

11. ENVIRONMENTAL MONITORING & AUDIT REQUIREMENT

11.1 Introduction

This section outlines key Environmental Monitoring and Audit (EM&A) requirements that are detailed in a stand alone EM&A Manual. The recommended EM&A requirements based on findings of the assessment in previous sections of this report. As discussed in *Sections 3 and 4*, construction dust and noise may lead to exceedances of environmental criteria and therefore EM&A at the affected sensitive receivers are recommended. EM&A is also required to ensure that the air quality inside the Eagle's Nest Tunnel is maintained in accordance with the Tunnel Air Quality Guidelines (TAQG) specified under the "*Practice Notes on Control of Air Pollution in Vehicle Tunnels*". The Manual also covers general audit requirements in relation to water quality, waste management, ecology and landscaping mitigation measures.

11.2 Objectives of Environmental Monitoring & Audit

11.2.1 The objectives of carrying out EM&A for the Route 16 include the following:

- to provide a database against which any short term or long term environmental impacts of the project can be determined;
- to provide an early indication should any of the environmental control measures or practices fail to achieve the acceptable standards;
- to monitor the performance of the project and the effectiveness of mitigation measures;
- to verify the environmental impacts predicted in the EIA Study;
- to determine project compliance with regulatory requirements, standards and government policies;
- to take remedial action should unexpected problems or unacceptable impacts arise; and
- to provide data to enable an environmental audit.

The following sections summarise the recommended EM&A requirements proposed.

11.3 Construction Noise

11.3.1 Noise produced during the construction phase will impact upon nearby noise sensitive receivers (NSRs) as assessed in *Section 4*. The construction noise criteria of 75 dB(A) and 70dB(A) may likely be exceeded at some of the representative NSRs if construction noise is unmitigated. Hence, noise mitigation measures were recommended to reduce the noise impact to within the noise criteria as presented in Section 4.5.4.

11.3.2 Noise monitoring requirements have been recommended in the EM&A Manual in order to ensure compliance with the construction noise criteria. Details of the monitoring requirements such as monitoring locations, frequency of baseline and impact monitoring are presented in the EM&A Manual.

11.4 Operational Noise

11.4.1 Noise monitoring during the operational phase of Route 16 shall be carried out at NSRs in the vicinity of the recommended direct technical remedies. The traffic noise level shall be measured twice within the first year of the road opening. Measurements shall be made in terms of the A-weighted L_{10} over 3 half hour periods during the peak traffic hour. The purpose of this monitoring is to ensure that the proposed mitigation measures are effective and that

the impact at NSRs not directly protected will be within acceptable noise limits. It is recommended that the Highways Department should be responsible for the operational phase monitoring. Qualified noise monitoring contractor or laboratory should be employed to carry out the proposed monitoring. Details of the monitoring requirements such as monitoring locations, frequency of baseline and impact monitoring are presented in the EM&A Manual.

11.5 Construction Dust

The construction work will inevitably lead to dust emissions, mainly from excavation, truck haulage and material handling activities. It was predicted that the dust generated would exceed the hourly and daily criteria of $500 \mu\text{g m}^{-3}$ and $260 \mu\text{g m}^{-3}$ respectively at some of the ASRs.

- 11.5.1 Mitigation measures are presented in *Section 3.5.3* and recommended to limit the dust emission and dispersion. With proper dust control measures in accordance with *Air Pollution Control (Construction Dust) Regulations*, the TSP levels at the affected air sensitive receivers will comply with the dust criteria. Details of the monitoring requirements such as monitoring locations, frequency of baseline and impact monitoring are presented in the EM&A Manual.

11.6 Tunnel Air Quality

- 11.6.1 Vehicular emissions during the operation of Eagle's Nest Tunnel will generate major air pollutants such as NO_2 , CO and SO_2 . The following air quality guidelines should be attained and maintained inside the tunnel:

Table 13.4 Tunnel Air Quality Guideline

Air Pollutants	Averaging Time	Maximum Concentration	
		Microgrammes Per Cubic Metre ($\mu\text{g m}^{-3}$)	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

- 11.6.2 In addition, the visibility in tunnels is a gross indicator of the smoke concentration. It should be monitored and controlled to a level equivalent to an extinction coefficient of 0.005 per metre or less during any 5-minute interval.
- 11.6.3 Effective control of air pollution within the tunnel sections of the Eagle's Nest Tunnel requires proper supervision on the maintenance and operation of the ventilation system and the monitoring equipment. Good preventive maintenance should be employed. Appropriate measures are presented in the EM&A Manual.
- ## 11.7 Waste Management
- 11.7.1 It has been recommended that auditing of each waste stream should be carried out regularly by the Contractor to determine if wastes are being managed in accordance with approved

procedures and the site waste management plan. The audits should look at all aspects of waste management including waste generation, storage, recycling, treatment, transport, and disposal. An appropriate audit programme would be to undertake the first audit at commencement of the construction works, and then quarterly audit should be carried out thereafter.

11.8 Ecology

- 11.8.1 The mitigation measures should be included into contract clauses for the Route 16. The implementation of the measures should be checked as part of the environmental monitoring and audit procedures during the construction period, the procedures of which are presented in the EM&A Manual.

11.9 Cultural Heritage

- 11.9.1 Visual inspection of the 5 historic buildings in Tin Sam Village and the historic buildings within Lai Chi Kok Hospital should be conducted prior to the commencement of the construction. All structural defects that could be identified during the visual inspection should be recorded. In addition, structural inspection survey for the above historic buildings shall be made in quarterly interval. Critical structural members, such as main beams and columns will also be included in the quarterly inspection. Future inspection record will be copied to AMO for record. Measurement of vibration would also be carried out on a need basis during piling work.
- 11.9.2 A piezometer will also be installed in Butterfly Valley to monitor any change in ground water table during construction. The measurement will be made twice a month during construction. Records of monitoring will be copied to AMO for record.