7. MITIGATION OF ADVERSE ENVIRONMENTAL IMPACTS

7.1 Construction Noise Impact

7.1.1 As discussed in Section 6.1, the majority of the existing NSRs are likely to be exposed to high construction noise in the Highest Construction Noise Scenario if unmitigated. Suitable noise mitigation measures should be provided to protect the affected NSRs throughout the construction period.

7.1.2 While it is not feasible to dictate the methods and schedule of construction and the equipment, including model and quantities, to be employed by the Contractor, noise control requirements can be incorporated in the Contract Documents, specifying the noise standards to be met and requirements of noise monitoring on the site. A set of recommended pollution control clauses is provided in Appendix H for incorporation into the Contract Documents. Also, details of the proposed environmental monitoring and audit (EM&A) requirements are contained in the EM&A Manual.

7.1.3 Potential noise control provisions to reduce noise levels from project activities include, but not be limited to, the following:

- Noisy equipment and activities shall be sited as far from sensitive receivers as is practical;
- Noisy plant or processes shall be replaced by quieter alternatives where possible. For example, pneumatic concrete breakers can be silenced with mufflers and bit dampers. Silenced diesel and gasoline generators and power units, as well as silenced and super-silenced air compressors, can be readily obtained. Manual operations are generally the most quiet, but they may require longer periods of time;
- Noisy activities can be scheduled to minimise exposure of nearby NSRs to high levels of construction noise. For example, noisy activities can be scheduled for midday, or at times coinciding with periods of high background noise (such as during peak traffic hours). Prolonged operation of noisy equipment close to dwellings should be avoided;
- Idle equipment shall be turned off or throttled down. Noisy equipment should be properly maintained and used no more often than is necessary;
- Construction activities shall be planned so that parallel operation of several sets of equipment close to a given receiver is avoided;
- If possible, the number of operating powered mechanical equipment(s) should be reduced;
- Construction plant should be properly maintained and operated. Construction equipment often has silencing measures built in or added on, e.g., bulldozer silencers, compressor panels, and mufflers. Silencing measures should be properly maintained and utilised;
- Temporary noise reduction measures such as curved or inverted-L acoustic barriers may be used to screen specific receivers. Enclosures for noisy activities such as concrete breaking should be provided where the noise impact is potentially severe; and

- The use of drilling machines for the foundation construction should be minimised as much as practicable.

7.1.4 The most effective mitigation measure is to control the sound emissions from the powered mechanical equipment used on site. This involves either selecting silenced equipment, or reducing the transmission of noise using mufflers, silencers, or acoustic enclosures. Table 7.1 shows the silenced type equipment in accordance with *BS 5228:Part I:1997* as noise control measures for the noisiest activities. Table 7.2 presents the range of mitigated construction noise levels at the affected NSRs adopting these silenced equipment.

7.1.5 Given the high-rise nature of NSRs within the Study Area, the use of acoustic enclosures and curved/inverted-L noise barriers (located close to the noise source) are considered appropriate especially in front of KL7 and CM4. Receiver-specific measures that include the use of mobile noise barriers will further alleviate the potential construction noise impacts. By adopting the use of silenced equipment in Table 7.1 and mobile noise barriers, the mitigated noise levels should comply with the daytime construction noise criteria.

Table 7.1 Silenced Equipment for Individual Single Construction Activities

Activity Construction	Equipment & SWLs		Proposed Silenced Type Equipment & SWLs	
Roadworks - Phase I	Backhoe Dump Truck	112 117	Wheeled excavator/loader (46kW) + Lorry (10t)	108
Bridge Works - Phase I	Large Diameter Bored Piling Rig (Oscillator or Grab-&-Chisel) Dump Truck	115 117	Large Diameter Bored Piling Rig (Oscillator or Grab-&-Chisel) Dump Truck (35t)	115 105
Subway & Retaining Walls Works - Phase I	Excavator Dump Truck	112 117	Wheeled excavator/loader (46kW) + Lorry (10t)	108

Table 7.2 Range of Mitigated Construction Noise Levels

NSR	Range of Construction Noise Levels, dB(A)				
	Road Works	Bridge Works	Subway Works	Retaining Wall Works	Overall*
KL2	62-64	-	-	-	65-67
KL7	69-71	56-61	53-57	68-72	75-78@
SC1	53-55	52-57	51-55	52-56	61-65
CM1	66-68	-	-	-	69-71
CM4	72-74	57-62	54-58	74-78	79-83@
CM6	63-65	59-64	54-58	64-68	70-74
ON2	57-79	61-66	56-60	58-62	67-72
ON6	58-60	65-70	56-60	50-54	69-74
ON8	60-62	62-67	-	50-54	67-71
CH1	68-70	57-62	51-55	49-53	71-74
CR2	65-67	54-59	49-53	47-51	69-71
CH2	62-64	56-61	48-52	57-61	67-70
SC6	68-70	52-57	46-50	54-58	71-74
ST4	58-60	51-56	46-50	52-56	63-66
ST6	53-55	52-57	47-51	52-56	61-64
MC1	58-60	46-51	-	51-55	62-65

- The facade is shielded from this activity.
* The overall noise levels have already included the +3 dB(A) facade effect.
@ The noise levels will be reduced by 5-10 dB(A) using mobile noise barriers. The permanent full enclosure, upon completion, will also further reduce the noise levels at these NSRs.

7.1.6 Apart from the above, the establishment of good community relations can be of great assistance to both the Contractor and local communities. Residents should be notified in advance of planned operations and informed of progress. If necessary, a liaison body can be established to bring together representatives of the affected communities, including the Government and the Contractor. In addition, residents should be provided with a telephone hotline number for the Engineer's office, where they may register complaints concerning excessive noise. If justified, the Engineer may authorise noisy operations to cease.

7.1.7 Cumulative Impact Assessment

In the vicinity of the Project, Mass Transit Railway Corporation (MTRC) has a reserve alignment for the future TKO Extension, and the expected completion date is tentatively the end of 2002. Though the alignment is expected to cut through many of the same Planning Areas (i.e. Areas 17, 23, 24, 38, 40 and 41) as that of the Study Area, the sensitive facades affected by this Project are not the same as those affected by the MTRC alignment construction. In other words, the sensitive facades facing the road improvement works will predominantly be affected by the construction noise generated from the road works, and the sensitive facades facing the railway alignment will predominantly be affected by its construction. Therefore, cumulative noise impact at the NSRs is virtually negligible.

According to the *Detailed Environmental Impact Assessment Report R9T for Tseung Kwan O Extension* completed in July 1997, the use of quiet plant, mobile noise barriers and site hoarding as well as limiting the number of equipment used at one time near critical NSRs, have been recommended. Given that all of the mitigation measures as mentioned above are being properly implemented in both projects, the cumulative noise levels should still comply with the noise criteria since the affected sensitive facades by the two projects are not likely to overlap.

7.2 Construction Dust Impact

7.2.1 Section 6.2 has shown that dust impact can be anticipated from the construction of the proposed roadworks in the vicinity to the T1/P1/P2 junction and therefore dust suppression measures are required especially for the open space areas. Potential dust suppression measures that are cost effective include watering of the works site twice per day, maintaining good housekeeping of the site and the implementation of the control measures as recommended in Appendix H as well as in the Air Pollution Control (Construction Dust) Regulation.

7.2.2 According to US EPA's AP-42, 5th publication, watering the working area twice a day can reduce dust emissions by about 50 percent. The implementation of other dust suppression measures, such as providing wheel-washing facilities at site exit(s) and covering of materials on trucks with tarpaulin sheeting, can also reduce the amount of dust generated considerably. As the effect of some of the measures cannot be quantified, it has been assumed that the implementation of these measures would reduce dust emissions by about 60%. Tables 7.3a & b and Figures 7-2 to 7-5 show the hourly and daily TSP concentrations at the outdoor sports playground and first-floor level assuming a minimal dust suppression of 60 percent. As can be seen, no significant dust impact would occur with dust suppression measures.

Table 7.3a Hourly and Daily TSP Concentrations at 1.5m Above Local Ground Level at Open Space Areas - Mitigated

ASR	TSP Concentrations in $\mu g/m^3$ at Local Ground Level at Open Space Areas	
	Hourly	Daily
OS1	206	113
OS2	275	133
OS3	252	147
OS4	229	91
OS5	241	95
OS6	244	134
OS7	197	107

Table 7.3b Hourly and Daily TSP Concentrations at First-Floor Receiver Level – Mitigated

ASR	TSP Concentrations in $\mu g/m^3$ at First-Floor Receiver Level	
	Hourly	Daily
KL2	121	86
KL3	146	93
KL7	228	121
SC11	133	88
MC1	111	83
SC9	176	96
SC6	244	129
ST6	140	92
CR2	140	83
CH1	166	87
ON6	160	91
ON2	137	88
CM1	154	96
CM2	228	117
CM4	283	127
CM6	144	96
SC1	148	91
CH2	172	102
HS2	109	84
VH1	88	79

7.2.3 Cumulative Impact Assessment

In anticipation of the construction of the MTRC TKO Extension in the vicinity of the Study Area, a comprehensive impact assessment has been carried out to quantify the amount of dust to be generated from the construction of the alignment. The cumulative impact of this Project and MTRC alignment construction at two of the representative worst-hit locations (ON2 & SC1) have been assessed. Assuming a worst-case scenario, the result shows that there would be significant exceedance at the ASRs that are close to the MTRC alignment and the roadwork (i.e. Chung Ming Court, On Ning Garden and King Lam Estate) if no dust suppression measures are applied. Dust suppression measures including the use of water sprays, blast nets and canvas covers, wind barriers and enclosures, wheel-washing, and paved haul roads within the site, etc. were recommended in the *Tseung Kwan O Extension: Final Detailed Environmental Impact Assessment.* The previously proposed dust suppression measures in this Project together with those mitigation measures recommended in the MTRC Report, will greatly minimize the impact. Without further mitigation measures, the mitigated cumulative impacts at the representative locations are predicted to comply with the AQO. The results are shown in Table 7.3c. Overall, the cumulative impact after implementation of the above recommended dust suppression measures should be reduced to within acceptable standards.

Table 7.3c Cumulative Hourly and Daily TSP Concentrations at First-Floor Receiver Level

ASR	TSP Concentrations in $\mu g/m^3$ at First-Floor Receiver Level						
	MTRC *β		Contract F β		Back-ground	Overall	
	Hourly	Daily	Hourly	Daily		Hourly	Daily
ON2	347	112	60	11	77	484	200
SC1	346	92	71	14	77	494	183

* Source: *Tseung Kwan O Extension: Final Detailed Environmental Impact Assessment* (July 1997)
β The background TSP level has been excluded

7.3 Traffic Noise Impact

7.3.1 As presented in the 'Do-Nothing' scenario, the receivers located near the roundabout are likely to be exposed to excessive noise from the proposed improvement work at the T1/P1/P2 junction in 2006, and thus mitigation schemes where feasible should be provided. Having considered the environmental setting of the site, the source-receiver configuration and the mitigation measures in the "Do-Nothing Scenario", the following combination of mitigation measures has been identified and evaluated for effectiveness:

- a full enclosure of about 120m along Po Shun Road in front of King Lam Estate and Chung Ming Court;
- a 5m plain barrier of about 265m on Slip Road A;
- an absorptive, 5.5m high inverted L-shaped barrier of about 155m on Slip Road C; and
- Low Noise Road Surfacing (LNRS) on the new segment of Road P2 and T1.

7.3.2 Figure 7-7 shows the locations of these proposed barriers and enclosures. Table 7.4 presents the mitigated noise levels including all of the above-mentioned measures. Appendices I and J give the detailed breakdown of the contributions of the recommended option and a less effective combination of barriers, respectively.

7.3.3 Evaluation of Effectiveness of the Identified Mitigation Measures

Area 5 - Hong Sing Garden Neighbourhood

No specific mitigation measure is provided for the sensitive receivers at Hong Sing Garden as the high noise levels are predominantly contributed by Po Lam Road North and Tseung Kwan O Tunnel Road, which are outside the current Project limit. The new road contribution is virtually negligible in that it contributes less than 1 dB(A) to the overall noise level. Therefore, the overall noise levels at the sensitive facades of Hong Sing Garden remain unaffected with the proposed locations of barriers.

Area 19 - Verbena Heights & Metro City Neighbourhood

As the nearest sensitive facades at Verbena Heights and Metro City Phase I are located about 170m beyond the current Project limit, any proposed barrier within the limit would only provide marginal benefit to the NSRs. Furthermore, engineering constraints preclude erection of additional structural members on the existing flyover and this limits any barriers to only the embankment section further south of the project limit. An inverted L-shaped barrier on the embanked section of the road has been examined, and the results show that the barrier provides no noise reduction to noise contribution from new road. In fact, noise contribution from the new roads amounts to less than 1 dB(A) overall. Therefore, no barrier is considered effective for this particular group of NSRs given the constraints.

Areas 23 & 24 - King Lam Estate Neighbourhood

Three segments of 5m high plain barriers along both sides of Po Shun Road as well as on the central divider have also been considered, but they could only reduce the noise levels at the lower-floor to middle-floor receivers at King Lam Estate, and thus the noise levels at upper-floor receivers still exceed the EIAO-TM criteria. Therefore, 5m plain barriers are not considered effective as they could not protect the upper-floor receivers.

As King Lam Estate and Chung Ming Court, both being high-rise receivers, are located on either side of Po Shun Road, a full enclosure is recommended to mitigate the high noise levels at King Lam Estate. As a result, the mitigated noise levels at all of the representative sensitive facades are expected to comply with the 70 dB(A) guideline except for the 5/F at KL3, which marginally exceeds the criteria by no more than 1 dB(A). As noise contribution from the new roads is less than 1dB(A) of overall noise levels, no direct mitigation measures is considered effective to further reduce the noise level at KL3.

As there was no allowance in the original design of the elevated Tseung Kwan O Tunnel Road for additional loading from noise screening structure, no barriers on the existing elevated part of Tseung Kwan O Tunnel Road are recommended. As an alternative, an inverted L-shaped barrier with a 2m horizontal extension along the northbound embankment section of Tseung Kwan O Tunnel Road was examined for effectiveness. The results show that the proposed barrier is acoustic ineffective to reduce the noise contribution from new road where is less than 1dB(A) of the total noise levels at NSRs MC, R and SC, hence, no barrier on the embankment section of Tseung Kwan O Tunnel Road is considered effective.

The effectiveness of plain barriers has also been examined, and the results conclude that they are even less effective especially for the upper floors of the schools.

Area 27 - Outlying Sensitive Receivers

No effective mitigation measure can be proposed along Road P2 for the church with air conditioning, hospital and nursing home as (a) the receivers are on high ground, (b) the elevated section of Po Hong Road partly screens the traffic on the underpass, (c) the cut slope between the road and the receivers drastically reduces the effectiveness of any roadside barriers. Furthermore, the dominant traffic noise impact is generated from existing road traffic namely Po Hong Road and Tseung Kwan O Tunnel Road, and the traffic from new roads contribute less than 1 dB(A) to the overall noise levels.

Area 37 - C/R Site & Adjacent Sites

The upper floors of NSRs CR1-CR3 would benefit from the recommended mitigation scheme near the junction by a noise reduction of 1-3 dB(A) at the sensitive facades.

The site is bounded by two schools, one on each side and a self-protective church of non-noise sensitive facades/blank facades facing Road P1 and with the provision of central air conditioning next to one of the two schools. The noise levels at the school site 37e (i.e. SC4) and the lower floors of the self-protective church (i.e. CH1) are predicted to comply with the 65 dB(A) guideline. However, the noise level at the top floor of CH1 is predicted to marginally exceed the noise limit by 1 dB(A).

No further mitigation measure is recommended for this area since the new road contribution from the Project roads is well below 70 dB(A) and the dominant traffic noise impact is generated from other existing roads.

Area 40 - On Ning Garden Neighbourhood

In order to protect the high-rise receivers at On Ning Garden, a 5m plain barrier on Slip Road A and an inverted L-shaped barrier on Slip Road C are recommended. As a result, the mitigated noise levels are reduced by 1-6 dB(A), and the majority of the representative sensitive facades are expected to comply with the 70 dB(A) guideline.

A more extensive combination of barriers on Slip Roads A and C (i.e. a typical inverted L-shaped barrier on Slip Road A and an inverted L-shaped barrier with 3m horizontal extension on Slip Road C) has been considered. However, this combination is not anymore effective than the recommended option in terms of the number of dwellings to be protected at On Ning Garden. Hence, the initial combination of barriers are recommended.

Area 41 - Chung Ming Court Neighbourhood

As discussed above, a full enclosure is recommended to mitigate the high noise levels at Chung Ming Court. The enclosure reduces the noise levels by 1-22 dB(A), and as a result, almost all of the representative sensitive facades comply with the 70 dB(A) guideline except for a marginal exceedance of 1-2 dB(A) at the 5/F -13/F of CM1. Due to safety and sightline requirement, the enclosure cannot be extended to fully protect CM1. Other possible mitigation measures, e.g. alternative alignment and barrier, have also been examined but considered not applicable due to space limitation by neighbouring land uses and traffic safety issues.

Three segments of 5m high plain barriers along both sides of Po Shun Road as well as on the central divider have also been considered. But they could only reduce the noise levels at the lower-floor to middle-floor receivers at Chung Ming Court.

With the proposed noise barriers, the noise levels at Po Leung Kuk Tseung Kwan O Primary School (i.e. SC5) located behind Fai Ming Court and Yin Ming Court are in the order of 59-61 dB(A), and therefore fully comply with the EIAO-TM criteria.

Area 59 - Sheung Tak Estate

With the above proposed barriers, the NSRs at Sheung Tak Estate also benefit by about 1 dB(A) noise reduction and additional dwellings are protected. Although the predicted noise levels at ST5 - ST9 still exceed the EIAO-TM criteria by 1-4 dB(A), the primary contributions come from existing roads such as Road D1, P2 and a nearby slip road. Therefore, no effective direct measures are recommended.

With the erection of a 6m/6.5m high plain barrier in front of the schools along Road P2, the noise levels at these schools, for the most part, comply with the 65 dB(A) noise criterion.

Future & Planned NSRs in Site 38b

The noise levels at these notional facades are further improved by 1-3 dB(A).

Table 7.4 Mitigated Noise Levels in Recommended Option

	Noise Levels in dB(A) at Various Floors								
NSRs	1/F	5/F	10/F	15/F	20/F	25/F	30/F	35/F	Top/F
HS1	78	79	79	78	78	77	77	76	76
HS2	82	82	81	80	80	79	79	78	78
HS3	79	78	78	78	77	77	76	76	76
HS4	85	83	82	81	80	80	79	79	78
VH1	76	76	76	76	76	-	-	-	-
VH2	76	76	76	-	-	-	-	-	-
VH3	77	77	76	76	76	76	76	76	-
VH4	61	65	66	67	71	72	72	72	-
MC1	74	76	77	77	76	76	76	76	76
MC2	70	71	72	73	72	72	72	72	72
MC3	70	72	73	73	73	73	73	73	73
MC4	66	70	71	71	71	71	71	71	71
MC5	64	67	69	69	70	70	69	69	69
R1	68	69	71	71	72	72	72	72	72
R2	68	70	73	73	73	73	73	74	73
R3	68	70	71	71	71	71	71	71	71
R4	67	68	69	70	70	70	70	70	70
R5	68	70	71	72	72	72	72	72	72
R6	66	69	70	71	71	71	71	71	71
KL1	43	49	60	60	61	61	61	61	61
KL2	69	70	70	69	69	69	69	69	69
KL3	70	71	70	70	69	69	69	68	68
KL4	68	69	68	68	67	67	66	66	66
KL5	60	62	62	63	63	63	63	63	63
KL6	69	70	70	70	69	69	68	68	68
KL7	59	66	66	66	66	66	65	65	65
KL8	61	65	67	67	67	67	66	66	66
CM1	69	72	71	71	-	-	-	-	-
CM2	68	70	70	69	69	68	68	67	67
CM3	45	57	59	59	58	58	57	57	57
CM4	59	69	69	68	68	67	67	67	66
CM5	59	65	67	67	66	66	66	65	65
CM6	60	66	67	67	67	66	66	66	66
CM7	59	64	66	66	66	66	66	66	66
CM8	58	62	64	65	65	65	65	65	65
CM9	56	59	61	62	63	63	63	63	63
ON1	55	58	60	61	62	62	62	62	62
ON2	62	64	66	68	69	69	69	69	69
ON3	61	62	64	66	67	67	67	68	68
ON4	58	60	60	62	63	63	63	63	63
ON5	63	65	67	69	70	70	70	70	70
ON6	62	65	68	70	70	70	70	70	70
ON7	62	65	67	69	70	70	70	70	70
ON8	62	65	67	70	70	70	70	70	70
ON9	58	61	63	67	67	68	67	67	67
CR1	55	62	65	66	66	66	66	66	66
CR2	64	69	69	70	70	69	69	68	68
CR3	69	69	71	70	70	69	69	68	68
ST1	54	56	62	66	66	66	66	66	66
ST2	56	59	65	69	69	69	69	69	69
ST3	62	67	70	70	70	70	70	70	70
ST4	60	67	68	68	69	69	68	68	68
ST5	64	71	71	71	71	71	71	70	70
ST6	70	73	73	73	73	72	72	72	72
ST7	72	74	73	73	73	72	72	71	71
ST8	70	71	71	71	71	71	70	70	70
ST9	71	73	72	72	71	71	70	70	70

Table 7.4 Mitigated Noise Levels in Recommended Option (Cont'd)

	Noise Levels in dB(A) at Various Floors		
NSR	1/F	3/F	6/F
SC1	66	66	67
SC2	67	68	69
SC3	51	53	59
SC4	59	59	62
SC5	59	60	61
SC6	61	64	-
SC7	51	53	59
SC8	51	53	62
SC9	59	61	-
SC10	57	60	64
SC11	72	73	74
CH1	63	63	66*
CH2	76	76	-
H1	71	71	-
H2	69	70	70
H3	72	72	-

* The top floor of the church is at 5/F.

	Noise Levels in dB(A) at Various Levels Above a 15m Podium		
NSR	10m	20m	30m
381	59	60	62
382	58	59	60

7.4 Vehicle Emissions Impact

7.4.1 The RSP and NO_2 concentrations resulting from the improved junction at Roads T1/P1/P2 along with the proposed noise mitigation measures as detailed in Section 7.3 have been predicted using the CALINE4 model and the Fleet Average Emission Factors described above. In order to show the air quality impact of the Project, contours of the maximum 1-hour average NO_2 and 24-hour RSP concentrations at 1.5m above ground in the open space areas and first-floor level are plotted in Figures 7-8 to 7-11. Designated discrete concentrations are presented in Table 7.5. It should be noted that NO_2 and RSP background have been included to obtain the cumulative impact. As shown in Tables 7.5 and 7.6 as well as the figures, the results indicate that there would be no exceedance of the relevant standards at the air sensitive uses along the road alignment.

Table 7.5 Hourly NO_2 and 24-hour RSP Concentrations at 1.5m Above Local Ground Level at Open Space Areas

ASR	Concentrations in $\mu g/m^3$ at Local Ground Level at Open Space Areas	
	NO2	RSP
OS1	150	125
OS2	226	167
OS3	169	124
OS4	132	106
OS5	169	128
OS6	132	93
OS7	132	88

7.4.2 Air quality impact on representative discrete receivers is also assessed, and the 1-hour NO_2 and 24-hour RSP concentrations at these ASRs are presented in Table 7.5 and 7.6. Assessed against the relevant standards, the modelling results indicate full compliance with the AQO at all the first-floor receivers' level and at 1.5m above local ground level at open space areas.

Table 7.6 1-Hour NO_2 and 24-Hour RSP Concentrations at First-Floor Receiver Level

ASR	Concentrations in $\mu g/m^3$ at First-Floor Level	
	NO_2	RSP
KL2	94	72
KL3	94	78
KL7	113	84
MC1	94	84
SC9	113	88
SC6	150	98
ST6	150	108
CR2	113	93
CH1	132	109
ON2	113	87
ON6	132	98
CM1	113	86
CM2	132	95
CM4	132	94
CM6	113	81
SC1	113	88
CH2	150	98
HS2	169	122
VH1	113	87
SC11	113	92

7.4.3 As a full enclosure is proposed along Po Shun Road in between Chung Ming Court and King Lam Estate, an additional air quality assessment was carried out to further assess the air quality inside the enclosure. The pollutants were assumed to eject from the portal as a portal jet such that 2/3 of the total emissions was dispersed within the first 50m of the portal and 1/3 of the total emissions within the second 50m, in accordance with the recommendation of PIARC 91. A sample calculation of composite emission factor for the full enclosure is included in Appendix K.

7.4.4 The maximum concentration of NO_2 under the worst case scenario inside the full enclosure is estimated to be 344 $\mu g/m^3$. The concentration has taken into account the contributions from vehicles inside the full enclosure as well as the boundary concentrations. A sample calculation is included in Appendix L.

7.4.5 Against the EPD's guideline of maximum NO_2 concentration (i.e. 1,800 $\mu g/m^3$) inside the vehicle tunnel, the impact on the drivers inside the proposed full enclosure along Po Shun Road is considered minimal.

7.5 Landscape And Visual Impacts

The scheme proposes the improvement of the existing T1/P1/P2 interchange from an at-grade roundabout to a grade separated interchange. It will cause a number of localised landscape and visual impacts. Mitigation measures have been formulated to alleviate these impacts. The mitigation measures for the scheme are as follows (refer to Figure 7-12 to 7-18):

- retention of all existing roadside planting, where possible;
- dense tree and shrub planting on any new cut slopes to create a landscape buffer zone and visual screen. Tree species used should be fast growing exotic species such as *Eucalyptus* and *Casuarina* to provide a quick screen with slower growing native species such as *Aleurites, Celtis, Machilus* and *Mallotus* used to provide the long-term vegetative cover and screen;
- re-instatement of street tree planting where it is required to be removed;
- transplantation of street tree planting within or in the vicinity of site, where it is regard to be removed, where possible;
- dense screen tree and shrub planting in the planned Open Space at Area 40. This plant will help screen the impact of the spilt level interchange from On Ning Garden, Hau Tak Estate and the future park users in Area 40 open space. Plants used in this area should be a mix of fast growing *Eucalyptus* and *Casuarina* species mixed with the slower growing native species of *Aleurities, Celtis* and *Mallotus*. Ornamental flowering shrubs should be used as an edge to the screen planting to provide seasonal display;
- dense tree and shrub planting in all roadside amenity areas within the interchange. Native tree species should be used in these areas, species should be selected for their form, resistance to pollutants and ease of maintenance, typical species would include *Michelia* and *Aleurities*;
- dense tree and shrub planting to screen all retaining walls and noise barriers/enclosure where possible;
- consideration of the design of, and hard materials finishes to, all elevated sections of road, particularly those section, together with their piers, in the planned Open Space at Area 40 incorporating the advice from Advisory Committee on the Appearance of Bridges and Associates Structures (ACABAS);

- consideration of the materials used to enhance the existing streetscape while maintaining consistency;
- consideration of the design of subway tubes and portals for consistency with the existing subways on or adjacent to the site and in conjunction with advice from ACABAS; and
- consideration of noise barrier design to create elements that are integrated within the scheme and the surrounding landscape, and incorporating the advice from ACABAS.

It should be noted that all proposed mitigation measures are within the site boundary.

The above mitigation measures will need to be further developed in the detailed design stage.

7.6 Land Use Impact

The proposed grade separated interchange T1/P1/P2 is not affecting existing and planned land use. Thus, land use mitigation measures are not required.