



**HIGHWAYS DEPARTMENT**

**HIGHWAYS ( HONG KONG ) REGION**

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**Final Environmental Monitoring  
and  
Audit Manual**

16 July 1997

The Design & Construction of the Interchange at  
Pok Fu Lam Road and Sassoon Road Junction

**Agreement No. CE 30/95  
The Design & Construction of the Interchange at  
Pok Fu Lam Road and Sassoon Road Junction**



**ARUP**  
in association with  
ERM & URBIS

78/11/82  
EIA-11/82/BC

Agreement No. CE 30/95

EIA/019.2/97

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*Annex A - Interim Notification*

## 1. INTRODUCTION

### 1.1 Background

Ove Arup & Partners (OAP), in association with ERM-Hong Kong, Ltd (ERM) and Urbis Ltd, have been commissioned by the Highways Department (HyD) to undertake the *Design and Construction of the Interchange at the Junction of Pok Fu Lam Road and Sassoon Road* (Agreement No CE30/95) (hereafter called the Roadworks). ERM are the environmental consultants to undertake the Environmental Impact Assessment (EIA) for the Roadworks during the Review Phase. The Roadworks scheme is depicted in *Figure 1.1a*.

The main construction activities of the Roadworks includes, bridge work, at-grade road widening, road pavement and retaining wall and will be carried out in 3 stages:

- Stage 1: Construction of link bridge for Pok Fu Lam and aligned Sassoon Road and re-aligned the Bisney Road.
- Stage 2: Carry out at grade road widening near QMS store for the depressed 3-lane northbound carriageway. Construct the interchange network bridges linking Sassoon Road and realigned Bisney Road.
- Stage 3: Reconstruct the existing retaining wall and the remaining depressed 2-lane southbound carriageway.

The construction works associated with the proposed Roadworks are summarised in the Construction Programme in *Figure 1.2a*.

### 1.2 Purpose of the Environmental Monitoring and Audit Manual

The EIA study has identified and justified construction noise as a key potential impact associated with the Roadworks and that there is a need for an Environmental Monitoring and Audit (EM&A) programme to be implemented to ensure the noise impact from the construction works are systematically controlled to Government ordinance. The noise impacts and associated mitigation measures of the Roadworks are presented in the *Section 3* of the Final EIA Report.

This Environmental Monitoring and Audit (EM&A) Manual prescribes the necessary EM&A requirements for the construction phase of the Roadworks ie from commencement of the construction contract until the submission of a statement of substantial completion of works by the Contractor and accepted by the Engineer. Further EM&A requirements after the substantial completion of works are not required.

The EM&A requirements prescribed in this Manual comprise the procedures for construction noise impact monitoring and audit to be undertaken, and the

guidance and instructions to the parties involved in the FM&A process on the Roadworks.

### 1.3 Scope of Construction Noise Monitoring and Audit

The scope of the construction noise monitoring and audit for the Roadworks includes the following:

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

### 1.4 The Layout of The EM&A Manual

Following this introductory Section, the Manual is set out as follows:

- *Section 2* provides a summary of the predicted noise impacts and the associated recommended mitigation measures for the construction of the Roadwork as identified in the EIA;
- *Section 3* describes of the roles and responsibilities of the various parties involved in the EM&A process;
- *Section 4* presents the monitoring requirements for the construction of the Roadworks including identification of sensitive receivers, monitoring locations, monitoring equipment to be used, details of the requirements for baseline and impact monitoring;
- *Section 5* describes the scope of construction noise audits and defines the criteria and methodology of the audits;
- *Section 6* presents the reporting requirements for the EM&A programme.

Legend:

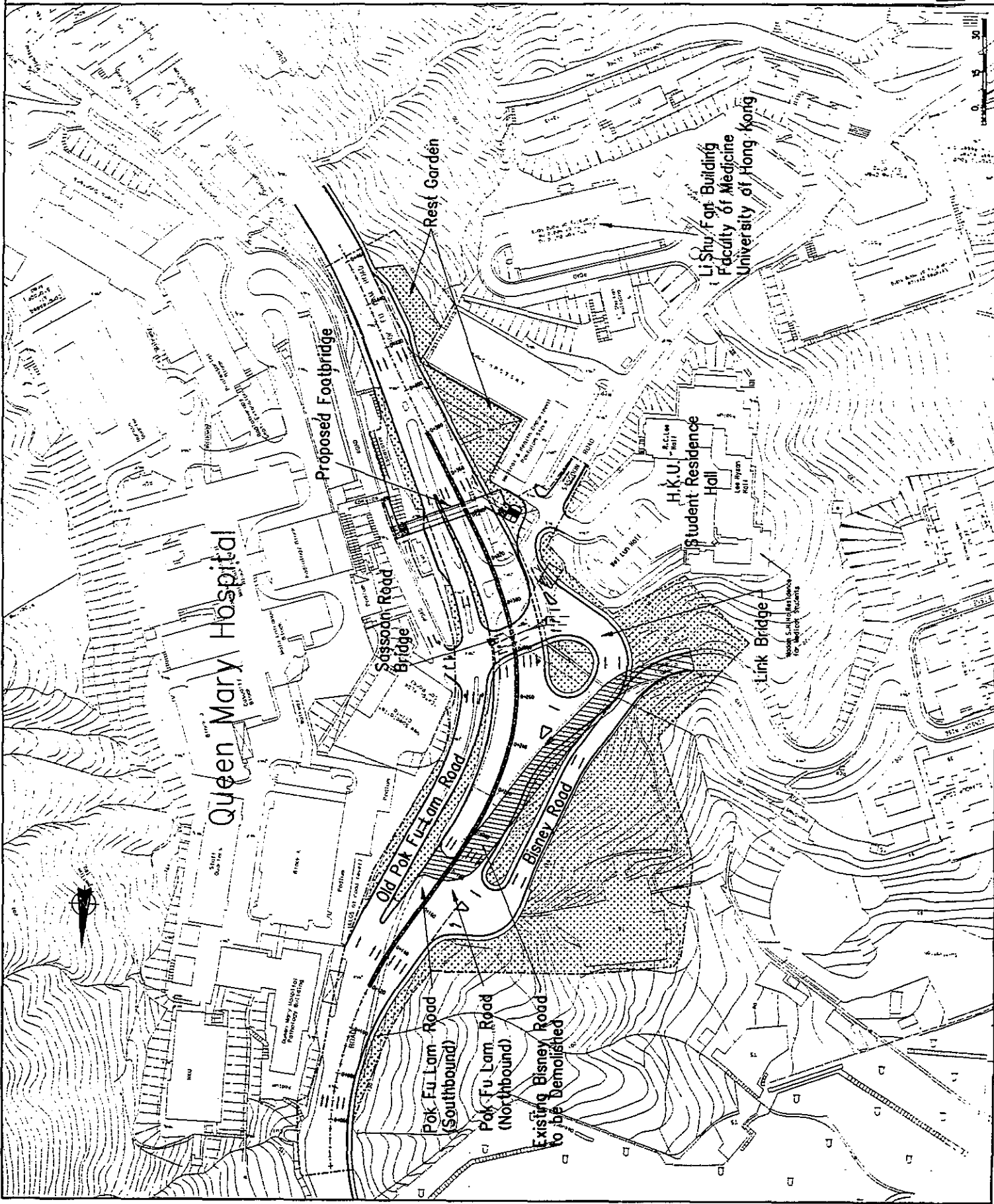
Landscape Area



Demolition of Bisney Road Bridge



Project Limit



MARK	REVISION	BY	DATE

**ARUP**  
 CONSULTANTS  
 One Ave. 6, Northcote  
 Hong Kong Limited

PROJECT NO.  
**Agreement No. CE 30/95**  
**Design and Construction of Interchange at the Junction of Pok Fu Lam Road and Sassoon Road**

DRAWING NO.  
**Figure 1.1a**  
**GENERAL LAYOUT PLAN**

DRAWN BY: [ ]  
 CHECKED BY: [ ]  
 DATE: [ ]

HIGHWAYS / HONG KONG REGION  
 HONG KONG DEPARTMENT OF TRANSPORTS  
 HONG KONG

**Agreement No. CE 30/95**  
**Design and Construction of flyover at the**  
**Junction of Pok Fu Lam Road and Sassoon Road**

Task Name	Start Date	Duration	End Date	1998				1999				2000					
				Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
<b>1. Bisney Road Bridge Reconstruction</b>	08/14/98	122.00d	02/15/99	██████████													
Foundation	08/14/98	2.00mon	10/15/98	██████████													
Abutment	10/16/98	2.00mon	12/18/98	██████████													
Bridge Deck	12/19/98	1.30mon	02/04/99	██████████													
Decommissioning of existing Bisney Road Bridge	02/05/99	0.23mon	02/15/99	██████████													
<b>2. Sassoon Road Bridge</b>	08/14/98	87.63d	12/18/98	██████████													
Foundation	08/14/98	1.50mon	09/30/98	██████████													
Abutment-Retaining Wall (temporary)	10/01/98	1.00mon	10/30/98	██████████													
Bridge Deck	10/31/98	1.50mon	12/18/98	██████████													
<b>3. Pok Fu Lam Road (Northbound)</b>	02/16/99	312.75d	05/15/00					██████████				██████████					
Foundation	02/16/99	1.50mon	04/01/99					██████████				██████████					
Abutment	04/02/99	1.00mon	05/04/99					██████████				██████████					
Deck	05/05/99	5.00mon	10/07/99					██████████				██████████					
Roadworks	12/07/99	5.00mon	05/15/00					██████████				██████████					
<b>4. Link Bridge</b>	02/04/99	216.50d	12/15/99					██████████				██████████					
Foundation	02/04/99	2.00mon	04/08/99					██████████				██████████					
Abutment	04/09/99	2.00mon	06/11/99					██████████				██████████					
Deck	06/12/99	3.00mon	09/15/99					██████████				██████████					
Roadworks	10/13/99	2.00mon	12/15/99					██████████				██████████					
<b>5. Retaining Wall along Pok Fu Lam Road</b>	05/16/00	98.63d	10/04/00									██████████					
Retaining Wall from chainage 210m to 270m	05/16/00	1.50mon	06/30/00									██████████					
Retaining Wall from chainage 296m to 340m	07/01/00	1.50mon	08/17/00									██████████					
Formation of Abutment-Retaining Wall for Sassoon Road Bridge	08/18/00	1.50mon	10/04/00									██████████					
<b>6. Pok Fu Lam Road (Southbound)</b>	02/04/99	442.63d	11/08/00					██████████				██████████					
Foundation	02/04/99	1.50mon	03/24/99					██████████				██████████					
Abutment	06/21/00	1.50mon	08/07/00									██████████					
Deck	08/08/00	1.50mon	09/22/00									██████████					
Roadworks	09/23/00	1.50mon	11/08/00									██████████					
<b>7. Reconstruction of Old Pok Fu Lam Road</b>	11/10/00	2.00mon	01/16/01									██████████					
<b>8. Footbridge</b>	08/14/98	340.88d	12/28/99	██████████				██████████				██████████					
Foundation for temporary footbridge	08/14/98	2.00mon	10/15/98	██████████				██████████				██████████					
Deck for temporary footbridge	10/16/98	2.00mon	12/18/98	██████████				██████████				██████████					
Decommissioning of existing footbridge	12/19/98	1.60mon	02/16/99	██████████				██████████				██████████					
Foundation for footbridge, Staircases	02/16/99	3.00mon	05/19/99	██████████				██████████				██████████					
Deck for footbridge	05/20/99	4.00mon	09/22/99	██████████				██████████				██████████					
Staircases	09/23/99	2.50mon	12/10/99	██████████				██████████				██████████					
Decommissioning of temporary footbridge	12/11/99	0.50mon	12/28/99	██████████				██████████				██████████					
<b>9. Utilities Diversion</b>	08/14/98	17.65mon	03/02/00	██████████				██████████				██████████					
<b>10. Decommissioning of existing Power Substation</b>	02/16/99	0.25mon	02/23/99	██████████				██████████				██████████					
<b>11. Storm Water Drains</b>	02/16/99	16.30mon	07/14/00	██████████				██████████				██████████					
<b>12. Sewers</b>	02/16/99	16.30mon	07/14/00	██████████				██████████				██████████					
<b>13. Construction of Rest Garden Reprovision</b>	08/14/98	398.25d	03/23/00	██████████				██████████				██████████					
Reprovision of Rest Garden to the south of QMH store	08/14/98	6.00mon	02/26/99	██████████				██████████				██████████					
De-commissioning of existing Rest Gardens	02/27/99	1.00mon	03/30/99	██████████				██████████				██████████					
Re-construction of existing larger Rest Garden	12/16/99	3.00mon	03/23/00	██████████				██████████				██████████					

FIGURE 1.2a - CONSTRUCTION PROGRAMME ( This document does not form part of the Contract )

## 2. SUMMARY OF EIA FINDINGS AND MITIGATION MEASURES

The EIA study has indicated that there will be noise impacts associated with the construction of the Roadworks at some sensitive receivers, exceeding the noise criteria. This section summaries the construction noise impacts and the mitigation measures as identified in the EIA Study.

### 2.1 Construction Noise Impact

The EIA has predicted that unmitigated construction activities, such as at-grade road widening and road pavement construction activities, would cause exceedances of the daytime noise criteria at the nearby noise sensitive receivers (NSRs) including the University of Hong Kong (HKU) - Student Residence Hall at 6 Sassoon Road; and some residential buildings along Bisney Road and Consort Rise including Glamour Court and Bisney Garden.

### 2.2 Recommended Mitigation Measures

#### 2.2.1 *Options for Mitigation Measures*

Options for mitigating construction noise as recommended in the EIA report include:

- selection of quieter plant and working methods;
- construction of the temporary noise barrier; and
- provision of noise insulation to HKU - Wei Lun Hall facing Pok Fu Lam Road.

In addition, good site practice and noise management is recommended. The following package of measures 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 works;
- 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, where possible, be orientated so that the noise is directed away from nearby NSRs;
- silencers or mufflers on construction equipment should be utilized and should be properly maintained during the construction works;

- mobile plant should be sited as far away from NSRs as possible; and
- material stockpiles and other structures should be effectively utilized, where practicable, to screen noise from on-site construction activities.

For all NSRs identified in the EIA, the construction noise impacts could be mitigated to within the noise criteria by the abovementioned standard mitigation measures, except for some units of the HKU - Wei Lun Hall in which indirect technical remedies are recommended for the protection from road traffic noise. It has been recommended in the EIA that the noise insulation to some of the affected units of Wei Lun Hall should be provided prior to the construction of the Roadworks.

### 2.2.2 *Construction within Restricted Hours*

Due to the proximity of the NSRs to the Roadworks, restricted hour construction activities (weekdays: 1900-0700 hours; and Sundays and Public Holidays: All hours) are not recommended. However, it is the responsibility of the Contractor to comply with the *Noise Control Ordinance* (NCO) and the relevant Technical Memoranda (TM) if there is any construction work during the restricted hours. The Contractor should submit an application for Construction Noise Permits (CNP), if required and will be assessed by the Noise Control Authority. Conditions stipulated in CNPs should be strictly followed.

### 2.2.3 *EM&A Requirements*

In addition to the recommended mitigation measures, it is also recommended in the EIA that a monitoring and audit programme should be carried out during the construction period of the Roadworks to ensure compliance with the noise criteria. The EM&A requirements are prescribed in this Manual.



### **3. ROLES AND RESPONSIBILITIES**

#### **3.1 Introduction**

The Engineer shall ensure that the Contractor implements the EM&A requirements as prescribed in this EM&A Manual during the Roadworks. The roles and responsibilities of the Engineer and the Contractor are presented below:

#### **3.2 Engineer**

- to supervise the noise monitoring works and review the monitoring data and procedures as required in the Final EIA Report;
- to supervise the noise audits and review the audit reports prior to submission to the relevant Government Departments;
- to review and approve the proposed mitigation measures prepared by the Contractor;
- to ensure the Contractor to follow the agreed protocols or those in the Contract Specifications in the event of exceedances or complaints;
- to notify complainant of the findings and actions taken to mitigate the problem; and
- to review and revise this EM&A Manual at regular intervals.

#### **3.3 Contractor**

- to employ an approved and suitably qualified environmental team (ET) or third party agent to carry out the EM&A in this Manual; and
- to carry out day to day monitoring activities and report on the monitoring results to the Engineer.

The roles and responsibilities of the environmental team or third party agent employed by the Contractor are as follows:

- to conduct periodic construction noise audits and prepare audit reports for approval by the Engineer;
- to prepare and submit proposed mitigation measures to the satisfaction of the Engineer;
- to anticipate construction noise issues during the Roadworks before a problem arises;

- to comply with contract specifications, including the effective implementation and operation of mitigation measures and the agreed Event and Action Plan (EAP); and
- to ensure the Engineer is kept up to date with all relevant on site development.

## 4. NOISE MONITORING REQUIREMENT

### 4.1 Monitoring Equipment

The Contractor should provide sufficient numbers of noise meters to conduct the necessary baseline sampling at the agreed monitoring locations. Sound level meters and calibrators shall comply with the *International Electrotechnical Commission (IEC) Publication 651:1979 (Type 1) and 804:1985 (Type 1)* specification as referred to in the *Technical Memoranda (TM)* of the NCO, subject to approval by the Engineer. The sound level meters should be supplied and used with the manufacturers recommended wind shield and with a tripod.

The calibration of the sound level meters and their respective calibrators should be carried out in accordance with the manufacturer's requirements. The sound level meters, including the calibrators, should be verified by the manufacturers once every two years to ensure they perform to the same level of accuracy as stated in the manufacturers specifications. Calibrated hand-held anemometers should also be supplied for the measurement of wind speeds during noise monitoring periods.

A waterproof sound level meter and noise logger should be used to obtain fully satisfactory baseline monitoring results. The proper functioning of the logger should be ensured during the baseline monitoring period and should be visited for a period not less than one hour every two days to ensure its continued operation and to detail specific noise sources audible at the monitoring location. The calibration of the logger kit should be as recommended by the manufacturer. Measurements should be recorded to the nearest 0.1 dB.

All equipment shall be kept in a good state of repair in accordance with the manufacturer's recommendations and maintained in proper working order with sufficient spare equipment available in the event of breakdown to maintain the planned monitoring programme.

*Table 4.1a* presents recommended noise monitoring equipment.

**Table 4.1a**     *Noise Monitoring Equipment*

Description	Quantity
Noise meter	One unit
Noise data logger	One unit
Calibrator	One unit
Hand held anemometer	One unit

## 4.2 Noise Sensitive Receivers and Monitoring Locations

The noise sensitive receivers (NSRs) identified in the EIA Study are presented in *Section 3* of the Final EIA Report. Noise monitoring should be carried out at the two NSRs as listed in *Table 4.2a*, as recommended in the EIA. Further noise monitoring should also be conducted at additional locations considered necessary, in agreement with the relevant Government Departments. The location of the monitoring stations are shown in *Figure 4.2a*.

**Table 4.2a** *Noise Monitoring Stations*

Monitoring Station Ref. No.	Monitoring Station Description
NSR 2b	R C Lee Hall
NSR 6a	Bisney Garden

## 4.3 Monitoring Methodology

Noise level measurements should be carried out using the methodology set out in *Section 3* of the *Technical Memorandum on Noise from Construction Work other than Percussive Piling*.

The appropriate parameter for measuring construction noise impacts should be the equivalent A-weighted sound pressure level ( $L_{Aeq}$ ) measured in decibels (dB).

The criterion against which the recorded noise levels should be assessed refers to the noise level 1 m from the nearest part of the building façade and at a height approximately 1.2 m above the ground or at the height that has the least obstructed view of the construction activity in relation to the receiver.

## 4.4 Monitoring Programme

### 4.4.1 Baseline Monitoring

Baseline noise levels should be measured over one consecutive period 7 to 14 days at a minimum logging interval of 15 minutes as determined by the Engineer. The quantities  $L_{Aeq}$ ,  $L_{10}$  and  $L_{90}$  should be recorded at the specified interval. The survey period should be selected prior to the commencement of construction activities and so as to avoid other atypical noise sources.

Checking for changes in the baseline noise levels should be carried out by taking "sample" noise measurements every six months when no noisy Roadworks construction activities are in progress. On other occasions, the monitoring staff should note any operational construction equipment or other activities, arising from either the Contractor or any other sources noted to be emitting "dominant", "audible" or "noticeable" noise levels

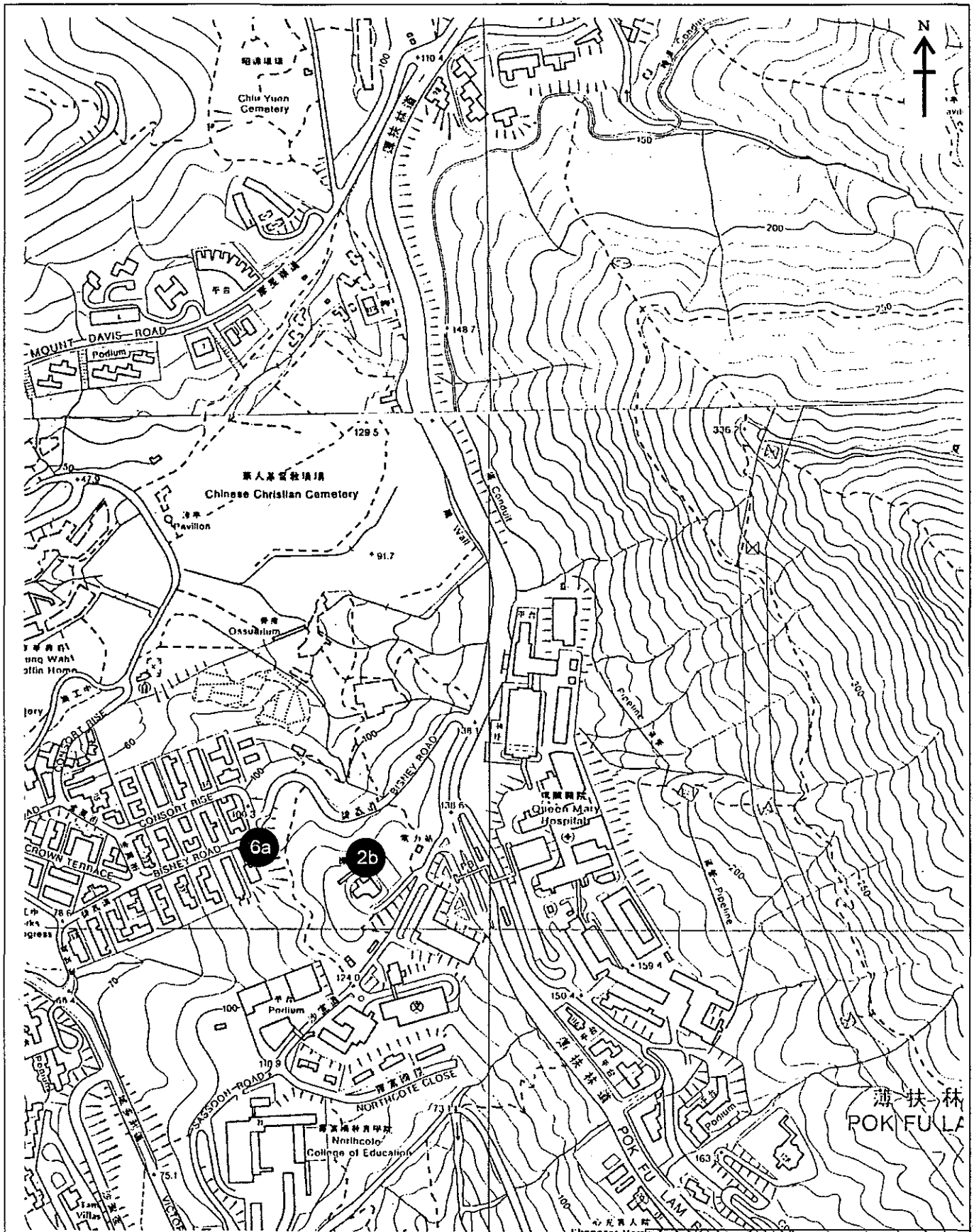


FIGURE 4.2a - EM&A NOISE MONITORING LOCATIONS

KEY  
 2a NSRS

ERM-Hong Kong, Ltd  
 6th Floor  
 Hecny Tower  
 9 Chatham Road  
 Tsimshatsui, Kowloon  
 Hong Kong



during the time of the measurement for the analysis and audit process.

The baseline monitoring results, agreed with relevant Government Departments, should be used in conjunction with the A/L Levels to determine the validity of complaints, the significance of impact monitoring results and the requirements for action under the Event and Action Plan (EAP).

#### 4.4.2 Impact and Compliance Monitoring

During normal construction working hours (0700-1900 Monday to Saturday), monitoring of  $L_{Aeq, 30min}$  noise levels (as six consecutive  $L_{Aeq, 5 min}$  readings) should be carried out at the agreed monitoring locations every week in accordance with the methodology in the TM. If restricted hours works are undertaken, monitoring of  $L_{Aeq, 15min}$  noise levels (as three consecutive  $L_{Aeq, 5 min}$  readings) should be carried out at the agreed monitoring stations at the same frequency as specified for normal working hours.

In relation to the monitored noise levels, other noise sources such as road traffic may make a noise contribution to the ambient environment. Therefore, the results of noise monitoring activities should take into account such influencing factors which were not present during the baseline monitoring period. All measurements should be recorded to the nearest 0.1 dB.

In order to confirm that typical conditions prevail throughout the survey period, observations of noise sources and weather conditions should be made and reported on all monitoring occasions or at the minimum specified interval.

The monitoring programme for the Roadworks is summarized in *Table 4.4a*.

**Table 4.4a Summary of Monitoring Programme**

	Noise Monitoring	Duration/Period
Location	HKU - R C Lee Hall (NSR 2b) Residential Buildings on Bisney Road (NSR 6a)	-
Initial-Baseline	Continuous at 15 minutes intervals	One week prior to construction
Baseline Checking	Twice per year (Continuous at 15 minutes intervals when no noisy Roadworks construction activities are in progress)	During construction period
Impact Monitoring	Logarithmic average of three consecutive readings of $L_{Aeq}$ 5 minutes in restricted periods and six consecutive readings $L_{Aeq}$ 5 minutes in unrestricted periods every week	During construction period
Additional Requirements	<i>Ad hoc</i> monitoring as required	During construction period

## 5. ENVIRONMENTAL AUDITING

### 5.1 Introduction

The EIA has identified construction noise impacts as the key potential impacts associated with the construction of the Roadworks. The environmental auditing programme should focus on the regular assessment of the effectiveness of management systems, practices and procedures in ensuring that the required mitigation measures are routinely implemented and maintained.

### 5.2 Action and Limit Levels

Action and Limit (A/L) Levels are defined levels of impact recorded by the environmental monitoring activities which represent levels at which a prescribed response is required. These levels are defined later in the relevant sections of this manual and described in principle below:

- *Action Limits:* beyond which there is a clear indication of a deteriorating ambient environment for which appropriate remedial actions are likely to be necessary to prevent environmental quality from falling outside the *Limit Levels*, which would be unacceptable; and
- *Limit Levels:* Statutory and/or agreed contract limits stipulated in the relevant pollution control ordinances, HKPSG or Environmental Quality Objectives established by Government. If these are exceeded, works should not proceed without appropriate remedial action, including a critical review of plant and working methods.

### 5.3 Compliance Check

The A/L Levels provide an appropriate framework for the interpretation of monitoring results. The noise impact monitoring data should be checked against the agreed A/L Levels as listed in *Table 5.3a*.

**Table 5.3a** *Action and Limit Levels for Construction Noise dB(A)*

Time Period	Action	Limit
0700-1900 on normal weekdays in accordance with ProPECC guidelines;	When one documented complaint is received	75 dB(A) for NSRs 2b & 6a
1900-2300 on any day and 0700-2300 on Sundays and general holidays; for use of specified power mechanical equipments (SPME) and carrying out of prescribed construction works (PCW) specified in <i>Technical Memorandum on Noise from Construction Work in Designed Areas</i>	When one documented complaint is received	55 dB(A)* for NSR 2b 50 dB(A)* for NSR 6a

Time Period	Action	Limit
2300-0700 on any day for use of SPME and carrying out of PCW specified in <i>Technical Memorandum on Noise from Construction Work in Designed Areas</i>	When one documented complaint is received	40 dB(A)* for NSR 2b 35 dB(A)* for NSR 6a
1900-2300 on any day and 0700-2300 on Sundays and general holidays for the use of power mechanical equipment (PME) other than those specified in <i>Technical Memorandum on Noise from Construction Work in Designed Areas</i>	When one documented complaint is received	70 dB(A)* for NSR 2b 65 dB(A)* for NSR 6a
2300-0700 on any day for the use of PME other than those specified in <i>Technical Memorandum on Noise from Construction Work in Designed Areas</i>	When one documented complaint is received	55 dB(A)* for NSR 2b 50 dB(A)* for NSR 6a

\* denote: Statutory limits specified under the NCO and the relevant TM

To account for cases where ambient noise levels as identified by baseline monitoring approaches or exceeds the stipulated Limit Level prior to commencement of construction, an Exceedance Level may be defined and agreed with the relevant Government Departments, which incorporates the baseline noise level and the 75 dB(A) Construction Noise Limit level specified in the ProPECC. The exceedance level will be therefore greater than 75 dB(A) and represents the maximum acceptable noise level at each monitoring station. Correction factors for the effects of acoustic screening and/or architectural features of NSRs may also be applied for from the relevant Government Departments as specified in the TM.

For the purposes of compliance checking, after taking into account any adjustments agreed with relevant Government Departments, comparison with either the Limit or Exceedance Level should represent the governing criteria for noise impact assessment during the EM&A.

#### 5.4 Event and Action Plan

The principle on which the Event and Action Plan (EAP) is based is the prescription of procedures and actions associated with the measurement of defined levels of noise impact recorded by the environmental monitoring process and defined in the tables above. In cases where exceedance of these criteria occurs, the Engineer and the Contractor should strictly observe the relevant actions of the EAP shown in *Table 5.4a*. A sample template for the interim notifications is shown in *Annex A*.



**Table 5.4a Noise Monitoring Event and Action Plan for Noise.**

Event	ACTION	
	Engineer	Contractor
Action Level Exceedance	<ol style="list-style-type: none"> <li>1. Require Contractor to further investigate the cause of exceedance and propose mitigation measures if necessary.</li> </ol>	<ol style="list-style-type: none"> <li>1. Investigate the cause of exceedance. This may involve increase noise monitoring frequency to the satisfaction of the Engineer to confirm the validity of the complaint, and implement noise mitigation proposals if necessary.</li> <li>2. Trigger Event and Action Plan for limit level exceedance, if complaint is found to be valid</li> </ol>
Limit Level Exceedance	<ol style="list-style-type: none"> <li>1. Notify the relevant Government Departments</li> <li>2. Review the proposal for mitigation measures</li> <li>3. Assess the effectiveness of mitigation measures</li> <li>4. If the circumstance has not been anticipated in the EIA report, the Engineer may vary the works under a variation order to mitigate noise.</li> </ol>	<ol style="list-style-type: none"> <li>1. Inform the Engineer immediately of the exceedance</li> <li>2. Submit a proposal for mitigation measures, subject to satisfaction of the Engineer</li> <li>3. Implement immediately the agreed measures</li> <li>4. Demonstrate to the Engineer the effectiveness of the mitigation measures applied</li> </ol>

## 5.5 Enquiries, Complaints and Requests for Information

All enquiries or complaints concerning the environmental effects of the works, irrespective of how they are received, should be reported to the Engineer who should set up procedures for the handling, investigation and storage of such information. The following steps should then be followed.

- 1) An investigation should be initiated by the Engineer to determine the validity of the complaint and inform the Contractor to identify the source of the problem.
- 2) The Contractor should undertake the following steps, as necessary:
  - investigate and identify the source of the problem, to the satisfaction of the Engineer (this may involve additional noise monitoring);
  - prepare proposal for mitigation measures if complaint is found to be valid;
  - implement the agreed mitigation measures; and
  - repeat monitoring to check compliance with A/L level criteria; and demonstrate effectiveness of the mitigation measures.
- 3) Where possible, a formal response to each complaint received will be prepared by the Engineer, within a maximum of seven days, in order to notify the concerned person(s) that action has been taken. If the source of complaint is the Environment Protection Department (EPD), the results should be reported within the time frame assigned.
- 4) All enquiries which trigger this process should be reported in the monthly reports to the Engineer which should include details of the mitigation measures taken and the additional monitoring results recorded for the period.

It should be noted that the receipt of complaints or enquiries will not, in itself, be sufficient reason to introduce additional mitigation measures. They will however initiate the Event and Action Plan (EAP) and this procedure may lead to the introduction of further measures if they are considered necessary.

In all cases the complainant should be notified by the Engineer of the findings of the EAP and audit procedures put in place to ensure that the problem does not recur.

## 5.6 Audit Procedures

The Contractor is responsible to employ an approved and suitably qualified environmental team or third party agency to carry out the environmental auditing programme under the supervision of the Engineer, and to prepare audit reports for approval and endorsement by the Engineer. The noise

audit should cover site inspections to ensure that appropriate environmental protection and noise control mitigation measures are properly implemented; compliance checking and the implementation of the EAP as presented in *Section 5.2 to 5.4* of this Manual; and the procedures on handling of complaints as presented in *Section 5.5* of this Manual.

The noise audits should be undertaken on the basis of criteria and methodologies contained within an Audit Protocol developed by the Contractor subject to acceptance by the Engineer in advance of the commencement of construction works.

The Audit Protocol should be derived from the clauses within the Contractual Documentation and those parts of the Contractor's method statement which incorporate the recommendations of the EIA and should be incorporated in the revised EM&A Manual. In addition, the management systems established by the Engineer to monitor the Contractor's compliance with Contractual requirements should be included within the audit protocols.

On the basis of the recommendations contained within the EIA, it is likely that the Protocols should include (but not be limited to) the auditing of the following activities:

- the allocation of responsibility for fulfilling noise monitoring and audit requirements and the effectiveness of lines of communication with regard to construction noise issues;
- compliance with procedures established to enable an effective response to noise incidents, exceedances or non-compliances;
- the extent and accuracy of record-keeping related to construction noise issues; and
- the effectiveness of staff training in ensuring high levels of awareness with regard to construction noise control requirements;

The Protocols should comprise checklists of auditable requirements and should be amended, over the lifetime of the construction phase, to focus on areas of frequent non-compliance and to reflect the potential impacts associated with specific activities within the construction programme.

## **5.7 Audit Reporting**

The findings of audits should be made known to site staff at the time of the audit to enable the rapid resolution of identified non-compliances. Non-compliances, and the corrective actions undertaken, should also be reported by the Contractor, and review and endorsed by the Engineer in the monthly EM&A Report.

## 5.8 Implementation Schedule

The Contractor shall prepare a project implementation schedule containing all the recommendations and mitigation measures with reference to the implementation programme to the satisfaction of the Engineer. The Contractor shall undertake necessary actions to meet the schedule.

## **6. REPORTING**

### **6.1 Introduction**

The primary reporting function, undertaken within the EM&A programme will be the issuance of formal exceedance notifications, corrective actions and ongoing feedback between the Engineer and the Contractor. Reporting will be driven by the results of the monitoring and audit programme, and will be recorded through written correspondence, monitoring reports, and minutes and notes of meetings. All reporting will be prepared by the Contractor and to be endorsed by the Engineer.

In addition, periodic reviews of the EM&A process will be prepared by the Contractor under the supervision of the Engineer as a means of gauging site staff and contractor performance. The periodic reviews will comprise Monthly and Annual EM&A Reports; these Reports will be copied to the relevant Government Department for comment. The time limits for submission, the number of copies and the format of the reports shall be agreed with the Engineer before submission.

### **6.2 Baseline Monitoring Report**

The Report will contain full details of the monitoring locations, methodology, equipment, parameters, monitoring programme and details on influencing factors as described in Section 4 of this EM&A Manual. The Baseline monitoring results and proposals for the A/L level parameters will be presented in the form of a draft Report which will be submitted to the relevant Government Departments for agreement. The draft Report will be supported by the baseline monitoring data in electronic format, along with information from the EM&A Manual covering project background information, monitoring results, locations, equipment and protocols.

The ET shall prepare and submit the Baseline Environmental Monitoring Report within 10 working days of completion of baseline monitoring. Copies of the Baseline Monitoring Report shall be submitted to each of the Contractor, the Engineer and the relevant Government Departments.

### **6.3 Monthly EM&A Report**

Monthly EM&A Reports shall include (but not be limited to) the following elements:

- an Executive Summary highlighting breaches of agreed criteria, complaints, reporting changes and future key issues;
- basic project information;
- a brief summary of EM&A requirements;
- a brief account of construction activities;

- monitoring results together with details of locations, dates, times, parameters monitored, etc;
- an interpretation of the significance of monitoring results and explanation of influencing factors;
- graphical plots of monitored trends over the past four reporting periods;
- a description of recommendations and/or actions taken, or outstanding, in the event of non-compliances or deficiencies, including site inspections and audits;
- a review of the implementation status and effectiveness of environmental protection works in relation to non-compliances and deficiencies and the mitigation measures recommended in the EIA report;
- a summary of complaints, results of investigations and any follow-up actions; and
- future key issues.

#### **6.4 Annual Review Reports**

In addition to the Monthly Reports, Annual Report will be issued which will provide a general overview of the progress of the Roadworks EM&A to date.

The Annual Report will document the findings of the audit of noise monitoring results by contract, referring first to baseline conditions and then impact results. Graphs of the monitoring trends will be included to indicate the performance for impact control over the reporting period.

A performance evaluation of the period monitoring results will review the roles of site staff, and the Contractors, to the environment, based on the number of measured exceedance and enacted mitigation measures.

A summation of the main findings and recommendations to further improve the environmental performance of the Roadworks will be included, as appropriate, in the conclusions.

#### **6.5 Data Keeping**

All documents and records submitted by the Contractor to the Engineer, in both paper and electronic format, pertaining to the EM&A will be retained as part of the Roadworks files and will be subject to appropriate data handling procedures.

Annex A

## Interim Notification

Table A

Sample Template for Interim Notifications of Environmental Quality Limits Exceedances

Incident Report on Action Limit Level Non-compliance

Project	
Date	
Time	
Monitoring Location	
Parameter	
Action & Limit Levels	
Measured Level	
Possible reason for Action or Limit Level Non-compliance	
Action taken / to be taken	
Remarks	

Prepared by : \_\_\_\_\_

Designation: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

Location Plan