

10. OPERATION PHASE EM&A

10.1 Introduction

Noise and air quality monitoring will be required during the operation of Route 10 (NLYLH). The methodology, equipment, monitoring locations, criteria and protocols for the monitoring and audit are discussed as follows.

10.2 Tunnel/Noise Enclosure Air Quality Monitoring

The following air quality guidelines shall be attained and maintained inside vehicle tunnels and full noise enclosures:

Table 10.1 Tunnel Air Quality Guideline

Air Pollutants	Averaging Time	Maximum Concentration	
		Microgrammes Per Cubic Metre ($\mu\text{g}/\text{m}^3$)	Parts Per Million (ppm)
Carbon monoxide	5 minutes	115,000	100
Nitrogen dioxide	5 minutes	1,800	1
Sulphur dioxide	5 minutes	1,000	0.4

Operation Practice

Effective control of air pollution requires proper supervision of the maintenance and operation of the ventilation system and the monitoring equipment. Good preventive maintenance shall be employed.

Staff shall be properly trained on their duties relating to control of air pollution.

The tunnel management shall, based on the historical correlation between the traffic flow and air pollutant concentration or otherwise, ensure the number of vehicles entering the tunnel or noise enclosure at any time will, as far as practicable, not exceed any level that may threaten the limit mentioned in *Table 10.1* above. Where the concentrations of pollutants have exceeded the Tunnel Air Quality Guidelines, the EPD shall be advised as soon as reasonably practicable.

Monitoring Requirement

Concentrations of carbon monoxide, nitrogen dioxide and visibility shall be monitored inside tunnels. Tunnel management shall install and operate at least one analyser for each pollutant at each kilometre section of tunnel/noise enclosure .

The monitoring of nitrogen dioxide may be replaced by nitric oxide through the application of the following equation or any correlation relationship between these two parameters demonstrated to have a regression coefficient of not less than 0.85:-

$$\text{Nitrogen dioxide} = 320 + 0.1056 \times \text{Nitric oxide concentration } \mu\text{g}/\text{m}^3$$

The tunnel management shall forward the results of monitoring on a floppy disk in an agreed format to the EPD once per month. This auditing procedure shall be limited to the first year of operation, and subsequently be reviewed by the Highways Department and EPD.

All monitoring instruments shall be checked for zero and span once a week and calibrated and certified by an independent environmental laboratory in accordance with the criteria.

The analyzers shall activate an audible alarm at the main tunnel control room whenever the measured carbon monoxide and nitrogen dioxide concentrations exceed $60,000 \mu\text{g}/\text{m}^3$ and $1,000 \mu\text{g}/\text{m}^3$ respectively. Prompt action, including increasing the fan operation, restriction of the traffic flow and other means acceptable to the EPD, shall be taken whenever appropriate.

10.3 Operational Phase Noise Monitoring

Noise monitoring during the operational phase of Route 10 (NLYLH) shall be carried out at NSRs which are located along Route 10 (NLYLH) and in the vicinity of the recommended direct technical remedies. The purpose of this monitoring is to ensure the proposed mitigation measures are effective and that the impact at unprotected NSRs are within acceptable noise limits. The Highway Department will be responsible for the operational phase monitoring. A qualified noise monitoring contractor or laboratory should be employed to carry out the proposed monitoring.

Noise Parameters

The operational phase noise monitoring shall focus on traffic noise. Noise levels shall be measured in terms of L_{10} for the a.m. and p.m. peak traffic flow on normal weekdays once the route is fully operational. In order to capture the actual peak hour traffic, noise monitoring is recommended for a period of 1.5 hour.

Monitoring Equipment

Monitoring equipment to be used shall be the same as that specified in *Section 3.3*, i.e. sound level meters complying with the International Electrotechnical Commission Publications 651:1979 (Type 1) and 804:1985 (Type 1) specifications shall be used for carrying out the traffic noise monitoring. Calibration procedures and other measurement conditions shall also as stated in *Section 3.3*.

Monitoring Locations

The noise monitoring locations should be at NSRs located along Route 10 (NLYLH) and which are in the vicinity of the recommended direct technical remedies. The recommended noise monitoring locations are shown in *Figures 10.1-2* and summarised in *Table 10.2*. However, the exact locations where the noise monitoring shall be conducted shall be confirmed after the completion of Route 10 (NLYLH) and shall be agreed with the EPD.

Table 10.2 Noise Monitoring Stations during Operational Phase

Noise Monitoring Station	Noise Monitoring Location
NL-1A	Tso Wan (Low and high levels)
SKW-19	Lo Tsing Shan Tsuen (Low and high levels)
SL-N9	Castle Peak Villa (Low and high levels)

Baseline Monitoring

As there shall be no traffic on Route 10 (NLYLH) before its official opening, baseline monitoring is not considered necessary. Any actions, if required, shall be based on whether the Action Levels as proposed in *Table 10.4* are met.

*Impact Monitoring*Traffic Noise

Traffic noise monitoring shall be carried out at the proposed monitoring stations (subject to approval by EPD) when Route 10 (NLYLH) is fully operational. It is recommended that two sets of traffic noise monitoring data shall be obtained during its first year of the operation (i.e. 2007). The following is a guide for the traffic noise monitoring at each station :

- (a) one set of measurements at the morning traffic peak hour on normal weekdays (exact timing to be confirmed with Transport Department and agreed with EPD); and
- (b) one set of measurements at the evening traffic peak hour on normal weekdays (exact timing to be confirmed with Transport Department and agreed with EPD).

During the traffic noise monitoring, traffic counts shall also be conducted so as to ensure the traffic noise is measured at the peak periods.

Fixed Plant Noise

It is recommended that noise monitoring is carried out for the ventilation buildings on two occasions; day one of commissioning and day 60 of operation.

Noise measurements shall be made in accordance with the procedures outlined in the "Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places and Construction Sites" (IND-TM) and shall be conducted at a time when the ventilation buildings are operating at its maximum capacity.

The monitoring location shall be outside the ventilation buildings at a distance of 1m from the centre of the louvre. Two types of measurement shall be carried out:

- (1) Broadband measurement of $L_{Aeq(t)}$. Note that the measurement period (t) shall normally be 30 minutes. However, if it can be demonstrated that the noise level is constant, then a shorter measurement period (no less than 5 minutes) may be used.
- (2) Frequency analysis between 31.5 and 16 kHz measured at 1/3 octave intervals. If the noise emanating from the louvre is found to be tonal (as defined in IND-TM) then an appropriate tonal correction should be applied to the measured noise level (MNL) to achieve the corrected noise level (CNL). This CNL shall be compared with the noise specifications.

Event and Action Plan

The Action Levels for the operational phase traffic noise monitoring are shown in Table 10.3. Should non-compliance of the criteria occur, actions in accordance with the Event/Action Plan in Table 10.4, shall be carried out.

Table 10.3 Action Levels for Operational Phase Traffic Noise

Sensitive Receiver	Action Level
Village Houses / other residential developments	L_{10} equal to or higher than 70 dB(A)
Schools / educational establishments	L_{10} equal to or higher than 65 dB(A)

Table 10.4 Event/Action Plan for Operational Phase Traffic Noise

EVENT	ACTION	
	Monitoring Contractor	Highway Department
Action Level is exceeded in any of the proposed monitoring stations	1. Notify Highways Department. Provide details of traffic flow and other monitoring condition to EPD	1. Liaise with EPD to investigate noise mitigation proposals. 2. Implement noise mitigation proposals if required