

## 1. INTRODUCTION

### 1.1 Background

- 1.1.1 The need for Route 16 was established in the Updating of the Second Comprehensive Transport Study to overcome anticipated traffic problems at the Lion Rock Tunnel, Tate's Cairn Tunnel and Tai Po Road, and has been committed in the Sha Tin Outline Zoning Plan (S/ST/6). The Route will connect the Lai Wan Interchange in West Kowloon to the future Trunk Road T3 and Che Kung Miu Road in Sha Tin.
- 1.1.2 In April 1997, the Route 16 Design Team was commissioned to undertake the Route 16 Investigation Assignment for the Conforming Alignment, which connects the Lai Wan Interchange in West Kowloon to the future Trunk Road T3 and Che Kung Miu Road in Sha Tin. The *Route 16 from West Kowloon to Sha Tin - Investigation Assignment: EIA Study, Final Assessment Report, Jan 1998, ERM* was endorsed by the Government in February 1998 (EIA-135/BC).
- 1.1.3 The recently completed Detailed Feasibility Study for Route 9 between Tsing Yi and Cheung Sha Wan recommended that a direct connection between Route 9 and Route 16 should be provided in order to provide a direct route between the New Airport and the New Territories East, and to simplify the at-grade movement on Lai Wan Interchange. In order to meet the traffic demand of the design year and to accommodate the merging and diverging movement for traffic from the direct connection and those from the Lai Wan Interchange, the proposed Dual-2 lane Lai Chi Kok Viaduct (LCKV) of the Conforming Alignment is required to be widened to Dual-3 lane for most of its length to meet traffic operation standards.
- 1.1.4 As a consequence of such widening, the traffic from/to the slip roads connecting Ching Cheung Road would be required to merge/diverge to/from the mainline traffic within the tunnel section if the Conforming Alignment were to be maintained. Such traffic movement within tunnel section was considered undesirable from traffic safety considerations. It is therefore necessary to undertake further investigation to allow merging/diverging movement to take place on an open road section to meet road safety standards.
- 1.1.5 Early in the Investigation Assignment, the Route 16 Study Team had come up with an Alternative Alignment option (see Figure 1.1a) for the West Kowloon end, which had benefits in traffic operation and reduced construction cost and programme. However, due to programming difficulties in meeting the scheduled road completion date in 2004, the option was dropped from further consideration at that time. The new connection with Route 9 requirement has provided an opportunity for Highways Department to commission the Study Team to investigate further the Alternative Alignment option which would alleviate the road safety and traffic operation problems.
- 1.1.6 In October 1998, an application for an EIA study brief under section 5(1) of the Environmental Impact Assessment Ordinance (EIAO) was submitted to Environmental Protection Department, together with a Project Profile (No. PP-031/1998), for the Route 16 Alternative Alignment. Pursuant to section 5(7)(a) of the EIAO, a study brief (ESB-021/1998) was issued by the Director of Environmental Protection (the Director).
- 1.1.7 The current Route 16 Alternative Alignment EIA study (The Project) is required as a result of major design changes in the West Kowloon, based on preliminary design by the engineering team. This EIA study is to provide information on the nature and extent of the environmental impacts arising from the construction and operation of the proposed changes.
- 1.1.8 The project name of this Project has been renamed to Route 9 between Cheung Sha Wan and Sha Tin. However as the name Route 16 has already registered under the EIAO in the current Study Brief, the name of this project would remain as Route 16 throughout this report.

On the other hand, the name Route 9, used in this Report, only refers to the section of Route 9 between Tsing Yi and Cheung Sha Wan.

## **1.2 Purpose of the Manual**

1.2.1 The purpose of this Environmental Monitoring and Audit (EM&A) Manual is to guide the setup of an EM&A programme to ensure compliance with the EIA study recommendations, to assess the effectiveness of the recommended mitigation measures and to identify any further need for additional mitigation measures or remedial action. This Manual outlines the monitoring and audit programme to be undertaken for the construction of the Route 16 Alternative Alignment. It aims to provide systematic procedures for monitoring, auditing and minimising of the environmental impacts associated with the construction works.

1.2.2 Hong Kong environmental regulations for air and water quality, noise and waste, the Hong Kong Planning Standards and Guidelines, and recommendations in the EIA report of Route 16 Alternative Alignment have served as environmental standards and guidelines in the preparation of this Manual.

1.2.3 This Manual contains the following :

- a) responsibilities of the Contractor, the Engineer or Engineer's Representative (ER) Environmental Team (ET), and the Independent Checker (Environment) (IC(E)) with respect to the environmental monitoring and audit requirements during the course of the project;
- b) information on project organisation and programming of construction activities for the project;
- c) the hypotheses of potential impacts, the basis for and description of the broad approach underlying the environmental monitoring and audit programme;
- d) requirements with respect to the construction schedule and the necessary environmental monitoring and audit programme to track the varying environmental impact;
- e) the specific questions and testable hypotheses that the monitoring programme is designed to answer;
- f) full details of the methodologies to be adopted, including all field, laboratory and analytical procedures, and details on quality assurance and quality control programme;
- g) the rationale on which the environmental monitoring data will be evaluated and interpreted and the details of the statistical procedures that will be used to interpret the data;
- h) definition of Action and Limit levels;
- i) establishment of Event and Action Plans;
- j) requirements of reviewing pollution sources and working procedures required in the event of non-compliance of the environmental criteria and complaints;
- k) requirements of presentation of environmental monitoring and audit data and appropriate reporting procedures.
- l) requirements for review of EIA predictions and effectiveness of the environmental monitoring and audit programme.

1.2.4 For the purpose of this manual, the "Engineer" shall refer to the Engineer as defined in the Contract and the Engineer's Representative (ER), in cases where the Engineer's powers

have been delegated to the ER, in accordance with the Contract. The ET leader, who shall be responsible for and in charge of the ET, shall refer to the person delegated the role of executing the environmental monitoring and audit requirements.

### **1.3 Project Description**

1.3.1 *Figure 1.1a* show the general layout of the Route 16 Alternative Alignment.

1.3.2 At the southern end, a Dual-2 lane carriageway which rises up over the Lai Wan Interchange linking directly with the Route 9 - Cheung Sha Wan and Tsing Yi section, will be provided. In addition, a Dual-2 lane slip road rises up to merge with the Dual-2 direct connection, linking the Lai Wan Interchange, will be provided. A Dual-3 carriageway will be formed after the Lai Wan slip roads and the Dual-2 direct connection completely merge/diverge. The mainline will continue to rise up over the elevated structure at Lai Chi Kok Interchange and continues alongside Butterfly Valley Road.

1.3.3 The Dual-3 mainline structure passes over Wai Man Tsuen at high level, and a filled embankment of the Conforming Scheme is no longer required. The viaduct continues through Butterfly Valley to an abutment located on the earthworks platform approximately 250m north of Ching Cheung Road. At about 400m after crossing over Ching Cheung Road, the mainline carriageways begin to separate before joining the tunnel section, at which the northbound and southbound bores are approximately 30m apart. The crossover will be provided after the slip roads completely merge/diverge with the mainline. This arrangement will provide better traffic operation and control than that of the Conforming Alignment. Slip road connections to Ching Cheung Road will be provided.

1.3.4 The at-grade section of the mainline will involve cutting or filling works in certain part of Butterfly Valley, together with the associated slope stabilisation measures. The use of soil nails as stabilisation or soil-nailed concrete berm stepped walls may be required.

1.3.5 The main tunnel section (Eagle's Nest Tunnel), approximately 2000m long, runs underneath the Lion Rock Country Park and surfaces at the western end of Sha Tin. After emerging from tunnel the route follows closely that of the Conforming Alignment.

### **1.4 Construction Activities**

1.4.1 The construction activities associated with the Toll Plaza, Sha Tin Heights Tunnel and the section after the northern portal of Sha Tin Heights will be the same as the Conforming Alignment and detailed assessment will not be carried out in this EIA study. For details of predicted results, required mitigation measures for this section of the alignment, reference can be made to the Conforming Alignment EIA (EIAO register reference number: EIA-135/BC).

1.4.2 The main construction activities of the Alternative Alignment comprise of:

- Earthworks excavation and construction of road embankment;
- Tunnel portal construction;
- Tunnel excavation; and
- Viaduct construction.

1.4.3 A preliminary construction programme of the Alternative Alignment is shown in Figure 1.4a covering a total period of approximately 3.5 years. This programme is for information of the ET Leader to get an initial idea of the projection of the works. The ET Leader shall make reference to the actual works progress and programme during the construction stage to

schedule the EM&A works, and the Contractor shall provide the respective information to the ET Leader for formulating the EM&A schedule

- 1.4.4 For the West Kowloon section, earthworks excavation will take place at the portals and mid ventilation building, and filling operations undertaken for embankment and Butterfly Valley. Piling activities for viaduct foundation works will mainly take place at the West Kowloon end.
- 1.4.5 Portals will be constructed for the two rock tunnel sections which will be excavated by bored tunnelling method. Tunnel excavation are expected to be 24 hour working and the other construction activities are likely to be between 0700 to 1900 hours.
- 1.4.6 Main works sites are anticipated to be at the Toll Plaza, Butterfly Valley and other portal areas.

## **1.5 Operation Phase**

### **Mid Ventilation Building**

- 1.5.1 A ventilation building, of a much reduced scale, is retained at the Conforming Scheme ventilation building site to supply and exhaust air from the middle section of the tunnel, via one ventilation adit connected to the quarter point of the bored tunnel. The layout will again be similar to that of the Conforming Scheme, but the plan area required is reduced from 5000m<sup>2</sup> to 2100m<sup>2</sup>. Four groups of tunnel ventilation fans will be installed. The new Mid Ventilation Building houses a total number of 16 fans compared with 38 fans for the Conforming Scheme.

## **1.6 Study Area and the Environmental Sensitive Receivers**

- 1.6.1 The boundary of the Study Area for the purpose of this EIA is 300 m either side and along the full stretch of the proposed alignment. Except in the case of waste management impact, landscape impact, ecological impact and air quality assessment, where the study area is defined by a distance of 500 m from the proposed alignment. All visually sensitive receivers will be assessed where necessary, regardless of the distance from the proposed alignment as part of visual impact assessment.
- 1.6.2 The West Kowloon area surrounding the Route 16 Alternative Alignment is mainly industrial area. The Butterfly Valley Cottage area (Wai Man Tsuen), mainly consists of one to two storey high village type housing is located east of Butterfly Valley Road, with a number of existing industries and godowns located on the far eastern part of the valley. To the west of Wai Man Tsuen, an existing knoll, the Lai Chi Kok Hospital and Lai Chi Kok Reception Centre and its Staff Quarters are located west of Butterfly Valley Road.
- 1.6.3 The proposed tunnel portal in Butterfly Valley is currently surrounded by natural slope and occupied by some village houses in Mui Kong Tsuen and Tai Ching Cheung. The southwestern region of Butterfly Valley is within the Green Belt area of Piper's Hill according to the Kwai Chung - Outline Zoning Plan S/KC/12, 11 April 1997. There is no planned landuse in the northeastern region of the Valley where currently occupied by scattered village houses and woodland, which will be replaced by the tunnel portal.
- 1.6.4 Three housing development sites have been identified within the Study Area including, Site 10, located to the north east of Lai Wan Interchange; the old Lai Chi Kok Amusement Park and the Sir Robert Black College Site. It is understood that the existing Wai Man Tsuen would be resumed in 2001 for future development. According to the draft Cheung Sha Wan Outline Zoning Plan, the affected Wai Man Tsuen area is currently zoned for industrial use. However, it is expected that at the Design and Construct stage, conceptual landuse layout

plans will be prepared for two different development scenarios (industrial-led and housing-led) taking into consideration the environmental constraints.

- 1.6.5 Annex A1 lists out the details of the air, noise and water sensitive receivers during construction and operation phase. In light of ecological impact, three main habitat types has been identified along the Route 16 alignment including: urbanized area, secondary woodland and stream habitat. There are neither existing or proposed Sites of Special Scientific Interest and Special Areas nor archaeological / historical sites within the Study Area.

## **1.7 Summary of the EIA Study and Environmental Monitoring and Audit Requirements**

- 1.7.1 The potential environmental impacts associated with the construction and operation of the proposed Route 16 Alternative Alignment have been assessed in the EIA report in accordance with the requirements in the Study Brief and EIA Ordinance. Environmental issues including air quality, noise, waste management, water quality, ecology, hazard, landscape & visual and cultural heritage have been assessed in the report. The findings of the report indicate that with the implementation of the recommended mitigation measures, the proposed Route 16 Alternative Alignment will comply with the established environmental criteria.

- 1.7.2 Annex A2 presents the environmental implementation schedule of the Project. The recommended environmental monitoring and audit (EM&A) requirements will ensure the efficacy of the environmental control measures and compliance with environmental standards as detailed in this Manual. Based on the findings of the EIA report, environmental monitoring at the affected sensitive receivers are recommended for construction dust and noise, as well as traffic noise and the air quality inside the Eagle's Nest Tunnel. This Manual also covers the general audit requirements in relation to water quality, waste management and ecology. To regulate the performance of the contractor, ET leader could make use of the Implementation Status Proforma shown in Annex A3 to check compliance.

### **Construction Dust**

- 1.7.3 The construction work may lead to dust emissions, mainly from excavation, truck haulage and material handling activities. Due to the close proximity of some ASRs, it was expected the dust levels at these ASRs may be high. Mitigation measures are recommended to limit the dust emission and dispersion. Details of the monitoring requirements are presented in Section 2.

### **Tunnel Air Quality**

- 1.7.4 Vehicular emissions during the operation of Eagle's Nest Tunnel will generate air pollutants such as NO<sub>2</sub>, CO and respirable suspended particulates (RSP). Relevant air quality guidelines should be attained and maintained inside the tunnel. In addition, the visibility in tunnels is a gross indicator of the RSP 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.
- 1.7.5 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 Section 2.

### **Construction Noise**

- 1.7.6 Unmitigated construction activities associated with the construction of the Route 16 will cause exceedances of the daytime construction noise criteria at some of the nearby NSRs.

Appropriate noise mitigation measures were recommended to reduce the impact within the noise criteria. Section 3 depicts the monitoring and audit requirements.

### **Operational Noise**

- 1.7.7 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 purpose of this monitoring is to ensure that the proposed mitigation measures are effective. 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 Section 3.

### **Water Quality**

- 1.7.8 Site inspections are recommended in the EIA Report to regulate the effluent discharge from the work site during construction phase to ensure the water pollution mitigation measures are properly implemented, functioned and maintained and comply with the statutory limits stated in WPCO and relevant Technical Memorandum. See Section 4.

### **Waste Management**

- 1.7.9 It has been recommended that auditing of each waste stream shall 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 shall 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 shall be carried out thereafter as described in Section 5.

### **Ecology**

- 1.7.10 The mitigation measures shall be included into contract clauses for the Route 16. The implementation of the measures shall be checked as part of the environmental monitoring and audit procedures during the construction period, the procedures of which are presented in the Section 6.

### **Cultural Heritage**

- 1.7.11 To ensure the structural integrity of the historic buildings within Lai Chi Kok Hospital and Tin Sam Village, visual inspection, structural survey, ground water table monitoring are recommended prior to and during the commencement of the construction as described in Section 6.
- 1.7.12 Table 1.7a presents a brief summary of the monitoring and audit requirements.

**Table 1.7a Summary of the Monitoring and Audit Requirements**

<b>Environmental Parameter</b>	<b>Monitoring and Audit Requirement</b>	<b>Recommended Monitoring Locations</b>
<b>Construction Phase</b>		
Construction Dust	Dust monitoring for TSP (1hour and 24 hours) concentration is recommended during construction to ensure compliance with the action and limit levels for air quality. Implementation audit for the mitigation measures is required.	AM1 (Government Quarter) AM2(Lai Chi Kok Indoor Centre)
Noise	Construction noise in terms of $L_{Aeq, 30min}$ dB(A) and $L_{Aeq, 5min}$ dB(A) with regular audit for the mitigation measures during construction phase should be maintained.	NMC1 (N1- Miu Kong Village) NMC2 (N6- LCK Reception Centre Staff Quarters) NMC3 (N7- Lai Chi Kok Hospital) NMC4 (N11- Mei Foo Sun Chuen, Phase 5, Blk 9) NMC5(N16- Pinehill)
Water	Site Audit is recommended for the mitigation measures proposed.	Random site inspection
Waste	Environmental audit is required to audit the implementation status of the waste management plan.	Random site inspection
Ecology	Audit for the implementation of the mitigation measures is recommended.	Random site inspection
Cultural Heritage	Visual inspection of historic buildings prior to the commencement of the construction works. In addition, structural inspection survey in quarterly interval	Historic buildings within LCK hospital and Tin Sam Village
	Monitoring for the change in ground water table	Butterfly Valley
	Measurement of vibration carried out on a need basis during the piling work	Work site
<b>Operation Phase</b>		
Tunnel Air Quality	Monitoring for the tunnel section is required to ensure the acceptability of the air quality criteria. Pollutants to be monitored include carbon monoxide, nitrogen dioxide and visibility.	Monitoring samplers for each pollutant should be set at every kilometre inside the tunnel.
Traffic Noise	Pre-audit for the mitigation measures is recommended prior to the opening of the New Road.  After that, about 3 monitoring locations should be selected for monitoring and audit in the first year of opening. Monitoring should be conducted during the peak hours in three consecutive sections of half hour each.	NMO1 - V13 (Village house in Tai Ching Cheung Village) NMO2 - NSR 640 of Site 10 NMO3 - ST-N3 (Southern facade of Shatin Heights)
Water	Site inspection is recommended	Random site inspection

## **1.8 Project Organisation**

1.8.1 The project organisation and lines of communication with respect to environmental protection works is shown in Figure 1.8a.

1.8.2 The ET leader shall have relevant professional qualifications, or have sufficient relevant EM&A experience subject to approval of the ER and the Environmental Protection Department (EPD).

1.8.3 The responsibility of respective parties are:

The Contractor:

- Employ an Environmental Team (ET) to undertake monitoring, laboratory analysis and reporting of environmental monitoring and audit;
- Provide assistance to ET in carrying out monitoring;
- Submit proposals on mitigation measures in case of exceedances of Action and Limit levels in accordance with the Event and Action Plans;
- Implement measures to reduce impact where Action and Limit levels are exceeded.
- Adhere to the procedures for carrying out complaint investigation in accordance with 7.3.

The Engineer or Engineer's Representative:

- Supervise the Contractor's activities and ensure that the requirements in the EM&A Manual are fully complied with;
- Inform the Contractor when action is required to reduce impacts in accordance with the Event and Action Plans;
- Employ an Independent Checker (Environment)(IC(E)) to audit the results of the EM&A works carried out by the ET.
- Adhere to the procedures for carrying out complaint investigation in accordance with 7.3.

The Environmental Team

- Monitor the various environmental parameters as required in the EM&A Manual;
- Analyse the environmental monitoring and audit data and review the success of EM&A programme to cost effectively confirm the adequacy of mitigatory measures implemented and the validity of the EIA predictions and to identify any adverse environmental impact arising;
- Carry out site inspection to investigate and audit the Contractor's site practice equipment and work methodologies with respect to pollution control and environmental mitigation, and anticipate environmental issues for proactive action before problems arise.
- Audit and prepare audit reports on the environmental monitoring data and the site environmental conditions;
- Report on the environmental monitoring and audit results to the IC(E), Contractor, the ER, and the EPD;
- Recommend suitable mitigation measures to the Contractor in the case of exceedance of Action and Limit levels in accordance with the Event and Action Plans.

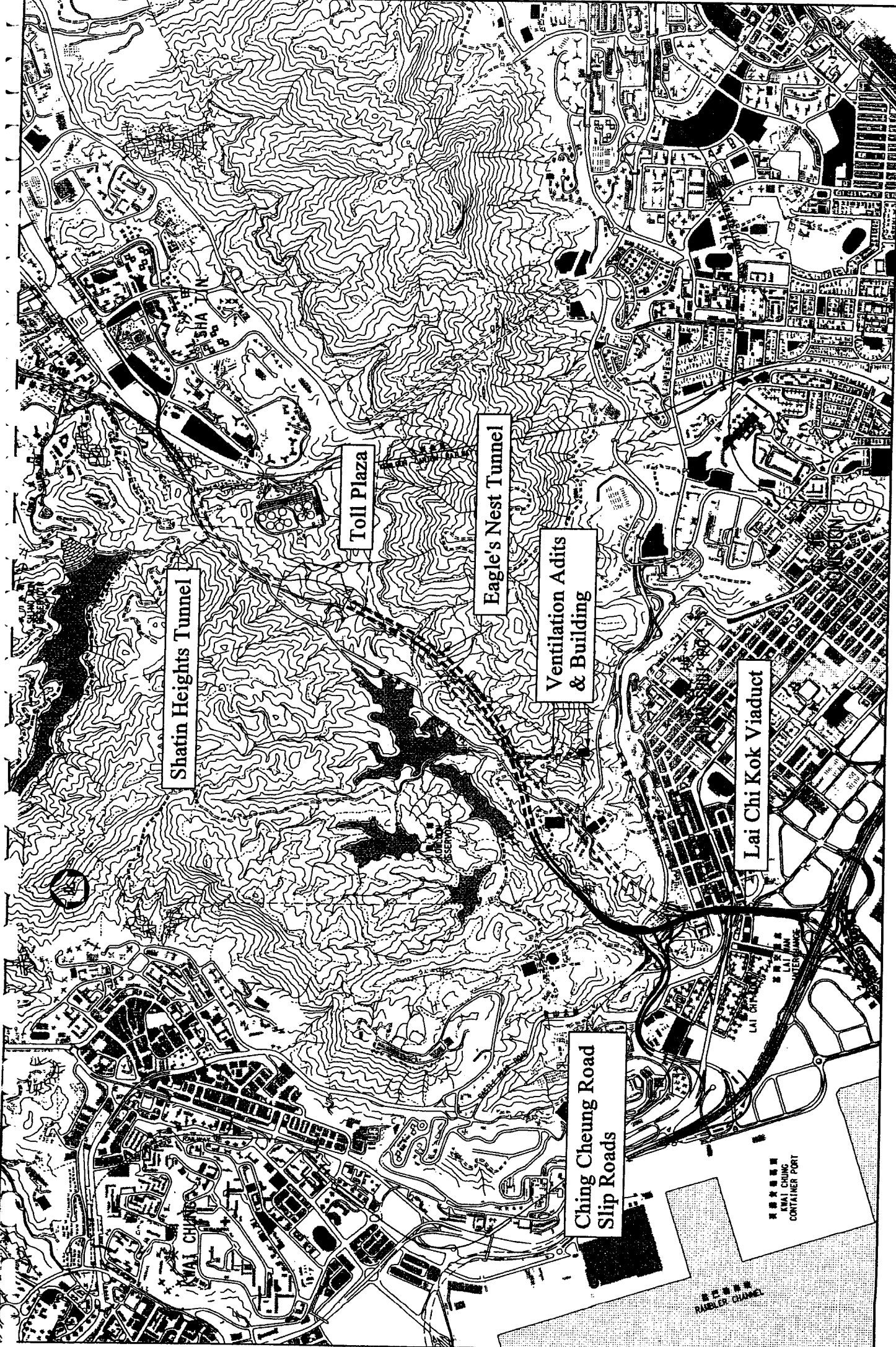


- Adhere to the procedures for carrying out complaint investigation in accordance with Section 7.3.

The Independent Checker (Environmental), IC(E)

- Review the EM&A works performed by the ET Leader;
- Audit the monitoring activities and results;
- Report the audit results to the ER and EPD in parallel;
- Review the EM&A reports submitted by the ET;
- Review the proposal on mitigation measures submitted by the Contractor in accordance with the Event and Action Plans;
- Adhere to the procedures for carrying out complaint investigation in accordance with Section 7.3.

1.8.4 Sufficient and suitably qualified professional and technical staff shall be employed by the respective parties to ensure full compliance with their duties and responsibility, as required under the EM&A programme for the duration of the project.



Shatin Heights Tunnel

Toll Plaza

Eagle's Nest Tunnel

Ventilation Adits & Building

Lai Chi Kok Viaduct

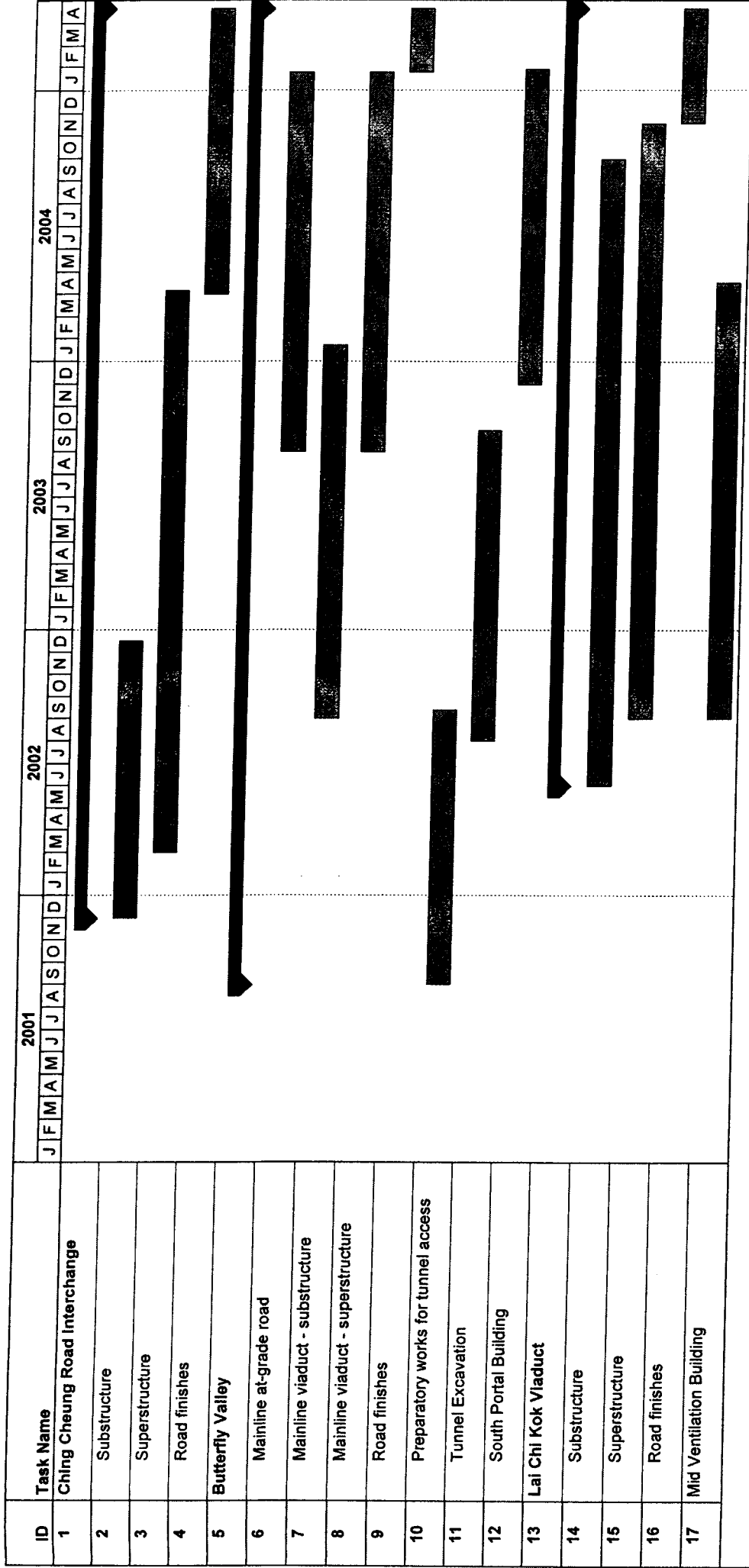
Ching Cheung Road Slip Roads

KWAI CHUNG CONTAINER PORT

RAMBLER CHANNEL

FIGURE 1.1a GENERAL LAYOUT OF THE ALTERNATIVE ALIGNMENT

LEGEND  
 VIADUCT OR AT GRADE ROAD  
 TUNNEL



Project: route16\_2.MPP  
Date: 28/05/99  
Figure 1.4a

Task



Summary



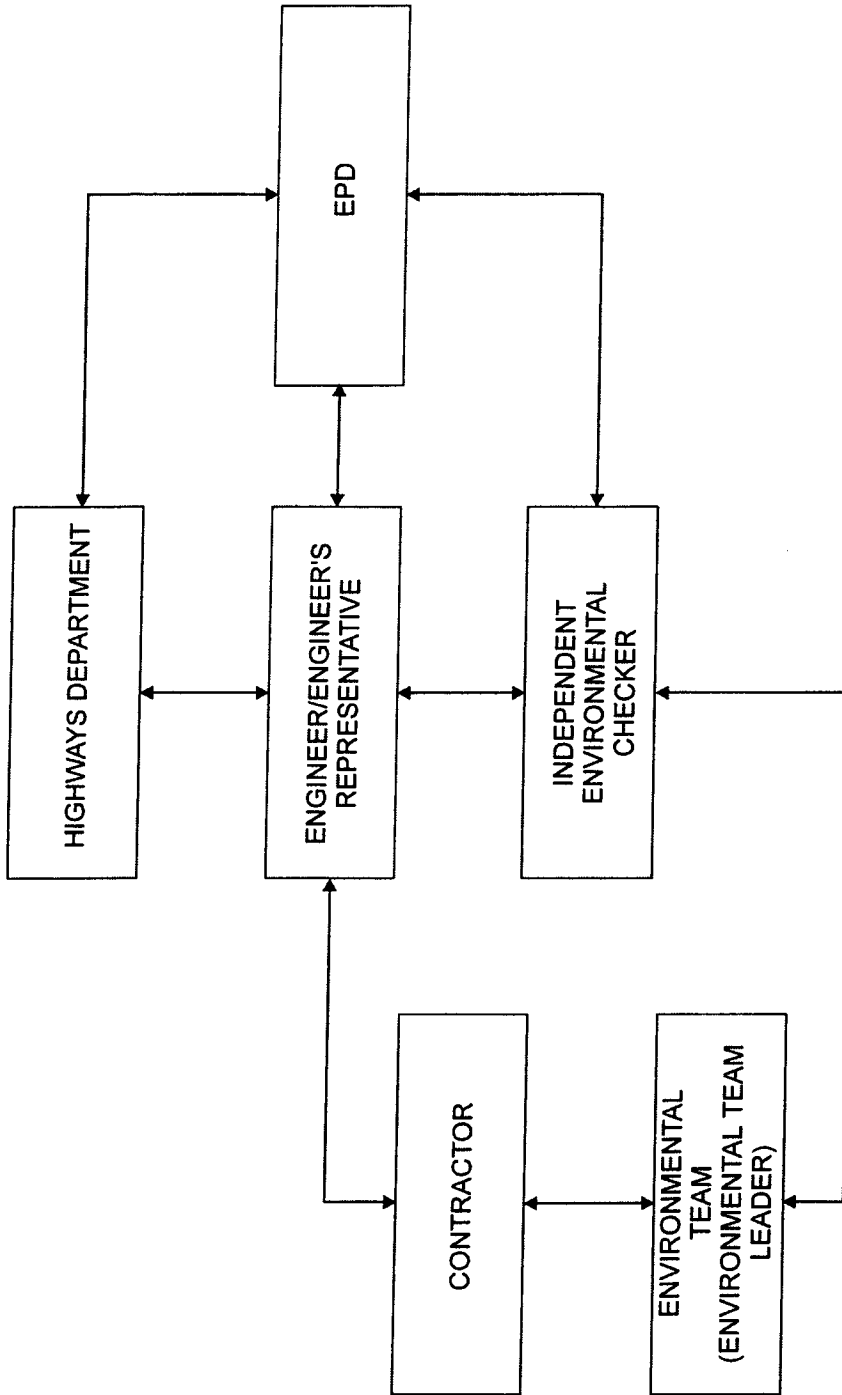


FIGURE 1.8a

PROJECT ORGANISATION

Environmental Resources Management

