3 AIR QUALITY IMPACT

3.1 Introduction

3.1.1 This section presents an assessment of potential air quality impacts associated with the construction and operation phases of the Project. These potential air quality impacts are expected to be dust nuisance during the construction phase and vehicular emissions during the operation phase. Appropriate mitigation measures are proposed to alleviate the potential air quality impacts if necessary.

3.2 Environmental Legislation, Standards and Criteria

3.2.1 The criteria for evaluating air quality impacts and the guidelines for air quality assessment are laid out in Annex 4 and Annex 12 of the EIAO-TM as well as the requirements set out under Clause 3.4.1 of the EIA Study Brief.

Air Quality Objective & EIAO-TM

3.2.2 The Air Pollution Control Ordinance (APCO) provides the statutory authority for controlling air pollutants from a variety of sources. The Hong Kong Air Quality Objectives (AQOs), which stipulate the maximum allowable concentrations over specific periods for typical pollutants, should be met. The relevant AQOs are listed in **Table 3.1**.

Table 3.1 Hong Kong Air Quality Objectives

Pollutant	Maximum Concentration ($\mu g\ m^{-3}$) (1)				
	Averaging Time				
	1 hour (2)	8 hour (3)	24 hour (3)	3 month (4)	Annual (4)
Total Suspended Particulates (TSP)	-	-	260	-	80
Respirable Suspended Particulates (RSP) (5)	-	-	180	-	55
Sulphur Dioxide (SO_2)	800	-	350	-	80
Nitrogen Dioxide (NO_2)	300	-	150	-	80
Carbon Monoxide (CO)	30,000	10,000	-	-	-
Photochemical Oxidants (as Ozone, O_3) (6)	240	-	-	-	-
Lead	-	-	-	1.5	-

Note:
(1) Measured at 298 K and 101.325 kPa.
(2) Not to be exceeded more than three times per year.
(3) Not to be exceeded more than once per year.
(4) Arithmetic mean.
(5) Suspended particulates in air with a nominal aerodynamic diameter of 10 μm or smaller.
(6) Photochemical oxidants are determined by measurement of ozone only.

3.2.3 The EIAO-TM stipulates that the hourly TSP level should not exceed 500 μgm^{-3} (measured at 25^{o}C and one atmosphere) for construction dust impact assessment. Mitigation measures for construction sites have been specified in the Air Pollution Control (Construction Dust) Regulation.

Air Pollution Control (Construction Dust) Regulation

3.2.4 Notifiable and regulatory works are under the control of Air Pollution Control (Construction Dust) Regulation. Notifiable works are site formation, reclamation, demolition, foundation and superstructure construction for buildings and road construction. Regulatory works are building renovation, road opening and resurfacing, slope stabilisation, and other activities including stockpiling, dusty material handling, excavation, concrete production, etc. This Project is expected to involve both notifiable works (road construction) and regulatory works (dusty material handling, excavation). 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.

Practice Note on Control of Air Pollution in Vehicle Tunnels

3.2.5 The Practice Note on Control of Air Pollution in Vehicle Tunnels, prepared by the EPD provides guidelines on control of air pollution in vehicle tunnels. Guideline values on tunnel air quality are presented in **Table 3.2** below.

Table 3.2 Tunnel Air Quality Guidelines (TAQG)

Air Pollutant	Averaging Time	Maximum Concentration	
		($\mu g/m^3$) (1)	ppm
Carbon Monoxide (CO)	5 minutes	115,000	100
Nitrogen Dioxide (NO_2)	5 minutes	1,800	1
Sulphur Dioxide (SO_2)	5 minutes	1,000	0.4

Note:
(1) Expressed at reference conditions of 298K and 101.325kPa.

3.3 Description of Environment

3.3.1 The Project is to provide a highway connecting TKO at Po Yap Road in the east and Trunk Road T2 in the west with associated interchange. The study areas include both Lam Tin area and Tiu Keng Leng and Town Centre South area (TKO side).

3.3.2 The locality of study area at Lam Tin area is a developed urban area with middle density of residential developments and educational institutes. The dominant existing emission source at this study area is the existing traffic from the Kwun Tong Bypass and Eastern Harbour Crossing (EHC) as well as emissions from EHC ventilation building.

3.3.3 The study area at TKO side is a newly developed area with residential buildings and educational institutes. Existing air quality in the study area is affected by emissions from local road traffic and construction activities in and around the study area.

3.3.4 For Lam Tin area, the nearest Environmental Protection Department (EPD) fixed air quality monitoring station is located at Kwun Tong. For TKO side, EPD's air quality monitoring station at TKO ceased operation in 1993 and there is no recent air quality monitoring data available for this area. The annual average monitoring data recorded at EPD's Kwun Tong air quality monitoring station has shown the pollutants' concentrations tend to be steady in the past five years. The recent five years (2007 –2011) annual average concentrations are summarized in **Table 3.3**.

Table 3.3 Annual Average Concentrations of Pollutants in the Latest Five Years (Year 2007 - 2011) at Kwun Tong EPD Air Quality Monitoring Station

Pollutant	Annual Average Concentration (μg/m3)
NO_2	60
RSP	49
TSP	73

3.4 Air Sensitive Receivers

3.4.1 In accordance with Annex 12 of the EIAO-TM, any domestic premises, hotel, hostel, hospital, clinic, nursery, temporary housing accommodation, school, educational institution, office, factory, shop, shopping centre, place of public worship, library, court of law, sports stadium or performing arts centre are considered as air sensitive receivers (ASRs). Any other premises or place with which, in terms of duration or number of people affected, has a similar sensitivity to the air pollutants as the aforelisted premises and places is also considered to be a sensitive receiver.

3.4.2 As stated in the EIA Study Brief, the boundary of the assessment area for air quality assessment should be 500m from the boundary of the Project site. After review of the latest Outline Zoning Plans (OZP) including Kai Tak OZP (Plan No. S/K22/4) dated September 2012, Cha Kwo Ling, Yau Tong, Lei Yue Mun OZP (Plan No. S/K15/19) dated June 2011 and Tseung Kwan O OZP (Plan No. S/TKO/20) dated April 2012, 21 representative ASRs in the proximity of the Project site which are most likely to be affected by the construction of the Project and 44 representative existing and planned ASRs which would be affected by the operation of the Project are identified for assessment and the details are listed in **Table 3.4** and **3.5**, respectively. The ASRs for the assessment are selected according to Clause 3.4.1.4(ii)(a) of the EIA Study Brief as representing the worst impact point of the identified ASRs within 500m from the Project boundary. Their locations are illustrated in **Figures 3.1a to 3.4b**.

Table 3.4 Representative Air Sensitive Receivers During Construction Phase

ASR	Description	Land Use	Distance from the nearest Open Works Area (m)	No. of storey	Assessment Height (mPD)	Respective Assessment Height metres above ground)
Lam Tin side						
CL1	Tin Hau Temple	Place of public worship	42	1/F	7, 10.5, 15.5, 20.5, 25.5	1.5, 5, 10, 15, 20
CL2	Cha Kwo Ling Village	Residential	80	3/F	7, 10.5, 15.5, 20.5, 25.5	1.5, 5, 10, 15, 20
CL3	Sitting out area	Recreation	75	-	7	1.5

ASR	Description	Land Use	Distance from the nearest Open Works Area (m)	No. of storey	Assessment Height (mPD)	Respective Assessment Height metres above ground)
CL4	Cha Kwo Ling Village	Residential	120	3/F	7, 10.5, 15.5, 20.5, 25.5	1.5, 5, 10, 15, 20
CL5	Planned ASR	GIC	260	-	7, 10.5, 15.5, 20.5, 25.5	1.5, 5, 10, 15, 20
CL6	Sai Tso Wan Recreation Ground	Recreational	135	-	15.5	1.5
CL7	Sin Fat Road Tennis Court	Recreational	24	-	15.5	1.5
CL8	Lam Tin Ambulance Depot	GIC	90	4/F	7, 10.5, 15.5, 20.5, 25.5	1.5, 5, 10, 15, 20
CL9	Yau Lai Estate Bik Lai House	Residential	63	42/F	7, 10.5, 15.5, 20.5, 25.5	1.5, 5, 10, 15, 20
CL10	Yau Lai Estate Cheuk Lai House	Residential	90	40/F	7, 10.5, 15.5, 20.5, 25.5	1.5, 5, 10, 15, 20
CL11	Yau Tong Road Playground	Recreational	96	-	7	1.5
CL12	C.C.C. Kei Fat Primary School (Yau Tong)	Institutional	183	8/F	7, 10.5, 15.5, 20.5, 25.5	1.5, 5, 10, 15, 20
CL13	Eastern Harbour Crossing Admini-stration Building (1)	GIC	12	5/F	15.5, 20.5, 25.5	10, 15, 20
CL14	Wing Shan Industrial Building	Industrial	120	13/F	7, 10.5, 15.5, 20.5, 25.5	1.5, 5, 10, 15, 20
CL15	Cha Kwo Ling Village	Residential	30	3/F	7, 10.5, 15.5, 20.5,	1.5, 5, 10, 15, 20

ASR	Description	Land Use	Distance from the nearest Open Works Area (m)	No. of storey	Assessment Height (mPD)	Respective Assessment Height metres above ground)
					25.5	
CL16	Sitting-out Area at Cha Kwo Ling Village	Recreational	16	-	7, 10.5, 15.5, 20.5, 25.5	1.5, 5, 10, 15, 20
TKO side						
CT1	Village House at Chiu Keng Wan	Residential	270	1/F	5.5, 9, 14, 19, 24	1.5, 5, 10, 15, 20
CT2	Ocean Shore Tower 1 (2)	Residential	18	48/F	14, 19, 24	10, 15, 20
CT3	Ocean Shore Tower 6 (2)	Residential	90	48/F	14, 19, 24	10, 15, 20
CT4	HK Design Institute Campus Block C	Institutional	235	11/F	5.5, 9, 14, 19, 24	1.5, 5, 10, 15, 20
CT5	Park Central Tower 6	Residential	175	48/F	5.5, 9, 14, 19, 24	1.5, 5, 10, 15, 20

Note:

(1) It is identified that the administration building of Eastern Harbour Crossing has been provisioned with central air conditioning located at the rooftop of the building without openable windows. Hence, the first assessment height is at 10 metres above ground.

(2) The residential tower of Ocean Shore is situated on top of the 3-storey podium without air sensitive uses facing to the construction works area of Road P2. Hence, the first assessment height is at 10 metres above ground.

Table 3.5 Representative Air Sensitive Receivers During Operation Phase

ASR	Description	Land Use	No. of storey	Assessment Height (metres above ground)
Lam Tin Side				
LT-A1	Yau Lai Estate Bik Lai House	Residential	42/F	1.5, 5,10,15
LT-A2	Yau Lai Estate Nga Lai House	Residential	42/F	1.5, 5,10,15
LT-A3	Yau Lai Estate Fung Lai House	Residential	42/F	1.5, 5,10,15
LT-A4	St. Antonius Primary School	Educational	8/F	1.5, 5,10,15

ASR	Description	Land Use	No. of storey	Assessment Height (metres above ground)
LT-A6	Sai Tso Wan Recreation Ground	Recreational	-	1.5, 5,10,15
LT-A7	Sceneway Garden Block 9	Residential	28/F	1.5, 5,10,15
LT-A8	Ping Tin Estate Ping Wong House	Residential	38/F	1.5, 5,10,15
LT-A9	Laguna City Block 23	Residential	25/F	1.5, 5,10,15
LT-A10	Yau Lai Estate Yung Lai House	Residential	40/F	1.5, 5,10,15
LT-A11	Yau Lai Estate Cheuk Lai House	Residential	40/F	1.5, 5,10,15
LT-PA1[(1)]	Planned ASR at Yau Tong Bay Redevelopment	Residential	-	1.5, 5,10,15
LT-PA2[(1)]	Planned ASR at Yau Tong Bay Redevelopment	Residential	-	1.5, 5,10,15
LT-PA3[(1)]	Planned ASR at Yau Tong Bay Redevelopment	Residential	-	1.5, 5,10,15
LT-PA4[(1)]	Planned ASR at Yau Tong Bay Redevelopment	Residential	-	1.5, 5,10,15
LT-PA7[(2)]	Planned Refuse Transfer Station at Cha Kwo Ling	GIC	-	1.5, 5,10,15
LT-PA10[(1)]	Planned ASR at Kaolin Site	Residential	-	1.5, 5,10,15
LT-PA11[(1)]	Planned ASR at Kaolin Site	Residential	-	1.5, 5,10,15
TKO Side				
TKO-A1	Village House	Residential	1/F	1.5, 5,10,15
TKO-A2	Ocean Shore Tower 1	Residential	48/F	1.5, 5,10,15
TKO-A3	Ocean Shore Tower 8	Residential	48/F	1.5, 5,10,15
TKO-A4	Ocean Shore Tower 17	Residential	48/F	1.5, 5,10,15
TKO-A5	Shing Ming Estate	Residential	38/F	1.5, 5,10,15
TKO-A6	Caritas Bianchi College of Careers	Educational Institute	10/F	1.5, 5,10,15
TKO-A7	Metro Town I Tower 1	Residential	55/F	1.5, 5,10,15
TKO-A8	Metro Town I Tower 5	Residential	50/F	1.5, 5,10,15
TKO-A9	Metro Town II – Le Point Tower 7	Residential	53/F	1.5, 5,10,15
TKO-A10	HK Design Institute Campus Block D	Educational Institute	10/F	1.5, 5,10,15
TKO-A11	HK Design Institute Campus Block C	Educational Institute	10/F	1.5, 5,10,15
TKO-A12	HK Design Institute Campus Block A	Educational Institute	8/F	1.5, 5,10,15
TKO-A13	Choi Ming Court Choi Kwai House	Residential	40/F	1.5, 5,10,15
TKO-A14	Park Central Tower 6	Residential	48/F	1.5, 5,10,15
TKO-A15	Park Central Tower 7	Residential	46/F	1.5, 5,10,15
TKO-A16	Choi Ming Court Choi To House	Residential	40/F	1.5, 5,10,15
TKO-A17	Tong Ming Court Tong Fai House	Residential	40/F	1.5, 5,10,15
TKO-PA1[(2)]	Planned ASR at Area 66	Residential	-	1.5, 5,10,15
TKO-PA2[(2)]	Planned ASR at Area 67	GIC	-	1.5, 5,10,15
TKO-PA3[(2)]	Planned ASR at Area 67	GIC	-	1.5, 5,10,15
TKO-PA4[(2)]	Planned ASR at Area 67	GIC	-	1.5, 5,10,15

ASR	Description	Land Use	No. of storey	Assessment Height (metres above ground)
TKO-PA5(2)	Planned ASR at Area 67	GIC	-	1.5, 5,10,15
TKO-PA6(2)	Planned ASR at Area 68	Residential	-	1.5, 5,10,15
TKO-PA7(2)	Planned ASR at Area 68	Residential	-	1.5, 5,10,15
TKO-PA8(2)	Planned ASR at Area 68	Residential	-	1.5, 5,10,15
TKO-PA9(2)	Planned ASR at Area 68	Residential	-	1.5, 5,10,15
TKO-PA10(2)	Planned ASR at Area 68	Residential	-	1.5, 5,10,15

Note:

(1) The locations of the planned ASRs located at planned residential site at ex-Cha Kwo Ling Kaolin Mine Site and CDA at Yau Tong Bay (YTB) are based on the building layout plans provided by the Planning Department (PlanD) and the YTB project proponent.

(2) The exact layouts for planned development are not available at the time of assessment. In these cases, the locations of the representative planned ASRs would be in accordance with any site condition/restriction as stipulated in the OZP/Layout Plan. If not, these planned ASRs are assumed to be located at the respective zone boundary, which would be the nearest to the roads, as indicative assessment points for assessment.

3.5 Identification of Pollutant Sources

Construction Phase

3.5.1 The construction activities for the Project would be commenced in February 2016 and completed in November 2020. The major construction activities with construction dust concern are summarized as below:

– Tunnel and Lam Tin Interchange
- Surface blasting
- Slope works/site formation
- Construction of highway structures

– TKO interchange & Depressed Road P2
- Reclamation
- Construction of highway structures

– Roads P2/D4 Junction Works and P2/D4 Cycle Track Cum Footbridge
- At-grade Road works

3.5.2 For this Project, there is one on-site rock crusher to be located within the works area at the south-western side of the Lam Tin Interchange. There are also two on-site barging points to be provided for this Project, one would be located at Cha Kwo Ling Pier and the other one would be proposed at Chiu Keng Wan.

3.5.3 The rock crusher is an enclosed plant which would handle the excavated rock materials from the TKO-LT Tunnel main tunnel, as well as those excavated materials from the Lam Tin Interchange. Rocks would be transported from the excavation areas to the rock crusher by trucks. The trucks would unload the rocks to the feed hopper of the crusher inside the enclosed structure. Dust collector would be provided at the exhaust of the enclosure to suppress the dust emission to the atmosphere. The crushed rocks would be transferred through the enclosed conveyor belt system to the barging point at Cha Kwo Ling Pier.

3.5.4 Both the rock crusher and the barging points would operate for 11 hours a day (7:00 to 12:00 and 13:00 to 19:00), while works areas would operate for 12 hours a day (7:00 – 19:00) except the hoisting of Typhoon No.3 or above, Sundays and public holidays. There would therefore be 21 – 27 working days per month, depending on the number of Sundays and public holidays in the month.

3.5.5 Apart from the enclosed conveyor belt system for transportation of the rocks to the barging point at Cha Kwo Ling, the spoil materials would also be transported to the tipping halls of the barging points at both Cha Kwo Ling and Chiu Keng Wan by trucks and then unloaded to the barges. The haul roads within the barging site would be all paved and provided with water spraying. Vehicles would be required to pass through designated wheel washing facilities before leaving the barging facility. Moreover, the dusty materials on the trucks would be well covered and flexible dust curtain together with water spraying system would be provided at the loading points (from barging point to the barges).

3.5.6 Referring to the construction programme received at the time of the assessment, the construction period for Trunk Road T2 tunnel portal, associated slope works and road works may be overlapped with this Project. The dusty activities of these construction works of Trunk Road T2 in the vicinity of Lam Tin side of TKO-LT Tunnel are therefore considered in the cumulative dust impact assessment. For TKO side, the construction works for some piers of CBL would be undertaken within 500m of Study Area of this Project. However, it is expected that the dust nuisance from the pier construction would be limited and no cumulative dust impacts are expected.

Operation Phase

3.5.7 As mentioned in **Section 2.9** and **Table 2.11**, potential cumulative air quality impact on the surrounding ASRs during the operation phase of the Project considered in the assessment includes:

- Background pollution levels predicted by PATH Model provided by EPD;
- Vehicle emissions from open road sections of the existing and planned new roads (including T2 and CBL) within 500m Study Area with the incorporation of the proposed vertical barriers, semi-enclosures and full enclosures;
- Portal emissions from the proposed TKO-LT Tunnel, T2 and EHC;
- Portal emissions from the proposed landscape decks/full enclosures on Lam Tin Interchange and landscape deck on Road P2; and
- Emissions from TKO-LT Tunnel, T2 and EHC ventilation buildings.

3.5.8 Within the 500m Study Area, there is no industrial chimney identified, therefore, no industrial emission is considered in the cumulative air quality impact assessment.

3.5.9 Marine emissions from local vessels, large marine vessels and ocean going vessels within the study area have been assessed using the EPD PATH model of 2012. There is no pier/mooring/typhoon shelter identified within the 500m Study Area except the Public Cargo Working Area (PCWA) at Cha Kwo Ling. However, it has been closed in October 2011 to make way for the development of Southeast Kowloon, according to the information presented by Marine Department and government's press release[1] [2]. On the Lam Tin side, the Kwun Tong Ferry Pier, the future Cruise Terminal at Kai Tak and the Sam Ka Tsuen and Kwun Tong Typhoon Shelters are at least 200m to 500m away from the site boundary of the Study Area. For marine facilities on the Tseung Kwan O side, the nearest Junk Bay Anchorage is at least 400m away from the Study Area. Regarding navigation routes for ocean-going vessels in the vicinity, the closest navigation channel to the Project is the Tathong Channel. Based on the "Charts for Local Vessels – Hong Kong Waters" issued by Marine Department in 2011, it is some 400m away from the closest site boundary of the Study Area. Moreover, there are no planned marine facilities in the Study Area. Given the above and the fact that the PATH model updated in July 2012 has included and adequately represented relevant marine emissions in the general environment as part of the future background, additional marine emission assessment for specific sources on top of those already covered in the PATH model is considered not necessary in the cumulative air quality impact assessment.

3.6 Assessment Methodology

Construction Phase

Identification of Key/Representative Air Pollutants of Emissions from Construction Activities

3.6.1 As above-mentioned, blasting activities, slope works/site formation, sandfilling activities for reclamation, road works, operation of the rock crusher and the barging points are major construction activities which would induce particulates emission impact. SO_2, NO_2 and smoke emitted from diesel-powered equipment may also the air pollutants from construction activities. However, the number of such plant required on-site (land based and water based) will be limited and under normal operation. Equipment with proper maintenance is unlikely to cause significant dark smoke emissions and gaseous emissions are expected to be minor. Thus, the principal source of air pollution during the construction phase will be dust from the construction activities. According to Annex 4: Criteria for Evaluating Air Quality Impact and Hazard to Life of EIAO-TM, Total Suspended Particulates (TSP) is the air pollutant parameter for construction dust impact assessment. Therefore, quantitative assessment of TSP emission impact is conducted for assessing construction phase air quality impact. The potential dust emission sources considered in the assessment are shown in **Appendix 3.1**.

Emission Inventory

3.6.2 Predicted dust emissions are based on emission factors from USEPA Compilation of Air Pollution Emission Factors (AP-42), 5th Edition. The major dusty construction activities for the Project to be considered in the modelling assessment include:

Lam Tin Side

(a) Blasting, Slope Work/Site Formation at Lam Tin Area
- Excavation and material handlings within the construction site modelled as heavy construction activities
- Wind erosion of open active site
- Rock crusher with loading, screening and crushing

(b) Barging Points at Cha Kwo Ling
- Unloading point to the barge

[1] http://www.mardep.gov.hk/en/publication/pdf/coer.pdf
[2] http://www.info.gov.hk/gia/general/201112/09/P201112080164.htm

(c) Construction for T2 Tunnel Portal, associated Slope works and Road Works at Lam Tin Area
- excavation and material handlings within the construction site modelled as heavy construction activities
- Wind erosion of open active site

TKO Side

(a) Reclamation at Junk Bay
- Sandfilling activities within the reclamation site modeled as heavy construction activities.
- Wind erosion of open active site

(b) Road Works for TKO Interchange, Depressed Road P2, Roads P2/D4 Junction
- excavation and material handlings within the construction site modelled as heavy construction activities
- Wind erosion of open active site

(c) Barging Points at Chiu Keng Wan
- Unloading point to the barge

3.6.3 According to the engineering design information, dust control measures have been incorporated into the design of the rock crusher and barging facilities, as presented in **Table 3.6**. These dust control measures have also been taken into account in the assessment.

Table 3.6 Rock Crusher and Barging Facilities – Dust Emission Design Control Measures

Process	Description	Dust Emission Design Control Measures
Rock Crusher		
Unloading from trucks, Screening and Crushing	Unloading from trucks, Screening and Crushing	The rock crushing plant is in the enclosed structure with dust curtains would be provided at the opening of the plant. Dust collector would be installed at the exhaust of the rock crusher to suppress the dust emission to the atmosphere.
Trucks	Vehicles leaving the rock crusher	Vehicles would be required to pass through the wheel washing facilities provided at site exit.
Barging Facilities		
Unloading of materials	Unloading of spoil materials from trucks and conveyor belt (for barging point at Cha Kwo Ling only)	The unloading process would be undertaken within a 3-sided screen with top tipping hall. Water spraying and flexible dust curtains would be provided at the discharge point for dust suppression.
Trucks	Vehicles leaving the barging facility	Vehicles would be required to pass through the wheel washing facilities provided at site exit.

3.6.4 Due to the tight construction programme, it will be necessary for active construction activities to be undertaken at multiple work faces spread across each site. Therefore, it is not feasible to identify the exact location of individual dust emission source at a time. As such, for the purpose of predicting annual TSP concentrations and in conservative approach, it is assumed that dust emissions would be distributed across the whole area of each site with all activities operating at the same time for a complete year. The dust emission rates are estimated based on the annual average percentage active works area of each works site. Based on the preliminary engineering design, the annual average active area is estimated to be 30% as presented in **Appendix 3.1** and would be assumed for predicting the annual average concentrations. The rock crusher and the two barging points are considered to be working at full capacity throughout the construction period, taken as a worst-case assumption. Thus, 100% emission from the operation of the rock crusher and barging points is assumed in the model.

3.6.5 Works activities and plant would not be concentrated in certain areas of the site close to ASRs for an extended period of time during the construction period. However, notwithstanding that such a scenario would not be expected to occur, a hypothetical Tier 1 screening test assuming 100% active area of construction site of the Project with mitigation measures in place has been undertaken for predicting hourly and daily average TSP levels. It aims to highlight the hot spot locations where construction dust may potentially become an issue. However, it should be emphasized that Tier 1 screening test is a hypothetical one which is very conservative and does not occurred in reality.

3.6.6 The Tier 1 results have allowed a more focused Tier 2 assessment to be undertaken at the specific hot spot locations where TSP non-compliance is predicted under the Tier 1 screening test, a focused Tier 2 assessment is undertaken whereby the percentage of daily maximum active works areas, which is assumed to be 30%, for the Project are positioned closest to the potentially worst affected ASRs. The Tier 2 assessment areas are shown in **Appendix 3.1**. Same as for predicting annual average TSP levels, 100% emission from the operation of rock crusher and barging points is assumed in the model.

3.6.7 The excavation rate, material handling rate, percentage active area, moisture content, silt content, number of trucks and truck speed are based on the preliminary engineering design. The emission rate of identified pollutant sources are summarised in **Table 3.7**. The justification for the percentage active area within the construction work sites and the detailed calculations of the emission factors are given in **Appendix 3.1**.

Table 3.7 Emission Factors for Dusty Construction Activities

Emission Source	Activity	Emission Rate	Remarks
Lam Tin Side			
1. Excavation, Surface Blasting and Cut & Cover under TKO-LT Tunnel Project 2. Excavation, Cut & Cover under T2 Project	Heavy Construction Activities	E=2.69 Mg/hectare /month of activity	100% area actively operating (for hourly and daily concentration prediction) 30% area actively operating (for annual concentration prediction) AP42, Section 13.2.3
	Wind Erosion	E=0.85Mg/hectare /year	100% area actively operating (for hourly and daily concentration prediction) 30% area actively operating (for annual concentration prediction) AP42, Section 11.9, Table 11.9.4

Emission Source	Activity	Emission Rate	Remarks
Rock Crusher at Lam Tin Works Area	Loading Point	E = 0.000008kg/Mg RSP to TSP factor = 2.1	100% area actively operating RSP Emission Factor EPA AP-42, 5th ed. 8/04 ed., Sec11.19.2, Table 11.19.2-1 RSP to TSP factor EPA AP-42 5th ed. 1/95 ed., Sec 11.19.2, Table 11.19.2-1
	Screening	E = 0.0015 kg/Mg	EPA AP-42, 5th ed. 8/04 ed., Sec11.19.2, Table 11.19.2-1
	Crushing	E = 0.0027 kg/Mg	EPA AP-42, 5th ed. 8/04 ed., Sec11.19.2, Table 11.19.2-1
Barging Point at Cha Kwo Ling	Unloading of spoils to barge	E = k x (0.0016) x $[(U/2.2)^{1.3} / (M/2)^{1.4}]$	AP-42, S13.2.4, particle size < 30 um, 11/06 ed AP-42, Table 13.2.4-1, 11/06 ed Handling capacity: 11550Mg/day Number of berth: 1
TKO Side			
Reclamation, Excavation under TKO-LT Tunnel Project	Heavy Construction Activities	E=2.69 Mg/hectare /month of activity	100% area actively operating (for hourly and daily concentration prediction) 30% area actively operating (for annual concentration prediction) AP42, Section 13.2.3
	Wind Erosion	E=0.85Mg/hectare /year	100% area actively operating (for hourly and daily concentration prediction) 30% area actively operating (for annual concentration prediction) AP42, Section 11.9, Table 11.9.4
Barging Point at Chiu Keng Wan	Unloading of spoils to barge	E = k x (0.0016) x $[(U/2.2)^{1.3} / (M/2)^{1.4}]$	AP-42, S13.2.4, particle size < 30 um, 11/06 ed AP-42, Table 13.2.4-1, 11/06 ed Handling capacity: 11550Mg/day Number of berth: 1

3.6.8 For the prediction of maximum daily average TSP concentration and annual average TSP concentration, 12-hour (07:00-19:00) per day is assumed for the construction period in the assessment except the operation period of the rock crusher and the two barging points is 11 hours (07:00-12:00 and 13:00-19:00).

Dispersion Modelling & Concentration Calculation

3.6.9 Fugitive Dust Model (FDM) (1993 version) is adopted to assess potential dust impact from the construction works.

3.6.10 Hourly meteorological data including wind speed, wind direction, air temperature and Pasquill stability class in Year 2009 from the nearest Hong Kong Observatory weather station, Kai Tak Station is employed for the model run in the work sites at Lam Tin side. For TKO side, it is noted that the valid data from Year 2007 to 2011 for Junk Bay Station are less than 90%. Hence, Year 2009 Hong Kong Observatory Kai Tak Station which is another nearest meteorological station is employed for the model run in the work sites at TKO side. Since no construction activities would occur on Sundays and public holidays, only wind erosion would be assumed for these days as well as for other non-working hours (19:00 to 07:00 of the following day) on normal working days.

3.6.11 As mentioned in **Section 3.3.4**, the background TSP level of 73 $\mu g/m^3$ is adopted as the future TSP background concentration in the assessment.

Operation Phase

Determination of the Assessment Year

3.6.12 According to Clause 3.4.1.4 (iv) (b) of the EIA Study Brief, the air pollution impacts of future road traffic should be calculated based on the highest emission strength from vehicles within the next 15 years upon commencement of operation of the proposed project. The selected assessment year should therefore represent the highest emission scenario for the roads within the 500m study boundary.

3.6.13 Vehicular tailpipe emissions from open roads are calculated based on the EPD EMFAC-HK model v2.1 at the time of assessment (end 2012). However, the latest model version EMFAC-HK v2.5 is just released by EPD in early January 2013. As concluded in the "Outline of Changes in January 2013 Release of EMFAC-HK" in EPD website[3], the overall effects on emission estimates are insignificant. There are only some changes in the output file formats due to items removal as comparing with v2.1. Besides, one output file name is also changed and the format for input files is changed from VKT to VMT to ensure the consistency in units used in input files (US units). The above format changes would not impose any change in the emission rate. Therefore, the vehicular tailpipe emission rates generated from v2.1 are still adopted in this assessment. As NO_2 is the pollutant of primary concern for a road project, the assessment year is determined based on the highest total NOx emission from the roads in the study area using the EMFAC-HK model. **Appendix 3.2** presents the methodology and assumptions adopted in estimating the emission factors, and the calculated results. **Table 3.8** below summarise the total emission of NOx and RSP (in ton/year) for different road types among Year 2021, 2029 and 2036.

Table 3.8 Total Emission of NOx and RSP (in ton/year) for different Road Types among Year 2021, 2029 and 2036

Year	Total NOx Emission (ton/year)	Total RSP Emission (ton/year)

[3] http://www.epd.gov.hk/epd/english/environmentinhk/air/guide_ref/files/Note_on_Emfac-HK_Changes_Jan2013.pdf

	Local Road (50kph)	Trunk Road (70kph)	Express-way (80kph)	Local Road (50kph)	Trunk Road (70kph)	Express-way (80kph)
2021	77.1613	27.5650	56.6059	3.7967	1.6028	2.9677
2029	37.5575	12.2910	25.9166	2.3908	1.1432	1.9864
2036	27.8650	8.9417	19.0490	1.9282	0.9563	1.6170

3.6.14 Based on **Table 3.8** as shown above, it is concluded that the highest vehicular emissions are found in Year 2021. Therefore, Year 2021 is selected as the assessment year for the operational phase air quality impact assessment. The hourly emissions of NOx and RSP in Year 2021 are divided by the number of vehicles and the distance travelled to obtain the emission factors in gram per miles per vehicle. The calculated 24-hour emission factors of 16 vehicle classes for the different road types in Year 2021 adopted in this air quality impact assessment are presented in **Appendix 3.3**. The 24-hour projected traffic flows and vehicle compositions for Year 2021 which have been agreed by TD (The agreement from TD for the methodology and traffic data adopted in this EIA is attached in **Appendix 3.2**) are presented in **Appendix 3.4**.

Background Pollutant Concentrations – PATH Model

3.6.15 PATH model is used to quantify the background air quality during operation phase of the Project. 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 model. The hourly concentration data of background concentration predicted by PATH model provided by EPD are Year 2020 and 2030. As presented in **Sections 3.6.14**, Year 2021 is selected as the assessment year for the operation phase air quality impact assessment. In addition, the trend for the background air quality concentration is decreasing from Year 2020 to Year 2030 due to the technology advancement on the vehicle emissions. Therefore, as a conservative assumption, Year 2020 background concentration are adopted in the calculation of the cumulative results. Graphical plots of the PATH background results are presented in **Appendix 3.5**.

Identification of Key/Representative Air Pollutants of Vehicle Emissions from Open Road

3.6.16 Vehicular emission comprises a number of pollutants, including Nitrogen Oxides (NOx), Respirable Suspended Particulates (RSP), Sulphur Dioxides (SO_2), Carbon Monoxide (CO), Lead (Pb), Toxic Air Pollutants (TAPs) etc. Accordingly to "An Overview on Air Quality and Air Pollution Control in Hong Kong"[4] published by EPD, motor vehicles are the main causes of high concentrations of respirable suspended particulates (RSP) and nitrogen oxides (NOx) at street level in Hong Kong and are considered as key air quality pollutants for road projects. For other pollutants, due to the low concentration in vehicular emission, they are not considered as key pollutants for the purpose of this study.

(i) Nitrogen Dioxide (NO_2)

3.6.17 Nitrogen oxides (NOx) is a major pollutant from fossil fuel combustion. According to the Emission Inventory for 2010 published on EPD's website[5], navigation is the dominant contributor to NOx generation in Hong Kong, accounted for 32% of NOx emission in 2010. Road transport is the second largest NOx contributor which accounted for 30% of the total in

[4] http://www.epd.gov.hk/epd/english/environmentinhk/air/air_maincontent.html
[5] http://www.epd.gov.hk/epd/english/environmentinhk/air/data/emission_inve.html

the same year.

3.6.18 In the presence of O_3 and VOC, NOx would be converted to NO_2. Increasing traffic flow would inevitably increase the NOx emission and subsequently the roadside NO_2 concentration. Hence, NO_2 is one of the key pollutants for the operational air quality assessment of the Project. 1-hour, 24-hour and annual averaged NO_2 concentrations at each identified ASRs would be assessed and compared with the relevant AQO to determine the compliance.

(ii) Respirable Suspended Particulates (RSP)

3.6.19 Respirable Suspended Particulates (RSP) refers to suspended particulates with a nominal aerodynamic diameter of 10um or less. According to the Emission Inventory for 2010 published on EPD's website, navigation is the dominant contributor to RSP generation in Hong Kong, accounted for 36% of RSP emission in 2010. Road transport is the second largest RSP contributor which accounted for 21% of the total in the same year. Increasing traffic flow would inevitably increase the roadside RSP concentration. Hence, RSP is also one of the key pollutants for the operational air quality assessment of the Project. The 24-hour and annual averaged RSP concentrations at each identified ASRs would be assessed and compared with the relevant AQO to determine the compliance.

(iii) Sulphur Dioxide (SO_2)

3.6.20 Sulphur dioxide (SO_2) is formed primarily from the combustion of sulphur-containing fossil fuels. In Hong Kong, power stations and marine vessels are the major sources of SO_2, followed by fuel combustion equipment and motor vehicles.[6] SO_2 emission from vehicular exhaust is due to the sulphur content in diesel oil. According to EPD's "Cleaning the Air at Street Level"[7], ultra low sulphur diesel (ULSD) with a sulphur content of only 0.005% has been adopted as the statutory minimum requirement for motor vehicle diesel since April 2002, which is 3 years ahead of the European Union. With the use of ULSD, according to the Emission Inventory for 2010 published on EPD's website, road transport is the smallest share of SO_2 emission sources in 2010 and only constitutes less than 1% of the total SO_2 emission. From 1 July 2010, EPD has tightened the statutory motor vehicle diesel and unleaded petrol specifications to Euro V level, which further tightens the cap on sulphur content from 0.005% to 0.001%.

3.6.21 In addition, the measured 1-hr average, daily average and annual average SO_2 concentration at all EPD air monitoring stations are all less than 40% of the respective AQO. In view that road transport only contributes a very small amount of SO_2 emission, relatively low measured concentrations and the adoption of low-sulphur and ultra-low-sulphur fuel under the existing government policy, SO_2 would not be a critical air pollutant of concern.

(iv) Carbon Monoxide (CO)

3.6.22 Carbon Monoxide (CO) is a typical pollutant emitted from fossil fuel combustion and comes mainly from vehicular emissions. With reference to the "*Air Quality in Hong Kong 2011"*, measured the highest 1-hour average (4030µg/m^3) and the highest 8-hour average (3309 µg/m^3) were both recorded at the Causeway Bay roadside station; these values were around one seventh and one third of the respective AQO limits. In view that there is still a large margin to the AQO, CO would not be a critical air pollutant of concern.

(v) Ozone (O_3)

[6] Air Quality in Hong Kong 2011
[7] http://www.epd.gov.hk/epd/english/environmentinhk/air/prob_solutions/cleaning_air_atroad.html

3.6.23 Ozone (O_3) is produced from photochemical reaction between NOx and VOCs in the presence of sunlight, which will not be generated by this project. Concentration of O_3 is governed by both precursors and atmospheric transport from other areas. When precursors transport along under favorable meteorological conditions and sunlight, ozone will be produced. This explains why higher ozone levels are generally not produced in the urban core or industrial area but rather at some distance downwind after photochemical reactions have taken place. In the presence of large amounts of NOx in the roadside environment, O_3 reacts with NO to give NO_2 and thus results in O_3 removal. O_3 is therefore not considered as a key air pollutant for the operational air quality assessment of a road project.

(vi) Lead (Pb)

3.6.24 The sale of leaded petrol has been banned in Hong Kong since April 1999. According to the "*Air Quality in Hong Kong 2011*", the measured ambient lead concentrations were ranging from 20ng/m^3 to 104ng/m^3. The measured concentrations were well below the AQO limits. Therefore, lead is not considered as a critical air pollutant of concern.

(vii) Toxic Air Pollutants (TAPs)

3.6.25 Vehicular exhaust is one of the emission sources of Toxic Air Pollutants (TAPs), which are known or suspected to cause cancer or other serious health and environmental effects. With reference to EPD's *Assessment of Toxic Air Pollutant Measurements in Hong Kong Final Report* [8], monitored TAPs in Hong Kong include diesel particulate matters (DPM), toxic elemental species, dioxins, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), carbonyls, and volatile organic compounds (VOCs). According to the results of *Assessment of Toxic Air Pollutant Measurements in Hong Kong Final Report* and *Sources of PCB emissions*[9], vehicular emission is not considered as primary source of dioxins, PCBs, carbonyls and most toxic elemental species in Hong Kong. Therefore, these pollutants are not considered as key pollutants for quantitative assessment for the operation phase of a road project.

Diesel Particulate Matters (DPM)

3.6.26 Diesel Particulate Matters (DPM), as part of the overall Respirable Suspended Particulates (RSP), is one of the most important parameter contributing to the overall health risk of the population. Local vehicular emission is one of the major sources of DPM.

3.6.27 EPD has embarked on the following three key programmes to reduce the diesel particulate level at the roadside[10]: (a) the LPG taxi and light bus program; (b) the introduction of an advanced test to check diesel vehicle smoke emission; and (c) the retrofit of pre-Euro diesel commercial vehicles with diesel oxidation Catalysts (DOCs). According to EPD's website[11], franchised bus companies have also retrofitted their Euro I buses with diesel oxidation catalysts (DOCs) and Euro II and III buses with diesel particulate filters (DPFs). A DPF can reduce particulate emissions from diesel vehicles by over 80%.

3.6.28 As recommended by EPD's *Assessment of Toxic Air Pollutant Measurements in Hong Kong Final Report*, elemental carbon (EC) is used as a surrogate for DPM, and with reference to *Measurements and Validation for the 2008/2009 Particulate Matter Study in Hong Kong*[12], EC showed a significant decrease in concentration from 2001 to 2009 in Hong Kong, i.e.

8 http://www.epd.gov.hk/epd/english/environmentinhk/air/studyrpts/assessment_of_tap_measurements.html
9 http://www.eea.europa.eu/publications/EMEPCORINAIR5/Sources_of_PCB_emissions.pdf/view
10 http://www.epd.gov.hk/epd/english/news_events/legco/files/EA_Panel_110526a_eng.pdf
11 http://www.epd.gov.hk/epd/english/environmentinhk/air/prob_solutions/cleaning_air_atroad.html
12 http://www.epd.gov.hk/epd/english/environmentinhk/air/studyrpts/files/HKEPDFinalReportRev_11-29-10_v2.pdf

-47.5%, -30.0% and -28.3% at Mong Kok, Tsuen Wan and Hok Tsui Monitoring Sites, respectively. With the continual efforts by EPD to reduce particulate emission from the vehicular fleet, a discernible decreasing trend is noted in the level of particulate matter. Therefore, DPM is not selected as representative pollutant for quantitative assessment for this Project.

Polycyclic Aromatic Hydrocarbons (PAHs)

3.6.29 Polycyclic Aromatic Hydrocarbons (PAHs) are organic compounds of two or more fused benzene rings, in liner, angular or cluster conformations. Local vehicular traffic is also an important source of PAHs. For this group, the most important TAP is Benzo[a]pyrene, and it is often selected as a marker for the PAHs[13]. The EU Air Quality Standards for PAHs (expressed as concentration of Benzo[a]pyrene) is 1 ng/m^3 for annual average[14]. With reference to "*Air Quality in Hong Kong 2011*", annual average concentrations of PAHs (Benzo[a]pyrene) measured at EPD's TAP monitoring stations (Tsuen Wan and Central/Western) were 0.22ng/m^3, which is far below the EU Standards. Thus, PAHs are not considered as key pollutants for quantitative assessment for this Project.

Volatile Organic Compounds (VOCs)

3.6.30 Volatile Organic Compounds (VOCs) are of great concern due to the important role played by them in a range of health and environmental problems. The US EPA has designated many VOC, including those typically found in vehicular emission, as air toxic. According to Assessment of Toxic Air Pollutant Measurements in Hong Kong Final Report, among the VOC compounds, benzene and 1,3-butadiene are the most significant ones for Hong Kong The UK Air Quality Standards for benzene and 1,3-butadiene are 5.0µg/m^3 and 2.25 µg/m^3 respectively[15]. Accordingly to "Air Quality in Hong Kong 2011", annual average concentrations of benzene and 1,3-butadiene at EPD's TAP monitoring stations (Tsuen Wan and Central/Western) were 1.53 - 1.62 µg/m^3 and 0.13 µg/m^3, respectively, which is far below the UK Standards. Thus, VOCs are not considered as key pollutants for quantitative assessment for this Project.

<u>Identification of Key/Representative Air Pollutants of Vehicle Emissions in Tunnel, Full Enclosures and under proposed Landscape Decks</u>

Nitrogen Dioxide (NO2)

3.6.31 As stated in **Section 3.6.17 to 18**, nitrogen oxides (NOx) is a major pollutant from fossil fuel combustion. Traffic flow would inevitably increase the NOx and NO_2 concentration in tunnel, full enclosures and under proposed landscape decks. Hence, NO_2 is one of the key pollutants for the in-tunnel air quality assessment and compared with the relevant TAQG to determine the compliance.

Sulphur Dioxide (SO2)

3.6.32 From 1 July 2010, EPD has tightened the statutory motor vehicle diesel and unleaded petrol specifications to Euro V level, which further tightens the cap on sulphur content from 0.005% to 0.001%. Referring to "*Practice Note on Control of Air Pollution in Vehicle Tunnels*" issued by EPD, continuous monitoring of SO_2 is normally not required considering the traffic mix in Hong Kong. Therefore, SO_2 vehicle emission impact in tunnel is expected to be insignificant. Thus, SO_2 is not considered as key pollutant for quantitative in-tunnel air quality assessment in this Project.

13 Assessment of Toxic Air Pollutant Measurements in Hong Kong Final Report
14 http://ec.europa.eu/environment/air/quality/standards.htm
15 http://www.medway.gov.uk/environmentandplanning/environmentalhealth/airquality/airqualityfordevelopers.aspx

Carbon Monoxide (CO)

3.6.33 Carbon Monoxide (CO) is a typical pollutant emitted from fossil fuel combustion and comes mainly from vehicular emissions. In view of the ratio of guideline standard of CO (5-minute) concentration to NO_2 (5-minute) concentration is 64, however, the emission rate of CO is only 2.8 times of emission rate of NOx according to the EMFAC v.2.1 emission factors. Therefore, CO would comply with the AQO if NO_2 concentration complies with the standard. Thus, CO is not considered as key pollutant for quantitative in-tunnel air quality assessment in this Project. In addition, continuous measurement of CO would be conducted inside the tunnel according to the monitoring requirements of "*Practice Note on Control of Air Pollution in Vehicle Tunnels*" issued by EPD to ensure the compliance of the TAQG.

Model Assumptions for Open Road Vehicle Emission

3.6.34 The USEPA approved line source air dispersion model, CALINE4 developed by the California Department of Transport is used to assess vehicular emissions impact from existing and planned road network. Since all the vehicular emissions associated with this Project are from ground level only, the first ASR level as tabulated in **Table 3.5** would therefore represent the worst-case scenario.

3.6.35 The dispersion modelling is conducted based on the meteorological data extracted from the PATH model. The grid cells used for extraction of meteorological data and background pollutant concentration are summarized in **Table 3.9**. Surface roughness coefficients as shown in **Table 3.9** are taken in the CALINE4 model.

Table 3.9 PATH Model Grid Cells for Extraction of Meteorological Data and Background Pollutant Concentrations

Study Area	Grid Cells	Surface Roughness (cm)
Lam Tin Area	32_27	370
	33_27	370
TKO Area	34_26	100
	34_27	100
	35_27	100

3.6.36 Ozone Limiting Method (OLM) is adopted for conversion of NOx to NO_2 based on the predicted O_3 level from PATH. A tailpipe emission NO_2/NOx ratio of 7.5% based on the EPD's "Guidelines on Choice of Models and Model Parameters" has been assumed. The NO_2/NOx conversion is calculated as follows:

$$[NO_2]pred = 0.075x[NO_X]pred + MIN \{0.925x[NO_X]pred, \text{ or } (46/48)x\ [O_3]bkgd\}$$

where

$[NO_2]$pred is the predicted NO_2 concentration

$[NO_X]$pred is the predicted NO_X concentration

MIN means the minimum of the two values within the brackets

$[O_3]$bkgd is the representative O_3 background concentration

(46/48) is the molecular weight of NO_2 divided by the molecular weight of O_3

3.6.37 Secondary air quality impacts arising from the implementation of roadside noise mitigation measures including vertical noise barriers, cantilevered noise barriers and semi-enclosures, and landscape decks for TKO-LT Tunnel Interchange are incorporated into the air quality model.

3.6.38 The locations of open road emission sources, 24-hour traffic flows and composite emission factors for each road link are presented in **Appendix 3.6.**

Model Assumptions for Emissions from Portals/Full Enclosures, Road P2 Landscape Deck and Ventilation Buildings

3.6.39 The portal emissions from TKO-LT Tunnel, EHC, Trunk Road T2, proposed full enclosures and the proposed landscape decks at Lam Tin Interchange and on Road P2, emissions from ventilation buildings of TKO-LT Tunnel (Lam Tin side and TKO side), EHC and Trunk Road T2 are predicted by EPD approved dispersion model, the Industrial Source Complex Short Term (ISCST3) model.

3.6.40 According to the design information, for the westbound carriageway of TKO-LT Tunnel, 40% vehicle emissions would be emitted from the Lam Tin side portal and remaining 60% emission would be emitted from the ventilation building located at the western portal of TKO-LT Tunnel. For the eastbound carriageway of TKO-LT Tunnel, 40% vehicles emissions would be emitted from TKO side portal and the remaining 60%emissions would be extracted and discharged at the ventilation building located at the eastern portal of TKO-LT Tunnel. The emission inventory and the design of the vent shaft adopted in the assessment are based on the design assumptions at the time of the assessment. The preliminary design of the ventilation buildings (including exit height, exhaust directions, exit velocity, design airflow rate and the exhaust area of the ventilation building) is summarized in **Table 3.10**.

Table 3.10 Design of TKO-LT Tunnel Ventilation Buildings

	Design Airflow Rate (m^3/s)	Exit Velocity (m/s)	Exit Height (m above ground)	Exhaust Area (m^2)	Exhaust Direction
Ventilation Building at eastern portal	390	6	8	65	Upward with inclined angle at 45°
Ventilation Building at western portal	390	6	8	65	Upward with inclined angle at 45°

3.6.41 There is no partition wall between the opposite traffic directions of Road P2 under the landscape deck. 50% of the emissions from the decked section of Road P2 are assumed to be emitted from the southbound portal while another 50% of the emission would be emitted from northbound portal.

3.6.42 The data of portal emissions from tunnel section of Trunk Road T2 and the design information for its ventilation building are provided by Trunk Road T2 Consultant. About 10% of the emissions from the eastbound carriageway of T2 Tunnel would be emitted from the portal at Lam Tin Area while the remaining 90% emission would be discharged at the ventilation building which is located at the top of the T2 Tunnel portal at Lam Tin Area. The emission information and locations for T2 ventilation building are presented in **Appendix 3.7**.

3.6.43 The emissions from EHC ventilation building at Kowloon side and its portal emissions from Kowloon bound are also considered in the cumulative operational air quality impact assessment. The data for EHC ventilation building are based on the Kai Tak Development Schedule 3 EIA Report. The emission data are presented in **Appendix 3.7**.

3.6.44 The portal emissions from tunnels/full enclosures are modelled in accordance with the recommendations of the Permanent International Association of Road Congress Report (PIARC, 1991). The pollutants are assumed to eject from the portal as a portal jet such that 2/3 of the total emissions is dispersed within the first 50m of the portal and the other 1/3 of the total emissions within the second 50m. The locations of the portal emissions considered in the assessment and emission calculations for the portals are presented in **Appendix 3.7**.

3.6.45 A summary for the mentioned portals and ventilation building emissions within 500m study area for Lam Tin area and Tseung Kwan O area are presented in **Table 3.11 and 3.12** respectively. A summary summarizing the total emissions from ventilation buildings is presented in **Table 3.13**.

Table 3.11 Summary of Portals and Ventilation Building Emissions within 500m Study Area (Lam Tin side)

Location	Daily Emission Rates in gram/second			
	Portal		Ventilation Building	
	NOx	RSP	NOx	RSP
Deck of Sceneway Garden at Lei Yue Mun Road Southbound (Portal Name: A)	2.2080	0.1064	N/A	N/A
Slip Road from Eastbound of Trunk Road T2 at Lam Tin Interchange (Portal Name: B; Ventilation Buildings: V1 & V2)	0.4335	0.0232	3.9010	0.2088
	10% Emission from Portal		90% Emission from Ventilation Building	
Slip Road S02 at Lam Tin Interchange (Portal Name: C)	0.2973	0.0153	N/A	N/A
Slip Road EHC4 at Lam Tin Interchange (Portal Name: D)	0.2168	0.0106	N/A	N/A
Slip Road S02 at Lam Tin Interchange (Portal Name: E)	0.2392	0.0123	N/A	N/A
Trunk Road T2 Eastbound Main Line (Portal Name: F;	0.6200	0.0326	5.5800	0.2931

Location	Daily Emission Rates in gram/second			
	Portal		Ventilation Building	
	NOx	RSP	NOx	RSP
Ventilation Buildings: V1 & V2)	10% Emission from Portal		90% Emission from Ventilation Building	
TKO-LT Tunnel Westbound Main Line (Portal Name: G; Ventilation Building: V3)	2.719	0.1422	4.0790	0.2133
	40% Emission from Portal		60% Emission from Ventilation Building	
Slip Road EHC1 at Lam Tin Interchange (Portal Name: H)	0.4088	0.0203	N/A	N/A
Slip Road from Westbound of TKO-LT Tunnel (Portal Name: J; Ventilation Building: V3)	1.0670	0.0576	1.6010	0.0864
	40% Emission from Portal		60% Emission from Ventilation Building	
Eastern Harbour Crossing Kowloon Bound (Portal Name: K; Ventilation Building: V4)	2.8560	0.1481	6.6630	0.3455
	30% Emission from Portal		70% Emission from Ventilation Building	

Note: Refer to the Appendix 3.6 for the detailed locations of the portals and ventilations buildings.

Table 3.12 Summary of Portals and Ventilation Building Emissions within 500m Study Area (Tseung Kwan O side)

Location	Daily Emission Rates in gram/second			
	Portal		Ventilation Building	
	NOx	RSP	NOx	RSP
Landscape Deck at Road P2 (Portal Name: A)	0.2280	0.0107	N/A	N/A
Landscape Deck at Road P2 (Portal Name: B)	0.2280	0.0107	N/A	N/A
TKO-LT Tunnel Eastbound Main Line (Portal Name: B; Ventilation Building: V1)	3.6960	0.1930	5.5430	0.2895
	40% Emission from Portal		60% Emission from Ventilation Building	

Note: Refer to the Appendix 3.6 for the detailed locations of the portals and ventilations buildings.

Table 3.13 Summary of Total Emissions from Ventilation Building Emissions within 500m Study Area

Location	Daily Emission Rates in gram/second	
	NOx	RSP
Lam Tin side		
Eastern T2 Ventilation Building Stack 1 (Source ID: V1) (1)	9.2610	0.4884
Eastern T2 Ventilation Building Stack 2 (Source ID: V2) (1)	9.2610	0.4884
TKO-LT Western Ventilation Building (Source ID: V3) (2)	5.6790	0.2998

Location	Daily Emission Rates in gram/second	
	NOx	RSP
Eastern Harbour Crossing Kowloon Bound (Source ID: V4)	6.6630	0.3455
Tseung Kwan O side		
TKO-LT Eastern Ventilation Building (Source ID: V1)	5.5430	0.2895

Note: Refer to the Appendix 3.6 for the detailed locations of the ventilations buildings.

(1) The emission from Eastern T2 Ventilation Building includes emissions from eastbound slip road, eastbound main line and westbound main line of the Trunk Road T2, and distributing to Stack 1 and Stack 2 at the Eastern T2 Ventilation Building. (Emissions from westbound main line of Trunk Road T2: NOx = 9.0420g/s; RSP = 0.4748g/s.)

(2) The emission from TKO-LT Western Ventilation Building includes emissions from westbound slip road and westbound main line of TKO-LT Tunnel.

3.6.46 Meteorological data extracted from the PATH model from different grid cells as listed in **Table 3.9** is employed for the model run. NOx concentrations from the open roads, the portals/full enclosures and ventilation buildings are firstly added together and OLM as mentioned in **Section 3.6.33** is also applied subsequently. The rural dispersion mode in ISCST3 model is selected depending on the land uses where the ASRs locate.

Cumulative Impact of Criteria Air Pollutants

3.6.47 The PATH model outputs based on Year 2020 emission inventories are added to the sum of the CALINE4 (for open road emissions from existing and proposed road networks) and ISCST3 (for all portal emissions, emissions from Road P2 landscape deck and emissions from ventilation building) model results sequentially on an hour-by-hour basis to derive the short-term and long-term cumulative impacts at each receptor. The highest pollutant concentration predicted at a receptor amongst the 8760 hours is taken as the worst predicted hourly pollutant concentration for that receptor. The maximum 24-hour average pollutant concentration at a receptor amongst the 365 days is the highest predicted daily average concentration. The annual average pollutant concentration at a receptor is the average of 8760 hourly concentrations.

3.7 Prediction and Evaluation of Environmental Impacts

Construction Phase

3.7.1 With considerations of dust emissions during construction phase of both TKO-LT Tunnel and Trunk Road T2, the predicted unmitigated cumulative maximum hourly, daily and annual average TSP concentrations at the representative ASRs are summarized in **Table 3.14**.

3.7.2 Based on the results shown in **Table 3.14**, the predicted cumulative maximum hourly, daily and annual average TSP concentrations at some representative ASRs at Lam Tin side and TKO side would exceed the criteria stipulated in EIAO-TM and AQO under unmitigated scenario. Hence, proper dust mitigation measures should be implemented. The contour plots of cumulative maximum hourly, daily and annual average unmitigated TSP concentrations at 7mPD and 15.5mPD (the worst-hit levels) at Lam Tin side are presented in

Figures 3.5a to 3.10b. The contour plots of cumulative maximum hourly, daily and annual average unmitigated TSP concentrations at 5.5mPD and 14mPD (the worst-hit levels) at Tseung Kwan O side are presented in **Figures 3.11a to 3.16b**.

Table 3.14 Predicted Cumulative Maximum Hourly, Daily and Annual Average TSP Concentrations at Representative Air Sensitive Receivers (Unmitigated)

ASRs	Assessment Height (mAG)	Assessment Height (mPD)	Cumulative Maximum TSP Concentrations in ug/m^3		
			Hourly Average	24-hour Average	Annual Average
Lam Tin Side					
CL1	1.5	7.0	**5082**	**1026**	**99.8**
CL1	5.0	10.5	**3952**	**842**	**94.8**
CL1	10.0	15.5	**2129**	**532**	**85.8**
CL1	15.0	20.5	**1204**	**343**	**80.5**
CL1	20.0	25.5	**859**	239	77.6
CL2	1.5	7.0	**4813**	**837**	**103.9**
CL2	5.0	10.5	**3833**	**720**	**101.6**
CL2	10.0	15.5	**2088**	**468**	**93.6**
CL2	15.0	20.5	**1506**	**299**	**86.8**
CL2	20.0	25.5	**1099**	202	**82.1**
CL3	1.5	7.0	**2215**	**405**	**101.7**
CL4	1.5	7.0	**2201**	**396**	**103.1**
CL4	5.0	10.5	**1971**	**390**	**102.8**
CL4	10.0	15.5	**1357**	**332**	**98.0**
CL4	15.0	20.5	**1157**	**268**	**93.0**
CL4	20.0	25.5	**947**	216	**88.5**
CL5	1.5	7.0	**1783**	**433**	**88.4**
CL5	5.0	10.5	**1686**	**420**	**88.7**
CL5	10.0	15.5	**1204**	**333**	**86.7**
CL5	15.0	20.5	**829**	254	**84.5**
CL5	20.0	25.5	**714**	221	**82.4**
CL6	1.5	15.5	**1614**	**331**	**87.8**
CL7	1.5	15.5	**2170**	**481**	**87.0**
CL8	1.5	7.0	**4424**	**670**	**81.7**
CL8	5.0	10.5	**3745**	**583**	**81.2**
CL8	10.0	15.5	**2250**	**386**	79.4
CL8	15.0	20.5	**1424**	**285**	77.9
CL8	20.0	25.5	**1115**	222	76.8
CL9	1.5	7.0	**3542**	**440**	**84.3**
CL9	5.0	10.5	**3104**	**373**	**83.1**
CL9	10.0	15.5	**2015**	**300**	**80.3**
CL9	15.0	20.5	**1332**	251	78.2
CL9	20.0	25.5	**1034**	212	76.9
CL10	1.5	7.0	**3159**	**601**	**84.9**
CL10	5.0	10.5	**2680**	**550**	**84.1**
CL10	10.0	15.5	**1576**	**402**	**81.3**
CL10	15.0	20.5	**1191**	**281**	78.8
CL10	20.0	25.5	**910**	201	77.2

ASRs	Assessment Height (mAG)	Assessment Height (mPD)	Cumulative Maximum TSP Concentrations in ug/m^3		
			Hourly Average	24-hour Average	Annual Average
CL11	1.5	7.0	**2707**	**617**	**85.8**
CL12	1.5	7.0	**2092**	**421**	**81.1**
CL12	5.0	10.5	**1866**	**403**	**80.8**
CL12	10.0	15.5	**1188**	**326**	79.3
CL12	15.0	20.5	**913**	258	77.8
CL12	20.0	25.5	**737**	209	76.5
CL13	10.0	15.5	**1423**	**381**	**88.5**
CL13	15.0	20.5	**994**	238	**81.8**
CL13	20.0	25.5	**798**	184	78.3
CL14	1.5	7.0	**2139**	**500**	**81.3**
CL14	5.0	10.5	**1806**	**469**	**80.9**
CL14	10.0	15.5	**1138**	**352**	79.1
CL14	15.0	20.5	**921**	247	77.3
CL14	20.0	25.5	**741**	175	76.1
CL15	1.5	7.0	**2791**	**453**	**99.2**
CL15	5.0	10.5	**1794**	**347**	**95.7**
CL15	10.0	15.5	**1295**	**283**	**90.6**
CL15	15.0	20.5	**997**	242	**86.8**
CL15	20.0	25.5	**754**	202	**83.8**
CL16	1.5	7.0	**2929**	**507**	**102.1**
CL16	5.0	10.5	**1716**	**328**	**97.3**
CL16	10.0	15.5	**1263**	**275**	**91.5**
CL16	15.0	20.5	**957**	240	**87.7**
CL16	20.0	25.5	**818**	208	**84.7**
TKO Side					
CT1	1.5	5.5	**1377**	**287**	76.1
CT1	5.0	9.0	**1317**	**284**	76.1
CT1	10.0	14.0	**1010**	245	75.6
CT1	15.0	19.0	**702**	204	75.1
CT1	20.0	24.0	466	168	74.7
CT2	10.0	14.0	**1108**	228	**90.0**
CT2	15.0	19.0	**728**	177	**81.3**
CT2	20.0	24.0	483	149	77.7
CT3	10.0	14.0	**891**	232	**91.1**
CT3	15.0	19.0	**561**	176	**84.7**
CT3	20.0	24.0	449	150	**80.5**
CT4	1.5	5.5	**966**	185	78.6
CT4	5.0	9.0	**963**	183	78.6
CT4	10.0	14.0	**798**	159	77.9
CT4	15.0	19.0	**607**	134	77.0
CT4	20.0	24.0	431	115	76.3
CT5	1.5	5.5	**1597**	182	75.1
CT5	5.0	9.0	**1474**	174	75.1
CT5	10.0	14.0	**1075**	144	74.7
CT5	15.0	19.0	**772**	131	74.4
CT5	20.0	24.0	**537**	121	74.2

Note:

(1) The background TSP level of 73 ug/m^3 is included in the above results.
(2) The hourly, daily and annual average TSP EIAO-TM/AQO criteria are 500 ug/m^3, 260 ug/m^3 and 80 ug/m^3 respectively.
(3) Boldfaced values represent the predicted TSP concentration exceeds the respective criteria.

Operation Phase

Traffic Emission Impact from Open Roads, Portals and Ventilation Buildings

Lam Tin Side

3.7.3 Taking into account vehicle emissions from open road networks, portal emissions from the tunnels (including TKO-LT Tunnel (Lam Tin side), EHC, Trunk Road T2 Tunnel) and proposed landscape decks/full enclosures at Lam Tin Interchange, emissions from Trunk Road T2, EHC and TKO-LT Tunnel (Lam Tin side) ventilation buildings, and background pollutant concentrations based on the PATH model outputs for Year 2020, the cumulative maximum 1-hour average NO_2, daily average NO_2 and RSP concentrations, and annual average NO_2 and RSP are predicted and presented in **Table 3.15**.

Table 3.15 Predicted Cumulative Maximum Hourly, Daily and Annual Average Air Pollutants Concentrations at Representative Air Sensitive Receivers at Lam Tin

ASRs	Assessment Height (mPD)	Cumulative Maximum NO_2 Concentrations in μg/m^3			Cumulative Maximum RSP Concentrations in μg/m^3	
		Hourly Average	24-hour Average	Annual Average	24-hour Average	Annual Average
LTA1	1.5	248	91.6	32.0	110.0	39.7
LTA1	5	248	89.8	31.2	109.8	39.7
LTA1	10	247	87.3	29.0	109.5	39.5
LTA1	15	246	85.7	26.7	109.2	39.4
LTA2	1.5	248	94.1	33.0	110.0	39.8
LTA2	5	247	92.3	31.7	109.9	39.7
LTA2	10	247	87.9	28.7	109.6	39.5
LTA2	15	246	84.3	25.7	109.3	39.3
LTA3	1.5	248	86.5	27.2	108.5	39.4
LTA3	5	249	87.0	27.6	108.5	39.4
LTA3	10	248	85.8	26.4	108.5	39.3
LTA3	15	248	84.1	24.5	108.3	39.2
LTA4	1.5	247	88.6	32.4	109.0	39.6
LTA4	5	247	87.3	30.1	108.9	39.5
LTA4	10	246	84.2	25.9	108.6	39.3
LTA4	15	246	81.5	23.3	108.5	39.2
LTA6	1.5	227	81.3	32.5	108.2	39.7
LTA6	5	227	81.3	32.3	108.2	39.7
LTA6	10	227	81.1	31.7	108.1	39.6
LTA6	15	226	80.9	30.8	108.1	39.6
LTA7	1.5	225	85.1	38.3	108.0	40.0
LTA7	5	224	84.7	37.2	108.0	39.9
LTA7	10	224	83.6	34.2	108.0	39.7
LTA7	15	224	82.3	30.6	108.0	39.5

ASRs	Assessment Height (mPD)	Cumulative Maximum NO_2 Concentrations in μg/m^3			Cumulative Maximum RSP Concentrations in μg/m^3	
		Hourly Average	24-hour Average	Annual Average	24-hour Average	Annual Average
LTA8	1.5	247	80.3	26.1	109.2	39.4
LTA8	5	247	80.0	25.9	109.1	39.3
LTA8	10	246	79.1	25.4	109.0	39.3
LTA8	15	243	78.6	24.6	108.8	39.2
LTA9	1.5	245	80.6	30.3	108.7	39.6
LTA9	5	237	80.3	28.6	108.4	39.5
LTA9	10	226	79.7	25.5	108.0	39.3
LTA9	15	222	78.5	23.8	107.8	39.2
LTA10	1.5	249	87.8	29.1	108.9	39.5
LTA10	5	249	87.2	28.7	108.9	39.5
LTA10	10	248	86.2	27.5	108.8	39.4
LTA10	15	248	84.8	26.0	108.6	39.3
LTA11	1.5	248	90.5	29.1	109.1	39.5
LTA11	5	248	88.8	28.7	109.0	39.5
LTA11	10	247	86.2	27.6	108.9	39.4
LTA11	15	247	84.7	26.2	108.7	39.3
LTPA1	1.5	247	93.0	36.7	108.6	40.1
LTPA1	5	247	89.8	35.0	108.5	39.9
LTPA1	10	247	87.4	32.0	108.4	39.7
LTPA1	15	246	86.1	29.6	108.3	39.5
LTPA2	1.5	247	93.2	33.3	108.4	39.8
LTPA2	5	246	90.6	31.5	108.3	39.6
LTPA2	10	246	87.1	28.5	108.2	39.4
LTPA2	15	240	85.5	26.6	108.1	39.3
LTPA3	1.5	248	98.9	37.1	108.7	40.0
LTPA3	5	247	89.7	32.1	108.4	39.7
LTPA3	10	245	86.0	28.0	108.2	39.4
LTPA3	15	236	84.3	25.9	108.1	39.3
LTPA4	1.5	249	92.7	33.8	108.6	39.8
LTPA4	5	247	86.7	27.9	108.3	39.4
LTPA4	10	246	84.4	25.0	108.1	39.2
LTPA4	15	243	83.3	23.7	108.1	39.2
LTPA7	1.5	222	89.2	38.2	108.1	40.0
LTPA7	5	222	87.4	35.8	108.1	39.9
LTPA7	10	222	83.9	32.2	108.0	39.6
LTPA7	15	222	81.7	30.6	108.0	39.5
LTPA10	1.5	226	81.9	34.2	107.9	39.9
LTPA10	5	225	81.9	34.1	107.9	39.9
LTPA10	10	225	81.9	33.9	107.9	39.9
LTPA10	15	224	82.1	33.5	107.9	39.9
LTPA11	1.5	225	81.1	34.8	107.9	39.9
LTPA11	5	225	81.1	34.7	107.9	39.9
LTPA11	10	224	80.9	34.4	107.9	40.0
LTPA11	15	224	80.8	34.0	107.9	40.0

Note:

(1) The maximum 1-hour and 24-hour average NO_2 concentration limit under AQO:300 and 150 µg/m^3.
(2) The maximum 24-hour average RSP concentration limit under AQO:180 µg/m^3.
(3) The annual average NO_2 and RSP concentration limit under AQO:80 and 55 µg/m^3.

3.7.4 Referring to the predicted results, no exceedance of maximum 1-hour average NO_2, daily average NO_2 and RSP, and annual average NO_2 and RSP AQO standards would occur at any representative ASR in the Study Area of Lam Tin side. The predicted maximum hourly average NO_2, daily average NO_2 and RSP, annual average NO_2 and RSP concentration contours at 1.5metres Above Ground(mAG) (The level that the highest predicted pollutants concentrations occur) are shown in **Figures 3.31a** to **3.35b**. The contour results show that no exceedance zone is predicted within the study area of the Project at Lam Tin side.

TKO Side

3.7.5 Taking into account vehicle emissions from open road networks, portal emissions from the TKO-LT Tunnel (TKO side) and proposed landscape deck on Road P2, emissions from the TKO-LT Tunnel ventilation building (TKO side) and the background pollutant concentrations predicted by PATH Model provided by EPD, the cumulative maximum 1-hour average NO_2, daily average NO_2 and RSP concentrations, and annual average NO_2 and RSP are predicted and presented in **Table 3.16**.

Table 3.16 Predicted Cumulative Maximum Hourly, Daily and Annual Average Air Pollutants Concentrations at Representative Air Sensitive Receivers at Tseung Kwan O

ASRs	Assessment Height (mPD)	Cumulative Maximum NO_2 Concentrations in µg/m^3			Cumulative Maximum RSP Concentrations in µg/m^3	
		Hourly Average	24-hour Average	Annual Average	24-hour Average	Annual Average
TKO-A1	1.5	253	75.7	19.4	103.4	38.8
TKO-A1	5	253	75.7	19.4	103.4	38.8
TKO-A1	10	253	75.6	19.3	103.4	38.8
TKO-A1	15	253	75.6	19.1	103.4	38.8
TKO-A2	1.5	209	74.6	18.0	104.4	38.3
TKO-A2	5	209	74.5	17.9	104.4	38.3
TKO-A2	10	209	73.9	17.5	104.4	38.3
TKO-A2	15	209	73.3	17.1	104.4	38.3
TKO-A3	1.5	217	75.2	20.7	105.4	38.9
TKO-A3	5	217	75.1	20.5	105.4	38.8
TKO-A3	10	216	74.8	20.2	105.4	38.8
TKO-A3	15	216	74.5	19.8	105.4	38.8
TKO-A4	1.5	222	79.2	21.8	105.6	38.9
TKO-A4	5	220	78.1	21.4	105.5	38.9
TKO-A4	10	218	76.2	20.6	105.5	38.8
TKO-A4	15	217	74.9	19.9	105.4	38.8
TKO-A5	1.5	219	73.6	20.4	105.6	38.8
TKO-A5	5	217	73.2	19.6	105.5	38.8
TKO-A5	10	216	72.5	19.0	105.4	38.8
TKO-A5	15	216	72.1	18.7	105.4	38.8

ASRs	Assessment Height (mPD)	Cumulative Maximum NO_2 Concentrations in μg/m^3			Cumulative Maximum RSP Concentrations in μg/m^3	
		Hourly Average	24-hour Average	Annual Average	24-hour Average	Annual Average
TKO-A6	1.5	218	74.3	21.5	105.6	38.9
TKO-A6	5	218	73.6	20.1	105.5	38.8
TKO-A6	10	217	73.1	19.5	105.4	38.8
TKO-A6	15	217	72.8	19.1	105.4	38.8
TKO-A7	1.5	218	79.8	25.0	105.5	39.0
TKO-A7	5	218	78.0	23.2	105.5	38.9
TKO-A7	10	218	75.8	21.2	105.5	38.9
TKO-A7	15	217	74.6	20.2	105.5	38.8
TKO-A8	1.5	218	77.2	22.1	105.5	38.9
TKO-A8	5	218	77.0	21.6	105.5	38.9
TKO-A8	10	218	76.4	20.7	105.5	38.8
TKO-A8	15	217	75.6	19.9	105.4	38.8
TKO-A9	1.5	221	77.4	21.7	105.6	38.9
TKO-A9	5	218	75.6	20.9	105.5	38.9
TKO-A9	10	217	74.3	20.2	105.5	38.8
TKO-A9	15	217	73.7	19.7	105.4	38.8
TKO-A10	1.5	222	76.8	22.7	105.6	38.9
TKO-A10	5	220	76.4	22.3	105.5	38.9
TKO-A10	10	218	75.5	21.3	105.5	38.9
TKO-A10	15	217	74.6	20.4	105.4	38.8
TKO-A11	1.5	220	76.6	22.6	105.5	38.9
TKO-A11	5	220	76.4	22.3	105.5	38.9
TKO-A11	10	219	75.7	21.6	105.5	38.9
TKO-A11	15	218	74.9	20.7	105.5	38.8
TKO-A12	1.5	226	78.5	22.9	105.6	38.9
TKO-A12	5	223	77.6	22.4	105.6	38.9
TKO-A12	10	218	75.7	21.3	105.5	38.9
TKO-A12	15	217	74.3	20.4	105.5	38.8
TKO-A13	1.5	219	78.8	29.7	105.9	39.2
TKO-A13	5	219	76.4	24.3	105.7	39.0
TKO-A13	10	218	74.8	21.6	105.6	38.9
TKO-A13	15	217	74.0	20.5	105.5	38.8
TKO-A14	1.5	215	76.5	20.5	104.6	38.4
TKO-A14	5	214	76.1	20.0	104.6	38.4
TKO-A14	10	212	75.1	18.9	104.5	38.3
TKO-A14	15	211	74.0	17.9	104.5	38.3
TKO-A15	1.5	217	78.1	20.2	104.6	38.4
TKO-A15	5	216	77.4	19.9	104.6	38.4
TKO-A15	10	214	75.9	19.0	104.5	38.3
TKO-A15	15	212	74.5	18.0	104.5	38.3
TKO-A16	1.5	211	75.9	21.9	104.6	38.5
TKO-A16	5	211	75.5	21.3	104.6	38.4
TKO-A16	10	211	74.5	19.8	104.5	38.4
TKO-A16	15	210	73.4	18.5	104.5	38.3

ASRs	Assessment Height (mPD)	Cumulative Maximum NO_2 Concentrations in µg/m^3			Cumulative Maximum RSP Concentrations in µg/m^3	
		Hourly Average	24-hour Average	Annual Average	24-hour Average	Annual Average
TKO-A17	1.5	216	77.4	21.2	104.7	38.4
TKO-A17	5	214	76.6	20.4	104.6	38.4
TKO-A17	10	212	75.2	19.0	104.6	38.3
TKO-A17	15	211	73.9	18.1	104.5	38.3
TKO-PA1	1.5	219	76.8	19.9	104.7	38.4
TKO-PA1	5	217	75.4	19.1	104.6	38.4
TKO-PA1	10	214	73.5	17.9	104.5	38.3
TKO-PA1	15	213	72.7	17.1	104.5	38.3
TKO-PA2	1.5	218	79.7	21.0	104.6	38.5
TKO-PA2	5	217	78.0	20.0	104.6	38.4
TKO-PA2	10	214	75.4	18.2	104.5	38.3
TKO-PA2	15	212	73.8	17.2	104.5	38.3
TKO-PA3	1.5	220	79.6	21.1	104.7	38.4
TKO-PA3	5	216	77.2	19.9	104.7	38.4
TKO-PA3	10	212	75.1	18.5	104.5	38.3
TKO-PA3	15	211	74.0	17.6	104.5	38.3
TKO-PA4	1.5	217	81.8	21.7	104.8	38.5
TKO-PA4	5	212	78.7	19.5	104.5	38.4
TKO-PA4	10	211	76.1	18.3	104.5	38.3
TKO-PA4	15	210	74.5	17.5	104.4	38.3
TKO-PA5	1.5	214	75.9	18.8	104.6	38.4
TKO-PA5	5	213	75.5	18.5	104.5	38.3
TKO-PA5	10	211	74.7	17.7	104.5	38.3
TKO-PA5	15	210	73.7	17.2	104.4	38.3
TKO-PA6	1.5	212	74.0	16.8	104.5	38.3
TKO-PA6	5	211	73.7	16.7	104.5	38.3
TKO-PA6	10	211	73.2	16.4	104.5	38.3
TKO-PA6	15	211	72.5	16.2	104.5	38.2
TKO-PA7	1.5	212	73.9	17.5	104.5	38.3
TKO-PA7	5	212	73.3	17.1	104.5	38.3
TKO-PA7	10	211	72.6	16.7	104.5	38.3
TKO-PA7	15	211	72.2	16.3	104.5	38.2
TKO-PA8	1.5	211	74.0	17.6	104.5	38.3
TKO-PA8	5	211	73.6	17.3	104.5	38.3
TKO-PA8	10	210	73.0	17.0	104.5	38.3
TKO-PA8	15	210	72.6	16.6	104.4	38.3
TKO-PA9	1.5	212	74.1	16.9	104.5	38.3
TKO-PA9	5	212	73.9	16.8	104.5	38.3
TKO-PA9	10	211	73.2	16.7	104.5	38.3
TKO-PA9	15	210	72.5	16.4	104.4	38.3
TKO-PA10	1.5	210	72.2	16.5	104.4	38.3
TKO-PA10	5	209	72.2	16.4	104.4	38.3
TKO-PA10	10	209	72.0	16.3	104.4	38.2

ASRs	Assessment Height (mPD)	Cumulative Maximum NO_2 Concentrations in µg/m^3			Cumulative Maximum RSP Concentrations in µg/m^3	
		Hourly Average	24-hour Average	Annual Average	24-hour Average	Annual Average
TKO-PA10	15	209	71.8	16.2	104.4	38.2

Note:
(1) The maximum 1-hour and 24-hour average NO_2 concentration limit under AQO:300 and 150 µg/m^3.
(2) The maximum 24-hour average RSP concentration limit under AQO:180 µg/m^3.
(3) The annual average NO_2 and RSP concentration limit under AQO:80 and 55 µg/m^3.

3.7.6 Referring to the predicted results, no exceedance of maximum 1-hour average NO_2, daily average NO_2 and RSP, and annual average NO_2 and RSP AQO standards would occur at any representative ASR in the Study Area of Tseung Kwan O side. The predicted maximum hourly average NO_2, daily average NO_2 and RSP, annual average NO_2 and RSP concentration contours at 1.5mAG (The level that highest predicted pollutants concentrations occur) are shown in **Figures 3.36a** to **3.40c**. The contour results show that no exceedance zone is predicted within the study area of the Project at Tseung Kwan O side.

<u>Vehicular Emission Impact inside the Tunnel, Full Enclosures and under proposed Landscape Decks</u>

3.7.7 The mechanical ventilation system for TKO-LT Tunnel is designed following "*The Practice Note on Control of Air Pollution in Vehicle Tunnels*" issued by EPD. The predicted maximum NO_2 concentrations at eastbound of TKO-LT Tunnel under normal peak traffic flow conditions and congested traffic flow conditions, would be 378 µg/m^3 and 880 µg/m^3, respectively. The predicted maximum NO_2 concentrations at westbound of TKO-LT Tunnel under normal peak traffic flow conditions and congested traffic flow conditions, would be 365 µg/m^3 and 724 µg/m^3, respectively. Therefore, the air pollutants concentrations inside the vehicle tunnel should meet its Tunnel Air Quality Guideline. The detailed calculation and results are presented in **Appendix 3.8**. In-tunnel air quality assessments have been conducted for proposed two land*scape decks and three full enclosures at Lam Tin Interchange, an*d proposed landscape deck at Road P2. The predicted maximum NO_2 concentrations at proposed three landscape decks and two full enclosures at Lam Tin Interchange under normal peak traffic flow conditions and congested traffic flow conditions, would be 270 µg/m^3 and 582 µg/m^3, respectively. These would comply with the Tunnel Air Quality Guidelines (1800µg/m^3). The predicted maximum NO_2 concentrations at the area under the proposed landscape deck at Road P2 would be 217 µg/m^3 under normal peak traffic flow conditions and 254 µg/m^3 under congested traffic flow conditions, which would also comply with the Tunnel Air Quality Guidelines. Detailed calculations and results are presented in **Appendix 3.9**.

3.8 Mitigation of Adverse Environmental Impacts

Construction Phase

3.8.1 In order to minimise the construction dust impact, the following dust mitigation measures shall be implemented:

- Watering eight times a day on active works areas, exposed areas and paved haul roads to reduce dust emission by 87.5%. Any potential dust impact and watering mitigation would be subject to the actual site condition. For example, a construction activity that produces inherently wet conditions or in cases under rainy weather, the above water application intensity may not be unreservedly applied. While the above watering frequency is to be followed, the extent of watering may vary depending on actual site conditions but should be sufficient to achieve the removal efficiency. The dust levels would be monitored and managed under an EM&A programme as specified in the EM&A Manual.

- Enclosing the unloading process at barging point by a 3-sided screen with top tipping hall, provision of water spraying and flexible dust curtains to reduce dust emission by 90%.

3.8.2 With the implementation of the above measures, the predicted mitigated cumulative maximum hourly, daily and annual average TSP concentrations at the representative ASRs at Lam Tin side and TKO side during construction are summarized in **Table 3.17**.

Table 3.17 Predicted Cumulative Maximum Hourly, Daily and Annual Average TSP Concentrations at Representative Air Sensitive Receivers (Mitigated Tier 1)

ASRs	Assessment Height (mAG)	Assessment Height (mPD)	Cumulative Maximum TSP Concentrations in ug/m^3		
			Hourly Average	24-hour Average	Annual Average
Lam Tin Side					
CL1	1.5	7.0	**707**	199	77.1
CL1	5.0	10.5	**563**	174	76.2
CL1	10.0	15.5	332	133	74.8
CL1	15.0	20.5	215	108	74.1
CL1	20.0	25.5	172	96	73.6
CL2	1.5	7.0	**666**	173	77.8
CL2	5.0	10.5	**543**	158	77.4
CL2	10.0	15.5	325	125	76.0
CL2	15.0	20.5	252	103	75.0
CL2	20.0	25.5	201	90	74.3
CL3	1.5	7.0	341	118	77.4
CL4	1.5	7.0	339	118	77.6
CL4	5.0	10.5	310	117	77.5
CL4	10.0	15.5	233	108	76.7
CL4	15.0	20.5	209	99	75.9
CL4	20.0	25.5	182	92	75.2
CL5	1.5	7.0	287	120	75.4
CL5	5.0	10.5	275	118	75.4
CL5	10.0	15.5	214	107	75.1
CL5	15.0	20.5	167	98	74.7
CL5	20.0	25.5	153	93	74.3
CL6	1.5	15.5	266	109	75.2

ASRs	Assessment Height (mAG)	Assessment Height (mPD)	Cumulative Maximum TSP Concentrations in ug/m^3		
			Hourly Average	**24-hour Average**	**Annual Average**
CL7	1.5	15.5	335	128	74.9
CL8	1.5	7.0	**617**	148	74.3
CL8	5.0	10.5	**532**	137	74.2
CL8	10.0	15.5	345	112	73.9
CL8	15.0	20.5	242	101	73.7
CL8	20.0	25.5	203	92	73.5
CL9	1.5	7.0	**507**	123	74.7
CL9	5.0	10.5	452	114	74.5
CL9	10.0	15.5	316	104	74.1
CL9	15.0	20.5	230	97	73.7
CL9	20.0	25.5	193	91	73.5
CL10	1.5	7.0	459	143	74.8
CL10	5.0	10.5	399	136	74.7
CL10	10.0	15.5	261	117	74.2
CL10	15.0	20.5	213	100	73.8
CL10	20.0	25.5	178	90	73.6
CL11	1.5	7.0	402	145	74.9
CL12	1.5	7.0	325	119	74.2
CL12	5.0	10.5	297	117	74.2
CL12	10.0	15.5	212	107	73.9
CL12	15.0	20.5	178	98	73.7
CL12	20.0	25.5	156	92	73.5
CL13	10.0	15.5	242	113	75.2
CL13	15.0	20.5	188	95	74.2
CL13	20.0	25.5	164	87	73.7
CL14	1.5	7.0	334	129	74.3
CL14	5.0	10.5	292	125	74.2
CL14	10.0	15.5	206	109	73.9
CL14	15.0	20.5	179	95	73.6
CL14	20.0	25.5	157	86	73.4
CL15	1.5	7.0	413	125	77.0
CL15	5.0	10.5	288	109	76.4
CL15	10.0	15.5	226	101	75.6
CL15	15.0	20.5	189	96	75.0
CL15	20.0	25.5	158	90	74.6
CL16	1.5	7.0	430	133	77.4
CL16	5.0	10.5	278	106	76.6
CL16	10.0	15.5	222	101	75.7
CL16	15.0	20.5	184	95	75.2
CL16	20.0	25.5	166	91	74.7
TKO Side					
CT1	1.5	5.5	236	101	73.5
CT1	5.0	9.0	229	100	73.5
CT1	10.0	14.0	190	95	73.4
CT1	15.0	19.0	152	90	73.3
CT1	20.0	24.0	122	85	73.2

ASRs	Assessment Height (mAG)	Assessment Height (mPD)	Cumulative Maximum TSP Concentrations in ug/m^3		
			Hourly Average	24-hour Average	Annual Average
CT2	10.0	14.0	202	94	75.4
CT2	15.0	19.0	155	86	74.1
CT2	20.0	24.0	124	83	73.6
CT3	10.0	14.0	175	95	75.6
CT3	15.0	19.0	134	87	74.6
CT3	20.0	24.0	120	83	74.0
CT4	1.5	5.5	185	87	73.9
CT4	5.0	9.0	184	87	73.9
CT4	10.0	14.0	164	84	73.7
CT4	15.0	19.0	140	81	73.6
CT4	20.0	24.0	118	78	73.5
CT5	1.5	5.5	264	87	73.3
CT5	5.0	9.0	248	87	73.3
CT5	10.0	14.0	198	84	73.3
CT5	15.0	19.0	160	82	73.2
CT5	20.0	24.0	131	80	73.2

Note:
(1) The background TSP level of 73 ug/m^3 is included in the above results.
(2) The hourly, daily and annual average TSP EIAO-TM/AQO criteria are 500 ug/m^3, 260 ug/m^3 and 80 ug/m^3 respectively.
(3) Boldfaced values represent the predicted TSP concentration exceeds the respective criteria.

3.8.3 Based on the results of the Tier 1 screening test, the predicted hourly TSP levels at ASRs CL1, CL2, CL8 and CL9 at Lam Tin side would still exceed the criteria stipulated in EIAO-TM while the predicted daily and annual TSP levels at all representative ASRs at Lam Tin side would comply with the criteria stipulated in AQO. The contour plots of cumulative maximum hourly, daily and annual average mitigated TSP concentrations at 7mPD and 15.5mPD (the worst-hit levels) at Lam Tin side are presented in **Figures 3.17a-b, 3.18a-b, 3.21a-b, 3.22a-b, 3.23a-b and 3.24a-b**. The contour results for cumulative maximum hourly TSP levels at 7mPD in **Figures 3.17a-b** indicated that apart from the Tin Hau Temple at Cha Kwo Ling (CL1), part of the Cha Kwo Ling Village (CL2), the Lam Tin Ambulance Depot (CL8) and part of the Yau Lai Court (CL9), the EHC ventilation building, EHC Administration Building (CL13) and Towngas Pigging Station at Cha Kwo Ling Road would also fall within the exceedance zone. However, the EHC ventilation building is for tunnel exhaust for EHC, the Towngas Pigging Station is utility's facility which is not of air sensitive use, and as mentioned in **Table 3.4** that the first assessment height is at 15.5mPD (equivalent to 10mAG) for the EHC Administration Building, hence no adverse hourly TSP impact would pose to the mentioned three buildings/facilities, while ASRs CL1, CL2, CL8 and CL9 would be selected for further assessment, i.e. Tier 2 assessment. As shown in **Figure 3.21a-b and 3.23a-b**, the cumulative maximum daily TSP and annual TSP levels at 7mPD have exceedance zone at Sin Fat Road, EHC Administration Building and some steep slopes enclosing the Lam Tin Interchange of TKO-LT Tunnel. However, as there are no air sensitive use for Sin Fat Road and EHC Administration Building, the first assessment height is at 15.5mPD (equivalent to 10mAG) for the Sin Fat Road and EHC Administration Building and no air sensitive uses are anticipated for the steep slopes enclosing Lam Tin Interchange. Hence, with the dust mitigation measures proposed, no adverse cumulative daily and annual average TSP levels at 7mPD would be expected in the Lam Tin area. There is also no exceedance zone identified in all the contour plots (**Figures 3.18a-b,**

3.22a-b and 3.24a-b) of the mitigated TSP concentrations for all the time-averaged at 15.5mPD at Lam Tin area.

3.8.4 The four ASRs (CL1, CL2, CL8 and CL9) where TSP non-compliance predicted under the Tier 1 screening test are selected to undergo the Tier 2 assessment. The assessment results of Tier 2 test are summarized in **Table 3.18**. Based on the results of the Tier 2 assessment, the cumulative maximum hourly average TSP at ASRs CL1, CL2, CL8 and CL9 located within the hot spot area would comply with the criterion in EIAO-TM. The Tier 2 contour plots of cumulative maximum hourly average TSP concentrations at 7mPD are presented in **Figure 3.19a-b and 3.20a-b**. From the contour plots of Tier 2 assessment, it is found that no land lots with air sensitive uses are located within the exceedance zone at 7mPD.

Table 3.18 Predicted Cumulative Maximum Hourly, Daily and Annual Average TSP Concentrations at Representative Air Sensitive Receivers (Mitigated Tier 2)

ASRs	Assessment Height (mAG)	Assessment Height (mPD)	Cumulative Maximum TSP Concentrations in ug/m^3
			Hourly Average
Lam Tin Side			
CL1	1.5	7.0	413
CL1	5.0	10.5	335
CL1	10.0	15.5	192
CL1	15.0	20.5	157
CL1	20.0	25.5	128
CL2	1.5	7.0	379
CL2	5.0	10.5	292
CL2	10.0	15.5	198
CL2	15.0	20.5	154
CL2	20.0	25.5	123
CL8	1.5	7.0	184
CL8	5.0	10.5	159
CL8	10.0	15.5	114
CL8	15.0	20.5	102
CL8	20.0	25.5	93
CL9	1.5	7.0	174
CL9	5.0	10.5	137
CL9	10.0	15.5	110
CL9	15.0	20.5	98
CL9	20.0	25.5	90

Note:
(1) The background TSP level of 73 ug/m^3 is included in the above results.
(2) The hourly, daily and annual average TSP EIAO-TM/AQO criteria are 500 ug/m^3, 260 ug/m^3 and 80 ug/m^3 respectively.

3.8.5 Referring to the results of Tier 1 screening test shown in **Table 3.17**, the cumulative maximum hourly, daily and annual average TSP levels at all representative ASRs at TKO side would comply with the criteria stipulated in EIAO-TM and AQO after implementation of the proposed dust mitigation measures. The contour plots of cumulative maximum hourly, daily and annual average TSP concentrations at 5.5mPD and 14mPD are presented in **Figures 3.25a** to **3.30b**. From the contour plots (**Figures 3.25a-b, 3.27a-b and 3.29a-b**), it is observed that exceedance zone of cumulative maximum hourly, daily and annual average TSP levels at 5.5mPD are confined within the works areas of the proposed Road P2 under the Project, part of the Ocean Shore (CT2), part of the slope at the TKO-LT Tunnel eastern tunnel portal and part of the Tseung Kwan O Cemetery. However, as mentioned in **Table 3.4**, the residential tower of Ocean Shore (CT2) is situated on top of the 3-storey podium without air sensitive uses facing to the construction works area of Road P2, the first assessment height is at 14mPD (equivalent to 10mAG) instead of 5.5mPD. Also, for the exceedance zone inside the Tseung Kwan O Cemetery, there are no normal active air sensitive use identified and the construction works areas would be closed during the peak public access to the cemetery on public holidays (Ching Ming Festival and Chung Yueng Festival) and Sundays. It is also noted that no air sensitive uses are present at the slope area of TKO-LT Tunnel eastern portal. Hence, no adverse air quality impact of cumulative maximum hourly, daily and annual average TSP concentrations at 5.5mPD at Tseung Kwan O area would be expected. There is also no exceedance zone identified in all the contour plots (**Figures 3.26a-b, 3.28a-b and 3.30a-b**) of the mitigated TSP concentrations for all the time-averaged at 14mPD at Tseung Kwan O area.

3.8.6 From the contour plots, localised exceedances of 1-hour average, 24-hour average and annual average TSP concentration at 1.5m above ground were found. However, no existing or planned ASR is identified within these predicted exceedance areas at the relevant heights. The detailed discussion on localised exceedance are summarised in **Table 3.19**. The modeling results indicate that the predicted cumulative concentrations of TSP at all representative ASRs would comply with the respective AQO.

Table 3.19 Summary of Localised Exceedance

Exceedance Area	Remarks
1-hr TSP concentration	
Figure 3.18a & 3.18b and 3.19a & 3.19b (Exceedance area found at 7mPD) **Figure 3.25b** (Exceedance area found at 5.5mPD)	No ASR identified in the exceedance zone areas.
Figure 3.17a – ASR CL7 (Exceedance area found at 7mPD)	ASR CL7 Sin Fat Road Tennis Court is located on a hill. 7mPD is well below the ground level at CL7, and hence there is no air sensitive use at the level.
Figure 3.17b – ASR CL13 (Exceedance area found at 7mPD)	Referring to **Table 3.4**, the first assessment height of the ASR CL13 administration building of Eastern Harbour Crossing is at 10 m above ground (15.5 mPD). Hence, there is no air sensitive use at the level.
Figure 3.25a – ASR CT2 (Exceedance area found at 5.5mPD)	Referring to **Table 3.4**, the first assessment height of the ASR CT2 residential tower of Ocean Shore is at 10 m above ground (14mPD). Hence, there is no air sensitive use at the level.
24-hr TSP concentration	
Figure 3.21b	No ASR identified in the exceedance zone areas.

Exceedance Area	Remarks
(Exceedance area found at 7mPD) **Figure 3.27a & 3.27b** (Exceedance area found at 5.5mPD)	
Figure 3.21a – ASR CL7 (Exceedance area found at 7mPD)	ASR CL7 Sin Fat Road Tennis Court is located on a hill. 7mPD is well below the ground level at CL7, and hence there is no air sensitive use at the level.
Annual TSP concentration	
Figure	No ASR identified in the exceedance zone area.
Figure 3.23a – ASR CL7 (Exceedance area found at 7mPD)	ASR CL7 Sin Fat Road Tennis Court is located on a hill. 7mPD is well below the ground level at CL7, and hence there is no air sensitive use at the level.
Figure 3.23b – ASR CL13 (Exceedance area found at 7mPD)	Referring to **Table 3.4**, the first assessment height of the ASR CL13 administration building of Eastern Harbour Crossing is at 10 m above ground (15.5mPD). Hence, there is no air sensitive use at the level.
Figure 3.29a – ASR CT2 (Exceedance area found at 5.5mPD)	Referring to **Table 3.4**, the first assessment height of the ASR CT2 residential tower of Ocean Shore is at 10 m above ground (14mPD). Hence, there is no air sensitive use at the level.
Figure 3.29b (Exceedance area found at 5.5mPD)	No ASR identified in the exceedance zone areas.

3.8.7 In addition to the dust control measures described above, dust suppression measures stipulated in the Air Pollution Control (Construction Dust) Regulation and good site practices listed below shall be carried out to further minimize construction dust impact:

- Use of regular watering to reduce dust emissions from exposed site surfaces and unpaved roads, particularly during dry weather.
- Use of frequent watering for particularly dusty construction areas and areas close to ASRs.
- Side enclosure and covering of any aggregate or dusty material storage piles to reduce emissions. Where this is not practicable owing to frequent usage, watering shall be applied to aggregate fines.
- Open stockpiles shall be avoided or covered. Where possible, prevent placing dusty material storage piles near ASRs.
- Tarpaulin covering of all dusty vehicle loads transported to, from and between site locations.
- Establishment and use of vehicle wheel and body washing facilities at the exit points of the site.
- Provision of wind shield and dust extraction units or similar dust mitigation measures at the loading area of barging point, and use of water sprinklers at the loading area where dust generation is likely during the loading process of loose material, particularly in dry seasons/ periods.
- Provision of not less than 2.4m high hoarding from ground level along site boundary where adjoins a road, streets or other accessible to the public except for a site entrance or exit.
- Imposition of speed controls for vehicles on site haul roads.
- Where possible, routing of vehicles and positioning of construction plant should be at the maximum possible distance from ASRs.

- Every stock of more than 20 bags of cement or dry pulverised fuel ash (PFA) should be covered entirely by impervious sheeting or placed in an area sheltered on the top and the 3 sides.
- Instigation of an environmental monitoring and auditing program to monitor the construction process in order to enforce controls and modify method of work if dusty conditions arise.

Operation Phase

3.8.8 The predicted cumulative maximum 1-hour average NO_2 concentrations, maximum daily average NO_2 and RSP concentrations, annual average NO_2 and RSP concentrations at the representative ASRs would comply with the AQO. There is also no exceedance zone predicted within the Study Area of the Project. The predicted air pollutants concentrations inside the TKO-LT Tunnel, the proposed full enclosures and under the landscape decks at Lam Tin Interchange and Road P2 would comply with the EPD Tunnel Air Quality Guidelines. No mitigation measure would be required during operation phase.

3.9 Evaluation of Residual Impacts

Construction Phase

3.9.1 With the implementation of the mitigation measures as stipulated in the Air Pollution Control (Construction Dust) Regulation together with the recommended dust control measures and good site practices, no adverse residual impact would be expected on the work sites at both Lam Tin and TKO sides.

Operation Phase

3.9.2 During operation phase of the Project, the predicted maximum 1-hour and daily average NO_2, annual average NO_2 and maximum daily average and annual average RSP concentrations at the representative ASRs would comply with the AQO and no exceedance zone is predicted within the Study Area of the Project. Hence evaluation of residual impacts is not required.

3.9.3 The predicted air pollutants concentrations inside the proposed underpasses and under the landscape decks would also comply with the EPD Tunnel Air Quality Guidelines. No adverse residual in-tunnel air quality is anticipated.

3.10 Environmental Monitoring and Audit Requirements

Construction Phase

3.10.1 With the implementation of the proposed dust suppression measures, good site practices and dust monitoring and audit programme, no adverse dust impact would be expected at the ASRs. Details of the monitoring requirements are presented in the stand-alone EM&A Manual.

Operation Phase

3.10.2 Since the Project would not pose adverse air quality impacts to the ASRs, no environmental monitoring and audit is proposed.

3.11 Conclusion

Construction Phase

3.11.1 Potential air quality impacts from the construction works of the Project would mainly be related to construction dust from excavation, materials handling, spoil removal and wind erosion. With the implementation of mitigation measures specified in the Air Pollution Control (Construction Dust) Regulation together with the recommended dust suppression measures, good site practices, and EM&A programme, the predicted dust impact at ASRs would comply with the hourly, daily and annual TSP criteria in the EIAO-TM and AQO.

Operation Phase

3.11.2 The potential impacts arising from the background pollutant levels within and adjacent to the Project site, vehicle emissions from open road networks, portal emissions from the TKO-LT Tunnel, T2 tunnel and EHC, proposed landscape decks and full enclosures, emissions from the ventilation buildings of TKO-LT Tunnel, T2 and EHC, and the implementation of roadside noise barriers/semi-enclosures/landscape decks are assessed. Results show that the predicted maximum 1-hour and daily average NO_2, annual average NO_2 and maximum daily average and annual average RSP concentrations at the representative ASRs and within the Study Area would comply with the AQO. No mitigation measures are required.

3.11.3 The predicted air pollutants concentrations inside the TKO-LT Tunnel, proposed full enclosures and under the landscape decks would comply with the EPD Tunnel Air Quality Guidelines. No mitigation measures are required.

Overall

3.11.4 An air quality impact assessment has been conducted in accordance to the criteria and guidelines as stated in Annexes 4 and 12 of the EIAO-TM. The predicted results showed that the air quality impact during both construction and operation phases of the Project would comply with the criteria and guidelines as stated in the aforesaid Annexes in the EIAO-TM.