3 AIR QUALITY

3.1 INTRODUCTION

3.1.1 This Section presents an evaluation of the potential air quality impacts from the construction and operation of the Project, and the results were assessed with reference to the relevant environmental legislation, standards and criteria.

3.2 LEGISLATIVE REQUIREMENTS AND EVALUATION CRITERIA

3.2.1 The principal legislation for the management of air quality in Hong Kong is the *Air Pollution Control Ordinance (APCO) (CAP.311)*. The new AQOs implemented on 1 January 2022 have been adopted as the assessment criteria as shown in **Table 3.1**.

Table 3.1 Hong Kong Air Quality Objectives

Air Pollutant	Averaging Time	Concentration (µg/m^3)	No. of Exceedances Allowed per Year
Respirable Suspended Particulates (RSP) (b)	24-hour	100	9
	Annual	50	-
Fine Suspended Particulates (FSP) (c)	24-hour	50	18 (d)
	Annual	25	-
Nitrogen Dioxide (NO_2)	1-hour	200	18
	Annual	40	-
Sulphur Dioxide (SO_2)	10-minute	500	3
	24-hour	50	3
Carbon Monoxide (CO)	1-hour	30,000	0
	8-hour	10,000	0
Ozone (O_3)	8-hour	160	9
Lead	Annual	0.5	-

Notes:

(a) Concentrations of gaseous air pollutants (i.e. NO_2, SO_2, CO and O_3) are measured at 293K and 101.325kPa.

(b) Suspended particles in the air with a nominal aerodynamic diameter of 10µm or less.

(c) Suspended particles in the air with a nominal aerodynamic diameter of 2.5µm or less.

(d) On a best endeavours basis, a reduced number of allowable exceedances of 18 days per year for 24-hour FSP (in lieu of 35 days per year as set out in the *Air Pollution Control (Amendment) Bill 2021*) should be adopted for air quality impact assessments for new government projects.

3.2.2 The Technical Memorandum on the EIAO-TM issued under the EIAO states that construction dust assessment shall be conducted qualitatively to ensure that the *Air Pollution Control (Construction Dust) Regulation* is complied with.

3.2.3 The measures stipulated in the *Air Pollution Control (Construction Dust) Regulation* will be followed to ensure that potential dust impacts are properly controlled. Requirements stipulated in the *Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation* and *Air Pollution Control (Fuel Restriction) Regulation* will also be followed to control potential emissions from non-road mobile machinery during the construction phase of the Project.

3.2.4 A set of engineering practices listed in *Recommended Pollution Control Clauses for Construction Contracts* will be followed to minimise the inconvenience and environmental nuisance to nearby sensitive receivers; and ensure the contractor to comply with the *Air Pollution Control Ordinance* and its subsidiary regulations.

3.2.5 The technical circular *DEVB's TC No.13/2020, Timely Application of Temporary Electricity and Water Supply for Public Works Contracts and Wider Use of Electric Vehicles in Public Works Contracts,* aims at widening the use of electric vehicles (EVs) in public works contracts, would be followed as adoption of EVs could improve roadside air quality and reduce emissions.

3.2.6 The technical circular *DEVB's TC No.1/2015, Emissions Control of NRMM in Capital Works Contracts of Public Works* promulgates the requirements for the use of non-road mobile machinery (NRMM) approved under the *Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation* in new capital work contracts of public works including design and build contracts. No exempted generators, air compressors, excavators and crawler cranes are allowed in new capital works contracts of public works with an estimated contract value exceeding HK$200 million from 1 June 2019 onwards, unless at the discretion of the Architect/ Engineer considering no feasible alternative.

3.3 ASSESSMENT AREA AND AIR SENSITIVE RECEIVERS

3.3.1 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 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.

3.3.2 In accordance with Clause 3.4.4.2 of the EIA Study Brief, the Assessment Area is defined as an area within 500m from the boundaries of the Project site and the work areas of the Project. The Project site boundary including all works areas of the Project during the construction phase is shown in **Figure 3.1**. The Project site boundary including the proposed new roads and existing roads with modifications and junction improvement during the operation phase is shown in **Figure 3.2**. The Project site and the 500m Assessment Area are shown in **Figure 3.3**. A number of representative ASRs within the 500m Assessment Area have been identified. Relevant Outline Zoning Plans (OZPs) and other published plans in the vicinity of the Project site have been reviewed in the identification of planned representative ASRs. The identified representative ASRs are presented in **Table 3.2** and their locations are shown in **Figure 3.3**. Full details of these representative ASRs are provided in **Appendix 3.1**.

Table 3.2 Identified Representative ASRs within 500m Assessment Area

ASR ID	Description	Type of Use	Status	Max Height of Building (mAG)	Assess-ment Heights (mAG)	Approx. Separation Distance from Construction Project Site Boundary (m)	Approx. Separation Distance from Operation Project Site Boundary (m)
A01	Sheung Shui Centre, Block 2	Residential	Existing	90	1.5-90	155	165
A02	Sheung Shu Town Centre, New York Court	Residential	Existing	90	1.5-90	100	110
A03	Village House No.50, So Kwun Po	Village	Existing	10	1.5-10	35	40
A04	Tung Wah Group of Hospitals Kap Yan Directors' College	Educational	Existing	20	1.5-20	60	65

ASR ID	Description	Type of Use	Status	Max Height of Building (mAG)	Assess-ment Heights (mAG)	Approx. Separation Distance from Construction Project Site Boundary (m)	Approx. Separation Distance from Operation Project Site Boundary (m)
A05	Tung Wah Group of Hospitals Hong Kong & Kowloon Electrical Appliances Merchants Association Ltd. School	Educational	Existing	30	1.5-30	40	55
A06	Tin Ping Estate, Tin Mei House	Residential	Existing	100	1.5-100	145	155
A07	Fan Leng Pak Wai, House 707	Village	Existing	10	1.5-10	150	155
A08	Fan Leng Pak Wai, House 801	Village	Existing	10	1.5-10	95	110
A09	S.K.H. Wing Chun Primary School	Educational	Existing	30	1.5-30	20	30
A10	Vienna Garden, Block 1	Residential	Existing	40	1.5-40	5	5
A11	Cheerful Park, Block 2	Residential	Existing	50	1.5-50	20	30
A12	Glamour Garden, Block 7	Residential	Existing	20	1.5-20	5	20
A13	Eden Garden, Block 1	Residential	Existing	20	1.5-20	5	20
A14	8 Royal Green	Residential	Existing	130	1.5-130	70	90
A15	Tai Ping Estate, Ping Yee House	Residential	Existing	80	1.5-80	240	255
A16	Sheung Shui Government Secondary School	Educational	Existing	30	1.5-30	20	30
A17	Buddhist Chan Shi Wan Primary School	Educational	Existing	30	1.5-30	215	230
A18	Yuk Po Court, Chun Wu House	Residential	Existing	60	1.5-60	200	215
A19	Sheung Shui Disciplined Services Quarters, Block B	Residential	Existing	80	1.5-80	50	70
A20	Metropolis Plaza, Block 3	Residential	Existing	90	1.5-90	240	260
A21	Venice Garden, Block 1	Residential	Existing	60	1.5-60	185	205
A22	Tung Wa Group of Hospitals Ma Kam Chan Memorial Primary School	Educational	Existing	25	1.5-25	55	60
A23	Greenpark Villa, Block 1	Residential	Existing	40	1.5-40	90	110
A24	Camellia Court, Block 10	Residential	Existing	10	1.5-10	80	95

ASR ID	Description	Type of Use	Status	Max Height of Building (mAG)	Assess-ment Heights (mAG)	Approx. Separation Distance from Construction Project Site Boundary (m)	Approx. Separation Distance from Operation Project Site Boundary (m)
A25	North District Park	Recreational	Existing	-	1.5	10	10
A26	Po Wing Road Playground	Recreational	Existing	-	1.5	10	25
A27	Kat Cheung Street Garden	Recreational	Existing	-	1.5	10	60
A28	Po Wing Road Sports Centre	Recreational	Existing	20	1.5-20	85	105
A29	Ching Ho Estate - Phase 4	Residential	Planned	130	1.5-130	35	50
A30	North District Park - Stand	Recreational	Existing	-	1.5	20	20
A31	North District Park – Skating Rink	Recreational	Existing	-	1.5	- [b]	5

Notes:

(a) All identified representative ASRs were considered in the assessment of both construction and operation phase air quality impacts (except A31).

(b) The Skating Rink (A31) was not considered as an ASR during the construction phase as it will be closed during the construction phase.

3.4 BASELINE CONDITIONS

3.4.1 The Project is located in Sheung Shui and the local air quality is primarily influenced by emissions from existing road traffic.

Measured Background Air Quality

3.4.2 The nearest EPD's air quality monitoring stations (AQMSs) are the North AQMS and the Tai Po AQMS. **Table 3.3** presents the relevant time averaging concentrations of air pollutants measured at the North AQMS and Tai Po AQMS in the most recent five years (i.e. 2018 to 2022).

Table 3.3 Concentrations of Air Pollutants Measured at EPD's North AQMS and Tai Po AQMS in the Recent Five Years (2018 to 2022)

Year	Concentration of Pollutants ($\mu g/m^3$)											
	19th Highest Hourly NO_2	Annual NO_2	4th Highest Daily SO_2	4th Highest 10-min SO_2	10th Highest Daily RSP	Annual RSP	10th Highest Daily FSP	19th Highest Daily FSP	Annual FSP	10th Highest Daily Max 8-hr O_3	Daily Max Hourly CO	Daily Max 8-hr CO
North AQMS [a]												
2018	-	-	-	-	-	-	-	-	-	-	-	-
2019	-	-	-	-	-	-	-	-	-	-	-	-
2020	112	- [c]	8	19	55	- [c]	32	8 [d] [e]	- [c]	166	1,830	1,238
2021	135	36	7	18	62	25	34	29 [d]	15	187	2,150	1,550
2022	115	31	7	27	50	23	35	29	14	197	1710	1304
Tai Po AQMS												
2018	125	36	8	24	69	31	47	38 [d]	19	167	- [b]	- [b]
2019	142	36	10	20	65	31	47	41 [d]	20	197	- [b]	- [b]
2020	106	30	7	19	58	24	38	33 [d]	15	165	- [b]	- [b]
2021	115	32	8	15	60	26	38	34 [d]	16	168	- [b]	- [b]
2022	93	27	5	12	48	21	35	30	14	188	- [b]	- [b]
AQOs	**200**	**40**	**125**	**500**	**100**	**50**	**75**	**-**	**35**	**160**	**30,000**	**10,000**

Concentration of Pollutants (μg/m^3)												
Year	19th Highest Hourly NO_2	Annual NO_2	4th Highest Daily SO_2	4th Highest 10-min SO_2	10th Highest Daily RSP	Annual RSP	10th Highest Daily FSP	19th Highest Daily FSP	Annual FSP	10th Highest Daily Max 8-hr O_3	Daily Max Hourly CO	Daily Max 8-hr CO
(2014-2021)												
AQOs (2022 onwards)	200	40	50	500	100	50	-	50	25	160	30,000	10,000

Notes:

(a) North AQMS was commissioned on 10 July 2020.
(b) CO is not measured at Tai Po AQMS.
(c) Annual averages were not reported as the data were less than eight representative months in 2020.
(d) Monitoring data was extracted from webpage “Air Quality Data – Download/Display” in EPD’s Environmental Protection Interactive Centre.
(e) Only eight representative months in 2020 were extracted and used to calculate the 19th highest Daily FSP.
(f) Underlined values mean AQO exceedance of the prevailing AQOs and previous AQOs (effective from 2014 to 2021) at the time of air quality monitoring.

3.4.3 No exceedances of 19th highest hourly NO_2 and annual NO_2 criteria were recorded at the AQMSs for the past five years (2018 to 2022).

3.4.4 No exceedances of 4th highest daily SO_2 and 4th highest 10-min SO_2 criteria were recorded at the AQMSs for the past five years (2018-2022).

3.4.5 No exceedances of 10th highest daily RSP and annual RSP criteria were recorded at the AQMSs for the past five years (2018-2022).

3.4.6 No exceedances of 10th highest daily FSP and annual FSP criteria were recorded at the AQMSs for the past five years (2018-2022).

3.4.7 No exceedances of maximum hourly CO and 8-hour CO criteria were recorded at the AQMSs for the past five years (2018-2022).

3.4.8 Exceedances of 10th highest daily 8-hour O_3 criterion were recorded at both AQMSs over the past five years (2018-2022). O_3 is a complicated air pollution issue as well as a regional issue. It is not a pollutant directly emitted from man-made sources but produced from photochemical reaction between NOx and VOCs in the presence of sunlight. Concentration of O_3 is governed by both precursors, atmospheric transport from other areas and meteorological factors. The formation of O_3 generally takes hours to proceed and O_3 measured locally could be attributed to emissions generated from places over long distances. In Hong Kong, emissions generated from places over the Pearl River Delta Metropolitan Region could lead to the formation of O_3, which contributes a high proportion on O_3 background concentration in Hong Kong. Although O_3 can be scavenged by some pollutants (such as NO) in the ambient air via chemical reactions, considerable reduction of NOx emissions from vehicles in recent years result in less reaction with O_3. As a result, O_3 remaining in the atmosphere would be increased in short-term leading to possible exceedance of the daily 8-hour O_3 criterion.

Predicted Future Background Air Quality

3.4.9 The background air pollutant concentrations predicted by the PATH v2.1 model (i.e. Pollutants in the Atmosphere and their Transport over Hong Kong) in different PATH grids where the identified ASRs are located within the Assessment Area in Year 2025 (i.e. the year of tentative commencement of construction of Project) and Year 2030 (i.e. the year of tentative commencement of operation of Project) are presented in **Table 3.4**.

Table 3.4 Background Air Pollutant Concentrations Predicted by the PATH v2.1 Model in 2025 and 2030

PATH Grid	Concentration of Pollutants (μg/m^3)										
	19th Highest Hourly NO_2	Annual NO_2	4th Highest 10-min SO_2	4th Highest Daily SO_2	10th Highest Daily RSP	Annual RSP	19th Highest Daily FSP	Annual FSP	10th Highest Daily Max 8-hr O_3	Daily Max Hourly CO	Daily Max 8-hr CO
Year 2025											
35,52	104.7	13.5	59.4	11.2	64.7	27.2	36.0	15.6	208.9	921.7	839.6
35,53	117.8	16.7	72.7	12.4	65.5	27.8	35.6	15.8	208.3	936.3	847.9
36,52	105.2	15.1	58.6	10.8	64.7	27.0	35.6	15.3	205.4	918.0	838.0
36,53	117.5	16.6	70.4	11.4	66.2	27.9	36.6	15.9	208.2	927.3	844.0
Year 2030											
35,52	86.5	11.1	55.8	10.5	64.8	26.5	35.4	15.1	201.4	921.6	846.8
35,53	101.3	13.5	71.1	12.1	65.7	27.2	35.1	15.4	201.0	933.0	853.8
36,52	89.9	12.2	56.6	10.4	64.8	26.5	35.0	14.8	199.6	919.2	845.5
36,53	100.4	13.3	68.4	10.5	66.3	27.3	36.1	15.4	200.0	927.9	851.4
AQOs (e)	**200**	**40**	**500**	**50**	**100**	**50**	**50**	**25**	**160**	**30,000**	**10,000**

Notes:
(a) The multiplicative factor for the stability class calculated for each hour was applied to the hourly SO_2 concentrations to estimate the 10-minute SO_2 concentrations.
(b) Underlined values mean AQO exceedance.
(c) An adjustment of 11.0ug/m^3 and 10.3ug/m^3 were added to the RSP background for calculation of daily RSP and annual RSP, respectively.
(d) An adjustment of 3.5ug/m^3 was added to the FSP background for calculation of annual FSP.
(e) Prevailing AQOs implemented on 1 January 2022.

3.4.10 As shown in **Table 3.4**, the predicted background concentrations of NO_2, SO_2, RSP, FSP and CO in all PATH grids within the Assessment Area in 2025 and 2030 are below the relevant AQO criteria. The predicted background concentrations of O_3 in 2025 and 2030 show exceedances of the relevant AQO criterion in all relevant PATH grids.

3.5 IDENTIFICATION OF AIR EMISSION SOURCES

Construction Phase

3.5.1 The construction of the Project primarily involves the construction of new at-grade roads, an underpass and flyovers, modification and realignment of existing roads, as well as associated junction modification works. The key construction activities associated with the construction of the Project include site clearance, slope works, piling works and superstructure works. Slope works and piling works may involve soil excavation. Soil excavation involves handling of excavated materials, wind erosion from temporary stockpiling and exposed works areas which are considered dust-generating sources and may have the potential to generate fugitive dust emissions if not properly managed. Superstructure works, typically involving cast-in-situ or installation of prefabricated bridge deck and segments, are not dust-generating activities and are expected to generate minimal fugitive dust emissions, if any.

3.5.2 Gaseous emissions (i.e. NO_2 and SO_2) will be emitted from construction equipment and dump trucks to be used on-site during the construction of the Project. However, considering that the Project works sites are relatively small with limited number of construction equipment and dump trucks operating concurrently, NO_2 and SO_2 emissions from construction equipment and dump trucks during the construction of the Project are expected to be minimal and not considered key air pollutants of concern, considering that these emissions will be regulated under the *Air Pollution Control (Non-road Mobile Machinery)(Emission) Regulation* and *Air Pollution Control (Fuel Restriction) Regulation*.

3.5.3 The key air pollutants of concern arising from the construction of the Project include TSP, RSP and FSP.

<u>Operation Phase</u>

3.5.4 Vehicular emissions arising from the proposed new roads of the Project and the modified existing roads are the key air emission sources associated with the operation of the Project. The proposed new roads of the Project include at-grade roads, an underpass and flyovers. The key air pollutants of concern arising from the operation of the Project are NO_2, RSP and FSP.

3.5.5 Apart from vehicular emissions from the proposed new roads of the Project and the modified existing roads associated with the Project, vehicular emissions from existing open road traffic, bus and minibus termini, and heavy goods vehicle and bus/ coach parking sites within the 500m Assessment Area may contribute to the cumulative air quality impact on the identified ASRs.

3.5.6 Given that ultra-low sulphur fuel is used for all types of vehicles in Hong Kong and the fact that SO_2 from vehicular emissions (including open road traffic, termini and parking sites emissions) contribute less than 1% of the total emissions (2020 Hong Kong Emission Inventory Report by EPD), SO_2 is not a key air pollutant of concern arising from vehicular emissions. Therefore, SO_2 is not a key air pollutant of concern arising from the operation of the Project and thus was not considered in the assessment.

3.5.7 Emissions from industrial emission sources within the 500m Assessment Area or major point sources within 4km (e.g. Wo Hop Shek Crematorium and K. Wah Sheung Shui Asphalt Plant) from the identified ASRs may contribute to the cumulative air quality impact on the identified ASRs. As stated in **Section 3.5.6**, SO_2 is not a key air pollutant of concern arising from the operation of the Project, thus SO_2 emissions from industrial emission sources were not considered in this assessment.

3.6 EVALUATION OF IMPACT – CONSTRUCTION PHASE

Overview of Fugitive Dust Emissions from Project

3.6.1 As mentioned in **Section 3.5**, slope works and piling works would involve excavation and handling of excavated materials, and thus have the potential to generate fugitive dust. The potential fugitive dust impacts arising from each of the work sites under this Project are discussed in the sections below.

<u>So Kwun Po Link (SKPL) – north section</u>

3.6.2 This section of SKPL includes the new at-grade road and underpass connecting to the flyover section of the SKPL, as well as widening of existing So Kwun Po Road (north section) northbound slip road. The construction works primarily include minor slope works, external lateral support (ELS) works for the underpass, superstructure works and associated road improvement works. The extent of areas requiring slope works is limited and thus the potential fugitive dust emissions arising from such minor slope works are expected to be limited and localised. The underpass is short (approximately 25m) with limited ELS works required and thus the potential fugitive dust emissions from the ELS works are also expected to be limited and localised. Minimal fugitive dust emissions are expected to be generated from the superstructure and road improvement works.

<u>SKPL – flyover section</u>

3.6.3 This section of SKPL includes a new two-lane flyover and a new one-lane flyover over the existing San Wan Road, So Kwun Po Interchange and Fanling Highway. The construction works primarily include ELS/ piling and superstructure works along the flyover section. ELS and piling works will take place within a small confined area and any associated fugitive dust emissions are also expected to be limited and localised. Minimal fugitive dust emissions are expected to be generated from superstructure works.

SKPL – south section

3.6.4 This section of SKPL includes two new at-grade roads connecting the flyover section to Pak Wo Road. The existing So Kwun Po Road (south section) northbound will be shifted to the west. The construction works primarily include minor slope works (due to realigned So Kwun Po Road northbound to the west), ELS/ piling and superstructure works. The extent of areas requiring slope works is limited and thus the potential fugitive dust emissions arising from such minor slope works are expected to be limited and localised. ELS and piling works will take place within confined area and any associated fugitive dust emissions are also expected to be limited and localised. Minimal fugitive dust emissions are expected to be generated from superstructure works.

Evaluation of Impact

Fugitive dust impact from construction of SKPL

3.6.5 Figures illustrating the indicative extent of the earthworks in sequence during the construction phase are provided in **Appendix 3.8**. Description of the works with potential earthworks, locations and timing are summarised in **Table 3.5**.

Table 3.5 Description of Works with Potential Earthworks, Locations and Timing during Construction Phase

Month of Construction	Location	Description of Works with Potential Earthworks	Approx. Maximum Extent of Earthworks Area (m²)
12-13	SKPL – south section: near So Kwun Po Road (south section)	Slope strengthening work for realigned So Kwun Po Road (south section) northbound	440
14	SKPL – north section: near So Kwun Po Road (north section)	ELS for box culvert reconstruction	700
15	SKPL – north section: near So Kwun Po Road (north section)	ELS for box culvert reconstruction	700
	SKPL – north section: near San Wan Road	ELS for lift shaft and staircases	145
16	SKPL – north section: near So Kwun Po Road (north section)	ELS for box culvert reconstruction	700
	SKPL – north section: near San Wan Road	ELS for lift shaft and staircases	145
	SKPL – south section: near So Kwun Po Interchange	ELS for abutment	55
	SKPL – south section: near Pak Wo Road	ELS for lift shaft and staircases	245
17	SKPL – north section: near So Kwun Po Road (north section)	ELS for box culvert reconstruction	700
	SKPL – south section: near So Kwun Po Interchange	ELS for abutment	55
	SKPL – south section: near Pak Wo Road	ELS for lift shaft and staircases	245
18-19	SKPL – north section: near So Kwun Po Road (north section)	ELS for box culvert reconstruction	700

Month of Construction	Location	Description of Works with Potential Earthworks	Approx. Maximum Extent of Earthworks Area (m²)
	SKPL – north section: under So Kwun Po Road (north section)	ELS for underpass	385
20-22	SKPL – north section: near So Kwun Po Road (north section)	ELS for box culvert reconstruction	700
26-27	SKPL – north section: near So Kwun Po Road (north section)	Slope work for the new at-grade road	East of SKPR: 1,165 West of SKPR: 1,145
	SKPL – north section: near So Kwun Po Road (north section)	ELS for retaining wall	East of SKPR: 450 West of SKPR: 410
28-29	SKPL – north section: near So Kwun Po Road (north section)	Slope work for the new at-grade road	of SKPR: 1,165 of SKPR: 1,145
	SKPL – north section: near So Kwun Po Road (north section)	ELS for retaining wall	East of SKPR: 450 West of SKPR: 410
	SKPL – south section: near So Kwun Po Interchange	ELS for abutment	45
	SKPL – south section: near Pak Wo Road	ELS for subway	55
30-32	SKPL – north section: near So Kwun Po Road (north section)	Slope work for the new at-grade road	East of SKPR: 1,165 West of SKPR: 1,145
	SKPL – north section: near So Kwun Po Road (north section)	ELS for retaining wall	East of SKPR: 450 West of SKPR: 410
37	SKPL – south section: near So Kwun Po Road (south section)	ELS for new at-grade road	1,430
38	SKPL – south section: near So Kwun Po Road (south section)	ELS for new at-grade road	1,430
	SKPL – flyover section	ELS for pier columns	915
39-40	SKPL – flyover section	ELS for pier columns	915
44-45	SKPL – south section: near Pak Wo Road	ELS for lift shaft and staircases	255
46-47	SKPL – flyover section: near So Kwun Po Interchange	ELS for abutment and pier column	200
53-54	SKPL – south section: near So Kwun Po Road (south section)	ELS for retaining wall	565
56-57	SKPL – south section: near So Kwun Po Road (south section)	ELS for abutment	50

Month of Construction	Location	Description of Works with Potential Earthworks	Approx. Maximum Extent of Earthworks Area (m²)
Note: "SKPR" in the table means So Kwun Po Road.			

3.6.6 It can be seen that the earthworks associated with the construction of the Project are minor (e.g. slope works, ELS for abutment/ pier columns) with limited active earthworks areas at any one time. No extensive or lasting excavation works is required. Potential fugitive dust emissions due to the abovementioned works during the construction phase would be limited, localised and transient. Therefore, adverse fugitive dust impact arising from the construction of the Project is not anticipated with implementation of good construction site practices and proper dust mitigation measures recommended in the *Air Pollution Control (Construction Dust) Regulation*.

Air quality impact from emissions from construction plant

3.6.7 Construction equipment would be used during the construction of the Project. Given the Project site areas and the associated construction works are relatively small scale, the number of construction plants deployed on site will be limited [(1)] and the associated emissions from the operation of these construction plants are expected to be minimal. Requirements in the *Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation* and *Air Pollution Control (Fuel Restriction) Regulation* will be followed to control the emissions from the construction plants. Adverse air quality impact associated with the operation of the construction plants is not anticipated.

Air quality impact from emissions from transportation of construction and demolition (C&D) materials

3.6.8 Due to limited amount of C&D materials to be disposed off-site, dust generated from construction vehicles for materials handling would generally be limited within the work areas. According to the preliminary engineering information, it is proposed to deliver the inert C&D materials at Tuen Mun Area 38 Fill Bank via New Territories Circular Road and Lung Mun Road. It is estimated that an average of about 1 truck trip per day would be required to deliver the inert C&D materials off-site. For non-inert C&D materials, it is proposed to dispose of at North East New Territories Landfill (NENT) or the proposed NENT extension via San Wan Road and Sha Tau Kok Road. It is estimated that an average of about 1 truck trip per day would be required to deliver the non-inert C&D materials off-site. Considering the limited number of dump trucks and that there would be tarpaulin covering these dump trucks and washing the vehicle wheel and body before leaving the construction site, dust nuisance during transportation of the C&D materials arising from the construction of the Project is not anticipated.

Summary

3.6.9 In view of the above discussions, fugitive dust emissions associated with the construction works of the Project are considered minor and adverse fugitive dust impact to the identified ASRs is not anticipated with the implementation of proper dust control measures. In addition, given the limited number of construction plants to be deployed on site, associated air emissions would be minimal and adverse air quality impact due to the operation of the construction plants is also not expected with the implementation of proper air emission control measures. Furthermore, given that only a few truck trips per day will be generated from the transportation of C&D

(1) Construction equipment including air compressor, grout mixer, hand-held poker vibrator, hand-held breaker, silenced generator, excavator or mini-robot mounted excavator and silent piling will be used for the construction works of the Project. About 5 numbers of these construction equipment will be operating within the Project site at any one time based on estimation by the Project Engineer.

materials, associated air emissions would be minimal and adverse air quality impact due to the transportation of C&D materials is not anticipated. Thus, adverse air quality impact arising from the construction of the Project is not anticipated.

3.7 OPERATION PHASE ASSESSMENT METHODOLOGY

Overview of Assessment Approach

3.7.1 A quantitative assessment has been carried out to evaluate the operational air quality impact at the identified ASRs per Clause 4(i), Appendix B of the EIA Study Brief. NO_2, RSP and FSP impacts have been quantitatively assessed as these were identified as the key air pollutants of concern during the operation phase.

3.7.2 Cumulative AQIA has been undertaken with reference to EPD's *Guidelines on Assessing the 'Total' Air Quality Impacts*, taking into account Tier 1, Tier 2 and Tier 3 emission source contributions:

(a) Tier 1 contributions – vehicular emissions from the proposed new roads and modified roads of the Project;

(b) Tier 2 contributions – other key emission sources within the 500m Assessment Area that may have the potential to contribute to the cumulative air quality impact, including vehicular and industrial emissions.

(c) Tier 3 contributions – represents background contributions which include other potential emission sources not captured by Tier 1 and Tier 2 contributions. The Project is expected to commence operation in 2030, and thus the predicted hourly background concentrations of NO_2, RSP and FSP in 2030 (2) in the relevant PATH grids obtained from the PATH model v2.1 were adopted as the background contributions.

3.7.3 The cumulative concentrations at the ASRs were estimated by adding together the hour-by-hour contributions from modelled results for Tier 1, Tier 2 and the predicted PATH hourly background concentrations in 2030 (Tier 3). Relevant time-period averages of the 8,760 hourly results for the air pollutants assessed were calculated and compared with the respective AQO criteria to evaluate the cumulative air quality impact at the ASRs.

Vehicular Emissions from Proposed New Roads and Existing Roads (Tier 1 and Tier 2)

3.7.4 Vehicular emissions (NO_2, RSP and FSP) from all proposed new roads and existing roads within the 500m Assessment Area as shown in **Figure 3.4** have been quantitatively assessed as Tier 1 and Tier 2 contributions. Traffic forecasts for the identified roads for 3 design years, including 2030 (i.e. commencement of operation of the Project), 2036, and 2041(3) (11 years after the commencement of operation of the Project) were provided by the Traffic Consultant and are presented in **Appendix 3.2**.

3.7.5 The traffic forecast data for each design year provided include a breakdown of hourly traffic flows for 18 vehicle types (as per EMFAC-HK model (latest version, i.e. v4.3)) and the hourly traffic speed for 24 hours for each of the identified roads. The methodology for the traffic

(2) PATH v2.1 data (Level 1, 0 to 17m above model ground) provided by EPD, October 2022.

(3) The highest traffic flows for the identified roads within the 500m Assessment Area are expected to occur in 2041 (11 years after the commencement of operation of the Project) as the population growth will be at the peak in 2041 according to the latest data in "Population and Household Projections" published by Census and Statistics Department (C&SD). As the population is proportional to the traffic flows, the highest possible traffic flows for the identified roads within the 500m Assessment Area within 15 years after the commencement of operation of the Project would be captured in 2041, instead of 2045 (15 years after the commencement of operation of the Project). Thus, the worst year for assessment would be determined among the selected years (i.e. 2030, 2036, 2041) with no underestimation of vehicular emissions.

forecast projection has been endorsed by Transport Department and the endorsement letter is also provided in **Appendix 3.2**.

3.7.6 Total vehicular emissions within the 500m Assessment Area in each of these 3 design years have been evaluated and 2030 was predicted to have the highest total vehicular emissions as presented in **Table 3.6**. Therefore, 2030 is considered the worst year and has been adopted for the assessment of vehicular emission impact during the operation phase as a conservative assessment. Traffic data and detailed calculations of total vehicular emissions within the 500m Assessment Area for 2030, 2036 and 2041 are provided in **Appendix 3.2**.

Table 3.6 Total Vehicular Emissions within the 500m Assessment Area in 2030, 2036 and 2041

Year	NO (g/day)	NO_2 (g/day)	RSP (g/day)	FSP (g/day)
2030	97981.1	13665.0	4745.0	4362.2
2036	52147.4	11570.7	2349.8	2167.0
2041	52873.6	11949.4	2387.4	2202.5

3.7.7 Apart from running vehicular emissions, start emissions may also occur along minor roads [(4)] which may have on-street parking spaces/ sites and carparks ingress/egress on the roads. Start emissions from different vehicle types (except Double-Decker Franchised Buses (FBDD), Single-Decker Franchised Buses (FBSD) and Public Light Buses (PLB)) along these identified minor roads within the 500m Assessment Area have been considered using a 'broad-brush' approach based on the default trip-to-vehicle kilometres travelled (VKT) ratio for each vehicle type obtained from the EMFAC-HK model (latest version, i.e. v4.3) in 2030, where the VKT adopted was reduced to 13.73% of the default territory-wide VKT to reflect the VKT from minor roads only [(5)]. These identified minor roads with start emissions considered in the 'broad-brush' approach are presented in **Appendix 3.2** and **Figure 3.4**.

3.7.8 Summary of the composite vehicular NO, NO_2, RSP and FSP emission factors in 2030 for each road link within the 500m Assessment Area for the assessment is provided in **Appendix 3.2**.

Vehicular Emissions associated with Bus and Minibus Termini, Heavy Goods Vehicle and Bus/ Coach Parking Sites (Tier 2)

3.7.9 A number of bus and minibus termini have been identified within the 500m Assessment Area. The locations of these bus and minibus termini are shown in **Figure 3.5**. The emissions associated with these bus and minibus termini have the potential to cause air quality impacts to the identified ASRs. NO_2, RSP and FSP impacts due to vehicular emissions from the identified bus and minibus termini (including starting, idling and running emissions from FBDD, FBSD, PLB and taxi) have been quantitatively assessed as Tier 2 contributions.

3.7.10 Besides, the Ma Sik Road Car Park, a possible HGV and NFB parking site has been identified within the 500m Assessment Area as shown in **Figure 3.5**. The emissions associated with the heavy goods vehicle and bus/ coach parking site have the potential to cause air quality impacts to the identified ASRs. NO_2, RSP and FSP impacts due to vehicular emissions from the identified Ma Sik Road Car Park (including starting and running emissions from HGV and NFB) have been quantitatively assessed as Tier 2 contributions.

3.7.11 Vehicle activity data for each relevant vehicle type (i.e. FBDD, FBSD, PLB and taxi) associated with the identified bus and minibus termini were obtained based on desktop information (e.g.

(4) Minor roads includes all trafficable roads that are outside the major road network, with the exception of roads assigned for special use, all types of restricted roads and local access roads leading to a few premises. Minor roads include various road types such as District Distributor (DD), Local Distributor (LD) and Rural Road (RR).

(5) The average daily VKT from minor roads accounts for 13.73% of the average daily VKT from all roads in Hong Kong with reference to the latest Annual Traffic Census (2021) by Transport Department.

schedules and routes from operators, etc.) and/or by site surveys conducted by the Traffic Consultant, including:

- Number of starts and corresponding soak times for terminating vehicles for 24 hours within the terminus;
- Number of non-terminating vehicles for 24 hours within the terminus;
- Average travelling distance from ingress to stopping place within the terminus;
- Average travelling distance from stopping place to egress within the terminus;
- Average travelling speed within the terminus; and
- Idling time for terminating and non-terminating vehicles.

3.7.12 Vehicle activity data for each relevant vehicle type (i.e. HGV, NFB) associated with the identified heavy goods vehicle and coach parking site were obtained by site surveys conducted by the Traffic Consultant, including:

- Number of starts and corresponding soak times for terminating vehicles for 24 hours within the parking site;
- Average travelling distance from ingress to stopping place within parking site;
- Average travelling distance from stopping place to egress within the parking site; and
- Average travelling speed within the parking site.

3.7.13 In order to appreciate the existing traffic conditions of the aforementioned traffic facilities, comprehensive traffic counts have been conducted to collect necessary existing traffic data for the emission assessment.

3.7.14 To collect the existing traffic data under the normal traffic pattern, the survey was conducted for 24 hours at the normal weekdays in end of June 2022 after the relaxation of social distancing measures effective on 21 April 2022 announced by the Government.

3.7.15 The methodology of the surveys for the aforementioned traffic facilities is described below:

<u>Bus and Minibus Termini</u>

3.7.16 For bus and minibus termini, surveyors were arranged at two main locations:

Ingress and Egress Points

3.7.17 Surveyors arranged at the ingress and egress points of the sites recorded the vehicle type, vehicle registration number, route number, travelling speed, arrival time and departure time.

Bus/ PLB/ Taxi Ranks

3.7.18 Surveyors arranged in each rank recorded vehicle type, vehicle registration number, route number, travelling speed and engine stop/start time.

3.7.19 Four vehicle types were recorded for the bus and minibus termini, namely FBDD, FBSD, PLB and taxi, where applicable. Soaking time of each vehicle was determined based on the vehicle engine stop/ start time. Idling time for terminating and non-terminating vehicles was determined based on the vehicle engine start/ departure time and the vehicle arrival/ departure time, respectively.

<u>Heavy Goods Vehicle and Coach Parking Site</u>

3.7.20 For heavy goods vehicle and coach parking site (i.e. Ma Sik Road Car Park), surveyors were arranged at the ingress and egress points of the site. They recorded the vehicle type, vehicle registration number, travelling speed, arrival time and departure time. Seven vehicle types were recorded for the parking sites, namely medium goods vehicles (>5.5-15t) (HGV7), medium goods vehicles (>15-24t) (HGV8), heavy goods vehicles (>24t) (HGV9), non-franchised buses (<=6.4t) (NFB6), non-franchised buses (>6.4-15t) (NFB7), non-franchised buses (>15-24t) (NFB8), and non-franchised buses (>24t) (NFB9), where applicable. Soaking time of each vehicle was determined based on the vehicle's arrival/ departure time.

3.7.21 For both termini and parking sites surveys, the average travelling distances between ingress/egress points and stopping places were determined according to the survey map or on-site measurement.

3.7.22 The abovementioned vehicle activity information associated with bus and minibus termini, heavy goods vehicle and coach parking site obtained from site surveys and desktop review is provided in **Appendix 3.4**. These information has been used as the basis for calculating the starting, idling and running emissions (including NO, NO_2, RSP and FSP vehicular emissions) associated with the identified bus and minibus termini, as well as starting and running emissions (including NO, NO_2, RSP and FSP vehicular emissions) associated with the identified heavy goods vehicle and coach parking site. Reference was made to the *Calculation of Start Emissions in Air Quality Impact Assessment* published by EPD for the calculations of the starting, idling and running emissions. Starting and running emissions were based on emission factors predicted by the EMFAC-HK model (latest version, i.e. v4.3). Cold idling emissions were based on emission factors from Annex A of the *Calculation of Start Emissions in Air Quality Impact Assessment*, while hot idling emissions were based on emission factors from *Road Tunnels: Vehicle Emissions and Air Demand for Ventilation* published by World Road Association (*PIARC-VEADV*).

3.7.23 The start emissions for diesel vehicles fitted with selective catalytic reduction (SCR) devices (i.e. FBDD, FBSD, diesel PLB, HGV and NFB) would be released over a total spread distance of 700m from where the vehicle start takes place, while the start emissions for liquefied petroleum gas (LPG) vehicles (i.e. LPG PLB, LPG taxi) would be released over a total spread distance of 150m from where the vehicle start takes place. Start emissions for petrol vehicles (i.e. petrol taxi) would be released on the spot. All running and idling emissions have been assumed to be released on the spot.

3.7.24 For emissions within the identified bus and minibus termini, start emissions from terminating vehicles as well as idling and running emissions from terminating and non-terminating vehicles have been considered and modelled. For emissions outside the identified bus and minibus termini, start emissions from terminating vehicles associated with the remaining spread distance outside of the identified bus and minibus termini have been considered and modelled. All the calculated start emissions from terminating vehicles were adjusted based on their respective idling emissions within that particular terminus, with reference to the *Calculation of Start Emissions in Air Quality Impact Assessment*.

3.7.25 For emissions within the identified heavy goods vehicle and coach parking site (i.e. Ma Sik Road Car Park), start and running emissions from terminating/ parking vehicles have been considered and modelled. For emissions outside the identified heavy goods vehicle and coach parking site, start emissions from terminating/ parking vehicles associated with the remaining spread distance outside of the parking site have been considered and modelled.

3.7.26 The locations of the emission sources, detailed emission calculations and emission inventory associated with bus and minibus termini, heavy goods vehicle and coach parking site are provided in **Appendix 3.4**.

Industrial Emissions in the Vicinity of the Project (Tier 2)

3.7.27 Surveys to identify chimneys within the 500m Assessment Area have been conducted on 23 December 2021 and 23 June 2023. According to the surveys, only chimney emissions from the North District Hospital and its expansion have been identified within the 500m Assessment Area. These chimney emissions (NO_2, RSP and FSP) have been quantitatively assessed as

Tier 2 contribution as they may contribute to the overall air quality impact at the identified ASRs. These chimneys serve the hot water boiler system, A/C cooling system, chiller and heat pump system and steam supply system in the hospital and its laboratories. The energy from these systems are generated from towngas or landfill gas. The locations of these identified industrial emission sources are shown in **Figure 3.6**. Emission inventory for industrial emissions is provided in **Appendix 3.5**.

3.7.28 In addition, Wo Hop Shek Crematorium and K. Wah Sheung Shui Asphalt Plant have been identified as major point sources located about 2.2km and 2.1km from the identified ASRs, respectively. However, emissions from these identified major point sources would not have a direct impact to the identified ASRs of this Project due to screening by natural terrain as well as other buildings and structures. Potential impact from emissions of these identified major point sources is considered sufficiently represented by the PATH v2.1 model (Tier 3 contribution) and thus not separately modelled by local dispersion model.

Determination of Modelling Scenarios

3.7.29 In order to understand the air quality implications of the proposed Direct Noise Remedies (DNR) as described in **Section 4**, two modelling scenarios, namely "With DNR" scenario and "Without DNR scenario, have been considered in the assessment as summarised in **Table 3.7**.

Table 3.7 Details of "With DNR" and "Without DNR" Scenarios

Modelling Scenario	Description	Assessment Parameters
"With DNR"	Scenario with operation of the proposed new roads and implementation of the proposed DNR (see **Figure 4.3**)	• hourly NO_2, annual NO_2 • daily RSP, annual RSP • daily FSP, annual FSP
"Without DNR"	Scenario with operation of the proposed new roads, but without the proposed DNR	• hourly NO_2, annual NO_2 • daily RSP, annual RSP • daily FSP, annual FSP

3.7.30 The cumulative air quality impacts (i.e. NO_2, RSP and FSP) at the identified ASRs under the "With DNR" scenario have been predicted and compared with those under the "Without DNR" scenario to evaluate the air quality implications induced by the proposed DNR.

Air Dispersion Model, Meteorological Data and Modelling Assumptions

3.7.31 An EPD recommended air dispersion model, AERMOD, was used to model the potential air quality impact at the ASRs due to emissions from bus/ minibus termini and HGV/ coach parking sites, and industrial emissions. The quantitative assessment was conducted following the latest EPD's *Guidelines for Local-scale Air Quality Assessment Using Model*.

3.7.32 The Project site and the 500m Assessment Area fall within the PATH grids (35,52), (35,53), (36,52) and (36,53). The relevant PATH grids in which the representative ASRs are located have been identified and shown in **Appendix 3.1**. The predicted meteorological data for the relevant PATH grids from the PATH v2.1 model obtained from EPD's website were used for model input.

3.7.33 AERMET, the meteorological pre-processor of AERMOD, was run to generate AERMOD-ready meteorological data for AERMOD model input. The land use parameters, including Albedo, Bowen ratio and surface roughness are required inputs for AERMET. The land use of 1km from the identified ASRs within each PATH grid has been evaluated to determine the PATH-grid specific surface roughness values. The land uses of the 10km x 10km region from the Project site have been evaluated to determine the values of the Albedo and Bowen ratio for the PATH grids. Detailed calculations of albedo, Bowen ratio and surface roughness are presented in **Appendix 3.6**. Land use maps illustrating the determination of the land use parameters are also shown in **Appendix 3.6**.

3.7.34 The AERMET/AERMOD model input parameters and assumptions for operation phase AQIA are summarised in **Table 3.8**.

Table 3.8 AERMET / AERMOD Model Input Parameters and Assumptions for Operation Phase AQIA

Input Parameters & Assumptions	Descriptions
Air dispersion model	AERMOD
Type of Sources	• Industrial emissions: point sources • Emissions from bus/ minibus termini, HGV/ coach parking sites: area and volume sources
Assessment Parameter	• hourly and annual NO_2 • daily RSP and annual RSP • daily FSP and annual FSP
Assessment Heights	• 1.5m, 5m, 10m, 15m, 20m, 25m, 30m above ground • 40m to 130m (at interval of 10m) above ground
Meteorological data	• Weather Research and Forecasting Model (WRF) data in 2015 from the PATH v2.1 were used to input into AERMET to produce AERMOD-ready meteorological data • PATH grids: (35,52), (35,53), (36,52), (36,53) • Actual mixing heights recorded by the HKO in 2015 were in the range of 131m to 1,941m. Mixing heights from WRF data which are lower than 131m or higher than 1,941m were adjusted to 131m and 1,941m, respectively • Wind direction of 0º adjusted to 360º • Wind speed smaller than 1m/s adjusted to 1m/s • Anemometer height of WRF data = 9m

3.7.35 An EPD's recommended model, EMFAC-HK model (latest version, i.e. v4.3), was used to predict the vehicular emission factors of NO, NO_2, RSP and FSP for the 18 vehicle types in 2030 (i.e. the year with the predicted highest vehicular emissions within 15 years of commencement of operation). "EMFAC" mode was used for the model run. The latest *Use of Temperature and Relative Humidity Data for Vehicular Emission Factor Prediction* issued by EPD was followed for the treatment of ambient temperature and relative humidity in generating vehicular emission factors for this assessment. For assessment of short-term impact (i.e. 24-hour averaging or less) and long-term impact (i.e. annual averaging) from vehicular emissions, the lowest hourly temperature and lowest hourly relative humidity recorded at the nearest weather station (i.e. Sheung Shui Weather Station) in 2022 (i.e. 8,760 hours) was adopted in the EMFAC-HK to generate vehicular emission factors of NO, NO_2, RSP and FSP. Details of the temperature and relative humidity adopted in the assessment are provided in **Appendix 3.2**.

3.7.36 Summary of the composite vehicular NO, NO_2, RSP and FSP emission factors in 2030 for each road link within the 500m Assessment Area for CALINE4 input are provided in **Appendix 3.2**.

3.7.37 An EPD's recommended air dispersion model, CALINE4, was used for predicting the NO_2, RSP and FSP impacts due to vehicular emissions from the identified roads (proposed new and existing roads) within the 500m Assessment Area. Details of the road configurations are provided in **Appendix 3.3**.

3.7.38 As the road elevation of CALINE4 model is limited to 10m, three separate model runs (M1, M2 and M3) were conducted to avoid any underestimation of pollutant concentrations at ASRs located 10mAG or above. **Table 3.9** shows the properties of the model groups.

Table 3.9 Properties of CALINE4 Model Groups

CALINE4 Model Group	Road Link Height (mAG)	ASR Height (mAG)
M1	0-10	All ASRs
M2	10-20 (All road links in this group will be deducted by 10mAG in model)	ASRs with height >10mAG (All ASRs in this group will be deducted by 10mAG in model)
M3	10-20 (All road links in this group will be set to 10mAG)	ASRs with height ≤10mAG

3.7.39 For road sections with vertical noise barriers, the mixing width adopted is the road width plus 3m on the side without the barrier and the height of emissions is at the top of the barriers. For those with cantilever noise barriers, the mixing width adopted is the road width plus 3m on the side without the barrier and the modelled roads were shifted by the horizontal extent of the cantilever to the uncovered side with the height of emissions at the top of cantilevered barriers.

3.7.40 The surface roughness height is a required parameter for CALINE4 and it is closely related to the land use characteristics within a study area. The land use types (i.e. urban, new development, rural and water areas) within each of the concerned PATH grids have been examined. Typical values of surface roughness height used for urban, new development, rural and water areas are 370cm, 100cm, 50cm and 0.1cm, respectively. The area-weighted surface roughness height for each of the concerned PATH grids as presented in **Table 3.10** have been calculated based on the percentage coverage of the aforementioned land use types within the PATH grid and were adopted for the CALINE4 model run. Detailed calculations of the area-weighted surface roughness heights for the identified PATH grids are provided in **Appendix 3.7**. Land use maps illustrating the determination of surface roughness heights are also shown in **Appendix 3.7**.

Table 3.10 Area-weighted Surface Roughness Heights for CALINE4 Input

PATH Grid	Area-weighted Surface Roughness Height (cm)
35,52	159
35,53	298
36,52	268
36,53	308

3.7.41 Wind directional variability was calculated based on the following formula according to the stability class with reference to Irwin, J.S., 1980 [(6)].

$S_o = S \times (Z_o/15cm)^{0.2}$
Where Zo = is the surface roughness length (in cm) of the PATH grid; So = is the standard deviation of the horizontal wind direction Fluctuations (in degrees) S = is the standard deviation of the horizontal wind direction fluctuations (in degrees) for an aerodynamic surface roughness length of 15cm with reference to Irwin, J.S., 1980. S is a function of Pasquill stability class.

3.7.42 The standard deviations of the horizontal wind direction fluctuations under different Pasquill Stability categories for each of the concerned PATH grids are presented in **Appendix 3.7**.

(6) Dispersion Estimate Suggestion #8: Estimation of Pasquill Stability Categories. U.S. Environmental Protection Agency, Research Triangle Park, NC. (Docket Reference No.II-B-10), Irwin, J.S., 1980.

3.7.43 The CALINE4 model input parameters and assumptions for operation phase AQIA are summarised in **Table 3.11**.

Table 3.11 CALINE4 Model Input Parameters and Assumptions for Operation Phase AQIA

Input Parameters & Assumptions	Descriptions
Air dispersion model	CALINE4
Year of traffic flow	• 2030 (Year of predicted highest vehicular emissions within 15 years of commencement of operation)
Vehicular Emission Factors	• EMFAC-HK (latest version) emission factors in 2030
Assessment Parameter	• hourly NO_2 and annual NO_2 • daily RSP and annual RSP • daily FSP and annual FSP
Assessment Heights	• 1.5m, 5m, 10m, 15m, 20m, 25m, 30m above ground • 40m to 130m (at interval of 10m) above ground
Meteorological data	• Weather Research and Forecasting Model (WRF) data in 2015 from the PATH v2.1 • PATH grids: (35,52), (35,53), (36,52), (36,53) • Actual mixing heights recorded by the HKO in 2015 were in the range of 131m to 1,941m. Mixing heights from WRF data which are lower than 131m or higher than 1,941m were adjusted to 131m and 1,941m, respectively • Wind speed smaller than 1m/s adjusted to 1m/s • Stability class extracted from each concerned PATH grid in PATH v2.1 • Calculation of wind directional variability based on stability class and surface roughness length for each concerned PATH grid

Post-processing of Modelling Results

1-hour and annual NO_2 assessment

3.7.44 Ozone Limiting Method (OLM) was adopted for the conversion of NO_x to NO_2. For stack emissions, the hourly concentrations of NO_x were predicted at the relevant assessment heights of the identified ASRs. The initial NO_2/NO_x ratio for stack emissions was assumed to be 0.1[(7)], with NO and NO_2 comprising 90% and 10% of NO_x, respectively.

3.7.45 For vehicular emissions, NO_x and NO_2 emission factors for each vehicle type are provided in EMFAC-HK model (latest version, i.e. v4.3). NO emission factor for each vehicle type was determined by subtracting the NO_2 emission factor from the NO_x emission factor. The hourly concentrations of NO and NO_2 were separately predicted at the relevant assessment heights of the identified ASRs.

3.7.46 The predicted NO concentrations from all modelled sources were converted to NO_2 based on OLM and were then added with the predicted NO_2 concentrations from all modelled sources to determine the total predicted NO_2 concentrations at the ASRs. The total NO_2 concentrations were calculated as follows:

$$[NO_2]_{pred\ total} = [NO_2]_{pred} + MIN\ \{[NO]_{pred},\ or\ (46/48) \times [O_3]_{bkgd}\}$$

$[NO_2]$ pred total	= the total predicted NO_2 concentration
$[NO_2]$ pred	= sum of the predicted NO_2 concentration due to direct emissions from all sources
[NO] pred	= sum of the predicted NO concentration from all sources
MIN	= means the minimum of the two values within the brackets

(7) Air Quality Studies for Heathrow: Base Case, Segregated Mode, Mixed Mode and Third Runway Scenarios modelled using ADMS-Airport, 2007.

$[O_3]bkgd$	= the representative O_3 background concentration; (46/48) is the molecular weight of NO_2 divided by the molecular weight of O_3

3.7.47 The predicted O_3 concentrations in 2030 in the relevant PATH grids obtained from the PATH v2.1 model were used for the conversion of NO_x to NO_2 in OLM.

Background Concentrations (Tier 3)

3.7.48 The hourly background NO_2, RSP and FSP concentrations in 2030 predicted by the PATH v2.1 were used to establish the background contributions (Tier 3) for the cumulative AQIA. The predicted PATH background concentrations specific to the PATH grids within which the ASRs are located were adopted. The predicted PATH background concentrations adopted are conservative estimates with double counting of vehicular emissions.

3.7.49 As per *Guidelines on Choices of Models and Model Parameters* published by EPD, the RSP and FSP concentrations from PATH v2.1 were adjusted as below:

- 10^{th} highest daily RSP concentration: add 11.0μg/m^3;
- Annual RSP concentration: add 10.3μg/m^3;
- 19^{th} highest daily FSP concentration: Nil; and
- Annual FSP concentration: add 3.5μg/m^3.

Cumulative Pollutant Concentrations at ASRs

3.7.50 The predicted NO_2, RSP and FSP results from AERMOD and CALINE4 (Tier 1 and Tier 2 contributions) at the relevant assessment heights of each ASR were added up with the PATH background concentrations (Tier 3) on an hour-by-hour basis. Relevant time-period averages of the 8,760 hourly results for NO_2, RSP and FSP at the ASRs were calculated for comparison with the respective assessment criteria to evaluate compliance.

3.8 EVALUATION OF IMPACTS – OPERATION PHASE

Operation Phase

3.8.1 The cumulative NO_2, RSP and FSP impacts, taking into account vehicular emissions from open roads, bus and minibus termini, heavy goods vehicles and coach parking sites, and industrial emissions within the 500m Assessment Area, as well as background air quality in 2030 from PATH v2.1, have been evaluated at the identified representative ASRs during the operation phase of the Project. The predicted cumulative NO_2, RSP and FSP concentrations at the worst affected height of the identified representative ASRs during the operation of the Project ("Without DNR" scenario) are presented in **Table 3.12**. Detailed assessment results of all relevant assessment heights of the identified representative ASRs are provided in **Appendix 3.9**.

3.8.2 As presented in **Table 3.12** and **Appendix 3.9**, it can be seen that the predicted cumulative NO_2, RSP and FSP impacts at all relevant assessment heights of all identified representative ASRs during the operation of the Project under the "Without DNR" scenario comply with the respective AQO criteria.

Table 3.12 Predicted Cumulative Pollutant Concentrations at the Worst Affected Height of the Identified Representative ASRs during Project Operation ("Without DNR" Scenario)

ASR ID	Predicted Cumulative Concentrations (μg/m^3)					
	19th Highest Hourly NO_2	Annual NO_2	10th Highest Daily RSP	Annual RSP	19th Highest Daily FSP	Annual FSP
A01	124.2	30.5	66.6	28.0	36.4	16.1
A02	112.4	25.3	66.7	27.8	36.5	15.8
A03	113.4	26.0	66.6	27.8	36.4	15.9
A04	116.1	28.9	67.0	28.0	36.8	16.0
A05	112.4	23.3	66.6	27.7	36.4	15.8
A06	111.6	23.6	66.4	27.7	36.3	15.8
A07	108.7	20.6	66.6	27.6	36.4	15.7
A08	111.3	21.0	66.5	27.6	36.2	15.7
A09	119.4	27.1	67.5	27.9	36.7	15.9
A10	107.8	25.2	65.8	27.0	35.5	15.4
A11	104.8	22.3	65.6	26.9	35.4	15.3
A12	108.2	23.0	66.1	27.0	35.6	15.3
A13	112.1	22.3	66.3	26.9	35.6	15.3
A14	108.8	24.0	65.8	27.0	36.0	15.5
A15	119.0	28.8	66.7	27.8	35.9	16.0
A16	104.6	23.6	65.6	27.1	35.9	15.5
A17	119.4	29.5	66.2	27.9	35.7	16.0
A18	116.7	28.5	66.4	27.8	35.7	16.0
A19	115.9	29.6	67.4	28.0	37.0	16.1
A20	118.6	25.0	66.0	27.7	35.4	15.8
A21	113.4	26.7	66.5	27.8	35.8	15.9
A22	118.2	29.6	67.1	28.0	36.9	16.1
A23	105.9	22.2	65.6	26.9	35.4	15.2
A24	107.6	22.6	66.0	26.9	35.5	15.3
A25	116.5	22.5	66.7	27.7	36.3	15.8
A26	117.8	29.5	67.4	28.0	37.0	16.0
A27	114.7	26.7	67.3	27.9	36.6	15.9
A28	114.5	25.2	66.5	27.7	35.7	15.8
A29	110.1	21.2	66.0	26.9	35.8	15.4
A30	112.7	25.5	66.6	27.8	36.4	15.9
A31	118.1	32.0	66.7	28.1	36.8	16.2

ASR ID	Predicted Cumulative Concentrations (μg/m³)					
	19th Highest Hourly NO_2	Annual NO_2	10th Highest Daily RSP	Annual RSP	19th Highest Daily FSP	Annual FSP
AQOs	**200**	**40**	**100**	**50**	**50**	**25**

Notes:
(a) The hourly NO_2 AQO allows 18 exceedances over a year and the results presented are in the 19th highest.
(b) The daily RSP AQO allows 9 exceedances over a year and the results presented are in the 10th highest.
(c) The daily FSP AQO allows 18 exceedances over a year and the results presented are in the 19th highest.

3.8.3 The cumulative NO_2, RSP and FSP impacts at the identified representative ASRs during the operation of the Project under "With DNR" scenario have also been evaluated. Detailed assessment results of all relevant assessment heights of the identified representative ASRs are provided in **Appendix 3.10**.

3.8.4 As presented in **Appendix 3.10**, it can be seen that the predicted cumulative NO_2, RSP and FSP impacts at all relevant assessment heights of all identified representative ASRs during the operation of the Project under the "With DNR" scenario also comply with the respective AQO criteria. The difference in predicted cumulative pollutant concentrations at the ASRs between "With DNR" and "Without DNR" scenarios is summarised in **Table 3.13**.

Table 3.13 Difference in Predicted Cumulative Pollutant Concentrations at the Identified Representative ASRs between "With DNR" and "Without DNR" Scenarios during Project Operation

ASR ID	Difference in Predicted Cumulative Concentrations (μg/m³)					
	19th Highest Hourly NO_2	Annual NO_2	10th Highest Daily RSP	Annual RSP	19th Highest Daily FSP	Annual FSP
A01	-0.08 to 0.01	-0.01 to 0.01	0.00	0.00	0.00	0.00
A02	0.00 to 0.13	-0.02 to 0.01	0.00	0.00	0.00	0.00
A03	-0.16 to 0.00	-0.06 to 0.00	0.00	0.00	0.00	0.00
A04	0.00	-0.03 to 0.02	0.00	0.00	0.00	0.00
A05	-0.36 to 0.00	-0.04 to 0.02	0.00	0.00	0.00	0.00
A06	0.00 to 0.05	0.00	0.00	0.00	0.00	0.00
A07	0.00	-0.01 to 0.01	0.00	0.00	0.00	0.00
A08	0.00	-0.01 to 0.01	0.00	0.00	0.00	0.00
A09	-0.05 to 0.29	-0.07 to 0.12	0.00	0.00 to 0.01	0.00	0.00 to 0.01
A10	0.00 to 2.05	-0.10 to 0.16	-0.02 to 0.04	-0.01 to 0.01	0.00	0.00 to 0.01
A11	-0.01 to 0.03	-0.01 to 0.02	0.00	0.00	0.00	0.00
A12	-0.02 to 0.02	-0.01 to 0.02	0.00	0.00	0.00	0.00
A13	0.00 to 0.69	-0.06 to 0.09	-0.03 to 0.04	0.00	0.00 to 0.01	0.00
A14	-0.64 to 0.01	-0.02 to 0.03	0.00	0.00	0.00	0.00
A15	-0.02 to 0.00	-0.02 to 0.03	0.00	0.00	0.00	0.00
A16	-0.01 to 0.00	-0.15 to 0.19	-0.01 to 0.01	-0.01 to 0.01	-0.01 to 0.02	-0.01 to 0.01
A17	0.00 to 0.23	-0.01 to 0.01	0.00	0.00	0.00	0.00
A18	0.00	-0.01 to 0.01	0.00	0.00	0.00	0.00
A19	-0.02 to 0.07	-0.06 to 0.13	0.00	0.00 to 0.01	0.00 to 0.01	0.00 to 0.01

ASR ID	Difference in Predicted Cumulative Concentrations (μg/m³)					
	19th Highest Hourly NO_2	Annual NO_2	10th Highest Daily RSP	Annual RSP	19th Highest Daily FSP	Annual FSP
A20	0.00	0.00	0.00	0.00	0.00	0.00
A21	0.00	-0.03 to 0.04	0.00	0.00	0.00	0.00
A22	-0.31 to 0.10	-0.04 to 0.03	0.00	0.00	0.00	0.00
A23	0.00	-0.01 to 0.01	0.00	0.00	0.00	0.00
A24	-0.11 to 0.00	-0.01 to 0.00	0.00	0.00	0.00	0.00
A25	-1.26	-0.17	0.00	-0.01	0.00	-0.01
A26	-0.71	-0.32	0.00	-0.01	-0.01	-0.01
A27	-0.05	-0.04	0.00	0.00	0.00	0.00
A28	0.00	-0.08 to 0.13	0.00	0.00 to 0.01	0.00 to 0.01	0.00 to 0.01
A29	-1.37 to 2.48	-0.04 to 0.05	-0.01 to 0.02	0.00	0.00	0.00
A30	0.00	-0.18	0.00	-0.01	0.00	-0.01
A31	-1.39	-0.87	-0.01	-0.04	-0.06	-0.04

Notes:
(a) Figures shown are the range of differences in predicted pollutant concentrations among all relevant assessment heights of each ASR (“With DNR” scenario – “Without DNR” scenario).
(b) Negative values represent a reduction of predicted pollutant concentrations due to DNR during Project operation.

3.8.5 The predicted cumulative NO_2, RSP and FSP impacts at all relevant assessment heights of all identified representative ASRs during the operation of the Project under both the “Without DNR” and “With DNR” scenarios comply with the respective AQO criteria. The effect of the proposed DNR to be implemented for this Project is considered acceptable from an air quality perspective. Therefore, it can be concluded that adverse air quality impact associated with the operation of the Project is not anticipated.

3.8.6 Contour plots showing the cumulative NO_2, RSP and FSP impacts with the operation of the Project (“With DNR” scenario) at the worst-hit level (i.e. 1.5mAG) are provided in **Figures 3.7 to 3.12**. For annual NO_2 impact at 1.5mAG, it can be seen that most of the exceedance zones predicted are inside and/or near Sheung Shui Bus Terminus and Sheung Shui Station Minibus Terminus, while a few exceedance zones are predicted along the San Wan Road and Lung Sum Avenue, and at the So Kwun Po Interchange. No air sensitive uses were identified within these exceedance zones. As the Landmark North, which is a shopping mall, is located topside of the Sheung Shui Bus Terminus and Sheung Shui Station Minibus Terminus at about 10m above ground, an additional contour plot for cumulative annual NO_2 impact at 10mAG has been produced as shown in **Figure 3.13** to check if there is any predicted exceedance zones at such level. From **Figure 3.13**, it can be seen that no exceedances are predicted at 10mAG within the 500m Assessment Area except for one small exceedance zone along the Fanling Highway, which is not of air sensitive use. Besides, no exceedance zones are predicted within the 500m Assessment Area for 1-hour NO_2, 24-hour and annual RSP, and 24-hour and annual FSP impact during the operation of the Project (“With DNR” scenario). Therefore, it can be concluded that adverse air quality impact associated with the operation of the Project is not anticipated.

<u>Incremental Air Quality Impact arising from the Project</u>

3.8.7 In order to evaluate the air quality impact arising from the Project, the cumulative air quality impact without the operation of the Project (i.e. “Without Project” scenario) has also been predicted. The detailed predicted cumulative NO_2, RSP and FSP concentrations at all relevant assessment heights of the identified representative ASRs without the operation of the Project are presented in **Appendix 3.11**. The difference in predicted cumulative pollutant concentrations at the ASRs between with and without the Project operation is summarised in **Table 3.14**.

Table 3.14 Difference in Predicted Cumulative Pollutant Concentrations at the Identified Representative ASRs between With and Without Project Operation

ASR ID	Range of Predicted Cumulative Concentrations (µg/m^3)					
	19th Highest Hourly NO_2	Annual NO_2	10th Highest Daily RSP	Annual RSP	19th Highest Daily FSP	Annual FSP
A01	-0.14 to 0.52	0.00 to 0.28	0.00	0.00 to 0.01	0.00 to 0.01	0.00 to 0.01
A02	0.00 to 1.20	0.00 to 0.41	0.00 to 0.01	0.00 to 0.02	0.00 to 0.01	0.00 to 0.02
A03	0.02 to 1.89	0.56 to 0.89	0.00 to 0.01	0.03 to 0.05	0.04 to 0.05	0.03 to 0.04
A04	-0.04 to 1.95	0.10 to 0.25	0.01	0.01	0.01 to 0.04	0.01
A05	0.06 to 0.78	0.02 to 0.63	0.00	0.00 to 0.03	0.00 to 0.01	0.00 to 0.03
A06	-0.27 to 1.33	-0.01 to 0.23	0.00	0.00 to 0.01	0.00	0.00 to 0.01
A07	-0.02 to 0.00	0.12 to 0.13	0.00	0.01	0.00	0.01
A08	-0.22 to 0.00	0.10 to 0.13	0.01	0.01	0.00	0.01
A09	-0.01 to 0.98	0.13 to 0.56	0.02 to 0.11	0.01 to 0.03	0.00 to 0.02	0.01 to 0.03
A10	-0.37 to 0.95	0.03 to 0.15	-0.01 to 0.03	0.00 to 0.01	0.00 to 0.01	0.00 to 0.01
A11	-0.42 to 0.42	0.01 to 0.17	0.00 to 0.05	0.00 to 0.01	0.00 to 0.01	0.00 to 0.01
A12	0.00 to 0.59	0.09 to 0.12	0.03 to 0.04	0.00 to 0.01	0.01	0.00 to 0.01
A13	-0.54 to 1.80	0.06 to 0.10	0.00 to 0.01	0.00	0.00	0.00
A14	-0.06 to 2.04	0.00 to 0.18	0.00 to 0.02	-0.01 to 0.01	0.00 to 0.01	0.00 to 0.01
A15	-0.24 to 0.81	0.00 to 0.29	0.00 to 0.02	0.00 to 0.01	0.00 to 0.01	0.00 to 0.01
A16	-3.34 to 2.26	0.07 to 0.21	0.00 to 0.02	0.00 to 0.01	0.01 to 0.02	0.00 to 0.01
A17	-0.16 to 0.38	0.06 to 0.19	0.00	0.00 to 0.01	0.01 to 0.02	0.00 to 0.01
A18	-0.09 to 0.40	0.01 to 0.21	0.00	0.00 to 0.01	0.00 to 0.01	0.00 to 0.01
A19	-2.53 to 0.24	0.01 to 0.25	0.00 to 0.03	0.00 to 0.01	-0.03 to 0.00	0.00 to 0.01
A20	-0.05 to 0.86	0.00 to 0.14	0.00	0.00 to 0.01	0.00	0.00 to 0.01
A21	-0.24 to 0.33	0.01 to 0.17	0.00 to 0.01	0.00 to 0.01	0.00 to 0.01	0.00 to 0.01
A22	-0.90 to 1.77	0.03 to 0.15	0.01 to 0.03	0.00 to 0.01	0.00 to 0.07	0.00 to 0.01
A23	-0.06 to 0.17	0.03 to 0.21	0.01 to 0.04	0.00 to 0.01	0.00 to 0.01	0.00 to 0.01
A24	-0.76 to 0.07	0.09	0.02	0.00	0.01	0.00
A25	5.30	0.41	0.02	0.02	0.00	0.02
A26	-0.54	-0.01	-0.01	0.00	0.05	0.00
A27	0.27	0.34	0.10	0.02	0.01	0.02
A28	-0.01 to 0.29	0.17 to 0.22	0.01 to 0.02	0.01	0.01	0.01
A29	-0.80 to 1.78	0.00 to 0.16	0.00 to 0.04	0.00 to 0.01	0.00 to 0.01	0.00 to 0.01
A30	0.53	1.84	0.00	0.09	0.03	0.09

ASR ID	Range of Predicted Cumulative Concentrations (μg/m^3)					
	19th Highest Hourly NO_2	Annual NO_2	10th Highest Daily RSP	Annual RSP	19th Highest Daily FSP	Annual FSP
A31	1.97	4.37	0.06	0.23	0.28	0.21

Notes:
(a) Figures shown are the range of differences in predicted pollutant concentrations among all relevant assessment heights of each ASR (“Without DNR” Scenario – “Without Project” Scenario).
(b) Negative values represent a reduction of predicted pollutant concentrations due to the operation of the Project.

3.8.8 With the presence of the Project, the increment in cumulative air quality impact at the identified representative ASRs is relatively minor, with a maximum increase of annual NO_2, RSP and FSP concentrations of about 4.37μg/m^3, 0.23μg/m^3 and 0.21μg/m^3, respectively.

3.9 MITIGATION MEASURES

Construction Phase

3.9.1 The following dust control measures stipulated in the *Air Pollution Control (Construction Dust) Regulation* and good site practices will be incorporated into the Contract Specifications and implemented throughout the construction phase:

- Impervious sheet shall be provided for skip hoist for material transport;
- The area where demolition work or any dusty work takes place should be sprayed with water or a dust suppression chemical immediately prior to, during and immediately after such work as far as practicable;
- Establishment and use of vehicle wheel and body washing facilities at the exit points of the site;
- 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;
- All dusty materials should be sprayed with water or a dust suppression chemical immediately prior to any loading, unloading or transfer operation;
- Dropping heights for excavated materials should be controlled to a practical height to minimise the fugitive dust arising from unloading;
- During transportation by truck, materials should not be loaded to a level higher than the side and tail boards, and should be dampened or covered before transport;
- Temporary stockpiles of dusty materials shall be either covered entirely by impervious sheets or sprayed with water to maintain the entire surface wet all the time;
- Stockpiles of more than 20 bags of cement, dry pulverised fuel ash and dusty construction materials shall be covered entirely by impervious sheeting sheltered on top and 3-sides;
- All exposed areas shall be kept wet to minimise dust emission;
- Ultra-low Sulphur Diesel (ULSD) will be used for all construction plants on-site, as defined as diesel fuel containing not more than 0.005% sulphur by weight) as stipulated in *Environment, Transport and Works Bureau Technical Circular (ETWB-TC(W)) No 19/2005* on Environmental Management on Construction Sites;
- The engine of the construction equipment during idling shall be switched off;

- Regular maintenance of construction equipment deployed on-site shall be conducted to prevent black smoke emission;
- Non-road Mobile Machinery (NRMM), e.g. mobile generators and air compressors, shall comply with the prescribed emission standards with a proper label approved by EPD in accordance with the *Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation*; and
- Electric power supply for on-site machinery shall be provided as far as practicable for construction activities.

3.9.2 Weekly environmental site inspection is also recommended to ensure that the recommended mitigation measures and good site practices stated in **Section 3.9.1** will be implemented during the construction phase. Details of the monitoring and audit programme are discussed in the stand-alone EM&A manual.

Operation Phase

3.9.3 No adverse air quality impact during the operation of the Project is anticipated. Mitigation measures are thus considered not necessary during the operation phase.

3.10 CUMULATIVE IMPACT

Construction Phase

3.10.1 The construction period of the Project is tentatively from 2025 to 2030. Concurrent projects in the vicinity of the Project site have been identified and presented in **Table 2.5** and **Figure 2.4**. Concurrent projects that may have the potential to interact with the construction of the Project are summarised in **Table 3.15**.

Table 3.15 Summary of the Concurrent Projects in the Vicinity of the Project Site during Construction Phase

Project	Project Proponent	Construction Period
Housing Development in Ching Hiu Road	Civil Engineering and Development Department (CEDD)/ Housing Department (HD)	2022 to 2030
Housing Development in Fanling Area 17	CEDD/ HD	2023 to 2031
Expansion of North District Hospital	Architecture Service Department (ArchSD)/ Hospital Authority (HA)	2021 to 2028
Utilities Works and Junction Improvement Works for Partial Development of Fanling Golf Course Site	Civil Engineering and Development Department (CEDD)	2024 to 2029
Reclaimed Water Supply to Sheung Shui and Fanling	Water Supplies Department (WSD)	2021 to 2026

Note:
(a) The implementation of these projects would be subject to further development and subsequent actions of the respective project proponents.

3.10.2 The construction of the housing development at Ching Hiu Road is considered relatively small scale according to its site area. The site is currently flat land and the construction is expected to mainly involve piling and superstructure works. Therefore, the associated fugitive dust emissions are expected to be limited with proper implementation of dust suppression measures and good site practices. Cumulative dust impact from the construction of the housing development at Ching Hiu Road is expected to be minimal.

3.10.3 The site for North District Hospital Expansion has been formed and the upcoming construction is expected to mainly involve piling and superstructure works. Therefore, the associated fugitive dust emissions are expected to be limited with proper implementation of dust suppression measures and good site practices. The site is also at least 450m away from the Project site and thus cumulative dust impact is expected to be minimal.

3.10.4 Utilities Works and Junction Improvement Works for Partial Development of Fanling Golf Course Site, as well as Reclaimed Water Supply to Sheung Shui and Fanling project are considered as minor works, and the associated fugitive dust emissions are expected to be limited. Cumulative dust impact from the abovementioned utilities and junction improvement works is expected to be minimal.

3.10.5 The construction of the housing development at Fanling Area 17 may overlap with the construction of the Project. However, given the large separation distance from the Project site (more than 300m away), cumulative dust impact from the construction of the housing development at Fanling Area 17 is expected to be minimal.

3.10.6 In view of the above discussions, adverse cumulative air quality impact from the identified concurrent projects during the construction phase is not expected.

Operation Phase

3.10.7 Cumulative air quality impact during the operation of the Project has been evaluated as discussed in **Section 3.8**. No adverse air quality impact from concurrent projects in the vicinity of the Project site is anticipated.

3.11 RESIDUAL IMPACT

Construction Phase

3.11.1 Adverse residual air quality impact during the construction phase of the Project is not expected with the implementation of the mitigation measures as described in **Section 3.9** and those stipulated in the *Air Pollution Control (Construction Dust) Regulation*.

Operation Phase

3.11.2 Cumulative air quality impact during the operation of the Project is predicted to comply with the relevant AQO criteria as discussed in **Section 3.8**. Adverse residual air quality impact during the operation phase of the Project is not anticipated.

3.12 ENVIRONMENTAL MONITORING AND AUDIT

Construction Phase

3.12.1 Adverse air quality impact during the construction phase is not anticipated with the implementation of proper mitigation measures and good construction site practices. However, regular dust monitoring and environmental site inspections are recommended to be carried out during the construction phase to ensure the proper implementation of the recommended mitigation measures and that the mitigation measures are effective and to ensure that no nearby ASRs will be subject to adverse air quality impact. Representative and closest ASRs in all directions shall be selected for on-site dust monitoring to ensure that there is no adverse dust impact on the nearby ASRs. Details of the EM&A programme for air quality during the construction phase are provided in a standalone EM&A Manual.

Operation Phase

3.12.2 Adverse air quality impact arising from the operation of the Project is not anticipated. EM&A programme for air quality during the operation phase is considered not necessary.

3.13 CONCLUSION

Construction Phase

3.13.1 The construction of the Project primarily involves the construction of new at-grade roads, an underpass and flyovers, modification and realignment of existing roads, as well as associated junction modification works. The key construction activities associated with the construction of the Project include site clearance, slope works, ELS/ piling works and superstructure works. Slope works and ELS/ piling works are considered potential dust-generating activities and may generate fugitive dust emissions. With the implementation of relevant air quality mitigation measures stipulated in the *Air Pollution Control (Construction Dust) Regulation* and good construction site practices, adverse air quality impact due to construction works of the Project is not anticipated.

Operation Phase

3.13.2 The cumulative air quality impacts, taking into account emissions from the Project, emissions from adjacent emission sources (i.e. vehicular emissions from open roads, bus and minibus termini, heavy goods vehicles and coach parking site, industrial emissions within the 500m Assessment Area), as well as general background air quality in 2030, have been evaluated during the operation phase of the Project. The results conclude that the predicted cumulative NO_2, RSP and FSP impacts would comply with the relevant AQO criteria. Hence, adverse air quality impact due to the operation of the Project is not anticipated.