

4 NOISE IMPACT

4.1 Introduction

4.1.1 This section presents the noise impact assessment for the construction and operation phases of the Project. Existing and planned noise sensitive receivers in the vicinity of the study area have been determined. Potential noise impacts associated with the Project have been identified together with suggestions for any practicable mitigation measures.

4.2 Environmental Legislation, Policies, Plans, Standards and Criteria

General

4.2.1 Noise impacts were assessed in accordance with the criteria and methodology given in the Technical Memoranda (TMs) under the Noise Control Ordinance (NCO), and the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM).

4.2.2 The NCO and EIAO provide the statutory framework for noise control. Assessment procedures and standards are set out in the five TMs listed below:

- TM on Environmental Impact Assessment Process (EIAO-TM)
- TM on Noise from Construction Work other than Percussive Piling (GW-TM)
- TM on Noise from Percussive Piling (PP-TM)
- TM on Noise from Construction Work in Designated Areas (DA-TM)
- TM on Noise from Places other than Domestic Premises, Public Places or Construction Sites (IND-TM)

Construction Noise – General Construction

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

4.2.4 Between 1900 and 0700 hours and all day on Sundays and public holidays, activities involving the use of PME for the purpose of carrying out construction work is prohibited unless a construction noise permit (CNP) has been obtained. A CNP may be granted provided that the Acceptable Noise Level (ANL) for the NSRs can be complied with. ANLs are assigned depending upon the area sensitivity rating (ASR). The corresponding basic noise levels (BNLs) for evening and night time periods are given in **Table 4.1**.

Table 4.1 Construction Noise Criteria for Activity other than Percussive Piling

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

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

4.2.5 Despite any description or assessment made in this EIA on construction noise aspects, there is no guarantee that CNP will be issued for the project construction. The Noise Control

Authority will consider a well-justified CNP application, once filed, for construction works within restricted hours as guided by the relevant Technical Memoranda issued under the Noise Control Ordinance. The Noise Control Authority will take into account of contemporary conditions / situations of adjoining land uses and any previous complaints against construction activities at the site before making his decision in granting a CNP. Nothing in this EIA shall bind the Noise Control Authority in making his decision. If a CNP is to be issued, the Noise Control Authority shall include in it any condition he thinks fit. Failure to comply with any such conditions will lead to cancellation of the CNP and prosecution action under the NCO.

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

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

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

4.2.8 Percussive piling is prohibited between 1900 and 0700 hours on any weekday not being a general holiday and at any time on Sunday or general holiday. A CNP is required for the carrying out of percussive piling between 0700 and 1900 hours on any day not being a general holiday. PP-TM sets out the requirements for working and determination of the permitted hours of operations. ANLs for percussive piling for different types of NSRs are shown in **Table 4.2**.

Table 4.2 Acceptable Noise Levels for Percussive Piling

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

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

4.2.9 In accordance with PP-TM, the permitted hours of operation for carrying out of percussive piling work, subject to the issuance of a CNP, are listed in **Table 4.3**.

Table 4.3 Permitted Hours of Operation for Percussive Piling

Amount by which Corrected Noise Level (CNL) exceeds Acceptable Noise Level (ANL), CNL-ANL	Permitted hours of operation on any day not being a general holiday
-10 dB(A) < CNL-ANL	Nil

Amount by which Corrected Noise Level (CNL) exceeds Acceptable Noise Level (ANL), CNL-ANL	Permitted hours of operation on any day not being a general holiday
CNL-ANL ≤ -10 dB(A)	0700 to 1900

Construction Noise – Ground-borne Noise

4.2.10 Construction ground-borne noise is under the control of the Noise Control Ordinance (NCO), the Environmental Impact Assessment Ordinance (EIAO), and their subsidiary Technical Memorandum. With reference to the Technical Memorandum for the Assessment of Noise from Places Other Than Domestic Premises, Public Places or Construction Sites (TM-Places) under the NCO, the criteria for noise transmitted primarily through the structural elements of the building or buildings should be 10dB(A) less than the relevant acceptable noise level (ANL). These criteria apply to all residential buildings, schools, clinics, hospitals, temples and churches.

4.2.11 The construction ground-borne noise criteria for the representative ground-borne noise sensitive receivers along the alignment are tabulated in **Table 4.4** below.

Table 4.4 Ground-borne Noise Assessment Criteria

Description	Ground-borne Noise Criteria, dB(A)		
	Daytime (0700-1900 hrs) (except General Holidays & Sunday)	Daytime during general holidays and Sundays and all days during Evening (1900 to 2300 hrs)	Night (2300 to 0700 hrs)
Churches, School – Classrooms and Temples	60/55 ⁽¹⁾	55	N/A ⁽²⁾
Domestic premises, clinics ⁽³⁾ and hospitals	65	55	40

Notes:

- (1) A 5dB(A) reduction to the ground-borne noise criteria is recommended for school during examination period.
- (2) No sensitive use during this period.
- (3) Clinics are considered to be noise sensitive during daytime and evening time only.

4.2.12 For construction activities involving the use of PME in restricted hours (1900-0700), it is necessary to apply for a CNP. However, there is no guarantee that a CNP will be issued for the project construction.

Construction Noise – Blasting

4.2.13 There are no statutory procedures and criteria under the NCO and EIAO for assessing the blasting impacts and are therefore beyond the scope of the EIA. However, the administrative and procedural control of all blasting operations in Hong Kong is vested in the Mines Division of the Civil Engineering and Development Department (CEDD). The Dangerous Goods (General) Regulations, Chapter 295 also stipulates that no person shall carry out blasting unless he possesses a valid mine blasting certificate to be issued by the Mines Division of CEDD. The Superintendent of Mines will review the application on a case-by-case basis before issuing the Mine Blasting Certificate. Blasting should be carried out outside sensitive hours as far as practicable, and the blasting schedule should be submitted to the concerned authority for approval prior for its implementation.

Operation Road Traffic Noise

4.2.14 For road traffic noise, Annex 5, Table 1A “A Summary of Noise Criteria” of the EIAO-TM defines the criteria $L_{10(1 \text{ hour})}$ for the road traffic noise at various noise sensitive receivers (NSRs):

- 70dB(A) at the façades of residential dwellings, hotels, offices;
- 65dB(A) at the façades of schools, places of public worship, courts of law, places where unaided voice communication is required; and
- 55dB(A) at the façades of hospital or clinics.

Operation Phase Fixed Plant Noise

4.2.15 Fixed plant noise sources, such as tunnel ventilation shafts & pumping stations, are controlled by the NCO and IND-TM with a noise criteria of 5 dB(A) below the appropriate Acceptable Noise Levels (ANL) shown in Table 3 of the IND-TM or the prevailing background noise levels (for quiet areas with level 5 dB(A) below the ANL). The ANLs for different Area Sensitivity Ratings (ASRs) are summarised in **Table 4.5** below.

Table 4.5 Operational Noise Criteria for Fixed Noise Sources

Time Period	ANL, dB(A)			Criteria (ANL-5), dB(A)		
	ASR A	ASR B	ASR C	ASR A	ASR B	ASR C
Day (0700 to 1900 hours)	60	65	70	55	60	65
Evening (1900 to 2300 hours)	60	65	70	55	60	65
Night (2300 to 0700 hours)	50	55	60	45	50	55

4.2.16 The Project areas are located in the proximity to well developed urban areas and the prevailing background noise level measurements at selected representative NSRs have been conducted and it is demonstrated that the prevailing background noise level are higher than ANL-5. Thus, ANL-5 has been adopted for the fixed plant noise impact assessment. The ASR of the type of area within which the NSR is located was determined for assessment. When determining the ASR for a Noise Sensitive Receiver, the following are considered:

- The type of area within the concerned NSR is located;
- The Influencing Factor (IF) identified;
- The Degree to which the NSR is affected by IF; and
- If applicable, nearby OZP “Industrial” or “Industrial Estates” zone

4.2.17 A summary of the ASRs for the NSRs for the fixed plant noise assessment is given in **Table 4.6** and the locations of background noise measurement are shown in **Appendix 4.1b**.

Table 4.6 Summary of Measured Prevailing Background Noise Level

NSRs	Location	Time Period	Prevailing Noise Level, dB(A) (a) ⁽¹⁾	Area Sensitivity Rating	ANL-5 (b)	Criteria, dB(A) Min. of (a) & (b)
Yau Lai Estate Phase 1 (N1)	Bik Lai House, Yau Lai Estate Phase 1 & Block T, Yau Lai Estate Phase 5	Daytime	68	C ⁽²⁾	65	65
		Evening time	67	C ⁽²⁾	65	65
		Nighttime	61	C ⁽²⁾	55	55
Ocean Shores (N2)	Towers 1 & 3, Ocean Shores	Daytime	64	B	60	60
		Evening time	62	B	60	60
		Nighttime	58	B	50	50

Note:

(1) Measurements conducted in May 2011

(2) NSR affected by “major road” (Eastern Harbour Crossing Tunnel Road) that has heavy and generally continuous flow of vehicular traffic and, in normal circumstances, means a road with an annual average daily traffic flow in excess of 30,000.

4.3 Description of the Environment

4.3.1 The Study Area is located in Cha Kwo Ling, Lam Tin (LT) & Tseung Kwan O (TKO). The existing land uses in adjoining areas are residential and recreational uses. Eastern Harbour Crossing Tunnel Road, Po Yap Road, Po Shun Road and other distributor networks are dominant noise sources in the area.

4.4 Noise Sensitive Receivers

4.4.1 In order to evaluate the construction and operation noise impacts from the Project, representative NSRs within the Study Area are identified for assessment. Only the first layer of NSRs has been identified for assessment because it would provide acoustic shielding to those receivers at further distance behind.

4.4.2 With reference to the latest Outline Zoning Plans (OZP), Kai Tak OZP (Plan No. S/K22/4) dated September 2012, Cha Kwo Ling, Yau Tong, Lei Yue Mun OZP (Plan No. S/K15/19) dated June 2011 and Tseung Kwan O OZP (Plan No. S/TKO/20) dated April 2012, existing and planned NSRs including domestic premises and educational institutions within the assessment area were identified following the requirement of Annex 13 of the EIAO-TM. Photographs of all the identified existing NSRs are provided in **Appendix 4.1a**. For the purpose of the noise assessment, a number of representative assessment points (APs) were selected for the assessment which were considered to be potentially worst-affected NSRs. The NSRs and APs for construction, road traffic and fixed plant noise assessments are summarised in **Table 4.7** below and their locations are illustrated in **Figures 4.1 & 4.2**.

4.4.3 Based on the OZPs, the following planned/committed NSRs were identified for noise assessment.

- Planned Residential Site at Ex-Cha Kwo Ling Kaolin Mine Site;

- Planned Comprehensive Development Area (CDA) at Yau Tong Bay (YTB);
 - Planned Residential site at TKO Area 66; and
 - Planned Residential site at TKO Area 68
 - Planned GIC site at TKO Area 72
- 4.4.4 The APs for the planned NSRs located at planned residential site at ex-Cha Kwo Ling Kaolin Mine Site, CDA at YTB have been determined based on the building layout plans provided by the Planning Department (PlanD) and the YTB project proponent respectively.
- 4.4.5 During the assessment, there were no confirmed layouts for the planned residential areas and areas with noise sensitive uses at TKO Areas 66 and 68. In these cases, the locations of the representative planned NSRs would be in accordance with any site condition/restriction as stipulated in the OZP/Layout Plan. If not, these planned NSRs were assumed to be located at the respective zone boundary, which would be the nearest to the roads, as indicated in the identified assessment points for assessment.
- 4.4.6 With reference to the latest information from PlanD, Area 72 is for the future development of a Fire Station, a sub-divisional police station and a site of undesignated GIC usage respectively. As the Fire Station and Police Station are of non noise sensitive usage, they have not been identified as an NSR for the assessment.
- 4.4.7 The proposed land-use arrangements for the northern portion of Area 72 as agreed with PlanD has been updated so that the “left hand side” of the site will be of undesignated GIC usage while the “right hand side” will be reserved for a sub-divisional police station. For the “left hand side” of the site of undesignated GIC usage, there will be a planning constraint of non noise sensitive use to be imposed along the northern façade of the building as agreed with PlanD. The building layout of TKO Area 72 could be designed by either avoiding locating noise sensitive uses along the northern façade of the building so that they do not face the major traffic noise sources (such as Chui Ling Road, P2 and Po Shun Road), providing the noise sensitive uses with window insulation and air conditioning which should be incorporated into the land lease conditions, providing setbacks and/or constructing boundary walls to further reduce traffic noise at the receiver end. As such, no planned NSR APs have been identified for the northern façade of the portion of Area 72 reserved for undesignated GIC usage and the NSR APs identified at the other facades of this site are assumed to be located at the site boundary, as indicated in the identified assessment points for the assessment shown in **Figure 4.2**.
- 4.4.8 Several site visits have been conducted to verify that the Village Houses near Chiu Keng Wan (shown in **Figure 4.1** (Sheet 3 of 4)), within the study area are of non noise sensitive usage as the structures were found to be abandoned and uninhabited. As such, no NSR APs have been identified for this area for the assessment.
- 4.4.9 Based on current information from PlanD, the reasons for not identifying the G/IC sites in the vicinity of Cha Kwo Ling Road and at TKO Area 67 as planned NSR in this EIA study are due to the facts listed in below:
- G/IC site at in the vicinity of Cha Kwo Ling Road: it is reserved for the possible refuse transfer station.
 - G/IC site at TKO Area 67: it is reserved for the development of a Civic Node. The Civic Node will comprise a cultural complex/town hall, Government offices, lorry park and public car parking facilities. No planned noise sensitive uses for this site have been identified at present stage.
- 4.4.10 Representative construction ground-borne noise NSRs and APs were identified for the

assessment of noise impact during the construction of the Project. As for the assessment of noise impact due to the use of PME for rock breaking / drilling, including hydraulic breakers, drill rigs and pile rigs, inside the tunnel, two representative APs located in the closest proximity to the tunnel alignment were identified. These identified ground-borne NSRs are presented in **Table 4.7** and shown in **Figures 4.1 to 4.2**.

Table 4.7 Representative NSRs and APs for Noise Impact Assessment

Noise Sensitive Receivers (NSR ID)	Existing / Planned Land Use	No. of Storeys	AP ID	Location / Description	No. of Storeys	Construction Phase		Operation Phase	
						Airborne	Ground-borne	Road Traffic Noise	Fixed Plant Noise
Yau Lai Estate Phase 1 (NSR 1)	Residential	40 - 46	N1101	Block A Nga Lai House, Yau Lai Estate Phase 1	46	x	x	✓	x
			N1102		46	✓	x	✓	x
			N1103		46	x	x	✓	x
			N1104		46	x	x	✓	x
			N1201	Block B Bik Lai House, Yau Lai Estate Phase 1	40	x	x	✓	x
			N1202		40	x	x	✓	x
			N1203		40	x	x	✓	x
			N1204		40	✓	x	✓	✓
			N1301	Block D Sau Lai House, Yau Lai Estate Phase 1	40	x	x	✓	x
			N1302		40	x	x	✓	x
			N1303		40	x	x	✓	x
			N1304		40	x	x	✓	x
			N1401	Block F Yi Lai House, Yau Lai Estate Phase 1	40	x	x	✓	x
			N1402		40	x	x	✓	x
			N1403		40	x	x	✓	x
			N1404		40	x	x	✓	x
			N1501	Block E Yat Lai House, Yau Lai Estate Phase 1	46	x	x	✓	x
			N1502		46	x	x	✓	x
			N1503		46	x	x	✓	x
			N1601	Block C Chi Lai House, Yau Lai Estate Phase 1	46	x	x	✓	x
N1602	46	x	x		✓	x			
Yau Lai Estate Phase 5 (NSR 2)	Residential	39 - 40	N2101	Block S, Yau Lai Estate Phase 5	40	x	x	✓	x
			N2102		40	x	x	✓	x
			N2103		40	x	x	✓	x
			N2104		39	x	x	✓	x
			N2105		39	✓	x	✓	x
			N2201	Block T, Yau Lai Estate Phase 5	39	x	x	✓	x
			N2202		39	x	x	✓	✓

Noise Sensitive Receivers (NSR ID)	Existing / Planned Land Use	No. of Storeys	AP ID	Location / Description	No. of Storeys	Construction Phase		Operation Phase	
						Airborne	Ground-borne	Road Traffic Noise	Fixed Plant Noise
			N2203		40	x	x	✓	x
			N2204		40	x	x	✓	x
			N2205		40	x	x	✓	x
			N2206		40	x	x	✓	x
Tin Hau Temple (NSR 3)	Place of Public Worship	1	N3101a	Tin Hau Temple	1	✓	x	✓	x
			N3101b		1	x	x	✓	x
Physartrain 90's Sports & Leisure Centre (NSR 4)	Educational	2	N3102	Physartrain 90's Sports & Leisure Centre	2	x	x	✓	x
Cha Kwo Ling Tsuen (NSR 5)	Residential	2	N3103	No. 26E, Cha Kwo Ling Tsuen	2	x	x	✓	x
			N3104	No. 121, Cha Kwo Ling Tsuen	1	✓	x	x	x
		2	N3105	No. 100, Cha Kwo Ling Tsuen	2	x	✓	x	x
Kwong Tin Estate (NSR14)	Residential	26	N3201	Kwong Ching House, Kwong Tin Estate	26	x	✓	x	x
Kei Faat & Kei Hin Primary School (NSR 6)	Educational	7	N4101	Kei Faat Primary School	7	✓	x	✓	x
SKH Yau Tong Kei Hin Primary School (NSR 7)	Educational	7	N4101	SKH Yau Tong Kei Hin Primary School	7	x	x	✓	x
Ocean Shores (NSR 8)	Residential	48 - 48	N5011	Block 1, Ocean Shores	48	x	x	✓	x
			N5012		48	✓	x	✓	✓
			N5013		48	x	x	✓	x
			N5031	Block 3, Ocean Shores	48	x	x	x	✓
			N5071	Block 7, Ocean Shore	48	x	x	✓	x
			N5072		48	✓	x	✓	x
			N5073		48	x	x	✓	x
			N5171	Block 17, Ocean Shore	48	x	x	✓	x
N5172	48	x	x		✓	x			

Noise Sensitive Receivers (NSR ID)	Existing / Planned Land Use	No. of Storeys	AP ID	Location / Description	No. of Storeys	Construction Phase		Operation Phase	
						Airborne	Ground-borne	Road Traffic Noise	Fixed Plant Noise
			N5173		48	x	x	✓	x
Metro Town (NSR 9)	Residential	50 - 55	N6101	Tower 1, Metro Town	55	✓	x	✓	x
			N6102		55	x	x	✓	x
			N6201	Tower 2, Metro Town	55	x	x	✓	x
			N6202		55	x	x	✓	x
			N6301	Tower 3, Metro Town	50	x	x	✓	x
			N6302		50	x	x	✓	x
Park Central (NSR 10)	Residential	46 - 48	N7001	Central Heights, Park Central	48	x	x	✓	x
			N7002		48	x	x	✓	x
			N7101	Tower 1, Park Central	48	x	x	✓	x
			N7102		48	x	x	✓	x
			N7201	Tower 2, Park Central	48	x	x	✓	x
			N7202		48	x	x	✓	x
			N7301	Tower 3, Park Central	48	x	x	✓	x
			N7302		48	x	x	✓	x
			N7501	Tower 5, Park Central	48	x	x	✓	x
			N7502		48	x	x	✓	x
			N7601	Tower 6, Park Central	48	x	x	✓	x
			N7602		48	x	x	✓	x
			N7603		48	✓	x	✓	x
			N7604		48	x	x	✓	x
			N7605		48	x	x	✓	x
			N7701	Tower 7, Park Central	46	x	x	✓	x
N7702	46	x	x		✓	x			
Tong Ming Court (NSR 11)	Residential	40	N8101	Block A Tong Fai House, Tong Ming Court	40	x	x	✓	x
			N8102		40	x	x	✓	x
Choi Ming Court (NSR 12)	Residential	20 - 40	N8103	Block E Choi To House, Choi Ming Court	40	x	x	✓	x
			N8104		20	x	x	✓	x

Noise Sensitive Receivers (NSR ID)	Existing / Planned Land Use	No. of Storeys	AP ID	Location / Description	No. of Storeys	Construction Phase		Operation Phase	
						Airborne	Ground-borne	Road Traffic Noise	Fixed Plant Noise
Po Kok Secondary School (NSR 13)	Educational	8	N9101	Po Kok Secondary School	8	x	x	✓	x
Planned Residential Site at Ex-Cha Kwo Ling Kaolin Mine Site (PNSR 1)	Planned Residential	16 - 23	PN1000	Planned NSR at Ex-Cha Kwo Ling Mine Site - Block 6	21	x	x	✓	x
			PN1001		21	x	x	✓	x
			PN1002		21	x	x	✓	x
			PN1003	Planned NSR at Ex-Cha Kwo Ling Mine Site - Block 7	23	x	x	✓	x
			PN1004		23	x	x	✓	x
			PN1005		23	x	x	✓	x
			PN1006	Planned NSR at Ex-Cha Kwo Ling Mine Site - Block 11	17	x	x	✓	x
			PN1007		17	x	x	✓	x
			PN1008	Planned NSR at Ex-Cha Kwo Ling Mine Site - Block 12	17	x	x	✓	x
			PN1009		17	x	x	✓	x
			PN1010		17	x	x	✓	x
			PN1011	Planned NSR at Ex-Cha Kwo Ling Mine Site - Block 13	17	x	x	✓	x
			PN1012		17	x	x	✓	x
			PN1013		17	x	x	✓	x
PN1014	Planned NSR at Ex-Cha Kwo Ling Mine Site - Block 14	16	x	x	✓	x			
Planned Residential Site at Yau Tong Bay (PNSR 2)	Planned Residential	27 - 29	PN1200	Planned NSR at Yau Tong Bay Redevelopment Tower 14	27	x	x	✓	x
			PN1201		27	x	x	✓	x
			PN1202		27	x	x	✓	x
			PN1203		27	x	x	✓	x
			PN1204		27	x	x	✓	x
			PN1205		27	x	x	✓	x
			PN1206	Planned NSR at Yau Tong Bay Redevelopment Tower 13	29	x	x	✓	x
			PN1207		29	x	x	✓	x
			PN1208		29	x	x	✓	x
Planned	Planned	15	PN2661 ⁽¹⁾	Planned NSR at TKO Area 66	15	x	x	✓	x

Noise Sensitive Receivers (NSR ID)	Existing / Planned Land Use	No. of Storeys	AP ID	Location / Description	No. of Storeys	Construction Phase		Operation Phase	
						Airborne	Ground-borne	Road Traffic Noise	Fixed Plant Noise
Residential Site at TKO Area 66 (PNSR 3)	Residential		PN2662		15	x	x	✓	x
			PN2663		15	x	x	✓	x
			PN2664		15	x	x	✓	x
			PN2665		15	x	x	✓	x
Planned Residential Site at TKO Area 68 (PNSR 4)	Planned Residential	9 - 14	PN2681	Planned NSR at TKO Area 68	9	x	x	✓	x
			PN2682		9	x	x	✓	x
			PN2683		14	x	x	✓	x
			PN2684		14	x	x	✓	x
			PN2685		14	x	x	✓	x
Planned GIC Site of undesignated usage at TKO Area 72 (PNSR 5)	Planned GIC	13	PN2724	Planned NSR at TKO Area 72	13	x	x	✓	x
			PN2725		13	x	x	✓	x

Note:

✓ Selected for assessment; ✗ Not selected for assessment

(1) Located at 5m from site boundary/boundary of breezeway

4.5 Assessment Methodology

Construction Noise – Airborne Noise

- 4.5.1 The construction activities of the Project taking place concurrently within 300 m of a given NSR are considered to contribute to the cumulative impact at that NSR. Noise sources from the areas greater than this distance were excluded from the assessment.
- 4.5.2 The methodology outlined in the GW-TM was used for the assessment of construction noise (excluding percussive piling). Sound Power Levels (SWLs) of the equipment were taken from Table 3 of this TM. Where no SWL is provided in the GW-TM, reference was made to BS 5228 or other previous similar studies or from measurements taken at other sites in Hong Kong. A positive 3 dB(A) façade correction was added to the predicted noise levels in order to account for the facade effect at each noise assessment point.
- 4.5.3 Referring to the construction programme of the Project and other projects within the study area, it is noted that the construction period of Trunk Road T2 and Cross Bay Link (CBL) do overlap. For the Cha Kwo Ling side, cumulative construction noise assessment was conducted to incorporate the construction works of the Trunk Road T2 project that lie in the vicinity of the Project with information provided by the T2 project consultant. For the TKO side, the separation distance between the CBL and the nearest NSR (Ocean Shore) would be more than 600m. No cumulative impacts would be expected during the construction phase.

Construction Noise – Ground-borne Noise

- 4.5.4 The methodology is based on the method recommended by the U.S. Department of Transportation and Federal Transit Administration¹. This projection methodology has been previously used for Ground-Borne Noise & Vibration Assessment for approved Kowloon Southern Link (KSL) EIA² (EIA Register No. AEIAR-083/2005).
- 4.5.5 The main components of the proposed prediction model for ground-borne noise are:
- Vibration propagation through the ground to the structure foundation;
 - Vibration reduction due to the soil/structure interface;
 - Vibration propagation through the building and into occupied areas; and
 - Conversion from floor and wall vibration to noise.
- 4.5.6 The empirical based prediction model used to project noise level within occupied areas of the structures adjacent to the tunnelling works is described below. The basic equation describing the model, in decibels, is

$$L = FDL + LSR + BCF + BVR + CTN$$

where the prediction components are:

- L ground-borne noise level within the structure, re: 20 μ -Pascal,
FDL force density level for the TBM in rock, mixed face or soil, re: 1 lb/in^{0.5} in English unit and re: 1 N/m^{0.5} in SI unit,
LSR unit force incoherent line source response for the ground, re: 1 μ -in/sec/(1 lb/in^{0.5}) in

¹ Transit Noise and Vibration Impact Assessment. Report No. FTA-VA-90-1003-06

² KCRC, KSL GSA 5100 Environmental Impact Assessment & Associated Services Environmental Impact Assessment Report. 2005. (EIA Register No. AEIAR-083/2005)

- English unit and 10^{-8} m/s/(1 N/m^{0.5}) in SI unit,
 BCF vibration coupling loss factor between the soil and the foundation, relative level,
 BVR building vibration reduction or amplification within a structure from the foundation to the occupied areas, relative level,
 CTN Conversion from floor and wall vibration to noise, 10^{-8} m/s or 10^{-6} in/s to 20 μ Pascal.

4.5.7 The measurement and analysis equipment used in obtaining these empirical results is given in operation ground-borne noise section. Predictions are based on assuming the closest distance along the alignment to the building foundation of the receiver.

Adaptation to Hydraulic Breaker, Rock Drill and Pile Rig

4.5.8 Reference was made to the assessment approach, source terms and transmission factors adopted in the approved EIA Report for the Kowloon Southern Link project. The assumptions adopted in the present assessment are provided in **Appendix 4.5**.

Soil Damping

4.5.9 Internal losses of soil would cause the vibration amplitude to decay against the propagation distance and the decay relationship is based on the equation set out in the Transportation Noise Reference Book³.

$$V(R) = V(R_o) \times e^{-2\pi f \eta R/2c}$$

4.5.10 The velocity amplitude V is dependent on the frequency f in Hz, the soil loss factor η , the wave speed c in m/s, the distance R from the source to the NSR. The properties of soil materials are shown in **Table 4.8**.

Table 4.8 Wave Propagation Properties of Soil

Soil Type	Longitudinal Wave Speed c, m/s	Loss Factor, η	Density, g/cm ³
Soil	1500	0.5	1.7
Rock	3500	0.01	2.65

4.5.11 No damping attenuation was applied for propagation in rocks for Kwong Ching House. Soil damping was applied in the prediction of noise levels at Cha Kwo Ling Tsuen with the damping distances 5 m. Relevant geological profiles showing the tunnel alignment are presented in **Appendix 4.5**.

Coupling Loss into Building Structures

4.5.12 The coupling loss into building structures represents the change in the incident ground-surface vibration due to the presence of the piled building foundation. The empirical values with reference to the “Transportation Noise Reference Book”, 1987 are given in **Table 4.9**. According to the FTA manual, a single value of -7 dB is applied to 1-2 Storey Masonry.

³ P. M. Nelson. Transportation Noise Reference Book. 1987.

Table 4.9 Loss factor for Coupling into Building Foundation

Frequency	Octave Band Frequencies, Hz					
	16	31.5	63	125	250	500
Loss factor for coupling into building foundation, dB	-7	-7	-10	-13	-14	-14

Coupling Loss Per Floor

4.5.13 The coupling loss per floor represents the floor-to-floor vibration transmission attenuation. For multi-storey buildings, a common value for the attenuation of vibration from floor-to-floor is approximately 1 dB attenuation in the upper floor regions and greater than 3 dB attenuation at lower floors. Coupling loss of 1 dB reduction per floor was assumed in this report for a conservative assessment to account for any possible amplification due to resonance effects.

Conversion from Floor Vibration to Noise Levels

4.5.14 Conversion from floor vibration levels to indoor reverberant noise levels is based on standard acoustic principles. The conversion factor is dependent on the surface area S of the room in m^2 , the radiation efficiency σ , the volume of the room V in m^3 and the room reverberation time RT in seconds. Conversion factors from floor vibration levels to indoor reverberant noise levels are 27 dB(A) for residential units.

Operation Road Traffic Noise

4.5.15 Traffic noise was predicted using the methodology provided in the UK Department of Transport Calculation of Road Traffic Noise (CRTN) 1988. The assessment was based on projected peak hour flows for the worst year within 15 years after opening of the road. Road traffic noise levels is presented in terms of noise levels exceeded for 10% of the one-hour period during the peak traffic flow, i.e. $L_{10,1hr}$ dB(A). The projected 2036 peak hour traffic flows and vehicle compositions which have been agreed by Transport Department (TD) (TD's reply attached in Appendix 3.2) are attached in **Appendix 4.2**. The roads with traffic flow below 50 veh/hr were not considered in this assessment.

4.5.16 For the purpose of the traffic noise assessment in this Report, the roads within 300m from the proposed project alignment were included in the assessment. All roads are described as one of the following:

- 'Existing' Roads: that is, roads that are unchanged or subject to minor changes by the proposed Project.
- 'New' Roads: roads that are completely new or major modification to an existing road section or substantial changes in alignment or characters of the existing road due to the proposed Project.

4.5.17 The extent of 'New' roads under this Project has been depicted in **Figure 4.3**.

4.5.18 With reference to the approved Further Development of Tseung Kwan O EIA Report, low noise road surface on the existing road (Po Shun Road) within the Study Area as shown in **Figure 4.4** has been included in the noise model.

4.5.19 Direct mitigation measures would be proposed in all situations where:

- the predicted traffic noise level due to the road sections within the meaning of Item A.1 of Schedule 2 of EIAO, exceeds the criteria in Table 1A of Annex 5 in the TM by 1 dB(A) or more; or
- for situations where the overall traffic noise level at the NSRs with the road project exceeds the criteria in Table 1A of Annex 5 in the TM by 1 dB(A) or more and at the same time is greater than that without the road project at the design year by 1.0 dB(A) or more; or
- If the NSRs are affected by noise from other existing roads, direct mitigation measures are required to reduce the noise from the ‘New’ roads to a level that it
 - (i) is not higher than the noise standard; and
 - (ii) has no significant contribution to the overall noise from other existing roads, if the cumulative noise level (i.e. noise from the new road together with other existing roads) exceeds the noise standard.

4.5.20 If any façades of NSRs are still exposed to predicted noise levels exceeding the relevant noise criteria after the implementation of all direct mitigation measures, provision of indirect technical remedies in the form of acoustic insulation and air conditioning should be considered under the EIAO-TM and the ExCo Directive “Equitable Redress for Persons Exposed to Increased Noise Resulting from the Use of New Roads”. The eligibility for indirect technical remedies shall be tested against the following three criteria:

- the predicted overall noise level from the new road, together with other traffic noise in the vicinity must be above a specified noise level (for example, 70 dB(A) for domestic premises and 65 dB(A) for educational institutions, all in $L_{10(1 \text{ hour})}$); and
- the predicted overall noise level is at least 1.0 dB(A) more than the prevailing traffic noise level, that is, the total traffic noise level existing before the works to construct the road commence; and
- the contribution to the increase in the predicted overall noise level from the new road must be at least 1.0 dB(A).

4.5.21 Traffic speeds adopted in the noise model are summarised as below:

<u>Road</u>	<u>Speed Limit</u>
Proposed Main Line	80 km per hour
Other slip roads	50 km per hour

4.5.22 In order to determine whether direct mitigation measures have to be proposed for a particular NSR, three sensitivity tests based on the traffic noise data generated for with and without Project scenarios at the assessment year (i.e. Year 2036) have been conducted. These three sensitivity tests are listed below:

4.5.23 ST1: the predicted traffic noise level due to the road sections within the meaning of Item A.1 of Schedule 2 of EIAO, exceeds the criteria in Table 1A of Annex 5 in the EIAO-TM by 1 dB(A) or more; or

4.5.24 ST2: for situations where the overall traffic noise level at the NSRs with the road project exceeds the criteria in Table 1A of Annex 5 in the EIAO-TM by 1 dB(A) or more and at the same time is greater than that without the road project at the design year by 1.0 dB(A) or more; or

4.5.25 ST3: If the NSRs are affected by noise from other existing roads, direct mitigation measures are required to reduce the noise from the ‘New’ roads to a level that it

- (i) is not higher than the noise standard; and
- (ii) has no significant contribution to the overall noise from other existing roads, if the cumulative noise level (i.e. noise from the new road together with other existing roads) exceeds the noise standard.

Operation Phase Fixed Plant Noise

- 4.5.26 Two ventilation buildings (VB) for the TKO-LT tunnel have been proposed and they are located in the vicinity of the portal at Lam Tin Interchange (LTI) and Tseung Kwan O (TKO). Two pumping stations (Drainage and Sewage) are proposed at the LTI and one pumping station is proposed at Road P2. The pump system should be enclosed in concrete building structures. Any doors will be closed during normal operation to avoid noise leakage. Noise impact from these noise sources is not expected. Potential noise impacts arising from the pumping station would be the ventilation fans.
- 4.5.27 As the Trunk Road T2 ventilation building is located in the vicinity of the Project, cumulative fixed plant noise assessment has been carried out with information provided by the T2 project consultant to incorporate the noise impacts due to the operation of this facility.
- 4.5.28 The fixed plant noise impact has been assessed in accordance with the IND-TM. As the fixed noise sources on the LTI side and TKO side are far away from each other, no cumulative fixed plant noise impact is expected.
- 4.5.29 The assessment has been carried out under the worst case scenario, which is when the maximum number of ventilation fans are all concurrently in operation 24 hours per day. The following procedures were applied to the operational phase fixed plant noise assessment:
- Identify fixed plant noise source;
 - Calculate the correction factors based on the distance between the NSRs and the noise source positions;
 - Apply acoustics correction factors for façade, distance, barrier attenuation, acoustic reflection where applicable;
 - Calculate the maximum allowable Sound Power Level (SWL) as the compliance criteria for each fixed noise sources; and
 - Quantify the level of impact at the NSRs in accordance with IND-TM.
- 4.5.30 Locations of the potential noise sources during operation phase are shown in **Figure 4.5**.

4.6 Identification of Environmental Impacts

Construction Noise – Airborne Noise

- 4.6.1 Based on the construction programme, potential construction noise impacts of the Project may arise from the following major construction activities:
- Excavation of LTI
 - Portal construction
 - Piling for the bridges/viaducts
 - Seawall construction at TKO side
 - Filling activities at TKO side
 - Road and road pavement formation and associated earthworks

- Tunnel construction
 - Drainage culvert construction
 - Re-provisioning of infrastructure, services and utilities
- 4.6.2 These construction activities will involve the use of PME including breakers, excavators, lorries, mobile cranes, concrete truck mixers, pokers, rollers, etc. The PMEs adopted for the assessment are detailed in **Appendix 4.3**.
- 4.6.3 Construction works would be expected to be carried out in non-restricted hours (0700-1900). According to the current engineering information, bored piling would be used under the Project and this assumption was considered in the construction noise impact assessment of this Study. If the Contractors in future use percussive piling for some construction works, CNP should be obtained from the Noise Control Authority prior to commencement of the works.
- 4.6.4 As mentioned in **Section 2**, drill and blast method would be adopted for the tunnelling works. The hand-held drillers would be used to make holes for installation of dynamite and this activity for tunnel works have been taken into account in the construction noise calculation. According to the information provided by the Engineer, there will not be more than one blasting per day for the tunnel construction. The construction period of the drill-&-blast tunnels would be about 20 months. All the detonation will be conducted underground within the tunnels. As blasting is under the control of the Dangerous Goods Ordinance, the contractor shall obtain a valid blasting permit from the Mines Division of CEDD before carrying out the blasting. The contractor shall enclose a method statement including manner of work and protective measures to protect adjacent land and property when blasting is carried out. It is noted that each blast would only last for a few seconds.

Construction Noise – Ground-borne Noise

- 4.6.5 Potential ground-borne noise impacts on ground-borne NSRs during the construction phase will arise mainly from PME for rock breaking/drilling including breakers, drill rigs and pile rigs.

Operation Phase

- 4.6.6 Operation phase impacts would arise from the following operations:
- Road traffic noise;
 - Ventilation shaft noise from TKO-LT Tunnel ventilation buildings;
 - Noise from sewerage pumping station (LT side);
 - Noise from drainage pumping station (LT side); and
 - Noise from pumping station (TKO Side).
- 4.6.7 Road traffic noise would arise from "new" roads constructed under the Project as well as cumulative traffic noise from the new and existing roads.
- 4.6.8 Two VBs for the Project are proposed to maintain the air quality within the TKO-LT Tunnel to meet the EPD air quality guideline. Two pumping stations are proposed at the LTI and one pumping station is proposed at Road P2. As mentioned in **S4.5.26**, as the Trunk Road T2 Ventilation Building in the vicinity of the Project, it has also been identified as a fixed noise source for the cumulative fixed plant noise assessment. The locations of the fixed noise sources and the representative APs are shown in **Figure 4.5**.

4.7 Prediction and Evaluation of Environmental Impacts

Construction Phase – Airborne Noise

4.7.1 For normal daytime working hours, exceedances of the construction noise criteria ($L_{eq(30-min)}$ 75 dB(A) for residential uses and 70 dB(A) for educational institutions (65 dB(A) during examinations)) are predicted at representative NSRs in the absence of mitigation measures. Details of construction noise calculations and results are presented in **Appendix 4.3** and **Appendix 4.4** respectively. The assessment results show that the predicted cumulative noise levels related to the concurrent construction works of the Project are in the range of 54 to 88 dB(A) $L_{eq(30-min)}$. A summary of the unmitigated construction noise levels of the representative NSRs during normal daytime working hours within the construction period of the Project is listed in **Table 4.10**. Noise mitigation measures would therefore be required to reduce noise levels at the NSRs for compliance with the noise standard.

Table 4.10 Summary of Cumulative Unmitigated Construction Noise Levels at Representative NSRs during Normal Daytime Working Hours

NSR ID	AP ID	Noise Criteria, dB(A)	Predicted Unmitigated Construction Noise Levels during Normal Daytime Working Hour ($L_{eq(30-min)}$, dB(A))	Exceedance, dB(A)
1	N1102	75	59 – 81	6
1	N1204	75	59 – 84	9
2	N2105	75	60 – 86	11
3	N3101a	75	67 – 87	12
5	N3104	75	66 – 87	12
6	N4101	70/65	61 – 85	15/20
8	N5012	75	60 – 84	9
8	N5072	75	59 – 77	2
9	N6101	75	56 – 73	0
10	N7603	75	54 - 81	6

Construction Noise – Ground-borne Noise

4.7.2 Ground-borne noise impacts from hydraulic breakers, drill rig and pile rig to the nearby sensitive receivers were predicted, and the prediction results are summarized in **Table 4.11**. It was assumed in the calculation that the hydraulic breaker, drill rig and pile rig would not operate simultaneously. Detail calculation and assumptions for each ground-borne AP are provided in **Appendix 4.5**.

Table 4.11 Predicted Construction Ground-borne Noise Impact

AP ID	Description	Predicted Ground-borne Noise Levels Leq(30mins), dB(A)			NCO Criteria for daytime	Mitigation Measures Required?
		Breaker	Drill Rig	Pile Rig		
N3105	No. 100, Cha Kwo Ling Tsuen	41	46	47	65	No
N3201	Kwong Ching House, Kwong Tin Estate	31	25	38	65	No

4.7.3 As shown in **Table 4.11**, construction ground-borne noise levels at construction ground-borne NSR would comply with the day time (0700-1900) noise criteria of 65 dB(A). Adverse ground-borne construction noise impact due to the use of PME at open works areas would not be envisaged.

4.7.4 In case of any construction activities during restricted hours (1900-0700), it is the Contractor’s responsibility to ensure compliance with the Noise Control Ordinance (NCO) and the relevant technical memoranda. The Contractor will be required to submit CNP application to the Noise Control Authority and abide by any conditions stated in the CNP, should one be issued.

Operation Road Traffic Noise

4.7.5 Traffic noise levels have been predicted at NSR AP including existing residential, institutional uses, and future uses on planned receivers for the scenarios of “with” and “without” Project at the assessment year. **Appendix 4.6** gives the breakdown of the noise contributions from the new roads and existing roads at all representative existing and planned NSRs. Road-plots of the traffic noise model showing the road segments, barriers and assessment points of sensitive receivers are also presented in **Appendix 4.7**.

4.7.6 Without the noise mitigation measures in place, the predicted noise levels at the identified NSRs and its APs would range from 31 to 79 dB(A) L_{10 (1-hour)}. The following **Table 4.12** shows the results of the sensitivity test for NSRs located within the study area. When a particular NSR fulfils any of the three sensitivity tests, direct mitigation measures would be required.

Table 4.12 Sensitivity Test for the Need of Direct Mitigation Measures

NSR ID	AP ID	Noise criteria	Overall noise level exceeds noise criteria?	ST1 (a)	ST2 (b)	ST3 (c)	Direct mitigation measures required (a) or (b) or (c)
NSR 1	N1101	70	Yes	Yes	Yes	Yes	Yes
	N1102	70	Yes	Yes	Yes	Yes	Yes
	N1103	70	Yes	Yes	Yes	Yes	Yes
	N1104	70	Yes	Yes	Yes	Yes	Yes
	N1201	70	Yes	Yes	Yes	Yes	Yes
	N1202	70	Yes	Yes	Yes	Yes	Yes
	N1203	70	Yes	Yes	No	Yes	Yes
	N1204	70	Yes	Yes	No	Yes	Yes
	N1301	70	Yes	No	No	Yes	Yes
	N1302	70	Yes	No	No	Yes	Yes
	N1303	70	Yes	No	No	Yes	Yes
	N1304	70	Yes	No	No	Yes	Yes

NSR ID	AP ID	Noise criteria	Overall noise level exceeds noise criteria?	ST1 (a)	ST2 (b)	ST3 (c)	Direct mitigation measures required (a) or (b) or (c)
	N1401	70	No	No	No	No	No
	N1402	70	No	No	No	No	No
	N1403	70	No	No	No	No	No
	N1404	70	No	No	No	No	No
	N1501	70	No	No	No	No	No
	N1502	70	Yes	No	No	No	No
	N1503	70	Yes	No	No	No	No
	N1601	70	Yes	No	No	No	No
NSR 2	N1602	70	Yes	No	No	No	No
	N2101	70	Yes	Yes	No	Yes	Yes
	N2102	70	Yes	Yes	No	Yes	Yes
	N2103	70	Yes	Yes	No	Yes	Yes
	N2104	70	Yes	Yes	No	Yes	Yes
	N2105	70	Yes	No	No	Yes	Yes
	N2201	70	Yes	No	No	Yes	Yes
	N2202	70	Yes	No	No	No	No
	N2203	70	Yes	No	No	No	No
	N2204	70	Yes	No	No	No	No
NSR 3	N2205	70	Yes	No	No	No	No
	N2206	70	Yes	No	No	No	No
NSR 3	N3101a	70	Yes	No	No	Yes	Yes
	N3101b	70	Yes	No	No	Yes	Yes
NSR 4	N3102	65	Yes	Yes	No	Yes	Yes
NSR 5	N3103	70	Yes	No	No	No	No
NSR 6	N4101	65	Yes	No	No	No	No
NSR 8	N5011	70	No	No	No	No	No
	N5012	70	No	No	No	No	No
	N5013	70	No	No	No	No	No
	N5071	70	No	No	No	No	No
	N5072	70	No	No	No	No	No
	N5073	70	No	No	No	No	No
	N5171	70	No	No	No	No	No
	N5172	70	Yes	No	No	Yes	Yes
NSR 9	N5173	70	Yes	No	No	No	No
	N6101	70	No	No	No	No	No
	N6102	70	No	No	No	No	No
	N6201	70	No	No	No	No	No
	N6202	70	No	No	No	No	No
	N6301	70	No	No	No	No	No
NSR 10	N6302	70	No	No	No	No	No
	N7001	70	No	No	No	No	No
	N7002	70	Yes	No	No	Yes	Yes
	N7101	70	No	No	No	No	No
	N7102	70	No	No	No	No	No
	N7201	70	No	No	No	No	No
	N7202	70	No	No	No	No	No
	N7301	70	No	No	No	No	No
	N7302	70	No	No	No	No	No
	N7501	70	Yes	No	No	Yes	Yes
	N7502	70	No	No	No	No	No
	N7601	70	No	No	No	No	No
N7602	70	No	No	No	No	No	

NSR ID	AP ID	Noise criteria	Overall noise level exceeds noise criteria?	ST1 (a)	ST2 (b)	ST3 (c)	Direct mitigation measures required (a) or (b) or (c)
	N7603	70	Yes	No	No	Yes	Yes
	N7604	70	Yes	No	No	Yes	Yes
	N7605	70	No	No	No	No	No
	N7701	70	No	No	No	No	No
	N7702	70	No	No	No	No	No
NSR 11	N8101	70	No	No	No	No	No
	N8102	70	No	No	No	No	No
NSR 12	N8103	70	No	No	No	No	No
	N8104	70	No	No	No	No	No
NSR 13	N9101	65	Yes	No	No	Yes	Yes
PNSR 1	PN1000	70	No	No	No	No	No
	PN1001	70	No	No	No	No	No
	PN1002	70	No	No	No	No	No
	PN1003	70	No	No	No	No	No
	PN1004	70	No	No	No	No	No
	PN1005	70	No	No	No	No	No
	PN1006	70	No	No	No	No	No
	PN1007	70	No	No	No	No	No
	PN1008	70	No	No	No	No	No
	PN1009	70	No	No	No	No	No
	PN1010	70	No	No	No	No	No
	PN1011	70	No	No	No	No	No
	PN1012	70	No	No	No	No	No
	PN1013	70	Yes	No	No	Yes	Yes
PN1014	70	Yes	No	Yes	Yes	Yes	
PNSR 2	PN1200	70	No	No	No	No	No
	PN1201	70	No	No	No	No	No
	PN1202	70	No	No	No	No	No
	PN1203	70	No	No	No	No	No
	PN1204	70	No	No	No	No	No
	PN1205	70	No	No	No	No	No
	PN1206	70	No	No	No	No	No
	PN1207	70	No	No	No	No	No
PNSR 3	PN1208	70	No	No	No	No	No
	PN2661	70	No	No	No	No	No
	PN2662	70	Yes	No	No	No	No
	PN2663	70	Yes	No	No	No	No
	PN2664	70	Yes	No	No	Yes	Yes
PNSR 4	PN2665	70	Yes	No	No	Yes	Yes
	PN2681	70	No	No	No	No	No
	PN2682	70	No	No	No	No	No
	PN2683	70	No	No	No	No	No
	PN2684	70	No	No	No	No	No
PNSR 5	PN2685	70	No	No	No	No	No
	PN2724	70	No	No	No	No	No
	PN2725	70	No	No	No	No	No

Notes:

ST1: the predicted traffic noise level due to the road sections within the meaning of Item A.1 of Schedule 2 of EIAO, exceeds the criteria in Table 1A of Annex 5 in the TM by 1 dB(A) or more; or

ST2: for situations where the overall traffic noise level at the NSRs with the road project exceeds the criteria in Table 1A of Annex 5 in the TM by 1 dB(A) or more and at the same time is greater

- than that without the road project at the design year by 1.0 dB(A) or more; or
- ST3: If the NSRs are affected by noise from other existing roads, direct mitigation measures are required to reduce the noise from the 'New' roads to a level that it
- (i) is not higher than the noise standard; and
 - (ii) has no significant contribution to the overall noise from other existing roads, if the cumulative noise level (i.e. noise from the new road together with other existing roads) exceeds the noise standard.

Operation Phase Fixed Plant Noise

- 4.7.7 The maximum allowable sound power levels for the TKO-LT Tunnel Ventilation Buildings and proposed pumping station(s) to meet the relevant noise criteria were determined. **Table 4.13** shows the required sound power level for the nearest affected NSRs to achieve noise compliance. The detailed calculation is shown in **Appendix 4.8**.

Table 4.13 Predicted Maximum Allowable Sound Power Levels for Fixed Noise Sources

Fixed Plant Noise Source	Sound Power Level (SWL, dB(A)) required at source in order to meet the criteria	
	Daytime / Evening Time	Night Time
LT Area		
TKO-LT Tunnel Ventilation Building	105	94
Proposed Sewerage Pumping Station	114	102
Proposed Drainage Pumping Station	111	100
TKO Area		
TKO-LT Tunnel Ventilation Building	113	103
Proposed P2 Pumping Station	106	96

- 4.7.8 The above SWL criteria should be implemented and refined during the detailed design stage of the respective ventilation building/pumping station by the contractor(s). Any new NSRs should also be identified and incorporated into the design as necessary. The contractor(s) shall install sound attenuators, noise barriers and acoustic enclosures as appropriate to ensure that the specified maximum SWLs in the above **Table 4.13** are achieved. The performance of the sound attenuators shall be obtained by comparing the total SWL of noise emanating from the façade and the specified maximum SWL specified in the above **Table 4.13**. A summary of the predicted noise levels at representative NSR APs due to the cumulative fixed plant operations (including T2 ventilation building) are presented in **Table 4.14** below and the detailed calculations are presented in **Appendix 4.8**.

Table 4.14 Summary of Predicted Operation Noise Levels

NSR AP	NSR Description	Predicted Noise Level, dB(A)/Criteria, dB(A)		
		Daytime	Evening time	Nighttime
N1204	Block B Bik Lai House, Yau Lai Estate Phase 1	64/65	64/65	54/55

NSR AP	NSR Description	Predicted Noise Level, dB(A)/Criteria, dB(A)		
		Daytime	Evening time	Nighttime
N2202	Block T, Yau Lai Estate Phase 5	64/65	64/65	55/55
N5012	Block 1, Ocean Shores	60/60	60/60	50/50
N5031	Block 3, Ocean Shores	60/60	60/60	50/50

4.7.9 All representative NSR APs are predicted to meet their own respective daytime, evening time and nighttime noise criterion. Thus, no adverse ventilation noise impacts would be expected.

4.8 Mitigation of Environmental Impacts

Construction Phase – Airborne Noise

4.8.1 In order to reduce the excessive noise impact at the affected NSRs during normal daytime working hours, mitigation measures such as adopting quiet PME, movable noise barriers and temporary noise barriers are recommended. The contractor(s) may be able to obtain particular models of plant that are quieter than the PMEs given in GW-TM. It is considered too restrictive to specify that a contractor has to use specific items of plant for the construction operations. It is practical to specify the total SWL of all plant to be used on site so that the contractor(s) is allowed some flexibility to select plant to suit his needs.

4.8.2 The use of quiet plant associated with the construction works is prescribed in British Standard “Code of practice for noise and vibration control on construction and open sites, BS5228” which contains the SWLs for specific quiet PME. The SWLs for quiet PMEs adopted for the assessment are detailed in **Appendix 4.9**.

4.8.3 To alleviate the construction noise impact on the affected NSRs, movable noise barrier for Excavator, Lorry, Dump Truck, Mobile Crane, Compactor, Concrete Mixer Truck, Concrete Lorry Mixer, Breaker, Mobile Crusher, Backhoe, Vibratory Poker, Saw, Asphalt Paver, Vibratory Roller, Vibrolance, Hydraulic Vibratory Lance and Piling (Vibration Hammer) are proposed. Movable temporary noise barriers that can be located close to noisy plant and be moved iteratively with the plant along a worksite can be very effective for screening noise from NSRs. A typical design which has been used locally is a wooden framed barrier with a small cantilevered upper portion of superficial density no less than 14kg/m² on a skid footing with 25mm thick internal sound absorptive lining. This measure is particularly effective for low level zone of NSRs. A cantilevered top cover would be required to achieve screening benefits at upper floors of NSRs. It is anticipated that suitably designed barriers could achieve at least 5 – 10 dB(A) reduction. For a conservative assessment, only a reduction of 5 dB(A) is assumed.

4.8.4 The use of full enclosure has been considered in this assessment to shelter relatively static plant including Air Compressor, Compressor, Bar Bender, Generator, Drilling Rig, Chisel, Large Diameter Bore Piling, Grout Mixer & Pump and Concrete Pump. These enclosures can provide about 10 dB(A) noise reduction.

4.8.5 Noise reduction from the use of mitigation measures including quiet plant, noise barrier and enclosure for construction plants as described above has been applied in the assessment. Details of construction noise calculations and results for the “mitigated” scenario are presented in **Appendix 4.9** and **Appendix 4.10** respectively. The predicted cumulative noise levels and the exceedances of the daytime construction noise criteria are summarised in the following **Table 4.15**.

4.8.6 As shown in **Appendix 4.10**, with the use of quiet equipment, movable noise barriers and temporary noise barriers, the overall noise levels at NSRs would be reduced by 8 to 14 dB(A) Leq (30-hour), depending on the type of construction activities. With the exception of Kei Fatt Primary School, the predicted construction noise levels arising from the Project at all other NSRs selected for construction noise impact assessment would comply with the EIAO-TM construction noise criteria.

4.8.7 In view of the limited buffer distance between the Kei Faat Primary School and the nearest work areas (~40m), the predicated construction noise levels at this NSR would exceed the noise criteria. Practical mitigation measures (i.e. use of quiet equipment, movable barriers, temporary barriers and PME grouping) have been exhausted, taking into account the engineering and programming point of view. The predicted noise level would exceed the noise standard of 65 dB(A) by up to 6 dB(A) during examination periods for a total of 10 months between Year 2016 and Year 2020. For the normal teaching period, the noise level would exceed the noise standard of 70 dB(A) by 1 dB(A) for 7 months.

Table 4.15 Summary of Cumulative Mitigated Construction Noise Levels at Representative NSRs during Normal Daytime Working Hours

NSR	Noise Criteria, dB(A)	Predicted Mitigated Construction Noise Levels during Normal Daytime Working Hour (Leq (30-min), dB(A))	Exceedance, dB(A)	Duration, Month
N1102	75	47-73	-	-
N1204	75	47-75	-	-
N2105	75	48-75	-	-
N3101a	75	58-73	-	-
N3104	75	53-75	-	-
N4101	Normal Teaching Period: 70dB(A)	49-71	Normal Teaching Period: 1 (exceedance 70dB(A))	Normal Teaching Period: 7 months (exceedance 70dB(A))
	Examination Period: 65dB(A)		Examination Period: 6 ⁽¹⁾ (exceedance 65dB(A))	Examination Period: 12 months ⁽¹⁾⁽²⁾ (exceedance 65dB(A))
N5012	75	49-75	-	-
N5072	75	48-69	-	-
N6101	75	45-64	-	-
N7603	75	43-70	-	-

Note:

- (1) It is noted that the examination periods will not occur for the entire exceedance duration and therefore, the duration of exceedance is much shorter when adhering to the 70 dB(A) EIAO-TM Criterion for schools.
- (2) Typical examination periods occur in the months of May, June, November and December. The exceedance duration indicated is during examination periods

Construction Noise – Ground-borne Noise

- 4.8.8 The predicted construction ground-borne noise levels from the tunnelling work will not exceed the daytime construction ground-borne noise criteria and hence no mitigation measures are required.

Operation Road Traffic Noise

- 4.8.9 As mentioned in **Section 4.5.19**, direct mitigation measures should be considered or proposed on road project under the subject DP such that the noise from the “new” road would be reduced to a level that fulfil the EIAO requirements. Mitigation Measures are proposed based on this principle.

Existing NSRs

- 4.8.10 The proposed direct mitigation measures for existing NSRs are shown in **Figure 4.6** and the cross sections shown in **Figure 4.8**. The proposed mitigation measures are summarized below with total length of the mitigation measures rounded off to the nearest 10m:
- VB4-1: about 10m of 4m High Vertical Noise Barrier on Cha Kwo Ling Road (shown in **Figure 4.6** (Sheet 1 of 4));
 - VB4-2: about 40m of 4m High Vertical Noise Barrier on Cha Kwo Ling Road (shown in **Figure 4.6** (Sheet 1 of 4));
 - CT1: about 100m of 6m High Cantilever Noise Barrier with 4.2m Cantilever (at 45 °) on Cha Kwo Ling Road (shown in **Figure 4.6** (Sheet 1 of 4));
 - CT2: about 80m of 6m High Cantilever Noise Barrier with 3.7m Cantilever (at 90) on road EHC2 (shown in **Figure 4.6** (Sheet 2 of 4));
 - FE1: about 400m Landscape deck provided on the entire extent of the Main line (Cha Kwo Ling Side) (shown in **Figure 4.6** (Sheet 2 of 4));
 - FE2: about 130m of Full-enclosure provided on road S2 (shown in **Figure 4.6** (Sheet 2 of 4));
 - FE3: about 120m of Full-enclosure provided on road EHC4 (shown in **Figure 4.6** (Sheet 2 of 4));
 - FE4: about 200m of Landscape Deck provided on road P2 (shown in **Figure 4.6** (Sheet 4 of 4));
 - SE1: about 230m of Semi-enclosure provided on road EHC2 (shown in **Figure 4.6** (Sheet 2 of 4));
 - SE2: about 150m of Semi-enclosure provided on road S2 (shown in **Figure 4.6** (Sheet 2 of 4));
 - SE3: about 30m of Semi-enclosure provided on road EHC4 (shown in **Figure 4.6** (Sheet 2 of 4));
 - VB5-1: about 130m of 5m High Vertical Noise Barrier provided at road EHC4 (shown in **Figure 4.6** (Sheet 2 of 4));
 - VB5-2: about 70m of 5m High Vertical Noise Barrier provided at road EHC4 (shown in **Figure 4.6** (Sheet 2 of 4));
 - VB5-3: about 80m of 5m High Vertical Noise Barrier provided at road EHC1 (shown in **Figure 4.6** (Sheet 2 of 4));
 - VB5-4: about 50m of 5m High Vertical Noise Barrier provided at road EHC1 (shown in **Figure 4.6** (Sheet 2 of 4));
 - VB5-5: about 170m of 5m High Vertical Noise Barrier provided at road S3 (shown in

Figure 4.6 (Sheet 2 of 4));

- VB5-6: about 180m of 5m High Vertical Noise Barrier provided at road S1 (shown in **Figure 4.6** (Sheet 2 of 4));
- LNS1: about 190m of Low Noise Surfacing on North and South Bound P2 Road (shown in **Figure 4.6** (Sheet 3 of 4));
- LNS2: about 240m of Low Noise Surfacing on East and West Bound Po Yap Road (shown in **Figure 4.6** (Sheet 3 of 4)); and
- LNS3: about 200m of Low Noise Surfacing on East and West Bound Po Yap Road (shown in **Figure 4.6** (Sheet 3 of 4))

4.8.11

With the implementation of the above noise mitigation measures, exceedance of the overall traffic noise criterion for most of the existing NSRs at LT area and at Ocean Shores and Park Central at TKO area are still predicted. However, the predicted ‘New’ road noise contributions to the overall noise levels would be less than 1.0 dB(A) and the ‘New’ road noise levels at these NSRs would all be below the relevant noise limits. Hence, no further direct mitigation measures are considered effective in mitigating the noise impact. The following **Table 4.16** shows the results of the sensitivity test conducted for existing NSRs located within the study area for the mitigated scenario. When a particular NSR fulfils any of the three sensitivity tests, further direct mitigation measures would be required. As shown in **Table 4.16** below, although some NSRs still exceeds the overall noise criteria, mitigation measures have already been exhausted and as all identified existing NSRs do not fulfil the sensitivity tests ST1-ST3, no further direct mitigation measures are required. Detailed mitigated results for these existing NSRs in form of table and plan are presented in **Appendix 4.11**.

Table 4.16 Sensitivity Test for the Need of Further Direct Mitigation Measures for Mitigated Scenario (Existing NSRs)

NSR ID	AP ID	Noise criteria	Overall noise level exceeds noise criteria?	ST1 (a)	ST2 (b)	ST3 (c)	Further Direct mitigation measures required (a) or (b) or (c)	Comply with EIAO requirement
NSR 1	N1101	70	Yes	No	No	No	No	Yes
	N1102	70	Yes	No	No	No	No	Yes
	N1103	70	Yes	No	No	No	No	Yes
	N1104	70	Yes	No	No	No	No	Yes
	N1201	70	Yes	No	No	No	No	Yes
	N1202	70	Yes	No	No	No	No	Yes
	N1203	70	Yes	No	No	No	No	Yes
	N1204	70	Yes	No	No	No	No	Yes
	N1301	70	No	No	No	No	No	Yes
	N1302	70	No	No	No	No	No	Yes
	N1303	70	Yes	No	No	No	No	Yes
	N1304	70	Yes	No	No	No	No	Yes
	N1401	70	No	No	No	No	No	Yes
	N1402	70	No	No	No	No	No	Yes
	N1403	70	No	No	No	No	No	Yes
	N1404	70	No	No	No	No	No	Yes
N1501	70	No	No	No	No	No	Yes	
N1502	70	Yes	No	No	No	No	Yes	
N1503	70	Yes	No	No	No	No	Yes	

NSR ID	AP ID	Noise criteria	Overall noise level exceeds noise criteria?	ST1 (a)	ST2 (b)	ST3 (c)	Further Direct mitigation measures required (a) or (b) or (c)	Comply with EIAO requirement
NSR 2	N1601	70	Yes	No	No	No	No	Yes
	N1602	70	Yes	No	No	No	No	Yes
	N2101	70	Yes	No	No	No	No	Yes
	N2102	70	Yes	No	No	No	No	Yes
	N2103	70	Yes	No	No	No	No	Yes
	N2104	70	Yes	No	No	No	No	Yes
	N2105	70	Yes	No	No	No	No	Yes
	N2201	70	Yes	No	No	No	No	Yes
	N2202	70	Yes	No	No	No	No	Yes
	N2203	70	Yes	No	No	No	No	Yes
	N2204	70	Yes	No	No	No	No	Yes
NSR 3	N3101a	70	No	No	No	No	No	Yes
	N3101b	70	No	No	No	No	No	Yes
NSR 4	N3102	65	Yes	No	No	No	No	Yes
NSR 5	N3103	70	Yes	No	No	No	No	Yes
NSR 6	N4101	65	Yes	No	No	No	No	Yes
NSR 8	N5011	70	No	No	No	No	No	Yes
	N5012	70	No	No	No	No	No	Yes
	N5013	70	No	No	No	No	No	Yes
	N5071	70	No	No	No	No	No	Yes
	N5072	70	No	No	No	No	No	Yes
	N5073	70	No	No	No	No	No	Yes
	N5171	70	No	No	No	No	No	Yes
	N5172	70	No	No	No	No	No	Yes
NSR 9	N5173	70	Yes	No	No	No	No	Yes
	N6101	70	No	No	No	No	No	Yes
	N6102	70	No	No	No	No	No	Yes
	N6201	70	No	No	No	No	No	Yes
	N6202	70	No	No	No	No	No	Yes
	N6301	70	No	No	No	No	No	Yes
NSR 10	N6302	70	No	No	No	No	No	Yes
	N7001	70	No	No	No	No	No	Yes
	N7002	70	Yes	No	No	No	No	Yes
	N7101	70	No	No	No	No	No	Yes
	N7102	70	No	No	No	No	No	Yes
	N7201	70	No	No	No	No	No	Yes
	N7202	70	No	No	No	No	No	Yes
	N7301	70	No	No	No	No	No	Yes
	N7302	70	No	No	No	No	No	Yes
	N7501	70	No	No	No	No	No	Yes
	N7502	70	No	No	No	No	No	Yes
	N7601	70	No	No	No	No	No	Yes
	N7602	70	No	No	No	No	No	Yes
	N7603	70	No	No	No	No	No	Yes
N7604	70	No	No	No	No	No	Yes	
N7605	70	No	No	No	No	No	Yes	
N7701	70	No	No	No	No	No	Yes	

NSR ID	AP ID	Noise criteria	Overall noise level exceeds noise criteria?	ST1 (a)	ST2 (b)	ST3 (c)	Further Direct mitigation measures required (a) or (b) or (c)	Comply with EIAO requirement
	N7702	70	No	No	No	No	No	Yes
NSR 11	N8101	70	No	No	No	No	No	Yes
	N8102	70	No	No	No	No	No	Yes
NSR 12	N8103	70	No	No	No	No	No	Yes
	N8104	70	No	No	No	No	No	Yes
NSR 13	N9101	65	No	No	No	No	No	Yes

Notes:

- ST1: the predicted traffic noise level due to the road sections within the meaning of Item A.1 of Schedule 2 of EIAO, exceeds the criteria in Table 1A of Annex 5 in the TM by 1 dB(A) or more; or
- ST2: for situations where the overall traffic noise level at the NSRs with the road project exceeds the criteria in Table 1A of Annex 5 in the TM by 1 dB(A) or more and at the same time is greater than that without the road project at the design year by 1.0 dB(A) or more; or
- ST3: If the NSRs are affected by noise from other existing roads, direct mitigation measures are required to reduce the noise from the ‘New’ roads to a level that it
- (i) is not higher than the noise standard; and
 - (ii) has no significant contribution (less than 1.0dB(A)) to the overall noise from other existing roads, if the cumulative noise level (i.e. noise from the new road together with other existing roads) exceeds the noise standard.

4.8.12 To facilitate the phased implementation of the proposed noise barriers, a barrier inventory showing NSRs protected by different barrier sections to achieve different extents of noise reduction is shown in **Appendix 4.12**.

Planned NSRs

4.8.13 The proposed direct mitigation measures for planned NSRs are shown in **Figure 4.7** and the cross sections shown in **Figure 4.9**. The proposed mitigation measures are summarized below with total length of the mitigation measures rounded off to the nearest 10m. These noise mitigation measures would only be required to be constructed before the occupation of the planned NSRs:

- FE5: about 80m of Full-enclosure on road EHC4 (shown in **Figure 4.7**)

4.8.14 With the implementation of the above noise mitigation measures, exceedance of the overall traffic noise criterion for the identified planned NSRs at Residential Site at Ex-Cha Kwo Ling Kaolin Mine Site and at TKO Area 66 are still predicted. However, the predicted ‘New’ road noise contributions to the overall noise levels would be less than 1.0 dB(A) and the ‘New’ road noise levels at these NSRs would all be below the relevant noise limits. Hence, no further direct mitigation measures are considered effective in mitigating the noise impact. The following **Table 4.17** shows the results of the sensitivity test conducted for planned NSRs located within the study area for the mitigated scenario. Although some NSRs still exceeds the overall noise criteria, mitigation measures have already been exhausted and as all identified planned NSRs do not fulfil the sensitivity tests ST1-ST3, no further direct mitigation measures are required. The detailed mitigated results are presented in **Appendix 4.11**.

Table 4.17 Sensitivity Test for the Need of Further Direct Mitigation Measures for Mitigated Scenario (Planned NSRs)

NSR ID	AP ID	Noise criteria	Overall noise level exceeds noise criteria?	ST1 (a)	ST2 (b)	ST3 (c)	Further Direct mitigation measures required (a) or (b) or (c)	Comply with EIAO requirement
PNSR 1	PN1000	70	No	No	No	No	No	Yes
	PN1001	70	No	No	No	No	No	Yes
	PN1002	70	No	No	No	No	No	Yes
	PN1003	70	No	No	No	No	No	Yes
	PN1004	70	No	No	No	No	No	Yes
	PN1005	70	No	No	No	No	No	Yes
	PN1006	70	No	No	No	No	No	Yes
	PN1007	70	No	No	No	No	No	Yes
	PN1008	70	No	No	No	No	No	Yes
	PN1009	70	No	No	No	No	No	Yes
	PN1010	70	No	No	No	No	No	Yes
	PN1011	70	No	No	No	No	No	Yes
	PN1012	70	No	No	No	No	No	Yes
	PN1013	70	Yes	No	No	No	No	Yes
PN1014	70	Yes	No	No	No	No	Yes	
PNSR2	PN1200	70	No	No	No	No	No	Yes
	PN1201	70	No	No	No	No	No	Yes
	PN1202	70	No	No	No	No	No	Yes
	PN1203	70	No	No	No	No	No	Yes
	PN1204	70	No	No	No	No	No	Yes
	PN1205	70	No	No	No	No	No	Yes
	PN1206	70	No	No	No	No	No	Yes
	PN1207	70	No	No	No	No	No	Yes
PN1208	70	No	No	No	No	No	Yes	
PNSR 3	PN2661	70	No	No	No	No	No	Yes
	PN2662	70	No	No	No	No	No	Yes
	PN2663	70	No	No	No	No	No	Yes
	PN2664	70	Yes	No	No	No	No	Yes
	PN2665	70	Yes	No	No	No	No	Yes
PNSR 4	PN2681	70	No	No	No	No	No	Yes
	PN2682	70	No	No	No	No	No	Yes
	PN2683	70	No	No	No	No	No	Yes
	PN2684	70	No	No	No	No	No	Yes
	PN2685	70	No	No	No	No	No	Yes
PNSR 5	PN2724	70	No	No	No	No	No	Yes
	PN2725	70	No	No	No	No	No	Yes

Notes:

ST1: the predicted traffic noise level due to the road sections within the meaning of Item A.1 of Schedule 2 of EIAO, exceeds the criteria in Table 1A of Annex 5 in the TM by 1 dB(A) or more; or

ST2: for situations where the overall traffic noise level at the NSRs with the road project exceeds the criteria in Table 1A of Annex 5 in the TM by 1 dB(A) or more and at the same time is greater than that without the road project at the design year by 1.0 dB(A) or more; or

ST3: If the NSRs are affected by noise from other existing roads, direct mitigation measures are required to reduce the noise from the 'New' roads to a level that it
(i) is not higher than the noise standard; and

- (ii) has no significant contribution (less than 1.0 dB(A)) to the overall noise from other existing roads, if the cumulative noise level (i.e. noise from the new road together with other existing roads) exceeds the noise standard.

4.8.15 Although the noise levels at the planned Residential Site at Ex-Cha Kwo Ling Kaolin Mine Site and at TKO Area 66 fulfill the EIAO requirement, the predicted overall noise levels at NSR APs PN1013, PN1014, PN2664 and PN2665 still exceed 70 dB(A) with more significant contribution from Eastern Harbour Crossing and Po Yap Road, respectively. It is suggested that measures such as building setback, provision of noise tolerant building or special building design would be considered to be incorporated into the design of the developments during planning stage in order to further reduce the traffic noise impacts from Eastern Harbour Crossing and Po Yap Road.

4.8.16 With the inclusion of the proposed direct mitigation measures such as noise barriers and semi-enclosures, there are potential side effects in terms of air quality and visual impact. However, as shown in the sections of this EIA report on air quality and landscape and visual impact (Sections 3 and 10 respectively), these side effects have already been assessed and there are no adverse air quality and landscape and visual impacts expected due to the Project.

Operation Phase Fixed Plant Noise

4.8.17 The main sources of noise for the TKO-LT Tunnel Ventilation Buildings (LT and TKO Side) and the proposed pumping stations (Drainage & Sewerage Pumping Station at LTI and P2 Pumping Station at Road P2) are the ventilation fans and pumps respectively. The detailed design should incorporate the following good practices in order to minimise the nuisance on the neighbouring NSRs.

- The exhaust of the ventilation system and any opening of the building should be located facing away from any NSRs; and
- Acoustic louver or other acoustic treatment equipment could also be applied to the exhaust of the ventilation system.

4.8.18 Residual fixed plant noise impacts are not anticipated. In order to ensure compliance of the operation noise level with the stipulated noise standards in TM, noise commissioning tests for all major fixed noise sources should be included in the Contract Document.

4.9 Evaluation of Residual Impacts

Construction Phase

4.9.1 With the exception of N4101, the construction noise levels at the other NSRs selected for construction noise impact assessment are predicted to comply with the noise standards stipulated in the EIAO-TM with the implementation of the above-mentioned mitigation measures. Residual impacts at these affected NSRs are summarised in **Table 4.18**.

4.9.2 All practical and feasible mitigation measures have been proposed and exhausted for Kei Faat Primary School, such as adopting quiet PME, movable noise barriers and temporary noise barriers. The on-site survey has revealed that it has already been noise insulated with air-conditioners. With the provision of air-conditioners, it is considered that the noise impact would be minimized by keeping the windows closed during the construction activities. Notwithstanding this, due to more stringent noise criterion of 65 dB(A), it is recommended that particularly noisy construction activities, especially those associated with foundation piers of bridge construction (at LTI), cut & cover slip road and at-grade road construction (at LTI) and drainage & E&M works for roads in LTI should be

scheduled to avoid examination periods of this NSR as far as practicable. The Contractor should liaise with the school representative(s) to obtain the examination schedule so as to avoid noisy construction activities during school examination period.

Table 4.18 Construction Noise Residual Impacts

NSR	Exceedance of the EIAO-TM Criterion	Construction Activity Causing Exceedance	Approximate duration of Exceedance
N4101 (Normal Teaching Period)	1 dB(A)	Construction of Slip road between Cha Kwo Ling Road and Yau Tong Road	7 months Sept 2018 to Mar 2019
N4101 (Examination Period)	6 dB(A)	<ul style="list-style-type: none"> • Surfacing Blasting for Lam Tin Tunnel Portal • Foundation Piers of Bridge Construction • Blasting for Slip Roads S2, S3, EHC4 • Construction of Slip road between Cha Kwo Ling Road and Yau Tong Road • Bridge Deck Construction • Footing and retaining structure at central divider • Civil works for landscape deck 	Total 12 months Nov to Dec 2016 Nov to Dec 2017 May to Jun 2018 Nov to Dec 2018 May to Jun 2019 Nov to Dec 2019

Note:

- (1) Normal teaching period is assumed to be held in September of each year to July of the following year.
- (2) Typical examination periods occur in the months of May, June, November and December. The exceedance duration indicated is during examination periods.

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

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

4.9.4 During school examination periods, the daytime construction noise criterion is 65dB(A)

which is lower than the normal daytime school criterion of 70dB(A). Scheduling of construction works outside school examination period to less intrusive periods would definitely reduce the overall noise impacts at the NSRs and for ensuring compliance with the construction noise criterion at some of the NSRs. The Contractor shall liaise with the school representative(s) to obtain the examination schedule and avoid noisy construction activities during school examination period.

Operation Road Traffic Noise

- 4.9.5 With the proposed noise mitigation measures in place, the ‘New’ road noise contributions to the overall noise levels at all representative NSRs would be less than 1.0 dB(A) and the ‘New’ road noise levels would all be below the relevant noise criteria. For the existing (including Yau Lai Estate Phase 1 and 5, Cha Kwo Ling Tsuen, Ocean Shores Block 17 and Central Heights Park Central) and planned NSRs (including Residential Site at Ex-Cha Kwo Ling Kaolin Mine Site and Tseung Kwan O Area 66) where the overall noise level still exceeds the criteria, all feasible direct mitigation measures such as noise enclosure, noise barrier, low noise surfacing (proposed with a 20m buffer distance from traffic junction stop lights as agreed with Highways Department (HyD)), etc. have been considered and exhausted. No further direct mitigation measures are required nor feasible.
- 4.9.6 For the NSR APs identified as educational use including Physartrain 90’s Sports and Leisure Centre (AP N3102) and Kei Faat Primary School (N4101), the mitigated noise levels still exceed the criteria after all feasible mitigation measures have been proposed and exhausted. With reference to **Appendix 4.11**, the overall noise levels with the adoption of the proposed mitigation measures are lower than that without the project. No further direct mitigation measures are considered feasible.
- 4.9.7 No adverse noise impacts arising from the ‘New’ roads would be predicted at any of the representative NSRs. Noise exceedances at the representative NSR APs, if any, would be due to the existing roads. The effectiveness of direct mitigation measures, in terms of the number of residential dwellings and classrooms that will either be protected or benefited (by at least 1 dB(A)), has been shown in **Appendix 4.13**.
- 4.9.8 Results of the eligibility assessment are presented in **Appendix 4.14**. Due to high prevailing noise levels and/or dominant noise contribution from other roads, none of the NSRs are eligible for consideration for indirect technical remedies under the EIAO-TM and the ExCo Directive “Equitable Redress for Persons Exposed to Increased Noise Resulting from the Use of New Roads”.

Operation Phase Fixed Plant Noise

- 4.9.9 Residual fixed plant noise impacts are not anticipated. In order to ensure compliance of the operation noise level with the stipulated noise standards in TM, noise commissioning tests for all major fixed noise sources should be included in the Contract Document.

4.10 Environmental Monitoring and Audit

Construction Phase

- 4.10.1 An EM&A programme has recommended to be established according to the expected occurrence of noisy activities. All the recommended mitigation measures for daytime normal working activities should be incorporated into the EM&A programme for implementation during construction. Details of the EM&A requirements are provided in the EM&A Manual.

Operation Phase

- 4.10.2 The results of the assessment suggest that noise from fixed plant operation would comply with the EIAO-TM standards. However, as part of the design process, monitoring of operational noise from the proposed fixed plants during the testing and commissioning stage would be recommended to verify the compliance of the EIAO-TM criteria.
- 4.10.3 Road traffic noise monitoring should be carried out during the first year and after road opening at representative NSRs located in the vicinity of the recommended direct mitigation measures. Details of the programme are provided in the EM&A Manual.

4.11 Conclusion

Construction Phase

- 4.11.1 This assessment has predicted the construction noise impacts of the Project, taking into account other concurrent projects. The predicted unmitigated noise levels would range from 54 to 87 dB(A) at the representative NSRs. To mitigate the noise impact, quiet PME, movable barriers, temporary barriers and all other possible mitigation measures have been proposed and exhausted in order to minimize the impact. The noise level at the NSRs selected for construction noise impact assessment (except Kei Faat Primary School) would not exceed the construction noise standard. The affected Kei Faat Primary School has been noise insulated with air conditioners. It is recommended that the particularly noisy construction activities should be scheduled to avoid examination periods of these NSRs as far as practicable.
- 4.11.2 During the actual construction period, as much as practically possible should be done to reduce the construction noise, and on-going liaison with all concerned parties and site monitoring should also be conducted during the course of the construction period.
- 4.11.3 Ground-borne construction noise impacts pertinent to the use of breaker, drill rig and pile rig were also found to comply with relevant criteria. No adverse ground-borne construction noise impacts were predicted.
- 4.11.4 A construction noise EM&A programme is recommended to check the compliance of the noise criteria during normal daytime working hours.

Operation Phase

- 4.11.5 The potential road traffic noise impacts have been assessed based on the worst case traffic flows in 2036. Without any noise mitigation measures in place, the predicted noise levels at the NSRs would range from 31 to 79 dB(A). Practicable traffic noise mitigation measures are therefore formulated for the NSRs with predicted noise levels exceeding the EIAO-TM traffic noise criteria.
- 4.11.6 With the proposed noise barriers, semi-enclosures, full-enclosures and low noise surfacing applied on roads in place, the predicted overall noise levels at some of the NSRs would still exceed the noise limit. For these NSRs, the predicted traffic noise level due to the road sections within the Project does not exceed (i.e. new road) the criteria by 1 dB(A) or more. The 'New' road noise contribution to the overall traffic noise level would be less than 1.0 dB(A) and the 'New' road noise levels at these NSRs would all be below criterion. It should be noted that such noise exceedances at the representative NSRs are due to the existing roads. Nevertheless, there will be an overall reduction of noise brought about by the project, which may be considered an environmental benefit.

- 4.11.7 Operation noise impacts from fixed plant noise can be effectively mitigated by implementing noise control treatment at source during the design stage and adverse residual operation noise impacts are not anticipated.
- 4.11.8 A summary of the range of noise levels for both unmitigated and mitigated scenarios are presented in **Table 4.19** below.

Table 4.19 Summary Table of Noise Levels during Construction and Operation Phase

Scenario	Construction Phase Noise Level Range dB(A)	Operation Phase Traffic Noise Level Range dB(A)
Unmitigated	54 – 87	31 – 79
Mitigated	43 – 75	31 – 78