4 AIR QUALITY IMPACT ASSESSMENT

4.1 Introduction

This section of the EIA evaluates the likely air quality impacts associated with the operational phase of the Project. The study focuses on the future road traffic emission impacts (Nitrogen Dioxide (NO_2) and Respirable Suspended Particulates (RSP)) and considers the existing Air Pollution Control Ordinance (APCO), the Technical Memorandum on Environmental Impact Assessment Process (EIA-TM), representative sensitive receivers and potential sources of air pollutants. The APCO establishes a number of Air Quality Objectives (AQOs) which stipulate the allowable Hong Kong statutory limits for a range of pollutants, including NO_2 and RSP (Section 3, Table 3.1). This assessment has been undertaken to evaluate potential residual impacts and determine their acceptability.

In accordance with Clause 3.6.1 of the EIA Study Brief ESB-004/1998, no construction dust impact assessment is required for this EIA study. However, under this Chapter, the potential for the generation of construction dust will be addressed qualitatively and recommendations on the appropriate remedial actions to minimise any potential impacts will be provided. This will be done to ensure compliance with Air Pollution Control (Construction Dust) Regulations (section 43, cap.311 of Air Pollution Control Ordinance) and to ensure effective control of any potential dust impacts.

4.2 Description of Surrounding Environment

4.2.1 Baseline Conditions

In line with accepted vehicle related air modelling procedures in Hong Kong, no "baseline" air quality measurements have been taken as part of this study. To identify suitable background concentrations for the modelling work, reference has been made to the results recorded under the long term monitoring programme being carried out by EPD. The Tai Po Air Quality Monitoring Station is the closest station to the study area and the most recent available monitoring data from this station has been utilised as being representative of background conditions. Annual averages of Total Suspended Particulates (TSP), Respirable Suspended Particulates (RSP) and Nitrogen Dioxide (NO_2) for 1998 are summarised in Table 4.1. These values have been adopted as the RSP and NO_2 background levels for the air quality modelling for this study and will be added to the modelling results generated by Trinity Consultants' CALINE4 model (which is approved for use by EPD).

Table 4.1 TSP, RSP and NO_2 Monitoring Data for 1998 from the Tai Po Air Quality Monitoring Station

Pollutant	Concentration in micrograms per cubic metre ($\mu g/m^3$)			
	Highest 1-hour	Highest 24-hour	Highest monthly	Annual Average
TSP	-	156	98 (Jan)	68
RSP	354	129	72 (Jan)	50
NO_2	245	124	67 (Nov)	51

Reference: "Air Quality Monitoring Network – Air Quality in Hong Kong 1998, EPD.
Note: Annual Average AQO limits for TSP, RSP and NO_2 are 80, 55 and 80 $\mu g/m^3$, respectively.

The measured concentrations all meet the applicable AQOs.

4.2.2 Future Trends

EPD monitoring results for 1998 indicate an improvement over 1997 for the annual average concentrations of both RSP and TSP, while that for NO_2 is essentially unchanged (+ 1.0 $\mu g/m^3$). With the completion of the road widening works, the traffic volume along the roadways will increase and this may lead to an increase in the ambient levels of gaseous (NO_2) and particulate (RSP) pollutants. However, with the impending conversion of both taxis and mini buses to LPG, improvements in fuels (i.e., ultra-low sulfur diesel), the adoption of the Euro 3 and in future, Euro 4 standards for vehicle engines, as well as the retroffiting of catalytic oxidizers and particulate traps on goods vehicles which do not meet the applicable Euro standard, it is possible that the overall future impacts may actually be lower than those which exist currently. This, however, will ultimately depend upon the vehicle numbers, mix of vehicle types, along with the general state of repair of the engines in question.

4.3 Air Sensitive Receivers (ASRs)

The spatial scope for the assessment of air quality impacts is to be defined as 500 metres from the boundary of the work site in accordance with Clause 6.40.4 of the Brief. Air quality impacts have been assessed for the operational phase of the project only and relate to potential vehicle emission impacts from road traffic (RSP and NO_2).

In accordance with Annex 12 of the *Technical Memorandum on Environmental Impact Assessment Process, Environmental Impact Assessment Ordinance Cap. 499, S.16* (EIA-TM), domestic premises, hotels, hostels, hospitals, clinics, nurseries, temporary housing accommodations, schools, educational institutions, offices, factories, shops, shopping centres, places of public worship, libraries, courts of law, sports stadia or performing arts centres are considered as Air Sensitive Receivers (ASRs). A thorough review of all the latest Outline Zoning Plan, Outline Development Plans, and the Register of all the recent rezoning applications in the Technical Services section of the Planning Department was conducted in order to identify both existing and committed land uses in order to identify potential sensitive receivers. The Outline Zoning Plans and Outline Development Plans referred during the research are listed in Table 4.2.

Table 4.2 List of Outline Zoning Plans and Outline Development Plans

Outline Zoning Plan No.	Date
Kau Lung Hang – Outline Zoning Plan S/NE-KLH/1	24th June 1994
Draft Kau Lung Hang – Outline Zoning Plan S/NE-KLH/2	6th August 1999
Proposed Amendment on the Draft Kau Lung Hang – Outline Zoning Plan S/NE-KLH/1	12th September 1997
Fanling / Sheung Shui – Outline Zoning Plan S/FSS/7	27th February 1998
Fanling / Sheung Shui – Outline Zoning Plan S/FSS/8	2nd July 1999
Tai Po – Outline Zoning Plan S/TP/9	27 January 1998
Proposed Amendment on the Tai Po – Outline Zoning Plan S/TP/7	21st November 1997
Proposed Amendment on the Tai Po – Outline Zoning Plan S/TP/9	13th November 1998
Tai Po – Outline Zoning Plan S/TP/10	23rd March 1999
Draft Tai Po – Outline Zoning Plan S/TP/11	20th August 1999

Outline Development Plan No.	Date
Tai Po New Town Outline Development Plan D/TP/A (Provisional)	20th March 1990
Fanling / Sheung Shui Outline Development Plan D/FSS/A (Provisional)	20th March 1990

The 42 representative ASRs selected for the traffic related air quality impact assessment modelling were identified in the Working Paper WP1 - EIA Identification of Sensitive

Receivers (June 1999) and are detailed in Table 4.3 through Table 4.6 below. The identified ASR locations are shown in Figure 4.1.

Table 4.3 Selected Air Sensitive Receivers (ASRs) between Pak Wo Road and Hong Lok Yuen Road

Selected SR#	Description	Land Use[A]	Easting (m)	Northing (m)	Separation distance from kerbside (m)
SR1	Avon Park	R	832816	838702	90
SR2	Fanling Government Secondary School	Ed	832959	838483	48
SR3	Dawning Views	R	832993	838637	65
SR7	Southwest Tong Hang	R	833385	838652	56
SR9	Wo Hop Shek 2	R	833622	838357	28
SR11	Kiu Tau	R	833907	837945	10
SR17B	Tai Hang 3	R	833739	836634	14
SR20	Hong Lok Yuen 2	R	833730	836187	34
SR22	Wai Tau Tsuen 1	R	833311	835997	22
SR75	Wong Kong Shan	R	832918	838843	78
SR77	Yuen Leng 2	R	833988	837406	56

Notes:
[A] : Residential uses (R); Educational uses (Ed)

Table 4.4 Selected Air Sensitive Receivers (ASRs) between Hong Lok Yuen Road and Tai Po Tai Wo Road

Selected SR#	Description	Land Use[B]	Easting (m)	Northing (m)	Separation distance from kerbside (m)
SR23	Wai Tau Tsuen 2	R	833295	835868	32
SR25	Kau Liu Ha 2	R	833011	835521	22
SR28	Northwest Shek Kwu Lung	R	833802	834667	17
SR29	Parc Versailles	R	833960	834769	96

Notes:
[B] : Residential uses (R)

Table 4.5 Selected Air Sensitive Receivers (ASRs) between Tai Po Tai Wo Road and Tat Wan Road

Selected SR#	Description	Land Use[C]	Easting (m)	Northing (m)	Separation distance from kerbside (m)
SR31	Shek Kwu Lung 2	R	834198	834446	47
SR33	Shek Kwu Lung 3	R	834123	834155	26
SR34	Pun Chun Yuen	R	833952	834079	88
SR35	Buddhist Tai Kwong Middle School	Ed	834184	834144	54
SR36	Ma Wo 1	R	834428	833704	17
SR55	Dynasty View 2	R	834512	833565	53
SR56	Monastery at Ma Wo	T	834560	833482	16
SR78	Dynasty View 3	R	834643	833476	75

Notes:
[C] : Residential uses (R); Educational uses (Ed); Temple/Place of Worship (T)

Table 4.6 Selected Air Sensitive Receivers (ASRs) between Tat Wan Road and Island House Interchange

Selected SR#	Description	Land Use[D]	Easting (m)	Northing (m)	Separation distance from kerbside (m)
SR39	The Paragon	R	835904	833771	52
SR43	Wan Tau Tong Estate - Wan Lam House 2	R	835365	833624	29
SR45	HK Teacher's Association Secondary School	Ed	835532	833672	66
SR47	Wang Fuk Court – Wang Cheong House 1	R	836216	834105	42
SR54	Riverrain Bayside	R	836343	833757	65
SR57	King Nga Court – King Yuet House 1	R	835187	833453	95
SR61	Tak Nga Court 2	R	835143	833463	114
SR62	Ha Wun Yiu	R	834870	833294	41
SR64	Shan Tong New Village 1	R	835425	833404	27
SR66	P.L.K. Tin Ka Ping Primary School	Ed	835287	833553	119
SR68	Island House Park – Bicycle Track	Rec	836295	834237	40
SR69	Island House Park – Garden	Rec	836340	834282	85
SR70	Kwong Fuk Estate - Kwong Lai House	R	836215	834287	42
SR71	Tai Po Waterfront Park	Rec	836351	834501	63
SR72	Tai Po Waterfront Park	Rec	836591	834530	68
SR73	Island House Conservation Studies Centre	Ed	836473	834040	125
SR74	Yuen Chau Tsai - Tennis Court	Rec	836409	834015	58
SR100	KCRC Staff Quarter at Tai Po Kau	R	836803	833546	54

Notes:
[D] : Residential uses (R); Educational uses (Ed); Recreational uses (Rec)

4.4 Meteorology

In accordance with Clause 3.6.1 of the EIA Study Brief, detailed air pollutant modelling will only be conducted for the operational phase of the project. The meteorological parameters which are in line with current practice in Hong Kong have been adopted for the "CALINE4" modelling. These are summarised in Table 4.7.

Table 4.7 Meteorological Parameters

	Daytime	Night-time
Wind Direction :	45°	45°
Wind Speed :	1 m/s	1 m/s
Atmospheric Stability Class :	4 (D)	6 (F)
Mixing Height :	500 m	500 m
Wind Direction Standard Deviation :	18°	12°
Ambient Temperature :	25.5°C	25.5°C
Aerodynamic Roughness	100 cm	100 cm

Note: "Wind direction" input prompt of CALINE4 model requires the general wind direction in Hong Kong, i.e., north-easterly.

4.5 Construction Phase Air Quality Impacts

4.5.1 Identification of Air Quality Impacts

During the construction phase of the project, there is a potential for dust generation arising during demolition, earthworks, stockpiling of materials and vehicle movements. If unmitigated, these activities may lead to the generation of dust emissions that exceed the hourly and daily (24 hour) TSP criteria listed in Table 3.1 of Section 3.3.1. The potential dust

generation sources during the works are as follows:

1. demolition work including breaking concrete;
2. earthworks, including excavation, soil stripping, re-grading;
3. site clearance, including removal of vegetation and topsoil;
4. unloading and handling of excavated materials;
5. truck movements on unpaved haul roads;
6. wind blown dust from stockpiled materials;
7. deposition of dust from haulage trucks onto local roads.

In addition, there are also gaseous emissions from construction vehicles and Powered Mechanical Equipment (PME) such as air compressors and generators. However, emissions from construction vehicles will unlikely result in any adverse impacts due to their limited number. Moreover, with adequate house-keeping on site (detailed in Section 4.5.3) and regular maintenance of the PME, gaseous emissions are unlikely to result in any adverse impacts. Therefore, construction dust is considered to be the most important air quality issue during the construction phase of the work.

4.5.2 Evaluation of Potential Impacts

The total suspended particulate (TSP) impacts caused by construction dust generation at the identified ASRs may exceed the hourly limit of 500 $\mu g/m^3$ if unmitigated. With the implementation of dust mitigation measures however, dust emissions will be effectively controlled and will comply with the Statutory Hong Kong AQOs (presented in Table 3.1 of Section 3.3.1).

The existing highways will be fully utilised to serve as access roads and haul roads during the construction phase. Therefore, it is likely that there will only be a limited number of unpaved access / haul roads. As such, the dust generation from construction vehicle movements is considered to be minor.

4.5.3 Mitigation Measures

Construction dust impacts should be controlled within the 1-hour TSP criterion of 500 $\mu g/m^3$ and 24-hour TSP AQO 260 $\mu g/m^3$. Therefore, effective control measures must be implemented to meet the requirements of the Air Pollution Control (Construction Dust) Regulation. Typical dust control measures during the construction phases will include:

- restricting heights from which materials are dropped, as far as practicable to minimise the fugitive dust arising from unloading/loading;
- all stockpiles of excavated materials or spoil of more than $50m^3$ should be enclosed, covered or dampened during dry or windy conditions;
- effective water sprays should be used to control potential dust emission sources such as unpaved haul roads and active construction areas;
- all spraying of materials and surfaces should avoid excessive water usage;
- vehicles that have the potential to create dust while transporting materials should be covered, with the cover properly secured and extended over the edges of the side and tail boards;
- materials should be dampened, if necessary, before transportation;
- travelling speeds should be controlled to reduce traffic induced dust dispersion and re-suspension within the site from the operating haul trucks; and
- vehicle washing facilities will be provided to minimise the quantity of material deposited on public roads.

4.5.4 Dust Monitoring and Audit

To ensure construction dust impacts are controlled within the relevant standards as stipulated in Annex 4 of the TM-EIA, an environmental monitoring and audit program should be established and implemented by the Contractor throughout the construction period. Details of the monitoring and audit requirements are discussed in Section 11, Environmental Monitoring and Audit (EM&A).

4.6 Operational Phase Air Quality Impacts

4.6.1 Identification of Air Quality Impacts

As is standard Hong Kong procedure for assessing vehicle traffic related air quality impacts, both Nitrogen Dioxide (NO_2) (1-hour) and Respirable Suspended Particulates (RSP) (24-hour) have been evaluated. The actual modelling is based on the worst case hourly traffic flows (Year 2020) as prepared by the Study Team's Traffic Consultants. Modelling results have been compared against the applicable AQOs (1-hour NO_2 – 300 $\mu g/m^3$, 24-hour RSP – 180 $\mu g/m^3$) to establish compliance.

4.6.2 Assessment Methodology

The evaluation of traffic related air quality impacts resulting from the project was performed utilising the Gaussian dispersion CALINE4 model. In accordance with the requirements of the EIA Study Brief, all roads, including the widened Tolo and Fanling Highways, their associated slip roads and the existing roads within a 500 m radius of the project area, i.e., the proposed road widening works limit, have been considered in the CALINE4 model.

In order to verify the maximum potential air quality impacts of the future vehicle traffic in the area, vehicle emissions from the worst case predicted traffic flow within 15 years of the commissioning of the widened highways have been used. The worst case hourly traffic flows are predicted to be during the AM peak hour in Year 2020 (refer to Appendix 5.5).

The most updated vehicle emission factors available from the EPD are for the Year 2011 and these have been adopted for this assessment. The calculation of emission factors for each road is presented in Appendix 4.1. It is understood that the vehicle emission factors for Hong Kong traffic will decline with time due to improvements in vehicle engines, the increased use of catalytic converters and particulate traps, as well as improved fuel (i.e., LPG and low sulphur diesel). However, as the future emission factors beyond Year 2011 are not available, the year 2011 fleet average emission factors of NOx (oxides of gaseous nitrogen) and PM (particulate matter) are used. By doing so, it should be recognised that the modelling detailed below represents the worst case scenario and likely overestimates the resultant Year 2020 contaminant concentrations.

Background levels used in this study are adopted from the Tai Po Air Quality Monitoring Station (Air Quality in Hong Kong 1998, EPD). They are as follows:

- NO_2: 51 $\mu g/m^3$ - Annual Average
- RSP: 50 $\mu g/m^3$ - Annual Average

As is detailed in Section 5, two types of direct noise mitigation, in the form of vertical and canopy type barriers, have been proposed to abate adverse traffic noise impacts arising from the widened highways. In order to account for the presence of these barriers, the EPD required approach of raising the vehicle related air pollutant release height to the top of the barriers has been adopted in the assessment. This also represents a worst case scenario and is considered to be very conservative.

In addition, the "worst case" wind direction option has been selected for each run of the CALINE4 input files.

Nitrogen Dioxide (NO_2)

For the calculation of NO_2 concentrations, an approach taking into consideration the ozone limiting factor on NO_2 emissions, which is acceptable to EPD, has been adopted. As such, the 'NO_2' option is used in the CALINE4 model with the NOx emission factor being utilized. The following input parameters, as agreed with EPD, are used in the CALINE4 model:

- Ambient ozone concentration = 62 $\mu g/m^3$
- Nitrogen dioxide photolysis rate constant (1/second) = 0 (for the most conservative analysis)

It should be noted that an ozone limiting factor had been applied to the total NOx emissions. The use of the ozone option in CALINE4 is thought to represent a more realistic condition. An example of one of the NO_2 formation pathways is represented by the following reaction:

$$O_3 + NO \rightarrow NO_2 + O_2$$

Since only a limited number of road segments can be input into each CALINE4 data file, each run has to be divided into 6 separate input files. Because the total ozone background concentration (62 $\mu g/m^3$) must be utilised in each CALINE4 modelling file, the actual NO_2 formation is overestimated in each run. As a result, the overall predicted NO_2 concentrations are overestimated.

Respirable Suspended Particulates (RSPs)

Due to a limitation of the CALINE4 model, only 1-hour pollutant concentrations can be predicted. In order to provide an RSP concentration that is comparable to the 24-hour RSP Air Quality Objective (AQO), the RSP concentration has been modelled separately for daytime and nighttime periods and the daily concentration will be calculated based on the daytime and night-time results. The meteorological conditions for the daytime modelling are considered to be applicable during 0800-2100 hours, while the nighttime parameters are utilised for 2100-0800 hours. The meteorological conditions adopted for the CALINE4 model are presented in Table 4.7.

The averaged hourly traffic flow figures during the two time periods are calculated based on the 24 hour traffic flow breakdown figures (refer to Appendix 5.3). These are used in the CALINE4 model for the daytime and nighttime model. The 24-hour concentrations are then calculated by adding the predicted concentrations proportionally according to the relative durations, i.e., 13/24 of the daytime predicted concentrations plus 11/24 of the night-time predicted concentrations.

4.6.3 Impact Prediction

The ASR locations selected for the CALINE4 modelling, as presented in Final EIA Working Paper 2 (June 1999) are shown in Figure 4.1. Due to limitations within the CALINE4 model (source elevation input parameter range: –10 to +10 m; receptor elevation input parameter: must be positive), the pollutant concentrations at some ASR heights cannot be modelled directly. When the vertical separation between the road segment and the ASR is greater than 10 metres and the road segment is at a higher level than the ASR, the ASR has been modelled at 10 metres below that particular segment(s). By doing so, a conservative prediction is obtained and this is considered to be representative of the worst case scenario.

Air pollutant concentrations were evaluated at the worst case elevations for the corresponding ASRs. The worst case elevations were estimated with reference to the shortest slant separations between the nearest roads and the ASRs.

4.6.4 Modelling Results

It should be noted that the limitations of the CALINE4 model (as discussed earlier), as well as the lack of vehicle emission factors for year 2020, have led to the generation of extremely conservative results. As such, it is believed that the reported results are representative of the worst case scenario and, in certain instances, may overestimate the level of impact.

ASRs

The NO_2 and RSP modelling results for the Year 2020 "with barrier" scenario, including background concentrations for the 42 ASRs are presented in Table 4.8. As seen from the modelling results, no exceedances of the either the NO_2 hourly AQO limit (300 $\mu g/m^3$) or the RSP 24-hour AQO limit (180 $\mu g/m^3$) have been predicted for any of the representative ASRs at the worst case elevations and wind directions. The CALINE4 results summary is presented in Appendix 4.2 and samples of the CALINE4 output files are given in Appendix 4.3.

Table 4.8 Predicted Year 2020 Vehicular Air Quality Impacts at the Worst Case Elevations with Noise Barriers in Place

SR#	Description	Worst Case		Predicted NO_2 $\mu g/m^3$	Predicted RSP $\mu g/m^3$		
		Elevation mPD	Floor Level	1-hour + Background	Day (hourly average)	Night (hourly average)	24-hour+ Background
SR1	Avon Park	38.1	1/F	150.7	38.8	29.4	84.5
SR2	Fanling Government Secondary School	23.0	1/F	177.3	36.78	28.2	82.8
SR3	Dawning Views	32.5	1/F	179.2	51.3	37.2	94.8
SR7	Southwest Tong Hang	17.1	1/F	258.8	82.5	61.8	123.0
SR9	Wo Hop Shek 2	23.6	G/F	201.5	61.3	42	102.5
SR11	Kiu Tau	18.8	G/F	288.8	111.4	85.5	149.5
SR17B	Tai Hang 4	25.7	G/F	242.9	72.27	51.2	112.6
SR20	Hong Lok Yuen 2	32.9	G/F	151.4	43.3	42.2	92.8
SR22	Wai Tau Tsuen 1	30.9	1/F	259.1	68.8	51.3	110.8
SR23	Wai Tau Tsuen 2	31.4	1/F	261.0	111.4	81.8	147.8
SR25	Kau Liu Ha 2	24.5	2/F	207.1	57.67	47.6	103.1
SR28	Northwest Shek Kwu Lung	23.9	1/F	240.4	117.29	62.4	142.1
SR29	Parc Versailles	25.5	5/F	167.9	42.46	28.9	86.2
SR31	Shek Kwu Lung 2	15.3	2/F	241.9	51.2	40.2	96.2
SR33	Shek Kwu Lung 4	32.2	G/F	237.4	88.6	53.1	122.3
SR34	Pun Chun Yuen	58.8	G/F	153.2	46.2	30.6	89.1
SR35	Buddhist Tai Kwong Middle School	47.4	5/F	227.4	71.9	44.4	109.3
SR36	Ma Wo 1	45.9	1/F	276.5	122.5	66.5	146.8
SR39	The Paragon	37.3	1/F	186.4	56.4	40.2	99.0
SR43	Wan Tau Tong Estate - Wan Lam House 2	26.8	6/F	158.7	37.16	29.3	83.6
SR45	HK Teacher's Association Secondary School	25.6	5/F	219.0	57.86	38.9	99.2
SR47	Wang Fuk Court – Wang Cheong House 1	12.4	3/F	237.6	62.8	53	108.3
SR54	Riverrain Bayside	8.5	G/F	182.0	37	35.3	86.2
SR55	Dynasty View 1	57.3	8/F	190.3	58.2	37.9	98.9
SR56	Monastery at Ma Wo	45.2	1/F	181.3	57.6	40.4	99.7
SR57	King Nga Court – King Yuet House 1	37.0	9/F	158.3	34.9	28.5	82.0
SR61	Tak Nga Court 2	38.7	9/F	146.5	30.7	21.6	76.5
SR62	Ha Wun Yiu	32.3	1/F	240.2	96.6	52.7	126.5

SR#	Description	Worst Case		Predicted NO_2 µg/m³	Predicted RSP µg/m³		
		Elevation mPD	Floor Level	1-hour + Background	Day (hourly average)	Night (hourly average)	24-hour+ Background
SR64	Shan Tong New Village 1	44.3	G/F	227.9	87.3	49.7	120.1
SR66	P.L.K. Tin Ka Ping Primary School	29.6	6/F	165.2	33.4	28.6	81.2
SR68	Island House Park – Bicycle Track	8.6	G/F	198.3	49.7	37	93.9
SR69	Island House Park – Garden	9.0	G/F	169.0	39.2	34.1	86.9
SR70	Kwong Fuk Estate - Kwong Lai House	12.5	2/F	188.5	43.8	37.1	90.7
SR71	Tai Po Waterfront Park 1	9.2	G/F	148.5	30.3	27.3	78.9
SR72	Tai Po Waterfront Park 2	10.0	G/F	119.9	22.3	23.8	73.0
SR73	Island House Conservation Studies Centre	17.4	G/F	225.5	57.2	54.3	105.9
SR74	Yuen Chau Tsai - Tennis Court	17.4	G/F	281.6	71.3	65.2	118.5
SR75	Wong Kong Shan	18.4	1/F	195.4	47.8	40.5	94.5
SR77	Yuen Leng 2	23.9	G/F	216.3	65.82	55.5	111.1
SR78	Dynasty View 3	53.3	8/F	157.9	43.7	32.9	88.8
SR100	KCRC Staff Quarter at Tai Po Kau	10.2	1/F	174.8	42.2	43.5	92.8

Note: The NO_2 AQO hourly limit is 300 µg/m³**;** the RSP AQO 24-hour limit is 180 µg/m³

Study Area Concentration Isopleths

As per the requirements of the EIA Study Brief, both NO_2 and RSP concentration isopleths have been prepared to give an indication of the Year 2020 worst case traffic related air quality impacts within the vicinity of the project area (as shown in Figures 4.2.1 to 4.7.5). Three elevations have been selected for the presentation of the concentration contour maps: 6 mPD, 35 mPD and 64 mPD. These 3 elevations represent the lowest, midway and the highest spot levels of Tolo Highway and Fanling Highway (the main polluting sources) within the project area. As such, they are considered to be representative of the traffic related air quality impacts likely to be generated during the operation phase of this project.

The pollutant concentration isopleths have been prepared to illustrate the predicted air pollutant concentrations in 5 defined areas (1.5×2.2 km²), each covering an area of at least 500 m from either side of the project limit. The 5 areas are shown in Figure 4.8.

The concentration isopleth plots appear to be in general agreement with the modelled results for the discreet receptors presented in Table 4.8. It should be noted that the plots show that there are areas which may be affected by elevated air pollutant concentrations. However, since there are no existing / planned sensitive uses located in these areas, no impacts are anticipated. Nevertheless, this information can be utilised as a planning tool for determining the planning value for future development within the potentially impacted areas. However, this must be done in full appreciation of the relevant modelling parameters and assumptions, as well as clear understanding that these results are specific to this project. As such, any future variations to the proposed highway design and/or traffic flows will directly impact upon the accuracy/usefullness of these isopleths.

4.6.5 Mitigation Measures

The predicted concentration levels of NO_2 and RSP at the identified representative ASRs comply with the applicable AQOs. Therefore no mitigation measures are considered necessary.

4.6.6 Residual Impacts

No adverse residual air quality impacts are anticipated from the operation phase of the roadways included under this project *"Investigation Assignment for Widening of Tolo Highway / Fanling Highway between Island House Interchange and Fanling"*.

4.7 Conclusions and Recommendations

A qualitative assessment on the construction dust impacts has identified that fugitive dust is the primary potential air pollutant during the road widening works. Established dust suppression techniques such as regular watering of haul roads, covering / dampening any stockpiles and dampening dusty materials before transportation, have been proposed. Through the proper implementation of the recommended mitigation measures, dust generation will be controlled and will not exceed the acceptable criteria. This, however, will be further verified through the EM&A program which will be undertaken as part of the construction works.

The CALINE4 modelling results indicate that neither the hourly NO_2 AQO or 24-hour RSP AQO will be exceeded during the operation phase of this project. Because these results are based upon both the worst case traffic flows (Year 2020) and wind directions, it is concluded that the traffic related air quality impacts will be insignificant.

4.8 References

Environmental Protection Department (EPD), 1997, Technical Memorandum on Environmental Impact Assessment Process.

Environmental Protection Department (EPD), Air Services Group, 1997, Air Quality in Hong Kong 1997.

Air Pollution Control (Construction Dust) Regulations (Section 43, Cap.311 of Air Pollution Control Ordinance)