15. EIA on Austin Road Flyover Serving the Planned WKCD

15.1 Introduction

15.1.1 Background

The idea and form of developing a site of approximately 40 ha on the northern shore of the magnificent Victoria Harbour of Hong Kong for arts and cultural facilities has had a rich history of discussion in the Hong Kong community. As a result of those discussions, a community consensus has been reached that the vision of Hong Kong should be to develop the area, now called the West Kowloon Cultural District (WKCD), into a world-class integrated arts, cultural, entertainment and commercial district. Those discussions have suggested a list of Core Arts and Cultural Facilities (CACF) including 15 performing arts venues, a cultural institution with museum functions (named “M+”) and an Exhibition Centre (EC).

In terms of planning, the community remarked that the WKCD should not be seen as an isolated development. Accessibility from and connectivity to the neighbouring community should be carefully thought through to help integrate the arts and cultural facilities in the WKCD with its neighbouring areas with a view to cultivate cultural ambience in the district and its immediate vicinity. Ample open space and a vibrant harbour-front should be provided to respond to the growing trend towards lowering building density, greater public awareness about good harbour-front planning and rising public aspiration for quality of life.

The West Kowloon Cultural District Authority (WKCDA), empowered by the WKCDA Ordinance (Cap. 601), was set up by the Government with the full support of the Legislative Council (LegCo) in October 2008 to take forward the WKCD project.

The WKCDA is responsible for the preparation of a comprehensive Development Plan (DP). The DP was submitted to the Town Planning Board (TPB) on 20 December 2011 in accordance with the WKCDA Ordinance (Cap. 601). The draft DP (No. S/K20/WKCD/1) was gazetted under sectin 5 of the Town Planning Ordinance (Cap. 131) on 20 March 2012. On 8 January 2013, the Chie Executive in Council, under section 9(1)(a) of the Town Planning Ordinance (Cap. 131), approved the draft DP. The approved DP (No. S/K/WKCD/2) now serves as the basis for implementation. The project area and project layout to be taken forward in this Schedule 2 EIA is shown in **Figure 15.1.1**.

15.1.2 Designated Projects under the EIA Ordinance

The Project referred to in this chapter is the individual Schedule 2 Designated Project “a flyover more than 100m in length between abutments over the Western Harbour Crossing toll plaza (Item A.8, Part I, Schedule 2)”, which forms part of the Schedule 3 project for the WKCD development.

15.1.3 Objectives of the EIA Study

In accordance with the EIA Study Brief (ESB-237/2011) issued on 21 November 2011, the EIA Study aims to provide information on the nature and extent of environmental impacts arising from the construction and operation of the Project and associated works that will take place concurrently. This information will contribute to decisions by the Director of Environmental Protection on:

(i) the overall acceptability of any adverse environmental consequences that are likely to arise as a result of the Project and associated works, and their staged implementation;

(ii) the conditions and requirements for the detailed design, construction and operation of the Project to mitigate against adverse environmental consequences; and

(iii) the acceptability of residual impacts after the proposed mitigation measures are implemented.

Section 2.1 of the EIA Study Brief sets out the specific objectives of the EIA study as follows:

(i) to describe the Project and associated works together with the requirements and environmental benefits for carrying out the Project;

(ii) to identify and describe elements of community and environment likely to be affected by the Project and/or likely to cause adverse impacts to the Project, including natural and man-made environment and the associated environmental constraints;

(iii) to provide information on the consideration of alternative options of the Project including alternative scale/size, extent, layout, configuration/orientation, alignment, design and construction methods with a view to avoiding and minimizing potential environmental impacts to environmentally sensitive areas and sensitive uses; to compare the environmental benefits and dis-benefits of different options; to provide reasons for selecting the preferred option(s) and to describe the part environmental factors played in the selection of preferred option(s);

(iv) to identify and quantify emission sources, including air and gaseous emission, noise emission, sewage and wastewater emission, waste generation, contaminated materials, and determine the significance of impacts on sensitive receivers and potential affected uses;

(v) to identify and quantify any potential losses or damage to flora, fauna and natural habitats;

(vi) to identify and systematically evaluate any potential landscape and visual impacts and to propose measures to mitigate these impacts;

(vii) to propose the provision of infrastructure or mitigation measures so as to minimize pollution, environmental disturbance and nuisance during construction and operation of the Project;

(viii) to investigate the feasibility, practicability, effectiveness and implications of the proposed mitigation measures;

(ix) to identify, predict and evaluate the residual environmental impacts (i.e. after practicable mitigation) and the cumulative effects expected to arise during the construction and operation phases of the Project in relation to the sensitive receivers and potential affected uses;

(x) to identify, assess and specify methods, measures and standards, to be included in the detailed design, construction and operation of the Project which are necessary to mitigate these environmental impacts and cumulative effects and reduce them to acceptable levels;

(xi) to investigate the extent of the secondary environmental impacts that may arise from the proposed mitigation measures and to identify constraints associated with the mitigation measures recommended in the EIA study, as well as the provision of any necessary modification;

(xii) to identify, within the study area, any individual project(s) that fall under Schedule 2 of the EIAO; to ascertain whether the findings of this EIA study have adequately addressed the environmental impacts of those projects; and where necessary, to identify the outstanding issues that need to be addressed in any further detailed EIA study; and

(xiii) to design and specify environmental monitoring and audit requirements to ensure the effective implementation of the recommended environmental protection and pollution control measures.

15.1.4 Key Environmental Issues

The EIA study shall address the likely key issues specified under Clause 3.2 of the EIA Study Brief, together with any other key issues identified during the course of the EIA study:

(i) the potential air quality impact on sensitive receivers from the construction and operation of the Project and associated works, and the potential air quality impact on the Project from the air pollutant emission sources (such as vehicular emission, exhaust gas from ventilation buildings, emission from marine vessels); the potential odour impacts and nuisances from New Yau Ma Tei Typhoon Shelter, with a view to assessing and recommending sound engineered mitigation proposal(s) to avoid or minimize such impacts and nuisances to the maximum extent practicable;

(ii) the potential noise impact on sensitive receivers caused by the Project and associated works, including the impact from construction equipments during construction and operational noise impacts from road traffic, fixed noise sources, marine traffic, railways and helicopter (if applicable);

(iii) the potential water quality impact caused by the Project and associated works, such as works associated with modification of seawalls, drainage and sewerage provisions, spent cooling water discharges, overflow bypass of sewage pumping stations (if applicable) and dredging works of other marine structures (if applicable);

(iv) the potential sewerage and sewage treatment implications, taking into account the staged implementation of planned developments within the Project;

(v) the potential impacts of various types of wastes, including excavated materials from construction works, construction and demolition wastes, and chemical wastes generated from the construction and operation of the Project and associated works;

(vi) the potential land contamination issue within the Project site;

(vii) the potential landscape and visual impacts caused by the construction and operation of the Project, which involves the introduction of a new urban development at a prominent location of the Victoria Harbour, including day-time and night-time visual impact from the Project;

(viii) the potential impact on ecological sensitive areas, the assessment of which shall be based on a field survey of at least 4 months covering the wet and dry seasons;

(ix) the potential fisheries impacts, if the dredging works associated with the construction of the possible piers/viewing platform will be involved in the Project; and

(x) potential cumulative environmental impacts of the Project, through interaction or in combination with other existing, committed and planned projects in the vicinity of the Project (such as Hong Kong Section of Guangzhou - Shenzhen - Hong Kong Express Rail Link, Road Works at West Kowloon, Proposed Road Improvement Works in West Kowloon Reclamation Development Phases I and II, Central Kowloon Route), and that those impacts may have a bearing on the environmental acceptability of the Project.

15.1.5 Use of Relevant Studies

This Schedule 2 EIA has made use of previous findings from the preliminary environmental assessments conducted as part of the Conceptual Plan Options for the WKCD project completed between 2010 and 2011. Previously approved EIA reports have also been referred to in this study, including the following:

- Hong Kong Section of the Guangzhou – Shenzhen – Hong Kong Express Rail Link; and

- Road Works at West Kowloon.

15.1.6 Structure of the Schedule 2 EIA Report

This Schedule 2 EIA report has been structured as follows:

- *Section 15.2 – Project Description* presents a description of the project including consideration of alternative options and concurrent projects
- *Section 15.3 – Air Quality Impact* presents the approach, findings and recommendations from the air quality impact assessment
- *Section 15.4 – Noise Impact* presents the approach, findings and recommendations from the noise impact assessment
- *Section 15.5 – Water Quality Impact* presents the approach, findings and recommendations from the water quality impact assessment
- *Section 15.6 – Sewerage and Sewage Treatment Implication* presents the approach, findings and recommendations from the sewerage and sewage assessment
- *Section 15.7 – Waste Management Implication* presents the approach, findings and recommendations from the waste assessment
- *Section 15.8 – Land Contamination* presents the approach, findings and recommendations from the land contamination assessment
- *Section 15.9 – Ecological (Terrestrial) Impact* presents the approach, findings and recommendations from the terrestrial ecology impact assessment
- *Section 15.10 – Landscape and Visual Impact* presents the approach, findings and recommendations from the landscape and visual impact assessment
- *Section 15.11 – Environmental Monitoring and Audit Requirements* summarises the environmental monitoring and audit requirements specified in Section 15.3 to 15.10
- *Section 15.12 – Conclusions* summarises the findings and recommendations from the environmental impact assessment
- *Section 15.13 – Implementation Schedule of Mitigation Measures* summarises the schedule for implementation of mitigation measures specified in Section 15.3 to 15.10

15.2 Project Description

15.2.1 Existing Site Conditions

The site for the Austin Road flyover is located outside the proposed WKCD site as shown in **Figure 15.1.1**. The site is currently occupied mainly by the Western Harbour Crossing (WHC) and its toll plaza, and part of the existing West Kowloon Waterfront Promenade on either side of the WHC.

15.2.2 Project Components

This Schedule 2 Project is for extension of the existing elevated deck at the junction of Austin Road West / Nga Cheung Road to the New Yau Ma Tei Public Cargo Working Area (NYMTPCWA) via a flyover above the WHC toll plaza at +14.0mPD. Its aim is to provide a second access for the Mega Performance Venue

and Exhibition Centre, and flexibility for event management. The flyover will also enhance the accessibility and robustness of the arrangements including post event traffic dispersal for serving the MPV and second emergency vehicle route. The flyover starts at the elevated junction of Austin Road West / Nga Cheung Road, spanning across the WHC toll plaza westward, turns southward and lands at the northwest corner of WKCD area adjacent to the NYMTPCWA area. This will provide an alternative return loop for the road access running along the outside perimeter of the portal of the WHC which connects with the roundabout at the junction of Nga Cheung Road and Austin Road West at ground level.

As shown in **Figures 15.2.1 to 15.2.4**, the proposed flyover will be a single two-lane two-way elevated highways structure supported by four piers (which had already been constructed under two previous projects as explained in **Section 15.2.4**); and its approach ramps span between piers and conventional abutments. The abutments will be located at the two ends of the bridge deck. The flyover is about 200m long and 7.3m width with 1m marginal strip at each side.

A new approach ramp adjacent to the existing WHC administration building is also proposed to connect with the elevated roundabout junction of Austin Road West / Nga Cheung Road. The new ramp will be constructed from the elevated roundabout junction to join at +5.0mPD of the new at-grade carriageway and the carriageway at WKCD Basement Level 1 (or B1). Additional piers and abutments will be constructed for the ramps of the flyover. Existing facilities on top of the WHC toll plaza which conflicts with the flyover structures will need to be rearranged, and utilities at the piers and abutments of the flyover will also need to be diverted.

15.2.3 Need of the Project

15.2.3.1 Purpose and Objective of the Project

The main purpose of the flyover is to serve as one of the key measures to meet the ‘accessibility and connectivity’ aspect of the overall WKCD development objectives mentioned in **Section 15.1.1**.

Specifically, the purpose of the flyover is to provide a second access for the proposed WKCD Mega Performance Venue (MPV) and Exhibition Centre (EC). This access can be used by general traffic under normal conditions and will provide flexibility for event management at the MPV/EC as well as enhance the accessibility and robustness of the arrangements including post event traffic dispersal for serving the MPV and second emergency vehicle route.

15.2.3.2 Environmental Benefits of the Project

Traffic congestion will inevitably cause deterioration of air quality arising from vehicular traffic emissions and noise impact. The Project will allow free flow traffic condition, evenly dispersed vehicular traffic and better transportation efficiency in the future such that the potential of air quality impact of traffic emissions on the West Kowloon region will be significantly reduced. It is also anticipated that less traffic noise impact will be occurred on current and planned Noise Sensitive Receivers (NSRs). Therefore, the Project is beneficial to the environment specifically in the aspects of air quality and noise.

15.2.3.3 Scenario with the Project

The MPV has been designed to cater for over 15,000 seating capacity. For time-specific events, such as concerts, the arrival or departure of over 15,000 visitors may be expected within a one hour timeframe. This has the potential to create a significant pressure on the vehicular access to MPV, where private cars and

some public transportation modes (buses and taxis) compete and queue for space to dropoff/pickup at the MPV entrance. With the provision of a second vehicular access to the MPV via the flyover, vehicular traffic arriving at or departing from the MPV can be more evenly dispersed, allowing better transportation efficiency and greater flexibility for handling unexpected or emergency situations.

15.2.3.4 Scenario without the Project

In the absence of the flyover, there will be only one vehicular access to the MPV and EC (via the at grade road between the Park and the WHC tunnel entrance) and the road around the WHC portal will become a dead-end road. In case of any blockage/accident at the road around the WHC portal, there would be no alternative vehicular route to/from the MPV, the EC and the hotel/office development around the WHC portal. From a transport planning view point, provision of the Austin Road flyover is considered to be essential such that traffic can be diverted via the Austin Road flyover to/from WKCD in case of emergency situations. In addition, it is considered desirable to provide an alternative vehicular route to cater for unexpectedly high vehicular travel demands to/from the MPV and EC during special events, which could otherwise result in significant traffic congestion during the drop off/pick up hours of such events.

15.2.4 Consideration of Alternative Development Options

Unlike most other new 'flyover' projects, this proposed flyover has technically already been planned and provisioned for by two predecessor projects, namely, Contract No. WK25/96 Remaining Road Works Stage 1, and the WHC project, whereby construction of the latter has included piled foundations and stub columns at the WHC toll plaza to allow for a future 6-lane Austin Road extension on an alignment directly above the toll plaza. Of the four piers required for the flyover superstructure, three are within the WHC boundary and have already been reserved during the construction of the toll plaza while the remaining pier at the junction of Nga Cheung Road and Austin Road had also been constructed under the West Kowloon Reclamation project. The east end of the proposed flyover will be connected to the existing elevated road junction of Austin Road West and Nga Cheung Road (constructed under Contract No. WK25/96 Remaining Road Works Stage 1) which will become an elevated roundabout after completion of the WKCD proposed road network.

Given these predefined conditions, the proposed flyover is virtually the only alignment option for provision of the essential alternative vehicular access to MPV and EC. Nevertheless, for comparison purposes the provision of this alternative vehicular access in the form of at-grade or underground road has been preliminarily reviewed as follows:

- At-grade – not possible due to direct conflict with the existing WHC operation
- Underground – would not be technically viable due to insufficient space and obstruction by existing piled foundations below the WHC toll plaza, as well as conflict with the design for Austin Road under the Road Works at West Kowloon project.

In view of the predefined conditions and the preliminary review results, the proposed flyover is the preferred and viable development option.

15.2.5 Consideration of Alternative Construction Methods and Sequences of Works

For construction of the superstructures for vehicular and pedestrian bridges, the following methods may be adopted:

- Cast in-situ deck – scaffolding/falsework is erected for the placement of formwork before in-situ concreting of deck structure;
- Single span lifting method – the entire span precast deck will be lifted into position;
- Steel truss with concrete deck – this method involves lifting the prefabricated steel truss followed by construction of the concrete deck; and
- Precast segmental method - the bridge deck will be constructed as precast segments (each a few metres long), which are lifted into position and then tied together with pre-stressing cables. This method has been extensively adopted in Hong Kong in the past.

The aforementioned methods do not differ significantly in terms of environmental impacts. The selection of method is, rather, driven by consideration on site constraints such as avoiding disturbance to existing traffic, providing sufficient headroom between the road and falsework during the construction stage, design form of the proposed bridges and also the individual contractors' available equipment/resources in-hand. Construction of the flyover is severely constrained by the Western Harbour Crossing (WHC) and the location of the existing piled foundations and stub columns. A comparison of the different construction methods is presented below.

15.2.5.1 Cast in-situ deck

In-situ cast concrete bridges are particularly suited to construction of bridge decks with alignments that have sharp curves, tapered shapes and sharp skewed angles. This method requires extensive false-work, temporary support from ground level, and would create significant disturbance to the existing traffic and operation of the WHC.

15.2.5.2 Single Span Lifting

For spans less than 75m in length, lifting the entire pre-cast may be appropriate. However, it requires a large crane area with necessary access and available space to locate the crane. The flyover will comprise of a triple span bridge and is within limits for lifting, however, the key concern is the availability of space to locate the crane. It is anticipated that the Contractor will adopt the precast spans method but this also depends on the availability of plant and space for lifting the precast spans. Similar concerns exist with the single lift of a steel truss and concrete deck method.

15.2.5.3 Steel Truss with Concrete Deck

This method also involves pre-fabrication of the whole steel truss span, which is then lifted into position by a crane. The concrete deck formwork is then laid prior to casting the concrete slab in-situ. This method also requires a large crane area, which will need to occupy a large part of the WHC area during the lifting operation.

15.2.5.4 Pre-cast Segmental Launching

In view of site constraints, pre-cast segmental launching method is considered the most appropriate method for the construction of the flyover. It has the benefit of requiring no scaffolding and quick erection, thereby limiting disturbance to the WHC and the surrounding environment. The launching gantry is

designed to cross the existing roads without disturbing existing traffic (i.e. traffic may pass underneath the partially launched bridge structure during non-active construction periods without any direct obstruction from the launching gantry). This method has been adopted extensively in other parts of Hong Kong. Precast segmental bridges are built using pre-fabricated, hollow concrete segments. A section of bridge consists of several of these concrete segments which can be pre-stressed into a single unit. This method requires a specially built launching gantry to lift and mount each segment, with segments manufactured offsite to reduce onsite environmental impacts. The segments are also small enough to be transported by conventional trucks. It should be noted that although the precast segmental method does not require mega lifting equipment as that for the precast spans method, the length of spans that the precast segmental method can sustain is usually limited to about 80m (due to limitation on the capacity of the launching girder for such a method). To avoid stretching to the limit, it is assumed that the length of spans for precast segmental method should be limited to 75m, which is considered suitable for the flyover, where the spans vary between 30m to 40m in length.

Given the aforementioned comparison of construction methods, it is anticipated that construction of the vehicular bridge will adopt the precast segmental method in the form of box girders subject to detailed design.

15.2.6 Preferred Scenario

Based on the considerations described in **Section 15.2.5**, the preferred construction scenario for the flyover is the precast segmental method, as this method is associated with less environmental impacts compared to other options, and is considered to be best able to meet the technical requirements and site constraints.

15.2.7 Proposed Project Programme

The flyover is a supplementary component of the WKCD development project, proposed mainly to support certain WKCD facilities. Implementation of the flyover is subject to factors such as funding and associated arrangements, as well as interface with and restrictions imposed by the operators of the existing WHC tunnel entrance and toll plaza. Despite such factors and restrictions, it is tentatively scheduled to complete construction of this flyover by 2017 (see **Appendix 2.4**).

15.2.8 Concurrent Projects

The following major projects under planning and/or construction are likely to interface with this Schedule 2 EIA:

- West Kowloon Cultural District Development;
- Hong Kong Section of the Guangzhou – Shenzhen – Hong Kong Express Rail Link;
- Road Works at West Kowloon;
- Road Improvement Works in West Kowloon Reclamation Development – Phases I and II; and
- Central Kowloon Route.

A summary of the concurrent projects for which potential cumulative impacts have been considered is shown in **Table 15.2.1**.

Table 15.2.1: List of concurrent projects for cumulative impact assessment

	Potential Cumulative Impacts	
Concurrent Project	**Construction Phase**	**Operation Phase**
West Kowloon Cultural District Development	All Areas	All Areas
Hong Kong Section of the Guangzhou – Shenzhen – Hong Kong Express Rail Link	Fugitive Dust Airborne Noise	n/a
Road Works at West Kowloon	Fugitive Dust Airborne Noise Landscape & Visual	Vehicular Emissions Traffic Noise Landscape & Visual
Road Improvement Works in West Kowloon Reclamation Development – Phases I and II	Fugitive Dust Airborne Noise Landscape & Visual	Vehicular Emissions Traffic Noise Landscape & Visual
Central Kowloon Route	Fugitive Dust	Vehicular Emissions

15.3 Air Quality Impact

This section presents the assessment of potential air quality impacts associated with the construction and operational phase of the proposed flyover road within the WKCD site. Dust generated from various construction activities is the primary concern during the construction phase. During the operation phase the major sources of air pollution include, but are not limited to; vehicular emissions in the vicinity of and within the project area including from open roads, ventilation shafts, tunnel portals and from the nearby Western Harbour Crossing (WHC) portal; marine emissions from the nearby China Ferry Terminal, Ocean Terminal and New Yau Ma Tei Public Cargo Working Area (NYPCWA). Representative Air Sensitive Receivers (ASRs) within 500 m of the subject site have been identified and the worst case impacts on these receivers will be assessed. Suitable mitigation measures, where necessary, have been recommended to protect the nearby sensitive receivers and to achieve the legislative criteria and guidelines.

15.3.1 Air Quality Legislations, Standards and Guidelines

The following legislation and regulations provide the standards and guidelines for evaluation of air quality impacts and the type of works that are subject to air pollution control:

- Environmental Impact Assessment Ordinance (EIAO) (Cap. 499.S16), EIAO-TM, Annexes 4 and 12;
- Air Pollution Control Ordinance (APCO) (Cap. 311) and the Air Quality Objectives (AQO);
- Air Pollution Control (Construction Dust) Regulation;
- Control of Air Pollution in Car Parks (ProPECC PN 2/96);
- Practice Note on Control of Air Pollution in Vehicle Tunnels, and;
- Guidance Note on the Best Practicable Means for Cement Works (Concrete Batching Plant) BPM 3/2

15.3.1.1 Technical Memorandum on Environmental Impact Assessment Process

The criteria and guidelines for evaluation of air quality impacts are laid out in Annex 4 and Annex 12 of the *Technical Memorandum on Environmental Impact Assessment* Process (EIAO-TM). Annex 4 stipulates the

criteria for evaluating air quality impacts. This includes meeting the Air Quality Objectives and other standards established under the *Air Pollution Control Ordinance*, as well as meeting the hourly Total Suspended Particulate concentration of 500 µg/m^3. Annex 12 provides the guidelines for conducting air quality assessments under the EIA process, including determination of air sensitive receivers, assessment methodology and impact prediction and assessment.

15.3.1.2 Air Pollution Control Ordinance

The principal legislation for the management of air quality is the *Air Pollution Control Ordinance (APCO) (Cap 311)*. The APCO specific Air Quality Objectives (AQOs) which stipulate the statutory limits of air pollutants and the maximum allowable numbers of exceedance over specific periods. The AQOs are summarised in **Table 15.3.1**.

Table 15.3.1: Hong Kong Air Quality Objectives

Pollutant	Averaging Time	AQO concentration (µg/m^3)	Allowable exceedances
Sulfur Dioxide (SO_2)	1 hour	800	3
	24 hour	350	1
	Annual	80	0
Total Suspended Particulates (TSP)	1 hour(1)	500(1)	
	24 hour	260	1
	Annual	80	0
Respirable Suspended Particulates (RSP)	24 hour	180	1
	Annual	55	0
Nitrogen Dioxide (NO_2)	1 hour	300	3
	24 hour	150	1
	Annual	80	0
Carbon Monoxide (CO)	1 hour	30,000	3
	8 hour	10,000	1
Ozone (O_3)	1 hour	240	3
Lead	3 month	1.5	0

Note (1) The criterion under EIAO-TM not an AQO

15.3.1.3 Air Pollution Control (Construction Dust) Regulation

The *Air Pollution Control (Construction Dust) Regulation* enacted under the APCO defines notifiable and regulatory works activities that are subject to construction dust control, as listed below:

Notifiable Works:

1. Site formation
2. Reclamation
3. Demolition of a building
4. Work carried out in any part of a tunnel that is within 100 m of any exit to the open air
5. Construction of the foundation of a building
6. Construction of the superstructure of a building

7. Road construction work

Regulatory Works:

1. Renovation carried out on the outer surface of the external wall or the upper surface of the roof of a building
2. Road opening or resurfacing work
3. Slope stabilisation work
4. Any work involving any of the following activities:
    a. Stockpiling of dusty materials
    b. Loading, unloading or transfer of dusty materials
    c. Transfer of dusty materials using a belt conveyor system
    d. Use of vehicles
    e. Pneumatic or power-driven drilling, cutting and polishing
    f. Debris handling
    g. Excavation or earth moving
    h. Concrete production
    i. Site clearance
    j. Blasting

Notifiable works require that advance notice of activities shall be given to EPD. The Regulation also requires the works contractor to ensure that both notifiable works and regulatory works are conducted in accordance with the Schedule of the Regulation, which provides dust control and suppression measures.

15.3.1.4 Practice Note on Control of Air Pollution in Car Parks and in Vehicle Tunnels

These practice note for professional persons *ProPECC PN 2/96* and the *Practice Note on Control of Air Pollution in Vehicle Tunnels* prepared by EPD provide guidance on the control of air pollution in car parks and vehicle tunnels respectively. These two practice notes include air quality guidelines required for the protection of public health and factors that should be considered in the design and operation of car parks and vehicle tunnels in order to achieve the required air quality. The limits for air pollutants as recommended by the two practice notes are summarised in **Table 15.3.2**.As there will be fully enclosed vehicle roads and car parks inside the proposed WKCD basement, the air quality within the basement will need to comply with the relevant air pollutant limits as given in the Table.

Table 15.3.2: Limits of air pollutant concentrations inside car parks and vehicle tunnes

Air Pollutant	Averaging Time	Maximum Concentration ($\mu g/m^3$)*	Parts Per Million (ppm)	Remarks
Carbon Monoxide (CO)	5 minutes	115,000	100	Applicable to both car parks and vehicle tunnels
Nitrogen Dioxide (NO_2)	5 minutes	1,800	1	Ditto
Sulfur Dioxide (SO_2)	5 minutes	1,000	0.4	Applicable to vehicle tunnels only

*Concentrations at reference conditions of 289k and 101.325kPa.

15.3.1.5 Guidance Note on the Best Practicable Means for Cement Works (Concrete Batching Plant) BPM 3/2

This note lists the minimum requirement for meeting the best practicable means for *Cement Works (Concrete Batching Plant)*. The guidance note includes: emission limits; fugitive emission control recommendations; monitoring requirements; commissioning details, and; operation and maintenance provisions. This guidance note is relevant because concrete batching plant currently used by the adjacent XRL project would be handed over to and used by the WKCD Project during the construction phase.

15.3.2 Baseline Conditions

15.3.2.1 Site Description

The flyover road lies within the WKCD site on the south-western tip of the Kowloon Peninsula with Victoria Harbour to the west and south of the site and the existing urbanised areas to the north and east.

Land uses surrounding the proposed flyover road are mainly comprised of residential, commercial and government/institution/community (GIC) use. The flyover road is flanked by primary distributor roads: Austin Road West, running immediately adjacent to the northern edge of the WKCD boundary; Canton Road, running adjacent to the eastern boundary; Lin Cheung Road, perpendicular to the mid-northern boundary, and; the Western Harbour Crossing on the northwest boundary. The Ocean Terminal and China Ferry Terminal are to the south-east of the site.

The site for the proposed flyover road is flat to undulating with a ground level of 5 to 23 mPD, the surrounding terrain is flat.

15.3.2.2 Meteorology

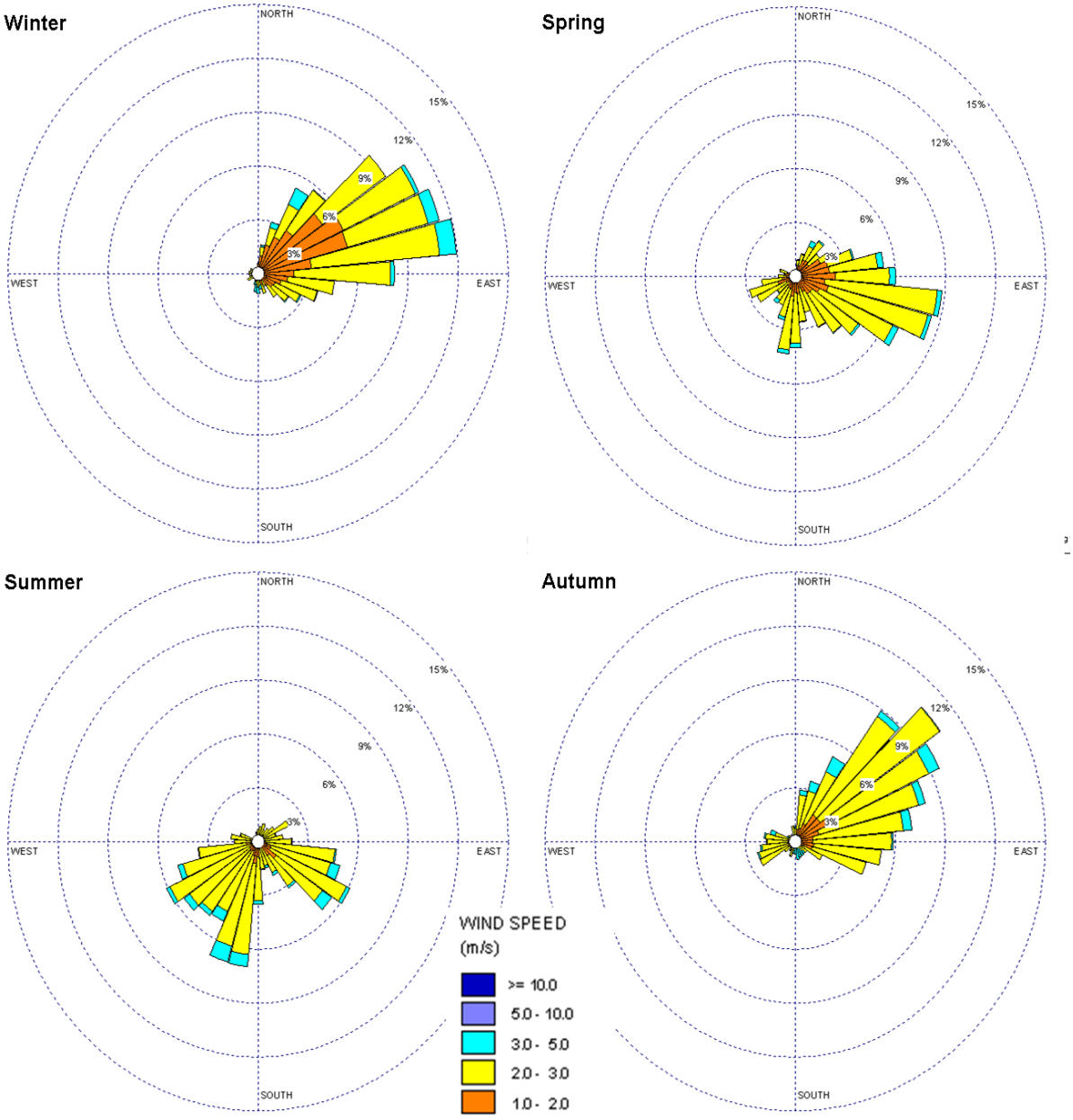
The PATH (Pollutants in the Atmosphere and their Transport over Hong Kong) model, a regional air quality prediction model developed by EPD, is used to predict the meteorology at the site of the flyover road. The PATH model is also used to predict background air quality as a result of various sources in Hong Kong and the surrounding regions including the Pearl River Delta Economic Zone (PRDEZ).

Features of the wind profile that are significant for the site are both the wind speed and wind direction. Low wind speeds are significant for dispersion of non buoyant area sources. At high wind speeds, dust emissions can become significant.

At the site, winds from the northeast are frequent in the autumn and winter. Significant sources that lay to the northeast of the site include Austin Road West and Lin Cheung Road. Easterly winds are dominant in spring. Kowloon Peninsula lays to the east of the site. During summer the winds are predominately from the southeast to southwest. The major source from the southwest is marine emissions in transit to and from at the China Ferry and Ocean Terminals; Victoria Harbour lays to the southeast of the site.

Graph 15.1 shows seasonal windroses for the site from PATH data at grid (28, 27). PATH uses wind data based on meteorology information from 2010.

Graph 15.1: Seasonal windroses for the flyover road site from 2010 PATH data at grid (28, 27)



15.3.2.3 Air Sensitive Receivers

The existing and planned representative Air Sensitive Receivers (ASRs) that could be effected by the flyover road Project within 500 m from its site boundary have been identified and are summarised in **Table 15.3.3**. The final use of each of the parcels may change in the future; therefore, ASRs have been assessed at a variety of intervals up to the proposed maximum height of the buildings that are currently planned. Receptors are located every four metres from 4 m to 20 m and every 10 metres from 20 m to the maximum height of the proposed building. A bias is generated towards the lower levels as this is where the maximum pollutant concentrations are expected to occur.

A field study of the selected existing ASRs external to the flyover road boundary was undertaken and the fresh air intake and residential levels were estimated based on a visual survey. Fresh air intakes for low level commercial property were assumed to be at podium level or where ventilation ducts were identified. Residential receptors were assessed every four metres from the lowest residential level up to 20 metres and then every 10 metres above that.

All the ASRs as listed in **Table 15.3.3** are subject to air quality impact during the operation phase of the flyover road. Construction of the flyover road forms part of the WKCD Project. The flyover road is scheduled to be constructed between 2013 and 2017. The planned ASRs representing facilities/buildings within the WKCD site that will be completed at the early stage of the Project will be subject to air quality impact due to construction of the facilities/buildings at a later stage. Hence, the years in which the planned ASRs will be subject to the construction phase air quality impacts are detailed in **Table 15.3.3** and shown in **Figures 15.3.1** and **15.3.2**. Shaded cells are indicative of residential ASRs.

Table 15.3.3: Representative ASRs Identified for the Assessment

No.	ASR	Description	Horizontal distance from WKCD site boundary (m)	Height (mPD)	Height above ground (m)	No. of storeys	Year subject to construction phase impact	Notes
1	SRT-1	Sorrento – Tower 1 Residential (Existing ASR)	404	24	19	65	2013 – 2017	4m above podium
2	SRT-2			28	23			8m above podium
3	SRT-3			32	27			12m above podium
4	SRT-4			36	31			16m above podium
5	SRT-5			40	35			20m above podium
6	SRT-6			50	45			30 m above podium
7	SRT-7			60	55			40 m above podium
8	SRT-8			70	65			50 m above podium
9	SRT-9			80	75			60 m above podium
10	SRT-10			90	85			70 m above podium
11	SRT-11			100	95			80 m above podium
12	SRT-12			110	105			90 m above podium
13	SRT-13			120	115			100 m above podium
14	SRT-14			130	125			110 m above podium
15	SRT-15			140	135			120 m above podium
16	SRT-16			150	145			130 m above podium
17	SRT-17			160	155			140 m above podium
18	SRT-18			170	165			150 m above podium
19	SRT-19			180	175			160 m above podium
20	SRT-20			190	185			170 m above podium
21	SRT-21			200	195			180 m above podium
22	SRT-22			210	205			190 m above podium
23	SRT-23			220	215			200 m above podium
24	SRT-24			230	225			210 m above podium
25	SRT-25			240	235			220 m above podium
26	SRT-26			250	245			230 m above podium

No.	ASR	Description	Horizontal distance from WKCD site boundary (m)	Height (mPD)	Height above ground (m)	No. of storeys	Year subject to construction phase impact	Notes
27	SRT-27			260	255			240 m above podium
28	CLS-1	The Cullinan – Lunar Sky	194	59.8	54.8	33	2013 – 2017	lowest possible fresh air intake (1st floor above podium)
29	CLS-2	Serviced Apartment (Existing ASR)		62.6	57.6			2nd lowest possible fresh air intake (2nd floor above podium)
30	CLS-3			127.0	122			24th floor inlet
31	CLS-4			129.8	124.8			25th floor inlet
32	CLS-5			163.4	158.4			37th floor inlet
33	CLS-6			166.2	161.2			38th floor inlet
34	WF3-1	The Waterfront – Tower 3 Residential (Existing ASR)	158	36.2	31.2		2013 – 2017	4m above podium
35	WF3-2			40.2	35.2			8m above podium
36	WF3-3			44.2	39.2			12m above podium
37	WF3-4			48.2	43.2			16m above podium
38	WF3-5			58.2	53.2			20m above podium
39	WF3-6			68.2	63.2			30 m above podium
40	WF3-7			78.2	73.2			40 m above podium
41	WF3-8			88.2	83.2			50 m above podium
42	WF3-9			98.2	93.2			60 m above podium
43	WF3-10			108.2	103.2			70 m above podium
44	WF3-11			118.2	113.2			80 m above podium
45	WF3-12			128.2	123.2			90 m above podium
46	WF3-13			138.2	133.2			100 m above podium
47	WF6-1	The Waterfront – Tower 6 Residential (Existing ASR)	309	36.1	31.1		2013 – 2017	4m above podium
48	WF6-2			40.1	35.1			8m above podium
49	WF6-3			44.1	39.1			12m above podium
50	WF6-4			48.1	43.1			16m above podium
51	WF6-5			58.1	53.1			20m above podium
52	WF6-6			68.1	63.1			30 m above podium
53	WF6-7			78.1	73.1			40 m above podium
54	WF6-8			88.1	83.1			50 m above podium
55	WF6-9			98.1	93.1			60 m above podium
56	WF6-10			108.1	103.1			70 m above podium
57	WF6-11			118.1	113.1			80 m above podium
58	WF6-12			128.1	123.1			90 m above podium
59	WF6-13			138.1	133.1			100 m above podium
60	ICC-1	International Commerce Centre(i) Office	142	61.3	56.3	>100	2013 – 2017	5th floor inlet
61	ICC-2			64.1	59.1			6th floor inlet
62	ICC-3			66.9	61.9			7th floor inlet
63	ICC-4			69.7	64.7			8th floor inlet

No.	ASR	Description	Horizontal distance from WKCD site boundary (m)	Height (mPD)	Height above ground (m)	No. of storeys	Year subject to construction phase impact	Notes
64	ICC-5	(Existing ASR)		72.5	67.5			9th floor inlet
65	ICC-6			75.3	70.3			10th floor inlet
66	ICC-7			145.3	140.3			35th floor inlet
67	ICC-8			148.1	143.1			36th floor inlet
68	ICC-9			150.9	145.9			37th floor inlet
69	ICC-10			153.7	148.7			38th floor inlet
70	ICC-11			156.5	151.5			39th floor inlet
71	ICC-12			159.3	154.3			40th floor inlet
72	ICC-13			220.9	215.9			62nd floor inlet
73	ICC-14			223.7	218.7			63rd floor inlet
74	ICC-15			226.5	221.5			64th floor inlet
75	ICC-16			229.3	224.3			65th floor inlet
76	ICC-17			285.3	280.3			85th floor inlet
77	ICC-18			288.1	283.1			86th floor inlet
78	ICC-19			290.9	285.9			87th floor inlet
79	ICC-20			293.7	288.7			88th floor inlet
80	ICC-21			302.1	297.1			91st floor inlet
81	ICC-22			335.7	330.7			103rd floor inlet
82	HT2-1	The HarbourSide – Tower 2 Residential (Existing ASR)	47	30.8	25.8	63	2013 – 2017	4m above podium
83	HT2-2			34.8	29.8			8m above podium
84	HT2-3			38.8	33.8			12m above podium
85	HT2-4			42.8	37.8			16m above podium
86	HT2-5			46.8	41.8			20m above podium
87	HT2-6			56.8	51.8			30 m above podium
88	HT2-7			66.8	61.8			40 m above podium
89	HT2-8			76.8	71.8			50 m above podium
90	HT2-9			86.8	81.8			60 m above podium
91	HT2-10			96.8	91.8			70 m above podium
92	HT2-11			106.8	101.8			80 m above podium
93	HT2-12			116.8	111.8			90 m above podium
94	HT2-13			126.8	121.8			100 m above podium
95	HT2-14			136.8	131.8			110 m above podium
96	HT2-15			146.8	141.8			120 m above podium
97	HT2-16			156.8	151.8			130 m above podium
98	HT2-17			166.8	161.8			140 m above podium
99	HT2-18			176.8	171.8			150 m above podium
100	HT2-19			186.8	181.8			160 m above podium
101	HT2-20			196.8	191.8			170 m above podium
102	HT2-21			206.8	201.8			180 m above podium
103	HT2-22			216.8	211.8			190 m above podium

No.	ASR	Description	Horizontal distance from WKCD site boundary (m)	Height (mPD)	Height above ground (m)	No. of storeys	Year subject to construction phase impact	Notes
104	HT2-23			226.8	221.8			200 m above podium
105	HT2-24			236.8	231.8			210 m above podium
106	HT2-25			246.8	241.8			220 m above podium
107	HT2-26			256.8	251.8			230 m above podium
108	HT2-27			266.8	261.8			240 m above podium
109	AMT-1	The Arch – Moon Tower Residential (Existing ASR)	95	42.0	37	52	2013 – 2017	4m above podium
110	AMT-2			46.0	41			8m above podium
111	AMT-3			50.0	45			12m above podium
112	AMT-4			54.0	49			16m above podium
113	AMT-5			58.0	53			20m above podium
114	AMT-6			68.0	63			30 m above podium
115	AMT-7			78.0	73			40 m above podium
116	AMT-8			88.0	83			50 m above podium
117	AMT-9			98.0	93			60 m above podium
118	AMT-10			108.0	103			70 m above podium
119	AMT-11			118.0	113			80 m above podium
120	AMT-12			128.0	123			90 m above podium
121	AMT-13			138.0	133			100 m above podium
122	AMT-14			148.0	143			110 m above podium
123	AMT-15			158.0	153			120 m above podium
124	AMT-16			168.0	163			130 m above podium
125	AMT-17			178.0	173			140 m above podium
126	AMT-18			188.0	183			150 m above podium
127	AMT-19			198.0	193			160 m above podium
128	AMT-20			208.0	203			170 m above podium
129	AMT-21			218.0	213			180 m above podium
130	AMT-22			228.0	223			190 m above podium
131	P16-1	Parcel 16 Retail/ Dining/ Entertainment (v) Residential (Planned ASR from 2018 onwards)	N/A	13.4	4.0	8	none	See Note (vi)
132	P16-2			17.4	8.0			
133	P16-3			21.4	12.0			
134	P16-4			25.4	16.0			
135	P16-5			29.4	20.0			
136	P16-6			39.4	30.0			Lowest residential floor
137	P16-7			49.4	40.0			
138	P16-8			59.4	50.0			
139	P17-1	Parcel 17 Retail/ Dining/ Entertainment +	N/A	13.4	4.0	15	none	See Note (vi)
140	P17-2			17.4	8.0			
141	P17-3			21.4	12.0			
142	P17-4			25.4	16.0			

No.	ASR	Description	Horizontal distance from WKCD site boundary (m)	Height (mPD)	Height above ground (m)	No. of storeys	Year subject to construction phase impact	Notes
143	P17-5	Residential (Planned ASR from 2018 onwards)		29.4	20.0			Lowest residential floor
144	P17-6			39.4	30.0			
145	P17-7			49.4	40.0			
146	P18a-1	Parcel 18 Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2020 onwards)	N/A	13.4	4.0	8	none	See Note (vi)
147	P18a-2			17.4	8.0			
148	P18a-3			21.4	12.0			
149	P18a-4			25.4	16.0			
150	P18a-5			29.4	20.0			
151	P18a-6			39.4	30.0			
152	P18a-7			49.4	40.0			
153	P18b-1	Parcel 18 Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2020 onwards)	N/A	13.4	4.0	8	none	See Note (vi)
154	P18b-2			17.4	8.0			
155	P18b-3			21.4	12.0			
156	P18b-4			25.4	16.0			
157	P18b-5			29.4	20.0			
158	P18b-6			39.4	30.0			
159	P18b-7			49.4	40.0			
160	P18c-1	Parcel 18 Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2020 onwards)	N/A	13.4	4.0	8	none	See Note (vi)
161	P18c-2			17.4	8.0			
162	P18c-3			21.4	12.0			
163	P18c-4			25.4	16.0			
164	P18c-5			29.4	20.0			
165	P18c-6			39.4	30.0			
166	P18c-7			49.4	40.0			
167	P18d-1	Parcel 18 Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2020 onwards)	N/A	13.4	4.0	8	none	See Note (vi)
168	P18d-2			17.4	8.0			
169	P18d-3			21.4	12.0			
170	P18d-4			25.4	16.0			
171	P18d-5			29.4	20.0			
172	P18d-6			39.4	30.0			
173	P18d-7			49.4	40.0			
174	P18e	Parcel 18 Planned Performance Art Venues within WKCD	N/A	49.4	40.0	8	none	

No.	ASR	Description	Horizontal distance from WKCD site boundary (m)	Height (mPD)	Height above ground (m)	No. of storeys	Year subject to construction phase impact	Notes
		(iv) (Planned ASR from 2030 onwards)						
175	P19-1	Parcel 19	N/A	13.4	4.0	14	none	See Note (vi)
176	P19-2	Hotel + Retail/ Dining/ Entertainment (v) Residential (Planned ASR from 2018 onwards)		17.4	8.0			
177	P19-3			21.4	12.0			
178	P19-4			25.4	16.0			
179	P19-5			29.4	20.0			
180	P19-6			39.4	30.0			Lowest residential floor
181	P19-7			49.4	40.0			
182	P19-8			59.4	50.0			
183	P20-1	Parcel 20	N/A	13.4	4.0		2017	See Note (vi)
184	P20-2	Planned Performance Art Venues within WKCD + Retail/ Dining/ Entertainment (iv) (Planned ASR from 2017 onwards)		17.4	8.0			
185	P20-3			21.4	12.0			
186	P20-4			25.4	16.0			
187	P20-5			29.4	20.0			
188	P20-6			39.4	30.0			
189	P20-7			49.4	40.0			
190	P20-8			59.4	50.0			
191	P21-1	Parcel 21	N/A	13.4	4.0	13	2017	See Note (vi)
192	P21-2	Office + Retail/ Dining/ Entertainment (v) Residential (Planned ASR from 2017 onwards)		17.4	8.0			
193	P21-3			21.4	12.0			
194	P21-4			25.4	16.0			
195	P21-5			29.4	20.0			
196	P21-6			39.4	30.0			Lowest residential floor
197	P21-7			49.4	40.0			
198	P22-1	Parcel 22	N/A	13.4	4.0	13	none	See Note (vi)
199	P22-2	GIC + Retail/ Dining/ Entertainment (v) Residential (Planned ASR from 2018 onwards)		17.4	8.0			
200	P22-3			21.4	12.0			
201	P22-4			25.4	16.0			
202	P22-5			29.4	20.0			Lowest residential floor
203	P22-6			39.4	30.0			
204	P22-7			49.4	40.0			
205	P22-8			59.4	50.0			

No.	ASR	Description	Horizontal distance from WKCD site boundary (m)	Height (mPD)	Height above ground (m)	No. of storeys	Year subject to construction phase impact	Notes
206	P23a-1	Parcel 23	N/A	13.4	4.0	8	2017	See Note (vi)
207	P23a-2	Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2020 onwards)		17.4	8.0			
208	P23a-3			21.4	12.0			
209	P23a-4			25.4	16.0			
210	P23a-5			29.4	20.0			
211	P23a-6			39.4	30.0			
212	P23a-7			49.4	40.0			
213	P23b-1	Parcel 23		13.4	4.0	8	none	See Note (vi)
214	P23b-2	Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2020 onwards)		17.4	8.0			
215	P23b-3			21.4	12.0			
216	P23b-4			25.4	16.0			
217	P23b-5			29.4	20.0			
218	P23b-6			39.4	30.0			
219	P23b-7			49.4	40.0			
220	P23c-1	Parcel 23		13.4	4.0	8	none	See Note (vi)
221	P23c-2	Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2020 onwards)		17.4	8.0			
222	P23c-3			21.4	12.0			
223	P23c-4			25.4	16.0			
224	P23c-5			29.4	20.0			
225	P23c-6			39.4	30.0			
226	P23c-7			49.4	40.0			
227	P23d-1	Parcel 23		13.4	4.0	8	none	See Note (vi)
228	P23d-2	Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2020 onwards)		17.4	8.0			
229	P23d-3			21.4	12.0			
230	P23d-4			25.4	16.0			
231	P23d-5			29.4	20.0			
232	P23d-6			39.4	30.0			
233	P23d-7			49.4	40.0			
234	P23e	Parcel 23 Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2020 onwards)		49.4	40.0	8	none	
235	P24-1	Parcel 24	N/A	13.4	4.0	14	none	See Note (vi)
236	P24-2	Office		17.4	8.0			
237	P24-3			21.4	12.0			

No.	ASR	Description	Horizontal distance from WKCD site boundary (m)	Height (mPD)	Height above ground (m)	No. of storeys	Year subject to construction phase impact	Notes
238	P24-4	+ Retail/ Dining/ Entertainment (v) Residential (Planned ASR from 2018 onwards)		25.4	16.0			
239	P24-5			29.4	20.0			
240	P24-6			39.4	30.0			Lowest residential floor
241	P24-7			49.4	40.0			
242	P24-8			59.4	50.0			
243	P25-1	Parcel 25 Pavilion (iv) (Planned ASR from 2017 onwards)	N/A	13.4	4.0	1	2017	See Noted (vi)
244	P25-2			17.4	8.0			
245	P25-3			21.4	12.0			
246	P25-4			25.4	16.0			
247	P25-5			29.4	20.0			
248	P26-1	Parcel 26 Office + Retail/ Dining/ Entertainment (v) Residential (Planned ASR from 2018 onwards)	N/A	13.4	4.0	15	none	See Note (vi)
249	P26-2			17.4	8.0			
250	P26-3			21.4	12.0			
251	P26-4			25.4	16.0			
252	P26-5			29.4	20.0			
253	P26-6			39.4	30.0			Lowest residential floor
254	P26-7			49.4	40.0			
255	P26-8			59.4	50.0			
256	P27-1	Parcel 27 Office + Retail/ Dining/ Entertainment (v) Residential (Planned ASR from 2018 onwards)	N/A	13.4	4.0	15	none	See Note (vi)
257	P27-2			17.4	8.0			
258	P27-3			21.4	12.0			
259	P27-4			25.4	16.0			
260	P27-5			29.4	20.0			
261	P27-6			39.4	30.0			
262	P27-7			49.4	40.0			Lowest residential floor
263	P27-8			59.4	50.0			
264	P28-1	Parcel 28 Office + Retail/ Dining/ Entertainment (v) Residential (Planned ASR from 2018 onwards)	N/A	13.4	4.0	21	none	See Note (vi)
265	P28-2			17.4	8.0			
266	P28-3			21.4	12.0			
267	P28-4			25.4	16.0			
268	P28-5			29.4	20.0			
269	P28-6			39.4	30.0			Lowest residential floor
270	P28-7			49.4	40.0			
271	P28-8			59.4	50.0			
272	P28-9			69.4	60.0			
273	P28-10			79.4	70.0			

No.	ASR	Description	Horizontal distance from WKCD site boundary (m)	Height (mPD)	Height above ground (m)	No. of storeys	Year subject to construction phase impact	Notes
274	P29-1	Parcel 29	N/A	13.4	4.0	23	none	See Note (vi)
275	P29-2	Office + Retail/ Dining/ Entertainment (v)		17.4	8.0			
276	P29-3			21.4	12.0			
277	P29-4			25.4	16.0			
278	P29-5			29.4	20.0			
279	P29-6	Residential (Planned ASR from 2018 onwards)		39.4	30.0			Lowest residential floor
280	P29-7			49.4	40.0			
281	P29-8			59.4	50.0			
282	P29-9			69.4	60.0			
283	P29-10			79.4	70.0			
284	P30a-1	Parcel 30	N/A	13.4	4.0	6	none	See Note (vi)
285	P30a-2	Planned Performance Art Venues within WKCD (iv) (Planned ASR from beyond 2020)		17.4	8.0			
286	P30a-3			21.4	12.0			
287	P30a-4			25.4	16.0			
288	P30a-5			29.4	20.0			
289	P30b-1	Parcel 30		13.4	4.0	6	none	See Note (vi)
290	P30b-2	Planned Performance Art Venues within WKCD (iv) (Planned ASR from beyond 2020)		17.4	8.0			
291	P30b-3			21.4	12.0			
292	P30b-4			25.4	16.0			
293	P30b-5			29.4	20.0			
294	P30c-1	Parcel 30		13.4	4.0	6	none	See Note (vi)
295	P30c-2	Planned Performance Art Venues within WKCD (iv) (Planned ASR from beyond 2020)		17.4	8.0			
296	P30c-3			21.4	12.0			
297	P30c-4			25.4	16.0			
298	P30c-5			29.4	20.0			
299	P30d-1	Parcel 30		13.4	4.0	6	none	See Note (vi)
300	P30d-2	Planned Performance Art Venues within WKCD (iv) (Planned ASR from beyond		17.4	8.0			
301	P30d-3			21.4	12.0			
302	P30d-4			25.4	16.0			
303	P30d-5			29.4	20.0			

No.	ASR	Description	Horizontal distance from WKCD site boundary (m)	Height (mPD)	Height above ground (m)	No. of storeys	Year subject to construction phase impact	Notes
		2020)						
304	P30e	Parcel 30 Planned Performance Art Venues within WKCD (iv) (Planned ASR from beyond 2020)		29.4	20.0	6	none	
305	P31-1	Parcel 31	N/A	13.4	4.0	22	none	See Note (vi)
306	P31-2	Retail/ Dining/ Entertainment (iv) Office(iv) (Planned ASR from 2018 onwards)		17.4	8.0			
307	P31-3			21.4	12.0			
308	P31-4			25.4	16.0			
309	P31-5			29.4	20.0			
310	P31-6			39.4	30.0			
311	P31-7			49.4	40.0			
312	P31-8			59.4	50.0			
313	P31-9			69.4	60.0			
314	P31-10			79.4	70.0			
315	P31-11			89.4	80.0			
316	P32-1	Parcel 32	N/A	13.4	4.0	15	none	
317	P32-2	Retail/ Dining/ Entertainment + Residential (Planned ASR from 2018 onwards)		17.4	8.0			
318	P32-3			21.4	12.0			Lowest residential floor
319	P32-4			25.4	16.0			
320	P32-5			29.4	20.0			
321	P32-6			39.4	30.0			
322	P32-7			49.4	40.0			
323	P34-1	Parcel 34	N/A	13.4	4.0	21	none	See Note (vi)
324	P34-2	Office + Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2018 onwards)		17.4	8.0			
325	P34-3			21.4	12.0			
326	P34-4			25.4	16.0			
327	P34-5			29.4	20.0			
328	P34-6			39.4	30.0			
329	P34-7			49.4	40.0			
330	P34-8			59.4	50.0			
331	P34-9			69.4	60.0			
332	P34-10			79.4	70.0			
333	P35a-1	Parcel 35	N/A	13.4	4.0	7	2017	See Note (vi)
334	P35a-2	Planned Performance		17.4	8.0			
335	P35a-3			21.4	12.0			

No.	ASR	Description	Horizontal distance from WKCD site boundary (m)	Height (mPD)	Height above ground (m)	No. of storeys	Year subject to construction phase impact	Notes
336	P35a-4	Art Venues within WKCD (iv) (Planned ASR from 2017 onwards)		25.4	16.0			
337	P35a-5			29.4	20.0			
338	P35b-1	Parcel 35 Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2017 onwards)		13.4	4.0	7	2017	See Note (vi)
339	P35b-2			17.4	8.0			
340	P35b-3			21.4	12.0			
341	P35b-4			25.4	16.0			
342	P35b-5			29.4	20.0			
343	P35c-1	Parcel 35 Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2017 onwards)		13.4	4.0	7	2017	See Note (vi)
344	P35c-2			17.4	8.0			
345	P35c-3			21.4	12.0			
346	P35c-4			25.4	16.0			
347	P35c-5			29.4	20.0			
348	P35d-1	Parcel 35 Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2017 onwards)		13.4	4.0	7	2017	See Note (vi)
349	P35d-2			17.4	8.0			
350	P35d-3			21.4	12.0			
351	P35d-4			25.4	16.0			
352	P35d-5			29.4	20.0			
353	P35e-1	Parcel 35 Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2017 onwards)		29.4	20.0	7	2017	
354	P36-1	Parcel 36 Retail/ Dining/ Entertainment (iv) (Planned ASR from 2018	N/A	11.4	4.0	15	none	See Note (vi)
355	P36-2			15.4	8.0			
356	P36-3			19.4	12.0			
357	P36-4			23.4	16.0			
358	P36-5			27.4	20.0			
359	P36-6			37.4	30.0			

No.	ASR	Description	Horizontal distance from WKCD site boundary (m)	Height (mPD)	Height above ground (m)	No. of storeys	Year subject to construction phase impact	Notes
360	P36-7	onwards)		47.4	40.0			
361	P36-8			57.4	50.0			
362	P36-9			67.4	60.0			
363	P36-10			77.4	70.0			
364	P37-1	Parcel 37	N/A	11.4	4.0	15	2017	See Note (vi)
365	P37-2	Retail/ Dining/ Entertainment (iv) (Planned ASR from 2017 onwards)		15.4	8.0			
366	P37-3			19.4	12.0			
367	P37-4			23.4	16.0			
368	P37-5			27.4	20.0			
369	P37-6			37.4	30.0			
370	P37-7			47.4	40.0			
371	P37-8			57.4	50.0			
372	P37-9			67.4	60.0			
373	P37-10			77.4	70.0			
374	P38-1	Parcel 38	N/A	13.4	4.0	21	2017	See Note (vi)
375	P38-2	Office + Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2017 onwards)		17.4	8.0			
376	P38-3			21.4	12.0			
377	P38-4			25.4	16.0			
378	P38-5			29.4	20.0			
379	P38-6			39.4	30.0			
380	P38-7			49.4	40.0			
381	P38-8			59.4	50.0			
382	P38-9			69.4	60.0			
383	P38-10			79.4	70.0			
384	P39-1	Parcel 39	N/A	13.4	4.0	11	none	See Note (vi)
385	P39-2	Office + Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2020 onwards)		17.4	8.0			
386	P39-3			21.4	12.0			
387	P39-4			25.4	16.0			
388	P39-5			29.4	20.0			
389	P39-6			39.4	30.0			
390	P39-7			49.4	40.0			
391	P39-8			59.4	50.0			
392	P39-9			69.4	60.0			
393	P39-10			79.4	70.0			
394	P40a-1	Parcel 40	N/A	13.4	4.0	6	none	See Note (vi)
395	P40a-2	Planned Performance Art Venues within WKCD (iv) (Planned ASR		17.4	8.0			
396	P40a-3			21.4	12.0			
397	P40a-4			25.4	16.0			
398	P40a-5			29.4	20.0			
399	P40a-6			39.4	30.0			

No.	ASR	Description	Horizontal distance from WKCD site boundary (m)	Height (mPD)	Height above ground (m)	No. of storeys	Year subject to construction phase impact	Notes
400	P40a-7	from 2018 onwards(		49.4	40.0			
401	P40b-1	Parcel 40		13.4	4.0	6	none	See Note (vi)
402	P40b-2	Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2018 onwards)		17.4	8.0			
403	P40b-3			21.4	12.0			
404	P40b-4			25.4	16.0			
405	P40b-5			29.4	20.0			
406	P40b-6			39.4	30.0			
407	P40b-7			49.4	40.0			
408	P40c-1	Parcel 40		13.4	4.0	6	none	See Note (vi)
409	P40c-2	Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2018 onwards)		17.4	8.0			
410	P40c-3			21.4	12.0			
411	P40c-4			25.4	16.0			
412	P40c-5			29.4	20.0			
413	P40c-6			39.4	30.0			
414	P40c-7			49.4	40.0			
415	P40d-1	Parcel 40		13.4	4.0	6	none	See Note (vi)
416	P40d-2	Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2018 onwards)		17.4	8.0			
417	P40d-3			21.4	12.0			
418	P40d-4			25.4	16.0			
419	P40d-5			29.4	20.0			
420	P40d-6			39.4	30.0			
421	P40d-7			49.4	40.0			
422	P40e	Parcel 40 Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2018 onwards)		49.4	40.0	6	none	
423	P41-1	Parcel 41	N/A	13.4	4.0	1	none	See Note (vi)
424	P41-2	Pavilion (iv) (Planned ASR from 2030 onwards)		17.4	8.0			
425	P41-3			21.4	12.0			
426	P41-4			25.4	16.0			
427	P41-5			29.4	20.0			
428	P43a-1	Parcel 43	N/A	16.5	4.0	13	none	See Note (vi)
429	P43a-2	Hotel + Retail/ Dining/ Entertainment		20.5	8.0			
430	P43a-3			24.5	12.0			
431	P43a-4			28.5	16.0			

No.	ASR	Description	Horizontal distance from WKCD site boundary (m)	Height (mPD)	Height above ground (m)	No. of storeys	Year subject to construction phase impact	Notes
		(iv) (Planned ASR from 2020 onwards)						
432	P43b-1	Parcel 43 Hotel + Retail/ Dining/ Entertainment (iv) (Planned ASR from 2020 onwards)		16.5	4.0	13	none	See Note (vi)
433	P43b-2			20.5	8.0			
434	P43b-3			24.5	12.0			
435	P43b-4			28.5	16.0			
436	P43b-5			32.5	20.0			
437	P43c-1	Parcel 43 Hotel + Retail/ Dining/ Entertainment (iv) (Planned ASR from 2020 onwards)		16.5	4.0	13	none	See Note (vi)
438	P43c-2			20.5	8.0			
439	P43c-3			24.5	12.0			
440	P43c-4			28.5	16.0			
441	P43c-5			32.5	20.0			
442	P43d-1	Parcel 43 Hotel + Retail/ Dining/ Entertainment (iv) (Planned ASR from 2020 onwards)		16.5	4.0	13	none	See Note (vi)
443	P43d-2			20.5	8.0			
444	P43d-3			24.5	12.0			
445	P43d-4			28.5	16.0			
446	P43d-5			32.5	20.0			
447	P43d-6			42.5	30.0			
448	P43d-7			52.5	40.0			
449	P43e-1	Parcel 43 Hotel + Retail/ Dining/ Entertainment (iv) (Planned ASR from 2020 onwards)		16.5	4.0	13	none	See Note (vi)
450	P43e-2			20.5	8.0			
451	P43e-3			24.5	12.0			
452	P43e-4			28.5	16.0			
453	P43e-5			32.5	20.0			
454	P43e-6			42.5	30.0			
455	P43e-7			52.5	40.0			
456	P43e-8			62.5	50.0			
457	P43f-1	Parcel 43 Hotel + Retail/ Dining/ Entertainment (iv) (Planned ASR from 2020 onwards)		16.5	4.0	13	none	See Note (vi)
458	P43f-2			20.5	8.0			
459	P43f-3			24.5	12.0			
460	P43f-4			28.5	16.0			
461	P43f-5			32.5	20.0			
462	P43f-6			42.5	30.0			
463	P43f-7			52.5	40.0			
464	P43f-8			62.5	50.0			

No.	ASR	Description	Horizontal distance from WKCD site boundary (m)	Height (mPD)	Height above ground (m)	No. of storeys	Year subject to construction phase impact	Notes
465	P43g-1	Parcel 43		16.5	4.0	13	none	See Note (vi)
466	P43g-2	Hotel + Retail/ Dining/ Entertainment (iv) (Planned ASR from 2020 onwards)		20.5	8.0			
467	P43g-3			24.5	12.0			
468	P43g-4			28.5	16.0			
469	P43g-5			32.5	20.0			
470	P43g-6			42.5	30.0			
471	P43g-7			52.5	40.0			
472	P43h-1	Parcel 43		16.5	4.0	13	none	See Note (vi)
473	P43h-2	Hotel + Retail/ Dining/ Entertainment (iv) (Planned ASR from 2020 onwards)		20.5	8.0			
474	P43h-3			24.5	12.0			
475	P43h-4			28.5	16.0			
476	P43h-5			32.5	20.0			
477	P43h-6			42.5	30.0			
478	P43h-7			52.5	40.0			
479	P43i-1	Parcel 43		16.5	4.0	13	none	See Note (vi)
480	P43i-2	Hotel + Retail/ Dining/ Entertainment (iv) (Planned ASR from 2020 onwards)		20.5	8.0			
481	P43i-3			24.5	12.0			
482	P43i-4			28.5	16.0			
483	P43i-5			32.5	20.0			
484	P43i-6			42.5	30.0			
485	P43j-1	Parcel 43		16.5	4.0	13	none	See Note (vi)
486	P43j-2	Hotel + Retail/ Dining/ Entertainment (iv) (Planned ASR from 2020 onwards)		20.5	8.0			
487	P43j-3			24.5	12.0			
488	P43j-4			28.5	16.0			
489	P43j-5			32.5	20.0			
490	P43k-1	Parcel 43		16.5	4.0	13	none	See Note (vi)
491	P43k-2	Hotel + Retail/ Dining/ Entertainment (iv) (Planned ASR from 2020 onwards)		20.5	8.0			
492	P43k-3			24.5	12.0			
493	P43k-4			28.5	16.0			
499	P46a-1	Parcel 46	N/A	16.4	4.0	5	none	See Note (vi)
500	P46a-2	Planned Performance Art Venues within WKCD		20.4	8.0			
501	P46a-3			24.4	12.0			
502	P46a-4			28.4	16.0			
503	P46a-5			32.4	20.0			

No.	ASR	Description	Horizontal distance from WKCD site boundary (m)	Height (mPD)	Height above ground (m)	No. of storeys	Year subject to construction phase impact	Notes
504	P46a-6	(iv) (Planned ASR from 2020 onwards)		42.4	30.0			
505	P46b-1	Parcel 46		16.4	4.0	5	none	See Note (vi)
506	P46b-2	Planned Performance Art Venues within WKCD (iv)		20.4	8.0			
507	P46b-3			24.4	12.0			
508	P46b-4			28.4	16.0			
509	P46b-5			32.4	20.0			
510	P45b-6	(Planned ASR from 2020 onwards)		42.4	30.0			
511	P46c-1	Parcel 46		16.4	4.0	5	none	See Note (vi)
512	P46c-2	Planned Performance Art Venues within WKCD (iv)		20.4	8.0			
513	P46c-3			24.4	12.0			
514	P46c-4			28.4	16.0			
515	P46c-5			32.4	20.0			
516	P45c-6	(Planned ASR from 2020 onwards)		42.4	30.0			
517	P46d-1	Parcel 46		16.4	4.0	5	none	See Note (vi)
518	P46d-2	Planned Performance Art Venues within WKCD (iv)		20.4	8.0			
519	P46d-3			24.4	12.0			
520	P46d-4			28.4	16.0			
521	P46d-5			32.4	20.0			
522	P46d-6	(Planned ASR from 2020 onwards)		42.4	30.0			
523	P46e-1	Parcel 46 Planned Performance Art Venues within WKCD (iv) (Planned ASR from 2020 onwards)		42.4	30.0	5	none	
524	P50-1	Parcel 50	N/A	9.0	4.0	NA	none	See Note (vi)
525	P50-2	Planned Performance Art Venues within WKCD (iv)		13.0	8.0			
526	P50-3			17.0	12.0			
527	P50-4			21.0	16.0			
528	P50-5	(Planned ASR from 2020 onwards)		25.0	20.0			

No.	ASR	Description	Horizontal distance from WKCD site boundary (m)	Height (mPD)	Height above ground (m)	No. of storeys	Year subject to construction phase impact	Notes
529	P51-1	Parcel 51	N/A	9.0	4.0	NA	2016 – 2017	See Note (vi)
530	P51-2	Freespace (Planned ASR from 2016 onwards)		13.0	8.0			
531	P51-3			17.0	12.0			
532	P51-4			21.0	16.0			
533	P51-5			25.0	20.0			
534	P52-1	Parcel 52	N/A	9.0	4.0	2	2016 – 2017	See Note (vi)
535	P52-2	Pavilion (iv) (Planned ASR from 2016 onwards)		13.0	8.0			
536	P52-3			17.0	12.0			
537	P52-4			21.0	16.0			
538	P52-5			25.0	20.0			
539	P53-1	Parcel 53	N/A	9.0	4.0	2	2014 – 2017	See Note (vi)
540	P53-2	Pavilion (iv) (Planned ASR from 2014 onwards)		13.0	8.0			
541	P53-3			17.0	12.0			
542	P53-4			21.0	16.0			
543	P53-5			25.0	20.0			
544	OP	Open space (Planned ASR from 2017 onwards)	N/A	6.5	1.5	0	2017	

Notes
(i) Estimated locations of the fresh air takes of these developments are taken as the ASRs.
(ii) The locations and no. of storeys of the planned ASRs representing the topside development at West Kowloon Terminus (WKT) Site A are based on the approved EIA for Hong Kong Section of the Guangzhou – Shenzhen – Hong Kong Express Rail Link (XRL).
(iii) According to the approved EIA for Road Works at West Kowloon, these planned ASRs will be occupied upon completion of construction of the Road Works at West Kowloon project in 2014.
(iv) The planned ASRs represent the indicative fresh air intake locations of these planned developments.
(v) Selected assessment height is the indicative location of fresh air intake at podium level.
(vi) The planned ASR at 4m above ground level are assessment points for reference only, but are not fresh air intake or openable window locations.

15.3.3 Identification of Pollution Sources

15.3.3.1 Background Air Quality

The flyover road is located on the Kowloon Peninsula and is surrounded by the sea on two of its four sides. In accordance with the *Guidelines in Assessing the 'TOTAL' Air Quality Impacts*, the WKCD area is categorised as an urban area. Since there is no EPD general air quality monitoring station located in this area, the recent five years (2007 –2011) annual average monitoring data recorded at five of EPD's general air quality monitoring stations in urban areas should therefore be used to estimate the background TSP concentration. Using this average allows for the harbour setting of the site to be considered and provides more representative estimation of the background concentrations than by using any one station only.

With reference to EPD's Air Quality Annual Report, the EPD's general air quality monitoring stations in urban areas that can be considered as an indication of the background concentration include

Central/Western, Kwun Tong, Sham Shui Po, Tsuen Wan and Kwai Chung. The average TSP concentration of all these five monitoring stations is detailed in **Table.15.3.4**.

Table.15.3.4 Average Background TSP Air Pollutant Concentrations (Year 2007-2011)

Urban Stations	Annual Average TSP Concentration (µg/m^3)					TSP Background Concentration (µg/m^3)
	2007	2008	2009	2010	2011	
Tsuen Wan	79	67	63	63	69	68.2
Kwai Chung	**85**	79	70	71	71	75.2
Sham Shui Po	79	**81**	77	76	79	78.4
Kwun Tong	**82**	72	70	67	74	73.0
Central/Western	77	78	73	76	78	76.4
					Average	74.2

Note: Monitoring results that exceeded AQO are shown in bold characters.

Dust monitoring has been undertaken in the vicinity of the proposed West Kowloon Terminus (WKT) from March 2010 to December 2012 inclusive as part of the environmental monitoring and audit (EM&A) works for XRL project. The air monitoring stations considered to be most relevant to WKCD area are AM16 and AM17, as both stations are in close proximity to the WKCD site (see **Figure 3.2**). The annual average TSP concentration during that construction period of WKT has been calculated, as shown in **Table 15.3.5** (see **Appendix 3.27** for details).

Table 15.3.5: Air Quality Monitoring Results for Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link relevant to WKCD (March 2010 – December 2012)

Monitoring Station	Location	Annual Average TSP Concentration (µg/m^3)			3-year Average Concentration (µg/m^3)
		2010[(1)]	2011	2012	
AM16	Tower 3, The Waterfront	74.2	73.4	54.3	67.1
AM17	The Victoria Towers	74.7	79.3	55.5	69.7
				Average	68.4

Note: (1) Monitoring results from March 2010 to December 2010.

As the air quality monitoring stations AM16 and AM17 border the XRL site boundary, it is reasonable to assume that the average TSP concentration of these two stations can represent XRL generated dust concentrations plus prevailing background dust concentrations at the WKCD area. While the 5-year average TSP concentration in urban areas as obtained from EPD's urban air quality monitoring stations (74.2 µg/m^3 from **Table.15.3.4**) is comparable to that from the XRL data (68.4 µg/m^3 from **Table 15.3.5**), it is considered that using the XRL monitoring data is a more reasonable estimate for the WKCD area TSP assessment. This is because there is a sufficient amount of XRL data (about 3 years' data) and the XRL monitoring stations are in close proximity to the WKCD site whereas the EPD's monitoring stations are at much larger distances (1.91 km to 8.65 km) from the site.

Operational air quality contaminants of significance to the Project area include: SO_2, from marine; NO_2, from vehicles and marine; RSP, from vehicles and marine. The 5-year average concentrations for these pollutants are detailed in **Table 15.3.6**.

Table 15.3.6: Average Background Air Pollutant Concentrations from EPD's Urban Air Monitoring Stations (Year 2007-2011)

Pollutant	Urban Stations and 5-year Average Concentration (µg/m^3)					AQO criteria (µg/m^3)	5-year Average Concentration (µg/m^3)
	Tsuen Wan	Kwai Chung	Sham Shui Po	Kwun Tong	Central/ Western		
Sulfur Dioxide (SO_2)	19.8	24.4	17.4	13.8	17.6	80	18.6
Nitrogen Dioxide (NO_2)	63.2	64.6	68.4	60.4	52.8	80	61.9
Respirable Suspended Particulate (RSP/PM_{10})	51.2	50.4	51.2	48.8	49.6	55	50.2

In addition to the urban air quality monitoring stations, EPD had operated a local air quality monitoring station at the WKCD site to record background air pollutant concentrations from September 2011 to August 2012. Although the monitoring data is only for a single year, the recorded information is useful as a direct indication of the onsite air quality. **Table 15.3.7** shows the background air quality data for the WKCD site for 2011-2012 (see details in **Appendix 3.20)**.

Table 15.3.7: Average Background Air Pollutant Concentrations from EPD's Local Monitoring Station at WKCD Site (September 2011 – August 2012)

Pollutant	Annual Average Concentration (µg/m^3)	AQO criteria (µg/m^3)
Sulfur Dioxide (SO_2)	11.4	80
Nitrogen Dioxide (NO_2)	46.7	80
Respirable Suspended Particulate (RSP/PM_{10})	45.0	55

By comparing the EPD's onsite monitoring results at WKCD with the 5-year average from the urban monitoring stations, it can be seen that the onsite monitoring results are significantly lower – approximately 39% lower for SO_2, 25% lower for NO_2, and 10% lower for RSP.

The future background air pollutant concentrations to be used for predicting the total air quality impact due to operational phase for NO_2 RSP and SO_2 are as extracted from the PATH model (for year 2015) released by EPD in December 2012.

15.3.3.2 Construction Phase

Construction of the WKCD basement will be carried out in zones, with construction of Zone 1 aimed at commencement in 2013 for completion of Zones 1 to 3 in 2017 (see **Appendix 2.4** for the assumed construction programme). During construction, the major activities that would generate construction dust emissions include the following:

- Excavation activities;
- Foundation works;
- Concrete batching plant and barging points (assumed to be handed over from the XRL project to WKCD);
- Site Formation, and;
- Movement of mobile plant and vehicles on haul roads.

Based on a review of the construction methods adopted for the WKCD Project, construction dust will be potentially generated from the aforementioned land-based construction activities and is therefore identified as the representative pollutants. Therefore, it is considered appropriate to adopt total suspended particulate (TSP) as the key pollutant during the construction phase. According to the *"2011 Hong Kong Emission Inventory Report"* published by EPD[1] in March 2013, which is the latest available information at the time of preparing this Report, the top 3 major sources of RSP include navigation, road transport and public electricity generation, which collectively accounted for about 72% of the total RSP emission in 2011 whereas non-combustion sources only constituted about 15% of the total emission. Since construction dust is only one of the various non-combustion sources, it is considered that RSP would not be a representative pollutant of construction dust.

Due to construction of concurrent projects in the vicinity, cumulative impacts are expected. **Table 15.3.8** summarises the concurrent projects that may contribute to cumulative construction dust impacts.

Table 15.3.8: Summary of concurrent projects during construction phase

Project	Construction Period	Possible Cumulative Impact	Included in Cumulative Impact Assessment
Hong Kong Section of the Guangzhou – Shenzhen – Hong Kong Express Rail Link (XRL)	Jan 2010 – 2015	Dust emissions from construction of the West Kowloon Terminus and operation of the concrete batching plant and barging points	Yes
Road Works at West Kowloon	2011 – 2014	According to the EIA, major dusty construction activities and excavation works are to be completed by March 2012. Minor dust emissions may arise from the remaining road works and movement of mobile plant and vehicles	No
Road Improvement Works in West Kowloon Reclamation Development – Phase I	Late 2013 / early 2014 – end 2015	Dust emissions from the roadworks construction and movement of mobile plant and vehicles	Yes
Central Kowloon Route	2015 – end 2020	Dust emissions from construction works	Yes

As an updated schedule of construction works for the WKT of the XRL project is not available for 2013-2015, it is not possible to incorporate realistic dust emission sources of WKT into the FDM model for assessment of cumulative impacts. As such, relevant EM&A monitoring data of the XRL project is used to assess the potential cumulative impacts as described below.

With reference to the dust monitoring results from the two air quality monitoring stations (AM16 and AM17) in the vicinity of the WKCD site from March 2010 to December 2012 inclusive, the average TSP concentration during that construction period of WKT has been calculated, as shown in **Appendix 3.27**. . It is reasonable to assume that the average TSP concentration from these two dust monitoring stations can represent XRL generated dust concentrations plus prevailing background dust concentrations at the WKCD area. The background concentration used for the TSP assessment for the flyover road is therefore taken as 68.4 $\mu g/m^3$ (Table 15.3.5).

[1] http://www.epd.gov.hk/epd/english/environmentinhk/air/data/files/2011HKEIReport.pdf

For the Central Kowloon Route (CKR) project, its construction dust impact assessment area overlaps part of the corresponding assessment area for the flyover road. Therefore, the relevant TSP modelling results from the published EIA of CKR project have been added to those of the flyover road for ASRs that are within the overlapped portion of both assessment areas in order to assess the cumulative effects.

15.3.3.3 Operation Phase – Vehicular Emissions

During the operation phase, there will be cumulative air quality impacts on the ASRs due to vehicular emissions from:

- Existing and proposed open roads outside the flyover road area but within the 500 m assessment area;
- Proposed underpasses/landscape decks along the Austin Road West and Lin Cheung Road and the associated top openings under the Road Works at West Kowloon project, which is within the 500 m assessment area; and
- Portal of the existing Western Harbour Crossing (WHC) which is in the vicinity of the flyover road site.
- Ventilation exhausts and portals serving the planned underground roads within the WKCD area.

It should be noted that all of the above vehicular emission sources, except the planned underground roads within WKCD, are due to the current and planned road networks serving the West Kowloon area. Therefore, it is anticipated that the flyover road itself would only have a relatively small contribution to total vehicular emissions in the area. On the contrary, the WKCD development would be subject to potential air quality impacts that are largely generated by the existing/planned road traffic in the area.

The air quality inside the WKCD basement where the underground vehicle roads are located should meet the air pollutant standards as recommended by the EPD's *Practice Note on Control of Air Pollution in Vehicle Tunnels* (see **Table 15.3.2**).. Therefore, the basement ventilation system should be properly designed by WKCDA's consultant/engineer to adequately remove or dilute vehicle emissions and the basement air quality should be monitored to ensure compliance with the relevant air quality standards.

15.3.3.4 Operation Phase – Marine Traffic Emissions

There are existing marine activities within the 500 m assessment area that will contribute to the background emissions, which include:

- Fast ferry traffic movements, based on scheduled sailings, of up to 170 daily movements (ferry going to is one movement, ferry leaving is a second movement) at the China Ferry Terminal;
- Tugs associated with Derrick lighter barge movements in the NYMTTS;
- Derrick lighter barges operating at the New Yau Ma Tei Public Cargo Working Area (NYPCWA), and;
- Ocean Cruise Ship berthing at the Ocean Terminal.

Although emissions from all the above current marine activities are not attributable to the flyover road development, the WKCD development would be subject to potential air quality impacts caused by such marine emissions.

Under the current development of marine traffic planning at the WKCD site, it is intended that marine services at WKCD will primarily be provided for visitor or leisure activities. In terms of traffic volume, the support on the need of the possible piers has been a key outcome from the public consultation in view of

general public's opinions and needs. No precedence case or similar scale of development as the WKCD has been developed in the Victoria Harbour and therefore no realistic marine traffic forecast can be developed at this stage of the Project. However, as the possible piers would only be used by visitors or for leisure purposes without any planning for routine uses, it is anticipated that the marine traffic to be generated at the two possible piers would be insignificant when compared to the aforementioned existing marine activities. No vessel landing will be included at the optional viewing platform and for the proposed landing steps of WKCD, and therefore they are being designed as features of the development and will not serve any marine traffic.

15.3.3.5 Operation Phase – Industrial Emissions

Chimney survey and desktop study have been conducted to identify any existing or planned chimneys of industrial operations within the 500m assessment area. Based on the survey and desktop study findings, no existing or planned chimneys were identified within the assessment area.

15.3.3.6 Operation Phase – Identification of Key Air Pollutants of Concern

As presented in **Section 15.3.1.2**, under the APCO, AQOs are stipulated for seven criteria air pollutants, namely, nitrogen dioxide (NO_2), sulphur dioxide (SO_2), total suspended particulates (TSP), respirable suspended particulates (RSP), carbon monoxide (CO), ozone and lead. As identified in **Sections 15.3.3.3** and **15.3.3.4**, during the operation phase, the existing/planned ASRs within 500m assessment would be subject to potential air quality impacts due to emissions from the flyover and the nearby road traffic as well as the surrounding marine traffic/vessels. Each of the seven criteria pollutants has been reviewed for its relevance to such major air pollution sources of the Project as follows.

Nitrogen Dioxide (NO_2)

According to the "*2011 Hong Kong Emission Inventory Report"* published by EPD in March 2013, navigation and road transport are the top two major sources of nitrogen oxides (NO_x) generated in Hong Kong, constituting respectively about 33% and 29% of the total NO_x emission in 2011. NO_x would be transformed to NO_2 in the presence of O_3 under sunlight. As summarised in **Table 15.3.6**, the latest 5-year average of the annual NO_2 concentration in the urban areas (i.e., Tsuen Wan, Kwai Chung, Sham Shui Po, Kwun Tung and Central/Western) is about 77% of the corresponding AQO. Therefore, NO_2 has been identified as a key air pollutant of the emissions from both road traffic and marine traffic/vessels, and has been assessed against the relevant AQOs for this Project.

Respirable Suspended Particulates (RSP)

According to the latest statistics of *"2011 Hong Kong Emission Inventory Report"*, navigation and road transport are the top two major sources of RSP in Hong Kong, accounting for respectively about 37% and 19% of the total RSP emissions in 2011. As summarised in **Table 15.3.6**, the latest 5-year average of the annual RSP concentration in the urban area is about 91% of the corresponding AQO. Therefore, RSP has been identified as a key air pollutant of the emissions from both road traffic and marine traffic/ vessels, and has been assessed against the relevant AQOs for this Project.

Sulphur Dioxide (SO_2)

According to the latest statistics of *"2011 Hong Kong Emission Inventory Report"*, 54% of total SO_2 emission in Hong Kong is attributed to navigation whereas only below 1% of the total emission is due to road transport. The introduction of ultra low sulphur diesel for vehicle fleet in 2000 has also helped reducing the SO_2 emission from road transport in Hong Kong. As summarised in **Table 15.3.6**, the latest

5-year average of the annual SO_2 concentration in the urban area is about 23% of the corresponding AQO. While the 5-year average SO_2 level appears to be well below the relevant AQO with a large margin, a number of the future ASRs within WKCD (such as those at Parcels 30, 35, 40, 51, 46, etc.) are close to the potential marine traffic/vessel emission sources from the fast ferries/derrick lighters in New Yau Ma Tei Public Cargo Working Area. Therefore, SO_2 has been identified as a key air pollutant of the emissions from marine traffic/vessels (but not from road transport), and has been assessed against the relevant AQOs for this Project.

Ozone

According to the *"Air Quality in Hong Kong 2011"* published by EPD[2], ozone is a major constituent of photochemical smog. It is not a pollutant directly emitted from man-made sources but formed by photochemical reactions of primary pollutants such as NO_x and volatile organic compounds (VOCs) under sunlight. As it takes several hours for these photochemical reactions to take place, ozone recorded in one place could be attributed to VOC and NOx emissions from places afar. Hence, ozone is a regional air pollution problem. In other words, unlike such air pollutants as NO_x,RSP and SO_2, ozone is not a pollutant directly attributable to emissions from nearby marine or road traffic. As a result, ozone is not identified as a key air pollutant for air quality impact assessment for this Project, though it is one of the criteria pollutants under the AQO.

Carbon Monoxide (CO)

According to the latest statistics of *"2011 Hong Kong Emission Inventory Report"*, road transport and navigation are the top two major sources of CO emissions in Hong Kong, contributing to respectively about 67% and 18% of the total CO emission in 2011. However, based on the *"Air Quality in Hong Kong 2012 Preliminary Report"* published by EPD[3], the highest 1-hour CO level and the highest 8-hour CO concentration in Mong Kok are respectively 3,590 $\mu g/m^3$ and 2,755 $\mu g/m^3$, which are only 12% and 28% of the corresponding AQO respectively. Given that the ambient CO levels are well below the relevant AQO with large margins as opposed to the other pollutants such as RSP and NO_2, it is considered appropriate to select RSP and NO_2, but not CO, as the key pollutants for air quality impact assessment against the AQO for this Project.

Lead

Since leaded petrol was banned in Hong Kong on 1 April 1999, it is no longer considered as a primary source in Hong Kong. According to the *"Air Quality in Hong Kong 2011"* published by EPD, the ambient lead concentrations continued to linger at very low levels during 2011 as in previous years, and the overall 3-month averages, ranging from 0.02 $\mu g/m^3$ (in Kwun Tong and Tung Chung) to 0.104 $\mu g/m^3$ (in Yuen Long), were well below the AQO limit of 1.5 $\mu g/m^3$. Therefore, it is not considered as a key air pollutant for the operation phase air quality impact assessment.

Identified Key Air Pollutants

Based on the above review results, the following key air pollutants of concerns are identified for the purpose of air quality impact assessment during the operation phase:

- For road traffic emissions – NO_2 and RSP; and

[2] http://www.epd-asg.gov.hk/english/report/files/AQR2011e_final.pdf

[3] http://www.epd-asg.gov.hk/english/report/files/AQR2012_prelim_en.pdf

- For marine traffic/vessel emissions – SO_2, NO_2 and RSP.

15.3.4 Assessment Methodology

15.3.4.1 Construction Phase

Introduction

To assess the construction phase through air quality modelling, use of the air quality model Fugitive Dust Model (FDM) was required. In accordance with the EPD's *Guidelines on Choice of Models and Model Parameters*, FDM was used to predict the air pollutant concentrations due to fugitive and open dust source impacts, which are shown in **Figures 3.3a-h** and **3.4a-e**. Details of the emission rates from the activities are given in **Appendices 3.1** to **3.3**.

Model Description – FDM

FDM is a computerised air quality model specifically designed for computing the concentration and deposition impacts from fugitive dust sources. The model is generally based on the well-known Gaussian Plume formulation for computing concentrations, but the model has been specifically adapted to incorporate an improved gradient transfer deposition algorithm. FDM is one of the air quality models listed as commonly used for EIA studies by EPD in *Guidelines on Choice of Models and Model Parameters.*

It should be noted that FDM and all Gaussian based dispersion models have limited ability to predict dispersion in the following situations:[4]

- Causality effects

  Gaussian plume models assume pollutant material is transported in a straight line instantly (like a beam of light) to receptors that may be several hours or more in transport time away from the source. The model takes no account for the fact that the wind may only be blowing at 1 m/s and will have only travelled 3.6 km in the first hour. This means that Gaussian models cannot account for causality effects, where the plume may meander across the terrain as the wind speed or direction changes. This effect is not considered to be significant for the WKCD site as the site is small.

- Low wind speeds

  Gaussian-plume models 'break down' during low wind speed or calm conditions due to the inverse speed dependence of the steady state plume equation. These models usually set a minimum wind speed of 0.5 m/s or 1.0 m/s and ignore or overwrite data below this limit.

- Straight-line trajectories

[4] *Good Practice Guide for Atmospheric Dispersion Modelling.* Ministry for the Environment, New Zealand (June 2004)

Gaussian models will typically overestimate terrain impingement effects during stable conditions because they do not account for turning or rising wind caused by the terrain itself. This effect is not considered to be important for WKCD as the site and surrounding terrain is flat.

- Spatially uniform meteorological conditions

  Gaussian models assume that the atmosphere is uniform across the entire modelling domain, and that transport and dispersion conditions exist unchanged long enough for the material to reach the receptor even if this is several kilometres away. In the atmosphere, truly uniform conditions rarely occur. As the WKCD site and surrounding assessment area is sufficiently small with no significant terrain features, uniform meteorological conditions are considered appropriate.

- No memory of previous hour's emissions

  In calculating each hour's ground-level concentrations, Gaussian models have no memory of the contaminants released during the previous hours. This limitation is especially important for the proper simulation of morning inversion break-up, fumigation and diurnal recycling of pollutants.

Assumptions and Inputs – FDM

During the construction stage, the study area will not have many tall buildings. As such, the *"Guideline on Air Quality model (revised), EPA - 450/2-78-027R, July 1986"* is used to calculate the roughness length for use in FDM.

The EPD guideline on *"Choice of Models and Model Parameters"* states: the selection of rural or urban dispersion coefficients in a specific application should follow a land use classification procedure. If the land use types including industrial, commercial and residential uses account for 50% or more of an area within a 3 km radius from the source, the site is classified as urban; otherwise it is classified as rural. The surface roughness height is closely related to the land use characteristics of a study area and associated with the roughness element height. As a first approximation, the surface roughness can be estimated as 3 to 10 percent of the average height of physical structures. Typical values used for urban and new development areas are 370 cm and 100 cm, respectively.

Within a three kilometre radius of the site 55% is classified as urban and the remaining 45% is sea. As the sea roughness is typically given a value of 0.01 cm and urban is assumed to be 370 cm, an area averaged roughness height of 205 cm is used. This is to take account of the low turbulence over the sea water, and also the very large turbulence generated due to nearby large structures.

Hourly meteorological data for a full year as extracted from PATH model released by EPD in December 2012 (metrological data year 2010, grid 28, 27) has been adopted for use in FDM and is considered to be the most up to date data available. PATH data has been observed to have a lower mixing height for some hours, when compared to the measured mixing height. The minimum mixing height recorded by HKO in 2010 is 121.3 m, whereas the PATH minimum mixing height is 40 m. The HKO minimum mixing height of 121.3 m is used to replace any PATH mixing height below this value. This approach is considered appropriate as it will minimise over-estimation due to lower mixing heights and also will minimise under-estimation due to high stacks being excluded in the mixing volume. The PATH data with the above modification is considered to be representative of the site wind data at the flyover road site.

Prediction of dust emissions is based on emissions factors from the *Compilation of Air Pollution Emission Factors (AP-42), 5th Edition* published by the US Environmental Protection Agency (USEPA). The emission factor for a typical heavy construction activity is 2.69 megagrams (Mg)/hectare/month according to *Section 13.2.3.3* of *AP-42*. The number of working days for a month and number of working hours per day of the project are anticipated to be 26 days and 12 hours respectively. No construction work is anticipated to be carried out on Sundays. Based on *Table 11.9-4* of *AP-42*, the emission factor of wind erosion is 0.85 megagrams (Mg)/hectare/year. The locations of assumed dust sources are given in **Figures 3.3a** to **3.3h**. The key dust emission factors adopted in FDM are summarised in Table 15.3.9.

For the mitigated scenario, the active construction areas have ground watering applied once per hour or 12 times per day. This gives rise to dust suppression of 91.7%, as estimated in **Appendix 3.8**. The unmitigated scenario does not employ any watering for dust suppression.

For the concrete batching plant, it is assumed that the plant will be handed over from the XRL project to the WKCD (including flyover road) Project, and therefore the emissions from the plant will be the same as those given in the approved EIA for XRL. All assumptions and calculations are extracted from the Specified Process (SP) License issued to the XRL for the concrete batching plant. The concrete batching plant and haul roads within the site are modelled as having operation hours of 12 hours per day, that is, from 7:00 am to 7:00 pm.

No stockpile is modelled as excavated material is anticipated to be transported out of the site immediately after generation. Barging points are assumed to be handed over from the XRL project to the WKCD Project, and therefore the emissions from the plant will be the same as those given in the approved EIA for XRL.

The emission inventory and calculation of emission factors for the construction activities are detailed in **Appendices 3.1 to 3.3.**

Table 15.3.9: Key Dust Emission Factors Adopted in the Assessment

Activities	Emission Factors	Reference
Heavy construction activities including all above ground and open construction works, excavation and slope cutting works	2.69 Mg/hectare/month	Section 13.2.3.3 AP-42, 5th Edition
Wind erosion from heavy construction	0.85 Mg/hectare/year	Table 11.9-4 AP-42, 5th Edition
Paved haul road within concrete batching plant	Emission Factor = $k \times (sL)^{0.91} \times (W)^{1.02}$ g/VKT where k is particle size multiplier * sL is road surface silt loading W is average truck weight	Section 13.2.1 AP-42, 5th Edition (Jan 2011 edition)

* The particle size distribution was made reference to Section 13.2.1(Table 13.2.1-1) of the USEPA Compilation of Air Pollution Emission Factors (AP-42), 5th Edition (Jan 2011 edition).

With addition of the average background TSP concentration of five urban monitoring stations as described in **Section 15.3.3.1**, i.e., 68.4 µg/m^3, the hourly, daily and annual TSP concentrations at the identified ASRs have been predicted and compared with the hourly, daily and annual average TSP criteria of 500 µg/m^3, 260 µg/m^3 and 80 µg/m^3 respectively.

Methodology – FDM

Construction of the flyover road is to be completed in stages; as such the FDM assessment has been completed for each construction year from 2013 to 2017, when the majority of the site works are expected to be completed.

For hourly and daily TSP, a tiered modelling approach has been adopted. Tier 1 assumes 100% active area for a given year is emitting TSP. This Tier 1 scenario (i.e. assuming 100% active area for the Project and the concurrent project) is hypothetical and for screening purposes to identify which ASRs may be subject to TSP concentrations above the relevant standards. For the purpose of the Tier 1 screening, the dust mitigation measures, including frequent water spraying, are taken into account when estimating the dust emission rates from the construction activities. Details of the Tier 1 dust sources including their coordinates, dimensions and estimated emission rates are detailed in **Appendix 3.4**. Locations of the assumed dust sources for Tier 1 assessment are shown in **Figure 3.3a** to **3.3k**. The Tier 1 hourly and daily TSP levels at all the ASRs are then predicted for both scenarios of with and without the dust mitigation measures in place.

The ASRs identified with hourly or daily TSP non-compliance under Tier 1 screening, where mitigation measures are in place, are selected for the subsequent Tier 2 assessment.

The entire works area is broken into a number of zones for construction timetabling purposes. Based on the assumed construction plant inventory of individual zones and planned construction activities for each year, the percentage active areas for different zones are calculated, as summarised in Table 15.3.10. The maximum percentage active area for each year is taken from all zones and applied to the entire site.

It is assumed in the Tier 2 assessment that the maximum percentage active area of the flyover road excavation site for each zone and the corresponding active areas of the relevant concurrent project would be located closest to the ASR being assessed. The Tier 2 hourly or daily TSP levels at each of these ASRs are then predicted with the dust mitigation measures in place.

Under normal circumstances, construction activities for the proposed Project and the concurrent projects would likely spread over the whole work sites and zones. As such, the maximum percentage active area calculated from all zones, applied to the entire WKCD site, and the corresponding active areas of the relevant concurrent project to be located closest to a particular ASR at any one time during the Tier 2 assessment is a conservative approach. Details of the Tier 2 dust sources including their coordinates, dimensions and estimated emission rates are given in **Appendix 3.5**. Locations of the assumed dust sources for Tier 2 assessment are shown in **Figures 3.4a** to **3.4f**.

For the assessment of annual TSP concentrations, the active work area over the entire year would be less than that for a typical working hour or a typical working day. The percentage active area averaged over each construction year has been estimated for each zone as summarised in **Table 15.3.10**. The annual TSP assessment is based on the percentage active areas for individual zones. The annual TSP levels are predicted at all the ASRs for both scenarios of with and without the dust mitigation measures in place. Details of the dust sources for annual TSP assessment including their coordinates, dimensions and estimated emission rates are given in **Appendix 3.6**. Locations of assumed dust sources for annual assessment are shown in **Figure 3.3a** to **3.3k**.

Based on project-specific information, the percentages active work areas for heavy construction activities for hourly, daily and annual TSP assessment have been estimated and are summarised in **Table 15.3.10.** Detailed estimation of the percentages active work areas are provided in **Appendix 3.7**.

Table 15.3.10: Summary of tentative active area calculations for Tier 2 and Annual TSP assessment

Construction Year	Zone	Percentage Active Area		
		Hourly	Daily	Annually
2013	1	47.1%	47.1%	18.4%
	2a	0.0%	0.0%	0.0%
	2b	17.8%	17.8%	6.1%
	3	21.1%	21.1%	3.5%
	4	0.0%	0.0%	0.0%
	5	0.0%	0.0%	0.0%
	The Park (A, B, C)	1.4%	1.4%	0.8%
	Maximum	**47.1%**	**47.1%**	**18.4%**
2014	1	3.7%	3.7%	1.3%
	2a	66.1%	66.1%	44.6%
	2b	13.4%	13.4%	9.0%
	3	16.1%	16.1%	9.6%
	4	0.0%	0.0%	0.0%
	5	0.0%	0.0%	0.0%
	The Park (A, B, C)	9.9%	9.9%	9.9%
	Maximum	**66.1%**	**66.1%**	**44.6%**
2015	1	0.9%	0.9%	0.8%
	2a	6.5%	6.5%	5.7%
	2b	4.5%	4.5%	3.9%
	3	5.1%	5.1%	2.2%
	4	0.0%	0.0%	0.0%
	5	0.0%	0.0%	0.0%
	The Park (A, B, C)	0.3%	0.3%	0.3%
	Maximum	**6.5%**	**6.5%**	**5.7%**
2016	1	0.6%	0.6%	0.6%
	2a	1.3%	1.3%	0.7%
	2b	0.6%	0.6%	0.3%
	3	0.2%	0.2%	0.2%
	4	22.9%	22.9%	16.7%
	5	0.0%	0.0%	0.0%
	The Park (A, B, C)	0.5%	0.5%	0.5%
	Maximum	**22.9%**	**22.9%**	**16.7%**
2017	1	0.0%	0.0%	0.0%
	2a	3.2%	3.2%	3.2%
	2b	0.7%	0.7%	0.7%
	3	0.2%	0.2%	0.2%
	4	13.0%	13.0%	3.7%

Construction Year	Zone	Percentage Active Area		
		Hourly	Daily	Annually
	5	3.1%	3.1%	1.8%
	The Park (A, B, C)	2.4%	2.4%	1.6%
	Maximum	**13.0%**	**13.0%**	**3.7%**

Note: (a) The Tier 2 assessment for hourly and daily TSP uses the maximum percentage active area for all zones.
(b) The assessment of annual TSP uses zone specific percentage active area.

15.3.4.2 Operation Phase – Vehicular Emissions

Introduction

To assess the operational air quality, a variety of models were required. In accordance with the EPD's *Guidelines on Choice of Models and Model Parameters*, the following air dispersion models have been employed to predict the cumulative NO_2 and RSP levels at the identified ASRs:

- EMFAC-HK V2.5.1 (I and M) model has been used to determine the fleet average emission factors, for all the planned and existing roads within the 500 m assessment area, including planned flyover roads within WKCD site, and the proposed Central Kowloon Route (CKR). The model has included the effect of Inspection and Maintenance (I/M) program and is applicable for calendar years between 2013 and 2040.
- CALINE4 has been used to predict the air pollutant concentrations due to vehicular emissions from all open road links within the 500 m assessment area, which are as shown in **Figures 3.5.1a** to **3.5.1y**.
- ISCST3 has been used to predict the air pollutant concentrations due to vehicular emissions from the Western Harbour Crossing (WHC) portal (modelled as volume sources); the proposed underpasses/landscape deck portals (modelled as volume sources) and the associated top openings (modelled as area source) under the Road Works at West Kowloon project; as well as from the assumed ventilation serving the planned underground roads within the WKCD site (modelled as volume or point sources). The locations of all such pollution sources are as shown in **Figure 3.6**.
- Pollutants in the Atmosphere and the Transport over Hong Kong (PATH) has been used to predict the current background air pollution due to sources outside the project boundary. Sources include, but are not limited to, the Pearl River Deltas Economic Zone (PRDEZ), the Hong Kong International Airport, power plants in HKSAR. roads beyond the WKCD and, marine emissions. Background data predicted by PATH for year 2015 represents the worst case year relevant to the assessment of the Project.

The localised impacts due to the vehicle emissions within the 500 m assessment area of flyover road have been separately modelled by the near-field models (CALINE4 and ISCST3) in which the vehicular emission factors have been calculated from the EMFAC-HKV2.5.1 model.

The cumulative hourly maximum NO_x and RSP concentrations are predicted by the above models by using the corresponding MM5 hourly meteorological data in 2010 as extracted from the PATH model released by EPD in December 2012.

Model Description – EMFAC-HKV2.5.1

EMFAC-HKV2.5.1 is an emissions inventory model that calculates emissions inventories for motor vehicles operating on roads in Hong Kong. The model is used for estimating vehicular tailpipe emissions including

RSP and NO_x. The model can take into account both vehicle technologies and driving conditions. The model follows that of the California Air Resources Boards' EMFAC model but with modifications to cater for local factors, including the substantial reduction of the smoky vehicle problem in recent years.

Assumptions and Inputs – EMFAC-HK

For all the planned and existing roads within the 500 m assessment area including those planned underpass roads within WKCD site and the proposed CKR, the EMFAC-HK V2.5.1 model (I and M), which is the latest version at the time of preparing this report, has been used to determine the fleet average emission factors.

The Burden mode, used for calculating area-specific emission factors, has been selected in the model. Under this mode, the total emissions of pollutants such as RSP and NO_x were computed for each type of vehicle class based on temperature, relative humidity, speed corrected emission factors and vehicle activity. Hourly output was selected.

The assumptions and input parameters on modelling of vehicle emission factors are presented in the following sections. The traffic data used for the assessment includes the hourly traffic flows of 16 vehicle classes at various road links and the speed fractions of various vehicle classes in four model years. The model years are: 2015 (the year when operation of the Project was originally planned to commence); intermediate years 2020 and 2025, and 2030 (15 years after commencement of operation of the Project). According to the recently updated Project programme (see **Appendix 2.4**), the planned commencement of operation of the Project has been changed to 2017. Despite the change, the EMFAC results as presented in **Graph 15.2** show that year 2015 represents the worst case scenario where the total traffic emission is the highest among all model years of 2015, 2020, 2025 and 2030. In other words, the total traffic emission in year 2017 when the Project is planned to commence operation is anticipated to be lower than that in year 2015. Therefore, use of the emission estimates in 2015 for air quality impact assessment is a conservative approach.

Traffic data is provided by the Traffic Consultant, and are presented in the following sections. The traffic forecast data has been submitted to the Transport Department (TD) for review. TD has no objection in principle to the traffic data. The correspondence from TD is provided in **Appendix 3.9** for reference. The 24-hour traffic patterns are given in **Appendix 3.10**.

Vehicle Emission Standards

The emission standards, according to the latest implementation programme (as of November 2012) have been adopted in EMFAC-HK V2.5.1 model for vehicles registered in Hong Kong. In this model, the latest European Union (EU) emission standard, Euro VI, for all vehicle classes can be applied, with the exception of motorcycles which do not have applicable new EU emission standards.

Road Grouping

The road links for assessment have been grouped into five types. Emission factors for the following five road types have been calculated:

- Road Type 1 - Expressway (Design speed limit: 100kph);
- Road Type 2 - Trunk Road (Design speed limit: 80kph);

- Road Type 3 - Trunk Road (Design speed limit: 50kph);
- Road Type 4 - Local Roads (Design speed limit: 50kph), and;
- Road Type 5 - Trunk Road (Design speed limit: 70kph).

The five road types are characterised by continuous and interrupted flow with different design speed limits. It is assumed that there is continuous traffic flow in Expressway and Trunk Roads (Road Types 1, 2, 3 & 5), whereas there is interrupted flow in Local Roads (Road Type 4). The road type classification of individual road links in the assessment area are as shown in **Figures 3.5.1a** to **3.5.1y.** Road Type 5 is associated with the CKR and will not be present in 2015 or 2020, but will be present in 2025 and 2030, as CKR is anticipated to be in operation in 2021.

Vehicle Classes

Vehicles operating on open roads have been categorised into 16 vehicle classes according to the *Guideline on Modelling Vehicle Emission – Appendix I* for EMFAC-HK V2.5.1, and is presented in **Table 15.3.11**.

Table 15.3.11: Vehicle Classification in the EMFAC-HK Model

Index	Description	Notation in EMFAC-HK Model	Fuel Type	Gross Vehicle Weight
1	Private Cars (PC)	PC	ALL	ALL
3	Taxi	taxi	ALL	ALL
4	Light Goods Vehicles (<=2.5t)	LGV3	ALL	<=2.5ton
5	Light Goods Vehicles (2.5-3.5t)	LGV4	ALL	>2.5-3.5ton
6	Light Goods Vehicles (3.5-5.5t)	LGV6	ALL	>3.5ton
7	Medium & Heavy Goods Vehicles (5.5-15t)	HGV7	ALL	>5.5ton-15ton
8	Medium & Heavy Goods Vehicles (>=15t)	HGV8	ALL	>15ton
11	Public Light Buses	PLB	ALL	ALL
12	Private Light Buses (<=3.5t)	PV4	ALL	<=3.5ton
13	Private Light Buses (>3.5t)	PV5	ALL	>3.5ton
14	Non-franchised Buses (<6.4t)	NFB6	ALL	<=6.4ton
15	Non-franchised Buses (6.4-15t)	NFB7	ALL	>6.4ton – 15ton
16	Non-franchised Buses (>15t)	NFB8	ALL	<=15ton
17	Single Deck Franchised Buses	FBSD	ALL	ALL
18	Double Deck Franchised Buses	FBDD	ALL	ALL
19	Motor Cycles	MC	ALL	ALL

Exhaust / Evaporation Technology Fraction

Vehicle classes are grouped with different exhaust technology indexes and technology fractions. Each technology group represent a distinct emission control technologies. The EMFAC-HK V2.5.1 model has a set of default exhaust technology fractions which best represents the scheduled implementation of new vehicle emission standards as of November 2012. As there is no update to the planned emission control measures since the release of the guideline in November 2012, the default exhaust technology fractions are considered to be applicable in this assessment.

Vehicle Population

According to the *Guideline on Modelling Vehicle Emissions,* the vehicle population forecast function in EMFAC-HKV2.5.1 used 2010 as the base year. Natural replacement of vehicles and a set of annual growth rates and survival rates for different vehicles are assumed for 2011 to 2040. In particular, vehicles including private cars, motorcycles, and goods vehicles are assumed to grow by a varying percentage (from 0% - 2.5% annual) during the period whereas the number of franchised buses, public light buses and taxis are assumed to have no growth.

There have been some minor policy changes from April 2012 to November 2012. The changes include moving two diesel taxis (TAXI) to the private car (PC) category and moving 4 LPG Private light buses (PV4) to the PV5 category. These changes, however, are considered to be insignificant and therefore have been excluded from the assessment. The default populations from the April 2012 population information have been adopted for the model years (2015, 2020, 2025, and 2030). The vehicle age distributions, in the base year 2010, are presented in **Appendix 3.11** for reference.

The use of electric vehicles (EVs), which do not have tailpipe emissions, has been promoted by the government in the recent years. By April 2012, there were more than 310 EVs in Hong Kong. The introduction of EVs will have an impact on the future vehicle fleet composition, although the effect is still unknown. Impacts will vary with policy in the future and the successful application of EVs as an alternative to the traditional vehicles. As a conservative approach, this assessment does not take into account the presence of EVs and any programme on the promotion of EVs.

Accrual Rate

Default values and compositions have been adopted with reference to in the EMFAC-HKV2.5.1 Guideline.

Diurnal Variation of Daily Vehicle Kilometres Travelled (VKT)

For each vehicle class, the Vehicle Kilometres Travelled (VKT) of individual hours is calculated by multiplying the hourly number of vehicles with the length of the corresponding road link (in kilometres). Diurnal (24-hour) traffic pattern has been provided by Traffic Consultant. The lengths of individual road links of the connecting road are given in **Appendix 3.12**. The 24-hour VKT values for all vehicle classes in each of the model years 2015, 2020, 2025 and 2030 together with a graphical plot, are provided in **Appendix 3.13**.

Daily Trips

The daily trips were used to estimate the cold start emissions of the petrol and LPG vehicles only, as is prescribed by the model. Therefore, trips for vehicles other than petrol or LPG type vehicles would be assumed to be zero. Different road types have different number of trips as follows.

Expressway and Trunk Road (Road Types 1, 2 & 3)

Zero trips are assumed in Expressway and Trunk Roads since there will be no cold start under normal circumstances.

Local Road (Road Type 4)

For Local Roads, the number of trips in the assessment area, Trip $_{\text{within assessment area}}$, has been estimated as:

Trip $_{\text{within assessment area}}$ = (Trip $_{\text{within HK}}$/VKT $_{\text{within HK}}$) x VKT $_{\text{within assessment area}}$

Trip $_{\text{within HK}}$ is the default data of EMFAC-HKV2.5.1 model. VKT $_{\text{within HK}}$ is the VKT of local roads in Hong Kong, which is estimated based on the default VKT data of EMFAC-HKV2.5.1 model and the relevant data as published in the *Annual Traffic Census 2010* by TD. Details of the trip estimation are as shown in **Appendix 3.14**. According to the Mobile Source Group of EPD, the default VKT and trips in the model are based on EPD's estimated data for Hong Kong. VKT $_{\text{within assessment area}}$ is calculated as mentioned above. The trips in each year are provided in **Appendix 3.13**.

While the number of trips is dependent on vehicle population, no project-specific vehicle population data can be identified for the assessment area according to the Traffic Consultants. However, project-specific VKT has been estimated based on the traffic forecast in the assessment area. Moreover, it can be argued that VKT is related to vehicle population in such a way that a higher vehicle population would generally result in a higher VKT. As a result, it has been proposed to estimate the number of trips in the assessment area on the basis of the project-specific VKT and the assumption that the number of trips per VKT in the assessment area would be similar to the number of trips per VKT in Hong Kong. It is considered that this proposed approach is based on best available data and reasonable assumption. This approach for estimating the number of trips together with the results of estimation has been submitted to TD for review. TD has no objection in principle to the method and the correspondence from TD is provided in **Appendix 3.9** for reference.

Hourly Temperature and Relative Humidity Profile

Annual and monthly hourly average ambient temperature and relative humidity (**Appendix 3.15**) obtained from the meteorological data as extracted from the 2010 HKO's, King's Park meteorology station (with at least 90% valid data) have been adopted. The 24-hour variations of the annual averages of temperature and relative humidity are presented graphically in **Appendix 3.15**.

Speed Fractions

The 24-hour speed fractions for different road types and individual vehicle classes are provided by the Traffic Consultant, and are calculated based on the 24-hour traffic flow in each model year and the volume/capacity ratio of different road types. For each vehicle class, the VKT of each road link was grouped into sub-groups with speed bins of 8 km/h (0 - 8 km/h, 8 - 16 km/h, 16 - 24 km/h, etc.). The speed fraction of each sub-group was derived by the summation of the total VKT of road link within this sub-group divided by the total VKT of all road links. The estimated speed fractions provided by the Traffic Consultant are given in **Appendix 3.16**.

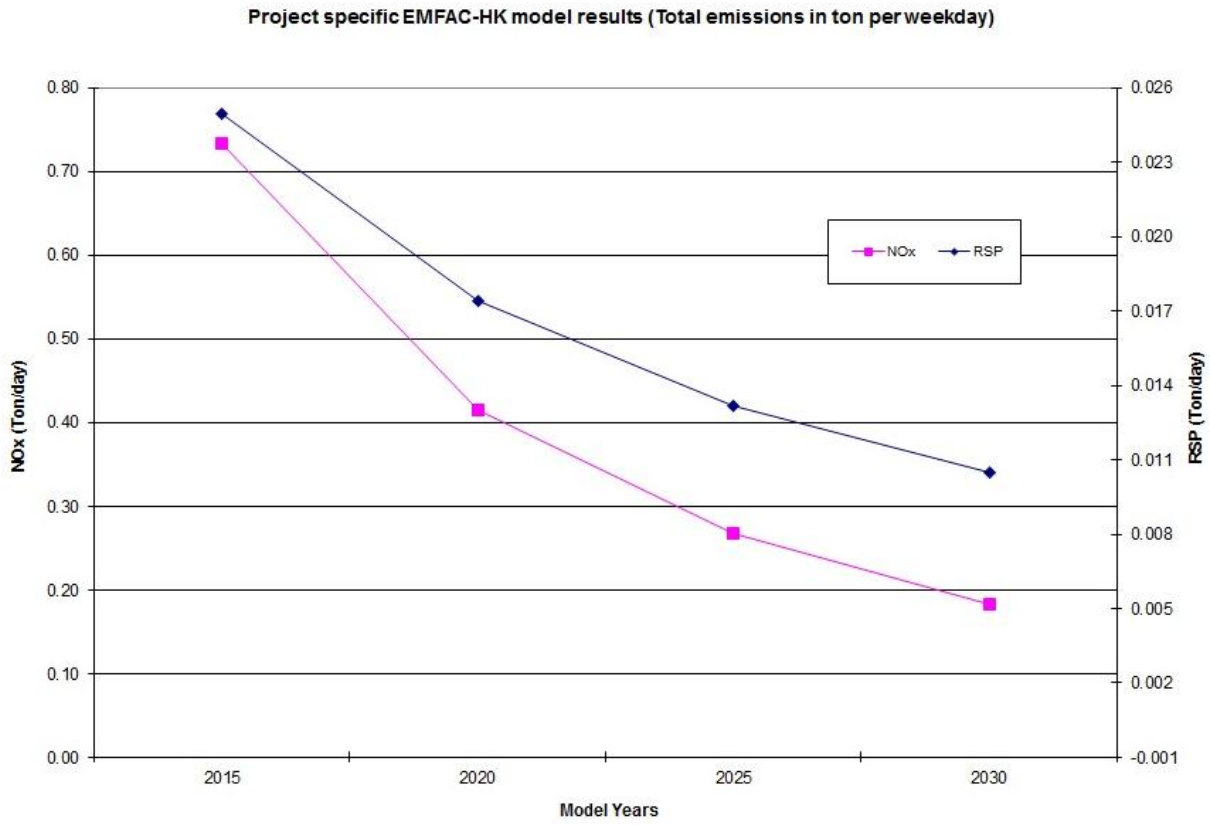
Predicted Emission Factors by EMFAC-HKV2.5.1 model

To determine the emissions with 15 years after commencement of the Project, emission rates are modelled for years 2015, 2020, 2025 and 2030. Upon modelling with EMFAC-HKV2.5.1, the emissions for each vehicle class at different hours are then divided by the corresponding VKT to obtain 24-hr emission factors in grams/vehicle-kilometre (g/veh-km). The calculation of emission factors for each model year are shown in **Appendix 3.17**. By comparing the total emissions in different model years as shown in Graph 15.2, year

2015 represents the worst case scenario where the total emission is the highest among all model years. Even with addition of the traffic due to the CKR project after 2020, the worst-case year is still predicted to be 2015. This is because despite the increased traffic volume, the total emissions are expected to decrease as a result of the retirement of older and more polluting vehicles in the fleet, which would be replaced with newer vehicles with lower emissions. Therefore, it is proposed to use the emission factors of this worst case year 2015 for the prediction of air quality impacts due to vehicular emissions in order to arrive at conservative impact assessment results.

Although the planned commencement year of operation of the Project has been updated from 2015 to 2017, use of the emission factors in 2015 represents conservative emissions for the assessment. This is because the total traffic emission in year 2017 is anticipated to be lower than that in year 2015 as illustrated in Graph 15.2.

Graph 15.2: Comparison of RSP and NOx EMFAC results for 2015, 2020, 2025 and 2030



Model Description – ISCST3

The Industrial Source Complex – Short Term version 3 (ISCST3) dispersion model was used to model the air pollutant concentrations due to vehicular emissions from the Western Harbour Crossing (WHC) portal (modelled as volume sources); the proposed underpasses/landscape deck portals (modelled as volume sources) and the associated top openings (modelled as area source) under the Road Works at West Kowloon project; as well as from the assumed ventilation serving the planned underground roads within the WKCD site (modelled as point or volume sources).

ISCST3 is a steady state Gaussian plume model which can be used to assess pollutant concentrations from sources associated with an industrial source complex. ISCST3 is one of the models prescribed by the EPD *Guidelines on Choice of Models and Model Parameters*. ISCST3 is considered an appropriate model to use for this situation as meteorological conditions will not vary greatly over the site, as the site is relatively flat and small and no significant effects are expected due to terrain variations.

It should be noted that ISCST3 and all Gaussian based dispersion models have limited ability to predict dispersion in the situations as described previously in **Section 15.3.4.1**.

Assumptions and Inputs – ISCST3

The operational sources for ISCST3 modelling (shown in **Figure 3.6**) include:

- Proposed underpasses/landscape decks along the Austin Road West and Lin Cheung Road and the associated top openings under the Road Works at West Kowloon project, which is within the 500 m assessment area;
- Portal of the existing WHC which is in the vicinity of the WKCD site; and
- Ventilation exhausts and portals serving the planned underground roads within the WKCD area.

EMFAC-HKV2.5.1 and the traffic modelling data from the Traffic Consultants were used to generate the inputs for use in ISCST3.

Hourly meteorological data for a full year as extracted from the PATH model released by EPD in December 2012 (meteorological data year 2010, grid 28, 27) has been adopted for use in ISCST3. The data is considered to be the most up to date data available, PATH data has been observed to have a lower mixing height for some hours, when compared to the measured mixing height. The minimum mixing height recorded by HKO in 2010 is 121.3 m, whereas the PATH minimum mixing height is 40 m. The HKO minimum mixing height of 121.3 m is used to replace any PATH mixing height below this value. This approach is considered appropriate as it will minimise over-estimation due to lower mixing heights and also will minimise under-estimation due to high stacks being excluded in the mixing volume. The PATH data with the above modification is considered to be representative of the site wind data at WKCD.

Ventilation Exhausts/Portals Serving WKCD Basement

The basement will be ventilated through stacks; however the proportion released through stacks and through the portals cannot be determined until a comprehensive ventilation study is carried out during the detailed design phase. Two scenarios were therefore considered for the ventilation of the WKCD basement:

Scenario I – 100% of the vehicle emissions generated within the basement is ventilated through a series of stack exhausts and 0% through the basement entry and exit points

Under this Scenario, the exhausts are assumed to be attached to buildings within the WKCD and were modelled as 6 m tall point sources with an exit air velocity of 2.0 m/s. The stack diameter was dependant on the ventilation area. The basement is broken into three areas, namely B1 Road, B1 Loading and B2 Carpark, for the purpose of the ventilation calculations. The areas are shown in **Figures 3.5.1n**, **3.5.1r**, **3.5.1s** and **3.5.1t**;

Standard practice is to model ventilation shafts as point sources. As the final dimensions of the exhaust louvres are yet to be known at this stage, it is considered appropriate to model the basement ventilation

louvres as stacks. A single stack is used at approximately the horizontal centre of the proposed louvre area to allow the greatest flexibility in the final stack location.

The Practice Note ADM-2 recommends MTR ventilation exhausts shall be located not closer than 5 m to any opening such as an openable or fixed window, doorway, building ventilation system intake or exhaust and the like in any building irrespective of whether such vent shaft is freestanding or is accommodated in a building. Although there is no such practice note for underground roads and tunnels, this basis has been used to adopt a minimum stack height of 6 m. This is considered to give worst case results at the ground level and allows for flexibility of the final design and the ventilation to be located at this level.

There are several ventilation exhausts for the XRL/WKT basement carpark, however this basement does not include an underground road and therefore does not need to be considered as a concurrent source.

Scenario II – 100% of the vehicle emissions generated within the basement is ventilated through the basement entry and exit points and 0% through a series of stack exhausts

Under this Scenario, the basement emissions were considered as a total of the three roads (basements roads A, B and C) as shown in **Figures 3.5.1n**, **3.5.1r**, **3.5.1s** and **3.5.1t**. The detailed design of the basement and its ventilation system is not yet complete; therefore it has been broadly assumed that the emissions would be evenly distributed among the three entry/exit points to approximate the scenario. Therefore, one third of the total basement emissions were assumed to be emitted from the western portal near the western tunnel, one third through the eastern portal onto Austin Road West and one third through the northern portal onto Austin Road West.

The basement entry and exit point are not treated as a standard portal as the traffic does not exit directly from the portal, that is the vehicles come to a T-intersection at the entry and exit point for Location A and C as shown in **Figure 3.6**. The entry and exit points are modelled as volume sources based on the dimensions of the opening.

Underpasses/landscape decks along the Austin Road West and Lin Cheung Road and the associated top openings

The portal emissions are the worst case emissions from portals and other openings of Austin Road West and Lin Cheung Road. EPD's *Guidelines on Choice of Models and Model Parameters* recommends portals and similar openings are modelled as volume sources according to the Permanent International of Road Congresses (PIARC) *XIXth World Road Congress Report*. To obtain worst case emissions from each top opening and portal, using the recommended guideline the following situations were considered:

- Scenario 1 - 10% of tunnel emissions released through short top openings, the remainder released through the tunnel portal;
- Scenario 2 - 20% of tunnel emissions released through short top openings, the remainder released through the tunnel portal;
- Scenario 3 - 30% of tunnel emissions released through short top openings, the remainder released through the tunnel portal, and;
- Scenario 4 - Maximum emissions according to PIARC recommendations (which are dependent on top opening lengths – 66% of emissions through top opening if the length is 50m and 100% through top opening if the length is 100m), the remainder released through the top openin are released through the tunnel portal.

By adopting the traffic forecast in the worst case year of 2015, rhe emission rates for Scenarios 1 to 4, with 100% of the WKCD basement emission through its portals (Scenario II) are given in **Appendix 3.18a –**

Appendix 3.18d whereas the emission rates for Scenarios 1 to 4, with 100% of the WKCD basement emissions through its stack exhausts (Scenario I) are given in **Appendix 3.18e – Appendix 3.18h**. All scenarios were modelled to determine the worst case effects.

By adopting the traffic forecast in 2020, the emission rates for the combination of Scenario I and Scenario 1 are also estimated, as presented in **Appendix 3.19**. Based on the comparison of the modeling results for all eight combinations of Scenarios I & II with Scenarios 1-4 for the worst case year of 2015, the results for different combinations differ by a small amount (less than 2%) and yet the combination of Scenario I with Scenario 1 tends to give relatively more conservative results. Therefore, this combination has been used to estimate the emission rates for year 2020, which are then used to refine the NO2 modelling results for those planned ASRs that will be in operation from 2020 onwards (see **Section 15.3.5.2**).

EMFAC-HKV2.5.1 model results and the traffic modelling data from the Traffic Consultants were used to generate the inputs for use in ISCST3.

Existing WHC Portal

The portal emissions are modelled according to EPD's *Guidelines on Choice of Models and Model Parameters*, which recommends portals and similar openings are modelled as volume sources according to the PIARC *XIXth World Road Congress Report*. Details of the assumptions are in **Appendix 3.18a – Appendix 3.18h** and **Appendix 3.19**.

Model Description – CALINE4

CALINE4 is a line source air quality model developed by the California Department of Transportation and is one of the models prescribed by the EPD *Guidelines on Choice of Models and Model Parameters*. It is based on the Gaussian diffusion equation and employs a mixing zone concept to characterise pollutant dispersion over the roadway.

The purpose of the model is to assess air quality impacts near transportation facilities. Given source strength, meteorology and site geometry, CALINE4 can predict pollutant concentrations for receptors located within 500 m of a given roadway. As with all Gaussian models, CALINE4 has some limitations, as described **in Section 15.3.4.1**.

Assumptions and Inputs – CALINE4

The predicted traffic flows have taken into account the development of the four concurrent projects, namely: Road Works at West Kowloon; Road Improvement Works in West Kowloon Reclamation; the Hong Kong Section of the XRL, and; Central Kowloon Route (CKR). **Appendix 3.10** presents details of the 24-hour traffic forecast for different vehicles and individual road links within the 500 m assessment area (see **Figures 3.5.1a** to **3.5.1y**) as provided by the Traffic Consultants.

Hourly meteorological data for a full year as extracted from the PATH model released by EPD in December 2012 (meteorological data year 2010, grid 28, 27) has been adopted for use in CALINE4. The data is considered to be the most up to date data available. PATH data has been observed to have a lower mixing height for some hours, when compared to the measured mixing height. The minimum mixing height recorded by HKO in 2010 is 121.3 m, whereas the PATH minimum mixing height is 40 m. The HKO minimum mixing height of 121.3 m is used to replace any PATH mixing height below this value. This approach is considered appropriate as it will minimise over-estimation due to lower mixing heights and also

will minimise under-estimation due to high stacks being excluded in the mixing volume. The PATH data with the above modification is considered to be representative of the site wind data at the flyover road site. A roughness coefficient of 370cm is used, as the area is considered to be urban

Based on the worst case emission factors and the 24-hour traffic flow in 2015, the composite fleet emission factors have been calculated for the road links, as detailed in **Appendix 3.23**.

By adopting the traffic forecast in 2020, the composite fleet emission factors have also been calculated for the road links, as detailed in **Appendix 3.24**. These emission factors have been used to refine the NO_2 modelling results for those planned ASRs that will be in operation from 2020 onwards (see **Section 15.3.5.2**).

15.3.4.3 Operation Phase – Marine Emissions

Introduction

To assess the operational air quality from marine sources ISCST3 was used to predict the cumulative NO_x, RSP and SO_2 levels at the identified ASRs in accordance with the EPD's *Guidelines on Choice of Models and Model Parameters*.

Marine emissions considered to be important for the assessment are: fast ferry traffic movements, based on scheduled sailings at the China Ferry Terminal; cargo-handling vessel traffic movements along the Yau Ma Tei Fairway at the western edge waterfront of the WKCD site; derrick lighter barges operating at the New Yau Ma Tei Public Cargo Working Area (NYPCWA), and; ocean cruise ship emissions at berth at the Ocean Terminal. As the marine emissions are all from existing marine activities within the surrounding waters and the WKCD development itself does not contribute to any marine traffic emissions, the cumulative SO_2 levels due to the various surrounding sources are assessed for the proposed ASRs within the WKCD site only. ISCST3 has been used to predict the air pollutant concentrations due to marine sources. The locations of all such pollution sources are as shown in **Figure 3.7**. Details of the emissions rates for individual sources are given in **Appendix 3.25**.

The cumulative hourly maximum NO_x, RSP and SO_2 concentrations are predicted by the above models by using the corresponding MM5 hourly meteorological data in 2010 as extracted from the PATH model released by EPD in December 2012.

Model Description – ISCST3

Gaussian model ISCST3 has been used for modelling potential impacts from the above-mentioned nearby marine emission sources. Refer to **Section 15.3.4.2** for model description and limitations.

Assumptions and Inputs – ISCST3

The operational sources for the ISCST3 modelling (shown in **Figure 3.7**) include:

- Fast ferry traffic movements, based on scheduled sailings, of up to 170 daily movements (ferry going to is one movement, ferry leaving is a second movement) at the China Ferry Terminal;
- Tugs associated with derrick lighter barge movements in the NYMTTS;
- Derrick lighter barges operating at the New Yau Ma Tei Public Cargo Working Area (NYPCWA), and;

- Ocean Cruise Ship movements at the Ocean Terminal.

Hourly meteorological data for a full year as extracted from the PATH model released by EPD in December 2012 (meteorological data year 2010, grid 28, 27) has been adopted for use in CALINE4. The data is considered to be the most up to date data available. PATH data has been observed to have a lower mixing height for some hours, when compared to the measured mixing height. The minimum mixing height recorded by HKO in 2010 is 121.3 m, whereas the PATH minimum mixing height is 40 m. The HKO minimum mixing height of 121.3 m is used to replace any PATH mixing height below this value. This approach is considered appropriate as it will minimise over-estimation due to lower mixing heights and also will minimise under-estimation due to high stacks being excluded in the mixing volume. The PATH data with the above modification is considered to be representative of the site wind data at flyover site.

New Yau Ma Tei Public Cargo Working Area (NYPCWA)

The NYPCWA is located on the north-south shoreline of the NYMTTS to the north of WKCD. The area is mainly used for loading and unloading cargo from derrick lighter barges. The shoreline is approximately 1,250 metres long. According to the *Merchant Shipping (Local Vessels) (Typhoon Shelters) Regulation – Chapter 548E* the maximum permitted length for local vessels in the typhoon shelter is 50 metres. For manoeuvring purposes it was assumed that each vessel would need 5 metres at bow and stern. The maximum number of vessels operating at any one time was therefore assumed to be the shoreline length divided by vessel and manoeuvring length, which gives 20 vessels. Although this does not take into account a larger possible vessel density should smaller barges being used, it is still considered realistic estimate, as a visual survey identified a similar number of vessels along the shore front.

The emission rates were estimated with reference to the *USEPA Non-Road Diesel Standards* and *USEPA Current Methodologies in Preparing Mobile Source Port-Related Emission Inventories (April 2009)*, hereafter referred to as "*USEPA Methodology*". The barges were assumed to have an engine size of 314.6 kW, which is based on average engine size information from 250 ton cranes. Based on the maximum theoretical loading factor of 43% for gantry cranes[5], a loading factor of 50%, which is considered to be conservative, is assumed for the barges. A visual survey showed the derrick lighters operate approximately 5 minutes out of every 20 minutes, with an on-off sequence of: rigging – 10 minutes; crane operation – 5 minutes; unrigging – 5 minutes. Therefore all engines are assumed to be operating at 50% load and for 25% of the operation hours.

Marine diesel engines are assumed to have an average operating lifetime of 10,000 hours. Derrick lighter barges are assumed to operate during the same period as the NYPCWA, i.e., 7:00 am to 9:00 pm daily or 14 hours per day (Monday to Saturday), with a time-in mode of 25%. Based on these assumptions, it can be estimated that the average life span of the marine engine on a derrick lighter barge is approximately 10 years, which is used to determine the emission rate for the engines by making reference to the emission standards for non-road diesel engines. This estimated engine life span is considered to give a conservative emission rate as the average age of engines is likely to be less than 10 years. Based on a visual survey, the exhaust height of the derrick lighter engine is assumed to be 8.7m (approximately the height of three shipping containers). Details of estimating the engine emission can be found in **Appendix 3.25**.

[5] Starcrest Consulting Group, LLC, 2009. *Rubber Tired Gantry (RTG) Crane Load Factor Study.* Poulsbo: Starcrest Consulting Group, LLC.

Information provided by the marine sub-consultant estimates 130 small craft movements in the NYMTTS (both entering and leaving). It is assumed that all the vessels are tugs and are restricted to the same operation period as the NYPCWA, that is 7:00 am to 9:00 pm daily.

The NO_x emission rates for tugs were estimated by using actual engine data sourced from maritime sales information. RSP emission rates are based on Harbour Craft Emission Factors as published in the "*USEPA Methodology"*. SO_2 emission rates were estimated from the *Starcrest Consulting Group, LLC Puget Sound Maritime Air Emission Inventory (April 2007).* The tugs were assumed to have two 696 kW engines (average engine size from maritime sales information). The RSP emission rates were adjusted according to the *Starcrest Consulting Group, LLC Puget Sound Maritime Air Emission Inventory (April 2007)*, whereas the SO_2 emission rates were adjusted based on the fuel sulfur content as given in the reference material, and the actual fuel sulfur content as used in Hong Kong marine vessels. Detailed information can be found in **Appendix 3.25**.

Engine loading factor for tugs was assumed to be 31% as described in the *"USEPA Methodology"*. The movements were divided evenly among the operating hours and so for modelling purposes there are nine tug movements per operating hour of NYPCWA.

As the tugs are moving, the emissions are modelled as a series of area sources. To allow for variation in the actual vessel route, a width of 30 m is applied. The average hourly area emission rate was calculated by the instantaneous emission rate (g/s) multiplied by the time that it takes for the vessel to move over the length of the route (based on the reported average speed), and then divided by the total route area and 3600 seconds (one hour).

The estimated emission rates are summarised in **Table 15.3.12** and details of the estimation are given in **Appendix 3.25**.

Table 15.3.12: Estimated Emission Rates of Barges at NYPCWA

Pollutant	Vessel type	Estimated Emission Rates
NOx	Barge	0.0799 g/s for each barge
	Tug	2.30×10^{-6} g/m^2.s for each tug
RSP	Barge	0.0022 g/s for each barge
	Tug	8.81×10^{-8} g/m^2.s for each tug
SO_2	Barge	0.0136 g/s for each barge
	Tug	6.07×10^{-7} g/m^2.s for each tug

China Ferry Terminal

The China Ferry Terminal is located to the south-east of WKCD. Three main companies operate at the Terminal, which are: CotaiJet, TurboJet and Chu Kong Passenger Transport Limited. Sailing timetables were reviewed for each of the companies and total vessel unloading/loading to the terminal calculated. The total unloading/loading was from one to 14 vessels per hour, between the hours of 7:00am and 11:00pm. Outside of these hours there are no scheduled ferry services and therefore no emissions modelled.

The emission rates were calculated based on the "*Institute for the Environment, The Hong Kong University of Science & Technology: Study on Marine Vessels Emission Inventory*", hereafter referred to as the *"HK Inventory"*. During berthing it is assumed that only auxiliary engines are operational. An overall average emission rate for all ferries was calculated for berthing based on the average auxiliary engine information

available. The auxiliary engines are assumed to have a loading factor of 45% during cruise and berthing, as stated in the *"HK Inventory"*.It is also assumed that each unloading/loading takes 30 minutes to complete, including manoeuvring and berthing.

From information available from ferry operators, the exhausts were assumed to emit at water level, as no stack was visible for the majority of the ferries surveyed, and stacks for fast ferries are horizontal. To account for this exhaust position, the stacks were modelled with an efflux velocity of 0.001 m/s and an equivalent stack diameter. This approach is as described in Section 6.1 of the *USEPA AERMOD Implementation Guide, 2009* and is considered conservative.

Emissions for the movement of fast ferries to and from the terminal were also modelled. Separate emission factors were calculated for Macau ferries (i.e., fast ferries travelling to/from Macau) and China ferries (i.e., fast ferries travelling to/from cities in Mainland China). Emissions are estimated based on the *"HK Inventory".* Slow cruise is defined as 8 – 12 knots, but the marine speed limit within Victoria Harbour is 10 knots. Therefore, all fast ferries are assumed to travel at 10 knots within the study area for the purpose of estimating the engine emission rates.

For Macau ferries, the largest engine power as stated in the "*HK Inventory"* is 9,280kW and the maximum design cruise speed is 45 knots. For China ferries, the largest engine power as stated in the "*HK Inventory"* is 5,490kW and the maximum design cruise speed is 32 knots. In order to estimate the ferry engine power at the cruise speed of 10 knots, it is assumed that the engine power, which can be estimated as hydrodynamic drag force multiplied by cruise speed, is directly proportional to the cruise speed. In other words, the hydrodynamic drag force is assumed to be at a constant level that equals to the highest hydrodynamic drag force at maximum engine power. This is a conservative assumption for estimating the engine power at reduced cruise speed conditions where the hydrodynamic drag force would be lower. With such a conservative assumption, it can be estimated that the engine power levels for Macau ferries and China ferries travelling at 10 knots are respectively 0.22 (i.e., 10knots / 45knots) x 9,280kW and 0.31 (i.e., 10knots / 32knots) x 5,490kW. Each scheduled travel of a fast ferry is considered to have two vessel trips along the ferry route (one to and one from). The estimated emission rates are summarised in **Table 15.3.13** and details of the estimation are given in **Appendix 3.25**.

As the marine traffic emissions are included as part of the emission inventory of the PATH model, there is a certain amount of double counting. The modelling results for the fast ferries are therefore considered to be conservative.

Table 15.3.13: Estimated Emission Rates of Fast Ferries at China Ferry Terminal

Pollutant	Mode	Estimated Emission Rates
NOx	Berth	0.12 g/s for each ferry*
	China Ferry - Transit	8.84×10^{-6} g/m^2.s for each ferry
	Macau Ferry - Transit	1.01×10^{-5} g/m^2.s for each ferry
RSP	Berth	0.004 g/s for each ferry*
	China Ferry - Transit	2.79×10^{-7} g/m^2.s for each ferry
	Macau Ferry - Transit	3.21×10^{-7} g/m^2.s for each ferry
SO_2	Berth	0.026 g/s for each ferry*
	China Ferry - Transit	1.88×10^{-6} g/m^2.s for each ferry
	Macau Ferry - Transit	2.15×10^{-6} g/m^2.s for each ferry

*Assumed to last for 30 minutes during each hour of operation

Ocean Terminal

The Ocean Terminal is located to the south-east of WKCD. A 40,000-ton ship is berthed at the Ocean Terminal during day-time but leaves for the sea during night-time. This 40,000-ship is hereafter referred to as the day-time ship. Other cruise ships are also periodically berthed at the Ocean Terminal. There are totally two berths available at the Ocean Terminal. Therefore, it is assumed for the worst-case scenario that both the day-time ship and another 70,000-ton ship are berthed at the Terminal simultaneously, with the 70,000-ton ship berthing for 24 hours of a day (hereafter referred to as the 24-hour ship). The day-time ship is generally berthed between about 8:00am and 8:00pm, and has been modelled as such. The 24-hour ship is assumed to be berthed for 24 hours at the Terminal, as when visiting it can be berthed at the Terminal for more than a day. This modelling approach is considered to have captured the worst-case scenario when both cruise ships are at the berths.

Emission rates of the ships berthing at the Ocean Terminal were estimated by using the "*USEPA Methodology*", MARPOL regulations, as stated in *Merchant Shipping (Prevention of Air Pollution) Regulation – Chapter 413M, Section 27 (3) (b)* and engine information for the auxiliary engines. No information was available as to whether the ship is to cold iron during berth, so it is assumed all auxiliary engines are running for the entire time the cruise ships are berthed at the Ocean Terminal. During berthing, the cruise ships would also be running auxiliary boilers to provide hot water, heating and other services. These services would be provided by exhaust heat exchangers on the main and auxiliary engines during cruising, however during berth the main engines are off and therefore auxiliary boilers are needed Boiler emissions were estimated based on the "*HK Inventory*". The fuel used during berthing is assumed to be residual oil, with a sulfur content of 2.8%. This is conservative as some ocean going vessels use distillate fuel, which has a lower sulfur content and leads to lower RSP and SO_2 emissions. The future projected average fuel sulfur content is 1.98% for auxiliary engines and 2.07% for auxiliary boilers, both of which are lower than the assumed 2.8% sulfur content. Moreover, the MARPOL regulations will reduce the sulfur content to 0.5% from 2020 onwards.

To prevent over-estimation of the SO_2 emissions from the ships berthing at the Ocean Terminal, a calibration exercise was performed with reference to the on-site SO_2 data recorded at the EPD's WKCD monitoring station (see **Section 15.3.1.2**). Historic berthing timetable at the Ocean Terminal during the monitoring period of the WKCD monitoring station (i.e., from Sep 2011 to Aug 2012) was identified. As there are many day-time marine traffic emission sources (e.g., Star Ferries, China ferries, Macau ferries, recreational and cargo vessels) during day-time, the calibration exercise was carried out only for night-tme periods between 9pm and 8am when the 24-hour ship alone is berthed at the Ocean Terminal (the day-time ship is at cruise during night-time) and the emissions from fast ferries and other marine traffic are minimal. The calibration results were then used to adjust the SO_2 emission rate for the 24-hour ship to provide more realistic estimates of the maximum SO_2 concentrations at the ASRs. The SO_2 emission rate for the day-time ship, which is smaller in tonnage than the 24-hour ship, is conservatively assumed to be the same as the adjusted emission rate for the 24-hour ship. Details of the calibration results for estimation of SO_2 emission rates are given in **Appendix 3.25**.

Based on a visual survey and information on the day-time ship, the height of the stacks was assumed to be 50 metres. Based on engine information, there are four auxiliary engines for day-time ship, and it is therefore assumed there are four stacks. The estimated emission rates of the ships are summarised in **Table 15.3.14** and details of the estimation are given in **Appendix 3.25**. No emissions for vessels sailing to

and from the terminal were estimated or modelled as this is considered to be adequately covered by the PATH model and is outside the 500 m assessment area.

Table 15.3.14: Estimated Emission Rates of Cruise Ships at Ocean Terminal

Pollutant	Vessel	Estimated Emission Rates (g/s)
NOx	Day-time ship	12.97
	24-hour ship	14.55
RSP	Day-time ship	1.88
	24-hour ship	1.97
SO_2	Day-time ship	7.62
	24-hour ship	7.62

15.3.4.4 Operation Phase – General Emissions

To assess the operational air quality, a variety of models were required. In accordance with the EPD's *Guidelines on Choice of Models and Model Parameters*.

Model Description - PATH

The PATH model is a numerical air quality modelling system developed specifically for use in Hong Kong. The model comprises of three modules: an emission model; a prognostic meteorological model and an Eulerian transport and chemistry model. These modules are interfaced together and set up on a series of nested domains to account for influences outside of Hong Kong.

Assumptions and Inputs – PATH

An updated version of PATH was released by the EPD for general use in December 2012. As there is no significant policy change or inventory update since the release of the latest PATH and the submission of this report, use of the 2012 PATH model in its current state is considered appropriate.

For EIA applications, PATH simulates wind field, pollutant emissions, transportation and chemical transformation and outputs pollutant concentrations over Hong Kong and the Pearl River Delta (PRD) region at a fine grid size of 1.5km.

During the 12th Hong Kong-Guangdong Joint Working Group Meeting on Sustainable Development and Environmental Protection (Nov 2012), the Hong Kong and Guangdong Governments jointly endorsed a Major Air Pollutant Emission Reduction Plan for the Pearl River Delta Region up to year 2020. A comprehensive emission inventory for Hong Kong and PRD was compiled for year 2010 based on current best estimates and projected to 2015 and 2020 in accordance with the emission reduction measures proposed in the plan. The emission inventory for year 2010 was used in PATH and produced reasonable agreement with air quality measurements. The projected emission inventories for years 2015 and 2020 were also used in PATH to predict air qualities for future years. The emission inventories include the total emissions from six key groups, namely, public electricity generation, road transport (emissions estimated based on VKT forecast provided by TD and EMFAC-HK model version 2.1), navigation, civil aviation (emissions estimated based on forecasted air traffic movements), other fuel combustion (covering emissions from such major facilities as HK & China Gas, Green Island Cement and Integrated Waste Management Facilities) and non-combustion. The Hong Kong emission inventories of the key air pollutants of concerns for the Project are summarized in **Table 15.3.15**.

Table 15.3.15: Summary of 2015 and 2020 Hong Kong Emission Inventory for the PATH Model

Pollutant	Total Emission in 2015 (ton/year)	Total Emission in 2020 (ton/year)
SO_2	26,625	23,075
NO_x	98,100	87,200
RSP	5,706	5,389

PATH model was used to quantify the background air quality during the operational phase of the Project. Emission sources including roads, marine, airports, power plants and industries within the Pearl River Delta Economic Zone and Hong Kong were considered in the PATH model. Details of the PATH Model and related emission inventory can be found in EPD's web site.

The hourly SO_2, NO_x and RSP concentrations as extracted from the PATH for year 2015 are adopted as the background air pollutant concentrations in the estimation of cumulative impact for the Project during the worst case year of 2015. The hourly pollutant concentrations as extracted from the PATH for year 2020 have also been used to refine the NO_2 modelling results for those planned ASRs that will be in operation from 2020 onwards (see **Section 15.3.5.2**).

Since the vehicular and marine traffic emissions at local scale (i.e. within the 500m assessment area) have been modeled by near-field dispersion models, namely, CALINE4 and ISCST (see **Sections 15.3.4.2** and **15.3.4.3**), adding the PATH background concentrations to the near-field modeling results would lead to certain amount of double counting, and hence conservative cumulative modeling results.

Other Assumptions

According to *Entec UK Limited: Defra UK Ship Emissions Inventory, 2010* the NO_x:NO_2 ratio can vary between 0.05 and 0.10. The NO_x formed during combustion comprise predominantly of NO, with a small percentage of primary NO_2. In the atmosphere the NO oxidises to NO_2 which is considered as secondary NO_2. For conservative results a conversion factor of 0.10 has been used for NO_x to NO_2.

The Ozone Limiting Method (OLM) as described in *EPD's Guidelines on Choice of Models and Model Parameters* has been adopted to estimate the conversion of NO_x to NO_2 from both marine and vehicular emissions. The ozone concentrations are based on the future hourly background ozone concentrations for year 2015 or 2020, which were extracted from grid (28, 27) of the most up to date PATH. Grid (28, 27) of the PATH model is used because the majority of the WKCD area falls within this grid (see **Figure 3.8**).

The NO_x/NO_2 conversion for vehicular and marine emissions is therefore estimated as follows:

$$[NO_2] = 0.075 \times [NO_x]_{vehicle} + \text{minimum of } \{0.925 \times [NO_x]_{vehicle} \text{ or } (46/48) \times [O_3]_{PATH}\} + 0.10 \times [NO_x]_{marine} + \text{minimum of } \{0.90 \times [NO_x]_{marine} \text{ or } (46/48) \times [O_3]_{PATH}\}$$

where

$[NO_2]$ is the estimated hourly vehicular NO_2 concentration (predicted by CALINE4 and ISCST);

$[NO_x]_{vehicle}$ is the hourly NO_x concentration as predicted by CALINE4 and ISCST3 for vehicular emissions at the receptor;

$[O_3]_{PATH}$ is the hourly ozone concentrations as extracted from the aforementioned grid of the PATH model for year 2015 or 2020, and;

$[NO_x]_{marine}$ is the hourly NO_x concentration as predicted by ISCST3 for marine emissions at the receptor;

To estimate the total hourly concentrations, the hourly pollutant concentrations as predicted by CALINE4 and ISCST3 (vehicular and marine) are added together with the future hourly background pollutant concentrations as extracted from the relevant grid of the PATH model. Therefore, the total hourly concentrations of NO_2 are calculated as follows:

$[NO_2]_{total} = [NO_2] + [NO_2]_{PATH}$

where

$[NO_2]_{total}$ is the total hourly NO_2 concentration;

$[NO_2]$ is the hourly vehicular and marine NO_2 concentration which is first predicted by CALINE4 and ISCST3 as NO_x and then converted to NO_2 by using OLM; and

$[NO_2]_{PATH}$ is the hourly NO_2 concentrations as extracted from the aforementioned grid of the PATH model for year 2015 or 2020.

Similarly, the total hourly RSP (vehicular and marine) and SO_2 (marine emissions only) concentrations are also calculated by adding together the hourly results predicted by CALINE4, ISCST3 and PATH.

With the total hourly NO_2, RSP and SO_2 estimated, the daily results are obtained by taking the arithmetic mean of the 24 hourly results. Similarly, the annual concentrations are calculated as the arithmetic mean of the whole year of hourly results.

15.3.5 Evaluation and Assessment of the Air Quality Impacts

15.3.5.1 Construction Phase

Tier 1 Results

The Tier 1 screening results for unmitigated and mitigated scenarios including the background contribution are tabulated in **Appendix 3.28**. The unmitigated and mitigated results are summarised as follows.

Hourly

The Tier 1 hourly TSP results under both unmitigated and mitigated scenarios are summarized in **Table 15.3.16**. There would be exceedances of the hourly TSP limit of 500 $\mu g/m^3$ under the Tier 1 unmitigated scenario from 2014 to 2017. However, under the Tier 1 mitigated scenario, exceedances of the hourly TSP limit would only occur from 2015 to 2017, but no exceedances in 2014.

The locations of the dust sources are shown in **Figures 3.3a** to **3.3k**. **Figures 3.11a** to **3.11h** and **3.12a** to **3.12h** show the Tier 1 hourly TSP concentration contours for unmitigated and mitigated scenarios, respectively.

Table 15.3.16: Summary of Predicted Cumulative Hourly Average TSP Concentrations for All ASRs (Tier 1 Unmitigated & Mitigated)

Year	Tier 1 Unmitigated Scenario Range of Maximum Hourly TSP (µg/m^3) [Criterion - 500 µg/m^3]	Tier 1 Mitigated Scenario Range of Maximum Hourly TSP (µg/m^3) [Criterion - 500 µg/m^3]
2014	97 – 1992	75 – 420
2015	150 – 4731	79 – 580
2016	175 – 5296	79 – 623
2017	203 – 5108	81 – 543

Table 15.3.17 shows the receptors that would breach the hourly TSP limit of 500 µg/m^3 under the Tier 1 mitigated scenario for years 2015 to 2017. ASRs that were predicted to exceed the hourly TSP limit of 500 µg/m^3 for the Tier 1 mitigated scenario were modelled further under Tier 2 conditions, as described in **Section 15.3.4.1**.

Table 15.3.17: Predicted Cumulative Hourly Average TSP Concentrations for ASRs with Exceedance (Tier 1 Mitigated)

ASR	Height above ground (m)	Maximum Hourly TSP (µg/m^3) [Criterion - 500 µg/m^3]	Remark
2015			
P53-1	4	575	Planned Performance Art Venues within WKCD. It is a possible open area. Exceedance subject to Tier 2 assessment.
2016			
P53-1	4	623	Planned Performance Art Venues within WKCD. It is a possible open area. Exceedance subject to Tier 2 assessment.
2017			
P52-1	4	543	Planned Performance Art Venues within WKCD. It is a possible open area. Exceedance subject to Tier 2 assessment

Daily

The daily TSP results for Tier 1 unmitigated and mitigated scenario including the background contribution are tabulated in **Appendix 3.28.** **Table 15.3.18** summarises the Tier 1 results for daily TSP under both unmitigated and mitigated scenarios. There would be exceedances of the daily TSP limit of 260 µg/m^3 under the Tier 1 unmitigated scenario from 2014 to 2017. However, under the Tier 1 mitigated scenario, no ASRs are predicted to exceed the daily TSP limit for any of the assessment years.

The locations of the dust sources are shown in **Figures 3.3a** to **3.3k**. **Figures 3.13a** to **3.13h** and **Figures 3.14a** to **3.14h** show the daily TSP concentration contours for unmitigated and mitigated scenarios, respectively.

Table 15.3.18: Summary of Predicted Cumulative Daily Average TSP Concentrations for All ASRs (Tier 1 Unmitigated & Mitigated)

Year	Tier 1 Unmitigated Scenario Range of Maximum Daily TSP (µg/m^3) [Criterion - 260 µg/m^3]	Tier 1 Mitigated Scenario Range of Maximum Daily TSP (µg/m^3) [Criterion - 260 µg/m^3]
2014	74 – 433	69 –132
2015	80 – 1110	70 – 223
2016	86 –1844	70 – 257
2017	84 –1278	70 – 204

Tier 2 Results

The Tier 2 results including the background contribution, as described in **Section 15.3.4.1** are tabulated in **Appendix 3.29**, and are discussed below.

Hourly

Tier 2 scenario was performed for those ASR subject to exceedance of the hourly TSP limit under the Tier 1 mitigated scenario. Under the Tier 2 mitigated scenario no ASRs were subject to exceedance of the hourly TSP limit of 500 µg/m³ as summarised in **Table15.3.19**. Detailed results can be found in **Appendix 3.29**. The locations of the dust sources are shown in **Figures 3.3a** to **3.3h**. **Figures 3.15a** to **3.15e** show the hourly TSP concentration contours under the Tier 2 mitigated scenario.

Table15.3.19: Summary of Predicted Cumulative Hourly Average TSP Concentrations (Tier 2 Mitigated)

ASR	Height above ground (m)	Maximum Hourly TSP (µg/m^3) [Criterion - 500 µg/m^3]
2015		
P53-1	4	265
2016		
P53-1	4	413
2017		
P52-1	4	247

Daily

There are no ASRs that would be subject to exceedance of the daily TSP limit under the Tier 1 mitigated scenario. Therefore, it is not necessary to run the Tier 2 mitigated scenario for daily TSP.

Annual Results

The annual results for mitigated and unmitigated scenarios including the background contribution are tabulated in **Appendix 3.30** and are also summarised in **Table 15.3.20**. There would be exceedances of the annual TSP limit of 80 µg/m^3 under the unmitigated scenario for years 2014 and 2016 only. However, under the mitigated scenario, no ASRs would exceed the annual TSP limit for any of the assessment years.

The locations of the dust sources are shown in **Figures 3.3a** to **3.3k**. **Figures 3.17a** to **3.17h** and **Figures 3.18a** to **3.18h** show the annual TSP concentration contours for unmitigated and mitigated scenarios, respectively.

Table15.3.20: Summary of Predicted Cumulative Annual Average TSP Concentrations for All ASRs (Unmitigated & Mitigated)

Year	Unmitigated Scenario Range of Maximum Annual TSP ($\mu g/m^3$) [Criterion - 80 $\mu g/m^3$]	Mitigated Scenario Range of Maximum Annual TSP ($\mu g/m^3$) [Criterion - 80 $\mu g/m^3$]
2014	69 - 81	68 - 75
2015	68 - 79	68 - 79
2016	69 - 84	68 - 78
2017	68 - 79	68 - 71

Operation Phase – Vehicular and Marine Emissions

The predicted air quality results have included the background pollutant levels as extracted from the PATH model for year 2015 based on the latest released model and the cumulative impacts of the following emissions:

- Existing and proposed open roads within the 500 m assessment area;
- Proposed underpasses/landscape decks along the Austin Road West and Lin Cheung Road and the associated top openings under the Road Works at West Kowloon project;
- Existing WHC portal in the vicinity of the WKCD site;
- Ventilation exhausts/portals serving the planned underground roads within the WKCD area;
- Emissions from stationary marine sources at NYPCWA, China Ferry Terminal and Ocean Terminal, and;
- Fast ferry and tug movements within the 500 m assessment area.

Comparison of the predicted cumulative NO_2, RSP and SO_2 concentrations and any exceedances for individual ASRs under all modelled scenarios during the worst case year of 2015 (see **Sections 15.3.4.2**) can be found in **Appendix 3.31**. For the planned ASRs that will only be in operation in or after 2020, however, the modelling results that are based on the worst case year of 2015 with the highest total road traffic emissions would be overly conservative because those planned ASRs are yet to exist in 2015. As a result, the relevant modelling works for road traffic emissions have been refined for such planned ASRs by adopting the traffic forecast in 2020 and the background concentrations as extracted from the PATH for year 2020 in order to obtain more realistic estimates of the predicted maximum cumulative NO_2 levels. Details of the modelling results using the traffic forecast and background concentrations in 2020 are given in **Appendix 3.32**. The contours for cumulative NO_2, SO_2 and RSP at 1.5m, 12m, 40m, 50m and 60m above ground are shown in **Figure 3.19** to **Figure 3.93**.

According to the modelling results as summarised in **Table 15.3.21**, all the ASRs would be in compliance with the corresponding AQOs for daily and annual RSP; for hourly, daily and annual SO_2; as well as for hourly, daily and annual NO_2. However, the predicted maximum hourly or daily NO_2 concentrations at some of the ASRs would exceed the corresponding AQO for up to once per year, which is within the allowable numbers of exceedance for hourly NO_2 (3 times per year) and for daily NO_2 (once per year).

Details of such hourly and daily NO_2 exceedances, together with the breakdown of NO_2 contributions due to different sources, are summarised in **Table 15.3.22**.

Table 15.3.21: Summary of Predicted Cumulative RSP, SO_2 and NO_2 Concentrations for All ASRs

Air Pollutant	Averaging Time	AQO ($\mu g/m^3$)	Allowable Exceedances in a Year	Range of Maximum Concentrations ($\mu g/m^3$)	Maximum No. of Exceedance in a Year
RSP	24 hours	180	1	114.5 – 117.7	0
Note (1)	1 year	55	0	42.8 – 51.7	0
SO_2	1 hour	800	3	84.7 – 619.1	0
Note (1)	24 hours	350	1	31.5 – 89.0	0
	1 year	80	0	7.9 – 16.2	0
NO_2	1 hour	300	3	259.7 – 314.9	0 – 1
Note (2)	24 hours	150	1	108.0 – 150.2	0 – 1
	1 year	80	0	45.0 – 79.7	0

Notes:
(1) The predicted SO_2 and RSP concentrations for all existing and planned ASRs are based on the traffic forecast during the worst-case year of 2015 and the background concentrations as extracted from the PATH for year 2015.
(2) The predicted NO_2 concentrations for existing ASRs and planned ASRs that will be in operation before 2020 are based on the traffic forecast during the worst-case year of 2015 and the background concentrations as extracted from the PATH for year 2015 whereas the predicted NO_2 concentrations for planned ASRs that will be in operation in/after 2020 have been refined based on the traffic forecast in 2020 and the background concentrations as extracted from the PATH for year 2020.

From **Table 15.3.22**, two existing ASRs, namely, SRT-1 and SRT-2, would be subject to exceedance of the AQO for hourly NO_2 for once a year, which is, however, below the allowable number of exceedances (3 times per year). At a planned ASR, namely, P37-1, the cumulative maximum daily NO_2 concentrations would marginally exceed the AQO for daily NO_2 by only 0.2 $\mu g/m^3$ (about 0.1% of the AQO for daily NO_2) for once per year, which is still within the allowable number of exceedance under the AQO for daily NO_2 (once per year). Therefore, these two existing ASRs and one planned ASRs would still be in compliance with the AQO for hourly NO_2 and daily NO_2 respectively. As noted in **Table 15.3.3**: Representative ASRs Identified for the Assessment, ASR P37-1 is at 4m above ground level, and is therefore an assessment point for reference only but not fresh air intake or openable window location.

It can also be seen from **Table 15.3.22** that majority (some 78%-81%) of the hourly/daily NO_2 concentrations would be from the background concentration and the remaining 19%-22% would be due to nearby marine traffic/vessel plus road traffic emissions. Of these 19%-22% contributions, the percentage contributions from nearby road traffic emissions for the two existing ASRs would be around 9%-12%, which are lower than the corresponding percentage (some 18%) for the one planned ASR. As the flyover project would only contribute to some road traffic emissions, the flyover project is not the key contributor to the exceedance of hourly or daily NO_2 limits (only once in a year) at the three ASRs.

Table 15.3.22: Breakdown of Predicted Cumulative NO_2 Concentrations by Sources for ASRs with Potential Exceedance

ASR	Height above ground (m)	Description	Maximum Cumulative Hourly/Daily NO_2 Concentrations ($\mu g/m^3$)*						
			Background Contribution		Marine Traffic Contribution		Road Traffic Contribution		Total Concentration#
Hourly NO_2 (AQO: 300 $\mu g/m^3$, not to be exceeded for more than 3 times per year)									
SRT-1	19	Sorrento – Tower 1	246.2	78.2%	30.0	9.5%	38.7	12.3%	314.9 [1]
SRT-2	23	Residential (Existing ASR)	246.2	81.1%	29.9	9.8%	27.6	9.1%	303.7 [1]

ASR	Height above ground (m)	Description	Maximum Cumulative Hourly/Daily NO_2 Concentrations ($\mu g/m^3$)*						
			Background Contribution		Marine Traffic Contribution		Road Traffic Contribution		Total Concentration#
Daily NO_2 (AQO: 150 $\mu g/m^3$, not to be exceeded for more than once per year)									
P37-1	4	Retail/ Dining/ Entertainment (Planned from 2017 onwards)	118.9	79.2%	3.7	2.5%	27.6	18.4%	150.2 [1]

*Percentages in shaded cells represent the percentage share of the total concentrations.
#Numbers in bracket refer to the numbers of exceedance per year.

As explained in **Sections 15.3.3.3** and **15.3.3.4**, majority of the vehicular emission sources and all marine emission sources are due to respectively the nearby current/planned road networks serving the West Kowloon area and the existing marine activities in the surrounding waters, but not due to the WKCD development itself. To illustrate this, breakdown of the predicted maximum hourly NO_2 contributions due to different sources has been identified at a number of selected ASRs during the worst case year of 2015, as presented in **Table 15.3.23**. These selected ASRs cover existing ASRs close to but outside the WKCD boundary and planned ASRs representing the various types of future developments (to be operated before 2020) scattering within the entire WKCD area. It can be seen from the Table that 88%-100% of NO_2 contributions would be due to the background concentration plus the surrounding marine traffic emissions, with 12% or less from the nearby road traffic emissions. As the flyover project would only result in some road traffic emissions, the project itself would have very minor contribution to the predicted air quality impacts at the ASRs.

Table 15.3.23: Breakdown of Predicted Cumulative Hourly NO_2 Concentrations by Sources for Selected ASRs (for the Worst Case Year of 2015)

ASR	Height above ground (m)	Description	Maximum Cumulative Hourly NO_2 Concentrations ($\mu g/m^3$)* (AQO: 300 $\mu g/m^3$, not to be exceeded for more than 3 times per year)						
			Background Contribution		Marine Traffic Contribution		Road Traffic Contribution		Total Concentration#
SRT-1	19	Sorrento – Tower 1	246.2	78.2%	30.0	9.5%	38.7	12.3%	314.9 [1]
SRT-2	23	Residential (Existing ASR)	246.2	81.1%	29.9	9.8%	27.6	9.1%	303.7 [1]
P16-1	4	Retail/ Dining/ Entertainment Residential (Planned ASR from 2018 onwards)	277.2	99.4%	1.8	0.6%	0.0	0.0%	279.0
P16-3	12		277.2	99.4%	1.7	0.6%	0.0	0.0%	278.9
P16-5	20		277.2	99.4%	1.7	0.6%	0.0	0.0%	278.9
P16-8	50		277.2	99.5%	1.3	0.5%	0.0	0.0%	278.5
P29-1	4	Office + Retail/ Dining/ Entertainment Residential (Planned ASR from 2018 onwards)	277.2	99.8%	0.5	0.2%	0.1	0.0%	277.8
P29-3	12		277.2	99.8%	0.5	0.2%	0.0	0.0%	277.7
P29-5	20		277.2	99.8%	0.5	0.2%	0.0	0.0%	277.7
P29-10	70		277.2	99.9%	0.4	0.1%	0.0	0.0%	277.6
P35c-1	4	Planned performance art venue (Planned ASR from 2017 onwards)	277.2	99.6%	1.1	0.4%	0.0	0.0%	278.3
P35c-3	12		277.2	99.6%	1.1	0.4%	0.0	0.0%	278.3
P35c-5	20		277.2	99.6%	1.1	0.4%	0.0	0.0%	278.3
P37-1	4	Retail/ Dining/ Entertainment (Planned ASR from 2017	246.2	88.1%	6.7	2.4%	26.6	9.5%	279.5
P37-3	12		277.2	99.6%	0.1	0.0%	1.0	0.4%	278.3
P37-5	20		277.2	99.7%	0.1	0.0%	0.8	0.3%	278.1

ASR	Height above ground (m)	Description	Maximum Cumulative Hourly NO_2 Concentrations ($\mu g/m^3$)* (AQO: 300 $\mu g/m^3$, not to be exceeded for more than 3 times per year)						
			Background Contribution		Marine Traffic Contribution		Road Traffic Contribution		Total Concentration#
P37-10	70	onwards)	277.2	100.0%	0.0	0.0%	0.0	0.0%	277.2
P51-1	4	Freespace (Planned ASR from 2016 onwards)	277.2	99.9%	0.2	0.1%	0.0	0.0%	277.4
P51-3	12		277.2	99.9%	0.2	0.1%	0.0	0.0%	277.4
P51-5	20		277.2	99.9%	0.2	0.1%	0.0	0.0%	277.4
P52-1	4	Pavilion (Planned ASR from 2016 onwards)	277.2	100.0%	0.0	0.0%	0.0	0.0%	277.2
P52-3	12		277.2	100.0%	0.0	0.0%	0.0	0.0%	277.2
P52-5	20		277.2	100.0%	0.0	0.0%	0.0	0.0%	277.2
OP	1.5	Open Space (Planned ASR from 2017 onwards)	277.2	100.0%	0.0	0.0%	0.0	0.0%	277.2

*Percentages in shaded cells represent the percentage share of the total concentrations.
#Numbers in bracket refer to the numbers of exceedance per year.

To illustrate the predicted air quality impacts in 2020, breakdown of the predicted maximum hourly NO_2 contributions due to different sources has also been identified by adopting the traffic forecast and background concentrations for the year of 2020 at selected ASRs, as presented in **Table 15.3.24**. The selected ASRs cover existing ASRs close to but outside the WKCD boundary and planned ASRs representing the future developments within WKCD, particularly those in the vicinity of the WHC portal. It can be seen from the Table that 73%-100% of NO_2 contributions would be due to the background concentration plus the surrounding marine traffic emissions, with 27% or less from the nearby road traffic emissions. The NO_2 contributions from nearby road traffic for P43d and P43e at not more than 12m above ground (21%-27%) are much higher than those for other ASRs (0.0%-8.9%), chiefly because of their proximity to the WHC portal. Another observation is that the cumulative maximum hourly NO_2 concentrations of the existing ASRs in 2020 would be considerably lower than those in 2015 (i.e.,**Table 15.3.23**), indicating an appreciable extent of improvement in air quality from 2015 to 2020.

Table 15.3.24: Breakdown of Predicted Cumulative Hourly NO_2 Concentrations by Sources for Selected ASRs (for Year 2020)

ASR	Height above ground (m)	Description	Maximum Cumulative Hourly NO_2 Concentrations ($\mu g/m^3$)* (AQO: 300 $\mu g/m^3$, not to be exceeded for more than 3 times per year)						
			Background Contribution		Marine Traffic Contribution		Road Traffic Contribution		Total Concentration
SRT-1	19	Sorrento – Tower 1	214.5	79.9%	30.0	11.2%	23.8	8.9%	268.3
SRT-2	23	Residential (Existing ASR)	259.7	98.8%	0.0	0.0%	3.1	1.2%	262.8
P37-1	4	Retail/ Dining/ Entertainment (Planned ASR from 2017 onwards)	259.7	98.8%	0.1	0.0%	3.0	1.1%	262.8
P37-3	12		259.7	98.9%	0.1	0.0%	2.7	1.0%	262.5
P37-5	20		259.7	99.0%	0.1	0.0%	2.4	0.9%	262.2
P37-10	70		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P39-1	4	Office + Planned performance art venues (Planned ASR from 2020 onwards)	259.7	99.0%	0.1	0.0%	2.6	1.0%	262.4
P39-3	12		259.7	99.4%	0.1	0.0%	1.5	0.6%	261.3
P39-5	20		259.7	99.7%	0.1	0.0%	0.7	0.3%	260.5
P39-10	70		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43a-1	4	Hotel + Retail/ Dining/	259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7

ASR	Height above ground (m)	Description	Maximum Cumulative Hourly NO_2 Concentrations ($\mu g/m^3$)* (AQO: 300 $\mu g/m^3$, not to be exceeded for more than 3 times per year)						
			Background Contribution		Marine Traffic Contribution		Road Traffic Contribution		Total Concentration
P43a-3	12	Entertainment (Planned ASR from 2020 onwards)	259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43a-4	16		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43b-1	4	Ditto	259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43b-3	12		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43b-5	20		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43c-1	4	Ditto	259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43c-3	12		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43c-5	20		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43d-1	4	Ditto	202.8	72.6%	2.7	1.0%	73.9	26.4%	279.4
P43d-3	12		202.8	77.3%	2.7	1.0%	56.7	21.6%	262.2
P43d-5	20		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43d-7	40		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43e-1	4	Ditto	202.8	72.2%	3.2	1.1%	74.9	26.7%	280.9
P43e-3	12		202.8	77.5%	3.2	1.2%	55.8	21.3%	261.8
P43e-5	20		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43e-8	50		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43f-1	4	Ditto	259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43f-3	12		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43f-5	20		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43f-8	50		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43g-1	4	Ditto	259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43g-3	12		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43g-5	20		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43g-7	40		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43h-1	4	Ditto	259.7	100.0%	0.0	0.0%	0.1	0.0%	259.8
P43h-3	12		259.7	100.0%	0.0	0.0%	0.1	0.0%	259.8
P43h-5	20		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43h-7	40		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43i-1	4	Ditto	259.7	99.9%	0.0	0.0%	0.2	0.1%	259.9
P43i-3	12		259.7	100.0%	0.0	0.0%	0.1	0.0%	259.8
P43i-5	20		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43i-6	30		259.7	100.0%	0.0	0.0%	0.0	0.0%	259.7
P43j-1	4	Ditto	259.7	99.9%	0.0	0.0%	0.3	0.1%	260.0
P43j-3	12		259.7	99.9%	0.0	0.0%	0.2	0.1%	259.9
P43j-5	20		259.7	100.0%	0.0	0.0%	0.1	0.0%	259.8
P43k-1	4	Ditto	259.7	99.9%	0.0	0.0%	0.3	0.1%	260.0
P43k-3	12		259.7	99.9%	0.0	0.0%	0.2	0.1%	259.9
P43k-4	16		259.7	100.0%	0.0	0.0%	0.1	0.0%	259.8

*Percentages in shaded cells represent the percentage share of the total concentrations.

15.3.6 Mitigation Measures

15.3.6.1 Construction Phase

General Dust Control Measures

To ensure compliance with the TSP criteria during the construction phase, the relevant requirements stipulated in the *Air Pollution Control (Construction Dust) Regulation* and EPD's *Guidance Note on the Best Practicable Means for Cement Works (Concrete Batching Plant) BPM 3/2(93)* as well as the good practices for dust control should be implemented to reduce the dust impact. The dust control measures are detailed as follows:

Dust emissions could be suppressed by regular water spraying on site. In general, water spraying twice a day could reduce dust emission from active construction area by 50%. However, for this flyover road Project, more frequent water spraying, i.e., 12 times a day or once every one hour, is required for heavy construction activities at all active works area in order to achieve a higher dust suppression efficiency of 91.7% to reduce the dust impacts to acceptable levels. A watering intensity of 3.75 L/m^2, 12 times a day or once every hour, is predicted to achieve 91.7% dust suppression efficiency. Detailed calculations can be found in **Appendix 3.8**. Heavy construction activities include construction of roads, drilling, ground excavation, cut and fill operations (i.e., earth moving), etc.

Best Practices for Dust Control

In addition to implementing the recommended dust control measures mentioned above, it is recommended that the relevant best practices for dust control as stipulated in the *Air Pollution Control (Construction Dust) Regulation* should also be adopted to further reduce the construction dust impacts of the Project. These best practices include:

Good Site Management

- Good site management is important to help reducing potential air quality impact down to an acceptable level. As a general guide, the Contractor should maintain high standard of housekeeping to prevent emission of fugitive dust. Loading, unloading, handling and storage of raw materials, wastes or by-products should be carried out in a manner so as to minimise the release of visible dust emission. Any piles of materials accumulated on or around the work areas should be cleaned up regularly. Cleaning, repair and maintenance of all plant facilities within the work areas should be carried out in a manner minimising generation of fugitive dust emissions. The material should be handled properly to prevent fugitive dust emission before cleaning.

Disturbed Parts of the Roads

- Each and every main temporary access should be paved with concrete, bituminous hardcore materials or metal plates and kept clear of dusty materials; or
- Unpaved parts of the road should be sprayed with water or a dust suppression chemical so as to keep the entire road surface wet.

Exposed Earth

- Exposed earth should be properly treated by compaction, hydroseeding, vegetation planting or seating with latex, vinyl, bitumen within six months after the last construction activity on the site or part of the site where the exposed earth lies.

Loading, Unloading or Transfer of Dusty Materials

- All dusty materials should be sprayed with water immediately prior to any loading or transfer operation so as to keep the dusty material wet.

Debris Handling

- Any debris should be covered entirely by impervious sheeting or stored in a debris collection area sheltered on the top and the three sides.
- Before debris is dumped into a chute, water should be sprayed so that it remains wet when it is dumped.

Transport of Dusty Materials

- Vehicle used for transporting dusty materials/spoils should be covered with tarpaulin or similar material. The cover should extend over the edges of the sides and tailboards.

Wheel washing

- Vehicle wheel washing facilities should be provided at each construction site exit. Immediately before leaving the construction site, every vehicle should be washed to remove any dusty materials from its body and wheels.

Use of vehicles

- The speed of the trucks within the site should be controlled to about 10km/hour in order to reduce adverse dust impacts and secure the safe movement around the site.
- Immediately before leaving the construction site, every vehicle should be washed to remove any dusty materials from its body and wheels.
- Where a vehicle leaving the construction site is carrying a load of dusty materials, the load should be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle.

Site hoarding

- Where a site boundary adjoins a road, street, service lane or other area accessible to the public, hoarding of not less than 2.4m high from ground level should be provided along the entire length of that portion of the site boundary except for a site entrance or exit.

Best Practices for Concrete Batching Plant

It is recommended that the relevant best practices for dust control as stipulated in the *Guidance Note on the Best Practicable Means for Cement Works (Concrete Batching Plant) BPM 3/2* should also be adopted to further reduce the construction dust impacts of the Project. These include:

Exhaust from Dust Arrestment Plant

- Wherever possible the final discharge point from particulate matter arrestment plant, where is not necessary to achieve dispersion from residual pollutants, should be at low level to minimise the effect on the local community in the case of abnormal emissions and to facilitate maintenance and inspection.

Emission Limits

- All emissions to air, other than steam or water vapour, shall be colourless and free from persistent mist or smoke

Engineering Design/Technical Requirements

- As a general guidance, the loading, unloading, handling and storage of fuel, raw materials, products, wastes or by-products should be carried out in a manner so as to prevent the release of visible dust and/or other noxious or offensive emissions

Detailed mitigation methods and guidance can be found in the stand-alone EM&A Manual.

15.3.6.2 Operation Phase – Vehicular and Marine Emissions

Since it has been assessed that all the ASRs would be in compliance with all the relevant AQOs for SO_2, NO_2 and RSP, no mitigation measures for vehicular or marine traffic emissions are required during the operation phase.

15.3.7 Evaluation of Cumulative and Residual Impacts

15.3.7.1 Construction Phase

It has been assessed that there would neither be exceedance of the hourly TSP limit under the Tier 2 mitigated scenario nor exceedance of the AQO for daily TSP under the Tier 1 mitigated scenario at any of the ASRs throughout the entire construction period. Similarly, no exceedance of the AQO for annual TSP was predicted at any of the ASRs for the entire construction period under the mitigated scenario. Hence no residual impacts are anticipated during the construction phase.

15.3.7.2 Operation Phase – Vehicular and Marine Emissions

According to the modelling results, all the identified ASRs would be in compliance with the corresponding AQO for hourly, daily and annual SO_2; for hourly, daily and annual NO_2 as well as for daily and annual RSP. However, during the worst case year of 2015, two existing ASRs, namely, SRT-1 and SRT-2, would be subject to exceedance of the AQO for hourly NO_2 (i.e., 300 $\mu g/m^3$) by about 3.7-14.9 $\mu g/m^3$ (or about 1.2%-5.0% of the relevant AQO) for once a year, and one planned ASR, namely, P37-1, would be subject to marginal exceedance of the AQO for daily NO_2 (i.e., 150 $\mu g/m^3$) by about 0.2 $\mu g/m^3$ (or about 0.1% of the relevant AQO) for once a year. Since the numbers of such hourly and daily NO_2 exceedances are within the respective allowable numbers of exceedances (3 times per year for hourly NO_2 and once per year for daily NO_2), the AQO for hourly and daily NO_2 would still be complied with at the three ASRs. Hence, no residual impacts are anticipated during the operation phase due to vehicular and marine emissions.

15.3.8 Environmental Monitoring and Audit

15.3.8.1 Construction Phase

Regular dust monitoring is considered necessary during the construction phase of the Project and regular site audits are also required to ensure the dust control measures are properly implemented. Details of the environmental monitoring and audit (EM&A) programme will be presented in the stand-alone EM&A Manual.

15.3.8.2 Operation Phase

Since it has been assessed that all the ASRs would be in compliance with all the relevant AQOs for SO_2, NO_2 and RSP, no residual air quality impacts due to vehicular or marine traffic emissions are anticipated. Therefore, no monitoring is considered necessary for vehicular or marine traffic emissions.

15.3.9 Conclusion

Construction Phase

With implementation of the recommended mitigation measures as well as the relevant control requirements as stipulated in the *Air Pollution Control (Construction Dust) Regulation* and EPD's *Guidance Note on the Best Practicable Means for Cement Works (Concrete Batching Plant) BPM 3/2(93)*, it has been assessed that there would neither be exceedance of the hourly TSP limit under the Tier 2 mitigated scenario nor exceedance of the AQO for daily TSP under the Tier 1 mitigated scenario at any of the ASRs throughout the entire construction period. For annual TSP results, no exceedance of the corresponding AQO was predicted at any of the ASRs during the construction phase provided the recommended mitigation measures are in place.

Operation Phase

Majority of the vehicular emission sources and all marine emission sources are due to respectively the nearby current/planned road networks serving the West Kowloon area and the existing marine activities in the surrounding waters, but not due to the flyover road itself. Therefore, the flyover road alone would only have very minor contribution to the predicted air quality impacts at the ASRs.

According to the modelling results, all the identified ASRs would be in compliance with the corresponding AQO for hourly, daily and annual SO_2; for hourly, daily and annual NO_2 as well as for daily and annual RSP. However, during the worst case year of 2015, two existing ASRs, namely, SRT-1 and SRT-2, would be subject to exceedance of the AQO for hourly NO_2 (i.e., 300 $\mu g/m^3$) by about 3.7-14.9 $\mu g/m^3$ (or about 1.2%-5.0% of the relevant AQO) for once a year, and one planned ASR, namely, P37-1, would be subject to marginal exceedance of the AQO for daily NO_2 (i.e., 150 $\mu g/m^3$) by about 0.2 $\mu g/m^3$ (or about 0.1% of the relevant AQO) for once a year. Since the numbers of such hourly and daily NO_2 exceedances are within the respective allowable numbers of exceedances (3 times per year for hourly NO_2 and once per year for daily NO_2), the AQO for hourly and daily NO_2 would still be complied with at the three ASRs.

In conclusion, no adverse air quality impacts due to vehicular or marine traffic emissions are anticipated during the operation phase of the WKCD Project.

15.4 Noise Impact

This section presents the assessment of the potential noise impacts associated with the construction and operation phases of the proposed Austin Road Flyover in WKCD. Noise generated from various construction activities is the primary concern during the construction phase. Road traffic noise is the major noise impact during the operation phase. Representative Noise Sensitive Receivers (NSRs) within 300m of the subject site have been identified and the worst case impacts on these receivers have been assessed. Suitable mitigation measures, where necessary, have been recommended accordingly to reduce the identified noise impacts to acceptable levels.

15.4.1 Noise Legislations, Standards and Guidelines

15.4.1.1 Construction Phase

Control over the generation of construction noise in Hong Kong is governed by the Noise Control Ordinance (NCO) and the EIAO and their subsidiary requirements. Various Technical Memoranda (TMs) have been issued under the NCO and the EIAO to stipulate control approaches and criteria. These TMs prescribe the maximum permitted noise levels for the use of Powered Mechanical Equipment (PME) and certain construction activities and processes, according to the type of equipment or activity, the perceived noise climate of the area, and the working hours of equipment operation and usage. The TMs applicable to the control of noise from construction activities of proposed construction works are:

- TM on Environmental Impact Assessment Process (EIAO-TM)
- TM on Noise from Construction Work other than Percussive Piling (GW-TM)
- TM on Noise from Construction Work in Designated Areas (DA-TM)

15.4.1.2 General Construction Activities during Non-Restricted Hours

Noise impacts arising from general construction activities other than percussive piling during the daytime period (07:00-19:00 hours of any day not being a Sunday or general holiday) are assessed against the noise standards tabulated in **Table 15.4.1** below.

Table 15.4.1: Noise Standards for Daytime Construction Activities

Noise Sensitive Uses	0700 to 1900 hours on any day not being a Sunday or general holiday, $L_{eq\ (30\ min)}$, dB(A)
All domestic premises including temporary housing accommodation	75
Hotels and hostel	
Educational institutions including kindergarten, nurseries and all others where unaided voice communication is required	70 65 during examination

Source: EIAO-TM, Annex 5, Table 1B - Noise Standards for Daytime construction Activities

Note: The above noise standards apply to uses, which rely on opened windows for ventilation
The above standards shall be viewed as the maximum permissible noise levels assessed at 1m from the external facade
The above standards shall be met as far as possible. All practicable mitigation measures shall be exhausted and the residual impacts are minimised

15.4.1.3 General Construction Activities during Restricted Hours

Noise impacts arising from general construction activities (excluding percussive piling) conducted during the restricted hours (19:00-07:00 hours on any day and anytime on Sunday or general holiday) and percussive piling during anytime are governed by the NCO.

For carrying out of any general construction activities involving the use of any Powered Mechanical Equipment (PME) within restricted hours, a Construction Noise Permit (CNP) is required from the Authority under the NCO. The noise criteria and the assessment procedures for issuing a CNP are specified in the GW-TM under the NCO.

The use of Specified PME (SPME) and/or the carrying out of Prescribed Construction Work (PCW) within a Designated Area (DA) under the NCO during the restricted hours are also prohibited without a CNP. The relevant technical details in Technical Memorandum on Noise from Construction Work in Designated Areas (DA-TM) under NCO can be referred.

Designated areas, in which the control of SPME and PCW shall apply, are established through the Noise Control (Construction Work Designated Areas) Notice made under Section 8A(1) of the NCO. According to the Designated Area defined under the NCO, all part of the works area of this project will fall within these areas where construction works would be carried out.

Regardless of any description or assessment made in this section, in assessing a filed application for a CNP the Authority will be guided by the relevant Technical Memoranda. The Authority will consider all the factors affecting their decision taking contemporary situations/ conditions into account. Nothing in this Report shall pre-empt the Authority in making their decisions, and there is no guarantee that a CNP will be issued. If a CNP is to be issued, the Authority may include any conditions they consider appropriate and such conditions are to be followed while the works covered by the CNP are being carried out. Failing to do so may lead to cancellation of the permit and prosecution action under the NCO.

According to the construction programme, the proposed construction works would be carried out during non-restricted hours. In case of any construction activities during restricted hours, it is the Contractor's responsibility to ensure compliance with the NCO and the relevant TMs. The Contractor will be required to submit CNP application to the Noise Control Authority and abide by any conditions stated in the CNP, should one be issued.

15.4.1.4 Operation Phase - Road Traffic Noise

The EIAO-TM published under Section 16(5) of the EIAO is the fundamental legislation of noise criteria for evaluating noise impact of designated projects. The summary of noise criteria is given in **Table 15.4.2**.

Table 15.4.2: Relevant Road Traffic Noise Standards for Planning Purposes

Uses	Road Traffic Noise Peak Hour Traffic $L_{10\ (1hour)}$, dB(A)
All domestic premises including temporary housing accommodation	70
Educational institutions including kindergartens, nurseries and all others where unaided voice communication is required	65

Notes: (i) The above standards apply to uses which rely on opened windows for ventilation

(ii) The above standards should be viewed as the maximum permissible noise levels assessed at 1m from the external facade

15.4.2 Baseline Conditions

15.4.2.1 Assessment Study Area

The Assessment Study Area is defined as within 300m of the site boundary of the Project for noise impact assessment. This assessment study area is identified and shown in **Figure 15.4.1**.

15.4.2.2 Description of the Environment

Site visits were conducted in June, July and August 2011 to understand the existing environment in the vicinity of the Project site. This Project site is surrounded by the areas with residential, commercial and recreational uses. The existing noise environment is dominated by the road traffic noise from Austin Road West, Lin Cheung Road, Canton Road and the West Kowloon Highway.

15.4.2.3 Identification of Noise Sensitive Receivers

Noise Sensitive Receivers (NSRs) have been identified in accordance with Annex 13 of the EIAO-TM. The NSRs have included existing, planned/committed noise sensitive developments and relevant uses identified on the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published land use plans, including plans and drawings published by Lands Department.

For the purpose of noise assessment, the first layer of residential premises located close to the site boundary have been selected as assessment points/ identified representative NSRs within the Assessment Area for prediction of noise impact levels.

According to the Outline Zoning Plans ("the Approved South West Kowloon OZP No. S/K20/28" gazetted on 8 January 2013 and "the Draft Tsim Sha Tsui OZP No. S/K1/27" gazetted on 11 January 2013), the assessment area mainly comprises zoning of Other Specified Uses and Comprehensive Development Area (CDA). Part of the assessment area is within Residential zoning adjacent to the Canton Road. Existing NSRs in the Residential and CDA zones located close to the site boundary have been identified and selected as representative NSRs.

As residential development is expected within the WKCD, planned NSRs are also identified within the 300m area for assessment of the potential noise impact to the residential premises within the WKCD development.

Descriptions of selected representative NSRs are tabulated in **Table 15.4.3**. The representative NSRs for construction noise impact assessment are shown in the **Figures 4.2a to 4.2j**. The representative NSRs for road traffic noise impact assessment are shown in the **Figure 4.3**. Photos of existing noise sensitive receivers are shown in **Figures 4.5**.

Table 15.4.3: Representative Noise Sensitive Receivers

No.	NSR ID	Description	Use	Existing/ Planned	No. of Storeys (Sensitive use only)	1st Assessment Level (mPD)	Area Sensitivity Rating	Noise Impact Assessment	
								Construction	Road Traffic
1	HT1	The Harbourside Tower 1	Residential	Existing	65	40	N/A	√	√
2	HT3	The Harbourside Tower 3	Residential	Existing	65	40	N/A	√	√
3	P29*	Parcel 29 in WKCD	Residential	Planned	16	37	B		√

Note: (N/A) Not Applicable

* P29 is a planned NSR within the WKCD and is scheduled for occupation in 2019 while the construction period of Flyover is completed. Therefore, this NSR is not included in construction noise impact assessment.

15.4.3 Identification of Pollution Sources

15.4.3.1 Construction Noise

The major construction activities involved in the Project are site formation, construction of basement structures and construction of flyover. The construction period of the flyover is scheduled between July of 2014 and June of 2017.

As mentioned in **Section 15.2.8**, the construction programme of this WKCD Project would overlap with other several construction projects including Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL), Road Works at West Kowloon and Proposed Road Improvement Works in West Kowloon Reclamation Development Phase 1. Construction noise from these projects was also identified as key noise sources to the identified NSRs under this Project.

15.4.3.2 Road Traffic Noise

During the operational phase, noise sensitive facades may be impacted by road traffic noise from roads surrounding WKCD. Austin Road West, the proposed flyover, other existing roads and roads of other committed projects are potential sources of the road traffic noise impact.

15.4.4 Assessment Methodology

15.4.4.1 Construction Noise

Assessment approach to the noise impact is in line with the Guidance Note titled “Preparation of Construction Noise Impact Assessment under the Environmental Impact Assessment Ordinance” (GN 9/2010).

In addition, the assessment of construction noise impact is based on standard acoustic principles, and the guidelines given in GW-TM issued under the NCO where appropriate. Where no sound power level (SWL) can be found in the relevant TM, reference has been made to BS 5228 Part 1:2009 or noise emission levels measured for PME used in previous projects in Hong Kong. The general approach is summarized below:

i. Formulate a typical construction schedule/ programme;

ii. Identify a typical project-specific equipment inventory for each work stage together with the number;

iii. Obtain from GW-TM, the Sound Power Level (SWL) for each PME assumed in the equipment inventory;

ii. Select representative NSRs for the construction noise impact assessment;

iii. Calculate the unmitigated Predicted Noise Level (PNL) and correct it for facade reflection to obtain the Corrected Noise Level (CNL) at any NSRs;

iv. If necessary, re-select typical project-specific silenced equipment and calculate the mitigated noise impact;

v. Compare the mitigated CNL with the noise standards to determine acceptability and the need for further mitigation.

The calculation methodology is estimated with the following standard formula (1):

$$SPL = SWL - DC + FC \quad (1)$$

where

Sound Pressure Levels, SPL in dB(A)

Sound Power Levels, SWL in dB(A)

Distance Attenuation, DC in dB(A) = 20·log(D)+8 (where D is the distance between NSRs and noise source in meters)

Façade Correction, FC in dB(A) = 3dB(A)

For the cumulative noise impact during construction phase, projects which included Express Rail Link, Road Works at West Kowloon and Road Improvement Works in West Kowloon Reclamation Development were considered in the noise assessment. The Central Kowloon Route project as listed in **Section 15.2.8** was not taken into account due to out of the 300m study area.

In addition, a current concrete batching plant (CBP) of XRL at east of Project area as shown in **Figures 4.2b to 4.2e** will be handed over to WKCDA in year 2014. The operation, demolition and relocation of that CBP have been taken into account in the construction noise impact assessment accordingly. It is assumed that the CBP will be relocated to the west of Project area in year 2017 for worst case scenario consideration as shown in **Figures 4.2f to 4.2i**.

15.4.4.2 Road Traffic Noise

Road traffic noise levels at the representative assessment points will be calculated based on the peak hour traffic flow within a 15 years period upon commencement of operation of the Project i.e. the assessment year. Traffic noise will be predicted using the model “RoadNoise”, which has been used before in other similar EIA studies. The model has fully incorporated the procedures and methodology documented in “Calculation of Road Traffic Noise (CRTN)” (1988) published by the U.K. Department of Transport.

The planned noise sensitive use facades within WKCD and vicinity NSRs may have potential road traffic noise impact from major roads surrounding WKCD. The peak hour traffic flows of the surrounding road links and the locations of the road links are shown in **Appendix 4.2a** for the scenario with the proposed flyover in place. As the PM peak hour traffic flows of those dominant surrounding road links are higher than that during the AM peak hour, the PM peak hour traffic flow will be adopted in the assessment. The key plans for WKCD external road links and the flyover are shown in **Appendices 4.2b** and **4.2c** respectively.

An assessment of the unmitigated road traffic noise levels at the representative NSRs in the assessment year has been carried out. If exceedance of the relevant road traffic noise criteria is predicted, direct noise mitigation measures will be considered. In case the proposed direct noise mitigation measures could not be implemented due to site constraints and other uncertainties, indirect noise mitigation measures have also been considered.

Other than the existing road sections paved with low noise surfacing, the extent of low noise road surfacing, barriers and semi-enclosures proposed in the Road Works at West Kowloon project have also been considered in the unmitigated scenario of the road traffic noise impact assessment.

15.4.5 Evaluation and Assessment of the Noise Impacts

15.4.5.1 Construction Noise

The type and quantity of Powered Mechanical Equipment (PME) likely to be used for the site formation works and construction of the proposed flyover and their Sound Power Levels (SWLs) are shown in **Appendices 4.4a to 4.4i**.

According to the tentative construction programme, it is likely that there will be an overlap of this Project with some other potentially concurrent projects including "Express Rail Link", and "Road Works at West Kowloon", and "Road Improvement Works in West Kowloon Reclamation Development". These projects are described in **Section 15.2.8**. MTRCL has recently confirmed that the assumptions adopted in the approved Road Works at West Kowloon and XRL EIA reports remained valid during the preparation of this EIA Report except for construction programme of West Kowloon Terminal which have been delayed for 6 months and the revised assumptions in "Environmental Review for Proposed West Kowloon Terminus Concrete Batching Facility" (i.e. update in construction commencement date from Dec 2009 to Jun 2010 for Works Area V WKT Zone 1 to 3 and Work Area W and updated plant inventory associated with the concrete batching plant) which have been considered in this construction impact assessment. Since the EIA of "Road Improvement Works in West Kowloon Reclamation Development" project was still in-progress at the time of preparing this EIA, the relevant findings of the Preliminary Environment Review (PER) for that project have been adopted in the cumulative construction noise impact assessment. The findings in relevant approved EIA, revised construction programme and PER reports have been referenced in the assessment for the cumulative construction noise impact.

The unmitigated predicted noise levels are presented in **Table 15.4.4** below. Details of the construction noise impact at the representative NSRs are shown in **Appendices 4.4a to 4.4i**.

The prediction results indicate that the noise impact of unmitigated construction activities from the flyover would not cause exceedance of the relevant daytime construction noise criteria. However, upon the inclusion of cumulative noise impact from concurrent projects, the overall construction noise level will exceed the relevant criteria. It is noted that construction noise from WKCD is the dominant noise source. Mitigation measures are expected to be implemented during the construction of WKCD, and it is predicted that all NSRs will comply with the relevant noise level after mitigation. Details of mitigated construction noise impact are shown in **Appendices 4.10a to 4.10i**.

Table 15.4.4: Unmitigated Construction Airborne Noise Impact

NSR ID	Use	Noise Source	Predicted Noise Level dB(A)					Noise Criteria dB(A)	Exceedance of Noise Criteria?	Mitigation Measure required?
			2014	2015	2016	2017	Overall			
HT1	Residential	Flyover	61	61	61	61	61	75	No	No
		Flyover and Other Projects including WKCD	**80-85**	**79-84**	**79-81**	**77-79**	**77-85**	75	Yes	Yes
HT3	Residential	Flyover	65	65	65	65	65	75	No	No
		Flyover and Other Projects including WKCD	**79-83**	**79-83**	**79-80**	**76-78**	**76-83**	75	Yes	Yes

Note: **Bold** figures denotes the predicted noise level is higher than the relevant daytime construction noise criteria

15.4.5.2 Road Traffic Noise

The operation of the proposed flyover is scheduled to be commenced in 2017. According to the projection of the traffic impact assessment, the year with maximum traffic flow within a 15-year period upon commencement of operation of the proposed flyover is determined to be 2032. Therefore, the peak hour traffic data for year 2032 has been adopted for the assessment. After reviewing the morning and afternoon peak hour flow data, the afternoon peak hour flow data was chosen for the assessment as greater noise impact shall be predicted at the NSRs in WKCD.

The potential unmitigated road traffic noise impacts on the NSRs for the Project at Year 2032 due to operation of the proposed flyover, as well as the overall noise impacts cumulating with other existing and planned road sections nearby have been assessed. The proposed underpass will be connected to the Austin Road West in the interim scheme before permanently connected to the Canton Road after the relocation of TST Fire station. The worst traffic noise impact to the identified NSRs within a 15 year period upon commencement of the operation proposed flyover will be assessed under these two schemes.

The assessment results are summarised in **Table 15.4.5** and **Table 15.4.6** below for the scenario with interim access to the proposed underpass of the WKCD Project at Austin Road West and the scenario with permanent access to the proposed underpass of the WKCD Project at Canton Road respectively. Detailed breakdowns of road traffic noise impacts are shown in **Appendices 15.4.1 and 15.4.2**. Locations of road plots are shown in **Appendix 4.5e**.

Table 15.4.5: Unmitigated Road Traffic Noise Impact in Year 2032 – Scenario with Interim Access to the Proposed Underpass of the WKCD Project at Austin Road West

NSR ID	Noise Criteria, $L_{10(1\ hr)}$ dB(A)	Predicted Road Traffic Noise Level, $L_{10\ (1hr)}$ dB(A)		
		Proposed Flyover	Overall	Contribution from Proposed Flyover
HT1	70	N/A*	69 - **72**	0.0
HT3	70	21 - 35	69 - **71**	0.0
P29	70	45 - 47	**72**	0.0 - 0.1

Note: * Road traffic noise level of Project road is negligible.

Bold figures denotes the predicted noise level is exceeded the relevant traffic noise criteria.

Table 15.4.6: Unmitigated Road Traffic Noise Impact in Year 2032 – Scenario with Permanent Access to the Proposed Underpass of the WKCD Project at Canton Road

NSR ID	Noise Criteria, $L_{10(1\ hr)}$ dB(A)	Predicted Road Traffic Noise Level, $L_{10\ (1hr)}$ dB(A)		
		Proposed Flyover	Overall	Contribution from Proposed Flyover
HT1	70	N/A*	69 - **72**	0.0
HT3	70	21 - 35	69 - **71**	0.0
P29	70	45 - 47	**72**	0.0 - 0.1

Note: * Road traffic noise level of Project road is negligible.

Bold figures denotes the predicted noise level is exceeded the relevant traffic noise criteria.

Noise levels of the selected representative NSRs were found exceeding the relevant noise criteria. However, the exceedances were found dominated by the contributions of the noise from the surrounding

existing and committed Road Works at West Kowloon road sections. The noise contributions from the Project's proposed flyover are estimated to be less than 1.0 dB(A) and the road traffic noise levels of the proposed roads are all below the noise criterion of 70 dB(A). Direct noise mitigation measures on the Project road sections are deemed not necessary as they would be ineffective in improving the noise environment at the NSRs. Therefore, the proposed flyover of this Project is not expected to have a significant contribution to the overall road traffic noise impact and no noise mitigation measure is required.

An assessment of the scenario without the proposed flyover has been conducted and the results with detailed breakdown of road traffic noise impacts are shown in **Appendix 15.4.3** for reference. The peak hour traffic flows of the surrounding road links and the locations of the road links are shown in **Appendix 15.4.4** for the scenario without the proposed flyover.

15.4.6 Mitigation Measures

15.4.6.1 Construction Noise

As discussed in **Section 15.4.5.1**, no exceedance of construction noise level is predicted from the flyover. Nevertheless, the contractor is recommended to implement the following measures to reduce the potential noise impact from construction activities:

- good site practice to limit noise emissions at source;
- selection of quieter plant;
- use of movable noise barrier;
- use of noise enclosure/ acoustic shed, and
- use of noise insulating fabric.

While it is recognised that the Contractor may develop a different package of mitigation measures to meet the required noise standards, the following suite of practical and implementable measures demonstrate an approach that would be feasible to reduce noise levels.

Good Site Practice

Good site practice and noise management can significantly reduce the impact of construction site activities on nearby NSRs. The following package of measures should be followed during each phase of construction:

- only well-maintained plant to be operated on-site and plant should be serviced regularly during the construction works;
- machines and plant that may be in intermittent use to be shut down between work periods or should be throttled down to a minimum;
- plant known to emit noise strongly in one direction, should, where possible, be orientated to direct noise away from the NSRs;
- mobile plant should be sited as far away from NSRs as possible; and
- material stockpiles and other structures to be effectively utilised, where practicable, to screen noise from on-site construction activities.

Selecting Quieter Plant

The Contractor may be able to obtain particular models of plant that are quieter than the standards given in the GW-TM. This is one of the most effective measures and is increasingly practicable because of the availability of quiet equipment.

Quiet plant whose actual SWL is less than the value specified in GW-TM for the same piece of equipment. SWLs for specific silenced PME can be referenced from EPD's QPME Inventory and "*Sound Power Levels of Other Commonly Used PME*". It should be noted that various types of silenced equipment can be found in Hong Kong.

Use of Movable Noise Barriers

Movable noise barriers can be very effective in screening noise from particular items of plant when constructing the Project. Noise barriers located along the active works area close to the noise generating component of a PME could produce at least 10 dB(A) screening for stationary plant and 5 dB(A) for mobile plant provided the direct line of sight between the PME and the NSRs is blocked. A schematic configuration of a single movable noise barrier for PME is shown in **Figure 4.9**.

Use of Noise Enclosure/ Acoustic Shed

The use of noise enclosure or acoustic shed is to cover stationary PME such as air compressor and concrete pump. With the adoption of the noise enclosure, the PME could be completely screened, and noise reduction of 15 dB(A) can be achieved according to the EIAO Guidance Note No.9/2010. A schematic configuration of full noise enclosure for PME is shown in **Figure 4.10**.

Use of Noise Insulating Fabric

Noise insulating fabric can also be adopted for certain PME (e.g. drill rig, pilling machine etc). The fabric should be lapped such that there are no openings or gaps on the joints. According to the approved Tsim Sha Tsui Station Northern Subway EIA report (AEIAR-127/2008), a noise reduction of 10 dB(A) can be achieved for the PME lapped with the noise insulating fabric.

These enclosures and noise barriers should be free of gaps and made of materials having a surface mass density in excess of 10 kg/m^2. To improve the effectiveness of noise reduction, non-flammable absorptive lining can be adhered on the inner surface of the noise barriers. The barrier can be in the form of vertical or bend top barrier with an effective height to block the line of sight to NSRs.

Mitigated Construction Noise Impacts

With the incorporation of quiet plant and the use of movable noise barriers, enclosure and insulating fabric, the results indicated that the mitigated noise impact associated with the construction of the Project would comply with the daytime construction noise criterion at all representative NSRs.

The effect of the use of quiet plant and using movable barriers, enclosure and insulating fabric has been investigated for the practicable construction activities. The mitigated noise levels from the construction of the flyover and overall cumulative construction noise levels with other projects are presented in **Table 15.4.7**. Mitigated Construction Plant Inventory and details of the mitigated construction noise impact are shown in **Appendices 4.10a to 4.10i**.

Table 15.4.7: Cumulative Mitigated Construction Airborne Noise Impact

NSR ID	Use	Noise Source	Predicted Noise Level dB(A)					Noise Criteria dB(A)	Exceedance of Noise Criteria?	Mitigation Measure required?
			2014	2015	2016	2017	Overall			
HT1	Residential	Flyover	52	52	52	52	52	75	No	No
		Flyover and Other Projects including WKCD	70-75	68-70	69-70	68-70	68-75	75	No	No
HT3	Residential	Flyover	55	55	55	55	55	75	No	No
		Flyover and Other Projects including WKCD	69-74	67-69	69-70	67-70	69-74	75	No	No

15.4.6.2 Road Traffic Noise

The noise contributions from the Project's proposed flyover are estimated to be less than 1.0 dB(A) and the road traffic noise levels of the proposed roads are all below the noise criterion of 70 dB(A). No adverse noise impacts arising from the proposed flyover would be predicted at any of the representative NSRs and hence no mitigation measure is required.

15.4.7 Evaluation of Cumulative and Residual Impacts

15.4.7.1 Construction Phase

No exceedance of relevant noise level from the flyover is predicted. With the implementation of mitigation measures during WKCD construction, the cumulative construction noise impact is expected to comply with the relevant noise level. Therefore, residual construction noise impact is not anticipated.

15.4.7.2 Operation Phase

Exceedance of the road traffic noise criteria was predicted at three representative sensitive receivers, two are existing residential development and the other is a planned residential use. However, the road noise contributions from the flyover to the overall noise levels at all representative NSRs would be less than 1.0 dB(A) and the road noise levels of the flyover would all be below the relevant noise criteria. Adverse impact arising from the flyover is not anticipated at any of representative NSR.

15.4.8 Environmental Monitoring and Audit

15.4.8.1 Construction Phase

Though no residual noise impact is predicted during the construction of the flyover, an Environmental Monitoring and Audit (EM&A) programme is recommended to ensure that nearby NSRs will not be subjected to unacceptable construction noise impact. Details of the noise monitoring requirements, methodology and action plans would be described in a separate EM&A Manual.

15.4.8.2 Operation Phase

No adverse noise impact is anticipated from the operation of the flyover, hence no monitoring is considered necessary.

15.4.9 Conclusion

15.4.9.1 Construction Phase

The construction phase noise impact assessment has been made based on the best available information. The construction noise levels at all representative NSRs are predicted to comply with the noise standards stipulated in the EIAO-TM. Residual construction noise impact is not anticipated.

15.4.9.2 Operation Phase

The potential road traffic noise impacts have been assessed based on the peak traffic flows in 2032. The noise levels predicted at the representative NSRs would range from 69 to 72 dB(A). Road traffic noise is predicted to be dominant by the existing and committed Road Works at West Kowloon road sections nearby. The noise contributions from the Project's proposed flyover are estimated to be less than 1.0 dB(A) and the road traffic noise levels of the proposed roads are all below the noise criterion of 70 dB(A). Adverse traffic noise impact is not anticipated.

15.5 Water Quality Impact

This section presents an assessment of potential water quality impacts which may arise from the construction and operational stages of proposed Austin Road flyover for the WKCD. Recommendations for mitigation measures have been made, where necessary, to minimise the identified water quality impacts to an acceptable level.

15.5.1 Water Quality Legislations, Standards and Guidelines

The criteria for evaluating water quality impacts include the following:

- Water Pollution Control Ordinance (WPCO) Cap. 358;
- Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM-DSS); and
- Practice Note for Professional Persons on Construction Site Drainage (ProPECC Note PN 1/94).

15.5.1.1 Water Pollution Control Ordinance (WPCO)

The Water Pollution Control Ordinance (WPCO) (Cap. 358) provides the statutory framework for the protection and control of water quality in Hong Kong. According to the WPCO and its subsidiary legislation, Hong Kong waters are divided into ten Water Control Zones (WCZs). Water Quality Objectives (WQOs) were established to protect the beneficial uses of water quality in WCZs. Specific WQOs are applied to each WCZ. The proposed flyover for the WKCD development is located within the Victoria Harbour, Western Buffer and Eastern Buffer WCZs and their corresponding WQOs are listed in **Tables 15.5.1, 15.5.2** and **15.5.3** respectively. The WQOs for the aforementioned WCZs had been used as the basis for assessment of water quality impacts.

Table 15.5.1: Water Quality Objectives for Victoria Harbour WCZ

Parameters	Objectives	Sub-Zone
Offensive Odour, Tints	Not to be present	Whole zone
Colour	Not to exceed 50 Hazen units, due to human activity	Inland waters
Visible foam, oil scum, litter	Not to be present	Whole zone
E. coli	Not to exceed 1000 per 100mL, calculated as the geometric mean of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days	Inland waters
Dissolved Oxygen (DO) within 2 m of the seabed	Not less than 2 mg L^{-1} for 90% of the sampling occasions during the whole year	Marine waters
Depth-averaged DO	Not less than 4 mg L^{-1} for 90% of the sampling occasions during the whole year; values should be calculated as the annual water column average (expressed normally as the arithmetic mean of at least 3 measurements at 1m below surface, mid depth and 1m above the seabed. However in water of a depth of 5m of less the mean shall be that of 2 measurements – 1m below surface and 1m above seabed, and in water of less than 3m the 1m below surface sample only shall apply.)	Marine waters
Dissolved Oxygen (DO)	Not less than 4 mg L^{-1}	Inland waters

Parameters	Objectives	Sub-Zone
pH	To be in the range of 6.5 - 8.5, change due to human activity not to exceed 0.2	Marine waters
Salinity	Change due to human activity not to exceed 10% of ambient	Whole zone
Temperature	Change due to human activity not to exceed 2 ^{o}C	Whole zone
Suspended Solids (SS)	Not to raise the ambient level by 30% caused by human activity	Marine waters
	Annual median not to exceed 25 mgL^{-1} due to human activity	Inland waters
Unionised Ammonia (UIA)	Annual mean not to exceed 0.021 mg L^{-1} as unionised form	Whole zone
Nutrients	Shall not cause excessive algal growth	Marine waters
	Annual mean depth-averaged inorganic nitrogen not to exceed 0.4 mg L^{-1}	Marine waters
BOD_5	Not to exceed 5 mg L^{-1}	Inland waters
	Not to exceed 30 mg L^{-1}	Inland waters
Toxic substances	Should not attain such levels as to produce significant toxic, carcinogenic, mutagenic or teratogenic effects in humans, fish or any other aquatic organisms.	Whole zone
	Human activity should not cause a risk to any beneficial use of the aquatic environment.	Whole zone

Source: Statement of Water Quality Objectives (Victoria Harbour (Phases One, Two and Three) Water Control Zone).

Table 15.5.2: Water Quality Objectives for the Western Buffer WCZ

Parameters	Objectives	Sub-Zone
Offensive Odour, Tints	Not to be present	Whole zone
Colour	Not to exceed 30 Hazen units, due to human activity	Water gathering ground subzones
	Not to exceed 50 Hazen units, due to human activity	Other inland waters
Visible foam, oil scum, litter	Not to be present	Whole zone
E. coli	Not to exceed 610 per 100 mL, calculated as the geometric mean of all samples collected in a calendar year	Secondary contact recreation subzones and Fish culture subzones
	Not to exceed 180 per 100 mL, calculated as the geometric mean of all samples collected from March to October inclusive in 1 calendar year. Samples should be taken at least 3 times in 1 calendar month at intervals of between 3 and 14 days	Recreation subzones
	Less than 1 per 100 mL, calculated as the geometric mean of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days	Water gathering ground subzones
	Not to exceed 1000 per 100 mL, calculated as the geometric mean of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days	Other Inland waters
Depth-averaged Dissolved Oxygen (DO)	Not less than 4 mg L^{-1} for 90% of the sampling occasions during the whole year; values should be calculated as water column average (arithmetic mean of at least 3 measurements at 1m below surface, mid-depth and 1m above seabed)	Marine waters except Fish culture subzones

Parameters	Objectives	Sub-Zone
	Not less than 5 mg L^{-1} for 90% of the sampling occasions during the year; values should be calculated as water column average (arithmetic mean of at least 3 measurements at 1m below surface, mid-depth and 1m above seabed)	Fish culture subzones
Dissolved Oxygen (DO) within 2 m of the seabed	Not less than 2 mg L^{-1} for 90% of the sampling occasions during the whole year	Marine waters and Fish culture subzones
Dissolved Oxygen (DO)	Not less than 4 mg L^{-1}	Water gathering ground subzones and other inland waters
pH	To be in the range of 6.5 - 8.5, change due to human activity not to exceed 0.2	Marine waters
	Not to exceed the range of 6.0 – 8.5 due to human activity	Water gathering ground subzones
	Not to exceed the range of 6.0 - 9.0 due to human activity	Other inland waters
Salinity	Change due to human activity not to exceed 10% of ambient	Whole zone
Temperature	Change due to human activity not to exceed 2 ^{o}C	Whole zone
Suspended Solids (SS)	Not to raise the ambient level by 30% caused by human activity and shall not accumulate to affect aquatic communities	Marine waters
	Annual median not to exceed 20 mg L^{-1} due to human activity	Water gathering ground subzones
	Annual median not to exceed 25 mg L^{-1} due to human activity	Other inland waters
Unionised ammonia (UIA)	Annual mean not to exceed 0.021 mg L^{-1} as unionised form	Whole zone
Nutrients	Shall not cause excessive algal growth	Marine waters
	Annual mean depth-averaged inorganic nitrogen not to exceed 0.4 mg L^{-1}	Marine waters
5-day biochemical oxygen demand (BOD_5)	Not to exceed 3 mg L^{-1}	Water gathering ground subzones
	Not to exceed 5 mg L^{-1}	Other inland waters
Chemical Oxygen Demand (COD)	Not to exceed 15 mg L^{-1}	Water gathering ground subzones
	Not to exceed 30 mg L^{-1}	Other inland waters
Toxic substances	Should not attain such levels as to produce significant toxic, carcinogenic, mutagenic or teratogenic effects in humans, fish or any other aquatic organisms.	Whole zone
	Human activity should not cause a risk to any beneficial use of the aquatic environment.	Whole zone

Source: Statement of Water Quality Objectives (Western Buffer Water Control Zone).

Table 15.5.3: Water Quality Objectives for the Eastern Buffer WCZ

Parameters	Objectives	Sub-Zone
Offensive Odour, Tints	Not to be present	Whole zone
Visible foam, oil scum, litter	Not to be present	Whole zone
Dissolved oxygen (DO) within 2m of the seabed	Not less than 2 mg L^{-1} for 90% of the sampling occasions during the whole year	Marine waters and Fish culture subzones
Depth-averaged DO	Not less than 4 mg L^{-1} for 90% of the sampling occasions during the	Marine waters excepting

Parameters	Objectives	Sub-Zone
	whole year; values should be calculated as water column average (arithmetic mean of at least 3 measurements at 1m below surface, mid-depth and 1m above seabed)	fish culture subzones
	Not less than 5 mg L^{-1} for 90% of the sampling occasions during the year; values should be calculated as water column average (arithmetic mean of at least 3 measurements at 1m below surface, mid-depth and 1m above seabed)	Fish culture subzones
	Not less than 4 mg L^{-1}	Water gathering ground subzone and other inland waters
5-day biochemical oxygen demand (BOD_5)	Not to exceed 3 mg L^{-1}	Water gathering ground subzones
	Not to exceed 5 mg L^{-1}	Other inland waters
Chemical oxygen demand (COD)	Not to exceed 15 mg L^{-1}	Water gathering ground subzones
	Not to exceed 30 mg L^{-1}	Other inland waters
pH	To be in the range of 6.5 – 8.5, change due to human activity not to exceed 0.2	Marine waters
	To be in the range of 6.5 – 8.5	Water gathering ground subzones
	To be in the range of 6.0 – 9.0	Other inland waters
Salinity	Change due to waste discharges not to exceed 10% of ambient	Whole zone
Temperature	Change due to waste discharges not to exceed 2 ^{o}C	Whole zone
Suspended solids (SS)	Not to raise the ambient level by 30% caused by human activity and shall not accumulate to affect aquatic communities	Marine waters
	Change due to human activity not to exceed 20 mg L^{-1} of annual median	Water gathering ground subzones
	Change due to human activity not to exceed 25 mg L^{-1} of annual median	Other inland waters
Unionized ammonia (UIA)	Annual mean not to exceed 0.021mg L^{-1} as unionized form	Whole zone
Nutrients	Shall not cause excessive algal growth	Marine waters
	Annual mean depth-averaged inorganic nitrogen not to exceed 0.4 mg L^{-1}	Marine waters
Toxic substances	Should not attain such levels as to produce significant toxic, carcinogenic, mutagenic or teratogenic effects in humans, fish or any other aquatic organisms.	Whole zone
	Human activity should not cause a risk to any beneficial use of the aquatic environment	Whole zone
E. coli	Not exceed 610 per 100mL, calculated as the geometric mean of all samples collected in one calendar year	Fish culture subzones
	Less than 1 per 100mL, calculated as the geometric mean of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days	Water gathering ground subzones
	Not exceed 1000 per 100mL, calculated as the geometric mean of the most recent 5 consecutive samples taken at intervals of between 7 and 21 days	Other inland waters
Colour	Change due to human activity not to exceed 30 Hazen units	Water gathering ground
	Change due to human activity not to exceed 50 Hazen units	Other inland waters

Source: Statement of Water Quality Objectives (Eastern Buffer Water Control Zone).

15.5.1.2 Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM-DSS)

Discharges of effluents are subject to control under the WPCO. The *Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters* (TM-DSS) sets limits for effluent discharges. Specific limits apply for different areas and are different between surface waters and sewers. The limits vary with the rate of effluent flow. Sewage from the proposed construction activities should comply with the standards for effluent discharged into foul sewers, inshore waters or marine waters of the Victoria Harbour, Western Buffer and Eastern Buffer WCZs, as shown in Tables 9a, 9b, 10a and 10b of the TM-DSS.

15.5.1.3 Practice Note for Professional Persons on Construction Site Drainage (ProPECC Note PN 1/94)

A practice note for professional persons was issued by the EPD to provide guidelines for handling and disposal of construction site discharges. The *Practice Note for Professional Persons on Construction Site Drainage* (ProPECC Note PN 1/94) provides good practice guidelines for dealing with various types of discharge from a construction site. Practices outlined in ProPECC Note PN 1/94 should be followed as far as possible during construction to minimize the water quality impact due to construction site drainage.

15.5.2 Assessment Area, Water Sensitive Receivers and Baseline Conditions

15.5.2.1 Assessment Area

Water quality impact assessment had been carried out in the Victoria Harbour, Western Buffer and Eastern Buffer Water Control Zones (WCZs) and all areas within 500m from the proposed flyover boundary. Locations of the water control zones are shown in **Figure 15.5.1**.

15.5.2.2 Water Sensitive Receivers

Key water sensitive receivers that may potentially be affected by the proposed flyover include:

- Yau Ma Tei Typhoon Shelter;
- WSD Flushing Water Intakes;
- Cooling Water Intakes; and
- Fish Culture Zones.

Locations of the key water sensitive receivers are shown in **Figure 15.5.2**.

15.5.2.3 Baseline Conditions

Marine Water Quality in Victoria Harbour

A summary of marine water quality data for EPD monitoring stations at Victoria Harbour (VM6 and 7), and Stonecutters Island (VM15) extracted from EPD's publication "Marine Water Quality in Hong Kong 2010" are presented in **Table 15.5.4**. Locations of these monitoring stations are shown in **Figure 15.5.1**.

Table 15.5.4: Marine Water Quality at Victoria Harbour and Stonecutters Island in 2010

Parameter	Monitoring Station		
	Victoria Harbour (Central)	Victoria Harbour (West)	Stonecutters Island
	VM6	VM7	VM15
Temperature (^{o}C)	23.2 (16.6 – 27.7)	23.0 (17.9 – 27.2)	23.4 (16.8 – 27.6)
Salinity	31.4 (28.8 – 33.4)	31.2 (26.1 – 33.3)	31.0 (26.7 – 33.5)
Dissolved Oxygen (mg/L)	5.2 (3.6 – 6.5)	5.8 (4.5 – 7.5)	5.5 (3.9 – 6.3)
Dissolved Oxygen (Bottom) (mg/L)	4.2 (1.9 – 5.2)	5.6 (3.4 – 7.0)	4.8 (1.3 – 6.4)
pH	7.9 (7.6 – 8.2)	7.9 (7.6 – 8.2)	7.9 (7.6 – 8.2)
Secchi Disc Depth (m)	2.7 (1.0 – 5.2)	2.7 (1.7 – 4.0)	2.4 (1.2 – 3.6)
Turbidity (NTU)	3.1 (1.0 – 5.5)	3.5 (1.0 – 6.6)	3.7 (1.3 – 7.5)
Suspended Solids (mg/L)	3.5 (1.0 – 6.9)	3.8 (1.6 – 5.6)	4.2 (1.3 – 8.7)
BOD_5 (mg/L)	1.0 (0.6 – 1.7)	1.0 (0.5 – 1.8)	0.9 (0.5 – 2.0)
Ammonia Nitrogen (mg/L)	0.177 (0.109 – 0.310)	0.163 (0.090 – 0.293)	0.199 (0.114 – 0.333)
Unionised Ammonia (mg/L)	0.006 (0.002 – 0.018)	0.005 (0.002 – 0.014)	0.007 (0.002 – 0.021)
Nitrite Nitrogen (mg/L)	0.031 (0.009 – 0.053)	0.034 (0.016 – 0.078)	0.034 (0.012 – 0.057)
Nitrate Nitrogen (mg/L)	0.141 (0.051 – 0.270)	0.157 (0.068 – 0.347)	0.147 (0.046 – 0.307)
Total Inorganic Nitrogen (mg/L)	0.35 (0.19 – 0.51)	0.35 (0.20 – 0.49)	0.38 (0.18 – 0.62)
Total Kjeldahl Nitrogen (mg/L)	0.32 (0.23 – 0.47)	0.35 (0.25 – 0.48)	0.34 (0.23 – 0.47)
Total Nitrogen (mg/L)	0.49 (0.30 – 0.67)	0.55 (0.45 – 0.65)	0.53 (0.29 – 0.73)
Orthophosphate Phosphorus (mg/L)	0.030 (0.017 – 0.048)	0.025 (0.008 – 0.039)	0.031 (0.016 – 0.046)
Total Phosphorus (mg/L)	0.05 (0.03 – 0.06)	0.05 (0.04 – 0.06)	0.05 (0.04 – 0.06)
Silica (SiO_2) (mg/L)	0.91 (0.36 – 1.80)	0.81 (0.13 – 2.13)	0.93 (0.16 – 1.87)
Chlorophyll-a (µg/L)	3.3 (0.3 – 15.6)	5.0 (0.4 – 13.7)	4.1 (0.2 – 21.8)

Parameter	Monitoring Station		
	Victoria Harbour (Central)	Victoria Harbour (West)	Stonecutters Island
	VM6	VM7	VM15
E.coli (count/100mL)	4400 (550 – 13000)	2800 (520 – 16000)	1800 (430 – 5900)
Faecal Coliforms (count/100mL)	11000 (1300 – 29000)	6100 (1000 – 28000)	4600 (880 – 28000)

Notes:

Unless otherwise specified, data represented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B)

Data presented are annual arithmetic means the depth-averaged results except for E.coli and faecal coliforms which are annual geometric means.

Data in brackets indicated the ranges.

Marine Water Quality in Yau Ma Tei Typhoon Shelter

A summary of marine water quality data for EPD monitoring stations at Yau Ma Tei Typhoon Shelter (VT10) extracted from EPD's publication "Marine Water Quality in Hong Kong 2010" are presented in **Table 15.5.5**. Location of this monitoring station is shown in **Figure 15.5.1**.

Table 15.5.5: Marine Water Quality at Yau Ma Tei Typhoon Shelter in 2010

Parameter	Yau Mei Tei
	VT10
Temperature (^{o}C)	23.6 (18.2 – 27.9)
Salinity	30.8 (29.1 – 31.8)
Dissolved Oxygen (mg/L)	4.1 (1.6 – 5.1)
Dissolved Oxygen (Bottom) (mg/L)	4.5 (3.1 – 5.6)
pH	7.7 (7.5 – 7.8)
Secchi Disc Depth (m)	1.8 (1.0 – 2.7)
Turbidity (NTU)	5.9 (1.3 – 13.6)
Suspended Solids (mg/L)	6.9 (2.8 – 15.5)
BOD_5 (mg/L)	1.3 (1.0 – 1.8)
Ammonia Nitrogen (mg/L)	0.309 (0.193 – 0.450)
Unionised Ammonia (mg/L)	0.006 (0.003 – 0.011)

Parameter	Yau Mei Tei
	VT10
Nitrite Nitrogen (mg/L)	0.038 (0.023 – 0.050)
Nitrate Nitrogen (mg/L)	0.147 (0.097 – 0.200)
Total Inorganic Nitrogen (mg/L)	0.49 (0.37 – 0.64)
Total Kjeldahl Nitrogen (mg/L)	0.50 (0.41 – 0.66)
Total Nitrogen (mg/L)	0.68 (0.59 – 0.85)
Orthophosphate Phosphorus (mg/L)	0.040 (0.024 – 0.051)
Total Phosphorus (mg/L)	0.06 (0.04 – 0.07)
Silica (as SiO_2) (mg/L)	0.83 (0.12 – 1.23)
Chlorophyll-a (µg/L)	6.6 (0.8 – 21.3)
E.coli (count/100mL)	2800 (1500 – 35000)
Faecal Coliforms (count/100mL)	7400 (2700 – 71000)

Notes:

Unless otherwise specified, data represented are depth-averaged (A) values calculated by taking the means of three depths: Surface (S), Mid-depth (M), Bottom (B)

Data presented are annual arithmetic means the depth-averaged results except for E.coli and faecal coliforms which are annual geometric means.

Data in brackets indicated the ranges.

15.5.3 Identification of Water Quality Impact

15.5.3.1 Construction Phase

Potential sources of water quality impact associated with the construction activities for the proposed flyover for the WKCD development had been identified. These include:

- Construction site runoff and drainage;
- Sewage effluent from construction workforce; and
- General construction activities.

15.5.3.2 Operation Phase

During operation phase, the only potential source of water quality impact associated with operation of the proposed flyover is road and surface runoff.

15.5.4 Evaluation of Water Quality Impact

15.5.4.1 Construction Phase

Construction site runoff and drainage

Runoff from the surface construction works areas may contain increased loads of sediments, other suspended solids (SS) and contaminants. Potential sources of pollution from site drainage include:

- Runoff from and erosion from site surfaces, drainage channels, earth working areas and stockpiles;
- Release of any bentonite slurries, concrete washings and other grouting materials with construction run-off and storm water;
- Wash water from dust suppression sprays and wheel wash facilities; and
- Fuel, oil, solvents and lubricants from maintenance of construction vehicles and mechanical equipment.

Sediment laden runoff particularly from works areas subjected to excavation or earth works, if uncontrolled, may carry pollutants (adsorbed onto the particle surfaces) into any nearby storm water drains. Bentonite and chemical grouting may be required for diaphragm walling works and as a result may pollute surface runoff.

As a good site practice, mitigation measures should be implemented to control construction site runoff and drainage from the works areas, and to prevent runoff and drainage water with high levels of SS from entering any nearby storm water drains. With the implementation of adequate construction site drainage and provision of sediment removal facilities, unacceptable water quality impacts are not anticipated. The construction phase discharge would be collected by the temporary drainage system installed by the Contractor and then treated or desilted on-site before discharge to storm water drains. The Contractor would be required to obtain a license from EPD under the WPCO for discharge to the public drainage system.

Sewage effluent from construction workforce

Domestic sewage would be generated from the workforce during construction phase. However, portable chemical toilets should be installed within the construction site. The Contractor has the responsibility to ensure that chemical toilets are used and properly maintained, and that licensed Contractors are employed to collect and dispose of the waste off-site at approved locations. Therefore, water quality impact is not anticipated.

General construction activities

On-site construction activities may result in water pollution from the following:

- Uncontrolled discharge of debris and rubbish such as packaging, construction materials and refuse; and
- Spillages of liquids stored on-site, such as oil, diesel and solvents etc.

Good construction and site management practices should be observed to ensure that litter, fuels and solvents do not enter the public drainage system.

15.5.4.2 Operation Phase

Road and surface runoff

Surface runoff from the flyover proposed under the WKCD development may be contaminated by oils leaked from passing vehicles. It is considered that impacts upon water quality would be minimal provided that the proposed flyover is designed with adequate drainage systems and appropriate oil interceptors, as required.

15.5.5 Mitigation of Adverse Impacts

15.5.5.1 Construction Phase

Construction site runoff and drainage

The site practices outlined in ProPECC Note PN 1/94 should be followed as far as practicable in order to minimise surface runoff and the chance of erosion. The following measures are recommended to protect water quality and sensitive uses of the coastal area, and when properly implemented should be sufficient to adequately control site discharges so as to avoid water quality impacts:

- At the start of site establishment, perimeter cut-off drains to direct off-site water around the site should be constructed with internal drainage works and erosion and sedimentation control facilities implemented. Channels, earth bunds or sand bag barriers should be provided on site to direct storm water to silt removal facilities. The design of the temporary on-site drainage system should be undertaken by CEDD's Contractor prior to the commencement of construction;
- Sand/silt removal facilities such as sand/silt traps and sediment basins should be provided to remove sand/silt particles from runoff to meet the requirements of the TM standards under the WPCO. The design of efficient silt removal facilities should be based on the guidelines in Appendix A1 of ProPECC Note PN 1/94. Sizes may vary depending upon the flow rate. The detailed design of the sand/silt traps should be undertaken by CEDD's Contractor prior to the commencement of construction.
- All drainage facilities and erosion and sediment control structures should be regularly inspected and maintained to ensure proper and efficient operation at all times and particularly during rainstorms. Deposited silt and grit should be regularly removed, at the onset of and after each rainstorm to ensure that these facilities are functioning properly at all times.
- Measures should be taken to minimize the ingress of site drainage into excavations. If excavation of trenches in wet periods is necessary, they should be dug and backfilled in short sections wherever practicable. Water pumped out from foundation excavations should be discharged into storm drains via silt removal facilities.
- All vehicles and plant should be cleaned before leaving a construction site to ensure no earth, mud, debris and the like is deposited by them on roads. An adequately designed and sited wheel washing facility should be provided at construction site exit where practicable. Wash-water should have sand and silt settled out and removed regularly to ensure the continued efficiency of the process. The section of access road leading to, and exiting from, the wheel-wash bay to the public road should be paved with sufficient backfall toward the wheel-wash bay to prevent vehicle tracking of soil and silty water to public roads and drains.

- Open stockpiles of construction materials or construction wastes on-site should be covered with tarpaulin or similar fabric during rainstorms. Measures should be taken to prevent the washing away of construction materials, soil, silt or debris into any drainage system.
- Manholes (including newly constructed ones) should be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris being washed into the drainage system and stormwater runoff being directed into foul sewers.
- Precautions should be taken at any time of the year when rainstorms are likely. Actions should be taken when a rainstorm is imminent or forecasted and actions to be taken during or after rainstorms are summarized in Appendix A2 of ProPECC Note PN 1/94. Particular attention should be paid to the control of silty surface runoff during storm events, especially for areas located near steep slopes.
- Bentonite slurries used in piling or slurry walling should be reconditioned and reused wherever practicable. Temporary enclosed storage locations should be provided on-site for any unused bentonite that needs to be transported away after all the related construction activities are completed. The requirements in ProPECC Note PN 1/94 should be adhered to in the handling and disposal of bentonite slurries.

Sewage effluent from construction workforce

Temporary sanitary facilities, such as portable chemical toilets, should be employed on-site where necessary to handle sewage from the workforce. A licensed contractor should be employed to provide appropriate and adequate portable toilets and be responsible for appropriate disposal and maintenance.

General construction activities

Construction solid waste, debris and refuse generated on-site should be collected, handled and disposed of properly to avoid entering any nearby storm water drain. Stockpiles of cement and other construction materials should be kept covered when not being used.

Oils and fuels should only be stored in designated areas which have pollution prevention facilities. To prevent spillage of fuels and solvents to any nearby storm water drain, all fuel tanks and storage areas should be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank. The bund should be drained of rainwater after a rain event.

15.5.5.2 Operational Phase

Road and surface runoff

For operation of the proposed flyover, a surface water drainage system would be provided to collect road and surface runoff. It is recommended that the road drainage should be provided with adequately designed silt trap and oil interceptors, as necessary. The design of the operation stage mitigation measures for the flyover should take into account the guidelines published in the *Practice Note for Professional Persons on Drainage Plans Subject to Comment by the Environmental Protection Department* (ProPECC Note PN 5/93) and *Highways Department Guidance Notes RD/GN/035 – Road Pavement Drainage Design*.

15.5.6 Evaluation of Cumulative and Residual Impacts

Provided that proper mitigation measures would be implemented by each of the concurrent projects such as XRL, no adverse cumulative land-based and marine-based water quality impacts would be expected.

With the implementation of the recommended mitigation measures for the construction and operation phases of the proposed flyover, no residual water quality impact is anticipated.

15.5.7 Water Quality Monitoring and Audit

Adverse water quality impact was not predicted during the construction and operation phases of the proposed flyover. Nevertheless, appropriate mitigation measures are recommended to minimize potential water quality impacts.

Water quality monitoring is recommended to obtain a robust, defensible database of baseline information of marine water quality before construction, and thereafter, to monitor any variation of water quality from the baseline conditions and exceedances of WQOs at sensitive receivers during construction and to ensure the recommended mitigation measures are properly implemented.

Regular audit of the implementation of the recommended mitigation measures during the construction phase at the work areas should also be undertaken to ensure the recommended mitigation measures are properly implemented.

Details of the water quality monitoring and audit programme and the Event and Action Plan are provided in the stand-alone EM&A Manual.

15.5.8 Conclusion

15.5.8.1 Construction Phase

The key issue in terms of water quality during the construction phase of the flyover would be the potential for release of wastewater into coastal waters from construction site runoff and drainage.

Deterioration in water quality could be minimised to acceptable levels through implementing adequate mitigation measures such as control measures on suspended solids release, on-site runoff and drainage from the works areas to minimise suspended solids spillage and construction runoff prior to discharge. Proper site management and good housekeeping practices would also be required to ensure that construction wastes and other construction-related materials would not enter the public drainage system and coastal waters. Sewage effluent arising from the construction workforce would also be handled through provision of portable toilets.

With the implementation of these recommended mitigation measures, no unacceptable impacts on water quality from the construction works for the flyover are anticipated. Water quality monitoring and site inspections during construction phase should be undertaken routinely to inspect the construction activities and works areas to ensure the recommended mitigation measures are properly implemented.

15.5.8.2 Operation Phase

Surface runoff from the proposed flyover may be contaminated by oils leaked from passing vehicles. It is considered that impacts upon water quality will be acceptable provided that the proposed flyover is

designed with adequate drainage systems and appropriate oil interceptors, as required in accordance with *Highways Department Guidance Notes RD/GN/035 – Road Pavement Drainage Design*.

15.6 Sewerage and Sewage Treatment Implication

The flyover is part of a network of infrastructure within the WKCD development to meet the connectivity and accessibility requirements of the WKCD. This Schedule 2 Designated Project does not require or generate any sewage or sewerage related facilities. Consequently, there are no sewerage and sewage treatment implications associated with the flyover.

Sewerage and sewage treatment implications associated with the other WKCD facilities is presented in **Section 6**.

15.7 Waste Management Implication

This section identifies the potential waste arising from the construction and operation activities of the Austin Road flyover, and evaluates the potential environmental impacts that may result from waste generated. Mitigation measures and good site practices, including waste handling, storage and disposal, are recommended with reference to applicable waste legislation and management guidelines to minimise potential waste management impacts.

15.7.1 Waste Management Legislations, Standards and Guidelines

The criteria and guidelines for assessing waste management implications are outlined respectively in Annexes 7 and 15 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM).

The following legislation relates to the handling, treatment and disposal of wastes in Hong Kong and has been used in assessing potential impacts:

- Waste Disposal Ordinance (Cap. 354)
- Waste Disposal (Chemical Waste) (General) Regulation (Cap. 354C)
- Waste Disposal (Charges for Disposal of Construction Waste) Regulation (Cap. 354)
- Public Health and Municipal Services Ordinance (Cap. 132) - Public Cleansing and Prevention of Nuisances Regulation
- Land (Miscellaneous Provisions) Ordinance (Cap. 28)

15.7.1.1 Waste Management

The Waste Disposal Ordinance (WDO) prohibits the unauthorised disposal of wastes. Construction waste is defined as any substance, matter or thing that is generated from construction work and abandoned, whether or not it has been processed or stockpiled before being abandoned, but does not include any sludge, screenings or matter removed in or generated from any desludging, desilting or dredging works. Under the WDO, wastes can be disposed of only at designated waste disposal facilities.

Under the WDO, the Chemical Waste (General) Regulation provides regulations for chemical waste control, and administers the possession, storage, collection, transport and disposal of chemical wastes.

The Environmental Protection Department (EPD) has also issued a 'guideline' document, the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes (1992), which details how the Contractor should comply with the regulations on chemical wastes.

The Public Cleansing and Prevention of Nuisances Regulation provides control on illegal tipping of wastes on unauthorised (unlicensed) sites.

15.7.1.2 Inert Construction and Demolition (C&D) Materials

The current policy related to the dumping of inert C&D materials is documented in the Works Branch Technical Circular No. 2/93, 'Public Dumps'. Construction and demolition materials that are wholly inert, namely public fill, should not be disposed of to landfill, but taken to public filling areas, which usually form part of reclamation schemes. The Land (Miscellaneous Provisions) Ordinance requires that dumping licences be obtained by individuals or companies who deliver public fill to public filling areas. The Civil Engineering & Development Department (CEDD) issues the licences under delegated powers from the Director of Lands.

Under the Waste Disposal (Charges for Disposal of Construction Waste) Regulation, enacted in January 2006, construction waste delivered to a landfill for disposal must not contain more than 50% by weight of inert material. Construction waste delivered to a sorting facility for disposal must contain more than 50% by weight of inert material, and construction waste delivered to a public fill reception facility for disposal must consist entirely of inert material.

15.7.2 Assessment Methodology

The criteria for assessing waste management implications are outlined in Annex 7 of the EIAO-TM. The methods for assessing potential waste management impacts during construction and operation phases of the flyover follow those presented in Annex 15 of the EIAO-TM and include the following:

- Identify the quantity, quality and timing of waste arising as a result of the construction and operation activities of the Project.
- Assessment of potential impacts from the management of solid waste with respect to potential hazards, air and odour emissions, noise, wastewater discharges and public transport.
- Assessment of impacts on the capacity of waste collection, transfer and disposal facilities.

15.7.3 Identification, Prediction and Evaluation of Environmental Impact

15.7.3.1 Construction Phase

The activities to be carried out for construction of the Austin Road flyover would generate a variety of wastes that can be divided into different key categories based on their composition and ultimate method of disposal. The identified waste types include:

- Inert Construction and demolition (C&D) materials;
- C&D materials from site clearance;
- Chemical waste; and
- General refuse.

Each type of the above waste arising is described below, together with an evaluation of the potential environmental impacts associated with the waste generation, handling, storage, transport and disposal. **Table 15.7.1** presents a summary of all key types of waste arising during the construction phase of the flyover.

Inert Construction and Demolition (C&D) Materials

Construction of the Austin Road flyover requires only limited excavation (for the piers and abutments at the ramps off the flyover) as the piled foundations and stub columns have already been constructed as part of predecessor projects (by the WHC project and the West Kowloon Reclamation project respectively). It is envisaged that bridge segments will be pre-fabricated off site, therefore only a minor quantity of inert C&D materials would be generated from construction of the bridge superstructure. Given that the main source of inert C&D materials is the limited excavation at the ramps off the flyover, construction of the flyover is anticipated to generate not more than 3,000 m^3 of inert C&D materials (assuming an excavation area of 930m^2 and excavation depth of 3m). Bridge segments are likely to be delivered either by barge or by trucks.

Tentatively, the inert C&D materials (not more than 3,000 m^3) would be generated during the construction period of the flyover project, i.e., 2014 to 2017. Therefore, such inert materials will be handled together with those generated from the WKCD Project, i.e., reuse on-site or off-site as far as practicable. As the estimated amount of inert C&D materials that would be reused on-site as fill materials for the Park from 2014 to 2017 is about 138,470 m^3 (see **Table 7.2**), it is reasonable to assume that all the inert C&D materials generated by the flyover project would be reused on-site. In case there is any surplus inert C&D materials that could not reused on-site, disposal of such inert C&D materials to the Government's Public Fill Reception Facilities (PFRFs) for beneficial use by other projects in Hong Kong may be required. No construction work is allowed to proceed until all issues on management of inert C&D materials have been resolved and all relevant arrangements have been endorsed by the relevant authorities including PFC and EPD.

C&D Materials from Site Clearance Works

General site clearance at the western and eastern end of the flyover (where the bridge ramps down to ground level) may be required, which would generate a small amount of C&D materials comprising mainly topsoil and vegetation. Assuming the top 0.3m soil layer of the bridge ramp down construction area (covering approximately 2,000m^2) would be removed, approximately 600m^3 of C&D materials would be generated. These C&D materials would mainly be a mixture of topsoil and vegetative material, and are considered as not suitable for direct reuse by any earthworks on site due to its non-inert contents. However, the inert materials should be segregated from the C&D materials on site for reuse as far as practicable, subject to constraints of the site area. The segregated inert materials that cannot be reused on site will be disposed of at the Government's PFRFs for beneficial use by other projects in Hong Kong. The amount of such segregated materials to be reused on site should be estimated in the Waste Management Plan to be prepared by the Contractor. The remaining non-inert portion of the C&D materials will be disposed of at a designated landfill site. 10% of the C&D materials (i.e. 600 x 10% = 60m^3) would be assumed for disposal of at the landfill. Time schedule for the disposal would be from 2014 to 2017.

Chemical Waste

Chemical wastes arising during the construction phase may pose environmental, health and safety hazards if not stored and disposed of in an appropriate manner as stipulated in the Waste Disposal (Chemical Waste) (General) Regulations. The potential hazards include:

- Toxic effects to workers;
- Adverse impacts on water quality from spills and associated adverse impacts on marine biota; and
- Fire hazards.

The maintenance and servicing of construction plant and equipment may generate some chemical wastes such as used solvents, contaminated rags and waste lubricating oil. It is difficult to quantify the amount of chemical waste that will arise from the construction activities since it will be dependent on the Contractor's on-site maintenance requirements and the amount of plant utilised. However, it is anticipated that the quantity of chemical waste, such as waste lubricating oil and solvents produced from plant maintenance, will be small and in the order of less than one cubic metre per month. The amount of chemical waste to be generated will be quantified in the Waste Management Plan to be prepared by the Contractor for the site.

Materials classified as chemical wastes will require special handling and storage arrangements before removal for off-site disposal at the approved Chemical Waste Treatment Facility or recycling by licensed facilities. Mitigation and control requirements for chemical wastes are detailed in **Section 15.7.4.1**. Provided that the handling, storage and disposal of chemical wastes are in accordance with these requirements, adverse environmental impacts are not expected.

General Refuse

The construction workforce will generate refuse comprising food scraps, waste paper and empty containers etc. Such refuse will be properly managed so that intentional or accidental release to the surrounding environment will be avoided. Disposal of refuse at sites other than approved waste transfer or disposal facilities will be prohibited. Effective collection of site wastes will be required to prevent waste materials being blown around by wind, flushed or leached into the marine environment, or creating an odour nuisance or pest/vermin problem. Waste storage areas will be well maintained and cleaned regularly. The daily arising of general refuse from the construction workforce can be estimated based on a generation rate of 0.65 kg per worker per day.

The maximum number of construction workers to be employed for the flyover is likely to be less than 100 workers per day. Based on a generation rate of 0.65 kg per worker per day, the maximum daily arising of general refuse during the construction period would be approximately 65 kg and this waste can be effectively controlled by normal measures. With the implementation of good waste management practices at the site as detailed in **Section 15.7.4.1**, adverse environmental impacts are not expected to arise from the storage, handling and transportation of the general refuse from construction workforce.

Table 15.7.1 Summary of Waste Arisings during Construction Phase

Waste Type	Key Sources of Waste Generation	Timing of Waste Generation	Estimated Quantity of Waste Generation	Waste Reuse or Disposal	Waste Handling
Inert C&D Materials	Minority from excavation at bridge piers and abutments, and from construction of the flyover superstructure	Tentatively from 2014 to 2017	Up to 3,000 m^3 in total	All inert C&D materials would be reused on-site as fill materials for the Park. In case of any surplus inert C&D materials, such materials may be disposed of at the Government's PFRFs for beneficial use by other projects in Hong Kong (subject to endorsement by the relevant authorities including PFC of CEDD and EPD)	Segregate inert C&D materials to avoid contamination from other waste arising
C&D Materials from Site Clearance	General site clearance	Tentatively from 2014 to 2017	About 600 m^3 in total	Any inert materials segregated from the C&D materials to be reused on-site as far as practicable or disposed of at the Government's PFRFs for beneficial use by other projects in Hong Kong Non-inert materials segregated from the C&D materials to be disposed of at the designated landfill sites	Segregate on site the C&D materials into inert and non-inert materials
General Refuse	Waste paper, discarded containers, etc. generated from the site workforce	Tentatively from 2014 to 2017	0.65 kg per worker per day, the maximum daily arising of general refuse during the construction period would be approximately 65 kg	Refuse station for compaction and containerisation and then to landfill for disposal	Provide on-site refuse collection points
Chemical Waste	Used solvents, contaminated rags, waste lubricating oil, etc., from maintenance and servicing of construction plant and equipment	Tentatively from 2014 to 2017	Less than one cubic metre per month (preliminary estimate)	Disposal of at the Chemical Waste Treatment Centre or other licensed recycling facilities	Stored on-site by suitably designed containers for off-site disposal or recycling

15.7.3.2 Operation Phase

During operation phase, the Austin Road flyover will not involve any waste generating activities. Therefore, no adverse waste management impact is anticipated during operation phase.

15.7.4 Mitigation of Adverse Environmental Impact

15.7.4.1 Construction Phase

Good Site Practices

Adverse impacts related to waste management such as dust, odour, noise and wastewater discharge will not be expected to arise, provided that good site practices will be strictly followed. Recommendations for good site practices during the construction activities include:

- Nomination of an approved person, such as a site manager, to be responsible for good site practices, arrangements for collection and effective disposal to an appropriate facility, of all wastes generated at the site
- Training of site personnel in proper waste management and chemical handling procedures
- Provision of sufficient waste disposal points and regular collection of waste
- Appropriate measures to minimise windblown litter and dust/odour during transportation of waste by either covering trucks or by transporting wastes in enclosed containers
- Provision of wheel washing facilities before the trucks leaving the works area so as to minimise dust introduction to public roads
- Well planned delivery programme for offsite disposal such that adverse environmental impact from transporting the inert or non-inert C&D materials is not anticipated

Waste Reduction Measures

Good management and control can prevent the generation of a significant amount of waste. Waste reduction is best achieved at the planning and design stage, as well as by ensuring the implementation of good site practices. Recommendations to achieve waste reduction include:

- Sort inert C&D materials to recover any recyclable portions such as metals;
- Segregation and storage of different types of waste in different containers or skips to enhance reuse or recycling of materials and their proper disposal;
- Encourage collection of recyclable waste such as waste paper and aluminium cans by providing separate labelled bins to enable such waste to be segregated from other general refuse generated by the work force;
- Proper site practices to minimise the potential for damage or contamination of inert C&D materials; and
- Plan the use of construction materials carefully to minimise amount of waste generated and avoid unnecessary generation of waste.

In addition to the above measures, specific mitigation measures are recommended below for the identified waste arising to minimise environmental impacts during handling, transportation and disposal of these wastes.

Inert and Non-inert C&D Materials

In order to minimise impacts resulting from collection and transportation of inert C&D materials for off-site disposal, the excavated materials should be reused on-site as fill material as far as practicable. In addition, inert C&D materials generated from construction of the flyover would be combined with inert C&D materials generated from the WKCD development for reuse as fill materials in local projects that require public fill for reclamation.

The surplus inert C&D materials, if any, may be disposed of at the Government's PFRFs for beneficial use by other projects in Hong Kong. Under such circumstances, liaison with the CEDD Public Fill Committee (PFC) on the allocation of space for disposal of the inert C&D materials at PFRF will be initiated. No construction work is allowed to proceed until all issues on management of inert C&D materials have been resolved and all relevant arrangements have been endorsed by the relevant authorities including PFC and EPD.

The C&D materials generated from general site clearance should be sorted on site to segregate any inert materials for reuse or disposal of at PFRFs whereas the non-inert materials will be disposed of at the designated landfill site.

In order to monitor the disposal of inert and non-inert C&D materials at respectively PFRFs and the designated landfill site, and to control fly-tipping, it is recommended that the Contractor should follow the Technical Circular (Works) No.6/2010 for Trip Ticket System for Disposal of Construction & Demolition Materials issued by Development Bureau. In addition, it is also recommended that the Contractor should prepare and implement a Waste Management Plan detailing their various waste arising and waste management practices in accordance with the relevant requirements of the Technical Circular (Works) No. 19/2005 Environmental Management on Construction Site.

Chemical Waste

If chemical wastes are produced at the construction site, the Contractor will be required to register with the EPD as a chemical waste producer and to follow the guidelines stated in the "Code of Practice on the Packaging Labelling and Storage of Chemical Wastes". Good quality containers compatible with the chemical wastes should be used, and incompatible chemicals should be stored separately. Appropriate labels should be securely attached on each chemical waste container indicating the corresponding chemical characteristics of the chemical waste, such as explosive, flammable, oxidizing, irritant, toxic, harmful, corrosive, etc. The Contractor should use a licensed collector to transport and dispose of the chemical wastes at the approved Chemical Waste Treatment Centre or other licensed recycling facilities, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.

Potential environmental impacts arising from the handling activities (including storage, collection, transportation and disposal of chemical waste) are expected to be minimal with the implementation of appropriate mitigation measures as recommended.

General Refuse

General refuse should be stored in enclosed bins or compaction units separated from inert C&D materials. A reputable waste collector should be employed by the Contractor to remove general refuse from the site, separately from inert C&D materials. Preferably an enclosed and covered area should be provided to reduce the occurrence of 'wind blown' light material.

15.7.4.2 Operation Phase

During operation phase, the Austin Road flyover will not involve any waste generating activities. Therefore, no adverse waste management impact is anticipated during operation phase, and no mitigation measures are required.

15.7.5 Evaluation of Residual Impact

With the implementation of the recommended mitigation measures for the handling, transportation and disposal of the identified waste arising, residual impacts are not expected for both construction and operation phases.

15.7.6 Environmental Monitoring and Audit

It will be the Contractor's responsibilities to ensure that all wastes produced during the construction of the Project are handled, stored and disposed of in accordance with good waste management practices and the relevant regulations and requirements. The recommended mitigation measures shall form the basis of the Waste Management Plan to be developed by the Contractor in the construction phase.

During construction phase, regular site inspection as part of the EM&A procedures should be carried out to determine if various types of waste are being managed in accordance with approved procedures and the Waste Management Plan. It should cover different aspects of waste management including waste generation, storage, recycling, treatment, transport and disposal.

15.7.7 Conclusion

15.7.7.1 Construction Phase

The major waste types generated by the construction activities will include inert C&D materials from minor excavation at piers and abutments as well as from construction of superstructures and substructures; C&D materials from general site clearance; chemical waste from maintenance and servicing of construction plant and equipment; and general refuse from the workforce. Provided that all these identified wastes are handled, transported and disposed of in strict accordance with the relevant legislative and recommended requirements and that the recommended good site practices and mitigation measures are properly implemented, no adverse environmental impact is expected during the construction phase.

15.7.7.2 Operation Phase

During operation phase, the Austin Road flyover will not involve any waste generating activities. Therefore, no adverse waste management impact is anticipated during operation phase, and no mitigation measures are required.

15.8 Land Contamination

According to the land contamination assessment for the WKCD site (see **Section 8**), the only location within the WKCD site with potential land contamination is the site of the existing Tsim Sha Tsui Fire Station, located at the east side of the WKCD site. This Schedule 2 Designated Project is located at the west side of the WKCD site, where no previous evidence of land contamination was found. Consequently, there is no potential land contamination issues associated with the flyover.

Land contamination issues associated with the other WKCD facilities is presented in **Section 8**.

15.9 Ecological Impact

The ecological impact assessment has been conducted in accordance with the requirements of Annexes 8 and 16 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM) and the requirements stated in Section 3.2.1 (viii), Section 3.4.10 and Appendix F of the EIA Study Brief (No. ESB-237/2011). This section presents the potential ecological impacts that may arise due to construction and operation of the Austin Road flyover for the WKCD development.

15.9.1 Ecological Legislations, Standards and Guidelines

A number of international conventions, local legislation and guidelines provide the framework for protection of species and habitats of ecological importance. Those of relevance include:

- *Forests and Countryside Ordinance* (Cap. 96), which protects the rare plant species from selling, offering for sale, or possession illegally;
- *Wild Animals Protection Ordinance* (Cap. 170), which protects wild animals listed under the second schedule from being hunted, possession, sale or export, disturbance of their nest or egg without permission by authorized officer;
- *Protection of Endangered Species of Animals and Plants Ordinance* (Cap. 586), which regulates the import, introduction from the sea, export, re-export, and possession of specimens of a scheduled species, including the live, dead, parts or derivatives. The Ordinance applies to all activities involving endangered species which include the parties of traders, tourists and individuals;
- *Environmental Impact Assessment Ordinance* (EIAO) (Cap. 499), which specifies designated projects under the Ordinance, unless exempted, must follow the statutory environmental impact assessment (EIA) process;
- *Annexes 8 and 16 of the Technical Memorandum on Environmental Impact Assessment Process* (EIAO-TM): Annex 8 recommends the criteria for evaluating ecological impacts. Annex 16 sets out the general approach and methodology for assessment of ecological impacts arising from a project or proposal, to allow a complete and objective identification, prediction and evaluation of the potential ecological impacts;
- EIAO Guidance Note No. 7/2010 "*Ecological Baseline Survey for Ecological Assessment*", provides the general guidelines for conducting an ecological baseline survey to fulfil the requirements stipulated in the EIAO-TM in respect of ecological assessment for a proposed development;
- EIAO Guidance Note No. 10/2010 "*Methodologies for Terrestrial and Freshwater Ecological Baseline Surveys*", provides some methodologies in conducting terrestrial and freshwater ecological baseline surveys. This guidance note should be read in conjunction with EIAO Guidance Note 7/2010;

- *Town Planning Ordinance* (Cap. 131), which gives designation to country parks, conservation area, green belts, sites of special scientific interest, coastal protection area and other specified uses to promote conservation , protection and education of the valuable environment; and
- *Hong Kong Planning Standards and Guidelines Chapter* 10 (HKPSG) provides the guidelines on landscape and conservation to achieve a balance between the need for development and the need to minimise disruption of the landscape and natural resources.

15.9.2 Assessment Methodology

15.9.2.1 Study Area

The Study Area for impact assessment of terrestrial ecology covers all the areas within 500m from the flyover site boundary and the areas likely to be affected by the flyover. The study was firstly conducted by literature review and supplemented by on site ecological baseline surveys where it is found necessary.

15.9.2.2 Literature Review

The ecological baseline condition of the Study Area was collected through a combination of both literature review and updated field survey. Preliminary desktop study and literature review were conducted to investigate the existing condition within the Study Area and identify habitats or species with conservation concern. Available sources of information relevant to this Project including Government and private sector reports, published literature and academic studies were covered in the literature review.

15.9.2.3 Ecological Baseline Surveys

Since previous literature for this urban area is very limited, ecological baseline survey was conducted to supplement the literature review finding. The ecological baseline condition was updated through ecological field surveys, which were conducted in accordance with the requirements stated in the EIA Study Brief (No. ESB-237/2011) and guidelines stated in EIAO Guidance Note No. 7/2010 "*Ecological Baseline Survey for Ecological Assessment*" and EIAO Guidance Note No. 10/2010 "*Methodologies for Terrestrial and Freshwater Ecological Baseline Surveys*".

Habitat and vegetation surveys were conducted for 4 months (during July to December 2011) covering both wet and dry seasons within the ecological Study Area. Special attention was paid on species of conservation concern and habitats within the proposed works area where the vegetation will be directly impacted.

Habitat map of suitable scale showing the type and location of habitats recorded within the Study Area, with the overlay plot of the Project boundary was produced, as shown in **Figure 15.9.1**.

Fauna surveys were conducted within the Study Area for 4 months (during July to December 2011) covering both wet and dry seasons. Since the Project Area are newly created through reclamation and enclosed by developed area, the colonization of flora and fauna species are of low ecological importance. Only the highly mobile bird species would have better chance of colonization of the newly created habitat and also use the habitat for stopover ground during migration; so, the baseline survey is mainly focused on avifauna. Transect count surveys were adopted with the aid by a pair of binoculars to assist the identification of species. The transect route is indicated in **Figure 15.9.2**.

15.9.3 Baseline Conditions

15.9.3.1 Terrestrial Habitat and Vegetation

The Project Area is located at the West Kowloon reclamation area at the south of Austin Road West and the West Harbour Crossing toll plaza. The site is currently occupied mainly by the Western Harbour Crossing (WHC) and its toll plaza, and part of the existing West Kowloon Waterfront Promenade on either side of the WHC.

There are 4 types of terrestrial habitat identified in the Study Area, namely:

- Plantation;
- Open Field;
- Artificial Seawall; and
- Developed Area.

A habitat map showing the location of each type of habitat is presented in **Figure 15.9.1**. Representative photographs of each type of habitats are illustrated in **Appendix 9.1**. Brief descriptions of these habitat types and the dominant floral species assemble of the habitat are described as follows:

Plantation

- Plantation refers to landscape plantation. This man-made habitat comprises short shrubs and ornamental trees. This habitat is scattered at a few locations within the Project Area for the flyover, mainly at the site boundary near the Western Harbour Crossing. Dominant tree species identified in these locations are common native species such as *Acacia auriculiformis*, *Ficus microcarpa* and *Hibiscus tiliaceus*, and exotic species *Leucaena leucocephala*.

Open Field

- Open field refers to bare ground or wasteland. This type of habitat is mainly identified close to West Kowloon Waterfront Promenade. It is sparsely vegetated with a few common self-seeded species, e.g. *Rhynchelytrum repens, Imperata koenigii* and *Bidens alba*.

Artificial Seawall

- The artificial seawall refers to the sloping waterfront formed by large boulders for protection of shoreline and typhoon shelter. It happens in the southwest of the WKCD site boundary and the breakwaters in the New Yau Ma Tei Typhoon Shelter. Owing to the short history of the artificial habitat, the intertidal habitat is mainly colonized by pioneer species which are common and widespread in Hong Kong coastal area.

Developed Area

- Developed areas are artificial habitats. This man-made habitat comprises the existing buildings, sitting-out area, work site, paths and roads within the Project Area for the flyover. This urbanised land use is of negligible ecological importance.
- To the northwest of the Project Area for the flyover is a New Yau Ma Tei Typhoon Shelter, which is enclosed by artificial breakwater structure. It is generally of low ecological value due to high level of marine traffic but sometimes used by ardeid species for foraging.

Within the Project Area for the flyover, both open field and plantation habitats are of limited ecological value owing to the high level of anthropogenic disturbance, low vegetation cover, high commonness of the flora and fauna species and short history of the vegetated habitat. The fauna species associated with these two habitats are mostly common species adapted to urbanized areas. The bird species found in the site is dominated by generalist species such as Tree Sparrow, Chinese Bulbul and Black-collared Starling, which are common in urban areas.

The West Kowloon district is an urbanized area where ecological resources are limited. Habitats recorded outside the Project Area for the flyover but within the Study Area comprise mainly developed area and plantation Vegetated habitat is mainly found along roadside in form of plantation and in urban park plantation, where it is used by a small number of fauna species adapted to urbanized areas. No site of conservation importance was identified in the Study Area.

15.9.3.2 Terrestrial Fauna

The fauna species inhabiting the Project Area for the flyover are mostly generalist species adapted to urban area, with some migratory bird species which sometimes use the fragmented vegetated habitat in urban area as temporary stopover point during their migratory journey. It is noted that open field and plantation in urban area are generally not the prime habitats for wild birds. Field surveys were conducted during July to December 2011 to verify the ecological status of the habitats.

Field surveys for avifauna were conducted on 18 July, 26 September, 30 November and 28 December 2011 covering both summer and winter periods, which also include bird's breeding and wintering season. The checklist of avifauna recorded within the Project Area for the flyover is presented in **Appendix 9.2**. It was observed that the open field and plantation habitats within the Project Area were inhabited by a number of generalist species, such as Black-collared Starling, Eurasian Tree Sparrow, Spotted Dove, Chinese Bulbul, Red-whiskered Bulbul and Crested Myna. All of them are very common in urban area. Long-tailed Shrike and Plain Prinia are less common in urban area; both were seen in the open field area. A few migratory species including Brown Shrike, Blackbird, Blue Rock Thrush and Yellow-browed Warbler were seen during the surveys conducted in September to December 2011, in the period of migratory season. The low number of migratory species recorded indicates that the habitats within the Study Area are not the prime habitat for migratory birds, probably due to lack of mature vegetation and proximity to high rise buildings. With regard to raptor species, only Black Kite, which is of conservation concern, was recorded during the survey. The wintering population of Black Kite forage along Victoria Harbour, therefore it is quite common along the Victoria Harbour coast.

The southern part of the New Yau Ma Tei Typhoon Shelter lies within the 500m Study Area. Typhoon shelter is generally not an optimal habitat for avifauna but a few seashore associated species such as ardeids and Black Kite are often found foraging in the typhoon shelter. Also, a passage migrant species Whiskered Tern was recorded in autumn migration period.

To the south of the project area is Victoria Harbour which is also not a prime habitat for bird species, but ardeids species and Black Kites are also common in the area. Low density of ardeids was recorded along the coastline of Victoria Harbour whilst Black Kites are commonly found soaring over the sky of Victoria Harbour.

15.9.3.3 Habitat Evaluation

Habitats identified within the Ecological Study Area are evaluated in accordance with the guidelines set forth in the Annex 8 of the EIAO-TM. Overall ecological values for each habitat type are ranked as follows:

- High
- High-moderate
- Moderate
- Moderate-low
- Low
- Very Low

Evaluation of these habitats is given in **Table 15.9.1**. Each habitat is evaluated in accordance with the requirements stipulated in Annex 8, Table (2) of the EIAO-TM.

Table 15.9.1: Habitat Evaluation

Criteria	Developed Area	Open Field	Plantation	Artificial Seawall
Naturalness	Man-made habitat	Man-made habitat	Man-made habitat	Man-made habitat
Size	Large (49.01 ha)	Small (11.84 ha)	Small (1.90 ha)	Small (1.59 ha)
Diversity	Low in both fauna and flora species diversity	Low in both fauna and flora species diversity; self-seeded flora species are common and widespread	Low in both fauna and flora species diversity	Low diversity of coastal fauna in new artificial habitat
Rarity	Habitat not rare	Common habitat	Common habitat	Common artificial habitat
Re-creatability	Readily re-creatable	Readily re-creatable	Readily re-creatable	Readily re-creatable
Fragmentation	N/A	N/A	These habitats are patchily created/ modified for urban land use	N/A
Ecological linkage	No ecological linkage	Low ecological linkage with other habitats	Low ecological linkage with other habitats	Ecological linkage to marine habitat
Potential value	Low potential value	Low potential value	Low potential value as the habitat is being maintained for urban landscaping	Low potential value
Nursery/ breeding ground	Not significant nursery/ breeding ground	Not significant nursery/ breeding ground	Not significant nursery/ breeding ground	Not significant nursery/ breeding ground
Age	N/A	5 – 10 years	Mostly around 10 years	Mostly around 10 years
Abundance/ Richness of wildlife	Low	Low	Low	Low
Overall Ecological Value	Very Low	Very low	Low	Low

15.9.4 Evaluation and Assessment of Ecological Impacts

In view of the developments proposed in Section 2, ecological impact on habitat, flora and fauna species are predicted and evaluated in accordance with Annex 16 of the EIAO-TM and the criteria set forth in Annex 8 of the EIAO-TM.

The potential ecological impact due to the construction and operation of the Project include following:

- Habitat Loss
- Indirect Impact
- Habitat Fragmentation
- Operation Phase Impact

Evaluation of the impacts is given below and a summary of the ecological impact is presented in **Table 15.9.2**.

15.9.4.1 Habitat Loss

The construction and operation of the flyover would cause the loss of existing habitat in the West Kowloon Reclamation area. Owing to the low ecological value of the artificial habitat, the ecological impact due to the loss of open field and plantation is considered to be insignificant. With regard to avifauna, since the habitats are used by very common generalist species, the impact on avifauna due to loss of open field and plantation is also insignificant.

15.9.4.2 Indirect Impact

Indirect impact through construction activities may cause local disturbance to off-site habitats. Excessive noise, vibrations, dust generation and increased human activities may all contribute to disturbance impact during construction and operation phases. The fauna species occurring in urban areas can generally tolerate a high level of human disturbance, so the impact on fauna species is considered to be minimal. Given that the West Kowloon Reclamation and adjacent area are predominately urbanized area with low to very low ecological value, the impact of indirect off-site disturbance is also considered to be insignificant.

New Yau Ma Tei Typhoon Shelter

As observed in the field survey, Black Kite was commonly seen soaring high above the New Yau Ma Tei Typhoon Shelter. Although it is the only raptor of conservation concern recorded, no impact on this species is predicted as it is adapted to urbanized area along the Victoria Harbour coast.

Also commonly recorded in the New Yau Ma Tei Typhoon Shelter is the ardeid species, foraging at the breakwater or standing on boats. The New Yau Ma Tei Typhoon Shelter is not particularly important to the ardeids as this species is common along the coastline in Victoria Harbour. The ardeids at the typhoon shelter has adapted a certain level of human activities, e.g. marine traffic, therefore it is expected the indirect off-site impact to the ardeids in New Yau Ma Tei Typhoon Shelter is not significant.

During the survey in September, a group of Whiskered Tern were observed foraging over the sea around the typhoon shelter. This species is an uncommon passage migrant in Hong Kong, not of conservation

concern. It is not anticipated that construction activities for the flyover will have any indirect impact on this species.

Victoria Harbour

Little Egret were commonly found passing and sometimes foraging along the coast of Victoria Harbour. As similar habitat is readily available in the vicinity for their foraging activities, they are unlikely to be affected by the construction activities. Also, no indirect impact on the Black Kite recorded is predicted as it is adapted to urbanized area along the Victoria Harbour coast.

15.9.4.3 Habitat Fragmentation

Given that the Project Area neighbours with urban area and no habitat of conservation concern is identified in the Study Area, there is no ecological linkage identified in the Study Area. As such, there is no habitat fragmentation impact.

15.9.4.4 Potential Impacts during Operation Phase

No ecological impacts are anticipated during the operation of the proposed flyover.

Table 15.9.2: Summary of the potential ecological impact

Criteria	Habitat Loss	Indirect Impact (disturbance)	Habitat Fragmentation	Operation Phase
Duration	Construction Phase	Construction Phase	Construction and operation phase	Operation Phase
Reversibility	Not Reversible	Reversible	Reversible	Not Reversible
Magnitude	Moderate-low for loss of open field of large size but of very low ecological value	Moderate	Low	Low
Impact Severity	Insignificant, the habitat to be lost is of low to very low ecological value	Insignificant, the ecological value of the urbanized area is very low	Negligible	Insignificant / potentially positive

15.9.5 Mitigation Measures

Since no significant ecological impact due to the flyover was identified, no specific ecological mitigation measures other than good site practice is required.

15.9.6 Residual Impacts

Since no significant ecological impact will arise from the proposed flyover, no residual impact is expected without specific ecological mitigation measures.

15.9.7 Environmental Monitoring and Audit

The implementation of good site practices would avoid and minimize any ecological impacts to an acceptable level. No specific ecological monitoring programme is thus required for the flyover.

15.9.8 Conclusion

The findings from the field survey and desktop review indicated that the major terrestrial habitats in the Study Area are developed area, open field and plantation, with small amount of sloping seawall along the coastline. All these habitats are with low vegetation cover, short planting history and of low to very low ecological value. Therefore, direct ecological impact on loss of habitat is considered to be of insignificant. The indirect disturbance impact to offsite habitat is considered to be of insignificant in both construction and operation phases, since the proposed flyover is surrounded by urbanized area. The plantation and landscape planting included in the development plan would have potential positive contribution to the local ecology.

15.9.9 References

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15.10 Landscape and Visual Impact

15.10.1 Introduction

The landscape and visual impact assessment (LVIA) has been conducted in accordance with the requirements of *Annexes 10 and 18 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM)*; the *EIAO Guidance Note No. 8/2010 – Preparation of Landscape and Visual Impact Assessment*, and the requirements stated in Section 3.4.12 and Appendix H of the EIA Study Brief (No. ESB-237/2011).

The purpose of this LVIA is to:

- Define the existing landscape and visual quality of the Assessment Area;
- Identify key landscape and visual resources as well as landscape and visually sensitive receivers (VSRs);
- Identify and evaluate the potential landscape and visual impacts associated with the Project during both the construction and operation phases;
- Define significance and magnitude of the landscape and visual impacts before and after mitigation;
- Propose mitigation measures to reduce the impacts on the existing landscape character and visual quality; and
- Describe the implementation, maintenance and management of these recommended mitigation measures.

15.10.2 Landscape and Visual Legislations, Standards and Guidelines

The following legislation, standards and guidelines are applicable to the evaluation of landscape and visual impacts associated with the construction and operation phases of the Austin Road flyover:

- *Environmental Impact Assessment Ordinance (Cap. 499, Section 16);*
- *EIAO Guidance Note No. 8/2010: Preparation of Landscape and Visual Impact Assessment under the Environmental Impact Assessment Ordinance;*
- *Hong Kong Planning Standards and Guidelines – Chapter 4 and 10;*
- *Approved South West Kowloon Outline Zoning Plan no. S/K/20/28 gazetted on 08/01/2013;*
- *Approved West Kowloon Cultural District Development Plan No.S/K20/WKCD/2 gazetted on 08/01/2013,;*
- *Landscape Value Mapping Study in Hong Kong;*
- *WBTC No. 7/2002 – Tree Planting in Public Works;*
- *WBTC No. 14/2002 – Management and Maintenance of Natural Vegetation and Landscape Works, and Tree Preservation;*
- *ETWB TCW No. 11/2004 on Cyber Manual for Greening;*
- *ETWB TCW No. 3/2006 – Tree Preservation;*
- *ETWB TCW No. 2/2004 – Maintenance of Vegetation and Hard Landscape Features;*
- *ETWBTCW No. 29/2004 – Registration of Old and Valuable Trees, and Guidelines for their Preservation*
- *Planning Study on the Harbour and its Waterfront Areas (February 2003);*
- *Environmental Impact Assessment Study Brief No. ESB-197/2008 – Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail link (XRL) (November 2008);*
- *Environmental Impact Assessment Study Brief No. ESB-202/2009 – Road Works at West Kowloon (April 2009);*
- *Environmental Impact Assessment of Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link (May 2009)*

- *Environmental Impact Assessment of Hong Kong Section of Guangzhou-Shenzhen-Hong Kong Express Rail Link – Environmental Impact Assessment Report Executive Summary (May 2009);*
- *Greening Master Plan for Mong Kok and Yau Ma Tei; and*
- *Greening Master Plan for Tsim Sha Tsui.*

15.10.2.1 Review of Relevant Guidelines on Landscape Strategies and Framework and Land Use Zoning

Relevant planning documents have been reviewed to gain an insight to the planning intentions of the site and its surroundings so as to assess whether the project can fit into the setting of the site and its surroundings as a whole.

The review of the relevant guidelines on landscape strategies and framework, and urban design for the proposed WKCD development is useful to gain an understanding of the planning and design intention of the surrounding areas and this is provided in **Section 10.2.1**.

In order to have a better understanding of the envisaged future landscape and visual characters/ context of the project site, the land use zoning and planning intentions of the project site has also been examined.

The site for the Austin Road flyover is located outside the WKCD site as shown in **Figure 15.1.1**. The site is currently occupied mainly by the Western Harbour Crossing (WHC) toll plaza. The site is surrounded by the WKCD to the south, CDA site to the east and Yau Ma Tei Typhoon Shelter to the west. The site is currently zoned as “Other Specified Uses” annotated “West Harbour Crossing Toll Plaza” under *Approved West Kowloon Cultural District Development Plan No.S/K20/WKCD/2*. The planning intention of this zone is primarily to provide land for the use of Western Harbour Crossing Toll Plaza.

With the existing “transport corridor” landscape setting of and planning intention, it is anticipated that the construction of this road infrastructure (i.e. flyover) is in line with the planning intention of the project site.

15.10.3 Assessment Methodology

The preparation of this LVIA follows the criteria stated in the *Annexes 10 and 18 of the Technical Memorandum to the Environmental Impact Assessment Ordinance (EIAO)*, the *EIAO Guidance Note No. 8/2010 – Preparation of Landscape and Visual Impact Assessment and* the report of *Landscape Value Mapping of Hong Kong* for evaluating and assessing the landscape and visual impacts associated with the proposed Austin Road flyover.

Relevant planning documents have been reviewed to gain an insight to the planning intentions of the site and its surroundings so as to assess whether the project can fit into the setting of the site and its surroundings as a whole.

15.10.3.1 Assessment Area

The scope for defining the Assessment Areas for Landscape Impact Assessment and Visual Impact Assessment are as follows:

Landscape Impact Assessment (LIA): In accordance with the Study Brief and *EIAO Guidance Note No. 8/2010*, the Landscape Impact Assessment area covers all areas within 500m from the boundary of the Austin Road flyover. This extent is illustrated in **Figure 15.10.1**.

Visual Impact Assessment (VIA): According to *the EIAO Guidance Note No. 8/2010,* the assessment area of the Visual Impact Assessment (VIA) covers the visual envelope which is the viewshed formed by natural or man made features such as ridgeline or building blocks. The visual envelope includes all terrestrial and aquatic areas within the visual envelope from the Project. The defined visual envelope is shown on **Figure 15.10.8**.

15.10.3.2 Baseline Survey and Assessment of Landscape Impacts

1: Identification of Key Landscape Resources and Landscape Character Areas (LCAs) within the Assessment Area

A baseline survey of the existing landscape resources (LRs) and landscape character areas (LCAs), comprising a desktop study of relevant background reports and a comprehensive field study, is undertaken. This aims to obtain information on topography and existing vegetation for further analysis.

Two categories of Landscape Resources, including Physical and Human Landscape Resources, are classified within the Assessment Area. Physical Landscape Resources include physical topography, water body (i.e. Victoria Harbour), open space and vegetation. Human Landscape Resources includes cultural heritage features and historical features. The findings of the broad brush tree survey will be incorporated in this LIA.

The conditions of the landscape resources and resources contribute to the overall character of the site and its surroundings. The LCAs represent broad tracts of landscape which have been determined with consideration of topography, vegetation types and land use patterns. The "*Landscape Value Mapping Study in Hong Kong*" will be reviewed to get an understanding of the landscape characters within the Assessment Area.

2: Assessment of the Sensitivity of the Landscape Resources (LRs) and Landscape Character Areas (LCAs)

The individual LRs /LCAs that have been identified are described qualitatively and quantitatively. Their sensitivities are then evaluated and rated as low, medium or high based on the following factors:

- Quality of landscape characters/resources;
- Importance and rarity of special landscape resources;
- Ability of the landscape to accommodate change;
- Significance of the change in local and regional context; and
- Maturity of the landscape.

The sensitivity rating for each LR / LCA are determined based on the following:

Low Landscape or landscape resource, the nature of which is largely tolerant to change

Medium	Landscape or landscape resource of moderately valued landscape characteristics reasonably tolerant to change
High	Important landscape or landscape resource of particularly distinctive character or high importance, sensitive to relatively small changes

3: Identification of Potential Source and Type of Impacts

Various elements of the construction works and operation procedures that would generate landscape impacts are identified.

4: Assessment of the Magnitude of Landscape Impacts

The factors affecting the magnitude of change in assessing landscape impacts are as follows:

- Compatibility of the project with the surrounding landscape;
- Duration of impacts under construction and operation phases;
- Scale of development; and
- Reversibility of change.

The magnitude of change rating for each LR / LCA are determined based on the following:

Negligible	The LRs/LCAs would suffer no discernible change by the proposed development
Small	The LRs/LCAs would suffer slight or barely perceptible changes by the proposed development
Intermediate	The LRs/LCAs would suffer a moderate change by the proposed development
Large	The LRs/LCAs would suffer a major change by the proposed development

5: Identification of Potential Landscape Mitigation Measures

Potential mitigation measures are developed to avoid or reduce the adverse landscape impacts derived from the WKCD development, which also includes enhancement of the landscape and visual quality. Remedial measures will be recommended such as tree preservation measures, and compensatory measures such as the implementation of landscape design measures (e.g. compensatory planting, landscape treatment, creation of new open space etc.) to compensate for unavoidable adverse impacts and/or generate potentially beneficial long term impacts.

6: Prediction of the Significance of Landscape Impacts Before and After the Implementation of the Mitigation Measures

Landscape impacts will be classified depending on whether the impacts are adverse/beneficial, and irreversible/reversible. Significance threshold of residual impact before and after mitigation (Day 1 and Year 10) will be assessed under the following categories:

Insubstantial	No discernible change to the existing landscape quality

Slight Adverse/ beneficial impact where the proposed development would cause a barely perceptible deterioration/improvement to existing landscape quality

Moderate Adverse/ beneficial impact where the proposed development would cause a noticeable deterioration/improvement to existing landscape quality

Substantial: Adverse/ beneficial impact where the proposed development would cause significant deterioration/improvement to existing landscape quality

The impact significance will also be determined. **Table 15.10.1** shows the relationship between sensitivity and magnitude of change.

Table 15.10.1: Impact significance – relationship between sensitivity and magnitude of change

Magnitude of Change caused by the proposed development	Sensitivity		
	Low	Medium	High
Large	Moderate	Moderate/Substantial	Substantial
Intermediate	Slight/Moderate	Moderate	Moderate/ Substantial
Small	Slight	Slight/Moderate	Moderate
Negligible	Insubstantial	Insubstantial	Insubstantial

7: Residual Impacts Assessment

Residual impacts are those impacts remaining after the proposed mitigation measures have been implemented. This often refers to 10 to 15 years of operation, when the planting mitigation measures are considered to have reached a level of maturity, which allow them to perform the intended design objectives.

In accordance with Annex 10 of the EIAO TM, an overall assessment also includes an assessment of the residual landscape and visual impacts for the project. The assessment categories for the residual landscape impacts are shown in **Table 15.10.2**.

Table 15.10.2: Assessment categories for residual impact

Beneficial	Acceptable	Acceptable with mitigation measures	Unacceptable	Undetermined
The impacts are beneficial if the proposed development will complement the landscape character of its setting, follow the relevant planning objectives and improve overall and visual quality.	The impacts are acceptable if the assessment indicates that there will be no significant impacts on the landscape, no significant adverse visual impacts caused by the appearance of the proposed development, or no interference with key views.	The impacts are acceptable with mitigation measures, if there will be some adverse impacts, but these can be eliminated, reduced or offset to a large extent by specific mitigation measures.	The impacts are unacceptable if the adverse impacts are considered too excessive and are unable to mitigate practically.	The impacts are undetermined if the significant adverse impacts are likely, but the extent to which they may occur or may be mitigated or cannot be determined from the study. Further detailed study will be required for the individual impact in question.

15.10.3.3 Baseline Survey and Assessment of Visual Impacts

1: Identification of Visual Resources and Visually Sensitive Receivers (VSRs)

Visual resources and key visually sensitive receivers (VSRs) within the visual envelope and primary zone of visual influence which would be affected by the Project will be identified. The *Notes, Schedule of Uses and Explanatory Statement of* the *Approved West Kowloon Cultural District Development Plan No.S/K20/WKCD/2* and *the Hong Kong Planning Standards and Guidelines – Chapter 11 Urban Design Guidelines for Hong Kong* are reviewed to determine the vantage VSRs. Minimum viewing distance of each VSRs are also determined.

2: Assessment of Sensitivity of Visually Sensitive Receivers (VSRs)

Visual sensitivity considers the impact on views to the site from potential VSRs and the nature/type of the VSR. A number of factors affecting the sensitivity of receivers for evaluation of visual impacts are as follows:

1 Value and quality of exiting views

2 Availability and amenity of alternative views

3 Type and estimated number of receiver population (many, medium and few)

4 Duration (long/ medium/ short) and frequency of view (frequent/ occasional/ rare)

5 Degree of visibility (no view, glimpse, partial view, vista, open view, and panoramic view)

The sensitivity rating for the VSR are determined as follows:

High: The VSR is highly sensitive to any changes in their viewing experience.

Medium: The VSR is moderately sensitive to any changes in their viewing experience.

Low: The VSR is only slightly sensitive to any changes in their viewing experience.

3: Identification of Potential Sources of Visual Impacts

Various elements located within the site that would generate visual impacts during the construction and operation phases are identified.

4: Assessment of Potential Magnitude of Visual Impacts

Visual impacts are determined by evaluating the conditions of the existing landscape and the visual character of the site and its surroundings, as well as the degree of integration of the Project's components with the existing landscape. Other major factors affecting the magnitude of changes for assessing visual impacts are:

1 Scale of development

2 Compatibility of the project with the surrounding landscape

3 Reversibility of change

4 Viewing distance

5 Potential blocking of view

6 Duration of impacts under construction and operation phases

7 Night glare effect

The potential magnitude of change is classified into four categories:

Negligible	The VSRs are likely to suffer no discernible change in their viewing experience
Small	The VSRs are likely to suffer a slight change in their viewing experience
Intermediate	The VSRs are likely to suffer a moderate change in their viewing experience
Large	The VSRs are likely to suffer a significant change in their viewing experience

5: Determination of the Visual Impacts during Construction and Operation Phases before Implementation of Mitigation Measures

The significance of the visual impacts is categorised as follows:

Insubstantial	No discernible change to the existing visual quality
Slight	Adverse / beneficial impact where the Project would cause a barely perceptible deterioration/ improvement to existing visual quality
Moderate	Adverse/beneficial impact where the Project would cause a noticeable deterioration/ improvement to existing visual quality
Substantial	Adverse/beneficial impact where the Project would cause significant deterioration/ improvement to existing visual quality

The impact significance will be also be determined. **Table 15.10.3** shows the relation between sensitivity and magnitude of change.

Table 15.10.3: Impact significance – relationship between sensitivity and magnitude of change

Magnitude of Change	Sensitivity of the VSR		
	Low	Medium	High
Large	Moderate	Moderate/Substantial	Substantial
Intermediate	Slight/Moderate	Moderate	Moderate/ Substantial
Small	Slight	Slight/Moderate	Moderate
Negligible	Insubstantial	Insubstantial	Insubstantial

6: Examination of Alternative Design(s) and Construction Method(s)

Before adopting other mitigation measures to alleviate the impacts, alternative design(s) and construction method(s) that would avoid or reduce the impacts on landscape, or that would make the Project visually more compatible with the setting has been examined.

7. Recommendation of Mitigation Measures to Minimize Adverse Visual Impacts

Mitigation strategies will be developed to reduce the overall visual impacts derived from the Austin Road Flyover during the construction and operation phases.

8: Residual Impacts Assessment

Residual impacts from the Project are assessed based on the 5 categories for residual visual impacts including "Beneficial", "Acceptable", "Acceptable with Mitigation Measures", "Unacceptable" and "Undetermined" (see **Table 15.10.2**).

9: Assessment of Cumulative Impacts

Cumulative impacts of the concurrent projects on landscape resources, landscape character areas and visual amenity will be assessed.

Graphics Presentation

The findings of this LVIA are presented and supported by a range of illustrative materials such as computer-generated photomontages, aerial photograph, photographs and plans etc. Flyover structure together with any mitigation measures are illustrated the overall appearance of the Austin Road Flyover.

15.10.3.4 Scope and Content of the Project

Scope and descriptions of the Project is provided in **Section 15.2**. The flyover is a supplementary component of the WKCD development, proposed mainly to support certain WKCD facilities.

It is noted that the baseline conditions are not static and may change over time. The Project will be completed before completing most of the other future developments within the WKCD. It is assumed that construction will occur at the same time as construction of WKCD facilities.

15.10.3.5 Benefits of the Project

The main purpose of the flyover is to serve as one of the key measures to meet the accessibility and connectivity objective of the WKCD development mentioned in **Section 15.1.1**. Specifically, the purpose of the flyover is to provide a second access for the proposed WKCD Mega Performance Venue (MPV) and Exhibition Centre (EC), and provide flexibility for event management as a route to enhance the accessibility and robustness of the arrangements including post event traffic dispersal for serving the MPV and second emergency vehicle route.

Economic and social benefits provided by the Project are considered to be associated with the proposed WKCD development, since the flyover is a supporting component of the WKCD development. The proposed WKCD development should not be considered alone. The support of the connections with the surrounding areas is equally important.

In addition to fulfilling the future demand, the construction of the flyover helps alleviate the traffic congestions generated by the WKCD and current congestions, and also provide better infrastructural support to various current and upcoming developments in the West Kowloon Reclamation Area. In turn, it enhances the accessibility and the use of the facilities particularly those located in the western part of the WKCD. This is an important planning criteria contributing to the success of the WKCD. It is anticipated that the proposed WKCD development will bring numerous economic and social benefits to Hong Kong.

15.10.3.6 Major Limitations of the Assessment

To meet the requirements of the TM of the EIAO, 8 VSRs within the Visual Envelope are identified for adequately assessing to the visual impacts derived by the Austin Road Flyover. However, only viewpoints which can represent the worst-case scenarios from the most sensitive VSRs, or those which are representative in terms of the location are selected for preparing photomontages.

As the programme for construction and completion of this flyover is not available at this moment in time, for the purpose of assessing the potential worse case environment impacts associated with the construction of the flyover, it is assumed that construction of flyover will occur at the same time as construction of WKCD facilities stated in Section 2.7 (i.e. between 2013 and 2020).

15.10.4 Baseline Study

Austin Road flyover is a supplementary component of the WKCD development project, proposed mainly to support certain facilities. The site is now currently occupied mainly by the Western Harbour Crossing (WHC) and its toll plaza and part of the existing West Kowloon Waterfront Promenade on either side of the WHC. The flyover starts at the elevated junction of Austin Road West/Nga Cheung Road, spanning across the WHC toll plaza westwards, turns southward and lands at the northwest corner of WKCD area, supported by four pairs of piers.

Currently, the landscaping setting of the site is mainly comprised roadside amenity plantings at the junction of Austin Road West/ Nga Cheung Road, which is outside the site boundary, and some tree buffering around the Western Harbour Tunnel Entrance, which consist of considerable amount of self-seeded weed *Leucaena leucocephala*. All landscape resources with high values are located outside the assessment area. Most of the landscape resources within the assessment area are low to medium value.

Landscape Resources are classified into two categories including Physical Landscape Resources and Human Landscape Resources. The surrounding landscape resources mainly consist of developed area and a water body (i.e. Victoria Harbour). A description of baseline landscape resources within the study area, their sensitivity and ability to accommodate changes are shown in **Table 15.10.4**. The baseline landscape resources and landscape character areas during construction and operation period are mapped in **Figure 15.10.1 and Figure 15.10.5.**

15.10.4.1 Physical Landscape Resources

Topography

The landform of the landscape impact assessment area which is the West Kowloon Cultural District comprises flat reclaimed land with no features of topographical interest or value.

Victoria Harbour

Victoria Harbour is one of the most beautiful harbours in the world. It is a unique public asset and natural resource. Its preservation is for the benefit of the current generation as well as the future ones. It is also safeguarded by the Protection of the Harbour Ordinance. This is considered as highly sensitive and of high landscape value.

Open Space

The site currently comprises 1.6 ha of temporary open space including a waterfront promenade along the Victoria Harbour. The assessment area is densely urbanized with limited provision of public open space. There are 2 no. public open spaces, namely temporary waterfront promenade and Public Open Space at the podium of Kowloon Station with approximate 1.61ha, which is within the assessment area of Austin Road Flyover. Other 4 major public open spaces with high value are outside the assessment area of Austin Road Flyover. All permanent open spaces are considered to have high to medium value and sensitivity due to the limited landscape resources in the district.

15.10.4.2 Human Landscape Resources

Cultural Heritage and Historical Features

The site is a reclaimed land that does not contain any cultural heritage features or landscape with important history. No cultural/religious built heritage features are found within the assessment area.

15.10.4.3 Existing Trees within the Assessment Area

A broad brush tree/vegetation survey has been carried out within the assessment area as shown in **Figure 15.10.4**.

Within the study area, there are approximately 1194 no. of trees. Many of the trees are found within public open spaces or are roadside trees or trees with amenity planting area. They are mostly exotic and common species with low to medium amenity value and poor to good condition. Tree species include *Acacia auriculiformis, Acacia confusa, Albizia lebbeck, Araucaria heterophylla, Archontophoenix alexandrae, Bauhinia x blakeana, Casuarina equisetifolia, Carica papaya, Celtis sinensis, Cinnamomum camphora, Caryota mitis, Crateva unilocularis, Delonix regia, Eucalyptus calophyllaoi, Ficus benjamina, Ficus microcarpa, Ficus virens, Grevillea robusta, Hibiscus tiliaceus, Koelreuteria bipinnata, Lagerstroemia speciosa, Leucaena leucocephala, Livistona chinensis, Melaleuca leucadendron, Melia azedarach, Morus alba, Peltophorum pterocarpum, Phoenix roebelenii, Phoenix sylvestris, Roystonea regia, Senna siamea, Senna surattensis, Syzygium cumini, ,Terminalia mantaly, and Washingtonia robusta.* Many of the trees are found within public open spaces or are street trees.

There are approximately 80 affected trees due to the construction of Austin Road Flyover. 50 affected trees are found within the site boundary of WKCD and other are found outside the site boundary of WKCD. Trees are mostly roadside planting. Dominant tree species within the site boundary include *Acacia auriculiformis*, ,*Cassia siamea, Casuarina equisetfolia*, *Celtis sinensis*, *Ficus microcarpa*, *Ficus virens*, *Hibiscus tiliaceus*, *Leucaena leucocephala*, *Melia azedarach*, *Morus alba*, etc. Trees found within the WKCD site are self seeded species of low to medium amenity value. There are considerable numbers of *Leucaena leucocephala*, which is a self seeded weed species are found on the site. No Old and Valuable Trees (OVT) is recorded within the site and the assessment area. Nevertheless, the proposed development would not pose any disturbance to any of the recorded OVTs

A list of landscape resources and their sensitivity is shown in **Table 15.10.4**. Lists of baseline landscape resources are mapped in **Figure 15.10.1**. Photo records are shown in **Figure 15.10.3a** to **Figure 15.10.3f**.

Table 15.10.4: Landscape resources and sensitivity

Ref. No.	Baseline Landscape Resources	Sensitivity (High, Medium and Low)
Existing Landscape Resources		
Physical Landscape Resources		
LR1: Open Space		
LR1.7	**Temporary open space along the waterfront promenade within the site boundary** This is a temporary open space (~1.6 ha) located along the waterfront promenade within the site boundary. It consists of a cycling track, children's play equipment and seating areas under trellis primarily for passive recreation purposes. There are main shrub planting (*Brassia actinophylla, Lantana camara*, *Hibiscus rosa-sinensis*, *Alternanthera paronychioides* and *Juniperus chinensis cv. Kaizuka*), groundcover (*Ophipogon japonicus* and *Hymenocallis speciosa*) and lawn area with lighting along pedestrian path. This area is well-maintained and the condition of the plants is fair. The amenity value is medium as most plant species are flowering species.	Medium
LR1.15	**Public Open Space at the podium of Kowloon Station** This is a public open space (~0.37 ha) within the private development at the podium of Kowloon Station. It includes a large piazza area with some water features. There are approximately 30 young to semi-mature trees located at the public open space, with height around 4-6m, crown 4-5m and DBH around 95-100mm. Amenity value is medium. The tree condition is fair. Species consists of *Phoenix sylvestris*, *Livistona chinensis* and *Ficus microcarpa variegata*.	Medium
Physical Landscape Resources		
LR2: Amenity Planting		
LR2.26	**Trees along West Kowloon Highway** There are approximately 30 young and semi-mature trees with shrubs and lawn area (~.004ha) located along Hoi Po Road and within West Kowloon Highway area, with height around 4-16m, crown spread 2-7m and DBH 95-300mm. Amenity value is considered to be low to medium with a considerable amount of *Leucaena leucocephala* which is a weed species. Species mainly consist of *Leucaena leucocephala*, Roystonea regia, *Acacia auriculiformis*, *Araucaria heterophylla*, *Bauhinia spp.*, *Delonix regia*, *Melia azedarach*, *Acacia confusa*, *Casuarina equisetifolia*, *Albizia lebbeck*, *Melaleuca quinquenervia*, *Ficus microcarpa*, *Hibiscus tiliaceus*, *Eucalyptus calophyllaoi* and *Livistona chinensis*. The condition of the trees range from poor to fair.	Low
LR2.27	**Amenity Planting within the Private Development at Kowloon Station** There are amenity planting areas (~0.96ha) within the private development at the podium of the Kowloon Station, such as the podium garden, private open space playground (~1.10ha) and along the access road within the private development area. There are approximately 70 young to semi-mature trees with shrubs located within the private development, with height around 4-8m, crown 4.5-8m and DBH around 120-210mm. Amenity value is considered to be medium. Predominant species consists of *Phoneix sylvestris*, *Bauhinia spp*., *Ficus microcarpa* and *Roystonea regia*. The condition of the trees range from poor to fair.	Medium
LR2.28	**Roadside Plantation along Western Harbour Crossing Bus Stop near Elements**	Medium

Ref. No.	Baseline Landscape Resources	Sensitivity (High, Medium and Low)
	There are approximately 54 young to semi-mature roadside trees with shrub in raised planter (~0.65ha) between WHC Bus Stop and Elements with height around 3-8m, crown spread 1-4m and DBH 150-300mm. Some trees grow under the shade of the Ngo Cheung Road Flyover. Amenity value is considered to be medium. All trees are in fair condition. Tree species mainly consist of *Crateva unilocularis*, *Ficus benjamina, Caryota mitis* and *Archontophoenix alexandrae*.	
LR2.29	**Roadside Plantation along Austin Road West** There are approximately 96 young to semi-mature roadside trees with shrubs along Austin Road West with height ranging from 8-11m, crown spread 2-4m and DBH 100-350mm. Amenity value is considered as medium. Species include *Bauhinia x blakeana, Celtis sinensis, Cinnamomum camphora, Crateva unilocularis, Ficus benjamina, Ficus microcarpa, Ficus virens, Grevillea robusta, Lagerstroemia speciosa, Peltophorum pterocarpum, Senna siamea, Senna surattensis, Syzygium cumini* and *Terminalia mantaly*. The condition of the trees range from poor to fair.	Medium
LR2.30	**Roadside Plantation next to Western Harbour Tunnel Administration Building** There are approximately 24 young trees with shrub in raised planter (~0.04ha) around the Administration Building with height around 8-11m, crown spread around 2m and DBH around 200mm. Amenity value is considered to be medium. Predominant tree species is *Archontophoenix alexandrae*. The condition of the trees is fair.	Medium
LR2.31	**Trees Buffering Western Harbour Tunnel Entrance** This is a tree buffer area (~1.67ha) located at the entrance of Western Harbour Tunnel. The tree buffer was developed when the former Urban Council instituted planting measures at the eastern edge of the site abutting the portal of the Western Harbour Crossing. There are approximately 250 young to semi-mature trees, of which 150 no. of trees are found within the site boundary, with height around 8-10m, crown spread around 4-5m and DBH around 250-400mm. Amenity value is considered to be low to medium. Tree species include Acacia *auriculiformis, Acacia confusa, Hibiscus tiliaceus, Casuarina equisetifolia, Ficus benjamina, Ficus microcarpa*, and a considerable amount of self-seeded weed *Leucaena leucocephala*. The condition of the trees range from poor to fair.	Medium
LR2.32	**Roadside Plantation along Western Harbour Crossing Bus Stop next to New Yau Ma Tei Typhoon Shelter** There are approximately 22 young to semi-mature trees with shrub in at grade planter (~0.03ha) next to the New Yau Ma Tei Typhoon Shelter with height around 8-10m, crown spread 4-5m and DBH 150-300mm. Amenity value is considered to be medium. Predominant tree species is *Acacia confusa*. The condititition of the trees range from poor to fair.	Medium
LR2.33	**Trees along New Yau Ma Tei Typhoon Shelter Pier** There are approximately 20 young to semi-mature trees with shrubs and grassland (~0.15ha) along the typhoon shelter pier with height around 4-5m, crown spread 3-4m and DBH 150-300mm. Amenity value is considered to be medium. Predominant species are *Carica papaya, Ficus microcarpa, Koelreuteria bipinnata* and self-seeded weed species *Leucaena leucocephala*. Note that there are more than 30 undersized self-seeded weed *Leucaena leucocephala.* The condititition of the trees range from poor to fair.	Medium
LR2.34	**Amenity Planting within Salt Water Pumping Station** There are total 65 young to mature trees with grassland (~0.08ha) located within and next to the	Low

Ref. No.	Baseline Landscape Resources	Sensitivity (High, Medium and Low)
	Salt Water Pumping Station with height around 2-10m, crown spread 2-5m and DBH around 95-300mm. Approximately 30 trees are located in planter boxes (1m X 1mX 1m) and planting area within the pumping station and 35 trees with grassland (~0.08ha) are located near the pump station. Amenity value is considered to be low since most of the trees are self-seeded weed species. Predominant tree species are *Leucaena leucocephala*, *Livistona chinensis, Bauhinia spp., Ficus microcarpa, Hibiscus tiliaceus* and *Washingtonia robusta*. The condition of the trees range from poor to fair.	
LR2.35	**Tree Cluster in the Western Part within the Boundary Area** There are approximately 161 young to semi-mature trees with grassland (~1.41ha) located in the western part of the site with height around 6-10m, crown spread 3-10m and DBH 95-200mm. Amenity value is considered to be low since most of the trees are self-seeded species with a considerable amount of *Leucaena leucocephala* which is a weed species. Tree species mainly consist of *Leucaena leucocephala*, *Hibiscus tiliaceus, Acacia auriculiformis, Caryota mitis* and *Morus alba*. The condition of the trees range from poor to fair.	Low
LR2.36	**Tree Cluster in the Eastern Part within the Boundary Area** There are approximately 372 young to semi-mature trees with grassland located in the eastern part of the site with height around 5-10m, crown spread 3-10m and DBH around 95-200mm. Amenity value is considered to be medium. A considerable amount of *Leucaena leucocephala*, which is a weed species, is surveyed. Tree species mainly consist of *Leucaena leucocephala, Casuarina equisetifolia, Melia azedarach, Hibiscus tiliaceus, Acacia auriculiformis, Ficus microcarpa, Ficus virens, Morus alba* and *Celtis sinensis.* The condition of the trees range from poor to fair.	Medium
Physical Landscape Resources		
LR3: Waterbody		
LR3.1	**Victoria Harbour** Lying in the middle of the territory's dense urban region, the harbour is famous for its deep and sheltered waters. It is a valuable natural asset of Hong Kong and is considered as highly sensitive and of high landscape value. The approximate size of Victoria Harbour within the assessment boundary is 47.08 ha.	High

15.10.4.4 Landscape Character of the Assessment Area

Landscape character zones have been identified within the Assessment Area in accordance to the *"Landscape Character Map of Hong Kong"* published by Planning Department in September 2003.

The project site is characterised by linear landscape, whose major features are highway, flyovers, footbridges and toll plaza as well as associated miscellaneous roadside land uses. Between the highway and flyover, there are landscape embankments and islands, generally with semi-matures amenity vegetation of trees, palms and shrubs.

Western Harbour Crossing Toll Gate Landscape

Austin Road flyover is mainly located within the LCA 08 – Western Harbour Crossing Toll Gate Landscape, which is outside the site boundary of WKCD and currently occupied as Western Harbour Crossing Toll

Gate toll plaza, and part of it located within another LCA01, “West Kowloon Cultural District Landscape Character Area”, which is at the periphery of WKCD site boundary. These are the transitional landscapes which are currently awaiting or are undergoing large scale construction or redevelopment. Part of the WKCD site consists of land undergoing development while most of the site is vacant and awaiting development. It is characterised by a flat, low-lying topography, lack of significant vegetation or significant built structures. The site includes some major earthworks and partially completed structures. It is part of the West Kowloon reclamation area and so is characterized by their proximity to the coast. As a result of their indeterminate status and the disturbance caused by ongoing construction work, the landscape of the study area has an incoherent, decollate and transient character.

The landscape character of the surrounding areas to the east and north of the site is classified as an Urban Landscape type “Late 20 Century/Early 21 Century Commercial/Residential Complex Landscape”, comprising Hong Kong’s most recent urban landscapes. The adjacent extensive comprehensive development, such as International Commercial Centre, the Harbourside Towers and Elements Shopping Mall, contain a large podium for retail uses and parking, with commercial or residential towers above and are characterised by their new building block using modern building materials, such as glass and steel. Streets are wide with significant roadside landscape provision and tree planting with footbridges connecting development at first floor or podium level. The result is an intensely urban landscape which is enclosed, angular, and colourful, and which is defined to a significant extent by its built form and the spaces they create. It forms a typical urban setting of Hong Kong’s urban landscape.

Accordingly, the landscape character of the surrounding assessment area varies from contemporary urban landscape, transportation corridor landscape and coastal waters landscape.

As WKCD is further sub-divided in a number of sub-district in accordance with the land use and district identity. Therefore, during operation phase, the LCA01& LCA03 will be further subdivided into a number of small LCAs in accordance with the sub-district identity, and impact on these LCAs due to Austin Road flyover is assessed.

15.10.4.5 Baseline Landscape Character Areas (LCAs)

The Landscape Character Areas are zoned with reference to the “*Study of Landscape Value Mapping of Hong Kong*”. **Table 15.10.5** summarises the baseline LCAs and their sensitivity. The locations and photo records of the Landscape Character Areas during operation and construction period can be referred to in **Figure 15.10.5**, and **Figure 15.10.7a** to **15.10.7f.**

Table 15.10.5: Landscape character areas and sensitivity

Ref. No.	Baseline Landscape Character Areas	Sensitivity (Low, Medium, High)
LCA01	**West Kowloon Cultural District Landscape Character Area** The approximate size of this LCA is 13.4ha. This area is where the Park would be located in the proposed development. The topography is generally flat. This area is open with clusters of trees. Tree plantation at the eastern edge of the area abutting the portal of the Western Harbour Crossing was planted by the former Urban Council. Elsewhere trees in this area are mostly self-seeded weed species. This area has held some temporary exhibitions such as the Hong Kong – Shenzhen Biennale Urbanism. The interface with Western Harbour Crossing is currently buffered by clusters of trees. As this LCA is still a vacant land reserved for WKCD development, which has no district or regional significance.	Low
LCA02	**West Kowloon Cultural District Construction Area** The approximate size of this LCA is 14.62ha. This area is currently under site formation and underground structure works. The landscape character is changing from time to time with construction operations. This LCA has no district or regional significance.	Low
LCA03	**West Kowloon Cultural District Temporary Waterfront Promenade** The approximate size of this LCA is 4.07ha. This area is currently opened to the public and allows activities along the waterfront. The temporary waterfront promenade provides basic recreation structures like seating area, children's play area, bicycle track and kiosk to the public. Generally hard paved with shrub plantings, some facilitates in the area can easily be demolished, replaced or reused. The DHL Hong Kong Balloon is temporarily located in the area. The maximum floating height is 100m, forming an icon of the area. As this LCA is temporary, it has no district or regional significance.	Low
LCA04	**New Yau Ma Tei Typhoon Shelter Landscape** The approximate size of this LCA is 20.78ha. This is an area for typhoon shelter use in New Yau Ma Tei. It is substantially enclosed by offshore breakwater. It is located at the northern part of the WKCD and the coastal edges of Yau Ma Tei District. It is an inshore aquatic landscape formed by the armourstone breakwaters constructed to protect large numbers of moored vessels, such as freights, fishing vessels and sampans. They consist primarily of water, which incorporate the jetties, pontoons and navigational features resulting in a landscape that is a transitional one between the coastal land and sea. It is a vibrant and active landscape characterised by a variety of form and colour and often by a significant sense of enclosure. This LCA has no district or regional significance.	Low
LCA05	**Victoria Harbour Inshore Water Landscape** The approximate size of this LCA is 11.67ha. This side of the water is facing west of the Victoria Harbour which created a sense of openness. This area has the backdrop of Stonecutters Bridge, Tsing Yi and Lantau Island. While the landscape is characterized predominantly by horizontality and muted hues of coastal water, container barges may be spotted randomly in the area. This results in an open landscape with colour changes (from blue to sunset red) though the course of the day which is punctuated by human features. This LCA has a major district and regional significance.	High

Ref. No.	Baseline Landscape Character Areas	Sensitivity (Low, Medium, High)
LCA06	**Victoria Harbour Strait Landscape** The approximate size of this LCA is 14.68ha. The Victoria Harbour is a world famous harbour. This is a unique feature and a public asset with busy marine traffic flow. This landscape is characterized with significant natural and marine landscape with a distinct sense of enclosure by the developments and hills on the two sides of the Harbour. This LCA is located at the southern part of the WKCD, is enclosed by significant landform of WKCD and the Tsim Sha Tsui Promenade, creating a distinct sense of enclosure. It is characterized predominantly by their surrounding landforms and the muted hues and horizontally of their coastal waters. It includes the ferry piers, passing vessels and various marine activities. This LCA has a major district and regional significance.	High
LCA07	**New Yau Ma Tei Container Terminal Landscape** The approximate size of this LCA is 2ha. This is a container terminal for container barges. The height of the container barges can be up to 30m which forms vertical elements towards the skyline. This LCA has no district or regional significance.	Low
LCA08	**Western Harbour Crossing Toll Gate Landscape** The approximate size of this LCA is 9.1ha. This is one of the 3 cross harbour tunnel in Hong Kong. This area is characterized with heavy traffic. The traffic forms a linear and near static movement in peak hours but become more vibrant in normal hours. Buffering trees are planted surrounding the entrance area. This LCA has no district or regional significance.	Medium
LCA09	**Tsim Sha Tsui Late 20C / Early 21C Commercial / Residential Complex Landscape** The approximate size of this LCA is 18.02ha. This area includes the Elements mall and the Victoria Towers. It is dominated with mixed residential / commercial use. This comprises a mix of high rise buildings for residential use, typically with landscape area on the podium containing retail uses and parking. The streets are utilitarian with few soft landscape treatments. The result is an enclosed and colourful urban landscape defined by its built form and the spaces they created without much landscape treatment in ground level. This LCA has no district or regional significance.	Medium
LCA10	**Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL) Terminus Construction Site and Austin Station** The approximate size of this LCA is 2.43ha. The XRL is part of the strategic national express rail network that connects Hong Kong to the major cities in the Mainland China. It is an important public transport interchange. The terminus with an area of about 11 ha will be located between Austin Station and Kowloon Station. The terminal will provide a large extent of public green space linking to the WKCD. The area is currently under construction and completion of the terminus is expected to be in 2015. This LCA has no district or regional significance.	Low

15.10.4.6 Baseline Visual Resources and Visually Sensitive Receivers

Visual Envelope

The baseline for the Visual Impact Assessment is an understanding of the existing visual qualities within an area that could be affected by the Project. This area refers to the Visual Envelope. The Visual Envelope of the Project is illustrated in **Figure 15.10.8**.

It is defined by the area in proximity and visually affected by the Project. It includes the first row of street blocks or buildings facing towards the Project site, such as the residential and commercial buildings located to the east and the northeast of the flyover structure, and the area where the flyover structure located (i.e. West Harbour Crossing Toll Plaza), and New Yau Ma Tei Typhoon Shelter.

Since the scale of the Project is small, the primary zone of the visual influence is considered as the Visual Envelope of the Project, covering the area in proximity to the site. Different from the Visual Envelope of the WKCD development, the Visual Envelope of the Project does not extend to the northern side of Hong Kong Island.

Visual Resources

Natural Ridgelines

Located to the north of West Kowloon, the ridgeline of Lion Rock is a natural visual resource, providing a natural backdrop to the high-rise urban areas of West Kowloon.

Victoria Harbour

Victoria Harbour is a unique natural asset of Hong Kong, providing an open sea view to the areas along the northern coast of Hong Kong Island and the southern coast of Kowloon Peninsula. It is also a valuable visual resource and a visually dominant natural feature to the Project site and the WKCD site, providing a magnificent sea view as the backdrop.

Key Views

Key views include the magnificent views to Victoria Harbour and Yau Ma Tei Typhoon Shelter.

Existing Site and Visual Character of the Project Site and Its Surroundings

The landscape character and the existing state of the project site and its surroundings described in **Section 15.10.4.1 to 15.10.4.4** contributes to the overall visual character of the project site.

According to the *Landscape Character Map of Hong Kong* published by Planning Department in September 2003, the landscape character type of the project site is Transport Corridor Landscape.

Where two or more major highways are constructed parallel to each other and in close proximity, they form what can be termed a Transportation Corridor Landscape. Situated on coastal reclamations, these are linear landscapes, whose major features are the highways and railways that define them, but which also include flyovers, noise barriers, signage gantries, clover-leaf interchanges, traffic islands, footbridges and toll plazas as well as associated miscellaneous roadside land uses. Between the roads and railways are landscaped embankments and islands, generally with a semi-mature amenity vegetation of trees and shrubs. The outcome is a particularly linear landscape of rather diverse features.

Accordingly, the existing landscape character of the project site comprises of transport corridor (i.e. West Harbour Crossing Toll Plaza and carriageways) with high rise residential/ commercial buildings and Yau Ma Tei Typhoon Shelter located to the east and west of the project site respectively.

The site for the Project is located outside the WKCD site as shown in **Figure 15.10.1**. It is currently occupied by the Western Harbour Crossing (WHC) toll plaza.

Visually Sensitive Receivers (VSRs)

Eight existing VSRs and one planned VSR located within the Primary Zone of Visual Influence have been identified and shown in **Figures 15.10.8**. The selected VSRs located within the Primary Zone of Visual Influence are considered to be visually most affected by the Project. Photos of the existing VSRs within the study area are illustrated shown in **Figure 15.10.9 and 15.10.10**.

The baseline assessment of the sensitivity of the existing and planned VSRs within the study area is shown in **Table 15.10.7**. The sensitivity of the VSRs depends on the location of VSRs, the distance from the project area, the degree of visibility, and the type of VSR which determines the duration and frequency of views.

The sensitivity of residential VSRs (e.g. VSR 3) located in close proximity to the site is considered to be high, since they will have direct and frequent views towards the project area.

The sensitivity of VSR 1 International Commerce Centre (ICC) is considered to be medium to high, whilst the sensitivity of VSR 2 (the Elements) is considered to medium. It is because the DP is generally fully visible to VSR 1, but it is partly visible to VSR 2. Residential/commercial VSR, the Cullinun (VSR 7) is considered to have high sensitivity because it has long and frequent of view.

Transient VSRs including travellers on the sea transportation at Yau Ma Tei Typhoon Shelter (VSR 7), and travellers arriving West Harbour Crossing Toll Plaza (VSR 5) and at the footbridge crossing the WHC Toll Plaza (VSR 6), and travelling on the roads in the periphery of the WKCD such as Austin Road West (VSR 8) have low sensitivity, because their views are transient in nature.

The sensitivity of the planned VSR, M+ Museum (Phase 2) (VSR 9) is considered to be medium as it will have partial views towards the project area.

Most of the VSRs are located at elevated levels, including VSR 1, VSR 2, VSR 3 and VSR 4. All the transient VSRs have views to the site at ground level.

This VIA also assesses committed developments located immediately adjacent to the site. These committed developments are the concurrent projects mentioned in **Section 15.10.7** Concurrent Projects. The cumulative visual impacts to the selected VSRs will be assessed.

Brief descriptions of the eight existing VSRs identified within the Visual Envelope are provided in **Table 15.10.6**.

Table 15.10.6: Brief descriptions of the VSRs and the existing views

Key VSR		Brief descriptions of the VSR and the existing views
Residential/Commercial VSRs Located Immediately to the East and Northeast of the site		
VSR 1	International Commerce Centre (ICC)	■ Standing above Kowloon Station and the Elements shopping mall, ICC rises to 490 metres above sea level and is the tallest building in Hong Kong. ■ Located to the east of the site. ■ Elevated view of the site can be seen.

Key VSR		Brief descriptions of the VSR and the existing views
		■ Due to the orientation of the building block, only the views from the western facing offices would be affected. ■ The workers at lower levels have partial views to the site, whilst the workers at higher levels have an open view to the site.
VSR 2	The Elements	■ At the base of the ICC tower and 5 high rise residential developments (i.e. the Harbourside, the Arch, the Waterfront, Sorrento Towers and the Cullinan), the Elements shopping mall comprises of 4 floors of retail shops, including ground, first, second and roof floors (i.e. podium level). ■ Views to the site are largely blocked by the existing footbridge and flyover located to the east of VSR 2. However, a close view of the site can be seen at podium level. ■ On the ground floor level, most of the areas are occupied by the transportation facilities, including public transport interchange, concourse of Kowloon Station, Airport Express in Town check in hall, coach terminus and parking etc. Most of these areas are enclosed. ■ Due to the orientation of the building block, only the views from the south western and western facing areas of the mall and its podium would be affected.
VSR 3	The Cullinun	■ Located next to ICC and above Kowloon Station and the Elements shopping mall, the Cullinun is comprised of a towering twin edifice. VSR 3 has a partial view of the site that is blocked by the existing footbridge. ■ W Hotel occupies the first to the 38th floors of the Cullinan. ■ Due to the orientation of the building block, only the view from the western and south western facing units of the hotel and residential development would be affected.
Transport related VSRs located to the southeast of the Project Site		
VSR 4	Administration Building at Western Harbour Crossing	■ Located to the southeast of the site, administration building at Western Harbour Crossing is a three storey building. ■ Close and partial view to the Project site can be seen. ■ Due to the orientation of the building block, only the view from the northern facing workers would be affected.
Transient VSRs		
VSR 5	Travellers arriving Western Harbour Crossing (WHC) Toll Plaza	■ The Western Harbour Crossing is a dual 3-lane immersed tube tunnel in Hong Kong, linking the newly reclaimed land in West Kowloon with Sai Ying Pun on Hong Kong Island. ■ Varying views depending on locations at WHC Toll Plaza. ■ Views to the Victoria Harbour are currently partially blocked by the dense planting at the entrance of the WHC. ■ The travellers arriving at WHC Toll Plaza has an open view of the WHC Toll Plaza.
VSR 6	Travellers at the footbridge crossing the WHC Toll Plaza	■ Varying views depending on locations at the footbridge. ■ It is viewed at elevated view. ■ Views to the site will be blocked by the footbridge structure itself and the advertisement board at the footbridge.
VSR 7	Travellers at Yau Ma Tei Shelter	■ Varying views depending on locations at Yau Ma Tei Typhoon Shelter. ■ Views to the site will be partially blocked by the footbridge structures located to the north of the site and the vegetation located along the waterfront.
VSR 8	Travellers along Austin Road West	■ Varying views depending on locations along Austin Road West. ■ Close and partial view to the site when approaching the western end of Austin

Key VSR		Brief descriptions of the VSR and the existing views
		Road West. ■ It is viewed at the ground level.
Planned VSR		
VSR 9	M+ Museum (Phase 2)	■ Immediately located to the east of the Park and the entrance of the Western Harbour Tunnel, M+ will be the Museum of Visual Culture in the West Kowloon Cultural District ■ It will have a partial view of the flyover structure when viewed to the north.

Table 15.10.7: Sensitivity of the VSRs

Type of VSR	VSRs	Name of VSRs	Viewing Distance (m) approx.	Estimated Number of Individuals / receiver population (Many/ medium/ few)	Type of VSR	Value and Quality of Existing View	Availability and amenity of alternative views	Degree of Visibility	Duration (Long/ Medium/ Short) and Frequency of View (Frequent/Occasional/ Rare)	Sensitivity (Low/ Medium/ High)
CDA	VSR 1	International Commerce Centre (ICC)	60m	Many	View from commercial development (i.e. offices and hotel) (workers/ hotel guests)	Good	Limited availability /Good amenity of alternative view	Partly to fully visible	Long/ Occasional	Medium to High
CDA	VSR 2	The Elements	45m	Many	View from commercial development (i.e. shopping mall) (workers/ visitors)	Medium	Medium availability/ Medium amenity of alternative view	Partly visible	Long/Occasional	Medium
R	VSR 3	The Cullinun	270m	Many	View from residential development and hotel (residents and hotel guests)	Good	Good availability /Good amenity of alternative views	Partly visible	Long/Frequent	High
C	VSR 4	Administration Building at Western Harbour Crossing	45m	Few	View from the administration building (Workers)	Medium	Medium availability /Medium amenity of alternative views	Fully visible	Long/Occasional	Low
T	VSR 5	Travellers arriving	Varies	Many	Travellers	Fair	Limited availability	Glimpse view	Short/Frequent	Low

Type of VSR	VSRs	Name of VSRs	Viewing Distance (m) approx.	Estimated Number of Individuals / receiver population (Many/ medium/ few)	Type of VSR	Value and Quality of Existing View	Availability and amenity of alternative views	Degree of Visibility	Duration (Long/ Medium/ Short) and Frequency of View (Frequent/Occasional/ Rare)	Sensitivity (Low/ Medium/ High)
		Western Harbour Crossing Toll Plaza			arriving the WHC Toll Plaza					
T	VSR 6	Travellers at the Footbridge Crossing the WHC Toll Plaza	Varies	Few	Travellers Crossing the WHC Toll Plaza	Fair	Medium availability	Glimpse view	Short/Occasional	Low
T	VSR 7	Travellers at Yau Ma Tei Typhoon Shelter	Varies	Medium	Travellers on sea transportation	Good	Good availability/ Good amenity of alternative views	Glimpse view	Short/Occasional	Low
T	VSR 8	Travellers along Austin Road West	Varies	Medium	Passengers/ pedestrians and other road users	Medium	Medium availability/ Fair amenity of alternative view	Glimpse view	Short/Occasional	Low
OU	VSR 9	M+ Musuem (Phase 2)	40m	Medium	View from M+ Building (Workers and Visitors)	Fair	Medium availability/ Medium amenity of alternative view	Partly visible	Long/Occasional	Medium

Notes: Type of VSR: Comprehensive Development Area (CDA); Residential (R); Commercial (C); Other Specified (OU) and Transient (T).

15.10.5 Evaluation and Assessment of Landscape and Visual Impacts

15.10.5.1 Landscape Impact Assessment

Source of Landscape Impacts

Landscape impacts arise due to the construction of the Austin Road flyover at the junction of Austin Road West/ Nga Cheung Road. During the construction phase, removal and disturbance of existing trees and the associated construction activities with the flyovers are the main sources of the impact, while the operation of the new flyover is the main concerns during operation phase.

Potential sources of impacts on LRs and LCAs during construction and operation phases are summarized in **Table 15.10.8**:

Table 15.10.8: Source of impacts during construction and operation phase

Landscape Impacts	
Construction Phase (Direct Impacts)	
LC1-1	Construction of the flyover and associated works
LC1-2	Removal and disturbance of existing trees
Construction Phase (Indirect Impacts)	
LC1-3	The laying down of utilities, including water, drainage and power,
LC1-4	Temporary site access areas, site cabins, material storage and heavy machinery,
Operation Phase Impacts	
LO1-1	Operation of the new flyover

Magnitude of Change of LRs and LCAs

The magnitude of change, before implementation of mitigation measures, on landscape resources and landscape character area that would occur in the construction and operation phase are summarized in **Table 15.10.9** and **Table 15.10.10** respectively. It is assumed that the construction of Austin Road flyover will occur at the same time as construction of WKCD facilities. As WKCD will be constructed in many phases, it is possible that the operation phase of Austin Road flyover will be the same time with the interim phase of the WKCD facilities.

Note that only the landscape resources (Open Space: LR1.7; Amenity Planting: LR2.29 and LR2.31 and LR2.36) and landscape characters area (LCA01, LCA03, LCA08 and LCA09) which are affected by Austin Road flyover will be assessed with magnitude of change. Some landscape resources (Open Space: LR1.15; Amenity Planting: LR2.26 to LR2.28; LR2.30; LR2.32 to LR2.35; Water Body: LR3.1) and landscape character area (LCA02, LCA04 to LCA07 and LCA10), which are not affected by Austin Road Flyover, are omitted in the assessment since they are insubstantially impacted and have no source of impact.

Table 15.10.9: Impacts on landscape resources during construction and operation phase

LR No.	Landscape Resources	Compatibility of the project with the surrounding landscape (High / Medium / Low)	Reversibility (High / Medium / Low)	Scale of Development (Large / Medium / Small)	Source of Impact		Description of Impacts	Duration of Impact under construction and operation phases (Long/Short)	Magnitude of changes (Large/ Intermediate/ Small / Negligible)	
					Construction Phase	Operation Phase			Construction Phase	Operation Phase
LR1: Open Space										
LR 1.7	Temporary open space along the waterfront promenade within the site boundary	Medium	Medium	Small	LC1-1, LC1-3, LC1-4	LO1-1	Due to the construction works, excavation works and interim works of the underpass road, there will be loss of approximately 0.002ha temporary open space to the public in the construction stage. Affected area consists of parts of the road and cycling track with associated street planting leading towards the temporary waterfront promenade. In the operation phase, affected area of the landscape resource will be reinstated as part of the Park with the provision of open space for public enjoyment.	Short	Small	Small
LR2: Amenity Planting										
LR2.29	Roadside Plantation along Austin Road West	Medium	Medium	Small	LC1-1 to LC1-4	LO1-1	Although there are 96 roadside trees in LR2.29, only 36 roadside trees in raised planter (~0.2 ha) near WKCD area will be affected by the construction of Austin Road Flyover (LC1-1), and indirectly affected by associated temporary works (LC1-2 to LC1-4) during construction period. 20 trees, with poor form/heath will be proposed to be felled. As the amenity and health condition of these tress are medium, 16 trees are proposed to be transplanted and 60 trees without affected by the works will be proposed to be retain in situ with adequate tree protection measures during the construction stage. In the	Long	Intermediate	Intermediate

LR No.	Landscape Resources	Compatibility of the project with the surrounding landscape (High / Medium / Low)	Reversibility (High / Medium / Low)	Scale of Development (Large / Medium / Small)	Source of Impact		Description of Impacts	Duration of Impact under construction and operation phases (Long/Short)	Magnitude of changes (Large/ Intermediate/ Small / Negligible)	
					Construction Phase	Operation Phase			Construction Phase	Operation Phase
							operation phase, this LR will become part of the WKCD pedestrian walkway.			
LR2.31	Trees Buffering Western Harbour Tunnel Entrance	Low	Low	Medium	LC1 -1 to, LC1-4	LO1-1	Although there are 250 trees in LR2.31, only 50 trees n the tree buffer area (~0.16ha) within WKCD area will be affected by construction of Austin Road Flyover (LC1-1) and indirectly affected by associated temporary works (LC1-2 to LC1-4) during construction period. 30 trees are proposed to be felled as they are mainly ubiquitous species easily replaceable by new planting with better quality, while others (20 trees) with medium amenity value, will be proposed to be transplanted. 200 trees, with no direct conflicts with the construction of Austin Road Flyover, are proposed to be retained in situ with adequate tree protection works. Part of this LR (~0.02ha) will become Austin Road Flyover during operation phase.	Long	Intermed-iate	Intermed-iate
LR2.36*	Tree Cluster in the Eastern Part within the Boundary Area	Low	Low	Medium	LC1-1 to LC1-4	LO1-1	Although there are 372 trees in LR 2.36, only 10 trees with grassland (~0.0027 ha) will be affected.10 trees with fair health and tree form and medium amenity value will be transplanted within site and 362 trees in this LR with no direct conflict with the construction of Austin Road Flyover, will be retained in situ. During operation phase, this LR will become part of the Park and Avenue.	Long	Small	Small

* Note that some trees located in LR2.36 are currently being relocated to areas around LR2.31 by LCSD, hence the actual tree numbers are subject to further changes.

Table 15.10.10: Impacts on landscape character areas during construction and operation phase

LCA. No.	Landscape Resources	Compatibility of the project with the surrounding landscape (High/Medium/ Low)	Reversibility (High/ Medium/ Low)	Scale of Develop-ment (Large/Medium/Small)	Source of Impact		Description of Impacts	Duration of Impact under construction and operation phases (Long/Short)	Magnitude of changes (Large/ Intermediate/ Small / Negligible)	
					Construction Phase	Operation Phase			Construct-ion Phase	Operation Phase
LCA01	West Kowloon Cultural District Landscape Character Area	Medium	Medium	Small	LC1-1 to LC 1-4	LO1-1	Approximately 0.35ha of this LCA will be affected permanently by construction of Austin Road Flyover(LC1-1), which will result in lost a portion of the LCA01.Part of this LCA will changed into part of the Flyover and will result to existing tree will be felled and incompatibility of construction works to the LCA. There are total 522 trees (150 trees in LR2.31 and 372 trees in LR2.36) in this LCA, of which 30 trees and tree buffer area (~0.16ha) in LR2.31 will be felled, 30 trees will be transplanted (20 trees in LR2.31 and 10 trees in LR2.36) and 462 trees will be retained in situ (100 trees in LR2.31 and 362 tree sin LR2.36). Also, this LCA may be indirectly affected by the associated excavation works and temporary works (LC1-2 to LC1-4) of the construction of Austin Road Flyover (LC1-1).	Long	Intermed-iate	Intermed-iate
LCA03	West Kowloon Cultural District Temporary Waterfront	Medium	Medium	Small	LC1-1, LC1-4	LO1-1	Relatively small area (approximately 0.02ha) of this LCA will be affected permanently by construction of Austin Road Flyover (LC1-1). Part of this LCA will changed into part of the Flyover, which will result to the incompatibility of construction works to this LCA. Also, this LCA	Long	Small	Small

LCA. No.	Landscape Resources	Compatibility of the project with the surrounding landscape (High/Medium/ Low)	Reversibility (High/ Medium/ Low)	Scale of Develop-ment (Large/Medium/Small)	Source of Impact		Description of Impacts	Duration of Impact under construction and operation phases (Long/Short)	Magnitude of changes (Large/ Intermediate/ Small / Negligible)	
					Construction Phase	Operation Phase			Construct-ion Phase	Operation Phase
							will be indirectly affected by the associated excavation works and temporary works of the flyover and may cause convenience to the entrance of the WKCD temporary waterfront during construction period..			
LCA08	Western Harbour Crossing Toll Gate Landscape	Low	Low	Large	LC1-1, LC1-3 and LC1-4	LO1-1	Approximately 0.3ha of this LCA will be permanently affected by the construction of Austin Road Flyover (LC1-1), which will result to the incompatibility of construction works to this LCA. 100 trees in LR2.31 with no direct conflicts with the construction of Austin Road Flyover will be retained in situ. Also, this LCA may be directly affected by associated temporary construction works (LC1-3 and LC1-4).	Long	Intermed-iate	Intermed-iate
LCA09	Tsim Sha Tsui Late 20C / Early 21C Commercial / Residential Complex Landscape	Medium	Medium	Medium	LC1-1 to LC 1-4	LO1-1	Approximately 0.32ha of this LCA will be affected by the construction of Austin Road Flyover (LC1-1), which will result in existing trees to be felled and and incompatibility of construction works to the LCA. There are total 96 trees in LR2.29, which 20 trees in raised planter (~0.2ha)will be felled, 16 trees will be transplanted and 60 trees, with no direct conflicts with the construction of Austin Road Flyover, will be retained in situ. Also, this LCA will be indirectly affected by the associated excavation works and temporary	Long	Small	Small

LCA. No.	Landscape Resources	Compatibility of the project with the surrounding landscape (High/Medium/ Low)	Reversibility (High/ Medium/ Low)	Scale of Develop-ment (Large/Medium/Small)	Source of Impact		Description of Impacts	Duration of Impact under construction and operation phases (Long/Short)	Magnitude of changes (Large/ Intermediate/ Small / Negligible)	
					Construction Phase	Operation Phase			Construct-ion Phase	Operation Phase
							works of the flyover			

* Note that some trees located in LR 2.36 are currently being relocated to areas around LR 2.31 by LCSD, hence the actual tree numbers are subject to further changes.

Landscape Impacts to LRs during Construction and Operation Phase (Before Mitigation)

The significance of landscape impact is a function of the sensitivity of the affected landscape receptors and the magnitude of change that they will experience. The major landscape impact that will arise from the proposed development is the existing trees would be felled within site boundary during construction phase.

In summary, it is anticipated that affected Landscape Resources during construction and operation phase are LR1.7, LR2.29, LR2.31 and LR2.36. Those LRs with insubstantial impact are not elaborated in details.

The significant of landscape impacts, before implementation of mitigation measures, to Landscape Resources, in the construction and operation phase are assessed and presented in Table 15.10.17. The significance of unmitigated impacts on landscape resources would vary from *slight adverse* to *moderate adverse*.

Impact on LR1 Open Space

LR 1.7 – Temporary open space along the waterfront promenade within the site boundary

It is a temporary open space with *medium sensitivity*. During construction phase, construction of Austin Road Flyover will result the temporary loss of public open space (~0.002ha). Affected area consists of parts of the road and cycling track with associated street planting leading towards the temporary waterfront promenade. However, as the affected area is relatively small (~0.002ha), which magnitude of change due to construction of Austin Road Flover is considered as *small* and the resultant unmitigated impact during construction and operation phase is *slight adverse*.

Impact on LR2 Amenity Planting

LR2.29 – Roadside Plantation along Austin Road West

96 roadside trees will be affected by the construction of Austin Road Flyover and indirectly affected by associated temporary works during construction period. Trees affected are common species with medium amenity value and poor to fair condition and of young to semi mature size. Their sensitivity is considered *medium*. Existing trees in raised planters (~0.2ha) will be felled, which 20 trees with poor form/health will be felled, 16 trees with medium amenity and health condition will be transplanted. Magnitude of change due to the construction activities is considered intermediate. The unmitigated landscape impact on this LR during construction and operation phase is *moderate adverse*.

LR2.31 – Tree Buffering Western Harbour Tunnel Entrance

250 existing trees in the tree buffer area (~-0.16ha) within the WKCD area will be affected by the construction of Austin Road Flyover and indirectly affected by associated temporary works. Trees found are common species with low to medium amenity value and poor to fair condition and of young to semi mature size. Their sensitivity is considered *medium*. Existing trees in tree buffer area within the works area will be felled from the site, of which 30 trees with tree buffer area (~0.16ha) will be felled and 20 trees with amenity value will be transplanted during the construction phase. 200 trees in this LR with no direct conflicts with the construction of Austin Road Flyover will be retained in situ. Magnitude of change to this LR is considered *intermediate*. It is noted that some trees in LR2.36 will be relocated to areas around LR 2.31 by

LCSD, hence actual tree numbers are subject to further changes. The unmitigated landscape impact on this LR during construction and operation phase is *moderate adverse*.

LR2.36 – Tree Cluster in the Eastern Part within the Boundary Area

This LR will be affected by the construction of Arena and the surrounding plaza and landscape area. Tree cluster, with medium amenity value and poor to fair condition, and grassland are found scattered in the eastern part within the boundary area. Their sensitivity is considered as *medium*. Although there are 372 trees in this LR, approximate 10 trees with fair health and tree form and medium amenity will be transplanted within site and grassland (~0.0027ha) will be removed from site. Other 362 trees in LR 2.36 with no direct conflicts with the construction of Austin Road Flyover will be retained in situ. The magnitude of change is considered as *small*. It is noted that some trees in LR2.36 will be relocated to areas around LR 2.31 by LCSD, hence actual tree numbers are subject to further changes. The unmitigated landscape impact during construction and operation phases on this LR is *slight adverse*.

Impact on Existing Trees

For LR, approximately 718 trees (96 trees in LR2.29, 250 trees in LR2.31 and 372 trees in LR2.36) will be affected by the construction of Austin Road Flyover, of which 50 trees (20 trees in LR2.29 and 30 trees in LR2.31) with self-seed species and/or poor health and tree form will be felled, 46 rees (16 trees in LR2.29, 20 trees in LR2.31 and 10 trees in LR2.36) with fair health condition and tree form and medium amenity value will be transplanted and 622 trees (60 trees in LR 2.29, 200 trees in LR 2.31 and 362 trees in LR2.36), with no direct conflicts with the construction of Austin Road Flyover, will be retained in situ.

Affected tree species include *Acacia auriculiformis, Acacia confusa, Bauhinia x blakeana, Casuarina equisetifolia, Celtis sinensis, Cinnamomum camphora, Crateva unilocularis, Ficus benjamina, Ficus microcarpa, Ficus virens, Grevillea robusta, Hibiscus tiliaceus, Lagerstroemia speciosa, Peltophorum pterocarpum, Senna siamea, Senna surattensis, Syzygium cumini* and *Terminalia mantaly*. The majority of tree species affected is self-seeded weed *Leucaena leucocephala*. The condition of the tree range from poor to fair. Amenity value range from low to medium.

Landscape Impacts to LCAs during Construction and Operation Phase (Before Mitigation)

For LCAs, approximately 0.99 ha of the LCAs will be affected. Affected Landscape Character Area during construction phase are LCA01, LCA03, LCA08 and LCA09. Major landscape impacts to affected LCAs (LCA01, LCA03, LCA08 and LCA09) are the loss of existing trees, permanent loss of portion of LCA and the incompatibility of construction works to the LCAs.

The significant of landscape impacts, before implementation of mitigation measures, to Landscape Character Area, in the construction and operation phases are assessed and presented in Table 15.10.18. The significance of unmitigated impacts on landscape character area would vary from slight to moderate. They are described as below:

LCA01 West Kowloon Cultural District Landscape Character Area

This LCA is still a vacant land reserved for WKCD development, which has no direct or regional significance. The sensitivity of this LCA is *low* during construction phase. Part of this LCA (~0.35ha) will be permanently affected by the construction of Austin Road Flyer and associated excavation works and temporary works. Part of this LCA will change into part of the Flyover and will result to the existing trees will

be felled and incompatibility of construction works to this LCA There are total 522 trees (150 trees in LR2.31 and 372 trees in LR2.36) in this LCA, of which 30 trees and tree buffer area (~0.16ha) in LR2.31 will be felled, 30 trees will be transplanted (20 trees in LR2.31 and 10 trees in LR2.36) and 462 trees will be retained in situ (100 trees in LR2.31 and 362 tree sin LR2.36). Magnitude of change to this LCA is considered as intermediate. The unmitigated landscape impact during construction and operation phase is *moderate adverse*.

LCA03 West Kowloon Cultural District Temporary Waterfront Promenade

This area is currently a temporary open space opened to the public and allow activities along the waterfront, as this LCA is temporary, which has no district or regional significance, the sensitivity of the LCA is considered as *low*. Part of this LCA (~-0.02ha) of this LCA will permanently affected by the construction of Austin Road Flyer and form part of it, which will result to the incompatibility of construction works to this LCA during construction phase. As the affected area (~0.02ha) is relatively small, magnitude of change to this LCA is considered as *small*. . The unmitigated landscape impact during construction and operation phase is *slight adverse*.

LCA08 Western Harbour Crossing Toll Gate Landscape

This cross harbour tunnel with buffering tree is characterised with heavy traffic, which has no district or regional significance, the sensitivity of this LCA is considered as *medium*. Part of this LCA (~0.3ha) will be affected by the construction of Austin Road Flyover, which will result incompatibility of construction works to this LCA. 100 trees in LR2.31 with no direct conflicts with the construction of Austin Road Flyover will be retained in situ. Magnitude of changes is considered as *intermediate*. The unmitigated landscape impact during construction and operation phase is *moderate adverse*.

LCA09 Tsim Sha Tsui Late 20C/Early 21C Commercial/ Residential Complex Landscape

This LCA is dominated with mixed residential and commercial use and characterized as an enclosed and colourful urban landscape, the sensitivity of this LCA is *medium*. Part of this LCA (0.32ha) will be affected by the construction of Austin Road Flyover, which will result to the existing trees to be felled and and incompatibility of construction works to the LCA. There are total 96 trees in LR2.29, which 20 trees in raised planter (~0.2ha)will be felled, 16 trees will be transplanted and 60 trees, with no direct conflicts with the construction of Austin Road Flyover, will be retained in situ. Magnitude of change to this LCA is considered as *small*. The significance of unmitigated landscape impact during construction and operation is considered as *slight adverse*.

15.10.5.2 Visual Impact Assessment

The assessment of the significance of visual impacts is based on a combination of factors, including the sensitivity of the selected VSRs, their magnitude of change and whether impacts are beneficial or adverse, short term or long term, reversible or irreversible and direct or indirect. Visual compatibility of the associated structures of the Project with the surroundings, and its obstruction and interference with key views of the VSRs are important considerations for the visual impact assessment.

Sources of Visual Impacts during Construction and Operation Phases

Major direct visual impacts, including degrading of visual quality of existing views, and visual incompatibility of the works with the visual context of the surrounding areas, will be resulted from the following

construction activities during construction phase. In addition to the construction activities mentioned above, night time lighting provided for the construction activities could be one of the sources of visual impacts during construction phase. However, the visual impacts derived by these construction activities are temporary.

The impacts during operation phase depend on visual compatibility of the associated structures to the surrounding landscape.

The sources of direct and indirect visual impacts during construction and operation phases are listed in **Table 15.10.11.**

Table 15.10.11: Sources of direct and indirect visual impacts during construction and operation phases

Sources of Direct Visual Impacts during Construction Phase	
DVIC 1	Construction of flyover and associated works
DVIC 2	Rearrangement of existing facilities on top of the WHC Toll Plaza
DVIC 3	Night time lighting provided for the construction activities
Sources of Indirect Visual Impacts during Construction Phase	
IVIC 1	Construction traffic
IVIC 2	Various construction activities including operation of PME, utilities at the piers and diversion of abutments of the flyover
IVIC 3	Temporary site access
IVIC 4	Heavy machinery
IVIC 5	Dust during dry weather
Source of Direct Visual Impacts during Operation Phase	
DVIO 1	Erection of flyover

Magnitude of Change of the VSRs

The factors determining the magnitude of impacts include scale of development, compatibility of the project with the surrounding landscape, reversibility of change, viewing distance, potential blocking of view, duration of impacts under construction and operation phases.

Given that the scale of the development is small, high reversibility of impact/change and short duration of impact during construction phase, the magnitude of change of the VSRs mainly depends on the viewing distance, and potential blocking of view by the Project. The magnitude of change of the VSR 4 (Administration Building at Western Harbour Crossing), VSR 5 (Travellers arriving WHC Toll Plaza) and VSR 6 (Travellers at the footbridge crossing WHC Toll Plaza) is considered to be intermediate, as they have a close view of the construction activities of the flyover structure. However, the magnitude of change of other VSRs is generally small during construction phase.

Except VSR 4 (Administration Building at Western Harbour Crossing) has an intermediate magnitude of change, the magnitude of change of all VSRs ranges from negligible to small during operation phase, due to the high compatibility of the proposed development with the surrounding landscape,.

The magnitude of change of the VSRs during construction and operation phases is shown in **Table 15.10.12**.

Table 15.10.12: Magnitude of Change of VSRs

VSRs		Viewing Distance (m) approx.	Potential Blocking of View (Full/Partial/ Slight/None)	Reversibility of Impact (Yes/No)	Compatibility of the Proposed development with the Surrounding Landscape (High/Medium/Low)	Scale of Proposed Development (large/small)	Duration of Impacts during Construction/ Operation Phases	Magnitude of Change	
								During Construction Phase	During Operation Phase
VSR 1	International Commerce Centre (ICC)	60m	Slight	Yes	High	Small	Short/ Permanent	Small	Small
VSR 2	The Elements	45m	Partial	Yes	High	Small	Short/ Permanent	Small	Small
VSR 3	The Cullinun	270m	None	Yes	High	Small	Short/ Permanent	Negligible	Negligible
VSR 4	Administration Building at Western Harbour Crossing	45m	Partial	Yes	High	Small	Short/ Permanent	Intermediate	Intermediate
VSR 5	Travellers arriving Western Harbour Crossing Toll Plaza	Varies	Partial	Yes	High	Small	Short/ Permanent	Intermediate	Small
VSR 6	Travellers at the Footbridge Crossing WHC Toll Plaza	Varies	Partial	Yes	High	Small	Short/ Permanent	Intermediate	Small
VSR 7	Travellers at Yau Ma Tei Typhoon Shelter	Varies	None to Slight	Yes	High	Small	Short/ Permanent	Negligible to small	Negligible
VSR 8	Travellers along Austin Road West	Varies	Partial	Yes	High	Small	Short/ Permanent	Small	Small
VSR 9	M+ Museum	40m	Partial	Yes	High	Small	Short/ Permanent	Small	Small

Visual Impacts during Construction Phase (Before Mitigation)

During construction phase, the unmitigated visual impacts are adverse in nature. The visual impacts are resulted from blockage of views to the visual resources, visual incompatibility of the construction works with the surroundings and degrading of visual quality of existing views.

Due to the small scale of the DP, most of the VSRs will experience slight to moderate visual impacts before mitigation. However, the visual impacts during construction phase are temporary. The assessment of visual impacts during construction phase is summarised in **Table 15.10.13**.

Visual Impacts during Operation Phase (Before Mitigation)

During operation phase, the major unmitigated visual impacts are resulted from blockage of views. Since the scale of the Project is localized, VSRs to be affected will be confined to those located in close proximity to the Project. Since the visual context in the proximity is dominated by road network structures, the proposed flyover is considered compatible with the surroundings. The visual impacts derived by the Project during operation phase are generally small.

The assessment of visual impacts during construction phase is summarised in **Table 15.10.13**. The photomontages showing the flyover structures are provided at **Figures 15.10.11a to 15.10.13b**.

Night Time Visual Impacts due to the Project

Since the scale of the Project is comparatively small and there are a number of light sources in the surrounding areas of the project site, it is considered that it is compatible with the existing urban setting, and hence the night time visual impacts arising from the Project during construction and operation phases are not significant to most VSRs. It is also acceptable to residential VSRs nearby (ie. VSR 3 The Cullinun), which is the most sensitive VSR to the night time visual impacts. It is because VSR 3 is located to the north of the project site, and the night time illumination arising from the project will be as strong as other road side night time lighting. Whilst some night time lighting will be blocked by the existing footbridge crossing Western Harbour Crossing Toll Plaza, the night time lighting arising from the Project generally will be compatible with the existing night time lighting from Western Harbour Crossing Toll Plaza.

Table 15.10.13: Assessment of Visual Impacts during Construction Phases

VSRs		Location of VSRs	Type & Approximate Number of VSRs	Description of Existing View & Degree of Visibility of DP	Receiver's Sensitivity	Source of Impact	Minimum Viewing Distance of VSRs	Magnitude of Change	Significance Threshold of Potential Visual Impact (Before Mitigation)	Mitigation Measures	Significance Threshold of Residual Impact
VSR 1	International Commerce Centre (ICC)	Located immediately to the east of the site and the WHC Toll Plaza	Type of VSR View from commercial development (i.e. offices and hotel) (workers/ hotel guest) Number of VSR Many	Existing View ■ Elevated view of the site can be seen. ■ Visual composition comprises a footbridge and the WHC toll plaza in the foreground, with Yau Ma Tei Typhoon Shelter in the background. Degree of Visibility of DP ■ The DP will be largely blocked by the existing footbridge when viewed from lower floors. ■ The top view of the DP will be seen from upper floors.	Medium to High	DVIC 1, DVIC 2, IVIC 1, IVIC 2, IVIC 3, IVIC 4	60m	Small	Slight (upper floors) Moderate (lower floors)	MMCP1	Slight (upper floors) Slight to Moderate (lower floors)
VSR 2	The Elements	Located immediately to the east of the site and the WHC Toll Plaza	Type of VSR View from commercial development (i.e. shopping mall) (workers/ visitors) Number of VSR Many	Existing View ■ Visual composition comprises footbridges, and existing flyover in the foreground, and WHC Toll Plaza in the background. Degree of Visibility of DP ■ Views to the site are largely blocked by the existing footbridges and flyover. ■ Partial view of the DP can be seen at podium level.	Medium	DVIC 1, DVIC 2, IVIC 1, IVIC 2, IVIC 3, IVIC 4	45m	Small	Moderate	MMCP1	Slight to Moderate
VSR 3	The Cullinun	Located immediately to the northeast of the site and to the east of WHC Toll Plaza	Type of VSR View from residential development and hotel (residents and hotel guests) Number of VSR Many	Existing View ■ Visual composition comprises WHC Toll Plaza in the foreground and Yau Ma Tei Typhoon Shelter in the background. Degree of Visibility of DP ■ VSR 3 has a partial view of the DP that is largely blocked by the existing footbridge.	High	DVIC 1, DVIC 2, DVIC 3 IVIC 1, IVIC 2, IVIC 3, IVIC 4,	270m	Negligible	Slight	MMCP1, MMCP2	Negligible
VSR 4	Administration Building at Western Harbour Crossing	Located immediately to the south of the site and in front of the entrance of the WHC	Type of VSR View from the administration building (Workers) Number of VSR Few	Existing View ■ Existing view comprises a footbridge, the WHC Toll Plaza with Yau Ma Tei Typhoon Shelter in the background. ■ Close and open view of the site and WHC Toll Plaza. Degree of Visibility of DP ■ Visual composition comprises the DP in the foreground.	Low	DVIC 1, DVIC 2, IVIC 1, IVIC 2, IVIC 3, IVIC 4, IVIC 5	45m	Intermediate	Moderate	MMCP1	Slight to Moderate
VSR 5	Travellers arriving Western Harbour Crossing Toll Plaza	Located to the north of the site	Type of VSR Travellers arriving the WHC Toll Plaza Number of VSR Many	Existing View ■ Varying views depending on locations at WHC Toll Plaza. Degree of Visibility of DP ■ Partial view of the DP can be seen due to the footbridge blocks the view to the DP when viewed from the north of the DP.	Low	DVIC 1, DVIC 2, IVIC 1, IVIC 2, IVIC 3, IVIC 4, IVIC 5, IVIC 6	Varies	Small (viewed from the north of the site) Intermediate (viewed from the south of the site)	Slight	MMCP1	Slight

VSRs		Location of VSRs	Type & Approximate Number of VSRs	Description of Existing View & Degree of Visibility of DP	Receiver's Sensitivity	Source of Impact	Minimum Viewing Distance of VSRs	Magnitude of Change	Significance Threshold of Potential Visual Impact (Before Mitigation)	Mitigation Measures	Significance Threshold of Residual Impact
VSR 6	Travellers at the Footbridge Crossing WHC Toll Plaza	Located immediately to the north of the site	Type of VSR Travellers Crossing the WHC Toll Plaza Number of VSR Few	Existing View ■ Varying views depending on locations at the footbridge. ■ Elevated view of the entrance of the WHC and the WHC Toll Plaza can be seen. Degree of Visibility of DP ■ Partial view of the DP can be viewed.	Low	DVIC 1, DVIC 2, IVIC 1, IVIC 2, IVIC 3, IVIC 4, IVIC 5, IVIC 6	Varies	Intermediate	Slight	MMCP1	Slight
VSR 7	Travellers at Yau Ma Tei Typhoon Shelter	Located to the west of the site and the WHC Toll Plaza	Type of VSR Travellers on sea transportation Number of VSR Medium	Existing View ■ Varying views depending on locations at Yau Ma Tei Typhoon Shelter. ■ Existing views to the WHC Toll Plaza are largely blocked by the vegetation along the waterfront and footbridge structures in the foreground. Degree of Visibility of DP ■ View to the DP is largely blocked by the vegetation along the waterfront and the footbridge in the foreground. ■ Only partial view of the DP can be seen.	Low	DVIC 1 & DVIC 2	Varies	Negligible to Small	Slight	MMCP1	Negligible
VSR 8	Travellers along Austin Road West	Located immediately to the east of the site and to the south of VSR 1and VSR 2	Type of VSR Passengers/ pedestrians and other road users Number of VSR Medium	Existing View ■ Varying views depending on locations at Austin Road West. ■ Visual composition comprises carriageways and roadside planting on both sides of the roads. Degree of Visibility of DP ■ Close view of the site can be seen when approaching to the western end of Austin Road West.	Low	DVIC 1, DVIC 2, IVIC 1, IVIC 2, IVIC 3, IVIC 4, IVIC 5, IVIC 6	Varies	Small	Slight	MMCP1	Slight
VSR 9	M+ Museum	Located to the east of the site	Type of VSR View from an arts and cultural facility (Workers and Visitors) Number of VSR Medium	Existing View ■ Existing view comprises a footbridge, the WHC Toll Plaza with Yau Ma Tei Typhoon Shelter in the background. ■ Close and partial view of the site. Degree of Visibility of DP ■ Only partial view of the DP can be seen. Part of the views is blocked by the administration building at WHC.	Medium	DVIC 1, DVIC 2, IVIC 1, IVIC 2, IVIC 4, IVIC 5.	40m	Small	Moderate	MMCP1	Slight to Moderate

Table 15.10.14: Assessment of Visual Impacts during Operation Phase

VSRs		Location of VSRs	Type & Approximate Number of VSRs	Description of Existing View & Degree of Visibility of DP	Receiver's Sensitivity	Source of Impact	Minimum Viewing Distance of VSRs	Magnitude of Change	Significance Threshold of Potential Visual Impact (Before Mitigation)	Mitigation Measures	Significance Threshold of Residual Impact	
											Operation (Day 1)	Operation (Year 10)
VSR 1	International Commerce Centre (ICC)	Located immediately to the east of the site and the WHC Toll Plaza	Type of VSR View from commercial development (i.e. offices and hotel) (workers/ hotel guest) Number of VSR Many	Existing View ■ Elevated view of the site can be seen. ■ Visual composition comprises a footbridge and the WHC toll plaza in the foreground, with Yau Ma Tei Typhoon Shelter in the background. Degree of Visibility of DP ■ The DP will be largely blocked by the existing footbridge when viewed from lower floors. ■ The top view of the DP will be seen from upper floors.	Medium to High	DVIO 1	60m	Small	Insubstantial (upper floors) Slight (lower floors)	MMOP1, MMOP2, MMOP3,	Insubstantial (upper floors) Slight (lower floors)	Insubstantial (upper floors) Slight (lower floors)
VSR 2	The Elements	Located immediately to the east of the site and the WHC Toll Plaza	Type of VSR View from commercial development (i.e. shopping mall) (workers/ visitors) Number of VSR Many	Existing View ■ Visual composition comprises footbridges, and existing flyover in the foreground, and WHC Toll Plaza in the background. Degree of Visibility of DP ■ Views to the site are largely blocked by the footbridges and flyover. ■ Partial view of the DP can be seen at podium level.	Medium	DVIO 1	45m	Small	Slight to Intermediate	MMOP1, MMOP2, MMOP3.	Slight	Slight
VSR 3	The Cullinun	Located immediately to the northeast of site and to the east of WHC Toll Plaza	Type of VSR View from residential development and hotel (residents and hotel guests) Number of VSR Many	Existing View ■ Visual composition comprises WHC Toll Plaza in the foreground and Yau Ma Tei Typhoon Shelter in the background. Degree of Visibility of DP ■ VSR 3 has a partial view of the DP that is largely blocked by the existing footbridge.	High DVIO 2	DVIO 1	270m	Negligible	Slight	MMOP1, MMOP2, MMOP3, MMOP4.	Insubstantial	Insubstantial
VSR 4	Administration Building at Western Harbour Crossing	Located immediately to the south of site and in front of the entrance of the WHC	Type of VSR View from the administration building (Workers) Number of VSR Few	Existing View ■ Existing view comprises a footbridge and the WHC Toll Plaza with Yau Ma Tei Typhoon Shelter in the background. ■ Close and open view of the site. . Degree of Visibility of DP ■ Visual composition comprises the DP in the foreground.	Low	DVIO 1	45m	Intermediate	Slight to Moderate	MMOP1, MMOP2, MMOP3.	Slight	Slight
VSR 5	Travellers arriving Western Harbour Crossing Toll Plaza	Located to the north of the site	Type of VSR Travellers arriving the WHC Toll Plaza Number of VSR Many	Existing View ■ Varying views depending on locations at WHC Toll Plaza. Degree of Visibility of DP ■ Partial view of the DP due to blockage of the view to the DP by the existing footbridge when viewed from the north of the D.	Low	DVIO 1	Varies	Small	Small (viewed from the north of the site) Small to Moderate (viewed from the south of the site)	MMOP1, MMOP2, MMOP3.	Insubstantial (viewed from the north of the site) Small (viewed from the south of the site)	Insubstantial viewed from the north of the site) Small (viewed from the south of the site)

VSRs		Location of VSRs	Type & Approximate Number of VSRs	Description of Existing View & Degree of Visibility of DP	Receiver's Sensitivity	Source of Impact	Minimum Viewing Distance of VSRs	Magnitude of Change	Significance Threshold of Potential Visual Impact (Before Mitigation)	Mitigation Measures	Significance Threshold of Residual Impact	
											Operation (Day 1)	Operation (Year 10)
VSR 6	Travellers at the Footbridge Crossing WHC Toll Plaza	Located immediately to the north of the site	Type of VSR Travellers Crossing the WHC Toll Plaza Number of VSR Few	Existing View ■ Varying views depending on locations at the footbridge. ■ Elevated view of the entrance of the WHC and the WHC Toll Plaza can be seen. Degree of Visibility of DP ■ Partial view of the DP can be viewed.	Low	DVIO 1	Varies	Small	Small	MMOP1, MMOP2, MMOP3.	Insubstantial	Insubstantial
VSR 7	Travellers at Yau Ma Tei Typhoon Shelter	Located to the west of the site and the WHC Toll Plaza	Type of VSR Travellers on sea transportation Number of VSR Medium	Existing View ■ Varying views depending on locations at Yau Ma Tei Typhoon Shelter. ■ Existing views to the WHC Toll Plaza are largely blocked by the vegetation along the waterfront and footbridge structures in the foreground. Degree of Visibility of DP ■ View to the DP is largely blocked by the vegetation along the waterfront and the footbridge in the foreground. ■ Only partial view of the DP can be seen.	Low	DVIO 1	Varies	Negligible	Insubstantial	MMOP1, MMOP2, MMOP3.	Insubstantial	Insubstantial
VSR 8	Travellers along Austin Road West	Located immediately to the east of the site and to the south of VSR 1and VSR 2	Type of VSR Passengers/ pedestrians and other road users Number of VSR Medium	Existing View ■ Varying views depending on locations at Austin Road West. ■ Visual composition comprises carriageways and roadside planting on both sides of the roads. Degree of Visibility of DP ■ Close view of the site can be seen when approaching to the western end of Austin Road West.	Low	DVIO 1	Varies	Small	Slight	MMOP1, MMOP2, MMOP3.	Insubstantial	Insubstantial
VSR 9	M+ Museum		Type of VSR View from an arts and cultural facility (Workers and Visitors) Number of VSR Medium	Existing View ■ Existing view comprises a footbridge, the WHC Toll Plaza with Yau Ma Tei Typhoon Shelter in the background. ■ Close and partial view of the site. Degree of Visibility of DP ■ Only partial view of the DP can be seen. Part of the views is blocked by the Administration Building at WHC.	Medium	DVIO 1	40m	Small	Slight to Intermediate	MMOP1, MMOP2, MMOP3.	Slight	Slight

Considerations of Alternative Options

Alternative options have been considered to compare the advantages and disadvantage of different options. It is considered that at-grade and underground options are not technically viable due to direct conflict with the existing WHC operation, and insufficient space and obstruction by existing piled foundations below the WHC toll plaza respectively.

Given the site constraints and site conditions, the proposed flyover is virtually the only alignment option for the provision of the essential alternative vehicular access to Mega Performance Venue (MPV) and Exhibition Centre (EC) at the WKCD.

During the planning process, design measures have been incorporated in the development layout so as to minimize any potential adverse visual impact on the VSRs at the WKCD. For instance, the eastern end of the proposed flyover will be connected to the existing elevated road junction of Austin Road West and Nga Cheung Road

The details of Consideration of Alternative Development Options are provided at **Section 15.2.4.**

15.10.6 Mitigation Measures

15.10.6.1 Landscape Mitigation Measures

The construction works would inevitably create undesired adverse impacts to the landscape resources and landscape character areas.

Design Measures as Mitigation Measures during Detail Design Stage

Design measures will be developed as mitigation measures during detail design stages.

- Transplanting of mature tree in good health and amenity value where appropriate and reinstatement of areas disturbed during construction by compensatory hydro-seeding and planting;

- Protection measures for the trees to be retained during construction activities;

- Maximize coverage of greenery with tree, shrub and other vegetation planting to compensate the loss of existing tree and amenity planting area;

- Providing salt tolerant tree species along the planter strips at the waterfront promenade;

- Temporary greening measures, e.g. roadside ornamental planting in removable planters around peripheral of site works area as temporary screening and carry out removal green roof panel/vertical green panel on the roof/facade of site offices during construction works;

- Maximize the opportunity of soft landscape treatments, such as vertical green wall/ climber/ roof greening, etc, to soften the hard architectural and engineering structures and facilities;

- Landscape design shall be incorporated to architectural and engineering structures in order to provide aesthetically pleasing designs.

Mitigation Measures to be applied during Construction and Operation Phase

To reduce the impact towards the existing landscape resources, mitigation measures during construction and operation phase are proposed and summarized in **Table 15.10.15** and **Table 15.10.16**. Generally, mitigation measures shall be implemented as early as possible and many of these measures perform multiple functions.

Table 15.10.15: Landscape mitigation measures during construction phase

Ref. No.	Mitigation Measures during Construction Phase	Funding Agency	Implementation Agency	Management/ Maintenance Agency
CM1	Trees should be retained in situ on site as far as possible. Should tree removal be unavoidable due to construction impacts, trees will be transplanted or felled with reference to the stated criteria in the Tree Removal Applications to be submitted to relevant government departments for approval in accordance to ETWB TCW No. 29/2004 and 3/2006.	WKCDA – for work area within WKCD site CEDD- for work areas of external connections Private Developer – for works areas within private land sale lots	Contractor	WKCDA or appointed landscape contractor
CM2	Compensatory tree planting shall be incorporated to the proposed project and maximize the new tree, shrubs and other vegetation planting to compensate tree felled and vegetation removed. Also, implementation of compensatory planting should be of a ratio not less than 1:1 in terms of quality and quantity within the site.	Same as above	Contractor	WKCDA or appointed landscape contractor
CM3	Buffer trees for screening purposes to soften the hard architectural and engineering structures and facilities.	WKCDA	Contractor	WKCDA or appointed landscape contractor
CM4	Softscape treatments such as vertical green wall panel /planting of climbing and/or weeping plants, etc, to maximize the green coverage and soften the hard architectural and engineering structures and facilities.	WKCDA	Detailed Design Consultant/ Contractor	WKCDA or appointed landscape contractor
CM7	Structure, ornamental planting shall be provided along amenity strips to enhance the landscape quality.	WKCDA	Contractor	WKCDA or appointed landscape contractor
CM8	Landscape design shall be incorporated to architectural and engineering structures in order to provide aesthetically pleasing designs.	WKCDA	Detailed Design Consultant / Contractor	WKCDA or appointed landscape contractor

Table 15.10.16: Landscape mitigation measures during operation phase

Ref. No.	Mitigation Measures during Operation Phase	Funding Agency	Implementation Agency	Management/ Maintenance Agency
OM1	Provide proper planting establishment works, including watering, pruning, weeding, pest control, replacement of dead plant, etc, on the new planting areas to enhance the aesthetic	WKCDA – for work area within WKCD site CEDD- for work areas of external connections	Contractor	LCSD – for public roadside and pedestrian footbridge planting[1] Private Developers – for all landscaping within the

Ref. No.	Mitigation Measures during Operation Phase	Funding Agency	Implementation Agency	Management/ Maintenance Agency
	design degree	Private Developer – for works areas within private land sale lots		private land sale lots WKCDA – for all other areas within WKCD
OM2	Provision of open space in various forms and at different levels on or above ground, including park, waterfront promenade, piazzas and terrace garden and assoociated green connections for public enjoyment.	WKCDA	Detailed Design Consultant / Contractor	WKCDA or appointed landscape contractor

[1] in accordance with ETWB No. 2/2004

The Landscape Master Plan and general landscape arrangement for the WKCD development is shown in **Figure 15.10.15**. The plan is preliminary and for illustrative purpose only and subject to further amendment in detailed design stage. List of Landscape and Visual Mitigation Measures for Austin Road Flyover are shown in **Figure 15.10.14**. Details of landscape mitigation measures are shown in **Figure 15.10.15 to 15.10.17**.

15.10.6.2 Significance Threshold of Residual Impact (Before and After Mitigation Measures)

The significance threshold of each LR and LCA has been derived through the assessment of sensitivity abnd magnitude of change associated with the proposed works. **Table 15.10.1** shows the relationship between sensitivity and magnitude of change. The efficiency and success of proposed mitigation measures are taken in consideration when analyzing the significance of the threshold of residual impact after mitigation. The residual impact of each LR and LCA regarding the significance threshold before and after mitigation measures are summarized in the **Table 15.10.17** and **Table 15.10.18**.

Table 15.10.17: Significance of impacts on landscape resources during construction and operation phases

LR No.	Landscape Resources	Sensitivity (Low, Medium, High)		Magnitude of Change (Negligible, Small, Intermediate, Large)		Significance Threshold of impacts before Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Significance Threshold of Residual Impact after Mitigation (Insubstantial, Slight, Moderate, Substantial)		
										Operation	
		Construction Phase	Operation Phase	Construction Phase	Operation Phase	Construction Phase	Operation Phase		Construction Phase	Day 1	YR 10
Existing Landscape Resources											
LR1: Open Space											
LR1.7	Temporary Open Space along the Waterfront Promenade within the Site Boundary	Medium	Medium	Small	Small	Slight (adverse)	Slight (adverse)	CM4, CM7 and CM8; OM1, OM2	Insubstantial	Insubstantial	Slight (beneficial)
LR1.15	Public Open Space at the podium of Kowloon Station	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LR2: Roadside Amenity											
LR2.26	Trees along West Kowloon Highway	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LR2.27	Amenity Planting within the private development at the Kowloon Station	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LR2.28	Roadside Plantation along Western Harbour Crossing Bus Stop next to Elements	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LR2.29	Roadside Plantation along Austin Road West	Medium	Medium	Intermediate	Intermediate	Moderate (adverse)	Moderate (adverse)	**CM1 to CM3, CM4, CM7 and CM8; OM1**	Slight (adverse)	Slight (adverse)	Insubstantial
LR2.30	Roadside Plantation next to Western Harbour Tunnel Administration Building	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LR2.31	Trees Buffering Western Harbour Tunnel Entrance	Medium	Medium	Intermediate	Intermediate	Moderate (adverse)	Moderate (adverse)	**CM1 to CM3, CM4, CM7 and CM8; OM1**	Slight (adverse)	Slight (adverse)	Insubstantial
LR2.32	Roadside Plantation along Western Harbour Crossing Bus Stop next to New Yau Ma Tei Typhoon Shelter	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	**-**	Insubstantial	Insubstantial	Insubstantial
LR2.33	Trees along New Yau Ma Tei Typhoon Shelter Pier	Medium	Medium	Negligible	Negligible	Insubstantial	Insubstantial	**-**	Insubstantial	Insubstantial	Insubstantial
LR2.34	Amenity Planting within Salt Water Pumping Station	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	**-**	Insubstantial	Insubstantial	Insubstantial
LR2.35	Tree Cluster in the Western Part within the Boundary Area	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	**-**	Insubstantial	Insubstantial	Insubstantial
LR2.36	Tree Cluster in the Eastern Part within the Boundary Area	Medium	Medium	Small	Small	Slight (adverse)	Slight (adverse)	**CM1 to CM3, CM4, CM7 and CM8; OM1**	Insubstantial	Insubstantial	Slight (beneficial)
LR3: Water Body											
LR3.1	Victoria Harbour	High	High	Negligible	Negligible	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial

*Notes: All significance thresholds are adverse unless otherwise stated.

Table 15.10.18: Significance of impacts on landscape character area during construction and operation phases (all impacts are adverse unless otherwise stated)

ID. No.	Landscape Character Areas	Sensitivity (Low, Medium, High)		Magnitude of Change (Negligible, Small, Intermediate, Large)		Significance Threshold of Impact before Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Significance Threshold of Residual Impact after Mitigation (Insubstantial, Slight, Moderate, Substantial)		
										Operation	
		Construction	Operation	Construction	Operation	Construction	Operation		Construction	Day 1	Year 10
Existing Landscape Character Areas											
LCA01	West Kowloon Cultural District Landscape Character Area	Low	High	Intermediate	Intermediate	Moderate (adverse)	Moderate (adverse)	**CM1 to CM3; OM1**	Slight (adverse)	Insubstantial	Slight (Beneficial)
LCA02	West Kowloon Cultural District Construction Area	Low	High	Negligible	Negligible	Insubstantial	Insubstantial	**-**	Insubstantial	Insubstantial	Insubstantial
LCA03	West Kowloon Cultural District Temporary Waterfront Promenade	Low	High	Small	Small	Slight (adverse)	Moderate (adverse)	**CM3, CM7 and CM8; OM1 and OM2**	Insubstantial	Insubstantial	Slight (Beneficial)

ID. No.	Landscape Character Areas	Sensitivity (Low, Medium, High)		Magnitude of Change (Negligible, Small, Intermediate, Large)		Significance Threshold of Impact before Mitigation (Insubstantial, Slight, Moderate, Substantial)		Recommended Mitigation Measures	Significance Threshold of Residual Impact after Mitigation (Insubstantial, Slight, Moderate, Substantial)		
									Construction	Operation	
		Construction	Operation	Construction	Operation	Construction	Operation			Day 1	Year 10
LCA04	New Yau Ma Tei Typhoon Shelter Landscape	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LCA05	Victoria Harbour Inshore Water Landscape	High	High	Negligible	Negligible	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LCA06	Victoria Harbour Strait Landscape	High	High	Negligible	Negligible	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LCA07	New Yau Ma Tei Container Terminal Landscape	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial
LCA08	Western Harbour Crossing Toll Gate Landscape	Medium	Medium	Intermediate	Intermediate	Moderate (adverse)	Moderate (adverse)	**CM1 to CM3; OM1**	Slight (adverse)	Insubstantial	Slight (Beneficial)
LCA09	Tsim Sha Tsui Late 20C / early 21C Commercial / Residential Complex Landscape	Medium	Medium	Small	Small	Moderate (adverse)	Moderate (adverse)	**CM1 to CM3; OM1**	Slight (adverse)	Insubstantial	Slight (Beneficial)
LCA10	Guangzhou-Shenzhen-Hong Kong Express Rail Link (XRL) Terminus Construction Site and Austin Station	Low	Low	Negligible	Negligible	Insubstantial	Insubstantial	-	Insubstantial	Insubstantial	Insubstantial

15.10.6.3 Visual Mitigation Measures

Representative views from the key VSRs have been selected to illustrate the effectiveness of the proposed mitigation measures. Photomontages of the viewpoints viewed by the selective key VSRs are shown in **Figure 15.10.11a to 15.10.13b.**

Visual Mitigation Measures during Construction Phase

Mitigation measures will be used to lessen any visual impacts of the construction works such as the use of decorative screen hoarding/boards and control of night time lighting. Screens or hoardings around the site limit should be in visually unobtrusive colour to screen the proposed works. These construction phase measures should be adopted from the commencement of construction and should be in place throughout the entire construction period. In addition to visual mitigation measures mentioned above, control of night time lighting such as avoidance of lighting from spilling onto nearby developments will be adopted to minimise the night time visual impacts during construction phase.

A summary of the visual mitigation measures to be implementation during construction phase is shown in **Table 15.10.19**.

Table 15.10.19: Visual Mitigation Measures during Construction Phase

Mitigation Measures		Target VSRs	Funding Agency	Implementation Agency	Management/ Maintenance Agency
MMCP 1	Use of decorative screen hoarding/ boards	All of the VSRs	WKCDA – for work area within WKCD site CEDD – for works areas of external connections	Contractor	Contractor
MMCP 2	Control of night time lighting such as avoidance of lighting from spilling onto nearby developments	Residential VSR (i.e. VSR 3)	WKCDA – for work area within WKCD site	Contractor	Contractor

Visual Mitigation Measures during Operation Phase

The Project will incorporate design measures aiming to avoid unacceptable visual impacts. An aesthetically pleasing, integrated design in terms of form, textures and colour of the proposed project components and associated structures will be compatible with the existing surroundings. Control of night time lighting is one of the mitigation measures for the potential night time visual impacts. It can be controlled by careful considerations for the locations and the angle of the lighting to avoid lighting from spilling onto nearby developments.

The operation phase mitigation measures should be adopted as part of the construction works so that they are in place at the date of commissioning of the Project.

It is noted that despite of infeasibility and inadequate space for planting at the flyover, softscape treatments such as climbers are proposed to mitigate the visual impacts derived by the hard engineering structures of the flyover. Full effect of the soft landscape mitigation measures at the WKCD, in particular the trees planted at the entrance of the WHC and the Park would reach a level maturity after several years. This may contribute to greening of the visual composition when viewed to the Project.

A summary of the visual mitigation measures to be implemented during operation phase is shown in **Table 15.10.20.**

Table 15.10.20: Visual Mitigation Measures during Operation Phase

	Mitigation Measures	Target VSRs	Funding Agency	Implementation Agency	Management/ Maintenance Agency
MMOP 1	Integrated design of the flyover with the existing flyover located to the west of the Elements	All VSRs	WKCDA – for work areas within WKCD site CEDD – for works areas of external connections	Contractor	n/a
MMOP 2	Softscape treatments such as climbers shall be incorporated to soften the hard engineering structures.	All VSRs	Same as above	Contractor	LCSD – for public roadside and pedestrian footbridge planting[1] WKCDA – for all other areas within WKCD
MMOP 3	Compensatory planting in close proximity of the flyover structure	All VSRs	Same as above	Contractor	LCSD – for public roadside and pedestrian footbridge planting[1] WKCDA – for all other areas within WKCD
MMOP 4	Control of night time lighting such as careful considerations for the locations and the angle of the lighting	Residential VSR (i.e. VSR 3)	WKCDA – for work areas within WKCD site	Contractor	WKCDA / Contractor

[1] in accordance with ETWB No. 2/2004

15.10.6.4 Programme of Implementation of Landscape and Visual Mitigation Measures

The construction phase measures listed in **Table 15.10.15** and **Table 15.10.19** should be adopted from commencement of construction, and shall be in place throughout the entire construction period. The operation phase measure listed in **Table 15.10.16** and **Table 15.10.20** should be adopted during the detailed design stage, and be built as part of the construction, so that they are in place at the dated of commissioning of the Project. It should be noted that the soft landscape mitigation measures would not be appreciated for several years.

The WKCD development will be constructed in many phase. It is assumed that the construction of Austin Road flyover will occur at the same time as the construction of WKCD facilities. General good site practice will be adopted for all construction activities.

15.10.7 Evaluation of Cumulative and Residual Impacts

15.10.7.1 Cumulative impacts

An assessment of the cumulative landscape and visual impacts of the Austin Road flyover development and the committed developments in the surrounding areas of the site has been undertaken. This considers changes that will result in conjunction with other existing and foreseeable proposals. The concurrent designated projects include the XRL and WKT, road works at West Kowloon, Road Improvement Works in West Kowloon Reclamation Development – Phase 1 and II and Central Kowloon Route, which pose cumulative impacts together with the Austin Road flyover on LRs, LCAs and VSRs.

The sources of impact from concurrent projects during construction and operation phases are summarised as **Table 15.10.21.**

Table 15.10.21: Potential cumulative landscape and visual impacts from concurrent projects

Proposed Development	Construction Phase	Operation Phase
Express Rail Link (and WKT)	Construction of diaphragm wall and foundations, excavation concreting and backfill works as well as the operation of concrete batching plant and barging points, etc.	Above-ground structures including WKT and ventilation shafts in West Kowloon
Road Improvement Works in West Kowloon Reclamation Development – Phase 1 and II	Excavation, roads/ underpasses construction and construction of noise screening structures, etc	Structures such as noise barriers
Central Kowloon Route	Construction of a trunk road and tunnel, with administration and ventilation buildings; and associated works.	Structures such as ventilation buildings

Table 15.10.22 shows the summary of the affected LRs and LCAs and VSRs and potential cumulative impacts generated by the concurrent designated projects in the adjacent areas and the proposed WKCD development.

Table 15.10.22: Summary of LRs, LCAs and VSRs affected by concurrent projects

Concurrent Designated Projects	Affected LRs/LCAs	Affected VSRs
Express Rail Link (and WKT) **Road works at West Kowloon**	As construction is in progress, accumulative impacts are minimal.	Construction and Operation Phases VSR 1, VSR 2, VSR 8, VSR 9
Road Improvement Works in West Kowloon Reclamation Development – Phase 1 and II		Construction Phase VSR 2, VSR 3, VSR 4, VSR 5 ,VSR 7 and VSR 8

	Operation Phase
	All of the above except VSR 7
Central Kowloon Route	N/A

Affected LRs/LCAs

Cumulative Impacts on Landscape Resources during Construction and Operation Phase

The concurrent projects in the surrounding area are concentrated at the northern site boundary. As the construction of the concurrent projects is in progress, accumulative landscape impacts to affected landscape resources are minimal. Only those LRs near the northern site boundary, e.g. LR2.29 will be affected by the construction of Austin Road Flyover and concurrent projects. The cumulative impacts on landscape resources are the loss of existing roadside planting area and existing trees (36 trees in LR2.29) would be felled. Some of the road side planting LR2.29 (~0.65ha) will be transformed to the future road works at West Kowloon. Affected road side planting will be reinstated after construction and the reduction of road side planting will be absorbed by the newly created landscape resources and new compensatory planting, e.g. planting on the podium of West Kowloon Terminus and connection network between WKCD and XRL's West Kowloon Terminus.

With the implementation of proposed mitigation landscape measures (including compensatory tree planting) during construction phase, it is considered that there would not have any additional insurmountable landscape impact during construction phase. Tree loss due to the construction of Austin Road Flyover and concurrent project will be compensated in a ratio of 1:1 or more in construction phase. Compensatory tree will be located within the site boundary. It is expected to have a net gain of trees. The residual cumulative impacts on existing trees during operation phase will be slight adverse in Day 1 and insubstantial in Year 10.

Construction activities might cause disturbances to the landscape resources in the surrounding area. For instance, dust and construction noise may deteriorate the value and usage of the surrounding open space. Dust and pollutant emissions due to traffic congestion during construction phase may affect the health of existing trees. The foundation works of the piers may affect the existing street trees. Given the number of trees located immediately within the construction area of the flyover is relatively small, these indirect impacts are considered to be low.

Cumulative Impacts on Landscape Character Area during Construction and Operation Phases

It is expected that construction of Austin Road Flyover and other concurrent projects, i.e. XRL Terminus, Residential/CDA development above Austin Station and Road Works at West Kowloon and Central Kowloon Route will affect both LCA09 and LCA10, which LCA 10 is also under a change on ongoing development. As the construction of concurrent projects is in progress, accumulative landscape impacts to affected LCAs are minimal. However, as the construction of the Austin Road Flyover and concurrent projects follow the existing road networks, it will not create any insurmountable cumulative impact on the existing LCAs with the implementation of mitigation measures.

As a whole, cumulative impacts on LCAs will not create additional insurmountable adverse impact with the implementation of mitigation measures.

Affected VSRs during Construction Phase

Road Works at West Kowloon

As the road works at West Kowloon involved construction of Austin Road West underpass and upgrading of Austin Road West, VSR 2 and VSR 8 are the most affected VSRs. Other affected VSRs include VSR 1 and VSR 9.

The cumulative visual impacts imposed on the relevant VSRs after the implementation of mitigation measures such as screens and hoardings are considered to be slight/ moderate.

Road Improvement Works in West Kowloon Reclamation Development – Phases I and II

VSR 2, VSR 3, VSR 5, VSR 7, VSR 8 and VSR 9 are the affected VSRs for the road improvement works in West Kowloon Reclamation Development (Phase I and Phase II).

Construction of road bridge linking to WKH and construction of road bridge and carriageway connecting WKH and NCR are anticipated to pose moderate to substantial cumulative impacts on VSR 2, VSR 3, VSR 4, VSR 5 and VSR 9, whilst junction improvement works at Junctions of Canton Road/ Austin Road are considered to pose moderate cumulative impacts on VSR 7 and VSR 8 during construction phase due to its transient nature.

Since the type of VSR 3 is residential, its sensitivity is considered to be high due to long and frequent duration of view. Therefore, the cumulative impacts on VSR 3 are substantial even after the implementation of the mitigation. However, the cumulative impacts during construction phase are temporary only.

Affected VSRs during Operation Phase

Road Works at West Kowloon

Given the magnitude of change of the affected VSRs (i.e. VSR 1, VSR 2, VSR 8 and VSR 9) is small, the cumulative visual impacts posed on the affected VSRs are mostly slight/ insubstantial during operation phase.

Road Improvement Works in West Kowloon Reclamation Development – Phases I and II

It is anticipated the road improvement works will be highly compatible with the visual amenity of the transport corridor type of landscape. Give the magnitude of change is small, the cumulative impacts on the affected VSRs are generally slight and even negligible.

15.10.7.2 Residual impacts

Residual Landscape Impact

Despite the mitigation measures mentioned in **Section 15.10.6**, it is inevitable that certain residual impacts would still be placed on the site, both in construction and operation phases. The residual impacts on landscape resources and landscape character areas are generally insubstantial to slight beneficial.

Residual Impact on Landscape Resources during Construction and Operation Phase

Impact on LR1 Open Space

None of these landscape resources will be affected during construction and operation phase.

LR 1.7 – Temporary open space along the waterfront promenade within the site boundary

Relatively small area (~0.002ha) of temporary open space to the public will be affected. Affected area consists of parts of the road and cycling track with associated street planting. However, as the construction of underpass road may be at the same time with the construction of the Park and waterfront promenade, There will be *slight adverse* residual impact on this LR during construction phase due to the construction of Austin Road Flyover. During operation phase, affected area of LR will become part of the Park for public enjoyment, with minimum 23ha of open space for public use will be provided within the site boundary . With the re-provided vegetation grows and established, enhancement of landscape quality with the provision of the open space and better connection of WKCD and neighbour area facilitate the public enjoyment during operation phase of Austin Road Flyover, residual impact on this LR will become *insubstantial* in Day 1 and *slight beneficial* in Year 10.

Impact on LR2 Amenity Planting

LR2.29 – Roadside Plantation along Austin Road West

36 roadside trees in raised planter (~0.2 ha) near WKCD area will be affected by the construction of Austin Road Flyover (LC1-1), and indirectly affected by associated temporary works (LC1-2 to LC1-4) during construction period. 20 trees, with poor form/heath will be proposed to be felled. As the amenity and health condition of these tress are medium, 16 trees are proposed to be transplanted and 60 trees without affected by the works will be proposed to be retain in situ with adequate tree protection measures during the construction stage. In the operation phase, this LR will become part of the WKCD pedestrian walkway. 16 transplanted trees and new compensatory trees will be planted to the reinstated new landscaped area during construction phase, there will be slight adverse residual impact on this LR. During operation phase, part of the LR will permanently become part of the road works. With the re-provided vegetation grows and established, enhancement of landscape quality, it is considered the residual impact will be *slight adverse* in Day 1 and insubstantial in Year 10 during operation phase with the implementation of mitigation measures.

LR2.31 – Tree Buffering Western Harbour Tunnel Entrance

30 trees with tree buffer area (~0.16ha) will be felled and 20 trees will be transplanted during construction of Austin Road Flyover. However, 20 transplanted trees and new compensatory buffer trees will be planted in landscaped area of this LR with the sensitive streetscape design during construction, there will be slight adverse residual impact on this LR. During operation phase, part of this LR will become Austin Flyover. With the re-provided vegetation grows and established, enhancement of landscape quality, it is considered that residual impact will be *slight adverse* in Day 1 and *insubstantial* in Year 10 during operation with the implementation of mitigation measures.

Impact on LR3 Waterbody

Total 5 trees will be transplanted and grassland (~0.0027ha) will be felled during the construction of Austin Road Flyover. However, 5 transplanted trees and new compensatory buffer trees with vertical green will be

provided in the site during construction phase. This relatively small affected area will be further developed into part of the Park and Avenue within this LR. Aesthetic landscape design, with new compensatory trees, will be incorporated to architectural/engineering structures to enhance the landscape quality of this LR during construction phase, it is considered there will be *insubstantial* residual impact on this LR. With the re-provided vegetation grows and established and enhancement of landscape quality during operation phase in this LR,, residual impact on this LR will become *insubstantial* in Day 1 and slight beneficial in Year 10 with the implementation of mitigation measures..

Impact on Existing Trees

Based on the broad brush tree survey, approximately 1194 trees are surveyed within the study boundary. There are 718 trees (96 trees in LR2.29, 250 trees in LR2.31 and 372 trees in LR2.36) will be affected by construction of Austin Road flyover. Many of them are located within and near the WKCD site boundary.

Approximately 50 trees (20 trees in LR2.29 and 30 trees in LR2.31) with self-seed species and/or poor health and tree form will be felled and 46 trees (16 trees in LR2.29, 20 trees in LR2.31 and 10 trees in LR2.36) with fair health condition and tree form and medium amenity value will be transplanted and 622 trees (60 trees in LR2.29, 200 trees in LR2.31 and 362 trees in LR2.36) with no direct conflicts with the construction of Austin Road Flyover, will be retained in situ during construction period. It is considered that transplanted trees will recover after Year 10.

With the implementation of new compensatory tree and transplanted trees to be provided within the site during construction phase, the residual impact is considered *slight beneficial*. Many of the trees are not recommended to be transplanted as they are either in poor form and health or are weed species. None of the affected trees are LCSD Champion Trees or Registered Old and Valuable Trees. There are no rare species or endangered species but common species. All trees with medium to high amenity value, which are unavoidably affected by the works will be transplanted where possible. Detailed tree felling application and compensatory planting proposal will be submitted in accordance with ETWB TC 3/2006 during the detailed design stage. Implementation of compensatory planting should be of a ratio not less than 1:1 in terms of quality and quantity within the site. The quality of compensatory trees should be at least of “heavy standard” (Section 3 of the General Specification for Civil Engineering Works refers). Proposals which deviate from this principle will be supported with justification, in order to ensure the greening opportunity within the site is optimised where feasible. Also, sufficient space will be provided for the planting of compensatory trees with the consideration of minimum space required to cater for the establishment and healthy growth of the trees.

Affected tree species include *Acacia auriculiformis, Acacia confusa, Bauhinia x blakeana, Casuarina equisetifolia, Celtis sinensis, Cinnamomum camphora, Crateva unilocularis, Ficus benjamina, Ficus microcarpa, Ficus virens, Grevillea robusta, Hibiscus tiliaceus, Lagerstroemia speciosa, Peltophorum pterocarpum, Senna siamea, Senna surattensis, Syzygium cumini* and *Terminalia mantaly*. The majority of tree species affected is self-seeded weed *Leucaena leucocephala*. The condition of the tree range from poor to fair. Amenity value range from low to medium.

The actual figure of trees to be transplanted/ felled should depend on the result of a more detailed tree survey on the affected tree. The quantities of trees affected are summarized in **Table 15.10.23**.

Table 15.10.23: Residual impacts on existing trees during construction phase

Ref. No.	Landscape Resources	Source of Impact	Residual Impacts during Construction Phase			
			Total no. of tree in LRs	No of trees to be felled	No of trees to be transplanted	No of trees to be retained
LR2.29	Roadside Plantation along Austin Road West	LC1-1 to LC1-4	96	20	16	60
LR2.31*	Trees Buffering Western Harbour Tunnel Entrance	LC1-1 to LC1-4	250	30	20	200
LR2.36*	Tree Cluster in the Eastern Part within the Boundary Area	LC1-1 to LC1-4	372	0	10	362
		Total: 718 no. affected tree	718	50	46	622

* Note that some trees located in LR2.36 are currently being relocated to areas around LR2.31 by LCSD, hence the actual tree numbers are subject to further changes.

Detail tree felling application and compensatory planting proposal will be submitted in accordance with ETWB TC 3/2006 during the detailed design stage. Implementation of compensatory planting should be of a ratio not less than 1:1 in terms of quality and quantity within the site. The quality of compensatory trees should be at least of “heavy standard” (Section 3 of the General Specification for Civil Engineering Works refers). Proposals which deviate from this principle will be supported with justification, in order to ensure the greening opportunity within the site is optimised where feasible. Also, sufficient space will be provided for the planting of compensatory trees with the consideration of minimum space required to cater for the establishment and healthy growth of the trees. The compensatory tree planting and new landscape works as mitigation measures to the loss of greenery are proposed for the Austin Road Flyover. As the landscape quality of the existing trees is low, the proposed substantial number of new tree plantings as a mitigation measures are sufficient to compensate the loss of existing trees. The overall cumulative residual impacts on existing trees are considered to be beneficial in the longer term after development. The beneficial impact would substantially increase with time after trees reach maturity.

Residual Impact on Landscape Character Areas during Construction and Operation Phase

The residual impacts on landscape character areas are generally *insubstantial* to *slight adverse* during construction phase and *insubstantial* to *slight beneficial* in operation phase The residual impact on landscape character areas during operation phase are mostly considered to be beneficial in the long term. Details are summarised in **Table 15.10.24**.

Table 15.10.24: Residual impacts on landscape character areas during operation phase

Ref. No.	Landscape Character Areas	Residual Impact on Landscape Character Areas
LCA01	West Kowloon Cultural District Landscape Character Area	31 and 372 trees in LR2.36) in this LCA, of which 30 trees and tree buffer area (~0.16ha) in LR2.31 will be felled, 30 trees will be transplanted (20 trees in LR2.31 and 10 trees in LR2.36) and 462 trees will be retained in situ (100 trees in LR2.31 and 362 tree sin LR2.36). With the new compensatory tree to be provided within the site, there will be ***slight adverse*** residual impact on this LCA during construction phase. As LCA01 will be under construction and largely become Park area and part of the M+ extension are, MPV, Hotel and the Arena Plaza during operation phase, the quality of the greenery space will be greatly improved. With the re-provided vegetation grows and established, enhancement of

Ref. No.	Landscape Character Areas	Residual Impact on Landscape Character Areas
		landscape quality and better connection between WKCD and neighbourhood area during operation phase, residual impact on this LCA is considered as ***insubstantial*** in Day 1 and ***slightly beneficial*** in Year 10 of operation phase.
LCA03	West Kowloon Cultural District Temporary Waterfront	Relatively small area (~0.02ha) of this LCA will be affected by the construction of Austin Road Flyover , which will result to the loss of temporary open space (~0.02ha) in LR1.7 and incompatibility to the LCA. With the new compensatory tree to be provided within the site, there will be ***insubstantail*** residual impact on this LCA during construction phase. However, as LCA03 will be under construction and substituted by a newly designed waterfront promenade providing better facilitates and open space quality. Also, the operation phase of Austin Road Flyover facilitates the public enjoyment and provide better connection between WKCD and neighbourhood area. With the re-provided vegetation grows and established and provision of open space during operation phase, the residual impact in Day 1 of operation phase is considered to be ***insubstantial*** and become ***slightly beneficial*** in Year 10.
LCA08	Western Harbour Crossing Toll Gate Landscape	Approximately 0.3 ha of this LCA will be affected by the construction of Austin Road Fl.over and will result to the incompatibility of the construction works to t his LCA. 100 trees in LR2.31 with no direct conflicts with the construction of A ustin Road Flyover will be retained in situ. With the provision of ornamental ro adside planting to further enhance the landscape quality during construction p hase, there will be ***slight adverse*** residual impact on this LCA. During operation phase, Austin Road Flyover will provide better connection in LCA08. LCA08 comprising West Harbour Crossing Toll Plaza and carriageways contribute its highly compatible with location of Austin Road Flyover and its surrounding area will facilitate the public enjoyment. With the re-provided vegetation grows and established, the residual impact in operation phase is considered to be ***insubstantial*** **in Day 1 and** ***slight beneficial*** **in Year 10 with implementation of mitigation measures during operation phase**
LCA09	Tsim Sha Tsui Late 20C / Early 21C Commercial Residential Complex Landscape	Approximate 0.32ha of this LCA will become part of the Austin Road Flyer, which will result existing trees to be felled and and incompatibility of construction works to the LCA. There are total 96 trees in LR2.29, which 20 trees in raised planter (~0.2ha)will be felled, 16 trees will be transplanted and 60 trees, with no direct conflicts with the construction of Austin Road Flyover, will be retained in situ. With the provision of new compensatory planting during construction phase, there will be ***slight adverse*** residual impact on this LCA. During operation phase, Austin Road Flyover will provide better connection in LCA09 and improve the accessibility brought by operation of Austin Road Flyover. New compensatory tree with planting area will be provided with sensitive streetscape design and further enhance the landscape quality. With the re-provided vegetation grows and established and further enhancement of the landscape quality to this LCA, the residual impact is considered to be **insubstantial** in Day 1 and *slight beneficial* in Year 10 with implementation of mitigation measures during operation phase .

Residual Visual Impact

Residual Visual Impacts during Construction Phase

As the scale of the Project is small, it is considered that the residual visual impact on most of the VSRs is slight to moderate during construction phase with the implementation of mitigation measures such as erection of screen hoarding, except VSR 3 The Cullinun and VSR 7 Travellers at Yau Ma Tei Typhoon Shelter. However, the mitigation measures proposed at ground level would not be able to mitigate the

visual impacts for views from the higher level of some of the VSRs, in particular VSR 1 International Commerce Centre (ICC).

Residual Visual Impacts during Operation Phase

The flyover structure is compatible with the "transport corridor" landscape setting of the West Harbour Crossing, the residual adverse impact on most of the VSRs, therefore, is considered to be slight or even insubstantial. A transport corridor is a generally linear tract of land that contains lines of transportation such as highways, or railroads.

The VSRs located in close proximity to the flyover such as VSR 1 International Commerce Centre (ICC), VSR 4 Administration Building at Western Harbour Crossing will have direct and full/partial views to the flyover structures. Despite of the short distance, the residual visual impacts on VSR 1 are considered to be slight and insubstantial for workers at the lower and upper floors respectively.

Despite the structures of the flyover can be seen from the south of the site, VSR 5 (Travellers arriving Western harbour Crossing Toll Plaza) and VSR 9 (M+ Museum) viewed from the south would experience small visual impacts, as the flyover structure is highly compatible with the surrounding areas.

VSRs located further away have partial views to the flyover structures and it is considered that the residual visual impacts on these VSRs are insubstantial. Transient VSRs such as VSR 5 Travellers Arriving Western Harbour Crossing Toll Plaza, VSR 6 Travellers at the Footbridge Crossing the WHC Toll Plaza, VSR 7 Travellers at Yau Ma Tei Typhoon Shelter, and VSR 8 Travellers along Austin Road West only have glimpse views of the flyover structures and therefore the residual visual impacts during operation phase is insubstantial.

The Photomontages showing the flyover structures are provided at **Figure 15.10.11a** to **Figure 15.10.13b.**

15.10.8 Environmental Monitoring and Audit

In addition to ensure the effective implementation of mitigation measure recommended in **Section 15.10.6** and compliance with relevant environment standards; systematic procedures for monitoring, auditing and minimizing the environmental impacts associated with construction and operation phase is required.

During construction and operation phases, monitoring programme are required to ensure that the Contractors and the Operators could properly carry out mitigation measures and evaluate the actual impact on landscape and visual amenity. This should be undertaken by a Registered Landscape Architect (RLA), or capable person, as landscape auditor. Corrective actions should be undertaken if there are unacceptable adverse impacts.

15.10.9 Conclusion

The WKCD is to be developed into a world-class integrated arts and cultural district to enrich the arts and cultural life for the people in Hong Kong and neighbouring area. In terms of planning, the WKCD should not be seen as an isolated development, with accessibility from and connectivity to the neighbouring community considered essential to integrate the arts and cultural facilities in the WKCD with its neighbouring areas. The Austin Road flyover serves one of the key connections to facilitate the accessibility and connectivity of the overall WKCD development. The location of Austin Road flyover is to

the northwest of the WKCD, which is currently occupied by Western Harbour Crossing (WHC) and its toll plaza, as well as the existing West Kowloon Waterfront Promenade on the eastern side of the WHC.

It is considered that potential impacts on both landscape and visual amenity are unavoidable. The major sources of impacts include various construction activities and removal of existing trees during construction phase. Potential impacts have been considered during the preliminary design stage to avoid direct impacts on significant landscape resources and VSRs.

There are 13 LRs, 10 LCAs, and 9 representative VSRs identified within the assessment area that may be affected by the construction of Austin Road flyover. As the size of the Austin Road flyover is relatively small in scale, there will be slight adverse to moderate adverse impacts on some LRs, LCAs and VSRs at close proximity to the site during construction phase. However, impacts during construction phase are temporary only.

In addition to situating in an urban setting, the transport corridor type of landscape character of the project site comprising the West Harbour Crossing Toll Plaza and carriageways contribute to its high compatibility with the site and its surrounding areas. .

Due to the scale of Austin Road flyover is small, the overall residual landscape and visual impacts associated with the construction and operation phases of the Austin Road flyover are anticipated to be acceptable with the implementation of appropriate mitigation measures and in the long term, the Project will be beneficial to the accessibility requirement of the planning context for the WKCD development.

15.11 Environmental and Monitoring Audit

15.11.1 Air Quality Impact

15.11.1.1 Construction Phase

Regular dust monitoring is considered necessary during the construction phase of the Project and regular site audits are also required to ensure the dust control measures are properly implemented. Details of the environmental monitoring and audit (EM&A) programme will be presented in the stand-alone EM&A Manual.

15.11.1.2 Operation Phase

Since it has been assessed that all the ASRs would be in compliance with all the relevant AQOs for SO_2, NO_2 and RSP, no residual air quality impacts due to vehicular or marine traffic emissions are anticipated. Therefore, no monitoring is considered necessary for vehicular or marine traffic emissions.

15.11.2 Noise Impact

15.11.2.1 Construction Phase

Though no residual noise impact is predicted during the construction of the flyover, an Environmental Monitoring and Audit (EM&A) programme is recommended to ensure that nearby NSRs will not be subjected to unacceptable construction noise impact. Details of the noise monitoring requirements, methodology and action plans would be described in a separate EM&A Manual.

15.11.2.2 Operation Phase

No monitoring is considered necessary.

15.11.3 Water Quality

Adverse water quality impact was not predicted during the construction and operation phases of the proposed flyover. Nevertheless, appropriate mitigation measures are recommended to minimize potential water quality impacts.

Water quality monitoring is recommended to obtain a robust, defensible database of baseline information of marine water quality before construction, and thereafter, to monitor any variation of water quality from the baseline conditions and exceedances of WQOs at sensitive receivers during construction and to ensure the recommended mitigation measures are properly implemented.

Regular audit of the implementation of the recommended mitigation measures during the construction phase at the work areas should also be undertaken to ensure the recommended mitigation measures are properly implemented.

Details of the water quality monitoring and audit programme and the Event and Action Plan are provided in the stand-alone EM&A Manual.

15.11.4 Sewerage and Sewage Treatment Implication

There are no sewerage and sewage treatment implications associated with the flyover.

15.11.5 Waste Management Implication

It will be the Contractor's responsibilities to ensure that all wastes produced during the construction of the Project are handled, stored and disposed of in accordance with good waste management practices and the relevant regulations and requirements. The recommended mitigation measures shall form the basis of the Waste Management Plan to be developed by the Contractor in the construction phase.

During construction phase, regular site inspection as part of the EM&A procedures should be carried out to determine if various types of waste are being managed in accordance with approved procedures and the Waste Management Plan. It should cover different aspects of waste management including waste generation, storage, recycling, treatment, transport and disposal.

15.11.6 Land Contamination

There is no potential land contamination issues associated with the flyover.

15.11.7 Ecology Impact

The implementation of good site practices would avoid and minimize any ecological impacts to an acceptable level. No specific ecological monitoring programme is thus required for the flyover.

15.11.8 Landscape and Visual Impact

In addition to ensure the effective implementation of mitigation measure recommended in **Section 15.10.6** and compliance with relevant environment standards; systematic procedures for monitoring, auditing and minimizing the environmental impacts associated with construction and operation phase is required.

During construction and operation phases, monitoring programme are required to ensure that the Contractors and the Operators could properly carry out mitigation measures and evaluate the actual impact on landscape and visual amenity. This should be undertaken by a Registered Landscape Architect (RLA), or capable person, as landscape auditor. Corrective actions should be undertaken if there are unacceptable adverse impacts.

15.12 Conclusions

15.12.1 Air Quality Impact

15.12.1.1 Construction Phase

With implementation of the recommended mitigation measures as well as the relevant control requirements as stipulated in the *Air Pollution Control (Construction Dust) Regulation* and EPD's *Guidance Note on the Best Practicable Means for Cement Works (Concrete Batching Plant) BPM 3/2(93)*, it has been assessed that there would neither be exceedance of the hourly TSP limit under the Tier 2 mitigated scenario nor exceedance of the AQO for daily TSP under the Tier 1 mitigated scenario at any of the ASRs throughout the entire construction period. For annual TSP results, no exceedance of the corresponding AQO was predicted at any of the ASRs during the construction phase provided the recommended mitigation measures are in place.

15.12.1.2 Operation Phase

Majority of the vehicular emission sources and all marine emission sources are due to respectively the nearby current/planned road networks serving the West Kowloon area and the existing marine activities in the surrounding waters, but not due to the flyover road itself. Therefore, the flyover road alone would only have very minor contribution to the predicted air quality impacts at the ASRs.

According to the modelling results, all the identified ASRs would be in compliance with the corresponding AQO for hourly, daily and annual SO_2; for hourly, daily and annual NO_2 as well as for daily and annual RSP. However, during the worst case year of 2015, two existing ASRs, namely, SRT-1 and SRT-2, would be subject to exceedance of the AQO for hourly NO_2 (i.e., 300 $\mu g/m^3$) by about 3.7-14.9 $\mu g/m^3$ (or about 1.2%-5.0% of the relevant AQO) for once a year, and one planned ASR, namely, P37-1, would be subject to marginal exceedance of the AQO for daily NO_2 (i.e., 150 $\mu g/m^3$) by about 0.2 $\mu g/m^3$ (or about 0.1% of the relevant AQO) for once a year. Since the numbers of such hourly and daily NO_2 exceedances are within the respective allowable numbers of exceedances (3 times per year for hourly NO_2 and once per year for daily NO_2), the AQO for hourly and daily NO_2 would still be complied with at the three ASRs.

In conclusion, no adverse air quality impacts due to vehicular or marine traffic emissions are anticipated during the operation phase of the WKCD Project.

15.12.2 Noise Impact

15.12.2.1 Construction Phase

The construction phase noise impact assessment has been made based on the best available information. The construction noise levels at all representative NSRs are predicted to comply with the noise standards stipulated in the EIAO-TM. Residual construction noise impact is not anticipated.

15.12.2.2 Operation Phase

The potential road traffic noise impacts have been assessed based on the peak traffic flows in 2032. The noise levels predicted at the representative NSRs would range from 69 to 72 dB(A). Road traffic noise is predicted to be dominant by the existing and committed Road Works at West Kowloon road sections nearby. The noise contributions from the Project's proposed flyover are estimated to be less than 1.0 dB(A) and the road traffic noise levels of the proposed roads are all below the noise criterion of 70 dB(A). Adverse traffic noise impact is not anticipated.

15.12.3 Water Quality Impact

15.12.3.1 Construction Phase

The key issue in terms of water quality during the construction phase of the flyover would be the potential for release of wastewater into coastal waters from construction site runoff and drainage.

Deterioration in water quality could be minimised to acceptable levels through implementing adequate mitigation measures such as control measures on suspended solids release, on-site runoff and drainage from the works areas to minimise suspended solids spillage and construction runoff prior to discharge. Proper site management and good housekeeping practices would also be required to ensure that construction wastes and other construction-related materials would not enter the public drainage system and coastal waters. Sewage effluent arising from the construction workforce would also be handled through provision of portable toilets.

With the implementation of these recommended mitigation measures, no unacceptable impacts on water quality from the construction works for the flyover are anticipated. Water quality monitoring and site inspections during construction phase should be undertaken routinely to inspect the construction activities and works areas to ensure the recommended mitigation measures are properly implemented.

15.12.3.2 Operation Phase

Surface runoff from the proposed flyover may be contaminated by oils leaked from passing vehicles. It is considered that impacts upon water quality will be acceptable provided that the proposed flyover is designed with adequate drainage systems and appropriate oil interceptors, as required in accordance with *Highways Department Guidance Notes RD/GN/035 – Road Pavement Drainage Design*.

15.12.4 Sewage and Sewage Treatment Implication

There are no sewerage and sewage treatment implications associated with the flyover.

15.12.5 Waste Management Implication

15.12.5.1 Construction Phase

The major waste types generated by the construction activities will include inert C&D materials from minor excavation at piers and abutments as well as from construction of superstructures and substructures; C&D materials from general site clearance; chemical waste from maintenance and servicing of construction plant and equipment; and general refuse from the workforce. Provided that all these identified wastes are handled, transported and disposed of in strict accordance with the relevant legislative and recommended requirements and that the recommended good site practices and mitigation measures are properly implemented, no adverse environmental impact is expected during the construction phase.

15.12.5.2 Operation Phase

During operation phase, the Austin Road flyover will not involve any waste generating activities. Therefore, no adverse waste management impact is anticipated during operation phase, and no mitigation measures are required.

15.12.6 Land Contamination

There is no potential land contamination issues associated with the flyover.

15.12.7 Ecology Impact

The findings from the field survey and desktop review indicated that the major terrestrial habitats in the Study Area are developed area, open field and plantation, with small amount of sloping seawall along the coastline. All these habitats are with low vegetation cover, short planting history and of low to very low ecological value. Therefore, direct ecological impact on loss of habitat is considered to be of insignificant. The indirect disturbance impact to offsite habitat is considered to be of insignificant in both construction and operation phases, since the proposed flyover is surrounded by urbanized area. The plantation and landscape planting included in the development plan would have potential positive contribution to the local ecology.

15.12.8 Landscape and Visual Impact

The WKCD is to be developed into a world-class integrated arts and cultural district to enrich the arts and cultural life for the people in Hong Kong and neighbouring area. In terms of planning, the WKCD should not be seen as an isolated development, with accessibility from and connectivity to the neighbouring community considered essential to integrate the arts and cultural facilities in the WKCD with its neighbouring areas. The Austin Road flyover serves one of the key connections to facilitate the accessibility and connectivity of the overall WKCD development. The location of Austin Road flyover is to the northwest of the WKCD, which is currently occupied by Western Harbour Crossing (WHC) and its toll plaza, as well as the existing West Kowloon Waterfront Promenade on the eastern side of the WHC.

It is considered that potential impacts on both landscape and visual amenity are unavoidable. The major sources of impacts include various construction activities and removal of existing trees during construction phase. Potential impacts have been considered during the preliminary design stage to avoid direct impacts on significant landscape resources and VSRs.

There are 13 LRs, 10 LCAs and 9 representative VSRs identified within the assessment area that may be affected by the construction of Austin Road flyover. As the size of the Austin Road flyover is relatively small in scale, there will be slight adverse to moderate adverse impacts on some LRs, LCAs and VSRs at close proximity to the site during construction phase. However, impacts during construction phase are temporary only.

In addition to situating in an urban setting, the transport corridor type of landscape character of the project site comprising the West Harbour Crossing Toll Plaza and carriageways contribute to its high compatibility with the site and its surrounding areas. .

Due to the scale of Austin Road flyover is small, the overall residual landscape and visual impacts associated with the construction and operation phases of the Austin Road flyover are anticipated to be acceptable with the implementation of appropriate mitigation measures and in the long term, the Project will be beneficial to the accessibility requirement of the planning context for the WKCD development.

15.13 Implementation Schedule

The implementation schedule for the mitigation measures to be implemented under this Project is presented in **Table 15.11.1**.

Table 15.11.1: Implementation Schedule

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stage[1] Des	Con	Op	Dec	Relevant Legislation & Guidelines
Air Quality Impact (Construction)									
15.3.6.1		**General Dust Control Measures** Frequent water spraying for active construction areas (12 times a day or once every one hour), including Heavy construction activities such as construction of buildings or roads, drilling, ground excavation, cut and fill operations (i.e., earth moving)	Within WKCD site / Duration of the construction phase / Prior to commencement of operation	Contractor appointed by WKCDA		✓			EIA Recommendation and Air Pollution Control (Construction Dust) Regulation
15.3.6.1		**Best Practice For Dust Control** The relevant best practices for dust control as stipulated in the Air Pollution Control (construction Dust) Regulation should be adopted to further reduce the construction dust impacts from the Project. These best practices include: *Good Site Management* ■ Good site management is important to help reducing potential air quality impact down to an acceptable level. As a general guide, the Contractor should maintain high standard of housekeeping to prevent emission of fugitive dust. Loading, unloading, handling and storage of raw materials, wastes or by-products should be carried out in a manner so as to minimise the release of visible dust emission. Any piles of materials accumulated on or around the work areas should be cleaned up regularly. Cleaning, repair and maintenance of all plant facilities within the work areas should be carried out in a manner minimising generation of fugitive dust emissions. The material should be handled properly to prevent fugitive dust emission before cleaning. *Disturbed Parts of the Roads* ■ Each and every main temporary access should be paved with concrete, bituminous hardcore materials or metal plates and kept clear of dusty materials; or ■ Unpaved parts of the road should be sprayed with water or a dust suppression chemical so as to keep the entire road	Within WKCD site / Duration of the construction phase / Prior to commencement of operation	Contractor appointed by WKCDA		✓			EIA Recommendation and Air Pollution Control (Construction Dust) Regulation

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stage[1] Des	Con	Op	Dec	Relevant Legislation & Guidelines
		surface wet. *Exposed Earth* ■ Exposed earth should be properly treated by compaction, hydroseeding, vegetation planting or seating with latex, vinyl, bitumen within six months after the last construction activity on the site or part of the site where the exposed earth lies. *Loading, Unloading or Transfer of Dusty Materials* ■ All dusty materials should be sprayed with water immediately prior to any loading or transfer operation so as to keep the dusty material wet. *Debris Handling* ■ Any debris should be covered entirely by impervious sheeting or stored in a debris collection area sheltered on the top and the three sides. ■ Before debris is dumped into a chute, water should be sprayed so that it remains wet when it is dumped. *Transport of Dusty Materials* ■ Vehicle used for transporting dusty materials/spoils should be covered with tarpaulin or similar material. The cover should extend over the edges of the sides and tailboards. *Wheel washing* ■ Vehicle wheel washing facilities should be provided at each construction site exit. Immediately before leaving the construction site, every vehicle should be washed to remove any dusty materials from its body and wheels. *Use of vehicles* ■ The speed of the trucks within the site should be controlled to about 10km/hour in order to reduce adverse dust impacts and secure the safe movement around the site. ■ Immediately before leaving the construction site, every vehicle should be washed to remove any dusty materials from its body and wheels. ■ Where a vehicle leaving the construction site is carrying a								

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stage[1] Des	Con	Op	Dec	Relevant Legislation & Guidelines
		load of dusty materials, the load should be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle. *Site hoarding* ■ Where a site boundary adjoins a road, street, service lane or other area accessible to the public, hoarding of not less than 2.4m high from ground level should be provided along the entire length of that portion of the site boundary except for a site entrance or exit.							
15.3.6.1		**Best Practicable Means for Cement Works (Concrete Batching Plant)** The relevant best practices for dust control as stipulated in the Guidance Note on the Best Practicable Means for Cement Works (Concrete Batching Plant) BPM 3/2(93) should be followed and implemented to further reduce the construction dust impacts of the Project. These best practices include: Exhaust from Dust Arrestment Plant ■ Wherever possible the final discharge point from particulate matter arrestment plant, where is not necessary to achieve dispersion from residual pollutants, should be at low level to minimise the effect on the local community in the case of abnormal emissions and to facilitate maintenance and inspection Emission Limits ■ All emissions to air, other than steam or water vapour, shall be colourless and free from persistent mist or smoke Engineering Design/Technical Requirements ■ As a general guidance, the loading, unloading, handling and storage of fuel, raw materials, products, wastes or by-products should be carried out in a manner so as to prevent the release of visible dust and/or other noxious or offensive emissions	Within WKCD site / Duration of the construction phase / Prior to commencement of operation	Contractor appointed by WKCDA		✓			EIA recommendation; Guidance Note on the Best Practicable Means for Cement Works (Concrete Batching Plant) BPM 3/2(93)
Air Quality Impact (Operation)									

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stage[1] Des	Con	Op	Dec	Relevant Legislation & Guidelines
		No mitigation measure is required.							
Noise Impact (Construction)									
15.4.6		**Good Site Practice** Good site practice and noise management can significantly reduce the impact of construction site activities on nearby NSRs. The following package of measures should be followed during each phase of construction: ■ only well-maintained plant to be operated on-site and plant should be serviced regularly during the construction works; ■ machines and plant that may be in intermittent use to be shut down between work periods or should be throttled down to a minimum; ■ plant known to emit noise strongly in one direction, should, where possible, be orientated to direct noise away from the NSRs; ■ mobile plant should be sited as far away from NSRs as possible; and ■ material stockpiles and other structures to be effectively utilised, where practicable, to screen noise from on-site construction activities.	Within WKCD site / During construction phase / Prior to commencement of operation	Contractor appointed by WKCDA		✓			EIAO and Noise Control Ordinance
15.4.6		**Adoption of Quieter PME** The recommended quieter PME adopted in the assessment were taken from EPD's QPME Inventory and "*Sound Power Levels of Other Commonly Used PME*". It should be noted that the silenced PME selected for assessment can be found in Hong Kong.	Within WKCD site / During construction phase / Prior to commencement of operation	Contractor appointed by WKCDA		✓			EIAO and Noise Control Ordinance
15.4.6		**Use of Movable Noise Barriers** Movable noise barriers can be very effective in screening noise from particular items of plant when constructing the Project. Noise barriers located along the active works area close to the noise generating component of a PME could produce at least 10 dB(A) screening for stationary plant and 5 dB(A) for mobile plant provided the direct line of sight between the PME and the NSRs is blocked.	Within WKCD site / During construction phase / Prior to commencement of operation	Contractor appointed by WKCDA		✓			EIAO and Noise Control Ordinance

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stage[1] Des	Con	Op	Dec	Relevant Legislation & Guidelines
15.4.6		**Use of Noise Enclosure/ Acoustic Shed** The use of noise enclosure or acoustic shed is to cover stationary PME such as air compressor and concrete pump. With the adoption of the noise enclosure, the PME could be completely screened, and noise reduction of 15 dB(A) can be achieved according to the EIAO Guidance Note No.9/2010.	Within WKCD site / During construction phase / Prior to commencement of operation	Contractor appointed by WKCDA		✓			EIAO and Noise Control Ordinance
15.4.6		**Use of Noise Insulating Fabric** Noise insulating fabric can also be adopted for certain PME (e.g. drill rig, pilling machine etc). The fabric should be lapped such that there are no openings or gaps on the joints. According to the approved Tsim Sha Tsui Station Northern Subway EIA report (AEIAR-127/2008), a noise reduction of 10 dB(A) can be achieved for the PME lapped with the noise insulating fabric.	Within WKCD site / During construction phase / Prior to commencement of operation	Contractor appointed by WKCDA		✓			EIAO and Noise Control Ordinance
Noise Impact (Operation)									
		No mitigation measure is required.							
Water Quality Impact (Construction)									
15.5.5.1		**Construction site runoff and drainage** The site practices outlined in ProPECC Note PN 1/94 should be followed as far as practicable in order to minimise surface runoff and the chance of erosion. The following measures are recommended to protect water quality and sensitive uses of the coastal area, and when properly implemented should be sufficient to adequately control site discharges so as to avoid water quality impacts: ■ At the start of site establishment, perimeter cut-off drains to direct off-site water around the site should be constructed with internal drainage works and erosion and sedimentation control facilities implemented. Channels, earth bunds or sand bag barriers should be provided on site to direct storm water to silt removal facilities. The design of the temporary on-site drainage system should be undertaken by the WKCDA's Contractor prior to the commencement of construction; ■ Sand/silt removal facilities such as sand/silt traps and sediment basins should be provided to remove sand/silt particles from runoff to meet the requirements of the TM standards under the WPCO. The design of efficient silt	Within WKCD site / Duration of the construction phase / Prior to commencement of operation	Contractor appointed by WKCDA		✓			ProPECC Note PN 1/94

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stage[1] Des	Con	Op	Dec	Relevant Legislation & Guidelines
		removal facilities should be based on the guidelines in Appendix A1 of ProPECC Note PN 1/94. Sizes may vary depending upon the flow rate. The detailed design of the sand/silt traps should be undertaken by the WKCDA's Contractor prior to the commencement of construction. ■ All drainage facilities and erosion and sediment control structures should be regularly inspected and maintained to ensure proper and efficient operation at all times and particularly during rainstorms. Deposited silt and grit should be regularly removed, at the onset of and after each rainstorm to ensure that these facilities are functioning properly at all times. ■ Measures should be taken to minimize the ingress of site drainage into excavations. If excavation of trenches in wet periods is necessary, they should be dug and backfilled in short sections wherever practicable. Water pumped out from foundation excavations should be discharged into storm drains via silt removal facilities. ■ All vehicles and plant should be cleaned before leaving a construction site to ensure no earth, mud, debris and the like is deposited by them on roads. An adequately designed and sited wheel washing facility should be provided at construction site exit where practicable. Wash-water should have sand and silt settled out and removed regularly to ensure the continued efficiency of the process. The section of access road leading to, and exiting from, the wheel-wash bay to the public road should be paved with sufficient backfall toward the wheel-wash bay to prevent vehicle tracking of soil and silty water to public roads and drains. ■ Open stockpiles of construction materials or construction wastes on-site should be covered with tarpaulin or similar fabric during rainstorms. Measures should be taken to prevent the washing away of construction materials, soil, silt or debris into any drainage system. ■ Manholes (including newly constructed ones) should be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris being washed into the							

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stage[1] Des	Con	Op	Dec	Relevant Legislation & Guidelines
		drainage system and stormwater runoff being directed into foul sewers. ■ Precautions should be taken at any time of the year when rainstorms are likely. Actions should be taken when a rainstorm is imminent or forecasted and actions to be taken during or after rainstorms are summarized in Appendix A2 of ProPECC Note PN 1/94. Particular attention should be paid to the control of silty surface runoff during storm events, especially for areas located near steep slopes. ■ Bentonite slurries used in piling or slurry walling should be reconditioned and reused wherever practicable. Temporary enclosed storage locations should be provided on-site for any unused bentonite that needs to be transported away after all the related construction activities are completed. The requirements in ProPECC Note PN 1/94 should be adhered to in the handling and disposal of bentonite slurries.							
15.5.5.1		**Sewage effluent from construction workforce** Temporary sanitary facilities, such as portable chemical toilets, should be employed on-site where necessary to handle sewage from the workforce. A licensed contractor should be employed to provide appropriate and adequate portable toilets and be responsible for appropriate disposal and maintenance.	Within WKCD site / During construction phase / Prior to commencement of operation	Contractor appointed by WKCDA		✓			ProPECC Note PN 1/94
15.5.5.1		**General construction activities** Construction solid waste, debris and refuse generated on-site should be collected, handled and disposed of properly to avoid entering any nearby storm water drain. Stockpiles of cement and other construction materials should be kept covered when not being used. Oils and fuels should only be stored in designated areas which have pollution prevention facilities. To prevent spillage of fuels and solvents to any nearby storm water drain, all fuel tanks and storage areas should be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of the storage capacity of the largest tank. The bund should be drained of rainwater after a rain event.	Within WKCD site / During construction phase / Prior to commencement of operation	Contractor appointed by WKCDA		✓			ProPECC Note PN 1/94

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stage[1] Des	Con	Op	Dec	Relevant Legislation & Guidelines
Water Quality Impact (Operation)									
15.5.5.2		**Road and surface runoff** For operation of the proposed WKCD development and associated local road network, a surface water drainage system would be provided to collect road and surface runoff. It is recommended that the road drainage should be provided with adequately designed silt trap and oil interceptors, as necessary. The design of the operation stage mitigation measures for the proposed WKCD development and associated local road network should take into account the guidelines published in the Practice Note for Professional Persons on Drainage Plans Subject to Comment by the Environmental Protection Department (ProPECC Note PN 5/93) and *Highways Department Guidance Notes RD/GN/035 – Road Pavement Drainage Design*.	Within WKCD site / During operation phase / Throughout operation phase	HyD (for exclusive road drains)			✓		ProPECC Note PN 5/93, *Highways Department Guidance Notes RD/GN/035*
Sewerage and Sewage Treatment Implications (Design)									
		No mitigation measure is required.							
Sewerage and Sewage Treatment Implications (Operation)									
		No mitigation measure is required.							
Waste Management Implications (Construction)									
15.7.4.1		**Good Site Practices** Recommendations for good site practices during the construction activities include: ■ Nomination of an approved person, such as a site manager, to be responsible for good site practices, arrangements for collection and effective disposal to an appropriate facility, of all wastes generated at the site ■ Training of site personnel in proper waste management and chemical handling procedures ■ Provision of sufficient waste disposal points and regular collection of waste ■ Appropriate measures to minimise windblown litter and dust/odour during transportation of waste by either covering	WKCD construction site / Throughout construction stage / Until completion of all construction activities	Contractor appointed by WKCDA		✓			Waste Disposal Ordinance; Waste Disposal (Chemical Wastes) (General) Regulation; and Technical Circular (Works) No. 19/2005 Environmental Management on Construction Site

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stage[1] Des	Con	Op	Dec	Relevant Legislation & Guidelines
		trucks or by transporting wastes in enclosed containers ■ Provision of wheel washing facilities before the trucks leaving the works area so as to minimise dust introduction to public roads ■ Well planned delivery programme for offsite disposal such that adverse environmental impact from transporting the inert or non-inert C&D materials is not anticipated							
15.7.4.1		**Waste Reduction Measures** Recommendations to achieve waste reduction include: ■ Sort inert C&D materials to recover any recyclable portions such as metals ■ Segregation and storage of different types of waste in different containers or skips to enhance reuse or recycling of materials and their proper disposal ■ Encourage collection of recyclable waste such as waste paper and aluminium cans by providing separate labelled bins to enable such waste to be segregated from other general refuse generated by the work force ■ Proper site practices to minimise the potential for damage or contamination of inert C&D materials ■ Plan the use of construction materials carefully to minimise amount of waste generated and avoid unnecessary generation of waste	WKCD construction site / Throughout construction stage / Until completion of all construction activities	Contractor appointed by WKCDA		✓			Waste Disposal Ordinance
15.7.4.1		**Inert and Non-inert C&D Materials** In order to minimise impacts resulting from collection and transportation of inert C&D materials for off-site disposal, the excavated materials should be reused on-site as fill material as far as practicable. In addition, inert C&D materials generated from excavation works could be reused as fill materials in local projects that require public fill for reclamation. ■ The surplus inert C&D materials, if any, will be disposed of at the Government's PFRFs for beneficial use by other projects in Hong Kong. ■ Liaison with the CEDD Public Fill Committee (PFC) on the	WKCD construction site / Throughout construction stage / Until completion of all construction activities	Contractor appointed by WKCDA		✓			Waste Disposal Ordinance ; Technical Circular (Works) No.6/2010 for Trip Ticket System for Disposal of Construction & Demolition Materials; and Technical Circular (Works) No.

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stage[1] Des	Con	Op	Dec	Relevant Legislation & Guidelines
		allocation of space for disposal of the inert C&D materials at PFRF will be initiated. No construction work is allowed to proceed until all issues on management of inert C&D materials have been resolved and all relevant arrangements have been endorsed by the relevant authorities including PFC and EPD. ■ The C&D materials generated from general site clearance should be sorted on site to segregate any inert materials for reuse or disposal of at PFRFs whereas the non-inert materials will be disposed of at the designated landfill site. ■ In order to monitor the disposal of inert and non-inert C&D materials at respectively PFRFs and the designated landfill site, and to control fly-tipping, it is recommended that the Contractor should follow the Technical Circular (Works) No.6/2010 for Trip Ticket System for Disposal of Construction & Demolition Materials issued by Development Bureau. In addition, it is also recommended that the Contractor should prepare and implement a Waste Management Plan detailing their various waste arising and waste management practices in accordance with the relevant requirements of the Technical Circular (Works) No. 19/2005 Environmental Management on Construction Site.							19/2005 Environmental Management on Construction Site
15.7.4.1		**Chemical Waste** If chemical wastes are produced at the construction site, the Contractor will be required to register with the EPD as a chemical waste producer and to follow the guidelines stated in the "Code of Practice on the Packaging Labelling and Storage of Chemical Wastes". Good quality containers compatible with the chemical wastes should be used, and incompatible chemicals should be stored separately. Appropriate labels should be securely attached on each chemical waste container indicating the corresponding chemical characteristics of the chemical waste, such as explosive, flammable, oxidizing, irritant, toxic, harmful, corrosive, etc. The Contractor should use a licensed collector to transport and dispose of the chemical wastes at the approved Chemical Waste Treatment Centre or other licensed recycling facilities, in accordance with the Waste Disposal	WKCD construction site / Throughout construction stage / Until completion of all construction activities	Contractor appointed by WKCDA		✓			Code of Practice on the Packaging Labelling and Storage of Chemical Wastes; Waste Disposal (Chemical Waste) (General) Regulation

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stage[1] Des	Con	Op	Dec	Relevant Legislation & Guidelines
		(Chemical Waste) (General) Regulation. Potential environmental impacts arising from the handling activities (including storage, collection, transportation and disposal of chemical waste) are expected to be minimal with the implementation of appropriate mitigation measures as recommended.							
15.7.4.1		**General Refuse** General refuse should be stored in enclosed bins or compaction units separated from inert C&D materials. A reputable waste collector should be employed by the Contractor to remove general refuse from the site, separately from inert C&D materials. Preferably an enclosed and covered area should be provided to reduce the occurrence of 'wind blown' light material.	WKCD construction site / Throughout construction stage / Until completion of all construction activities	Contractor appointed by WKCDA		✓			Waste Disposal Ordinance and Public Health and Municipal Services Ordinance - Public Cleansing and Prevention of Nuisances Regulation
Waste Management Implications (Operation)									
		No mitigation measure is required.							
Land Contamination (Construction)									
		No mitigation measure is required.							
Land Contamination (Operation)									
		No mitigation measure is required.							
Ecological Impact (Construction)									
		No mitigation measure is required.							
Ecological Impact (Operation)									
		No mitigation measure is required.							
Landscape and Visual Impact (Construction)									
Table 15.10.15 (CM1)		Trees should be retained in situ on site as far as possible. Should tree removal be unavoidable due to construction impacts, trees will be transplanted or felled with reference to the stated criteria in the Tree Removal Applications to be submitted to relevant government departments for approval in accordance to ETWB TCW No. 29/2004 and 3/2006.	WKCD construction site / Throughout construction stage / Until completion of all construction activities	Contractor appointed by WKCDA	✓	✓			ETWB TCW No. 29/2004 and 3/2006

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stage[1] Des	Con	Op	Dec	Relevant Legislation & Guidelines
Table 15.10.15 (CM2)		Compensatory tree planting shall be incorporated to the proposed project and maximize the new tree, shrubs and other vegetation planting to compensate tree felled and vegetation removed. Also, implementation of compensatory planting should be of a ratio not less than 1:1 in terms of quality and quantity within the site.	WKCD Park and public areas / After completion of site formation / Prior to operation stage	Contractor appointed by WKCDA	✓	✓			ETWB TCW No. 3/2006
Table 15.10.15 (CM3)		Buffer trees for screening purposes to soften the hard architectural and engineering structures and facilities.	Alongside superstructures within WKCD / After completion of superstructure construction / Prior to operation stage	Contractor appointed by WKCDA	✓	✓			EIAO-TM
Table 15.10.15 (CM4)		Softscape treatments such as vertical green wall panel /planting of climbing and/or weeping plants, etc, to maximize the green coverage and soften the hard architectural and engineering structures and facilities.	Alongside superstructures within WKCD / After completion of superstructure construction / Prior to operation stage	Contractor appointed by WKCDA	✓	✓			EIAO-TM
Table 15.10.15 (CM7)		Structure, ornamental planting shall be provided along amenity strips to enhance the landscape quality.	Alongside superstructures within WKCD / After completion of superstructure construction / Prior to operation stage	Contractor appointed by WKCDA	✓	✓			EIAO-TM
Table 15.10.15 (CM8)		Landscape design shall be incorporated to engineering structures in order to provide aesthetically pleasing designs.	WKCD structures / After completion of structure construction / Prior to operation stage	Detailed Design Consultant / Contractor appointed by WKCDA	✓	✓			EIAO-TM
Table 15.10.19 (MMCP 1)		Use of decorative screen hoarding/boards	WKCD construction sites / Throughout construction stage / Prior to operation stage	Contractor appointed by WKCDA		✓			ETWB TCW No. 3/2006
Table		Control of night time lighting.	WKCD construction sites	Contractor		✓			EIAO-TM

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stage[1] Des	Con	Op	Dec	Relevant Legislation & Guidelines
15.10.19 (MMCP2)			/ During night time / Throughout construction stage	appointed by WKCDA					
Landscape and Visual Impact (Operation)									
Table 15.10.16 (OM1)		Provide proper planting establishment works, including watering, pruning, weeding, pest control, replacement of dead plant, etc, on the new planting areas to enhance the aesthetic design degree	WKCD open areas / Throughout operation phase / As-needed basis	Landscape Contractor appointed by WKCDA			✓		EIAO-TM
Table 15.10.16 (OM2)		Provision of open space in various forms and at different levels on or above ground, including park, waterfront promenade, piazzas and terrace garden and associated green connection for public enjoyment.	WKCD open areas / Throughout operation phase / As-needed basis	Contractor appointed by WKCDA			✓		EIAO-TM
Table 15.10.20 (MMOP1)		Integrated design of the flyover with the existing flyover located to the west of the Elements	Project site of flyover/ During detailed design stage / Throughout operation phase	Detailed Design Consultant appointed by WKCDA	✓		✓		EIAO-TM
Table 15.10.20 (MMOP2)		Softscape treatments such as climbers are proposed to be incorporated to soften the hard engineering structures and facilities.	Alongside superstructures within WKCD / After completion of superstructure construction / Throughout operation stage	Landscape Contractor appointed by WKCDA			✓		EIAO-TM
Table 15.10.20 (MMOP3)		Compensatory planting in close proximity of the flyover structure	In close proximity of the project site/ After completion of superstructure construction / Throughout operation stage	Landscape Contractor appointed by WKCDA			✓		EIAO-TM
Table 15.10.2		Lighting control measures such as careful considerations for the locations and the angle of the lighting.	WKCD building exterior and open areas / During night time / Throughout	Contractor appointed by WKCDA			✓		EIAO-TM

EIA Ref.	EM&A Ref.	Environmental Protection Measures	Location / Duration of measures / Timing of completion of measures	Implementation Agent	Implementation Stage[1] Des	Con	Op	Dec	Relevant Legislation & Guidelines
0 (MMOP 4)			operation stage						

[1] Des = Design; Con = Construction; Op = Operation; Dec = Decommission