

6. AIRBORNE NOISE IMPACT

Introduction

- 6.1 Potential airborne noise impacts likely arising during the construction and operational phases of the Project have been evaluated and mitigation measures have been recommended in this section.

Environmental Legislation, Standards and Guidelines

General

- 6.2 Noise impacts have been assessed in accordance with the criteria and methodology given in the Technical Memoranda (TMs) under the Noise Control Ordinance (NCO), and Annexes 5 and 13 in the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM).
- 6.3 The Noise Control Ordinance, Cap. 400 (NCO) and Environmental Impact Assessment Ordinance, Cap. 499 (EIAO) provide the statutory framework for noise control. Assessment procedures and standards are set out in the following Technical Memoranda (TMs):
- Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM)
 - Technical Memorandum on Noise from Construction Work other than Percussive Piling (GW-TM)
 - Technical Memorandum on Noise from Percussive Piling (PP-TM)
 - Technical Memorandum on Noise from Construction Work in Designated Areas (DA-TM)
 - Technical Memorandum for the Assessment of Noise from Places Other Than Domestic Premises, Public Places or Construction Sites (IND-TM)
- 6.4 As a general principle for noise assessment as stated in the associated TMs, “any premises or place shall, however, be considered to be a Noise Sensitive Receiver (NSR) only when it is in use for its intended purpose”.
- 6.5 Percussive piling is governed under the PP-TM and a construction noise permit (CNP) is required in order to carry out such work. As the issuance of a CNP by the Noise Control Authority would depend on the compliance of percussive piling noise impact with the limits set out within the PP-TM, the assessment of this type of noise would not be covered in the EIA report.

Construction Noise during Non-restricted Hours

- 6.6 Daytime general construction works (excluding percussive piling) between the hours 0700 – 1900 on weekdays, i.e. non-restricted hours, is controlled under the EIAO. Annex 5 of the EIAO-TM sets out the construction noise assessment limits, which are $L_{eq(30\ min)}$ 75dB(A) for domestic premises, hotels and hostels; and $L_{eq(30\ min)}$ 70dB(A) for schools during normal hours (65dB(A) during examination periods) and all other places where unaided voice communication is required. The criteria are summarized in [Table 6.1](#).

Table 6.1 Air-borne Daytime Construction Noise Criteria

Uses	Daytime Noise Criteria, ($L_{eq, 30min}$, dB(A))
Domestic premises	75
Educational Institution	70
Educational Institution (during examination)	65

Note: The above standards apply to uses which rely on opened windows for ventilation

Construction Noise Standards during Restricted Hours

- 6.7 All days between 1900 and 0700 hours and the whole day on Sundays and public holidays, activities involving the use of Powered Mechanical Equipment (PME) for the purpose of carrying out construction work are 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. The corresponding basic noise levels (BNLs) for evening and night-time periods are given in [Table 6.2](#).

Table 6.2 Construction Noise Criteria for Activity other than Percussive Piling during Restricted Hours

Time Period	ANL on Different Area Sensitivity Rating During Restricted Hours ($L_{eq, 30min}$, dB(A))		
	Area Sensitivity Rating A	Area Sensitivity Rating B	Area Sensitivity Rating C
All days during evening (1900 to 2300 hours), and general holidays (including Sundays) during the day-time evening (0700 to 2300 hours)	60	65	70
Night (2300 to 0700 hours)	45	50	55

Construction Noise Permits

- 6.8 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.
- 6.9 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
- 6.10 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 construction noise criteria are presented in [Table 6.3](#).

Table 6.3 Construction Noise Criteria for SPME

Time Period	Basic Noise Level (BNLs)		
	Area Sensitivity Rating A	Area Sensitivity Rating B	Area Sensitivity Rating C
All days during evening (1900 to 2300 hours), and general holidays (including Sundays) during the day-time evening (0700 to 2300 hours)	45	50	55
Night (2300 to 0700 hours)	30	35	40

Airborne Rail Noise during Operational Phase

6.11 The EIAO-TM and IND-TM stipulate the appropriate ANL for airborne rail noise. The ANLs are dependent on Area Sensitivity Ratings of the Noise Sensitive Receivers (NSRs) and are shown in [Table 6.4](#). The EIAO-TM also specifies the noise limit of L_{max} to be 85 dB(A) during night-time. In accordance with the Hong Kong Planning Standards and Guidelines (HKPSG), a 24-hour averaged noise level of 65dB(A) $L_{eq,24hr}$ has been specified.

Table 6.4 Airborne Rail Noise Criteria

ABNSR Description	ANL on Different Area Sensitivity Rating for Air-borne Operational Noise, ($L_{eq, 30min}$, dB(A))					
	Daytime and Evening time (0700 to 2300 hrs)			Night-time (2300 to 0700 hrs)		
	A	B	C	A	B	C
Domestic premises, hotel, hostel and hospitals	60	65	70	50	55	60
Churches, School, medical clinics, and performing arts centre ^[b]	60	65	70	[a]		

Notes:

[a] No sensitive use/activities during this period.

[b] Churches, School, performing arts centre, Clinics are considered to be noise sensitive during daytime and evening time only.

Fixed Plant Noise during Operational Phase

6.12 Fixed plant noise sources are controlled by Section 13 of the NCO. For the assessment of impacts from fixed noise sources, the Area Sensitivity Ratings are determined based on the best available information at this stage. Nothing in this report shall bind the Noise Control Authority in the context of law enforcement against any fixed sources being assessed.

6.13 More stringent criteria for fixed plant noise impact recommended in the EIAO-TM for planning purposes are as follows ([Table 6.5](#)):

- 5dB(A) below the appropriate ANL set out in the IND-TM (the ANL-5dB(A) criterion); or
- The prevailing background noise level where the prevailing background noise level is lower than 5dB(A) below the appropriate ANL (i.e. ANL - 5dB(A)).

Table 6.5 Fixed Plant Noise Criteria

Time Period	Fixed Plant Noise for Different Area Sensitivity Rating, ($L_{eq, 30min}$, dB(A))					
	ANL, dB(A)			ANL-5, dB(A)		
	A	B	C	A	B	C
Day (0700 to 1900 hours)	60	65	70	55	60	65
Evening (1900 to 2300 hours)	60	65	70	55	60	65
Night (2300 to 0700 hours)	50	55	60	45	50	55

- 6.14 The above-mentioned second criteria would generally apply to areas with low prevailing noise levels such as suburban areas. For areas without major nearby noise sources such as road and rail traffic, NSRs adjacent to these locations would be subject to low prevailing noise levels which could be lower than the ANL-5dB(A) criterion. In order to determine the appropriate criteria for noise assessment, background noise measurements at representative NSRs were conducted. For those NSRs which are found to experience prevailing noise levels lower than the ANL-5dB(A) criterion, fixed plant noise impact would be assessed against the prevailing background noise levels.

Description of the Existing Environment

- 6.15 The alignment of the Project is located at well-developed area. The surrounding land uses mainly comprise a mixture of commercial, Government/Institution/Community and residential uses. Dominant noise sources were identified as the road traffic noise from Princess Margaret Road, Hong Chong Road, Chatham Road South, Chatham Road North, Cheong Tung Road South, Hung Luen Road and Cross Harbour Tunnel, etc. Key sources of noise impact are summarised in [Table 6.6](#).

Table 6.6 Key Noise Sources to the Existing Environment

Existing Noise Sources	Affecting Areas
Road Traffic Noise from Princess Margaret Road, Hong Chong Road, Chi Man Street, Chatham Road South, Chatham Road North and associated slip roads	Areas around Oi Man Estate and Carmel Secondary School
Princess Margaret Road, Hong Chong Road, Cross Harbour Tunnel, Chatham Road South, Chatham Road North and associated slip roads	Areas around Parc Palais, Wylie Court and Wing Fung Building
Hong Chong Road, Princess Margaret Road link, Cheong Tung Road South and Cross Harbour Tunnel	Areas around The Hong Kong Polytechnic University
Princess Margaret Road link, Cheong Tung Road South, and Hong Chong Road	Areas around Royal Peninsula
Salisbury Road, Hung Hom Bypass, Hung Luen Road, Cheong Tung Road South and associated slip roads	Areas around The Metropolis Residence, Harbour Plaza Metropolis and Harbourfront Horizon

- 6.16 Several noise measurements have been conducted from January to April 2009 to identify the prevailing noise levels. As observed during the measurements, existing noise was dominated by traffic noise from major roads. Railway noise from the East Rail Line was also audible at some locations. The prevailing noise levels were listed in [Table 6.7](#).

Table 6.7 Prevailing Noise Levels

Areas	Time Period	Prevailing Noise Level, dB(A) $L_{eq, 30 mins}$
Areas around Oi Man Estate & Carmel Secondary School facing Princess Margaret Road	Day & Evening	>70dB(A)
	Night	>60dB(A)
Areas around Parc Palais, Wylie Court and Wing Fung Building facing Princess Margaret Road and Hong Chong Road	Day & Evening	>70dB(A)
	Night	>60dB(A)
Areas around Parc Palais, facing Wylie Road and Gascoigne Road	Day & Evening	>70dB(A)
	Night	>60dB(A)
Areas around The Hong Kong Polytechnic University facing Hong Chong Road	Day & Evening	>70dB(A)
	Night	>60dB(A)

Areas	Time Period	Prevailing Noise Level, dB(A) $L_{eq, 30 mins}$
Areas around Royal Peninsula facing Hong Chong Road and Cheong Wan Road South	Day & Evening	>70dB(A)
	Night	>60dB(A)
Areas around Harbour Plaza Metropolis and Harbourfront Horizon facing Cheong Wan Road and Hung Hom Bypass	Day & Evening	>70dB(A)
	Night	>60dB(A)
Areas around The Metropolis Residence facing existing HUH	Day & Evening	>65dB(A)
	Night	>55dB(A)

Noise Sensitive Receivers

- 6.17 Existing and planned/committed noise sensitive receivers have been identified based on Survey and Mapping Office drawings of the assessment areas (i.e. 300m from project alignment associated with fixed noise sources), Outline Zoning Plans, and Outline Development Plans and Layout Plans, while existing receivers have been verified through site visits. For NSRs like hotels (e.g. Harbour Plaza Metropolis) and educational institutions (e.g. Hong Kong Polytechnic University) which are air-conditioned and do not rely on openable windows for ventilation, those would not be identified for air-borne construction noise impact assessment in this Report. For consistent approach, same NSRs have been considered for KTE, SCL (HUH-ADM) and SCL (TAW-HUH) at the interfacing areas. Key Noise Sensitive Receivers (NSR) for the Cut & Cover Scheme (C&C) during construction phase is shown in [Figure No. NEX2213/C/361/ENS/M52/501](#) whereas [Figure No. NEX2213/C/361/ENS/M52/601](#) is for operational phase. More details are summarized in [Tables 6.8 and 6.9](#).

Table 6.8 Representative Noise Sensitive Receivers/Assessment Point for Air-borne Noise Assessment

NSR ID	Description	Land Use	No. of storey
<i>Air-borne Construction Phase</i>			
OM1	Shun Man House, Oi Man Estate	Residential	23
OM2	Parc Palais, Block 6	Residential	24
OM3	Parc Palais, Block 1	Residential	24
OM4a	Carmel Secondary School (South Block) (All rooms are air-conditioned and soundproof windows)	Educational Institution	5
HH1	Wylie Court, Block C	Residential	20
HH2	Wing Fung Building	Residential	8
HH4	Royal Peninsula, Block 2	Residential	42
HH7	The Metropolis Residence (with centralised fresh-air supply) ^[a]	Service Apartment	18
HH9	Harbourfront Horizon (with centralised fresh-air supply) ^[b]	Commercial/ Service Apartment	22
<i>Air-borne Operational Phase (Rail Noise)</i>			
OM1a	Shun Man House (South Block), Oi Man Estate	Residential	23
OM1b	Shun Man House (North Block), Oi Man Estate	Residential	23
OM2	Parc Palais, Block 6	Residential	24
OM4b	Carmel Secondary School (North Block) (All rooms are air-conditioned and soundproof windows)	Educational Institution	5
HH1	Wylie Court, Block C	Residential	20
HH2	Wing Fung Building	Residential	8
<i>Air-borne Operational Phase (Fixed Plant Noise)</i>			
HH4	Royal Peninsula, Block 2	Residential	42
HH7	The Metropolis Residence, Tower 2 (with centralised fresh-air supply) ^[a]	Service Apartment	18
HH9b	Harbourfront Horizon (with centralised fresh-air supply) ^[b]	Commercial/ Service Apartment	22

Note:

- [a] Metropolis Residence is a service apartment and shall not rely on openable windows for ventilation. Nonetheless, for conservative consideration that occupier might open window under special circumstances, this premise has been considered as an assessment point.
- [b] Harbourfront Horizon shall not rely on openable windows for ventilation. Nonetheless, for conservative consideration that occupier might open window under special circumstances, this premise has been considered as an assessment point.

Table 6.9 Area Sensitive Rating for Representative Noise Sensitive Receivers/Assessment Point

NSR ID	Description	Type of Area Containing NSR	Influencing Factor	Degree of Influence	Area Sensitive Rating
<i>Air-borne Construction Phase (Construction Works in Restricted Hours)</i>					
OM1	Shun Man House, Oi Man Estate	Mixed area with high density residential and GIC uses ^[a]	Directly facing heavy trafficked road, Princess Margaret Road with annual average daily traffic	Direct Influence	C
OM2	Parc Palais, Block 6				C
HH1	Wylie Court, Block C				C

NSR ID	Description	Type of Area Containing NSR	Influencing Factor	Degree of Influence	Area Sensitive Rating
			flow (AADT) >30,000		
OM3	Parc Palais, Block 1	Mixed area with high density residential and GIC uses ^[a]	Indirectly facing heavy trafficked road, Princess Margaret Road with annual average daily traffic flow (AADT) >30,000	Indirect Influence	B
Air-borne Operational Phase (Rail Noise)					
OM1a	Shun Man House (South Block), Oi Man Estate	Mixed area with high density residential and GIC uses ^[a]	Directly facing heavy trafficked road, Princess Margaret Road with annual average daily traffic flow (AADT) >30,000	Direct Influence	C
OM1b	Shun Man House (North Block), Oi Man Estate				C
OM2	Parc Palais, Block 6				C
OM4a & OM4b	Carmel Secondary School (All rooms are air-conditioned and soundproof windows)				C
HH1	Wylie Court, Block C				C
HH2	Wing Fung Building	Mixed area with medium density residential and GIC uses ^[a]	Directly facing heavy trafficked road, Chatham Road North (AADT >30,000)	Direct Influence	C
Air-borne Operational Phase (Fixed Plant Noise)					
HH4	Royal Peninsula, Block 2	Mixed area with high density residential and GIC uses ^[a]	Directly facing heavy trafficked road, Princess Margaret Road Link (AADT >30,000)	Direct Influence	C
HH7	The Metropolis Residence, Tower 2 (with centralised fresh-air supply)	Mixed area with medium density residential and GIC uses ^[a]	Indirectly facing Cross Harbour Approach Road (AADT >30,000)	Indirect Influence at high level and not Influence at low level	B
HH9b	Harbourfront Horizon (with centralised fresh-air supply)	Mixed area with medium density residential and commercial uses ^[a]	Nil	Not Influence	B

Notes:

[a] Under the category of Areas Other Than Rural Area, Low-rise Residential or Urban Area, in accordance with IND-TM.

Potential Sources of Impact

Construction Phase

Construction Noise During Non-restricted Hours

- 6.18 The potential source of noise impact during the construction phase of the Project would mainly be the use of PME for various construction activities. Major construction works would include cut and cover works for tunnel and surface works, construction of superstructures including ventilation shafts, modification work to HUH podium structures as well as loading and unloading at barging point.
- 6.19 The key elements involved for air-borne construction noise at different rail sections were summarized in [Table 6.10](#). A figure showing the SCL (MKK-HUH) alignment and location of Portal 1A is presented in [Figure No. NEX2213/C/361/ENS/M52/501](#). Details of the proposed construction methods and phasing programme are described in Section 3 of this EIA Report.

Table 6.10 Construction Phase Elements for the Project (Non-restricted Hours)

Sections	Key Construction Items	Nearby Representative NSR
Portal 1A (the most northern part of the project boundary) to North of Hung Hom Station (HUH) – using Cut & Cover Construction Method	<ul style="list-style-type: none"> Construction of a branch off track (and troughs and tunnels toward Chatham Road Interchange) Construction Works Area above ground, e.g. Associated slope works at Oi Sen Path. 	<u>Air-borne (AB) Construction Noise</u> <ul style="list-style-type: none"> Oi Man Estate (Shun Man House) (OM1) Parc Palais Block 6 (OM2) Parc Palais Block 1 (OM3) Carmel Secondary School (South Block) (OM4a) Wylie Court Block C (HH1) Wing Fung Building (HH2)
North of HUH to Hung Hom North Ventilation Building, Plant Rooms and Emergency Access (NOV) - using Cut & Cover and Underpinning Construction Method	<ul style="list-style-type: none"> Construction of the approach tunnel Construction of platform/station (at existing Hung Hom podium) Construction of ventilation shafts at the north and south sides of HUH Construction Works Areas above Ground, eg. Cooling Tower Barging Point at Hung Hom Freight Pier 	<u>AB Construction Noise</u> <ul style="list-style-type: none"> Royal Peninsula Block 2 (HH4) The Metropolis Residence (HH7) Harbourfront Horizon (HH9)

Construction Noise During Restricted Hours

- 6.20 The construction programme for the Project takes into account the likelihood that the contractor will, if permitted, undertake construction works during restricted hour (2300 to 0700 hours) at the areas immediately along the existing East Rail Line. This is for the safety reason for avoiding works above or underneath the existing East Rail during the railway traffic hours.
- 6.21 The activity that may be carried out during night time which requires CNP is listed in [Table 6.11](#).

Table 6.11 Construction Phase Elements for the Project (Restricted Hours)

Sections	Key Construction Items	Nearby Representative NSR
Portal 1A (the most northern part of the project boundary) to North of Hung Hom Station (HUH)	<ul style="list-style-type: none"> Construction of Noise Mitigation Structures near Portal 1A 	<u>Air-borne (AB) Construction Noise</u> <ul style="list-style-type: none"> Oi Man Estate (Shun Man House) (OM1) Parc Palais Block 6 (OM2) Parc Palais Block 1 (OM3) Wylie Court Block C (HH1)

6.22 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.

Cumulative Construction Noise Impact from Other Concurrent Project

6.23 There are some nearby projects that would have interfacing issues. Details are discussed as follows and the locations are illustrated in [Figure No. NEX2213/C/361/ENS/M50/503](#):

- KTE - the new Ho Man Tin Station would be constructed by cut and cover method with operation of rock crushing plant at Hung Hom Freight Pier, the cumulative noise contribution for the KTE construction works, including rock crushing activities have therefore been incorporated.
- SCL – Hung Hom to Admiralty Section (SCL (HUH-ADM)) – the cumulative impacts from works near the NOV and Hung Hom Landfall have been included.
- SCL – Tai Wai to Hung Hom Section (SCL (TAW-HUH)) - the tunnel sections at Hung Hom and HUH would be constructed by cut and cover method. The cumulative construction noise contribution has therefore been included.
- Shared barging point at Hung Hom Freight Pier – the cumulative noise contribution for the loading/unloading has been incorporated. Based on the latest design information, two berths will be operated until works at the Hung Hom Landfall commence that the berth at the tip of the freight pier will be demolished and only one berth will be used after that.
- Improvement works for viaducts associated with the Project have been considered as concurrent works and their contribution has been incorporated:
 - Upgrading Cheong Wan Road vehicular parapets; and
 - Upgrading of vehicular parapets for Chatham Road Slip Road Bridge.
- Central Kowloon Route (CKR) – the alignment within the Project Boundary will be deep underground, and therefore no cumulative air-borne noise impact would be anticipated.
- Widening of Gascoigne Road Flyover - there would be no programme overlapping between Widening of Gascoigne Road Flyover with the Project, and hence no cumulative impacts would be anticipated.

Operational Phase

Rail Noise

6.24 The MLR and SP1900 trains on the existing East Rail Line will continue to run on its existing tracks and stations until the whole SCL comes into operation. Upon the commissioning of the SCL (HUH-ADM), the existing East Rail Line will “switchover” to the SCL alignment, i.e. new 9-car SP1900 or equivalent trains would run on the new alignment and new stations. Section that is open and would contribute to rail noise to the nearby sensitive receivers is appropriately 250m long between the Portal 1A and the Chatham Road South.

6.25 Other existing East Rail Line noise sources include:

- freight trains,

- intercity through trains and
 - maintenance trains
- 6.26 With the rapid development of road and port facilities in the Mainland China, the freight business at the East Rail Line has sharply dropped. In 2009, it has been decided to cease the freight business. Therefore, the freight trains will not pose additional noise contribution to NSR when the SCL is in operation.
- 6.27 For intercity through trains, it is expected that services will be maintained at the existing alignment and prevailing frequency if not less with the Express Rail Link in operation:
- No intercity train is scheduled before 0700hr peak night time;
 - A maximum of one intercity movement (either uptrack or downtrack) in a half-hour period would be deployed during day-time peak hour; and
 - Only one intercity train (downtrack) is scheduled during non-peak night time period.
- 6.28 As explained in Chapter 2, the existing Homantin Siding will be slightly modified. Three existing tracks will be reduced to one track with spur track approaching the Hong Kong Polytechnic University Phase 8 (HKPU Phase 8) area and the number of crossing will be reduced. The alignment of the reprovisioned track will also be slightly further away from the nearby residential blocks (Wylie Court). In addition, the operation mode and function of the siding remain the same and the siding will only be used for maintenance and emergency operation, no significant environmental impact would be expected.
- 6.29 In general, the noise climate near Portal 1A would be improved with the SCL since noise mitigation measures for SCL would be developed over the shared section of East Rail Line. Thus, the noise contribution from East Rail Line at this section will be reduced. Whereas, the remaining section of SCL will be designed with troughs or tunnels that rail noise impact would be reduced. Therefore, the overall noise climate will be improved with the introduction of SCL.

Fixed Plant Noise

- 6.30 According to the design information, the major fixed plant noise sources are identified as the new exhausts and intakes of ventilation shafts at HUH and illustrated in [Figure No. NEX2213/C/361/ENS/M52/601](#).

Road Traffic Noise Contribution from Realignment of Cheong Wan Road

- 6.31 As discussed in Chapter 1, one of the works items is to realign the Cheong Wan Road Viaduct. This section of Cheong Wan Road connecting between HUH and Gillies Avenue South would be shifted to the west for about 10m ([Appendix 1.3](#)).
- 6.32 Based on the latest design information, both the traffic flow and traffic composition would not be changed due to the road realignment. The road traffic impact arising from the operation of the re-aligned Cheong Wan Road would be as follows:
- To the east of the road – the nearest NSRs are Royal Peninsula and The Metropolis Residence. As the road would be shifted further away, the impact would expect to be lesser than the prevailing condition.
 - To the south and west of the road, the nearest developments are Hong Kong Polytechnic University (HKPU), HUH, hotel, service apartment, GIC or commercial buildings, which either do not rely on natural ventilation or would be considered as non-noise sensitive uses. Thus, there are no sensitive premises on these directions.
 - To the north of the road, the nearest NSR is On Tai Mansion which more than 150m away. The building is screened by a group of noise non-sensitive buildings, such as Universal Funeral Parlour. The consideration on screening and setback effect, the contribution from Cheong Wan Road itself would be insignificant. Also, as there is no change in the setback distance as compared to the original alignment, the change in noise contribution before and after will be zero. In other words, the realignment of Cheong Wan Road Viaduct is not a concern.

6.33 Therefore, the realignment of Cheong Wan Road would not constitute any adverse environmental impact on the road traffic noise aspects on any NSR.

Summary of Noise Source

6.34 [Table 6.12](#) summarizes the key elements involved in operational phase for air-borne noise at different rail sections.

Table 6.12 Operational Phase Elements for the Project

Section	Before SCL (HUH - ADM) comes into Operation in Yr 2020 (Using Existing East Rail Line Track and Station)	After SCL (HUH - ADM) comes into Operation in Yr 2020 (when the entire section from MKK to ADM in operation – mostly underground)	Representative NSR (Operational Phases)
Portal 1A to north of HUH	<u>AB Rail Noise Sources</u> <ul style="list-style-type: none"> • Using existing MLR/SP1900 trains (same as existing East Rail Line) • Using existing ballast tracks (above Ground) • Freight train operation to cease • Infrequent Intercity and maintenance locomotive movements, same as the prevailing condition • Alignment of Homantin Siding slightly further away from NSR and the number of crossing reduced 	<u>AB Rail Noise Sources</u> <ul style="list-style-type: none"> • Using new 9-car trains of SP 1900, or equivalent • Using slab tracks at trough near Carmel Secondary School • Using HUH with new platforms • Freight train operation to cease • Infrequent Intercity and maintenance locomotive movements, expected to be same as the prevailing condition • Alignment of Homantin Siding slightly further away from NSR and the number of crossing reduced 	<u>AB Rail Noise</u> <ul style="list-style-type: none"> • Shun Man Estate (South Block), Oi Man Estate (OM1a) • Shun Man Estate (North Block), Oi Man Estate (OM1b) • Parc Palais Bk 6 (OM2) • Carmel Secondary School (North Block) (OM4b) • Wyle Court Bk C (HH1) • Wing Fung Building (HH2)
North of HUH to HUH NOV	<u>AB Rail Noise Sources</u> <ul style="list-style-type: none"> • Using existing MLR/SP1900 trains (same as existing East Rail Line) • Using existing ballast track (above Ground) • Using existing HUH • Freight train operation to cease • Infrequent Intercity movement, same as the prevailing condition <u>Fixed Source Noise Sources</u> <ul style="list-style-type: none"> • New Exhaust/Intakes at HUH in operation under SCL (TAW-HUH) <u>Road Traffic Noise Sources</u>	<u>AB Rail Noise Sources</u> <ul style="list-style-type: none"> • Using new 9-car trains of SP 1900, or equivalent • Using new slab tracks (most are underground) • Using HUH with new platforms • Freight train operation to cease • Infrequent Intercity movement, expected to be same as the prevailing condition <u>Fixed Source Noise Sources</u> <ul style="list-style-type: none"> • Exhaust/Intakes at HUH 	<u>AB Fixed Source Noise</u> <ul style="list-style-type: none"> • Royal Peninsula Block 2 (HH4) • The Metropolis Residence (HH7) • Harbourfront Horizon (HH9b) <u>AB Road Traffic Noise</u> <ul style="list-style-type: none"> • Royal Peninsula Block 2 • The Metropolis Residence • On Tai Mansion

Section	Before SCL (HUH - ADM) comes into Operation in Yr 2020 (Using Existing East Rail Line Track and Station)	After SCL (HUH - ADM) comes into Operation in Yr 2020 (when the entire section from MKK to ADM in operation – mostly underground)	Representative NSR (Operational Phases)
	<ul style="list-style-type: none"> Realignment of Cheong Wan Road 	<u>Road Traffic Noise Sources</u> <ul style="list-style-type: none"> Realignment of Cheong Wan Road 	

6.35 In terms of the operational noise impact, owing to the fact that the services at the East Rail Line will be maintained on the existing alignment before Year 2020, condition before 2020 remains the same as the prevailing condition, and no rail noise assessment will be necessary for the case before Yr 2020. Thus, rail noise impact will be focussed on the mode of operation after Yr 2020 using the new SCL alignment.

Cumulative Operational Noise Impact from other concurrent projects

6.36 There are three rail projects that would have interfacing issues within the study area:

- KTE - the track will be underground and the station will be located more than 250m away. Thus, cumulative noise impact is not anticipated;
- SCL (HUH-ADM) – the track will be underground and no air-borne rail noise contribution would be anticipated. Nonetheless, the fixed source noise impact from the NOV at the water front area has been considered as a cumulative noise source; and
- SCL (TAW-HUH) - open air railway tracks confined between HUH and Chatham Road North. All sections beyond Chatham Road North are underground. Thus, no air-borne rail noise contribution would be anticipated.

Assessment Methodology

Air-borne Noise during Construction Phase

6.37 The methodology for the noise impact assessment is in accordance with the procedures outlined in the GW-TM. The general approach is summarized below:

- Locate the NSRs which would most likely be affected by noise from the construction work;
- Determine the items of Powered Mechanical Equipment (PME) for each discrete construction activity, based on available information or agreed plant inventories;
- Assign Sound Power Levels (SWLs) to the proposed PME according to the GW-TM or other sources;
- Calculate distance attenuation to NSRs from notional noise source;
- Apply corrections in the calculations such as potential screening effects and acoustic reflection, if any;
- Predict construction noise levels at NSRs in the absence of any mitigation measures;
- Any cumulative impact from the concurrent construction activity within 300m; and
- Compare the cumulative noise level against the noise criteria and propose suitable mitigation measures.

6.38 SWLs of the equipment have been made reference from Table 6 of GW-TM. Where no relevant SWL is found in the GW-TM, reference has been made to *British Standard 5228: Part 1:2009* Noise Control on Construction and Open Sites and previous similar studies or from measurements taken at other sites in Hong Kong. Groups of PME have been assigned for various construction activities of the proposed Project. The proposed plant inventory for the construction of the Project has been provided by the Detailed Design Consultants of the Project Proponent.

Air-borne Rail Noise during Operational Phase

- 6.39 Airborne rail noise from train movement has been predicted in accordance with “The Calculation of Railway Noise (CRN)” published by Department of Transport in 1995, and standard acoustical principles and practices. The general assessment approach is outlined below:
- Locate the NSRs which would most likely be affected by air-borne noise from the rail operation;
 - Identify the train frequency and make appropriate frequency correction;
 - Review the impact of infrequent usage of existing intercity train / maintenance locomotive movement;
 - Identify the distance from the NSR to the train and make distance correction;
 - Identify the train type and the source term of the train;
 - Identify the angle of view and make appropriate angle of view correction;
 - Incorporate Façade Correction;
 - Incorporate Track Wear Correction;
 - Incorporate Turnout Correction;
 - Incorporate Slab Track Correction;
 - Identify any barrier effect and make appropriate barrier correction;
 - Calculate the noise level from all rail segments;
 - Incorporate the noise contributions from other railway vehicles when the train schedule is available; and
 - Compare the cumulative air-borne noise level against the noise criteria
- 6.40 For ease of reference, [Table 6.13](#) summaries the general corrections adopted in the CRN.

Table 6.13 Air-borne Rail Noise Parameters and Correction Factors

Parameters	Approach
Train Type	SP1900 or equivalent, train length of 9-car
Source Term SEL _{ref}	Train Noise: 75.3dB(A) L _{max} at 130kph measured at 25m away from the ballast track for SP1900 ^[a] AC Noise: 57.0 dB(A) L _{max} at 15m (converted to 130kph), in accordance with Lok Ma Chau EIA In accordance with “Equation 15.21 of the Transportation Noise Reference Book”, edited by Harris, the equation for the calculation of L _{max} is given below: $SEL = L_{max} + 10\log(L/V) + 10.5 - 10\log[(4D/(4D^2+1)) + 2\tan^{-1}(1/(2D))]$ Where L = train length (m); V = train speed (kph); d = Perpendicular distance from track (m); D = d / L
Distance Correction for Wheel/Rail Noise	-10 log ₁₀ (d'/25), where d' = Slant Distance to NSR (d'>=10m)
Distance Correction for A/C Noise	-10 log ₁₀ (d'/15), where d' = Slant Distance to NSR (d'>=10m)
Train Frequency Effect	+10 log ₁₀ (N), where N = Train Frequency per 30 min per Direction

Parameters	Approach
Ground Effect	Hard Ground, no absorption
Air Absorption Effect	Nil (Close proximity with NSR in HK environment)
Barrier Effect	<p>Shadow Zone: -21dB(A) for $\delta \geq 2.5\text{m}$ where δ is the Path Difference in metre -7.75 $\log_{10}(5.2 + 203 \delta)$ dB(A) for $0 \leq \delta < 2.5\text{m}$</p> <p>Illuminated Zone: 0dB(A) for $\delta \geq 0.4\text{m}$ 0.88 + 2.14 $\log_{10}(10^{-3} + \delta)$ dB(A) for $0 \leq \delta < 0.4\text{m}$</p>
Reflection Effect	<p>Standard +1.5dB(A) adopted.</p> <ul style="list-style-type: none"> • No extra correction when the far-side barrier is not vertical and the slope is greater than 15°, or if the height of far-side barrier is less than 1.5m above the near-side railhead, then the correction for reflection shall be neglected. • Absorptive Panel will be applied for proposed noise barrier, reflective effect from those structure is negligible
Speed Effect	+20 $\log_{10}(V/130)$, where V = Train Speed
Angle of View Effect	+10 $\log_{10}(\pi\theta/180 - \cos^2 \alpha \sin\theta) - 5$, where θ = Angle of View and α = Acute angle between a line drawn through the NSR, parallel to the track, and the line bisecting the angle of view, θ
Façade Effect	+2.5dB(A) ^[b]
Track Wear Correction	+3.0dB(A) ^[b]
Joint/Turnout Correction	As a very conservative assumption, +7.0dB(A) for a representative 20m segment ^[b]
Slab Track Correction	+2.5dB(A)
Train Frequency	30/24 trains per hour in each direction during daytime/nighttime
Train Frequency per 24hrs both directions	850 trains
Train Speed at the open-track section	60 - 80 kph near portal1A
Noise Criteria	ANL

Note:

[a] Measurement data obtained from previous measurement from West Rail "Wayside Noise Levels for the SP1900 EMU Operating on West Rail Ballast and Sleeper Track"

[b] Refer to "Section 4.5.5 of the Approved Tai Wai to Ma On Shan EIA Report, KCRC East Rail Extension, Oct 1999"

6.41 Noise levels in $L_{eq(30mins)}$, $L_{eq(24\text{ Hours})}$ and L_{max} were predicted at representative floor levels and the noise impact has been quantified by exceedance of the criteria.

6.42 Mitigation measures, in terms of provision of noise barrier would be proposed where appropriated.

Fixed Plant Noise during Operational Phase (Ventilation Shafts)

6.43 It is anticipated that noise specification of the proposed fixed plant may not be available during the EIA Study, the maximum permissible noise emission levels has been therefore determined for future detailed design of the fixed plant. Cumulative impact from both the SCL (HUH-ADM), the SCL (TAW-HUH) and the KTE have been considered if there is any plant located within 300m.

- 6.44 For the assessment of noise from the fixed plant, the maximum permissible sound power levels (Max. SWLs) of the identified fixed noise sources have been determined by adopting standard acoustics principles. The following formula has been used for calculating the Max. SWLs of the fixed plant

$$\text{SPL} = \text{Max SWL} - \text{DC} + \text{FC} - \text{BC}$$

Where

SPL	Sound Pressure Level, in dB(A)
Max. SWL	Maximum Permissible Sound Power Level, in dB(A)
DC	Distance Attenuation, in dB(A) (i.e. $20 \log D + 8$ [where D is the distance in metres])
FC	Facade Correction, in dB(A) (i.e. 3 dB(A))
BC	Barrier Correction, in dB(A)

- 6.45 It was assumed that all the fixed plant within the same location would be operated at the same time as worst case scenario. Screening correction offered by buildings or other structures such as office and residential buildings has been taken into account in calculating the predicted noise levels. According to the GW-TM, effective barriers can result in noise reduction of 5 to 10dB(A) for the fixed plant depending on the line of sight of the representative NSRs. A positive 3 dB(A) has been added to predicted noise levels at the NSRs due to the façade effect.
- 6.46 Corrections of tonality, intermittency or impulsiveness have not been included owing to the lack of design/supplier information at this detailed design stage. If the noise exhibits any of these characteristics during detailed design or operation of the plant, the noise limit of the plants should be reduced in accordance with the recommendation given in IND-TM.

Airborne Noise Impact Assessment

Construction Phase

Construction Noise during Non-restricted Hours

- 6.47 The plant inventory for the assessment was confirmed by the Project Proponent that it is practicable for the proposed works and listed in [Appendix 6.2A](#). To strike a balance between the need for providing a railway system to the public and the public concerns on the adverse impacts, the following key features have been considered during the design of the Project to alleviate the construction noise impacts as far as practicable:
- Minimisation of number of PME; and
 - PME adopted for the same construction activities would be grouped, where practicable, in order to reduce the construction noise emission due to concurrent use of PME.
- 6.48 The unmitigated noise levels at representative NSRs during non-restricted hours were predicted and presented in [Table 6.14](#) based on construction programme and plant inventory as shown in [Appendices 6.1A](#) and [6.2A](#) respectively. Locations of notional sources and distance to NSRs are shown in [Appendix 6.3A](#). A section illustrating the topography screening effect between the construction site and Carmel Secondary School has included in [Appendix 6.4A](#).
- 6.49 The sample calculation of unmitigated construction noise levels during non-restricted hours for the most affected NSR and the results according to the construction programme are presented in [Appendix 6.5A](#) and [6.6A](#) respectively.

Table 6.14 Unmitigated Construction Noise Levels due to the Project

NSR ID	Description	Predicted Unmitigated Construction Noise Levels, dB(A)	EIAO-TM Noise Criteria, dB(A)
OM1	Shun Man House, Oi Man Estate	52 - 83	75
OM2	Parc Palais, Block 6	50 - 76	75
OM3	Parc Palais, Block 1	48 - 69	75
OM4a ^(a)	Carmel Secondary School (South Block) (All rooms are air-conditioned and soundproof)	52 - 76 (60 - 76) ^(c)	65/70 ^(b)
HH1	Wylie Court, Block C	51 - 78	75
HH2	Wing Fung Mansion	63 - 84	75
HH4	Royal Peninsula, Block 2	58 - 79	75
HH7	The Metropolis Residence, Tower 2	50 - 77	75
HH9	Harbourfront Horizon	73 - 82	75

Note:

- (a) For OM4a, topography screening effect has been included in calculation
 (b) EIAO-TM noise limits of $L_{eq(30min)}$ 70 dB(A) for schools during normal hours, 65 dB(A) during examination periods.
 (c) Range in parenthesis signifies predicted noise level during examination periods which are assumed to be March, April, May and December of every year.
 (d) Numbers in bold signify exceedances of the noise criteria.

- 6.50 The predicted noise levels at the representative NSRs would range from 48 to 84 dB(A). Exceedances in the range of 1 to 9 dB(A) were predicted at some NSRs. Mitigation measures will be required to abate the construction noise impacts.

Construction Noise during Restricted Hours

- 6.51 According to the construction programme, most of the proposed construction works will be carried out during non-restricted hours. Nonetheless, owing to the safety reason for works adjoining the existing East Rail Line, construction works can only be undertaken after the railway traffic hour

(2300 to 0700hr). 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.

- 6.52 As discussed in Section 6.7, the construction criteria of 55 dB(A) has been adopted at restricted hour (2300 to 0700hr) for the operation of PMEs.
- 6.53 The unmitigated noise levels at representative NSRs during restricted hours was predicted and presented in [Table 6.15](#) based on construction programme as shown in [Appendix 6.1B](#); and plant inventory as shown in [Appendix 6.2B](#). Locations of notional sources and distance to NSRs are shown in [Appendix 6.3B](#). The works areas locations of the works during restricted hour are presented in [Appendix 6.4B](#).
- 6.54 The sample calculation of unmitigated construction noise levels during restricted hours for the affected NSRs according to the construction programme are presented in [Appendix 6.5B](#) and the summary of the assessment results are presented in [Appendix 6.6B](#).

Table 6.15 Unmitigated Construction Noise Levels during Restricted Hour

NSR ID	Description	Predicted Unmitigated Construction Noise Levels, dB(A)	NCO Noise Criteria, dB(A)
OM1	Shun Man House, Oi Man Estate	75	55
OM2	Parc Palais, Block 6	72	55
OM3	Parc Palais, Block 1	63	55
HH1	Wylie Court, Block C	64	55

Note:

- (a) Numbers in bold signify exceedances of the noise criteria.

- 6.55 The predicted noise levels at the representative NSRs would range from 63 to 75 dB(A). Exceedances in the range of 8 to 20 dB(A) were predicted at some NSRs. Mitigation measures will be required to abate the construction noise impacts.

Operational Phase – Rail Noise

- 6.56 The predicted air-borne rail noise results from the Project are presented in [Table 6.16](#). The segment distribution for rail noise calculation is shown in [Appendix 6.7](#), and sample calculation for unmitigated scenario is shown in [Appendix 6.8](#). Exceedances were predicted at representative NSRs OM1a and OM1b at night-time. Mitigation measures will be required to abate the rail noise impact during operation.

Table 6.16 Airborne Rail Noise Calculation Summary – Unmitigated

NSR	Area Sensitivity Rating	Noise Criteria, dB(A)		Floor	Leq, 30min, dB(A)	
		Daytime /evening	Night-time		0700-2300 hrs	2300-0700 hrs
Shun Man House South Block (OM1a)	C	70	60	2	51	49
				7	64	62
				12	65	64
				17	64	63
				23	63	62
Shun Man House North Block (OM1b)	C	70	60	2	49	48
				7	62	61
				12	64	63
				17	63	62
				23	62	61
Parc Palais, Block 6	C	70	60	2	52	51

NSR	Area Sensitivity Rating	Noise Criteria, dB(A)		Floor	Leq, 30min, dB(A)	
		Daytime /evening	Night-time		0700-2300 hrs	2300-0700 hrs
(OM2)				7	55	54
				12	54	54
				17	54	53
				24	53	52
Carmel Secondary School (North Block) (OM4b) ^[a]	C	70	-	2	52	-
				5	57	-
Wylie Court, Block C (HH1)	C	70	60	2	51	50
				7	51	50
				12	51	50
				17	51	50
				20	52	51
Wing Fung Mansion (HH2)	C	70	60	2	36	35
				8	36	35

Note:

[a] Carmel Secondary School is not considered as a night-time NSR.

[b] Numbers in bold signify exceedances of the noise criteria.

Operational Phase – Fixed Plant Noise

- 6.57 Locations of fixed plant noise sources and NSRs are shown in [Figure No. NEX2213/C/361/ENS/M52/601](#).
- 6.58 Most of the premises around the HUH are non-noise sensitive developments in terms of fixed source noise aspect, including hotels and service apartment. The nearest Assessment Point/NSR is the Metropolis Residence (HH7). Based on the backward calculation findings, the maximum sound power levels are detailed in [Table 6.17](#) for HUH and [Table 6.18](#) for NOV. Details calculation for Daytime is shown in [Appendix 6.9](#) whereas night-time calculation is shown in [Appendix 6.10](#).

Table 6.17 Fixed Plant Noise Design Criteria for HUH

Time Period	Predicted Maximum Sound Power Level, dB(A) ^[a]	
	Each Exhaust/Intake Point at the Ventilation Shafts ^[b]	Cooling Tower ^[b]
Day and Evening (0700 to 2300 hours)	Group 1: 104 Group 2: 99	Group 3: 101 Group 4: 104
Night (2300 to 0700 hours)	Group 1: 92 Group 2: 88	Group 3: 88 Group 4: 94

Remark:

[a] If the noise exhibits any tonality, intermittency or impulsiveness characteristics during the operation of the plant, the noise design limit should be reduced to absorb these corrections in accordance with the recommendation given in IND-TM

[b] Based on the preliminary engineering information, the louver arrangements are:

- ✧ Group 1 - VS1 (1 louver at E direction); VS2 (1 louver at N direction); VS3 (1 louver at N direction); VS4 (1 louver at N direction); VS5 (1 louver at N direction); VS6 (1 louver at N direction); VS7 (1 louver at N direction) - Assuming a total of 7 louvers, each with the same Group 1 SWL (each louver as a point source)
- ✧ Group 2 - VS8(1 louver at S direction); VS9 (1 louver at S direction); VS10 (1 louvers at S direction); VS11 (1 louvers at S direction); VS12(1 louver at S direction); VS13(1 louver at S direction); VS14(1 louver at S direction); VS15(1 louver at S direction) - Assuming a total of 8 louvers, each with the same Group 2 SWL (each louver as a point source)
- ✧ Cooling Tower Group 3 - (1 louver at N direction; 1 louver at E direction) - Assuming a total of 2 louvers, each will be represented as a point source with the same Group 3 SWL
- ✧ Cooling Tower Group 4 - 5 louvers at top, assuming each louver will be represented as a point source with the same Group 4 SWL

Table 6.18 Fixed Plant Noise Design Criteria for NOV

Time Period	Predicted Maximum Sound Power Level, dB(A) ^[a]
	Each Exhaust/Intake Point at the Ventilation Building ^[b]
Day and Evening (0700 to 2300 hours)	100
Night (2300 to 0700 hours)	90

Remark:

[a] If the noise exhibits any tonality, intermittency or impulsiveness characteristics during the operation of the plant, the noise design limit should be reduced to absorb these corrections in accordance with the recommendation given in IND-TM

[b] Based on the preliminary engineering information, the louver arrangements are:

- ✧ 2 louvers at the Top
- ✧ Assuming a total of 2 louvers each with the same SWL (each louver as a point source)

6.59 If there is any change in engineering design information during detailed design stage or fitting-out stage, the fixed source noise design should be reviewed by engineer/contractor ensuring that both the NCO and EIAO-TM criteria at NSR can be met in the future.

Recommended Mitigation Measures

Air-borne Noise during Construction Phase

6.60 The construction noise assessment indicated that, in the absence of any mitigation measures, there would be exceedance of the construction noise criteria at some of the NSRs. Various mitigation options have thus been considered in accordance with the guidelines laid down in the Environmental Impact Assessment Ordinance, Guidance Note No. 9/2004 "Preparation of Construction Noise Impact Assessment under the Environmental Impact Assessment Ordinance" (GN 9/2004). It should be noted that the assumptions used in formulating mitigation measures and their practicality

were based on the best available information from the detailed design stage of the Project. Alternative mitigation proposals which could achieve the same noise reduction effect may be formulated by the contractor before construction. Mitigation measures considered are discussed below.

Good Site Practice

6.61 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 utilized 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
- Plant known to emit noise strongly in one direction should, wherever possible, be orientated so that the noise is directed away from the nearby NSRs
- Material stockpiles and other structures should be effectively utilized, wherever practicable, in screening noise from on-site construction activities.

Adoption of Quiet PME

6.62 In order to reduce the excessive noise impacts at the affected NSRs during non-restricted hours, quieter PME are recommended. The Contractors may use other types of quiet plant instead of specific items of quiet plant adopted in this assessment, which have the same total SWL, to meet their needs. Quiet PME adopted in the assessment were taken from the BS5228: Part 1:2009. It should be noted that the selected quiet PME for assessment could be found in Hong Kong.

6.63 A list of quiet PME recommended for adoption during the construction phase is presented in [Table 6.19](#).

Table 6.19 Quiet PME Recommended for Adoption during Construction Phase

PME	Reference	SWL, dB(A)
Asphalt Paver	BS D8/24	101
Backhoe	BS D3/35	106
Backhoe with Hydraulic Breaker	BS D8/13	110
Concrete Lorry mixer	BS D6/33	96
Concrete mixer truck	BS D6/33	96
Concrete Pump	BS D6/36	106
Concrete Pump Truck	BS D6/36	106
Crane, mobile	BS D7/101	94
Crawler crane	BS D7/112	102
Drill, hand-held #	CNP 065	98
Dump truck	BS D9/24	104
Excavator	BS D3/35	106
Flat Bed Lorry	BS D9/19	102
Generator	CNP 103	95
Giken Piler and Power-pack	EIA Ref.	94
Hydraulic breaker	BS D8/13	110
Hydraulic Excavator	BS D3/35	106
Lorry	BS D9/19	102
Lorry with crane/grab	BS D7/101	94
Mini Piling Rig	BS D11/2	112
Piling Rig	BS D11/2	112
Poker, vibrator, hand-held	BS D6/40	98
Road Roller	BS D8/30	101

PME	Reference	SWL, dB(A)
Rock Drill	EIA Ref.	108
Roller	BS D8/30	101
Truck	BS D9/39	103
Vibratory Hammer	BS D4/53	118

Note:

#: Applied for the works during restricted hours only.

EIA Ref.: The SWL of Giken Piler and Power-pack & Rock Drill were made reference to the approved EIA Report of "Tsim Sha Tsui Station Northern Subway"

Use of Movable Noise Barrier

6.64 The use of movable barrier for certain PME could further alleviate the construction noise impacts. In general, 5dB(A) reduction for movable PME and 10dB(A) for stationary PME can be achieved depending on the actual design of movable noise barrier. Typical arrangements of the moveable noise barriers for sample NSRs are shown in [Appendix 6.11C](#).

6.65 [Table 6.20](#) shows the assumed noise reduction effects achieved by the movable noise barrier for certain items of PME. The Contractor shall be responsible for design of the movable 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. Barrier material of surface mass in excess of 14 kg/m² is recommended to achieve the predicted screening effect.

Use of Noise Insulating Fabric

6.66 Noise insulating fabric (the Fabric) would be adopted for certain PME (e.g. drill rig, piling rig etc). The Fabric should be lapped such that there would be no openings 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.

Use of Noise Enclosure/Acoustic Shed

6.67 Noise enclosure would be used to cover stationary PME such as air compressors and generator. With the adoption of the noise enclosure, the PME could be completely screened, and noise reduction of 15 dB(A) could be achieved with reference to Paragraph 4.5 of EIAO Guidance Note No. 9/2004. Schematic configurations of typical noise enclosure and movable barrier are depicted in [Appendix 6.11D](#).

Temporary hoardings

6.68 Temporary hoardings of 2.4m high are recommended for identified NSRs which are located near to the works area. PMEs involved in construction would be or partly screened by the erected site hoardings.

Summary of direct mitigation measures

6.69 A summary of the assumed noise reduction effects achieved by the use of movable noise barrier for certain item of PME is presented in [Table 6.20](#).

Table 6.20 Noise Mitigation Measures for Certain PME during Construction Phase

PME	Mitigation Measures Proposed	Noise Reduction, dB(A)
Air compressor	Enclosure/ Shed	15
Asphalt paver	Movable Barrier	5
Backhoe	Movable Barrier	5
Backhoe with Hydraulic Breaker	Movable Barrier	5
Bar Bender and Cutter	Movable Barrier	10
Crane, mobile	Movable Barrier	5
Concrete Pump	Movable Barrier	10
Drill Rig	Fabric	10
Drill, hand-held	Movable Barrier	5

PME	Mitigation Measures Proposed	Noise Reduction, dB(A)
Excavator	Movable Barrier	5
Generator	Movable Barrier	10
Generator #	Enclosure/ Shed	15
Grout Pump	Movable Barrier	10
Hand held Breaker	Movable Barrier	5
Hydraulic Breaker	Movable Barrier	5
Hydraulic Excavator	Movable Barrier	5
Lorry with crane/grab	Movable Barrier	5
Mini Piling Rig	Fabric	10
Piling Rig	Fabric	10
Piling, diaphragm wall, bentonite filtering plant	Fabric	10
Piling, large diameter bored, grab and chisel	Fabric	10
Saw, concrete	Movable Barrier	10
Vibratory Hammer	Fabric	10

Note:

#: Applied for the works during restricted hours only.

Construction Works next to School

- 6.70 The daytime construction noise criterion during school examination period is 65 dB(A), which is lower than the normal daytime school criterion of 70 dB(A).
- 6.71 As Carmel Secondary School has been noise insulated with air conditioners and, by keeping the windows closed during construction activities, noise impacts at the indoor environment can be alleviated. Notwithstanding this, it is recommended that the particularly noisy construction activities be scheduled to avoid examination period as far as practicable.

Mitigated Construction Noise Impacts

Construction Phase during Non-restricted Hours

- 6.72 With the implementation of all the above-mentioned mitigation measures, the total SWLs of each activity were predicted and presented in [Appendix 6.11A](#). Detailed calculation of the most affected NSR is given in [Appendix 6.12A](#) for reference. Whereas predicted construction noise level according to working schedule is summarized in [Appendix 6.13A](#) and ranges of noise level are shown in [Table 6.21](#). The predicted noise levels due to the Project itself at all NSRs are ranged from 32 -73 dB(A) and comply with the EIAO-TM noise criteria.
- 6.73 In terms of the cumulative impacts with SCL (HUH-ADM), SCL (TAW-HUH) and KTE, the predicted noise levels are also presented in [Table 6.21](#). Exceedance of 1 to 3 dB(A) would be expected at Wing Fung Building (HH2); while exceedance of 1 to 4 dB(A) during examination period would be expected at Carmel Secondary School (OM4a) with concurrent works of SCL (TAW-HUH) and KTE. Residual noise impact at OM4a and HH2 is discussed under the section “*Evaluation of Residual Impacts*” below.

Table 6.21 Cumulative Construction Noise Levels during Construction Period – Mitigated

NSR ID	EIAO-TM Noise Criteria, dB(A)	Predicted Noise Levels arising from, dB(A), $L_{eq(30mins)}$				Cumulative Noise Level, dB(A)
		The Project	SCL (HUH-ADM)	SCL (TAW-HUH)	KTE (with KTE's EPIWs)	
OM1	75	36 - 71	-	-	-	36 - 71
OM2	75	34 - 63	-	-	53	34 - 63
OM3	75	32 - 56	-	-	48 - 62	48 - 62
OM4a ^[a]	65/70 ^[b]	36 - 65 (48 - 65) ^[c]	-	-	56 - 69 (56 - 67) ^[c]	53 - 70 (53 - 69) ^[c]
HH1	75	35 - 64	-	-	-	35 - 64
HH2	75	49 - 73	-	51 - 77	58 - 67	55 - 78
HH4	75	55 - 73	-	55 - 57	-	55 - 73
HH7	75	47 - 73	-	54 - 55	-	50 - 73
HH9	75	64 - 73	62 - 71	50 - 54	57	64 - 74

Note:

[a] For OM4a, topography screening effect has been included in calculation.

[b] EIAO-TM noise limits of $L_{eq(30min)}$ 70 dB(A) for schools during normal hours, 65 dB(A) during examination periods.

[c] Range in parenthesis signifies predicted noise level during examination periods which are assumed to be March, April, May and December of every year.

[d] Numbers in bold signify exceedances of the noise criteria.

Construction Phase during Restricted Hours

- 6.74 With the adoption of the recommended mitigation measures, as shown in [Appendix 6.11B](#), including reduction of plant, use of enclosure/barrier and regrouping of PME works, detailed calculation of the affected NSRs is given in [Appendix 6.12B](#). Whereas, the predicted construction noise levels according to working schedule are summarized in [Appendix 6.13B](#), and ranges of noise level are shown in [Table 6.22](#).
- 6.75 The predicted noise levels at all NSRs would comply with the construction noise criterion during restricted hours.

Table 6.22 Mitigated Construction Noise Levels during Restricted Hour

NSR ID	Description	Predicted Mitigated Construction Noise Levels, dB(A)	NCO Noise Criteria, dB(A)
PME Works under GW-TM			
OM1	Shun Man House, Oi Man Estate	55	55
OM2	Parc Palais, Block 6	51	55
OM3	Parc Palais, Block 1	43	55
HH1 ^[a]	Wylie Court, Block C	44	55

Evaluation of Residual Impacts

Construction Phase during Non-restricted Hours

- 6.76 As shown in [Table 6.21](#), the residual noise impacts at OM4a are mostly in the range of 1-4dB(A) during examination period. As OM4a has already been noise insulated with air-conditioners that a noise attenuation of 10 dB(A) could be achieved, it is considered that the noise impact would be minimised by keeping the windows closed during the construction activities. Notwithstanding this, it is recommended that particularly noisy construction activities especially for diversion works of Oi Sen Path (Site ID. No. OSPPS in [Appendix 6.3A](#)), should be scheduled to avoid examination periods as far as practicable to minimise residual impact.
- 6.77 Impact of 1 to 3 dB(A) would be expected at Wing Fung Building (HH2) when considering cumulative construction noise impacts with concurrent work of SCL (TAW-HUH) and KTE. With reference to the SCL (TAW-HUH) EIA Report, quiet PMEs, temporary movable noise barriers and enclosures have already been proposed to alleviate the noise impact. Residual impact to HH2

would mainly due to its limited separation between HH2 and construction site (~10m). The construction noise criteria have been met as far as practicable. All practical direct mitigation measures have been exhaustively investigated and residual impact is minimised.

6.78 The magnitude of the residual impacts has been assessed in accordance with Section 4.4.3 of the EIAO-TM in [Table 6.23](#) below.

Table 6.23 Assessment of Residual Impacts from Construction Noise

Criteria	Assessment
Effects on public health and health of biota or risk to life	The extent of noise nuisance would be unlikely to induce public health concern
Magnitude of the adverse environmental impacts.	Residual impacts of between 1-3dB(A) could occur at up to 100 flats; and 1-4dB(A) at 1 school for examination period during the construction phase based upon worse case scenarios.
Geographic extent of the adverse environmental impacts.	The geographic extent of the adverse impacts from noise will not be large and is anticipated to be limited to within about 10m from the Project works area.
Duration and frequency of the adverse environmental impacts	The construction noise impacts of the Project will be from 1 to 8 months for the affected residential premises; and 1 to 5 months for the affected school (noise insulated with air conditioners), and are, therefore, temporary and reversible.
Likely size of the community or the environment that may be affected by the adverse impacts	Minimal size of the community would be affected, and therefore be considered acceptable.
Degree to which the adverse environmental impacts are reversible or irreversible.	Construction phase impacts should be reversible.
Ecological context.	Not Applicable
Degree of disruption to sites of cultural heritage.	Not Applicable
International and regional importance.	The impacts are localised and not of international and regional importance.
Likelihood and degree of uncertainty of adverse environmental impacts.	The impacts predicted are based upon worst case assumptions and as such, would not occur to the extent predicted on all occasions. However, the assessment has been made using approved mathematical modelling techniques and the degree of certainty on the results is high.

6.79 Based upon the above, the following factors should be considered in determining the residual impacts:

- The noise impacts are not predicted to significantly affect their health or cause loss of life;
- The predicted impacts are temporary and reversible;
- Impacts are localised and not of international and regional importance;
- The geographic extent of the adverse impacts is confined to small works areas around the trunk road Chatham Road South sites which have been highly affected by existing road traffic noise;
- The mitigation measures proposed will reduce the levels of impacts; and
- The study area has not shown itself to be fragile or undisturbed.

6.80 The MTR Corporation will facilitate communications with the concerned parties with cumulative residual impacts during construction and review to consider other initiatives, such as construction phasing, if required.

6.81 As such, the residual impacts associated with the construction phase would be considered minor and acceptable.

Operational Phase – Rail Noise

- 6.82 In order to minimise the noise impact, mitigation measures have been proposed and depicted in the [Appendix 6.14](#). Proposed mitigation measures near Portal 1A will only be required after SCL (MKK-HUH) comes into operation when the existing East Rail Line is diverted to the SCL tracks. Details are summarized as below:
- 150m long natural ventilated absorptive noise enclosure extending from portal 1A, typical section is shown in [Appendix 6.14](#).
- 6.83 The proposed mitigation measure for rail noise may be revised subject to compliance of fire services requirements. Fire Service Department (FSD)'s requirement of 45% opening on top of the proposed noise enclosure for natural ventilation provision has been incorporated in the design. In addition, the top will be offset by 3m down to allow smoke to pass through. In order to reduce the line of sight to the nearby sensitive receivers, an overlapping of 500mm between the opening will be in place.
- 6.84 The predicted airborne rail noise results for mitigated scenario from the Project are presented in [Table 6.24](#) and detailed in [Appendix 6.15](#). The results show that the predicted noise levels, in terms of $L_{eq, 30mins}$, $L_{eq, 24hrs}$ and L_{max} , at all NSRs would comply with the noise criteria after the implementation of the above-mentioned mitigation measures.

Table 6.24 Airborne Rail Noise Calculation Summary – Mitigated

NSR	Area Sensitivity Rating	Criteria, dB(A)		Floor	$L_{eq, 30min}$, dB(A)	
		Daytime /evening	Night-time		0700-2300 hrs	2300-0700 hrs
Shun Man House South Block (OM1a)	C	70	60	2	50	49
				7	49	48
				12	48	47
				17	48	47
				23	48	46
Shun Man House North Block (OM1b)	C	70	60	2	49	47
				7	48	47
				12	47	46
				17	47	45
				23	46	45
Parc Palais, Block 6 (OM2)	C	70	60	2	40	39
				7	40	39
				12	40	39
				17	40	39
				24	40	38
Carmel Secondary School (North Block) (OM4b) ^[a]	C	70	-	2	47	-
				5	47	-
Wylie Court, Block C (HH1)	C	70	60	2	51	50
				7	51	50
				12	51	50
				17	51	50
				20	51	50
Wing Fung Mansion (HH2)	C	70	60	2	36	35
				8	36	35

Note:

^[a] Carmel Secondary School is not considered as a night-time NSR.

Cumulative impact

6.85 The Project will interface with SCL (TAW-HUH) and KTE in Hung Hom and Ho Man Tin, Nonetheless, the interfacing rail segments for SCL (TAW-HUH) and KTE are either underground or shielded by existing buildings. No contribution from these two concurrent projects is anticipated as shown in [Table 6.25](#).

Table 6.25 Cumulative Airborne Rail Noise Summary – Mitigated

NSR ID	Criteria dB(A)	Predicted Noise Levels arising from, dB(A), L _{eq} (30mins)			Cumulative Noise Level, dB(A)
		The Project	SCL (TAW-HUH) ^[a]	KTE ^[c]	
Daytime/evening					
OM1a	70	48-50	- ^[a]	-	48-50
OM1b		46-49	- ^[a]	-	46-49
OM2		40	- ^[a]	-	40
OM4b		47	- ^[a]	-	47
HH1		51	- ^[a]	-	51
HH2		36	42 ^[d]	-	43
Night-time					
OM1a	60	46-49	- ^[a]	-	46-49
OM1b		45-47	- ^[a]	-	45-47
OM2		38-39	- ^[a]	-	38-39
OM4b ^[b]	-	-	-	-	-
HH1	60	50	- ^[a]	-	50
HH2		35	39 ^[d]	-	40

Notes:

- ^[a] SCL (TAW-HUH) has open air railway tracks confined between HUH and Chatham Road North. All sections beyond Chatham Road North are underground, and thus there is no cumulative impact.
- ^[b] Carmel Secondary School is not considered as a night-time NSR
- ^[c] All tracks for KTE will be underground, and thus there is no cumulative impact
- ^[d] In SCL (TAW - HUH) EIA Report, 24 trains/direction/hour is assumed for the noise assessment. In addition, a sensitivity test has been conducted to examine the noise effect if the train frequency is increased in the future operation. As compared with the predicted daytime noise levels based on the assumption of 24 trains/direction/hour, an increase of 0.3 dB(A) and 0.7 dB(A) would be predicted respectively for 26 and 28 trains/direction/hour. Hence, the predicted noise levels of SCL (TAW - HUH) would still comply with the noise criterion even if 26 and 28 trains/direction/hour during day time periods are adopted.

6.86 Considering the cumulative contribution from the Project, SCL (TAW-HUH) and KTE, the predicted noise levels at all NSRs are more than 10dB(A) below the noise criteria. Adverse impact from the Project is not anticipated.

6.87 In terms of the East Rail Line operation, with the extra noise attenuation effect from the SCL noise mitigation measures at Portal 1A, the noise contribution from the infrequent intercity and maintenance trains could be lower as compared to the existing condition. With the 10dB(A) margin below the noise criteria, adverse impact from the Project is therefore not anticipated.

Operational Phase – Fixed Plant Noise

6.88 The fixed plant properly designed to meet the maximum SWL listed in [Tables 6.17 and 6.18](#), there would not be any adverse residual impacts predicted. However, it is still recommended that the following noise reduction measures be considered as far as practicable during the processes of detailed design and procurement:

- Choose quieter plant such as those which have been effectively silenced.
- Include noise levels specification when ordering new plant (including chillier and E/M equipment).
- Locate fixed plant/louver away from any NSRs as far as practicable.

- Locate fixed plant in walled plant rooms or in specially designed enclosures.
- Locate noisy machines in a basement or a completely separate building.
- Install direct noise mitigation measures including silencers, acoustic louvers and acoustic enclosure where necessary.
- Develop and implement a regularly scheduled plant maintenance programme so that equipment is properly operated and serviced in order to maintain controlled level of noise. The programme should be implemented by properly trained personnel.

Environmental Monitoring and Audit Requirements

Construction Phase

- 6.89 An Environmental Monitoring and Audit programme is recommended to be established according to the predicted occurrence of noisy activities. The recommended mitigation measures should be implemented during construction stage. Details of the programme are provided in a stand-alone EM&A Manual.

Operational Phase

- 6.90 Rail noise monitoring should be conducted during operation phase to ensure the compliance of the operational airborne noise levels with the EIAO-TM noise criteria. Details of the EM&A programme are provided in a stand-alone EM&A Manual.

Conclusion

Construction Phase

- 6.91 Noise arising from the construction activities of the project would have unavoidable potential impact on the NSRs located in the vicinity of the works areas. Unmitigated construction noise levels at the representative NSRs are predicted, which are found to be in the range of 48 to 83 dB(A) for the works during non-restricted hours; and in the range of 63 to 75 dB(A) for the works during restricted hours.
- 6.92 With respect to the Project contribution alone, mitigation measures have been recommended to reduce the noise levels to within the EIAO-TM noise criterion, including good site practices, quieter plant, movable noise barrier and noise insulating fabric. With these measures in place, predicted construction noise levels due to the Project at all NSRs comply with the EIAO-TM daytime construction noise criterion.
- 6.93 With respect to the cumulative impact, mitigated cumulative construction noise levels at the representative NSRs were predicted ranging from 34 to 78 dB(A). Residual cumulative noise impact of 1 to 4 dB(A) for a short duration of non-persistent 5 months was found at Carmel Secondary School (OM4a) during examination period; and 1-3dB(A) exceedance is anticipated for non-persistent 8 months was found at Wing Fung Building (HH2).
- 6.94 As OM4a has been noise insulated with air conditioners and, by keeping the windows closed during construction activities, noise impacts at the indoor environment can be alleviated. Notwithstanding this, it is recommended that the particularly noisy construction activities be scheduled to avoid examination period as far as practicable.
- 6.95 Impact at HH2 would be dominated by concurrent project SCL (TAW-HUH) and the Project due to close distance to the construction site (~10m). The construction noise criteria have been met as far as practicable. All practical direct mitigation measures have been exhaustively investigated and residual impact is minimised. Communication with the concerned parties on the residual impacts during the construction and review to consider other initiatives, if required will be undertaken.
- 6.96 Thus, the residual impacts are concluded to be temporary, reversible and unlikely to induce public health concern and as such, are considered to be minor and acceptable.
- 6.97 According to the construction programme, most of the proposed construction works will be carried out during non-restricted hours. Nonetheless, owing to the safety reason for works adjoining the existing East Rail, a minor portion of construction works can only be undertaken after the railway traffic hour (2300 to 0700hr). 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. With the consideration of quiet plant, movable barrier/enclosure, regrouping of PME works and reduction of active plants, all NSRs would comply with the construction noise criterion.

Operational Phase – Rail Noise

- 6.98 According to [Table 6.16](#), under unmitigated scenario, noise exceedance at night-time would occur at Shun Man House North and South Blocks by up to 4dB(A). In order to minimise the noise impact, natural ventilated noise enclosure and barriers are proposed at Portal 1A.
- 6.99 Considering the cumulative contribution from the Project, SCL (TAW-HUH) and KTE, the predicted noise levels at all NSRs are more than 10dB(A) below the noise criteria. Adverse impact from the Project is not anticipated.
- 6.100 In terms of the East Rail Line operation, the freight train operation to cease before the Project operation, and thus there will be no contribution from freight train. Together with the extra noise attenuation effect from the SCL noise mitigation measures at Portal 1A, the noise contribution from the infrequent intercity and maintenance train could be lower as compared to the existing condition. With the 10dB(A) margin below the noise criteria, adverse impact from the Project is therefore not anticipated.

Operational Phase – Fixed Plant Noise

- 6.101 The maximum sound power levels allowed to be emitted from each louver of ventilation shafts were predicted as point sources. With the proper selection of plant and adoption of acoustic treatment, the NSRs located in the vicinity of ventilation buildings will not be affected by the noise from louvers.
- 6.102 If there is any change in engineering design information during detailed design stage or fitting-out stage, the fixed source noise design should be reviewed by engineer/contractor ensuring that both the NCO and EIAO-TM criteria at NSR can be met in the future.