

5 Noise

5.1 Introduction

The EIA has considered the potential airborne noise impacts during both the construction and operational phases of the Project. Noise monitoring is proposed to be conducted during construction and operational phase.

5.2 Mitigation Measures

5.2.1 Construction Phase

The EIA Report has recommended construction noise control measures including the use of quiet plant and temporary noise barriers, etc. All the proposed mitigation measures are summarized in the EMIS in **Appendix 2-2**. Temporary noise barriers are proposed to mitigate construction access road traffic noise impacts at Year 2016 and 2020. These mitigation measures include the following and are shown in **Figures 5.1 to 5.2** and **Table 5.1** for Year 2016, **Figures 5.3 to 5.4** and **Table 5.1a** for Year 2020.

Table 5.1 Noise mitigation measures for construction access road traffic noise in Year 2016

Type of Noise Mitigation Measures ^[1]	ID No.	Height above road level (m)	Approximate Length (m)
Temporary Noise Barrier	TNB 1	0.8	46
Temporary Noise Barrier	TNB 2	1.5	8
Temporary Noise Barrier	TNB 3	1.5	5
Temporary Noise Barrier	TNB 4	1.5	9
Temporary Noise Barrier	TNB 5	3	16
Temporary Noise Barrier	TNB 6	1.5	15
Temporary Noise Barrier	TNB 7	1.5	12
Temporary Noise Barrier	TNB 8	1.5	28
Temporary Noise Barrier	TNB 9	1.5	22
Temporary Noise Barrier	TNB 10	1.5	17
Temporary Noise Barrier	TNB 11	1.5	23
Temporary Noise Barrier	TNB 12	3	18
Temporary Noise Barrier	TNB 13	1.5	28
Temporary Noise Barrier	TNB 14	1.5	27
Temporary Noise Barrier	TNB 15	0.8	47
Temporary Noise Barrier	TNB 16	3	2

Note:

[1] All the proposed noise barriers are reflective in terms of acoustic characteristic.

Table 5.1a Noise mitigation measures for construction access road traffic noise in Year 2020

Type of Noise Mitigation Measures ^[1]	ID No.	Height above road level (m)	Approximate Length (m)
Temporary Noise Barrier	TNB 1	0.8	46
Temporary Noise Barrier	TNB 2	3	8
Temporary Noise Barrier	TNB 3	3	5

Type of Noise Mitigation Measures ^[1]	ID No.	Height above road level (m)	Approximate Length (m)
Temporary Noise Barrier	TNB 4	3	9
Temporary Noise Barrier	TNB 5	5	16
Temporary Noise Barrier	TNB 6	3	15
Temporary Noise Barrier	TNB 7	3	12
Temporary Noise Barrier	TNB 8	3	21
Temporary Noise Barrier	TNB 9	0.8	24
Temporary Noise Barrier	TNB 10	3	17
Temporary Noise Barrier	TNB 11	1.5	23
Temporary Noise Barrier	TNB 12	3	18
Temporary Noise Barrier	TNB 13	3	28
Temporary Noise Barrier	TNB 14	3	27
Temporary Noise Barrier	TNB 15	0.8	47
Temporary Noise Barrier	TNB 17	1	37

Note:

[1] All the proposed noise barriers are reflective in terms of acoustic characteristic.

5.2.2 Operational Phase

Mitigation measures of noise barriers would need to be implemented along the roadworks for LMC Loop. These mitigation measures include the following and are shown in **Figures 5.5 to 5.8** and **Table 5.2**:

Table 5.2 Noise mitigation measures for operational phase

Type of Noise Mitigation Measures ^[1]	ID No.	Height above road level (m)	Approximate Length (m)
Noise Barrier	NB 1	0.8	16
Noise Barrier	NB 2	0.8	42
Noise Barrier	NB 3	0.8	27
Noise Barrier	NB 4	0.8	14
Noise Barrier	NB 6	0.8	50
Noise Barrier	NB 7	0.8	8
Noise Barrier	NB 8	3	10
Noise Barrier	NB 9	5	33
Noise Barrier	NB 10	3	12
Noise Barrier	NB 11	5	12
Noise Barrier	NB 12	3	36
Noise Barrier	NB 13	3	12
Noise Barrier	NB 14	0.8	32
Noise Barrier	NB 15	3	27
Noise Barrier	NB 16	3	57
Noise Barrier	NB 21	0.8	47
Noise Barrier	NB 22	0.8	46
Noise Barrier	NB 23	3	16
Noise Barrier	NB 24	0.8	80

Note:

[1] All the proposed noise barriers are reflective in terms of acoustic characteristic.

5.3 Noise Monitoring Parameters for Construction Phase

Construction noise level shall be measured in terms of the A-weighted equivalent continuous sound pressure level (L_{eq}). $L_{eq\ 30\ min}$ shall be used as the monitoring parameter for the time period between 0700 and 1900 hours on normal weekdays. For all other time periods, $L_{eq\ 5\ min}$ shall be employed for comparison with the Noise Control Ordinance (NCO) criteria.

As supplementary information for data auditing, statistical results such as L_{10} and L_{90} shall also be obtained for reference. A sample data record sheet is shown in **Appendix 5-1** for reference.

5.4 Monitoring Equipment for Construction Phase

As referred to in the Technical Memorandum (TM) issued under the NCO, sound level meters in compliance with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications shall be used for carrying out the noise monitoring. Immediately prior to and following each noise measurement, the accuracy of the sound level meter shall be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements may be accepted as valid only if the calibration level from before and after the noise measurement agrees to within 1.0 dB.

Noise measurements should be made in accordance with standard acoustical principles and practices in relation to weather conditions.

The ET is responsible for the provision, installation, operation, maintenance, dismantle of the monitoring equipment. He shall ensure that sufficient noise measuring equipment and associated instrumentation are available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. All the equipment and associated instrumentation shall be clearly labelled.

5.5 Monitoring Locations for Construction Phase

Most representative and affected NSRs were selected as monitoring stations. Details could refer to EIA report.

The locations of construction airborne noise monitoring stations are summarised in **Table 5.3** and shown in **Figure 5.9**. Details of sensitive receivers could refer to the EIA report. For easy reference, the sensitive receiver locations are attached in **Appendix 5.2**.

Table 5.3 Proposed construction noise monitoring locations

ID	Description
HWT-8	Village house in Ha Wan Tsuen
HWTR-11	Village house along existing Ha Wan Tsuen Road
BR-4	Village house along Border Road
MTL-20	Village house in Ma Tso Lung close to the proposed Eastern Connection Road

The above proposed construction noise monitoring locations are preliminary proposal, due to the large project site and phased implementation of the Project, the ET shall select the monitoring locations based on the locations of the

construction activities and seek approval from ER and agreement from the IEC and EPD to the proposal. The ER/IEC/EPD may also request a closer locations based on on-site conditions and environmental complaint. The monitoring locations should be chosen based on the following criteria:

- At locations close to the major site activities which are likely to have noise impacts;
- Close to the most affected existing noise sensitive receivers; and
- For monitoring locations located in the vicinity of the sensitive receivers, care should be taken to cause minimal disturbance to the occupants during monitoring.

The monitoring station shall normally be at a point 1 m from the exterior of the sensitive receiver building facade and be at a position 1.2 m above the ground. If there is problem with access to the normal monitoring position, an alternative position may be chosen, and a correction to the measurements shall be made. For reference, a correction of +3 dB(A) shall be made to the free field measurements. The ET shall agree with the IEC on the monitoring position and the corrections adopted. Once the positions for the monitoring stations are chosen, the baseline monitoring and the impact monitoring shall be carried out at the same positions.

The IEC may, depending on site conditions and monitoring results, decide whether additional monitoring locations shall be included or any monitoring locations could be removed/relocated during any stage of the construction phase.

5.6 Baseline Monitoring for Construction Phase

The ET shall carry out baseline noise monitoring prior to the commencement of the construction works. There shall not be any construction activities in the vicinity of the stations during the baseline monitoring. Continuous baseline noise monitoring for the A-weighted levels L_{eq} , L_{10} and L_{90} shall be carried out daily for a period of at least two weeks in a sample period of 5 minutes or 30 minutes between 0700 and 1900, and 5 minutes between 1900 and 0700. A schedule on the baseline monitoring shall be submitted to the ER and IEC for approval before the monitoring starts.

In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET shall liaise with the IEC and EPD to agree on an appropriate set of data to be used as a baseline reference and submit to the ER for approval.

5.7 Impact Monitoring for Construction Phase

During normal construction working hour (0700-1900 Monday to Saturday), monitoring of L_{eq} , 30min noise levels (as six consecutive L_{eq} , 5min readings) shall be carried out at the agreed monitoring locations once every week in accordance with the methodology in the TM.

In case of non-compliance with the construction noise criteria, more frequent monitoring, as specified in the Action Plan, shall be carried out. This additional monitoring shall be continued until the recorded noise levels are rectified or proved to be irrelevant to the construction activities.

A schedule on the compliance monitoring shall be submitted to the ER and IEC for approval before the monitoring starts.

5.8 Action / Limit Levels

The ET shall compare the construction noise monitoring results with noise criteria. **Table 5.4** shows the noise criteria, namely Action and Limit levels to be used.

Table 5.4 Action and Limit Levels for construction noise

Time Period	Action Level	Limit Level
0700 - 1900 hours on normal weekdays	When one documented complaint is received	75 dB(A) *

Note : If works are to be carried out during restricted hours, the conditions stipulated in the construction noise permit issued by the Noise Control Authority have to be followed.

* Reduce to 70 dB(A) for schools and 65 dB(A) during school examination periods.

5.9 Event and Action Plan for Construction Noise

Should non-compliance of the noise criteria occur, actions in accordance with the Action Plan in **Table 5.5** shall be carried out.

Table 5.5 Event / Action Plan for construction noise

Event	Action			
	ET	IEC	ER	Contractor
Action Level Exceedance	<ol style="list-style-type: none"> 1. Notify IEC, ER and Contractor; 2. Carry out investigation; 3. Report the results of investigation to the IEC, ER and Contractor; 4. Discuss with the Contractor and formulate remedial measures; 5. Increase monitoring frequency to check mitigation effectiveness. 	<ol style="list-style-type: none"> 1. Review the analysed results submitted by the ET; 2. Review the proposed remedial measures by the Contractor and advise the ER accordingly; 3. Supervise the implementation of remedial measures. 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. Require Contractor to propose remedial measures for the analysed noise problem; 4. Ensure remedial measures are properly implemented 	<ol style="list-style-type: none"> 1. Submit noise mitigation proposals to IEC and ER; 2. Implement noise mitigation proposals.
Limit Level Exceedance	<ol style="list-style-type: none"> 1. Identify source; 	<ol style="list-style-type: none"> 1. Discuss amongst ER, 	<ol style="list-style-type: none"> 1. Confirm receipt of 	<ol style="list-style-type: none"> 1. Take immediate

Event	Action			
	ET	IEC	ER	Contractor
	2. Inform IEC, ER, EPD and Contractor; 3. Repeat measurements to confirm findings; 4. Increase monitoring frequency; 5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented; 6. Inform IEC, ER and EPD the causes and actions taken for the exceedances; 7. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results; 8. If exceedance stops, cease additional monitoring.	ET, and Contractor on the potential remedial actions; 2. Review Contractors remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly; 3. Supervise the implementation of remedial measures.	notification of failure in writing; 2. Notify Contractor; 3. Require Contractor to propose remedial measures for the analysed noise problem; 4. Ensure remedial measures properly implemented; 5. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated.	action to avoid further exceedance; 2. Submit proposals for remedial actions to IEC within 3 working days of notification; 3. Implement the agreed proposals; 4. Resubmit proposals if problem still not under control; 5. Stop the relevant portion of works as determined by the ER until the exceedance is abated.

Note:

- ET – Environmental Team
- IEC – Independent Environmental Checker
- ER – Engineer's Representative
- Each step of actions required shall be implemented within 1 working day unless otherwise specified or agreed with EPD.

5.10 Impact Monitoring for Operational Phase

Traffic noise monitoring shall be carried out at all the designated traffic noise monitoring stations. The following is an initial guide on the traffic noise monitoring requirements during the operational phase:

- One set of measurements at the morning traffic peak hour on normal weekdays.
- One set of measurement at the evening traffic peak hour on normal weekdays.
- The traffic noise shall be measured in terms of the A-weighted L_{10} (1 hour) over 2 hourly periods. As supplementary information for data auditing, statistical results such as L_{eq} , L_{90} and L_{max} shall also be obtained for reference.
- A concurrent census of traffic flow and percentage heavy vehicles shall be conducted for the far-side and near-side of the road and the existing road network in the vicinity of each measurement points.
- Average vehicle speed estimated for far-side and near-side of the road and the existing road network in the vicinity of each measuring points.
- The two sets of monitoring data shall be obtained within the first year of operation.
- Measured noise levels shall be compared with the predicted noise levels by applying appropriate conversion corrections to allow for the traffic conditions at the time of measurement.

5.11 Monitoring Equipment and Methodology for Operational Phase

The monitoring equipments for operational noise monitoring should be same as those recommended for construction noise monitoring.

For the traffic noise, the measured/monitored noise levels shall be compared with the predicted results and the predicted traffic flow conditions (calculated noise levels based on concurrent traffic census obtained). In case discrepancies are observed, explanation shall be given to justify the discrepancies.

5.12 Noise Monitoring Stations for Operational Phase

The locations of operational airborne noise monitoring stations are summarised in **Table 5.6** and shown in **Figure 5.9**. Details of sensitive receivers could refer to the EIA report. For easy reference, the sensitive receiver locations are attached in **Appendix 5.2**.

Table 5.6 Proposed traffic noise monitoring locations

ID	Description	mPD	Storey level
LMCR-3	Village house along Lok Ma Chau Road	9.2	3
EL-P3	Proposed Eco-Lodge close to the proposed Eastern Connection Road	14.2	1
HWTR-16	Village house along Ha Wan Tsuen Road	4.8	1
HWTR-23	Village house along Lok Ma Chau Road	8.2	2

The ET shall select the monitoring location and seek approval from ER and agreement from the IEC and EPD to the proposal. The ER/IEC/EPD may also request a closer locations based on on-site conditions and environmental complaint. The monitoring locations should be chosen based on the following criteria:

- At locations close to the noise mitigation measures such as noise barriers;
- Close to the most affected existing noise sensitive receivers; and
- For monitoring locations located in the vicinity of the sensitive receivers, care should be taken to cause minimal disturbance to the occupants during monitoring.

The monitoring station shall normally be at a point 1 m from the exterior of the sensitive receiver building facade and be at a position 1.2 m above the ground. If there is problem with access to the normal monitoring position, an alternative position may be chosen, and a correction to the measurements shall be made. For reference, a correction of +3 dB(A) shall be made to the free field measurements. The ET shall agree with the IEC on the monitoring position and the corrections adopted.