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# Tseung Kwan O Development
# TKO Town Centre North - Roads, Bridge & Subways
# Contract No. TK 39/93

# Environmental Impact Assessment

## Final Report

MAY 1995

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CONSULTANTS ASIA LTD.
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# Environmental Impact Assessment

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# Tseung Kwan O Development
# TKO Town Centre North - Roads, Bridge & Subways
# Contract No. TK 39/93

# Environmental Impact Assessment

## 1 INTRODUCTION

### 1.1 Background

1.1.1 The concepts for developing the Town Centre area at Tseung Kwan O (TKO) and a recommended highway layout were originally defined in the Tseung Kwan O Feasibility Study of Opportunities for Further Development in 1990. Environmental assessments were undertaken as part of the study and recommendations were made for the development within the area.

1.1.2 Since 1990 details of the development of the area to the north of the town centre have been evolved and a detailed design for the highway network in the area has been prepared under TKO Development Contract No. TK 39/93. Detailed planning of developments in the area has also been undertaken in Planning Areas 55, 56, 57 and 59.

1.1.3 Minor changes have also been made to the highway layout and traffic forecasts in the area have changed due to different development assumptions. A scheme for housing development in Area 59 has also been prepared by Housing Department and is in the final stages of preparation. This scheme involves the provision of noise barriers which would entail substantial construction works and be costly to implement as drainage works have already been completed in the area.

1.1.4 A separate Environmental Impact Assessment (EIA) has now been conducted in response to an Environmental Review completed in May 1994 and as part of the impact assessment for the new Road P2 on the said housing development. It also provides information on the nature and extent of potential environmental impacts in relation to the construction and future operation of the highway network within the area covered by TKO Development Contract No. TK 39/93.

1.1.5 This report examines the environmental conditions arising from the construction and operation of the roads under TKO Development Contract No. TK 39/93. It also recommends practical noise mitigation measures to ensure that noise levels within the area will not exceed the required environmental standards and guidelines for the Territory.

## 1.2 Objectives

1.2.1 The objectives of the EIA are to identify any adverse environmental conditions. The noise and air quality impacts in the Town Centre North area within TKO are to be considered.

1.2.2 The environmental conditions prevailing within the area should comply with the environmental planning guidelines and where these standards are exceeded recommendations should be made to ensure compliance with the standards.

1.2.3 High noise barriers have been recommended as part of mitigatory measures to reduce the impact of traffic noise in Area 59. These will be difficult to construct due to the underlying drainage culverts and alternative measures to provide the same protection should therefore be investigated. The most appropriate measures of limiting the impact of road traffic noise, to the noise standards given in the Hong Kong Planning Standards & Guidelines, should be determined.

## 1.3 Scope and Location of Study

1.3.1 TKO Development Contract No. TK 39/93 comprises the area to the north of the proposed Tseung Kwan O Town Centre. The area covered by the study is shown in Figure 1 and includes Planning Area 59, and parts of Planning Areas 55, 56 and 57 which are bounded by Roads P2 and D1. Outside of Roads P2 and D1 the Haven of Hope Sanatorium is the only existing building in the vicinity.

1.3.2 The wider environmental issues relating to the development of TKO New Town have already been assessed as part of the Feasibility Study of Opportunities for Further Development and no adverse environmental issues, apart from traffic related impacts, within the area covered by this study were identified. Development of the area to the north of the Town Centre does not give rise to new environmental issues, nor will the development be adversely affected by developments in adjacent areas. The assessments are therefore limited to assessing the environmental impacts due to road traffic and construction.

## 1.4 Approach

1.4.1 The noise assessment includes two different parts of impact analysis, each part having different assumptions and assessment criteria. The first part examines the impact of traffic noise on the existing and future developments adjacent to the proposed highway network. The second part investigates the likely noise impact on existing developments due to the construction activities of the relevant proposed highways.

1.4.2 Assessment of the impact on air quality arising from traffic using the proposed highways, and the effect on the adjacent development has similarly been assessed. Predictions of pollutants have been calculated using a line source dispersion computer model.

## 1.5 Structure of Report

1.5.1 This section briefly describes the context of the study and the general approach. A description of the study area and locations of the noise sensitive receivers is included in Section 2. The assumptions and assessment criteria for noise evaluations are described in Section 3. Section 4 describes the impact of road traffic noise and Section 5 describes the impact of noise arising from construction activities. Section 6 describes the assessment criteria and assumptions adopted for modelling air quality and Section 7 describes the impact of road traffic on air quality. Section 8 describes the impact of construction activities on air quality. Section 9 makes recommendations for monitoring and auditing. A summary of the main conclusions and recommendations is given in Section 10. A summary of the comments on the EIA draft final report and the corresponding responses is given in Appendix 6.

# 2 THE STUDY AREA

## 2.1 General

2.1.1 The study area comprises the northern part of TKO Town Centre where it is proposed to build residential developments, schools, a commercial centre and other Government, Institutional and Community buildings. TKO Development Contract No. TK 39/93 will provide the necessary highway network to access this area from the existing TKO highway network. It provides for the construction of Road P2, from the existing Road P1 to the proposed roundabout junction with Road L463, Road D1 from Road P2 to Road L463, Road L463, Road L464 and the sections of Roads L461 and L462 north of Road L464. The roads are shown on Figure 1.

2.1.2 The roads proposed under Contract No. TK 39/93 are the first stage of the highway network in the proposed Town Centre area of TKO. As development of the New Town proceeds Roads P2 and D1 will become strategic links within the TKO road network and will carry substantial volumes of traffic in the peak periods. The main environmental impact will therefore arise, not upon development of the town centre north area, but upon the full development of the TKO New Town area.

2.1.3 Full development is assumed to have taken place by 2011. The assessments therefore take into consideration conditions assuming that the TKO New Town area is fully developed.

2.1.4 The selection of sensitive receivers has been made following the guidelines set out in the Hong Kong Planning Standards and Guidelines (HKPSG) for road traffic noise assessment and air quality assessment. The locations which will be most affected by noise and air pollution have been derived using building layout plans for the proposed developments and are outlined in the following sections. Receivers for noise assessments have been selected on facades which have opening windows. For the air quality assessment, receptors have been assumed at the point on the buildings closest to the source of pollution.

## 2.2 Identification of Sensitive Receivers in Area 59

2.2.1 Roads P2 and D1 will be the most heavily trafficked roads in the area upon full development of TKO New Town. Within Area 59 those premises likely to be most affected are the schools adjacent to Road P2 and the residential blocks which face Roads P2 and D1. Facades which face onto Road L463, which runs from east to west between Roads P2 and D1, will be less affected due to the lower traffic flows. The impact from Road L463 will also be reduced as the facades on the residential blocks closest to the road will not be noise sensitive and other sensitive facades will be partially screened.

2.2.2 Residential blocks within the central part of Area 59 will be shielded from excessive road traffic noise by blocks located around the outside of the area. The distance from the roads will also be greater and therefore the impact of noise and pollution from traffic will be lower than that on blocks located around the perimeter of the site.

2.2.3 Other buildings proposed within Area 59 are a commercial centre, housing for senior citizens and a neighbourhood community centre. The layout of these buildings have not yet been finalised but it is understood that no sensitive facades would be located to face the adjacent highways.

## 2.3 Sensitive Receivers in Area 57

2.3.1 The latest available information shows proposals for 3 residential towers and two schools. The residential towers will, in the main, be subject to traffic noise from Road P2 and the schools will be affected by traffic noise from Roads L463 and L462.

## 2.4 Sensitive Receivers in Area 56

2.4.1 Current proposals are for Area 56 to be developed with GIC uses and 3 schools. It is planned for a recreational centre and telephone exchange to be sited along Road L463. Neither of these buildings will be sensitive to traffic using Road L463. Only the schools which abut Roads L461, L462 and L464 will be sensitive to road traffic noise.

## 2.5 Sensitive Receivers in Area 55

2.5.1 Two schools which are currently proposed in Area 55 face onto Road L461. The eastern portion of the site adjacent to Road D1 has been zoned for residential development under the Private Sector Participation Scheme. Detailed proposals for the site have not yet been evolved but residential towers will be subject to traffic noise from Roads D1 and L463.

## 2.6 Sensitive Receivers in Other Areas

2.6.1 The area to the northeast of Road D1 and to the northwest of Road P2 are not to be developed but will become a Town Park and Countryside Conservation Area respectively. There will not be any noise sensitive development in these areas.

2.6.2 Area 74 has been zoned as rental housing estate. The proposed layout plan for this area has yet to be developed. Any sensitive development close to the proposed Road P2 should take into consideration of the noise impact from the adjacent road network.

2.6.3 The Haven of Hope Sanatorium is located to the north and west of Road P2 and comprises a number of low storey buildings. These buildings are the only existing premises within the area which are likely to be affected by traffic using roads to be constructed under TKO Development Contract No. TK 39/93. The sanatorium is currently undergoing re-development and it is understood that air-conditioning will be provided for the re-development.

## 2.7 Identification of Sensitive Receivers During Construction Works

2.7.1 The only properties likely to be affected by the construction of roads under Contract No. TK 39/93 will be the Haven of Hope Sanatorium. The earliest developments proposed in Areas 55, 56, 57 and 59 are not due to be occupied until after the roadworks are completed.

2.7.2 A flyover across the Road P2/Road L463 roundabout junction is proposed for 2003 but does not form part of the TK 39/93 Contract works. It is not expected that construction of the flyover will result in unreasonable noise levels and an assessment at the current time is not considered to be necessary.

# 3 ASSUMPTIONS AND ASSESSMENT CRITERIA FOR NOISE EVALUATIONS

## 3.1 General

3.1.1 The assumptions and assessment criteria which have been adopted for the noise assessments are outlined in the following context. Different criteria apply for assessments of road traffic noise and construction noise.

## 3.2 Traffic Flow Assumptions

3.2.1 The noise assessments have been prepared using traffic flow forecasts for the am peak period in 2011 and are considered to be representative of the highest hourly flows which are likely to be experienced in the area within the first 15 years following the opening of the roads. It has been agreed that the forecasts should be taken from the traffic model prepared for the Engineering Feasibility Study of Development of Tseung Kwan O Area 137 which was conducted in 1992/93.

3.2.2 The traffic forecasts assume that TKO will be fully developed by 2011 with a population of 333,000 with 100,000 employment places. The development potential is now projected to increase to a total population of 382,000 in 2011. This would result in increasing the traffic flows on Roads D1 and P2 by approximately 10%.

## 3.3 Assessment Criteria for Road Traffic Noise

3.3.1 The criteria used to assess the impact of traffic noise on developments are defined in the Hong Kong Planning Standards Guidelines (HKPSG). Chapter 9, Environment, defines maximum noise levels which are permitted for different forms of development to minimise disturbance to occupants. Table 1 states the guideline noise levels for the various forms of development which have been adopted for the noise assessments conducted for this study. The standards apply to building facades with openable windows at a point 1 metre in front of the window.

**TABLE 1 NOISE ASSESSMENT CRITERIA**

| Property | Noise Level dB(A) $L_{10}$ (1-hour) |
|---|---|
| **Residential Dwellings** | 70 |
| **Hotel and Hostels** | 70 |
| **Offices** | 70 |
| **Technical Institutes, Schools and Clinics** | 65 |
| **Hospitals** | 55 |

3.3.2 Traffic noise levels have been calculated in accordance with the methodology defined in the Calculation of Road Traffic Noise (CRTN), 1988 Edition, published by the UK Department of Transport. This is the methodology accepted for use in Hong Kong.

3.3.3 The traffic data which has been used in the assessments is shown on Figure 2. Predicted traffic flows in 2011 are considered to be representative of prevailing conditions within the 15 year period following the opening of the roads. The forecasts assume that TKO New Town will be fully developed and reflects conditions in the long term. The highest traffic flows occur in the am peak period and these have been adopted in the assessments.

3.3.4 The likely increase in traffic noise on Roads D1 and P2 due to the possible increase in the total population to 382,000 would only be in the order of 0.4dB(A). Such increase is not considered to be significant.

3.3.5 The proportions of heavy vehicles which will use each link have been derived from CTS-2 forecasts. Heavy vehicles are defined as vehicles exceeding 1525 kg unladen weight as recommended in CRTN.

3.3.6 Traffic speeds adopted for the assessments are also shown on Figure 2. These have generally been determined from the following road types as follows:

| | |
|---|---|
| Primary Distributors | 70 kph |
| District Distributors | 50 kph |
| Local & other roads | 50 kph |

3.3.7 Forecasts from the TKO Area 137 traffic model show that only a low traffic volume will use the slip road between Road P2 and Road D1. The assessments have used traffic data derived from earlier model results which are considered to be more representative for this link.

3.3.8 It is desirable to protect buildings subject to adverse traffic noise by direct mitigation measures located away from the premises. Where it is not feasible to reduce the noise to acceptable levels, noise insulation of properties may be considered. Insulation of properties, in general, should only be considered where other means of mitigating the effects of noise are unsuitable.

3.3.9 New developments are required to demonstrate that an acceptable environment can be achieved within the building. For existing residential properties which are adversely affected by road traffic noise arising from new highway schemes noise insulation of the property may be considered. To qualify for noise insulation the following criteria for residential properties must be met:

(i) The combined expected maximum traffic noise level i.e. the relevant noise level from the new or altered highway together with other traffic in the vicinity must not be less than 70 dB(A) $L_{10}$ (1-hour)

(ii) The relevant noise level must be at least 1.0 dB(A) $L_{10}$ (1-hour) more than the total traffic noise level existing before the works to construct or improve the highway were begun

(iii) The contribution to the increase in the relevant noise level from the new or altered highway must be at least 1.0 dB(A) $L_{10}$ (1-hour).

## 3.4 Assessment Criteria for Construction Noise

3.4.1 With the exception of percussive piling works there are no statutory controls to limit construction noise during the day-time period other than on Sundays and public holidays. Current practice recommended by Environmental Protection Department (EPD) is that noise levels from construction sites at sensitive facades should not exceed 75 dB(A) $L_{eq}$ (30 min) for residential buildings.

3.4.2 Noise levels at sensitive facades were assessed using the methodology and procedures defined in the "Technical Memorandum on Noise from Construction Work other than Percussive Piling". Reference was also made to the publication "A Practical Guide for the Reduction of Noise from Construction Works", EPD July 1991 and British Standard BS 5228 Part 1, 1984 "Noise Control on Construction and Open Sites".

3.4.3 The impact of construction noise has been assessed by considering the likely construction activities associated with the highway works for TKO Development Contract No. TK 39/93. Outside the normal working period, i.e. between 1900 and 0700 and all day on general holidays (including Sundays), the control of construction noise is governed by the Noise Control Ordinance (NCO). A construction noise permit obtained prior to work being undertaken outside normal working hours is required.

# 4 IMPACT ASSESSMENT OF ROAD TRAFFIC NOISE

## 4.1 General

4.1.1 The facades which will be affected by road traffic noise in the TK 39/93 Contract area have been outlined in Section 2. Noise levels have been calculated for affected facades assuming that the buildings do not have the benefit of noise mitigation measures. Measures to ameliorate the effects of noise to achieve the guidelines set out in the HKPSG are subsequently described together with their effects.

4.1.2 Planning and detailed layouts for Area 59 are at an advanced stage and it has been possible to conduct a detailed assessment in this area. Layouts for other areas are less advanced and are likely to change. The assessment of the impact in these other areas has been conducted to determine the general impact of road traffic noise on the development and identify problems likely to arise with the layouts as currently proposed. Where appropriate, mitigating measures are given for guidance to assist in the further development of each area. Detailed assessments for each area should be carried out to ensure the layouts and site details will comply with the guidelines for road traffic noise before finalising the development plan.

## 4.2 Assessment without Noise Mitigation Measures (Do Nothing Scheme)

4.2.1 The predicted noise levels for various floors for the facades which will be most affected by road traffic noise are given on Drawing 60493/04/1C. The main effects are described below.

***Schools in Area 59***

4.2.2 The standard school layout comprises a main classroom block, a hall and a special classroom block which extends for the full height of the building on secondary schools. The hall and special classroom block are joined to the main classroom block. The sensitive facades are the plane elevations of the classroom block and the walls of the special classroom blocks. The facade between the hall and special classroom block contains an open corridor from which doors lead into the classrooms.

4.2.3 Noise levels have been calculated for facades at critical locations on the three schools proposed in Area 59. Without any noise mitigation measures the schools within Area 59 will experience noise levels at the sensitive classroom facades which exceed 74 dB(A) $L_{10}$ (1-hour) at Facades 51 and 54 on Schools PS2 and SS1 respectively. The noise is generated by traffic using Road P2 and significantly exceeds the HKPSG standard for classrooms within schools of 65 dB(A) $L_{10}$ (1 hour).

4.2.4 All receivers would be expected to experience noise levels in excess of 70 dB(A) with the exception of Facade 52 which is partially screened by the halls of the two primary schools. Mitigation measures will therefore be required to achieve acceptable noise levels at all three schools.

4.2.5 The classrooms which face away from Road P2 will not be subject to traffic noise from Road P2. School PS2 is located close to the slip road from Road P2 to Road D1. Although it is partly shielded by the residential tower blocks it suffers the noise impact from the slip road and Road D1. The highest noise level on Facade 44 is predicted to be 68.4 dB(A) $L_{10}$ (1-hour) exceeds the HKPSG standard for schools.

***Residential Units in Area 59 Facing Road P2***

4.2.6 Residential blocks A, 3, 5 & 9 will be affected by road traffic noise from Road P2. Representative facades with windows which face onto Road P2 have been selected for assessment as shown on Drawing 60493/04/1C. Facades 515 and 516 typically represent conditions which are likely to be experienced for those dwellings which face towards Road P2.

4.2.7 Predicted noise levels at the lower floors will be within the guideline noise level of 70 dB(A) $L_{10}$ (1-hour) for residential properties. This is due to the shielding effects of the school buildings. It is predicted that the noise levels from the 12th floor would generally exceed the 70 dB(A) $L_{10}$ (1-hour) guideline value. The highest sound levels would be experienced around the 23rd floor on Facade 516 where the guideline value would be exceeded by nearly 2 dB(A) $L_{10}$ (1-hour).

***Residential Units Facing the Slip Road Between Road P2 and Road D1***

4.2.8 Blocks A, B and C, located in the north part of the site, will be subject to noise generated from Road P2, the Road P2 to Road D1 slip road and Road D1. Facades 18, 19, 20, and 517 will be subject to the highest noise levels and dwellings on most floors may be expected to experience noise levels greater than 70 dB(A) $L_{10}$ (1-hour).

***Residential Units in Area 59 Facing Road D1***

4.2.9 Facades 20 to 25 will be representative of units in Blocks C, E and 6 which face onto Road D1. The highest noise levels are predicted to occur at Facade 23A which directly faces Road D1.

4.2.10 Road P1 is approximately 300 metres away from the housing towers and the contribution of traffic noise from Road P1 has not generally been included for the receivers facing Road D1. In general traffic noise from Road P1 will increase noise levels at facades by between 0.5 and 1.0 dB(A) $L_{10}$ (1-hour). The critical facade along Road D1 is Facade 23A for which the stated noise levels on Drawing 60493/04/1C include noise generated from Road P1.

4.2.11 The highest noise levels at Facade 23A are predicted to be 72.8 dB(A) $L_{10}$ (1-hour). At other facades along Road D1 noise levels, excluding any contribution from Road P1, do not exceed 71.5 dB(A) $L_{10}$ (1-hour). It is concluded that mitigating measures will be required to avoid future noise levels exceeding the HKPSG standard of 70 dB(A) $L_{10}$ (1-hour) for residential dwellings.

***Residential Units in Area 59 Facing Road L463***

4.2.12 The residential blocks in Area 59 located along Road L463 will have blank facades facing Road L463 and therefore these facades will not be sensitive to road traffic noise. Noise levels at Facades 26 and 30 will be representative of noise levels which will be experienced by dwellings which have aspects onto Road L463. Noise levels at Facade 30 (Block 9) are predicted to increase to 72 dB(A) $L_{10}$ (1-hour) and will be higher than other facades facing Road L463 due to traffic noise from Road P2.

***Commercial Building in Area 59***

4.2.13 The commercial building located along Road L463 will not accommodate noise sensitive activities. The commercial building will not therefore be adversely affected by road traffic noise generated from Road L463.

***Other Buildings in Area 59***

4.2.14 Buildings providing housing for senior citizens (HSC) and community facilities (NCC) are also located alongside Road P2 in the southeast area of the site. Detailed planning of these buildings has not yet been finalised. The close proximity of the buildings to Road P2 will cause noise levels on the facades facing Road P2 to exceed noise levels recommended in HKPSG and facade noise levels are predicted to be between 75 and 80 dB(A) $L_{10}$ (1-hour). Based on the current proposed building layout plans for the NCC and HSC developments, noise sensitive uses, such as bedrooms will not be located with sensitive facades facing Road P2. Therefore, these two buildings are not considered to be noise sensitive.

***Area 57***

4.2.15 Area 57 is located to the south of Area 59, adjacent to Road P2. Detailed plans for development of the area have been approved by the Housing Authority Building Committee. Part of the area beside Road P2 has been zoned for residential use. Noise levels have been assessed using the latest available layouts.

4.2.16 A car park, with a Youth Centre and Convenience Store at ground floor, is proposed in the north west corner of the site. No sensitive uses will face Road P2. The building will provide some screening to the lower floors of the residential blocks proposed in Area 57.

4.2.17 Noise levels on the residential blocks are predicted to exceed the noise levels recommended in HKPSG. At Block 1 (Facade 58) noise levels of up to 74 dB(A) $L_{10}$ (1-hour) are predicted. Noise mitigation measures will therefore be required to reduce noise levels for facades facing Road P2.

4.2.18 Two schools are proposed along Road L462 in Area 57. The classrooms will be shielded from Road P2 by the residential towers and car park. These schools will however be subject to traffic noise from Roads L463 and L462. Noise levels along the rear facade of the classroom block, are predicted to exceed 65 dB(A) $L_{10}$ (1-hour) without any mitigating measures. Noise levels along the front facade will also exceed the HKPSG standard for schools due to the close proximity to Road L462.

*Area 55*

4.2.19 Area 55 is located to the south of Area 59 and bounded by Road D1. Detailed plans for development of the area have not yet been finalised but the eastern part of the site facing Road D1 has been zoned for residential use. Facade 29 represents a typical high rise residential block set back 40 metres from the carriageway and maximum noise levels of 72.2 dB(A) $L_{10}$ (1-hour) are predicted around the 10th floor level. These values are conservative as they have not assumed any traffic noise contributed from Road P1. It is predicted that an additional 0.5 to 1 dB(A) $L_{10}$ (1-hour) would be added to the noise levels shown on Drawing 60493/04/1 due to traffic using Road P1.

4.2.20 Two primary schools are currently planned along the western side of Area 55 facing Road L461. Preliminary assessments indicate that noise levels will exceed the maximum noise levels recommended in HKPSG by around 3 dB(A) $L_{10}$ (1-hour). The highest noise levels will occur on the facades closest to Road L463.

*Area 56*

4.2.21 Area 56 is not zoned for residential development but will mainly accommodate Government, Institutional and Community buildings. Current proposals indicate a recreation centre and 3 schools. Only the schools in Area 56 will be sensitive to road traffic noise.

4.2.22 A preliminary layout for the proposed schools is shown in Drawing No. 60493/04/1C. The preliminary assessments indicate that noise levels at the sensitive facades would exceed the HKPSG standards by about 1 to 2 dB(A).

*Haven of Hope Sanatorium*

4.2.23 The Haven of Hope Sanatorium comprises a number of low rise buildings. Noise levels have been calculated at the three facades which are most likely to be affected by road traffic noise. Representative noise levels for these low rise buildings have been calculated at a height of 1 metre above ground level for the ground floor and 3.7 metres above ground for buildings with an upper storey.

4.2.24 Facade 41 is an administration building and Facade 43 is a residential home. At both buildings the noise levels are not predicted to exceed the HKPSG standard of 70 dB(A) $L_{10}$ (1-hour) for their respective uses.

4.2.25 Facade 42 is a single storey hospital ward which faces Road D1 and Trunk Road T1. A facade noise level of 63.2 dB(A) $L_{10}$ (1-hour) is predicted at this location which exceeds the HKPSG standard of 55 dB(A) $L_{10}$ (1-hour) for a hospital ward.

*Area 74*

4.2.26 Area 74 is currently being zoned as rental housing (RS). Detailed layout plan for this area has yet to be developed. As far as traffic noise impact is concerned, the sensitive facades facing Road P2 at a distance of 30 metres from the edge of the northbound carriageway would be expecting the similar noise levels as in Area 57, i.e. in the order of 73 to 74 dB(A)$L_{10}$ (1-hour). A separate impact assessment should be conducted in the preparation of the master layout plan for this housing estate to ensure that the planning guidelines for the environmental consideration can be met.

## 4.3 Measures to Mitigate the Effects of Noise in Area 59

4.3.1 Mitigatory measures are required to reduce the impact of noise generated from traffic. Residential dwellings are generally predicted to experience noise levels up to 2 dB(A) $L_{10}$ (1-hour) greater than the HKPSG guideline values. The area of greatest concern however is the schools which require a quieter environment for learning and without any measures to mitigate the effects of noise, would experience noise levels at sensitive facades of up to 9 dB(A) $L_{10}$ (1-hour) higher than the standard of 65 dB(A) $L_{10}$ (1-hour) recommended in HKPSG.

4.3.2 The major source of traffic noise is generated from Road P2. Proposals have previously been put forward to build a continuous barrier between 6.5 and 8 metres high alongside Road P2 and a 5 metre high barrier along part of Road D1 as part of development proposals for Area 59. Neither of these solutions are entirely satisfactory as the mitigating effects on dwellings towards the top of the high rise buildings is relatively small.

4.3.3 If a barrier is to be used as the only measure to mitigate the effects of road traffic noise a 9 metre high noise barrier located 2 metres from the edge of carriageway will be required to achieve satisfactory noise levels. A substantial engineering structure would be required to support a 9 metre high free-standing linear barrier. The proposed barrier would be located on top of an existing major drainage box culvert and its proximity at the top of an embankment would require a greater structural height.

4.3.4 The 9 metre high noise barrier would effectively mitigate the impact of noise to HKPSG values for both the schools and residential dwellings. Apart from the engineering difficulties of such a structure it would also be visually intrusive and generally have an adverse visual impact in the area. Highways Department has also expressed its concern of locating such a structure adjacent to the road.

4.3.5 Several alternative schemes which combine various techniques for mitigating the effects of road traffic noise have been developed for Area 59. These have been assessed and will satisfactorily reduce road traffic noise at sensitive facades to HKPSG standards. The schools and residential dwellings have been considered separately below.

4.3.6 Measures for mitigating the effects of road traffic noise in other Planning Areas are also discussed. The planning in these areas is not at such an advanced stage as Area 59 and therefore the concepts of acceptable mitigatory measures are discussed in general terms. Changes to the layouts are likely to affect noise levels at the facades and therefore it is advised that noise assessments are confirmed upon finalisation of development proposals within each area.

## 4.4 Mitigation Measures for Residential Dwellings in Area 59

4.4.1 All of the residential blocks which face Roads P2 and D1 within the TKO Town Centre North area may be expected to experience noise levels above the HKPSG residential standard noise value of 70 dB(A) $L_{10}$ (1-hour) if mitigation measures are not adopted.

4.4.2 With the exception of noise levels at Facade 23A all of the residential blocks within Area 59 are predicted to be subject to noise levels less than 72.5 dB(A) $L_{10}$ (1-hour). It is therefore recommended that open texture road surfacing should be applied to all roads surrounding Area 59. An open texture road surface will reduce noise levels at least 2.5 dB(A) $L_{10}$ (1-hour) throughout the life of the pavement. By abating the noise at source, open texture pavement will not only reduce noise levels to within the standard for residential dwellings but also result in a quieter environment.

4.4.3 The use of open texture on the Road P2 to Road D1 slip road is not just required for noise mitigation purposes but it will also be applied to the slip road for safety reasons. It is not normal practice to install open texture on district distributor roads subject to the 50 kph speed limit, mainly due to the higher maintenance costs associated with slower moving traffic. In this instance, proposals for the installation of open texture surfacing on district distributor roads has already been agreed by Highways Department and Transport Department following previous consultations amongst Housing Department and Environmental Protection Department.

4.4.4 The impact of road traffic noise from Road P1 on the facades along Road D1 has generally not been assessed as it is more than 300 metres from receivers in Area 59. Traffic noise from Road P1 is however predicted to increase noise levels by between 0.5 and 1.0 dB(A) $L_{10}$ (1-hour) for the higher floors of those facades with aspects facing Road P1. Noise levels at facades facing Road D1 will be highest at Facade 23A and the cumulative impact of noise from Road P1 has been included in the levels shown on Drawing 60493/04/1C for Facade 23A.

4.4.5 Previous studies conducted for Housing Department have indicated that a length of 5 metre high barrier located along Road D1 would reduce noise levels to HKPSG standards for Block E of the Area 59 development. It is not considered that a barrier will be required if open texture pavement is applied to Road D1. Noise levels assuming an impervious flexible wearing course are predicted to be a maximum of 72.8 dB(A) $L_{10}$ (1-hour). A 2.8 dB(A) reduction of noise is considered to be within the range of noise reduction which can be achieved by the use of open texture surfacing.

4.4.6 It is concluded therefore that open texture surfacing applied to the roads surrounding Area 59 will reduce noise levels at all residential dwellings to the standards contained in the HKPSG. Barriers will not therefore be required to screen noise for residential properties.

### 4.5 Mitigation Measures for Schools in Area 59 - 6.5 and 8.0 Metre Barrier

4.5.1 A scheme prepared for Housing Department proposes a barrier along Road P2 which varies in height between 6.5 and 8.0 metres. Open texture surfacing will reduce noise levels at the residential dwellings which face Road P2 to acceptable levels and therefore the primary function of the barrier will be to protect the schools.

4.5.2 Noise levels at the school facades for a 6.5 and 8.0 metre barrier are shown on Drawing 60493/04/2C. In general the barrier protects the schools against the impact of road traffic noise with the exception of Facade 51 at School PS2. Noise levels shown on Drawing 60493/04/2C have not been adjusted for open texture surfacing and noise levels at the facades will be 2.5 dB(A) lower if open texture surfacing is adopted. Predicted noise levels at Facade 51 will remain above the planning standard noise value for schools of 65 dB(A) $L_{10}$ (1-hour).

4.5.3 Noise levels at the other school facades are predicted to be below 60 dB(A) $L_{10}$ (1-hour) with the exception of Facade 54 at which the predicted noise level will be 60.6 dB(A) $L_{10}$ (1-hour) after adjusting for open texture surfacing.

4.5.4 Two buttress walls are proposed for School PS2 at the northern end of the classroom block. However these measures, and the 8.5 metre proposed barrier are not sufficient to satisfactorily mitigate the effects of noise at the school. At the other schools the barrier would appear to be higher than necessary to achieve acceptable noise levels.

## 4.6 Mitigation Measures for Schools in Area 59 - 6.0 and 6.5 Metre Barrier

4.6.1 The option of using a lower height barrier along Road P2 and extending the noise barrier in the vicinity of School PS2 was investigated. It was found that a 6.0 metre high barrier used in conjunction with open texture surfacing would generally be adequate to protect Schools SS1 and PS1 and Facade 52 at School PS2. The noise levels assessed for this scheme are shown on Drawing 60493/04/3C.

4.6.2 It is not practicable to provide extra shielding to School PS2 by extending the barrier in a northerly direction due to the proximity of the slip road. It is therefore necessary to continue the barrier around the slip road. An acceptable arrangement of barrier was found by using a 6.5 metre high barrier as shown on Drawing 60493/04/3C. With this arrangement the maximum noise level at Facade 51 is predicted to be 65.2 dB(A) $L_{10}$ (1-hour) with open texture surfacing applied to Road P2. Noise levels at Facade 44 will also be reduced to below 65 dB(A)$L_{10}$ (1-hour).

## 4.7 Mitigation Measures for Schools in Area 59 - Re-orientate School Buildings

4.7.1 An alternative approach to avoid exceeding the HKPSG guideline noise values is to position noise sensitive uses in locations which are less susceptible to noise. The existing plans for Area 59 assume that the window facades of the main classroom blocks face away from the main source of traffic noise. For the standard school layout this arrangement results in the special classrooms facing Road P2.

4.7.2 Noise levels were assessed for an alternative layout, in which the schools had been rotated to minimise the impact of traffic noise on both the main classroom facades and the special classroom facades. Testing revealed that generally a 2.5 metre high noise barrier would be adequate along Road P2 to achieve satisfactory noise levels assuming that Road P2 was surfaced with an open texture wearing course.

4.7.3 To protect the rear facade of the school located closest to the slip road a 5 metre high barrier was found to be necessary around the slip road from Road P2 to Road D1 and along Road P2 north of the slip road. The barrier locations and heights are shown on Drawing 60493/04/4B. Without open texturing the barriers along Road P2 would need to be increased by an additional 0.5 metre to achieve satisfactory noise levels at the sensitive facades of the schools.

4.7.4 The proposed school layout and predicted noise levels are shown in Drawing 60493/04/4B. As for other assessments the noise levels have been calculated for an impermeable road surface and therefore a 2.5 dB(A) reduction should be made to the stated noise levels to correct for open texture surfacing.

4.7.5 The advantage of this layout is that the height of the noise barrier along Road P2 can be reduced. The alternative school positions would require the Block 5 Annex to be located as shown on earlier layouts and an alternative alignment following the site boundary would be required for the internal access road. Provisional locations for vehicular access to the housing estates are also shown.

## 4.8 Recommendations for Noise Mitigation Measures in Area 59

4.8.1 The use of open texture surfacing on all roads surrounding Area 59 is recommended. Its application will reduce noise levels at residential dwellings to within 70 dB(A) $L_{10}$ (1-hour), without which, a 9 metre high barrier would be required for the schools. Open texture will not, on its own, be sufficient to mitigate the effects of noise at the schools but will result in lower noise levels in the area as a whole. A noise barrier along Road D1 is not considered to be necessary.

4.8.2 Two alternative schemes, which combine the use of barriers and open texture surfacing to mitigate the impact of noise at the schools to HKPSG have been evolved. The option of rotating the schools minimises the susceptibility of the schools to traffic noise from Road P2 and a 2.5 metre barrier will generally be sufficient.

4.8.3 The detailed planning of Area 59 is at an advanced stage and detailed drawings for construction and tender are likewise at an advanced stage. Housing Department have advised that it is not possible to amend the layout of the site and re-orientate the layout of the schools. Although a 2.5 metre barrier would reduce the structural loading on the existing drainage culvert and the visual impact of a lower wall would be less, the option of a higher barrier have to be adopted at this stage.

4.8.4 It is recommended therefore that a scheme utilising a 6 metre and 6.5 metre high barrier is adopted. The height of barrier is lower than that proposed by Housing Department but is capable of limiting road traffic noise at the sensitive facades of the schools to the standards contained in HKPSG. It is not desirable to erect a 6 metre high noise barrier but further reductions of height cannot be achieved without breaching road traffic noise planning criteria. Other schemes to mitigate the effects of noise, subject to the schools remaining in their existing locations, are to provide a canopy or alter the alignment of the road. The provision of a canopy would be more expensive and would have added implications on safety. An alternative road alignment cannot practicably be achieved if it is to be constructed in time to provide access to developments in the Town Centre North area.

## 4.9 Mitigation of Noise in Area 57

4.9.1 Provision of open texture on all roads surrounding Area 59 will assist in mitigating the effects of noise in the adjacent areas. Assessments of road traffic noise levels in Area 57, using the latest available layouts for the area, have identified that noise levels will exceed the standards laid down in the HKPSG at both residential dwellings and a school. Assessment of two facades on the residential blocks (Facades 58 and 510) indicates that additional noise mitigating measures will be required to achieve acceptable noise levels for most of the sensitive facades facing onto Road P2 and Roundabout P2/L463. At Block 3 some screening is provided by the car park. At Block 1 (Facade 58) there is no screening and noise levels with open texture surfacing are predicted to reach 71.5 dB(A) $L_{10}$ (1-hour).

4.9.2 Initial analysis indicates that a 2 metre high barrier, located on top of the proposed flyover parapet, would attenuate noise levels to acceptable standards. At Block 3 the predicted levels only slightly exceed 70 dB(A). It is recommended that a 2 metre high noise barrier located on top of the edge parapet of the proposed flyover is needed for the current housing layout in Area 57.

4.9.3 The revised layout of the primary school shown in Drawing No. 60493/04/1C has been taken into account. The findings of the preliminary assessment are that the classrooms will, in the main, be shielded by Block 3 and the car park building.

4.9.4 Some mitigatory measures would still be required along Road L462 to achieve the 65 dB(A) $L_{10}$ (1-hour) noise level required for schools but this could be achieved by the provision of boundary walls within the school site.

4.9.5 Preliminary assessments for the secondary school indicate that noise levels will not exceed 65 dB(A) $L_{10}$ (1-hour) at the sensitive facades if the proposed boundary walls were erected or else the application of open texture surfacing on Road L462 would need to be considered.

## 4.10 Mitigation of Noise in Area 56

4.10.1 Only the proposed schools in Area 56 will be noise sensitive. Maximum noise levels at the sensitive facades of the schools are predicted to be between 1 and 2 dB(A) $L_{10}$ (1-hour) above the 65 dB(A) HKPSG noise level for schools if the roads are surfaced with impervious road surfacing. With the proposed layout for the primary and secondary schools in this area, boundary walls within the school sites along Roads L461, L462, and L464 would achieve the required noise level 65 dB(A)$L_{10}$ (1-hour). The use of open texture surfacing will only be considered on these local roads if the school boundary walls were not possible to be built.

## 4.11 Mitigation of Noise in Area 55

4.11.1 No details are available for the area of residential development proposed within Area 55. A typical facade set back 40 metres from the carriageway of Road D1 has been assumed to identify the likely noise impact in this area. The set-back is 10 metres greater than that defined in the Planning Brief for the area and additional mitigatory measures will be required. These measures can include orientating buildings or windows to minimise the impact of noise at sensitive receivers and using podiums or buildings with non sensitive facades to screen other more sensitive buildings. The noise levels ultimately experienced in Area 55 will therefore be dependent upon the block layout and building design. With careful siting of the blocks and other non noise sensitive buildings it will be possible to mitigate the effects of road traffic noise to below the guideline level.

4.11.2 Noise levels at the southern primary school in Area 55 are not expected to exceed 65 dB(A) $L_{10}$ (1-hour) subject to the erection of boundary walls within the school site along Road L461. The northern primary school will be subject to road traffic noise from both Road L461 and Road L463. The predicted noise levels at the facades adjacent to Road L463 are expected to exceed the 65 dB(A) HKPSG for schools by around 2 dB(A) with open texture surfacing. Noise levels at the main classroom facade will depend upon the location of buildings in the adjacent housing development. Noise barriers in the form of boundary walls would assist to reduce noise levels at the school. It is recommended that mitigatory measures at these schools should be developed in conjunction with the continued development of Area 55 to minimise the need for barriers.

## 4.12 Mitigation Measures for Haven of Hope Sanatorium

4.12.1 The single storey ward, (see Facade 42 on Drawing 60493/04/1C) is the only building within the Sanatorium at which HKPSG guideline noise levels will be exceeded. This is due to the quiet environment which is set for hospital wards. The predicted noise level on the facade facing Road D1 is 63.2 dB(A) $L_{10}$ (1-hour) and it is not realistic to provide direct mitigatory measures to reduce noise levels to the hospital standard of 55 dB(A) $L_{10}$ (1-hour). A 5 metre barrier at Road D1 was evaluated to assess the feasibility of direct mitigatory measures and with maximum screening the predicted noise level at the facade was only reduced to 59 dB(A) $L_{10}$ (1-hour). Contribution from Trunk Road T1 would also need to be mitigated.

4.12.2 In consultation with the consultants for the Hospital Authority, it is understood that this ward will be vacated when new fully air-conditioned hospital is built before the completion of Road D1. Therefore, it is not considered to be a real problem.

4.12.3 The Haven of Hope Sanatorium is currently undergoing re-development and the use of modern building design will enable the HKPSG noise standards for hospitals to be met. It is understood that air-conditioning will be provided in the redevelopment as one of the mitigatory measures for the anticipated impact of road traffic noise.

## 4.13 Summary of Traffic Noise Impact Assessment

4.13.1 It is concluded that noise mitigation measures will be required throughout the area covered by Contract No. TK 39/93. The main points arising from the assessment are summarised as follows:

- Open texture surfacing is recommended on Roads P2, D1, L463 and the slip road between Roads P2 and D1 surrounding either Areas 55, 57 or 59 to mitigate the relatively minor impact of traffic noise on the affected facades where barriers are not found to be effective i.e. at the higher floors of tower blocks. This will avoid the use of barriers to protect residential dwellings in Area 59 and minimise mitigatory measures which may be required for the residential developments proposed in Areas 55 and 57. The noise impact from the local roads on the proposed schools will in most cases be mitigated to acceptable levels through orientation of school blocks and erection of barrier walls at the boundary of the affected schools. Application of open texture pavement on local roads should only be considered where appropriate.

- Additional mitigating measures will be required to protect the schools in Area 59 and this will best be achieved by the use of barriers.

- Most of the sensitive facades at the proposed schools in Area 56 will be protected by the proposed indoor recreation centre, telephone exchange building and commercial development. Other affected sensitive facades at these schools can be protected by the erection of appropriate boundary walls within their sites.

- The use of a barrier solely on Road P2 will not protect the most northern school (PS2) and will need to be continued around the Road P2 to Road D1 slip road.

- The optimum height of barrier along Road P2 is 6 metres to protect Schools SS1 and PS1. A 6.5 metre high barrier is required along Road P2 and the slip road to Road D1 to protect School PS2. The extent of the barrier is shown in Drawing 60493/04/3C.

- Noise levels in Area 57 will exceed HKPSG standards for both schools and residential dwellings. A 2m high noise barrier on the top of the edge parapet along the future P2 flyover would be needed for the protection of the proposed residential blocks and boundary walls should be provided for the affected schools to meet the HKPSG.

- Noise levels at the primary schools proposed in Area 55 near the junction of Roads L461 and L463 are expected to exceed 65 dB(A) $L_{10}$ (1-hour). Detailed noise mitigatory measures such as erection of boundary walls fronting Roads L461 and L463 and changing the siting and layout of the schools are likely to be the most practical methods of achieving the noise criteria defined in HKPSG for schools.

- HKPSG noise levels for residential properties are likely to be exceeded for residential blocks located in Area 55. The location of buildings to ameliorate the effects of road traffic noise will allow guideline noise values to be achieved at sensitive facades. Careful planning of the site layout at the design stage would avoid imposing severe constraint on the layout of the site.

- The Haven of Hope Sanatorium is going through a re-development plan. Future re-development of the Sanatorium has included fully air-conditioning system as noise mitigatory measures for the hospital. Existing wards are expected to be vacated before the completion of the road contract.

4.13.2 The implementation of the above stated proposals will reduce predicted noise levels to comply with the current planning guidelines for road traffic noise.

# 5 IMPACT ASSESSMENT OF CONSTRUCTION NOISE

## 5.1 General

5.1.1 The brief does not require a detailed assessment of construction noise to be carried out. A brief assessment of the impact of construction noise on the adjacent area has however been conducted to highlight any potential problems.

5.1.2 Works to be conducted under TKO Contract No. TK39/93 are on land reclaimed under the TKO Phase II Development. There are no existing dwellings or premises on the land which will be affected by construction noise. Any development of the area will take place during or after the construction works under Contract No. TK 39/93 and none of the developments will be occupied prior to the completion of these works. Buildings at the Haven of Hope Sanatorium, located northwest of the site area, are the only buildings in the adjacent area which may be affected by construction noise.

## 5.2 Major Works

5.2.1 The major works involved in the Contract include,

- Construction of Road P2, from the existing Road P1 to the proposed roundabout at the intersection with Road D8, including formation of embankments,
- Construction of Road D1, from Road P2 to the junction with Road L463, including the formation of embankments,
- Construction of the slip road between Road D1 and Road P2 on an embankment,
- Improvement of the existing road linking Road D1 with the Haven of Hope Sanatorium and construction of a new section which will connect to Road P2,
- Construction of the Road D1 bridge across the proposed Road P2,
- Construction of the local highway network within the proposed Town Centre North area,

5.2.2 The bridge foundations for the Road D1 bridge across Road P2 are anticipated to be constructed with bored piles. Percussion piling techniques are not expected to be used for the Contract.

## 5.3 Other Planned Works

5.3.1 A flyover to carry Road P2 across the proposed roundabout junction at Road L463 is proposed in the future but will not be constructed as part of the TKO Development Contract No. TK 39/93. Construction of the flyover is likely to occur after the occupancy of dwellings in Areas 57 and 59 but the foundations are to be constructed under this current Contract. The proposed flyover will be over 100 metres from the closest noise sensitive facade and no specific difficulties are likely to be encountered in controlling construction noise to acceptable levels.

## 5.4 Existing Conditions

5.4.1 As far as construction noise levels are concerned , the only NSR's affected by the construction activities will be the Haven of Hope Sanatorium. The most susceptible building to noise will be the hospital ward facing Road D1 (shown as Facade 42 on Drawing 60493/04/1C). This building is currently subject to noise generated by traffic using Road D1 and the principal access Trunk Road T1 leading to Tseung Kwan O Tunnel. Construction noise from the re-development works of the Haven of Hope Sanatorium contributes to the background.

## 5.5 Assessment of Construction Noise

5.5.1 Calculations of predicted noise levels from the construction activities were undertaken in accordance with the methodology given in the "Technical Memorandum on Noise from Construction Work other than Percussive Piling". Reference has also been made to the publications "A Practical Guide for the Reduction of Noise from Construction Works", EPD July 1989 and British Standard BS 5228 Part 1, 1984, "Noise Control on Construction and Open Sites".

5.5.2 The impact of construction noise at the Haven of Hope Sanatorium will result from a series of construction activities to be carried out in the vicinity. The noise levels will depend on the number of plants and/or lorries to be used for one particular or more activities.

5.5.3 The construction sequence will involve the building of embankments within the new carriageway area, constructing other works related to the provision of drainage systems and utilities within the defined works area, the formation of the road base, pavement and installation of relevant road furniture. One bulldozer and one pay loader are assumed to be working during the construction of the embankments. Other works would have different plants assumed.

5.5.4 A number of assumptions have to be made for the assessment in the estimation of the impact from construction noise at each of the construction stages. These include:

- Sound power levels of plants adopted for the construction are those contained in the Technical Memorandum on Noise from Construction Work other than Percussive Piling,
- Lorries are assumed to be used for handling filling and excavated material,
- One paver/roller is adopted for the periods of earthworks,

5.5.5 The impact of construction noise at the hospital ward building assumes that the construction activities will be continuously carried out within the section of Road D1 to be constructed under Contract No. TK 39/93. A noise level of 71 dB(A) was estimated based on the anticipated construction activities. Such level has exceeded the 65 dB(A) value for hospital environment. However, the new wards would be occupied in 1996/1997. Relevant works can be programmed at the time when existing wards are to be vacated. Otherwise, the items of machinery to be operating at the same time and the area of works would have to be monitored carefully to meet the 65 dB(A) standard. Construction noise is subject to the control of the Noise Control Ordinance. Application for a construction noise permit shall be submitted to the Authority for concession if some essential construction activities cannot meet the level of 65 dB(A).

## 5.6 Summary

5.6.1 Noise levels arising from general construction works are predicted to be at a maximum of 71 dB(A). These levels represent a worst case and are considered to be acceptable during the daytime. It is therefore concluded that the Sanatorium will need to be monitored in order not be adversely affected by general construction noise arising from Contract No. TK 39/93. It is expected that bored piling works will be undertaken for bridge foundation works.

5.6.2 EPD currently require day time noise levels from construction sites to be limited to 65dB(A) $L_{eq}$ (30 min) at facades of sensitive buildings in the vicinity of the Sanatorium. Areas other than the Sanatorium will be subject to the limit of 75dB(A) $L_{eq}$ (30 min). It is unlikely that these criteria will be exceeded if the duration of works and plants to be applied are monitored carefully.

# 6 ASSUMPTIONS AND ASSESSMENT CRITERIA FOR AIR QUALITY ASSESSMENT

## 6.1 General

6.1.1 The assessment of air quality has been undertaken for the future year of 2011 to assess the worst possible impact on air quality. The potential impact of vehicle exhaust emissions has been predicted using the CALINE4 line source dispersion model.

## 6.2 Traffic Projections

6.2.1 The air quality assessments have been prepared using traffic flow forecasts for the am peak period in 2011 and are considered to be representative of the highest hourly flows which are likely to be experienced in the area within the first 15 years following the opening of the roads. It has been agreed that forecasts prepared for the Engineering Feasibility Study of Development of Tseung Kwan O Area 137, conducted in 1992/93, should be used for the assessments.

6.2.2 The traffic forecast assumptions are the same as those adopted for the traffic noise impact study. Traffic flows used in the assessments are shown on Drawing No. 60493/04/5B.

## 6.3 Vehicle Composition

6.3.1 Forecasts of vehicle proportions for each of the roads were not available for 2011. Existing traffic records have been examined to assess the likely vehicle composition in the future. The vehicle proportions shown in Table 2 are considered to be representative of the area and have been assumed to apply for all road links.

**TABLE 2 ASSUMED VEHICLE COMPOSITION**

| Vehicle Category | Proportion (%) |
|---|---|
| Car | 40% |
| Taxi | 20% |
| Goods vehicle | 20% |
| Bus | 20% |

## 6.4 Assessment Criteria

6.4.1 The Air Pollution Control Ordinance provides powers for controlling air pollutants from a variety of sources to protect the community against excessive levels of pollution. Acceptable levels of various pollutants are defined in the Hong Kong Air Quality Objectives (HKAQO). The major pollutants arising from road traffic are carbon monoxide (CO), nitrogen dioxide ($NO_2$) and respirable suspended particulates (RSP). HKAQO's acceptable maximum concentration of these pollutants are listed in Table 3.

**TABLE 3 HONG KONG AIR QUALITY OBJECTIVES**

| Parameter | Average Concentration $\mu gm/m^3$ | | | |
|---|---|---|---|---|
| | 1-hour[1] | 8-hour[2] | 24-hour[2] | Annual |
| CO | 30,000 | 10,000 | | |
| $NO_2$ | 300 | | 150 | 80 |
| RSP | | | 180 | 55 |

**Notes** [1] **Not to be exceeded more than three times per year**
[2] **Not to be exceeded more than once per year**

6.4.2 The impact on air quality has been assessed for the peak hour using the criteria stated in Table 3. A significant impact is taken to be where the predicted pollutants exceed the criteria in Table 3.

## 6.5 Existing Air Quality

6.5.1 The level of pollutants at any location will be a combination of the ambient levels experienced in the area and the locally generated pollutants from road traffic. Existing concentrations of pollutants have been derived from data recorded at the air quality monitoring station in Tseung Kwan O. The station ceased monitoring in 1993 and therefore the last 12 months data collected at the station has been used to determine existing annual average concentrations of pollutants in the Tseung Kwan O area.

6.5.2 Table 4 shows the ambient levels of pollutants adopted for the study and are considered to be the most reliable for the area. Pollutant levels may be expected to change in the future as the area is developed. Existing concentrations of nitrous oxides recorded at the Tseung Kwan O monitoring station are low and are not necessarily considered to be representative of conditions in the future. Ambient levels for NO and $NO_2$ were therefore derived from data recorded at the Tai Po monitoring station which is considered to be more representative of a developed area.

**TABLE 4 AMBIENT POLLUTANT LEVELS USED IN ASSESSMENTS**

| Pollutant | Concentration $\mu g/m^3$ |
|---|---|
| Carbon Monoxide (CO) | 2090 |
| Nitrogen Dioxide ($NO_2$) | 60 |
| Respirable Suspended Particulates (RSP) | 42 |
| Nitric Oxide (NO) | 30 |
| Ozone ($O_3$) | 40 |

6.5.3 Analyses have not been conducted to assess pollutant levels for NO and $O_3$. These chemicals however play an important role in the conversion of nitrous oxides ($NO_x$) to $NO_2$. Underestimation of NO and $O_3$ concentrations will result in lower values of $NO_2$ in the analysis.

## 6.6 Air Quality Modelling/Assessment Methodology

6.6.1 The impact of vehicle emissions on the adjacent properties was undertaken using the line source dispersion model CALINE4. Pollutants CO, $NO_2$ and RSP were modelled for the peak hour. For the assessments a worst case scenario of meteorological conditions was assumed as specific data for the Tseung Kwan O area was not available. The procedure therefore accentuates the likely impact under peak hour traffic conditions and the results are only representative of a single peak hour period for which the assumed conditions apply. In practice these conditions will only coincide infrequently and are not representative of average daily conditions over a long term. The parameters adopted for the modelling are given in Table 5.

**TABLE 5 ASSUMED METEOROLOGICAL CONDITIONS FOR WORST CASE SCENARIO**

| Parameter | Assumption |
|---|---|
| Wind speed | 1 $ms^{-1}$ |
| Wind direction | Worst case leading to maximum pollutant concentrations at the receiver |
| Stability Class | D |
| Mixing height | 500 metres |

6.6.2 The above values represent a worst case scenario. Such conditions will only occur very infrequently and pollutant levels at the receivers will, for most of the time, be lower than the values derived from the analysis.

6.6.3 The methodology for the assessment of the effects on the sensitive receivers due to noise barrier are detailed in Section 7.4.

## 6.7 Vehicle Emissions

6.7.1 Emission rates for various vehicle types have been taken from data supplied by Environmental Protection Department (EPD). In general, vehicle emissions are predicted to decline in the future due to improved technology and legislation. Full development of Tseung Kwan O is not likely to occur significantly before 2011 and therefore an assessment based on forecast flows for 2011 will provide a realistic base to estimate pollutant levels in the future. The emission factors adopted for the assessments are average values for a range of speeds and are given in Table 6.

**TABLE 6 VEHICLE EMISSION FACTORS**

| Vehicle category | Emission rate (gm/veh/km) | | |
|---|---|---|---|
| | CO | $NO_x$ | RSP |
| Car | 13.508 | 1.321 | 0.041 |
| Taxi | 0.910 | 0.779 | 0.238 |
| Goods | 8.410 | 7.061 | 0.566 |
| Public transport | 9.017 | 8.578 | 0.894 |

6.7.2 It has been assumed that all cars are petrol driven and taxis, goods vehicles and public transport vehicles are diesel operated.

# 7 IMPACT OF ROAD TRAFFIC ON AIR QUALITY

## 7.1 Location of Sensitive Facades

7.1.1 Pollutant levels were modelled at sensitive buildings at key locations to illustrate the maximum impact of road generated pollution within the area covered by Contract No. TK 39/93. In general the points on buildings closest to the highway were chosen as the receptors. Opening windows in most cases will be further away from the road and the actual levels of pollutants experienced will be lower.

7.1.2 Receptors were considered for non centrally air conditioned buildings including schools. The commercial building located adjacent to Road L463, is proposed to be air conditioned and has not therefore been considered. Plans for the Housing for Senior Citizens (HSC) and the Community Building (NCC) located along Road P2 have not yet been finalised but are likely to have air conditioning and are not considered to be sensitive. Pollutant levels were calculated for receptors at the locations shown on Drawing No. 60493/04/5B for the following buildings within Area 59.

| | |
|---|---|
| School PS2 | facing Road P2 |
| School SS1 | facing Road P2 |
| Residential Block E | facing Road D1 |
| Residential Block 6 | facing Road L463 |
| Residential Block 9 | facing Road L463 |

7.1.3 The layout of buildings in Areas 55, 56 and 57 have not yet been finalised. The levels of pollutants in these areas have not specifically been calculated but will be similar to the results derived for the buildings within Area 59.

7.1.4 In general, pollutant levels at a position closest to the ground are the highest. Pollutant levels have therefore been calculated for the ground storey of buildings

## 7.2 Impact on Air Quality at Facades

7.2.1 Predicted 1-hour average concentrations of CO, $NO_2$ and RSP at each of the receptors are shown on Drawing No. 60493/04/5B. The concentrations include both the pollutants generated from the adjacent highways and the background ambient levels stated in Table 4. The pollutant concentrations at the Receptors are similarly summarised in Table 7.

## TABLE 7 SUMMARY OF POLLUTANT CONCENTRATIONS

| Receptor | Pollutant Concentrations ($\mu gm/m^3$)[1] | | |
|---|---|---|---|
| | CO | $NO_2$[2] | RSP |
| **D1-1 (Residential Block E)** | 2600 | 101 | 62 |
| **D1-2 (Residential Block 6)** | 2600 | 101 | 62 |
| **L463-1 (Residential Block 6)** | 2830 | 134 | 71 |
| **L463-2 (Residential Block 6)** | 2940 | 134 | 76 |
| **P2-1 (School PS2)** | 3050 | 134 | 82 |
| **P2-2 (School SS1)** | 2710 | 134 | 69 |

[1] Concentrations are 1-hour average co-inciding with worst case meterological conditions and peak hour traffic flows

[2] 20% conversion of $NO_x$ to $NO_2$ assumed

7.2.2 The predicted concentrations are indicative of absolute levels at the receptors in the future. In all cases the predicted concentrations are within the Hong Kong Air Quality Objectives (HKAQO) hourly and daily values. It is concluded therefore that future traffic flows on the proposed roads to be built under Contract No. TK 39/93 will not have a significant impact on air quality. No measures to mitigate the effects of pollutants from road traffic are therefore required.

7.2.3 The $NO_2$ concentrations in Table 7 have been derived by assuming a 20% conversion of $NO_x$ emissions. $NO_2$ concentrations shown on Drawing No. 60493/04/5B are slightly lower as they have been computed using the Discrete Parcel Method in CALINE4.

7.2.4 The highest levels of pollutants occur at the receptors located at the schools. This is due to the higher traffic volumes forecast for Road P2 and the closer proximity of the receptors to the traffic. However, the values of pollutants calculated for the peak period are well below both the hourly and daily values recommended in the HKAQO. Similar concentrations will be experienced at School PS1.

7.2.5 Barriers are recommended along Road P2 to mitigate the impact of noise. An assessment of the impact of the barriers on the air quality at Receptors was made and the effect of the barrier was not found to be significant. The analysis indicated that the distance between the barrier and the Receptors was sufficient to cause a reduction of pollutant levels behind the barrier. The methodology adopted for such assessment is given in Section 7.4 below.

7.2.6 The facades of buildings to be air-conditioned will not be sensitive to traffic emissions and pollutant levels have not therefore been calculated at these locations. Air intakes for air-conditioning on these buildings should not be located in locations likely to be affected by adverse air quality. Reference to pollutant concentrations at other receivers in the area indicates that there will not be any constraints on the location of the air intakes but this should be confirmed by those responsible for the detailed design of the building.

7.2.7 Annual values of pollutants at the receptors will be noticeably lower than those calculated for the peak hour. The assessment methodology assumes that worst case meteorological conditions coincide with the peak period traffic flows and this will only occur infrequently. Differing wind directions, wind speeds and traffic flows will result in significantly lower levels of pollutants at the receptors averaged over a period of time. Pollutant levels on an annual basis will be less sensitive and HKAQO annual standards will not be exceeded.

7.2.8 It is considered therefore that the impact of air quality at sensitive facades of buildings within the TK 39/93 Contract area will be minimal.

## 7.3 Air Quality Adjacent to Carriageways

7.3.1 The assessments of pollution levels for the sensitive facades have been made for receptors which are located between 15 and 30 metres away from the edge of the carriageway. Higher pollutant levels will be experienced closer to the carriageway.

7.3.2 Traffic flows on the surrounding roads are not at the level which is likely to have a significant air quality impact on the land adjacent to the highway. Assessment of the air quality at a distance of 5 metres from the edge of the carriageways showed that air quality would be within HKAQO values at all locations within the TK 39/93 Contract area under the worst case assessment scenario.

7.3.3 Assessments have shown that the 1-hour average $NO_2$ concentration will not exceed 200 $\mu gm/m^3$ at a distance of 5 metres from the edge of the carriageway under the worst case meteorological conditions. Concentrations for CO and RSP are 4100 $\mu gm/m^3$ and 170 $\mu gm/m^3$ respectively. It is therefore concluded that the impact of road traffic emissions on the land adjacent to the carriageway will be minimal. There are no locations where HKAQO values are likely to be exceeded.

7.3.4 HKPSG currently recommend that a 20 metre wide buffer should be maintained between major roads and air sensitive uses. Although the assessments indicate that HKAQO will not be exceeded 5 metres from the carriageway it is considered to be prudent to respect the 20 metre buffer zone, particularly for a green field site, unless there are compelling reasons to depart from the established standards. This should minimise the likelihood of unacceptable air quality beyond the 15 year evaluation period in the event of higher traffic flows or changed conditions.

## 7.4 Impact of Noise Barrier Provision on Air Quality

7.4.1 The erection of a noise barrier will limit the horizontal dispersion of pollutants emitted from traffic and cause higher concentrations on the road side of the barrier. Pollutant concentrations close to the barrier will also be increased. The effects on the sensitive receivers along Road P2 due to the proposed noise barrier were assessed.

7.4.2 There is not a function within CALINE4 which allows pollutant concentrations at receivers located in the vicinity of barriers to be modelled directly. The impact of a barrier along Road P2 was evaluated by modelling Road P2 as a 'depressed section' within CALINE4 and pollutant concentrations were modelled at a height corresponding to the height of the barrier. The investigations were carried out for CO pollutant but the general effects and outcome will similarly apply for both $NO_2$ and RSP.

7.4.3 Pollutant concentrations at the same height of the proposed barrier were found to be marginally lower than the scenario without a barrier along Road P2. These levels were found to be approximately 20% lower than those predicted at ground level of the same location for the case without a barrier.

7.4.4 The analysis shows that the concerned buildings are not located within the zone of higher pollutant concentrations behind the barrier and the provision of barrier will reduce the pollutant levels at the concerned receivers. It is concluded that the installation of a barrier will not cause higher pollutant concentrations at the sensitive receivers along Road P2.

# 8 AIR QUALITY DURING CONSTRUCTION

## 8.1 General

8.1.1 The highways and associated works to be constructed under Contract No. TK 39/93 are on land reclaimed under the TKO Phase II Development. Development of the land within the site limits will take place during or after Contract No. TK 39/93 and none of the developments will be occupied before the works are completed. Buildings at the Haven of Hope Sanatorium, located northwest of the site area, are the only buildings in the adjacent area which may be affected by construction activity.

## 8.2 Major Works

8.2.1 The major works involved in the Contract include,

- Construction of Road P2, from the existing Road P1 to the proposed roundabout at the intersection with Road D8, including formation of embankments,
- Construction of Road D1, from Road P2 to the junction with Road L463, including the formation of embankments,
- Construction of the slip road between Road D1 and Road P2 on an embankment,
- Improvement of the existing road linking Road D1 with the Haven of Hope Sanatorium and construction of a new section which will connect to Road P2,
- Construction of the Road D1 bridge access the proposed Road P2,
- Construction of the local highway network within the proposed Town Centre North area.

## 8.3 Assessment of Air Quality during Construction

8.3.1 The overall impact on air quality during construction is not expected to be great. The reclamation works, which have the potential to create large volumes of dust, have already been completed. In addition there will only be a limited number of buildings in the area during construction activity.

8.3.2 The major air quality impacts from road construction projects usually result from dust emissions. Vehicle and plant exhaust emissions do not normally give rise to increased pollutant levels because the number of emitters are low.

8.3.3 The major activities which are likely to give rise to dust during construction works are:

- excavation and earthworks
- truck movements on unpaved haul roads
- stockpiles
- concrete batching

8.3.4 The use of a large on-site batching plant, bulk cement storage facilities and other facilities which are likely to generate large quantities of dust is not expected. The main source of dust will therefore arise from the construction activities on site.

8.3.5 Construction of the new roads under Contract No. TK 39/93 will not result in activities which are likely to generate excessive volumes of dust. The construction of embankments and the movement of trucks on unpaved haul roads will be the major activities which produce dust. Excavations for bridge foundations will be localised and will not contribute to significant dust levels at the properties near the site. Some dust will be emitted during the placing and compaction of fill materials but the major source of dust will arise from the movement of lorries carrying fill material over unpaved haul roads.

8.3.6 The closest buildings to the site form part of the Haven of Hope Sanatorium and these are located, at their closest, about 100 meters from the proposed site boundary. These will be the only buildings likely to be affected by dust from construction activities.

8.3.7 The route of haul roads and routes for lorries carrying material will be largely determined by the Contractor. The site is not linear in nature and therefore there is considerable flexibility for the location of haul routes and the routeing of vehicles within the site to minimise dust emissions near the Sanatorium.

8.3.8 To assess the maximum impact on air quality, a worst case scenario of dust levels arising from lorries moving on an unmade haul road at a distance of 100 metres from the Haven of Hope Sanatorium was assessed. This is the closest distance that a haul road could be located to the Sanatorium but in practice it would be located further away. A dust emission factor for unpaved haul roads was estimated using USEPA Compilation of Air Pollutant Emission Factors (AP-42) for a 30 micron particle size, a surface silt content of 15% and an average vehicle speed of 15kph.

8.3.9 The concentrations of TSP were assessed using Fugitive Dust Model assuming vehicles to be depositing fill at a rate of 1 lorry every 5 minutes. TSP levels at the Haven of Hope Sanatorium were modelled for worst case wind direction and meteorological conditions under which an 1-hour average TSP concentration of 737$\mu$gm/m$^3$ was predicted at the closest wards. The second location modelled within the site was a nursing home where an 1-hour average TSP concentration was predicted to be 524$\mu$gm/m$^3$. Detailed assumptions and sample calculation are included in Appendix 5. Such level is an indication of the worst possible impact and would only occur in the event that normal site practices to suppress dust emissions were not being followed when the wind is blowing directly towards the Haven of Hope Sanatorium buildings.

8.3.10 A maximum concentration of 500 $\mu$gm/m$^3$ at affected buildings is the standard applied by EPD for TSP arising from construction activities. The average 24-hour standard of 260$\mu$gm/m$^3$ specified in HKAQO should also be complied with. The analysis shows that haul roads operated at the site boundary in the vicinity of the Haven of Hope Sanatorium could cause this level to be exceeded under worst case meteorological conditions when the wind is blowing dust directly towards the Sanatorium buildings and dust prevention measures are not being followed.

8.3.11 The calculated level of TSP should not cause undue concern as practical measures to reduce dust emissions to meet the required hourly standard of 500 $\mu$gm/m$^3$ can be achieved by good working practices on site. The level of dust generated by vehicles moving around the site will depend upon the surface silt content, moisture content, vehicle speed and weight of vehicle. In general, dry conditions predominantly prevail in the winter months and are accompanied by northerly winds which will not affect the nearby buildings. Easterly winds primarily occur in the wetter summer season during which the higher moisture content will result in lower dust emissions. Watering of haul roads twice a day can reduce dust emissions by up to 50 per cent which would reduce dust levels at the Sanatorium to around 370 $\mu$gm/m$^3$, i.e. well within the required standard of 500 $\mu$gm/m$^3$.

8.3.12 A reduction of dust emissions of around 30% is required to meet the standard under the worst assessment scenario. It is considered that this can be practicably achieved and need not impose severe constraints on the Contractor's method of working.

8.3.13 None of the other construction activities, either in isolation or cumulatively, are likely to lead to a reduction of the air quality standard to below the recommended criterion.

8.3.14 Fill materials are likely to be transported to the site from the Pak Shing Kok Borrow Area using the existing highway network. With adequate tyre cleaning facilities, sheeting of loads etc, the emission of dust arising from lorries travelling on existing roads will be minimised and will not cause the TSP criterion to be exceeded.

## 8.4 Mitigatory Measures

8.4.1 Movements of vehicles on unpaved haul roads on the edges of the site in the vicinity of the Haven of Hope Sanatorium are the only locations that may cause dust emissions to exceed recommended levels at adjacent properties. Such conditions have been assessed assuming a worst case scenario and these conditions are not expected to occur frequently.

8.4.2 With good working practices on site the Contractor should be able to carrying out construction activities without breaching the HKAQO at the Sanatorium.

8.4.3 It is recommended that unpaved haul roads and lorry movements should be avoided in that part of the site near the Haven of Hope Sanatorium except where necessary to complete the construction works.

8.4.4 Good operating practices will minimise dust emissions. The following measures are capable of reducing dust emissions by at least 30%:

- Restriction of vehicle speeds to a maximum of 15 kph
- Water spraying of haul roads
- Use of damping and dust covers for dusty loads
- Materials should not be loaded to a level higher than the side and tail boards of lorries.

8.4.5 It should be stipulated under the Contract for the Contractor to ensure that the TSP hourly concentration at the Haven of Hope Sanatorium does not exceed 500 $\mu gm/m^3$. The Contractor will also be required to comply with the HKAQO 24 hour average TSP level of 260 $\mu gm/m^3$.

# 9 ENVIRONMENTAL MONITORING AND AUDITING

## 9.1 General

9.1.1 Monitoring and auditing procedures are required as a check during the construction and operation of a development that the specified control criteria and standards are being complied with. The pre-construction and pre-operation analysis will highlight potential problems and can be used to minimise or eliminate adverse impacts prior to their occurrence. Analysis requires various assumptions to be made which may differ from those actually employed or arising on site and therefore monitoring would be required to confirm that the required standards and objectives are being met.

9.1.2 Auditing defines methods and procedures to ensure that the monitoring is effectively carried out and that the monitoring will identify adverse impacts. Auditing also covers procedures to be followed in the event that the assumed criteria or standards are exceeded.

## 9.2 Monitoring of Operational Road Traffic Noise

9.2.1 Traffic noise can be monitored following the opening of the proposed new roads. The monitoring results will form the basis for the continuous improvement of the general environmental conditions when the opportunity arises.

9.2.2 The predicted noise levels will be materialised when the development of Tseung Kwan O is completed as planned. Specific monitoring should not be required for the initial years following the completion of the said contract. The monitoring of the operational traffic noise for these proposed roads should be included in the overall general monitoring of the traffic noise impact programme for the entire town.

## 9.3 Post Opening Audit of Road Traffic Noise

9.3.1 No auditing procedures are considered to be necessary following the completion of the roads. Initial traffic flows will be low and design year traffic flows are unlikely to materialise for about 10 to 15 years pending the full development of Tseung Kwan O New Town.

## 9.4 Air Quality Monitoring of Road Traffic Pollutants

9.4.1 It is unlikely that HKAQO values will be exceeded due to road traffic using the roads proposed under Contract No. TK 39/93. The predicted impact is low and it is not therefore recommended that any specific monitoring should be undertaken.

9.4.2 Development plans for Area 59 are at an advanced stage and the distance of the properties from the road reduces the level of traffic related pollutants to minimal amounts. The existing buildings within the Haven of Hope Sanatorium are likewise sufficiently far away from the proposed roads so as not to be affected by traffic generated pollutants. In general, all the sensitive buildings will be set back an adequate distance from the roads such that pollutant levels will not be sensitive to traffic flows in the future.

## 9.5 Post Opening Audit for Air Quality

9.5.1 In view of the nature of the road improvement scheme and the minimal impact on air quality no specific measures are deemed to be necessary. It is unlikely that pollutants generated by road traffic will cause HKAQO standards at the properties to be exceeded.

## 9.6 Monitoring of Construction Noise

9.6.1 The only buildings likely to be affected by noise from construction activities will be those within the Haven of Hope Sanatorium. In general the impacts at the affected buildings are not expected to be significant and construction noise levels are not predicted to exceed the guideline limit of 65 dB(A) $L_{eq}$ (30 min) under the controlled situation.

9.6.2 It is not considered that regular monitoring of construction noise in the area will be necessary. In the event of complaints, or it is noticed by site supervision staff that operations are particularly noisy, noise monitoring should be undertaken to confirm noise levels at the building facades. The Contractor should be required under the Contract to carry out the works in a manner which limits noise levels at the Sanatorium to 65 dB(A) $L_{eq}$ (30 min).

## 9.7 Auditing Procedure for Noise During Construction

9.7.1 The limited impact of construction noise is not considered to require an elaborate auditing procedure. It is considered that noise monitoring need only be carried out in response to complaints or if particularly noisy construction activity is noticed to occur in the vicinity of the Haven of Hope Sanatorium.

9.7.2 Noise measurements should be undertaken in response to complaints at the affected facades. Noise recordings should be made by personnel with appropriate training in the use of the equipment which should be calibrated before and after readings. Records should be maintained of all readings undertaken together with details of the types and numbers of plant contributing to noise at the facades.

9.7.3 A record of all noise monitoring activity should be kept and this should be made available to Environmental Protection Department if required. A record of complaints received should similarly be maintained together with the action taken and the results of any noise monitoring undertaken as a result of complaints.

9.7.4 Where noise levels are at, or approaching, the criteria, the Contractor should be informed to avoid exceeding the recommended noise levels. Any readings in excess of 5 dB(A) $L_{eq}$ (30 min) of the guideline value, the Contractor should be asked to stop work and submit proposals for an amended method of working which is capable of meeting the criteria. Where measured noise levels exceed the 65 dB(A) $L_{eq}$ (30 min) by less than 5 dB(A) the measurements should be repeated. If the second measurement similarly exceeds the criteria the Contractor should stop work and be required to submit proposals for a method of working which will meet the criterion, i.e. less working hours or less plants at the same period of works.

## 9.8 Monitoring of Air Quality During Construction

9.8.1 Buildings at the Haven of Hope Sanatorium are the only buildings likely to be susceptible to dust concentrations during construction activity. This is only likely to occur when construction activity is concentrated in the area of the site closest to the Sanatorium buildings and meteorological conditions result in dust emissions being directed towards the buildings with minimal dispersion.

9.8.2 Measures to minimise dust emissions in this area of the site have already been described and include minimising the movement of vehicles on unpaved haul roads and the use of good working site practices to minimise dust emissions. The Contractor should conduct activities without visible dust plumes being blown outside the site limits. Subject to visible dust levels being minimised within the site the dust concentrations at the Sanatorium are unlikely to exceeded either the 1-hour or 24-hour air quality standards for TSP.

9.8.3 The location of the Sanatorium, combined with the additional sensitivity of the Ward building to poor air quality requires additional vigilance to ensure that dust levels at the Sanatorium are kept to a minimum. It is therefore recommended that regular monitoring of TSP levels should be conducted at the Sanatorium to confirm that the required standards are not being exceeded. Measurements should be carried out using a high volume sampler conforming to the USEPA Standard Method 40, CFR Part 50. Sampling should be conducted for a full 24 hour period once every 6 days.

9.8.4 Monitoring of dust levels using portable equipment should also be conducted when necessary to ensure compliance with the 1-hour TSP criterion. Regular monitoring is not considered necessary but should be available in the event of complaints or under conditions giving rise to a potential impact at the Sanatorium.

## 9.9 Air Quality Auditing Procedures During Construction

9.9.1 In general good working practice will minimise dust emissions which will both minimise the amount of dust emitted from the site and reduce dust levels experienced by workers employed on the site. Site supervision staff should ensure that the Contractor makes adequate provision to limit air borne dust.

9.9.2 Only one property has been identified as susceptible to dust arising from construction activity associated with the TK 39/93 Contract. It is recommended that monitoring of dust levels should be undertaken in the vicinity of the Ward building at the Sanatorium once every 6 days. Supplementary monitoring using portable equipment should also be undertaken when required to monitor 1-hour concentrations.

9.9.3 Where monitoring is undertaken and acceptable levels of TSP are breached, then the Contractor should be required to amend his method of working, either by improving dust reduction measures, limiting the number of plant or avoid working in sensitive areas during periods in which meteorological conditions give rise to the maximum impact at the hospital. The responsibility to comply with acceptable air quality standards will be with the Contractor but this will need to be monitored by site supervision staff.

9.9.4 A copy of complaints should be maintained and this should be made available to EPD. For each complaint a report stating the validity of the complaint, the cause and the action undertaken to prevent further occurrence should be compiled.

# 10 CONCLUSIONS AND RECOMMENDATIONS

10.1 This Environmental Impact Assessment updates the EIA studies conducted as part of the TKO Feasibility Study of Opportunities for Further Development in 1990. Since these studies there have been no significant changes which are likely to adversely affect environmental conditions in the TKO Town Centre North area nor will the development of the area lead to adverse environmental conditions in adjacent areas. The environmental issues relating to noise and air quality therefore primarily relate to the impact of road traffic on the proposed development in Area 59.

10.2 Road traffic noise generated from Roads P2 and D1 will cause HKPSG guideline noise levels at residential units and schools within Area 59 to be exceeded. Open texture surfacing will reduce road traffic noise to acceptable levels for the residential units without the need for barriers. Open texture road surfacing is therefore recommended on all roads surrounding Area 59.

10.3 Barriers will be required along Road P2 to protect the immediately adjacent school buildings. The location and orientation of the school buildings will influence the height of the barrier required. An alternative layout which minimises the height of barrier required along Road P2 to a general height of 2.5 metres was developed and evaluated. It has not been possible to adopt this layout due to the advanced stage of design in Area 59.

10.4 The school layout currently adopted for Area 59 will generally require a 6 metre high barrier along Road P2 to reduce noise levels to the standards recommended in HKPSG. A 6.5 metre high barrier will be required to protect School PS2 and it will need to be extended around the slip road joining Road D1. Although the barrier would impose adverse visual impact and require major maintenance liability, this proposal is considered the recommended option amongst other alternatives explored.

10.5 The proposed residential developments in Areas 55 and 57 will be affected by road traffic noise and HKPSG noise levels are likely to be exceeded. Open texture surfacing will reduce traffic noise but additional measures will be required to reduce noise levels to acceptable levels. The layouts and detailed design of buildings in Areas 55 and 56 are in different stages of preparation and have not been finalised. Locations where acceptable noise levels are likely to be exceeded have been identified. The mitigatory measures include the provision of noise barriers in the form fence wall within the school sites or modification of the school orientation. However, the responsibility for planning and developing the area should ensure the designs comply with HKPSG noise levels.

10.6 The layout for Area 57 has recently been endorsed. A 2 metre high noise barrier has been recommended for inclusion at the top of the edge parapet on the proposed Road P2 flyover to protect the proposed housing blocks. Noise barriers in the form of boundary walls at the school sites should also be provided along Roads L462, L463 and L464 as alternatives to the application of open texture pavement on local roads to protect the school sites.

10.7 The Haven of Hope Sanatorium is the only existing development in the area which will be affected by road traffic noise. One existing ward, will be subject to noise levels exceeding 55 dB(A)$L_{10}$ (1-hour), the HKPSG for hospitals. This ward is going to be vacated in late 1996 or early 1997,i.e. before the completion of the roadworks included in this contract. The new hospital building is going to be air-conditioned. The plan for future re-development of the hospital buildings should consider the impact of road traffic noise from the adjacent highways.

10.8 Occupation of the proposed developments within the Tseung Kwan O Town Centre North area will not occur until the highway works are completed and will not therefore be affected by construction noise. The Haven of Hope Sanatorium buildings are the only existing premises subject to possible construction noise impact in the area but these premises will be vacated before the completion of the Contract. The affected works can be programmed and monitored accordingly to minimise the possible impact of noise from the construction activities.

10.9 The impact on air quality following the full development of Tseung Kwan O New Town and the advent of resulting traffic flows on the roads to be constructed under Contract No. TK 39/93 will be minimal. None of the existing or proposed buildings in the area will experience pollutant levels which are expected to exceed the Hong Kong Air Quality Objective values.

10.10 Dust is the usual cause for a deterioration of air quality during construction. The nature of the site and associated construction activities will not lead to significant volumes of dust being generated from construction activities. The Haven of Hope Sanatorium is the only property likely to be affected by diminished air quality during construction and good working practices combined with adequate site supervision will be sufficient to limit any localised dust emissions to the required standards.

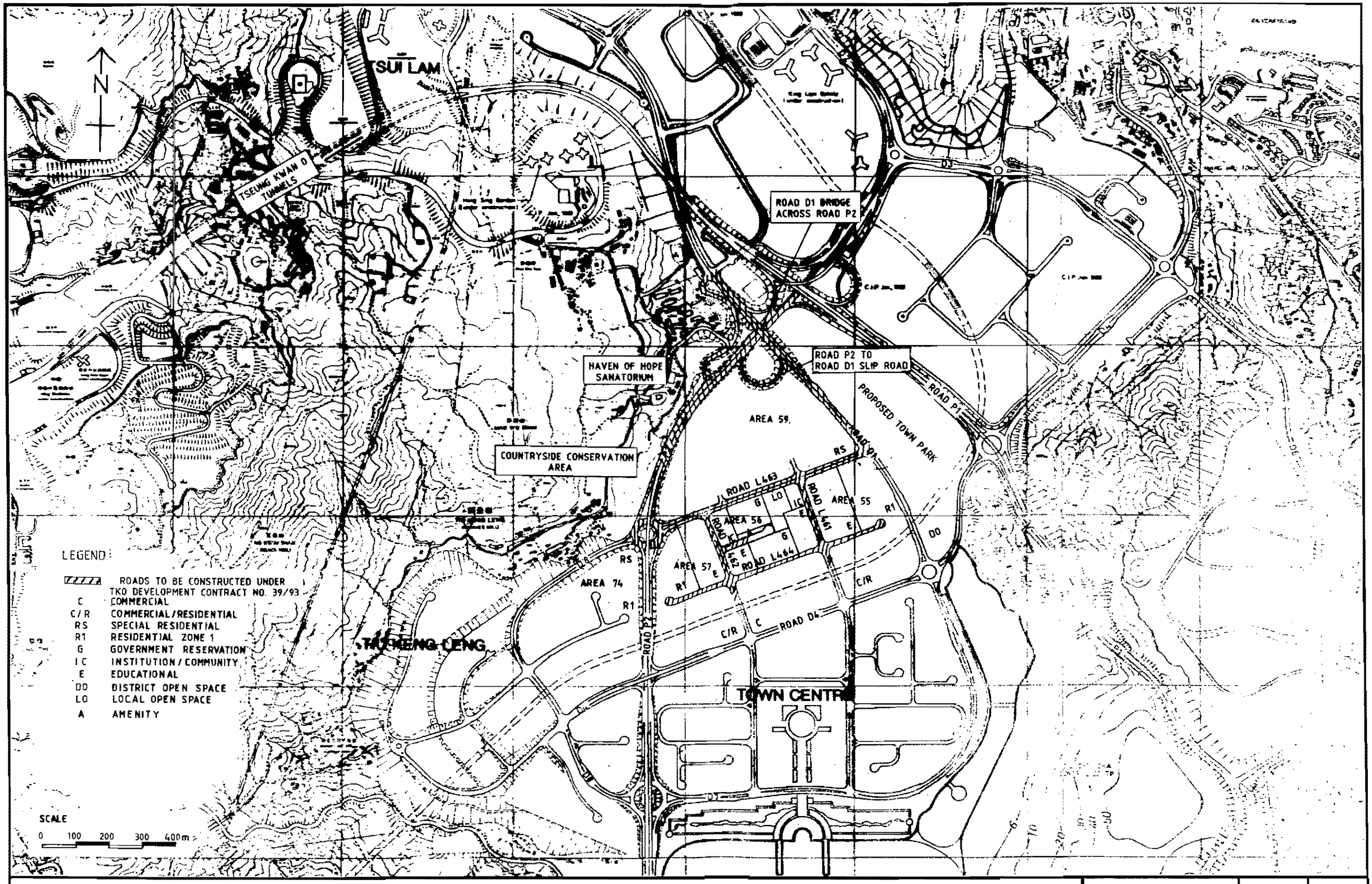
10.11 Recommendations for monitoring and auditing during construction have been made. In general the low impact will not require elaborate procedures and it is recommended that monitoring should be undertaken where the impact of works is unusually high or in response to complaints. In addition, it is recommended that regular monitoring of TSP should be undertaken in the vicinity of the Ward building at the Sanatorium closest to the proposed Works. Traffic levels in the initial years after the road opening will be low until development of the surrounding area and the remainder of Tseung Kwan O New Town is completed. Monitoring of environmental conditions will not therefore be necessary for the foreseeable future following the completion of the roads.

10.12 It is concluded that the environmental impact of the roads proposed under Contract No. TK 39/93 will not be significant. The Haven of Hope Sanatorium is the only existing property likely to be affected during the construction period and measures to minimise the impact and monitor dust levels have been identified. Noise levels in the future are predicted to increase to beyond the standards recommended in HKPSG at sensitive facades. Noise mitigation measures including noise barriers and open texture pavement have been identified to mitigate the effects of noise from road traffic for dwellings which are planned for Area 59.

10.13 Detailed plans for the development of Areas 55 and 56 are currently being prepared and noise mitigation measures will be similarly required to protect sensitive receivers in these areas. The responsibility for ensuring that adequate measures are taken to mitigate against adverse environmental impacts in the future lies with those responsible for planning and designing the buildings.

10.14 Area 74 has been zoned for residential development. A detailed layout plan has yet to be prepared with the view to mitigate the noise impact from Road P2. It is recommended that a separate impact assessment should be conducted in conjunction with the master layout plan for the area to establish mitigatory measures required at the planning stage.

# FIGURES




TSEUNG KWAN O DEVELOPMENT CONTRACT TK 39/93 ENVIRONMENTAL IMPACT ASSESSMENT

**LOCATION AND KEY PLAN**

MAUNSELL CONSULTANTS ASIA LTD.

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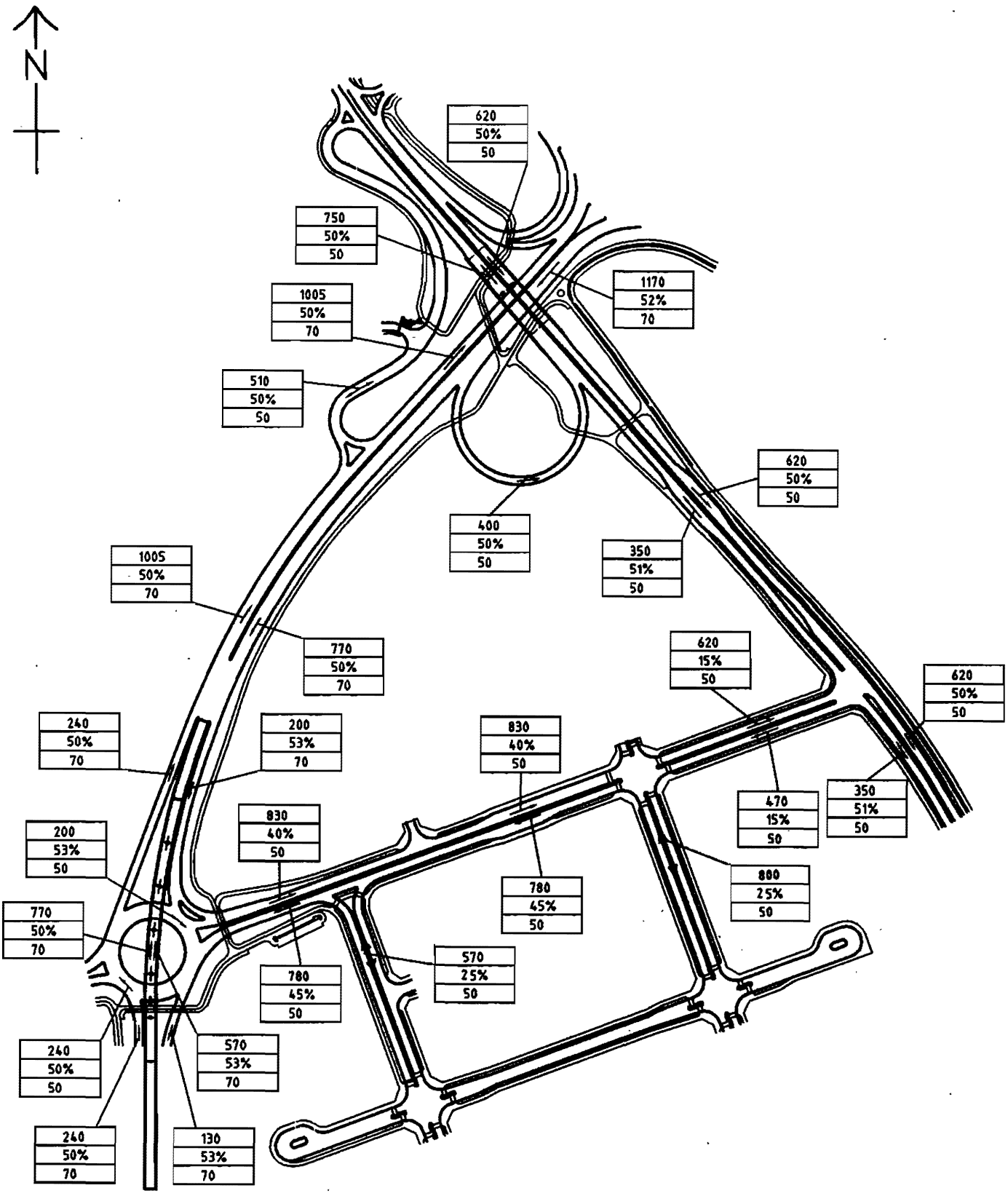
FIG.1




**Legend:**

DIRECTION OF FLOW

| |
|---|
| 780 |
| 45% |
| 50 |

Traffic flow (vehicles per hour)
Percentage of heavy vehicles
Speed (kph)

Note:

Traffic flows are for 2011 a.m. peak period

'SEUNG KWAN O DEVELOPMENT CONTRACT TK 39/93 ENVIRONMENTAL MPACT ASSESSMENT

# TRAFFIC FLOW DATA FOR ROAD TRAFFIC NOISE ASSESSMENT

MAUNSELL CONSULTANTS ASIA LTD.

60493

FIG.2

# APPENDIX 1

## Typical CALINE4 data input and output files for CO

# Typical CALINE4 data input file for CO

```
TK39 Air Quality Assessment  CO.DAT
1CO
      100.000000       28.000000    0.000000E+00    0.000000E+00           1
          19         1.000000           1
P2-1
      617.000000      379.000000        1.800000
PA
PB
PC
PD
PE
DA
DB
DC
DD
LA
LB
LC
LD
SA
SB
P1
P2
P3
DE
           1      412.000000       77.000000      443.000000      170.000000
    0.000000E+00       30.000000    0.000000E+00    0.000000E+00           0
           1      443.000000      170.000000      505.000000      285.000000
    0.000000E+00       30.000000    0.000000E+00    0.000000E+00           0
           1      505.000000      285.000000      560.000000      375.000000
    0.000000E+00       30.000000    0.000000E+00    0.000000E+00           0
           1      560.000000      375.000000      648.000000      453.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
           1      648.000000      453.000000      721.000000      528.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
           1      600.000000      690.000000      795.000000      460.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
           1      795.000000      460.000000      909.000000      340.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
           1      909.000000      340.000000     1024.000000      207.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
           1     1024.000000      207.000000     1116.000000       80.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
           1      455.000000      -32.000000      838.000000      111.000000
    0.000000E+00       22.000000    0.000000E+00    0.000000E+00           0
           1      838.000000      111.000000     1006.000000      173.000000
    0.000000E+00       22.000000    0.000000E+00    0.000000E+00           0
           1      563.000000       11.000000      660.000000     -212.000000
    0.000000E+00       22.000000    0.000000E+00    0.000000E+00           0
           1      838.000000      111.000000      920.000000     -112.000000
    0.000000E+00       22.000000    0.000000E+00    0.000000E+00           0
           1      670.000000      455.000000      723.000000      376.000000
    0.000000E+00       13.000000    0.000000E+00    0.000000E+00           0
           1      723.000000      376.000000      785.000000      448.000000
    0.000000E+00       13.000000    0.000000E+00    0.000000E+00           0
           1      390.000000     -600.000000      390.000000     -100.000000
    0.000000E+00       30.000000    0.000000E+00    0.000000E+00           0
           1      390.000000     -100.000000      412.000000       77.000000
    0.000000E+00       30.000000    0.000000E+00    0.000000E+00           0
           1      721.000000      528.000000      890.000000      715.000000
    0.000000E+00       30.000000    0.000000E+00    0.000000E+00           0
           1     1116.000000       80.000000     1220.000000     -157.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
31111CO (1M/S)
     1773.000000     1773.000000     1773.000000     1773.000000
     2173.000000      970.000000      970.000000      970.000000
     1370.000000     1610.000000     1090.000000      570.000000
      800.000000      400.000000      400.000000     2150.000000
     1773.000000     2175.000000      970.000000
       14.513000       14.513000       14.513000       14.513000
       14.513000       14.513000       14.513000       14.513000
       14.513000       14.513000       14.513000       14.513000
       14.513000       14.513000       14.513000       14.513000
       14.513000       14.513000       14.513000
       90.000000        1.000000           4       500.000000       20.000000
        1.850000       25.000000
```

# Typical output file from CALINE4 for CO

```
        CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                 JULY 1985 VERSION
                 PAGE   1

             JOB: TK39 Air Quality Assessment  CO.DAT
             RUN: CO (1M/S)        (WORST CASE ANGLE)
       POLLUTANT: CO
```

I. SITE VARIABLES

| | | | |
|---|---|---|---|
| U= | 1.0 M/S | Z0= | 100. CM |
| BRG= | WORST CASE | VD= | .0 CM/S |
| CLAS= | 4 (D) | VS= | .0 CM/S |
| MIXH= | 500. M | AMB= | 1.9 PPM |
| SIGTH= | 20. DEGREES | TEMP= | 25.0 DEGREE (C) |

II. LINK VARIABLES

| LINK DESCRIPTION | * | LINK COORDINATES (M) X1 | Y1 | X2 | Y2 | * TYPE | VPH | EF (G/MI) | H (M) | W (M) |
|---|---|---|---|---|---|---|---|---|---|---|
| A. PA | * | 412 | 77 | 443 | 170 | * AG | 1773 | 14.5 | .0 | 30.0 |
| B. PB | * | 443 | 170 | 505 | 285 | * AG | 1773 | 14.5 | .0 | 30.0 |
| C. PC | * | 505 | 285 | 560 | 375 | * AG | 1773 | 14.5 | .0 | 30.0 |
| D. PD | * | 560 | 375 | 648 | 453 | * AG | 1773 | 14.5 | .0 | 28.0 |
| E. PE | * | 648 | 453 | 721 | 528 | * AG | 2173 | 14.5 | .0 | 28.0 |
| F. DA | * | 600 | 690 | 795 | 460 | * AG | 970 | 14.5 | .0 | 28.0 |
| G. DB | * | 795 | 460 | 909 | 340 | * AG | 970 | 14.5 | .0 | 28.0 |
| H. DC | * | 909 | 340 | 1024 | 207 | * AG | 970 | 14.5 | .0 | 28.0 |
| I. DD | * | 1024 | 207 | 1116 | 80 | * AG | 1370 | 14.5 | .0 | 28.0 |
| J. LA | * | 455 | -32 | 838 | 111 | * AG | 1610 | 14.5 | .0 | 22.0 |
| K. LB | * | 838 | 111 | 1006 | 173 | * AG | 1090 | 14.5 | .0 | 22.0 |
| L. LC | * | 563 | 11 | 660 | -212 | * AG | 570 | 14.5 | .0 | 22.0 |
| M. LD | * | 838 | 111 | 920 | -112 | * AG | 800 | 14.5 | .0 | 22.0 |
| N. SA | * | 670 | 455 | 723 | 376 | * AG | 400 | 14.5 | .0 | 13.0 |
| O. SB | * | 723 | 376 | 785 | 448 | * AG | 400 | 14.5 | .0 | 13.0 |
| P. P1 | * | 390 | -600 | 390 | -100 | * AG | 2150 | 14.5 | .0 | 30.0 |
| Q. P2 | * | 390 | -100 | 412 | 77 | * AG | 1773 | 14.5 | .0 | 30.0 |
| R. P3 | * | 721 | 528 | 890 | 715 | * AG | 2175 | 14.5 | .0 | 30.0 |
| S. DE | * | 1116 | 80 | 1220 | -157 | * AG | 970 | 14.5 | .0 | 28.0 |

III. RECEPTOR LOCATIONS

| RECEPTOR | * | COORDINATES (M) X | Y | Z |
|---|---|---|---|---|
| 1. P2-1 | * | 617 | 379 | 1.8 |

JOB: TK39 Air Quality Assessment CO.DAT
RUN: CO (1M/S) (WORST CASE ANGLE)
POLLUTANT: CO

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

| RECEPTOR | BRG (DEG) | PRED CONC (PPM) | CONC/LINK (PPM) A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. P2-1 | 28. | 2.7 | .0 | .0 | .0 | .3 | .3 | .1 | .0 | .0 |

| RECEPTORS | CONC/LINK (PPM) I | J | K | L | M | N | O | P | Q | R |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. P2-1 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .2 | .0 |

# APPENDIX 2

## Typical CALINE4 data input and output files for $NO_2$

# Typical CALINE4 data input file for $NO_2$

```
TK39 Air Quality Assessment  NO2I.DAT
3   NO2
      100.000000       46.000000    0.000000E+00    0.000000E+00           1
          19        1.000000           1           1
P2-1
      617.000000      379.000000        1.800000
PA
PB
PC
PD
PE
DA
DB
DC
DD
LA
LB
LC
LD
SA
SB
P1
P2
P3
DE
           1      412.000000       77.000000      443.000000      170.000000
    0.000000E+00       30.000000    0.000000E+00    0.000000E+00           0
           1      443.000000      170.000000      505.000000      285.000000
    0.000000E+00       30.000000    0.000000E+00    0.000000E+00           0
           1      505.000000      285.000000      560.000000      375.000000
    0.000000E+00       30.000000    0.000000E+00    0.000000E+00           0
           1      560.000000      375.000000      648.000000      453.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
           1      648.000000      453.000000      721.000000      528.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
           1      600.000000      690.000000      795.000000      460.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
           1      795.000000      460.000000      909.000000      340.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
           1      909.000000      340.000000     1024.000000      207.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
           1     1024.000000      207.000000     1116.000000       80.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
           1      455.000000      -32.000000      838.000000      111.000000
    0.000000E+00       22.000000    0.000000E+00    0.000000E+00           0
           1      838.000000      111.000000     1006.000000      173.000000
    0.000000E+00       22.000000    0.000000E+00    0.000000E+00           0
           1      563.000000       11.000000      660.000000     -212.000000
    0.000000E+00       22.000000    0.000000E+00    0.000000E+00           0
           1      838.000000      111.000000      920.000000     -112.000000
    0.000000E+00       22.000000    0.000000E+00    0.000000E+00           0
           1      670.000000      455.000000      723.000000      376.000000
    0.000000E+00       13.000000    0.000000E+00    0.000000E+00           0
           1      723.000000      376.000000      785.000000      448.000000
    0.000000E+00       13.000000    0.000000E+00    0.000000E+00           0
           1      390.000000     -600.000000      390.000000     -100.000000
    0.000000E+00       30.000000    0.000000E+00    0.000000E+00           0
           1      390.000000     -100.000000      412.000000       77.000000
    0.000000E+00       30.000000    0.000000E+00    0.000000E+00           0
           1      721.000000      528.000000      890.000000      715.000000
    0.000000E+00       30.000000    0.000000E+00    0.000000E+00           0
           1     1116.000000       80.000000     1220.000000     -157.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
31111NO2 (1M/S)
     1773.000000     1773.000000     1773.000000     1773.000000
     2173.000000      970.000000      970.000000      970.000000
     1370.000000     1610.000000     1090.000000      570.000000
      800.000000      400.000000      400.000000     2150.000000
     1773.000000     2175.000000      970.000000
        6.099000        6.099000        6.099000        6.099000
        6.099000        6.099000        6.099000        6.099000
        6.099000        6.099000        6.099000        6.099000
        6.099000        6.099000        6.099000        6.099000
        6.099000        6.099000        6.099000
       90.000000        1.000000           4       500.000000       20.000000
    0.000000E+00       25.000000
```

# Typical output file from CALINE4 for $NO_2$

```
        CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                 JULY 1985 VERSION
                 PAGE   1

             JOB: TK39 Air Quality Assessment  NO2I.DAT
             RUN: NO2 (1M/S)       (WORST CASE ANGLE)
      POLLUTANT:    NO2
```

I. SITE VARIABLES

```
     U=   1.0  M/S           Z0= 100. CM
   BRG= WORST CASE           VD=   .0 CM/S
  CLAS=     4  (D)           VS=   .0 CM/S
  MIXH=  500.  M            AMB=   .0 PPM
 SIGTH=   20.  DEGREES     TEMP= 25.0 DEGREE (C)
```

II. LINK VARIABLES

| LINK DESCRIPTION | * | LINK COORDINATES (M) X1 | Y1 | X2 | Y2 | * TYPE | VPH | EF (G/MI) | H (M) | W (M) |
|---|---|---|---|---|---|---|---|---|---|---|
| A. PA | * | 412 | 77 | 443 | 170 | * AG | 1773 | 6.1 | .0 | 30.0 |
| B. PB | * | 443 | 170 | 505 | 285 | * AG | 1773 | 6.1 | .0 | 30.0 |
| C. PC | * | 505 | 285 | 560 | 375 | * AG | 1773 | 6.1 | .0 | 30.0 |
| D. PD | * | 560 | 375 | 648 | 453 | * AG | 1773 | 6.1 | .0 | 28.0 |
| E. PE | * | 648 | 453 | 721 | 528 | * AG | 2173 | 6.1 | .0 | 28.0 |
| F. DA | * | 600 | 690 | 795 | 460 | * AG | 970 | 6.1 | .0 | 28.0 |
| G. DB | * | 795 | 460 | 909 | 340 | * AG | 970 | 6.1 | .0 | 28.0 |
| H. DC | * | 909 | 340 | 1024 | 207 | * AG | 970 | 6.1 | .0 | 28.0 |
| I. DD | * | 1024 | 207 | 1116 | 80 | * AG | 1370 | 6.1 | .0 | 28.0 |
| J. LA | * | 455 | -32 | 838 | 111 | * AG | 1610 | 6.1 | .0 | 22.0 |
| K. LB | * | 838 | 111 | 1006 | 173 | * AG | 1090 | 6.1 | .0 | 22.0 |
| L. LC | * | 563 | 11 | 660 | -212 | * AG | 570 | 6.1 | .0 | 22.0 |
| M. LD | * | 838 | 111 | 920 | -112 | * AG | 800 | 6.1 | .0 | 22.0 |
| N. SA | * | 670 | 455 | 723 | 376 | * AG | 400 | 6.1 | .0 | 13.0 |
| O. SB | * | 723 | 376 | 785 | 448 | * AG | 400 | 6.1 | .0 | 13.0 |
| P. P1 | * | 390 | -600 | 390 | -100 | * AG | 2150 | 6.1 | .0 | 30.0 |
| Q. P2 | * | 390 | -100 | 412 | 77 | * AG | 1773 | 6.1 | .0 | 30.0 |
| R. P3 | * | 721 | 528 | 890 | 715 | * AG | 2175 | 6.1 | .0 | 30.0 |
| S. DE | * | 1116 | 80 | 1220 | -157 | * AG | 970 | 6.1 | .0 | 28.0 |

III. RECEPTOR LOCATIONS

| RECEPTOR | * | COORDINATES (M) X | Y | Z |
|---|---|---|---|---|
| 1. P2-1 | * | 617 | 379 | 1.8 |

JOB: TK39 Air Quality Assessment NO2I.DAT
RUN: NO2 (1M/S) (WORST CASE ANGLE)
POLLUTANT: NO2

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

| RECEPTOR | BRG (DEG) | PRED CONC (PPM) | CONC/LINK (PPM) A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. P2-1 | 28. | .2 | .0 | .0 | .0 | .1 | .1 | .0 | .0 | .0 |

| RECEPTORS | CONC/LINK (PPM) I | J | K | L | M | N | O | P | Q | R |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. P2-1 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 |

# APPENDIX 3

## Typical CALINE4 data input and output files for RSP

# Typical CALINE4 data input file for RSP

```
TK39 Air Quality Assessment  RSP.DAT
4RSP
      100.000000    61957.000000    0.000000E+00    0.000000E+00          1
          19        1.000000           1            1
P2-1
      617.000000      379.000000       1.800000
PA
PB
PC
PD
PE
DA
DB
DC
DD
LA
LB
LC
LD
SA
SB
P1
P2
P3
DE
          1     412.000000      77.000000     443.000000     170.000000
    0.000000E+00      30.000000    0.000000E+00    0.000000E+00           0
          1     443.000000     170.000000     505.000000     285.000000
    0.000000E+00      30.000000    0.000000E+00    0.000000E+00           0
          1     505.000000     285.000000     560.000000     375.000000
    0.000000E+00      30.000000    0.000000E+00    0.000000E+00           0
          1     560.000000     375.000000     648.000000     453.000000
    0.000000E+00      28.000000    0.000000E+00    0.000000E+00           0
          1     648.000000     453.000000     721.000000     528.000000
    0.000000E+00      28.000000    0.000000E+00    0.000000E+00           0
          1     600.000000     690.000000     795.000000     460.000000
    0.000000E+00      28.000000    0.000000E+00    0.000000E+00           0
          1     795.000000     460.000000     909.000000     340.000000
    0.000000E+00      28.000000    0.000000E+00    0.000000E+00           0
          1     909.000000     340.000000    1024.000000     207.000000
    0.000000E+00      28.000000    0.000000E+00    0.000000E+00           0
          1    1024.000000     207.000000    1116.000000      80.000000
    0.000000E+00      28.000000    0.000000E+00    0.000000E+00           0
          1     455.000000     -32.000000     838.000000     111.000000
    0.000000E+00      22.000000    0.000000E+00    0.000000E+00           0
          1     838.000000     111.000000    1006.000000     173.000000
    0.000000E+00      22.000000    0.000000E+00    0.000000E+00           0
          1     563.000000      11.000000     660.000000    -212.000000
    0.000000E+00      22.000000    0.000000E+00    0.000000E+00           0
          1     838.000000     111.000000     920.000000    -112.000000
    0.000000E+00      22.000000    0.000000E+00    0.000000E+00           0
          1     670.000000     455.000000     723.000000     376.000000
    0.000000E+00      13.000000    0.000000E+00    0.000000E+00           0
          1     723.000000     376.000000     785.000000     448.000000
    0.000000E+00      13.000000    0.000000E+00    0.000000E+00           0
          1     390.000000    -600.000000     390.000000    -100.000000
    0.000000E+00      30.000000    0.000000E+00    0.000000E+00           0
          1     390.000000    -100.000000     412.000000      77.000000
    0.000000E+00      30.000000    0.000000E+00    0.000000E+00           0
          1     721.000000     528.000000     890.000000     715.000000
    0.000000E+00      30.000000    0.000000E+00    0.000000E+00           0
          1    1116.000000      80.000000    1220.000000    -157.000000
    0.000000E+00      28.000000    0.000000E+00    0.000000E+00           0
31111RSP (1M/S)
     1773.000000    1773.000000    1773.000000    1773.000000
     2173.000000     970.000000     970.000000     970.000000
     1370.000000    1610.000000    1090.000000     570.000000
      800.000000     400.000000     400.000000    2150.000000
     1773.000000    2175.000000     970.000000
    5.696000E-01   5.696000E-01   5.696000E-01   5.696000E-01
    5.696000E-01   5.696000E-01   5.696000E-01   5.696000E-01
    5.696000E-01   5.696000E-01   5.696000E-01   5.696000E-01
    5.696000E-01   5.696000E-01   5.696000E-01   5.696000E-01
    5.696000E-01   5.696000E-01   5.696000E-01
       90.000000      1.000000           4      500.000000      20.000000
    0.000000E+00      25.000000
```

# Typical output file from CALINE4 for RSP

```
CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
         JULY 1985 VERSION
         PAGE   1

     JOB: TK39 Air Quality Assessment  RSP.DAT
     RUN: RSP (1M/S)       (WORST CASE ANGLE)
POLLUTANT: RSP
(NOTE: OUTPUT IN MICRO-GRAMS/METER**3. IGNORE PPM LABEL)
```

I. SITE VARIABLES

```
    U=   1.0  M/S            Z0= 100. CM
  BRG= WORST CASE            VD=   .0 CM/S
 CLAS=     4  (D)            VS=   .0 CM/S
 MIXH=  500.  M             AMB=   .0 PPM
SIGTH=   20.  DEGREES      TEMP= 25.0 DEGREE (C)
```

II. LINK VARIABLES

| LINK DESCRIPTION | LINK COORDINATES (M) X1 | Y1 | X2 | Y2 | TYPE | VPH | EF (G/MI) | H (M) | W (M) |
|---|---|---|---|---|---|---|---|---|---|
| A. PA | 412 | 77 | 443 | 170 | AG | 1773 | .6 | .0 | 30.0 |
| B. PB | 443 | 170 | 505 | 285 | AG | 1773 | .6 | .0 | 30.0 |
| C. PC | 505 | 285 | 560 | 375 | AG | 1773 | .6 | .0 | 30.0 |
| D. PD | 560 | 375 | 648 | 453 | AG | 1773 | .6 | .0 | 28.0 |
| E. PE | 648 | 453 | 721 | 528 | AG | 2173 | .6 | .0 | 28.0 |
| F. DA | 600 | 690 | 795 | 460 | AG | 970 | .6 | .0 | 28.0 |
| G. DB | 795 | 460 | 909 | 340 | AG | 970 | .6 | .0 | 28.0 |
| H. DC | 909 | 340 | 1024 | 207 | AG | 970 | .6 | .0 | 28.0 |
| I. DD | 1024 | 207 | 1116 | 80 | AG | 1370 | .6 | .0 | 28.0 |
| J. LA | 455 | -32 | 838 | 111 | AG | 1610 | .6 | .0 | 22.0 |
| K. LB | 838 | 111 | 1006 | 173 | AG | 1090 | .6 | .0 | 22.0 |
| L. LC | 563 | 11 | 660 | -212 | AG | 570 | .6 | .0 | 22.0 |
| M. LD | 838 | 111 | 920 | -112 | AG | 800 | .6 | .0 | 22.0 |
| N. SA | 670 | 455 | 723 | 376 | AG | 400 | .6 | .0 | 13.0 |
| O. SB | 723 | 376 | 785 | 448 | AG | 400 | .6 | .0 | 13.0 |
| P. P1 | 390 | -600 | 390 | -100 | AG | 2150 | .6 | .0 | 30.0 |
| Q. P2 | 390 | -100 | 412 | 77 | AG | 1773 | .6 | .0 | 30.0 |
| R. P3 | 721 | 528 | 890 | 715 | AG | 2175 | .6 | .0 | 30.0 |
| S. DE | 1116 | 80 | 1220 | -157 | AG | 970 | .6 | .0 | 28.0 |

III. RECEPTOR LOCATIONS

| RECEPTOR | COORDINATES (M) X | Y | Z |
|---|---|---|---|
| 1. P2-1 | 617 | 379 | 1.8 |

JOB: TK39 Air Quality Assessment RSP.DAT
RUN: RSP (1M/S) (WORST CASE ANGLE)
POLLUTANT: RSP
(NOTE: OUTPUT IN MICRO-GRAMS/METER**3. IGNORE PPM LABEL)

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

| RECEPTOR | BRG (DEG) | PRED CONC (PPM) | CONC/LINK (PPM) A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. P2-1 | 28. | 40.2 | .0 | .0 | .0 | 11.9 | 15.4 | 4.1 | .0 | .0 |

| RECEPTOR | CONC/LINK (PPM) I | J | K | L | M | N | O | P | Q | R | S |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. P2-1 | .0 | .0 | .0 | .0 | .0 | .8 | .0 | .0 | .0 | 8.1 | .0 |

# APPENDIX 4

## CALINE4 data input and output files for assessment of impact of barrier

# CALINE4 data input file to assess impact of barrier

```
Barrier along Road P2              CO.DAT
1CO
      100.000000       28.000000    0.000000E+00    0.000000E+00          1
          19         1.000000           1             1
P2-1
      617.000000      379.000000        1.000000
PA
PB
PC
PD
PE
DA
DB
DC
DD
LA
LB
LC
LD
SA
SB
P1
P2
P3
DE
           2      412.000000       77.000000      443.000000      170.000000
       -5.000000       30.000000    0.000000E+00    0.000000E+00           0
           2      443.000000      170.000000      505.000000      285.000000
       -5.000000       30.000000    0.000000E+00    0.000000E+00           0
           2      505.000000      285.000000      560.000000      375.000000
       -5.000000       30.000000    0.000000E+00    0.000000E+00           0
           2      560.000000      375.000000      648.000000      453.000000
       -5.000000       28.000000    0.000000E+00    0.000000E+00           0
           1      648.000000      453.000000      721.000000      528.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
           1      600.000000      690.000000      795.000000      460.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
           1      795.000000      460.000000      909.000000      340.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
           1      909.000000      340.000000     1024.000000      207.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
           1     1024.000000      207.000000     1116.000000       80.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
           1      455.000000      -32.000000      838.000000      111.000000
    0.000000E+00       22.000000    0.000000E+00    0.000000E+00           0
           1      838.000000      111.000000     1006.000000      173.000000
    0.000000E+00       22.000000    0.000000E+00    0.000000E+00           0
           1      563.000000       11.000000      660.000000     -212.000000
    0.000000E+00       22.000000    0.000000E+00    0.000000E+00           0
           1      838.000000      111.000000      920.000000     -112.000000
    0.000000E+00       22.000000    0.000000E+00    0.000000E+00           0
           1      670.000000      455.000000      723.000000      376.000000
    0.000000E+00       13.000000    0.000000E+00    0.000000E+00           0
           1      723.000000      376.000000      785.000000      448.000000
    0.000000E+00       13.000000    0.000000E+00    0.000000E+00           0
           1      390.000000     -600.000000      390.000000     -100.000000
    0.000000E+00       30.000000    0.000000E+00    0.000000E+00           0
           1      390.000000     -100.000000      412.000000       77.000000
    0.000000E+00       30.000000    0.000000E+00    0.000000E+00           0
           1      721.000000      528.000000      890.000000      715.000000
    0.000000E+00       30.000000    0.000000E+00    0.000000E+00           0
           1     1116.000000       80.000000     1220.000000     -157.000000
    0.000000E+00       28.000000    0.000000E+00    0.000000E+00           0
31111CO (1M/S)
     1773.000000     1773.000000     1773.000000     1773.000000
     2173.000000      970.000000      970.000000      970.000000
     1370.000000     1610.000000     1090.000000      570.000000
      800.000000      400.000000      400.000000     2150.000000
     1773.000000     2175.000000      970.000000
       14.513000       14.513000       14.513000       14.513000
       14.513000       14.513000       14.513000       14.513000
       14.513000       14.513000       14.513000       14.513000
       14.513000       14.513000       14.513000       14.513000
       14.513000       14.513000       14.513000
       90.000000        1.000000           4       500.000000       20.000000
        1.850000       25.000000
```

# Output file from CALINE4 for assessment of impact of barrier

```
CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
         JULY 1985 VERSION
         PAGE   1

     JOB: Barrier along Road P2          CO.DAT
     RUN: CO (1M/S)       (WORST CASE ANGLE)
POLLUTANT: CO
```

I. SITE VARIABLES

```
     U=   1.0  M/S          Z0= 100. CM
   BRG= WORST CASE          VD=   .0 CM/S
  CLAS=     4  (D)          VS=   .0 CM/S
  MIXH=  500.  M           AMB=  1.9 PPM
 SIGTH=   20.  DEGREES     TEMP= 25.0 DEGREE (C)
```

II. LINK VARIABLES

| LINK DESCRIPTION | * | LINK COORDINATES (M) X1 | Y1 | X2 | Y2 | * TYPE | VPH | EF (G/MI) | H (M) | W (M) |
|---|---|---|---|---|---|---|---|---|---|---|
| A. PA | * | 412 | 77 | 443 | 170 | * DP | 1773 | 14.5 | -5.0 | 30.0 |
| B. PB | * | 443 | 170 | 505 | 285 | * DP | 1773 | 14.5 | -5.0 | 30.0 |
| C. PC | * | 505 | 285 | 560 | 375 | * DP | 1773 | 14.5 | -5.0 | 30.0 |
| D. PD | * | 560 | 375 | 648 | 453 | * DP | 1773 | 14.5 | -5.0 | 28.0 |
| E. PE | * | 648 | 453 | 721 | 528 | * AG | 2173 | 14.5 | .0 | 28.0 |
| F. DA | * | 600 | 690 | 795 | 460 | * AG | 970 | 14.5 | .0 | 28.0 |
| G. DB | * | 795 | 460 | 909 | 340 | * AG | 970 | 14.5 | .0 | 28.0 |
| H. DC | * | 909 | 340 | 1024 | 207 | * AG | 970 | 14.5 | .0 | 28.0 |
| I. DD | * | 1024 | 207 | 1116 | 80 | * AG | 1370 | 14.5 | .0 | 28.0 |
| J. LA | * | 455 | -32 | 838 | 111 | * AG | 1610 | 14.5 | .0 | 22.0 |
| K. LB | * | 838 | 111 | 1006 | 173 | * AG | 1090 | 14.5 | .0 | 22.0 |
| L. LC | * | 563 | 11 | 660 | -212 | * AG | 570 | 14.5 | .0 | 22.0 |
| M. LD | * | 838 | 111 | 920 | -112 | * AG | 800 | 14.5 | .0 | 22.0 |
| N. SA | * | 670 | 455 | 723 | 376 | * AG | 400 | 14.5 | .0 | 13.0 |
| O. SB | * | 723 | 376 | 785 | 448 | * AG | 400 | 14.5 | .0 | 13.0 |
| P. P1 | * | 390 | -600 | 390 | -100 | * AG | 2150 | 14.5 | .0 | 30.0 |
| Q. P2 | * | 390 | -100 | 412 | 77 | * AG | 1773 | 14.5 | .0 | 30.0 |
| R. P3 | * | 721 | 528 | 890 | 715 | * AG | 2175 | 14.5 | .0 | 30.0 |
| S. DE | * | 1116 | 80 | 1220 | -157 | * AG | 970 | 14.5 | .0 | 28.0 |

III. RECEPTOR LOCATIONS

| RECEPTOR | * | COORDINATES (M) X | Y | Z |
|---|---|---|---|---|
| 1. P2-1 | * | 617 | 379 | 1.0 |

JOB: Barrier along Road P2 CO.DAT
RUN: CO (1M/S) (WORST CASE ANGLE)
POLLUTANT: CO

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

| RECEPTOR | BRG (DEG) | PRED CONC (PPM) | CONC/LINK (PPM) A | B | C | D | E | F | G | H |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. P2-1 | 31. | 2.6 | .0 | .0 | .0 | .1 | .3 | .1 | .0 | .0 |

| RECEPTOR | CONC/LINK (PPM) I | J | K | L | M | N | O | P | Q | R | S |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. P2-1 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .0 | .2 | .0 |

# APPENDIX 5

## Details of FDM Dust Analysis

Contract TKO 39/93

Fugitive Dust Model for Tseung Kwan O - Town Centre North

Assumptions

- A Worst case scenario was used to model the maximum possible dust emissions during construction.
- All embankments are being constructed simultaneously in dry conditions.
- On haul roads which cater for the whole site, varying flows of 24t dump trucks carrying fill are used in the assessment. The haul roads are the major contributor of dust to the receptors.
- The embankments are considered as being sources which emit dust through handling of the fill materials, from the filling area and from soft excavation. The embankment area are divided into areas of roughly 1 hectare each. It is assumed that a truck deposits 13 tonnes of fill materials on each area every 5 minutes which is spread over the hectare area. The dumping of the fill is considered as a point source in the centre of each embankment area with a continuous emission. The haul roads are considered as line sources of 6m width.
- The emissions rates for TSP below 30$\mu$m are taken from "Compilation of Air Pollutant Emission Factors" (AP-42) (USEPA, 4th edn. 1986). Particles of larger sizes tend to settle out within short distances of plant and are therefore not considered. It is assumed that background dust is negligible.
- One hour average concentrations in $\mu g/m^3$ are calculated by FDM for 16 different wind directions and are displayed in output files. The co-ordinates and orientations of the sources are entered in input files.

Results

- Two receptors are used in the model. One is at the Haven of Hope Sanatorium and the other at the residential nursing home.
- For a realistic flow of 25 vehs/hr the maximum TSP concentrations at the nursing home and sanatorium are 545 $\mu g/m^3$ and 740 $\mu g/m^3$ respectively. Such levels are an indication of the worst possible impact if proper site practices were not followed and the wind directions were directly towards the receptors.
- Practical measures to reduce dust emissions to below the EPD hourly TSP standard of 500$\mu g/m^3$ can be achieved by good working practices on site. Watering of the haul roads twice a day can reduce dust emissions by up to 50%.

## Calculations of Dust Emissions

(using rates taken from "Compilation of Air Pollutant Emission Factors" (AP-42) (USEPA, 4th edn. 1986)

Unpaved Haul Road (11.2.1)

- dump truck av. wt. 24 tonnes

TSP $\leq 30\mu m$ 3.8kg/veh-km

= 3.8g/veh-m

TSP Emission = $\frac{3.8x(veh/hr)}{3600}$ g/m - sec

Handling Materials (11.2.3)

- for a lorry depositing fill every 5 mins (13t each trip)

Weight dumped of fill in 1 sec = $\frac{13}{5 \times 60}$ = 0.04333t/s

Assumed to be point source in centre of area involved.

For dry conditions (M=2%)

TSP $\leq 30\mu m$ = 0.0099 kg/t

TSP Emission = $0.04333 \times 0.0099 \times 10^3$

= 0.429g/s

Filling Area (Table 8.19.1-1)

TSP $\leq 30\mu m$ Emission = 3.9kg/hectare/day

= 0.39 $g/m^2/day$

= $\frac{0.39}{24x60x60}$ $g/m^2/s$ = $4.514 \times 10^{-6} g/m^2/s$

Soft Excavation (11.2.3)

TSP $\leq 30\mu m$ Emission = 0.004kg/tonne

- trruming 13 tonnes taken every 10 mins

TSP $\leq 30\mu m$ Emission = $\frac{0.004 \times 13 \times 10^3}{10 \times 60}$ g/s

= $8.67 \times 10^{-3}$ g/s

Dividing by area involved

TSP $\leq 30\mu m$ Emission = $\frac{8.67 \times 10^{-3}}{A}$ $g/m^2$-sec

# FDM data input file for assessment of dust during construction

```
          TSUENG KWAN O AIR ASSESSMENT FOR CONSTRUCTION

 1 1 1 1 1 1 2 1 1 1 1
   25   2    1   16
 60.      1.        1.        2.5
30.
1.
819583.0  844561.0
819328.0  844406.0
 30.451400E-05        819451.0  844691.0     180.0      56.0         42.
 30.451400E-05        819549.0  844731.0     200.0      50.0         42.
 30.451400E-05        819626.0  844626.0     210.0      48.0         42.
 30.451400E-05        819482.0  844601.0     200.0      50.0         42.
 30.451400E-05        819402.0  844950.0     200.0      50.0         42.
 30.451400E-05        819235.0  844478.0     200.0      50.0         27.
 30.451400E-05        819052.0  844404.0     171.0      59.0         14.
 30.451400E-05        818918.0  844405.0     100.0     100.0        -10.
 30.451400E-05        818990.0  844512.0      70.0     142.0        -23.5
 30.451400E-05        819421.0  844716.0     100.0     100.0         42.
 30.000014450         819615.0  844612.0      15.0      40.0         42.
 20.0264000           819620.0  844799.0  819459.0  844649.5         6.
 20.0264000           819158.0  844433.0  818944.0  844365.0         6.
 20.0264000           818940.0  844369.0  819183.0  844739.0         6.
 20.0264000           819189.0  844741.5  819540.0  844728.0         6.
 10.429               819451.0  844691.0
 10.429               819549.0  844731.0
 10.429               819626.0  844626.0
 10.429               819482.0  844601.0
 10.429               819402.0  844950.0
 10.429               819235.0  844478.0
 10.429               819052.0  844404.0
 10.429               818918.0  844405.0
 10.429               818990.0  844512.0
 10.429               819421.0  844716.0
      2.00     0.       4        500.       297.0
      2.00     22.5     4        500.       297.0
      2.00     45.      4        500.       297.0
      2.00     67.5     4        500.       297.0
      2.00     90.      4        500.       297.0
      2.00     112.5    4        500.       297.0
      2.00     135.     4        500.       297.0
      2.00     157.5    4        500.       297.0
      2.00     180.     4        500.       297.0
      2.00     202.5    4        500.       297.0
      2.00     225.     4        500.       297.0
      2.00     247.5    4        500.       297.0
      2.00     270.     4        500.       297.0
      2.00     292.5    4        500.       297.0
      2.00     315.     4        500.       297.0
      2.00     337.5    4        500.       297.0
```

# Output file from FDM for assessment of dust during construction

1

FUGITIVE DUST MODEL (FDM)
VERSION 90121
MAY, 1990

RUN TITLE:
TSUENG KWAN O AIR ASSESSMENT FOR CONSTRUCTION

INPUT FILE NAME: TKO39.IN
OUTPUT FILE NAME: TKO39.OUT

| | |
|---|---|
| CONVERGENCE OPTION 1=OFF, 2=ON | 1 |
| MET OPTION SWITCH, 1=CARDS, 2=PREPROCESSED | 1 |
| PLOT FILE OUTPUT, 1=NO, 2=YES | 1 |
| MET DATA PRINT SWITCH, 1=NO, 2=YES | 2 |
| POST-PROCESSOR OUTPUT, 1=NO, 2=YES | 1 |
| DEP. VEL./GRAV. SETL. VEL., 1=DEFAULT, 2=USER | 1 |
| PRINT 1-HOUR AVERAGE CONCEN, 1=NO, 2=YES | 4 |
| PRINT 3-HOUR AVERAGE CONCEN, 1=NO, 2=YES | 1 |
| PRINT 8-HOUR AVERAGE CONCEN, 1=NO, 2=YES | 1 |
| PRINT 24-HOUR AVERAGE CONCEN, 1=NO, 2=YES | 1 |
| PRINT LONG-TERM AVERAGE CONCEN, 1=NO, 2=YES | 1 |
| NUMBER OF SOURCES PROCESSED | 25 |
| NUMBER OF RECEPTORS PROCESSED | 2 |
| NUMBER OF PARTICLE SIZE CLASSES | 1 |
| NUMBER OF HOURS OF MET DATA PROCESSED | 16 |
| LENGTH IN MINUTES OF 1-HOUR OF MET DATA | 60. |
| ROUGHNESS LENGTH IN CM | 1.00 |
| SCALING FACTOR FOR SOURCE AND RECPTORS | 1.0000 |
| PARTICLE DENSITY IN G/CM**3 | 2.50 |

GENERAL PARTICLE SIZE CLASS INFORMATION

| PARTICLE SIZE CLASS | CHAR. DIA. (UM) | GRAV. SETTLING VELOCITY (M/SEC) | DEPOSITION VELOCITY (M/SEC) | FRACTION IN EACH SIZE CLASS |
|---|---|---|---|---|
| 1 | 30.0000000 | ** | ** | 1.0000 |

** COMPUTED BY FDM

1

RECEPTOR COORDINATES (X,Y,Z)

(819583., 844561., 0.) (819328., 844406., 0.) (

1

SOURCE INFORMATION

| TYPE | ENTERED EMIS. RATE (G/SEC, G/SEC/M OR G/SEC/M**2) | TOTAL EMISSION RATE (G/SEC) | WIND SPEED FAC. | X1 (M) | Y1 (M) | X2 (M) | Y2 (M) | HEIGHT (M) | WIDTH (M) |
|---|---|---|---|---|---|---|---|---|---|
| 3 | 0.000004514 | 0.04550 | 0.000 | 819451. | 844691. | 180. | 56. | 0.50 | 42.00 |
| 3 | 0.000004514 | 0.04514 | 0.000 | 819549. | 844731. | 200. | 50. | 0.50 | 42.00 |
| 3 | 0.000004514 | 0.04550 | 0.000 | 819626. | 844626. | 210. | 48. | 0.50 | 42.00 |
| 3 | 0.000004514 | 0.04514 | 0.000 | 819482. | 844601. | 200. | 50. | 0.50 | 42.00 |
| 3 | 0.000004514 | 0.04514 | 0.000 | 819402. | 844950. | 200. | 50. | 0.50 | 42.00 |
| 3 | 0.000004514 | 0.04514 | 0.000 | 819235. | 844478. | 200. | 50. | 0.50 | 27.00 |
| 3 | 0.000004514 | 0.04554 | 0.000 | 819052. | 844404. | 171. | 59. | 0.50 | 14.00 |
| 3 | 0.000004514 | 0.04514 | 0.000 | 818918. | 844405. | 100. | 100. | 0.50 | -10.00 |
| 3 | 0.000004514 | 0.04487 | 0.000 | 818990. | 844512. | 70. | 142. | 0.50 | -23.50 |
| 3 | 0.000004514 | 0.04514 | 0.000 | 819421. | 844716. | 100. | 100. | 0.50 | 42.00 |
| 3 | 0.000014450 | 0.00867 | 0.000 | 819615. | 844612. | 15. | 40. | 0.50 | 42.00 |
| 2 | 0.026400000 | 5.80027 | 0.000 | 819620. | 844799. | 819459. | 844650. | 0.50 | 6.00 |
| 2 | 0.026400000 | 5.92796 | 0.000 | 819158. | 844433. | 818944. | 844365. | 0.50 | 6.00 |
| 2 | 0.026400000 | 11.68626 | 0.000 | 818940. | 844369. | 819183. | 844739. | 0.50 | 6.00 |
| 2 | 0.026400000 | 9.27325 | 0.000 | 819189. | 844742. | 819540. | 844728. | 0.50 | 6.00 |
| 1 | 0.429000000 | 0.42900 | 0.000 | 819451. | 844691. | 0. | 0. | 0.50 | 0.00 |
| 1 | 0.429000000 | 0.42900 | 0.000 | 819549. | 844731. | 0. | 0. | 0.50 | 0.00 |
| 1 | 0.429000000 | 0.42900 | 0.000 | 819626. | 844626. | 0. | 0. | 0.50 | 0.00 |
| 1 | 0.429000000 | 0.42900 | 0.000 | 819482. | 844601. | 0. | 0. | 0.50 | 0.00 |
| 1 | 0.429000000 | 0.42900 | 0.000 | 819402. | 844950. | 0. | 0. | 0.50 | 0.00 |
| 1 | 0.429000000 | 0.42900 | 0.000 | 819235. | 844478. | 0. | 0. | 0.50 | 0.00 |
| 1 | 0.429000000 | 0.42900 | 0.000 | 819052. | 844404. | 0. | 0. | 0.50 | 0.00 |
| 1 | 0.429000000 | 0.42900 | 0.000 | 818918. | 844405. | 0. | 0. | 0.50 | 0.00 |
| 1 | 0.429000000 | 0.42900 | 0.000 | 818990. | 844512. | 0. | 0. | 0.50 | 0.00 |
| 1 | 0.429000000 | 0.42900 | 0.000 | 819421. | 844716. | 0. | 0. | 0.50 | 0.00 |
| | | ========== | | | | | | | |
| TOTAL EMISSIONS | | 37.43867 | | | | | | | |

1

1 HOUR AVERAGE FOR HOUR ENDING 1
CONCENTRATIONS IN MICROGRAMS/M**3

(819583., 844561., 288.749) (819328., 844406., 100.128) (

1

1 HOUR AVERAGE FOR HOUR ENDING 1
DEPOSITION RATE IN MICROGRAMS/M**2/SEC

(819583., 844561., 19.975) (819328., 844406., 6.927) (

1

1 HOUR AVERAGE FOR HOUR ENDING 2
CONCENTRATIONS IN MICROGRAMS/M**3

(819583., 844561., 135.178) (819328., 844406., 174.294) (

1

1 HOUR AVERAGE FOR HOUR ENDING 2
DEPOSITION RATE IN MICROGRAMS/M**2/SEC

(819583., 844561., 9.351) (819328., 844406., 12.057) (

1

1 HOUR AVERAGE FOR HOUR ENDING 3
CONCENTRATIONS IN MICROGRAMS/M**3

(819583., 844561., 122.480) (819328., 844406., 39.291) (

1

1 HOUR AVERAGE FOR HOUR ENDING 3
DEPOSITION RATE IN MICROGRAMS/M**2/SEC

(819583., 844561., 8.473) (819328., 844406., 2.718) (

1

1 HOUR AVERAGE FOR HOUR ENDING 4
CONCENTRATIONS IN MICROGRAMS/M**3

(819583., 844561., 3.899) (819328., 844406., 0.385) (

```
1
             1 HOUR AVERAGE FOR HOUR ENDING     4
                  DEPOSITION RATE IN MICROGRAMS/M**2/SEC

 (819583., 844561.,     0.270)  (819328., 844406.,     0.027)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING     5
                  CONCENTRATIONS IN MICROGRAMS/M**3

 (819583., 844561.,   120.730)  (819328., 844406.,     0.000)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING     5
                  DEPOSITION RATE IN MICROGRAMS/M**2/SEC

 (819583., 844561.,     8.352)  (819328., 844406.,     0.000)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING     6
                  CONCENTRATIONS IN MICROGRAMS/M**3

 (819583., 844561.,     0.000)  (819328., 844406.,     0.000)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING     6
                  DEPOSITION RATE IN MICROGRAMS/M**2/SEC

 (819583., 844561.,     0.000)  (819328., 844406.,     0.000)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING     7
                  CONCENTRATIONS IN MICROGRAMS/M**3

 (819583., 844561.,     0.000)  (819328., 844406.,     0.000)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING     7
                  DEPOSITION RATE IN MICROGRAMS/M**2/SEC

 (819583., 844561.,     0.000)  (819328., 844406.,     0.000)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING     8
                  CONCENTRATIONS IN MICROGRAMS/M**3

 (819583., 844561.,     4.602)  (819328., 844406.,     0.000)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING     8
                  DEPOSITION RATE IN MICROGRAMS/M**2/SEC

 (819583., 844561.,     0.318)  (819328., 844406.,     0.000)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING     9
                  CONCENTRATIONS IN MICROGRAMS/M**3

 (819583., 844561.,    96.848)  (819328., 844406.,     0.000)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING     9
                  DEPOSITION RATE IN MICROGRAMS/M**2/SEC

 (819583., 844561.,     6.700)  (819328., 844406.,     0.000)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING    10
                  CONCENTRATIONS IN MICROGRAMS/M**3

 (819583., 844561.,   121.525)  (819328., 844406.,     0.000)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING    10
                  DEPOSITION RATE IN MICROGRAMS/M**2/SEC

 (819583., 844561.,     8.407)  (819328., 844406.,     0.000)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING    11
                  CONCENTRATIONS IN MICROGRAMS/M**3

 (819583., 844561.,   136.450)  (819328., 844406.,     0.000)  (
```

```
1
             1 HOUR AVERAGE FOR HOUR ENDING    11
                  DEPOSITION RATE IN MICROGRAMS/M**2/SEC

 (819583., 844561.,     9.439)  (819328., 844406.,     0.000)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING    12
                  CONCENTRATIONS IN MICROGRAMS/M**3

 (819583., 844561.,   100.212)  (819328., 844406.,     0.142)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING    12
                  DEPOSITION RATE IN MICROGRAMS/M**2/SEC

 (819583., 844561.,     6.932)  (819328., 844406.,     0.010)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING    13
                  CONCENTRATIONS IN MICROGRAMS/M**3

 (819583., 844561.,    86.821)  (819328., 844406.,   543.539)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING    13
                  DEPOSITION RATE IN MICROGRAMS/M**2/SEC

 (819583., 844561.,     6.006)  (819328., 844406.,    37.600)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING    14
                  CONCENTRATIONS IN MICROGRAMS/M**3

 (819583., 844561.,   503.633)  (819328., 844406.,   128.869)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING    14
                  DEPOSITION RATE IN MICROGRAMS/M**2/SEC

 (819583., 844561.,    34.840)  (819328., 844406.,     8.915)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING    15
                  CONCENTRATIONS IN MICROGRAMS/M**3

 (819583., 844561.,   737.427)  (819328., 844406.,   217.793)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING    15
                  DEPOSITION RATE IN MICROGRAMS/M**2/SEC

 (819583., 844561.,    51.013)  (819328., 844406.,    15.066)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING    16
                  CONCENTRATIONS IN MICROGRAMS/M**3

 (819583., 844561.,   603.065)  (819328., 844406.,    96.988)  (
1
             1 HOUR AVERAGE FOR HOUR ENDING    16
                  DEPOSITION RATE IN MICROGRAMS/M**2/SEC

 (819583., 844561.,    41.718)  (819328., 844406.,     6.709)  (
```

1

METEOROLOGICAL DATA FOR DAY 1. (HOURS -7 TO 16)

| WIND SPEED (M/SEC) | WIND DIRECTION (DEGREES) | STABILITY CLASS (TURNER) | MIXING HEIGHT (M) | AMBIENT TEMP. (DEG. K) |
|---|---|---|---|---|
| 2.00 | 0. | 4 | 500. | 297.0 |
| 2.00 | 23. | 4 | 500. | 297.0 |
| 2.00 | 45. | 4 | 500. | 297.0 |
| 2.00 | 68. | 4 | 500. | 297.0 |
| 2.00 | 90. | 4 | 500. | 297.0 |
| 2.00 | 113. | 4 | 500. | 297.0 |
| 2.00 | 135. | 4 | 500. | 297.0 |
| 2.00 | 158. | 4 | 500. | 297.0 |
| 2.00 | 180. | 4 | 500. | 297.0 |
| 2.00 | 203. | 4 | 500. | 297.0 |
| 2.00 | 225. | 4 | 500. | 297.0 |
| 2.00 | 248. | 4 | 500. | 297.0 |
| 2.00 | 270. | 4 | 500. | 297.0 |
| 2.00 | 293. | 4 | 500. | 297.0 |
| 2.00 | 315. | 4 | 500. | 297.0 |
| 2.00 | 338. | 4 | 500. | 297.0 |

1

TABLE OF TOP VALUES FOR 1 HOUR AVERAGES

| RANK | RECEPTOR | X-COORDINATE | Y-COORDINATE | ENDING HOUR | CONCENTRATION | DEPOSITION |
|---|---|---|---|---|---|---|
| 1 | 1 | 819583.0 | 844561.0 | 15 | 737.4266 | 51.0127 |
| 2 | 1 | 819583.0 | 844561.0 | 16 | 603.0654 | 41.7181 |
| 3 | 2 | 819328.0 | 844406.0 | 13 | 543.5390 | 37.6002 |
| 4 | 1 | 819583.0 | 844561.0 | 14 | 503.6329 | 34.8396 |
| 5 | 1 | 819583.0 | 844561.0 | 1 | 288.7489 | 19.9747 |
| 6 | 2 | 819328.0 | 844406.0 | 15 | 217.7933 | 15.0662 |
| 7 | 2 | 819328.0 | 844406.0 | 2 | 174.2945 | 12.0571 |
| 8 | 1 | 819583.0 | 844561.0 | 11 | 136.4501 | 9.4392 |
| 9 | 1 | 819583.0 | 844561.0 | 2 | 135.1780 | 9.3512 |
| 10 | 2 | 819328.0 | 844406.0 | 14 | 128.8687 | 8.9147 |
| 11 | 1 | 819583.0 | 844561.0 | 3 | 122.4800 | 8.4728 |
| 12 | 1 | 819583.0 | 844561.0 | 10 | 121.5252 | 8.4067 |
| 13 | 1 | 819583.0 | 844561.0 | 5 | 120.7299 | 8.3517 |
| 14 | 1 | 819583.0 | 844561.0 | 12 | 100.2121 | 6.9323 |
| 15 | 2 | 819328.0 | 844406.0 | 1 | 100.1281 | 6.9265 |
| 16 | 2 | 819328.0 | 844406.0 | 16 | 96.9881 | 6.7093 |
| 17 | 1 | 819583.0 | 844561.0 | 9 | 96.8477 | 6.6996 |
| 18 | 1 | 819583.0 | 844561.0 | 13 | 86.8213 | 6.0060 |
| 19 | 2 | 819328.0 | 844406.0 | 3 | 39.2908 | 2.7180 |
| 20 | 1 | 819583.0 | 844561.0 | 8 | 4.6019 | 0.3183 |
| 21 | 1 | 819583.0 | 844561.0 | 4 | 3.8995 | 0.2698 |
| 22 | 2 | 819328.0 | 844406.0 | 4 | 0.3854 | 0.0267 |
| 23 | 2 | 819328.0 | 844406.0 | 12 | 0.1418 | 0.0098 |

1

HIGHEST AND SECOND HIGHEST VALUES FOR 1 HOUR AVERAGES

| RECEPTOR | X-COORDINATE | Y-COORDINATE | HIGHEST VALUE | ENDING HOUR | DEPOSITION | SECOND HIGH | ENDING HOUR | DEPOSTION |
|---|---|---|---|---|---|---|---|---|
| 1 | 819583.0 | 844561.0 | 737.4266 | 15 | 51.0127 | 603.0654 | 16 | 41.7181 |
| 2 | 819328.0 | 844406.0 | 543.5390 | 13 | 37.6002 | 217.7933 | 15 | 15.0662 |

# APPENDIX 6

## Comments on EIA Draft Final Report and Responses

# APPENDIX 6

## COMMENTS ON EIA DRAFT FINAL REPORT AND RESPONSES

### 1. ENVIRONMENT PROTECTION DEPARTMENT

| | COMMENT | RESPONSE |
|---|---|---|
| **1.1** | **EPD's letter (21) in EP1/N8/599II of 10th April 1995.** | |
| 1.1.1 | Para 3.4.3 : Add " and all day on general holidays (including Sundays)" following "0700". | Noted and added. |
| 1.1.2 | Para 3.4.3 : Delete "Noise emissions..... noise levels and "and add" is required." following the last word "hours". | Noted and amended. |
| 1.1.3 | Para 4.2.5 : "68.3dB(A)" should read as "68.4dB(A)". | Noted and amended. |
| 1.1.4 | Para 5.5.5 : Add " Construction noise is controlled under the NCO. Application for a CNP shall be submitted to the Noise Control Authority and mitigation measures will be needed to satisfy the NCO requirements. " at the end of the paragraph. | Construction noise is subject to the control of the Noise Control Ordinance. Application for a construction noise permit shall be submitted to the Noise Control Authority for concession if some essential construction activities cannot meet the requirement of 65dB(A). |

| | |
|---|---|
| 1.1.5 PM/NTE needs to ensure that the recommendations of constructing a 2m barrier on the flyover for Area 57 and the using of open texture surfacing material in this area should be adopted in the detailed design. | Detailed assessment to finalise the mitigation measures require to protect the HOS development in Area 57 would be undertaken in the course of implementation of the roadwork contract covering the flyover. Section of Road P2 south of Roundabout P2/L463 is the only additional length of road adjacent to Area 57 which requires to be laid with open texture surfacing as part of the overall mitigatory measures to bring the noise levels at the HOS site in Area 57 to the acceptable level. A 2m barrier was identified to be included along the future flyover. This will be subject to review during the detailed design stage. |

| COMMENT | RESPONSE |
|---|---|
| 1.1.6 Paragraphs 4.7 and 10.3 may need to be amended with respect to HD's responses. | These parts of the report outline one alternative solution to the issue. |
| 1.1.7 Details of assessment for air quality impact that may be caused by barriers such as the agreed methodology, relevant assumptions and prediction of impacts on receptors should be included in the final report. | Noted and the required information added in the final report. |
| 1.1.8 FDM should be preferred to assess the air quality during construction phase. | Noted and relevant parts of the report amended. |
| 1.1.9 Portable dust meter to monitor dust emissions on site for the purpose of alerting site staff to take action in case of exceedance of TSP limits can be used. | Noted. |
| 1.1.10 The two receptor names P2-1 in Table 7 of page 40 should be corrected. | The last receptor in Table 7 should read P2-2. |
| **1.2 EPD's memo (38) in EP1/N8/599II of 25th April 1995.** | |
| 1.2.1 Para 4.8.4 : The noise barrier should be 6 and 6.5m high. | Noted and amended. |
| 1.2.2 Para 4.2.5 : Add "from" after "impact" in Line 4. | Noted and amended. |
| 1.2.3 ASD's latest layouts of primary and secondary schools in Areas 55, 56 and 57 should be adopted. | Layouts amended on drawings. |

| | COMMENT | RESPONSE |
|---|---|---|
| 1.2.4 | Environmental Reviews for the two primary schools in Area 55, the one primary school in Area 56 and the one primary and one secondary schools in Area 57 were conducted. Mitigation measures at schools were agreed by ASD and EPD. The proposed 2.5m high noise barrier along Road L463 is unnecessary. | Noted and the 2.5 high noise barrier deleted. No direct mitigation measures are required for schools in Areas 55, 56 and 57. |
| **1.3** | **EPD's memo (51) in EP1/N8/599II of 3rd May 1995.** | |
| 1.3.1 | EPD have not carried out Environmental Review for the two secondary schools in Area 56 and request PM/NTE to carry out assessment to determine whether low noise surfacing or other alternatives should be used. | Assessment carried out. Comments and mitigation measures proposed in MCAL's letters NCC:af:60493/01-0121 dated 12/5/95 and NCC:af:60493/01-0131 dated 15/5/95. The anticipated noise impact from the adjacent roads can be mitigated by the provision of boundary walls and orientation of school building layout. |
| **1.4** | **EPD's letter (58) in EP1/N8/599II of 12th May 1995.** | |
| 1.4.1 | There is no source in calculating the dust emission factor for soil excavation. | The source reference is Section 11.2.3 USEPA AP-42 and it has been specified in the final report. |
| 1.4.2 | No meterological data is given in the FDM output file. | Data incorporated in the final report. |
| 1.4.3 | Adverse air quality impact should be investigated in view of the increase in planning population. | The increase in population would result in an increase of about 10% of traffic flows on the concerned roads. The increase in concentration of $NO_2$ at the identified receptors due to increased traffic would be approximately 10%. There is ample margin to accommodate the likely increase before the air quality objective for $NO_2$ of 300$\mu g/m^3$ is reached or exceeded. |

## 2. DRAINAGE SERVICES DEPARTMENT

| | COMMENT | RESPONSE |
|---|---|---|
| **2.1** | **DSD's letter ( ) in MS 8/10/8-22 of 10th April 1995.** | |
| 2.1.1 | No comment on the proposed noise barrier along Road P2 provided that Highways Department undertakes to remove barrier as and when required by DSD. | Noted. |
| **2.2** | **DSD's letter ( ) in MS 8/10/8-22 of 10th April 1995.** | |
| 2.2.1 | No comment on the report from drainage viewpoint | Noted. |

## 3. TRANSPORT DEPARTMENT

| | COMMENT | RESPONSE |
|---|---|---|
| **3.1** | **TD's letter ( ) in NR 146/190-77 of 11th April 1995.** | |
| 3.1.1 | The effect of recent proposed increase in population intake in Po Lam and Hang Hau South areas should be accounted for in the traffic forecast. | A sensitivity analysis had been performed in the Study for Area 137 to demonstrate the effects on the increase in traffic flows on all external links of Tseung Kwan O if the total population were increased to 440,000 by 2011. The flows on the external links would have a maximum increase of less than 10%. In view of such findings, the increased flows on Roads P2 and D1 would not cause a significant increase in noise level. The predicted increase in basic noise level is in the order of 0.5dB(A). |
| 3.1.2 | Para 3.2.2 : The population data needs to be confirmed with DPO/SK&TKO. | DPO/SK&TKO confirmed in their letter (5) in SKT1/1/37II of 18th April 1995 that the planned population should be 382, 342. The population figure of 333,000 adopted in the draft final report was based upon the previous Metroplan development scenario for Tseung Kwan O. As pointed out in the response to 3.1.1 above, the increase in impact would be minimal. |

## 4. FIRE SERVICES DEPARTMENT

| | COMMENT | RESPONSE |
|---|---|---|
| **4.1** | **FSD's letter (18) in FSD 14/7596/94 of 12th April 1995.** | |
| 4.1.1 | Relevant information on the materials for constructing the proposed noise barrier should be supplied to FSD. Different materials under fire situations have a direct bearing on the safety of the public and fire-fighters. | Plexiglas XT Soundstop (GS 237) panels or similar products are currently envisaged to be used for the proposed noise barrier. This material has been proven to have the required properties to enhance safety under fire. |

## 5. HOUSING DEPARTMENT

| | COMMENT | RESPONSE |
|---|---|---|
| **5.1** | **HD's memo HD(AR) 55/683/1 of 12th April 1995.** | |
| 5.1.1 | Para 4.8.4 : The height of the noise barrier should be 6 to 6.5m. | Noted and amended. |
| 5.1.2 | Para 4.9.2 : The proposed use of window treatments or changing the angle of the facades at Block 3 is totally unacceptable. | Description on the alternative of window treatments and orientation of facades deleted. Without these measures, the noise levels are still below the acceptable level if the proposed barrier on the flyover is constructed. |
| 5.1.3 | Para 4.9.3 : The 5 storey high carpark block and the footbridge lift tower in Area 57 already provide good shielding effect to the primary school. The proposed 2.5m high barrier along Road L463 may be unnecessary. | Barrier deleted. |
| 5.1.4 | Para 4.9.5 : Provision of open texture surfacing on Road L462 is subject to PM/NTE's decision. | Open texture surfacing would not be provided on Road L462 if other practical mitigation measures are adopted. |
| 5.1.5 | Figure 3 : The proposed 2.5m high noise barrier along Road L463 would break the visual link between Areas 57 and 59. | No barrier is now required. |

## 6. HIGHWAYS DEPARTMENT

| | COMMENT | RESPONSE |
|---|---|---|
| **6.1** | **HyD's letter (17) in HNT 703/SK/104 of 13th April 1995.** | |
| 6.1.1 | Para 4.8.3 to 4.8.4 : The 6 to 6.5m high noise barrier along Road P2 would not only impose adverse visual impact to road users but also demand substantial maintenance liability. However, this noise mitigation proposal appears the only practical solution under the present constraints. The proposed barrier is undesirable from a highway point of view. | Noted. |
| 6.1.2 | Para 4.9.2 : The height of the proposed noise barrier above the flyover deck needs to be clarified. | The proposed 2m high noise barrier is required on the edge parapet of the flyover. Wording amended. |
| 6.1.3 | Para 4.13 : Open texture surfacing should only be used on the roads surrounding Area 59, but not on the access roads to Areas 55, 56 and 77. | Open texture surfacing would not be provided on Roads L461, L462 and L464 provided that mitigation measures at the school buildings are undertaken. |
| 6.1.4 | Para 4.13 : The noise barrier mentioned in Para 4.9.2 should be described in the summary. | The height of the barrier on the future flyover has not been exactly determined. Both the flyover and the noise barrier would not be built under Contract TK39/93. |
| 6.1.5 | Para 5.2 : The construction of the proposed noise barrier along Road P2 would be substantial and should be mentioned in this paragraph. | The foundations of the noise barrier would be constructed under Contract TK39/93. The construction of the foundations would not bring about major interim environmental impacts. |

| COMMENT | RESPONSE |
|---|---|
| 6.1.6 Para 10.4 : Add the sentence "Although the barrier would impose adverse visual impact and require major maintenance liability, this proposal is considered the recommended option amongst other alternatives explored." at the end of the paragraph. | Noted and added. |

## 7. EDUCATION DEPARTMENT

| | COMMENT | RESPONSE |
|---|---|---|
| **7.1** | **Dir of E's memo (72) in ED (BS) 6/30/3911/51 III of 13th April 1995.** | |
| 7.1.1 | No comment on the draft final report. | Noted. |

## 8. PLANNING DEPARTMENT

| | COMMENT | RESPONSE |
|---|---|---|
| **8.1** | **DPO/SK&TKO's letter (5) in SKT 1/1/37 II of 18th April 1995.** | |
| 8.1.1 | Paras 2.2.3 and 4.2.14 : No noise barrier was proposed to protect the buildings like Housing for Senior Citizens. | The current layouts of the buildings like the HSC and NCC in Area 59 indicate that there is no noise sensitive facade facing Road P2. |
| 8.1.2 | Para 3.2.2 : According to the 1994 Edition of the Tseung Kwan O, Sai Kung Development Programme, the TKO population upon full development will be 382, 342. The adoption of the population figure of 333,000 may under-estimate the possible impacts. | Noted and response same as those to comments in 3.1.1 and 3.1.2 above. |
| 8.1.3 | Paras 4.8.2 to 4.8.4 : The option of rotating the schools in Area 59 is favoured. | Noted. |
| 8.1.4 | Paras 4.9.3 and 4.9.4 : The suggestion of reversing the primary school in Area 57 together with the associated mitigation measures is supported. | Noted. ASD have already reversed the layout of the school and EPD do not consider the 2.5m barrier along Road L463 required. |
| 8.1.5 | Suggest to change the layout of the secondary school at the south-east corner of Area 56 to mitigate noise impacts. | ASD have changed the layout of the school. |

## 9. DISTRICT LANDS OFFICE

| | COMMENT | RESPONSE |
|---|---|---|
| **9.1** | **DLO/SK&TKO's letter (13) in DLO/SK 471/SRN/59II dated 18th April 1995** | |
| 9.1.1 | No comment. | Noted. |

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845 000 E

819 500 N

819 000 N

## NOTES:

1. ROUNDABOUT AT JUNCTION OF ROADS P1 & P2 REPLACED BY FLYOVERS PRIOR TO 2011.
2. TRAFFIC FLOWS ARE FOR 2011 A.M. PEAK PERIOD.
3. CONCENTRATIONS SHOWN ARE 1 HOUR AVERAGE COINCIDING WITH WORST CASE METEOROLOGICAL CONDITIONS AND PEAK HOUR TRAFFIC FLOWS.
4. LAYOUTS DERIVED FROM HD's DRAWING TK07/SITE/A/DL0-01/Q FOR AREA 59, HD's DRAWING TK13/SITE/A/PR-08 A FOR AREA 57 AND PD's DRAWING PLAN E/TKO 94/62 FOR AREA 55. DETAILS FOR AREA 56 ARE AS SHOWN ON HD's DRAWING TK07/SITE/A/DL0-01/Q AND AS ADVISED BY ASD.

## LEGEND:

1370 TWO-WAY TRAFFIC FLOW (IN VEHICLES PER HOUR)

400 ONE-WAY TRAFFIC FLOW (IN VEHICLES PER HOUR)

N

| RECEPTOR | P2-1 |
|---|---|
| POLLUTANT | CONCENTRATION ($\mu g/m^3$) |
| CO | 3050 |
| $NO_2$ | 130 |
| RSP | 82 |

| RECEPTOR | P2-2 |
|---|---|
| POLLUTANT | CONCENTRATION ($\mu g/m^3$) |
| CO | 2710 |
| $NO_2$ | 111 |
| RSP | 69 |

| RECEPTOR | L463-2 |
|---|---|
| POLLUTANT | CONCENTRATION ($\mu g/m^3$) |
| CO | 2940 |
| $NO_2$ | 111 |
| RSP | 76 |

| RECEPTOR | D1-1 |
|---|---|
| POLLUTANT | CONCENTRATION ($\mu g/m^3$) |
| CO | 2600 |
| $NO_2$ | 93 |
| RSP | 62 |

| RECEPTOR | D1-2 |
|---|---|
| POLLUTANT | CONCENTRATION ($\mu g/m^3$) |
| CO | 2600 |
| $NO_2$ | 93 |
| RSP | 62 |

| RECEPTOR | L463-1 |
|---|---|
| POLLUTANT | CONCENTRATION ($\mu g/m^3$) |
| CO | 2830 |
| $NO_2$ | 111 |
| RSP | 71 |

HAVEN OF HOPE SANATORIUM

WARD

ADMINISTRATION BUILDING

RESIDENTIAL NURSING HOME

ROAD P1

ROAD P2

ROAD D1

ROAD L463

ROAD L461

ROAD L462

ROAD L464

2175

1370

400

970

1775

1090

1610

890

510

P2-1

P2-2

D1-1

D1-2

L463-1

L463-2

SCHOOL PS1

SCHOOL SS1

PROPOSED TOWN PARK

COUNTRYSIDE CONSERVATION AREA

AREA 59

AREA 55

AREA 56

AREA 57

COMMERCIAL CENTRE

TELEPHONE EXCHANGE

INDOOR RECREATION CENTRE

PRIMARY SCHOOL

SECONDARY SCHOOL

WCC

HSC

CAR PARK WITH COMMUNITY FACILITIES AT GROUND FLOOR

| REV. 修訂 | DESCRIPTION 內容摘要 | DATE 日期 | CHECKED 核對 |
|---|---|---|---|
| B | LAYOUT OF PRIMARY SCHOOL IN AREA 57 AND SECONDARY SCHOOLS IN AREA 56 REVISED | 05-95 | C.N. |
| A | LAYOUT UPDATED AND AIR QUALITY RE-ASSESSED | 02-95 | WCC |

Territory Development Department 拓展署

NT EAST DEVELOPMENT OFFICE 新界東拓展處

# TSEUNG KWAN O DEVELOPMENT

ENVIRONMENTAL IMPACT ASSESSMENT
AIR QUALITY

| | |
|---|---|
| DESIGNED 設計 | CKH |
| CHECKED 審核 | WCC |
| DRAWN 繪圖 | BEN CHAN |
| CHECKED 審核 | CPHON |
| APPROVED FOR ISSUE 批准人 | |
| DATE 日期 | 12-94 |
| SCALE 比例 | 1 : 2 000 |
| DIMENSIONS ARE IN 尺寸單位 | METRES |

MAUNSELL CONSULTANTS ASIA LTD. 茂盛(亞洲)工程顧問有限公司

DRG.NO. 圖紙編號 60493/04/5 B

CONTRACT NO. 合約號碼 TK 39/93

DATE OF ISSUE 發圖日期

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| FACADE 12 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 57.3 |
| 2/F | 58.5 |
| 3/F | 60.0 |
| 4/F | 60.9 |
| 5/F | 62.3 |

| FACADE 13 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 53.0 |
| 2/F | 53.5 |
| 3/F | 53.9 |
| 4/F | 54.4 |
| 5/F | 54.9 |

| FACADE 31 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 56.6 |
| 2/F | 58.9 |
| 3/F | 62.9 |
| 4/F | 66.4 |
| 5/F | 67.4 |

| FACADE 34 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 57.6 |
| 2/F | 58.9 |
| 3/F | 60.7 |
| 4/F | 62.1 |
| 5/F | 63.5 |

| FACADE 35 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 60.2 |
| 2/F | 61.4 |
| 3/F | 63.3 |
| 4/F | 64.2 |
| 5/F | 65.4 |

| FACADE 36 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 59.4 |
| 2/F | 60.4 |
| 3/F | 62.1 |
| 4/F | 62.6 |
| 5/F | 64.0 |

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| FACADE 15 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 59.8 |
| 4/F | 62.0 |
| 6/F | 64.6 |
| 8/F | 65.9 |
| 10/F | 67.9 |
| 12/F | 69.0 |
| 14/F | 69.8 |
| 16/F | 70.4 |
| 18/F | 70.8 |
| 20/F | 71.0 |
| 23/F | 71.2 |
| 26/F | 71.3 |
| 29/F | 71.2 |
| 32/F | 71.1 |
| 35/F | 71.0 |

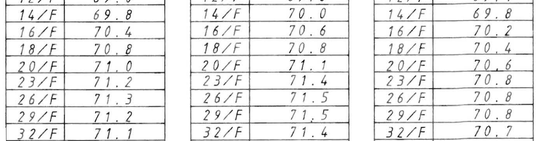
| FACADE 16 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 59.6 |
| 4/F | 61.9 |
| 6/F | 64.3 |
| 8/F | 66.8 |
| 10/F | 68.3 |
| 12/F | 69.0 |
| 14/F | 70.0 |
| 16/F | 70.6 |
| 18/F | 70.8 |
| 20/F | 71.1 |
| 23/F | 71.4 |
| 26/F | 71.5 |
| 29/F | 71.5 |
| 32/F | 71.4 |
| 35/F | 71.3 |

| FACADE 17 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 61.4 |
| 4/F | 64.9 |
| 6/F | 66.9 |
| 8/F | 67.7 |
| 10/F | 68.3 |
| 12/F | 69.4 |
| 14/F | 69.8 |
| 16/F | 70.2 |
| 18/F | 70.4 |
| 20/F | 70.6 |
| 23/F | 70.8 |
| 26/F | 70.8 |
| 29/F | 70.8 |
| 32/F | 70.7 |
| 35/F | 70.6 |

| FACADE 18 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 57.0 |
| 4/F | 62.1 |
| 6/F | 65.4 |
| 8/F | 65.9 |
| 10/F | 66.4 |
| 12/F | 67.1 |
| 14/F | 68.1 |
| 16/F | 68.4 |
| 18/F | 68.5 |
| 20/F | 68.7 |
| 23/F | 69.0 |
| 26/F | 69.1 |
| 29/F | 69.2 |
| 32/F | 69.2 |
| 35/F | 69.2 |

| FACADE 19 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 61.6 |
| 4/F | 66.1 |
| 6/F | 67.6 |
| 8/F | 68.3 |
| 10/F | 68.8 |
| 12/F | 69.2 |
| 14/F | 69.5 |
| 16/F | 69.8 |
| 18/F | 70.1 |
| 20/F | 70.4 |
| 23/F | 70.8 |
| 26/F | 71.1 |
| 29/F | 71.1 |
| 32/F | 71.1 |
| 35/F | 71.1 |

819 000 N




TYPICAL SECTION THROUGH BARRIER
SCALE 1:200

844 500 E

845 000 E

NOTES:

1. PREDICTED NOISE LEVELS IN dB(A) $L_{10}$ 1 HR.
2. NOISE LEVELS WITHOUT ADJUSTMENT FOR OPEN TEXTURE ROAD SURFACING.
3. ROUNDABOUT AT JUNCTION OF ROADS P1 AND P2 REPLACED BY FLYOVERS PRIOR TO 2011
4. FOR LATEST DETAILS OF THE LAYOUTS IN AREAS 55, 56 AND 57 SEE DRAWING NO.60493/04/1.

N

HAVEN OF HOPE SANATORIUM

ROAD P1

ROAD P2

ROAD D1

PROPOSED TOWN PARK

5.0m

0.5m

F34 SCHOOL PSS F31

F35

F17 F18 F19

F12 SCHOOL PSS F16

F36

F13 SCHOOL PSS F14

NFC

HSC

COUNTRYSIDE CONSERVATION AREA

2.5m

AREA 59

COMMERCIAL CENTRE

ROAD L463

AREA 55

ROAD L461

AREA 56

ROAD L462

ROAD L464

AREA 57

| REV. 修訂 | DESCRIPTION 內容摘要 | DATE 日期 | CHECKED 核實 |
|---|---|---|---|
| B | SHE IN AREA 59 RE-NAMED AS HSC | 05/95 | C.N.Y |
| A | NOTE ADDED | 02/95 | WLC |

Territory Development Department 拓展署

NT EAST DEVELOPMENT OFFICE 新界東拓展處

# TSEUNG KWAN O DEVELOPMENT

## ENVIRONMENTAL IMPACT ASSESSMENT
## PREDICTED TRAFFIC NOISE LEVELS
## SCHOOL LAYOUTS ROTATED

| | |
|---|---|
| DESIGNED 設計 | Cady |
| CHECKED 審核 | WLC |
| DRAWN 繪圖 | BEN CHAN |
| CHECKED 核實 | C PHON |
| APPROVED FOR ISSUE 批准人 | |
| DATE 日期 | 12-94 |
| SCALE 比例 | 1 : 2 000 |
| DIMENSIONS ARE IN 尺寸單位 | METRES |

MAUNSELL CONSULTANTS ASIA LTD. 茂盛(亞洲)工程顧問有限公司

DRG.NO. 圖紙編號 60493/04/4 B

CONTRACT NO. 合約編號 TK 39/93

DATE OF ISSUE 發出日期

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844 000 E | 844 500 E | 845 000 E

| FACADE 51 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 58.1 |
| 2/F | 59.6 |
| 3/F | 61.4 |
| 4/F | 64.2 |
| 5/F | 67.7 |

| FACADE 52 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 54.5 |
| 2/F | 56.4 |
| 3/F | 61.0 |
| 4/F | 62.8 |
| 5/F | 64.4 |

| FACADE 53 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 57.7 |
| 2/F | 58.9 |
| 3/F | 60.2 |
| 4/F | 61.3 |
| 5/F | 62.5 |

| FACADE 54 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 59.5 |
| 2/F | 61.0 |
| 3/F | 62.7 |
| 4/F | 64.3 |
| 5/F | 66.1 |

| FACADE 55 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 56.5 |
| 2/F | 57.7 |
| 3/F | 60.4 |
| 4/F | 61.9 |
| 5/F | 63.4 |

| FACADE 44 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 59.6 |
| 2/F | 62.8 |
| 3/F | 64.2 |
| 4/F | 65.3 |
| 5/F | 66.1 |

819 500 N

| FACADE 56 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 50.9 |
| 4/F | 52.6 |
| 6/F | 55.2 |
| 8/F | 58.4 |
| 10/F | 61.4 |
| | |
| 12/F | 64.7 |
| 14/F | 66.8 |
| 16/F | 67.9 |
| 18/F | 68.4 |
| 20/F | 68.8 |
| | |
| 23/F | 69.2 |
| 26/F | 69.3 |
| 29/F | 69.4 |
| 32/F | 69.5 |
| 35/F | 69.8 |

| FACADE 57 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 50.4 |
| 4/F | 52.7 |
| 6/F | 56.9 |
| 8/F | 61.7 |
| 10/F | 64.1 |
| | |
| 12/F | 66.4 |
| 14/F | 67.8 |
| 16/F | 68.6 |
| 18/F | 69.3 |
| 20/F | 69.6 |
| | |
| 23/F | 69.8 |
| 26/F | 69.8 |
| 29/F | 69.9 |
| 32/F | 70.0 |
| 35/F | 70.0 |

| FACADE 515 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 53.1 |
| 4/F | 54.9 |
| 6/F | 57.6 |
| 8/F | 60.1 |
| 10/F | 63.7 |
| | |
| 12/F | 65.8 |
| 14/F | 67.6 |
| 16/F | 68.6 |
| 18/F | 69.1 |
| 20/F | 69.3 |
| | |
| 23/F | 69.6 |
| 26/F | 69.9 |
| 29/F | 69.9 |
| 32/F | 70.0 |
| 35/F | 70.1 |

| FACADE 516 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 52.1 |
| 4/F | 54.6 |
| 6/F | 57.7 |
| 8/F | 61.3 |
| 10/F | 64.9 |
| | |
| 12/F | 66.5 |
| 14/F | 67.7 |
| 16/F | 68.7 |
| 18/F | 69.4 |
| 20/F | 69.7 |
| | |
| 23/F | 69.8 |
| 26/F | 69.8 |
| 29/F | 69.8 |
| 32/F | 69.8 |
| 35/F | 69.9 |

| FACADE 517 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 61.2 |
| 4/F | 63.1 |
| 6/F | 65.2 |
| 8/F | 66.8 |
| 10/F | 67.3 |
| | |
| 12/F | 67.6 |
| 14/F | 68.2 |
| 16/F | 68.9 |
| 18/F | 69.5 |
| 20/F | 69.8 |
| | |
| 23/F | 69.9 |
| 26/F | 69.9 |
| 29/F | 69.9 |
| 32/F | 69.9 |
| 35/F | 69.9 |

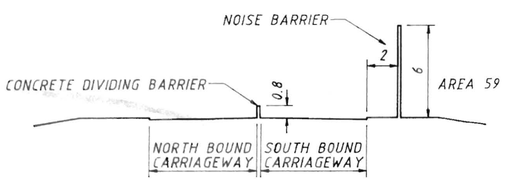
819 000 N

## NOTES:

1. PREDICTED NOISE LEVELS IN dB(A) $L_{10}$ 1 HR.
2. NOISE LEVELS WITHOUT ADJUSTMENT FOR OPEN TEXTURE ROAD SURFACING.
3. ROUNDABOUT AT JUNCTION OF ROADS P1 & P2 REPLACED BY FLYOVERS PRIOR TO 2011.
4. NOISE BARRIER AND HEIGHT SHOWN THIS. 6m 6m
5. SEE DRAWING 60493/04/1A FOR NOISE LEVELS AT OTHER FACADES.
6. LAYOUTS DERIVED FROM HD's DRAWING TK07/SITE/A/DLO-01/Q FOR AREA 59, HD's DRAWING TK13/SITE/A/PR-08 A FOR AREA 57 AND PD's DRAWING PLAN E/TKO 94/62 FOR AREA 55. DETAILS FOR AREA 56 ARE AS SHOWN ON HD's DRAWING TK07/SITE/A/DLO-01/Q AND AS ADVISED BY ASD.

N

HAVEN OF HOPE SANATORIUM
WARD
ADMINISTRATION BUILDING
RESIDENTIAL NURSING HOME
ROAD P1
PROPOSED TOWN PARK
ROAD P2
ROAD D1
6.5m
6.0m
F51
F52
F53
F54
F54A
F55
F56
F57
F516
F517
SCHOOL P51
SCHOOL P52
SCHOOL S51
NKC
HSC
COUNTRYSIDE CONSERVATION AREA
AREA 59
COMMERCIAL CENTRE
ROAD L463
TELEPHONE EXCHANGE
PRIMARY SCHOOL
AREA 55
ROAD L461
INDOOR RECREATION CENTRE
AREA 56
SECONDARY SCHOOL
ROAD L462
F510
AREA 57
ROAD L464
F58
AREA 74 (RS)
CAR PARK WITH COMMUNITY FACILITIES AT GROUND FLOOR
2.0m
PROPOSED 2m HIGH NOISE BARRIER ON THE FUTURE FLYOVER FOR AREA 57.




TYPICAL SECTION THROUGH BARRIER
SCALE 1:200

| FACADE 58 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 62.7 |
| 4/F | 63.9 |
| 6/F | 65.4 |
| 8/F | 67.9 |
| 10/F | 69.8 |
| | |
| 12/F | 70.4 |
| 14/F | 70.9 |
| 16/F | 71.3 |
| 18/F | 71.7 |
| 20/F | 72.0 |
| | |
| 23/F | 72.4 |
| 26/F | 72.7 |
| 29/F | 72.7 |
| 32/F | 72.7 |
| 35/F | 72.5 |

| FACADE 510 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 47.1 |
| 4/F | 52.5 |
| 6/F | 62.9 |
| 8/F | 67.5 |
| 10/F | 68.9 |
| | |
| 12/F | 70.5 |
| 14/F | 71.3 |
| 16/F | 71.6 |
| 18/F | 71.8 |
| 20/F | 71.9 |
| | |
| 23/F | 72.0 |
| 26/F | 72.2 |
| 29/F | 72.2 |
| 32/F | 72.1 |
| 35/F | 72.0 |

| REV. 修訂 | DESCRIPTION 內容說明 | DATE 日期 | CHECKED 核實 |
|---|---|---|---|
| C | LAYOUT OF PRIMARY SCHOOL IN AREA 57 AND SECONDARY SCHOOLS IN AREA 56 REVISED | 05-95 | C.N.K. |
| B | NOISE BARRIERS REVISED NOISE LEVELS AT FACADES 44, 51 TO 57, 515 & 517 REVISED NOISE LEVELS AT FACADES 58 AND 510 ADDED | 03-95 | WCC |
| A | LAYOUT UPDATED AND BARRIER DETAIL ALONG ROAD P2 & SLIP CHANGED. | 02-95 | WCC |

Territory Development Department 拓展署
NT EAST DEVELOPMENT OFFICE 新界東拓展處

# TSEUNG KWAN O DEVELOPMENT

ENVIRONMENTAL IMPACT ASSESSMENT
PREDICTED TRAFFIC NOISE LEVELS
6.0 AND 6.5 METRE BARRIER
ALONG ROAD P2 (RECOMMENDED OPTION)

| | |
|---|---|
| DESIGNED 設計 | CMK |
| CHECKED 審核 | WCC |
| DRAWN 繪圖 | BEN CHAN |
| CHECKED 審核 | CPHow |
| APPROVED FOR ISSUE 批准人 | |
| DATE 日期 | 12-94 |
| SCALE 比例 | 1 : 2 000 |
| DIMENSIONS ARE IN 尺寸單位 | METRES |

MAUNSELL CONSULTANTS ASIA LTD. 茂盛(亞洲)工程顧問有限公司

DRG.NO. 圖紙編號 60493/04/3C

CONTRACT NO. 合約編號 TK 39/93

DATE OF ISSUE 發出日期

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844 000 E

| FACADE 51 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 65.0 |
| 2/F | 68.3 |
| 3/F | 69.4 |
| 4/F | 70.0 |
| 5/F | 70.3 |

| FACADE 52 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 53.7 |
| 2/F | 56.2 |
| 3/F | 64.8 |
| 4/F | 67.4 |
| 5/F | 67.9 |

| FACADE 53 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 57.1 |
| 2/F | 58.4 |
| 3/F | 59.7 |
| 4/F | 61.2 |
| 5/F | 62.8 |

| FACADE 54 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 58.8 |
| 2/F | 60.2 |
| 3/F | 61.9 |
| 4/F | 63.3 |
| 5/F | 64.9 |

| FACADE 55 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 55.8 |
| 2/F | 57.0 |
| 3/F | 59.7 |
| 4/F | 61.1 |
| 5/F | 62.4 |

819 500 N

| FACADE 515 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 52.4 |
| 4/F | 54.2 |
| 6/F | 56.9 |
| 8/F | 59.3 |
| 10/F | 62.3 |
| | |
| 12/F | 64.5 |
| 14/F | 66.8 |
| 16/F | 68.0 |
| 18/F | 68.6 |
| 20/F | 69.0 |
| | |
| 23/F | 69.4 |
| 26/F | 69.7 |
| 29/F | 69.8 |
| 32/F | 69.9 |
| 35/F | 69.9 |

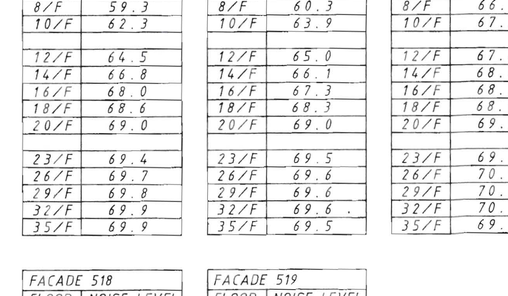
| FACADE 516 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 50.6 |
| 4/F | 53.3 |
| 6/F | 56.5 |
| 8/F | 60.3 |
| 10/F | 63.9 |
| | |
| 12/F | 65.0 |
| 14/F | 66.1 |
| 16/F | 67.3 |
| 18/F | 68.3 |
| 20/F | 69.0 |
| | |
| 23/F | 69.5 |
| 26/F | 69.6 |
| 29/F | 69.6 |
| 32/F | 69.6 |
| 35/F | 69.5 |

| FACADE 517 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 63.8 |
| 4/F | 65.5 |
| 6/F | 66.1 |
| 8/F | 66.8 |
| 10/F | 67.2 |
| | |
| 12/F | 67.6 |
| 14/F | 68.0 |
| 16/F | 68.5 |
| 18/F | 68.9 |
| 20/F | 69.5 |
| | |
| 23/F | 69.9 |
| 26/F | 70.0 |
| 29/F | 70.0 |
| 32/F | 70.0 |
| 35/F | 69.9 |

| FACADE 518 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 63.7 |
| 4/F | 65.3 |
| 6/F | 66.0 |
| 8/F | 66.6 |
| 10/F | 67.0 |
| | |
| 12/F | 67.3 |
| 14/F | 67.5 |
| 16/F | 67.7 |
| 18/F | 67.9 |
| 20/F | 68.1 |
| | |
| 23/F | 68.4 |
| 26/F | 68.7 |
| 29/F | 68.7 |
| 32/F | 68.7 |
| 35/F | 68.7 |

| FACADE 519 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 66.7 |
| 4/F | 68.3 |
| 6/F | 69.3 |
| 8/F | 69.8 |
| 10/F | 70.1 |
| | |
| 12/F | 70.2 |
| 14/F | 70.3 |
| 16/F | 70.3 |
| 18/F | 70.4 |
| 20/F | 70.4 |
| | |
| 23/F | 70.5 |
| 26/F | 70.6 |
| 29/F | 70.8 |
| 32/F | 70.7 |
| 35/F | 70.7 |

819 000 N




TYPICAL SECTION THROUGH BARRIER
SCALE 1:200

844 500 E

845 000 E

NOTES:

1. PREDICTED NOISE LEVELS IN dB(A) $L_{10}$ 1 HR.
2. NOISE LEVELS WITHOUT ADJUSTMENT FOR OPEN TEXTURE ROAD SURFACING.
3. ROUNDABOUT AT JUNCTION OF ROADS P1 & P2 REPLACED BY FLYOVERS PRIOR TO 2011.
4. NOISE BARRIER AND HEIGHT SHOWN THIS. 8.0m
5. NOISE LEVELS FOR OTHER FACADES ARE SHOWN ON DRAWING 60493/04/1.
6. LAYOUTS DERIVED FROM HD's DRAWING TK07/SITE/A/DLO-01/Q FOR AREA 59, HD's DRAWING TK13/SITE/A/PR-08 A FOR AREA 57 AND PD's DRAWING PLAN E/TKO 94/62 FOR AREA 55. DETAILS FOR AREA 56 ARE AS SHOWN ON HD's DRAWING TK07/SITE/A/DLO-01/Q AND AS ADVISED BY ASD.

N

HAVEN OF HOPE SANATORIUM
WARD
ADMINISTRATION BUILDING
RESIDENTIAL NURSING HOME
ROAD P1
PROPOSED TOWN PARK
8.0m
6.5m
ROAD P2
FS1
SCHOOL PS2
FS2
SCHOOL PS1
FS4
SCHOOL SS1
FS5
M.C.
517
518
519
516
57
56
AREA 59
COUNTRYSIDE CONSERVATION AREA
COMMERCIAL CENTRE
ROAD L463
H.S.C.
TELEPHONE EXCHANGE
PRIMARY SCHOOL
AREA 55
ROAD L461
INDOOR RECREATION CENTRE
SECONDARY SCHOOL
AREA 56
ROAD L462
AREA 57
CAR PARK WITH COMMUNITY FACILITIES AT GROUND FLOOR
ROAD L464

| FACADE 56 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 50.2 |
| 4/F | 51.8 |
| 6/F | 54.2 |
| 8/F | 56.4 |
| 10/F | 58.8 |
| | |
| 12/F | 62.8 |
| 14/F | 64.9 |
| 16/F | 66.8 |
| 18/F | 68.0 |
| 20/F | 68.6 |
| | |
| 23/F | 69.1 |
| 26/F | 69.2 |
| 29/F | 69.2 |
| 32/F | 69.3 |
| 35/F | 69.4 |

| FACADE 57 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 49.6 |
| 4/F | 51.5 |
| 6/F | 55.6 |
| 8/F | 59.1 |
| 10/F | 61.4 |
| | |
| 12/F | 63.4 |
| 14/F | 65.8 |
| 16/F | 67.7 |
| 18/F | 68.9 |
| 20/F | 69.3 |
| | |
| 23/F | 69.6 |
| 26/F | 69.7 |
| 29/F | 69.7 |
| 32/F | 69.7 |
| 35/F | 69.7 |

| REV. 修訂 | DESCRIPTION 內容摘要 | DATE 日期 | CHECKED 核實 |
|---|---|---|---|
| C | LAYOUT OF PRIMARY SCHOOL IN AREA 57 AND SECONDARY SCHOOLS IN AREA 56 REVISED | 05-95 | C.N.Y. |
| B | NOISE LEVELS AT FACADES 51 TO 55 REVISED | 03-95 | |
| A | LAYOUT UPDATED AND BARRIER DETAILS ALONG ROAD P2 CHANGED | 02-95 | |

Territory Development Department 拓展署
NT EAST DEVELOPMENT OFFICE 新界東拓展處

# TSEUNG KWAN O DEVELOPMENT

## ENVIRONMENTAL IMPACT ASSESSMENT PREDICTED TRAFFIC NOISE LEVELS 6.5 AND 8 METRE BARRIER ALONG ROAD P2

| | |
|---|---|
| DESIGNED 設計 | |
| CHECKED 核實 | |
| DRAWN 繪圖 | BEN CHAN |
| CHECKED 核實 | CPHau |
| APPROVED FOR ISSUE 批准人 | |
| DATE 日期 | 12-94 |
| SCALE 比例 | 1 : 2 000 |
| DIMENSIONS ARE IN 尺寸單位 | METRES |

MAUNSELL CONSULTANTS ASIA LTD. 萬盛(亞洲)工程顧問有限公司

DRG.NO. 圖紙編號 60493/04/2[C]

CONTRACT NO. 合約編號 TK 39/93

DATE OF ISSUE 簽發日期

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844 000 E | 844 500 E | 845 000 E

819 500 N | 819 000 N

## NOTES:

1. PREDICTED NOISE LEVELS IN dB(A) $L_{10}$ 1 HR.
2. NOISE LEVELS WITHOUT ADJUSTMENT FOR OPEN TEXTURE ROAD SURFACING.
3. ROUNDABOUT AT JUNCTION OF ROADS P1 & P2 REPLACED BY FLYOVERS PRIOR TO 2011.
4. LAYOUTS DERIVED FROM HD's DRAWING TK07/SITE/A/DLO-01/Q FOR AREA 59, HD's DRAWING TK13/SITE/A/PR-08A FOR AREA 57 AND PD's DRAWING PLAN E/TKO 94/62 FOR AREA 55. DETAILS FOR AREA 56 ARE AS SHOWN ON HD's DRAWING TK07/SITE/A/DLO-01/Q AND AS ADVISED BY ASD.

N

| FACADE 44 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 64.0 |
| 2/F | 66.9 |
| 3/F | 67.8 |
| 4/F | 68.3 |
| 5/F | 68.4 |

| FACADE 51 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 71.1 |
| 2/F | 72.9 |
| 3/F | 73.8 |
| 4/F | 74.4 |
| 5/F | 74.9 |

| FACADE 52 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 67.4 |
| 2/F | 68.4 |
| 3/F | 70.9 |
| 4/F | 72.7 |
| 5/F | 73.7 |

| FACADE 53 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 70.0 |
| 2/F | 71.1 |
| 3/F | 71.7 |
| 4/F | 72.4 |
| 5/F | 72.9 |

| FACADE 54 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 72.6 |
| 2/F | 73.3 |
| 3/F | 73.9 |
| 4/F | 74.3 |
| 5/F | 75.0 |

| FACADE 55 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 1/F | 69.2 |
| 2/F | 69.9 |
| 3/F | 70.7 |
| 4/F | 72.0 |
| 5/F | 72.7 |

| FACADE 58 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 68.2 |
| 4/F | 69.9 |
| 6/F | 71.4 |
| 8/F | 72.7 |
| 10/F | 73.6 |
| 12/F | 73.9 |
| 14/F | 74.0 |
| 16/F | 74.0 |
| 18/F | 74.0 |
| 20/F | 73.9 |
| 23/F | 73.7 |
| 26/F | 73.5 |
| 29/F | 73.3 |
| 32/F | 73.1 |
| 35/F | 72.8 |

| FACADE 510 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 49.5 |
| 4/F | 54.6 |
| 6/F | 64.0 |
| 8/F | 69.1 |
| 10/F | 71.1 |
| 12/F | 72.3 |
| 14/F | 72.9 |
| 16/F | 73.0 |
| 18/F | 73.0 |
| 20/F | 73.0 |
| 23/F | 72.9 |
| 26/F | 72.7 |
| 29/F | 72.6 |
| 32/F | 72.4 |
| 35/F | 72.2 |

| FACADE 515 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 65.1 |
| 4/F | 65.9 |
| 6/F | 66.6 |
| 8/F | 67.3 |
| 10/F | 68.5 |
| 12/F | 70.5 |
| 14/F | 71.2 |
| 16/F | 71.5 |
| 18/F | 71.6 |
| 20/F | 71.7 |
| 23/F | 71.7 |
| 26/F | 71.6 |
| 29/F | 71.5 |
| 32/F | 71.4 |
| 35/F | 71.2 |

| FACADE 516 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 63.4 |
| 4/F | 64.7 |
| 6/F | 65.5 |
| 8/F | 66.4 |
| 10/F | 67.7 |
| 12/F | 69.7 |
| 14/F | 70.9 |
| 16/F | 71.5 |
| 18/F | 71.8 |
| 20/F | 71.9 |
| 23/F | 71.9 |
| 26/F | 71.9 |
| 29/F | 71.8 |
| 32/F | 71.7 |
| 35/F | 71.5 |

| FACADE 517 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 64.1 |
| 4/F | 65.8 |
| 6/F | 66.6 |
| 8/F | 67.2 |
| 10/F | 69.6 |
| 12/F | 70.2 |
| 14/F | 70.5 |
| 16/F | 70.7 |
| 18/F | 70.9 |
| 20/F | 71.1 |
| 23/F | 71.2 |
| 26/F | 71.2 |
| 29/F | 71.2 |
| 32/F | 71.1 |
| 35/F | 71.0 |

| FACADE 18 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 63.7 |
| 4/F | 65.4 |
| 6/F | 66.2 |
| 8/F | 67.1 |
| 10/F | 68.5 |
| 12/F | 69.3 |
| 14/F | 69.5 |
| 16/F | 69.6 |
| 18/F | 69.7 |
| 20/F | 69.7 |
| 23/F | 69.8 |
| 26/F | 69.7 |
| 29/F | 69.7 |
| 32/F | 69.6 |
| 35/F | 69.5 |

| FACADE 19 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 68.0 |
| 4/F | 69.4 |
| 6/F | 70.4 |
| 8/F | 70.8 |
| 10/F | 71.1 |
| 12/F | 71.3 |
| 14/F | 71.4 |
| 16/F | 71.5 |
| 18/F | 71.6 |
| 20/F | 71.6 |
| 23/F | 71.6 |
| 26/F | 71.6 |
| 29/F | 71.5 |
| 32/F | 71.5 |
| 35/F | 71.4 |

| FACADE 20 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 67.2 |
| 4/F | 68.7 |
| 6/F | 69.6 |
| 8/F | 70.3 |
| 10/F | 70.6 |
| 12/F | 70.7 |
| 14/F | 70.8 |
| 16/F | 70.8 |
| 18/F | 70.7 |
| 20/F | 70.6 |
| 23/F | 70.5 |
| 26/F | 70.3 |
| 29/F | 70.2 |
| 32/F | 69.9 |
| 35/F | 69.8 |

| FACADE 21 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F. | 67.9 |
| 4/F | 69.1 |
| 6/F | 69.8 |
| 8/F | 70.0 |
| 10/F | 70.1 |
| 12/F | 70.1 |
| 14/F | 70.0 |
| 16/F | 69.9 |
| 18/F | 69.7 |
| 20/F | 69.5 |
| 23/F | 69.2 |
| 26/F | 69.0 |
| 29/F | 68.7 |
| 32/F | 68.4 |
| 35/F | 68.1 |

| FACADE 41 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| G/F | 66.5 |
| 1/F | 68.5 |

| FACADE 42 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| G/F | 63.2 |

| FACADE 43 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| G/F | 62.3 |

| FACADE 22 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 65.9 |
| 4/F | 67.5 |
| 6/F | 68.2 |
| 8/F | 68.3 |
| 10/F | 68.4 |
| 12/F | 68.3 |
| 14/F | 68.1 |
| 16/F | 67.9 |
| 18/F | 67.6 |
| 20/F | 67.4 |
| 23/F | 67.1 |
| 26/F | 66.8 |
| 29/F | 66.5 |
| 32/F | 66.2 |
| 35/F | 65.9 |

| FACADE 23 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 68.9 |
| 4/F | 70.3 |
| 6/F | 71.0 |
| 8/F | 71.4 |
| 10/F | 71.5 |
| 12/F | 71.5 |
| 14/F | 71.4 |
| 16/F | 71.2 |
| 18/F | 71.1 |
| 20/F | 70.9 |
| 23/F | 70.7 |
| 26/F | 70.4 |
| 29/F | 70.1 |
| 32/F | 69.9 |
| 35/F | 69.6 |

* INCLUDES CONTRIBUTION OF NOISE FROM ROAD P1

| FACADE 23A * | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 70.9 |
| 4/F | 71.9 |
| 6/F | 72.6 |
| 8/F | 72.8 |
| 10/F | 72.8 |
| 12/F | 72.8 |
| 14/F | 72.7 |
| 16/F | 72.7 |
| 18/F | 72.6 |
| 20/F | 72.5 |
| 23/F | 72.4 |
| 26/F | 72.3 |
| 29/F | 72.2 |
| 32/F | 72.0 |
| 35/F | 71.9 |

| FACADE 24 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 66.4 |
| 4/F | 69.5 |
| 6/F | 70.4 |
| 8/F | 70.5 |
| 10/F | 70.4 |
| 12/F | 70.1 |
| 14/F | 69.9 |
| 16/F | 69.7 |
| 18/F | 69.4 |
| 20/F | 69.2 |
| 23/F | 68.8 |
| 26/F | 68.5 |
| 29/F | 68.1 |
| 32/F | 67.8 |
| 35/F | 67.6 |

| FACADE 25 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 64.9 |
| 4/F | 67.6 |
| 6/F | 68.7 |
| 8/F | 69.7 |
| 10/F | 70.0 |
| 12/F | 70.1 |
| 14/F | 70.1 |
| 16/F | 69.9 |
| 18/F | 69.7 |
| 20/F | 69.6 |
| 23/F | 69.3 |
| 26/F | 68.9 |
| 29/F | 68.7 |
| 32/F | 68.4 |
| 35/F | 68.1 |

| FACADE 26 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 57.5 |
| 4/F | 64.4 |
| 6/F | 66.6 |
| 8/F | 67.4 |
| 10/F | 67.5 |
| 12/F | 67.5 |
| 14/F | 67.3 |
| 16/F | 67.1 |
| 18/F | 66.8 |
| 20/F | 66.5 |
| 23/F | 66.1 |
| 26/F | 65.8 |
| 29/F | 65.4 |
| 32/F | 65.1 |
| 35/F | 64.8 |

| FACADE 29 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 70.7 |
| 4/F | 71.4 |
| 6/F | 72.0 |
| 8/F | 72.2 |
| 10/F | 72.2 |
| 12/F | 72.1 |
| 14/F | 72.0 |
| 16/F | 71.8 |
| 18/F | 71.6 |
| 20/F | 71.4 |
| 23/F | 71.1 |
| 26/F | 70.8 |
| 29/F | 70.5 |
| 32/F | 70.2 |
| 35/F | 69.8 |

| FACADE 30 | |
|---|---|
| FLOOR | NOISE LEVEL (dBA) |
| 2/F | 63.4 |
| 4/F | 65.6 |
| 6/F | 68.5 |
| 8/F | 70.5 |
| 10/F | 71.5 |
| 12/F | 71.8 |
| 14/F | 71.9 |
| 16/F | 71.9 |
| 18/F | 71.9 |
| 20/F | 71.9 |
| 23/F | 71.7 |
| 26/F | 71.4 |
| 29/F | 71.2 |
| 32/F | 71.0 |
| 35/F | 70.7 |

RESIDENTIAL NURSING HOME F43 | HAVEN OF HOPE SANATORIUM | WARD F42 | ADMINISTRATION BUILDING F41 | ROAD P1 | PROPOSED TOWN PARK | ROAD P2 | F51 | SCHOOL P51 | F44 | F52 | SCHOOL P52 | F53 | SCHOOL S51 | F54 | F517 | F18 | F19 | F20 | F516 | F21 | F23 | F23A | ROAD D1 | F22 | F24 | F25 | F26 | F29 | COUNTRYSIDE CONSERVATION AREA | NKC | HSC | AREA 59 | COMMERCIAL CENTRE | ROAD L463 | TELEPHONE EXCHANGE | PRIMARY SCHOOL | AREA 55 | F30 | INDOOR RECREATION CENTRE | SECONDARY SCHOOL | ROAD L461 | AREA 56 | F510 | CAR PARK WITH COMMUNITY FACILITIES AT GROUND FLOOR | AREA 57 | ROAD L462 | ROAD L464 | F58

| REV. 修訂 | DESCRIPTION 內容摘要 | DATE 日期 | CHECKED 核實 |
|---|---|---|---|
| C | LAYOUTS OF PRIMARY SCHOOL IN AREA 57 AND SECONDARY SCHOOLS IN AREA 56 REVISED FACADE F59 DELETED | 05-95 | C.Ng |
| B | NOISE LEVELS AT FACADES 44, 51,52,53,54 & 55 REVISED | 03-95 | |
| A | LAYOUT UPDATED AND NOISE LEVELS RE-ASSESSED | 02-95 | |

Territory Development Department 拓展署
NT EAST DEVELOPMENT OFFICE 新界東拓展處

# TSEUNG KWAN O DEVELOPMENT

ENVIRONMENTAL IMPACT ASSESSMENT
PREDICTED TRAFFIC NOISE LEVELS
WITHOUT MITIGATION MEASURES

| | |
|---|---|
| DESIGNED 設計 | CAM |
| CHECKED 審核 | WLC |
| DRAWN 繪圖 | BEN CHAN |
| CHECKED 審核 | C PHan |
| APPROVED FOR ISSUE 批准人 | |
| DATE 日期 | 12-94 |
| SCALE 比例 | 1 : 2 000 |
| DIMENSIONS ARE IN 尺寸單位 | METRES |

MAUNSELL CONSULTANTS ASIA LTD. 茂盛(亞洲)工程顧問有限公司

DRG.NO. 圖紙編號 60493/04/1 C

CONTRACT NO. 合約編號 TK 39/93

DATE OF ISSUE 發展日期

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**DRAWINGS**