

4 NOISE IMPACT

4.1 Introduction

4.1.1 This section presents an assessment on the potential noise impacts arising from the construction and operation of the Project. The noise impact assessment is conducted in accordance with the requirements of Annex 5 and Annex 13 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO -TM) as well as the requirements set out under Clause 3.4.5 and Appendix C of the EIA Study Brief (ESB-323/2019).

4.2 Environmental Legislation, Standards and Criteria

General

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

4.2.2 Assessment procedures and standards are set out in the following TM:

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

Construction Noise during Non-restricted Hours

4.2.3 The NCO provides the statutory framework for the control of noise from construction works, 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 holidays (i.e. restricted hours). Noise from construction activities taking place at 0700 – 1900 hours on any day not being a Sunday or general holiday is subject to the Noise Standards for Daytime Construction Activities in Table 1B of Annex 5 of the EIAO-TM. The criteria are summarized in **Table 4.1**.

Table 4.1 Noise Criteria for Daytime Construction Noise

Uses	Daytime (0700 to 1900 hours on any day not being a Sunday or general holiday), Leq (30mins), dB(A)
Domestic premises	75
Educational Institution	70
Educational Institution (during examination)	65

Notes:

- (a) The above standards apply to uses which rely on opened windows for ventilation.
- (b) The above standards shall be viewed as the maximum permissible noise levels assessed at 1m from the external façade

Construction Noise during Restricted Hours

4.2.4 On all days during 1900 and 0700 hours and at any time on Sundays and public holidays, 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 in cases where the noise can be contained within the Acceptable Noise Level (ANL) at the NSRs. ANLs are assigned depending upon the Area Sensitivity Ratings (ASRs). The corresponding ANLs for construction work other than percussive piling during restricted hours are given in **Table 4.2**.

Table 4.2 ANLs under GW-TM

Time Period	ANL on Different Area Sensitivity Rating During Restricted Hours (Leq, 5mins, dB(A))		
	ASR A	ASR B	ASR C
All days during evening (1900 to 2300 hours), and general holidays (including Sundays) during the day-time and evening (0700 to 2300 hours)	60	65	70
All days during the night-time (2300 to 0700 hours)	45	50	55

4.2.5 The construction noise impact assessment in restricted hours is conducted to evaluate whether the construction works in restricted hours are feasible or not in the context of programming construction work. Despite any description or assessment made in this EIA Report on construction noise aspects, there is no guarantee that a 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 TMs issued under the NCO. The Noise Control Authority will take into account contemporary conditions/ situations of adjoining land uses and any previous complaints against construction activities at the site before deciding whether to grant a CNP. Nothing in the EIA Report should bind the Noise Control Authority in making its decision. If a CNP is to be issued, the Noise Control Authority should include in the permit any condition it considers appropriate. Failure to comply with any such conditions will lead to cancellation of the CNP and prosecution 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 Project falls within DA). 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; and
- 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. The ANLs for construction work in Designated Area using SPME are presented in **Table 4.3**.

Table 4.3 ANLs under DA-TM

Time Period	ANL on Different Area Sensitivity Rating During Restricted Hours (Leq, 5mins, dB(A))		
	ASR A	ASR B	ASR C
All days during evening (1900 to 2300 hours), and general holidays (including Sundays) during the day-time and evening (0700 to 2300 hours)	45	50	55
All days during the night-time (2300 to 0700 hours)	30	35	40

Construction Ground-borne Noise

4.2.8 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.

4.2.9 Noise arising from general construction works of the Project during normal daytime (0700-1900 except general holidays and Sunday) is governed by the EIAO-TM. With reference to the Technical Memorandum for the Assessment of Noise from Places Other Than Domestic Premises, Public Places or Construction Sites (IND-TM) 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 NSRs, such as residential buildings, schools, clinics, hospitals, temples and churches. Therefore, the ground-borne construction noise criteria are limited to 10 dB(A) below respective ANL stipulated in the GW-TM.

4.2.10 The construction ground-borne noise criteria for the representative ground-borne NSR of the Project are tabulated in **Table 4.4** below:

Table 4.4 Noise Criteria for Construction Ground-borne Noise

Type of NSR / Assessment Point ^(d)	Ground-borne Noise Criteria ^(a)		
	Daytime (0700 to 1900 hours on any day not being a Sunday or general holiday), Leq (30mins), dB(A)	All days during evening (1900 to 2300 hours), and general holidays (including Sundays) during the daytime and evening (0700 to 2300 hours) (Leq 5 mins, dB(A))	All days during the night-time (2300 to 0700 hrs) (Leq 5 mins, dB(A))
Domestic premises, hotels and service apartments	65	55	40
Schools	60 / 55 (c)	55	N/A (b)

Notes:

- (a) Ground-borne noise transmitted primarily through structural elements of the building(s) affects internal area of the building(s), and hence it is assumed that the NSR at the internal location of building(s) is not affected by Influencing Factors (IF) such as major roads and industrial areas. As all of the identified ground-borne NSRs within the study area of the Project are located in either "Urban Area" or "Area other than above", therefore, Area Sensitivity Rating of "B" is considered for identifying criteria during restricted hours.
- (b) Generally, no sensitive use/operation during this time period.
- (c) A 5dB(A) reduction to the ground-borne noise criteria is recommended for school during examination period.
- (d) Assessment point locates at an internal location of a building in which the NSR is located.

Road Traffic Noise

4.2.11 For road traffic noise, the following $L_{10(1\text{ hr})}$ criteria stipulated in Annex 5, Table 1A of EIAO-TM are adopted for different types of noise sensitive receivers (NSRs) which rely on opened window for ventilation. Relevant criteria are listed in **Table 4.5**.

Table 4.5 Noise Criteria for Road Traffic Noise

NSR ID	Road Traffic Noise Criteria, $L_{10(1\text{ hr})}$, dB(A)
All domestic premises including temporary housing accommodation	70
Hotel and hostels	70
Offices	70
Educational institutions including kindergartens, nurseries and all others where unaided voice communication is required	65
Places of public Worship and courts of law	65
Hospitals, clinics, convalescences and homes for the aged, diagnostic rooms, wards	55

Remarks:

- (a) The road traffic noise criteria apply to uses which rely on opened window for ventilation only.
- (b) The road traffic noise criteria should be viewed as the maximum permissible noise levels assessed at 1 m from the external façade.

Fixed Noise Sources

4.2.12 Fixed noise sources are controlled by Section 13 of the NCO and IND-TM. Noise criteria for fixed noise sources impact with a noise criteria of 5dB(A) below the appropriate ANL shown in Table 2 of the IND-TM or the prevailing background noise levels (for quiet areas with level

5 dB(A) below the ANL) recommended in the Annex 5 of EIAO-TM for planning purposes are applied to this study. The ANLs and criteria for different ASRs are summarised in **Table 4.6** below.

Table 4.6 Noise Criteria for Fixed Noise Sources

Time Period	Fixed Noise Criteria for Different Area Sensitivity Rating (Leq 30 min, dB(A)) ^(a)					
	ANL, dB(A)			ANL-5, dB(A) for Planned Fixed Noise Sources		
	ASR A	ASR B	ASR C	ASR A	ASR B	ASR C
Day (0700 to 1900 hrs)	60	65	70	55	60	65
Evening (1900 to 2300 hrs)	60	65	70	55	60	65
Night (2300 to 0700 hrs)	50	55	60	45	50	55

Remarks:

- (a) The fixed noise criteria apply to uses which rely on opened window for ventilation only.
- (b) The above standards should be viewed as the maximum permissible noise levels assessed at 1 m from the external façade.

4.3 Description of the Environment

4.3.1 The proposed improvement of LRT is located at connecting rims of Kowloon and Shatin districts. It lies across the Lion Rock and spans along the northern part of Waterloo road, Lion Rock Tunnel Road, and to the south part of the Shatin Road. The land uses in the assessment area, i.e. the area within a distance of 300m from the boundary of the Project, are mainly residential uses and schools. The existing noise climate is dominated by road traffic noise from Lung Cheung Road, Waterloo road and Lion Rock Tunnel Road at Kowloon side, and by Lion Rock Tunnel Road, Hung Mui Kuk Road and Shatin Road at Shatin side.

4.4 Identification of Noise Receiver Receivers

4.4.1 In accordance with Annex 13 of the EIAO-TM, domestic premises including temporary housing, educational institutions (including kindergartens and nurseries), hospitals, medical clinics, homes for the aged, convalescent homes, places of public worship, libraries, courts of law, performing arts centres, auditoria and amphitheatres, and Country Park are noise sensitive receivers (NSRs).

4.4.2 According to the observations from site visits and review of relevant land use plans including the Outline Zoning Plans (OZP), NSRs within 300m of the Project Boundary have been reviewed. Locations of the assessment area and NSRs are shown in **60604728/R42b/Figure 4.1**, **60604728/R42b/Figure 4.1.1 to 60604728/R42b/Figure 4.1.4**. In accordance with the OZP (S/K8/23 - Wang Tau Hom & Tung Tau, S/K18/21 – Kowloon and S/ST/35 Shatin), the assessment area mainly comprises zoning of Residential, Village Type Development, Green Belt, G/IC, Open Space and Other Specifies Uses. In addition to the above existing uses, a planned residential development (NKIL 6579) at Kowloon side is identified within the assessment area. For NSR which is air-conditioned and do not rely on openable windows for ventilation (e.g. Union Hospital), adverse noise impact is not expected and those would not be identified for air-borne noise impact assessment in this Report. Identified NSRs within 300m assessment boundary from the Project are listed in **Table 4.7** and **Table 4.8** below. Photos of the representative NSRs are presented in **Appendix 4.1**.

Table 4.7 Identified Noise Sensitive Receivers within 300m from the Boundary of the Project (Kowloon Side)

NSR ID	Description	Land Use
PHD	Planned Housing Development (NKJ6579)	Planned Residential
LCC	Lung Cheung Court	Residential
WG	Welcome Gardens	Residential
MC	Marple Court	Residential

NSR ID	Description	Land Use
AC	Alice Court	Residential
JC	Jumbo Court	Residential
WH	Westland Heights	Residential
EH	Eastland Heights	Residential
PH	Peninsula Heights	Residential
MH	Meridian Hill	Residential
TP	The Palace	Residential
KKC	Ka Keung Court	Residential
LSTYKHSS	Lok Sin Tong Yu Kan Hing Secondary School	Educational
TMC	Tin Ma Court	Residential
K01	Beverley Heights	Residential
K02	Pearl Court	Residential
K03	Vista Panorama	Residential
K04	Chermain Heights	Residential
K05	Dragon Heights	Residential
K06	Joy Garden	Residential
K07	Manhattan Court	Residential
K08	Le Chateau	Residential
K09	Moonbeam Terrace	Residential
K10	Luso Apartments	Residential
K11	Beacon Hill School	Educational
K12	Orion Court	Residential
K13	Ede Terrace	Residential
K14	Eden Gate Tower 1	Residential
K15	Arcadia Gardens	Residential
K16	Verdun Villa	Residential
K17	Hong Kong Baptist University	Residential
K18	Commercial Radio	Office
K19	Radio Television Hong Kong TV House	Office
K20	Radio Television Hong Kong Broadcasting House	Office
K21	Carlton Court	Residential
K22	Boland Court	Residential
K23	Belmont Heights	Residential
K24	Fairyland Garden	Residential
K25	Broadway Towers	Residential
K26	Comfort Court	Residential
K27	Marconi Court	Residential
K28	Twilight Court	Residential
K29	Faber Garden	Residential
K30	Phoenix Court	Residential

NSR ID	Description	Land Use
K31	Fessenden Court	Residential
K32	Kwong Fai Court	Residential
K33	Avon Court	Residential
K34	Merry Court	Residential
K35	Jade Court	Residential
K36	Rockford Mansion and Clifford Mansion	Residential
K37	Merlin Court	Residential
K38	Ava Court	Residential
K39	Radio Television Hong Kong Education Television Centre	Office
K40	Happy Garden	Residential
K41	87 - 91 Broadcast Drive	Residential
K42	Kit Sam Lam Bing Yim Secondary School	Educational
K43	Wang Tau Hom Estate	Educational
K44	Price Memorial Catholic Primary School	Educational
K45	Tin Wang Court	Residential
K46	Grace Methodist Church Kindergarten	Educational
K47	Tsui Chuk Garden	Residential
S16 ^(a)	Lion Rock Country Park	Recreational

Notes:

- (a) In accordance with Annex 13 of the EIAO-TM, country parks are considered to be a NSR. However, the EIAO-TM and IND-TM do not provide a specific noise limits for Country Parks.

Table 4.8 Identified NSRs within 300m from the Boundary of the Project (Shatin Side)

NSR ID	Description	Land Use
STWTWSQ	Shatin Water Treatment Works Staff Quarter	Residential
KATC	Ka Tin Court	Residential
HLMSS	Helen Liang Memorial Secondary School	Educational
KSC	Ka Shun Court	Residential
UC	Union Court	Residential
HP	Hill Paramount	Residential
JG	Julimount Garden	Residential
POHCKMC	Pok Oi Hospital Chan Kai Memorial College	Educational
WWG	World-Wide Garden	Residential
KTC	King Tin Court	Residential
GLG	Golden Lion Garden	Residential
HMKR	Hung Mui Kuk Road Village Houses	Residential
KTV	Kak Tin Village / Kak Tin Village Kung Miu	Residential
MWG	Merry World Garden	Residential
KTVT	Kak Tin Village Temple (Koon Yam Kok and Fat Wan Lan Yuek)	Place of Public Worship
STGPS	Shatin Government Primary School	Educational
STW	Sun Tin Wai Estate	Residential
STTNV	Shatin Tau New Village	Residential

NSR ID	Description	Land Use
FSC	Fung Shing Court	Residential
STT	Shatin Tau Village	Residential
S01	Hin Keng Estate	Residential
S02	C.U.H.K.F.A.A. Thomas Cheung School	Educational
S03	Hin Tin Village Houses	Residential
S04	Union Hospital	Hospital
S05	Parc Royale	Residential
S06	Choi Jun School	Educational
S07	Ha Keng Hau Village Houses	Residential
S08	Lung Hang Estate	Residential
S09	Golden Lion Garden Stage 1	Residential
S10	Shatin Methodist College	Educational
S11	Christian Alliance H. C. Chan Primary School	Educational
S12	Shatin Methodist College (Ample Campus)	Educational
S13	Kwok Tak Seng Catholic Secondary School	Educational
S14	Chun Shek Estate	Residential
S15	Shan Ha Wai (Tsang Tai Uk) Village Houses	Residential
S16 ^(a)	Lion Rock Country Park	Recreational
S17	Lok Sin Tong Young Ko Hsiao Lin Secondary School	Educational

Notes:

- (a) In accordance with Annex 13 of the EIAO-TM, country parks are considered to be a NSR. However, the EIAO-TM and IND-TM do not provide a specific noise limits for Country Parks.

Noise Assessment Points for Construction Noise Impact Assessment

- 4.4.3 The first layer of NSRs would provide acoustic shielding to those receivers at further distance behind. The predicted noise levels at the first layer of NSRs represent the worst-case scenario, and therefore representative Noise Assessment Points (NAPs) at these NSRs are selected for construction noise impact assessment. In accordance with Annex 13 of the EIAO-TM, country park is also classified as NSRs. However, there would be no noise sensitive uses in Lion Rock Country Park that rely on opened windows for ventilation. Therefore, noise criteria listed in Annex 5 of EIAO-TM is not applicable to Lion Rock Country Park. The EIAO-TM however does not stipulate specific noise limits for this type of NSRs. Given that visitors using hiking trails in the Country Park are of transient nature, no adverse construction noise impact is anticipated. A summary of identified representative NAPs, is presented in **Table 4.9** with their locations shown in **60604728/R42b/Figure 4.2**, **60604728/R42b/Figure 4.2.1** to **60604728/R42b/Figure 4.2.4**.

Table 4.9 Identified Representative Noise Assessment Points for Construction Noise Impact Assessment

NAP ID	Description	Land Use	Number of Storeys	Floor of selected assessment point ^(a)
Kowloon Side				
EH1	Eastland Heights	Residential	6	1/F, 5/F & 6/F
MC1	Rear Block, Marple Court	Residential	9	1/F, 3/F & 9/F
PH2	Block B, Peninsula Heights	Residential	15	1/F, 8/F & 15/F

NAP ID	Description	Land Use	Number of Storeys	Floor of selected assessment point ^(a)
PHD1	Planned Housing Development (NKIL6579)	Planned Residential	13	1/F , 7/F & 13/F
Shatin Side				
WSH2	Wah Shing House, Fung Shing Court	Residential	34	1/F, 3/F & 34/F
STTNV1	Village House, Sha Tin Tau New Village	Residential	1	G/F
STTNV2	Village House, Sha Tin Tau New Village	Residential	1	G/F
STTNV5	Village House, Sha Tin Tau New Village	Residential	2	G/F , 1/F
STW2	Shing Wai House, Sun Tin Wai Estate	Residential	20	1/F , 10/F & 20/F
STW6	Yu Wai House, Sun Tin Wai Estate	Residential	17	1/F , 9/F & 17/F
STGPS2	Sha Tin Government Primary School	Educational	7	1/F, 5/F & 7/F
KTV2	House 3, Kak Tin Village	Residential	1	G/F
MWG1	Merry World Garden	Residential	3	1/F, 2/F & 3/F
KTV5	House 36, Kak Tin Village	Residential	3	1/F, 2/F & 3/F
HMKR1	Hung Mui Kuk Road Village Houses	Residential	1	G/F
WWG5	Block 4, World-Wide Gardens	Residential	20	1/F , 10/F & 20/F
WWG8	Block 3A, World-Wide Gardens	Residential	21	1/F , 10/F & 21/F
JG4	Block 3, Julimount Garden	Residential	21	1/F, 4/F & 21/F
HP1	House 1, Hill Paramount	Residential	3	1/F, 2/F & 3/F
UC1	Union Court	Residential	24	1/F, 5/F & 24/F
KSC1	Ka Shun Court	Residential	31	1/F, 15/F & 31/F
KATC1	Ka Yin House, Ka Tin Court	Residential	35	1/F, 20/F & 35/F

Note:

- (a) Bolded floor levels indicate the floor closest to the construction work zones. The selected floors are considered as representative floors for the NSR in the assessment.

Noise Assessment Points for Ground-borne Construction Noise

- 4.4.4 Potential ground-borne noise impact during construction phase of the Project would arise mainly from the PME (such as hydraulic breaker, drill rig and hand-held breaker and tunnel boring machine (TBM)) to be operated inside the tunnels for rock breaking/drilling works. Two NSRs, namely Lion Rock Country Park and Planned Housing Development (NKIL6579), are located within 300m from the tunneling works. In accordance with Annex 13 of the EIAO-TM, country park is also classified as NSRs. However, there would be no noise sensitive uses in Lion Rock Country Park that rely on opened windows for ventilation. Therefore, noise criteria listed in Annex 5 of EIAO-TM is not applicable to Lion Rock Country Park. Given that visitors using hiking trails in the Country Park are of transient nature, no adverse ground-borne construction noise impact is anticipated. Therefore, in this EIA Study, only the Planned

Housing Development (NKIL6579) (PHD) is identified as a representative NSR for quantitative construction ground-borne noise assessment.

Noise Assessment Points for Road Traffic Noise Impact Assessment

4.4.5 The first layer of NSRs would provide acoustic shielding to those receivers at further distance behind. The predicted noise levels at the first layer of NSRs represent the worst-case scenario, and therefore representative NAPs at these NSRs are selected for road traffic noise impact assessment. In accordance with Annex 13 of the EIAO-TM, country park is also classified as NSRs. However, there would be no noise sensitive uses in Lion Rock Country Park that rely on opened windows for ventilation. Therefore, noise criteria listed in Annex 5 of EIAO-TM is not applicable to Lion Rock Country Park. Given that visitors using hiking trails in the Country Park are of transient nature, no adverse traffic noise impact is anticipated. A summary of identified NAPs, is presented in **Table 4.10** with their locations shown in **60604728/R42b/Figure 4.3, 60604728/R42b/Figure 4.3.1 to 60604728/R42b/Figure 4.3.4.**

Table 4.10 Noise Assessment Points for Road Traffic Noise Impact Assessment

NAP ID	Description	Land Use	Number of Noise Sensitive Storeys	Road Traffic Noise Criteria, L ₁₀ (1hr), dB(A)
Kowloon Side				
AC1	Alice Court	Residential	9	70
EH1	Eastland Heights	Residential	6	70
EH2				
JC1	Jumbo Court	Residential	9	70
LCC1	Lung Cheung Court	Residential	4	70
LCC2			5	70
LCC3			7	70
MC1	Rear Block, Marple Court	Residential	9	70
PH1	Peninsula Heights	Residential	15	70
PH2				70
PHD1	Planned Housing Development (NKIL6579)	Planned Residential	13	70
PHD2				
PHD3				
WG1	Welcome Gardens	Residential	9	70
WH1	Wetland Heights	Residential	8	70
KKC1	Ka Keung Court	Residential	37	70
LSTYKHSS1	Lok Sin Tong Yu Kan Hing Secondary School	Educational	6	65
TMC1	Tin Ma Court	Residential	37	70
MH1	Meridian Hill	Residential	9	70
TP1	The Palace	Residential	33	70
Shatin Side				
STWTWSQ	Sha Tin Water Treatment Works Staff Quarters	Residential	4	70
KATC1	Ka Tin Court	Residential	35	70
HLMSS1	Helen Liang Memorial Secondary School	Educational	6	65
KSC1	Ka Shun Court	Residential	31	70

NAP ID	Description	Land Use	Number of Noise Sensitive Storeys	Road Traffic Noise Criteria, L ₁₀ (1hr), dB(A)
UC1	Union Court	Residential	24	70
HP1	Hill Paramount	Residential	3	70
HP2			27	70
JG1	Julimount Garden	Residential	25	70
JG2			23	70
JG3			21	70
JG4			21	70
JG5			20	70
JG6			18	70
POHCKMC	Pok Oi Hospital Chan Kai Memorial College	Educational	6	65
WWG1	World-Wide Garden	Residential	15	70
WWG2				70
WWG3				70
WWG4			20	70
WWG5				70
WWG6				70
WWG7			21	70
WWG8				70
WWG9				70
KTC1	King Tin Court	Residential	30	70
KTC2				70
KTC3				70
KTC4				70
GLG1	Golden Lion Garden	Residential	28	70
GLG2				70
HMKR1	Hung Mui Kuk Road Village Houses	Residential	1	70
HMKR2				70
KTV1	Kak Tin Village and Kak Tin Village Kung Miu	Residential	3	70
KTV2				70
KTV3				70
KTV4				70
KTV5				70
MWG1	Merry World Garden	Residential	3	70
KTVT1	Koon Yam Kok	Place of Public Worship	1	65
KTVT2	Fat Wan Lan Yeuk	Place of Public Worship	1	65
STGPS1		Educational	7	65

NAP ID	Description	Land Use	Number of Noise Sensitive Storeys	Road Traffic Noise Criteria, L ₁₀ (1hr), dB(A)
STGPS2	Shatin Government Primary School		3	65
STW1	Sun Tin Wai Estate	Residential	20	70
STW2				70
STW3				70
STW4				70
STW5			17	70
STW6				70
STTNV1	Shatin Tau New Village	Residential	1	70
STTNV2				70
STTNV3				70
STTNV4				70
STTNV5			2	70
FSC1	Fung Shing Court	Residential	34	70
FSC2				70
FSC3				70
STT1	Shatin Tau Village	Residential	3	70
STT2				70

Noise Assessment Points for Fixed Noise Sources Impact Assessment

4.4.6 No existing NSR, other than the Lion Rock Country Park, is identified located within the assessment boundary from the planned fixed noise sources under the Project for both Kowloon and Shatin sides of the Project. In accordance with Annex 13 of the EIAO-TM, country park is also classified as NSRs. However, there would be no noise sensitive uses in Lion Rock Country Park that rely on opened windows for ventilation. Therefore, noise criteria listed in Annex 5 of EIAO-TM is not applicable to Lion Rock Country Park. Given that visitors using hiking trails in the Country Park are of transient nature, no adverse fixed noise impact is anticipated. No planned noise sensitive development is identified at Shatin side of the Project. Only one planned NSR, planned housing development (NKIL6579), is located within 300m assessment area from the proposed ventilation building at Kowloon side of the Project area. With reference to the Noise Impact Assessment Report of the residential development at NKIL6579, the nearest point (PHD3) which is approximately 60m in distance to the ventilation building is chosen as the NAP for fixed noise sources assessment. The location of this NAP is shown on 60604728/R42b/Figure 4.3.1.

4.5 Identification of Source of Impact

Construction Phase

4.5.1 The potential source of noise impact during the construction of the Project would be the use of PME for various construction activities. The key construction works would include the following:

- Construction of a road tunnel of approximately 1.4 km long between the two existing tunnel tubes of the LRT by Tunnel Boring Machine (TBM);

- Enlargement of the existing Kowloon bound tunnel tube to a three-lane road tunnel, together with the construction of cross passages linking the new Kowloon bound tunnel tube with the new tunnel
 - Full-scale rehabilitation/reconstruction of the existing tunnel tubes of the LRT from tunnel lining to equipment and fittings following the latest standards;
 - Demolish the existing toll plaza together with the provision of equipment and facilities for free-flow tolling;
 - Re-provision of tunnel buildings including tunnel administration building, ventilation buildings etc.;
 - Widening of Lion Rock Tunnel Road at Kowloon side to dual three-lane from slip road of Lung Cheung Road interchange to LRT Kowloon portal and construct a single lane vehicular bridge crossing over Lung Cheung Road for the Shatin bound direction;
 - Widening of the slip road from Lion Rock Tunnel Road southbound (S/B) to Lung Cheung Road eastbound (E/B) to two lanes, and realigning the slip road from Lung Cheung Road (E/B) to Lion Rock Tunnel Road northbound (N/B);
 - Widening of a section of Lion Rock Tunnel Road at Shatin side to dual three-lane from tunnel toll plaza to Fung Shing Court;
 - Provision of noise barriers/enclosures to mitigate the noise impact on noise sensitive receivers;
 - Re-provisioning of footbridge NF74; and
 - Ancillary works including slope works/formation (including rigid and flexible barriers for natural terrain hazard mitigation measures), road lighting, drainage, landscaping works, etc.
- 4.5.2 The plant inventory provided by the Project Engineer for the construction noise impact assessment is presented in **Appendix 4.2**. **Appendix 4.3** presents the currently envisaged work programme, locations of the work sites and distances between the notional sources and the NAPs. The feasibility and practicability for construction programme and zoning arrangements of construction activities together with the PME inventory and utilization rate adopted for the assessment have been confirmed by the Project Engineer. The currently envisaged construction programme would not require percussive piling works.
- 4.5.3 During restricted hours (i.e. the hours from 1900 to 0700 hours or at any time on a general holiday), the following construction works are anticipated: -
- TBM Tunneling and works inside tunnels
 - Construction of Noise Barrier Structures
 - Demolition and Erection of Sign Gantries
 - Construction of New Vehicular Bridge next to Existing K7A Vehicular Bridge
 - Construction of New Vehicular Cross-over Bridge at Shatin Portal
- 4.5.4 Some of the above construction works would be carried out within the designated area in which the noise criteria for SPME and the requirements for carrying out PCW apply. Nevertheless, no SPME would be used and no PCW would be carried out during the restricted hours within the designated area.
- 4.5.5 The locations of construction work during restricted hours are presented in **Appendix 4.6a**. The construction noise impact assessment in restricted hours is conducted to evaluate whether the construction works in restricted hours are feasible or not in the context of programming construction work. In case of any construction works within the restricted hours, CNP should be obtained from the Noise Control Authority prior to commencement of the relevant construction works.
- 4.5.6 Potential ground-borne noise impact during construction phase of the Project would arise mainly from the PME for rock breaking/drilling works (such as hydraulic breaker, drill rigs and handheld-breaker, etc.) and TBM. The items of PME and the associated quantity that would be used for tunneling activities during non-restricted hours are shown in **Appendix 4.2** (Activity index 6.1, 6.2 & 6.3 refer).

Operation Phase Road Traffic Noise Sources

- 4.5.7 Road traffic noise from vehicular traffic on existing road network and the proposed open road network within the 300m assessment boundary are anticipated. The main road traffic noise sources in the Kowloon side of Project Area would mainly be the existing Lung Cheung Road, Waterloo Road and Lion Rock Tunnel Road, while the Project would involve the following road improvement works. The locations of these improvement works are indicated in **60604728/R42b/Figure 2.5**.
- Construction of a new single lane vehicular bridge parallel to the existing K7A vehicular bridge to provide direct connection between the road section mentioned in 4.5.7(b) to the northbound road section mentioned in 4.5.7(c) (Road Section (a) in **Appendix 4.17b**);
 - A section of existing Waterloo Road N/B: widening from two lanes to three lanes (Road Section (b) in **Appendix 4.17b**);
 - A section of existing Lion Rock Tunnel Road (immediate next to the proposed Kowloon portal) both N/B and S/B (southbound): widening from dual two lanes to dual three lanes, and alignment shift to align with the tunnel portals (Road Section (c) in **Appendix 4.17b**);
 - An existing slip road from Lion Rock Tunnel Road S/B to Lung Cheung Road E/B (eastbound): widening of the slip road from one lane to two lanes, and alignment shift to the northeast direction (Road Section (d) in **Appendix 4.17b**); and
 - An existing slip road from Lung Cheung Road E/B to Lion Rock Tunnel Road N/B: alignment shift to the northwest direction (Road Section (e) in **Appendix 4.17b**).
- 4.5.8 On the Shatin side of Project Area, the main existing road traffic noise source within the 300m assessment boundary would be the Lion Rock Tunnel Road. The Project would involve the following road improvement works. The locations of these road improvement are indicated in **60604728/R42b/Figure 2.2 to 60604728/R42b/Figure 2.4**.
- A section of the existing Lion Rock Tunnel Road (from Lion Rock Tunnel Shatin portal to Fung Shing Court): widening from dual two lanes to dual three lanes and straightening except a section of the northbound carriageway between the slip roads to and from Hung Mui Kuk Road;
 - An existing slip road from Hung Mui Kuk Road southbound to Lion Rock Tunnel Road southbound: minor shift of the northern road kerb;
 - An existing slip road from Lion Rock Tunnel Road northbound to Hung Mui Kuk Road northbound: alignment shift towards the west; and
 - An existing slip road from Hung Mui Kuk Road southbound to Lion Rock Tunnel Road northbound: alignment shift towards the north.

Operation Phase Fixed Noise Sources

- 4.5.9 Two ventilation shafts for the Project are proposed and they are located in the vicinity of the Shatin Portal and Kowloon Portal, respectively. Potential fixed noise impacts arising from the ventilation buildings would be due to operation of the ventilation fans. The locations of the potential fixed noise sources during operation phase are shown in **60604728/R42b/Figure 4.3.1 and 60604728/R42b/Figure 4.3.2**.

4.6 Construction Noise Impact Assessment

Assessment Methodology - Airborne Construction Noise

- 4.6.1 The construction noise impact assessment was undertaken in accordance with Annexes 5 and 13 of the EIAO-TM and the methodology for the construction noise impact assessment followed the procedures outlined in the GW-TM. The general approach is summarized as follows:
- Identify all existing NSRs in the assessment area and select assessment points to represent identified NSRs which would most likely be affected by noise from the construction work;
 - Identify and quantify an inventory of noise sources for representative construction equipment;

- Identify representative phases of construction that would have noticeable varying construction noise emissions at existing NSRs at the assessment area;
 - Assign sound power levels (SWLs) to the proposed PME according to the GW-TM or other sources;
 - Calculate distance attenuation based on the distance between NSR and the notional noise source position;
 - Apply corrections in the calculations such as façade reflection, potential screening effects and acoustic reflection, if any;
 - Predict construction noise levels at the selected assessment points in the absence of any mitigation measures at different phases of construction of the Project;
 - Consider cumulative impact from concurrent projects within 300m of the NSRs, if any;
 - Compare the cumulative construction noise level against the corresponding noise criterion and propose suitable mitigation measures where necessary; and
 - Evaluate the residual construction noise impact in accordance with section 4.4.3 of the EIAO-TM and estimate the total number of existing dwellings, classrooms and other noise sensitive elements that will be exposed to residual noise impact exceeding the criteria set in Annex 5 in the EIAO-TM.
- 4.6.2 For the SWLs of the PME, reference is made to Table 3 of the GW-TM, "Sound power levels of other commonly used PME" published by EPD, the Quality Powered Mechanical Equipment (QPME) System available at EPD's website and the previous approved EIA reports. SWLs of the equipment adopted in this noise assessment and sources of the reference are presented in **Appendix 4.4**.
- 4.6.3 It is assumed that all PME items required for a particular construction activity would be located at the notional position of work zones where such activity is to be performed. The locations of work zones are shown in **Appendix 4.3**. To predict the noise level, PME has been organised into groups required for each discrete task of the construction works. The sound pressure level (SPL) of each construction task was calculated, depending on the number of plant items involved and the distance from the NSR. A positive 3 dB façade correction was added to the predicted noise levels to account for the façade effect at each assessment point. The noise levels at the NSRs were then predicted by adding up the SPLs of all concurrent construction tasks from the Project. Notional source positions that are at distances greater than 300m from the NSRs were excluded from the assessment. For determining the distance correction factors, the horizontal distances between the notional source positions and the NSRs were used as a more conservative approach.
- 4.6.4 Based on the available information of the concurrent projects as presented in **Section 2** of the EIA Report, concurrent projects, namely Revised Trunk Road T4 in Shatin, In-situ Reprovisioning of Sha Tin Water Treatment Works - South Works - Designs and Construction, Relocation of Diamond Hill Fresh Water and Salt Water Service Reservoirs to Caverns and The Proposed Drainage Improvement Works at Chui Tin Street and Chui Tin Street Soccer Pitch are located within 300m from the Project Area. The cumulative construction noise impacts at the representative NSRs were evaluated in this assessment.
- 4.6.5 The unmitigated construction noise impacts at the identified NSRs were predicted accordingly. Practicable direct mitigation measures including the use of quieter equipment, movable noise barriers, noise barrier, enclosures and quieter alternative methods have been considered if exceedance of relevant criteria is predicted. Appropriate correction factors for barrier effect have been adopted in accordance with Section 2.10 of the GW-TM. In cases where the mitigated noise levels still exceed the relevant criteria, the duration of the noise exceedance would be estimated.

Assessment Methodology - Airborne Construction Noise During Restricted Hours

- 4.6.6 According to GW-TM, for any construction works planned during the restricted hours, the Contractor will be required to apply for a CNP from the Noise Control Authority and has the responsibility to ensure compliance with the NCO and relevant TM. Therefore, an indicative noise assessment in this EIA is for the evaluation of whether construction works in restricted hours are feasible or not in the context of programming construction work only.

- 4.6.7 The methodology for the construction noise impact assessment during restricted hours followed the procedures outlined in the GW-TM. Different construction activities were assumed not to be carried out concurrently during restricted hours. For night-time works, PME would be operated at relatively fixed locations rather than frequently moving within the work zone. For conservative approach, the shortest distance between the work zone and the NSR was assumed for noise assessment. In addition, all PME to be used within tunnels were assumed to be located at tunnel portal.
- 4.6.8 All representative NAPs identified in this assessment are located in either “Urban Area” or “Area other than above” or “Low density residential area consisting of low-rise or isolated high-rise developments” and also directly affected by the Influencing Factors (i.e. Lion Rock Tunnel Road or Waterloo Road). In accordance with GW-TM, all representative NAPs should be ASR “C”. Considering the situations / conditions around the sites may change from time to time, ASR “B” was assumed for all representative NAPs for conservative assessment approach. The construction noise criteria during restricted hours are 65 dB(A) and 50 dB(A) during evening period and night-time period, respectively. The Noise Control Authority would decide the Area Sensitivity Rating at the time of assessment of such an application based on the contemporary situations / conditions. The Area Sensitivity Ratings assumed in this EIA Report are for indicative assessment only.

Assessment Methodology - Ground-borne Construction Noise

- 4.6.9 The ground-borne noise projection methodology is based on the method recommended by the U.S. Department of Transportation and Federal Transit Administration. This projection methodology has been used in the approved EIA report for Shatin to Central Link - Mong Kok East to Hung Hom Section (EIA Register No. AEIAR-165/2012) and Shatin to Central Link - Hung Hom to Admiralty Section (EIA Register No. AEIAR-166/2012).
- 4.6.10 The main components of the proposed prediction model for ground-borne noise are:
- Vibration source levels from operation of TBM and concerned PMEs (e.g. hydraulic breaker, drill rig and hand-held breaker);
 - 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.
- 4.6.11 The vibration level $L_{v,rms}$ at a distance R from the source is related to the vibration source level at a reference distance R_0 . The conversion from vibration levels to ground-borne noise levels is determined by the following factors:

C_{dist} : Distance attenuation

$C_{damping}$: Soil damping loss across the geological media

$C_{building}$: Coupling loss into building foundation

C_{floor} : Coupling loss per floor

C_{noise} : Conversion factor from floor vibration levels to noise levels

C_{multi} : Noise level increase due to multiple sources

C_{cum} : Cumulative effect due to neighbouring sites

- 4.6.12 The predicted ground-borne noise level (L_p) inside the noise sensitive rooms is given by the following equation.

$$L_p = L_{v,rms} + C_{dist} + C_{damping} + C_{building} + C_{floor} + C_{noise} + C_{multi} + C_{cum}$$

4.6.13 The assessment was based on worst-case assumptions and the details of the assumptions are described in the following:

Reference Vibration Sources

4.6.14 Reference is made to the assessment approach, source terms and transmission factors adopted in the approved EIA studies for the Shatin to Central Link projects. The reference vibration levels of the PME's are summarized in **Table 4.11**.

Table 4.11 Summary of Reference Vibration Level of PME's

PME	Reference Vibration Level, mm/s	Remarks
Drilling rig	0.536	rms Vibration velocity level at reference distance of 5.5m
Hydraulic breaker	0.298	rms Vibration velocity level at reference distance of 5.5m
Hand-held breaker	0.279	rms Vibration velocity level at reference distance of 5.5m
TBM	2.5 ^(a)	PPV Vibration velocity level at reference distance of 5.5m

Notes:

(a) Reference was made to the approved KSL EIA Report. The geology encountered during the KSL EIA study consists predominately of granite, which is similar to the geology expected to be encountered in the study area. The KSL source vibration measurements are therefore considered the most appropriate available information for the purpose of assessing TBM ground-borne noise.

Distance Attenuation (C_{dist})

4.6.15 Ground-borne noise can attenuate by longer distance of vibration energy transmission pathway. For this assessment, the shortest plan distances between the ground-borne NSRs and the closest work areas are identified for correction. For separate distance over 300m, ground-borne noise assessment is excluded. Following equation is used to evaluate the distance attenuation factor (C_{dist}):

$$C_{dist} = 20 \times \log (R/R_0), \text{ where}$$

R = Separation between the tunnel boundary and the NSR;

R₀ = Reference distance of the vibration measurement (i.e. 5.5m)

Soil damping Factor ($C_{damping}$)

4.6.16 No damping attenuation was applied in this assessment as conservative approach.

Coupling Loss into Building Foundation, ($C_{building}$)

4.6.17 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 4.12**. In this assessment, the correction factor was assumed to be zero as conservative approach.

Table 4.12 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 (C_{floor})

4.6.18 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 (C_{noise})

4.6.19 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 adopted in the assessment are reduction of 27 dB for residential units, which is in line with the previous approved EIA reports.

Noise Level Increase due to Multiple Sources (C_{multi})

4.6.20 This represents the increase in noise level due to multiple noise sources. The factor adopted for this assessment is based on the number of plants used concurrently.

Cumulative Effect due to Neighbouring Sites (C_{cum})

4.6.21 Any cumulative effect of construction ground-borne noise due to nearby concurrent projects shall be included. However, for this Project, there is no concurrent project inducing ground-borne noise.

Conversion to A-weighted Noise

4.6.22 For assessment of ground-borne noise, a 20 dB(A) reduction is adopted for conversion to A-weighted noise. This conversion factor is obtained from the “Transit Noise and Vibration Impact Assessment”¹ and was also adopted in the previous approved EIA reports.

Prediction and Evaluation of Environmental Impacts

Unmitigated Airborne Construction Noise Impact (Non-Restricted Hours)

4.6.23 For normal daytime working hours, exceedances of the construction noise criteria for residential uses and educational institution were predicted at most the representative NAPs with no mitigation measures in place. Details of the unmitigated construction noise assessment are presented in **Appendix 4.5a** with the results summarized in **Table 4.13**. Predicted unmitigated construction noise levels at various representative floor levels are presented in **Appendix 4.5b**. With noise exceedance predicted, direct noise mitigation measures are required to alleviate the adverse construction noise impact on the affected NSRs.

Table 4.13 Summary of Unmitigated Construction Noise Levels

NAP ID	Description	Daytime Noise Criterion, Leq (30mins), dB(A)	Predicted Unmitigated Construction Noise Levels, Leq (30mins), dB(A)	Max. Noise Exceedance, dB(A)
Kowloon Side				
EH1	Eastland Heights	75	63 - 85	10
MC1	Marple Court	75	70 - 79	4
PH2	Peninsula Heights	75	75 - 84	9
PHD1	Planned Housing Development (NKIL6579)	75	73 - 86	11
Shatin Side				
WSH2	Wah Shing House, Fung Shing Court	75	80 - 86	11

¹ https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/FTA_Noise_and_Vibration_Manual.pdf

NAP ID	Description	Daytime Noise Criterion, Leq (30mins), dB(A)	Predicted Unmitigated Construction Noise Levels, Leq (30mins), dB(A)	Max. Noise Exceedance, dB(A)
STTNV1	Village House, Sha Tin Tau New Village	75	80 - 86	11
STTNV2	Village House, Sha Tin Tau New Village	75	83 - 89	14
STTNV5	Village House, Sha Tin Tau New Village	75	82 - 89	14
STW2	Shing Wai House, Sun Tin Wai Estate	75	81 - 86	11
STW6	Yu Wai House, Sun Tin Wai Estate	75	75 - 83	8
STGPS2	Sha Tin Government Primary School	70 65 (during examination)	74 - 82	12 (17 during Exam)
KTV2	House 3, Kak Tin Village	75	70 - 82	7
MWG1	Merry World Garden	75	71 - 83	8
KTV5	House 36, Kak Tin Village	75	63 - 90	15
HMKR1	Hung Mui Kuk Road Village Houses	75	62 - 84	9
WWG5	Block 4, World-Wide Gardens	75	74 - 84	9
WWG8	Block 3A, World-Wide Gardens	75	66 - 91	16
JG4	Block 3. Julimount Garden	75	63 - 87	12
HP1	House 1, Hill Paramount	75	71 - 85	10
UC1	Union Court	75	71 - 85	10
KSC1	Ka Shun Court	75	66 - 81	6
KATC1	Ka Yin House, Ka Tin Court	75	65 - 81	6

Remarks:

- Boldfaced values indicate exceedance to the respective noise criterion.

Unmitigated Airborne Construction Noise Impact (Restricted Hours)

4.6.24 As mentioned in **Section 4.5.3**, construction works may be undertaken during restricted hours. These activities will be under the control of the NCO and the contractors are required to apply for a CNP from the Noise Control Authority before works commence. An indicative assessment has been undertaken to determine the impacts. Details of the unmitigated construction noise assessment are presented in **Appendix 4.6b** with the results summarized in **Table 4.14**.

Table 4.14 Summary of Unmitigated Construction Noise Levels during Restricted Hours

NAP ID	Max. Predicted Unmitigated Construction Noise Levels, dB(A)	Noise Criterion, dB(A) Night-time (2300-0700)	Compliance
Kowloon Side			
EH1	70	50	No
MC1	64		No

NAP ID	Max. Predicted Unmitigated Construction Noise Levels, dB(A)	Noise Criterion, dB(A) Night-time (2300-0700)	Compliance	
PH2	62	50	No	
PHD1	80		No	
Shatin Side				
WSH2	73		No	
STTNV1	75		No	
STTNV2	75		No	
STTNV5	73		No	
STW2	76		No	
STW6	71		No	
KTV2	71		No	
MWG1	63		No	
KTV5	70		No	
HMKR1	73		No	
WWG5	83		No	
WWG8	83		No	
JG4	74		No	
UC1	67		No	
HP1	73	No		
KSC1	64	No		
KATC1	61	No		

Remarks:

- Boldfaced values indicate exceedance to the respective noise criterion.

Notes:

(a) In this assessment, it was assumed that only one work location for demolition and erection of sign gantry will be active.

Unmitigated Ground-borne Construction Noise Impact during Non-Restricted Hours

4.6.25 Ground-borne noise levels at the representative NSR associated with the use of TBM and PME for rock breaking/drilling works were predicted and are summarized in **Table 4.15** below. For the worst-case scenario, it was assumed in the calculation that all the PME would be operated simultaneously. Detailed calculations and assumptions are provided in **Appendix 4.7a**.

Table 4.15 Summary of Unmitigated Construction Ground-borne Noise Levels during Non-Restricted Hours

NAP ID	Predicted Unmitigated Ground-borne Construction Noise Levels, Leq (30mins), dB(A)	Daytime Noise Criterion, Leq (30mins), dB(A)	Compliance
Construction of New Middle Third Tunnel			
PHD1	58	65	Yes
Enlargement of Existing Kowloon bound Tunnel			
PHD1	49	65	Yes
Rehabilitation of Existing Shatin Bound Tunnel			
PHD1	53	65	Yes

4.6.26 As shown in **Table 4.15**, the predicted construction ground-borne noise levels at the representative NSR are expected to comply with the daytime ground-borne noise criterion.

Adverse construction ground-borne noise impact due to the use of TBM and PME during daytime period is not envisaged.

Unmitigated Ground-borne Construction Noise Impact during Restricted Hours

4.6.27 For the construction of new middle tunnel, TBM would be the only ground-borne noise source during construction within restricted hours. For the Enlargement of Existing Kowloon bound Tunnel and Rehabilitation of Existing Shatin Bound Tunnel, the PME inventory for restricted hours would be same as that assumed for non-restricted hours. Ground-borne noise impact during restricted hours are shown in **Table 4.16** below. Detailed calculations and assumptions are provided in **Appendix 4.7b**. The unmitigated ground-borne noise levels from the tunnel construction would comply with the noise criterion for evening period (1900-2300), but would exceed the noise criterion for night-time period (2300-0700).

Table 4.16 Summary of Unmitigated Construction Ground-borne Noise Levels during Restricted Hours

NAP ID	Predicted Unmitigated Construction Noise Levels, dB(A)	Noise Criterion, dB(A)		Compliance	
		Evening (1900-2300)	Night-time (2300-0700)	Evening (1900-2300)	Night-time (2300-0700)
Construction of New Middle Third Tunnel					
PHD1	42	55	40	Yes	No
Enlargement of Existing Kowloon bound Tunnel					
PHD1	49	55	40	Yes	No
Rehabilitation of Existing Shatin Bound Tunnel					
PHD1	53	55	40	Yes	No

Mitigation Measures

4.6.28 The results of the construction noise assessment indicate that, there would be exceedance of the construction noise criteria at most of NSRs in the absence of any mitigation measures. The various mitigation options listed below have thus been considered:

- Good site practices to limit noise emissions at the sources;
- Use of quiet powered mechanical equipment;
- Use of movable noise barrier, noise enclosure, noise insulating fabric, silencer, etc. to screen noise from construction plant;
- Install acoustic tunnel door or enclosure at portals for construction activities to be carried out inside tunnel during restricted hours; and
- Use of purpose-built noise barrier or acoustic shed for road works during restricted hours; and
- Providing sufficient separation distance between NSRs and items of PME.

4.6.29 The above mitigation measures would be implemented on work sites as good practices where appropriate. Detailed descriptions of these mitigation measures are given in the following sections.

Good Site Practice

4.6.30 Although the noise mitigation effects are not easily quantifiable and the benefits may vary with site conditions and operating conditions, good site practices are easy to implement and do not impact upon the works schedule. The site practices listed below should be followed during each phase of construction:

- 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 from NSRs as possible;
- Machines and plant (such as trucks) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum; and
- 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.

4.6.31 In addition, the “*Recommended Pollution Control Clauses for Construction Contracts*” published by the EPD should be adopted in the Contract Specification for the Contractors to follow and implement relevant measures and good site practices in minimising noise impact.

Quiet Powered Mechanical Equipment

4.6.32 To reduce the noise impacts at the affected NSRs during normal daytime working hours, mitigation measure such as the use of quiet PME is recommended. The type of quiet PME adopted in this assessment is for reference only. The contractors may adopt alternative quiet PME as long as it can be demonstrated that they would not result in construction noise impacts worse than those predicted in this assessment.

4.6.33 For the use of quiet plant associated with the construction works, reference has been made to Quality Powered Mechanical Equipment (QPME) list available on the EPD website, which provides the SWLs for specific quiet PME or PME specification published by equipment manufacturer. The items of QPME and the associated SWLs adopted for the assessment are listed in **Table 4.17**. The plant inventory for mitigated scenario and SWLs adopted for noise assessment are detailed in **Appendix 4.8**.

Table 4.17 SWL of QPME adopted for Construction Noise Mitigation

QPME / Quiet PME	QPME Reference Number	Brand	Model Number	SWL, dB(A)
Air Compressor	EPD-09710	AIRMAN	PDS185S-5C5	94
Roller, vibratory	EPD-09720	SAKAI	SW502S-1	94
Crane, mobile	EPD-10792	KOBELCO	CKS900	101
Loader, wheeled	EPD-09366	Liebherr	L524	100
Asphalt Paver	EPD-01226R	VOLVO	ABG5770	104
Bulldozer, tracked	EPD-07836	SHANTUI	DH13K	105
Generator	EPD-03347	Denyo	DCA-220ESM	93
Hand-held Percussive Breaker	EPD-09826	Hilti	TE 2000-AVR	100
Crane, mobile	EPD-05797	Maeda	CC985-1	91
Excavator, wheeled/tracked	EPD-10780	KOMATSU	PC138US-8	97

4.6.34 Traditional demolition and rock excavation method rely on excavator mounted hydraulic breaker to break rocks or concrete pavement, however, operating hydraulic breakers would inevitably generate significant noise impact to the NSRs nearby. As confirmed by Project Engineer, it is feasible to adopt quieter rock or concrete breaking equipment (e.g. hydraulic crusher, hydraulic rock splitter, breaker (mini-robot mounted) or hand-held breaker with QPME label) in some activities as a mitigation measure. These quieter rock breaking equipment would create less noise impact to the NSRs. The Contractor should, subject to the actual site condition, proactively adopt quieter rock breaking equipment, hydraulic crusher

or non-mechanical breaking method (e.g. use of chemical expansion agent) to carry out the demolition / excavation works, where practicable.

- 4.6.35 For sheet piles installation, “Press-in” method is more preferable than the use of vibratory hammer due to less noise and vibration impact generated. According to the EPD web page, the noise emission of “Press-in” method is 69 dB(A) at 7 m from the silent piler, which is quieter than the vibratory hammer by more than 20 dB(A). The Contractors should prioritize the use of “Press-in” method over the traditional method if site conditions allowed. However, “Press-in” method would also has its own limitations and it should not restrict Contractors to fully adopt the “Press-in” as long as the Contractor can demonstrate the full compliance of daytime noise criteria by using vibratory hammer with proper mitigation measures.

Use of Movable Noise Barrier, Purpose-built Barrier, Noise Insulating Fabric and Noise Enclosure

- 4.6.36 To alleviate the construction noise impact on the affected NSRs, noise barriers or enclosures would be erected to provide screening from the construction plant. Noise barriers will become more effective when located immediately adjacent to the PME and can reduce the noise level by up to 5 dB(A) and 10 dB(A) for mobile and stationary plants, respectively. The contractors shall be responsible for design of the noise barrier with due consideration given to the size of the PME and the requirement of intercepting the line of sight between the NSRs and PME. The barrier material of movable noise barrier should have at least 10 kg/m² surface density. Purpose-built acoustics barrier can be used to screen noise from particular items of PME or noisy construction activities. The direct line of sight between the PME and the NSRs should be totally screened by a substantial barrier such that the PME will not be visible when viewed from any window, door or other opening in any façade of the NSR. Reference can be made to the EPD webpage² for the design of purpose-built noise barrier. Subject to the work arrangement in construction stage, the Contractor may propose other form of mitigation measures to achieve the full compliance. A noise reduction of 10 dB(A) is assumed for purpose-built noise barrier.
- 4.6.37 In addition, noise insulating fabric (the Fabric) would be installed for PME such as piling rigs and drilling rigs and the Fabric shall be lapped such that there would be no opening or gaps on the joints. With reference to MTRC Contract C4420 Tsim Sha Tsui Modification Noise Assessment Report for Variation of Environmental Permit (July 2003) and the technical data from manufacturer, a noise reduction of over 10 dB(A) could be achieved with the use of the Fabric. As a conservative approach, a noise reduction of 10 dB(A) for the PME lapped with the Fabric was assumed in this assessment.
- 4.6.38 The use of full enclosure has been considered in this assessment to shelter the noise from conveyor belt. The minimum surface density of the enclosure panel should achieve 10 kg/m². These enclosures could provide about 15 dB noise attenuation.
- 4.6.39 The use of noise barrier and enclosure for various items of PME adopted for noise assessment are detailed in **Appendix 4.8**.

Install Acoustic Tunnel Door or Enclosure at the Kowloon Portal for Tunnelling Activities during Restricted Hours

- 4.6.40 For “Enlargement of Existing Kowloon Bound Tunnel” and “Rehabilitation of Existing Shatin Bound Tunnel”, the construction activities will be conducted inside the tunnel during restricted hours. It is considered that installation of acoustic tunnel door or enclosure at the tunnel portals is an effective mitigation measure for construction works to be conducted inside the tunnels. Based on the result of noise assessment, acoustic tunnel doors may be required at Kowloon portals, and it is envisaged that all construction activities would be conducted behind the acoustic tunnel doors during restricted hours. The acoustic tunnel door or enclosure should be made of acoustic panels and the ventilation openings of the tunnel door or enclosure should also be fitted with silencers. The Contractor should select a proper type of

² https://www.epd.gov.hk/epd/misc/construction_noise/contents/index.php/en/road-works/item/74-mitigation-measures/157-construction-noise-barrier.html

acoustic panel and silencer which can provide necessary noise reduction performance to achieve the full compliance of ANLs. Schematic drawing of acoustic door is shown in **Appendix 4.11**. Subject to the work arrangement in construction stage, the Contractor may propose other form of mitigation measures to achieve the full compliance of ANLs. In applying for a CNP, the Contractor shall require to demonstrate to the satisfaction of the Noise Control Authority the noise reduction effect of the mitigation measures to be adopted.

Use of Purpose-built Noise Barrier or acoustic shed for Road Works during Restricted Hours

- 4.6.41 To comply with noise criteria for night-time road works, the Contractor should set up purpose-built noise barriers or acoustic shed to alleviate the adverse noise impact. Reference can be made to the EPD webpage³ for the design of purpose-built noise barrier.

Providing Sufficient Separation between NSR and Construction Activities during Restricted Hours

- 4.6.42 It is noted that the night-time construction works would be undertaken in close proximity of some NSRs, would require further arrangement to alleviate the noise impact. The Contractor should place the PME farthest away from the NSRs where possible. Minimum separation distances between the PMEs and the affected NSRs were calculated in this assessment and details are presented **Appendix 4.11**. These minimum separation distances were calculated based on the assumption of ASR "B" for the NSRs, and may be changed depending on the actual ASR determined by the Authority at the time of assessment in the CNP application.
- 4.6.43 To minimizing the ground-borne noise impact during restricted hours, it is recommended that the PME that generate ground-borne noise should not be used at a location close to the NSRs. The PME may require to maintain a sufficient separation distance from NSR in order to comply with the ground-borne noise criteria for restricted hours. For the assessment purpose, setback distance of 420 m is assumed when the construction activities of "Enlargement of Existing Kowloon bound Tunnel" and "Rehabilitation of Existing Shatin Bound Tunnel" are undertaken during restricted hours.

Mitigated Construction Noise Levels during Non-Restricted Hours

- 4.6.44 Having taken into account the noise reduction achieved by the above-mentioned mitigation measures, the mitigated construction noise levels at the representative NAPs would be in the range of 49 to 78 dB(A). The predicted noise impacts at different NAPs are summarized in **Table 4.18** with detailed calculations given in **Appendix 4.9a**. Predicted mitigated construction noise levels at various representative floor levels are presented in **Appendix 4.9b**. The results revealed that the construction noise levels at most of NSRs would comply with the EIAO-TM daytime noise criterion after the implementation of the proposed noise mitigation measures, except Block 3A, World-Wide Gardens, House 36, Kak Tin Village, Sha Tin Government Primary School during examination periods and village houses in Sha Tin Tau New Village. Non-compliance at these NSRs is due to the relative short separation distance from the work zones. Further noise mitigation measures are required for these non-compliance NSRs.

Table 4.18 Summary of Mitigated Construction Noise Levels during Non-Restricted Hours

NAP ID	Description	Daytime Noise Criterion, Leq (30mins), dB(A)	Predicted Mitigated Construction Noise Levels, Leq (30mins), dB(A)	Max. Noise Exceedance, dB(A)
Kowloon Side				
EH1	Eastland Heights	75	52 - 74	-

³ https://www.epd.gov.hk/epd/misc/construction_noise/contents/index.php/en/road-works/item/74-mitigation-measures/157-construction-noise-barrier.html

NAP ID	Description	Daytime Noise Criterion, Leq (30mins), dB(A)	Predicted Mitigated Construction Noise Levels, Leq (30mins), dB(A)	Max. Noise Exceedance, dB(A)
MC1	Marple Court	75	56 - 68	-
PH2	Peninsula Heights	75	61 - 72	-
PHD1	Planned Housing Development (NKIL6579)	75	62 - 75	-
Shatin Side				
WSH2	Wah Shing House, Fung Shing Court	75	69 - 74	-
STTNV1	Village House, Sha Tin Tau New Village	75	69 - 74	-
STTNV2	Village House, Sha Tin Tau New Village	75	72 - 77	2
STTNV5	Village House, Sha Tin Tau New Village	75	70 - 76	1
STW2	Shing Wai House, Sun Tin Wai Estate	75	69 - 74	-
STW6	Yu Wai House, Sun Tin Wai Estate	75	65 - 71	-
STGPS2	Sha Tin Government Primary School	70 65 (during examination)	63 - 70	- (5 during Exams)
KTV2	House 3, Kak Tin Village	75	58 - 69	-
MWG1	Merry World Garden	75	55 - 70	-
KTV5	House 36, Kak Tin Village	75	47 - 77	2
HMKR1	Hung Mui Kuk Road Village Houses	75	46 - 72	-
WWG5	Block 4, World-Wide Gardens	75	60 - 72	-
WWG8	Block 3A, World-Wide Gardens	75	53 - 78	3
JG4	Block 3, Julimount Garden	75	50 - 74	-
HP1	House 1, Hill Paramount	75	60 - 75	-
UC1	Union Court	75	56 - 75	-
KSC1	Ka Shun Court	75	51 - 71	-
KATC1	Ka Yin House, Ka Tin Court	75	56 - 72	-

Further Noise Mitigation Measures for Non-Compliance NSRs – Sequencing Operation of Construction Activities at Critical Works Area and Reduction of number of PME

- 4.6.45 With the implementation of the abovementioned mitigation measures, noise exceedance would still be predicted at NAP WWG8, KTV5, STTNV5, STTNV2 and STGPS2 during examination period. Further noise mitigation measures are required for these NSRs.
- 4.6.46 Based on the assessment result, the noise exceedance would be mainly caused by operation of several noisy construction activities concurrently. In practice, it is feasible that the

Contractor can arrange to carry out different noisy construction activities in sequence at works area close to WWG8, KTV5, STTNV5 and STTNV2. For WWG8, KTV5, STTNV5 and STTNV2, it is recommended to create a buffer zone in which only one type of construction activity is allowed to be carried out at the same time. Other concurrent construction activities should be conducted outside the buffer zone. Moreover, for WWG8 and KTV5, it is also recommended that the number of Vibratory Compactor should reduce from 6 nos. to 4 nos. when “Road Surfacing” Works is carried out within the respective buffer zones. Further noise mitigation measures and the predicted mitigated construction noise levels for WWG8, KTV5, STTNV5 and STTNV2 are summarized in **Table 4.19** below. With the implementation of the further noise mitigation measures, the maximum construction noise levels at WWG8, KTV5, STTNV5 and STTNV2 would comply with the daytime noise criterion of 75 dB(A). Detailed results are presented in **Appendix 4.10a**, **Appendix 4.10b**, **Appendix 4.10c** and **Appendix 4.10d**.

Table 4.19 Summary of Mitigated Construction Noise Levels after implementation of Further Noise Mitigation Measures

NAP ID	Buffer Zone Size	Further Mitigation Measures	Daytime Noise Criterion, Leq (30mins), dB(A)	Maximum Predicted Mitigated Construction Noise Levels, Leq (30mins), dB(A)	Max. Noise Exceedance, dB(A)
WWG8	50m	<ul style="list-style-type: none"> Only one type of construction activity is allowed to be carried out at the same time Vibratory Compactor should reduce from 6 nos. to 4 nos. when “Road Surfacing” Works is carried out within the respective buffer zones 	75	75	-
KTV5	40m	<ul style="list-style-type: none"> Only one type of construction activity is allowed to be carried out at the same time Vibratory Compactor should reduce from 6 nos. to 4 nos. when “Road Surfacing” Works is carried out within the respective buffer zones 	75	75	-
STTNV5	45m	<ul style="list-style-type: none"> Only one type of construction activity is allowed to be carried out at the same time 	75	75	-
STTNV2	45m	<ul style="list-style-type: none"> Only one type of construction activity is allowed to be carried out at the same time 	75	75	-

4.6.47 With the assumption of typical examination periods occurred in the month May, June, November and December, noise exceedance at STGPS2 would be predicted in 9 months, including June and November 2030, May, June, November & December 2031, May & June 2032 and November 2033, with maximum exceedance of 5 dB(A). It is recommended that particularly noisy construction activities in work zone 1 & 2 (i.e. “Pile Cap, L-retaining Wall and Formation of new road”, “Pile Cap and Formation of new road”, “Foundation of Noise Barrier”, “Slope Formation / Upgrading Works” and “Road Surfacing”), 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. With the particularly noisy construction activities not to be carried out during the examination periods, the mitigated construction noise impact would comply with the noise criterion, 65 dB(A).

Cumulative Construction Noise Impact

Revised Trunk Road T4 in Sha Tin

- 4.6.48 Only three representative NAPs of the Project (i.e. STTNV1, STTNV2 and WSH2), are located within 300m from certain work fronts of Revised Trunk Road T4 in Sha Tin. Based on the best available information of Revised Trunk Road T4, the construction works will be completed in September 2028, while the construction activities in Work Zone 1 and Work Zone 1a of the Project will be commenced in December 2028. Therefore, no cumulative construction noise impact from Revised Trunk Road T4 is expected.

In-situ Reprovisioning of Sha Tin Water Treatment Works - South Works - Designs and Construction

- 4.6.49 According to the construction programme provided by the project proponent of In-situ Reprovisioning of Sha Tin Water Treatment Works – South Works, major construction works of this concurrent project would be completed by January 2025 before the commencement of the Project. No cumulative construction noise impact is anticipated.

Relocation of Diamond Hill Fresh Water and Salt Water Service Reservoirs to Caverns

- 4.6.50 Two representative NAPs, namely EH1 and PH2, are located within 300m from the Relocation of Diamond Hill Fresh Water and Salt Water Service Reservoirs to Caverns. Based on the information provided by the project proponent, the construction of this concurrent project will be completed by 2027, therefore, the construction activities in Work Zone 7 & 7a of the Project may pose cumulative construction noise impacts to EH1 and PH2 in Years 2025, 2026 and 2027. Owing to the fact that EH1 has no direct line of sight to this concurrent project and the mitigated construction noise impacts from Work Zone 7 & 7a are 10 dB(A) less than the daytime construction noise criterion, cumulative construction noise impact would be insignificant. The respective notional source position of Work Zone 7 & 7a are located beyond 300m from PH2, therefore, cumulative construction noise impact at PH2 would be insignificant.

The Proposed Drainage Improvement Works at Chui Tin Street and Chui Tin Street Soccer Pitch

- 4.6.51 Based on the best available information, some of the construction works (e.g. road breaking, excavation, backfilling...etc.) of this concurrent project would be carried out along Chui Tin Street and Kak Tin Street from Year 2023 – 2031. Only a small work site of the drainage improvement works (near Kak Tin Playground) would be located within 300m study area of the Project. Considering only small-scale construction works would be involved for the drainage improvement works and the associated work site would be located far away from the Project (>200m), no significant cumulative construction noise impact is anticipated.

Mitigated Construction Noise Levels during Restricted Hours

- 4.6.52 Based on the indicative assessment results, the mitigated construction noise impacts arising from the construction work to be undertaking during restricted hours would comply with the night-time noise criterion at the representative NSRs. Detailed calculation of construction noise impacts during restricted hours is presented in **Appendix 4.11**.
- 4.6.53 The above assessment only demonstrates that the construction works in restricted hours would be feasible in the context of programming construction work. If the Contractor considers that there is a need to carry out construction works during restricted hours, a CNP shall be obtained from the Noise Control Authority prior to commencement of such works. There are some factors affecting the assessment results of a CNP application, such as the assigning of Area Sensitivity Rating, Acceptable Noise Levels etc. The Noise Control Authority would decide these at the time of assessment of such application based on the contemporary situations / conditions. It should be noted that the situations / conditions around the sites may change from time to time. The Authority may make correction for multiple permit situations if in the opinion of the Authority the NSR will be materially affected by noise from construction work associated with more than one CNP, and the Authority may make such

correction to the relevant noise level as it considers appropriate having regard to standard acoustical principles and practices. The Area Sensitivity Ratings assumed in this EIA Report are for indicative assessment only. It is also recommended that the use of QPMEs for constructions works during restricted hours should be stated clearly in the D&C contract.

Mitigated Construction Ground-borne Noise Levels during Restricted Hours

- 4.6.54 Similar to the construction airborne noise impact assessment for restricted hours, the ground-borne noise assessment for the construction during restricted hours demonstrates the construction works during restricted hours would be feasible. The ground-borne noise impact would depend on the number of PME to be used and the separation distance between the NSR and the PME. It should be noted that the ground-borne assessment in this EIA study conducted with various conservative assumptions. After the commencement of the Project, the Contractor can collect on-site measurement data for accurate prediction of ground-borne noise. The indicative ground-borne noise assessment has shown that the ground-borne noise impact would comply with the noise criterion for night-time period when TBM operation maintains 160m from the NSRs and the items of PME to be used for “Enlargement of Existing Kowloon bound Tunnel” and “Rehabilitation of Existing Shatin Bound Tunnel” have at least 420 m setback from the NSRs. Detailed calculations are presented in **Appendix 4.12**.

Evaluation of Residual Construction Noise Impacts

- 4.6.55 With the implementation of the recommended noise mitigation measures, including the use of QPME, deployment of construction noise barriers, sequencing operation of construction activities at critical area, reduction of number of PME at critical works area and avoiding to carry out particular noisy construction activities during examination periods, the predicted noise levels at the NSRs during non-restricted hours due to the construction of the Project would comply with the noise criteria set out in EIAO-TM. Therefore, residual construction airborne noise impacts are not anticipated.
- 4.6.56 No residual impact of construction ground-borne noise was predicted from construction works during non-restricted hours.
- 4.6.57 An indicative assessment has been undertaken for possible construction activities during restricted hours (1900 – 0700 hours) associated with the Project. Provided that appropriate noise mitigation measures would be implemented, the predicted airborne and ground-borne noise levels at the NSRs would comply with the noise criteria set out in the GW-TM under NCO.

4.7 Operation Phase Road Traffic Noise Impact Assessment

Identification of Project Roads Sections

- 4.7.1 For the purpose of traffic noise impact assessment, the road sections of the Project within the meaning of Item A.1 of Schedule 2 of the EIAO “A road which is an expressway, trunk road, primary distributor road or district distributor road including new roads and major extensions or improvements to existing roads” are considered as “Project roads”.
- 4.7.2 If the improvement work at the existing road would not change the nature of the road, the alignment or the traffic capacity or traffic composition, and these road improvement works would not induce significant traffic noise impact, i.e. the traffic noise level with the Project would not greater than that without the Project at the design year by 1.0 dB(A) or more in accordance with EIAO Guidance Note GN 12/2010 “Road Traffic Noise Impact Assessment under the Environmental Impact Assessment Ordinance”, this road improvement work is not considered within the ambits of Item A.1 of Schedule 2 of the EIAO. These improved roads sections that the nature of road, alignment, traffic capacity or traffic composition are not significantly changed by the Project are considered as “Other roads”.
- 4.7.3 For Kowloon side, road works under the Project would include provision of a new vehicular bridge to connect the slip road from Lung Cheung Road westbound to Lion Rock Tunnel Road

- northbound. The new vehicular bridge would be considered as “Project roads” in the assessment. The location of the vehicular bridge is presented in **Appendix 4.16**.
- 4.7.4 The details of road improvement works on the existing roads at Kowloon side under the Project are presented in **Section 4.5.7**. A sensitivity test has been conducted to determine whether these proposed improvement works would result in significant noise impact to the nearby NSRs at Kowloon side. The difference in term of the predicted overall road traffic noise levels at Kowloon side between without- and with-Project scenario would be less than 1.0 dB(A). Hence, the traffic noise impact induced by the Project on these existing roads would be insignificant. These road sections with improvement works under the Project at Kowloon side were considered as “Other Roads” in the assessment.
- 4.7.5 For Shatin side, the details of road improvement works on the existing roads under the Project are presented in **Section 4.5.8**. A sensitivity test has been conducted to determine whether these proposed improvement works would result in significant noise impact to nearby NSRs at Shatin side. The difference in term of the predicted overall road traffic noise levels at Shatin side between without- and with-Project scenario would be more than 1.0 dB(A). Hence, the traffic noise impact induced by the Project on these existing roads would be significant. These road sections with improvement works under the Project at Shatin side were considered as “Project roads” in the assessment.
- 4.7.6 The road segments classified as “Project roads” and “Other roads” are presented in **Appendix 4.16**.
- Assessment Methodology
- 4.7.7 Traffic noise impact 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 6-lanes Lion Rock Tunnel. Road traffic noise levels were 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 commencement year of the opening of the 6-lanes Lion Rock Tunnel would be in Year 2034. The assessment year with maximum traffic projections (morning peak hour traffic flows and vehicle compositions, which is generally higher traffic flows than afternoon peak) within 15 years upon operation of the Project would be 2041. Year 2041 was adopted as assessment year in road traffic noise assessment due to its peak population prediction in Traffic Impact Assessment of the Project. The predicted traffic data of the prevailing year and the assessment year is presented in **Appendix 4.13**. Transport Department (TD) agreement on the adopted traffic data is presented in **Appendix 4.14**.
- 4.7.8 For the purpose of the road traffic noise assessment in this EIA study, the roads within 300m from the proposed Project Boundary, including the planned Trunk Road T4 under the year 2041-based scenarios, are included in the assessment. Road-plots of the traffic noise model showing the extent of “Project roads” and traffic speed of roads are depicted in **Appendix 4.16**.
- 4.7.9 Referring to the requirements of the EIA study brief, the following scenarios were assessed in the EIA study.
- With-Project unmitigated scenario at the assessment year with maximum traffic projection within 15 years upon operation of the Project, i.e. Year 2041
 - With-Project mitigated scenario at Year 2041
 - Prevailing scenario at Year 2024 (for indirect mitigated measures eligibility test)
- 4.7.10 In accordance with HyD Guidance Notes on Road Surface Requirements for Expressways and High Speed Road (RD/GN/032), polymer modified friction course (PMFC) is proposed as the standard surfacing material on the road sections with design speed of 70km/h or above without traffic lights and classified as trunk road/high speed road. PMFC would therefore be provided on Lion Rock Tunnel Road N/B and S/B at Shatin side in accordance with the engineering design. The PMFC would be considered as pervious road surface with reference to CRTN and hence provide a noise reduction of 2.5 dB(A) compared with concrete road

surface. The extent of road section with PMFC is presented in **Appendix 4.15**. The existing noise barriers and low noise surfacing (LNRS) on the existing roads within 300m assessment area were included in the models for all assessment scenarios. The existing roads with LNRS are presented in **Appendix 4.15**. The latest available noise mitigation measures proposed for Trunk Road T4 were also included in the models for all assessment scenarios, except the Prevailing scenario.

- 4.7.11 Direct mitigation measures would be proposed when the predicted road traffic noise levels exceed the criteria set in Annex 5 of EIAO-TM. In accordance with the EPD's Guidance Note GN 12/2010, the direct mitigation measures would be considered or proposed on the road project under the subject DP if there would be adverse environmental impact. If the NSRs are affected by noise from other existing roads, direct mitigation measures are required to reduce the noise from the concerned road project(s) to a level that it
- (a) is not higher than the standard (stated in **Section 4.2.11**); and
 - (b) has no significant contribution to the overall noise from other existing roads, if the cumulative noise level, i.e. noise from the road project under the subject DP together with "Other roads", exceeds the standard.
- 4.7.12 In cases where direct noise mitigation measures alone are not adequate in mitigating noise to a level in compliance with the EIAO-TM noise criteria, indirect noise mitigation measures for existing NSRs may be adopted. Eligibility of the affected premises for indirect noise mitigation measures is determined with reference to EPD's Guidance Note GN 12/2010, the following three criteria, all of which must be satisfied:
- (a) The predicted overall noise level exceeds the noise standard in accordance with EIAO-TM (as stated in **Section 4.2.11**); and
 - (b) The predicted overall noise level is at least 1.0 dB(A) more than the prevailing traffic noise level, i.e. the total traffic noise level existing before the works to construct the road were commenced; and
 - (c) The contribution from the Project to the increase in the predicted overall noise level is at least 1.0 dB(A).
- 4.7.13 If indirect mitigation measures are required, the total number of affected existing dwellings, classrooms and other noise sensitive elements would be estimated.
- 4.7.14 The potential tunnel portal noise impact due to the proposed tunnel portals was also assessed qualitatively.

Prediction and Evaluation of Road Traffic Noise Impact (With-Project Unmitigated Scenario)

- 4.7.15 Road traffic noise assessment has been conducted for the representative NAPs in the assessment year 2041. The predicted traffic noise levels at the representative NAPs of Kowloon side and Shatin side under the with-Project unmitigated scenario are summarised in **Table 4.20** and **Table 4.21**, respectively. **Appendix 4.17a** shows the details of the road traffic noise assessment results of each NAPs at different assessment levels under the unmitigated scenario.
- 4.7.16 The predicted overall noise levels at all representative NSRs on the Kowloon side were found to exceed the noise criteria under with-Project unmitigated scenario. The noise exceedance would be mainly contributed by existing roads, including Lung Cheung Road, Waterloo Road and non-"Project roads" sections of the Lion Rock Tunnel Roads. The predicted "Project roads" noise levels at all NSRs would comply with the respective noise criteria and the "Project roads" contribution to the overall noise level would be less than 1.0 dB(A). Hence, the exceedance of the predicted overall noise levels at these NSRs would be due to the "Other roads". Provision of road traffic noise mitigation measure at the "Project roads" would be ineffective.

Table 4.20 Summary of Predicted Road Traffic Noise Levels under Unmitigated Scenario at Kowloon Side

NSR ID	Criterion, L ₁₀ (1-hr) dB(A)	Predicted Noise Level, L ₁₀ (1-hr) dB(A)				Whether Noise Mitigation Measures on “Project Roads” are Required or Not
		Overall	“Project Roads”	“Other Roads”	Max. “Project Roads” Contribution when Overall Noise Level exceed Criteria	
AC	70	69 ~ 80	41 ~ 62	69 ~ 80	0.1	No
EH	70	74 ~ 79	46 ~ 63	74 ~ 79	0.1	No
JC	70	69 ~ 78	42 ~ 61	69 ~ 78	0.2	No
KKC	70	73 ~ 74	24 ~ 45	73 ~ 74	< 0.1	No
LCC	70	68 ~ 80	37 ~ 55	68 ~ 80	0.1	No
LSTYKHSS	65	76 ~ 76	16 ~ 16	76 ~ 76	< 0.1	No
MC	70	68 ~ 80	43 ~ 61	68 ~ 80	< 0.1	No
MH	70	83 ~ 86	39 ~ 44	83 ~ 86	< 0.1	No
PH	70	80 ~ 83	45 ~ 61	80 ~ 83	0.1	No
PHD	70	58 ~ 71	-	58 ~ 71	< 0.1	No
TMC	70	78 ~ 82	-	78 ~ 82	< 0.1	No
TP	70	71 ~ 75	43 ~ 54	71 ~ 75	0.1	No
WG	70	69 ~ 81	44 ~ 60	69 ~ 81	0.1	No
WH	70	69 ~ 79	42 ~ 61	69 ~ 79	0.1	No

Remarks:

- Boldfaced values indicate exceedance to the respective noise criterion.
- Hyphenated indicate less than 10 dB(A) noise level.
- With reference to CRTN, noise levels should be rounded to nearest integer for comparison with the criterion.

4.7.17

On the Shatin side, the dominant road traffic noise sources were found to be Lion Rock Tunnel Road (both “Project roads” section and non-“Project roads” section), Hung Mui Kuk Road and Shatin Road. The predicted overall noise levels under the with-Project unmitigated scenario at NSRs HLMSS, HMKR, KATC, KSC, KTVT1, KTVT2, MWG, POHCKMC and STWTWSQ would comply with the respective criteria. No adverse road traffic noise impact would be anticipated at these NSRs under the with-Project unmitigated scenario. For NSR STT, the predicted overall noise levels under the with-Project unmitigated scenario would exceed the respective criterion, but the “Project roads” contribution would be less than 1.0 dB(A), indicating the exceedance would solely due to Other Roads. For other NSRs at the Shatin side, the predicted overall noise levels would exceed the respective criteria, and “Project roads” section of Lion Rock Tunnel Road would contribute at least 1.0 dB(A) in the total overall noise level. Therefore, direct mitigation measures are required to mitigate the road traffic noise impact from the “Project roads” at Shatin side.

Table 4.21 Summary of Predicted Road Traffic Noise Levels under Unmitigated Scenario at Shatin Side

NSR ID	Criterion, L ₁₀ (1-hr) dB(A)	Predicted Noise Level, L ₁₀ (1-hr) dB(A)				Whether Noise Mitigation Measures on “Project Roads” are Required or Not
		Overall	“Project Roads”	“Other Roads”	Max. “Project Roads” Contribution when Overall Noise Level exceed Criteria	
FSC	70	66 ~ 78	65 ~ 76	60 ~ 76	8.5	Yes
GLG	70	73 ~ 79	58 ~ 68	71 ~ 79	2.1	Yes
HLMSS	65	52 ~ 56	52 ~ 56	20 ~ 20	-	No
HMKR	70	64 ~ 65	55 ~ 56	63 ~ 64	-	No
HP	70	60 ~ 74	57 ~ 74	47 ~ 59	17.2	Yes
JG	70	69 ~ 78	64 ~ 77	64 ~ 71	12.5	Yes
KATC	70	55 ~ 70	55 ~ 70	32 ~ 47	-	No
KSC	70	52 ~ 69	52 ~ 69	24 ~ 25	-	No
KTC	70	71 ~ 76	52 ~ 67	70 ~ 76	1.9	Yes
KTV	70	60 ~ 72	60 ~ 72	19 ~ 58	23.1	Yes
KTVT1	65	63 ~ 63	62 ~ 62	51 ~ 51	-	No
KTVT2	65	62 ~ 62	62 ~ 62	41 ~ 41	-	No

NSR ID	Criterion, L ₁₀ (1-hr) dB(A)	Predicted Noise Level, L ₁₀ (1-hr) dB(A)				Whether Noise Mitigation Measures on “Project Roads” are Required or Not
		Overall	“Project Roads”	“Other Roads”	Max. “Project Roads” Contribution when Overall Noise Level exceed Criteria	
MWG	70	63 ~ 65	63 ~ 65	39 ~ 43	-	No
POHCKMC	65	64 ~ 65	49 ~ 53	64 ~ 65	-	No
STGPS	65	69 ~ 74	63 ~ 69	68 ~ 74	2.4	Yes
STT	70	62 ~ 71	54 ~ 64	62 ~ 70	0.9	No
STTNV	70	67 ~ 78	67 ~ 77	53 ~ 69	9.0	Yes
STW	70	71 ~ 78	67 ~ 78	62 ~ 68	15.2	Yes
STWTWSQ	70	53 ~ 54	53 ~ 54	15 ~ 15	-	No
UC	70	59 ~ 72	59 ~ 72	35 ~ 56	17.8	Yes
WWG	70	71 ~ 83	62 ~ 83	58 ~ 72	23.3	Yes

Remarks:

- Boldfaced values indicate exceedance to the respective noise criterion.
- Hyphenated indicate no exceedance for the NSR.
- With reference to CRTN, noise levels should be rounded to nearest integer for comparison with the criterion.

Consideration of Direct Mitigation Measures at Kowloon side

- 4.7.18 Since the noise contribution from the “Project roads” would be less than 1.0 dB(A) in the overall noise level at Kowloon side, it is not effective to provide the direct noise mitigation measures on the “Project roads”. Review on the feasibility of provision of direct noise mitigation measures on the “Other roads” that involve road improvement works by the Project, is conducted and the findings are presented as below and in **Appendix 4.17b**.
- 4.7.19 For road improvement at the widened road section of Waterloo Road northbound as mentioned in **Section 4.5.7(b)** (referred as Road Section (b) in **Appendix 4.17b**), application of LNRS is not recommended due to the sharp turning at the portion of Waterloo road between the slip road from Lung Cheung Road westbound to the new vehicular, according to Clause 3.2.3 in Guidance Notes on Low Noise Road Surfacing (RD/GN/011C) by HyD. Should LNRS be applied on the road section, frequent road resurfacing would be expected, causing maintenance burden and extra noise nuisance to the nearby NSRs. Regarding the existing NSRs along Waterloo Road, provision of noise barrier at the central median of Waterloo Road and along the existing Waterloo Road southbound would not be engineering feasible, due to the structural support limitation from existing structure. Provision of noise barrier as a standalone structure along the existing Waterloo Road southbound would also be engineering infeasible, due to the limited space for standalone structural construction. Provision of noise barrier along the west side of the widened section of Waterloo Road northbound would only provide insignificant noise reduction to the NSR PHD. In view of the above, no direct mitigation measure is recommended for this road section.
- 4.7.20 For road improvement works at the Lion Rock Tunnel road in the vicinity of tunnel portals (both northbound and southbound) as mentioned in **Section 4.5.7(c)** (referred as Road Section (c) in **Appendix 4.17b**), application of LNRS is not recommended due to the large maximum gradient (larger than 5%) and frequent sharp turning/braking is also expected at the vicinity of tunnel portal for other lanes merging in/diverging out of the mainline, according to Clause 3.2.3 in Guidance Notes on Low Noise Road Surfacing (RD/GN/011C) by HyD. Consideration is also given from the maintenance point of view for the application of the LNRS, frequent resurfacing is expected due to the aforesaid concerns and closure of this strategic route may result in heavy traffic congestion for the traffic from/to Kowloon Region. In addition, it would cause maintenance burden and extra noise nuisance to the nearby NSRs. In fact, noise from these road sections has been screened by the existing slopes on the east and west sides. Provision of vertical and/or cantilever barrier along these road sections would not provide effective noise reduction to the nearby NSRs, hence, it is not recommended. Provision of noise enclosure at the road section is also not recommended since it may direct the tunnel portal noise toward the NSRs along Waterloo Road and Lung Cheung Road. In view of the above, no direct mitigation measure is recommended for these road sections.

- 4.7.21 For road improvement works at the slip road from Lion Rock Tunnel Road southbound to Lung Cheung Road eastbound as mentioned in **Section 4.5.7(d)** (referred as Road Section (d) in **Appendix 4.17b**), application of LNRS is not recommended due to the large maximum gradient (larger than 5%) and sharp turning/braking is also expected at the slip road, according to Clause 3.2.3 in Guidance Notes on Low Noise Road Surfacing (RD/GN/011C) by HyD. The slip road from Lion Rock Tunnel Road southbound provide connection from two strategic route (i.e. Lion Rock Tunnel Road and Lung Cheung Road). In view of its large gradient and heavy traffic at the mainline for merging in/diverging out of the slip road, frequent baking is expected at the slip road and causing durability issue to the road surfacing leading to frequent road resurfacing. Should LNRS be applied on this slip road, frequent road resurfacing would be expected, causing maintenance burden and extra noise nuisance to the nearby NSRs. Therefore, LNRS is not proposed. Provision of noise barrier at the south-west side of this slip road is not proposed as it would have potential obstruction of sightline for road users which cause safety concern and the noise from this slip road is insignificant to the NSRs along Lung Cheung Road. Provision of noise barrier at the central median of existing Lung Cheung Road (within the Project Boundary area) is also not recommended due to limited space at the central median for foundation works of noise barrier. Therefore, no direct mitigation measure is recommended for this road section.
- 4.7.22 For road improvement works at the slip road from Lung Cheung Road eastbound to Lion Rock Tunnel Road northbound as mentioned in **Section 4.5.7(e)** (referred as Road Section (e) in **Appendix 4.17b**), application of LNRS is not recommended due to the large maximum gradient (larger than 5%) and sharp turning/baking is also expected at the slip road, according to Clause 3.2.3 in Guidance Notes on Low Noise Road Surfacing (RD/GN/011C) by HyD. Similar to the slip road from Lion Rock Tunnel Road southbound to Lung Cheung Road eastbound, frequent baking at the merging point with the mainline and sharp turning at the center portion of the slip road is expected which will cause durability issue to the road surfacing with PMFC and frequent resurfacing is required. Should LNRS be applied on this road section, frequent road resurfacing would be expected, causing maintenance burden and extra noise nuisance to the nearby NSRs. Provision of noise barrier at the north-western kerb would not provide effective noise reduction as the existing slope already provided noise screening effect. For NSRs along Waterloo Road, provision of noise barrier at the south-east side of the slip road would provide insignificant noise reduction. In view of the above, no direct mitigation measure is recommended for this road section.
- 4.7.23 Review on the feasibility of provision of direct noise mitigation measures on the “Other roads” within the Project Boundary but without improvement works under the Project, is conducted and the findings are presented as below.
- 4.7.24 For the existing Waterloo Road vehicular bridge crossing Lung Cheung Road (K7A bridge) (referred as Road Section (f) in **Appendix 4.17b**), application of LNRS is not recommended on the jointed concrete pavement, according to Clause 3.2.3 in Guidance Notes on Low Noise Road Surfacing (RD/GN/011C) by HyD. Should LNRS be applied on this road section, frequent road resurfacing would be expected, causing maintenance burden and extra noise nuisance to the nearby NSRs. Provision of noise barrier at the existing vehicular bridge would not be engineering feasible, due to the structural support limitation from existing structure. Substantial modification of the existing bridge structure is required for the provision of the noise barrier which may lead to long duration of temporary full closure of the Waterloo road in both direction and as a result of causing serious traffic congestion and impact to “Other roads” in the vicinity. Therefore, no direct mitigation measure is recommended for the Waterloo Road vehicular bridge.
- 4.7.25 For the existing Waterloo Road section within the Project Boundary(referred as Road Section (g) in **Appendix 4.17b**), application of LNRS is not recommended on jointed concrete pavement at both northbound and southbound, according to Clause 3.2.3 in Guidance Notes on Low Noise Road Surfacing (RD/GN/011C) by HyD. Should LNRS be applied on these road sections, frequent road resurfacing would be expected, causing maintenance burden and extra noise nuisance to the nearby NSRs. Regarding the existing NSRs along Waterloo Road, provision of noise barrier at the central median of Waterloo Road and along the existing Waterloo Road southbound would not be engineering feasible, due to the structural support limitation from existing structure. Provision of noise barrier as a standalone structure along

the existing Waterloo Road southbound would not be engineering feasible, due to the limited space for standalone structural construction and long duration of the temporary closure of the slow lane of Waterloo road southbound. Therefore, no direct mitigation measure is recommended for the Waterloo Road vehicular bridge.

- 4.7.26 It is noted that there are limitations for provision of LNRS according to the existing Guidance Notes on Low Noise Road Surfacing (RD/GN/011C) by HyD. Other materials for LNRS are being reviewed and tested by the Government for application in Hong Kong. Application of new LNRS material on roads within Project Boundary would be reviewed in the detailed design stage.

Recommended Direct Mitigation Measures at Shatin side

- 4.7.27 For Shatin side, as stated in **Section 4.7.10**, application of LNRS on Lion Rock Tunnel Road N/B and S/B at Shatin side would mitigate the adverse road traffic noise impact. Other direct noise mitigation measures including vertical barriers, cantilever barriers and semi-enclosures are recommended to mitigate the adverse traffic noise impact on the affected NSRs. The details of the proposed noise mitigation measures are summarised in below **Table 4.22** with total length of the mitigation measures rounded off to the nearest 10m. The locations of the barriers are shown on **60604728/R42b/Figure 4.4**, **60604728/R42b/Figure 4.4.1 to 60604728/R42b/Figure 4.4.5**. These direct mitigation measures have been reviewed by Project Engineer to be feasible from engineering point of view. The noise mitigation measures should be provided prior to operation of the respective section of the road.

Table 4.22 Summary of Noise Mitigation Measures at Shatin Side

ID	Noise Mitigation Measures	Approximate Length (m)	Nearest NSRs with their IDs to be Benefitted ⁽¹⁾
S-C-01	7m tall + 3.5m at 90 degree cantilever barrier	130	UC, HP and JG
S-S-03	7.5m to 12m tall semi-enclosure	410	UC, HP, JG and WWG
S-C-02	7m tall + 3.5m at 90 degree cantilever barrier with absorptive material at the vertical panel (facing World Wide Garden)	50	WWG
S-S-01	7.5m to 12m tall semi-enclosure	400	KTC, GLG, and WWG
S-V-01	2m tall vertical barrier	40	KTV
S-S-02	7.5m to 12m tall semi-enclosure	490	KTV, KTVT, STGPS, STW and FSC
S-C-03	7m to 10m tall + 3.5m at 90 degree cantilever barrier	60	FSC and STT
S-V-02	6m tall vertical barrier	70	STTNV
S-V-03	6m tall vertical barrier	60	STTNV

Remarks:

- (1) At least one dwelling or one classroom benefited, i.e. at least 1.0 dB(A) decrease in predicted overall noise level under mitigated scenario, compared with unmitigated scenario.

Consideration of Other Direct Mitigation Measures at Shatin side

- 4.7.28 Apart from the mitigation measures in **Table 4.22**, review on the feasibility of provision of direct noise mitigation measures on “Other” roads within the Project Boundary at Shatin side, is conducted and the findings are presented in **Appendix 4.17b** and below.
- 4.7.29 For the section of Hung Mui Kuk Road within the Project Boundary(referred as Road Section (s) in **Appendix 4.17b**), application of LNRS is not recommended due to the frequent braking expected at the vicinity of bus stop and the slip road from/to Lion Rock Tunnel Road, and sharp turning at the portion of Hung Mui Kuk Road connecting Lion Rock Tunnel Road, according to Clause 3.2.3 in Guidance Notes on Low Noise Road Surfacing (RD/GN/011C) by HyD. Should LNRS be applied on these road sections, frequent road resurfacing would be expected, causing maintenance burden and extra noise nuisance to the nearby NSRs. In view of the merging lane from the slip road (Lion Rock Tunnel Road northbound to Hung Mui Kuk Road northbound) to Hung Mui Kuk Road, provision of noise barrier and/or enclosure

may induce potential obstruction of sightline for road users, especially at the slip road merging sections, which cause safety concern. Therefore, no direct mitigation measure is recommended for this road section. As stated in **Section 4.7.26**, the application of new LNRS material on roads within Project Boundary would be reviewed in detailed design stage.

- 4.7.30 For the Lion Rock Tunnel Road next to Fung Shing Court(referred as Road Section (t) in **Appendix 4.17b**), LNRS has been applied as mentioned in **Section 4.7.10**. Provision of noise barrier along the existing Lion Rock Tunnel Road is also explored to further reduce the noise impact to nearby receivers as far as possible. Cantilever barrier S-C-03 is proposed at the northbound of the concerned road. Due to the limited construction space for the foundation of noise barrier/enclosure and structural support limitation from existing elevated structure at both northbound and southbound, upgrading of the cantilever barrier S-C-03 to semi-enclosure is considered to be engineering infeasible. Therefore, no additional direct mitigation measure is recommended for this road section.

Prediction and Evaluation of Road Traffic Noise Impact (With-Project Mitigated Scenario)

- 4.7.31 For Kowloon side of the Project, as the exceedance are due to “Other roads”, noise mitigation measures on the “Project roads” would not be effective to have noise protection on the NSRs. As discussed in **Sections 4.7.19 to 4.7.25**, installation of noise mitigation measures on “Other roads” is not feasible due to engineering constraints or not effective in noise reduction at the NSRs. Thus, no direct noise mitigation measure is recommended on the “Project roads” and “Other roads”.

- 4.7.32 With the implementation of the above recommended noise mitigation measures at Shatin side, the predicted mitigated traffic noise levels at the representative NSRs are summarised in below **Table 4.23**, and the detailed results are presented in **Appendix 4.17a**. The predicted overall noise levels at most of the NSRs at Shatin side under the with-Project mitigated scenario would comply with the respective noise criteria, except NSRs FSC, GLG, JG, KTC, STGPS and WWG which would be affected by “Other roads”. For these NSRs exposed to noise exceedance, their respective contributions from “Project roads” in their predicted overall traffic noise level would be less than 1.0 dB(A), as indicated in **Table 4.23**, and their predicted traffic noise levels due to “Project roads” are in compliance with the respective traffic noise criteria. As such, no further direct mitigation measures on “Project roads” are required. As discussed in **Sections 4.7.28 to 4.7.30**, further installation of noise mitigation measures on “Other roads” is not feasible due to engineering constraints. The noise exceedance at these NSRs would be due to “Other roads” which have not been involved in any road improvement works in this Project.

Table 4.23 Summary of With-Project Mitigated Road Traffic Noise Assessment Results at Assessment Year (Shatin Side)

NSR ID	Criterion, L ₁₀ (1-hr) dB(A)	Predicted Noise Level, L ₁₀ (1-hr) dB(A)				Whether Further Noise Mitigation Measures on “Project Roads” are Required or Not
		Overall	“Project Roads”	“Other Roads”	Max. “Project Roads” Contribution when Overall Noise Level exceed Criteria	
FSC	70	56 ~ 75	45 ~ 59	55 ~ 75	0.2	No
GLG	70	71 ~ 79	50 ~ 63	70 ~ 79	0.7	No
HLMSS	65	52 ~ 56	52 ~ 56	20 ~ 20	-	No
HMKR	70	64 ~ 64	51 ~ 52	63 ~ 64	-	No
HP	70	56 ~ 70	51 ~ 70	47 ~ 59	-	No
JG	70	66 ~ 71	50 ~ 69	64 ~ 71	0.1	No
KATC	70	54 ~ 70	54 ~ 70	32 ~ 47	-	No
KSC	70	52 ~ 69	52 ~ 69	24 ~ 25	-	No
KTC	70	71 ~ 76	45 ~ 61	70 ~ 76	0.5	No
KTV	70	59 ~ 70	57 ~ 70	19 ~ 58	-	No
KTVT1	65	62 ~ 62	61 ~ 61	51 ~ 51	-	No

NSR ID	Criterion, L ₁₀ (1-hr) dB(A)	Predicted Noise Level, L ₁₀ (1-hr) dB(A)				Whether Further Noise Mitigation Measures on “Project Roads” are Required or Not
		Overall	“Project Roads”	“Other Roads”	Max. “Project Roads” Contribution when Overall Noise Level exceed Criteria	
KTVT2	65	61 ~ 61	61 ~ 61	41 ~ 41	-	No
MWG	70	62 ~ 64	62 ~ 64	39 ~ 43	-	No
POHCKMC	65	64 ~ 65	44 ~ 49	64 ~ 65	-	No
STGPS	65	69 ~ 74	57 ~ 65	68 ~ 74	0.9	No
STT	70	61 ~ 69	35 ~ 43	61 ~ 69	-	No
STTNV	70	62 ~ 70	61 ~ 70	51 ~ 67	-	No
STW	70	59 ~ 68	47 ~ 65	58 ~ 68	-	No
STWTWSQ	70	53 ~ 54	53 ~ 54	15 ~ 15	-	No
UC	70	55 ~ 69	55 ~ 69	35 ~ 56	-	No
WWG	70	50 ~ 72	45 ~ 64	48 ~ 72	0.9	No

Remarks:

- Boldfaced values indicate exceedance to the respective noise criterion.
- Hyphenated indicate no exceedance for the NSR.
- With reference to CRTN, noise levels should be rounded to nearest integer for comparison with the criterion.

Noise Sensitive Receivers Exposed to Exceedance

4.7.33 With reference to Clause 3.3.2(c) of the Appendix C of the EIA Study Brief, the estimated number of the total number of dwellings, classrooms and other NSRs that exposed to road traffic noise impact exceeding the respective criteria are listed below **Table 4.24**.

Table 4.24 Estimated Number of Dwellings, Classrooms and Other NSRs Exposed to Exceedance

NSR Type	Estimated Number of NSR				
	Kowloon Side		Shatin Side		
	Prevailing Scenario in 2024	Unmitigated Scenario in 2041	Prevailing Scenario in 2024	Unmitigated Scenario in 2041	Mitigated Scenario in 2041
Dwellings	544	546	1,754	1,701	462
Classroom	24	24	40	40	40
Place of Public Worship	-	-	1	0	0

4.7.34 Prior to the commencement of the Project, it is estimated that a total of 2,363 existing dwellings, classroom and other NSRs have already been subject to traffic noise impact due to the existing roads. The proposed Project without any noise mitigation measures will slightly decrease the number of existing dwellings, classroom and other NSRs along the Project to be exposed to the excessive traffic noise by 52. Upon exhausting all practicable direct noise mitigation measures, it is estimated that the number of dwellings, classroom and other NSRs exposed to exceedance will be 1,072, which is 1,291 less than that prior to the commencement of the Project. The noise exceedance at these NSRs would be due to “Other roads” which have not been involved in any road improvement works in this Project

NSRs Benefited from and Protected by the Proposed Direct Mitigation Measures

4.7.35 With reference to Clause 3.4.1(b) of Appendix C of the EIA Study Brief, the estimated number of NSRs that will be benefited from and protected by provision of the direct noise mitigation measures in Shatin side are listed below in **Table 4.25**. No direct noise mitigation measure is proposed in Kowloon side.

Table 4.25 Estimated Number of Dwellings, Classrooms and Other NSRs Benefited from and Protected by Provision of Direct Noise Mitigation Measures

NSR Type	Estimated Number of NSR in Shatin Side	
	Benefited	Protected
Dwellings	1,510	1,239
Classroom	16	0
Place of Public Worship	1	0
Total	1,527	1,239

Remarks:

- “Benefited” indicates a reduction of at least 1.0 dB(A) predicted overall noise level at the NSR due to the provision of direct noise mitigation measures.
- “Protected” indicates the predicted overall noise level at the NSR reduced from exceedance to compliance to the respective criterion due to the provision of direct noise mitigation measures.

Tunnel Portal Noise Impact

- 4.7.36 Located within 300m of the Kowloon portal, only one NSR PHD (i.e. planned residential development NKIL 6579) is identified. The NSR is not directly facing the tunnel portal. In view of the highly directional nature of tunnel portal noise, the associated noise impact is expected to be insignificant.
- 4.7.37 Since no NSR within 300m of the Shatin portal is identified, no adverse operation phase tunnel portal noise impact would be anticipated.

Evaluation of Residual Road Traffic Noise Impacts

- 4.7.38 For the existing and planned NSRs where the overall noise level still exceeds the criteria, all feasible direct mitigation measures such as noise enclosure, noise barrier, low noise surfacing, etc. have been considered and exhausted. With the proposed noise mitigation measures in place, the “Project roads” noise levels at all representative NSRs would comply with the relevant noise criteria and the “Project roads” contributions to the overall noise levels at all representative NSRs would be insignificant, i.e. less than 1.0 dB(A). No further direct mitigation measures are required.
- 4.7.39 **Appendix 4.18** presents the eligibility test against the above three testing criteria stated in **Section 4.7.12** for indirect noise mitigation measure. As comparing, the increase in noise levels at the NSRs between Year 2024 Prevailing Scenario and Year 2041 Scenario is less than 1.0 dB(A). Due to high prevailing noise levels and/or dominant noise contribution from “Other roads”, all representative NSRs do not fall within the three testing criteria, indirect noise mitigation measure is therefore not required under this Project.
- 4.7.40 Therefore, no adverse road traffic noise impact due to the Project would be anticipated for NSRs at both Kowloon side and Shatin side of the Project Area.

4.8 Operation Phase Fixed Noise Impact Assessment

Assessment Methodology – Fixed Noise

- 4.8.1 The fixed noise impact assessment for operation of the proposed ventilation buildings were undertaken based on standard acoustic principles and followed the procedures given in the IND-TM. The following standard acoustic formula was used for calculating the sound pressure levels at the representative NSR.

$$SPL = SWL - DC + FC + TC$$

Where:

- SPL = Sound Pressure Level at NSR, in dB(A)
- SWL = Sound Power Level of the PME, in dB(A)
- DC = Distance Attenuation, in dB(A) (i.e. $20\log D + 8$ [where D is the distance in metres])
- FC = Façade Correction, in dB(A) (i.e. 3 dB(A))
- TC = Tonality Correction, in dB(A) (i.e. 6 dB(A))

- 4.8.2 It is assumed that all the fixed noise sources within the same location would be operated simultaneously at any time of the day for the worst-case scenario.
- 4.8.3 With reference to EPD's Good Practices on Pumping System Noise Control and Good Practices on Ventilation System Noise Control, a positive 6 dB(A) for correction of tonality was considered in the assessment as a worst-case assumption.

Prediction and Evaluation of Fixed Noise Impact

- 4.8.4 Two ventilation shafts for the tunnel have been proposed, one near the Shatin Portal and one near the Kowloon Portal. The locations of the potential fixed noise sources during operation phase are shown in [60604728/R42b/Figure 4.3.1](#) and [60604728/R42b/Figure 4.3.2](#).
- 4.8.5 There is no existing or planned noise sensitive use identified within the 300m assessment boundary from the Shatin Portal ventilation building. Hence, no adverse operation phase fixed noise impact due to the Shatin Portal ventilation building is anticipated at Shatin side of Project area.
- 4.8.6 The maximum sound power level of the Kowloon Portal ventilation building would be L_{eq} (30 min) 90 dB(A), as specified by the Project Engineer and agreed by HyD. The representative planned NSR PHD3 is located in "area other than those above" and directly affected by major influencing factors of Lion Rock Tunnel Road and Lung Cheung Road with over 30,000 vehicles annual average daily traffic (AADT). Therefore, the ASR rating is considered to be "C". The Acceptable Noise Level (ANL) -5 dB(A) noise criteria at 65, 65, 55 dB(A) during day, evening and night time respectively is found to be more stringent than the background noise measurement conducted and are therefore adopted as the noise criteria. The detailed background noise measurement data is shown in [Appendix 4.19](#) and fixed noise calculation is shown in [Appendix 4.20](#).
- 4.8.7 The predicted fixed noise level at the representative NSRs (PHD3) due to the operation of fixed plant (i.e. the fixed noise sources) of the Kowloon Portal ventilation building would be L_{eq} (30 min) 55 dB(A) which would meet the relevant noise criterion. No mitigation measures would be required.

Evaluation of Residual Fixed Noise Sources Impacts

- 4.8.8 No residual fixed noise sources impact due to the operation of the Project is anticipated.

4.9 Environmental Monitoring and Audit requirement

Construction Noise

- 4.9.1 Noise monitoring is recommended as part of the environmental monitoring and audit (EM&A) programme for the construction phase of the Project to check compliance with the daytime construction noise criterion. The implementation of the recommended mitigation measures for daytime construction activities should also be audited as part of the EM&A programme. Details of the EM&A requirements are provided in the EM&A Manual. A Construction Noise Management Plan, which to verify the inventory of noise sources, evaluate the potential construction noise impacts and to assess the effectiveness and practicality of all identified measures for mitigating the construction noise impact of the project, would be prepared before commencement of construction works.

Operation Phase Road Traffic Noise

- 4.9.2 Road traffic noise monitoring should be carried out at representative noise sensitive receivers, during operation phase at representative NSRs located in the vicinity of the recommended direct mitigation measures, during the first year after road opening. Details of the programme are provided in the EM&A Manual.

Operation Phase Fixed Noise

- 4.9.3 The assessment results indicated that fixed noise from ventilation building operation would comply with the EIAO-TM criterion. 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 Conclusion

Construction Noise

- 4.10.1 This assessment has presented the construction noise impacts of the Project during normal daytime working hours. The assessment results indicated that the mitigated noise levels at all NSRs would comply with the noise criteria set out in the EIAO-TM with the implementation of the proposed noise mitigation measures, including the use of QPME, deployment of construction noise barriers, sequencing operation of construction activities at critical area, reduction of PME at critical works area and avoiding to carry out particular noisy construction activities during examination periods. Adverse noise impact arising from construction works of the Project during non-restricted hours is not anticipated. It is recommended that a Construction Noise Management Plan, which to verify the inventory of noise sources, evaluate the potential construction noise impacts and to assess the effectiveness and practicality of all identified measures for mitigating the construction noise impact of the project, would be prepared before commencement of construction works.
- 4.10.2 Cumulative construction noise impacts from concurrent projects during normal daytime working hours have been evaluated and no adverse cumulative construction noise impact would be anticipated.
- 4.10.3 Construction ground-borne noise impacts arising from tunnelling, rock breaking/drilling associated with the operation of TBM and concerned PME (such as hydraulic breaker, drill rig, and hand-held breaker) would comply with the noise criteria. No adverse construction ground-borne noise impacts were predicted.
- 4.10.4 An indicative assessment has been undertaken for possible construction activities during restricted hours (1900 – 0700 hours) associated with the Project. Provided that appropriate noise mitigation measures would be implemented, the predicted airborne and ground-borne noise levels would comply with the noise criteria set out in the GW-TM under NCO. It should be noted that the construction noise impact assessment in restricted hours is conducted to evaluate whether the construction works in restricted hours are feasible or not in the context of programming construction work, the Noise Control Authority will process any CNP application based on the NCO and the relevant technical memoranda in addition to considering the contemporary situations / conditions.

Road Traffic Noise

- 4.10.5 Road traffic noise impact assessment has been conducted. The predicted overall noise levels would exceed the respective noise criteria at most NSRs in the unmitigated scenario during the assessment year 2041. However, it is found that the exceedance in Kowloon side would be solely due to the traffic noise from other existing roads. The predicted “Project roads” noise levels at NSRs of Kowloon side would comply with the respective criteria and the predicted “Project roads” contribution to the overall noise level would be less than 1.0 dB(A), indicating the “Project roads” noise contribution would be insignificant under the unmitigated scenario. No further direct noise mitigation measures on “Project roads” at Kowloon side are considered effective in mitigating the noise impact.
- 4.10.6 In Shatin side, various types of noise barriers and enclosures have been proposed as direct noise mitigation measures. The predicted “Project roads” noise levels at the representative NSRs would comply with the noise criteria with the mitigation measures in place. However, the predicted overall noise levels at some NSRs would still exceed the noise criteria under the mitigated scenario. The major noise source would be the other existing roads, such as non-“Project Roads” section of Lion Rock Tunnel Road, Hung Mui Kuk Road and Sha Tin

Road. The predicted noise levels of “Project roads” contribution to the overall noise levels would be less than 1.0 dB(A), indicating the “Project roads” noise contribution would be insignificant under the mitigated scenario. No further direct noise mitigation measures on “Project roads” at Shatin side are considered effective in mitigating the noise impact.

- 4.10.7 Eligibility tests showed that none of the NSRs are eligible for consideration of indirect mitigation measures under the EIAO-TM.
- 4.10.8 Since no NSR has been identified within 300m of the Shatin Portal, no adverse tunnel portal noise impact would be anticipated from the Shatin Portal. On the other hand, one NSR was identified within 300m of the Kowloon Portal. Since the NSR is not directly facing the tunnel portal the portal and the highly directional nature of portal noise, the associated portal noise impact is expected to be insignificant. No mitigation measures would be required.

Fixed Noise

- 4.10.9 Quantitative operation phase fixed noise sources impact assessment on vent shaft of the ventilation buildings has been conducted. The predicted fixed noise level at the representative NSR at Kowloon side of Project Area would meet the relevant criteria. On the other hand, no NSR was identified within 300m assessment boundary of Shatin ventilation building. Therefore, no adverse fixed noise sources impact would be anticipated for both Kowloon side and Shatin side ventilation buildings, and no mitigation measures would be required.