9 Groundborne Noise Impact Assessment

9.1 Introduction

This section presents findings of the assessment of groundborne noise for both construction and operational groundborne noise of the Project. For construction phase, the dominant groundborne noise impacts from Tunnel Boring Machine (TBM) have been assessed for the construction of a short tunnel section approaching to Diamond Hill Station (DIH). Open cut construction will be adopted for construction of Kai Tak Station (KAT) and DIH. Modification works of Hung Hom Station (HUH) will be constructed underneath the existing Hung Hom podium. Hence, construction groundborne noise due to these works would not be anticipated. For the construction of Hung Hom train stabling sidings (HHS), hydraulic breaker, drilling rig, pipeline, handheld breaker would be used. The use of these Powered Mechanical Equipments (PME) would be adopted for at-grade construction works such as demolition, site investigation and utilities diversion, etc and hence, construction groundborne noise due to the proposed HHS would not be anticipated.

For operational phase, the noise impact caused by train movement near HHS, KAT and DIH has been taken into account. It is concluded that the noise impact generated would not cause adverse impact and hence mitigation measures would not be required.

9.2 Legislation and Standards

9.2.1 Construction Groundborne Noise

Control over construction groundborne noise is governed by the Noise Control Ordinance (NCO), the Environmental Impact Assessment Ordinance (EIAO), and their subsidiary requirements. Noise arising from general construction works during normal working hours is governed by the TM-EIAO under the EIAO as shown in **Table 9.1** below. TM for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (TM-Places) under the NCO stipulates that noise transmitted primarily through the structural elements of building, or buildings, shall be 10 dB(A) less than the relevant ANLs. This approach to derive groundborne noise limit is pragmatic given the temporary nature of the construction works and the practical difficulty to abate the inherently noise construction activities (e.g. rock drilling / breaking).

The TMs applicable to the control of groundborne noise from construction activities in the current proposed SCL (HHS) works are:

- Technical Memorandum for the Assessment of Noise from Places Other Than Domestic Premises, Public Places or Construction Sites (TM-Places) under the Noise Control Ordinance (NCO);
- TM on Noise from Construction Work other than Percussive Piling (TM-GW); and
- TM on Environmental Impact Assessment Process (TM-EIAO).

For schools where a completely immersed attention is often needed, daytime groundborne construction noise criterion of 60dB(A) applies with reference to TM-EIAO 70dB(A) criterion and taking account of the minus 10dB(A) requirement under the NCO TM-Places. Following the same principle for groundborne noise criteria, groundborne construction noise levels inside domestic premises relying on open window for ventilation will be limited to 65dB(A), with reference to the daytime airborne noise criterion of 75dB(A) in accordance with TM-EIAO.

In the evening (1900 – 2300hrs) and during nighttime (2300 – 0700hrs), the TM on Noise from Construction Work other than Percussive Piling (TM-GW) applies. Again, following the principle of deriving groundborne noise criteria, groundborne noise level will be limited to

10dB(A) below the respective ANLs for the Area Sensitivity Rating. A summary of these criteria is given in **Table 9.1** below.

Table 9.1: Construction groundborne noise criteria for schools and domestic premises

NSR Description	Groundborne Noise Criteria, dB(A) [1]		
	Daytime (except General Holidays & Sunday)	Daytime during general holidays and Sundays and all days during Evening (1900 to 2300 hrs)	Night-time (2300 to 0700 hrs)
School – Classrooms	60/55[3]	55	[2]
Domestic Premises	65	55	45

Notes: [1] Parameter used is $L_{eq,\ 30mins}$
[2] No sensitive uses during these periods
[3] A 5dB(A) reduction to the groundborne noise criterion is recommended for school during examination period.

9.2.2 Operation Groundborne Noise

The operational groundborne noise criteria for the representative Noise Sensitive Receivers (NSRs) of SCL (HHS) are tabulated in **Table 9.2** below.

Table 9.2: Operational groundborne noise criteria

NSR Description	ASR Rating	Groundborne Noise Criteria, $L_{Aeq\ 30mins}$		
		Day & Evening (0700 to 2300 hrs)	Night (2300 to 0700 hrs)	Criteria Employed
Domestic premises along alignment	A	50	40	40
	B	55	45	45
	C	60	50	50

9.3 Assessment Methodology – Construction Groundborne Noise

9.3.1 Noise Sensitive Receivers

There is one existing residential NSR that would be potentially affected by the TBM construction of a short (~100m) tunnel section approaching to DIH. **Appendix 8.2 and Appendix 8.3** present the information of this NSR and its location is illustrated in **Figure 9.1.3**.

9.3.2 Groundborne Noise Sources from Construction Activities

Details of the construction methodologies are given in **Section 3** of this EIA report. Potential groundborne noise impacts on NSRs during the construction phase will arise mainly from the operation of TBM. Other construction activities such as lorry movement, concreting, road paving etc are unlikely to generate significant groundborne noise. Airborne construction noise of these activities is addressed in **Section 8** of this EIA Report.

9.3.3 Groundborne Noise Prediction Methodology

The method used to predict construction groundborne noise is based on the U.S. Department of Transportation "High-Speed Ground Transportation Noise and Vibration Impact Assessment", 1998 [9-1]. 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_o. The conversion from vibration levels to groundborne 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

The predicted groundborne noise level L_p inside the noise sensitive rooms is given by the following equation.

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

9.3.4 Reference Vibration Sources

The vibration measurements for the TBM were extracted from the in-situ measurements during the bored tunnelling of Kwai Tsing Tunnel of the West Rail project. These measurements were adopted in previous approved EIA study[9-3]. The geology consists of mainly granite, which is considered similar to the geology along the alignment. The measurements records are considered the most appropriate available information for the purpose of assessing TBM groundborne noise.

9.3.5 Soil Damping Loss

Internal losses of soil would cause the vibration amplitude to decay against the propagation distance and the decay relationship is based on the equation set out in the Transportation Noise Reference Book[6-3]:

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

The velocity amplitude V is dependent on the frequency f in Hz, the soil or rock loss factor η, the wave speed c in m/s, the distance R from the source to the NSR. The properties of soil materials are based on Ungar and Bender[9-2] and reproduced in **Table 9.3**. No soil damping loss is applied for conservative.

Table 9.3: Wave propagation properties of soils

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

9.3.6 Coupling Loss into Building Structures

This represents the change in the incident ground-surface vibration due to the presence of the piled building foundation. The empirical values based on the guidance set out in the Transportation Noise Reference Book[9-2] are given in **Table 9.4**. In addition, a coupling loss correction of -18 dB from bedrock to pile should be adopted. However, the correction from bedrock to pile depends on actual site condition and correction of zero is assumed for conservative approach.

Table 9.4 : 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

9.3.7 Coupling Loss Per Floor

This represents the floor-to-floor vibration transmission attenuation. In multi-storey buildings, a common value for the attenuation of vibration from floor-to-floor is approximately 1dB attenuation in the upper floor regions at low frequencies and greater than 3dB attenuation at lower floors at high frequencies. Coupling loss of –1 dB reduction per floor is assumed for conservative assessment.

9.3.8 Conversion from Floor Vibration to Noise Levels

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 η, the volume of the room V in m^3 and the room reverberation time RT in seconds. Analyses had been carried out for concert hall, theatres, lecture hall and recording studios for the KTE EIA report[9-16], these values are summarised in **Table 9.5** and adopted for the present study.

Table 9.5: Conversion factors from floor vibration levels to indoor reverberant noise levels

NSR Description	Conversion C_{noise} (dB re 1x10^{-6} mm/s)
Hotel guestrooms and residential units	-27
School classrooms	-27

9.4 Assessment Methodology – Operational Groundborne Noise

9.4.1 Noise Sensitive Receivers

NSRs identified for the Project include existing and planned domestic premises near the short tunnel under Chatham Road North for HHS, the associated tunnel of KAT and the associated tunnel of DIH. Domestic premises are taken into account during both the daytime and night-time periods. **Appendix 8.2** and **Figures 9.1.1 to 9.1.3** show the details of these NSRs.

9.4.2 Groundborne Noise Sources from Operation

When trains operate in tunnels that are located in close proximity to occupied structures, vibrations associated with train passbys will be transmitted through the ground and structure, and radiated as noise in the spaces occupied within the structure. Depending on the source strength and receiver sensitivity, noise and vibration levels may be high enough to cause annoyance to the NSRs.

The respective train frequency assumed along the main alignment of SCL(TAW-HUH) (including tracks within KAT and DIH and their associated alignment) and shunt neck (including the short tunnel section south of Chatham Road North) for the noise assessment is presented in **Section 8.6.3** and **Table 8.16.**

9.4.3 Groundborne Noise Prediction Methodology

The current prediction methodology recommended by the FTA Manual [9-1] is used in this EIA study. The manual is issued by the US Department of Transportation in 1995 and is intended to provide guidance in preparing and reviewing the noise and vibrations sections of environmental submittals to the US Government. The methodology has been applied to a number of transit systems in Hong Kong over the years, including West Rail, East Rail Tsim Sha Tsui Extension, MTR Tseung Kwan O Line and Kowloon Southern Link.

The basic equation describing the model, in decibels, is

L = FDL + LSR + TIL + TCF + BCF + BVR + CTN + TOC + SAF,

Where the prediction components are:

- L : Ground borne vibration or noise level within the structure, re: 1 μ-in/sec or 20 μ-Pascal
- FDL : Force density level for the KCR SP1900 EMU, re: 1 lb/in$^{0.5}$
- LSR : Unit force incoherent line source response for the ground, re: 1 μ-in/sec
- TIL : Trackform attenuation or insertion loss, relative level
- TCF : Vibration coupling between the tunnel and the ground for soil based tunnels, relative level
- BCF : Vibration coupling loss factor between the soil and the foundation, relative level

BVR : Building vibration reduction or amplification within a structure from the foundation to the occupied areas, relative level

CTN : Conversion from floor and wall vibration to noise, 1 μ-in/sec to 20 μ-Pascal

TOC : Turnout and Crossover Factor

SAF : Safety margin to account for wheel/rail condition and projection uncertainties

Predictions are in most cases based on assuming the closest distance from the track centreline to the building foundation of the receiver; however, if a particular facility within a structure is the sensitive receiver, the setback distance is assumed to be from the track centreline to the closest part of the affected receivers. Where curved track occurs the track is considered to be straight and perpendicular to the closest setback point of the venue or receiver.

Predicted groundborne noise levels are compared to relevant noise criteria for different trackform options. Using these comparisons, trackform requirements is assessed and design recommendations made, as necessary, so that there will be no adverse impact caused by groundborne noise.

9.4.4 Force Density Level (FDL)

The vibration source strength level (Force Density Level) for train operations on the SCL (HHS) will be derived from wayside vibration measurements taken in March 2003 during SP1900 seven car EMU passbys on ballast and sleeper track at Pat Heung Depot for the approved KSL EIA Report [9-3]. The FDL spectrum was measured at a reference train speed of 60kph. FDL spectrum for other speeds are obtained with a correction of $20\log(V/V_{ref})$, in-line with FTA manual[9-1]. The duration of one passby is the period between the passage of the front and rear ends of the train pasts the closest point on the alignment to the building foundation. Measurement results have been given in the KSL EIA Report and presented in **Appendix 9.4**.

9.4.5 Line Source Response (LSR)

The basic quantity required for the determination of LSR is the vibration response caused by a unit point source impact, which is defined as the Point Source Response (PSR). Given the PSR is along the alignment over the length of the train, the LSR follows directly by incoherent integration of the PSR over the length of the train. However, the determination of the PSR for force point impacts along the alignment over the length of the alignment is not practical. LSR has already been measured in Hong Kong at a number of locations, and the most relevant of these measured results taking into account the ground type have been used for calculation. The appropriate vibration propagation characteristic, in terms of LSR & PSR, will be established from the approved XRL EIA Report [9-4] and WIL EIA Report [9-5] respectively. While reference LSR data adopted are presented in **Appendix 9.5**, typical PSRs are presented in **Table 9.6** below:

Table 9.6: Typical PSR values to be adopted

NSR ID	NSR Description	Reference Borehole
HUH-3-1	Wing Fung Building	WIL D018 D=15m R=28m
KAT-P1-1	Residential premises near Kai Tak Station	WIL D018 D =15m R=28m
DIH-P3-1	TBA	WIL D002 D=20m R=24m

LSR values depend on the depth of the tunnel and the depth of the rock head, and to a lesser extent on the ground material types. It varies along the length of any project. It is generally possible to measure LSR values at some sites along the alignment, it is not possible to measure at all NSRs. Further, it is uncommon to be able to measure at particular NSRs because of site constraints and difficulty of gaining testing and drill rig access. For this reason, site measurements are mostly used to obtain generalized information pertinent to particular ground conditions so that the results can be used to establish the LSR values to apply to NSRs with the same or similar ground conditions.

When LSR testing was carried out for the WIL project, a number of tests were carried out to provide information for future MTR Corporation's projects. Sixteen boreholes were tested in a range of ground conditions over the full length of WIL project. At each borehole, two depths were tested and for each depth, seven measurement distances were used. The extensive amount of information derived was more than the information required for WIL analysis. The obtained LSR values form a database of LSR information. This database is a better source of LSR information for present assessment.

Nonetheless, MTR Corporation will further review the LSR values and mitigation during the construction stage after the tunnel boring.

9.4.6 Trackform Insertion Loss (TIL)

The TIL for various trackform types of existing MTR alignments had been presented in previous EIA reports. Wherever appropriate, these TIL maybe adopted in the present study. Specifically, four types of trackforms have been considered for the design of SCL (HHS):

Type 0: Direct fixation.

Type 1: Alternative 1 baseplate trackform.

Type 2: Egg type baseplate trackform.

Type 3: Floating Slab Trackform with resonant frequency of 12.5Hz.

The prediction is based on a conservative approach. Despite the slim chance of mitigation measure being required, contingency mitigation measures could be adopted within the current tunnel diameter if necessary. These contingency measures could be as follows:

- Alt 1 resilient baseplates (Type 1) – additional attenuation of 5 to 10(A) or
- Isolated Slab Track (Type 4) – additional attenuation of 15 to 20 dB(A).

Changing of the tunnel dimensions would not be required in cases where contingency measures are required. Further measurements would be conducted to check the accuracy of the noise prediction after the tunnel construction where necessary.

9.4.7 Tunnel Coupling Factor (TCF)

With reference to the FTA Manual[9-1], a 5dB reduction in ground-borne noise level with reference to bored tunnel in soil would be assumed for station structures respectively.

9.4.8 Building Coupling Factor (BCF)

This factor is recommended by the US DOT Report [9-1]. This factor applies to large heavy structures identified for SCL (HHS) where vibration intrusions into the structure occur primarily over foundation surfaces that are adjacent to soil. No BCF should be applied to structures over foundations that are adjacent to rock. The following 5 types of buildings would be considered:

Type 1: Large masonry building on piles

Type 2: Large masonry building on spread footings

Type 3: Single family residential

Type 4: 1 to 2 Storey residential

Type 5: 2 to 4 Storey masonry building on spread

The typical setting along the SCL (HHS) alignment is that the piles of a building penetrates the soil layer and (for some taller buildings) touches the rock below. As a conservative approach, no BCF is applied to the NSRs assessed.

9.4.9 Building Vibration Response (BVR)

The BVR is introduced to account for the floor-to-floor vibration attenuation. The corrections for resonance amplification due to floor, wall and ceiling spans for all buildings are presented in **Table 9.6a**. The correction adopted was the case for WIL EIA Report [9-5]. A -2dB attenuation per floor is adopted for the first 5 floors. This is in line with the FTA Manual [9-1].

Table 9.6a: Building amplification values to be adopted

Corrections	1/3 Octave Band Frequency (Hz)							
	20	25	32	40	50	63	80	100
BVR	6.0	6.0	6.0	6.0	5.8	5.4	5.2	5.0
Corrections	**125**	**160**	**200**	**250**	**315**	**400**	**500**	
BVR	4.8	4.0	3.0	2.0	1.0	0.7	0.7	

9.4.10 Conversion To Noise (CTN)

A +2dB correction is assumed for conversion of vibration (re.: 10^{-6}in/sec) to noise (re.: 20 μPa). This is in line with previously approved EIA report.

9.4.11 Ground Vibration Transmission

In most groundborne noise assessments, and usually on account of a lack of measurement data, only the most rudimentary aspects of the propagation of vibration through the ground from the tunnel to the structure are taken into account. In this study, considerable care was taken in quantifying the six possible paths through the soil, the rock and along the rock interface that vibration can take from the tunnel to the structure. It is then assumed that vibration propagates to the structure along all relevant paths and the vibration impact on the structure is determined as the energetic sum of vibration following all relevant paths, thus necessarily resulting in predictions that are conservative in nature.

9.4.12 Turnout and Crossover Factor (TOC)

At points and crossings, where the wheel transitions from one rail to another, the sudden loading/unloading of the leading and trailing rails results in increased broadband vibration levels over that of plain line continuous rail. In addition, it is not possible to machine grind the rails through either the points or crossings, so surface deterioration compared with that of the placed track, is often evident.

The increase in vibration level at turnouts and crossings is not easily characterized. For standard level turnouts and crossings receiving average maintenance, the USFTA handbook recommends a correction of 10dB. For modern inclined turnouts in good condition, where impact loads are lessened, it was found through measurement that a correction of 5dB is often more appropriate.

9.4.13 Safety Factor

An attempt has been made to estimate the other components of the prediction as accurately as possible, neither underestimating nor overestimating their effect. Thus, the prediction conservatism is primarily determined by the 10 dB safety factor (this safety factor reduces to 5 dB for NSRs where site-specific LSR data is available) and the use of an FDL determined on rail whose rough condition is not representative of expected operational conditions.

9.4.14 Cumulative Groundborne Train Noise Impacts

There would be cumulative groundborne train noise impacts at the following locations.

Location	Cumulative Train Noise Sources
HHS	• Proposed KTE • SCL (MKK-HUH) • SCL (TAW-HUH)
DIH	• Existing Kwun Tong Line (KTL)

The planned receivers DIH-P3-1 and DIH-P3-2 are located about 60m horizontally from the existing KTL near Diamond Hill. Hence, it is not envisaged that the operation of KTL would result in adverse cumulative effects at a separation distance more than 60m.

Cumulative groundborne noise impacts due to other railway projects (i.e. SCL (TAW-HUH), SCL (MKK-HUH) and Proposed KTE) near HHS have been assessed, and the results can be found in **Table 9.8**. With the combined effect of distance receivers and significant margin to the noise criteria, adverse cumulative noise impact is not anticipated.

Outside the worksites of KAT and DIH, cumulative groundborne noise impacts associated with the remaining alignment (i.e. due to SCL (TAW-HUH)) are considered not significant on the identified NSRs given the shortest separation distance between track and NSRs has been assumed on HHS option as the worst case scenario.

9.5 Assessment Results – Construction Groundborne Noise

9.5.1 Diamond Hill

Details of the construction methodologies, plant inventory and construction programme are given in **Section 3** of this EIA report. Bored tunnelling would be conducted for the following area:

i. Diamond Hill - near the entrance of DIH

The extent of this section runs from south-west of the proposed alignment to DIH for about 100m based on the HHS option. The area mainly consists of residential premises. The identified NSR that could be affected by the proposed bored tunnelling is at least 60m away from the tunnel boring machine. The predicted maximum groundborne noise level of the identified NSR is 36dB(A) and is well below the adopted groundborne noise criteria. Adverse groundborne noise impact due to bored tunnelling on the NSR for this short section of the alignment is not anticipated. Detailed analyses of construction groundborne noise are given in **Appendix 9.1**.

9.5.2 Cumulative Noise Impacts

Given the construction groundborne noise is much lower than the stipulated criteria, cumulative noise impacts from concurrent projects are not anticipated.

9.6 Assessment Results – Operational Groundborne Noise

9.6.1 Noise Impact from SCL (HHS)

With the methodology and corrections presented in the above sections, groundborne noise levels for the identified NSRs are tabulated in **Table 9.7** below. NSRs are identified at HHS, KAT and DIH. Detailed calculations are given in **Appendices 9.2** and **9.3**. Speed profile of the SCL (HHS) is given in **Appendix 9.7**.

Table 9.7: Summary of predicted groundborne noise level

NSR ID	NSR Description	Sensitive Floor	Train Averg.	Predicted Maximum	Nighttime Scenario	Daytime Scenario

			Speed[1] (kph)	Noise Level (L_{max})	Predicted $L_{eq,30min}$ (dB(A))	Criterion $L_{eq,30min}$ (dB(A))	Predicted $L_{eq,30min}$ (dB(A))	Criterion $L_{eq,30min}$ (dB(A))
HUH-1-3	Wing Fung Building	1	25	30	22	45	25	55
KAT-P1-1	Residential premises near Kai Tak Station	2	35	32	23	45	26	55
KAT-P1-2	Residential premises near Kai Tak Station	2	50	35	25	45	28	55
KAT-P1-3	Residential premises near Kai Tak Station	2	70	43	31	45	34	55
KAT-P1-4	Residential premises near Kai Tak Station	2	65	30	<20	45	<20	55
KAT-P1-5	Residential premises near Kai Tak Station Site 1A	2	60	51	40	45	43	55
KAT-P1-6	Residential premises near Kai Tak Station Site 1B	2	55	36	25	45	28	55
DIH-11-1	Lung Wan House	1	35	26	<20	45	<20	55
DIH-P3-1	TBA	2	60	47	36	45	39	55
DIH-P3-2	TBA	2	60	47	36	45	39	55

Notes: [1] Individual speed is estimated from tentative speed profiles.

As the nighttime noise criteria is 10dB(A) more stringent than the daytime, compliance with the nighttime criteria would typically mean compliance with the daytime criteria at the NSRs. 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 (see **Table 9.7**), an increase of 0.3dB(A) and 0.7dB(A) would be predicted respectively for 26 and 28 trains/direction/hour. So even cumulative impacts from the main alignment are taken into account, the upward adjustment would still result in compliance of the daytime noise criteria at all NSRs.

It should be noted that the refuge sidings in KAT are for emergency purpose and are normally not in operation, groundborne noise impact is therefore not anticipated.

Results in **Table 9.7** show that the predicted groundborne noise levels for NSRs for the Project are well below the NCO criteria. Hence, mitigation measures are not required.

9.6.2 Cumulative Noise Impact from Concurrent Projects

As discussed in **Section 9.4.14**, the identified NSR near HHS would be subject to the cumulative impacts from KTE, SCL (TAW-HUH) and SCL (MKK-HUH). The following table summarises the predicted cumulative impact.

Table 9.8: Cumulative Noise Impact at Noise Sensitive Receivers

NSR ID	NSR Description	Noise Contribution, $L_{eq\ 30mins}$ dB(A)				Total $L_{eq\ 30mins}$ dB(A)	Compliance
		SCL (HHS)	SCL (TAW-HUH)	SCL (MKK-HUH)	KTE		
HUH-1-3	Wing Fung Building	22	38	20	<20	38	Yes

9.6.3 Recommendations

Prediction of operational groundborne noise indicates the criteria will be achieved and mitigation measures are not required. MTR Corporation will further review the LSR values and mitigation during the construction stage after the tunnel boring. A noise commissioning test is recommended to be conducted prior to operation of the Project for verification of EIA predictions and checking of the compliance of the operational ground-borne noise levels with the NCO noise criteria.

9.7 Conclusion

Potential groundborne noise sources during the construction phase have been identified. The noise impacts on neighbouring sensitive receivers have been quantified. Results indicate that the predicted impacts are within the statutory requirements and hence mitigation measures are not required. There are no adverse residual impacts exceeding the construction groundborne noise criterion.

Projections of ground borne noise at identified representative sensitive receivers have been performed, based on a methodology recommended by the US Department of Transportation and assuming an additional 10 dB safety factor. Results suggest that the predicted impacts are within the statutory requirements and hence mitigation measures are not required. MTR Corporation will further review the LSR values and mitigation during the construction stage after the tunnel boring. A noise commissioning test is recommended to be conducted prior to operation of the Project for verification of EIA predictions and checking of the compliance of the operational ground-borne noise levels with the NCO noise criteria.

9.8 References

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[9-6] Noise Control Ordinance (Cap 400), HKSAR dated June 1997

[9-7] Technical Memorandum on Noise from Construction Work other than Percussive Piling, EPD dated March 1996

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[9-9] Technical Memorandum on Environmental Impact Assessment Process (EIA Ordinance), EPD dated September 1997

[9-10] Technical Memorandum on Noise from Percussive Piling, EPD dated June 1999

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