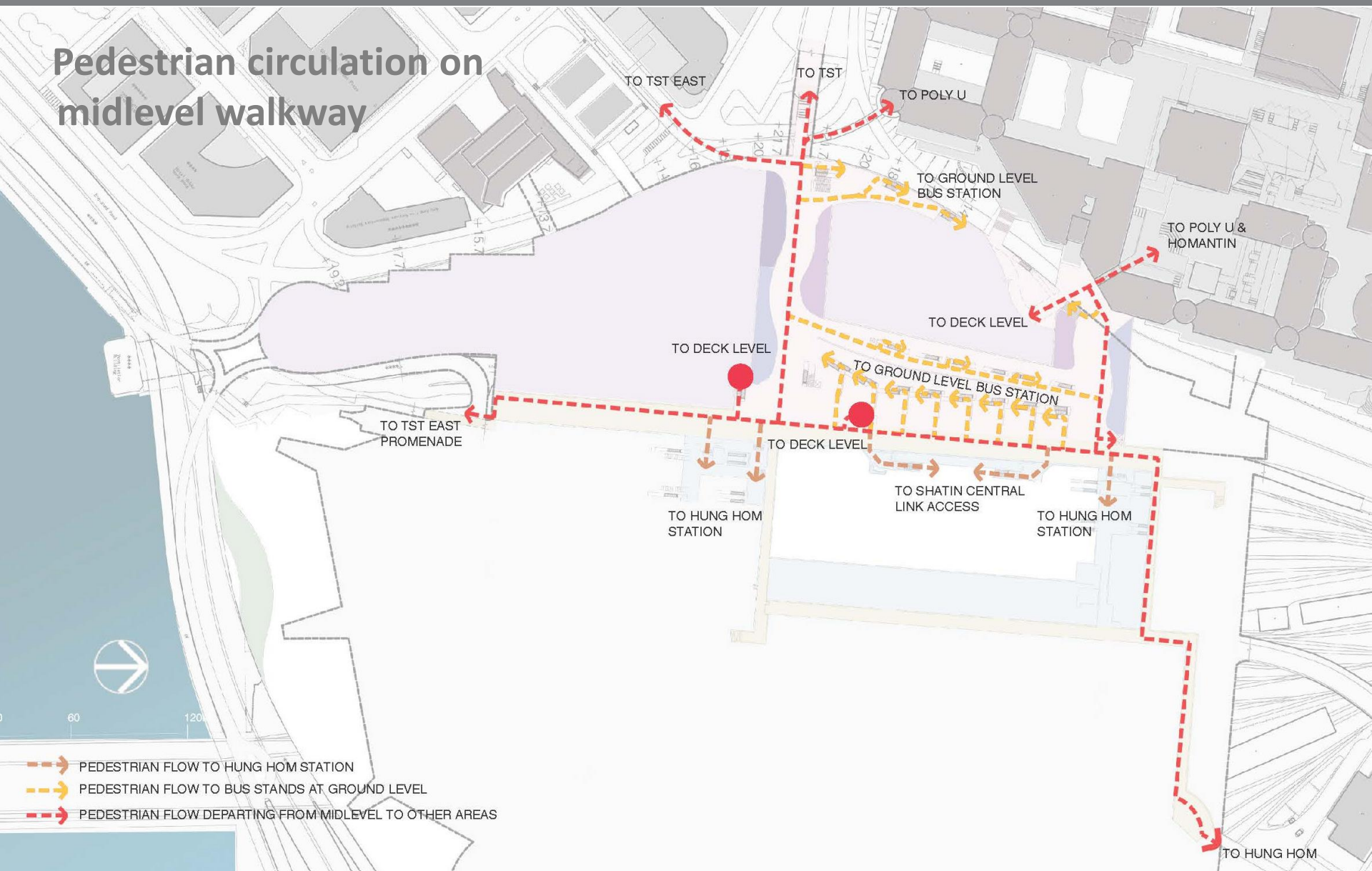


The Lawn

Kids' Play Area

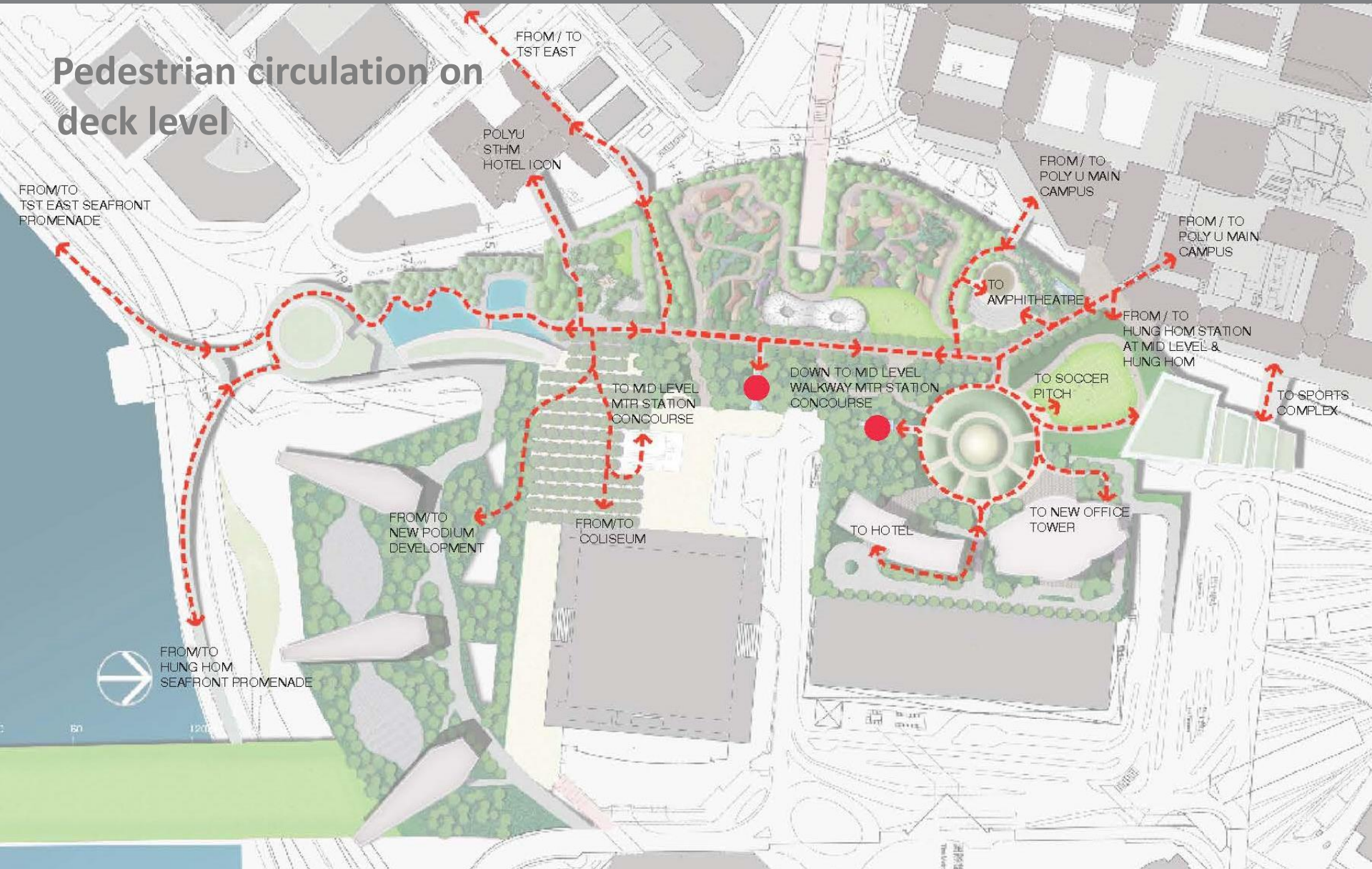
Green Deck Benefits (II) – Improved Connectivity

Pedestrian circulation on midlevel walkway



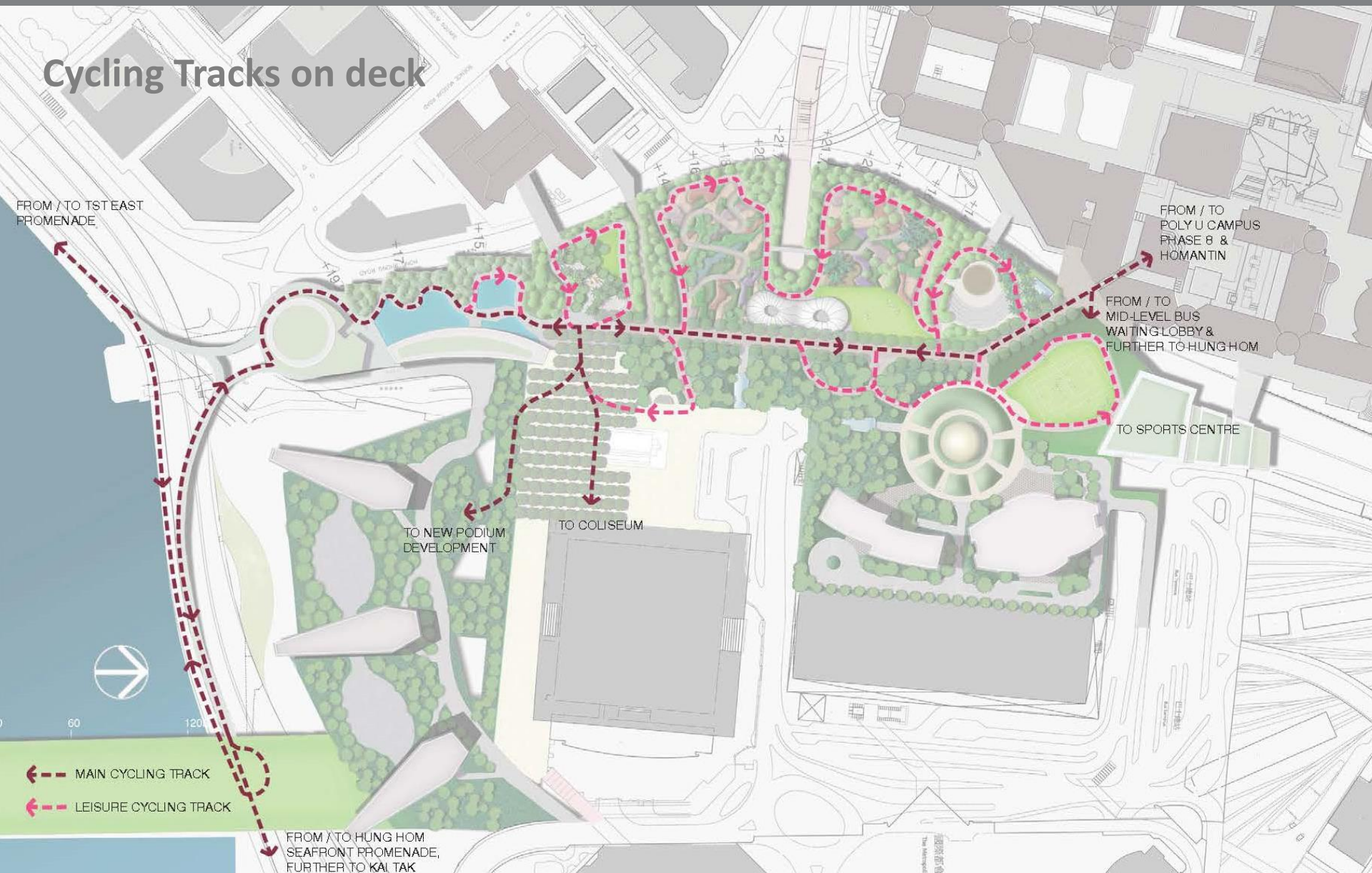
Green Deck Benefits (II) – Improved Connectivity

Pedestrian circulation on deck level



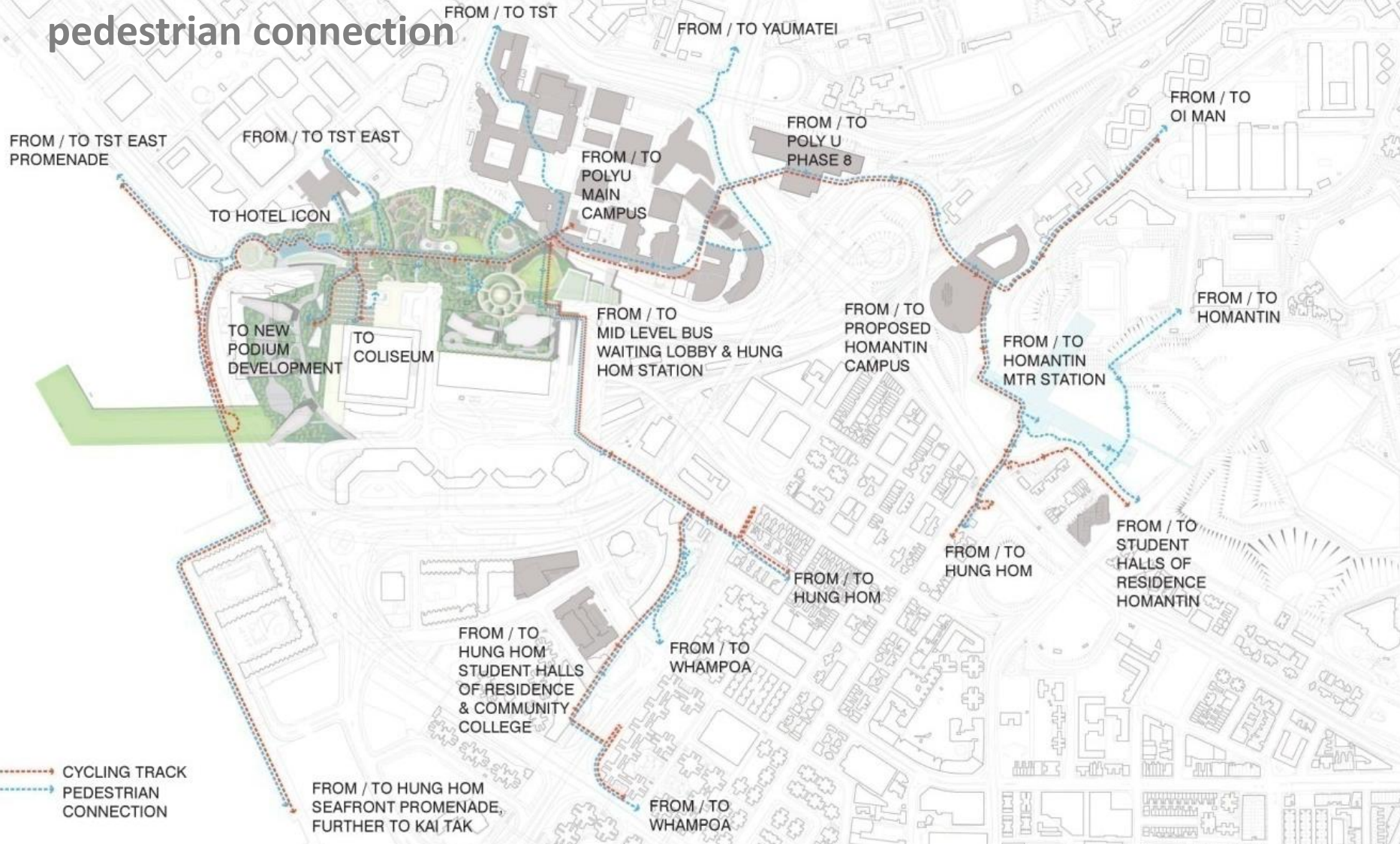
Green Deck Benefits (II) – Improved Connectivity

Cycling Tracks on deck



Green Deck Benefits (II) – Improved Connectivity

Inter-district cycling and pedestrian connection



Green Deck Benefits (II) – Improved Connectivity

Inter-district cycling
and pedestrian
connection



Green Deck Benefits (III) – Improved Environmental Quality Dust, Air, Noise

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 louver walls for supply air and solid fire rated walls.

Air filtration

Exhaust air from vehicles in Toll Plaza, at the Hung Hom Entry / Exit of Cross Harbour Tunnel and part of Hong Chong Road is first sucked into the 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.

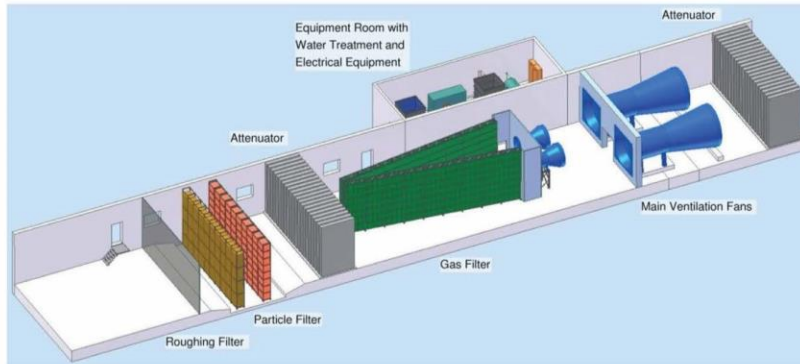
Air Ventilation

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.

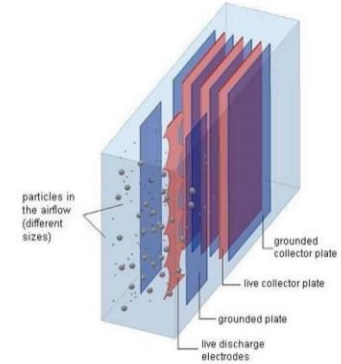
Notes: Technical info above is from <http://www.filtrantec.de/index.php/en/products/air-filters-for-road-tunnels>



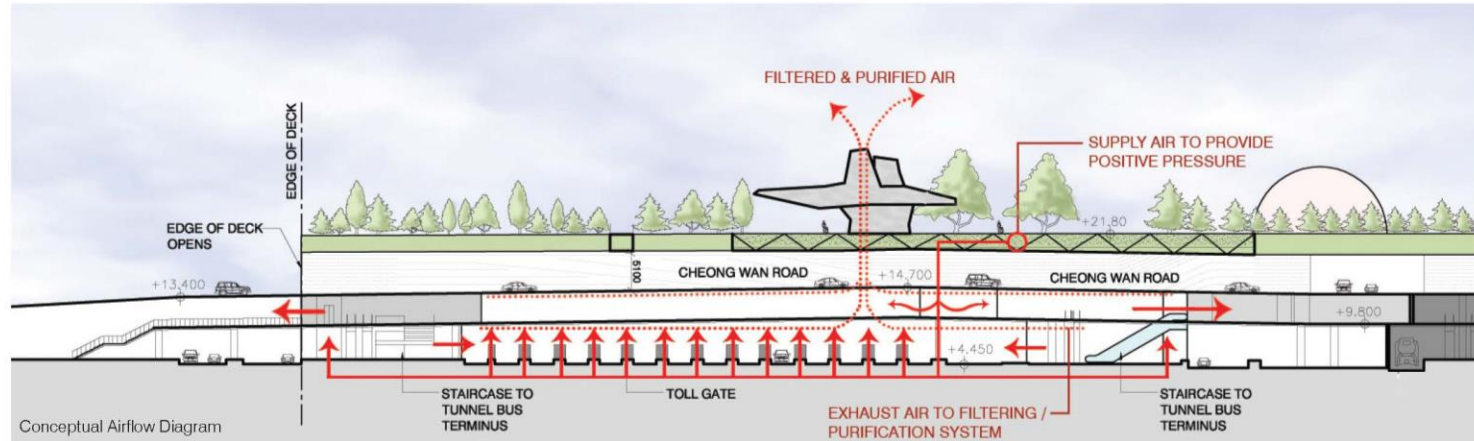
Air Purification Process



Electrostatic precipitator



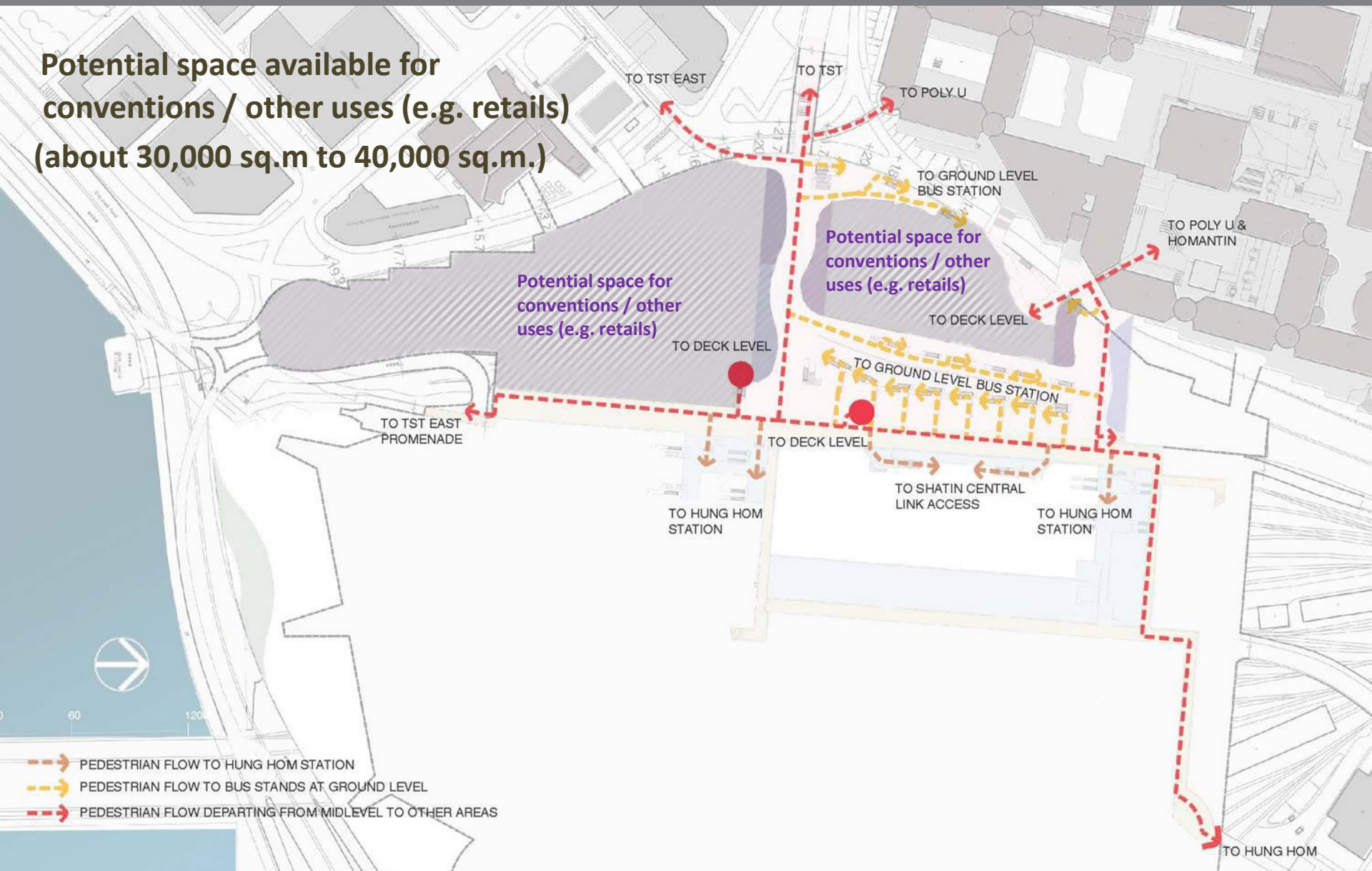
Separation of particles in an electrostatic precipitator



Conceptual Airflow Diagram

Green Deck Benefits (IV) – Enhanced Development Potential

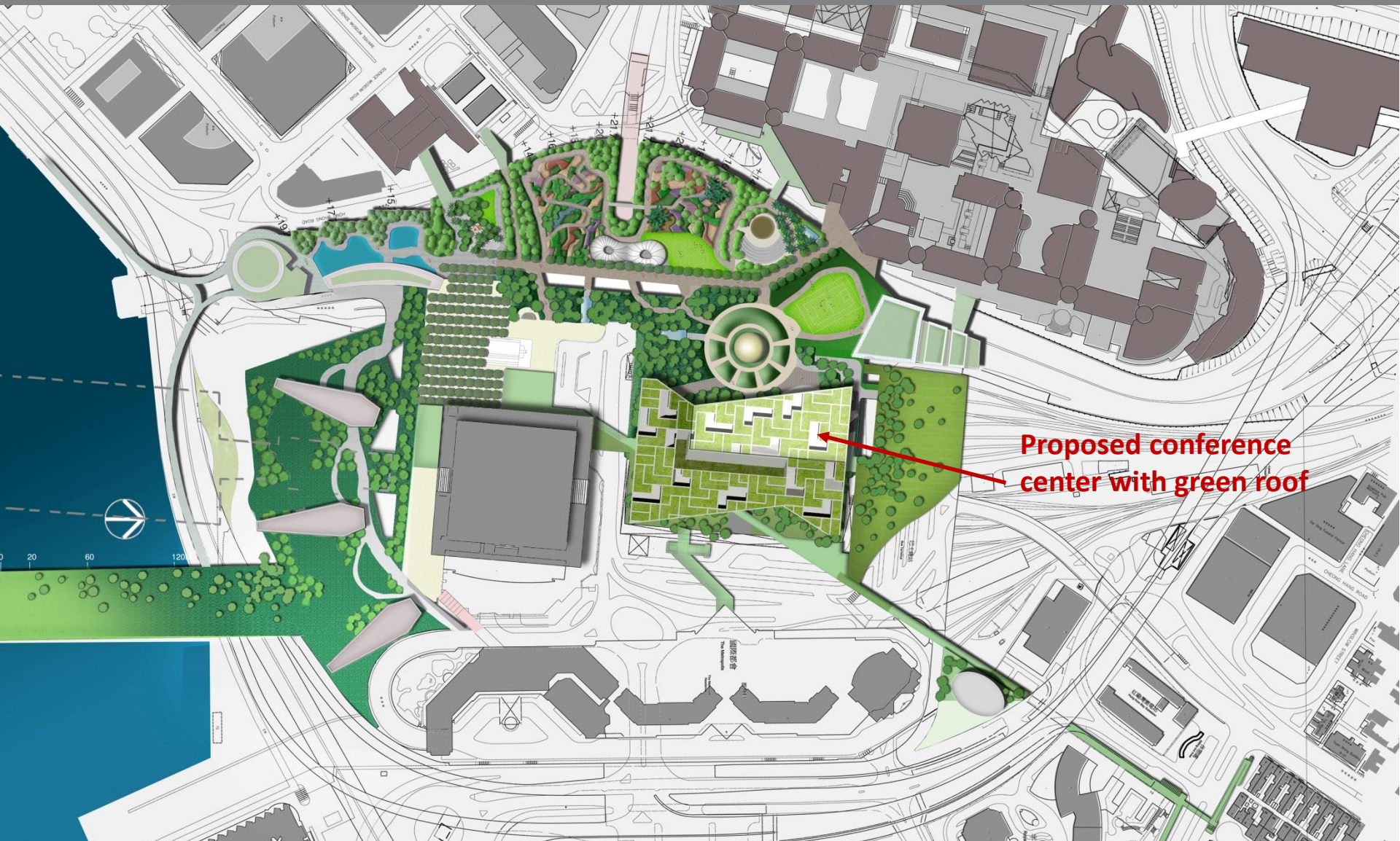
Potential space available for conventions / other uses (e.g. retails) (about 30,000 sq.m to 40,000 sq.m.)



Green Deck Benefits (IV) – Enhanced Development Potential



Green Deck Benefits (V) – Benefits to Tourism (Proposed Conference Centre)



Proposed conference center with green roof



Green Deck Benefits (V) – Benefits to Tourism (Proposed Conference Centre)



Green Deck Benefits (V) – Benefits to Tourism (Proposed Conference Centre)



Proposed conference center with green roof

International Precedents

The Central Artery / Tunnel Project Big Dig, Boston, United States



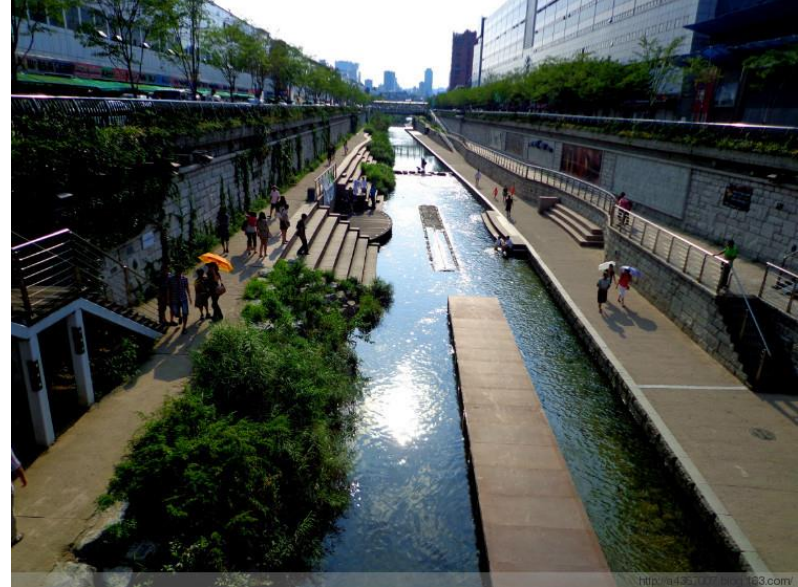
International Precedents

New York High Line



International Precedents

Cheonggyecheon, Seoul



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.

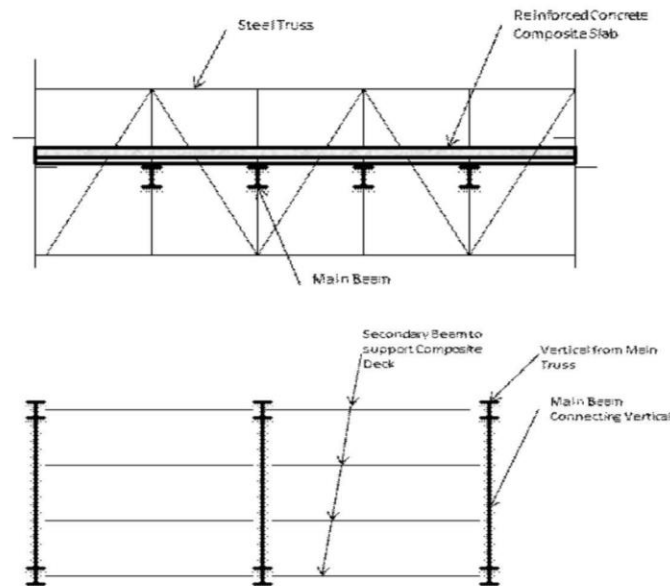
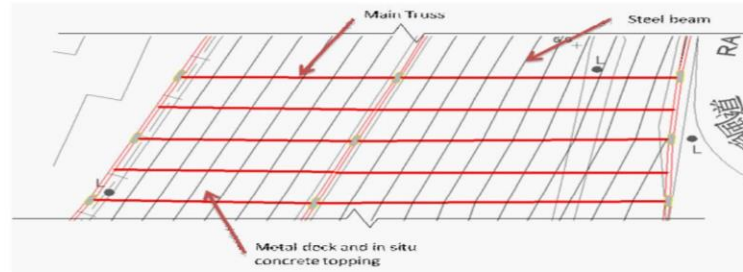
Proposed Truss Type, Depth and Fire Rating Required

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.

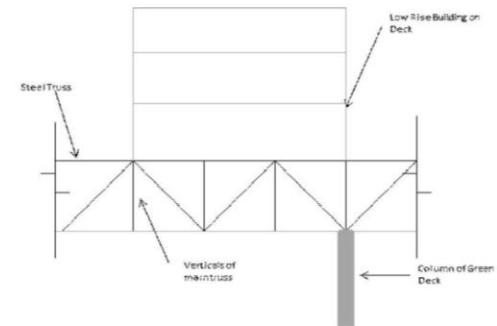


Plant room level in between

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.



2014 Green Building Award – Merit Award



green building award 2014
環保建築大獎

Merit Award 優異獎
Research & Planning Category
研究及規劃類別

Proposed Green Deck Over
Cross Harbour Tunnel Plaza
海底隧道收費廣場上的擬建綠洲項目

Client / Developer
The Hong Kong Polytechnic University
Project Manager
Campus Development Office,
The Hong Kong Polytechnic University
Architect
Dennis Lau & Ng Chun Man
Architects & Engineers (P&Q) Limited
Civil & Structural Engineer
AECOM
Quantity Surveyor
Langdon & Seah Hong Kong Limited
Landscape Architect
AECOM
Environmental / Ecology Consultant
Dennis Lau & Ng Chun Man
Architects & Engineers (P&Q) Limited
Traffic Consultant
AECOM


Sr Sam CHENG Sum-hing
Chairman
GBA 2014 Organising Committee



green building award 2014
環保建築大獎

AWARD PRESENTATION & HKGBC 5TH ANNIVERSARY

EXCELLENCE IN SUSTAINABLE BUILT ENVIRONMENT



	Proposal Title / Field of Study	Professor in Charge
1	A study on the proposed Green Deck at Cross Harbour Tunnel – Assessment of pedestrian circulation and vehicular traffic emissions	Hung, Wing-tat [CEE]
2	Effect of the Green Deck on the local noise environment	Tang, Shiu-keung [BSE]
3	Effect of the Green Deck on local air quality	Lee, Shun-cheng [CEE]
4	Renewable energy applications on the Green Deck	Yang, Hong-xing [BSE]
5	Ventilation strategies for bus passenger waiting areas and boarding passages	Niu, Jian-lei [BSE]
6	Maximise the use of recycled glass in cement-based construction materials for the Green Deck	Poon, Chi-sun [CEE]
7	The effect of the Green Deck on the local real estate market	Hui, Eddie [BRE]
8	A framework for stakeholder engagement to formulate the proposed Green Deck project at Cross Harbour Tunnel	Chan, Edwin [BRE]

Green Deck Research Studies

	Proposal Title / Field of Study	Professor in Charge
9	The health and social impact of the Green Deck project on the population living in the neighborhood	Wong, Frances [FHSS]
10	Costs and benefits analysis on the thermal effect of the Green Deck to the surrounding outdoor environment	Chan, Edwin [BRE]
11	Investigating the effects of greenery on temperature and thermal comfort in urban parks	Chau, Chi-kwan [BSE]
12	Programme for the Green Deck	Jachna, Timothy Joseph [SD]
13	Cost-benefit analysis of the Green Deck development	Shu-Chien Hsu [CEE]
14	Research and development of solar PV pavement for application on Green Deck	Yang, Hong-xing [BSE]
15	The economic contribution of the Green Deck project	Haiyan Song [SHTM]
16	A study of development potential in Tsim Sha Tsui East as a result of the Green Deck project using 3D spatial analysis technology	Geoffrey Q.P. Shen [BRE]

Thank you