ANNEX I

Environmental Assessment Report

Agreement No. CE 41/2014 (HY)

Boardwalk underneath Island Eastern Corridor – Investigation

土木工程拓展署
Civil Engineering and Development Department
Hong Kong Island and Islands Development Office

Agreement No. CE 41/2014 (HY)
Boardwalk underneath Island Eastern Corridor -
Investigation

Working Paper on Hazard to Life Assessment
(Ref. R22-01)

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1 INTRODUCTION

1.1 Background

1.1.1 In May 2009, the Planning Department commissioned the Hong Kong Island East Harbour-front Study (HKIEHS) to formulate a comprehensive plan for enhancing the Hong Kong Island East harbour front, with a focus on improving connectivity and pedestrian accessibility of the harbour front. As part of the study process, a three-stage public engagement exercise was undertaken to solicit public views on the proposed enhancements and to build consensus on the proposals recommended in the HKIEHS. The HKIEHS was completed in March 2012. Among the various proposed harbour front enhancement initiatives, a pedestrian boardwalk of about 2km long was proposed to be constructed underneath the Island Eastern Corridor (IEC) from Oil Street to Hoi Yu Street to enhance connectivity along the North Point waterfront. The proposed boardwalk was well received by the public during the said public engagement exercise.

1.1.2 In January 2012, the Civil Engineering and Development Department (CEDD) commissioned a topical study on proposed boardwalk underneath the existing IEC structure (Topical Study) to establish preliminary engineering feasibility of the proposal and to assess possible implications of the Protection of the Harbour Ordinance (PHO) (Cap. 531) to facilitate further project planning and implementation.

1.1.3 Based on the findings of the Topical Study, the proposed scheme under the HKIEHS was refined (the Refined Scheme). The proposed boardwalk would be supported by the IEC foundation resting on the existing IEC pile caps. The structural form of the boardwalk may be a steel bridge with cast in-situ concrete deck to minimise the self-weight of the proposed boardwalk.

1.1.4 The HKIEHS identified that the points of access from the inland to the boardwalk should not be separated greater than 800m apart to facilitate operations during emergencies. In the Refined Scheme endorsed by the Task Force on Harbour front Developments on Hong Kong Island of Harbour front Commission (Task Force), the boardwalk would be connected to Oil Street, Tong Shui Road, ex- North Point Estate site and Hoi Yu Street for public access from the Fortress Hill MTR Station, residential buildings near King's Road, North Point MTR Station and Quarry Bay MTR Station respectively.

1.1.5 Views on the provision of cycling facilities alongside the waterfront promenade at the Stage 2 Public Engagement Programme of the HKIEHS were diverse. Requests for cycling facilities was seen not only as a leisure or recreational activity but also as an alternative means of transport were also received during the Stage 3 Public Engagement Programme of the HKIEHS. Later in the Topical Study, only a dis-continuous cycle track was found feasible in the Refined Scheme.

1.1.6 It is noted that while an extensive public engagement exercise was undertaken by the HKIEHS, the need for the boardwalk was only established largely based on community's wish and the recommendation of the boardwalk was not presented to the public in the light of the need of reclamation. Geographically, the proposed boardwalk lies within the statutory limit of Victoria Harbour in which PHO applies.

1.1.7 In the judgement handed down by the Court of Final Appeal (CFA) on 9 January 2004 in respect of the judicial review on the Draft Wan Chai North OZP (No. S/H25/1), the CFA ruled that the presumption against reclamation in the PHO can only be rebutted by establishing an overriding public need for reclamation. The decision that there is an overriding public need for rebutting the presumption against reclamation must be based on cogent and convincing materials (CCM).

1.1.8 At the 14th meeting of the Task Force held on 24 October 2013, CEDD presented a refined boardwalk alignment and its associated constraints, and highlighted legal advice suggesting

that the proposed boardwalk fell within the definition of "reclamation" under the PHO. The Government agreed to take forward the Project to ascertain if the "reclamation" can be justified under PHO.

1.1.9 In the Refined Scheme, with a view to bringing people closer to the water, the section of boardwalk between the planned waterfront open space formed on reclaimed land near Oil Street and Tong Shui Road Pier was recommended to maintain a level of +5.5 mPD approximately with a retractable bridge to allow marine access to the affected waters. A section of the boardwalk was recommended to be connected to the waterfront promenade to be constructed by the developers of the Inland Lot No. 9020 and Inland Lot No. 9027, i.e. ex- North Point Estate site at +4.5mPD approximately. The boardwalk would gradually rise from the waterfront promenade to +9.2 mPD approximately at North Point Vehicular Ferry Pier and further up to +12.5 mPD approximately near North Point Victoria Permanent Pier No. 55, North Point Kodak Pier and North Point (Fire Services Department) Pier to maintain the existing air draft for marine access to the existing piers. After that, the boardwalk would gradually decrease in level until joining the shore at Hoi Yu Street at +5.5 mPD approximately.

1.1.10 The Government committed in fostering a "bicycle-friendly" environment in new towns and new development areas as stated in the Chief Executive's 2014 Policy Address.

1.2 The Assignment

1.2.1 The hazard to life assessment include the following:

i. Identify hazardous scenarios associated with the proposed boardwalk with and without cycle track and then determine a set of relevant scenarios to be included in a Quantitative Risk Assessment (QRA);

ii. Execute a QRA of the set of hazardous scenarios determined in sub-clause (i) above, expressing population risks in both individual and societal terms;

iii. Compare individual and societal risks with the criteria for evaluating hazard to life stipulated in the Hong Kong Government Risk Guidelines; and

iv. Identify and assess practicable and cost-effective risk mitigation measures.

1.3 Scope of Hazard Assessment

1.3.1 In accordance with Clause 6.6.3 of the Study Brief for this Project, hazard assessments are required for the hazardous sources listed in **Table 1-1**.

Table 1-1 Hazardous Sources within the Study Area of this HA

Hazardous Sources	Location	Remarks
North Point Vehicular Ferry Pier	Java Road, North Point	A ferry pier for DG ferries carrying dangerous goods vehicles.
North Point Offtake station, North Point Pigging Station and associated pipeworks	Hoi Yu Street and Hoi Chak Street, North Point	Town gas offtake and pigging stations, and associated intermediate pressure (IP) underground town gas transmission pipelines running along Java Road and Hoi Yu Street.
Petrol-cum-LPG filling station	Java Road, North Point	A petrol-cum-LPG filling station for LPG supply.
Collision by vessel	Various locations along the pedestrian boardwalk	The proposed pedestrian boardwalk underneath the IEC from Oil Street to Hoi Yu Street along the North Point waterfront may experience collision by vessels. Further, the proposed retractable bridge may also experience collision by vessels during operation.

2 RISK ACCEPTABILITY CRITERIA

2.1.1 As set out in Chapter 12 of the Hong Kong Planning and Standard Guidelines (HKPSG)[1], the Hong Kong Risk Guideline (HKRG) comprise two measures is shown as follows:

a) **Individual Risk (IR)**: the maximum level of off-site individual risk should not exceed 1 x 10^{-5} / year, i.e. 1 in 100,000 per year.

b) **Societal Risk (SR)**: The Societal Risk Guideline is expressed in terms of lines plotting the frequency (F) of N or more fatalities in the population from accidents at the facility of concern. The SR Guideline is presented graphically in **Figure 2-1**.

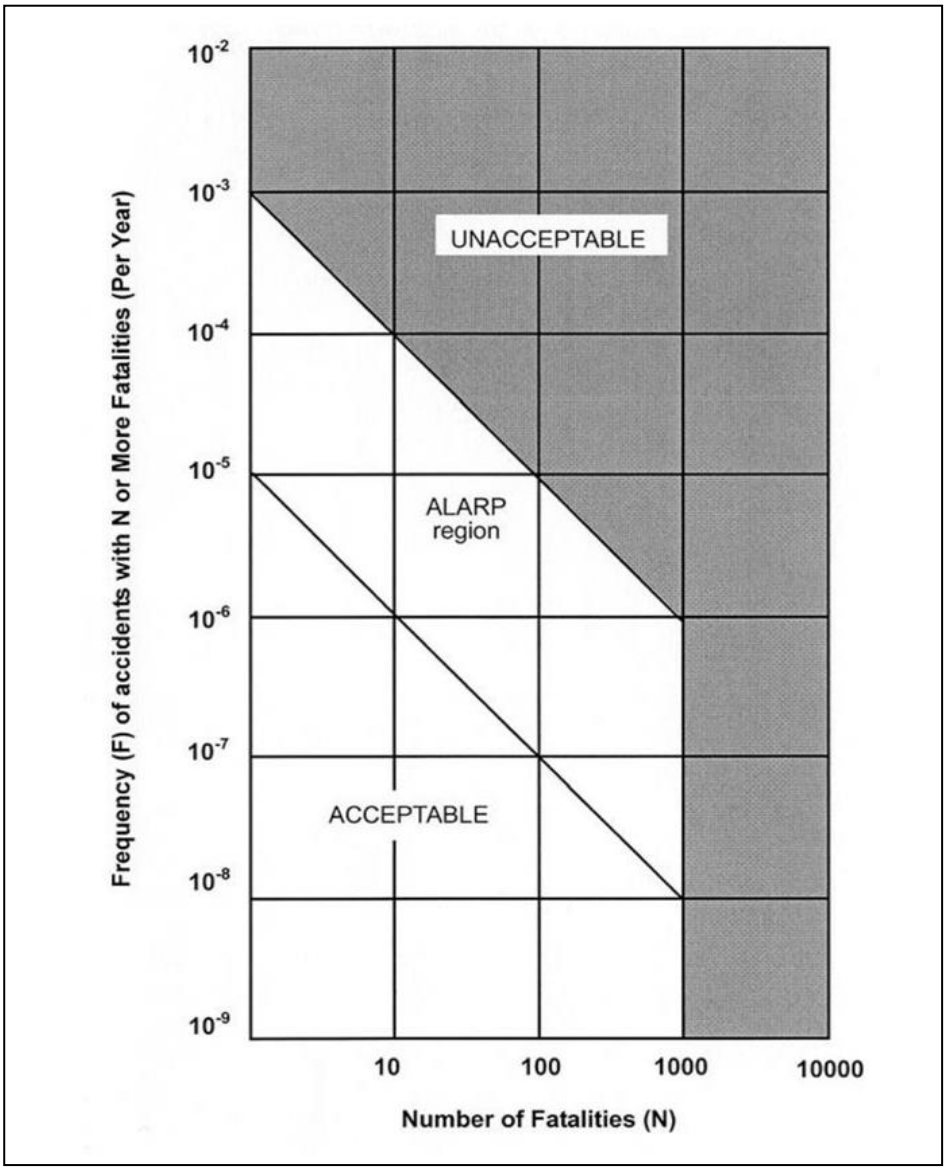

Figure 2-1 Societal Risk Guideline

[1] The Hong Kong Risk Guideline (HKRG) as exhibited in Chapter 12.4 of HKPSG apply to PHI but the guideline is adopted in this study for administrative convenience.

3 HAZARD ASSESSMENT FOR THE NORTH POINT VEHICULAR FERRY PIER (NORTH POINT DGVFP)

3.1 Introduction

3.1.1 The North Point DGVFP is located at Java Road, North Point, **Figure 3-1**. Since vehicles carrying Dangerous Goods (DGs) are prohibited to use any road tunnels or cross-harbours tunnels under the laws of Hong Kong, Road Tunnels (Government) Regulations (Cap 368A), North Point DGVFP provides one of a few transit points for delivery of Dangerous Goods (DGs) from Kowloon.

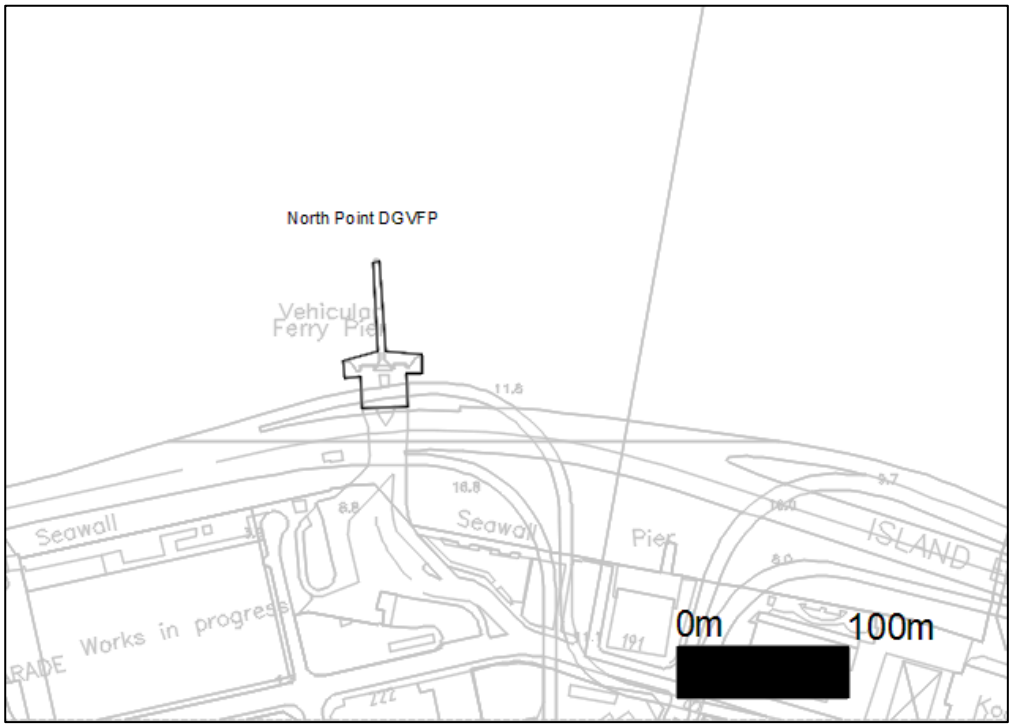

Figure 3-1 Location of North Point DGVFP

3.2 Assessment Approach

3.2.1 The Hazard Assessment (HA) consists of the following six main tasks:

a) **Data / Information Collection and Update**: Collect relevant data / information which are necessary for the hazard assessment.

b) **Hazard Identification**: Identify hazardous scenarios associated with operation of the North Point DGVFP.

c) **Frequency Estimation**: Estimate the frequencies of each hazardous event leading to fatalities with full justification by reviewing historical accident data and previous similar projects.

d) **Consequence Analysis**: Analyse the consequences of the identified hazardous scenarios.

e) **Risk Assessment and Evaluation**: Evaluate the risks associated with the identified hazardous scenarios. The evaluated risks will be compared with the Hong Kong Risk Guidelines (HKRG) to determine their acceptability. Where necessary, risk mitigation measures will be identified and assessed to comply with the “as low as reasonably practicable (ALARP) principle used in the Hong Kong Risk Guidelines.

f) **Identification of Mitigation Measures:** Review the recommended risk mitigation measures from previous studies, practicable and cost-effective risk mitigation measures will be identified and assessed as necessary. Risk outcomes of the mitigated case will then be reassessed to determine the level of risk reduction.

3.2.2 The hazard assessment would cover three (3) assessment scenarios:

- Existing (Year 2016) - It assesses risk impact to the existing population due to the DGVFP and demonstrate the baseline risk level.
- Construction phase (Year 2018) - It assesses risk impact to the planned population and peak construction workforce level due to the DGVFP. Construction activities pose potential damage to the facilities will be addressed and accounted for in the assessment.
- Operation phase (Year 2019 with and without cycle track) – It assesses risk impact to the overall population including the population increase due to the Project during operation phase.

3.3 Details of North Point DGVFP

3.3.1 The North Point DGVFP is operated by the Hongkong and Yaumati Ferry Co. Ltd (the HYF operator). The pier is accessible from Java Road. In general, if a DG vehicle has entered the pier area, the driver will be asked to park at a designated parking slot and wait for boarding. An inspector of the pier records vehicle registration number, number of persons on vehicle and category of dangerous goods on vehicle while the vehicle is waiting for the ferry. Once registration has completed, the inspector would carry out a visual inspection to check if the vehicle and associated facilities are in normal condition. If the vehicle passes the visual inspection, the inspector would then issue a ticket according to the weight and length of the vehicle. Having said that, all DG vehicles leaving the North Point DGVFP are assumed empty with no DGs according to information provided by the HYF operator.

3.3.2 According to the HYF operator, there is no Category 1 (Cat. 1) DGs being delivered via the pier. Apart from CEDD, there are other government departments which may use the DGVFP for the delivery of Cat. 1 DG. As such, similar to the Kai Tak Development (KTD) EIA [10], this Study has made the assumption that only CEDD and Hong Kong Police Force or other disciplinary force of the HKSAR government would use the North Point DGVFP for conveying Cat. 1 explosive. However, the quantity and frequency of explosives deliveries by CEDD would depend on the requirement of blasting sites on Hong Kong Island and based on recent communication with CEDD, no explosives are being delivered via the pier. Nonetheless, CEDD have suggested that the delivery estimations of explosives used in KTD EIA [10] should be adopted in this Study. Further, dangerous goods under the charge of Hong Kong Police Force (HKPF) would not be conveyed via the North Point DGVFP. The reply letters from CEDD and HKPF are attached in **Appendix B**.

3.3.3 For Category 2 (Cat. 2) DGs, there are LPG and chlorine delivery via the North Point DGVFP. According to WSD, since only the Red Hill Water Treatment Works is still currently in use on Hong Kong Island, the delivery frequency of chlorine to Hong Kong Island has dropped significantly (by almost three-folds) compared to the estimated number used in the KTD EIA Study. The reply letter from WSD is attached in **Appendix C.**

3.3.4 There are diesel and petrol delivery via the North Point DGVFP based on the information provided by the HYF operator. Diesel and petrol are Category 5 (Cat. 5) DGs. Full-loaded diesel/petrol road tankers are assumed to be delivered from Kwun Tong DGVFP to North Point DGVFP. After the unloading of fuel oils in Hong Kong Island, the empty road tankers would leave Hong Kong Island via North Point DGVFP.

3.3.5 Based on the information provided by HYF operator and government departments, average utilization of the North Point DGVFP is estimated with breakdown by DGs onboard. Details of the delivery frequencies are tabulated in **Table 3-1**.

Table 3-1 Delivery Frequency of DGs in North Point DGVFP

Types of DG Delivery		Vehicle type	Assumption
Cat 1	Explosive	Explosive truck	for 200kg explosive truck : 56 trucks/year for 800kg explosive truck : 936 trucks/year
Cat 2	LPG	9- ton Road tanker	14 veh/day (daytime) + 3 veh/day (night -time)
Cat 2	LPG	50kg Cylinder	13 veh/day (daytime) + 3 veh/day (night -time)
Cat 5	Petrol	9- ton Tanker	15 veh/day (daytime) + 2 veh/day (night -time)
Cat 5	Diesel	9- ton Tanker	15 veh/day (daytime) + 2 veh/day (night -time)
Cat 2	Chlorine	50kg Cylinder	8 x 50kg cylinders

3.4 Population

3.4.1 Societal risk is a measure of the consequence magnitude and the frequency of the hazardous events. In order to establish the impact of any release (the number of people likely to be affected) in the future, it is necessary to have a good knowledge of the future surrounding population levels. It includes residential population, government and institutional population and transport population, excluding staff operating the North Point DGVFP (as these are considered to be voluntary takers of risk). **Figure 3-2** shows locations of population groups and roads which are included in the assessment.

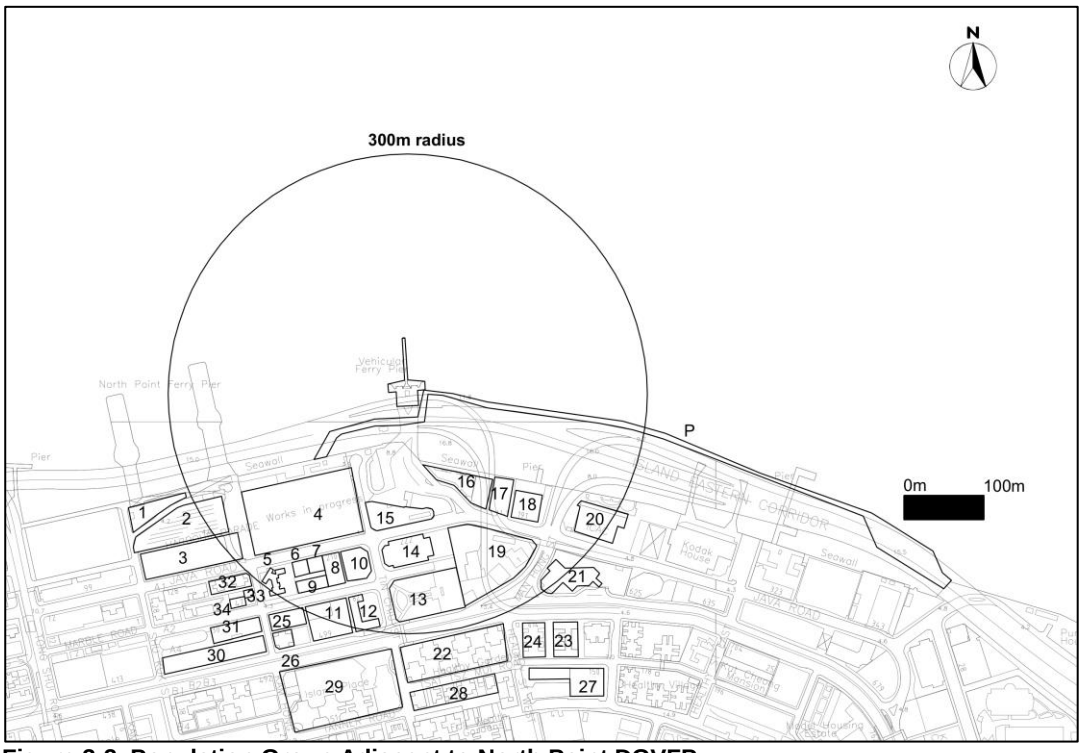

Figure 3-2 Population Group Adjacent to North Point DGVFP

3.4.2 The construction year and commencement year are Year 2018 and Year 2019 respectively. Therefore Year 2018 is taken as the assessment year for the construction phase and Year 2019 is taken as the assessment year for the operation phase. Residential and employment population are estimated based on the observation through site surveys and data from the enhanced 2011-based Territorial Population and Employment Data Matrix (TPEDM) provided by the Planning Department (PlanD), which estimates the population in various areas of Hong Kong in Year 2011 and Year 2021. TPEDM data for household sizes of Year 2016, Year 2018 and Year 2019 are calculated by linear regression between Year 2012 and Year 2021 as shown in **Table 3-2**.

Table 3-2 Estimated Household Size According to TPEDM

PDZ	Household Size				
	2011	2016	2018	2019	2021
23	2.79	2.74	2.73	2.72	2.7
24	2.94	2.88	2.86	2.85	2.83

3.4.3 The population in each area are listed in **Table 3-3**. Details of population at different time modes and information sources are given in **Appendix D**. The following assumptions are adopted:

(a) Four representative time modes are adopted in the assessment to address the variations in population in the study area with time;
(b) 50% and 70% of night-time population is assumed for daytime population on weekdays and weekends for residential buildings respectively;
(c) The household sizes for residential building in PDZ #23 and 24 in different years are adopted as shown in **Table 3-2**;
(d) An average of 5% residential and office populations is taken to be out of doors; and
(e) Population in the proposed boardwalk is estimated based on the development parameters provideded.
(f) For recreational, community and government facilities, no projection is made and current population data is applied to construction phase and operation phase.

Table 3-3 Population around 300 meter from the North Point DGVFP

Location	Description	Land Use	Maximum Population		
			2016	2018	2019
1	North Point Ferry Pier	OU	50	50	50
2	Bus Terminus / North Point Estate Redevelopment T7-T10 [Note 1]	CDA	50	50	848
3	North Point Estate Redevelopment Site / North Point Estate Redevelopment T7- T10 (merge with 2 in year 2019)	CDA	200	200	0
4	North Point Estate Redevelopment Site / North Point Estate Redevelopment T1- T6	CDA	600	600	1060
5	Island Lodge	C/R	505	502	500
6	Kiu Wah Building	C/R	242	240	239
7	Kar Fu Building	C/R	242	240	239
8	North Point Welfare Association	G/IC	30	30	30
9	Hong Lok Building	C/R	225	224	223
10	Tin Chiu Street Playground	G/IC	12	12	12
11	North Point Industrial Building	R(E)	2492	2492	2492
12	Chan's Creative School (Hong Kong Island)	G/IC	943	943	943
13	King's road playground	O	45	45	45
14	Customs Headquarters Building	G/IC	3046	3046	3046

15	Tin Chiu Street Children's Playground	O	20	20	20
16	Sitting Out Area	O	19	19	19
17	Open Car Park	-	11	11	11
18	K. Wah Centre	C	1682	1682	1682
19	North Point Sewage Screening Plant	OU	150	150	150
20	ICAC North Point Headquarters	G/IC	4592	4592	4592
21	WSD Hong Kong Regional Building (Hong Kong & Island Regional Office)	GIC	267	267	267
22	Healthy Gardens	C	3030	3010	3000
23	Elegance House (Block A, B & C)	R(A)	260	258	257
24	Ruby Court	R(A)	254	252	251
25	Wah Lai Mansion	R(A)	576	573	571
26	Tung Po Building	C/R	439	436	435
27	Anne Black General Out-Patient Clinic & North Point Market	G/IC	218	218	218
28	Chaton House, Eternal Building, Siu Wah Building, Welford Court & Siu Bo Mansion	R(A)	1076	1069	1065
29	Island Place	C/R	2152	2138	2131
30	On Ning Building, Chu Kee Building & Kingsfield Mansion	C/R	475	472	470
31	30-52 Marble Road	C/R	549	545	544
32	Ka Wai Building	C/R	823	818	815
33	Yu Wai Mansion	C/R	126	125	125
34	Workingberg Commercial Building	C/R	253	253	253
P1	Proposed Boardwalk (from Tin Chiu St to Hoi Yu St)(without cycle track)	-	0	40	294
P2	Proposed Boardwalk (from Tin Chiu St to Hoi Yu St)(with cycle track)	-	0	40	302

Note 1: Number of flats (702) is adopted from the planning application of North Point Estate Redevelopment (A/H8/719).

Population – Transient (Road and Pedestrian)

3.4.4 Population of other traffic in normal travelling condition is calculated based on the following equation for each type of traffic mix. The reference data source is attached in **Appendix E**.

$$\text{Traffic Population} = \frac{\text{No. of person per vehicle} * \text{No. of vehicles per hr} * \text{Road Length}}{\text{Vehicle speed}}$$

3.4.5 The estimated population on road is presented in **Table 3-4** with the following assumptions:

(a) "The Annual Traffic Census 2014" for Victoria Park Road (from Houston Street to Island Eastern Corridor) is adopted for estimation of vehicle type distribution and corresponding occupancy.

(b) According to information provided in "The Annual Traffic Census 2014" for King's Road (from North Point Road to Tong Shui Road), the percentage of daytime (12-hour basis) and night-time traffic are 65.7% and 34.3% respectively. Therefore, night-time road population assumed is 52% of the daytime population.

(c) Traffic flow of Island Eastern Corridor in Year 2016, 2018 and 2019 are projected from the Year 2014 data with 2.5% annual growth rate which is the annual growth rate in 2013-2014 of Counting Station 1202, which is Island Eastern Corridor from Healthy Street INT western end to Healthy Street INT eastern end.

(d) There are decreases in traffic flow from 2013 to 2014 in other roads in the study area. Growth rate for traffic on these roads are assumed as 0% for conservative.

(e) Traffic speed is 70 km/hr for Island Eastern Corridor, and 50 km/hr for other ramps and roads.

Table 3-4 Road Population within the Study Area

Road	Current (2016)			Future (2018)			Future (2019)		
	Average Daily Traffic Flow (vehicle per day)	Estimated Population		Average Daily Traffic Flow (vehicle per day)	Estimated Population		Average Daily Traffic Flow (vehicle per day)	Estimated Population	
		Day	Night		Day	Night		Day	Night
Java Road	19,170	54	28	19,170	54	28	19,170	54	28
Java Road ramp to IEC	9,585	18	9	9,585	18	9	9,585	18	9
IEC ramp to Java Road	11,594	18	10	12,186	19	10	12,494	20	10
Java Road (2)	6,390	8	4	6,390	8	4	6,390	8	4
IEC (a)	92,754	70	37	97,488	74	39	99,949	76	40
IEC (b)	69,566	90	47	73,116	94	49	74,962	97	51
IEC ramp to Java Road from (a)	9,300	26	13	9,300	26	13	9,300	26	13
Kings Road ramp to IEC (a)	11,340	29	15	11,340	29	15	11,340	29	15
IEC (c)	23,189	24	13	24,372	26	13	24,987	26	14
IEC (d)	57,971	62	32	60,930	65	34	62,468	66	35

3.4.6 Pedestrians are only allowed to walk along Java Road and Java Road (2) as other roads within the study area are either highways or linkage of highway. Pedestrian flow on the pavement along Java Road was estimated by site survey carried out in October 2015. Pavement population was collected and the population density is calculated from:

Pedestrian density (person/m^2) = P/1000/Q/W

Where
P = number of pedestrians passing a given point
W = the pavement width (m)
Q = the pedestrian speed (km/hr) = assumed as 5 km/hr for average walking speed.

3.4.7 The calculated pedestrian density is 0.04 person per m^2.

3.5 Meteorological Data

3.5.1 The meteorological conditions affect the consequence of release and hence risk outcomes, in particular the wind direction, speed and stability, which influences the direction and degree of turbulence of gas dispersion. Latest meteorological data from the Hong Kong Observatory North Point weather station is adopted in this HA.

3.5.2 Meteorological data is required for consequence modelling and risk calculation. Consequence modelling (dispersion modelling) requires wind speed and stability class to determine the degree of turbulent mixing potential whereas risk calculation requires wind-rose frequencies for each combination of wind speed and stability class.

3.5.3 Meteorological data is obtained from North Point Anemometer Station (2014) where wind speed, stability class, weather class and wind direction are available. This data represents the weather conditions for the whole year in 2014 and has already taken into account of seasonal variations, and is therefore considered applicable for this assessment. **Table 3-5** shows the wind speed-stability frequencies.

Table 3-5 Stability Category-Wind Speed Frequencies at North Point Station

Daytime							
Wind Speed (m/s)	**A**	**B**	**C**	**D**	**E**	**F**	**Total (%)**
0.0-1.9	6.63	3.1	0	4.27	0	6.15	20.15
2.0-3.9	2.69	13.42	7.05	10.08	3.72	0.99	37.95
4.0-5.9	0	10.05	9.52	11.93	0.62	0	32.12
6.0-7.9	0	0	1.79	6.5	0	0	8.29
Over 8.0	0	0	0.09	1.4	0	0	1.49
All (%)	9.32	26.57	18.45	34.18	4.34	7.14	100

Night-time							
Wind Speed (m/s)	**A**	**B**	**C**	**D**	**E**	**F**	**Total (%)**
0.0-1.9	0	0	0	0.53	0	35.4	35.93
2.0-3.9	0	0	0	12.98	17.78	4.93	35.69
4.0-5.9	0	0	0	17.02	2.73	0	19.75
6.0-7.9	0	0	0	6.31	0	0	6.31
Over 8.0	0	0	0	2.32	0	0	2.32
All (%)	0	0	0	39.16	20.51	40.33	100

3.5.4 According to **Table 3-5**, 6 combinations (3B, 1D, 4D, 7D, 3E and 1F) and 5 combinations (1D, 4D, 7D, 3E and 1F) of wind speed and stability class are chosen for day-time and night-time meteorological conditions respectively. These combinations of wind speed and stability class are referred as weather classes. These combinations are considered adequate to reflect the full range of observed variations in these quantities. It is not necessary and efficient to consider every combination observed. The principle is to group these combinations into representative weather classes which together cover all conditions observed.

3.5.5 Once the weather classes have been selected, frequencies for each wind direction for each weather class can then be determined. These frequency distributions are given in **Table 3-6** for the day-time and night-time meteorological conditions respectively.

Table 3-6 Weather Class-Wind Direction Frequencies at North Point Station

Daytime							
Direction	**3B**	**1D**	**4D**	**7D**	**3E**	**1F**	**Total**
0 – 30	4.07	1.46	2.73	0.05	0.96	2.11	11.38
30 – 60	1.17	0.07	0.81	0.07	0.48	0.1	2.7
60 – 90	2.47	0.17	3.14	0.48	0.69	0.14	7.09
90 – 120	16.43	0.36	21.37	13.75	2.73	0.41	55.05
120 – 150	0.46	0.1	0.67	0	0.69	0.31	2.23
150 – 180	0.02	0	0	0	0.02	0	0.04
180 – 210	0.14	0	0.02	0	0	0.02	0.18
210 – 240	0.36	0	0.14	0	0.07	0.02	0.59
240 – 270	4.07	0.17	2.32	0.53	0.5	0.22	7.81
270 – 300	5.39	0.14	3.5	1.2	0.69	0.24	11.16
300 – 330	0.22	0.02	0.24	0.02	0.12	0.1	0.72
330 – 360	0.19	0	0.55	0	0.26	0.05	1.05
All	34.99	2.49	35.49	16.1	7.21	3.72	100.00

Night-time						
Direction	**1D**	**4D**	**7D**	**3E**	**1F**	**Total**
0 – 30	0.27	2.37	0.05	3.18	11.49	17.36
30 – 60	0	0.66	0.15	1.78	0.24	2.83
60 – 90	0	2.52	0.39	3.69	1.08	7.68
90 – 120	0	17.63	11.49	15.99	3.45	48.56
120 – 150	0	0.24	0.02	2.79	1.86	4.91
150 – 180	0	0	0	0	0.1	0.1
180 – 210	0	0.02	0	0.07	0.17	0.26
210 – 240	0	0	0	0.34	0.22	0.56
240 – 270	0.07	1.74	0.2	3.81	0.86	6.68
270 – 300	0	3.2	0.12	4.64	1.37	9.33
300 – 330	0	0.02	0.02	0.1	0.2	0.34
330 – 360	0.02	0.42	0.02	0.61	0.32	1.39
All	0.36	28.82	12.46	37	21.36	100

3.6 Hazard Identification

3.6.1 Based on the information provided by the HYF operator and government departments, Cat.1, Cat. 2 and Cat. 5 DGs are currently being delivered using the ferry services.

Properties of Explosives (Cat.1 DG)

3.6.2 Cat. 1 Dangerous Goods includes Blasting Explosives, such as blasting agents, detonators, and Explosive for Industrial and other uses (Non-blasting). The control on the classification, manufacture, storage, conveyance on land, use and destruction of explosives in Hong Kong is under the Dangerous Goods Ordinance (Cap. 295). The control is more stringent than that of many advanced countries such as the United Kingdom, the United States, Canada and Australia, due to the dense population in Hong Kong.

3.6.3 CEDD on behalf of the Government provide storage facilities mainly for blasting explosives and provide delivery service to convey the explosives to and from Government explosives depots, including the delivery of blasting explosives to blast site or Mode A Store. The storage and conveyance of non-blasting explosives are normally arranged by their owners under relevant licences and permits. The CEDD explosives delivery team is responsible for the delivery of explosives. Custom-made vehicles with delegated explosives officers, explosives security guards, motor drivers, under stringent supervision, are responsible for the explosives delivery.

3.6.4 Similar to the KTD EIA Study, it is assumed only CEDD and Hong Kong Police Force or other disciplinary force of the HKSAR government would use the North Point DGVFP for conveying of Cat. 1 explosive. Some Cat.1 explosive are not transported by CEDD, such as non-blasting explosives transported by commercial companies such as gun clubs.

3.6.5 According to HKPF, dangerous goods under the charge of HKPF would not be conveyed via the North Point DGVFP. The HYF operator also verified that no Cat. 1 DG is to be delivered via the pier at the time of enquiry. To be conservative, the assumption of Cat. 1 DG delivery frequency other than CEDD Mines is adopted from KTD EIA Study.

3.6.6 At the time of enquiry, as advised by Mines Division of CEDD, the department would not be using the North Point DGVFP for Cat. 1 DG delivery. However, it is suggested that the assumption of using the pier to deliver explosives 2200 kg (Net Explosives Quantity (NEQ)) per day to Hong Kong Island and the estimation of explosive transport should be adopted from KTD EIA. These are used to estimate the risk of Cat.1 DGs transportation using the pier. The estimation is summarized as **Table 3-7**.

Table 3-7 Estimation of Category 1 DG Transportation using the North Point DGVFP

Type of Cat.1 DGs	Max. Loading per truck	Max. Ferry transit per day	Max. Ferry transit per year
Cartridge explosive, Booster, Detonating Cords, Detonators (delivered by disciplinary forces of the HKSAR government)	200 kg (NEQ)	2	56 Note B
Cartridge explosive, Booster, Detonating Cords, Detonators (delivered by CEDD)	800 kg (NEQ) Note A	3	936 Note C

Note A: (quantity of explosive to be delivered per day) / (max. ferry transit per day) = (2200)/(3) = 800kg
Note B: Adopted from KTD EIA as a conservative assumption.
Note C: (no. of transits per day) * (no. of days per week having delivery) * (no. of weeks per year) = 3*6*52=936

Properties of LPG (Cat. 2)

3.6.7 LPG is a mixture of butane and propane. The gas is twice as heavier than that of air. For a release of LPG, the nature of the combustion will depend on the timing of ignition and the size of the release.

Properties of Chlorine (Cat. 2)

3.6.8 Chlorine is a greenish yellow gas which is 2.5 times as dense as air. It has a critical temperature of 144°C and an atmospheric boiling point of -34°C. It is handled as liquefied gas under amber temperature in saturated liquid form. It is toxic by inhalation, ingestion and through skin contact. Inhalation can cause serious lung damage and may be fatal.

Properties of Fuel Oils (Cat.5)

3.6.9 Diesel, petrol and kerosene are under the Cat. 5 DG. However, petrol is highly flammable among the other two with lowest flashing point -40^{o}C. With flash point well below ambient temperature, petrol forms explosive air/vapour mixture in spillage or leakage. Although diesel and kerosene are also flammable, they have relatively high flashing points, typically>66^{o}C and 38^{o}C respectively, and are ignited only being heated above the flashing points or open flame.

3.6.10 Hazardous events involving the DGVFP are classified into 2 types, transportation and stationary. The first type is due to movement of DG vehicles along access road within the pier area. The second type is due to DG vehicles waiting at queue area for boarding or departure.

Transport Risk

3.6.11 Failure events identified are tabulated in **Table 3-8**. Events for LPG and Petrol/Diesel have also been selected in the approved EIA study of South East Kowloon Development (SEKD) [1].

Table 3-8 Failure Events of Transport Risk

Material	**Vehicle Type**	**Release Description**
Explosive	Explosive Delivery Truck	Fire/Explosion
LPG	Road tanker	BLEVE*
LPG	Road tanker	Cold rupture
LPG	Road tanker	Large (50mm) leak (liquid)
LPG	Road tanker	Large (50mm) leak (vapour)
LPG	Road tanker	Medium (25mm) leak (liquid)
LPG	Cylinder Wagon	Multiple BLEVE
LPG	Cylinder Wagon	Rupture
Petrol/Diesel	Road tanker	Medium (25mm) spill/leak (liquid)
Petrol/Diesel	Road tanker	Large (100mm) spill/leak (liquid)
Petrol/Diesel	Road tanker	Fireball explosion
Petrol/Diesel	Road tanker	Fire
Chlorine	Cylinder / drum truck	Medium (7.5mm) leak (liquid)
Chlorine	Cylinder / drum truck	Medium (7.5mm) leak (vapour)
Chlorine	Cylinder / drum truck	Rupture

Stationary Risk

3.6.12 As failure events for the stationary risk would involve the same vehicle types as in transport risk, events for transport risk are also applied. Apart from those events, hazards associated with the DG vehicles queuing at the DGVPF are tabulated in **Table 3-9**. However, due to the short residence time of vehicles being present at the DGVFP, stationary risk is not assessed further is this study.

Table 3-9 Hazards Associated with DG vehicles Waiting at Queuing Area

Hazard event	Release Description
Spontaneous failure	• LPG/ Petrol/ Diesel road tanker failures • LPG cylinder failure • Chlorine drum/ cylinder failure
External event	• Earthquake • Car crash • Dropped object • Collapse and strike by object • Aircraft crash
Escalation	• BLEVE/ fireball/ explosion due to fire initiated by other DG vehicles • Collapse of building/ structure due to detonation of explosives

Knock-on Effect

3.6.13 The schedule for delivery of explosives can be arranged with the HYF operator such that there will not be other DG vehicles waiting within the premise except for the explosives delivery truck itself implying that there is no knock-on effect of an explosives delivery truck to other DG vehicles and vice versa. Since BLEVE and fireball explosions typically happen in very short period of time, provided that there is an effective Emergency Response Plan in place, evacuation time in case of an emergency should be sufficient. As advised by the HYF operator, vehicles leaving the North Point DGVFP are generally empty with no DGs on their trucks. Therefore, it is not likely that loss of containment of the queuing DG vehicles would result in knock on effect with an explosives delivery truck.

3.6.14 For DG vehicles arriving at the North Point DGVFP, truck drivers would drive through without stopping at the pier. Due to the short duration of vehicles present at the pier, stationary risk will not be assessed further is this study. No knock-on effect will be expected.

3.7 Frequency Estimation

3.7.1 With the potential hazards identified, the likelihood of each hazardous scenario is then determined. Base failure frequencies adopted for Kwun Tong DGVFP in the KTD EIA and SEKD EIA have been reviewed and adopted in this HA to assess the risk to the overall population where appropriate.

3.7.2 Fault Tree Analysis (FTA) permits the hazardous incident ("Significant Failure Events") frequency to be estimated from a logical model of the failure mechanisms of a system. The model is based on the combinations of failures of more basic components, safety systems and human errors. FTA is used for estimating failure frequencies for significant DGs failure events.

3.7.3 FTA is the use of a combination of simple logic gates, "AND" and "OR" gates, to synthesize a failure model of the hazardous installation. The "Significant Failure Events" frequency is calculated from failure data of more simple events.

3.7.4 A basic assumption in FTA is that all failures in a system are binary in nature, a component or operator either performs successfully or fails completely. In addition, the system is assumed to be functioning if all sub-components are operating properly.

3.7.5 The stepwise procedure for undertaking FTA is presented below:

(a) Hazard identification and selection of the "Significant Failure Events"
(b) Construction of fault tree
(c) Quantitative evaluation of the fault tree

3.7.6 **Table 3-10** summarizes the failure frequencies by scenarios.

Table 3-10 Frequency of Failure Events of Transport Risk

DG	Vehicle type	Release Description	Likelihood per vehicle km	Number of movement per year	Length of internal access road (km)	Failure freq. per year
Explosive	Explosive truck (a) Note A	Fire / Explosion	7.69E-10	56	0.196	8.44E-09
Explosive	Explosive truck (b) Note B	Fire / Explosion	7.69E-10	936	0.196	1.41E-07
LPG	Road tanker	BLEVE	2.70E-12	6205	0.196	3.28E-09
		Cold rupture	2.60E-09	6205	0.196	3.16E-06
		Large leak (liquid)	1.80E-08	6205	0.196	2.19E-05
		Large leak (vapor)	2.10E-09	6205	0.196	2.55E-06
		Medium leak (liquid)	6.80E-09	6205	0.196	8.27E-06
LPG	Cylinder	Multiple BLEVE	1.30E-09	5840	0.196	1.49E-06
		Rupture	2.80E-08	5840	0.196	3.20E-05
Petrol	Tanker	Fireball explosion	0.00E+00	6205	0.196	0.00E+00
		Rupture	9.40E-10	6205	0.196	1.14E-06
		Large leak (liquid)	4.40E-11	6205	0.196	5.35E-08
		Medium leak (liquid)	1.90E-10	6205	0.196	2.31E-07
Diesel	Tanker	Fireball explosion	0.00E+00	6205	0.196	0.00E+00
		Rupture	2.40E-10	6205	0.196	2.92E-07
		Large leak (liquid)	1.10E-11	6205	0.196	1.34E-08
		Medium leak (liquid)	4.80E-11	6205	0.196	5.84E-08
Chlorine	Cylinder	Rupture	5.10E-09	8	0.196	8.00E-09
		Medium leak (liquid)	8.20E-09	8	0.196	1.29E-08
		Medium leak (vapor)	7.30E-08	8	0.196	1.14E-07

Note A: explosive delivery by other parties other than CEDD Mines
Note B: explosive delivery by CEDD Mines

3.8 Consequence Assessment

3.8.1 Consequence and impact analysis is conducted to provide a quantitative estimate of the likelihood and number of deaths associated with the range of possible outcomes (i.e. fireball, explosion, jet fire, flash fire etc.) which are resulted from failure cases identified in previous. In this study, PhastRisk 6.7, upgraded version of DNV SAFETI, is used.

Blasting Effect (Explosive)

3.8.2 Several levels of impacts to people may be anticipated due to blasting effects. Sensitive human organs, such as lung and ear, may be directly impacted. Further blasting injuries of human such as displacement of whole body may lead to extensive damage of internal organs by shock wave of explosion. People in the proximity of explosion may also be injured by the collapse of the nearby structures or by the fragment from the containers of the explosive in case of a massive explosion.

3.8.3 To estimate the effect to human due to explosion of explosive, the affected distance of overpressure and heat radiation is calculated and the results are summarized in **Table 3-11**.

3.8.4 Sizes of the fireball and thermal radiation have been modelled based on the Fire Ball Model by Prank P. Lees [4]. The overpressure and the respective probability of fatality have been modelled based on ESTC Blast model of HSE [5].

Fireball model [4]

$$r = 1.75 \times M^{1/3}$$

where r is fireball radius in m

M is mass of TNT explosive in kg

$$\mathrm{E} = \mathrm{Fr} * \mathrm{Qc} / \mathrm{Af}$$

$$\mathrm{t} = 0.3 \times M^{1/3}$$

where E = surface emissive power (kW/m^2)

F_r = fraction of heat radiated, typical value 0.4

A_f = surface area of fireball (m^2)

Q_c = total heat release rate (kW)

t = duration of fireball (s)

$$\mathrm{I} = \mathrm{E} \times t_a \times (\frac{r}{L})^2$$

where I = thermal radiation intensity (kW/m2)

t_a = transmissivity, 0.75 for 70% humidity

L = distance from centre of fireball (m)

Probit equation for thermal radiation of the fireball,

$$\mathrm{Y} = -14.9 + 2.56 \times \ln(\mathrm{t} \times I^{(4/3)})$$

ESTC Indoor Blast model [5]

$log_{10}P = 1.827 - 3.433log_{10}S - 0.853(log_{10}S)^2 + 0.356(log_{10}S)^3$ for $3 < S < 55$

where $S = R/Q^{1/3}$;

P is the probability of death;

R is the range in meters; and

Q is the explosive charge mass in kg (TNT equivalent mass).

ESTC Outdoor Blast model [5]

$$Lo = (e^{(-5.785 \times S + 19.047)})/100$$

For $S \leq 2.5$, Lo = 1

$S \geq 5.3$, Lo = 0

where Lo is the probability of death for population outdoors

$S = R/(M^{1/3})$

R is distance from blast (m)

M is mass of TNT explosive (kg)

Table 3-11 Overpressure, Fireball and Building Collapse Hazard Distances

Quantity of Explosive (NEQ/TNT equivalent)	Consequence	Hazard Distance/ radius (m)	Probability of Fatality
200 kg/ 122 kg	Indoor Overpressure	17	0.62
	Indoor Overpressure	28	0.086
	Indoor Overpressure	46	0.009
	Outdoor Overpressure	13	0.62
	Outdoor Overpressure	14	0.086
	Outdoor Overpressure	16	0.009
	Fireball	9	1
800 kg/ 478 kg	Indoor Overpressure	27	0.62
	Indoor Overpressure	44	0.086
	Indoor Overpressure	76	0.009
	Outdoor Overpressure	20	0.62
	Outdoor Overpressure	23	0.086
	Outdoor Overpressure	26	0.009
	Fireball	14	1

Gas Dispersion

3.8.5 The Unified Dispersion Model (UDM), without rainout effect, of the PhastRisk software is used for the dispersion in non-immediate ignition scenarios. The model takes into account various transition phases, from dense cloud dispersion to buoyant passive gas dispersion, in both instantaneous and continuous releases. Besides, toxic effect has been evaluated using the UDM dispersion model when the cloud reaches population sites for release of gas without ignition.

3.8.6 Upon release of flammable gas, a number of possible outcomes may be occurred depended on whether the gas is ignited immediately or ignited after a period of time. The dispersion characteristics will be influenced by the meteorological conditions and the material properties, such as density, of the released gas.

3.8.7 Fire scenarios of different kinds may be developed in the presence of ignition source in the proximity of gas release. If no ignition source exists, the gas cloud may disperse downwind and be diluted to the concentration below its Lower Flammable Limit (LFL). In this case, no harm effect is anticipated since the gas would become too lean to ignite.

Fireball

3.8.8 A fireball will be formed for immediate ignition of an instantaneous gas release. Fireball is more likely for immediate ignition of instantaneous release from vessels/tankers due to cold catastrophic failure. Instantaneous ignition of a certain mass of fuel (flammable gas/LPG)

results in explosion and fire of hemispherical shape. The principal hazard of fireball arises from thermal radiation. Due to its intensity, its effects are not significantly influenced by weather, wind direction or source of ignition.

BLEVE

3.8.9 A Boiling Liquid Expanding Vapour Explosion (BLEVE) is a sudden rupture due to fire impingement of a vessel, LPG tanks on road tankers or cylinders on LPG wagons, containing liquefied flammable gas under pressure, which results in a fireball as the flashing liquid ignited. For LPG cylinders transport by wagon, cylinders are placed closely with each other or in stacks in the cargo bay. It is possible that multiple cylinders fail at the same time due to cylinder wall weakening and high pressure built up inside the cylinder after the cylinder wagon has been engulfed in fire with flame spreading to the cargo bay.

Jet Fire

3.8.10 A jet fire is typically resulted from ignition of gas/liquid from a pressurised containment. The major concern regarding jet fire is the heat radiation effect generated from the fire.

Flash Fire

3.8.11 A flash fire is the consequence of combustion of gas cloud resulting from delayed ignition. The flammable gas cloud can be ignited at its edge and cause a flash fire of the cloud within the LFL and Upper Flammable Limit (UFL) boundaries. Major hazards from flash fire are thermal radiation and direct flame contact. Since the flash combustion of a gas cloud normally lasts for a short duration, the thermal radiation effect on people near a flash fire is limited. Humans who are encompassed outdoors by the flash fire will be fatally injured. A fatality rate of unity is assumed.

Vapour Cloud Explosion (VCE)

3.8.12 A vapour cloud explosion can occur when a flammable vapour is ignited in a confined or partially confined situation. TNO vapour cloud explosion correlation is used for calculating the consequences of an explosions. The early explosion occurs at the release source and is the most common for instantaneous releases. The late explosions occurs at downstream of releases. The model calculates early and late explosions according to ignition probability. TNT Multi-Energy model is used for detailed consequence analysis which accounts for confinement effect by specifying confined strength and confined volume.

Source Term Modelling

3.8.13 Chlorine is modelled as 50-kg cylinder. Except chlorine, DGs involved in this study are mixtures of hydrocarbons and chemicals. To enable the assessment, simple mixtures or representative component will be used for the risk model building. Assumptions are made as follows:

- LPG is modelled as mixture of propane and n-butane in 30:70 ratios by mass.
- Petrol and diesel/kerosene – are modelled as mixture of low molecular weight hydrocarbons (C5 to C10).

Effect Modelling

3.8.14 Following Probit equations is used to determine lethal doses for various hazard scenarios.

Thermal radiation (TNO) [2]

$$Pr = -36.38 + 2.56\, ln(Q^{1.333} \times t)$$

where Q is the thermal radiation intensity in W/m^2 and t is the exposure time in seconds.

Toxicity for chlorine (TNO, 1992) [3]

$$Pr = -14.3 + ln(C^{2.3} \times t)$$

where C is concentration in mg/m^3 and t is exposure time in minutes

3.9 Risk Assessment

3.9.1 The risks arising from the North Point DGVFP is evaluated in terms of both individual and societal risks.

3.9.2 Individual risk is a measure of the risk to a chosen individual at a particular location. As such, this is evaluated by summing the contributions to that risk across a spectrum of incidents which could occur at a particular location.

3.9.3 Societal risk is a measure of the overall impact of an activity upon the surrounding community. As such, the likelihoods and consequences of the range of incidents postulated for that particular activity are combined to create a cumulative picture of the spectrum of the possible consequences and their frequencies. This is usually presented as an FN curve and the acceptability of the results can be judged against the societal risk criterion under the risk guidelines.

Individual risk

3.9.4 The associated individual risk levels are shown in **Figure 3-3**. Four levels of risk area shown are 1×10^{-6}, 1×10^{-7}, 1×10^{-8} and 1×10^{-9} per year. The risk level is based on 100% occupancy with no allowance made for shelter or escape.

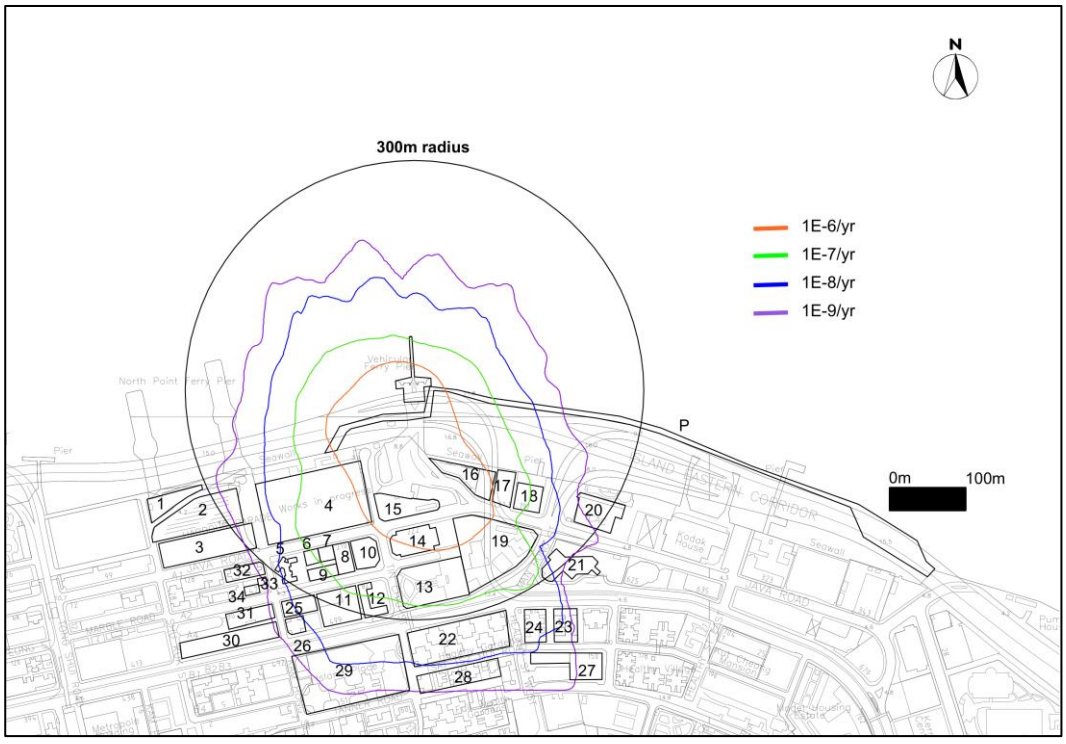

Figure 3-3 Individual Risk Contours of North Point DGVFP

3.9.5 The 1×10^{-6}, 1×10^{-7}, 1×10^{-8} and 1×10^{-9} per year contours extend 120m, 190m, 210m and 270m from the North Point DGVFP, respectively. As observed in the figure, no off-site risk with frequency of 1×10^{-5} per year risk is found. Therefore, no individual would be exposed under risk level greater than 1×10^{-5} per year offsite of the North Point DGVFP.

3.9.6 On this basis, it would appear that the level of individual risk associated with the North Point DGVFP and individual risk imposed to the proposed boardwalk should be acceptable since it meets the Hong Kong Risk Guidelines.

Societal risk

3.9.7 The societal risks are evaluated for the range of incidents with the potential for fatalities in the vicinity of the North Point DGVFP are shown in **Figure 3-4** (Existing and construction phase) and **Figure 3-5** (Operation phase, with and without cycle track). The societal risk is more complex than that for individual risk but, in essence, comprises three regions:

(a) Unacceptable - a region within which the risks may be regarded as unacceptable
(b) Acceptable – a region within which the risks may be regarded as acceptable
(c) ALARP – a region between the two in which measures should be taken to demonstrate the risks as "as low as reasonably practicable" (ALARP). In other words, consideration is given not only to the level of risk but also the cost and practicality of reducing it

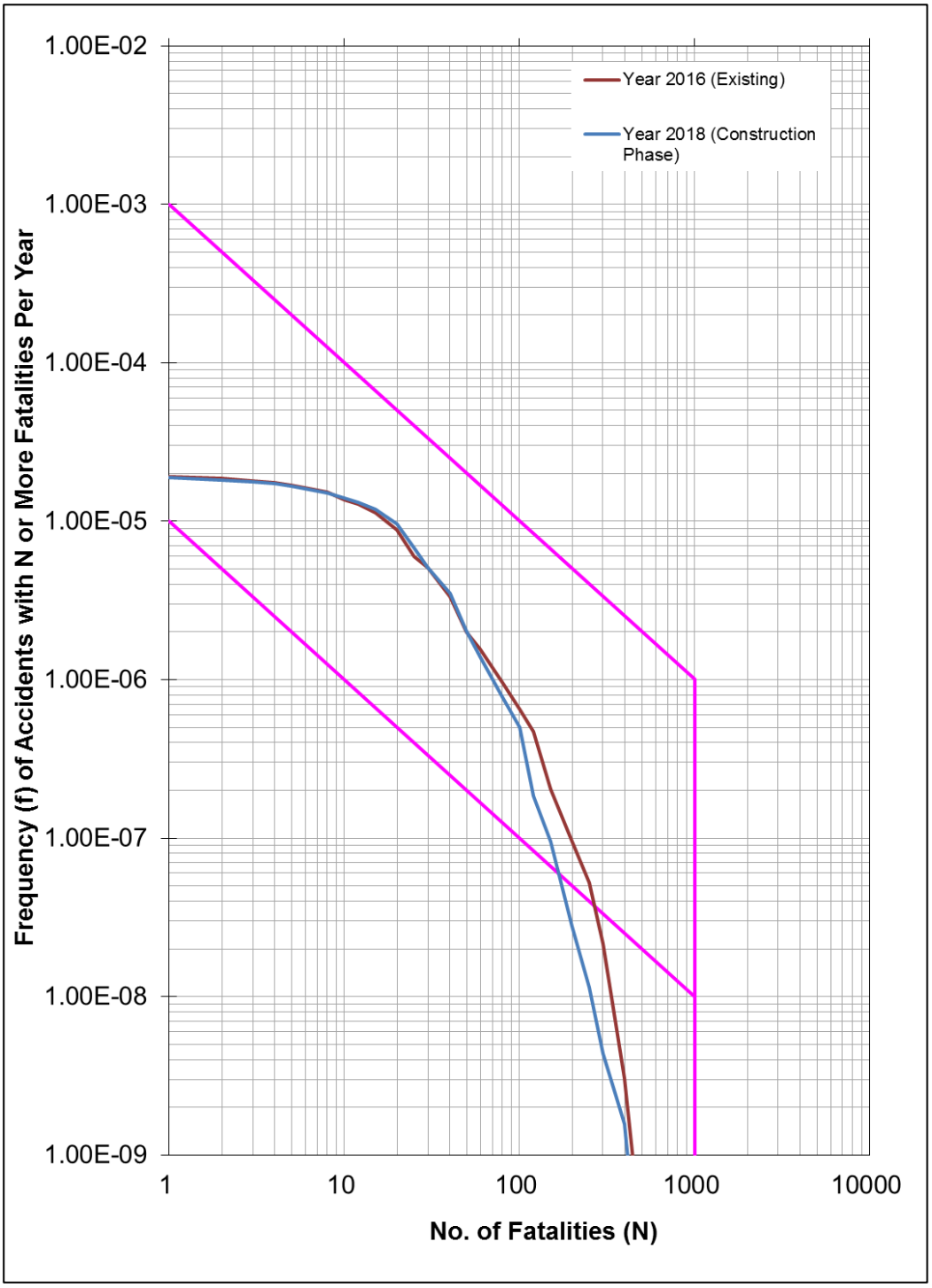

Figure 3-4 FN Curve for North Point DGVFP (Existing and Construction Phase)

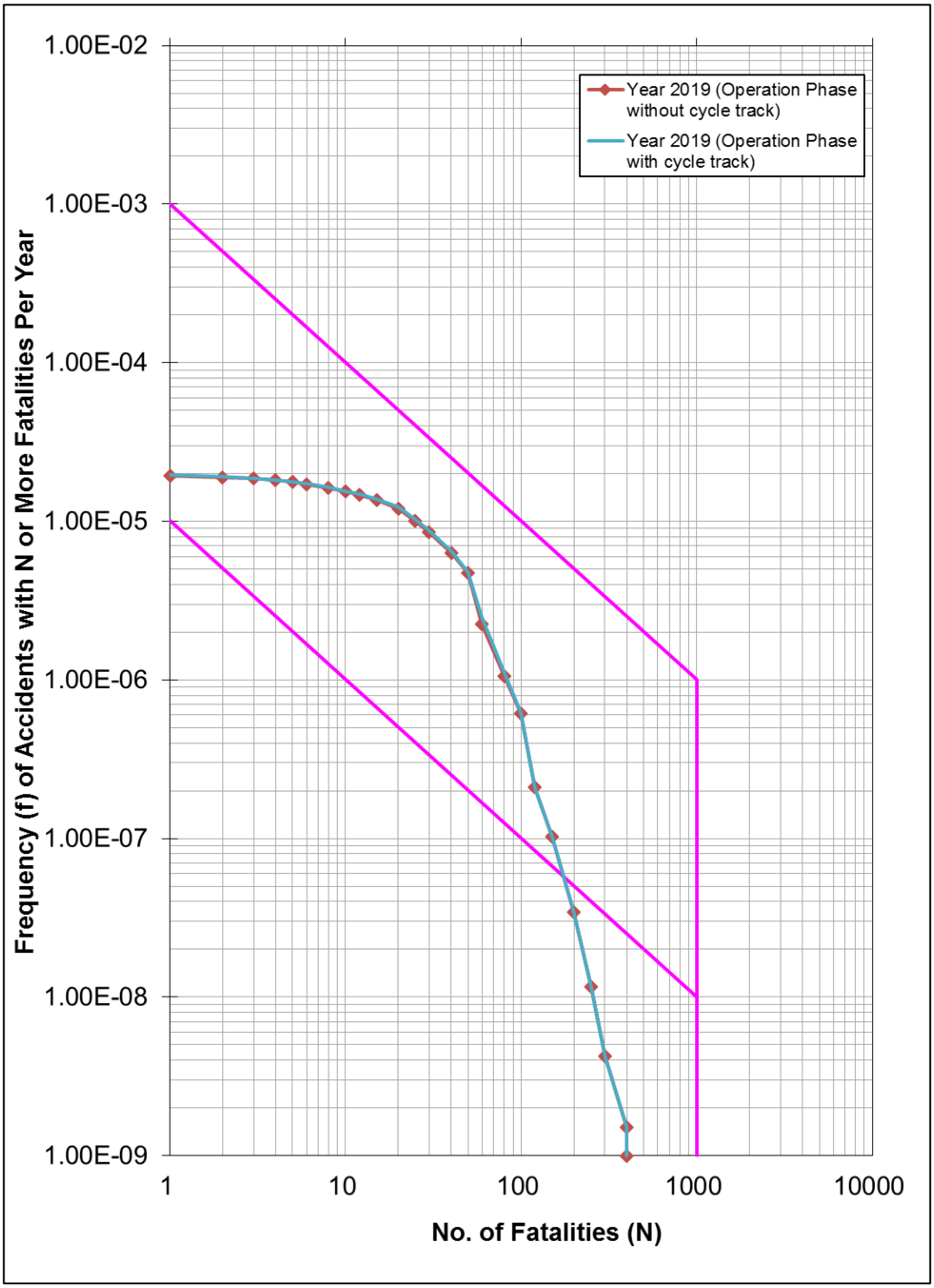

Figure 3-5 FN Curve for North Point DGVFP (Operation Phase)

3.9.8 As shown in **Figure 3-4** and **Figure 3-5**, the societal risk associated with the operation of the North Point DGVFP falls within the "ALARP" region in all scenarios. Data points for the Year 2019 with cycle track and Year 2019 without cycle track are tabulated in **Table 3-12** and **Table 3-13** respectively.

Table 3-12 Societal Risk Data for Operation Phase (Year 2019, with cycle track)

No. Fatalities	Frequency (/year)	No. Fatalities	Frequency (/year)	No. Fatalities	Frequency (/year)
1	1.95E-05	25	1.04E-05	300	4.26E-09
2	1.91E-05	30	8.75E-06	400	1.51E-09
3	1.86E-05	40	6.49E-06		
4	1.82E-05	50	4.80E-06		
5	1.77E-05	60	2.47E-06		
6	1.72E-05	80	1.10E-06		
8	1.64E-05	100	6.24E-07		
10	1.55E-05	120	2.10E-07		
12	1.48E-05	150	1.03E-07		
15	1.37E-05	200	3.43E-08		
20	1.23E-05	250	1.16E-08		

Table 3-13 Societal Risk Data for Operation Phase (Year 2019, without cycle track)

No. Fatalities	Frequency (/year)	No. Fatalities	Frequency (/year)	No. Fatalities	Frequency (/year)
1	1.95E-05	25	1.01E-05	300	4.26E-09
2	1.90E-05	30	8.53E-06	400	1.51E-09
3	1.86E-05	40	6.29E-06		
4	1.81E-05	50	4.71E-06		
5	1.76E-05	60	2.24E-06		
6	1.71E-05	80	1.06E-06		
8	1.63E-05	100	6.14E-07		
10	1.54E-05	120	2.11E-07		
12	1.47E-05	150	1.03E-07		
15	1.37E-05	200	3.43E-08		
20	1.21E-05	250	1.16E-08		

Potential Loss of Life (PLL)

3.9.9 The total PLL and top 4 most significant contributing events for the modelled case at Year 2019 with and without cycle track for the North Point DGVFP are tabulated in **Table 3-14** and **Table 3-15** respectively. Based on the risk model results, LPG road tanker large leak in liquid phase is found to be the main contributor to the overall risk.

Table 3-14 Breakdown of PLL for the North Point DGVFP for Operation Phase (Year 2019, with cycle track)

Event Description	Potential Loss of Life (PLL) / per year	% of Total PLL
LPG Road Tanker Large Leak in Liquid Phase	3.65E-04	56.55
LPG Road Tanker Rupture	1.32E-04	20.48
Multiple BLEVE of LPG Cylinder Wagon	1.23E-04	19.08
LPG Road Tanker Medium Leak in Liquid Phase	2.48E-05	3.83
Others	2.78E-07	0.06
Total	**6.46E-04**	**100**

Table 3-15 Breakdown of PLL for the DGVFP for Operation Phase (Year 2019, without cycle track)

Event Description	Potential Loss of Life (PLL) / per year	% of Total PLL
LPG Road Tanker Large Leak in Liquid Phase	3.58E-04	56.33
LPG Road Tanker Rupture	1.31E-04	20.56
Multiple BLEVE of LPG Cylinder Wagon	1.22E-04	19.25
LPG Road Tanker Medium Leak in Liquid Phase	2.41E-05	3.77
Others	2.75E-07	0.09
Total	**6.35E-04**	**100**

3.10 Conclusion

3.10.1 A full quantitative risk assessment has been carried out for the proposed boardwalk underneath IEC in North Point, which is near the North Point DGVFP located at Java Road, North Point. The assessment is based on information collected from Census & Statistics Department, Hong Kong Observatory, Planning Department, and Transport Department, Civil Engineering and Development Department and site visits made by the Consultant.

3.10.2 The predicted individual risk for the North Point DGVFP complies with the Hong Kong Risk Guidelines as stipulated in HKPSG. The predicted societal risk for North Point DGVFP, taking into account the proposed boardwalk development, is considered acceptable by satisfying the following criteria,

(a) The 1×10^{-5} per year contour for individual risk is not found and the offsite individual risk is below 1×10^{-5} per year;
(b) Societal risk for the DGVFP falls into “ALARP” region. However, the induced population of the boardwalk development does not significantly contribute in the number of fatalities.

3.10.3 Therefore, results of this assessment support that the proposed boardwalk development would not result in unacceptable risks to the overall population around the North Point DGVFP.

3.10.4 For the compliance of Hong Kong Risk Guidelines, it is feasible to allow maximum population 300 on roof deck of DGVFP and the adjacent open space in the Operation Phase (Year 2019) with adequate safety control measures and evacuation plan. However, a detailed assessment may be required when the detailed design is available.

4 HAZARD ASSESSMENT FOR THE RISK LEVEL OF COLLISION BY VESSEL

4.1 Overview

4.1.1 The proposed boardwalk underneath the IEC from Oil Street to Hoi Yu Street along the North Point waterfront may experience collision by vessels. In addition to the proposed boardwalk, there is a proposed retractable bridge on the boardwalk near Block 6, City Garden. To assess the risk due to the collision by vessel, reference is made to the Marine Traffic Risk Assessment for Hong Kong Waters (MARA Study) [7] conducted by Marine Department. Historical incidents review and site survey are also conducted.

4.2 General Approach

4.2.1 The MARA Study has adopted the Formal Safety Assessment methodology for the assessment of risks and control mechanisms. This methodology has five principal steps:

1) Identification of Hazards;
2) Assessment of Risk;
3) Risk Control Options;
4) Cost Benefit Assessment; and
5) Recommendations

4.2.2 Similar to the MARA Study, the following data have been collected by site survey and desktop review, including:

- Vessel History Incident Record;
- Vessel Type Record; and
- Vessel Distribution Record

Vessel Collision History Record

4.2.3 The principal hazard posed by marine traffic is the potential for collision between vessel and the proposed boardwalk. The consequences of collision incidents within the HKSAR waters has been summarised in **Table 4-1**.

Table 4-1 Consequence of Vessel Collisions (within HKSAR waters)

Incident		**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Average**
Total number of incidents [11]		361	278	323	331	329	351	311	302	358	319	326
Collision / Contact	Incident	253	181	206	201	217	252	183	192	196	188	207
	Injury	7	20	38	34	28	97	126	153	47	26	58
	Fatality	1	1	18	1	8	1	39	6	0	0	8
Collision/Incidents		0.70	0.65	0.64	0.61	0.66	0.72	0.59	0.64	0.55	0.59	0.63
Injury/Collision or Contact		0.03	0.11	0.18	0.17	0.13	0.38	0.69	0.80	0.24	0.14	0.28
Fatality/Collision or Contact		0.00	0.01	0.09	0.00	0.04	0.00	0.21	0.03	0.00	0.00	0.04

4.2.4 It is identified that, on average the injury rate is 28% with a fatality rate per collision of 4% within Hong Kong waters.

Vessel Type Record

4.2.5 Survey was undertaken on 27th October 2015 in 4 locations (as shown in **Figure 4-1**). Vessels identified in the surveys were categorised into 17 classes for the purposes of

analysis, **Figure 4-2** to **Figure 4-5** illustrates a summary of all activity recorded (distribution of vessel classes) during the site survey.

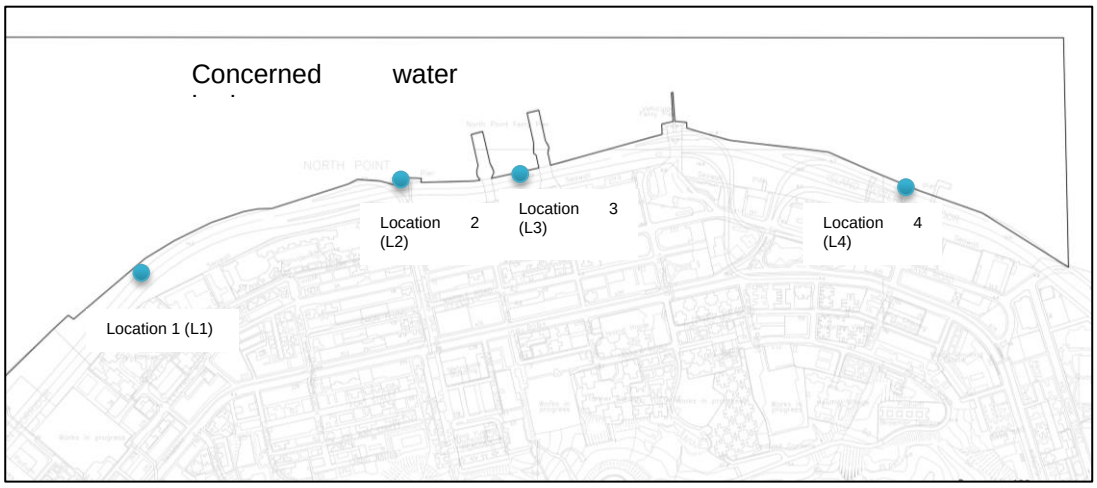

Figure 4-1 Survey Locations

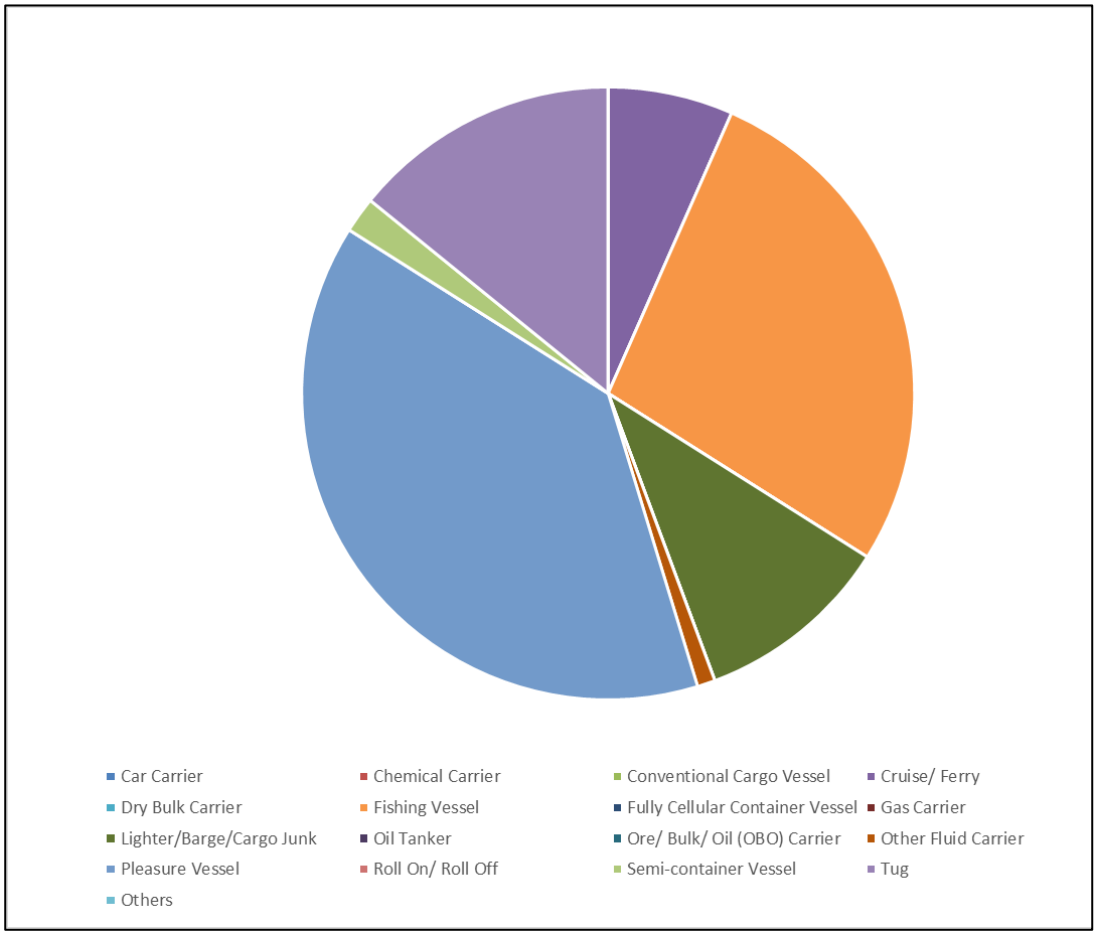

Figure 4-2 Distribution of vessel classes at Location 1

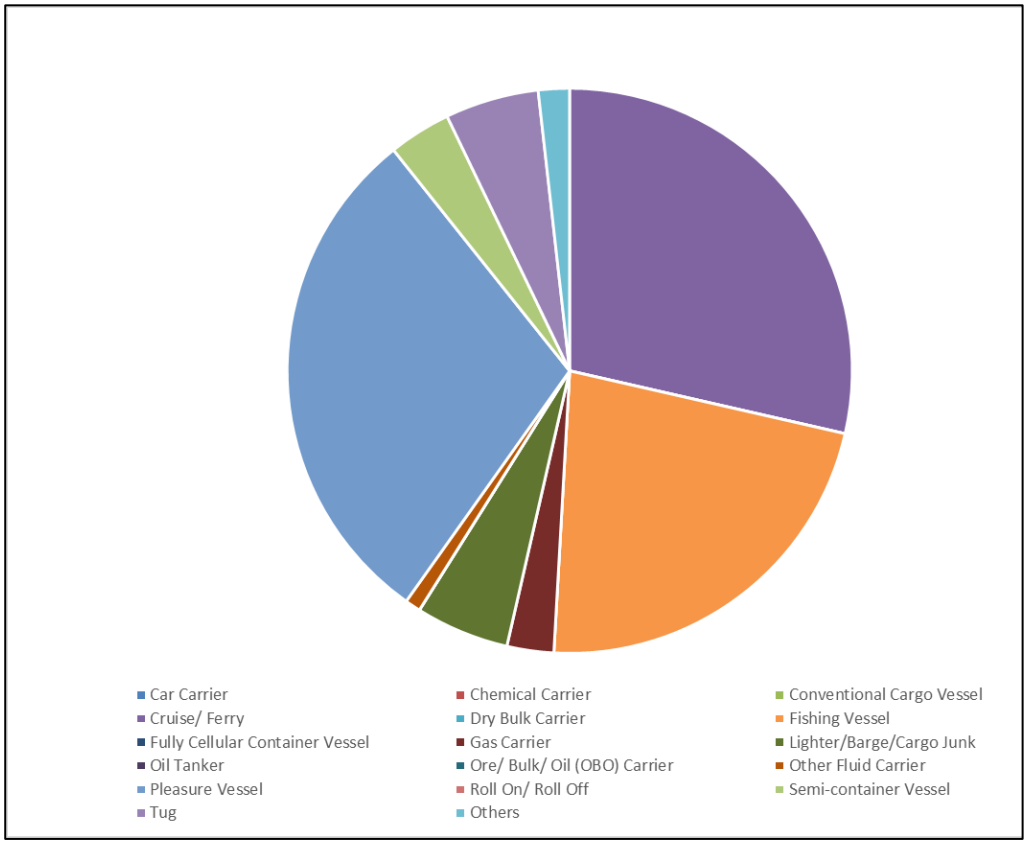

Figure 4-3 Distribution of vessel classes at Location 2

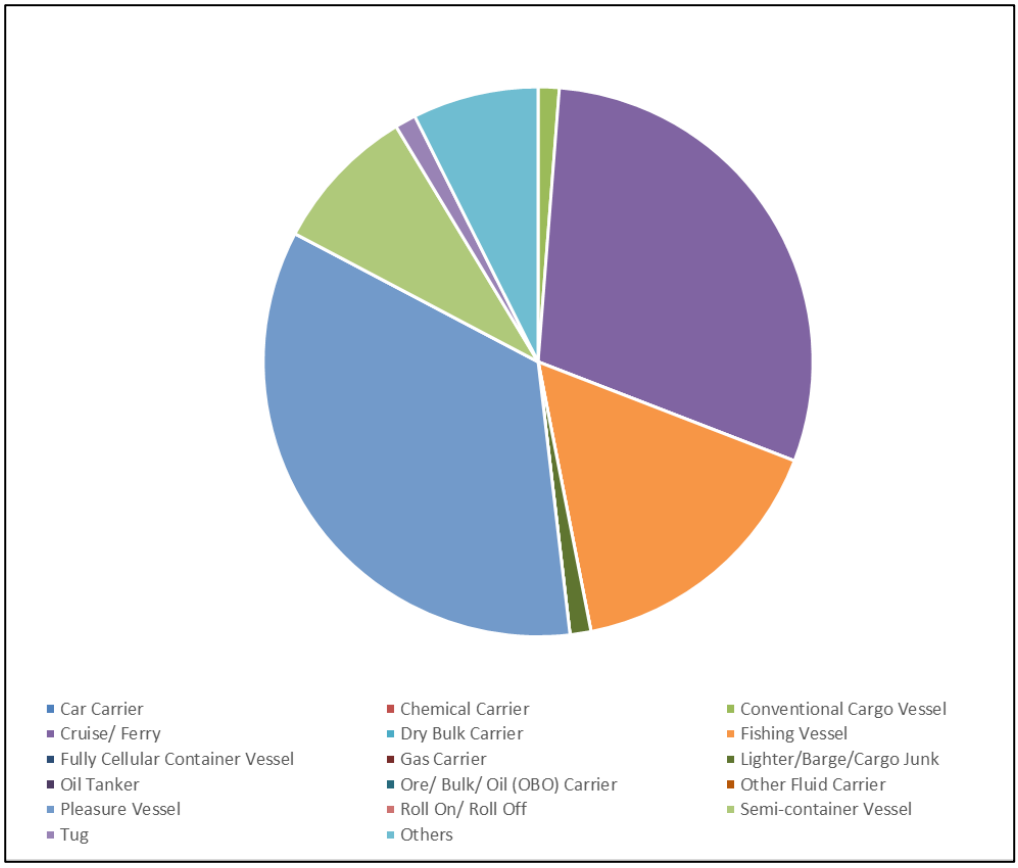

Figure 4-4 Distribution of vessel classes at Location 3

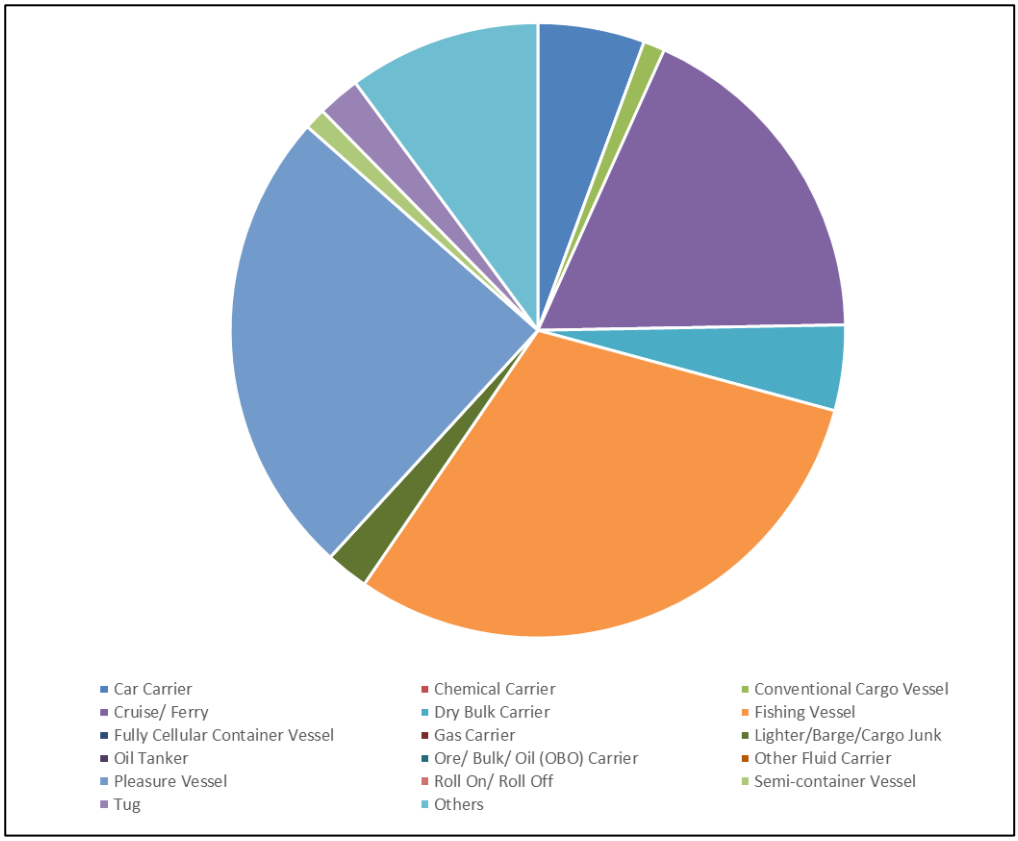

Figure 4-5 Distribution of vessel classes at Location 4

4.2.6 As shown in the above figures, it is identified that the dominant vessel types passing the concerned water body are pleasure vessels, fishing vessels and cruise/ferries.

Vessel Distribution Record

4.2.7 It is shown that the proposed boardwalk is to be rested on the existing pile caps and dolphins of the IEC. Based on the observations from site survey and the nautical chart, only vessels with low tonnage were seen to pass within the area 200m from the proposed boardwalk.

4.2.8 Ferries to the North Point Ferry Pier also operate in close proximity to the proposed boardwalk. As observed during the site survey, they essentially travelled across with extra cautions in slow speed when they were approaching North Point Ferry Pier. It is therefore reasonable to deduce that the collision/contact by ferries to the proposed boardwalk will not cause serious damages leading to severe injuries or fatalities.

4.3 Hazard Identification and Risk Assessment

Collision between a Vessel and the Proposed Boardwalk

4.3.1 The main hazard considered is a vessel crashes into the proposed boardwalk causing injuries or fatalities on either the vessel or the boardwalk or both.

4.3.2 The average annual distribution of all reported marine incidents, (developed from data for 2001 to 2003), are concentrated at Yau Ma Tei, South West of Tsing Yi Island, the Western Harbour and Tuen Mun as shown in the MARA Report. Referring to the MARA Report, it is believed that in general the risk environment of HKSAR waters is anticipated to remain relatively static over the next decade (after 2003), and has the potential to fall if safety improvements are realised. The Central Harbour and Yau Ma Tei areas maintain the focus

of port activity and will experience the largest proportion of all incidents; while risks at Ma Wan, Western Harbour and Southern Approaches are not anticipated to rise significantly. The proposed boardwalk is not located close to the Central Harbour or Yau Ma Tei areas and therefore is not likely to experience high probability of incidents.

4.3.3 From the data for 2006 to 2015, it can be noted that almost 63% of all accident recorded were collisions or contacts, and the value stated in MARA Study for the period 2001 – 2003 was 70%. Among the 70% of the accidents during 2001 to 2003, more than 40% of the collisions were dominated by 500 to 1599 Gross Registered Tonnage (GRT), 25% were dominated by 60 to 299 GRT. The most dominant vessel types identified during site surveys carried out by the Consultant are pleasure vessel, fishing vessel and cruise/ferry, which are usually vessels with low GRT and contributed less than 20% of the total collision.

4.3.4 The marine incidents were reviewed and it was identified that, on average the injury rate was 28% with a fatality rate per collision of 4% within Hong Kong waters. Since only vessels with low tonnage would travel in close proximity to the proposed boardwalk, the injury rate and fatality rate are thus considered to be significantly lower than the average injury rates within Hong Kong waters.

Risks due to the Operation of the Proposed Retractable Bridge

4.3.5 Beside the hazard of collision between vessel and the proposed boardwalk, there is also the potential collision between the vessel and the proposed retractable bridge during its operation. The main purpose of the retractable bridge is to allow emergency rescue and maintenance of the inner harbour area adjacent to the seawall. Therefore the retractable bridge will only be opened during maintenance and rescue service.

4.3.6 Since the retractable bridge is part of the structure of the bridge, the probability of the vessel crashes into the retractable bridge is assumed to be the same as the proposed boardwalk. Therefore, the failure of the retractable bridge may be considered as a potential hazard. **Sections 4.3.7** to **4.3.13** details an examination of the said retractable bridge.

4.3.7 The average number of bridge failures was approximately 1/4700 annually [15]. A desktop review is conducted. It is shown that among the 194 bridge failure incidents occurred between pre-1900 to 21st century, there is a total of 12 incidents related to movable bridge (approximately 6%). Therefore, the failure frequency of a movable bridge is 1/4700*6% = 1.28E-5/yr. The historical incidents are summarized in **Table 4-2**.

4.3.8 For this Study, in view of FSD's request, the proposed retractable (movable) bridge should be provided at a strategic location of the boardwalk for fireboat to access and carry out marine rescue operation in the vicinity of the North Point seafront areas. Considering the limited headroom bounded by the existing IEC viaduct deck, a folding bridge similar to the Hörn Bridge at Kiel, Germany (as shown **Figure 4-6**) would be a possible solution to be considered for further exploration.

Figure 4-6 Hörn Bridge at Kiel, Germany

4.3.9 A notable variation for the current bridge design may be folding modules at both piers will be implemented to complete the span while the Hörn Bridge acquired only a single-side folding form. The conceptual design for the proposed retractable bridge is illustrated in **Appendix G.**

Table 4-2 Historical incidents associated with movable bridge

Bridge	Type of Movable Bridge	Year	Location	Incident	Casualties	Damages
Rialto Bridge	Wooden structure with central drawbridge.	1444	Venice, Italy	Overload by spectators during a wedding	Unknown	Bridge total damage
Saalebrücke bei Mönchen-Nienburg	Chain-stayed bridge with small bascule section	1825	Nienburg, Saxony-Anhalt, Germany	Poor materials, unbalanced load and vibrations by subjects singing to honour the duke	55 drowned or frozen to death	Bridge half damaged, other side demolished
Portage Canal Swing Bridge	Steel swing bridge	1905	Houghton, Michigan, US	Swing span struck by the steamer Northern Wave.	0	Swing span rebuilt.
Appomattox River Drawbridge	Drawbridge	1935	Hopewell, Virginia, US	Bus drove across the drawbridge when it was open.	14 killed	Little damage on the bus
Chesapeake City Bridge	Road bridge, vertical lift drawbridge	1942	Chesapeake City, Maryland, US	Tanker Franz Klasen rammed the movable bridge supports, causing collapse	Unknown	Central span completely destroyed
Heiligenstedten Bascule Bridge	Road bridge	1966	Heiligenstedten, Germany	Ship collision	0	Bridge Rebuilt
Sidney Lanier Bridge	Vertical Lift Bridge	1972	Brunswick, Georgia, US	Struck by the freighter African Neptune	10 deaths, multiple injuries	Several spans knocked out
Welland Canal Bridge No. 12	Vertical lift bridge	1974	Port Robinson, Ontario, Canada	Struck by the ore carrier Steelton	0 killed, 2 injured	Bridge declared a loss; new tunnel or bridge rebuilding costs were found to be unjustified.
Benjamin Harrison Memorial Bridge	Lift bridge	1977	Hopewell, Virginia, US	An ocean-going tanker ship, the 5,700 ton, 523-ft long Marine Floridian struck the bridge collapsing a section of the bridge.	0 killed, minor injuries	Section of bridge destroyed

Green Island Bridge	Lift bridge	1977	Troy, New York, US	Flooding undermined the lift span pier resulting in the western lift tower and roadbed span of the bridge collapsing into the Hudson River.	0	Bridge destroyed
Walnut Street Bridge	Truss bridge	1996	Harrisburg, Pennsylvania, US	As a result of rising flood waters and ice floe from the North American blizzard of 1996, when high floodwaters and a large ice floe lifted the spans off their foundations and swept them down the river.	0	Lost two of its seven western spans, A third span was damaged and later collapsed into the river.
Queen Juliana Bridge	Steel bascule bridge	2015	Willemstad, Curaçao	Crane collapse during lift of bridge span.	20 injuries	Bridge span crashed into buildings.

4.3.10 During a collision, different levels of consequence severity may be resulted to the population of the proposed retractable bridge, including pedestrians on the proposed boardwalk and the crew members on the command boat / rescue vessel.

4.3.11 The design of the proposed retractable bridge is assumed to be carried out in accordance with the international design codes. Some design measures will be implemented the whole section of the proposed boardwalk such as the erection of warning signs during typhoon season. There is also a suggestion to install CCTV for monitoring purposes. Automated warning signals and gates will be activated to stop public access during FSD's rescue operations. The proposed boardwalk will be closed during the operation of the proposed retractable bridge. As a result, it is not likely to have people presence when the retractable bridge is under operation.

4.3.12 When the command boat of FSD is approaching the retractable bridge, they operate with cautions in slow speed. So even under the circumstances that the retractable bridge fails to open, the collision/contact by the command boat is not expected to cause serious damage to the retractable bridge leading to severe off-site injuries or fatalities.

4.3.13 Since the length of the proposed retractable bridge will be approximate 15m for each folding deck, the affected distance would not be more than 15m radius during the potential collapse of the retractable bridge. It is also observed that there are no structures/buildings within 15m radius of the retractable bridge as such the incident where the bridge span crashed into buildings (2015 Queen Juliana Bridge incident as listed in **Table 4-2**) causing multiple injuries is considered not probable.

4.3.14 From previous incidents, it is observed that time plays a key role of the collapse progression. If the Authority is notified of bridge failure in time with sufficient details and necessary emergency procedures are activated (e.g. closing of pedestrian boardwalk, etc.), catastrophic outcomes resulting from the bridge collapse can then be avoided.

4.3.15 Based on the above analysis and findings, it can be concluded that the impact from the collision between vessels and the proposed retractable bridge and related bridge failures does not appear to be insurmountable with appropriate control measures as below:

- Design of the proposed retractable bridge out in accordance with the international design codes;
- Erection of warning signs during typhoon season;
- Installation of CCTV for monitoring purposes;
- Automated warning signals ; and
- Activation of automated gates to stop public access during FSD's rescue operations.

4.4 Conclusion

4.4.1 The Final Report of Hong Kong Island East Harbour-front Study [16] provided an historical review of vessels striking the present IEC support structures and subsequently the possible consequence risk of impacts on the proposed boardwalk was investigated. The review concluded that the probability of vessel crashing into the boardwalk is relatively low and installation of safety enhancement such as marine lighting and illumination lights on the boardwalk could further improve the overall safety.

4.4.2 Similarly, combining the survey data and results from the MARA Study, it can be concluded that since the proposed boardwalk will not be located at the waters with proportionately large number of incidents and the dominant vessel types passing the concerned water body are pleasure vessel, fishing vessel and cruise/ferry which is not likely to cause serious collision or damage to the proposed boardwalk. In design aspect of the proposed boardwalk, for the possibility of impact from small vessels onto the span of the boardwalk, a 50kN impact load should be designed in accordance with Part 8 of BS6349. As a result, the risk due collision by vessels is considered insignificant.

4.4.3 Since the retractable bridge is part of the structure of the bridge, the probability of the retractable bridge being crashed is assumed to be the same of that of the proposed boardwalk. The frequency of movable bridge failure is 1.28E-5 / yr. With the designs and the safety features that will be adopted, the risk due to the collision between vessel and proposed retractable bridge and the bridge failure are considered insignificant.

5 REVIEWS ON OTHER HAZARDOUS SOURCES IN VICINITY OF THE PROPOSED BOARDWALK

5.1 The North Point Pigging and Offtake Station with Associated Pipeworks

5.1.1 The Hong Kong and China Gas Company (HKCG) is responsible for the supply of town gas to North Point. Town gas is produced from naphtha and natural gas at To Kwa Wan Gas Plant and supplied through a network of intermediate pressure submarine pipelines (IPB, 7 bar) to North Point. The gas in the submarine pipeline enters the intermediate or medium pressure pipeline via North Point Offtake Station after passing the North Point Pigging Station. According to HKCG, there are two live submarine pipelines from To Kwa Wan to North Point and two reserved submarine pipelines from Ma Tau Kok to North Point. The characteristics of town gas are summarized in **Table 5-1** below.

Table 5-1 Town Gas Characteristics

Chemical Composition	**%**
Carbon Dioxide	16.3% - 19.9%
Carbon Monoxide	1.0% - 3.1%
Methane	28.8% - 30.7%
Hydrogen	46.3% - 51.8%
Nitrogen and Oxygen	0% - 3.3%

Physical Composition	
Calorific Value	17.27 MJ/m3
Specific Gravity	0.52
Wobbe Index	24
Weaver Flame Speed	35

5.1.2 The pipeline network located in the vicinity of the proposed boardwalk include IPB pipeline, one gas pigging station and one offtake station. The landing point for the two 450mm diameter submarine gas pipeline, the pigging station, the offtake station and the associated pipework situated at a seafront site at Hoi Yu Street and along Java Road as shown in **Figure 5-1**.

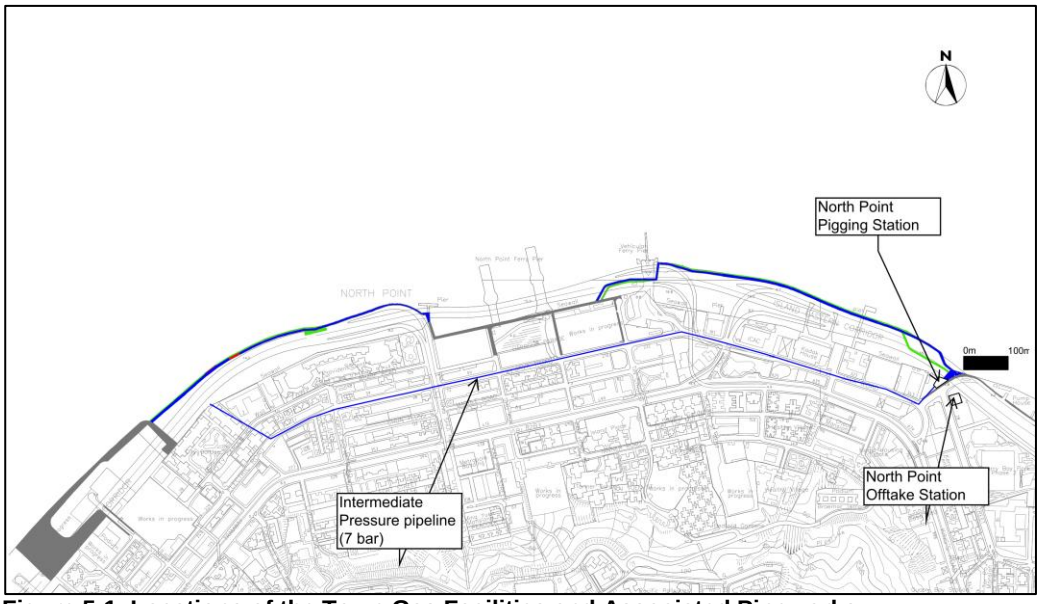

Figure 5-1 Locations of the Town Gas Facilities and Associated Pipeworks

5.2 Review of Hazards to the Town Gas Facilities and Associated Pipeworks during Construction Stage

5.2.1 It is an international practice that pipelines operating with at pressures less than 7 barg (ie intermediate pressure, medium pressure and low pressure) are permitted to be laid in urban areas. It is considered that the risk from these low pressure pipelines is acceptable according to the individual and societal risk criteria of the HKRG.

5.2.2 The design and operating pressures of the submarine pipelines and the pigging and offtake station are 7 barg therefore the risk is considered acceptable. Also, the design parameters for the intermediate pressure pipelines in HK are more stringent and in accordance with the international design codes [12,13]. Therefore, a quantitative risk assessment would not be required for this case.

5.2.3 During the design and construction stage of the project, the HKCG should be consulted regarding the location of the existing and planned underground gas pipelines/ gas installations in the vicinity of the working area.

5.2.4 Reference should also be made to the Code of Practice on Avoiding Danger from Gas Pipes of the Electrical and Mechanical Services Department [14]. The general requirements for construction works adjacent to existing gas station and in the vicinity of gas main from HKCG should be followed. The general requirements are attached at **Appendix F**.

5.3 The Petrol-cum-LPG filling station

5.3.1 The existing Feoso Petrol-cum-LPG filling station (the LPG Filling Station) is located between ICAC Headquarters Building and Kodak House Phase 2 at Java Road, North Point (as shown in **Figure 5-2**). As the construction of the boardwalk underneath Island Eastern Corridor would not induce a substantial increase of resident population in the vicinity of the petrol-cum-LPG filling station at Java Road, North Point, a quantitative risk assessment would not be required for this case.

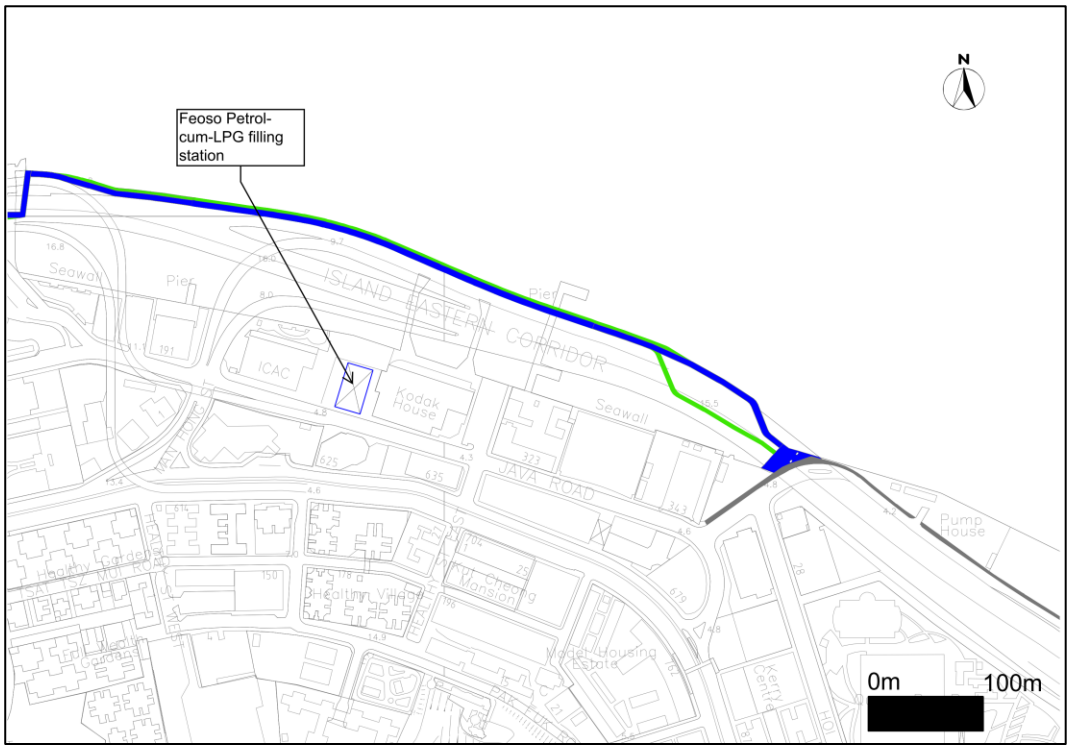

Figure 5-2 Location of the Feoso Petrol-cum-LPG Filling Station

5.4 Review of Hazards to the LPG Filling Station during Construction Stage

5.4.1 Attention should be paid to the following when the construction work is in close vicinity of the filling station:

- All activities that create ignition source(s) should be placed / carried out as far as possible from the LPG filling station.
- Adequate firefighting measure(s) should be placed in the concerned construction area.
- Precautionary measure(s) should be well in place to avoid any ignition source(s), e.g. flames from impacting the filling station.

6 CONCLUSION

6.1.1 The risk level posed by 4 hazardous sources, namely; i) North Point Vehicular Ferry Pier, ii) Collision by vessel, iii) North Point Offtake station, Pigging Station and associated pipeworks and iv) Petrol-cum-LPG filling station were assessed.

6.1.2 A full quantitative risk assessment has been carried out for the DGVFP located at Java Road, North Point. The predicted individual risk for the North Point DGVFP complies with the Hong Kong Risk Guidelines as stipulated in HKPSG. The predicted societal risk for North Point DGVFP, taking into account the proposed boardwalk development, is considered acceptable by satisfying the following criteria,

(c) The 1×10^{-5} per year contour for individual risk is not found and the offsite individual risk is below 1×10^{-5} per year;
(d) Societal risk for the North Point DGVFP falls into “ALARP” region. However, the induced population of the boardwalk development does not significantly contribute in the number of fatalities.

6.1.3 Therefore, results of this assessment support that the proposed boardwalk development would not result in unacceptable risks to the overall population around the North Point DGVFP.

6.1.4 Risk assessment is conducted to assess the risk due to the collision by vessel. Based on the findings, it is concluded that the impact from the collision by vessel to proposed boardwalk (including the retractable bridge) is insignificance with the design and the safety features that will be adopted.

6.1.5 It is considered that the risk from the 7 barg gas transmission pipelines is acceptable according to the individual and societal risk criteria of the HKRG due to the stringent design parameters adopted for the intermediate pressure pipeline in Hong Kong.

6.1.6 During the design and construction stage of the Project, HKCG should be consulted. COP [14] and general requirements from HKCG should be referred and followed.

6.1.7 Since the population increase from the proposed boardwalk is only transient and will not substantially increase the residential population, a quantitative risk assessment for the North Point LPG Filling Station would not be required for this case. Caution should be exercised during the construction of the Project.

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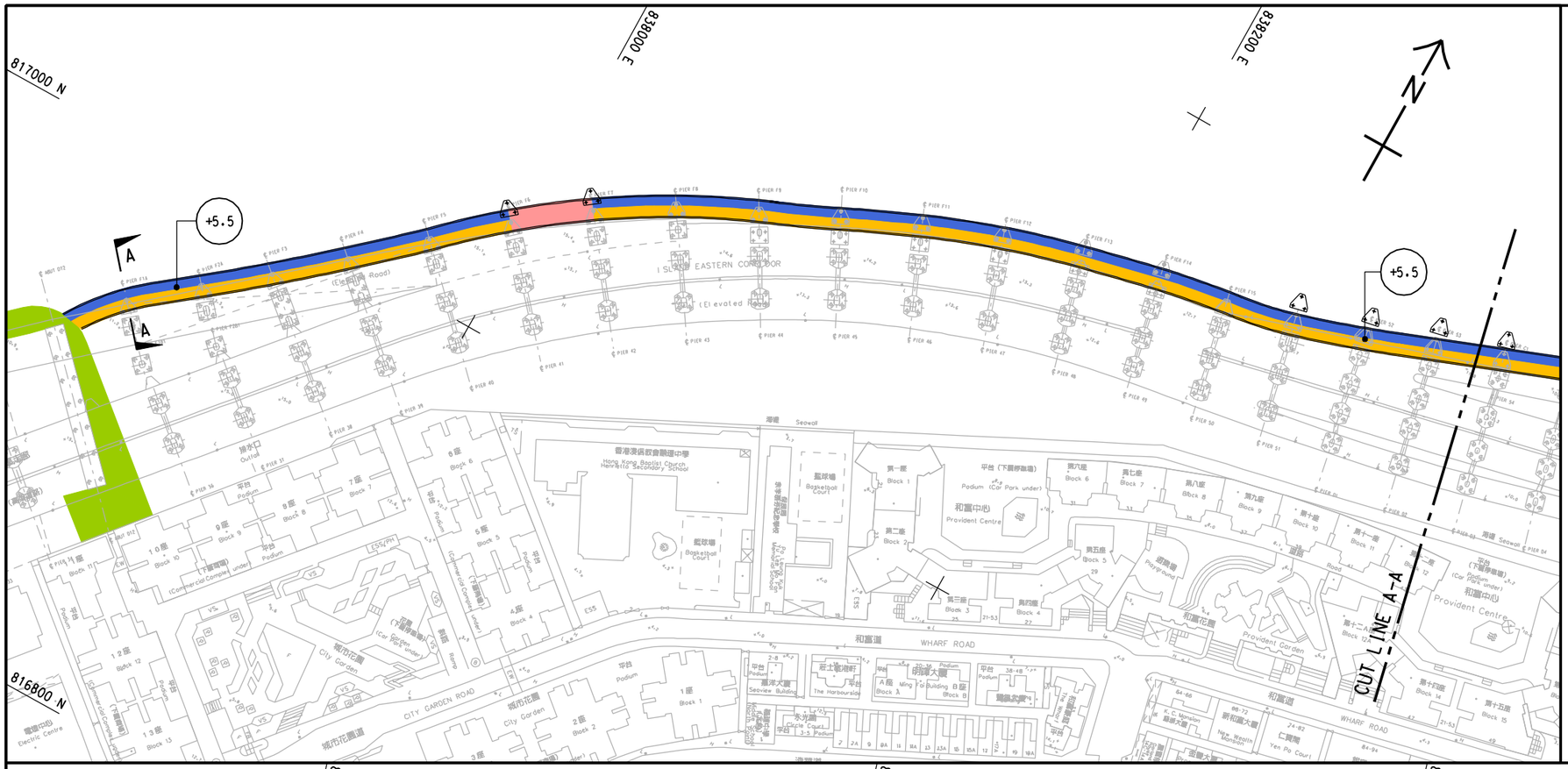
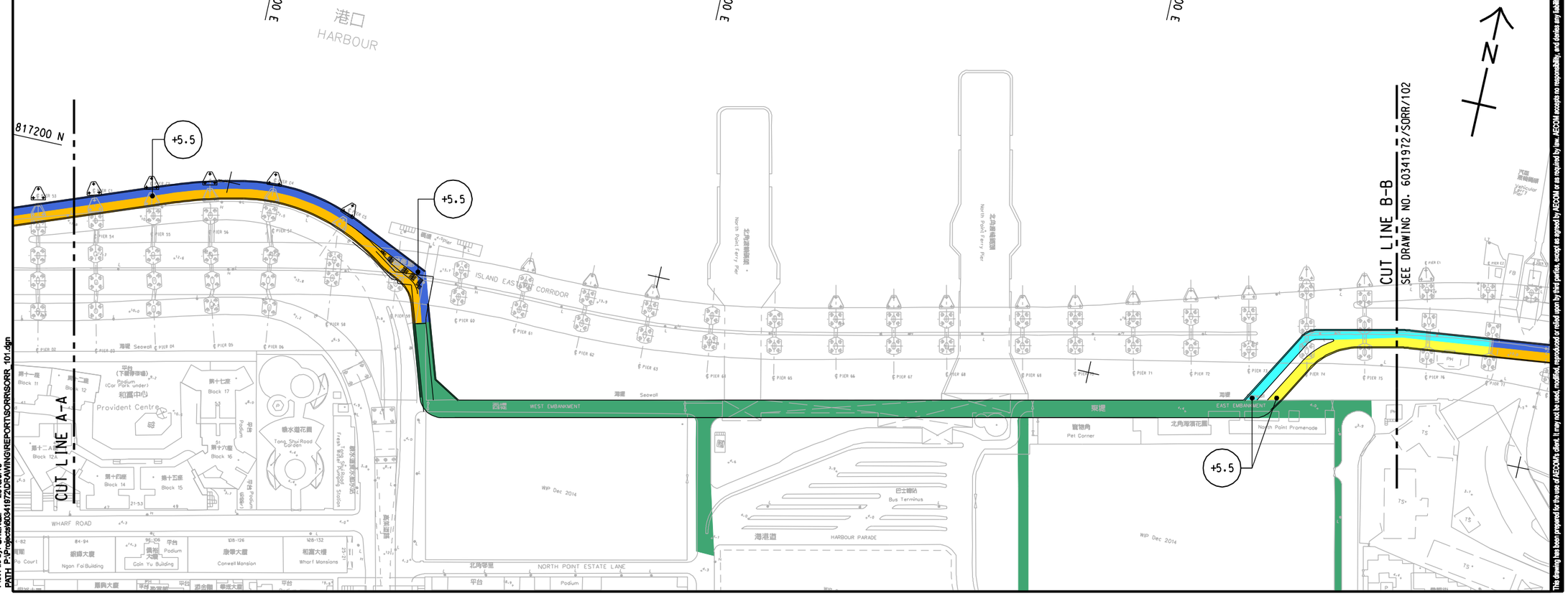
Designer:

Project Management Initials:



LEGEND:

- PROPOSED DOLPHIN STRUCTURE
- PROPOSED BOARDWALK UNDER IEC (RAMP)
- PROPOSED BOARDWALK UNDER IEC (FLAT)
- MOVEABLE BRIDGE
- PROPOSED CYCLE TRACK UNDER IEC (RAMP)
- PROPOSED CYCLE TRACK UNDER IEC (FLAT)
- PROPOSED PROMENADE
- +5.5 PROPOSED FINISHED FLOOR LEVEL (IN mPD)



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STATUS
情況

SCALE 比例
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DIMENSION UNIT 尺寸單位
METRES

KEY PLAN
索引圖

PROJECT NO. 項目編號
60341972

CONTRACT NO. 合約編號
CE 41/2014 (HY)

SHEET TITLE
圖紙名稱

PROPOSED BOARDWALK LAYOUT (WITH CONTINUOUS CYCLE TRACK)

SHEET 1 OF 2

SHEET NUMBER
圖紙編號

60341972/SORR/101

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DIMENSION UNIT 尺寸單位
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SHEET TITLE
圖紙名稱

PROPOSED BOARDWALK LAYOUT (WITH CONTINUOUS CYCLE TRACK)

SHEET 2 OF 2

SHEET NUMBER
圖紙編號

60341972/SORR/102

ISO A1 594mm x 841mm

Approved:

Checked:

Designer:

Project Management Initials:

LEGEND:

- PROPOSED DOLPHIN STRUCTURE
- PROPOSED BOARDWALK UNDER IEC (RAMP)
- PROPOSED BOARDWALK UNDER IEC (FLAT)
- MOVEABLE BRIDGE
- PROPOSED PROMENADE
- +5.5 PROPOSED FINISHED FLOOR LEVEL (IN mPD)

817000 N
838000 E
838200 E
+5.5
ISLAND EASTERN CORRIDOR
(Elevated Road)
CUT LINE A-A
816800 N
838400 E
838600 E
838800 E
港口
HARBOUR
817200 N
CUT LINE B-B
SEE DRAWING NO. 60341972/SORR/202
WHARF ROAD
CITY GARDEN ROAD
WEST EMBANKMENT
EAST EMBANKMENT
NORTH POINT ESTATE LANE
HARBOUR PARADE
North Point Promenade
Wip Dec 2014

AECOM

PROJECT
項目

BOARDWALK UNDERNEATH ISLAND EASTERN CORRIDOR - INVESTIGATION

CLIENT
業主

土木工程拓展署
Civil Engineering and Development Department

CONSULTANT
工程顧問公司

AECOM Asia Company Ltd.
www.aecom.com

SUB-CONSULTANTS
分判工程顧問公司

ISSUE/REVISION
修訂

I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 核核

STATUS
狀況

SCALE
比例
A1 1 : 1000

DIMENSION UNIT
尺寸單位
METRES

KEY PLAN
索引圖

PROJECT NO.
項目編號
60341972

CONTRACT NO.
合約編號
CE 41/2014 (HY)

SHEET TITLE
圖紙名稱
PROPOSED BOARDWALK LAYOUT (WITHOUT CYCLE TRACK)

SHEET 1 OF 2

SHEET NUMBER
圖紙編號
60341972/SORR/201

Plot File by: CHENO2 2015/6/18
PATH: P:\Projects\60341972\DRAWING\REPORT\SORR\SORR_201.dgn

ISO A1 594mm x 841mm

Approved:

Checked:

Designer:

Project Management Initials:

Plot File by: CHENG2 2015/6/23
PATH: P:\Projects\60341972\DRAWING\REPORT\SORR\SORR_202.dgn

AECOM

PROJECT
項目

BOARDWALK UNDERNEATH ISLAND EASTERN CORRIDOR - INVESTIGATION

CLIENT
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Civil Engineering and Development Department

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STATUS
階段

SCALE 比例
A1 1 : 1000

DIMENSION UNIT 尺寸單位
METRES

KEY PLAN
索引圖

PROJECT NO. 項目編號
60341972

CONTRACT NO. 合約編號
CE 41/2014 (HY)

SHEET TITLE
圖紙名稱

PROPOSED BOARDWALK LAYOUT (WITHOUT CYCLE TRACK)

SHEET NUMBER
圖紙編號

SHEET 2 OF 2

60341972/SORR/202

土木工程拓展署
CEDD Civil Engineering and Development Department

土力工程處
Geotechnical Engineering Office

Web site 網址 : http://www.cedd.gov.hk
E-mail 電子郵件 :
Telephone 電話 : (852) 2716 8698
Facsimile 傳真 : (852) 2714 0193
Our ref 本署檔號 : 2C/17/62
Your ref 來函檔號 : CLUK:JLYW:ttmk: 60341972/01-2015007262T

香港九龍觀塘道 410 號觀點中心 25 樓
礦務部
Mines Division,
25/F, Kwun Tong View,
410 Kwun Tong Road,
Kowloon, Hong Kong

31 August 2015

AECOM
8/F, Grand Central Plaza, Tower 2
138 Sha Tin Rural Committee Road
Sha Tin, Hong Kong

By Fax
No. 3922 9797

Attn: Mr Charles LUK

Dear Sirs,

Agreement No. CE41/2014(HY)
Boardwalk underneath Island Eastern Corridor
Explosives Delivery via North Point DGV Ferry Pier

I refer to your above-referenced letter of 21 August 2015 regarding our explosives delivery service via North Point DGV Pier.

The quantity and frequency of our explosives deliveries via the pier depend on the requirements of blasting sites on Hong Kong Island. We currently do not deliver any explosives via the pier, but it is vital that North Point DGV Ferry Pier remains available for our use in the future in order to serve the blasting projects on the Island.

We are unable to forecast the long term explosives requirements on Hong Kong Island. Therefore, for the purpose of your study, we suggest that you adopt our 2008 delivery estimate, i.e. 2,200 kg (NEQ) per day during day time with a maximum of 3 ferry trips per day. However, this estimate should not be taken as a limit on the quantity of explosives we may deliver in the future.

Yours faithfully,

(P W LEUNG)
for Chief Geotechnical Engineer/Mines

P WL/LKRW/pl

OUR REF.: (39) in CP/T/TMAN 216/278 Pt.69
YOUR REF : SKMW:JLYW:ecbt:60341972/01-2015007483T
TELEPHONE: 2860 6277
FAX.: 2200 4377

Hong Kong Police Force
Traffic Branch Headquarters
32/F, Arsenal House
No.1 Arsenal Street
Wanchai
Hong Kong

31 August 2015

Mr. Simon Wong
AECOM
8/F, Grand Central Plaza, Tower 2,
138 Shatin Rural Committee Road,
Shatin, Hong Kong.

(By Fax – 3922 9797)

Dear Mr. Ng,

Re. Agreement No. CE 41/2014(HY)
Boardwalk underneath Island Eastern Corridor –
Investigation – Hazard Assessment Study
Data Verification on Explosive Trucks Delivery using North Point DGV Ferry Pier

I refer to your letter under the above reference dated 27 August 2015.

Please be advised that according to our Senior Force Armourer, dangerous goods under the charge of Police would not be conveyed via the captioned ferry pier. Should you have any query, please contact our Force Armourer direct.

Yours sincerely,

(CHU Hing-lim)
for Commissioner of Police

c.c. Senior Force Armourer

水務署
Water Supplies Department

香港及離島分署
香港北角英皇道六一一號
Hong Kong and Islands Regional Office
611 King's Road, North Point, Hong Kong.

電子郵件 E-mail: wsdinfo@wsd.gov.hk

電話 Telephone 2880 2567 圖文傳真 Facsimile 2811 8152

Urgent by FAX: 3922 9797

檔號 Reference (3) in WSD(HK) 1743/822/14 T/J(1) 27 August 2015

AECOM
8/F Grand Central Plaza, Tower 2
138 Shatin Rural Committee Road
Shatin, Hong Kong

(Attn:. Mr. Charles LUK)

Agreement No. CE 41/2014 (HY)
Boardwalk underneath Island Eastern Corridor - Investigation
Hazard Assessment Study

Data Verification on Chlorine Trucks Delivery to Hong Kong Island using North Point DGV Ferry Pier

I refer to your letter ref. CLUK:JLYW:ttmk:60341972/01-2015007261T dated 21 August 2015. Please be informed that the only treatment works on Hong Kong Island currently still in use is Red Hill Water Treatment Works (WTW). Eastern WTW has been mothballed since 2003, and the modernization/reactivation of Eastern WTW is still under review.

2. A summary on the latest consumption/delivery pattern of 50 kg chlorine cylinders for Red Hill WTW is as follows for your reference:

- The storage capacity of chlorine in Red Hill WTW is about 2.2 tonne. At any time, at least 1 tonne of chlorine must be stored in Red Hill WTW for maintaining fresh water supply to cater for unforeseen circumstances.
- The number of chlorine cylinders to be delivered to Red Hill WTW each time is about 20, which is less than the maximum allowable loading per truck according to the Dangerous Goods Regulations.
- The yearly consumption of chlorine is about 7.3 tonne. Since about 1 tonne of chlorine will be delivered to Red Hill WTW each time, the delivery frequency is about 7 to 8 times per year.

Yours faithfully,

(Ken M. K. CHO)
for Chief Engineer/Hong Kong & Islands
Water Supplies Department

c.c. Ch/T(1) Fax: 2833 5883

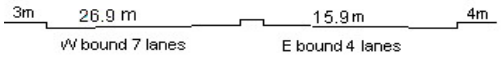
ID	ID	Description	Maximum Population			Indoor Ratio	Occupancy Year 2016				Population Year 2016			
			Existing (Year 2016)	Construction Phase (Year 2018)	Operation Phase (Year 2019)		WDD	WDN	WED	WEN	WDD	WDN	WED	WEN
40	1	North Point Ferry Pier	50	50	50	0.5	1	0.1	1	0.1	50	5	50	5
41	2	Bus Terminus / North Point Estate Redevelopment T7-T10	50	848	848	0.5	1	0.1	0.4	0.05	50	5	20	3
42	3	North Point Estate Redevelopment Site / North Point Estate Redevelopment T7- T10 (merge with 2)	200			0	1	0.1	1	0.1	200	20	200	20
43	4	North Point Estate Redevelopment Site / North Point Estate Redevelopment T1- T6	600	1060	1060	0	1	0.1	1	0.1	600	60	600	60
44	5	Island Lodge	505	502	500	0.95	0.5	1	0.7	1	253	505	354	505
45	6	Kiu Wah Building	242	240	239	0.95	0.5	1	0.7	1	121	242	169	242
46	7	Kar Fu Building	242	240	239	0.95	0.5	1	0.7	1	121	242	169	242
47	8	North Point Welfare Association	30	30	30	0.95	1	0.1	1	0.1	30	3	30	3
48	9	Hong Lok Building	225	224	223	0.95	0.5	1	0.7	1	113	225	158	225
49	10	Tin Chiu Street Playground	12	12	12	0	1	0.1	1	0.1	12	1	12	1
50	11	North Point Industrial Building	2492	2492	2492	0.95	1	0.1	0.4	0.05	2492	249	997	125
51	12	Chan's Creative School (Hong Kong Island)	943	943	943	0.95	1	0	0	0	943	0	0	0
52	13	King's road playground	45	45	45	0	1	0.1	1	0.1	45	5	45	5
53	14	Customs Headquarters Building	3046	3046	3046	0.95	1	0.1	0.4	0.05	3046	305	1218	152
54	15	Tin Chiu Street Children's Playground	20	20	20	0	1	0.1	1	0.1	20	2	20	2
55	16	Sitting Out Area	19	19	19	0	1	0.1	1	0.1	19	2	19	2
56	17	Open Car Park	11	11	11	0	1	0.5	1	0.5	11	6	11	6
57	18	K. Wah Centre	1682	1682	1682	0.95	1	0.1	0.4	0.05	1682	168	673	84
58	19	North Point Sewage Screening Plant	150	150	150	0.5	1	0.1	0.4	0.05	150	15	60	8
59	20	ICAC North Point Headquarters	4592	4592	4592	0.95	1	0.1	0.4	0.05	4592	459	1837	230
60	21	WSD Hong Kong Regional Building (Hong Kong & Island Regional Office)	267	267	267	0.95	1	0.1	0.4	0.05	267	27	107	13
	22	Healthy Gardens	3030	3010	3000	0.95	0.5	1	0.7	1	1515	3030	2121	3030
83	23	Elegance House (Block A, B & C)	260	258	257	0.95	0.5	1	0.7	1	130	260	182	260
84	24	Ruby Court	254	252	251	0.95	0.5	1	0.7	1	127	254	178	254
85	25	Wah Lai Mansion	576	573	571	0.95	0.5	1	0.7	1	288	576	403	576
86	26	Tung Po Building	439	436	435	0.95	0.5	1	0.7	1	220	439	307	439
	27	Anne Black General Out-Patient Clinic & North Point Market	218	218	218	0.95	1	0.1	1	0.1	218	22	218	22
	28	Chaton House, Eternal Building, Siu Wah Building, Welford Court & Siu Bo Mansion	1076	1069	1065	0.95	0.5	1	0.7	1	538	1076	753	1076
	29	Island Place	2152	2138	2131	0.95	0.5	1	0.7	1	1076	2152	1506	2152
87	30	On Ning Building, Chu Kee Building & Kingsfield Mansion	475	472	470	0.95	0.5	1	0.7	1	238	475	333	475
88	31	30-52 Marble Road	549	545	544	0.95	0.5	1	0.7	1	275	549	384	549
90	32	Ka Wai Building	823	818	815	0.95	0.5	1	0.7	1	412	823	576	823
91	33	Yu Wai Mansion	126	125	125	0.95	0.5	1	0.7	1	63	126	88	126
92	34	Workingberg Commercial Building	253	253	253	0.95	1	0.1	0.4	0.05	253	25	101	13
	P1	Proposed Boardwalk (from Tin Chiu St to Hoi Yu St)(without cycle track)	0	40	294	0	0	0	0	0	0	0	0	0
	P2	Proposed Boardwalk (from Tin Chiu St to Hoi Yu St)(with cycle track)	0	40	302	0	0	0	0	0	0	0	0	0

ID	Description	Indoor Ratio	Occupancy Year 2018				Construction Phase (Year 2018)			
			WDD	WDN	WED	WEN	WDD	WDN	WED	WEN
1	North Point Ferry Pier	0.5	1	0.1	1	0.1	50	5	50	5
2	Bus Terminus / North Point Estate Redevelopment T7-T10	0.95	0.5	1	0.7	1	424	848	594	848
3	North Point Estate Redevelopment Site / North Point Estate Redevelopment T7- T10 (merge with 2)	0.95	0.5	1	0.7	1	0	0	0	0
4	North Point Estate Redevelopment Site / North Point Estate Redevelopment T1- T6	0.95	0.5	1	0.7	1	530	1060	742	1060
5	Island Lodge	0.95	0.5	1	0.7	1	251	502	351	502
6	Kiu Wah Building	0.95	0.5	1	0.7	1	120	240	168	240
7	Kar Fu Building	0.95	0.5	1	0.7	1	120	240	168	240
8	North Point Welfare Association	0.95	1	0.1	1	0.1	30	3	30	3
9	Hong Lok Building	0.95	0.5	1	0.7	1	112	224	157	224
10	Tin Chiu Street Playground	0	1	0.1	1	0.1	12	1	12	1
11	North Point Industrial Building	0.95	1	0.1	0.4	0.05	2492	249	997	125
12	Chan's Creative School (Hong Kong Island)	0.95	1	0	0	0	943	0	0	0
13	King's road playground	0	1	0.1	1	0.1	45	5	45	5
14	Customs Headquarters Building	0.95	1	0.1	0.4	0.05	3046	305	1218	152
15	Tin Chiu Street Children's Playground	0	1	0.1	1	0.1	20	2	20	2
16	Sitting Out Area	0	1	0.1	1	0.1	19	2	19	2
17	Open Car Park	0	1	0.5	1	0.5	11	6	11	6
18	K. Wah Centre	0.95	1	0.1	0.4	0.05	1682	168	673	84
19	North Point Sewage Screening Plant	0.5	1	0.1	0.4	0.05	150	15	60	8
20	ICAC North Point Headquarters	0.95	1	0.1	0.4	0.05	4592	459	1837	230
21	WSD Hong Kong Regional Building (Hong Kong & Island Regional Office)	0.95	1	0.1	0.4	0.05	267	27	107	13
22	Healthy Gardens	0.95	0.5	1	0.7	1	1505	3010	2107	3010
23	Elegance House (Block A, B & C)	0.95	0.5	1	0.7	1	129	258	181	258
24	Ruby Court	0.95	0.5	1	0.7	1	126	252	176	252
25	Wah Lai Mansion	0.95	0.5	1	0.7	1	287	573	401	573
26	Tung Po Building	0.95	0.5	1	0.7	1	218	436	305	436
27	Anne Black General Out-Patient Clinic & North Point Market	0.95	1	0.1	1	0.1	218	22	218	22
28	Chaton House, Eternal Building, Siu Wah Building, Welford Court & Siu Bo Mansion	0.95	0.5	1	0.7	1	535	1069	748	1069
29	Island Place	0.95	0.5	1	0.7	1	1069	2138	1497	2138
30	On Ning Building, Chu Kee Building & Kingsfield Mansion	0.95	0.5	1	0.7	1	236	472	330	472
31	30-52 Marble Road	0.95	0.5	1	0.7	1	273	545	382	545
32	Ka Wai Building	0.95	0.5	1	0.7	1	409	818	573	818
33	Yu Wai Mansion	0.95	0.5	1	0.7	1	63	125	88	125
34	Workingberg Commercial Building	0.95	1	0.1	0.4	0.05	253	25	101	13
P1	Proposed Boardwalk (from Tin Chiu St to Hoi Yu St)(without cycle track)	0	1	0	1	0	40	0	40	0
P2	Proposed Boardwalk (from Tin Chiu St to Hoi Yu St)(with cycle track)	0	1	0	1	0	40	0	40	0

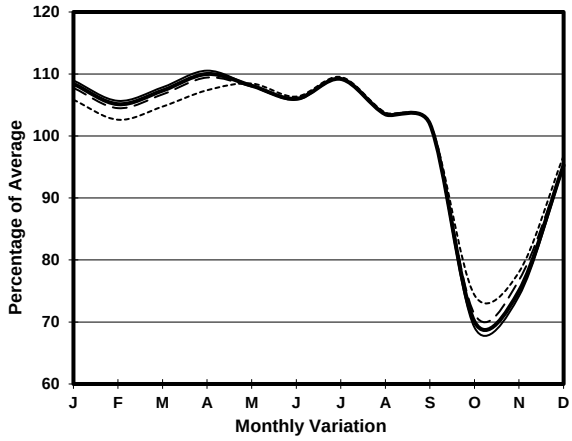
ID	Description	Indoor Ratio	Occupancy Year 2019				Operation Phase (Year 2019)				Remarks / Reference Sources
			WDD	WDN	WED	WEN	WDD	WDN	WED	WEN	
1	North Point Ferry Pier	0.5	1	0.1	1	0.1	50	5	50	5	Site survey
2	Bus Terminus / North Point Estate Redevelopment T7-T10	0.95	0.5	1	0.7	1	424	848	594	848	North Point Estate Redevelopment A/H8/719 (T7-T10)
3	North Point Estate Redevelopment Site / North Point Estate Redevelopment T7- T10 (merge with 2)	0.95	0.5	1	0.7	1	0	0	0	0	North Point Estate Redevelopment A/H8/719 (T7-T10) (Merged with 2 in Year 2018 & 2019)
4	North Point Estate Redevelopment Site / North Point Estate Redevelopment T1- T6	0.95	0.5	1	0.7	1	530	1060	742	1060	North Point Estate Redevelopment A/H8/719 (T1-T6)
5	Island Lodge	0.95	0.5	1	0.7	1	250	500	350	500	Flats 184 ; PDZ:23
6	Kiu Wah Building	0.95	0.5	1	0.7	1	120	239	167	239	Flats: 88 ; PDZ:23
7	Kar Fu Building	0.95	0.5	1	0.7	1	120	239	167	239	Flats: 88 ; PDZ:23
8	North Point Welfare Association	0.95	1	0.1	1	0.1	30	3	30	3	Density :0.01ppl/m^2
9	Hong Lok Building	0.95	0.5	1	0.7	1	112	223	156	223	Flats: 82 ; PDZ:23
10	Tin Chiu Street Playground	0	1	0.1	1	0.1	12	1	12	1	Density :0.01ppl/m^2
11	North Point Industrial Building	0.95	1	0.1	0.4	0.05	2492	249	997	125	Density :20m^2/ppl
12	Chan's Creative School (Hong Kong Island)	0.95	1	0	0	0	943	0	0	0	Number of Classroom : 25
13	King's road playground	0	1	0.1	1	0.1	45	5	45	5	Density :0.01ppl/m^2
14	Customs Headquarters Building	0.95	1	0.1	0.4	0.05	3046	305	1218	152	Density: 20m^2/ppl
15	Tin Chiu Street Children's Playground	0	1	0.1	1	0.1	20	2	20	2	Density :0.01ppl/m^2
16	Sitting Out Area	0	1	0.1	1	0.1	19	2	19	2	Density :0.01ppl/m^2
17	Open Car Park	0	1	0.5	1	0.5	11	6	11	6	Density :0.01ppl/m^2
18	K. Wah Centre	0.95	1	0.1	0.4	0.05	1682	168	673	84	Density :20m^2/ppl
19	North Point Sewage Screening Plant	0.5	1	0.1	0.4	0.05	150	15	60	8	Site survey
20	ICAC North Point Headquarters	0.95	1	0.1	0.4	0.05	4592	459	1837	230	Density :20m^2/ppl
21	WSD Hong Kong Regional Building (Hong Kong & Island Regional Office)	0.95	1	0.1	0.4	0.05	267	27	107	13	Density :20m^2/ppl
22	Healthy Gardens	0.95	0.5	1	0.7	1	1500	3000	2100	3000	Flats 1104 ; PDZ:23
23	Elegance House (Block A, B & C)	0.95	0.5	1	0.7	1	129	257	180	257	Flats 90 ; PDZ:24
24	Ruby Court	0.95	0.5	1	0.7	1	126	251	176	251	Flats 88 ; PDZ:24
25	Wah Lai Mansion	0.95	0.5	1	0.7	1	286	571	400	571	Flats 210 ; PDZ:23
26	Tung Po Building	0.95	0.5	1	0.7	1	218	435	305	435	Flats 160 ; PDZ:23
27	Anne Black General Out-Patient Clinic & North Point Market	0.95	1	0.1	1	0.1	218	22	218	22	Density:10m2/ppl
28	Chaton House, Eternal Building, Siu Wah Building, Welford Court & Siu Bo Mansion	0.95	0.5	1	0.7	1	533	1065	746	1065	Flats 392 ; PDZ:23
29	Island Place	0.95	0.5	1	0.7	1	1066	2131	1492	2131	Flats 784 ; PDZ:23
30	On Ning Building, Chu Kee Building & Kingsfield Mansion	0.95	0.5	1	0.7	1	235	470	329	470	173 flats, PDZ:23
31	30-52 Marble Road	0.95	0.5	1	0.7	1	272	544	381	544	200 flats, PDZ:23
32	Ka Wai Building	0.95	0.5	1	0.7	1	408	815	571	815	300 flats, PDZ:23
33	Yu Wai Mansion	0.95	0.5	1	0.7	1	63	125	88	125	46 flats, PDZ:23
34	Workingberg Commercial Building	0.95	1	0.1	0.4	0.05	253	25	101	13	Density :20m^2/ppl
P1	Proposed Boardwalk (from Tin Chiu St to Hoi Yu St)(without cycle track)	0	0.4	1.0	0.4	1.0	120	294	120	294	Provided by Project Proponent
P2	Proposed Boardwalk (from Tin Chiu St to Hoi Yu St)(with cycle track)	0	0.4	1.0	0.4	1.0	121	302	121	302	Provided by Project Proponent

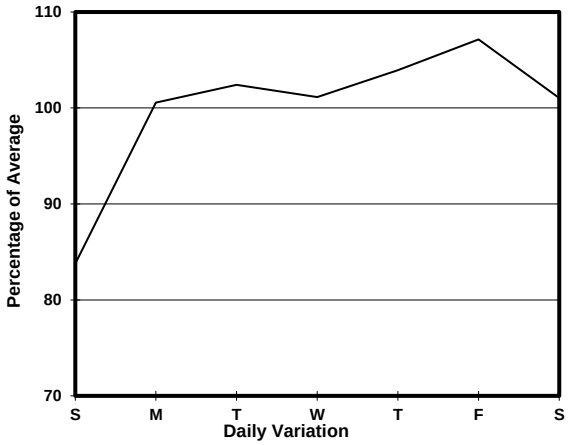
YEAR 2014 **LINK** VICTORIA PARK RD (from HOUSTON ST to ISLAND EASTERN CORRIDOR)

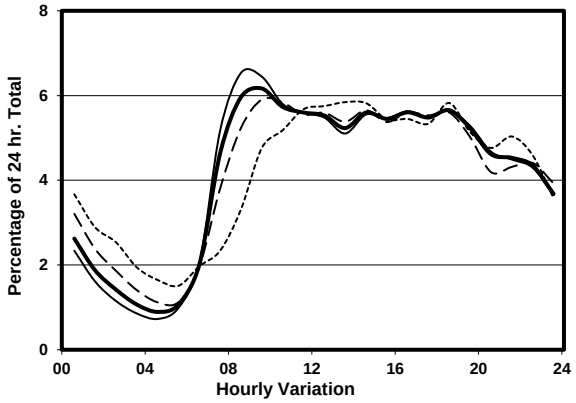
CORE STATION 1002
ROAD NETWORK MAJOR
ROAD TYPE URBAN TRUNK ROAD

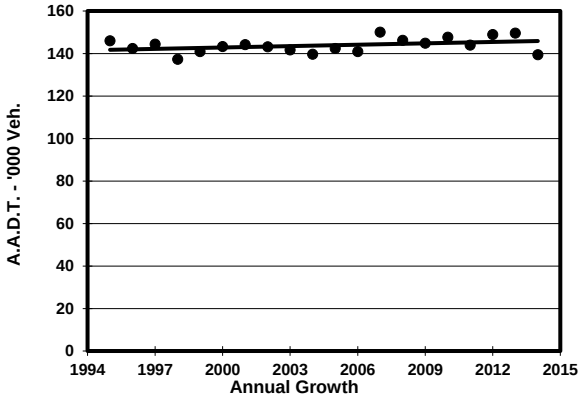


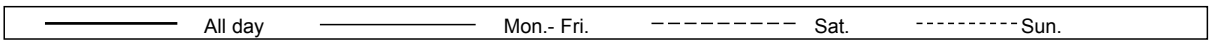
1. TRAFFIC FLOW VARIATION AND GROWTH











2. TRAFFIC CHARACTERISTICS (BY DIRECTION)

Parameter	All - Day	Mon. - Fri.	Sat.	Sun.
EAST BOUND				
A.A.D.T.	66220	68630	66810	57620
R 12 / 24 - %	64.6	66.1	61.5	59
R 16 / 24 - %	84.5	86.1	80.5	79.7
AM Peak Hour	0900-1000	0800-0900	0900-1000	0900-1000
One-way flow at AM peak hour	3720	4190	3260	2640
T - % (AM)	-	12.2	-	-
PM Peak Hour	1600-1700	1600-1700	1600-1700	1600-1700
One-way flow at PM peak hour	3880	4040	3900	3270
T - % (PM)	-	9.4	-	-
Prop.of commercial vehicles - 16 hr.	-	9.3	-	-
WEST BOUND				
A.A.D.T.	73200	76340	74560	60570
R 12 / 24 - %	68.5	69.6	68.2	62.4
R 16 / 24 - %	86.1	87.1	85.3	80.8
AM Peak Hour	0900-1000	0800-0900	0900-1000	0900-1000
One-way flow at AM peak hour	4880	5280	5090	2990
T - % (AM)	-	11.6	-	-
PM Peak Hour	1800-1900	1800-1900	1800-1900	1800-1900
One-way flow at PM peak hour	4210	4370	4230	3640
T - % (PM)	-	8.1	-	-
Prop.of commercial vehicles - 16 hr.	-	11.1	-	-

3. OTHER INFORMATION AND COMMENT

Traffic was diverted due to closure of some main roads in urban area from 28 September to 15 December 2014.

4. Vehicle classification and occupancy - Monday to Friday

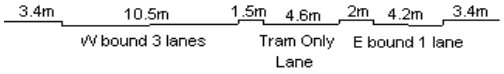
Time		Class of vehicle									
		Motor Cycle	Private Car	Taxi	Private LB	PLB	Goods veh.		Non Fr. Bus	Fr. Bus	
							Light	M & H		SD	DD
0700-0800	Pro	4.5	38.6	27.8	3.7	0.6	11.5	3.1	6.5	0.1	3.5
	Ocp	1.1	1.3	1.9	5.6	10.6	1.3	1.2	18.9	7.8	52.2
0800-0900	Pro	3.4	48.7	22.5	1.4	0.6	11.5	3.3	3.6	0.1	4.9
Peak hour	Ocp	1.0	1.3	2.1	4.4	14.6	1.4	1.1	12.8	42.5	62.5
0900-1000	Pro	3.1	39.5	26.2	0.8	0.2	17.8	5.4	1.8	0.1	5.1
	Ocp	1.0	1.3	2.0	1.8	13.8	1.4	1.2	13.5	9.7	23.9
1000-1100	Pro	2.5	31.9	27.5	0.8	0.4	23.9	6.7	1.9	0.1	4.4
	Ocp	1.1	1.3	2.0	1.5	5.0	1.4	1.3	10.3	2.2	18.1
1100-1200	Pro	2.8	33.0	26.2	0.8	0.4	26.0	5.6	2.0	0.1	2.9
	Ocp	1.0	1.3	1.9	1.6	5.9	1.5	1.3	8.5	11.5	20.2
1200-1300	Pro	2.2	44.1	21.4	1.2	0.2	20.2	5.3	2.7	0.1	2.7
	Ocp	1.0	1.3	2.0	4.8	10.0	1.4	1.3	11.9	11.3	24.1
1300-1400	Pro	2.4	35.6	22.5	1.9	0.3	24.3	7.5	2.9	0.1	2.7
	Ocp	1.0	1.4	2.0	2.8	11.0	1.4	1.3	10.5	13.3	21.0
1400-1500	Pro	2.4	39.0	25.1	0.7	0.3	21.8	6.2	1.9	0.1	2.5
	Ocp	1.0	1.4	2.0	3.0	8.6	1.5	1.2	6.8	7.2	22.3
1500-1600	Pro	2.4	41.5	23.9	1.7	0.3	21.2	4.0	2.1	0.1	2.9
	Ocp	1.0	1.4	2.0	7.4	6.3	1.4	1.2	17.7	13.0	22.0
1600-1700	Pro	1.7	38.5	26.4	1.5	0.3	20.5	4.5	2.9	0.1	3.7
	Ocp	1.1	1.5	1.9	5.3	5.8	1.4	1.3	16.8	15.5	23.0
1700-1800	Pro	4.3	42.8	24.4	1.6	0.5	16.3	3.0	3.2	0.1	3.8
	Ocp	1.1	1.3	2.0	3.1	10.7	1.4	1.2	5.9	10.0	31.9
1800-1900	Pro	4.3	51.7	24.2	0.4	0.8	10.1	1.6	2.8	0.1	4.0
	Ocp	1.1	1.4	1.8	1.7	14.6	1.4	1.4	12.7	30.6	43.6
1900-2000	Pro	3.5	54.9	24.9	0.5	0.5	7.2	0.8	3.7	0.1	3.9
	Ocp	1.2	1.3	2.1	1.8	10.4	1.4	1.4	12.1	16.6	31.9
2000-2100	Pro	2.7	43.5	38.5	0.4	0.6	5.8	0.9	3.8	0.1	3.7
	Ocp	1.1	1.4	1.9	1.8	12.0	1.2	1.4	5.1	1.0	20.1
2100-2200	Pro	2.1	40.6	46.4	0.1	0.6	5.1	0.7	0.8	0.1	3.5
	Ocp	1.1	1.4	1.9	1.0	8.7	1.3	1.2	6.5	1.0	19.3
2200-2300	Pro	2.5	38.0	50.5	0.2	0.7	4.1	0.3	0.7	0.1	3.1
	Ocp	1.0	1.4	1.8	1.7	11.3	1.2	1.0	1.0	2.8	19.0
16 hours	Pro	2.9	41.3	28.5	1.1	0.4	15.6	3.7	2.7	0.1	3.6
	Ocp	1.1	1.4	1.9	4.1	10.5	1.4	1.3	12.1	10.5	29.7

Legend

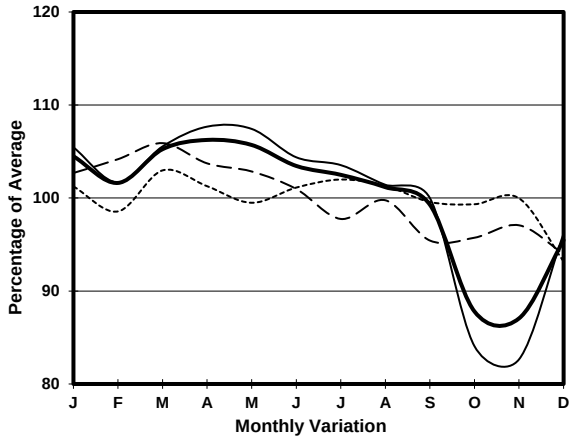
Pro. Proportion of vehicles in % (Sum may not add up to 100% due to figure rounding)
Ocp. Average occupancy of vehicles
M&H Medium and Heavy

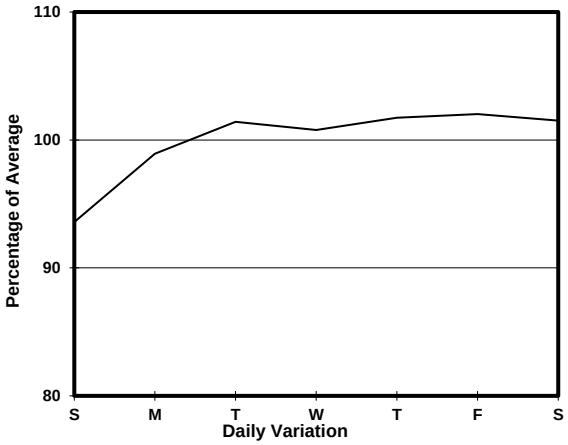
YEAR 2014 **LINK** KING'S RD (from NORTH POINT RD to TONG SHUI RD)

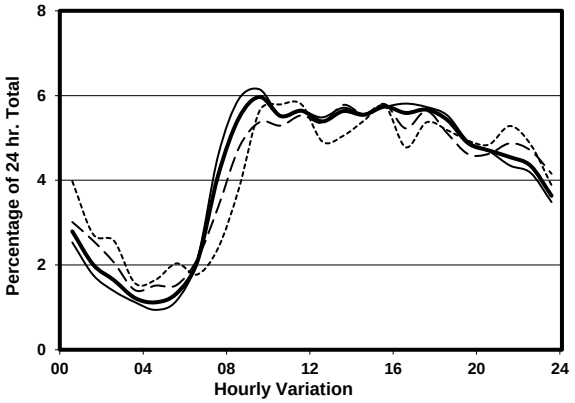
CORE STATION 1008
ROAD NETWORK MAJOR
ROAD TYPE PRIMARY DISTRIBUTOR

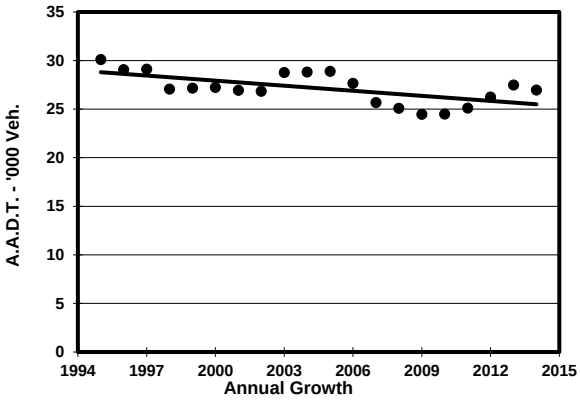


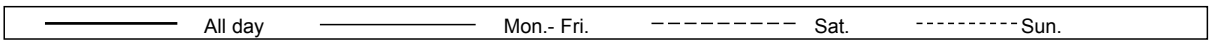
1. TRAFFIC FLOW VARIATION AND GROWTH











2. TRAFFIC CHARACTERISTICS (BY DIRECTION)

Parameter	All - Day	Mon. - Fri.	Sat.	Sun.
EAST BOUND				
A.A.D.T.	4110	4100	4160	4160
R 12 / 24 - %	62.6	63.5	61	59.8
R 16 / 24 - %	82.8	83.4	81.9	80
AM Peak Hour	0900-1000	0900-1000	0900-1000	0900-1000
One-way flow at AM peak hour	220	220	220	200
T - % (AM)	-	-	-	-
PM Peak Hour	1600-1700	1700-1800	1800-1900	1800-1900
One-way flow at PM peak hour	230	240	220	250
T - % (PM)	-	-	-	-
Prop.of commercial vehicles - 16 hr.	-	-	-	-
WEST BOUND				
A.A.D.T.	22840	23220	23270	21140
R 12 / 24 - %	66.3	68.1	63.1	59.9
R 16 / 24 - %	84.4	85.9	81.6	79.8
AM Peak Hour	0900-1000	0900-1000	0900-1000	0900-1000
One-way flow at AM peak hour	1390	1460	1260	1230
T - % (AM)	-	-	-	-
PM Peak Hour	1700-1800	1600-1700	1700-1800	1700-1800
One-way flow at PM peak hour	1300	1350	1370	1160
T - % (PM)	-	-	-	-
Prop.of commercial vehicles - 16 hr.	-	-	-	-

3. OTHER INFORMATION AND COMMENT

Traffic was diverted due to closure of some main roads in urban area from 28 September to 15 December 2014.

香港中華煤氣有限公司
The Hong Kong and China Gas Company Limited

25 May 2016

Your Ref.: CLUK:JLYW:mlpm:60341972/01-2016003920T
Our Ref. : UNE2016/01634/I

AECOM Asia Co. Ltd.
8/F, Grand Central Plaza, Tower 2
138 Shatin Rural Committee Road
Shatin, N.T.

Attn. : Charles Luk

In view of safety, HKCG provides FREE service to assist the road opening parties to locate the approximate gas pipe alignment on site, Please call 29631811 before work starts.

Dear Sirs

Re: Agreement No. CE41/2014(HY) - Boardwalk underneath Island Eastern Corridor

We received your letter of 11 May 2016 requesting drawings on the location of Towngas pipelines. We are attaching the drawings for the location of existing/proposed pipelines that you requested. These drawings are only approximate. The pipes may be located in different positions and depths due to continual road development, system alterations and underground obstructions. Therefore, the exact location may be altered from point to point. There is the possibility that some gas pipes particularly those laid long time ago or laid by other Registered Gas Contractors may not appear in our records. In the case of some unknown pipes being exposed during your construction work, please contact us immediately. In the case the construction work is to be carried out 6 months after the date of drawing, you are required to send us another request for obtaining an updated drawing.

We suggest that you do not work too close to the pipes as any damage to them could create a hazardous accident. You should be very careful when excavating the area. You should locate the exact position and depth of the pipes by making a series of hand-dug trial holes. Heavy machinery such as drills or mechanical excavators cannot be used to do this. If your company damages our pipelines, you will be responsible for all resultant costs.

We would also like to remind you not to disturb any part of Towngas pipeline or their associated properties and not to temporarily or permanently encase part or all of our gas pipes in any form of concrete structures. Please provide steel gas pipes a clearance of 600mm and other gas pipes a clearance of 300mm. This space is necessary for future maintenance.

For enquiry of information on this letter or pipe location drawing, please contact Mr. Anthony Lo on 29631321.
Transmission Operation Department 20/F, 363 Java Road, North Point, Hong Kong Tel: 2963 1166 Fax: 3106 0527 E-mail:une@towngas.com

If your work involves construction of new manholes or performing operation in existing manholes, we recommend sealing off all the duct openings in new/existing manholes, to avoid accumulation of hazardous gas in manholes, which might create a dangerous explosive environment.

Should your proposed works involving any kind of trenchless technology, you should approach HKCG to discuss the protective and safety precautionary measures before your work commences, as well as the monitoring procedures to be implemented throughout the entire construction period in order to ensure the integrity of existing gas facilities will not be affected.

If you want to divert gas pipes, we must have at least two months and six months notice respectively for distribution and transmission networks before commencing our planning works. Your company will be responsible for the full cost of any diversion. A written agreement will be required before we begin any diversion.

SAFETY:

1. If a gas pipe is damaged or a leak is suspected, phone the Emergency Services Hotline, 28806999, immediately. Also, keep all ignition sources away from the site.
2. Cigarette smoking is prohibited when working near the pipelines.
3. In case of a leak, stop work, evacuate all employees and the public from the area.
4. Construction activities require naked fire must not be applied within 3 meters proximity of exposed gas pipes without prior approval under proper management procedures, such as permit to work, etc.

Please contact Mr Chan Yuen Lok on 2963 1811 for the matters related to existing pipeline or to arrange for a joint site inspection regarding the pipe location. Further, you should notify us 2 days before the works begin on site. For enquiry of proposed pipeline, if any, or availability of gas supply, please contact Mr Y L Lau on 2963 1830.

You may provide us your E-mail address so that we can send the drawings to you by E-mail. If you want further information or the drawings in different scale, you can write to us by quoting the reference of this letter.

Yours faithfully

pp Eric E Tsang
System Development Manager

ET/une

Encl. Get All Safe Leaflet
General Requirements For Construction Work In The Vicinity Of Gas Main
General Requirements of Construction Works Adjacent to the Existing Gas Station (GS)
Avoiding Danger from Underground Gas Pipes and Electricity Cables Leaflet

香港中華煤氣有限公司
The Hong Kong and China Gas Company Limited

[此乃中文譯本，內容以英文本為準]

來函編號：_____
本函編號：_____

_____先生/小姐

查詢煤氣管道

茲收到貴公司於____年__月__日發出的函件，索取有關煤氣管道位置的圖則。現隨函附上一份現有及擬建管道位置的圖則，此等圖則只作工程參考之用，管道的實際位置和深度可能因為道路的發展、系統的改變及地下設施的阻礙而與圖則所示有些微差距。另外，部分現有的管道是由其他的註冊氣體工程承辦商鋪設或是建於很久之前，以致本公司沒有相關的記錄。貴公司在施工期間如發現來歷不明的管道，請即與本公司聯絡。貴公司在施工前，如發現圖則在六個月之前發出，貴公司應再次入信本公司，要求索取更新的圖則。

本公司建議貴公司切勿在煤氣管道附近施工，以免引起嚴重意外，在施工期間務必要加倍小心。貴公司須以人手開挖探孔來確定煤氣管道的位置及深度，不能使用重型機械如機動探孔機或挖土機。如貴公司損毀本公司的煤氣管道，一切因事故所引致的支出及費用，將全部由貴公司承擔。

請注意不要移動煤氣管道以及相關的配件，也不可以用任何混凝土結構臨時或永久套入部分或全部煤氣管道。為方便本公司日後進行維修保養工作，貴公司的設施與氣體鋼管之間須保留 600 毫米的間距，與其他氣體管道之間也要保留 300 毫米的間距。

如貴公司的工程包括新建沙井或於現有沙井內進行，本公司建議將沙井內所有導管接口密封，避免積聚危險氣體而可能引致爆炸。

如貴公司的工程採用無坑挖掘方法，在開工前，請聯繫本公司，以便能與貴公司討論在整個施工過程時應採取的保護煤氣管道措施和監察行動，確保煤氣設施的完整性不受影響。

貴公司如需要改動煤氣管道的路線：如屬配氣管道，請於施工前至少兩個月以書面通知本公司；如屬輸氣管道，則須於施工前至少 6 個月發出書面通知，以便作出安排，一切相關費用須由貴公司支付。

安全事項：

1. 如有損毀煤氣管道或懷疑有氣體洩漏，請即致電緊急服務熱線 28806999. 此外，也須盡快熄滅所有火種。
2. 在煤氣管道附近工作時嚴禁吸煙。
3. 如有氣體洩漏，請立刻停止工作，並把所有工作人員及公眾人士撤離事發地點。
4. 在外露的煤氣管道 3 米範圍內，不可進行任何使用明火的工序。但於施工前經認可途徑申請並獲有關管理單位批准（如獲發工作准許證等）的工序，則作別論。

關於現有喉管的事宜或如需要本公司就管道位置安排工地視察，請致電 29631811 與陳遠樂先生聯絡。另外，貴公司必須在施工前兩天通知本公司有關工程的開展日期。如須查詢有關擬建管道或煤氣供應的事宜，請致電 29631830 與劉潤良先生聯絡。

貴公司可提供電郵地址，方便本公司把圖則以電郵傳遞。如貴公司需要更多相關資料或其他比例的圖則，請來函提出並註明本函編號。

系統發展經理

曾帆 謹啟
(日期)

For Reference Only

General Requirements For Construction Work Adjacent to Existing Gas Station (GS)

1. Contact HKCG at least one month in advanced for site inspection before commencement of construction work adjacent to the GS.

2. Should any vibration is induced by the construction work, the vibration force acting on the gas facilities inside GS should not more than 13mm/s PPV and 0.1mm vibrational amplitude.

3. The station access shall be maintained at all time.

4. The site should be kept reasonably level, adequately drained and free from flooding, landslip and subsidence.

5. The contractor should keep clear of the existing drainage system for preventing the station from flooding throughout the construction period.

6. Minimum clearance from inlet and outlet gas pipeline of GS shall be 2.5 metres and the span of the exposed pipe section should not be longer than 8 metres and 2.2 metres for steel and D.I. gas pipes respectively.

7. Minimum clearance from the station boundary shall be 1.0 metre from the toe wall of palisade fence and the fence should never be used as a path or a conductor for welding process.

8. Operating range of any tower crane or lifting appliances should be outside GS. Risk assessment should be conducted so that the gas facilities inside GS will not be affected even in case the worst of tower crane / high-rise scaffolding collapse especially during strong wind season,

9. In case of emergency, contact HKCG at 2880 6999 which is manned 24 hours.

For Reference Only

General Requirements For Construction Work In The Vicinity Of Gas Main

1. Notification of work should be circulated as stipulated in the Excavation Permit issued by Highways. The same procedure should also be followed for construction site other than Highways' area.

2. Contact HKCG at least 3 days in advance for excavation adjacent to gas pipe. Site meeting to be arranged whenever required. HKCG could be contacted via 29631811 or 28806999 in case of emergency.

3. When excavation is to be carried out adjacent to a gas main, the exact alignment and profile must be ascertained by a series of hand-dug trial holes.

4. BORING AND DRILLING IN THE VICINITY OF GAS MAIN IS STRICTLY PROHIBITED. HKCG must be consulted first should this work be required.

5. No excavator is allowed for excavation at 1 metre around the gas pipe.

6. No naked flame is allowed adjacent to the gas pipe.

7. Do not encase, even temporarily, part or all of our gas pipes in any form of concrete structure.

8. To avoid the risk of gas accumulation leading to any tragedy, no gas pipe is allowed being enclosed in confined space such as long decked over trench.

   8.1 In case the proposed deck of trench will cover any gas pipe, it should be considered to adjust the trench alignment and/or the working method at the planning stage. Should any gas pipe required to be diverted, the request should be made to HKCG and the diversion should be completed before the trench is decked.

   8.2 If inevitably any gas pipe to be left in the decked trench, prior agreement should be sought from HKCG. Adequate protection measure such as partition should be built to separate the gas pipe from the confined space under deck.

9. No machinery should sit directly above our metal iron gas pipes.

10. The velocity and amplitude of vibration acting on the gas pipe by the work must not exceed 25mm/s peak particle velocity and 0.2mm respectively.

11. The velocity and amplitude of vibration acting on the gas governor by the work must not exceed 13mm/s peak particle velocity and 0.1mm respectively.

12. Vibration monitoring records should be forwarded to HKCG for reference.

13. Excavation running close and parallel to the gas pipe should be avoided. Should such excavation be required, discussion/agreement must be sought from HKCG. Any mechanical joint to be exposed, the working party shall inform HKCG in advance and make provision to HKCG for leak detection and bolts replacement where necessary.

14. Suspension of gas pipe to be agreed with HKCG.

15. The gas pipe would normally have a cover of 450mm and 900mm in footpath and carriageway respectively. However, there are cases where gas mains have cover less than the before stated figures. Steel protection plates would normally be laid on top of shallow cover pipe. Due care should be given in subsequent excavation with the presence of steel plate.

16. Report any damage, even superficial, to HKCG for remedial action.

17. Access to HKCG's installations should be maintained at all times for regular inspection and emergency repair.

18. Sufficient clearance to be maintained for both safety and maintenance purpose. Normally, 600mm and 300mm clearance is required for steel and all other gas pipe respectively.

19. No exposed PE gas pipe under steel deck is allowed as welding slag from the jointing of steel deck may damage the gas pipe underneath unless proper protection agreed by HKCG. In other occasion, exposure of PE pipes should be avoided as far as practicable. Where exposure of PE pipes is inevitable, fire resistance protection wrapping of the exposed PE pipes should be installed and agreed with HKCG prior to application.

20. In case of emergency, contact HKCG at 28806999 which is manned 24 hours. If a gas leak is suspected, immediately stop work and evacuate the site personnel from the trenches. It should be noted that gas might travel through underground drains or conduits to other areas of the site. Evacuate the personnel from these areas if this is suspected.

21. HKCG should be consulted prior to any cutting or removal of a decommissioned gas pipe. As there may be residue gas inside a decommissioned gas pipe, cutting should only by employed by mechanical cutter or hack saw. In all circumstances, oxy-acetylene cutting SHOULD NOT be employed for cutting a decommissioned gas pipe.

22. Should there be settlement expected to be caused by the work, the predicted settlement contour should be forwarded to HKCG for assessment of the impact.

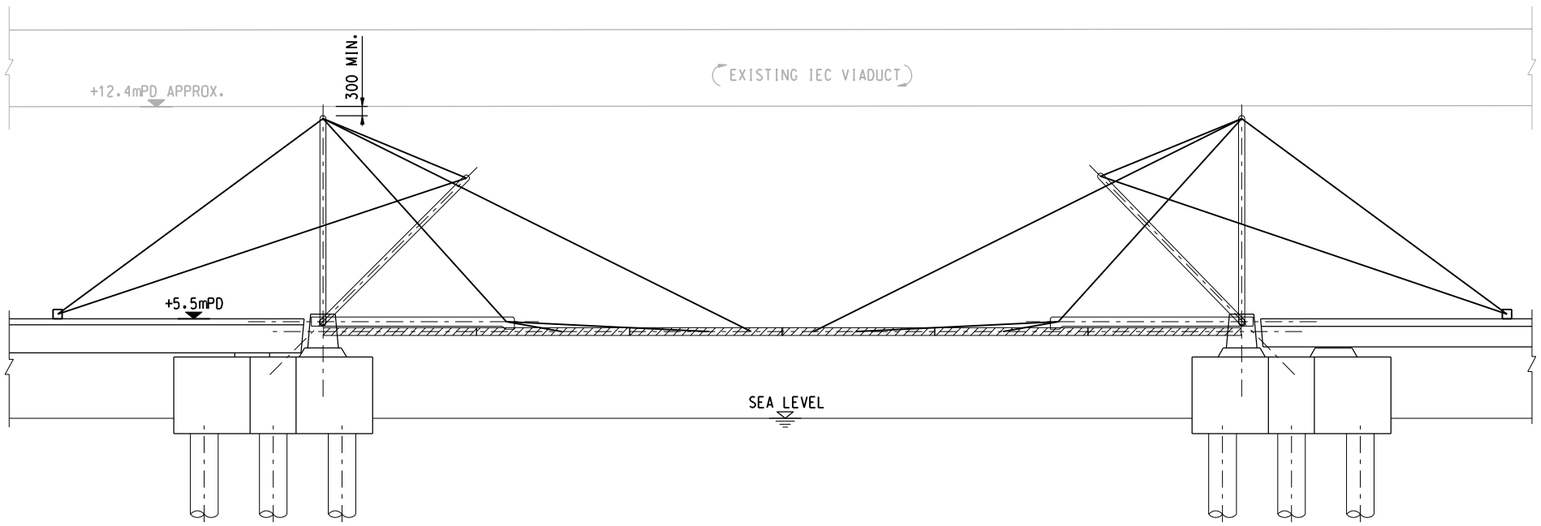
23. For plantation work with tree guard installation, the exact location and depth of the gas pipe should be confirmed by hand-dug trial holes prior to the driven of the tree guard into the ground to avoid damage of gas pipe underneath.

24. Due care should be given to the ancillary equipment attached to the gas main. Cathodic protection is installed for corrosion-resistant purpose and it has some cables linking from the gas pipe to the anodes and connected in a junction box placed in a pit. The anodes are normally installed at 1m away from the pipe whilst the anodes junction boxes would be installed at footpath at a distance from those gas main laid under carriageway.

25. The Code of Practice "Avoiding danger from gas pipes" has been prepared by the Gas Authority and approved and brought into effect in accordance with the provisions of section 9 of the Gas Safety Ordinance Cap 51 (the Ordinance). Its purpose is to provide practical guidance in respect of the requirements of the Ordinance and the Gas Safety (Gas Supply) Regulations (the regulations) concerning the avoidance of damage to gas pipes. These requirements are more specifically defined in regulation 23A of the regulations as follows-

> ***"23A. Works in the vicinity of gas pipes***
>
> *1) No person shall carry out, or permit to be carried out, any works in the vicinity of a gas pipe unless he or the person carrying out the works has, before commencing the works, taken all reasonable steps to ascertain the location and position of the gas pipe.*
>
> *2) A person who carries out, or who permits to be carried, any works in the vicinity of a gas pipes shall ensure that all reasonable measures are taken to protect the gas pipe from damage arising out of the works that would be likely to prejudice safety."*

MOVABLE BRIDGE - OPENING STATE
(PEDESTRIAN RAILING NOT SHOWN FOR CLARITY)



MOVABLE BRIDGE - CLOSING STATE
(PEDESTRIAN RAILING NOT SHOWN FOR CLARITY)

AECOM

PROJECT
項目

BOARDWALK UNDERNEATH ISLAND EASTERN CORRIDOR - INVESTIGATION

CLIENT
業主

土木工程拓展署
Civil Engineering and Development Department

CONSULTANT
工程顧問公司

AECOM Asia Company Ltd.
www.aecom.com

SUB-CONSULTANTS
分判工程顧問公司

ISSUE/REVISION
參訂

I/R 參訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 核對

STATUS
階段

SCALE 比例
A1 1 : 100

DIMENSION UNIT 尺寸基位
MILLIMETRES

KEY PLAN
索引圖

PROJECT NO. 項目編號
60341972

CONTRACT NO. 合約編號
CE 41/2014 (HY)

SHEET TITLE
圖紙名稱

PROPOSED BOARDWALK
MOVABLE BRIDGE

SHEET NUMBER
圖紙編號

60341972/SORR/311

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本函檔號 Your Reference CLUK:JLYW:mlpm:60341972/01-2016004761T
本署檔號 Our Reference ( ) in HK-R/CS/16/4
電話號碼 Tel No.: 2231 4933
傳真機號碼 Fax No.: 2895 3957

Please quote our reference in future correspondence

21 June 2016

AECOM
8/F Grand Central Plaza, Tower 2
138 Shatin Rural Committee Road
Shatin, Hong Kong

(Attn: Charles LUK)

Dear Mr. LUK,

Agreement No. CE41/2014 (HY)
Boardwalk underneath Island Eastern Corridor – Investigation
Verification of Population Data

I refer to your letter dated 7.6.2016 regarding the subject study. I append below the comments on the submission for your consideration:

(a) When compared to the Working Paper on Methodology on Hazard Assessment (Ref. R15-01) dated 1.4.2016, the hazard sources mentioned in your letter does not tally with those identified in the working paper. Please clarify.

(b) It is noted that reference has been made to the Enhanced 2011-based TPEDM as one of the sources to derive the population estimate. Please be advised that TPEDM users must satisfy themselves that the data matrix is suitable for their own purposes, taking into account the underlying assumptions and the compilation method, and they should be accountable for the proposed development or infrastructure projects so formulated. There is no comment on the population figures from TPEDM point of view.

(c) Nevertheless, it is noticed that the population figures are estimated in Years 2016, 2018 and 2019 of which TPEDM data set has no breakdown figures for individual year between 2011 and 2021. The consultant may find it useful to make reference to the latest released "Projections of Population Distribution 2015-2024" (http://www.pland.gov.hk/pland_en/info_serv/statistic/wgpd15.html) of which population data of individual year are available at TPU level up to 2020.

.../2

(d) Please state clearly the assumptions adopted in deriving the maximum population under different phases and the type of development for each site to facilitate understanding the population estimation.

(e) EMSD should be consulted for the Hazard Assessment Study.

This serves as a coordinated reply of Strategic Planning Section and District Planning Officer/Hong Kong of this Department. Should you have any enquiries, please contact the undersigned at 2231 4933.

Yours sincerely,

(Kevin LAU)
for District Planning Officer/Hong Kong
Planning Department

c.c.
PM(HKI&I), CEDD (Attn.: Ms. H Y LAM)
CTP/SP (Attn.: Miss Rosa TSE)

IL/KL

Agreement No. CE 41/2014 (HY)
Boardwalk underneath Island Eastern Corridor - Investigation

Comments on Verification of Population Data

Comments Received	Date
1. Planning Department (Hong Kong District Planning Office)	21 June 2016

Agreement No. CE 41/2014 (HY)
Boardwalk underneath Island Eastern Corridor - Investigation

Comments on Verification of Population Data

No.	Comments	Responses
1.	**From : Planning Department (Hong Kong District Planning Office)** **Ref : ( ) in HK-R/CS/16/4** **Date : 21 June 2016** I refer to your letter dated 7.6.2016 regarding the subject study. I append below the comments on the submission for your consideration:	
1.1	When compared to the Working Paper on Methodology on Hazard Assessment (Ref.R15-01) dated 1.4.2016, the hazard sources mentioned in your letter dose not tally with those identified in the working paper. Please clarify.	As per EMSD's request dated 10 May 2016, the IP town gas pipeline running along Java Road and Hoi Yu street are supplemented as hazard source in this study. Therefore, the hazard sources mentioned in the letter to your office for the population verification (issued on 7 June 2016) are different from those in the Working Paper on Methodology on Hazard Assessment dated 1 April 2016.
1.2	It is noted that reference has been made to the Enhanced 2011-based TPEDM as one of the sources to derive the population estimate. Please be advised that TPEDM users must satisfy themselves that the data matrix is suitable for their own purposes, taking into account the underlying assumptions and the compilation method, and they should be accountable for the proposed development or infrastructure projects so formulated. There is no comment on the population figures from TPEDM point of view.	Noted.

No.	Comments	Responses
1.3	Nevertheless, it is noticed that the population figures are estimated in Years 2016, 2018 and 2019 of which TPEDM data set has no breakdown figures for individual year between 2011 and 2021. The consultant may find it useful to make reference to the latest released "Projections of Population Distribution 2015-2024" (http://www.pland.gov.hk/pland_en/info_serv/statistic/wgpd15.html) of which population data of individual year are available at TPU level up to 2020.	Noted.
1.4	Please state clearly the assumptions adopted in deriving the maximum population under different phases and the type of development for each site to facilitate understanding the population estimation.	The relevant information is stated in Section 3.4 of the report.
1.5	EMSD should be consulted for the Hazard Assessment Study. This serves as a coordinated reply of Strategic Planning Section and District Planning Officer/Hong Kong of this Department. Should you have any enquiries, please contact the undersigned at 2231 4933.	Noted.

AECOM

Transportation

Working Paper on
Air Quality Assessment

(Ref. R35-01)

July 2017

Agreement No. CE 41/2014 (HY)

Boardwalk underneath Island Eastern Corridor – Investigation

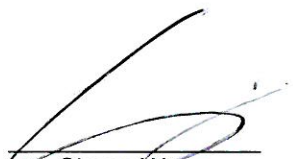
土木工程拓展署
Civil Engineering and Development Department
Hong Kong Island and Islands Development Office

Agreement No. CE 41/2014 (HY)
Boardwalk underneath Island Eastern Corridor - Investigation

Working Paper on Air Quality Assessment

(Ref. R35-01)

July 2017

Reviewed:  10 July 2017
Simon Wong

Approved for Issue:  10 July 2017
Charles Luk

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1 INTRODUCTION

1.1 Background

1.1.1.1 AECOM Asia Company Limited (AECOM) is commissioned by CEDD as the Consulting Engineer to undertake the assignment of Boardwalk underneath Island Eastern Corridor – Investigation (hereafter referred to as "the Project"). The overall objective of the assignment is to conduct a review of the feasibility of the proposed boardwalk under the Island Eastern Corridor (IEC) to demonstrate its compliance with the Protection of the Harbour Ordinance (PHO) before proceeding with the detailed design and construction of the Project. Besides, an Environmental Assessment (EA) of the Project would also be carried out to review its environmental implications.

1.1.1.2 The objective of this working paper is to identify the potential air quality impacts associated with the construction and the operation of the Project and formulate effective and practicable mitigation measures if necessary.

1.2 Description of Project

1.2.1.1 The Project consists of a pedestrian boardwalk underneath the IEC from Oil Street to Hoi Yu Street along the North Point waterfront, cycle track alongside the pedestrian boardwalk are also proposed. In addition, roof deck and adjacent open space of North Point Vehicular Ferry Pier, and the area underneath the IEC Bridge east to Hoi Yu Street will also be development under the Project. The boardwalk would be supported by the IEC foundation resting on the existing IEC pile caps. The structural form of the boardwalk is a steel bridge with cast in-situ concrete deck to minimise the self-weight of the proposed boardwalk.

1.2.1.2 A promenade is proposed at the embankment between Tong Shui Road and Tin Chiu Street connecting the boardwalk, while another promenade is proposed to the western-end of the boardwalk near City Garden. The promenade connecting the boardwalk will be developed by the proponent of North Point Estate Redevelopment Site, while the promenade to the west is planned open space under other developments. Hence these proposed promenades are not included in the study and hence the environmental assessment of the Project.

1.2.1.3 The construction of the Project would be carried out from 2018 to 2019 tentatively. As the boardwalk would be supported by the IEC foundation resting on the existing IEC pile caps, construction works would mainly comprise short duration of pre-bored H piling, reinforced concrete structural modification works for pile caps, subsequent installation of pre-fabricated platform structures, lift installation, E&M installations, architectural finishing and landscaping works. For the roof deck and adjacent open space of North Point Vehicular Ferry Pier, and the area underneath the IEC Bridge east to Hoi Yu Street, the construction works would mainly comprise structural modification, lift installation, E&M installations, architectural finishing and landscaping works.

1.2.1.4 The layout plan of the Project is shown on **Appendix 1.1**.

2 ENVIRONMENTAL LEGISLATION, PLANS, STANDARDS, AND GUIDELINES

2.1.1.1 The Air Pollution Control Ordinance (APCO) provides the statutory framework for controlling air pollutants from a variety of sources. The Hong Kong Air Quality Objectives (AQOs), which must be satisfied, stipulate the maximum allowable concentrations over specific periods for a number of criteria air pollutants. The AQOs are listed in **Table 2.1**.

Table 2.1 Hong Kong Air Quality Objectives

Pollutants	Averaging Time	Concentration Limit (µg/m³) (1)	No. of Exceedances to be Allowed per Calendar Year
Sulphur Dioxide (SO_2)	10-min	500	3
	24-hour	125	3
Respirable Suspended Particulates (PM_{10} / RSP) (2)	24-hour	100	9
	1-year	50	Not applicable
Fine Suspended Particulates ($PM_{2.5}$ / FSP) (3)	24-hour	75	9
	1-year	35	Not applicable
Nitrogen Dioxide (NO_2)	1-hour	200	18
	1-year	40	Not applicable
Ozone (O_3)	8-hour	160	9
Carbon Monoxide (CO)	1-hour	30000	0
	8-hour	10000	0
Lead (Pb)	1-year	0.5	Not applicable

Notes:
(1) All measurements of the concentration of gaseous air pollutants, i.e., sulphur dioxide, nitrogen dioxide, ozone and carbon monoxide, are to be adjusted to a reference temperature of 293 Kelvin and a reference pressure of 101.325 kilopascal.
(2) Respirable suspended particulates means suspended particles in air with a nominal aerodynamic diameter of 10 µm or less.
(3) Fine suspended particulates means suspended particles in air with a nominal aerodynamic diameter of 2.5 µm or less.

2.1.1.2 Chapter 9 of "Environment" of the Hong Kong Planning Standards and Guidelines (HKPSG) suggests the buffer distance requirements for roads and highways.

2.1.1.3 Since there is no criteria of TSP level in the AQOs, the criteria of TSP level for construction dust impact assessment is made reference to the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM), which stipulates that the hourly TSP level at sensitive receivers should not exceed 500 µg/m³ (measured at 25ºC and one atmosphere).

2.1.1.4 Notifiable and regulatory works are under the control of Air Pollution Control (Construction Dust) Regulation. Notifiable works under this regulation include works such as site formation, demolition, foundation and superstructure construction for buildings and road construction. Regulatory works under this regulation include works such as road opening and resurfacing, slope stabilisation, and other activities including stockpiling, dusty material handling, excavation, etc. This Project is expected to involve both notifiable works and regulatory works. Contractors and site agents are required to inform EPD and adopt dust control measures to minimize dust emission, while carrying out construction works, to the acceptable level.

3 MAJOR ELEMENTS OF SURROUNDING ENVIRONMENT

3.1 Description of Surrounding Environment

3.1.1.1 The vicinity of the western side of the Project (Oil Street to Tong Shui Street) mainly consist of private residential dwellings including City Garden and Provident Centre, while the surroundings near the eastern side of the Project (Tin Chiu Street to Hoi Yu Street) mainly consist of commercial developments and Government buildings such as ICAC North Point Headquarters and North Point Government Offices.

3.1.1.2 North Point Ferry Pier is located near the half way of the boardwalk. North Point Estate Redevelopment Site is located between Tong Shui Street and Tin Chiu Street near the embankment of North Point Ferry Pier. The North Point Estate Redevelopment Site will be completed in 2018 tentatively and comprise private residential development, commercial complex and hotel. It is also noteworthy that proposed promenade connecting the boardwalk in front of the North Point Estate Redevelopment Site will be developed by its proponent.

3.2 Background Air Quality

3.2.1.1 The nearest Environmental Protection Department (EPD) air quality monitoring station is located at Eastern. The recent five years (2011 – 2015) air quality monitoring data of NO_2, RSP, FSP and SO_2 recorded at this monitoring station are summarized in **Table 3.1**.

Table 3.1 Air Quality Monitoring Data in the latest Five Years (Year 2011 – 2015) at EPD's Eastern Air Quality Monitoring Station

			Concentration in μg/m³				
Pollutant	**Averaging Time**		**Year 2011**	**Year 2012**	**Year 2013**	**Year 2014**	**Year 2015**
Sulphur Dioxide (SO_2)	24-hr	1st Highest	41	45	46	30	34
		4th Highest	28	30	33	27	19
Respirable Suspended Particulates (PM_{10})	24-hr	1st Highest	**111**	**160**	**154**	**121**	**133**
		10th Highest	92	82	**103**	90	86
	Annual		43	38	43	37	35
Fine Suspended Particulates ($PM_{2.5}$)	24-hr	1st Highest	75	66	**109**	**84**	**87**
		10th Highest	64	54	71	55	56
	Annual		30	25	28	26	23
Nitrogen Dioxide (NO_2)	1-hr	1st Highest	**257**	**240**	**230**	**236**	**281**
		19th Highest	180	177	189	175	176
	Annual		**59**	**58**	**58**	**52**	**47**

Notes:
(1) Monitoring results exceeded AQOs are shown as bold and underlined characters.
(2) All data is calculated from the hourly data provided in EPD's website (http://epic.epd.gov.hk/EPICDI/air/station/?lang=en).
(3) Reference conditions of gaseous pollutants concentration data: 298K and 101.325 kPa.

3.2.1.2 Future background air quality levels can be predicted from the Pollutants in the Atmosphere and the Transport over Hong Kong 2016 Version (PATH-2016) model which was released by EPD in January 2016. The emission sources including those in Pearl River Delta Economic Zone, roads, marine, airport, power plants and industries within Hong Kong are all considered in the PATH-2016 model. The emission inventory adopted in the PATH-2016 model has taken into account various emission control measures (such as (1) Reducing roadside air pollution; (2) Reducing marine emissions; (3) emission control of Power Plant; and (4) Emission control of non-road mobile) to be implemented in HKSAR. The predicted concentrations by PATH-2016 model with Year 2020 emission inventory are summarized in **Table 3.2**, and the locations of the related PATH grids are shown in **Figure 3.1**.

Table 3.2 Air Pollutant Concentrations Extracted from the PATH-2016 Model with Year 2020 Emission Inventory

Pollutant	Averaging Time		AQOs (μg/m³)	Concentration in μg/m³ at Grids			
				(42,30)	(43,30)	(43,31)	(44,30)
SO_2 (1)	10-min	1st Highest	500	117	113	113	110
	24-hr	4th Highest	125	29	28	27	26
RSP (PM_{10})	24-hr	10th Highest	100	78	80	83	79
	Annual		50	33	34	38	34
FSP (2) ($PM_{2.5}$)	24-hr	10th Highest	75	59	60	62	59
	Annual		35	24	24	27	24
NO_2	1-hr	19th Highest	200	142	129	141	121
	Annual		40	26	23	29	21

Notes:
(1) The outputs from the PATH model are hourly averages. As recommended by EPD's *Guidelines on the Estimation of 10-minute Average SO_2 Concentration for Air Quality Assessment in Hong Kong*, the stability-dependent multiplicative factors from Duffee et al. (1991) are adopted to convert 1-hour averaged SO_2 concentrations to 10-minute averaged SO_2 concentration.
(2) With reference to the EPD's *Guidelines on the Estimation of $PM_{2.5}$ for Air Quality Assessment in Hong Kong*, the following conservative formulae are adopted to calculate background FSP concentration from the RSP concentration extracted from the PATH model:
Annual (μg/m³): $PM_{2.5} = 0.71 \times PM_{10}$
Daily (μg/m³): $PM_{2.5} = 0.75 \times PM_{10}$
(3) Reference conditions of gaseous pollutants concentration data: 293 K and 101.325 kPa.

3.3 Air Sensitive Receivers

3.3.1.1 The study area for air quality impact assessment is defined by distance of 500m away from the boundary of the Project. Existing and planned representative Air Sensitive Receivers (ASRs) in the study area have been identified. The identified representative ASRs are summarized in **Table 3.3** below and shown in **60341972/WPAIR/Figure 3.2.**

Table 3.3 Identified Representative Air Sensitive Receivers

ID	Description	Land Use
A1	Tower 8, Harbour Glory	Residential
A2	Block 7, City Garden	Residential
A3	Block 6, City Garden	Residential
A4	HK Baptist Church Henrietta Secondary School	Educational
A5	PLK Yu Lee Mo Fan Memorial School	Educational
A6	Block 1, Provident Centre	Residential
A7	Block 9, Provident Centre	Residential
A8	Block 17, Provident Centre	Residential
A9	Tong Shui Road Garden	Open Space
A10	Proposed Development at North Point Estate Redevelopment Site (West)	Residential
A11	Proposed Development at North Point Estate Redevelopment Site (East)	Residential
A12	Tin Chiu Street Children's Playground	Open Space
A13	Office of North Point Concourse Promenade	G/IC
A14	North Point Ferry Concourse Promenade	Open Space
A15	K. Wah Centre	Commercial
A16	ICAC Headquarters Building	G/IC
A17	Kodak House	Commercial
A18	North Point Fire Services Married Quarters	G/IC
A19	North Point Government Offices	G/IC
A20	North Point Police Station	G/IC
A21	The Hong Kong and China Gas Company Limited	Commercial
A22	Eastern Harbour Centre	Commercial
A23	Quarry Bay Park Phase II	Open Space

4 IDENTIFICATION OF POLLUTANT SOURCES

4.1 Construction Phase

4.1.1.1 Potential sources of air quality impacts would be dust emissions during construction activities. The major construction activities of the Project will involve short duration of the construction works summarized in **Table 4.1** below. Extensive excavation and transportation of dusty material would not be required.

Table 4.1 Construction works for Proposed Boardwalk and Adjacent Development Areas under the Project

Development Area	Construction Work Involved
Proposed Boardwalk	• Pre-bored H piling • Reinforced concrete structural modification works for pile caps • Transporting and installation of pre-fabricated platform structures • E&M installations • Architectural finishing • Landscape works
Roof deck and adjacent Open Space of North Point Vehicular Ferry Pier	• Structural Modification • Piling Foundation • Passenger lift installation • E&M installation • Architectural finishing • Landscape works
Area underneath the IEC bridge east to Hoi Yu Street	• Structural Modification • E&M installation • Architectural finishing • Landscape works

4.2 Operation Phase

4.2.1.1 Since the Project consists of a pedestrian boardwalk, a cycle track and some open spaces to serve the purpose of providing a place of relaxation for pedestrians and residents in the area, there will be no air pollutant emission sources from the Project during the operation phase. Adverse air quality impact from the Project to the ASRs in the vicinity during the operation phase is not expected.

4.2.1.2 The major air pollutant sources in the vicinity are identified for the evaluation of air quality implication to the Project, including background air pollutants and vehicular emissions from existing roads within the air quality study area.

5 EVALUATION OF POTENTIAL AIR QUALITY IMPACTS

5.1 Construction Phase

5.1.1.1 During construction phase, dust emissions generated from construction activities would be the major source of air quality impact. As the boardwalk would be supported by the IEC foundation resting on the existing IEC pile caps, construction works for the Project would mainly comprise short duration of pre-bored H piling, reinforced concrete structural modification works for pile caps, subsequent installation of pre-fabricated platform structures, lift installation, E&M installations, architectural finishing and landscaping works. Dust would be generated from material handling and hauling, vehicle movement and wind erosion of exposed areas. In view of the minor and limited scale of the proposed development, the construction activities of this Project are not expected to generate significant amount of construction dust, and significant impacts are not expected with appropriate site management and mitigation.

5.1.1.2 Dust suppression measures in the *Air Pollution Control (Construction Dust) Regulation* and good site practices should be incorporated to control dust emission from the site. Major control measures relevant to this Project are listed below, and they are recommended to be included in relevant contract documents:

- Skip hoist for material transport should be totally enclosed by impervious sheeting;
- All dusty materials should be sprayed with water prior to any loading, unloading or transfer operation so as to maintain the dusty materials wet;
- All stockpiles of aggregate or spoil should be covered and water applied;
- The height from which materials are dropped should be controlled to a minimum practical height to limit fugitive dust generation from unloading;
- Every vehicle should be washed to remove any dusty materials from its body and wheels before leaving the construction sites; and
- The load of dusty materials carried by a vehicle leaving a construction site should be covered entirely by clean impervious sheeting to ensure dust materials do not leak from the vehicle.

5.1.1.3 With effective implementation of these mitigation measures, adverse construction dust impacts are not expected.

5.2 Operation Phase

5.2.1.1 The purpose of the Project is to enhance connectivity and pedestrian accessibility of the harbour front, and to provide a place of relaxation for pedestrians and residents in the area. As the nature of the proposed boardwalk is intended for relaxation and allow pedestrians to enjoy the harbour view, emission sources such as vehicular emissions or chimney emissions are not expected from the Project. Hence, adverse air quality impact from the Project to the ASRs in the vicinity during the operation phase is not expected.

5.2.1.2 The nature of the proposed Project is a recreation open space, where people can enjoy the surroundings in a leisurely manner. Since the proposed alignment of the Project can fulfil the planning requirements as stipulated in the HKPSG for passive recreational uses, no adverse air quality impact is anticipated for the future users of the boardwalk.

5.2.1.3 Moreover, air quality measurement was carried out at two stations along the proposed alignment of the boardwalk for 7 consecutive days at each station. The air quality measurement has been conducted in accordance to the methodology as presented in the approved *Air Quality Measurement Methodology Paper* (**Appendix 5.1**). The locations of the two measurement stations, i.e. the roof platform of the North Point Dangerous Goods Vehicular Ferry Pier (Location 1) and Tong Shui Road Pier (Location 2), are shown in **Figure 5.1**. The Data Report of the Air Quality Measurement is presented in **Appendix 5.2**. The monitoring data is summarized in **Table 5.1**.

Table 5.1 Summary of Air Quality Measurement Results

Pollutants	Averaging Time	AQOs	Concentration			
			Location 1 (North Point Dangerous Goods Vehicular Ferry Pier)		Location 2 (Tong Shui Road Pier)	
			ppb (NO_2, NOx) mg/m^3 (RSP, FSP)	µg/m^3	ppb (NO_2, NOx) mg/m^3 (RSP, FSP)	µg/m^3
Nitrogen Dioxide (NO_2)	1-hr Max	200	60	112	65	122
Nitrogen Oxides (NO_x)	1-hr Max	N.A.	255	353	116	186
Respirable Suspended Particulates (PM_{10} / RSP)	24-hr Max	100	0.078	78	0.073	73
Fine Suspended Particulates ($PM_{2.5}$ / FSP)	24-hr Max	75	0.048	48	0.043	43

5.2.1.4 According to **Table 5.1**, the criteria air pollutants concentrations are well within AQOs with adequate buffer. Hence, adverse air quality impact to the proposed boardwalk is not expected.

6 CONCLUSION

6.1.1.1 Air quality impact arising from the construction of the project has been reviewed to be mainly dust generated from construction activities. In view of the minor and limited scale of the proposed development, with appropriate dust suppression measures as stipulated in the *Air Pollution Control (Construction Dust) Regulation* and good site practices, adverse dust quality impact to ASRs in the vicinity is not expected.

6.1.1.2 As the nature of the Project is intended for relaxation and allow pedestrians to enjoy the harbour view, emission sources such as vehicular emissions or chimney emissions are not anticipated from the Project. Adverse air quality impact from the Project to the ASRs in the vicinity during the operation phase is not expected.

6.1.1.3 The major air pollution sources in the vicinity of the Project would be background air pollutants and vehicular emissions from the open roads within the air quality study area. The proposed alignment of the Project can fulfil the planning requirements as stipulated in the HKPSG for passive recreational uses. Also, the measured air quality concentrations are complied with relevant AQOs, adverse air quality impact to the proposed boardwalk is not expected.

Figures

ISO A1 594mm x 841mm

Approved:

Checked:

Designer:

Project Management Initials:

837300 E

838300 E

839300 E

818000 N

817000 N

816000 N

LEGEND:

500m ASSESSMENT BOUNDARY

PROJECT BOUNDARY

(41,30) PATH GRID

N

VICTORIA HARBOUR

(43,31)

(42,30)

(43,30)

(44,30)

北角
NORTH POINT

NORTH POINT

銅鑼灣
CAUSEWAY BAY

銅鑼灣避風塘
CAUSEWAY BAY TYPHOON SHELTER

鰂魚涌
QUARRY BAY

BRAEMAR HILL

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AECOM

PROJECT
項目

BOARDWALK UNDERNEATH ISLAND EASTERN CORRIDOR - INVESTIGATION

CLIENT
業主

土木工程拓展署
Civil Engineering and Development Department

CONSULTANT
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修訂

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STATUS
階段

SCALE 比例
A1 1 : 5000

DIMENSION UNIT 尺寸基位
METRES

KEY PLAN
索引圖

PROJECT NO. 項目編號
60341972

CONTRACT NO. 合約編號
CE 41/2014 (HY)

SHEET TITLE
圖紙名稱

LOCATIONS OF THE RELATED PATH GRIDS

SHEET NUMBER
圖紙編號

60341972/WPAIR/FIGURE 3.1

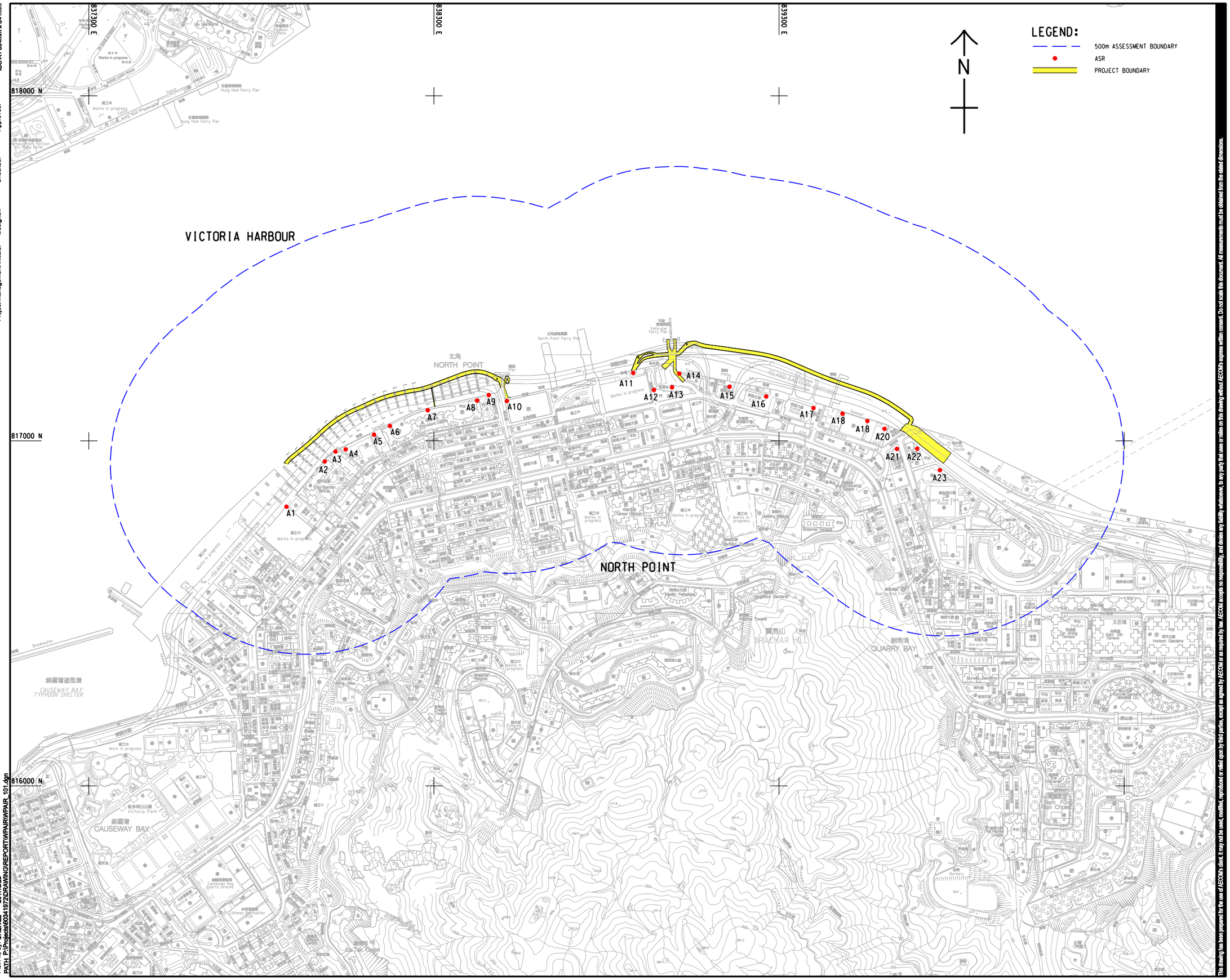
ISO A1 594mm x 841mm

Approved:

Checked:

Designer:

Project Management Initials:



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SCALE 比例
A1 1 : 5000

DIMENSION UNIT 尺寸單位
METRES

KEY PLAN
索引圖

PROJECT NO. 項目編號
60341972

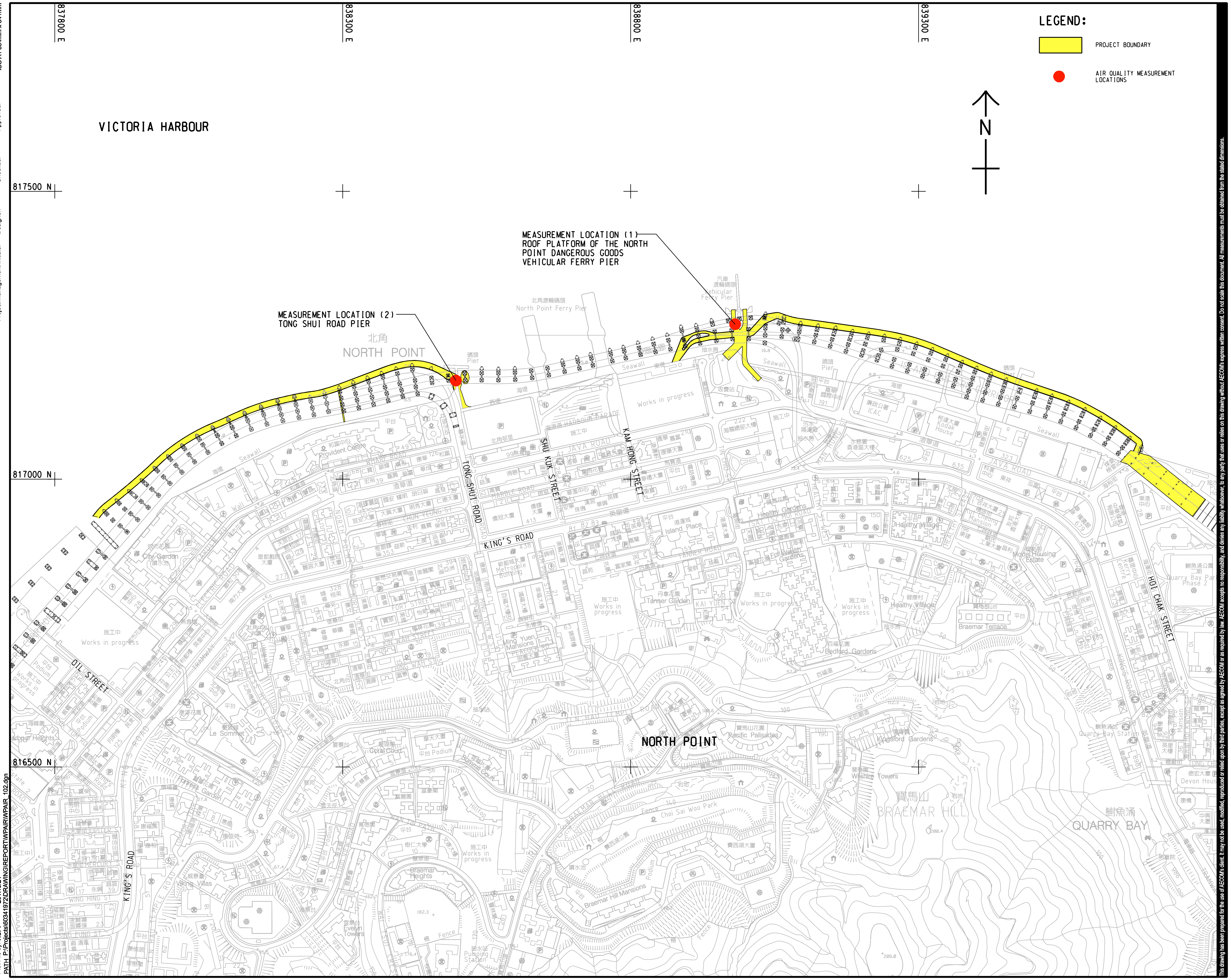
CONTRACT NO. 合約編號
CE 41/2014 (HY)

SHEET TITLE
圖紙名稱

LOCATIONS OF REPRESENTATIVE AIR SENSITIVE RECEIVERS

SHEET NUMBER
圖紙編號

60341972/WPAIR/FIGURE 3.2



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階段

SCALE 比例: A1 1 : 3000

DIMENSION UNIT 尺寸單位: METRES

KEY PLAN
索引圖

PROJECT NO. 項目編號: 60341972

CONTRACT NO. 合約編號: CE 41/2014 (HY)

SHEET TITLE
圖紙名稱

AIR QUALITY MEASUREMENT LOCATIONS

SHEET NUMBER
圖紙編號

60341972/WPAIR/FIGURE 5.1

Project Management Initials: Designer: Checked: Approved: ISO A1 594mm x 841mm

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Appendix 1.1
Layout of the Proposed Boardwalk

ISO A1 594mm x 841mm

Approved:

Checked:

Designer:

Project Management Initials:

NOTE:

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING NO. 60341972/EAR/102.

LEGEND:

- PROPOSED DOLPHIN STRUCTURE
- PROPOSED WALKWAY UNDER IEC
- MOVEABLE BRIDGE
- PROPOSED CYCLE TRACK UNDER IEC
- PROPOSED PROMENADE (BY OTHERS)
- RECLAMATION (BY OTHERS)
- RECLAMATION AREA
- AFFECTED WATER AREA
- BOARDWALK AREA
- +5.5 PROPOSED FINISHED FLOOR LEVEL (IN mPD)
- +5.5 ANTICIPATED LEVELS OF WATERFRONT AREA (IN mPD)
- PROJECT BOUNDARY FOR ENVIRONMENTAL ASSESSMENT

817000 N

838000 E

838200 E

CUT LINE A-A

CUT LINE B-B

SEE DRAWING NO. 60341972/EAR/102

ISLAND EASTERN CORRIDOR (Elevated Road)

WHARF ROAD

CITY GARDEN ROAD

NORTH POINT ESTATE LANE

HARBOUR PARADE

816800 N

838400 E

838600 E

838800 E

817200 N

港口 HARBOUR

WEST EMBANKMENT

EAST EMBANKMENT

North Point Promenade

North Point Ferry Pier

Wip Dec 2014

PLAN
(10m WITH VERSION, WALKWAY & CYCLETRACK WITHOUT SEPERATION)

PLAN

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BOARDWALK UNDERNEATH ISLAND EASTERN CORRIDOR - INVESTIGATION

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STATUS 狀況

SCALE 比例
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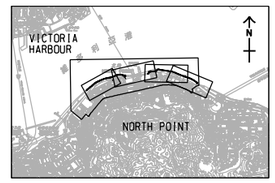
DIMENSION UNIT 尺寸單位
METRES

KEY PLAN 索引圖 A1 1 : 50000



PROJECT NO. 項目編號
60341972

CONTRACT NO. 合約編號
CE 41/2014 (HY)

SHEET TITLE 圖紙名稱
RECOMMENDED BOARDWALK SCHEME - GENERAL LAYOUT

SHEET 1 OF 2

SHEET NUMBER 圖紙編號
60341972/WPAIR/FIGURE 1.1

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Approved:
Checked:
Designer:
Project Management Initials:

NOTES:

1. FOR NOTES AND LEGEND REFER TO DRAWING NO. 60341972/EAR/101.
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING NO. 60341972/EAR/101.

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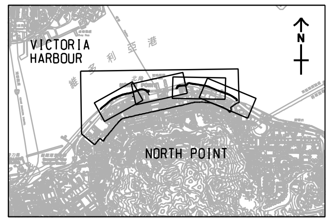
STATUS 階段

SCALE 比例 A1 1:1000

DIMENSION UNIT 尺寸單位 METRES

KEY PLAN 索引圖 A1 1:50000



PROJECT NO. 項目編號 60341972

CONTRACT NO. 合約編號 CE 41/2014 (HY)

SHEET TITLE 圖紙名稱

RECOMMENDED BOARDWALK SCHEME - GENERAL LAYOUT

SHEET 2 OF 2

SHEET NUMBER 圖紙編號

60341972/WPAIR/FIGURE 1.1

Appendix 5.1
Approved Air Quality Measurement Methodology Paper

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Our Ref: CLUK:JLYW:mlpm:60341972/01-2016005630T

30 June 2016

By Hand

Distribution List

Dear Sir/Madam,

Agreement No. CE41/2014 (HY)
Boardwalk underneath Island Eastern Corridor – Investigation

Air Quality Measurement Methodology Paper (Ref. R14-03)

Further to comments received from relevant departments regarding the Air Quality Measurement Methodology Paper (Issue 2) issued under our letter ref: CLUK:JLYW:mlpm:60341972/01-2016003896T dated 11 May 2016, we are pleased to submit the revised Air Quality Measurement Methodology Paper (Issue 3) for your approval.

Should you have any enquiry, please do not hesitate to contact the undersigned at 3922 8322 or our Mr. Jimmy Lau at 3922 8347.

Yours faithfully,
For and on behalf of
AECOM Asia Co. Ltd.

Charles Luk
Executive Director
Transportation

Encl.

cc CEDD – Attn: Ms HY Lam (Fax: 2577 5040; Email: hylam@cedd.gov.hk)

Agreement No. CE41/2014 (HY)
Boardwalk underneath Island Eastern Corridor – Investigation

Air Quality Measurement Methodology Paper (Ref. R14-03)

	Gov B/D	Division/Office	To	Attn	No. of Copies	Fax	Address
1	EPD	Environmental Protection Department Environmental Assessment Division	Sr Env Protection Offr(Metro Assessment)3	Mr. LI Tat Sang, Steve	1	2591 0558	Metro Assessment Group Hong Kong Island Section (3) 27th floor, Southorn Centre 130 Hennessy Road, Wan Chai, Hong Kong
2	PlanD	Hong Kong District Planning Office	DPO/HK	Mr. Kevin LAU	1	2895 3957	14/F, North Point Government Offices, 333 Java Road, Hong Kong
3	PlanD	Studies and Research Section	CTP/SR	Mr. C. P. AU	1	2231 4655	16/F, North Point Government Offices, 334 Java Road, Hong Kong
4	TD	TED (HK)	CTE/HK	Mr. Alan K L WONG	1	2824 0399	37/F, Immigration Tower 7 Gloucester Road Wan Chai, Hong Kong
5	TD	Ferry and Paratransit Division	CTO/Planning/Ferry	Mr. Charles WU Yu-man	1	28242176	40/F, Immigration Tower, 7 Gloucester Road, Wan Chai, Hong Kong
6	CEDD	HKI&IDevO (File Ref.:HKI 217/4)	CE/HK.I	Mr. C B MAK	3		13/F, North Point Government Offices, 333 Java Road, North Point,Hong Kong
7	HyD	Urban Region	CHE/HK	Mr Peter W T MA	1	2576 6244	7th Floor, North Point Government Offices, 333 Java Road, Hong Kong
8	LandsD	DLO	DLO/HKE	Mr George SH LIU	1	2834 4324	3rd & 19th floor, Southorn Centre, 130 Hennessy Road, Wan Chai, Hong Kong

Agreement No. 41/2014 (HY)
Boardwalk underneath Island Eastern Corridor - Investigation

Air Quality Measurement Methodology Paper (Issue 2)

Responses to Comments

		Date
1.	TD TED (HK)	17 May 2016
2.	HyD	26 May 2016
3.	TD Ferry and Paratransit Division's email	14 June 2016
4.	EPD's email	16 June 2016
5.	PlanD	17 June 2016

Agreement No. 41/2014 (HY)
Boardwalk underneath Island Eastern Corridor - Investigation

Air Quality Measurement Methodology Paper (Issue 2)

Responses to Comments

No.	Comments	Responses
1.	**From : TD TED (HK)** **Ref : (H24WT) in TD HR171/70-13** **Date : 17 May 2016** I refer to your above letter dated 11 May 2016 enclosing the subject. I note that it is proposed to locate two air quality measurement stations at (1) Tong Shui Road Pier under IEC and (2) the roof platform of the North Point Dangerous Goods Vehicular Ferry Pier Close to the IEC. For Location (1), please ensure the proposed air quality measurement stations will not affect the pedestrians reaching and leaving the area. For location (2), I note that you have included our ferry team in the circulation list, please seek comments / advice from them accordingly.	Noted. For location (1), proper location will be selected to set up the monitoring point to avoid affecting the pedestrians reaching and leaving the area. For location (2), advice from ferry team will be consulted.
2.	**From : HyD** **Ref : (HQSLH) HyD UHK / 12 – 2 / 1 / 17 / (DNP)** **Date : 26 May 2016** I refer to your above-quoted letter dated 11. 5. 2016 and have no comment on the captioned submission from highways maintenance point of view.	Noted.
3.	**From : TD Ferry and Paratransit Division** **Ref : email** **Date : 14 June 2016** I refer to the captioned subject. Please be informed that we have no comment for the captioned submission from ferry operation point of view. Should actual air quality measurement would be taken place at the upper deck platform of the North Point Vehicular Pier, please give three week advance notices to TD and the concerned	Noted.

No.	Comments	Responses
	Ferry Operator. Thanks for noting.	
4.	**From : EPD** **Ref : email** **Date : 16 June 2016** Re. your preceding emails below, please find our comment on the subject AQ measurement methodology paper ("MP") from air quality perspective:	
	1. Section 2.2.1, we note that " ... Selection of the locations of the two measurement stations have taken into consideration of accessibility to the site and safety issue during measurement ... , which are best available locations to simulate the height difference between the proposed alignment of the boardwalk and the IEC. ... "	Noted.
	2. Section 3.1, given that the nearby ferry piers are in close proximity to the proposed site area, please include SO2 measurement.	North Point Ferry Pier (NPFP) and North Point Dangerous Goods Vehicular Ferry Pier (NPDGVFP) are located in the vicinity of the proposed site area. According to Transport Department's website, there are services from NPFP to Hung Hom, Kowloon City and Kwun Tong at a frequency of about 30 minutes during day time. According to Hong Kong Ferry (Holdings) Company Limited's website, there are about 18 to 20 services per day at NPDGVFP. Since there are only about 6 services each hour at NPFP and about 1 service each hour at NPDGVFP, it is considered that the frequency of the ferries is low. Moreover, since Hong Kong has capped the sulphur content of locally supplied marine light diesel at 0.05% since April 2014, SO2 emission from the ferries is limited. Besides, the annual average concentrations of SO2 measured at EPD's nearest air quality monitoring stations, i.e. Eastern and Causeway Bay Stations, are in a range of 5-10 µg/m3, which show very large margin to the HKAQOs. Therefore, measurement of SO2 is not considered necessary.

No.	Comments	Responses
	3. Section 3.1, please review and justify whether odour measurement is required.	During site survey carried out on 29 April 2016, odour source is not noticed along the coastal area near the proposed alignment. Therefore, odour measurement is not considered necessary.
	4. Please be reminded that the measurement results should be presented in a format relevant to the AQO requirements, i.e., facilitating comparison against the time interval of the AQOs of each parameters.	The hourly data of NOx, NO2, RSP and FSP concentrations collected during the 7-day measurement will be presented, and will be further processed to present the maximum 1-hour average NO2 and maximum 24-hour average RSP and FSP concentrations. Section 3.4 is added accordingly.
	5. Please include job references, if any, for the proposed continuous gaseous analyzer and dust monitor that have been used in other projects in the revised MP.	The job references are included in Table 3.1.
5.	**From : PlanD** **Ref : ( ) in HK-R/CS/16/4** **Date : 17 June 2016** I refer to your letter dated 11. 5. 2016regarding the subject study. This office has no comment on the Air Quality Measurement Methodology Paper. Should you have any enquiries, please contact the undersigned at 2231 4933.	Noted.

土木工程拓展署
Civil Engineering and Development Department
Hong Kong Island and Islands Development Office

Agreement No. CE 41/2014 (HY)
Boardwalk underneath Island Eastern Corridor - Investigation

Air Quality Measurement Methodology Paper (Issue 3)

(Ref. R14-03) – Issue 3

June 2016

Reviewed: Simon Wong 29 June 2016

Approved for Issue: Charles Luk 29 June 2016

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1.3 Aim of This Paper 2

2 IDENTIFICATION OF LOCATIONS OF MEASUREMENT STATIONS 3

3 APPROACH AND METHODOLOGY 4

3.1 Monitoring Parameters 4
3.2 Frequency of the Measurement 4
3.3 Measurement Methodology 4
3.4 Presentation of Measurement Results 5
3.5 Approval for the Site Access and Installation for the Monitoring Stations 5

Drawings

60341972/SORR/101	Proposed Boardwalk Layout (with Continuous Cycle Track) Sheet 1 of 2
60341972/SORR/102	Proposed Boardwalk Layout (with Continuous Cycle Track) Sheet 2 of 2
60341972/SORR/103	Proposed Boardwalk Cross Sections
60341972/SORR/201	Proposed Boardwalk Layout (without Cycle Track) Sheet 1 of 2
60341972/SORR/202	Proposed Boardwalk Layout (without Cycle Track) Sheet 2 of 2
60341972/AQA/101	Proposed Locations of Air Quality Measurement Stations

Appendices

Appendix A	Measurement System
Appendix B	Specification Sheet for Continuous NO_x/NO/NO_2 Analyzer
Appendix C	Specification Sheet for Continuous Dust Monitor
Appendix D	Responses to Comments

1 INTRODUCTION

1.1 Background

1.1.1 In May 2009, the Planning Department commissioned the Hong Kong Island East Harbourfront Study (HKIEHS) to formulate a comprehensive plan for enhancing the Hong Kong Island East harbourfront, with a focus on improving connectivity and pedestrian accessibility of the harbourfront. A 3-stage public engagement programme was undertaken to solicit public views on the proposed enhancements and to build consensus on the proposals recommended in the HKIEHS. The HKIEHS was completed in March 2012.

1.1.2 Among the various proposed harbourfront enhancement initiatives, a pedestrian boardwalk of about 2km long was proposed to be constructed underneath the Island Eastern Corridor (IEC) from Oil Street to Hoi Yu Street to enhance connectivity along the North Point waterfront. The proposed boardwalk was well received by the public during the said public engagement exercise.

1.1.3 In January 2012, the Civil Engineering and Development Department (CEDD) commissioned a topical study on proposed boardwalk underneath the existing IEC structure (Topical Study) to establish preliminary engineering feasibility of the proposal and to assess possible implications of the Protection of the Harbour Ordinance (PHO) (Cap. 531) to facilitate further project planning and implementation.

1.1.4 The HKIEHS also identified that the points of access from the inland to the boardwalk should not be separated greater than 800m apart to facilitate operations during emergencies. In the Refined Scheme endorsed by the Task Force on Harbourfront Developments on Hong Kong Island of Harbourfront Commission (Task Force), the boardwalk would be connected to Oil Street, Tong Shui Road, ex- North Point Estate site and Hoi Yu Street for public access from the Fortress Hill MTR Station, residential buildings near King's Road, North Point MTR Station and Quarry Bay MTR Station respectively.

1.1.5 The Government committed in fostering a "bicycle-friendly" environment in new towns and new development areas as stated in the Chief Executive's 2014 Policy Address. Views on the provision of cycling facilities alongside the waterfront promenade at the Stage 2 Public Engagement Programme of the HKIEHS were diverse. Requests for cycling facilities was seen not only as a leisure or recreational activity but also as an alternative means of transport were also received during the Stage 3 Public Engagement Programme of the HKIEHS. Later in the Topical Study, only a dis-continuous cycle track was found feasible in the Refined Scheme.

1.1.6 Geographically, the proposed boardwalk lies within the statutory limit of Victoria Harbour in which PHO applies. At the 14th meeting of the Task Force held on 24 October 2013, the Government agreed to take forward the Project to ascertain if the "reclamation" can be justified under PHO.

1.1.7 The proposed boardwalk layout is developed from the Compromise Option with Cycle Track in the Topical Study. According to SDMHR issued by HyD, the clear headroom for pedestrians and cyclists on bridges should be 2.6m and 2.7m respectively. Based on this requirement, a further review was conducted for the boardwalk portion running wholely/partly underneath the existing IEC viaducts/slip roads. The following refinement on the alignment is proposed:

(a) Shifting the low-level boardwalk portion between Pier F1A and Pier F8A northward;

(b) Lowering the diverged boardwalk deck at Pier E5 to +7.90mPD; and

(c) Shifting the high-level boardwalk portion between Pier A6 and Pier A14 northward;

1.1.8 The refined layout of the 7.5m wide boardwalk deck, containing 3.5m wide footpath and 4m wide cycle track is shown on ***Drg. 60341972/SORR/101 & 102*** and some critical sections are shown on ***Drg. 60341972/SORR/103***. Another alternative layout for the 5.0m wide boardwalk deck without cycle track refers ***Drg. 60341972/SORR/201 & 202***.

1.2 The Assignment

1.2.1 The scope of the Project comprises:

(a) provision of a pedestrian boardwalk underneath the IEC from Oil Street to Hoi Yu Street along the North Point waterfront;

(b) provision of cycling facilities alongside the boardwalk in (a) and waterfront promenade, if appropriate; and

(c) associated geotechnical, structural, electrical and mechanical (E&M), marine, drainage, sewerage, greening and landscaping works, waterworks, utilities and traffic engineering works, environmental mitigation measures and other related works.

1.2.2 The overall objective of this Assignment is to conduct a review of the feasibility of the proposed boardwalk under the IEC to demonstrate its compliance with the PHO before proceeding with the detailed design and construction of the Project.

1.3 Aim of This Paper

1.3.1 According to Clause 6.10.3 of the Brief, measurements on nitrogen oxides, nitrogen dioxide, respirable suspended particulates and fine suspended particulates should be carried out for acquiring the baseline data in the Project area. The purpose of this Paper is to present the methodology of the air quality measurement to be adopted, including the locations of the measurement stations, the extent of the parameters to be measured, the frequency of measurement, and the measurement methodology, for prior comments and in-principle agreement with the EPD and the Client.

2 IDENTIFICATION OF LOCATIONS OF MEASUREMENT STATIONS

2.1.1 According to the Brief, two air quality measurement stations are required for acquiring the baseline data. Since the proposed alignment of the boardwalk include low level alignment underneath the IEC and high level alignment close to the IEC, one low level location and one high level location are selected to represent the baseline condition of air quality at the proposed boardwalk. Selection of the locations of the two measurement stations have taken into consideration of accessibility to the site and safety issue during measurement. Based on desktop review and site visits, locations at (1) Tong Shui Road Pier underneath the IEC and at (2) the roof platform of the North Point Dangerous Goods Vehicular Ferry Pier close to the IEC are selected, which are best available locations to simulate the height difference between the proposed alignment of the boardwalk and the IEC. The locations of the proposed air quality measurement stations are presented in ***Drg. 60341972/AQA/101***. Photos showing the surrounding environment of the proposed locations are presented below.

Proposed Location (1): Tong Shui Road Pier

Proposed Location (2): Roof Platform of the North Point Dangerous Goods Vehicular Ferry Pier

3 APPROACH AND METHODOLOGY

3.1 Monitoring Parameters

3.1.1 Nitrogen oxides (NO_x), nitrogen dioxide (NO_2), respirable suspended particulates (RSP) and fine suspended particulates (FSP) will be measured by the continuous monitoring equipment in each of the air quality measurement station.

3.2 Frequency of the Measurement

3.2.1 The baseline air quality monitoring will be carried out continuously at hourly intervals for a period of 7 consecutive days at two measurement stations in two separate measurement periods.

3.3 Measurement Methodology

3.3.1 A continuous NO_x/NO/NO_2 analyzer (Ecotech EC9841T) will be installed inside an enclosure with a dimension of 760mm (W) x 800mm (D) x 1230mm (H). The drawing showing the dimension and general set up of the measurement system is presented in **Appendix A**. The sampling inlet of the analyser will be at a height of 2.7 m above ground level at Proposed Location (1), i.e. Tong Shui Road Pier, and a height of 5.0 m above rooftop level at Proposed Location (2), i.e. Roof Platform of the North Point Dangerous Goods Vehicular Ferry Pier. This analyzer utilises microprocessor control and chemiluminescence detection which is USEPA approved method to measure NO_x, NO and NO_2 concentrations in ambient air. The hourly measurement data will be logged and retrieved after completion of the measurement period. The detailed specification sheet for the analyzer is presented in **Appendix B**.

3.3.2 Two continuous dust monitors (Met One ES-642) will be deployed to measure RSP and FSP mass concentrations respectively. The sampling inlet of the two dust monitors will be at a height of 2.7 m above ground level at Proposed Location (1), i.e. Tong Shui Road Pier, and a height of 5.0 m above rooftop level at Proposed Location (2), i.e. Roof Platform of the North Point Dangerous Goods Vehicular Ferry Pier. The dust monitor is designed for providing accurate measurements of particle concentrations using a highly sensitive forward scatter laser nephelometer. The hourly measurement data will be logged and retrieved after completion of the measurement period. The detailed specification sheet for the dust monitor is presented in **Appendix C**.

3.3.3 The previous job references of the continuous NO_x/NO/NO_2 analyzer (Ecotech EC9841T) and the dust monitors (Met One ES-642) are listed in **Table 3.1**.

Table 3.1 Job References of Gas Analyzer and Dust Monitor

Equipment	Project name	Project period	Client name
Ecotech EC9841T	Installation, Commissioning and Monitoring Works of Background Air Quality at Cape D'Aguilar	Mar 2010 - Feb 2012	Hong Kong Environmental Protection Department
Ecotech EC9841T	Provision of Services of the Monitoring of Air Quality in Tung Chung Contract 3	Jun 2009 - Oct 2011	Hong Kong Environmental Protection Department
Met One ES-642	Health Medical Project in PM Data Comparison	Jan 2016 - now	The Chinese University of Hong Kong

3.3.4 A multi-point dynamic calibration and zero calibration will be performed for the NO_x/NO/NO_2 analyzer and two dust monitors respectively before they are deployed to the measurement stations to ensure the data accuracy.

3.3.5 As the permanent electricity supply will not be available at the two air quality measurement stations, all the continuous NO_x/NO/NO_2 analyzer and dust monitors will be powered by the battery pack installed inside the equipment enclosure. Replacement of the battery pack will be carried daily to prevent the occurrence of power interruption during the measurement period resulting in loss of the monitoring data. Solar panel may be considered to be installed as another source of power supply.

3.3.6 If power supply interruption occurs during the 7-day measurement period resulting in loss of monitoring data, the measurement period will be extended until a minimum of 168 valid hourly data are obtained. In case more than 1/3 of the hourly data (i.e. 8 hours) were lost on any monitoring day, all the hourly data on that monitoring day will be considered as invalid.

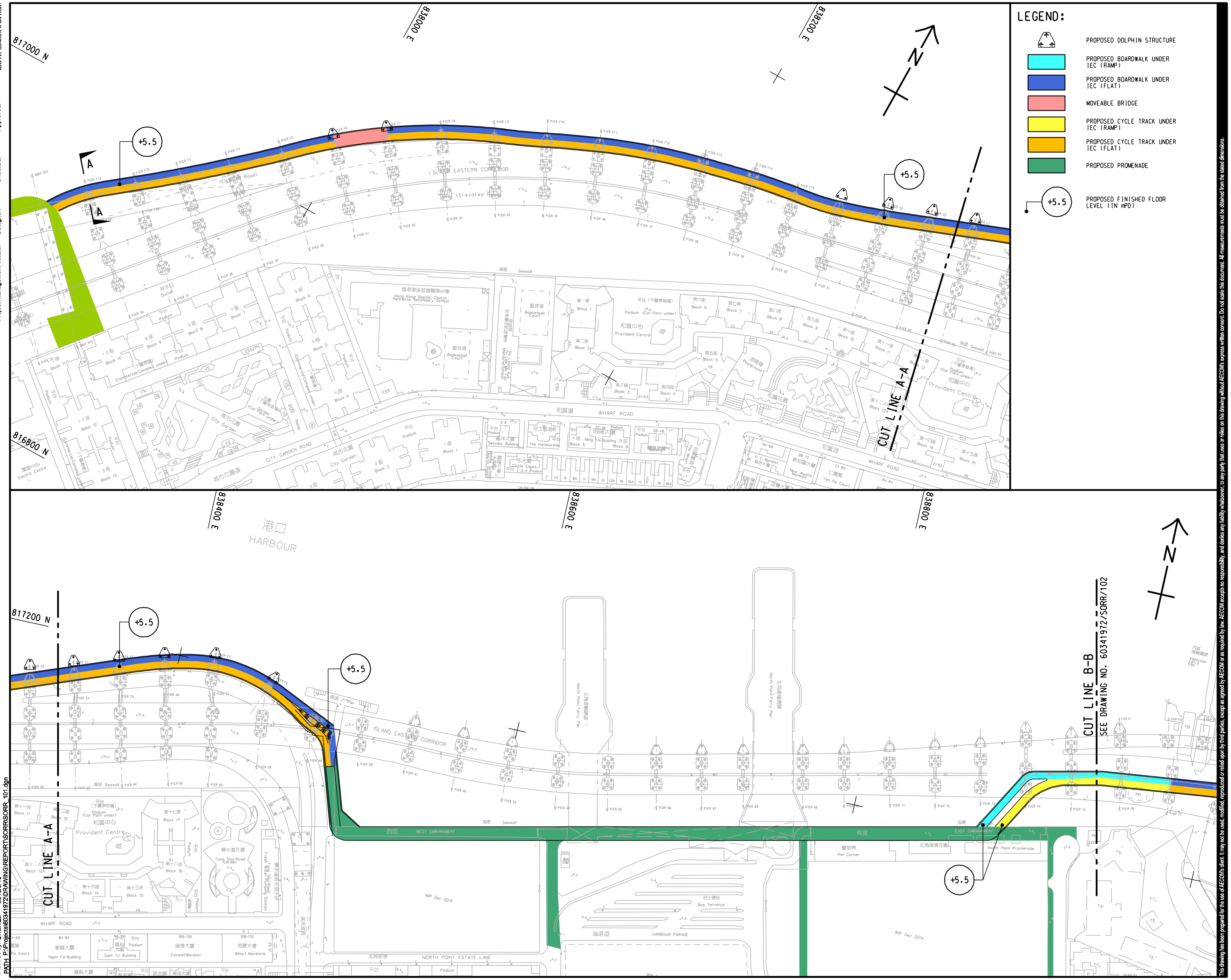
3.4 Presentation of Measurement Results

3.4.1 The hourly data of NOx, NO_2, RSP and FSP concentrations collected during the 7-day measurement will be presented, and will be further processed to present the maximum 1-hour average NO_2 and maximum 24-hour average RSP and FSP concentrations.

3.5 Approval for the Site Access and Installation for the Monitoring Stations

3.5.1 Upon approval of the methodology paper and relative monitoring locations, request for permission to conduct the air quality measurement at the corresponding locations will be sent to relevant management parties for approval.

Drawings



AECOM

PROJECT 項目

BOARDWALK UNDERNEATH ISLAND EASTERN CORRIDOR - INVESTIGATION

CLIENT 業主

土木工程拓展署
CEDD Civil Engineering and Development Department

CONSULTANT 工程顧問公司

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ISSUE/REVISION 修訂

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STATUS 階段

SCALE 比例: A1 1 : 1000

DIMENSION UNIT 尺寸單位: METRES

KEY PLAN 索引圖

PROJECT NO. 項目編號: 60341972

CONTRACT NO. 合約編號: CE 41/2014 (HY)

SHEET TITLE 圖紙名稱

PROPOSED BOARDWALK LAYOUT (WITH CONTINUOUS CYCLE TRACK)

SHEET 1 OF 2

SHEET NUMBER 圖紙編號: 60341972/SORR/101

ISO A1 594mm x 841mm
Approved:
Checked:
Designer:
Project Management Initials:

Plot File by: CHENQ2 2015/6/18
PATH: P:\Projects\60341972\DRAWING\REPORT\SORR\SORR_101.dgn

ISO A1 594mm x 841mm

Approved:

Checked:

Designer:

Project Management Initials:

LEGEND:

- PROPOSED DOLPHIN STRUCTURE
- PROPOSED BOARDWALK UNDER IEC (RAMP)
- PROPOSED BOARDWALK UNDER IEC (FLAT)
- MOVEABLE BRIDGE
- PROPOSED CYCLE TRACK UNDER IEC (RAMP)
- PROPOSED CYCLE TRACK UNDER IEC (FLAT)
- PROPOSED PROMENADE
- +5.5 PROPOSED FINISHED FLOOR LEVEL (IN mPD)

Plot File by: CHENG2 2015/6/23
PATH: P:\Projects\60341972\DRAWING\REPORT\SORR\SORR_102.dgn

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PROJECT 項目

BOARDWALK UNDERNEATH ISLAND EASTERN CORRIDOR - INVESTIGATION

CLIENT 業主

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STATUS 階段

SCALE 比例
A1 1 : 1000

DIMENSION UNIT 尺寸單位
METRES

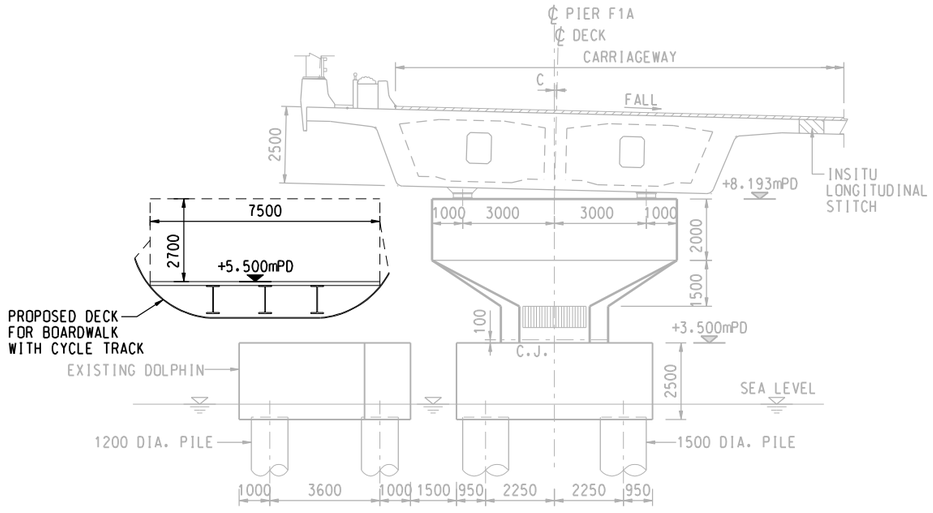
KEY PLAN 索引圖

PROJECT NO. 項目編號
60341972

CONTRACT NO. 合約編號
CE 41/2014 (HY)

SHEET TITLE 圖紙名稱
PROPOSED BOARDWALK LAYOUT (WITH CONTINUOUS CYCLE TRACK)

SHEET NUMBER 圖紙編號
SHEET 2 OF 2
60341972/SORR/102



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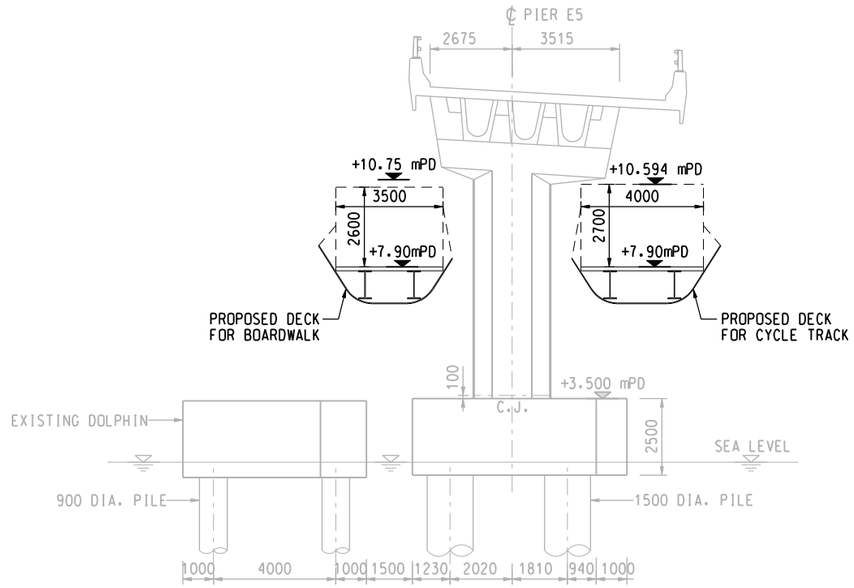
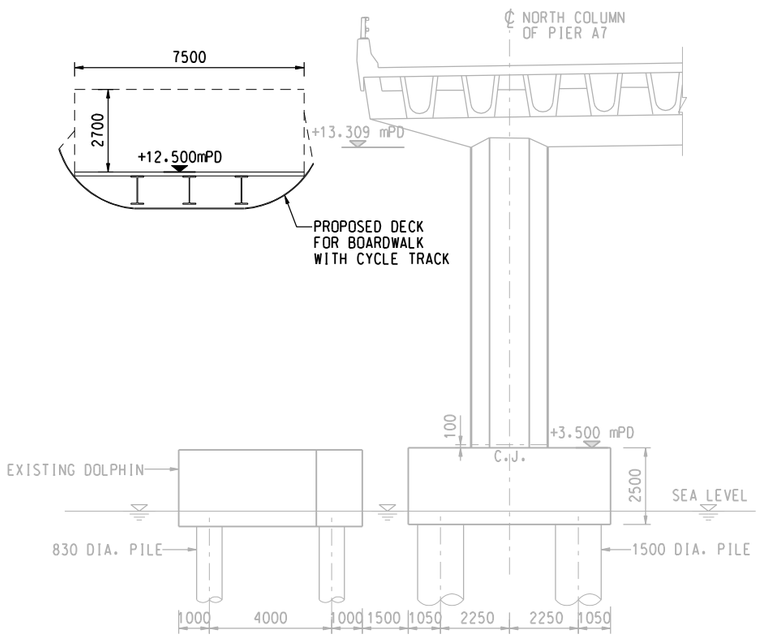


SECTION B - B



SECTION C - C

ISO A1 594mm x 841mm

Project Management Initials: Designer: Checked: Approved:

Plot File by: CHENC2 2015/9/12
PATH: P:\Projects\60341972\DRAWING\REPORTS\ORR\SORR_103.dgn

AECOM

PROJECT
項目

BOARDWALK UNDERNEATH ISLAND EASTERN CORRIDOR - INVESTIGATION

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階段

SCALE 比例
A1 1 : 100

DIMENSION UNIT 尺寸單位
MILLIMETRES

KEY PLAN
索引圖

PROJECT NO. 項目編號
60341972

CONTRACT NO. 合約編號
CE 41/2014 (HY)

SHEET TITLE
圖紙名稱

PROPOSED BOARDWALK
CROSS SECTIONS

SHEET NUMBER
圖紙編號

60341972/SORR/103

ISO A1 594mm x 841mm

Approved:

Checked:

Designer:

Project Management Initials:

LEGEND:

- PROPOSED DOLPHIN STRUCTURE
- PROPOSED BOARDWALK UNDER IEC (RAMP)
- PROPOSED BOARDWALK UNDER IEC (FLAT)
- MOVEABLE BRIDGE
- PROPOSED PROMENADE
- +5.5 PROPOSED FINISHED FLOOR LEVEL (IN mPD)

817000 N
838000 E
838200 E
+5.5
ISLAND EASTERN CORRIDOR (Elevated Road)
CUT LINE A-A
816800 N
838400 E
838600 E
838800 E
港口 HARBOUR
817200 N
CUT LINE B-B
SEE DRAWING NO. 60341972/SORR/202
WHARF ROAD
CITY GARDEN ROAD
NORTH POINT ESTATE LANE
HARBOUR PARADE
WEST EMBANKMENT
EAST EMBANKMENT
North Point Promenade
Wip Dec 2014

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BOARDWALK UNDERNEATH ISLAND EASTERN CORRIDOR - INVESTIGATION

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STATUS 狀況

SCALE 比例
A1 1 : 1000

DIMENSION UNIT 尺寸單位
METRES

KEY PLAN 索引圖

PROJECT NO. 項目編號
60341972

CONTRACT NO. 合約編號
CE 41/2014 (HY)

SHEET TITLE 圖紙名稱
PROPOSED BOARDWALK LAYOUT (WITHOUT CYCLE TRACK)

SHEET 1 OF 2

SHEET NUMBER 圖紙編號
60341972/SORR/201

Plot File by: CHENG2 2015/6/18
PATH: P:\Projects\60341972\DRAWING\REPORT\SORR\SORR_201.dgn

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Approved:

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Designer:

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Plot File by: CHENG2 2015/6/23
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階段

SCALE 比例
A1 1 : 1000

DIMENSION UNIT 尺寸單位
METRES

KEY PLAN
索引圖

PROJECT NO. 項目編號
60341972

CONTRACT NO. 合約編號
CE 41/2014 (HY)

SHEET TITLE
圖紙名稱

PROPOSED BOARDWALK LAYOUT (WITHOUT CYCLE TRACK)

SHEET 2 OF 2

SHEET NUMBER
圖紙編號

60341972/SORR/202

ISO A1 594mm x 841mm

Approved:

Checked:

Designer:

Project Management Initials:

837800 E

838300 E

838800 E

839300 E

817500 N

817000 N

816500 N

VICTORIA HARBOUR

LEGEND:

PROPOSED BOARDWALK UNDER IEC

PROPOSED LOCATIONS OF AIR QUALITY MEASUREMENT STATIONS

N

PROPOSED LOCATION (1)
TONG SHUI ROAD PIER

PROPOSED LOCATION (2)
ROOF PLATFORM OF THE
NORTH POINT DANGEROUS
GOODS VEHICULAR FERRY PIER

北角
NORTH POINT

NORTH POINT

KING'S ROAD

TONG SHUI ROAD

SHU KUK STREET

KAM HONG STREET

OIL STREET

HOI CHAK STREET

JAVA ROAD

HARBOUR GRADE

Works in progress

施工中

Plot File by: CHENG2 2016/5/9
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BOARDWALK UNDERNEATH ISLAND EASTERN CORRIDOR - INVESTIGATION

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STATUS
階段

SCALE 比例
A1 1 : 3000

DIMENSION UNIT 尺寸單位
METRES

KEY PLAN
索引圖

PROJECT NO. 項目編號
60341972

CONTRACT NO. 合約編號
CE 41/2014 (HY)

SHEET TITLE
圖紙名稱

PROPOSED LOCATIONS OF AIR QUALITY MEASUREMENT STATIONS

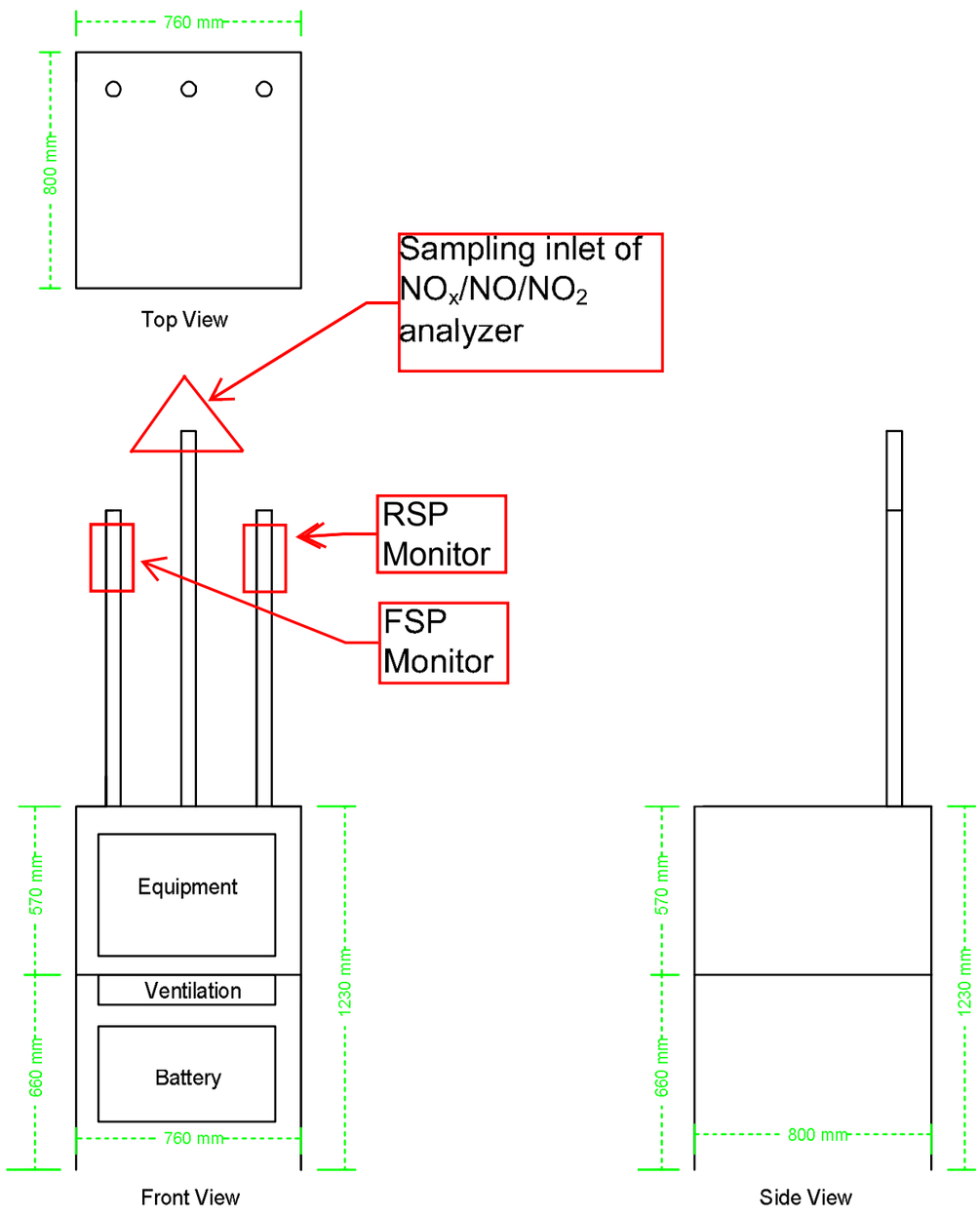
SHEET NUMBER
圖紙編號

60341972/AQA/101

Appendices

Appendix A
Measurement System

Measurement System



Appendix B
Specification Sheet for
Continuous NO_x/NO/NO_2 Analyzer

ecotech
environmental monitoring solutions

EC9841T

TRACE NITROGEN OXIDES ANALYSER

The EC9841T Nitrogen Oxides Analyser utilises microprocessor control and chemiluminescence detection to measure low concentration nitric oxide (NO), total oxides of nitrogen (NO_x), and nitrogen dioxide (NO_2).

Based on a modified version of the standard EC9841 series analyser, the EC9841T features a higher operating vacuum, more highly polished reaction cell and optimised photomultiplier tube to facilitate greater sensitivity for detection of low level Oxides of Nitrogen.

NO, NO_2 and NO_X concentrations are automatically corrected for gas temperature and pressure changes and can be displayed in units of ppm, ppb, µg/m^3 or mg/m^3.

STANDARDS

- EC9841T is U.S. EPA approved (Automated Reference Method RFNA-1292-090).

FEATURES

- Low concentration NO/NO_X measurement using proven chemiluminescence detection.
- Specifically designed for background monitoring with a range of 0-2000 ppb and a LDL of 50 ppt.
- Kalman digital filter continuously provides the best compromise between response time and noise reduction.
- Internal data logging using Flash ROM of up to 135 days of 5 minute data averages.
- Increased ozone to sample ratio reduces CO_2 and H_2O quenching effects.
- Operates at a lower reaction cell pressure (i.e. fewer molecules in the reaction cell means less interference due to collisions between NO and H_2O/CO_2 molecules).
- Full external remote control capability.
- User up-gradable firmware via USB or RS232 port.

SPECIFICATIONS

Ranges display:
Auto ranging 0-2000 ppb

Data display:
Graphic LCD display, auto ranging 0-2000 ppb full scale, with unit selection mg/m^3, µg/m^3, ppm, ppb, ppt.

Resolution:
User selectable (0-5 decimal points displayed).

Analog out:
0 - 5 ppb to 0 - 2000 ppb
Selectable offset of 0 %, 5 % or 10 %.

Filter types:
No filter, Kalman, 10, 30, 60, 90, 300 second.

Noise (At zero):
25 ppt RMS with Kalman or 300 sec filter active.

Lower detectable limit:
50 ppt with Kalman or 300 sec filter active.

Precision:
100 ppt or ± 0.5 % of reading (whichever is greater).

Zero drift:
Temperature dependence, 0.1 % per °C changes.
24 hours; less than 100 ppt.

Span drift:
Temperature dependence, 0.05 % per °C changes.
24 hours less than 1 % of reading.
30 days less than 1 % of reading.

Temperature/Pressure compensation:
Pressure compensation with selectable reference temperature of 0 °C , 20 °C , 25 °C at 1 01.3 kPa.

Sample flow rate:
0.64 SLPM (Std.)

Temperature range:
Operating temperature 20 °C - 30°C may be operated 15 °C – 35 °C.

Analog outputs:
The 50 pin I/O PCA allows for jumper selectable voltage outputs of 100 mV, 1 V, 5 V, 10 V with menu selectable zero offset of 0, 5 % or 10 % or menu selectable current output 0-20 mA, 2-20 mA, 4-20 mA.

Digital outputs:
Multidrop RS232 port shared between analysers for data, status and control. Service RS232 port gives front panel access to a local user DB50 with discrete status, user controls and analog, USB interface.

Data logging

Supports internal data logging capability with storage up to 135 days of 5 minute data stored in flash memory.

Data selection:
Instantaneous data: 1, 3, 5, 10, 30, or 60 minute intervals average 1, 3, 5, 10, 15, 30 minutes, 1, 4, 8, 12, or 24 hours.

Power:
99-132 VAC, 198-264 VAC 47-63 HZ.

Dimensions/weight:
43.2 cm x 17.8 cm x 64.8 cm (w x h x d), 20.9 kg.

OPTIONS

- Rack mount kit assembly (19")
- External zero/span valve assembly (EZS)
- External pump 115 V 60 Hz or 220 V 50/60 Hz (specify)
- PCA 50 pin I/O.

For your local certified distributor visit:
www.ecotech.com/distributors

Ecotech Pty Ltd
T (Australia) 1300 364 946 **T** (International) +61 3 9730 7800
E info@ecotech.com **W** www.ecotech.com

Appendix C
Specification Sheet for Continuous Dust Monitor

ES-642

Particulate Monitoring Solutions

Remote Dust Monitor Model ES-642

INDUSTRIAL OUTPUTS

MODBUS

Serial ASCII Text

RS-232 and RS-485

0-10 Volts Analog Signal

4-20 mA Analog Signal

FEATURES

Automatic zero calibration

Controlled input heater

Easily removable filters

Contact closure alarm output

Front panel LCD Display

Sealed environmental enclosure

APPLICATIONS

Building Automation

Military Applications

Environmental Cleanup Sites

Air Pollution Level Monitoring

Dust Level Warning Systems

- **Designed to provide accurate information on particle concentration and operate continuously in adverse environments.**
- **Special features such as the purge air system and automatic zero calibration enable the monitor to operate 24/7.**
- **A sheath air system isolates the aerosol in the chamber to keep the optics clean for long term reliability and low maintenance.**
- **LCD Display provided information on operation including: power, heater power, flow operation, status and particulate concentration.**

The ES-642 Remote Dust Monitor is an industrial air-quality sensor designed to provide accurate measurements of particle concentration in both indoor and outdoor environments. The unit is supplied in a rugged weatherproof enclosure. It includes an LCD display to provide information about particulate concentration, flow rate, instrument status and power. The electronics and optical system are protected from moisture by a built in intake heater that is humidity level controlled. The heater power is regulated to maintain a minimum humidity level. Additional features include a purge air system and an automatic zero calibration routine.

The sensor can be wall mounted or installed on a vertical mast up to 3 inch in diameter.

The ES-642 is supplied with a 10 ft cable and connector for power (15 to 40 VDC) and signal output.

The ES-642 measures particulate concentration using a highly sensitive forward scatter laser nephelometer, having a measurement range of 0 to 100 mg/cubic meter or 0 to 100,000 ug/cubic meter. Optional sharp-cut cyclones are used to set the measurement level of the ES-642. As supplied it provides particulate monitoring for TSP, with the addition of the sharp-cut cyclone it can be set for particulate smaller than PM10 or smaller than PM2.5, or PM1. The accuracy of the instrument is +/-5% based on a traceable PSL 0.6 micron reference standard.

Met One Instruments

1600 NW Washington Blvd, Grants Pass, OR 97526

Tel: (541) 471-7111 E-Mail: sales@metone.com

WWW.METONE.COM

Specifications ES-642

PARAMETER	SPECIFICATION
Measurement Principles:	Particulate concentration by forward light scatter laser Nephelometer.
Available Cut Points:	TSP Inlet Standard. PM_{10}, $PM_{2.5}$, and PM_1 sharp-cut cyclone inlets available.
Measurement Range:	0 to 100 mg/m^3 (0 to 100,000 µ g/m^3)
Measurement Sensitivity:	.001 mg/m^3.
Nephelometer Accuracy:	± 5% traceable standard with 0.6um PSL.
Particle Size Sensitivity:	0.1 to 100 micron. Optimal sensitivity 0.5 to 10 micron particles.
Display:	2 X 16 backlit LCD. Provides information on operation including: Power, Flow Operation, Status and Concentration.
Zero Calibration:	Automatic Zero Calibration every hour or as programmed from 1 to 999 minutes.
Flow Rate:	2.0 liters/minute ± 0.1 lpm.
Power:	15 – 40 VDC @ 1.5 A maximum.
Power Consumption:	350 mA (no heater) 1.1 A (with heater) @ 15 VDC.
Analog Output:	4-20 mA and 0 – 10 VDC.
Digital I/O:	RS-485 full and half duplex, RS-232.
Serial Communication:	ASCII Text data format and MODBUS RTU.
Alarm Output:	Normally open and normally closed relay 30 VDC @ 1A maximum.
Operating Temperature:	-10 to +50°C . (Ambient Temperature Sensor Range -30 to +50°C).
Barometric Pressure:	600 to 1040 mbar pressure sensor range.
Ambient Humidity Range:	0 to 90% RH, non-condensing.
Intake Moisture Control:	Automatic 10 Watt inlet heater module controlled to sample RH set point.
Factory Service Interval:	24 Months typical, under continuous use in normal ambient air.
Mounting Options:	Wall mount bracket standard. Optional EX-905 tripod.
Unit Weight:	2.27 kg (6.0 lbs)
Unit Dimensions:	22.9cm high, 17.8cm wide, 10.8cm deep. (9.0” x 7.0” x 4.25”). w/out inlet assy. 48.3cm high, 17.8cm wide, 10.8cm deep. (19.0” x 7.0” x 4.25”). w/ inlet assy.

Specifications are subject to change without notice

Appendix D
Responses to Comments (Issue 1 and Issue 2)

Agreement No. 41/2014 (HY)
Boardwalk underneath Island Eastern Corridor - Investigation

Air Quality Measurement Methodology Paper (Issue 2)

Responses to Comments

		Date
1.	TD TED (HK)	17 May 2016
2.	HyD	26 May 2016
3.	TD Ferry and Paratransit Division's email	14 June 2016
4.	EPD's email	16 June 2016
5.	PlanD	17 June 2016

Agreement No. 41/2014 (HY)
Boardwalk underneath Island Eastern Corridor - Investigation

Air Quality Measurement Methodology Paper (Issue 2)

Responses to Comments

No.	Comments	Responses
1.	**From : TD TED (HK)** **Ref : (H24WT) in TD HR171/70-13** **Date : 17 May 2016** I refer to your above letter dated 11 May 2016 enclosing the subject. I note that it is proposed to locate two air quality measurement stations at (1) Tong Shui Road Pier under IEC and (2) the roof platform of the North Point Dangerous Goods Vehicular Ferry Pier Close to the IEC. For Location (1), please ensure the proposed air quality measurement stations will not affect the pedestrians reaching and leaving the area. For location (2), I note that you have included our ferry team in the circulation list, please seek comments / advice from them accordingly.	Noted. For location (1), proper location will be selected to set up the monitoring point to avoid affecting the pedestrians reaching and leaving the area. For location (2), advice from ferry team will be consulted.
2.	**From : HyD** **Ref : (HQSLH) HyD UHK / 12 – 2 / 1 / 17 / (DNP)** **Date : 26 May 2016** I refer to your above-quoted letter dated 11. 5. 2016 and have no comment on the captioned submission from highways maintenance point of view.	Noted.
3.	**From : TD Ferry and Paratransit Division** **Ref : email** **Date : 14 June 2016** I refer to the captioned subject. Please be informed that we have no comment for the captioned submission from ferry operation point of view. Should actual air quality measurement would be taken place at the upper deck platform of the North Point Vehicular Pier, please give three week advance notices to TD and the concerned	Noted.

No.	Comments	Responses
	Ferry Operator. Thanks for noting.	
1.	**From : EPD** **Ref : email** **Date : 16 June 2016** Re. your preceding emails below, please find our comment on the subject AQ measurement methodology paper ("MP") from air quality perspective:	
	1. Section 2.2.1, we note that " ... Selection of the locations of the two measurement stations have taken into consideration of accessibility to the site and safety issue during measurement ... , which are best available locations to simulate the height difference between the proposed alignment of the boardwalk and the IEC. ... "	Noted.
	2. Section 3.1, given that the nearby ferry piers are in close proximity to the proposed site area, please include SO2 measurement.	North Point Ferry Pier (NPFP) and North Point Dangerous Goods Vehicular Ferry Pier (NPDGVFP) are located in the vicinity of the proposed site area. According to Transport Department's website, there are services from NPFP to Hung Hom, Kowloon City and Kwun Tong at a frequency of about 30 minutes during day time. According to Hong Kong Ferry (Holdings) Company Limited's website, there are about 18 to 20 services per day at NPDGVFP. Since there are only about 6 services each hour at NPFP and about 1 service each hour at NPDGVFP, it is considered that the frequency of the ferries is low. Moreover, since Hong Kong has capped the sulphur content of locally supplied marine light diesel at 0.05% since April 2014, SO2 emission from the ferries is limited. Besides, the annual average concentrations of SO2 measured at EPD's nearest air quality monitoring stations, i.e. Eastern and Causeway Bay Stations, are in a range of 5-10 μg/m3, which show very large margin to the HKAQOs. Therefore, measurement of SO2 is not considered necessary.

No.	Comments	Responses
	3. Section 3.1, please review and justify whether odour measurement is required.	During site survey carried out on 29 April 2016, odour source is not noticed along the coastal area near the proposed alignment. Moreover, there is no complaint about odour problem in the coastal area of North Point. Therefore, odour measurement is not considered necessary.
	4. Please be reminded that the measurement results should be presented in a format relevant to the AQO requirements, i.e., facilitating comparison against the time interval of the AQOs of each parameters.	The hourly data of NOx, NO2, RSP and FSP concentrations collected during the 7-day measurement will be presented, and will be further processed to present the maximum 1-hour average NO2 and maximum 24-hour average RSP and FSP concentrations. Section 3.4 is added accordingly.
	5. Please include job references, if any, for the proposed continuous gaseous analyzer and dust monitor that have been used in other projects in the revised MP.	The job references are included in Table 3.1.
5.	**From : PlanD** **Ref : ( ) in HK-R/CS/16/4** **Date : 17 June 2016** I refer to your letter dated 11. 5. 2016regarding the subject study. This office has no comment on the Air Quality Measurement Methodology Paper. Should you have any enquiries, please contact the undersigned at 2231 4933.	Noted.

Agreement No. 41/2014 (HY)
Boardwalk underneath Island Eastern Corridor - Investigation

Air Quality Measurement Methodology Paper (Issue 1)

Responses to Comments

		Date
1.	CEDD's letter ref. ( ) in HKI 2/7/4	11 March 2016
2.	EPD's email	22 March 2016
3.	PlanD (HKDPO)'s letter ref. (4) in HK-R/CS/16/4 pt.6	21 April 2016
4.	TD's letter ref. (H1R3F) in TD HR 171/70-13	2 March 2016
5.	HyD's letter ref. (HPVLS)HyD UHK/12-2/1/17(DNP)	7 March 2016

Agreement No. 41/2014 (HY)
Boardwalk underneath Island Eastern Corridor - Investigation

Air Quality Measurement Methodology Paper (Issue 1)

Responses to Comments

No.	Comments	Responses
1.	**From : CEDD** **Ref : ref. ( ) in HKI 2/7/4** **Date : 11 March 2016** I refer to your above referenced letter dated 19 February 2016 and have the following comments on the paper:	
	(i) Para. 2.1.1 – Please provide justification for selecting the 2 locations of the baseline air quality measurement stations.	According to the Study Brief, two air quality measurement stations are required for acquiring the baseline data. Since the proposed alignment of the boardwalk include low level alignment underneath the Island Eastern Corridor (IEC) and high level alignment close to the IEC, one low level location and one high level location would be selected to represent the baseline condition of air quality at the proposed boardwalk. Selection of the locations of the two measurement stations have taken into consideration of accessibility to the site and safety issue during measurement. Based on desktop review and site visits, locations at (1) Tong Shui Road Pier underneath the IEC and at (2) the roof platform of the North Point Dangerous Goods Vehicular Ferry Pier close to the IEC are selected, which are best available locations to simulate the height difference between the proposed alignment of the boardwalk and the IEC. Para. 2.1.1 is revised accordingly.
	(ii) Para. 2.1.1 – Consideration should be given to provide an air quality measurement station close to the Island Eastern Corridor where the high level alignment is proposed for the Boardwalk.	The measurement inside the Dangerous Goods Vehicular Ferry Pier will be conducted at the roof platform (subject to accessibility) to reflect the high level alignment close to the IEC.
	(iii) Para. 3.4.1 – Please advise the management and maintenance parties of the proposed locations for the air quality measurement stations.	The management and maintenance parties of the Tong Shui Road Pier and North Point Dangerous Goods Vehicular Ferry Pier are Port Works Division of CEDD and Hong Kong Ferry (Holdings) Company Limited respectively.

No.	Comments	Responses
2.	**From : EPD** **Ref : By email** **Date : 22 March 2016** I refer to your consultant/ AECOM's letter dated 19.2.2016 (Ref: CLUK: JLYW: mlpm:60341972/01-2016001278T) enclosing the subject methodology paper (the Paper) for our comment.	
	2. Having reviewed the Paper, we have the following comment: **Section 1.3**, while we note that the main purpose of this MP is to present *" ... the methodology of the air quality measurement to be adopted for acquiring the baseline data"*, please **provide justifications** for the **proposed locations** of the measurement stations, the **extent** of the parameters to be measured, the **frequency** of measurement, the **measurement methodology**, etc, by referencing to the relevant approved EIA studies and/or technical guideline/EM&A Manual such as Technical Requirements for Monitoring: Location, Sampling, Frequency and Laboratory Analysis (http://www.epd.gov.hk/eia/hb/materials/images/4Construction.pdf)	According to the Study Brief, two air quality measurement stations are required for acquiring the baseline data. Since the proposed alignment of the boardwalk include low level alignment underneath the Island Eastern Corridor (IEC) and high level alignment close to the IEC, one low level location and one high level location would be selected to represent the baseline condition of air quality at the proposed boardwalk. Selection of the locations of the two measurement stations have taken into consideration of accessibility to the site and safety issue during measurement. Based on desktop review and site visits, locations at (1) Tong Shui Road Pier underneath the IEC and at (2) the roof platform of the North Point Dangerous Goods Vehicular Ferry Pier close to the IEC are selected, which are best available locations to simulate the height difference between the proposed alignment of the boardwalk and the IEC. Para. 2.1.1 is revised accordingly. According to the requirements of Study Brief, nitrogen oxides (NOx), nitrogen dioxide (NO_2), respirable suspended particulates (RSP) and fine suspended particulates (FSP) will be measured, and the baseline air quality monitoring will be carried out continuously at hourly intervals for a period of 7 consecutive days. Regarding the measurement methodology for NOx, NO_2, RSP and FSP, continuous monitoring measurement will be adopted instead of using traditional High Volume Sampling (RSP & FSP) and grab sampling (NOx and NO_2) methods. As such, hourly concentrations of the measured parameters can be collected and the daily variation can be obtained as well.
	3. If you have any questions on the above comment, please feel free to contact our air specialist, Mr. Charles NG at 2835 1540. Thx.	Noted.

No.	Comments	Responses
3.	**From : PlanD** **Ref : (4) in HK-R/CS/16/4 pt.6** **Date : 21 April 2016** I refer to your letter dated 19.2.2016 regarding the subject study. This office has no comment on the Air Quality Measurement Methodology Paper. Should you have any enquiries, please contact the undersigned at 2231 4933.	Noted.
4.	**From : TD** **Ref : (H1R3F) in TD HR 171/70-13** **Date : 2 March 2016** I refer to your above letter dated 19 Feb 2016 enclosing the subject. We have no comment on the subject.	Noted.
5.	**From : HyD** **Ref : (HPVLS)HyD UHK/12-2/1/17(DNP)** **Date : 7 March 2016** I refer to your above-quoted letter dated 19.2.2016 and have no comment on the captioned submission from highways maintenance point of view.	Noted.

Appendix 5.2
Data Report of the Air Quality Measurement

祥威環境科技有限公司
SUNWAY ENVIRONMENTAL TECHNOLOGY CO., LTD.

Short-term Air Quality Measurement for Two Locations at Island Eastern Corridor

Data Report

(ver. 1.2)

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1. INTRODUCTION

The short-term monitoring service aimed to assess the air quality in part of the investigation study for the proposed boardwalk underneath the Island Eastern Corridor. Two accessible locations closed to the Corridor at North point were selected for the monitoring service. A temporary Air Quality Measurement Station equipped with air sampling equipment and analyzers were installed for monitoring.

This data report presented verified sampled data of nitrogenous gases and particulates at the monitoring locations.

1.1 Sampling Parameters and Equipment

This service focused on the nitrogenous gases and particulate in total of five parameters.

Parameters	**Analyzer model**
Nitrogenous gases	
Nitrogen Oxides, NO	"Ecotech" EC9841
Nitrogen Dioxide, NO_2	"Ecotech" EC9841
Nitric Oxide, NOx	"Ecotech" EC9841
Particulates	
PM10	"Metone" ES-642 c/w PM10 sharp-cut cyclone inlets
PM2.5	"Metone" ES-642 c/w PM2.5 sharp-cut cyclone inlets

Table 1. Summary of Monitoring parameters and applied equipment models

1.2 Distribution of Monitoring Locations

Two designated locations were selected as below:

a) Roof Platform of the North Point Dangerous Goods Vehicular Ferry Pier (Location 1)
b) Tong Shui Road Pier (Location 2)

The detailed locations could refer to Appendix A (Site Photos).

1.3 Monitoring Period

- Location 1: 26 November 2016 to 3 December 2016
- Location 2: 9 December 2016 to 16 December 2016

1.4 Temporary Air Quality Measurement Station Setup

A temporary enclosure was built and installed at the two designated locations to provide a protection and supporting to monitoring equipment. The nitrogen gas analyzer and its accessories including electrical supply and data logging system were setup inside the waterproof enclosure. Two waterproof particulate samplers were supported by two metal poles and reached to designated level from the ground. The detailed setup could refer to Appendix A (Site Photos).

2. SUMMARY OF MONITORING DATA

2.1 North Point Dangerous Goods Vehicular Ferry Pier (Location 1)

The first monitoring services performed at the Roof Platform of the North Point Dangerous Goods Vehicular Ferry Pier from 26 November 2016 to 3 December 2016, lasted for 8 days. After the data validation, the summary of data in daily average is shown as following tables and figures. The hourly data could refer to Appendix B (Summary of hourly monitoring data). All daily average are valid as over 2/3 valid hourly data per day.

Time	PM10(mg/m^3)	PM2.5(mg/m^3)	NO(ppb)	NO_2(ppb)	NOx(ppb)	Data Capture Rate
26/11/2016	0.012	0.008	14.153	18.748	32.901	100%
27/11/2016	0.009	0.006	8.853	14.580	23.432	100%
28/11/2016	0.019	0.013	10.305	18.233	28.539	100%
29/11/2016	0.038	0.023	14.655	28.667	43.323	100%
30/11/2016	0.048	0.029	18.208	24.308	42.516	100%
1/12/2016	0.067	0.040	17.624	27.134	44.758	100%
2/12/2016	0.071	0.044	19.702	25.540	45.242	100%
3/12/2016	0.078	0.048	6.360	28.476	34.836	100%

Table 2. Summary of monitoring data in daily average at Location 1

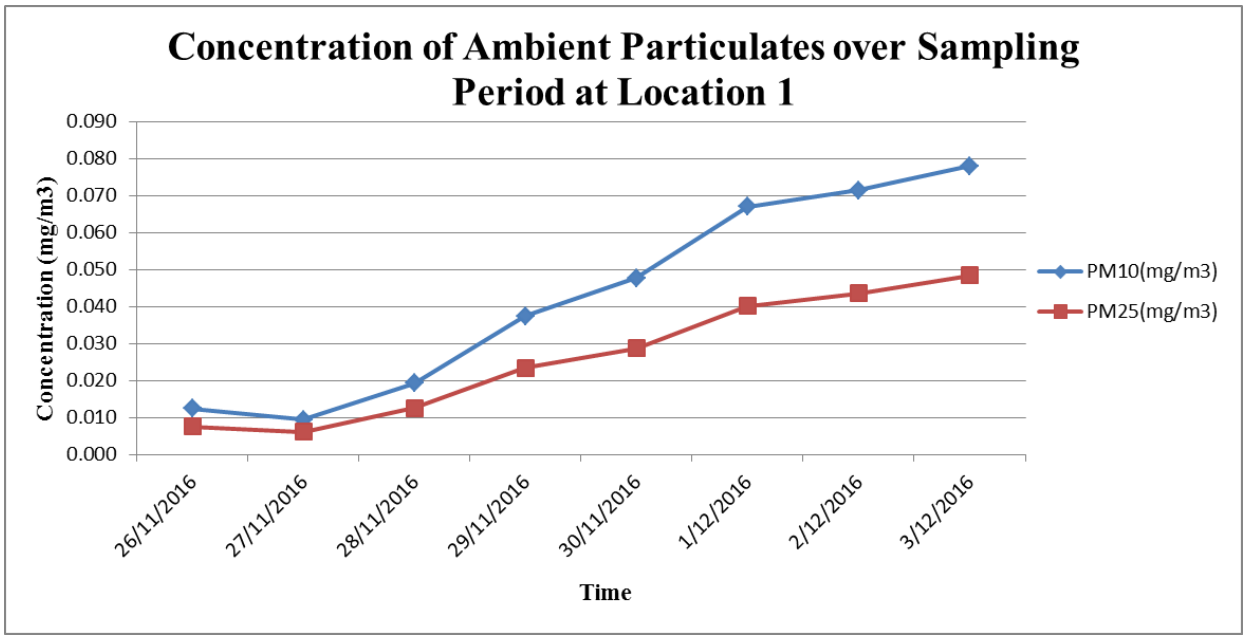


Figure 1. Concentration of Ambient Particulates over Sampling Period at Location 1

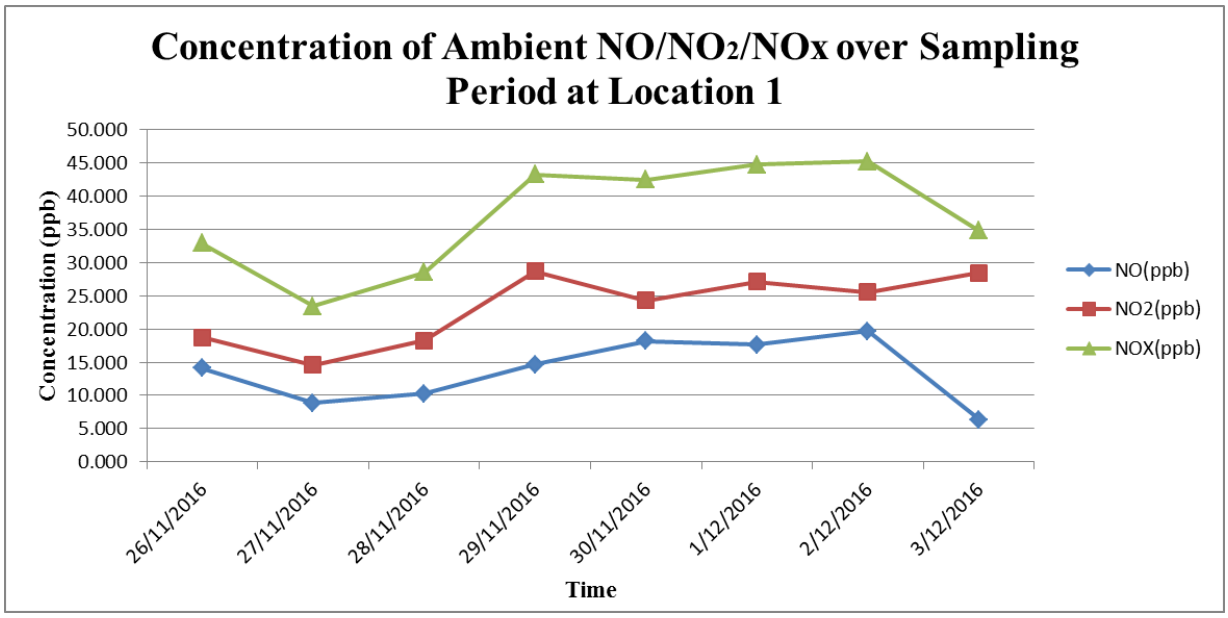


Figure 2. Concentration of Ambient NO/NO_2/NOx over Sampling Period at Location 1

2.2 Tong Shui Road Pier (Location 2)

The second monitoring services performed at the Tong Shui Road Pier from 9 December 2016 to 16 December 2016, lasted for 8 days. After the data validation, the summary of data in daily average is shown as following tables and figures. The hourly data could refer to Appendix B (Summary of hourly monitoring data). On 13 December 2016, power failure was occurred from 15:00 to 21:00 and leaded to7 hours data loss. All daily average are valid as over 2/3 valid hourly data per day.

Time	PM10(mg/m^3)	PM2.5(mg/m^3)	NO(ppb)	NO_2(ppb)	NOx(ppb)	Data Capture Rate
9/12/2016	0.065	0.043	13.791	41.115	54.906	100%
10/12/2016	0.055	0.035	9.805	38.056	47.861	100%
11/12/2016	0.043	0.026	6.148	18.906	25.054	100%
12/12/2016	0.031	0.017	12.915	32.460	45.375	100%
13/12/2016	0.033	0.019	19.478	40.870	60.348	71%
14/12/2016	0.051	0.028	15.682	29.999	45.681	100%
15/12/2016	0.056	0.029	12.308	24.313	36.621	100%
16/12/2016	0.073	0.040	14.543	29.051	43.594	100%

Table 3. Summary of monitoring data in daily average at Location 2

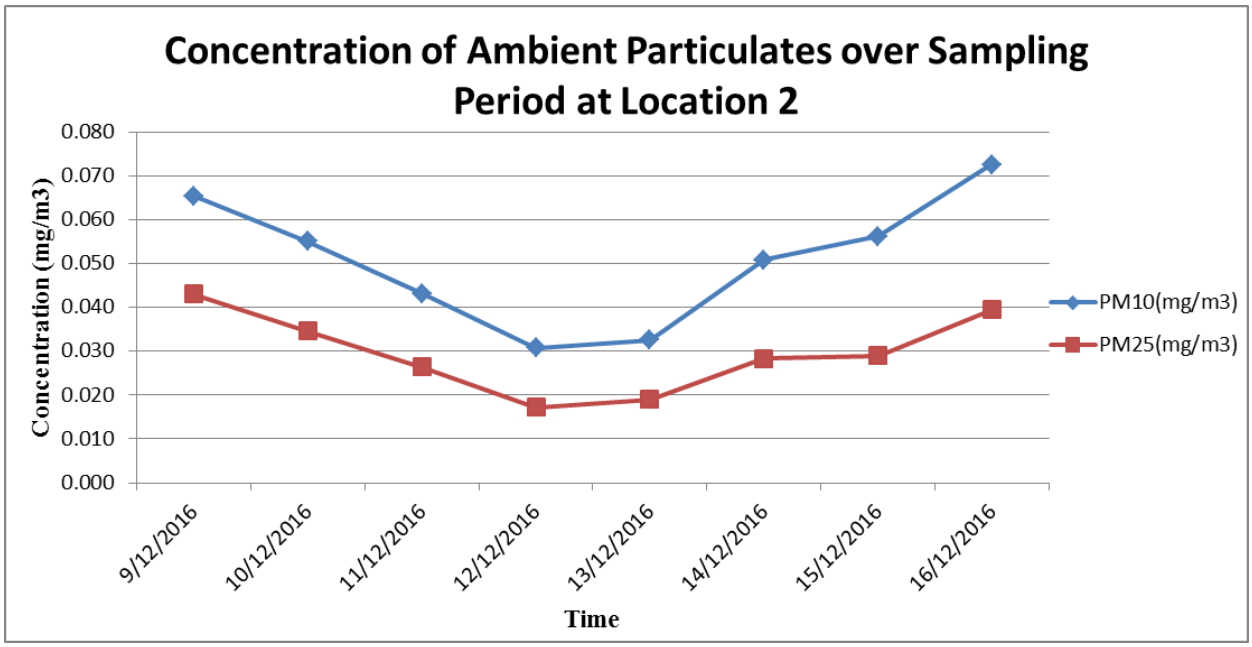


Figure 3. Concentration of Ambient Particulates over Sampling Period at Location 2

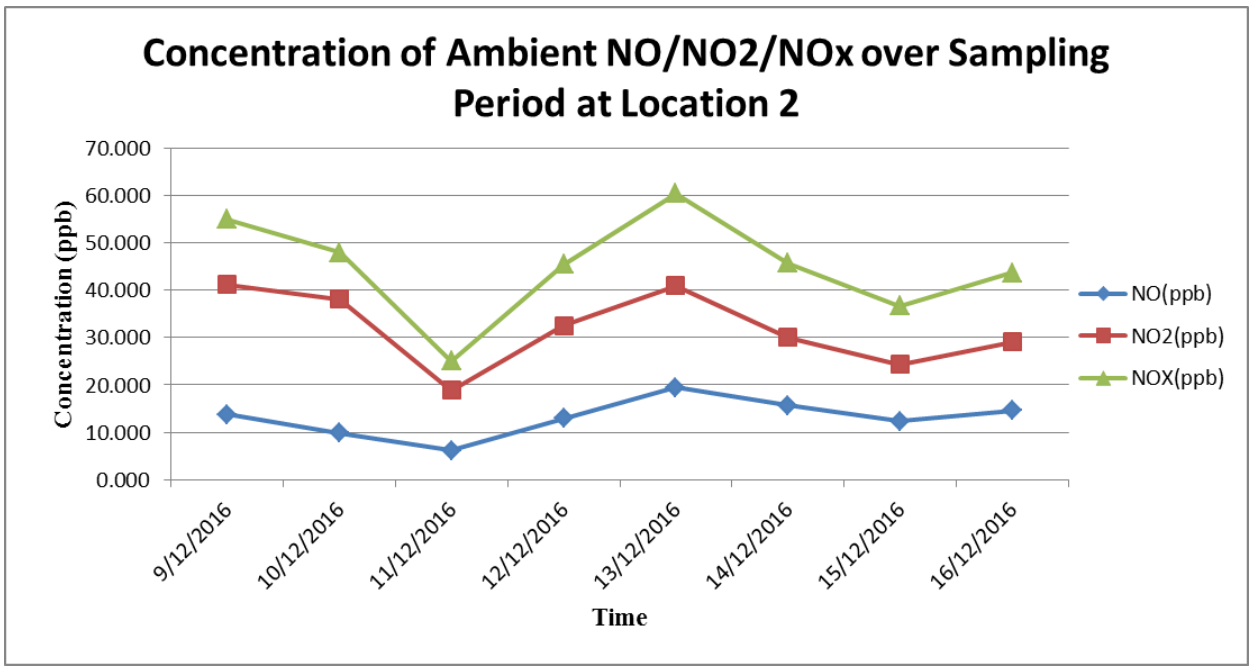


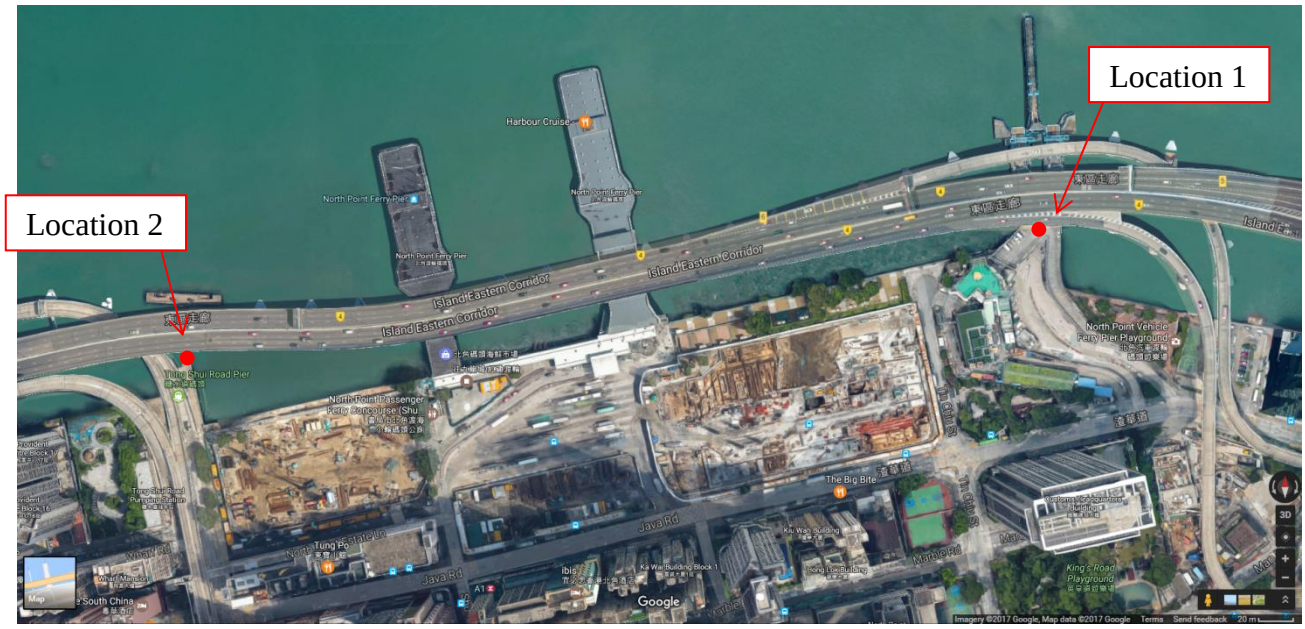
Figure 4. Concentration of Ambient $NO/NO_2/NOx$ over Sampling Period at Location 2

Appendix A

Site Photos

1. DISTRIBUTIONS OF MONITORING SITES

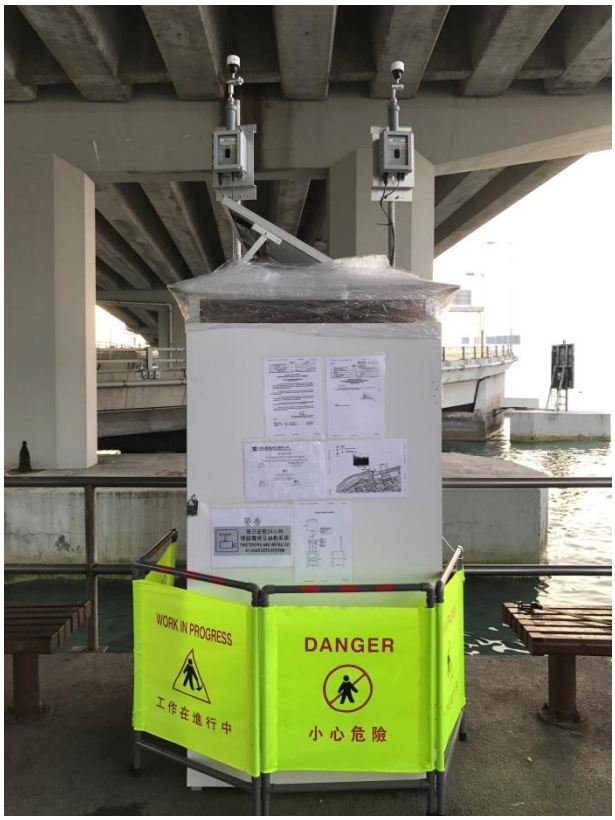
	Locations	Sampling Period
Location 1	Roof Platform of the North Point Dangerous Goods Vehicular Ferry Pier	26 November 2016 to 3 December 2016
Location 2	Tong Shui Road Pier	9 December 2016 to 16 December 2016

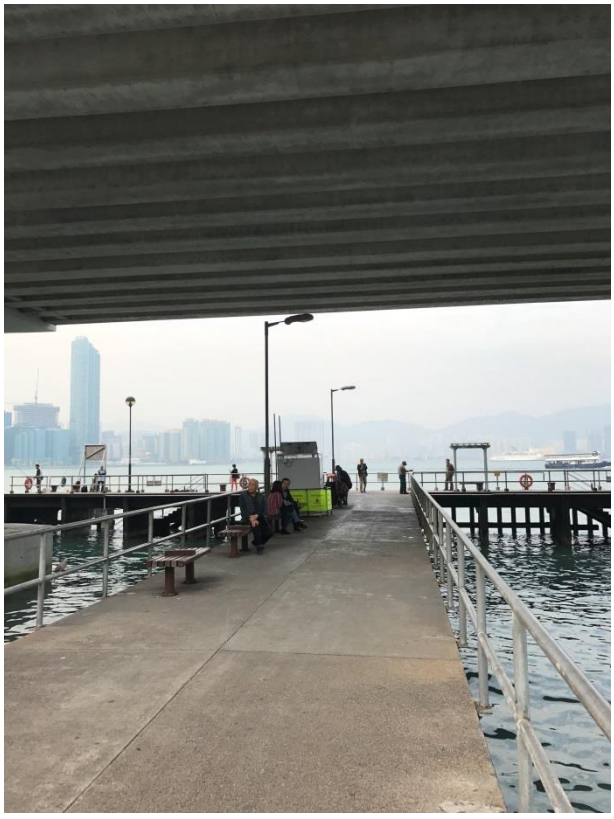


2. PHOTOS OF MONITORING SITES

2.1 Roof Platform of the North Point Dangerous Goods Vehicular Ferry Pier

2.2 Tong Shui Road Pier





Appendix B

Summary of Hourly Monitoring Data

Time	PM10(mg/m3)	PM25(mg/m3)	NO(ppb)	NO2(ppb)	NOX(ppb)
26/11/2016 0:00	0.03	0.018	3.953	12.182	16.136
26/11/2016 1:00	0.029	0.018	5.853	15.802	21.655
26/11/2016 2:00	0.029	0.018	4.236	13.498	17.733
26/11/2016 3:00	0.026	0.016	4.663	13.498	18.16
26/11/2016 4:00	0.02	0.013	3.927	12.888	16.814
26/11/2016 5:00	0.019	0.012	14.277	24.455	38.732
26/11/2016 6:00	0.02	0.013	8.4	23.013	31.413
26/11/2016 7:00	0.019	0.012	25.888	30.008	55.896
26/11/2016 8:00	0.025	0.015	59.588	32.791	92.378
26/11/2016 9:00	0.019	0.011	34.378	26.306	60.685
26/11/2016 10:00	0.008	0.005	19.898	19.387	39.285
26/11/2016 11:00	0.005	0.003	24.772	19.694	44.466
26/11/2016 12:00	0.004	0.003	18.865	17.053	35.918
26/11/2016 13:00	0.004	0.003	14.646	14.273	28.918
26/11/2016 14:00	0.005	0.003	13.406	14.151	27.556
26/11/2016 15:00	0.004	0.003	12.533	16.384	28.917
26/11/2016 16:00	0.005	0.003	16.077	20.489	36.566
26/11/2016 17:00	0.005	0.002	16.259	23.749	40.008
26/11/2016 18:00	0.006	0.002	12.909	22.861	35.77
26/11/2016 19:00	0.003	0.002	6.145	16.504	22.648
26/11/2016 20:00	0.004	0.002	7.045	18.051	25.096
26/11/2016 21:00	0.003	0.002	5.402	14.181	19.583
26/11/2016 22:00	0.003	0.001	2.949	12.323	15.271
26/11/2016 23:00	0.003	0.002	3.611	16.415	20.025

Time	PM10(mg/m3)	PM25(mg/m3)	NO(ppb)	NO2(ppb)	NOX(ppb)
27/11/2016 0:00	0.003	0.001	2.379	13.01	15.388
27/11/2016 1:00	0.002	0.001	7.172	17.015	24.187
27/11/2016 2:00	0.001	0.001	2.554	9.335	11.889
27/11/2016 3:00	0.001	0.001	2.085	7.829	9.914
27/11/2016 4:00	0.002	0.002	2.638	7.919	10.557
27/11/2016 5:00	0.004	0.003	5.385	9.127	14.512
27/11/2016 6:00	0.005	0.003	4.838	9.225	14.063
27/11/2016 7:00	0.006	0.004	8.46	14.308	22.768
27/11/2016 8:00	0.006	0.004	12.227	14.419	26.646
27/11/2016 9:00	0.007	0.005	13.189	14.882	28.071
27/11/2016 10:00	0.008	0.005	14.473	12.834	27.307
27/11/2016 11:00	0.009	0.006	13.543	12.157	25.7
27/11/2016 12:00	0.012	0.008	8.58	12.128	20.708
27/11/2016 13:00	0.016	0.01	23.461	27.602	51.063
27/11/2016 14:00	0.017	0.011	18.07	23.687	41.757
27/11/2016 15:00	0.021	0.014	17.355	23.442	40.797
27/11/2016 16:00	0.018	0.011	5.413	19.484	24.896
27/11/2016 17:00	0.019	0.012	7.045	24.918	31.963
27/11/2016 18:00	0.016	0.011	17.404	25.225	42.629
27/11/2016 19:00	0.013	0.008	3.775	13.87	17.645
27/11/2016 20:00	0.011	0.007	6.022	10.501	16.523
27/11/2016 21:00	0.01	0.007	7.367	8.308	15.674
27/11/2016 22:00	0.01	0.006	4.663	8.21	12.873
27/11/2016 23:00	0.01	0.007	4.376	10.473	14.849

Time	PM10(mg/m3)	PM25(mg/m3)	NO(ppb)	NO2(ppb)	NOX(ppb)
28/11/2016 0:00	0.011	0.008	4.24	13.542	17.782
28/11/2016 1:00	0.012	0.008	12.228	15.475	27.703
28/11/2016 2:00	0.014	0.009	3.253	12.375	15.628
28/11/2016 3:00	0.017	0.011	2.409	8.289	10.697
28/11/2016 4:00	0.018	0.012	4.125	8.583	12.708
28/11/2016 5:00	0.018	0.012	9.101	12.325	21.427
28/11/2016 6:00	0.018	0.012	9.14	12.497	21.637
28/11/2016 7:00	0.018	0.012	23.226	19.776	43.002
28/11/2016 8:00	0.018	0.012	44.452	29.997	74.449
28/11/2016 9:00	0.016	0.01	20.466	20.754	41.22
28/11/2016 10:00	0.016	0.01	10.897	14.767	25.664
28/11/2016 11:00	0.017	0.011	11.05	13.693	24.743
28/11/2016 12:00	0.018	0.012	6.601	11.787	18.389
28/11/2016 13:00	0.018	0.011	9.819	20.548	30.367
28/11/2016 14:00	0.017	0.01	10.608	28.103	38.71
28/11/2016 15:00	0.019	0.011	11.713	37.307	49.02
28/11/2016 16:00	0.019	0.012	10.816	35.004	45.819
28/11/2016 17:00	0.018	0.012	5.708	18.097	23.805
28/11/2016 18:00	0.019	0.012	4.793	19.407	24.201
28/11/2016 19:00	0.025	0.017	14.8	21.977	36.776
28/11/2016 20:00	0.027	0.018	7.537	20.453	27.99
28/11/2016 21:00	0.027	0.018	1.94	13.194	15.135
28/11/2016 22:00	0.029	0.019	5.052	16.449	21.501
28/11/2016 23:00	0.033	0.021	3.355	13.202	16.557

Time	PM10(mg/m3)	PM25(mg/m3)	NO(ppb)	NO2(ppb)	NOX(ppb)
29/11/2016 0:00	0.033	0.022	3.84	12.426	16.267
29/11/2016 1:00	0.035	0.023	3.405	11.825	15.23
29/11/2016 2:00	0.034	0.022	2.891	10.735	13.625
29/11/2016 3:00	0.035	0.023	2.634	8.1	10.734
29/11/2016 4:00	0.035	0.023	2.365	8.541	10.906
29/11/2016 5:00	0.036	0.023	3.84	10.824	14.664
29/11/2016 6:00	0.037	0.023	8.386	24.669	33.054
29/11/2016 7:00	0.04	0.025	17.253	39.433	56.686
29/11/2016 8:00	0.038	0.024	16.915	34.389	51.304
29/11/2016 9:00	0.037	0.023	15.695	30.684	46.379
29/11/2016 10:00	0.038	0.023	11.826	23.328	35.155
29/11/2016 11:00	0.039	0.022	11.763	20.201	31.964
29/11/2016 12:00	0.039	0.024	18.763	32.487	51.249
29/11/2016 13:00	0.043	0.028	20.671	36.362	57.034
29/11/2016 14:00	0.049	0.031	92.756	46.059	138.815
29/11/2016 15:00	0.05	0.031	24.912	49.934	74.846
29/11/2016 16:00	0.044	0.027	9.652	39.338	48.99
29/11/2016 17:00	0.043	0.027	14.615	42.575	57.19
29/11/2016 18:00	0.039	0.023	19.763	48.264	68.026
29/11/2016 19:00	0.036	0.022	16.913	47.162	64.076
29/11/2016 20:00	0.031	0.019	8.161	31.752	39.913
29/11/2016 21:00	0.032	0.02	9.956	29.794	39.751
29/11/2016 22:00	0.028	0.017	7.972	22.757	30.729
29/11/2016 23:00	0.029	0.018	6.778	26.377	33.155

Time	PM10(mg/m3)	PM25(mg/m3)	NO(ppb)	NO2(ppb)	NOX(ppb)
30/11/2016 0:00	0.03	0.018	8.084	21.054	29.138
30/11/2016 1:00	0.031	0.019	26.722	17.725	44.448
30/11/2016 2:00	0.032	0.019	14.976	13.673	28.648
30/11/2016 3:00	0.034	0.021	2.942	7.034	9.976
30/11/2016 4:00	0.036	0.022	2.271	6.223	8.494
30/11/2016 5:00	0.039	0.024	5.628	9.369	14.997
30/11/2016 6:00	0.041	0.025	4.801	19.765	24.566
30/11/2016 7:00	0.041	0.025	11.715	28.218	39.933
30/11/2016 8:00	0.04	0.024	22.208	30.932	53.14
30/11/2016 9:00	0.044	0.026	28.873	32.775	61.648
30/11/2016 10:00	0.046	0.028	50.088	31.468	81.556
30/11/2016 11:00	0.046	0.028	32.427	31.932	64.359
30/11/2016 12:00	0.05	0.031	11.928	22.673	34.602
30/11/2016 13:00	0.059	0.036	35.829	29.535	65.364
30/11/2016 14:00	0.057	0.034	7.248	17.494	24.742
30/11/2016 15:00	0.055	0.033	5.971	24.942	30.913
30/11/2016 16:00	0.053	0.031	19.234	28.474	47.708
30/11/2016 17:00	0.049	0.029	29.961	39.452	69.412
30/11/2016 18:00	0.054	0.032	21.999	34.945	56.944
30/11/2016 19:00	0.061	0.036	13.065	31.612	44.677
30/11/2016 20:00	0.065	0.039	5.87	25.989	31.859
30/11/2016 21:00	0.064	0.039	49.207	27.437	76.644
30/11/2016 22:00	0.061	0.036	22.376	27.986	50.362
30/11/2016 23:00	0.058	0.035	3.578	22.682	26.261

Time	PM10(mg/m3)	PM25(mg/m3)	NO(ppb)	NO2(ppb)	NOX(ppb)
1/12/2016 0:00	0.06	0.036	4.847	20.831	25.678
1/12/2016 1:00	0.062	0.038	5.84	22.321	28.161
1/12/2016 2:00	0.062	0.037	2.795	14.766	17.561
1/12/2016 3:00	0.063	0.039	2.694	19.442	22.136
1/12/2016 4:00	0.063	0.039	2.328	9.098	11.426
1/12/2016 5:00	0.064	0.04	2.757	12.534	15.291
1/12/2016 6:00	0.068	0.04	2.57	16.586	19.156
1/12/2016 7:00	0.071	0.042	11.421	26.301	37.722
1/12/2016 8:00	0.072	0.042	17.975	35.311	53.287
1/12/2016 9:00	0.067	0.042	36.012	39.702	75.714
1/12/2016 10:00	0.064	0.04	38.247	43.078	81.325
1/12/2016 11:00	0.042	0.025	34.046	22.129	56.175
1/12/2016 12:00	0.06	0.036	131.669	34.583	166.252
1/12/2016 13:00	0.045	0.028	6.457	18.962	25.42
1/12/2016 14:00	0.055	0.032	9.143	34.145	43.288
1/12/2016 15:00	0.06	0.036	7.922	32.744	40.666
1/12/2016 16:00	0.071	0.042	9.165	42.243	51.408
1/12/2016 17:00	0.066	0.039	6.17	30.935	37.105
1/12/2016 18:00	0.083	0.049	4.221	30.811	35.032
1/12/2016 19:00	0.088	0.053	62.776	38.996	101.772
1/12/2016 20:00	0.085	0.05	8.735	27.501	36.236
1/12/2016 21:00	0.082	0.048	4.293	32.467	36.76
1/12/2016 22:00	0.077	0.045	5.483	27.12	32.603
1/12/2016 23:00	0.08	0.047	5.399	18.611	24.011

Time	PM10(mg/m3)	PM25(mg/m3)	NO(ppb)	NO2(ppb)	NOX(ppb)
2/12/2016 0:00	0.071	0.042	2.993	14.995	17.988
2/12/2016 1:00	0.07	0.042	3.033	12.735	15.768
2/12/2016 2:00	0.076	0.046	2.671	9.19	11.861
2/12/2016 3:00	0.073	0.044	4.294	11.239	15.534
2/12/2016 4:00	0.072	0.044	7.23	15.917	23.147
2/12/2016 5:00	0.067	0.041	4.003	11.262	15.265
2/12/2016 6:00	0.068	0.042	45.492	22.375	67.867
2/12/2016 7:00	0.071	0.043	49.422	35.596	85.018
2/12/2016 8:00	0.078	0.047	60.285	44.914	105.199
2/12/2016 9:00	0.081	0.05	199.734	54.789	254.523
2/12/2016 10:00	0.073	0.047	11.525	22.9	34.425
2/12/2016 11:00	0.069	0.042	8.167	17.43	25.597
2/12/2016 12:00	0.061	0.038	9.429	13.775	23.203
2/12/2016 13:00	0.064	0.039	5.812	19.545	25.357
2/12/2016 14:00	0.075	0.046	6.595	27.015	33.61
2/12/2016 15:00	0.079	0.05	6.575	39.012	45.588
2/12/2016 16:00	0.084	0.051	7.922	44.539	52.461
2/12/2016 17:00	0.087	0.054	8.157	55.859	64.016
2/12/2016 18:00	0.081	0.049	5.404	32.272	37.676
2/12/2016 19:00	0.077	0.047	5.027	29.96	34.987
2/12/2016 20:00	0.065	0.04	3.431	27.028	30.459
2/12/2016 21:00	0.059	0.035	7.255	16.758	24.013
2/12/2016 22:00	0.057	0.033	3.58	16.406	19.986
2/12/2016 23:00	0.056	0.033	4.805	17.451	22.256

Time	PM10(mg/m3)	PM25(mg/m3)	NO(ppb)	NO2(ppb)	NOX(ppb)
3/12/2016 0:00	0.058	0.034	2.672	13.654	16.326
3/12/2016 1:00	0.058	0.034	3.461	12.432	15.894
3/12/2016 2:00	0.06	0.035	2.663	9.095	11.758
3/12/2016 3:00	0.065	0.038	2.553	10.358	12.911
3/12/2016 4:00	0.077	0.046	2.497	9.669	12.166
3/12/2016 5:00	0.088	0.053	5.407	16.577	21.984
3/12/2016 6:00	0.088	0.053	3.706	15.613	19.319
3/12/2016 7:00	0.088	0.054	8.27	21.903	30.173
3/12/2016 8:00	0.085	0.052	11.426	24.568	35.994
3/12/2016 9:00	0.083	0.052	17.001	24.943	41.944
3/12/2016 10:00	0.082	0.051	10.977	20.338	31.315
3/12/2016 11:00	0.08	0.05	7.941	23.294	31.235
3/12/2016 12:00	0.079	0.05	7.076	25.844	32.92
3/12/2016 13:00	0.079	0.051	7.752	37.729	45.481
3/12/2016 14:00	0.078	0.05	9.095	48.84	57.934
3/12/2016 15:00	0.082	0.053	7.324	51.713	59.037
3/12/2016 16:00	0.087	0.056	6.583	55.927	62.51
3/12/2016 17:00	0.088	0.057	6.351	59.814	66.165
3/12/2016 18:00	0.088	0.056	6.922	50.787	57.709
3/12/2016 19:00	0.085	0.054	4.982	40.425	45.407
3/12/2016 20:00	0.087	0.055	4.371	38.69	43.061
3/12/2016 21:00	0.084	0.053	3.694	29.041	32.735
3/12/2016 22:00	0.071	0.044	4.4	25.196	29.596
3/12/2016 23:00	0.052	0.032	5.523	16.973	22.496

Time	PM10(mg/m3)	PM25(mg/m3)	NO(ppb)	NO2(ppb)	NOX(ppb)
9/12/2016 0:00	0.111	0.073	6.929	53.433	60.362
9/12/2016 1:00	0.103	0.067	4.547	46.627	51.174
9/12/2016 2:00	0.102	0.068	4.16	37.208	41.368
9/12/2016 3:00	0.098	0.066	2.951	24.507	27.458
9/12/2016 4:00	0.094	0.06	2.29	12.833	15.123
9/12/2016 5:00	0.091	0.06	3.273	22.496	25.769
9/12/2016 6:00	0.085	0.057	13.638	38.807	52.445
9/12/2016 7:00	0.085	0.056	33.876	62.355	96.231
9/12/2016 8:00	0.088	0.058	45.899	64.964	110.863
9/12/2016 9:00	0.088	0.059	24.355	53.067	77.422
9/12/2016 10:00	0.089	0.059	11.741	37.293	49.034
9/12/2016 11:00	0.087	0.057	25.774	46.914	72.688
9/12/2016 12:00	0.079	0.052	15.398	40.212	55.611
9/12/2016 13:00	0.033	0.021	13.01	30.601	43.611
9/12/2016 14:00	0.027	0.017	14.688	34.303	48.991
9/12/2016 15:00	0.035	0.024	16.155	42.655	58.81
9/12/2016 16:00	0.043	0.028	19.811	52.55	72.362
9/12/2016 17:00	0.045	0.03	17.818	58.199	76.017
9/12/2016 18:00	0.038	0.025	12.684	49.069	61.754
9/12/2016 19:00	0.039	0.025	18.475	50.822	69.297
9/12/2016 20:00	0.035	0.023	6.759	43.057	49.816
9/12/2016 21:00	0.026	0.017	5.775	31.873	37.649
9/12/2016 22:00	0.022	0.014	5.465	26.003	31.468
9/12/2016 23:00	0.027	0.017	5.517	26.911	32.427

Time	PM10(mg/m3)	PM25(mg/m3)	NO(ppb)	NO2(ppb)	NOX(ppb)
10/12/2016 0:00	0.037	0.022	4.45	22.621	27.071
10/12/2016 1:00	0.043	0.026	2.922	17.615	20.537
10/12/2016 2:00	0.041	0.025	2.849	14.203	17.052
10/12/2016 3:00	0.037	0.022	2.928	14.901	17.829
10/12/2016 4:00	0.041	0.026	3.693	19.29	22.983
10/12/2016 5:00	0.048	0.031	6.285	23.468	29.754
10/12/2016 6:00	0.047	0.03	6.191	24.497	30.688
10/12/2016 7:00	0.062	0.039	18.704	49.331	68.035
10/12/2016 8:00	0.073	0.048	42.052	55.584	97.636
10/12/2016 9:00	0.067	0.043	25.073	51.262	76.334
10/12/2016 10:00	0.062	0.039	15.939	46.815	62.754
10/12/2016 11:00	0.052	0.032	12.899	44.434	57.333
10/12/2016 12:00	0.05	0.032	10.17	42.288	52.458
10/12/2016 13:00	0.052	0.033	13.469	51.547	65.016
10/12/2016 14:00	0.053	0.035	12.134	59.271	71.404
10/12/2016 15:00	0.056	0.035	9.111	56.611	65.723
10/12/2016 16:00	0.052	0.033	7.506	54.264	61.77
10/12/2016 17:00	0.042	0.027	7.448	56.359	63.807
10/12/2016 18:00	0.044	0.028	11.404	60.413	71.816
10/12/2016 19:00	0.053	0.034	3.634	39.731	43.364
10/12/2016 20:00	0.062	0.039	4.873	32.153	37.026
10/12/2016 21:00	0.076	0.047	3.752	29.863	33.614
10/12/2016 22:00	0.087	0.054	3.605	23.648	27.252
10/12/2016 23:00	0.084	0.052	4.239	23.169	27.408

Time	PM10(mg/m3)	PM25(mg/m3)	NO(ppb)	NO2(ppb)	NOX(ppb)
11/12/2016 0:00	0.067	0.042	4.419	20.56	24.979
11/12/2016 1:00	0.061	0.038	3.734	14.832	18.567
11/12/2016 2:00	0.058	0.036	3.488	12.047	15.535
11/12/2016 3:00	0.06	0.037	3.03	11.318	14.348
11/12/2016 4:00	0.054	0.034	2.717	9.424	12.141
11/12/2016 5:00	0.061	0.038	3.068	13.703	16.772
11/12/2016 6:00	0.077	0.048	5.213	20.424	25.638
11/12/2016 7:00	0.067	0.042	5.952	21.307	27.259
11/12/2016 8:00	0.05	0.031	8.946	22.626	31.572
11/12/2016 9:00	0.048	0.03	13.851	28.097	41.948
11/12/2016 10:00	0.045	0.028	7.161	18.11	25.271
11/12/2016 11:00	0.042	0.026	7.721	19.539	27.26
11/12/2016 12:00	0.039	0.024	5.73	17.752	23.483
11/12/2016 13:00	0.035	0.021	6.288	18.119	24.407
11/12/2016 14:00	0.03	0.018	6.405	17.809	24.214
11/12/2016 15:00	0.026	0.015	6.865	19.929	26.794
11/12/2016 16:00	0.026	0.016	8.341	24.138	32.479
11/12/2016 17:00	0.026	0.015	8.946	25.333	34.28
11/12/2016 18:00	0.027	0.016	8.043	23.328	31.371
11/12/2016 19:00	0.025	0.015	6.339	21.33	27.669
11/12/2016 20:00	0.027	0.015	5.318	21.003	26.321
11/12/2016 21:00	0.028	0.016	5.943	18.129	24.072
11/12/2016 22:00	0.029	0.016	5.74	18.079	23.819
11/12/2016 23:00	0.029	0.017	4.288	16.809	21.097

Time	PM10(mg/m3)	PM25(mg/m3)	NO(ppb)	NO2(ppb)	NOX(ppb)
12/12/2016 0:00	0.029	0.017	3.85	14.142	17.993
12/12/2016 1:00	0.029	0.016	3.071	10.528	13.599
12/12/2016 2:00	0.028	0.016	2.988	7.826	10.815
12/12/2016 3:00	0.027	0.015	2.837	8.098	10.936
12/12/2016 4:00	0.028	0.015	2.998	8.163	11.161
12/12/2016 5:00	0.028	0.015	3.289	10.877	14.166
12/12/2016 6:00	0.03	0.017	7.93	24.939	32.869
12/12/2016 7:00	0.032	0.017	24	44.261	68.262
12/12/2016 8:00	0.03	0.017	30.47	40.838	71.308
12/12/2016 9:00	0.029	0.017	37.665	45.444	83.109
12/12/2016 10:00	0.029	0.017	27.588	41.051	68.639
12/12/2016 11:00	0.027	0.015	17.619	33.417	51.036
12/12/2016 12:00	0.028	0.014	14.811	31.102	45.913
12/12/2016 13:00	0.026	0.015	15.603	32.52	48.123
12/12/2016 14:00	0.027	0.014	17.016	35.069	52.085
12/12/2016 15:00	0.025	0.014	15.821	37.49	53.311
12/12/2016 16:00	0.028	0.015	17.425	46.173	63.597
12/12/2016 17:00	0.031	0.017	13.103	50.245	63.348
12/12/2016 18:00	0.033	0.019	9.135	50.956	60.09
12/12/2016 19:00	0.036	0.021	7.261	41.701	48.963
12/12/2016 20:00	0.037	0.021	9.004	42.444	51.449
12/12/2016 21:00	0.04	0.023	7.741	39.836	47.577
12/12/2016 22:00	0.041	0.024	11.179	42.961	54.14
12/12/2016 23:00	0.041	0.023	7.547	38.969	46.516

Time	PM10(mg/m3)	PM25(mg/m3)	NO(ppb)	NO2(ppb)	NOX(ppb)
13/12/2016 0:00	0.038	0.023	5.804	40.567	46.371
13/12/2016 1:00	0.034	0.02	3.612	26.182	29.794
13/12/2016 2:00	0.031	0.018	4.782	26.058	30.841
13/12/2016 3:00	0.029	0.017	3.114	19.449	22.562
13/12/2016 4:00	0.025	0.015	8.781	34.124	42.904
13/12/2016 5:00	0.022	0.013	7.224	37.79	45.014
13/12/2016 6:00	0.025	0.014	21.38	50.174	71.554
13/12/2016 7:00	0.041	0.025	23.149	45.763	68.912
13/12/2016 8:00	0.04	0.023	22.092	40.024	62.116
13/12/2016 9:00	0.044	0.025	22.711	41.948	64.658
13/12/2016 10:00	0.039	0.022	16.771	35.225	51.996
13/12/2016 11:00	0.03	0.018	21.501	38.558	60.059
13/12/2016 12:00	0.027	0.016	46.895	49.218	96.113
13/12/2016 13:00	0.029	0.018	39.655	55.58	95.235
13/12/2016 14:00	0.031	0.018	50.943	64.9	115.842
13/12/2016 15:00	P	P	P	P	P
13/12/2016 16:00	P	P	P	P	P
13/12/2016 17:00	P	P	P	P	P
13/12/2016 18:00	P	P	P	P	P
13/12/2016 19:00	P	P	P	P	P
13/12/2016 20:00	P	P	P	P	P
13/12/2016 21:00	P	P	P	P	P
13/12/2016 22:00	0.035	0.02	19.54	51.373	70.912
13/12/2016 23:00	0.034	0.019	13.164	37.864	51.029

Time	PM10(mg/m3)	PM25(mg/m3)	NO(ppb)	NO2(ppb)	NOX(ppb)
14/12/2016 0:00	0.038	0.021	4.759	31.755	36.514
14/12/2016 1:00	0.05	0.027	7.002	32.799	39.801
14/12/2016 2:00	0.051	0.027	2.795	12.637	15.432
14/12/2016 3:00	0.042	0.024	1.958	7.699	9.658
14/12/2016 4:00	0.043	0.024	2.172	4.994	7.166
14/12/2016 5:00	0.04	0.022	2.508	5.039	7.548
14/12/2016 6:00	0.04	0.023	6.559	22.036	28.595
14/12/2016 7:00	0.045	0.025	44.963	25.848	70.811
14/12/2016 8:00	0.045	0.025	32.31	38.512	70.822
14/12/2016 9:00	0.043	0.026	40.838	44.165	85.002
14/12/2016 10:00	0.045	0.026	27.19	38.34	65.531
14/12/2016 11:00	0.048	0.029	37.693	42.795	80.488
14/12/2016 12:00	0.051	0.03	19.991	32.779	52.77
14/12/2016 13:00	0.057	0.034	21.222	40.632	61.854
14/12/2016 14:00	0.067	0.038	6.815	28.934	35.75
14/12/2016 15:00	0.063	0.035	3.985	26.059	30.044
14/12/2016 16:00	0.058	0.033	22.09	59.891	81.981
14/12/2016 17:00	0.057	0.033	25.258	63.295	88.552
14/12/2016 18:00	0.051	0.028	8.695	34.219	42.913
14/12/2016 19:00	0.055	0.032	37.716	48.143	85.859
14/12/2016 20:00	0.055	0.028	9.14	26.905	36.045
14/12/2016 21:00	0.056	0.028	2.944	13.957	16.901
14/12/2016 22:00	0.057	0.03	3.382	19.147	22.529
14/12/2016 23:00	0.063	0.031	4.394	19.39	23.784

Monitoring Location : Tong Shui Road Pier (Location 2)

Time	PM10(mg/m3)	PM25(mg/m3)	NO(ppb)	NO2(ppb)	NOX(ppb)
15/12/2016 0:00	0.062	0.03	5.496	16.872	22.368
15/12/2016 1:00	0.057	0.028	2.496	10.856	13.353
15/12/2016 2:00	0.057	0.029	2.264	8.099	10.363
15/12/2016 3:00	0.06	0.029	1.928	9.403	11.332
15/12/2016 4:00	0.059	0.029	3.721	10.305	14.025
15/12/2016 5:00	0.058	0.028	4.645	8.229	12.874
15/12/2016 6:00	0.059	0.028	3.385	12.631	16.017
15/12/2016 7:00	0.061	0.029	13.37	22.11	35.479
15/12/2016 8:00	0.06	0.027	22.506	23.372	45.878
15/12/2016 9:00	0.061	0.03	23.316	27.315	50.631
15/12/2016 10:00	0.061	0.031	21.236	32.589	53.825
15/12/2016 11:00	0.06	0.031	22.205	35.798	58.003
15/12/2016 12:00	0.062	0.034	19.882	37.106	56.988
15/12/2016 13:00	0.066	0.037	22.252	43.127	65.379
15/12/2016 14:00	0.066	0.034	18.428	44.613	63.041
15/12/2016 15:00	0.065	0.035	21.986	46.802	68.789
15/12/2016 16:00	0.059	0.033	14.329	27.559	41.888
15/12/2016 17:00	0.053	0.03	12.414	38.607	51.021
15/12/2016 18:00	0.048	0.028	33.124	42.338	75.462
15/12/2016 19:00	0.041	0.023	9.118	24.613	33.73
15/12/2016 20:00	0.04	0.023	6.848	20.478	27.325
15/12/2016 21:00	0.04	0.022	4.863	16.74	21.603
15/12/2016 22:00	0.045	0.023	3.268	12.32	15.589
15/12/2016 23:00	0.05	0.025	2.305	11.628	13.933

Time	PM10(mg/m3)	PM25(mg/m3)	NO(ppb)	NO2(ppb)	NOX(ppb)
16/12/2016 0:00	0.053	0.027	3.198	16.182	19.38
16/12/2016 1:00	0.064	0.03	2.923	12.814	15.736
16/12/2016 2:00	0.073	0.034	2.587	10.628	13.215
16/12/2016 3:00	0.079	0.037	2.167	10.8	12.967
16/12/2016 4:00	0.084	0.039	2.545	9.569	12.115
16/12/2016 5:00	0.086	0.044	5.136	12.891	18.027
16/12/2016 6:00	0.085	0.042	5.016	17.353	22.369
16/12/2016 7:00	0.082	0.043	9.574	24.564	34.138
16/12/2016 8:00	0.082	0.045	34	29.175	63.176
16/12/2016 9:00	0.077	0.042	21.503	32.05	53.553
16/12/2016 10:00	0.08	0.042	18.047	25.939	43.986
16/12/2016 11:00	0.072	0.041	16.778	30.895	47.672
16/12/2016 12:00	0.069	0.041	16.858	31.49	48.347
16/12/2016 13:00	0.071	0.041	25.38	40.801	66.18
16/12/2016 14:00	0.059	0.034	21.322	38.748	60.071
16/12/2016 15:00	0.067	0.04	16.535	44.003	60.538
16/12/2016 16:00	0.07	0.042	21.081	37.084	58.166
16/12/2016 17:00	0.073	0.043	12.979	32.081	45.061
16/12/2016 18:00	0.077	0.046	34.361	50.052	84.413
16/12/2016 19:00	0.072	0.043	40.298	58.422	98.72
16/12/2016 20:00	0.068	0.04	12.692	38.177	50.869
16/12/2016 21:00	0.067	0.037	10.585	30.251	40.836
16/12/2016 22:00	0.068	0.039	9.685	35.342	45.026
16/12/2016 23:00	0.065	0.036	3.788	27.907	31.695

Remarks:

- Power failure (" P ") was occurred at 15:00 - 21:00 on 13 December 2017 and leaded to data loss.

AECOM

Transportation

Working Paper on Noise Assessment

(Ref. R25-01)

December 2016

Agreement No. CE 41/2014 (HY)

Boardwalk underneath Island Eastern Corridor – Investigation

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1 INTRODUCTION

1.1 Background

1.1.1 AECOM Asia Company Limited (AECOM) is commissioned by CEDD as the Consulting Engineer to undertake the assignment of Boardwalk underneath Island Eastern Corridor – Investigation (hereafter referred to as "the Project"). The overall objective of the assignment is to conduct a review of the feasibility of the proposed boardwalk under the Island Eastern Corridor (IEC) to demonstrate its compliance with the Protection of the Harbour Ordinance (PHO) before proceeding with the detailed design and construction of the Project. Besides, an Environmental Assessment (EA) of the Project would also be carried out to review its environmental implications.

1.1.2 The objective of this working paper is to identify the potential noise impacts caused by the construction and the operation of the Project and formulate effective and practicable mitigation measures if necessary.

1.2 Description of Project

1.2.1 The Project consist of a pedestrian boardwalk underneath the IEC from Oil Street to Hoi Yu Street along the North Point waterfront, cycling facilities alongside the pedestrian boardwalk are also proposed. The boardwalk would be supported by the IEC foundation resting on the existing IEC pile caps. The structural form of the boardwalk is a steel bridge with cast in-situ concrete deck to minimise the self-weight of the proposed boardwalk.

1.2.2 A promenade is proposed at the embankment between Tong Shui Road and Tin Chiu Street connecting the boardwalk, while another promenade is proposed to the western-end of the boardwalk near City Garden. The promenade connecting the boardwalk will be developed by the proponent of North Point Estate Redevelopment Site, while the promenade to the west is planned open space under other developments. Hence these proposed promenades are not included in the study and hence the environmental assessment of the Project.

1.2.3 The construction of the Project would be carried out from 2018 to 2019 tentatively. As the boardwalk would be supported by the IEC foundation resting on the existing IEC pile caps, construction works for the project would mainly comprise short duration of pre-bored H piling, reinforced concrete structural modification works for pile caps, subsequent installation of pre-fabricated platform structures, lift installation, E&M installations, architectural finishing and landscaping works.

1.2.4 The layout plan of the Project is shown in **Appendix A**.

2 MAJOR ELEMENTS OF SURROUNDING ENVIRONMENT

2.1 Description of Surrounding Environment

2.1.1 The vicinity of the western side of the Project (Oil Street to Tong Shui Street) mainly consist of private residential dwellings including City Garden and Provident Centre, while the surroundings near the eastern side of the Project (Tin Chiu Street to Hoi Yu Street) mainly consist of commercial developments and Government buildings such as ICAC North Point Headquarters and North Point Government Offices.

2.1.2 North Point Ferry Pier is located near the half way of the boardwalk. North Point Estate Redevelopment Site is located between Tong Shui Street and Tin Chiu Street near the embankment of North Point Ferry Pier. The North Point Estate Redevelopment Site will be completed in 2018 tentatively and comprise private residential development, commercial complex and hotel. It is also noteworthy that proposed promenade connecting the boardwalk in front of the North Point Estate Redevelopment Site will be developed by its proponent.

2.2 Noise Sensitive Receivers

2.2.1 Majority of the noise sensitive uses potentially affected from the construction and operation of the Project are located to the western side of the Project, they include City Garden, HK Baptist Church Henrietta Secondary School, PLK Yu Lee Mo Fan Memorial School and Provident Centre. The noise sensitive uses at North Point Estate Redevelopment Site are also identified. For the developments near eastern side of the Project, with the exception of North Point Fire Services Married Quarters as noise sensitive receiver, other commercial developments and Government buildings in the area are provided with central air conditioning and do not rely on opened window as means of ventilation. The representative Noise Sensitive Receivers (NSRs) identified are summarized in **Table 2.1** below and shown in **60341972/WPNOISE/Figure 2.1 (Appendix B).**

Table 2.1 Identified Representative Noise Sensitive Receivers

ID	Premise	Nature
N1	City Garden (Block 7)	Residential
N2	City Garden (Block 6)	Residential
N3	HK Baptist Church Henrietta Secondary School	Education Institution
N4	PLK Yu Lee Mo Fan Memorial School	Education Institution
N5	Provident Centre (Block 1)	Residential
N6	Provident Centre (Block 9)	Residential
N7	Provident Centre (Block 17)	Residential
N8	North Point Fire Services Married Quarters	Residential
N9	Proposed Development at North Point Estate Redevelopment Site (West)	Residential
N10	Proposed Development at North Point Estate Redevelopment Site (East)	Residential

3 ENVIRONMENTAL LEGISLATION, PLANS, STANDARDS, AND GUIDELINES

3.1 Construction Noise

3.1.1 The Noise Control Ordinacne (NCO) provides the statutory framework for noise control of construction work, other than percussive piling, using powered mechanical equipment (PME) between the hours of 1900 and 0700 hours or at any time on Sundays and general holiday (that is, restricted hours). Noise control on construction activities taking place at other times is subject to either the Assessment Criteria in EPD ProPECC PN 2/93 or the Criteria for Evaluating Noise Impact stated in Table 1B of Annex 5 in the TM on Environmental Impact Assessment Process (EIAO-TM). The noise limit is $L_{eq\ (30\ minutes)}$ 75 dB(A) at the façades of dwellings and 70 dB(A) at the façade of schools (65 dB(A) during examinations).

3.1.2 Between 1900 and 0700 hours and all day on Sundays and public holidays, activities involving the use of PME for the purpose of carrying out construction work is prohibited unless a construction noise permit (CNP) has been obtained. A CNP may be granted provided that the Acceptable Noise Level (ANL) for the NSRs can be complied with. ANLs are assigned depending upon the area sensitivity rating. The corresponding basic noise levels (BNLs) for evening and night time periods are given in **Table 3.1**.

Table 3.1 Construction Noise Criteria for Activity other than Percussive Piling

Time Period	Basic Noise Level (BNLs)		
	Area Sensitivity Rating		
	A	B	C
Evening (1900 to 2300 hours) (1)	60	65	70
Night (2300 to 0700 hours)	45	50	55

Note: (1) Includes Sundays and Public Holiday during daytime and evening.

3.1.3 Despite any description or assessment made in this paper on construction noise aspects, there is no guarantee that CNP will be issued for the project construction. The Noise Control Authority will consider a well-justified CNP application, once filed, for construction works within restricted hours as guided by the relevant Technical Memoranda issued under the *Noise Control Ordinance*. The Noise Control Authority will take into account of contemporary conditions / situations of adjoining land uses and any previous complaints against construction activities at the site before making his decision in granting a CNP. Nothing in this ERR shall bind the Noise Control Authority in making his decision. If a CNP is to be issued, the Noise Control Authority shall include in it any condition he thinks fit. Failure to comply with any such conditions will lead to cancellation of the CNP and prosecution action under the NCO.

3.1.4 Under the DA-TM, the use of five types of Specified Powered Mechanical Equipment (SPME) and three types of Prescribed Construction Work (PCW) within a designated area during restricted hours would require a valid CNP. The SPME includes hand-held breaker, bulldozer, concrete lorry mixer, dump truck and hand-held vibratory poker. The PCW are:

- Erecting or dismantling of formwork or scaffolding
- Loading, unloading or handling of rubble, wooden boards, steel bars, wood or scaffolding material
- Hammering

3.1.5 In general, it should not be presumed that a CNP would be granted for carrying out PCW within a designated area during restricted hours. The CNP may be granted for the execution of construction works during restricted hours involving the use of PME and / or SPME if the relevant Acceptable Noise Levels and criteria stipulated in the GW-TM and DA-TM can be met.

3.1.6 Percussive piling is prohibited between 1900 and 0700 hours on any weekday not being a general holiday and at any time on Sunday or general holiday. A CNP is required for the carrying out of percussive piling between 0700 and 1900 hours on any day not being a general holiday. PP-TM sets out the requirements for working and determination of the permitted hours of operations. ANLs for percussive piling for different types of NSRs are shown in **Table 3.2**.

Table 3.2 Acceptable Noise Levels for Percussive Piling

NSR Window Type or Means of Ventilation		ANL, dB(A)
(i)	NSR (or part of NSR) with no windows or other opening	100
(ii)	NSR with central air conditioning system	90
(iii)	NSR with windows or other openings but without central air conditioning system	85

Note: 10 dB(A) should be subtracted from the ANLs shown above for NSRs which are hospitals, medical clinics, educational institutes, courts of law or other NSRs which are considered by the Noise Control Authority to be particularly sensitive to noise.

3.1.7 In accordance with PP-TM, the permitted hours of operation for carrying out of percussive piling work, subject to the issuance of a CNP, are listed in **Table 3.3**.

Table 3.3 Permitted Hours of Operation for Carrying Out of Piling Works

Amount by which Corrected Noise Level (CNL) exceeds Acceptable Noise Level (ANL), CNL-ANL	Permitted hours of operation on any day not being a general holiday
10 dB(A) < CNL-ANL	0800 to 0900 and 1230 to 1330 and 1700 to 1800
0 dB(A) < CNL-ANL ≤ 10 dB(A)	0800 to 0930 and 1200 to 1400 and 1630 to 1800
CNL-ANL ≤ 0 dB(A)	0700 to 1900

3.2 Operation Noise

3.2.1 The purpose of the proposed boardwalk is to enhance connectivity and pedestrian accessibility of the harbour front, and to provide a place of relaxation for pedestrians and residents in the area. In addition, as the nature of the proposed boardwalk is intended for relaxation and allow pedestrians to enjoy the harbour view, noise from human activities on the proposed boardwalk is expected to have insignificant impact of sensitive receivers nearby. There is no ventilation system or other fixed noise sources in the proposed boardwalk. In view of the above, adverse noise impact from the proposed boardwalk to the representative NSRs is not expected.

4 IDENTIFICATION OF NOISE IMPACT

4.1 Construction Phase

4.1.1 Construction of the boardwalk would mainly involve short duration of pre-bored H piling, reinforced concrete structural modification works for pile caps, transporting and installation of pre-fabricated platform structures. Potential noise impacts arising from these construction activities would be the use of powered mechanical equipment (PME) such as mobile crane, concrete lorry mixer, etc.

4.1.2 No construction work during restricted hours is expected. A Construction Noise Permit is required under the Noise Control Ordinance (NCO) in case the construction works are to be carried out during night-time (1900 – 0700), Sundays and public holidays.

4.2 Operation Phase

4.2.1 The purpose of the proposed boardwalk is to enhance connectivity and pedestrian accessibility of the harbour front, and to provide a place of relaxation for pedestrians and residents in the area. Open air entertainment activities including music, singing and instrument performance activities are not anticipated on the proposed boardwalk under normal circumstances. In addition, as the nature of the proposed boardwalk is intended for relaxation and allow pedestrians to enjoy the harbour view, noise from human activities on the proposed boardwalk is expected to have insignificant impact to sensitive receivers nearby. There is no ventilation system or other fixed noise sources in the proposed boardwalk. In view of the above, adverse noise impact from the proposed boardwalk to the NSRs in the vicinity is not expected.

4.2.2 Performance venue such as auditorium and amphitheatre is not present on the boardwalk. In addition, there is no noise sensitive uses such as clinics and hostels on the proposed boardwalk. Hence, adverse noise impact to the proposed boardwalk is not expected.

5 EVALUATION OF NOISE IMPACT

5.1 Construction Phase

5.1.1 As the boardwalk would be supported by the IEC foundation resting on the existing IEC pile caps, only a few additional dolphins structures to be erected by proposed pre-bored H piling would be required for supporting the proposed boardwalk. Hence the construction of additional dolphin structures would be of short duration. Moreover, the additional dolphin structures will be located at the far side of the boardwalk from the NSRs facing the harbour. In view of the above, adverse noise impact from construction piling works to NSRs in the vicinity is not expected.

5.1.2 For other construction activities including reinforced concrete structural modification works for pile caps, installation of pre-fabricated platform structures, lift installation, E&M installations, architectural finishing and landscaping works, the possible noise impacts arising from these construction activities would be the use of Powered Mechanical Equipment (PME) including mobile cranes, concrete lorry mixers, etc. In view that the boardwalk would be supported by the IEC foundation resting on the existing IEC pile caps such that only a few additional dolphins structures are required and the bridge structure of the boardwalk will be pre-fabricated before installation on site, the amount of PMEs required on site would be limited and their rate of utilization would be low and of short duration. In addition, quieter work activities will be arranged and noisy works, such as concrete operation and operation of dump trucks would be avoided during examination periods. With noise mitigation measures including use of quiet or quality PME, providing full enclosure for static plant, provide movable noise barriers and temporary noise barriers, and scheduling of construction works to avoid noisy construction activities to take place during exam period, adverse construction noise impact to NSRs in the vicinity is not expected.

5.1.3 In addition to the above-mentioned mitigation measures, the good site practices listed below shall be adopted by all the contractors to further ameliorate the noise impacts. Although the noise mitigating effects are not easily quantifiable and the benefits may vary with the site conditions and operating conditions, good site practices are easy to implement and do not impact upon the works schedule:

- Only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction program
- Silencers or mufflers on construction equipment should be utilized and should be properly maintained during the construction program.
- Mobile plant, if any, should be sited as far away from NSRs as possible.
- Machines and plant (such as trucks) that may be in intermittent use should be shut down between works periods or should be throttled down to a minimum.
- Plant known to emit noise strongly in one direction should, wherever possible, be orientated so that the noise is directed away from the nearby NSRs.
- Material stockpiles and other structures should be effectively utilized, wherever practicable, in screening noise from on-site construction activities.

5.2 Operation Phase

5.2.1 The purpose of the proposed boardwalk is to enhance connectivity and pedestrian accessibility of the harbour front, and to provide a place of relaxation for pedestrians and residents in the area. Open air entertainment activities including music, singing and instrument performance activities are not anticipated on the proposed boardwalk under normal circumstances. If open air entertainment activities including music, singing and instrument performance activities are to be held on the boardwalk, the proponent should apply for “Places of Public Entertainment Licence for Places Other Than Cinemas and

Theatres" (PPEL) and demonstrate the noise sources from these events would comply with the noise criterion as outlined in the Noise Control Guidelines for Music, Singing and Instrument Performing Activities as stipulated by EPD, or through separate assessment to the satisfaction of relevant government authorities. In addition, as the nature of the proposed boardwalk is intended for relaxation and allow pedestrians to enjoy the harbour view, noise from human activities on the proposed boardwalk is expected to have insignificant impact to sensitive receivers nearby. Hence, adverse noise impact from performance activities and other human activities to the NSRs in the vicinity is not expected.

5.2.2 There is no ventilation system or other fixed noise sources in the proposed boardwalk. Hence, adverse fixed noise impact from the proposed boardwalk to the NSRs in the vicinity is not expected.

5.2.3 Performance venue such as auditorium and amphitheatre is not present on the boardwalk. In addition, there is no noise sensitive uses such as clinics and hostels on the proposed boardwalk. Hence, adverse noise impact to the proposed boardwalk is not expected.

6 CONCLUSION

6.1.1 Noise impact arising from the construction of the project has been reviewed. In view of the short duration of noisy construction works, and limited amount of PMEs required on site, with noise mitigation measures including use of quiet or quality PME, providing full enclosure for static plant, provide movable noise barriers and temporary noise barriers, and scheduling of construction works to avoid noisy construction activities to take place during exam period, adverse construction noise impact to NSRs in the vicinity is not expected.

6.1.2 Open air entertainment activities including music, singing and instrument performance activities are not anticipated on the proposed boardwalk under normal circumstances. If open air entertainment activities including music, singing and instrument performance activities are to be held on the boardwalk, the proponent should apply for "Places of Public Entertainment Licence for Places Other Than Cinemas and Theatres" (PPEL) and demonstrate the noise sources from these events would comply with the noise criterion as outlined in the Noise Control Guidelines for Music, Singing and Instrument Performing Activities as stipulated by EPD, or through separate assessment to the satisfaction of relevant government authorities. In addition, as the nature of the proposed boardwalk is intended for relaxation and allow pedestrians to enjoy the harbour view, noise from human activities on the proposed boardwalk is expected to have insignificant impact of sensitive receivers nearby. There is no ventilation system or other fixed noise sources in the proposed boardwalk. In view of the above, adverse noise impact from the proposed boardwalk to the NSRs in the vicinity is not expected.

6.1.3 There is no performance venue such as auditorium and amphitheatre and other noise sensitive uses such as clinics and hostels on the proposed boardwalk. Hence, adverse noise impact to the proposed boardwalk is not expected.

Appendix A

Location of Representative Noise Sensitive Receivers

ISO A1 594mm x 841mm

Approved:

Checked:

Designer:

Project Management Initials:

837800 E

838600 E

839400 E

817400 N

816600 N

815800 N

VICTORIA HARBOUR

北角
NORTH POINT

NORTH POINT

鰂魚涌
QUARRY BAY

銅鑼灣
CAUSEWAY BAY

N1

N2

N3

N4

N5

N6

N7

N8

N9

N10

N

LEGEND:

300m ASSESSMENT BOUNDARY

NSR

BOARDWALK LAYOUT

NORTH POINT ESTATE REDEVELOPMENT SITE

Plot File by: LID
PATH: Z:\Projects\60341972\DRAWING\REPORT\WPNOISE\WPNOISE_201.dgn
2016/12/8

AECOM

PROJECT
項目

BOARDWALK UNDERNEATH ISLAND EASTERN CORRIDOR - INVESTIGATION

CLIENT
業主

CEDD 土木工程拓展署 Civil Engineering and Development Department

CONSULTANT
工程顧問公司

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ISSUE/REVISION
修訂

I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 核實

STATUS
階段

SCALE
比例

A1 1 : 4000

DIMENSION UNIT
尺寸單位

METRES

KEY PLAN
索引圖

PROJECT NO.
工程項號

60341972

CONTRACT NO.
合約編號

CE 41/2014 (HY)

SHEET TITLE
圖紙名稱

LOCATION OF REPRESENTATIVE NOISE SENSITIVE RECEIVERS

SHEET NUMBER
圖紙編號

60341972/WPNOISE/FIGURE 2.1

Appendix B

Proposed Boardwalk Layout

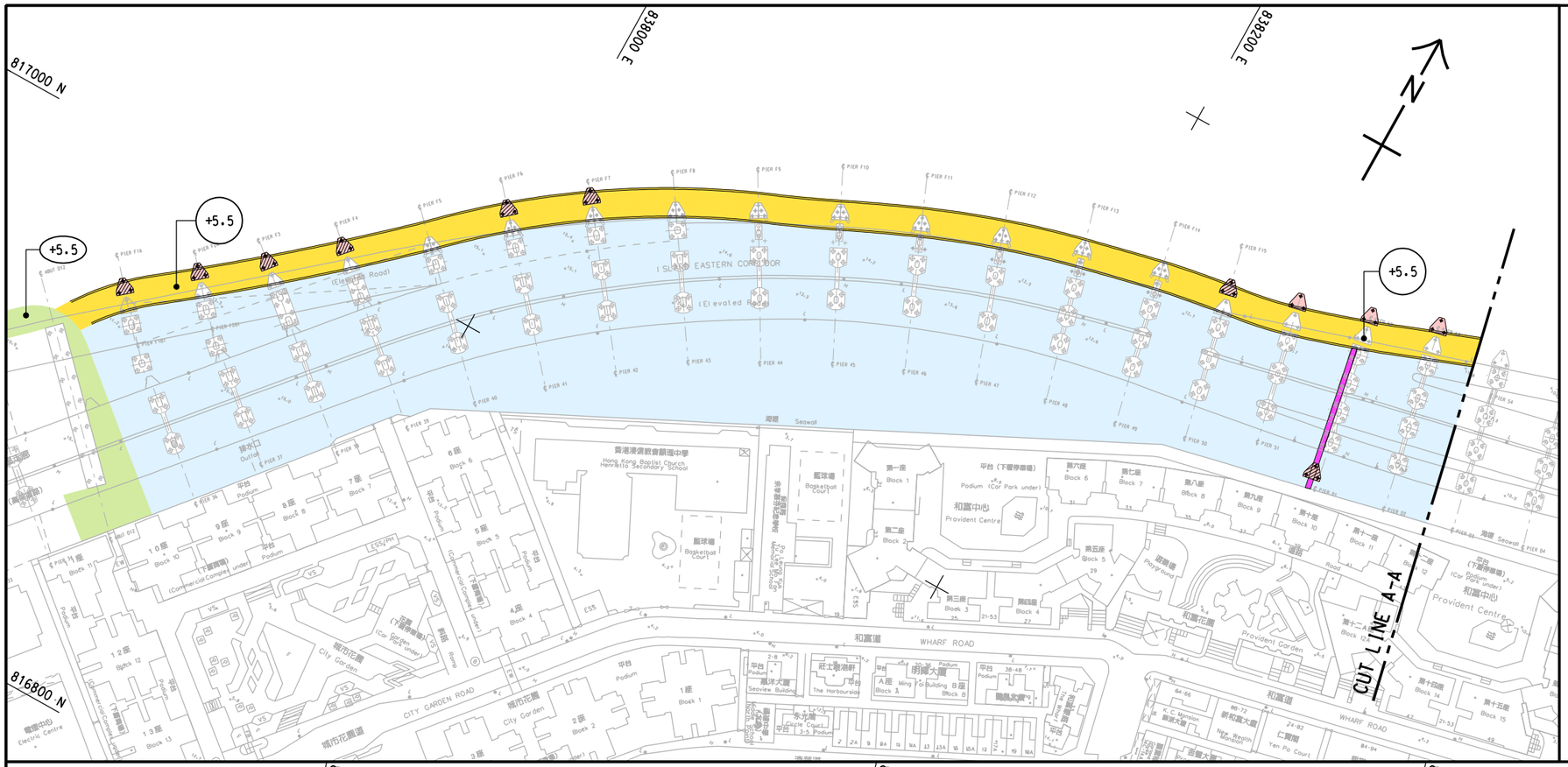
ISO A1 594mm x 841mm

Approved:

Checked:

Designer:

Project Management Initials:



NOTE:

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWING NO. 60341972/PAER/102.

LEGEND:

- PROPOSED DOLPHIN STRUCTURE
- PROPOSED BOARDWALK UNDER IEC
- MOVEABLE BRIDGE
- PROPOSED CYCLE TRACK UNDER IEC
- PROPOSED PROMENADE
- WDII RECLAMATION (BY OTHERS)
- RECLAMATION AREA
- AFFECTED WATER AREA
- +5.5 PROPOSED FINISHED FLOOR LEVEL (IN mPD)
- +5.5 ANTICIPATED LEVELS OF WATERFRONT AREA (IN mPD)

AECOM

PROJECT 項目

BOARDWALK UNDERNEATH ISLAND EASTERN CORRIDOR - INVESTIGATION

CLIENT 業主

土木工程拓展署 Civil Engineering and Development Department

CONSULTANT 工程顧問公司

AECOM Asia Company Ltd.
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SUB-CONSULTANTS 分判工程顧問公司

ISSUE/REVISION 修訂

I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 核核
A	DEC. 16	MINOR AMENDMENT	-

STATUS 狀況

SCALE 比例
A1 1 : 1000

DIMENSION UNIT 尺寸單位
METRES

KEY PLAN 索引圖

PROJECT NO. 項目編號
60341972

CONTRACT NO. 合約編號
CE 41/2014 (HY)

SHEET TITLE 圖紙名稱
AFFECTED WATER AREA/ RECLAMATION UNDER PROPOSED BOARDWALK (WITH CONTINUOUS CYCLE TRACK)

SHEET 1 OF 2

SHEET NUMBER 圖紙編號
60341972/PAER/101A

Plot File by: CHENG2 2016/10/26
PATH: F:\Projects\60341972\ZDRAW\NGREPORT\PAER\PAER_101.dgn

AECOM

PROJECT
項目

BOARDWALK UNDERNEATH ISLAND EASTERN CORRIDOR - INVESTIGATION

CLIENT
業主

土木工程拓展署
CEDD Civil Engineering and Development Department

CONSULTANT
工程顧問公司

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分判工程顧問公司

ISSUE/REVISION
修訂

I/R 修訂	DATE 日期	DESCRIPTION 內容摘要	CHK. 複核
A	DEC. 16	MINOR AMENDMENT	-

STATUS
階段

SCALE 比例: A1 1 : 1000

DIMENSION UNIT 尺寸單位: METRES

KEY PLAN
索引圖

PROJECT NO. 項目編號: 60341972

CONTRACT NO. 合約編號: CE 41/2014 (HY)

SHEET TITLE
圖紙名稱

AFFECTED WATER AREA/ RECLAMATION UNDER PROPOSED BOARDWALK (WITH CONTINUOUS CYCLE TRACK)

SHEET 2 OF 2

SHEET NUMBER
圖紙編號

60341972/PAER/102A

ISO A1 594mm x 841mm

Approved:

Checked:

Designer:

Project Management Initials:

Plot File by: CHENQ2 2016/12/8
PATH: P:\Projects\60341972\DRAWING\REPORT\PAER\PAER_102.dgn