

Environmental Impact Assessment Ordinance (Cap. 499), Section 5 (7)

Environmental Impact Assessment Study Brief No. ESB-174/2007

Project Title : **Tuen Mun Western Bypass**
 (hereinafter known as the "Project")

Name of Applicant : **Highways Department**
 The Government of the Hong Kong Special
 Administrative Region
 (hereinafter known as the "Applicant")

1. BACKGROUND

1.1 An application (No. ESB-174/2007) for an Environmental Impact Assessment (EIA) study brief under section 5(1) of the Environmental Impact Assessment Ordinance (EIAO) was submitted by the Applicant on 20 November 2007 with a project profile (No. PP-335/2007) (the Project Profile).

1.2 The scope of the Project is to construct a dual two-lane highway of 8.5km in length connecting the Kong Sham Western Highway in the north and the proposed Tuen mun – Chek Lap Kok (TMCLKL) in the south, as shown in Figure 1 in Appendix A, and is divided into the following two sections:

(a) Southern Section

The Southern Section comprises the following:

- (i) a toll plaza near Lung Mun Road and a 2.7km long land tunnel continuing from TMCLKL running from Castle Peak and emerging at the south of the Tuen Mun North Freshwater Service Reservoir at Por Lo Shan;
- (ii) a 1.1km long viaduct emerging from the northern portal of the toll plaza mentioned in (i) above running between the Tuen Mun North Freshwater Service Reservoir and Saltwater Service Reservoir, which then turns northward to the western hillside of Leung King Estate, to connect to the Northern Section described in (b) below; and
- (iii) 1km long link roads bifurcating from the viaduct mentioned in (ii) above near the Tuen Mun North Freshwater Service Reservoir and Saltwater Service Reservoir, to connect to Tsing Tin Road to allow traffic

movement to/from Tuen Mun East.

(b) Northern Section

The Northern Section comprises the following:

- (iv) a 2.7km long land tunnel continuing from the Southern Section at the west of Leung King Estate through Castle Peak encroaching upon the Tsing Shan Firing Range and emerging at the north of Villa Pinada;
- (v) a 0.4km long viaduct continuing from the northern portal of the land tunnel mentioned in (iv) above, spanning across the valley at the north of Villa Pinada and ending at the western side of Chung Shan;
- (vi) a 0.4km tunnel through Chung Shan and emerging at the east of Chung Shan; and
- (vii) a 1.7km long viaduct and associated slip roads bifurcating to connect with Kong Sham Western Highway at both the northern side towards Shenzhen Bay Bridge (formerly known as Shenzhen Western Corridor) and the southern side towards Yuen Long Highway.

1.3 The Project is a designated project under:

- (a) Item A.1, Part I, Schedule 2 of the EIAO: “A road which is an expressway, trunk road, primary distributor road or district distributor road including new roads, and major extensions or improvements to existing roads”;
- (b) Item A.7, Part I, Schedule 2 of the EIAO: “A road or railway tunnel more than 800m in length between portals”;
- (c) Item A.8, Part I, Schedule 2 of the EIAO: “A road or railway bridge more than 100m in length between abutments”; and
- (d) Item Q.1, Part I, Schedule 2 of the EIAO: “All projects including new access roads, railways.....partly or wholly in a site of special scientific interest”.

1.4 Pursuant to section 5(7)(a) of the EIAO, the Director of Environmental Protection (the Director) issues this EIA study brief to the Applicant to carry out an EIA study.

1.5 The purpose of this EIA study is to provide information on the nature and extent

of environmental impacts arising from the construction and operation of the Project and related activities that take place concurrently. This information will contribute to decisions by the Director on :

- (i) the overall acceptability of any adverse environmental consequences that are likely to arise as a result of the Project;
- (ii) the conditions and requirements for the detailed design, construction and operation of the Project to mitigate against adverse environmental consequences wherever practicable; and
- (iii) the acceptability of residual impacts after the proposed mitigation measures are implemented.

2. OBJECTIVES OF THE EIA STUDY

2.1 The objectives of the EIA study are as follows :

- (i) to describe the Project and associated works together with the requirements for carrying out the Project;
- (ii) to identify and describe the elements of the community and environment likely to be affected by the Project and/or likely to cause adverse impacts to the Project, including both the natural and man-made environment;
- (iii) to provide information on the consideration of alternatives/options for the alignments(s) and built-forms of the Project to avoid and minimise potential environmental impacts to environmentally sensitive areas and other sensitive uses; to compare the environmental benefits and dis-benefits of each of the different options; to provide reasons for selecting the preferred option(s) and to describe the part of environmental factors played in the selection of the preferred option(s);
- (iv) to identify and assess air quality impact, noise impact, water quality impact, waste management implication, ecological impact, cultural heritage impact, hazard to life impact, landscape and visual impact and landfill gas hazards risk; and determine the significance of impacts on sensitive receivers and potential affected uses;
- (v) to propose the provision of infrastructure or mitigation measures so as to minimize pollution, environmental disturbance and nuisance during construction and operation of the Project;
- (vi) to identify, predict and evaluate the residual (i.e. after practicable mitigation) environmental impacts and the cumulative effects expected to arise during the

- construction and operation phases of the Project in relation to the sensitive receivers and potential affected uses;
- (vii) to identify, assesses and specify methods, measures and standards, to be included in the detailed design, construction and operation of the Project which are necessary to mitigate these environmental impacts and reduce them to acceptable levels;
 - (viii) to investigate the extent of the secondary environmental impacts that may arise from the proposed mitigation measures, and to identify constraints associated with the mitigation measures recommended in the EIA study as well as the provision of any necessary modification;
 - (ix) to identify any individual project element(s) and associated works of the Project that fall under Schedule 2 of the EIA Ordinance; to ascertain whether the findings of this EIA study have adequately addressed the environmental impacts of those projects; and, where necessary, to identify the outstanding issues that need to be addressed in any further detailed EIA study; and
 - (x) to design and specify the environmental monitoring and audit requirements to ensure the effective implementation of the recommended environmental protection and pollution control measures.

3. DETAILED REQUIREMENTS OF THE EIA STUDY

3.1 The Purpose

The purpose of this study brief is to scope the key issues of the EIA study. The Applicant has to demonstrate in the EIA report that the criteria in the relevant sections of the Technical Memorandum on the Environmental Impact Assessment Process of the Environmental Impact Assessment Ordinance (hereinafter referred to as “the TM”) are fully complied with.

3.2 The Scope

3.2.1 The scope of this EIA study shall cover the Project mentioned in sub-section 1.2 above. The EIA study shall address the likely key issues described below, together with any other key issues identified during the course of the EIA study:

- (i) the potential noise and air quality impacts from the construction and operation of the Project to sensitive receivers along or near the Project, taking into

account the cumulative impact from the operation of existing and planned/committed roads in the vicinity of the Project, in particular TMCLKL and major existing and planned/committed air pollutant emission sources within North West New Territories (NWNT) including Black Point Power Station, Castle Peak Power Station, industrial uses in and around Tuen Mun Area 38, the proposed Sludge Treatment Facility and Shenzhen Ma Wan Power Station.;

- (ii) the potential water quality impact from the construction and operation of the Project on the relevant water system(s), such as the gazetted beaches in Tuen Mun;
- (iii) confirmation on minimal or no potential losses or damage to flora, fauna and natural habitats and, if otherwise, the potential ecological impacts from the Project to the ecological sensitive areas, such as Tuen Mun Area 54 woodland;
- (iv) waste arising as a result of the construction activities of the Project and potential land contamination from land to be resumed for the Project;
- (v) the potential landscape and visual impacts from construction and operation of the Project;
- (vi) the potential hazard to life impacts from construction and operation of the Project;
- (vii) the potential impacts on site of cultural heritage from construction and operation of the Project;
- (viii) the potential landfill gas hazards risk on site during construction and operation of the Project as the Project falls within the consultation zone of the closed Pillar Point Valley Landfill; and
- (ix) the potential cumulative environmental impacts of the Project, through interaction or in combination with other existing, committed and planned developments in the vicinity of the Project, and that those impacts may have a bearing on the environmental acceptability of the Project. Consideration shall be given to account for impacts from likely concurrent projects, in particular TMCLKL.

3.3 Consideration of Alternatives

3.3.1 The Need of the Project

The Applicant shall provide information on the need of the Project, including the purpose and objectives of the Project, and describe the scenarios with and without the

Project.

3.3.2 Consideration of Different Alignment Options and Built-forms

In addition to the proposed alignment option mentioned in sub-section 1.2 above, the Applicant shall consider other feasible alignment options for the Project, provide justification regarding how the proposed scheme is arrived at, including the descriptions of the environmental factors considered in the option selection. Alternative built-forms (such as changing the proposed viaduct sections to tunnels) and design of the highway shall be reviewed and investigated. A comparison of the environmental benefits and dis-benefits of possible alignment options and alternative built-forms and design shall be made with a view to recommending the preferred option to avoid/minimize adverse environmental effects to the maximum practicable extent. In particular, considerations shall be given to avoid or minimize the disturbance to sites of special scientific interest and cultural and heritage resources, and to avoid or minimize adverse environmental impacts.

3.3.3 Consideration of Alternative Construction Methods and Sequences of Works

Taking into consideration the combined effect with respect to the severity and duration of the construction impacts to the affected sensitive receivers, the EIA study shall explore alternative construction methods and sequences of works for the Project, with a view to shortening the construction period and avoiding prolonged adverse environmental impacts to the maximum practicable extent. A comparison of the environmental benefits and dis-benefits of applying different construction methods and sequence of works shall be made.

3.3.4 Selection of Preferred Alignment, Construction Method(s) and Sequence(s) of Works

Taking into consideration of the findings in sub-sections 3.3.2 and 3.3.3 above, the Applicant shall recommend/justify the adoption of the preferred alignment, construction method(s) and sequence(s) of works that will avoid or minimize adverse environmental effects arising from the Project, and adequately describe the part that environmental factors played in arriving at the final selection.

3.4 **Technical Requirements**

The Applicant shall conduct the EIA study to address all environmental aspects of the activities as described in sections 3.1, 3.2 and 3.3 above. The assessment shall be based on the best and latest information available during the course of the EIA study. The

Applicant shall include in the EIA report details of the construction programme and methodologies. The Applicant shall clearly state in the EIA report the time frame and work programmes of the Project and other concurrent projects, and assess the cumulative environmental impacts from the Project with all interacting projects as identified in the EIA study, including any phased implementation of the Project and the associated works.

The EIA study shall include the following technical requirements on specific impacts.

3.4.1 Air Quality Impact

- 3.4.1.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing air quality impact as stated in section 1 of Annex 4 and Annex 12 of the TM, respectively.
- 3.4.1.2 The study area for air quality impact assessment shall generally be defined by a distance of 500 metres from the boundary of the Project site, yet it shall be extended to include major emission sources that may have a bearing on the environmental acceptability of the Project. Such assessment shall be based on the best available information at the time of the assessment. In particular, the assessment for the operation stage shall take into account the impacts of major existing and planned/committed air pollutant emission sources within NWNT including Black Point Power Station, Castle Peak Power Station, industrial uses in and around Tuen Mun Area 38, the proposed Sludge Treatment Facility and Shenzhen Ma Wan Power Station, whereas the assessment for the construction stage shall take into account the impacts of major emission sources from other construction projects.
- 3.4.1.3 The Applicant shall assess the air pollutant concentrations with reference to the relevant sections of the Guidelines for Local-Scale Air Quality Assessment Using Models given in Appendices B1 to B3, or other methodology as agreed by the Director. The Applicant shall note that the “Odour Impact” in sub-section 3.8 of Appendix B-1 is unlikely to be relevant to this Project unless there are major changes in the Project or circumstances during the course of this EIA study. The Applicant shall also note that the PATH model may be used for estimating the cumulative background concentrations by taking into account all the major air pollutant emission sources in Hong Kong and nearby regions.

3.4.1.4 The air quality impact assessment shall include the following:

- (i) Background and Analysis of Activities
 - (a) Provide background information relating to air quality issues relevant to the Project, e.g. description of the types of activities of the Project that may affect air quality during both construction and operation stages.
 - (b) Give an account, where appropriate, of the consideration/measures that had been taken into consideration in the planning of the Project to abate the air pollution impact. That is, the Applicant shall consider alternative construction methods / phasing programmes and alternative modes of operation to minimize the construction and operational air quality impact respectively.
 - (c) Present the background air quality levels in the assessment area for the purpose of evaluating the cumulative constructional and operational air quality impacts.

- (ii) Identification of Air Sensitive Receivers (ASRs) and Examination of Emission/Dispersion Characteristics
 - (a) Identify and describe representative existing and planned/committed ASRs that are likely affected by the Project, including those earmarked on relevant Outline Zoning Plan(s), Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published land use plans. The Applicant shall select the assessment points of identified ASRs that represent the worst impact point of these ASRs. A map showing the location and description such as name of building, use and height of selected assessment points shall be given. Separation distances of these ASRs from nearest emission sources shall also be given.
 - (b) Provide a list of air pollutant emission sources, including any nearby emission sources which are likely to have impact related to the Project based on the analysis of the construction and operational activities in sub-section 3.4.1.4(i) above. Examples of construction stage emission sources include stock piling, blasting, concrete batching, and vehicular movements on unpaved haul roads on site. Examples of operational stage emission sources include exhaust emissions from vehicles and vent shafts. Confirmation regarding the validity of assumptions and the magnitude of activities (e.g. volume of construction material to be handled, traffic mix and volume on a road) shall be obtained from the relevant government departments/authorities and documented.

- (c) The Applicant shall identify chimneys and obtain relevant chimney emission data in the study area by carrying out a survey for assessing the cumulative air quality impact of air pollutants through chimneys. The Applicant shall ensure and confirm that the chimney emission data used in their assessment have been validated and updated by their own survey. If there are any errors subsequently found in their chimney emission data used, the Applicant shall be fully responsible and the submission might be invalidated.

(iii) Construction Phase Air Quality Impact

- (a) The Applicant shall follow requirements stipulated under Air Pollution Control (Construction Dust) Regulation to ensure construction dust impacts are controlled within relevant standards stipulated in section 1 of Annex 4 of the TM. A construction phase monitoring and audit programme shall be devised to verify effectiveness of control measures to ensure proper construction dust control.
- (b) If the Applicant anticipates that the Project will give rise to significant construction dust impacts likely to exceed the recommended limits in the TM at the ASRs despite the incorporation of dust control measures proposed in accordance with sub-section 3.4.1.4(iii)(a) above, a quantitative assessment shall be carried out to evaluate the construction dust impact at identified ASRs. The Applicant shall follow the methodology set out in sub-section 3.4.1.4(v) below when carrying out the quantitative assessment.

(iv) Operational Phase Air Quality Impact

- (a) The Applicant shall calculate the expected air pollutant concentrations at the identified ASRs based on an assumed reasonably worst-case scenario. The evaluation shall be based on the strength of the emission sources identified in sub-section 3.4.1.4(ii)(b) above. The Applicant shall follow sub-section 3.4.1.4(v) below when carrying out the quantitative assessment.
- (b) The air pollution impacts of future road traffic shall be calculated based on the highest emission strength from the road within the next 15 years upon commencement of operation of the proposed road. The Applicant shall demonstrate that the selected year of assessment represents the highest emission scenario given the combination of vehicular emission factors and traffic flow for the selected year. The Fleet Average Emission Factors used in the assessment shall be agreed with the Director. If necessary, the

Fleet Average Emission Factors shall be determined by a motor vehicle emission model such as EMFAC-HK model to be agreed with the Director. All the traffic flow data and assumptions that used in the assessment shall be clearly and properly documented in the EIA report.

- (c) If full enclosures are proposed in the Project, it is the responsibility of the Applicant to ensure that the air quality inside these proposed structures shall comply with EPD's "*Practice Note on Control of Air Pollution in Vehicle Tunnels*". When assessing air quality impact due to emissions from full enclosures, the Applicant shall ensure prior agreement with the relevant ventilation design engineer over the amount and the types/kinds of pollutants emitted from these full enclosures; and such assumptions shall be clearly and properly documented in the EIA report.

(v) Quantitative Assessment Methodology

- (a) The Applicant shall conduct the quantitative assessment with reference to relevant sections of the modelling guidelines stated in section 3.4.1.3 or any other methodology as agreed with the Director. The specific methodology must be documented in such level of details (preferably with tables and diagrams) to allow the readers of the EIA report to grasp how the model has been set up to simulate the situation at hand without referring to the model input files. Detailed calculation of the pollutant emission rates for input to the model and a map showing all the road links shall be presented in the EIA report. The Applicant shall ensure consistency between the text description and the model files at every stage of submissions for review. In case of doubt, prior agreement between the Applicant and the Director on specific modelling details shall be sought.
- (b) The Applicant shall identify the key/representative air pollutant parameters (types of pollutants and the averaging time concentrations) to be evaluated and provide explanation for choosing such parameters for assessing the impact of the Project. Ozone Limiting Method (OLM) or Discrete Parcel Method (DPM) or other method to be agreed with the Director shall be used to estimate the conversion ratio of NO_x to NO₂ if NO₂ has been identified as a key/representative air pollutant.
- (c) The Applicant shall calculate the cumulative air quality impact at the identified ASRs and compare these results against the criteria set out in section 1 of Annex 4 in the TM. The predicted air quality impacts (both unmitigated and mitigated) shall be presented in the form of summary table

and pollution contours, to be evaluated against the relevant air quality standards and on any effect they may have on the land use implications. Plans of a suitable scale shall be used to present pollution contour to allow buffer distance requirements to be determined properly.

- (d) If there are any direct technical noise remedies recommended in the study, the air quality implication due to these technical remedies shall be assessed. For instance, if barriers that may affect dispersion of air pollutants are proposed, then the implications of such remedies on air quality impact shall be assessed. If noise enclosure is proposed, then portal emissions of the enclosed road section and air quality inside the enclosed road section shall also be addressed. The Applicant shall highlight clearly the locations and types of agreed noise mitigating measures (where applicable), be they noise barriers, road enclosures and their portals, and affected ASR's, on contour maps for easy reference.

(vi) Mitigation Measures for Non-compliance

The Applicant shall propose remedies and mitigating measures where the predicted air quality impact exceeds the criteria set in section 1 of Annex 4 in the TM. These measures and any constraints on future land use planning shall be agreed with the relevant government departments/authorities and documented in the EIA report. The Applicant shall demonstrate quantitatively that the resultant impacts after incorporation of the proposed mitigating measures will comply with the criteria stipulated in section 1 of Annex 4 in the TM.

(vii) Submission of Model Files

All input and output file(s) of the model run(s) shall be submitted to the Director in electronic format.

3.4.2 Noise Impact

3.4.2.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing noise impact as stated in Annexes 5 and 13 of the TM, respectively.

3.4.2.2 The noise impact assessment shall include the following :

(i) Determination of Assessment Area

The study area for the noise impact assessment shall generally include all areas within 300m from the Project shown in Appendix A or other Project alignments as identified in the EIA. Subject to the agreement of the Director, the assessment area could be reduced accordingly if the first layer of noise sensitive receivers (NSRs), closer than 300m from the outer Project limit, provides acoustic shielding to those receivers at distances further away from the Project. Subject to the agreement of the Director, the assessment area shall be expanded to include NSRs at distances over 300m from the Project, which are affected by the construction and operation of the Project.

(ii) Provision of Background Information and Existing Noise Levels

The Applicant shall provide all background information relevant to the Project, e.g. relevant previous or current studies. Unless required for determining the planning standards, e.g. those for planning of fixed noise sources (such as ventilation systems of traffic noise enclosures), no existing noise levels are particularly required.

(iii) Identification of Noise Sensitive Receivers

- (a) The Applicant shall refer to Annex 13 of the TM when identifying the NSRs. The NSRs shall include all existing NSRs and all planned/committed noise sensitive developments and uses earmarked on the relevant Outline Zoning Plans, Development Permission Area Plans, Outline Development Plans, Layout Plans and other relevant published land use plans. Photographs of all existing NSRs shall be appended to the EIA report.
- (b) The Applicant shall select assessment points to represent all identified NSRs for carrying out quantitative noise assessment described below. The assessment points shall be agreed with the Director prior to the quantitative noise assessment. A map showing the location and description such as name of building, use, and floor of each and every selected assessment point shall be given. For planned noise sensitive land uses without committed site layouts, the Applicant shall use the relevant planning parameters to work out representative site layouts for operational noise assessment purpose.

(iv) Provision of an Emission Inventory of the Noise Sources

The Applicant shall provide an inventory of noise sources including representative construction equipment for construction noise assessment, and traffic flow/ fixed plant equipment (e.g. ventilation systems of traffic noise enclosures), as appropriate, for operational noise assessment. Confirmation of the validity of the inventory shall be obtained from the relevant government departments/authorities and documented in the EIA report.

(v) Construction Noise Assessment

- (a) The assessment shall cover the cumulative noise impacts due to the construction works of the Project and other concurrent projects identified during the course of the EIA study.
- (b) The Applicant shall carry out assessment of noise impact from construction (excluding percussive piling) of the Project during daytime, i.e. 7 a.m. to 7 p.m., on weekdays other than general holidays in accordance with the methodology in sections 5.3. and 5.4 of Annex 13 of the TM. The criteria in Table 1B of Annex 5 of the TM shall be adopted in the assessment.
- (c) To minimize the construction noise impact, alternative construction methods to replace percussive piling shall be proposed as far as practicable. In case blasting works is involved, it shall be carried out, as far as practicable, outside the sensitive hours of 7 p.m. to 7 a.m. on Monday to Saturday and any time on a general holiday, including Sunday. For blasting that must be carried out during the above-mentioned sensitive hours, the noise impact from the removal of debris and rocks shall be fully assessed and adequate mitigation measures shall be recommended to reduce the noise impact.
- (d) If the unmitigated construction noise levels are found exceeding the relevant criteria, the Applicant shall propose practicable direct mitigation measures (including movable barriers, enclosures, quieter alternative methods, re-scheduling and restricting hours of operation of noisy tasks) to minimize the impact. If the mitigated noise levels still exceed the relevant criteria, the duration of the noise exceedance shall be given.
- (e) The Applicant shall, as far as practicable, formulate a reasonable construction programme so that no work will be required in restricted hours as defined under the Noise Control Ordinance (NCO). In case

the Applicant needs to evaluate whether construction works in restricted hours as defined under the NCO are feasible or not in the context of programming construction works, reference shall be made to relevant technical memoranda issued under the NCO. Regardless of the results of construction noise impact assessment for restricted hours, the Noise Control Authority will process Construction Noise Permit (CNP) application, if necessary, based on the NCO, the relevant technical memoranda issued under the NCO, and the contemporary conditions/situations. This aspect shall be explicitly stated in the noise chapter and the conclusions and recommendations chapter in EIA report.

(vi) Operational Noise Assessment

(a) Road Traffic Noise

(a1) Calculation of Noise Levels

The Applicant shall analyse the scope of the proposed road alignment(s) to identify road sections within the meaning of Item A.1 of Schedule 2 of EIAO and other road sections for the purpose of traffic noise impact assessment. Figures showing extents of road sections within the meaning of Item A.1 of Schedule 2 of EIAO and other road sections shall be provided in the EIA report. In determining whether the traffic noise impact due to a road improvement project / work is considered significant, detailed information with respect to factors including change of nature of road, change of alignment and change of traffic capacity or traffic composition etc. shall be assessed. The traffic noise impact shall be considered significant if the traffic noise level with the road project is greater than that without the road project at the design year by 1 dB(A) or more.

The Applicant shall calculate expected road traffic noise using methods described in the U.K. Department of Transport's "*Calculation of Road Traffic Noise*" (1988). Calculations of future road traffic noise shall be based on peak hour traffic flow in respect of maximum traffic projection within a 15 years period upon commencement of operation of the Project. The Applicant shall calculate traffic noise levels in respect of each road section and the overall noise levels from combined road sections (road sections within the meaning of Item A.1 of Schedule 2 of EIAO and other road sections) at NSRs.

The EIA report shall contain sample calculations and input parameters for 10 assessment points as requested by the Director. Also, the Applicant shall provide the input data set of the traffic noise model in the format of electronic files in the EIA. The Applicant shall prepare and provide drawings (i.e., road-plots of the traffic noise model) of appropriate scale to show the road segments, topographic barriers, and assessment points of sensitive receivers input into the traffic noise model.

The Applicant shall provide input data sets of traffic noise prediction model adopted in the EIA study as requested by the Director for the following scenarios:

- (1) unmitigated scenario at assessment year;
- (2) mitigated scenario at assessment year; and
- (3) prevailing scenario for indirect technical remedies eligibility assessment.

The data shall be in electronic text file (ASCII format) containing road segments, barriers and noise sensitive receivers information. The data structure of the above file shall be agreed with the Director. CD-ROM(s) containing the above data shall be attached in the EIA report.

(a2) Presentation of Noise Levels

The Consultants shall present the existing and future noise levels in L_{10} (1 hour) at the NSRs at various representative floor levels in (m P.D.) on tables and plans of suitable scale.

A quantitative assessment at the NSRs for road sections within the meaning of Item A.1 of Schedule 2 of EIAO shall be carried out and compared against the criteria set out in Table 1A of Annex 5 of the TM. The potential noise impact of road sections within the meaning of Item A.1 of Schedule 2 of EIAO shall be quantified by estimating the total number of dwellings, classrooms and other noise sensitive elements that will be exposed to noise levels exceeding the criteria set in Table 1A of Annex 5 in the TM.

3-dimensional electronic visualizations of the road traffic noise predictions of the EIA report, including impacts with and without the Project, and the mitigated and unmitigated impacts shall be presented. The Applicant shall follow the requirements set out in section 5.8 when

producing the electronic visualizations.

(a3) Proposals for Noise Mitigation Measures

After rounding off the predicted noise levels according to U.K. Department of Transport's "*Calculation of Road Traffic Noise*" (1988), the Applicant shall propose in accordance with Section 6 in Annex 13 of the TM direct technical remedies in all situations where predicted traffic noise level exceeds the criteria in Table 1A of Annex 5 in the TM by 1 dB(A) or more, and, under section 4.4.3 of the TM, noise from the road sections within the meaning of Item A.1 of Schedule 2 of EIAO has significant contribution to the cumulative environmental impacts when considered in conjunction with the existing or potential impacts from other projects. Specific reasons for not adopting certain direct technical remedies in the design to reduce the traffic noise to a level meeting the criteria in the TM or to maximize the protection for NSRs as far as possible shall be clearly quantified and laid down. Total number of dwellings, classrooms and other noise sensitive element that will benefit from and be protected by provision of direct technical remedies shall be provided. In order to clearly present the extents/locations of recommended noise mitigation measures, plans prepared from 1:1000 or 1:2000 survey maps showing the mitigation measures (e.g., enclosures/barriers, low noise road surfacing, etc.) shall be included in the EIA report.

The total number of dwellings, classrooms and other noise sensitive elements that will still be exposed to noise levels above the criteria with the implementation of all recommended direct technical remedies shall be quantified. The Applicant shall provide in the EIA report information of recommended noise mitigation measures (such as barrier types, nominal dimensions at different cross-sections, extents/locations, lengths, mPD levels of barriers) in electronic format as agreed by the Director.

Section 6.2, Annex 13 of the TM states that upon exhaust of direct mitigation measures, indirect mitigation measures in the form of window insulation and air-conditioning is often the "last resort" in an attempt to ameliorate the residual impact. The Applicant shall identify and estimate the total number of existing dwellings, classrooms and other noise sensitive elements which may qualify for indirect technical

remedies, the associated costs and any implications for such implementation. For the purpose of determining eligibility of the affected premises for indirect mitigation measures, reference shall be made to the relevant procedures stipulated in “The Calculation of Road Traffic Noise” (paragraph 6 on “Requirements for use with the Noise Insulation Regulations”) which is used for the assessment of road traffic noise as per section 5.1, Annex 13 of the TM. The testing criteria are set out as below:

- (1) the predicted overall noise level at the NSR from the road sections in this project within the meaning of Item A.1 of Schedule 2 of EIAO together with other traffic noise in the vicinity must be above a specified noise level (e.g. 70 dB(A) for domestic premises and 65 dB(A) for education institutions, all in L10(1hr));
- (2) the predicted overall noise level at the NSR is at least 1.0 dB(A) more than the prevailing traffic noise level, i.e. the total traffic noise level existing before the works to construct the road were commenced; and
- (3) the contribution from the road sections in this project within the meaning of Item A.1 of Schedule 2 of EIAO to the increase in predicted overall noise level at the NSR must be at least 1.0dB(A).

(b) Fixed Noise Sources

If the Project will cause any fixed noise sources, such as the ventilation systems of enclosed road sections, if any, the following assessment shall be followed.

(b1) Assessment of Fixed Source Noise Levels

The Applicant shall calculate the expected noise using standard acoustics principles. Calculations for the expected noise shall be based on assumed plant inventories and utilization schedule for the worst-case scenario. The Applicant shall calculate noise levels taking into account correction of tonality, impulsiveness and intermittency in accordance with Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites issued under the NCO.

(b2) Presentation of Noise Levels

The Applicant shall present the existing and future noise levels in L_{eq} (30 min) at the NSRs at various representative floor levels (in m P.D.) on tables and plans of suitable scale. A quantitative assessment at the NSRs for the proposed fixed noise source(s) shall be carried out and compared against the criteria set out in Table 1A of Annex 5 of the TM.

(b3) Proposals for Noise Mitigation Measures

The Applicant shall propose direct technical remedies within the Project limits in all situations where the predicted noise level exceeds the criteria set out in Table 1A of Annex 5 of the TM to protect the affected NSRs.

(vii) Assessment of Side Effects and Constraints

The Applicant shall identify, assess and propose means to minimize any side effects and to resolve any potential constraints due to the inclusion of any recommended direct technical remedies.

(viii) Evaluation of Constraints on Planned Noise Sensitive Developments/Land uses

For planned noise sensitive uses which will still be affected even with all practicable direct technical remedies in place, the Applicant shall propose, evaluate and confirm the practicability of additional measures within the planned noise sensitive uses and shall make recommendations on how these noise sensitive uses will be designed for the information of relevant parties.

The Applicant shall take into account agreed environmental requirements / constraints identified by the EIA study to assess the development potential of concerned sites which shall be made known to the relevant parties.

3.4.3 Water Quality Impact

3.4.3.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing water pollution as stated in Annexes 6 and 14 of the TM respectively.

3.4.3.2 The EIA report shall cover the following:

- (i) The water quality impacts of the site run-off generated during the construction stage, including but not limited to the effluents generated from dewatering associated with piling activities, grouting and concrete washing;
- (ii) The water quality impacts of the road runoff containing oil/grease and suspended solids during the operational stage; and
- (iii) The water quality impacts on river courses and drainages around the work sites.

3.4.3.3 The Assessment Area shall include areas within 300m from the Project boundary, and shall cover relevant sensitive receivers that have a bearing on the environmental acceptability of the Project. Potential water sensitive receivers shall include gazetted/non-gazetted beaches and existing/planned seawater intake points.

3.4.3.4 The physical, chemical and biological disruptions of the water system(s) within the study area arising during the construction and operation of the Project shall be identified.

3.4.3.5 The water quality impact assessment shall address the following:

- (i) Identification of pertinent water quality objectives and water quality criteria or standards for the water system(s);
- (ii) Review the specific construction methods and configurations, and operation of the Project to identify and predict the likely water quality impacts arising from the Project;
- (iii) Proposal of effective and practicable water pollution prevention and mitigation measures to be implemented during the construction and operation stages so as to reduce storm water and non-point source pollution. Requirements to be incorporated in the Project contract document shall also be proposed; and
- (iv) Evaluation of residual impacts (if any) on the water system(s).

3.4.4 Waste Management Implications

3.4.4.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing waste management implications as stated in Annexes 7 and 15 of the TM respectively.

3.4.4.2 The assessment of waste management implications shall cover the following:

(i) Analysis of Activities and Waste Generation

The Applicant shall identify the quantity, quality and timing of the waste arising as a result of the construction and operation activities of the Project, based on the sequence and duration of these activities.

(ii) Proposal for Waste Management

- (a) Prior to considering the disposal options for various types of wastes, opportunities for reducing waste generation, on-site or off-site re-use and recycling shall be fully evaluated. Measures which can be taken in the planning and design stages e.g. by modifying the design approach and in the construction stage for maximizing waste reduction shall be separately considered.
- (b) After considering all the opportunities for reducing waste generation and maximizing re-use, the types and quantities of the wastes required to be disposed of as a consequence shall be estimated and the disposal options for each type of waste shall be described in detail. Pre-treatment processes for slurry before disposal shall be addressed in details. The disposal methods/options recommended for each type of waste shall take into account of the result of the assessment in (c) below.
- (c) The impact caused by handling (including labelling, packaging & storage), collection, and re-use/disposal of wastes shall be addressed in detail and appropriate mitigation measures shall be proposed. This assessment shall cover the following areas :
- potential hazard;
 - air and odour emissions;
 - noise;
 - wastewater discharge; and
 - public transport.

(iii) Land Contamination

- (a) The Applicant shall identify all land lots/sites within the Project boundary which, due to their past or present land uses, are potentially contaminated sites. A detailed account of the present activities and past land use history in relation to possible land contamination shall be provided.
- (b) The list of potential contaminants which are anticipated to be found in these potentially contaminated sites shall be provided and the possible remediation options shall be discussed.

3.4.5 Ecological Impact

3.4.5.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing ecological impact as stated in Annexes 8 and 16 of the TM respectively.

3.4.5.2 The study area for the terrestrial ecological environment shall include all areas within 500 m from the site boundary of the land based works areas or the area likely to be impacted by the Project.

3.4.5.3 In the ecological impact assessment, the Applicant shall examine the flora, fauna and other components of the ecological habitats within the assessment area. The aim shall be to protect, maintain or rehabilitate the natural environment. In particular, the Project shall avoid impacts on recognized sites of conservation importance and other ecological sensitive areas. The assessment shall identify and quantify as far as possible the potential ecological impacts arising from the construction and operation of the Project and in combination with those cumulative impacts from associated works of the Project.

3.4.5.4 The assessment shall include the following major tasks:

- (i) review and incorporate the findings of relevant studies and collate all the available information regarding the ecological characters of the assessment area;
- (ii) carry out necessary field surveys, the duration of which shall be at least six months (covering wet and dry seasons), and investigation to verify the information collected, fill the information gaps identified in sub-section 3.4.5.4 (i) above and fulfil the objectives of the EIA study;

- (iii) evaluate the information collected from sub-sections 3.4.5.4 (i) and (ii) above, and determine whether further ecological survey is required under the following sub-section 3.4.5.4 (v);
- (iv) present the findings of all relevant studies together with surveys carried out under this Study;
- (v) establish an ecological profile of the study area based on data of relevant previous studies/surveys and results of additional ecological field surveys, and describe the characteristics of each habitat found. Major information to be provided shall include:
 - (a) description of the physical environment, including all recognized sites of conservation importance and ecologically sensitive areas, and assess whether these sites will be affected by the Project or not;
 - (b) habitats maps of suitable scale (1:1000 to 1:5000) showing the types and locations of habitats in the study area;
 - (c) ecological characteristics of each habitat type such as size, vegetation type, species present, dominant species found, species diversity and abundance, community structure, seasonal patterns, inter-dependence of the habitats and species, and presence of any features of ecological importance;
 - (d) representative colour photographs of each habitat type and any important ecological features identified;
 - (e) species found that are rare, endangered and/or listed under local legislation, international conventions for conservation of wildlife/habitats or Red Data Books;
- (vi) investigate and describe the existing wildlife uses of the various habitats with special attention to those wildlife groups and habitats with conservation interests, including but not limited to the following:
 - woodlands
 - shrubland
 - agricultural land

- wetlands
 - natural stream courses and rivers
 - intertidal habitats
 - vertebrates (e.g. avifauna, fish, mammals including bats, birds, reptiles, herpetofauna)
 - macroinvertebrates (e.g. butterflies, odonates, crustaceans)
 - any other habitats and wildlife groups as having special conservation interests by this EIA study;
- (vii) use suitable methodology to identify and quantify as far as possible any direct, indirect, on-site, off-site, primary, secondary and cumulative ecological impacts (such as those impacts from the construction of the proposed viaduct near Por Lo Shan and Chung Shan) on the wildlife groups and habitats mentioned in sub-section 3.4.5.4 (vi) above, such as direct loss of habitat and potential diversion or modification of stream courses due to site clearance, slope formation/excavation and foundation construction for viaducts, disturbance to wildlife due to noise impact and vibration from piling and blasting activities during construction, bird strike in case of the use of transparent noise barriers, destruction of habitats, reduction of species abundance/diversity, loss of feeding grounds, reduction of ecological carrying capacity, habitat fragmentation;
- (viii) demonstrate that the ecological impacts due to the construction and operation stages of the Project are avoided by design to the maximum practicable extent;
- (ix) evaluate the significance and acceptability of the ecological impacts identified using well-defined criteria;
- (x) recommend all possible alternative options (such as using other construction methods and sequences) and practicable mitigation measures to avoid, minimize and/or compensate for the adverse ecological impacts identified;
- (xi) evaluate the feasibility and effectiveness of the recommended mitigation measures and define the scope, type, location, implementation arrangement, subsequent management and maintenance of such measures;
- (xii) determine and quantify as far as possible the residual ecological impacts after implementation of the proposed mitigation measures;

- (xiii) evaluate the severity and acceptability of the residual ecological impacts using well-defined criteria; and
- (xiv) review the need for and recommend any ecological monitoring programme required.

3.4.6 Landscape and Visual Impact

- 3.4.6.1 The Applicant shall follow the criteria and guidelines as stated in Annexes 10 and 18 of the TM for evaluating and assessing landscape and visual impacts of any above ground structures and work areas associated with the Project. Landscape and visual impacts during both construction and operation stages within the study area shall be assessed.
- 3.4.6.2 Study areas for landscape impact assessment shall include landscape resources within 100m from the Project and landscape character adjacent to the Project. Study area for visual impact assessment shall be defined by the visual envelope of the Project. The defined visual envelope must be shown on a plan in the EIA report.
- 3.4.6.3 The Applicant shall review relevant Outline Zoning Plans, Development Permissions Area Plans, Outline Development Plans, Layout Plans, other relevant published land use plans, planning briefs and studies which may identify areas of high landscape value and recommend country park, coastal protection area, conservation area, open space, amenity area and green belt designations. Any guidelines on landscape strategies, landscape frameworks, urban design concepts, building height profiles, special design areas, landmarks, designated view corridors, open space networks, landscape links that may affect the appreciation of the Project shall also be reviewed. The aim is to gain an insight to the future outlook of the area so as to assess whether the project can fit into surrounding setting. Any conflict with statutory town plan(s) and any published land use plans shall be highlighted and appropriate follow-up action shall be recommended.
- 3.4.6.4 The Applicant shall describe, appraise, analyse and evaluate the existing and planned landscape resources and character of the study area. A system shall be derived for judging the landscape and visual impact significance. Annotated oblique aerial photographs and plans of suitable scale showing the baseline landscape character areas and landscape resources and mapping of impact assessment shall be extensively used to present the findings of impact assessment. Descriptive text shall provide a concise and reasoned judgment from a landscape and visual point of view. The assessment shall be particularly focused on the sensitivity of the

landscape framework and its ability to accommodate change. The Applicant shall identify the degree of compatibility of the Project with the existing and planned landscape settings. The landscape impact assessment shall quantify potential landscape impacts as far as possible, so as to illustrate the significance of such impacts arising from the Project. Clear mapping of the landscape impact is required. A tree survey shall be carried out and the impacts on existing trees shall be addressed. Cumulative landscape and visual impacts of the Project with other existing, committed and planned developments in the study area shall be assessed.

3.4.6.5 The Applicant shall assess the visual impacts of the Project. Clear illustrations including mapping of visual impact is required. The assessment shall include :

- (i) identification and plotting of visual envelope of the Project;
- (ii) identification of the key groups of existing and planned sensitive receivers within the visual envelope with regard to views from sea level, ground level and elevated vantage points;
- (iii) description of the visual compatibility of the Project with the surrounding and the existing and planned setting, and its obstruction and interference with the key views of the study areas as defined in section 3.4.6.2;
- (iv) description of the severity of visual impacts in terms of nature, distance and number of sensitive receivers; and
- (v) clear evaluations and explanations of all the factors considered in arriving the significance thresholds of visual impact.

3.4.6.6 The Applicant shall evaluate the merits of preservation in totality, in parts or total destruction of existing landscape and the establishment of a new landscape character area. In addition, alternative alignment, design and construction methods that avoid or reduce the identified landscape and visual impacts shall be evaluated for comparison before adopting other mitigation or compensatory measures to alleviate the impacts. The mitigation measures proposed shall not only be concerned with damage reduction but shall also include consideration of potential enhancement of existing landscape and visual quality. The Applicant shall recommend mitigation measures to minimize adverse effects identified above, including provision of a landscape design.

3.4.6.7 The mitigation measures shall include preservation of vegetation and natural coastline, transplanting of trees (with appropriate techniques and sufficient time for preparing the root system of trees for transplantation), provision of screen planting, re-vegetation of disturbed land, woodland restoration, compensatory planting using native trees, provisioning / reprovisioning of amenity areas and open spaces,

avoidance or minimization of noise barriers, design of structures, provision of finishes to structures, colour scheme and texture of material used and any measures to mitigate the impact on existing and planned land uses and sensitive receivers. Parties shall be identified for the on going management and maintenance of the proposed mitigation works to ensure their effectiveness throughout the operation phase of the Project. A practical programme and funding proposal for the implementation of the recommended measures shall be provided. Presentation of photomontages of the Project in the existing and planned setting illustrating the effectiveness of the proposed mitigation measures shall be included.

3.4.6.8 Annotated illustration materials such as coloured perspective drawings, plans and section/elevation diagrams, oblique aerial photographs, photographs taken at vantage points, and computer-generated photomontage shall be adopted to fully illustrate the landscape and visual impacts of the Project. The landscape and visual impacts of the Project with and without mitigation measures from representative viewpoints, particularly from views of the most severely affected visually sensitive receivers (i.e. worst case scenario), shall be properly illustrated in existing and planned setting at four stages (existing condition, Day 1 with no mitigation measures, Day 1 with mitigation measures and Year 10 with mitigation measures) by computer-generated photomontage so as to demonstrate the effectiveness of the proposed mitigation measures. All computer graphics shall be compatible with Microstation DGN file format or as agreed with the Director. The Applicant shall record the technical details such as system set-up, software, data files and function in preparing the illustration, which may need to be submitted for verification of the accuracy of the illustrations.

3.4.7 **Landfill Gas Hazards Assessment**

3.4.7.1 The Applicant shall follow the guidelines as stated respectively in Annex 7 and Annex 19 of the TM and the Landfill Gas Hazard Assessment Guidance Note issued by the Director for evaluating and assessing landfill gas hazards.

3.4.7.2 The landfill gas hazards assessment shall entail two main components, which are qualitative risk assessment and landfill gas precautionary/protection design. Specifically, the assessment shall include the following technical tasks:

- (i) review of background information and studies related to the closed Pillar Point Valley Landfill;
- (ii) identification of the nature and extent of the sources, including the likely

concentrations/amounts of hazardous emissions which might have the potential for causing impacts on the Project;

- (iii) identification of possible pathways through the ground, underground cavities, utilities or groundwater and the nature of these pathways through which hazardous emissions must traverse if they were to reach the facilities within the Project site;
- (iv) identification of the potential targets associated with the proposed facilities which are sensitive to the impacts of the hazardous emissions;
- (v) qualitative assessment on the degrees of risk which the hazardous emissions may pose to the target for each of the source-pathway-target combinations;
- (vi) design of suitable level of precautionary measures and the types of protection measures for the construction and operation of the Project; and
- (vii) identification of monitoring requirement for assessing the adequacy and performance of the implemented protection measures.

3.4.8 Hazard to Life

3.4.8.1 If there is use of explosives for the construction activities and the storage or blasting location is in close proximity to populated areas and/or Potentially Hazardous Installation sites, the Applicant shall carry out hazard assessment as follows:

- (i) Identify hazardous scenarios associated with the transport, storage and use of explosives and then determine a set of relevant scenarios to be included in a Quantitative Risk Assessment (QRA);
- (ii) Execute a QRA of the set of hazardous scenarios determined in (i), expressing population risks in both individual and societal terms;
- (iii) Compare individual and societal risks with the criteria for evaluating hazard to life stipulated in Annex 4 of the TM; and
- (iv) Identify and assess practicable and cost-effective risk mitigation measures.

3.4.8.2 The methodology of hazard assessment shall be agreed and approved by the

Director.

3.4.9 Impact on Cultural Heritage

3.4.9.1 The Applicant shall follow the criteria and guidelines for evaluating and assessing the cultural heritage impacts as stated in Annexes 10 and 19 of the TM respectively, Criteria for Cultural Heritage Impact Assessment (Appendix C1), Guidelines for Archaeological Reports (Appendix C2) and Guidelines for Handling of Archaeological Finds and Archives (Appendix C3) to conduct a Cultural Heritage Impact Assessment (CHIA).

3.4.9.2 The CHIA shall comprise an Archaeological Impact Assessment (AIA) and a Built Heritage Impact Assessment (BHIA) as follows:

(i) Archaeological Impact Assessment (AIA):

The Applicant shall engage a qualified archaeologist to conduct the AIA in accordance with relevant sections of the *Criteria for CHIA*. If existing information is insufficient to ascertain the archaeological potential of the project area, further field investigation shall be conducted to obtain archaeological data. The archaeologist shall obtain a licence from the Antiquities Authority before undertaking field investigation under the provision of the Antiquities and Monuments Ordinance (Cap. 53).

The Applicant shall identify all the archaeological sites that might be adversely affected by construction of the project. A plan of proper scale showing the location of the proposed works and all archaeological sites identified is required. A check list including all affected archaeological sites, impacts identified, recommended mitigation measures as well as the implementation agent and period shall also be included in the EIA.

The Applicant shall assess the extent to which those archaeological sites might be directly and indirectly affected and recommend possible alternatives (such as modification of alignment and design of the project) and practicable monitoring and mitigation measures to avoid or keep the adverse impact on the archaeological sites to the minimum.

(ii) Built Heritage Impact Assessment (BHIA):

The Applicant shall draw necessary reference to relevant sections of the *Criteria for CHIA* to conduct the BHIA to identify known and unknown built heritage items within the assessment area that may be affected by the project and its associated works and to assess the direct and indirect impacts on built heritage items.

Appropriate mitigation measures shall be recommended in the BHIA.

3.4.10 Summary of Environmental Outcomes

The EIA report shall contain a summary of key environmental outcomes arising from the EIA study, including the population and environmentally sensitive areas protected, environmentally friendly designs recommended, key environmental problems avoided, compensation areas included and the environmental benefits of environmental protection measures recommended.

3.4.11 Environmental Monitoring and Audit (EM&A) Requirements

3.4.11.1 The Applicant shall identify and justify in the EIA study whether there is any need for EM&A activities during the construction and operation phases of the Project and, if affirmative, to define the scope of EM&A requirements for the Project in the EIA study.

3.4.11.2 Subject to the confirmation of the EIA study findings, the Applicant shall comply with the requirements as stipulated in Annex 21 of the TM. The Applicant shall also propose reporting of monitoring data for the Project through a dedicated internet website.

3.4.11.3 The Applicant shall prepare a Project Implementation Schedule (in the form of a checklist as shown in Appendix D to this EIA study brief) containing all the EIA study recommendations and mitigation measures with reference to the implementation programme. The Project Implementation Schedule shall include the explicit agreement reached between the Applicant and relevant parties on the responsibility for funding, implementation, management and maintenance of mitigation measures. Alternatively, the Project Implementation Schedule shall include an undertaking from the Applicant to assume the responsibility of all those mitigation measures until an agreement is reached between the Applicant and relevant parties on the funding, implementation, management and maintenance of mitigation measures.

4. DURATION OF VALIDITY

4.1 The Applicant shall notify the Director of the commencement of the EIA study. If the EIA study does not commence within 36 months after the date of issue of the EIA study brief, the Applicant shall apply to the Director for a fresh EIA study brief

before commencement of the EIA study.

5. REPORT REQUIREMENTS

- 5.1 In preparing the EIA report, the Applicant shall refer to Annex 11 of the TM for the contents of an EIA report. The Applicant shall also refer to Annex 20 of the TM, which stipulates the guidelines for the review of an EIA report.
- 5.2 The Applicant shall supply the Director with the following number of copies of the EIA report and the executive summary:
- (i) 50 copies of the EIA report in English and 80 copies of the executive summary (each bilingual in both English and Chinese) as required under section 6(2) of the EIAO to be supplied at the time of application for approval of the EIA report.
 - (ii) When necessary, addendum to the EIA report and the executive summary submitted in sub-section 5.2 (i) above as required under section 7(1) of the EIAO, to be supplied upon advice by the Director for public inspection.
 - (iii) 20 copies of the EIA report in English and 50 copies of the executive summary (each bilingual in both English and Chinese) with or without Addendum as required under section 7(5) of the EIAO, to be supplied upon advice by the Director for consultation with the Advisory Council on the Environment.
- 5.3 The Applicant shall, upon request, make additional copies of above documents available to the public, subject to payment by the interested parties of full costs of printing.
- 5.4 In addition, to facilitate public inspection of EIA report via EIAO Internet Website, the Applicant shall provide electronic copies of both the EIA report and executive summary prepared in HyperText Markup Language (HTML) (version 4.0 or later) and in Portable Document Format (PDF version 1.3 or later), unless otherwise agreed by the Director. For the HTML version, a content page capable of providing hyperlink to each section and sub-section of the EIA report and executive summary shall be included in the beginning of the document. Hyperlinks to all figures, drawings and tables in the EIA report and executive summary shall be provided in the main text from where respective references are made. All graphics in the report shall be in interlaced GIF format unless otherwise agreed by the Director.

- 5.5 The electronic copies of the EIA report and the executive summary shall be submitted to the Director at the time of application for approval of the EIA report.
- 5.6 When the EIA report and the executive summary are made available for public inspection under section 7(1) of the EIAO, the content of the electronic copies of the EIA report and the executive summary must be the same as the hard copies and the Director shall be provided with the most updated electronic copies.
- 5.7 To promote environmentally friendly and efficient dissemination of information, both hardcopies and electronic copies of future EM&A reports recommended by the EIA study shall be required and their format shall be agreed by the Director.
- 5.8 To facilitate public involvement in the EIA process, the Applicant shall produce electronic visualisations of the major findings and elements of the EIA report, including 3-dimensional electronic visualizations of the road traffic noise predictions (including impacts with and without the Project, and the mitigated and unmitigated impacts) and key recommended environmental mitigation measures so that the public can understand the Project and the associated environmental issues. The visualisations shall be based on the EIA report. The visualisations shall be submitted in CD-ROM or other suitable means agreed with the Director in commonly readable formats. Unless otherwise advised or agreed by the Director, copies of the CD-ROM shall be the same as the number of EIA reports required under section 5.2 of this study brief.

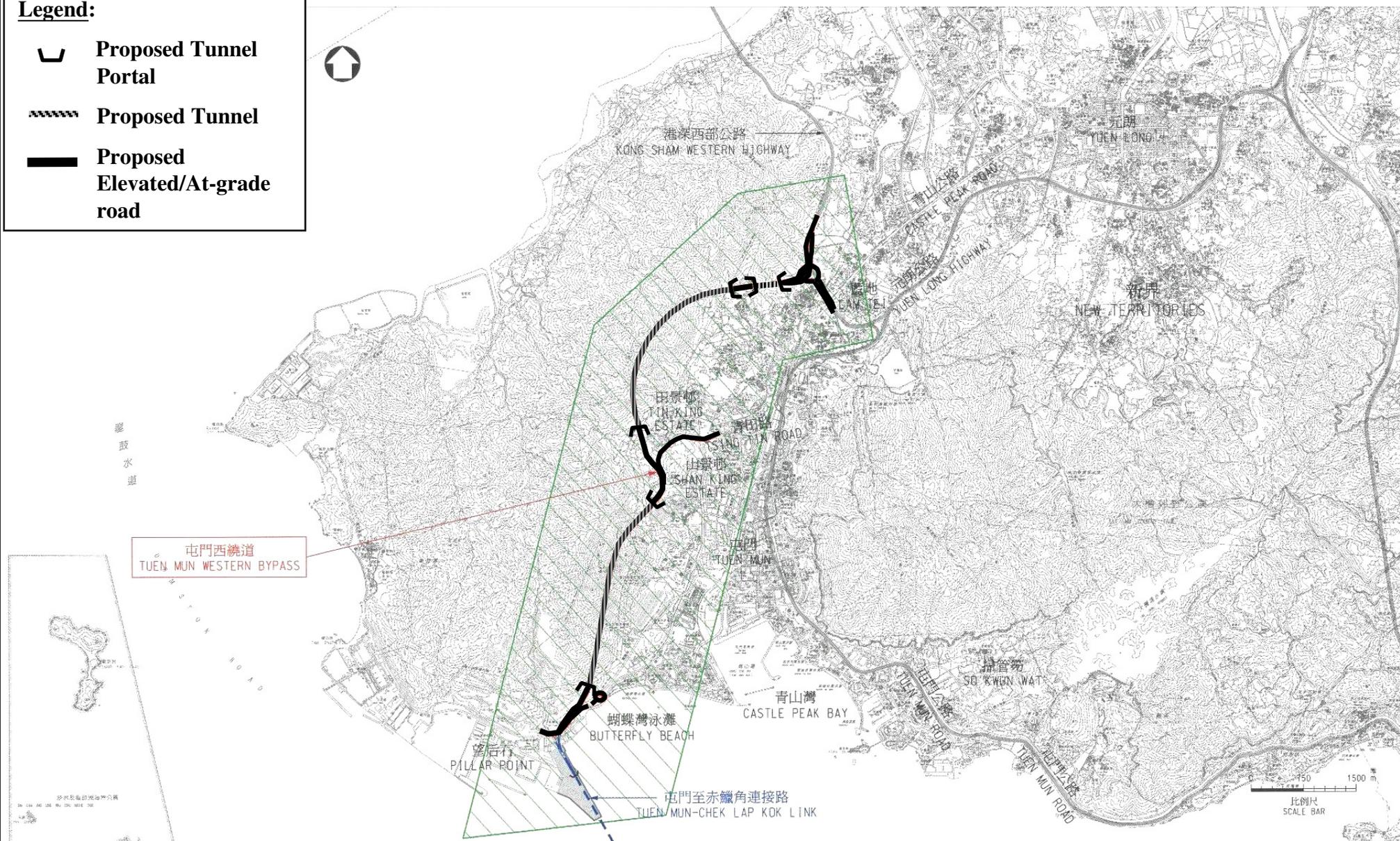
6. OTHER PROCEDURAL REQUIREMENTS

- 6.1 If there is any change in the name of Applicant for this EIA study brief during the course of the EIA study, the Applicant must notify the Director immediately.
- 6.2 If there is any key change in the scope of the Project mentioned in sub-section 1.2 of this EIA study brief and in Project Profile (No. PP-335/2007), the Applicant must seek confirmation from the Director in writing on whether or not the scope of issues covered by this EIA study brief can still cover the key changes, and the additional issues, if any, that the EIA study must also address. If the changes to the Project fundamentally alter the key scope of the EIA study brief, the Applicant shall apply to the Director for a fresh EIA study brief.

--- END OF EIA STUDY BRIEF ---

Legend:

-  Proposed Tunnel Portal
-  Proposed Tunnel
-  Proposed Elevated/At-grade road



Tuen Mun Western Bypass

Environmental Study Brief: **ESB-174/2007**

Appendix A

Figure 1



Appendix B-1

Guidelines on Choice of Models and Model Parameters in Air Quality Assessment

[The information contained in this Appendix is only meant to assist the Applicant in performing the air quality assessment. The Applicant must exercise professional judgment in applying this general information for the Project.]

1. Introduction

1.1 To expedite the review process by the Authority and to assist project proponents or environmental consultants with the conduct of air quality modelling exercise which are frequently called for as part of environmental impact assessment studies, this paper describes the usage and requirements of a few commonly used air quality models.

2. Choice of Models

2.1 The models which have been most commonly used in air quality impact assessments, due partly to their ease of use and partly to the quick turn-around time for results, are of Gaussian type and designed for use in simple terrain under uniform wind flow. There are circumstances when these models are not suitable for ambient concentration estimates and other types of models such as physical, numerical or mesoscale models will have to be used. In situations where topographic, terrain or obstruction effects are minimal between source and receptor, the following Gaussian models can be used to estimate the near-field impacts of a number of source types including dust, traffic and industrial emissions.

<u>Model</u>	<u>Applications</u>
FDM	for evaluating fugitive and open dust source impacts (point, line and area sources)
CALINE4	for evaluating mobile traffic emission impacts (line sources)
ISCST3	for evaluating industrial chimney releases as well as area and volumetric sources (point, area and volume sources); line sources can be approximated by a number of volume sources.

These frequently used models are also referred to as Schedule 1 models (see attached list).

2.2 Note that both FDM and CALINE4 have a height limit on elevated sources (20 m and 10m, respectively). Source of elevation above these limits will have to be modelled using the ISCST3 model or suitable alternative models. In using the latter, reference should be made to the 'Guidelines on the Use of Alternative Computer Models in Air Quality Assessment' in Appendix

B-3.

- 2.3 The models can be used to estimate both short-term (hourly and daily average) and long-term (annual average) ambient concentrations of air pollutants. The model results, obtained using appropriate model parameters (refer to Section 3) and assumptions, allow direct comparison with the relevant air quality standards such as the Air Quality Objectives (AQOs) for the relevant pollutant and time averaging period.

3. Model Input Requirements

3.1 Meteorological Data

- 3.1.1 At least 1 year of recent meteorological data (including wind speed, wind direction, stability class, ambient temperature and mixing height) from a weather station either closest to or having similar characteristics as the study site should be used to determine the highest short-term (hourly, daily) and long-term (annual) impacts at identified air sensitive receivers in that period. The amount of valid data for the period should be no less than 90 percent.

- 3.1.2 Alternatively, the meteorological conditions as listed below can be used to examine the worst case short-term impacts:

Day time: stability class D; wind speed 1 m/s (at 10m height); worst-case wind angle;
mixing height 500 m

Night time: stability class F; wind speed 1 m/s (at 10m height); worst case wind angle;
mixing height 500 m

This is a common practice with using CALINE4 model due to its inability to handle lengthy data set.

- 3.1.3 For situations where, for example, (i) the model (such as CALINE4) does not allow easy handling of one full year of meteorological data; or (ii) model run time is a concern, the followings can be adopted in order to determine the daily and annual average impacts:

- (i) perform a frequency occurrence analysis of one year of meteorological data to determine the actual wind speed (to the nearest unit of m/s), wind direction (to the nearest 10°) and stability (classes A to F) combinations and their frequency of occurrence;
- (ii) determine the short term hourly impact under all of the identified wind speed, wind direction and stability combinations; and
- (iii) apply the frequency data with the short term results to determine the long term

(daily / annual) impacts.

Apart from the above, any alternative approach that will capture the worst possible impact values (both short term and long term) may also be considered.

- 3.1.4 Note that the anemometer height (relative to a datum same for the sources and receptors) at which wind speed measurements were taken at a selected station should be correctly entered in the model. These measuring positions can vary greatly from station to station and the vertical wind profile employed in the model can be grossly distorted from the real case if incorrect anemometer height is used. This will lead to unreliable concentration estimates.
- 3.1.5 An additional parameter, namely, the standard deviation of wind direction, σ_{θ} , needs to be provided as input to the CALINE4 model. Typical values of σ_{θ} range from 12° for rural areas to 24° for highly urbanised areas under 'D' class stability. For semi-rural such as new development areas, 18° is more appropriate under the same stability condition. The following reference can be consulted for typical ranges of standard deviation of wind direction under different stability categories and surface roughness conditions.

Ref.(1): Guideline On Air Quality Models (Revised), EPA-450/2-78-027R, United States Environmental Protection Agency, July 1986.

3.2 Emission Sources

All the identified sources relevant to a process plant or a study site should be entered in the model and the emission estimated based on emission factors compiled in the AP-42 (Ref. 2) or other suitable references. The relevant sections of AP-42 and any parameters or assumptions used in deriving the emission rates (in units g/s, g/s/m or g/s/m²) as required by the model should be clearly stated for verification. The physical dimensions, location, release height and any other emission characteristics such as efflux conditions and emission pattern of the sources input to the model should also correspond to site data.

If the emission of a source varies with wind speed, the wind speed-dependent factor should be entered.

Ref.(2): Compilation of Air Pollutant Emission Factors, AP-42, 5th Edition, United States Environmental Protection Agency, January 1995.

3.3 Urban/Rural Classification

Emission sources may be located in a variety of settings. For modelling purposes these are classified as either rural or urban so as to reflect the enhanced mixing that occurs over urban

areas due to the presence of buildings and urban heat effects. The selection of either rural or urban dispersion coefficients in a specific application should follow a land use classification procedure. If the land use types including industrial, commercial and residential uses account for 50% or more of an area within 3 km radius from the source, the site is classified as urban; otherwise, it is classified as rural.

3.4 Surface Roughness Height

This parameter is closely related to the land use characteristics of a study area and associated with the roughness element height. As a first approximation, the surface roughness can be estimated as 3 to 10 percent of the average height of physical structures. Typical values used for urban and new development areas are 370 cm and 100 cm, respectively.

3.5 Receptors

These include discrete receptors representing all identified air sensitive receivers at their appropriate locations and elevations and any other discrete or grid receptors for supplementary information. A receptor grid, whether Cartesian or Polar, may be used to generate results for contour outputs.

3.6 Particle Size Classes

In evaluating the impacts of dust-emitting activities, suitable dust size categories relevant to the dust sources concerned with reasonable breakdown in TSP ($< 30 \mu\text{m}$) and RSP ($< 10 \mu\text{m}$) compositions should be used.

3.7 NO₂ to NO_x Ratio

The conversion of NO_x to NO₂ is a result of a series of complex photochemical reactions and has implications on the prediction of near field impacts of traffic emissions. Until further data are available, three approaches are currently acceptable in the determination of NO₂:

- (a) Ambient Ratio Method (ARM) - assuming 20% of NO_x to be NO₂; or
- (b) Discrete Parcel Method (DPM, available in the CALINE4 model); or
- (c) Ozone Limiting Method (OLM) - assuming the tailpipe NO₂ emission to be 7.5% of NO_x and the background ozone concentration to be in the range of 57 to 68 $\mu\text{g}/\text{m}^3$ depending on the land use type (see also the EPD reference paper 'Guidelines on Assessing the 'TOTAL' Air Quality Impacts' in Appendix B-2).

3.8 Odour Impact

In assessing odour impacts, a much shorter time-averaging period of 5 seconds is required due to the shorter exposure period tolerable by human receptors. Conversion of model computed hourly average results to 5-second values is therefore necessary to enable comparison against recommended standard. The hourly concentration is first converted to 3-minute average value according to a power law relationship which is stability dependent (Ref. 3) and a result of the statistical nature of atmospheric turbulence. Another conversion factor (10 for unstable conditions and 5 for neutral to stable conditions) is then applied to convert the 3-minute average to 5-second average (Ref. 4). In summary, to convert the hourly results to 5-second averages, the following factors can be applied:

<u>Stability Category</u>	<u>1-hour to 5-sec Conversion Factor</u>
A & B	45
C	27
D	9
E & F	8

Under 'D' class stability, the 5-second concentration is approximately 10 times the hourly average result. Note, however, that the combined use of such conversion factors together with the ISCST results may not be suitable for assessing the extreme close-up impacts of odour sources.

Ref.(3): Richard A. Duffee, Martha A. O'Brien and Ned Ostojic, 'Odor Modeling – Why and How', Recent Developments and Current Practices in Odor Regulations, Controls and Technology, Air & Waste Management Association, 1991.

Ref.(4): A.W.C. Keddie, 'Dispersion of Odours', Odour Control – A Concise Guide, Warren Spring Laboratory, 1980.

3.9 Plume Rise Options

The ISCST3 model provides by default a list of the U.S. regulatory options for concentration calculations. These are all applicable to the Hong Kong situations except for the 'Final Plume Rise' option. As the distance between sources and receptors are generally fairly close, the non-regulatory option of 'Gradual Plume Rise' should be used instead to give more accurate estimate of near-field impacts due to plume emission. However, the 'Final Plume Rise' option may still be used for assessing the impacts of distant sources.

3.10 Portal Emissions

These include traffic emissions from tunnel portals and any other similar openings and are generally modelled as volume sources according to the PIARC 91 (or more up-to-date version) recommendations (Ref. 5, section III.2). For emissions arising from underpasses or any

horizontal openings of the like, these are treated as area or point sources depending on the source physical dimensions. In all these situations, the ISCST3 model or more sophisticated models will have to be used instead of the CALINE4 model. In the case of portal emissions with significant horizontal exit velocity which cannot be handled by the ISCST3 model, the impacts may be estimated by the TOP model (Ref. 6) or any other suitable models subject to prior agreement with EPD. The EPD's 'Guidelines on the Use of Alternative Computer Models in Air Quality Assessment' should also be referred to in Appendix B-3.

Ref.(5): XIXth World Road Congress Report, Permanent International Association of Road Congresses (PIARC), 1991.

Ref.(6): N. Ukegunchi, H. Okamoto and Y. Ide "Prediction of vehicular emission pollution around a tunnel mouth", Proceedings 4th International Clean Air Congress, pp. 205-207, Tokyo, 1977.

3.11 Background Concentrations

Background concentrations are required to account for far-field sources which cannot be estimated by the model. These values, to be used in conjunction with model results for assessing the total impacts, should be based on long term average of monitoring data at location representative of the study site. Please make reference to the paper 'Guidelines on Assessing the 'TOTAL' Air Quality Impacts' in Appendix B-2 for further information.

3.11 Output

The highest short-term and long-term averages of pollutant concentrations at prescribed receptor locations are output by the model and to be compared against the relevant air quality standards specified for the relevant pollutant. Contours of pollutant concentration are also required for indicating the general impacts of emissions over a study area. Copies of model files in electronic format should also be provided for EPD's reference.

Schedule 1

Air Quality Models Generally Accepted by Hong Kong Environmental Protection Department for Regulatory Applications as at 1 July 1998 : *

Industrial Source Complex Dispersion Model - Short Term Version 3 (ISCST3) or the latest version developed by U.S. Environmental Protection Agency

California Line Source Dispersion Model Version 4 (CALINE4) or the latest version developed by Department of Transportation, State of California, U.S.A.

Fugitive Dust Model (FDM) or the latest version developed by U.S. Environmental Protection Agency

* EPD is continually reviewing the latest development in air quality models and will update this Schedule accordingly.

Appendix B-2

Guidelines on Assessing the 'TOTAL' Air Quality Impacts

[The information contained in this Appendix is only meant to assist the Applicant in performing the air quality assessment. The Applicant must exercise professional judgment in applying this general information for the Project.]

1. Total Impacts - 3 Major Contributions

1.1 In evaluating the air quality impacts of a proposed project upon air sensitive receivers, contributions from three classes of emission sources depending on their distance from the site should be considered. These are:

Primary contributions:	project induced
Secondary contributions:	pollutant-emitting activities in the immediate neighbourhood
Other contributions: (Background contributions)	pollution not accounted for by the previous two

2. Nature of Emissions

2.1 Primary contributions

In most cases, the project-induced emissions are fairly well defined and quite often (but not necessarily) the major contributor to local air quality impacts. Examples include those due to traffic network, building or road construction projects.

2.2 Secondary contributions

Within the immediate neighbourhood of the project site, there are usually pollutant emitting activities contributing further to local air quality impacts. For most local scale projects, any emission sources in an area within 500m radius of the project site with notable impacts should be identified and included in an air quality assessment to cover the short-range contributions. In the exceptional cases where there is one or more significant sources nearby, the study area may have to be extended or alternative estimation approach employed to ensure these impacts are reasonably accounted for.

2.3 Background contributions

The above two types of emission contributions should account for, to a great extent, the air

quality impacts upon local air sensitive receivers, which are often amenable to estimation by the 'Gaussian Dispersion' type of models. However, a background air quality level should be prescribed to indicate the baseline air quality in the region of the project site, which would account for any pollution not covered by the two preceding contributions. The emission sources contributing to the background air quality would be located further afield and not easy to identify. In addition, the transport mechanism by which pollutants are carried over long distances (ranging from 1km up to tens or hundreds of kms) is rather complex and cannot be adequately estimated by the 'Gaussian' type of models.

3. Background Air Quality - Estimation Approach

3.1 The approach

In view of the difficulties in estimating background air quality using the air quality models currently available, an alternative approach based on monitored data is suggested. The essence of this approach is to adopt the long-term (5-year) averages of the most recent monitored air quality data obtained by EPD. These background data would be reviewed yearly or biennially depending on the availability of the monitored data. The approach is a first attempt to provide a reasonable estimate of the background air quality level for use in conjunction with EIA air quality assessment to address the cumulative impacts upon a locality. This approach may be replaced or supplemented by superior modelling efforts such as that entailed in PATH (Pollutants in the Atmosphere and their Transport over Hong Kong), a comprehensive territory-wide air quality modelling system currently being developed for Hong Kong. Notwithstanding this, the present approach is based on measured data and their long term regional averages; the background values so derived should therefore be indicative of the present background air quality. In the absence of any other meaningful way to estimate a background air quality for the future, this present background estimate should also be applied to future projects as a first attempt at a comprehensive estimate until a better approach is formulated.

3.2 Categorisation

The monitored air quality data, by 'district-averaging' are further divided into three categories, viz, Urban, Industrial and Rural/New Development. The background pollutant concentrations to be adopted for a project site would depend on the geographical constituency to which the site belongs. The categorisation of these constituencies is given in Section 3.4. The monitoring stations suggested for the 'district-averaging'(arithmetic means) to derive averages for the three background air quality categories are listed as follows:

Urban:	Kwun Tong, Sham Shui Po, Tsim Sha Tsui and Central/Western
Industrial:	Kwun Tong, Tsuen Wan and Kwai Chung

Rural/New Development: Sha Tin, Tai Po, Junk Bay, Hong Kong South and Yuen Long

The averaging would make use of data from the above stations wherever available. The majority of the monitoring stations are located some 20m above ground.

3.3 Background pollutant values

Based on the above approach, background values for the 3 categories have been obtained for a few major air pollutants as follows:

POLLUTANT	URBAN	INDUSTRIAL	RURAL / NEW DEVELOPMENT
NO ₂	59	57	39
SO ₂	21	26	13
O ₃	62	68	57
TSP	98	96	87
RSP	60	58	51

All units are in micrograms per cubic metre. The above values are derived from 1992 to 1996 annual averages with the exception of ozone which represent annual average of daily hourly maximum values for year 1996.

In cases where suitable air quality monitoring data representative of the study site such as those obtained from a nearby monitoring station or on-site sampling are not available for the prescription of background air pollution levels, the above tabulated values can be adopted instead. Strictly speaking, the suggested values are only appropriate for long term assessment. However, as an interim measure and until a better approach is formulated, the same values can also be used for short term assessment. This implies that the short term background values will be somewhat under-estimated, which compensates for the fact that some of the monitoring data are inherently influenced by secondary sources because of the monitoring station location.

Indeed, if good quality on-site sampling data which cover at least one year period are available, these can be used to derive both the long term (annual) and short term (daily / hourly) background values, the latter are usually applied on an hour to hour, day to day basis.

3.4 Site categories

The categories to which the 19 geographical constituencies belong are listed as follows:

DISTRICT	AIR QUALITY CATEGORY
Islands	Rural / New Development
Southern	Rural / New Development
Eastern	Urban
Wan Chai	Urban
Central & Western	Urban
Sai Kung	Rural / New Development
Kwun Tong	Industrial
Wong Tai Sin	Urban
Kowloon City	Urban
Yau Tsim	Urban
Mong Kok	Urban
Sham Shui Po	Urban
Kwai Tsing	Industrial
Sha Tin	Rural / New Development
Tsuen Wan	Industrial
Tuen Mun	Rural / New Development
Tai Po	Rural / New Development
Yuen Long	Rural / New Development
Northern	Rural / New Development

3.5 Provisions for 'double-counting'

The current approach is, by no means, a rigorous treatment of background air quality but aims to provide an as-realistic-as-possible approximation based on limited field data. 'Double-counting' of 'secondary contributions' may be apparent through the use of such 'monitoring-based' background data as some of the monitoring stations are of close proximity to existing emission sources. 'Primary contributions' due to a proposed project (which is yet to be realized) will not be double-counted by such an approach. In order to avoid over-estimation of background pollutant concentrations, an adjustment to the values given in Section 3.3 is possible and optional by multiplying the following factor:

$$(1.0 - E_{\text{Secondary contributions}}/E_{\text{Territory}})$$

where E stands for emission.

The significance of this factor is to eliminate the fractional contribution to background pollutant level of emissions due to 'secondary contributions' out of those from the entire territory. In most cases, this fractional contribution to background pollutant levels by the secondary contributions is minimal.

4. Conclusions

- 4.1 The above described approach to estimating the total air quality impacts of a proposed project, in particular the background pollutant concentrations for air quality assessment, should be adopted with immediate effect. Use of short term monitoring data to prescribe the background concentrations is no longer acceptable.

Appendix B-3

Guidelines on the Use of Alternative Computer Models in Air Quality Assessment

[The information contained in this Appendix is only meant to assist the Applicant in performing the air quality assessment. The Applicant must exercise professional judgment in applying this general information for the Project.]

1. Background

1.1 In Hong Kong, a number of Gaussian plume models are commonly employed in regulatory applications such as application for specified process licences and environmental impact assessments (EIAs). These frequently used models (as listed in Schedule 1 attached; hereafter referred to as Schedule 1 models) have no regulatory status but form the basic set of tools for local-scale air quality assessment in Hong Kong.

1.2 However, no single model is sufficient to cover all situations encountered in regulatory applications. In order to ensure that the best model available is used for each regulatory application and that a model is not arbitrarily applied, the project proponent (and/or its environmental consultants) should assess the capabilities of various models available and adopt one that is most suitable for the project concerned.

1.3 Examples of situations where the use of an alternative model is warranted include:

- (i) the complexity of the situation to be modelled far exceeds the capability of the Schedule 1 models; and
- (ii) the performance of an alternative model is comparable or better than the Schedule 1 models.

1.4 This paper outlines the demonstration / submission required in order to support the use of an alternative air quality model for regulatory applications for Hong Kong.

2. Required Demonstration / Submission

2.1 Any model that is proposed for air quality applications and not listed amongst the Schedule 1 models will be considered by EPD on a case-by-case basis. In such cases, the proponent will have to provide the followings for EPD's review:

- (i) Technical details of the proposed model; and
- (ii) Performance evaluation of the proposed model

Based on the above information, EPD will determine the acceptability of the proposed model for a specific or general applications. The onus of providing adequate supporting materials rests entirely with the proponent.

2.2 To provide technical details of the proposed model, the proponent should submit documents containing at least the following information:

- (i) mathematical formulation and data requirements of the model;
- (ii) any previous performance evaluation of the model; and
- (iii) a complete set of model input and output file(s) in commonly used electronic format.

2.3 On performance evaluation, the required approach and extent of demonstration varies depending on whether a Schedule 1 model is already available and suitable in simulating the situation under consideration. In cases where no Schedule 1 model is found applicable, the proponent must demonstrate that the proposed model passes the screening test as set out in USEPA Document "Protocol for Determining the Best Performing Model" (Ref. 1).

Ref.(1): William M. Cox, 'Protocol for Determining the Best Performing Model'; Publication No. EPA-454/R-92-025; U.S. Environmental Protection Agency, Research Triangle Park, NC.

2.4 For cases where a Schedule 1 model is applicable to the project under consideration but an alternative model is proposed for use instead, the proponent must demonstrate either that

- (i) the highest and second highest concentrations predicted by the proposed model are within 2 percent of the estimates obtained from an applicable Schedule 1 model (with appropriate options chosen) for all receptors for the project under consideration; or
- (ii) the proposed model has superior performance against an applicable Schedule 1 model based on the evaluation procedure set out in USEPA Document "Protocol for Determining the Best Performing Model" (Ref. 1).

2.5 Should EPD find the information on technical details alone sufficient to indicate the acceptability of the proposed model, information on further performance evaluation as specified in Sections 2.3 and 2.4 above would not be necessary.

2.6 If the proposed model is an older version of one of the Schedule 1 models or was previously included in Schedule 1, the technical documents mentioned in Section 2.2 are normally not required. However, a performance demonstration of equivalence as stated in Section 2.4 (i)

would become necessary.

- 2.7 If EPD is already in possession of some of the documents that describe the technical details of the proposed model, submission of the same by the proponent is not necessary. The proponent may check with EPD to avoid sending in duplicate information.

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* EPD is continually reviewing the latest development in air quality models and will update this Schedule accordingly.

Appendix C1

Criteria for Cultural Heritage Impact Assessment

(1) Baseline Study

1.1 A baseline study shall be conducted:

- a. to compile a comprehensive inventory of archaeological sites (including marine archaeological sites), historic buildings and structures within the proposed project area, which include:
 - (i) all sites of archaeological interest (including marine archaeological sites);
 - (ii) all pre-1950 buildings and structures;
 - (iii) selected post-1950 buildings and structures of high architectural and historical significance and interest; and
 - (iv) landscape features include sites of historical events or providing a significant historical record or a setting for buildings or monuments of architectural or archaeological importance, historic field patterns, tracks and fish ponds and cultural element such as *fung shui* woodlands and clan grave.
- b. to identify the direct and indirect impacts on the site of cultural heritage at the planning stage in order to avoid causing any negative effects. The impacts include the direct loss, destruction or disturbance of an element of cultural heritage, impact in its settings causing impinge on its character through inappropriate sitting or design, potential damage to the physical fabric of archaeological remains, historic buildings or historic landscapes through air pollution, change of ground water level, vibration, recreation pressure and ecological damage by the development. The impacts listed are merely to illustrate the range of potential impacts and not intended to be exhaustive.

1.2 The baseline study shall also include a desk-top study and a field evaluation.

1.3. Desk-top Study

- 1.3.1 Desk-top searches should be conducted to analyse, collect and collate extant information. They include but not limited to:

- a. Search of the list of declared monuments protected by the Antiquities and Monuments Ordinance (Chapter 53).
- b. Search of the list of deemed monuments through the Antiquities and Monuments Office (AMO) of the Leisure and Cultural Services Department.
- c. Search of the list of sites of cultural heritage identified by the AMO.
- d. Search of publications on local historical, architectural, anthropological, archaeological and other cultural studies, such as, Journals of the Royal Asiatic Society (Hong Kong Branch), Journals of the Hong Kong Archaeological society, Antiquities and Monuments Office Monograph Series and so forth.
- e. Search of other unpublished papers, records, archival and historical documents through public libraries, archives, and the tertiary institutions, such as the Hong Kong Collection and libraries of the Department of Architecture of the University of Hong Kong and the Chinese University of Hong Kong, Public Records Office, photographic library of the Information Services Department and so forth.
- f. Search of any other unpublished archaeological investigation and excavation reports kept by the AMO.
- g. Search of historical documents in the Public Records Office, the Land Registry, District Lands Office, District Office and the Hong Kong Museum of History and so forth.
- h. Search of cartographic and pictorial documents. Old and recent maps and aerial photos searched in the Maps and Aerial Photo Library of the Lands Department.
- i. Study of existing geological information (for archaeological desk-top research).
- j. Discussion with local informants.

1.4 Field Evaluation

1.4.1 The potential value of the project area with regard to the cultural heritage could be established easily where the area is well-documented. However, it does not mean that the area is devoid of interest if it lacks information. In these instances, a site visit combined with discussions with appropriate individuals or organisations should be conducted by those with expertise in the area of cultural heritage to clarify the position.

1.4.2 Historic buildings and structures survey

- a. Field scan of all the historic buildings and structures within the project area.
- b. Photographic recording of each historic building or structure including the exterior (the elevations of all faces of the building premises, the roof, close up

for the special architectural details) and the interior (special architectural details), if possible, as well as the surroundings of each historic building or structure.

- c. Interview with local elders and other informants on the local historical, architectural, anthropological and other cultural information related to the historic buildings and structures.
- d. Architectural appraisal of the historic buildings and structures.

1.4.3 Archaeological Survey

- a. A licence shall be obtained from the Antiquities Authority for conducting an archaeological survey. It takes at least two months to process the application.
- b. A detailed archaeological survey programme should be designed to assess the archaeological potential of the project area. The programme should clearly elaborate the strategy and methodology adopted, including what particular question(s) can be resolved, how the archaeological data will be collected and recorded, how the evidence will be analyzed and interpreted and how the archaeological finds and results will be organized and made available. Effective field techniques should also be demonstrated in the programme. The programme should be submitted to the AMO for agreement prior to applying for a licence.
- c. The following methods of archaeological survey (but not limited to) should be applied to assess the archaeological potential of the project area:
 - (i) Definition of areas of natural land undisturbed in the recent past.
 - (ii) Field scan of the natural land undisturbed in the recent past in detail with special attention paid to areas of exposed soil which were searched for artifacts.
 - (iii) Conduct systematic auger survey and test pitting. The data collected from auger survey and test pitting should be able to establish the horizontal spread of cultural materials deposits.
 - (iv) Excavation of test pits to establish the vertical sequence of cultural materials. The hand digging of 1 x 1 m or 1.5 x 1.5 m test pits to determine the presence or absence of deeper archaeological deposits and their cultural history.
 - (v) The quantity and location of auger holes and test pits should be agreed with the Antiquities and Monuments Office prior to applying for a licence.
 - (vi) A qualified surveyor should be engaged to record reduced levels and

coordinates as well as setting base points and reference lines in the course of the field survey.

- 1.4.4 If the field evaluation identifies any additional sites of cultural heritage within the study area which are of potential historic or archaeological importance and not recorded by AMO, the office should be reported as soon as possible.

1.5 The Report of Baseline Study

- 1.5.1 The study report should have concrete evidence to show that the process of the above desk-top and field survey has been satisfactorily completed. This should take the form of a detailed inventory of the sites of cultural heritage supported by full description of their cultural significance. The description should contain detailed geographical, historical, archaeological, architectural, anthropological, ethnographic and other cultural data supplemented with illustrations below and photographic and cartographic records.

1.5.2 Historic Buildings and Structures

- a. A map in 1:1000 scale showing the boundary of each historic building or structure.
- b. Photographic records of each historic building or structure.
- c. Detailed record of each historic building or structure including its construction year, previous and present uses, architectural characteristics, as well as legends, historic persons and events, and cultural activities associated with the structure.

1.5.3 Archaeological Sites

- a. A map showing the boundary of each archaeological site as supported and delineated by field walking, augering and test-pitting;
- b. Drawing of stratigraphic section of test-pits excavated which shows the cultural sequence of a site.
- c. Reduced levels, coordinates, base points and reference lines should be clearly defined and certified by a qualified surveyor.
- d. *Guidelines for Archaeological Reports* should be followed (Appendix C2).

- 1.5.4 A full bibliography and the source of information consulted should be provided to assist the evaluation of the quality of the evidence. To facilitate verification of the accuracy, the AMO will reserve the right to examine the full details of the research materials collected under the baseline study.

1.6 Finds and Archives

1.6.1 Archaeological finds and archives should be handled following *Guidelines for Handling of Archaeological Finds and Archives* (Appendix C3).

(2) Impact Assessment

2.1 Culture heritage impact assessment must be undertaken to identify the impacts of the sites of cultural heritage which will be affected by the proposed development subject to the result of desktop research and field evaluation. The prediction of impacts and an evaluation of their significance must be undertaken by an expert in cultural heritage. During the assessment, both the direct impacts such as loss or damage of important features as well as indirect impacts such as change of ground water level which may affect the preservation of the archaeological and built heritage in situ should be stated. A detailed description and plans should be provided to elaborate to what extent the site of cultural heritage will be affected.

2.2 Preservation in totality must be taken as the first priority. Please refer to paragraph 4.3.1(c), item 2 of Annex 10, items 2.6 to 2.9 of Annex 19 and other relevant parts of the Technical Memorandum on Environmental Impact Assessment Process for the detailed requirements of the impact assessment.

(3) Mitigation Measures

3.1 It is always a good practice to recognise the site or monument early in the planning stage and site selection process, and to avoid it, i.e. preserve it in-situ, or leaving a buffer zone around the site. Built heritage, sites and landscapes are to be in favour of preservation unless it can be shown that there is a need for a particular development which is of paramount importance and outweighs the significance of the heritage feature.

3.2 If avoidance of the cultural heritage is not possible, amelioration can be achieved by reduction of the potential impacts and the preservation of heritage features, such as physically relocating it. Measures like amendments of the sitting, screening and revision of the detailed design of the development are required to lessen its degree of exposure if it causes visual intrusion to the cultural heritage and affecting its character.

3.3 All the assessments should be conducted by an expert in cultural heritage and further evaluated and endorsed by the AMO and the Antiquities Advisory Board.

- 3.4 Please refer to paragraph 4.3.1(d), items 2.10 to 2.14 of Annex 19 and other relevant parts of the Technical Memorandum. Proposals for mitigation measures should be accompanied with a master layout plan together with all detailed treatment, elevations, and landscape plan. A rescue programme, when required, may involve preservation of the historic building or structure together with the relics inside, and its historic environment through relocation, detailed cartographic and photographic survey or preservation of an archaeological site “by record”, i.e. through excavation to extract the maximum data as the very last resort.
- 3.5 The programme for implementation of agreed mitigation measures should be able to be implemented. It is to be clearly stated in the EIA report, as required in Annex 20 of the Technical Memorandum. In particular, item 6.7 of Annex 20 requires to define and list out clearly the proposed mitigation measures to be implemented, by whom, when, where, to what requirements and the various implementation responsibilities. A comprehensive plan and programme for the protection and conservation of the partially preserved Site of Cultural Heritage, if any, during the planning and design stage of the proposed project must be detailed.

Appendix C2

Guidelines for Archaeological Reports

I. General

1. All reports should be written in a clear, concise and logical style.
2. The reports should be submitted in A4 size and accompanying drawings of convenient sizes.
3. Draft reports should be submitted to the Antiquities and Monuments Office (AMO) for comments within two months after completion of archaeological work unless otherwise approved by AMO.
4. The draft reports should be revised as required by AMO and relevant parties. The revised reports should be submitted to AMO within three weeks after receiving comments from AMO and relevant parties.
5. At least 3 hard copies of the final reports should be submitted to AMO for record purpose.
6. At least 2 digital copies of the final reports in both Microsoft Word format and Acrobat (.PDF) format without loss of data and change of appearance compared with the corresponding hard copy should be submitted to AMO. The digital copies should be saved in a convenient medium, such as compact discs with clear label on the surface and kept in protective pockets.

II. Suggested Format of Reports

1. Front page:
 - Project/Site name
 - Nature of the report
e.g. (Draft/Final)
Archaeological Investigation/Survey Report
Archaeological Impact Assessment Report
Watching Brief Report
Rescue Excavation Report
Post-excavation Report
 - Organization
 - Date of report
2. Contents list
Page number of each section should be given.
3. Non-technical summary (both in English and Chinese with not less than 300 words each)
This should outline in plain, non-technical language, the principal reasons for the archaeological work, its aims and main results, and should include reference to authorship and commissioning body.
4. Introduction
This should set out background leading to the commission of the reports. The location, area, scope and date of conducting the archaeological work must be given. The location of archaeological work should be shown on maps in appropriate scales and

with proper legends.

5. Aims of archaeological work
These should reflect the aims set in the project design.
6. Archaeological, historical, geological and topographical background of the site
Supporting aerial photos and maps (both old and present) in appropriate scales, with proper legends and with the site locations clearly marked on should be provided.
7. Methodology
The methods used including any variation to the agreed project design should be set out clearly and explained as appropriate.
8. Result
This should outline the findings, known and potential archaeological interests by period and/or type. Their significance and value with reference/inclusion of supporting evidence should be indicated. For impact assessment, the likely effect of the proposed development on the known or potential archaeological resource should be outlined.
9. Conclusion
This should include summarization and interpretation of the result.
10. Recommendation
Recommendations on further work and the responsible party as well as a brief planning framework should be outlined.
11. Reference and bibliography
A list of all primary and secondary sources used should be given. Director and members of the archaeological team and author of the report should be listed.
12. Supporting illustrations
They should be clearly numbered and easily referenced to the text. They should be scanned and saved in TIFF or JPEG formats.

A. Maps

Archaeological work locations, such as auger hole and test pit locations (with relevant coordinates certified by a qualified surveyor), should be clearly shown on maps in appropriate scales, with proper legends, grid references (in 8 digits) and captions.

B. Drawings of test pits, archaeological features and finds

The below scales should be followed:

Cross section and profile drawings of test pits	1:20
Archaeological feature drawings	1:10
Finds drawings	1:1

If drawings of the above stated scales are not appropriate to be incorporated into the report under certain occasions, reduced copy of the drawings with the same scales are acceptable. Proper captions, legends and indication of reduced

size should be given.

C. Photos of site and finds

All photos should be at least in 3R size with proper captions and scales. They should be clearly numbered and easily referenced to the text. They should be scanned and saved in TIFF or JPEG formats.

13. Supporting data in appendices

These should consist of essential technical details to support the result. These may include stratigraphy record of test pits and auger holes, record of general and special finds discovered with description, quantity and context number/stratigraphical sequence, index of field archives.

14. Comment and Response

All comments and responses from AMO and relevant parties should be attached.

III. Green Measures

1. All reports should be of single line spacing and printed on both sides of the paper.
2. Excessive page margins should be avoided. A top/bottom margin of 2 cm and left/right margin of 2.5 cm are sufficient.
3. Use of blank paper should be avoided as far as possible.
4. Suitable font type of font size 12 should be used generally in balancing legibility and waste reduction objective.

Appendix C3

Guidelines for Handling of Archaeological Finds and Archives

I. General

1. Site Code

The Licensee should contact the Central Archaeological Repository (CAR) of the Antiquities and Monuments Office (AMO) [Contact Person: Mr. Michael TANG, Tel: 2384 5446; Email: mkstang@lcsd.gov.hk] about the allocation of site code before the commencement of the project to avoid duplicate of site code assignment.

II. Archaeological Finds

2. Cleaning

Every excavated finds should be properly cleaned before handing over to the CAR of the AMO.

3. Marking

- All the excavated finds should be cleaned before marking object number.
- “Sandwich” technique¹ should be adopted for marking permanent identification number on an object.
- Every special finds should be marked with site code, context number and object number, etc.
- All representative samples collected from general finds should be marked.
- For the finds which is too small, has unstable surface, or leather, textiles or wood, it should not be marked/labeled directly and should be bagged separately or attached with tags by tying. The tag should contain information about the object number, context number and site code, etc.

4. Labeling and bagging

- A label should be attached on each bag.
- Information about the object number, context number, test-pit number, site code and bag number should be stated clearly on the label.
- Finds excavated within the same context should be bagged together. However, if they have been categorized according to their types, materials or characteristics, separate

¹ *Steps for “Sandwich” technique*

1. First of all, the object should be marked in appropriate area and size that does not impact important diagnostic or aesthetic parts of the object.
2. Clean the area to be marked.
3. Apply a thin coat of clear reversible lacquer on the area. Use white lacquer if the object is dark in colour. Let the base coat dry completely.
4. Use a permanent water-based ink to write the object number on top of the base coat. Let ink dry completely.
5. Apply a top coat of clear varnish.
6. Let the marking dry completely before packing.

bagging is required.

5. Conservation
 - To refit and reconstruct pottery vessels by appropriate adhesive. A heat and waterproof adhesive, e.g. product of H. Marcel Guest Ltd., is recommended.
 - Any adhesives which are not reversible or will damage artefacts, e.g. the pottery vessel should not be applied on the finds.
6. Finds register

A clear finds register with information about the finds description, quantity, form, weight, dimensions and field data should be prepared for handover to the CAR.

III. Field Archives and Laboratory Records

7. Field archives include field dairy, context recording sheet, special finds recording sheet, soil sample/sample recording sheet, map, survey sheet and video/visual records etc. Laboratory records also form part of the archaeological archives, which include finds processing record, conservation record, finds drawings and photos, records of typological analysis and objects card etc.
8. All the aforesaid archives should be handed over to the CAR after the compilation of the excavation report. Attention should be drawn to the followings:
 5. All the field archives should be submitted together with their indexes.
 6. The video footage should be submitted together with a detailed script introducing the content of the video record.
 7. All the slides, colour/black & white negatives and digital photographs should be submitted together with their contact prints and indexes.

Handover of Finds

9. Packing
 - Every special finds should be protected with tissue paper, bubble sheet or P.E. foam with shock-proofed packing. No packing material other than the aforesaid items should be used.
 - All the general finds should be stored in heavy duty plastic container with shock-proofed packing.
 - The heavy duty plastic container, e.g. product of the Star Industrial Co., Ltd. (No. 1849 or 1852), is recommended.
 - For oversized finds, prior advice on packing method should be sought from the AMO.
10. Handover procedure
 - The Licensee should arrange to transport the finds and archives to the CAR upon the completion of the finalized excavation report.
 - Separate handover forms for finds and archives should be signed by the representatives of the Licensee and the AMO.

