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WEST KOWLOON RECLAMATION
FOCUSED EIA ON ROADWORKS

FINAL REPORT

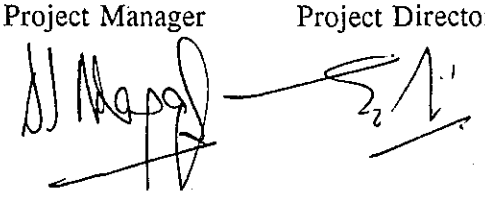
Mott MacDonald Hong Kong Limited

WEST KOWLOON RECLAMATION
FOCUSED EIA ON ROADWORKS

FINAL REPORT

Issue and Revision Record:

Rev	Date	Originator	Approved	Description
A	30.12.94	David J. Maggs Project Manager	J.D.C. Burt Project Director	Issue for Circulation



WEST KOWLOON RECLAMATION
FOCUSED EIA ON ROADWORKS

FINAL REPORT

Mott MacDonald

ERM Hong Kong

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FOCUSED EIA ON ROADWORKS
FINAL REPORT

INDEX

WEST KOWLOON RECLAMATION
FOCUSED EIA ON ROADWORKS
FINAL REPORT

1.INTRODUCTION

Background and Objectives

1.01 As part of the design study for the West Kowloon Reclamation, the Territory Development Department carried out an environmental (planning) study to identify the potential environmental impacts associated with the operation of the project. This study was completed in 1991 and identified a broad scheme of mitigation measures.

1.02 In September 1994 the Territory Development Department commissioned a further study to examine the operational and construction impacts of the project with specific reference to the new roads on the reclamation. The study was broken down into two stages, the first of which was to examine the cumulative noise and air impacts due to the operation of the project and the effects of various measures to minimise these impacts at sensitive receivers.

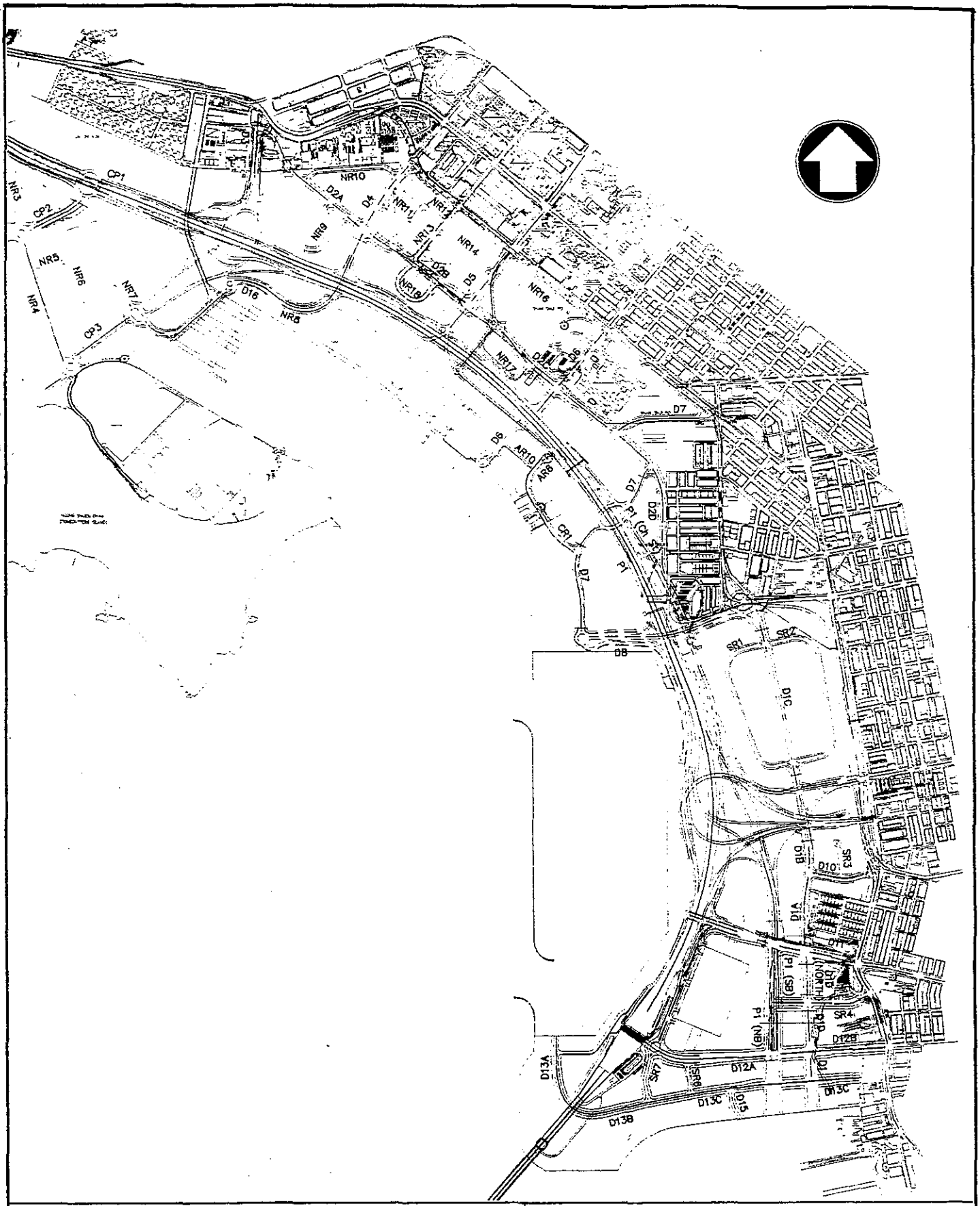
1.03 Examination of the environmental impacts associated with the construction of the roads was included in the second stage of the study, and for each stage a draft final report was submitted.

1.04 The study was managed by Project Manager, Kowloon Development Office and a Study Management Group (SMG) including various Government Departments was established to consider and advise the Consultants on a variety of issues associated with the project. A plan showing the study area is shown in Figure 1.1.

Report Structure

1.05 The operational & construction phase draft final reports, as referred to above have been combined in this final report and as a consequence, some sectional headings which appeared in the above reports have had to be amended. However, as an aide to guide the reader through the final text, sub-paragraph headings and numbers have been retained as in the original reports, wherever possible. The initial sections of the report provide background information to the assumptions and inputs adopted in the study, much of which has been discussed and agreed with the relevant Government Departments or the Study Management Group, together with details of the project and the anticipated construction programme.

1.06 Options to mitigate the predicted noise impacts are discussed in Section 2 of the Report. Section 3 describes the proposed road network and Sections 4 to 7 give detailed discussion of the construction and operational phases and the predicted impacts. Since circulation of the draft operational report additional modelling has been carried out of the effects of semi-enclosures and these results are discussed in Section 6 of the Report. The report does not consider the introduction of mitigation measures on those works already under construction, such as the West Kowloon Expressway, but focuses on what practical measures can be provided in association with the proposed roadworks so as to minimise the impacts identified at the sensitive receivers. Conclusions and recommendations are contained in Section 9 of the Report.



HONG KONG GOVERNMENT
TERRITORY DEVELOPMENT DEPARTMENT
KOWLOON DEVELOPMENT OFFICE

WEST KOWLOON RECLAMATION

FOCUSED EIA ON ROADWORKS STUDY AREA

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Scale

Figure 1.1

Rev.

2.INPUTS TO THE STUDY

Introduction

2.01 A number of studies carried out previously have direct relevance to the findings of this study and these are discussed below. Any assumptions made or conclusions reached in these studies which have formed direct inputs to this study are specifically identified. Also included in this Section is a discussion of the practical constraints or other considerations which migh limit the application of the mitigation measures to be assessed in the study.

West Kowloon Reclamation Transport Study

2.02 The traffic forecasting procedure adopted for this study is based on the Reclamation Area Model developed during the West Kowloon Reclamation Transport Study (WKRTS). However, since completion of the WKRTS Study in 1990 various land use changes have occurred, as identified in the West Kowloon Reclamation Final Report on Planning and Urban Design of 1991, with subsequent updating having also taken place by the Planning Department of Hong Kong Government. These updates not only include changes in land use but also in terms of the network assumptions in the years 1996 and 2011.

2.03 For the purpose of this study the latest updates as at the beginning of 1994 have been adopted from which traffic forecasts for the year 2011 have been generated. Details of the associated landuse and network assumptions are shown in Tables 2.1, 2.2 and 2.3 below.

Table 2.1 2011 Land Use Data for Kowloon Point Reclamation

Use	Floor Area
Office	347,750m²GFA
Retail	71,000m²GFA
Hotel	14,530 rooms

Table 2.2 2011 Development Data in West Kowloon Reclamation

	Northern	Central	Southern	Total
Residential Population				
Public Rental	13330	-	9500	22830
Private	-	21879	37165	59044
Home Ownership	-	-	7580	7580
Total	13330	21879	54245	89454
Commercial GFA				
Office GFA (m^2)	561600	173000	487500	1222100
Retail GFA (m^2)	-	17500	140000	157500
Hotel GFA (m^2)	-	-	830000	830000
Total	561600	190500	1457500	2209600
(Note : 1 Hotel Room = 100m^2)				
Industrial (No of Workers)				
1(A)	16687	-	-	16687
1(B)	1803	522	-	2325
1(C)	159	74	-	233
Total	18649	596	0	19245

Table 2.3 CTS Highway Network Assumptions for 2011

1)	New Territories Circular Road improvements (Mai Po to Au Tau, & widening to dual 3-lane)
2)	Yuen Long - Tuen Mun eastern corridor and Yuen Long West Link
3)	Kwai Chung Road improvements
4)	Route 7 (Sai Ying Pun to Kennedy Town)
5)	Route 3 (Western Harbour Crossing)
6)	Route 3 (West Kowloon Expressway)
7)	Route 3 (CRA1)
8)	Lantau Fixed Crossing
9)	North Lantau Expressway
10)	West Kowloon Corridor
11)	Yuen Long Southern Bypass
12)	Tin Shui Wai West Access
13)	Texaco Road improvements - Phase 1, 2 & 3
14)	Tin Shui Wai east access and Long Ping Estate Link
15)	Route 3 (Country Park)
16)	Hung Hom Bypass and Princess Margaret Road Link
17)	North Tsing Yi Coastal Road
18)	Route 5 extension from Shek Wai Kok to Chai Wan Kok
19)	Island Eastern Corridor Link (Causeway Bay to Wan Chai)
20)	Central & Wan Chai Bypass
21)	Route 16 between West Kowloon and Sha Tin
22)	Central Kowloon Route
23)	Route 7 (Kennedy Town to Aberdeen)
24)	Green Island Link
25)	Route 3 (CRA4)
26)	Ma Wan - Sham Tseng Link
27)	Kai Tak Connector between Hung Hom and Kwun Tong
28)	Leung Cheung Road and Ching Cheung Road Improvement

For the 2011 RAM road network, all the roads within WKR area are assumed to be completed. For this study, the RAM network model was further refined to incorporate the details on the layout plans, such as entry/exit points.

West Kowloon Expressway Environmental Assessment

2.04 To ensure a consistent approach is adopted in the modelling exercise a review has been undertaken of the assumptions made in respect of vehicle speeds on the West Kowloon Expressway, Road P1 and the associated slip roads, as identified in the WKE Environmental Assessment Report. Although design speeds are higher, vehicle speeds have been assumed to be as shown below due to the increased traffic flows on these roads in 2011.

Table 2.4

Road	Vehicle Speed km/hr (2011)	Design Speed km/hr
Expressway	70	85
Slip Roads	45	50
Road P1	50	70
Yau Ma Tei Interchange	45	50

2.05 The above assumptions are considered reasonable and have been adopted for the purpose of this study. All other roads within the study area are assumed to have traffic speeds of 50 km/hr. Whilst the distance between junctions is relatively small for some roads, e.g. Road D2 between Road D6 and D7, and stop/starts using low gears would be expected, this is not considered to contribute noise levels greater than would be generated by the assumed 50 km/hr vehicle speed.

Land Use Planning Assumptions

2.06 In cases where future developments are planned in the vicinity of the existing sensitive receivers, it has been necessary to make assumptions as to the most likely building form for inclusion in the noise modelling. The buildings within these sites may produce noise screening or noise reflection effects which could significantly affect the noise levels at the existing receivers. Traffic pollutant dispersion patterns could also be affected. Planning Department was consulted and advised on the most likely building form for those sites which might produce such effects. For the two MTRC development sites at Tai Kok Tsui (LAR Station site D) and at Kowloon Station, the current Master Layout Plan is assumed. In most other areas the likely presence of podium structures has been identified and a realistic podium height assumed. It has not generally been necessary to consider the form of towers above podium level since the podium itself will form the noise screening or reflecting structure. *Figures 2.1 to 2.4* show the building forms that have been assumed for noise and air modelling.

West Kowloon Expressway Noise Mitigation

2.07 Two forms of noise mitigation are included in the design of the WKE and these have been included in this study. Friction course road surfacing will be used on the main WKE carriageways constructed and on the whole of the Yau Ma Tei Interchange. Noise barriers, 3m high, will be constructed on the eastern side of both the main carriageways over a length of about 850 m opposite Nam Cheong Estate.

Existing Traffic Flows

2.08 The current traffic conditions on the existing roads within the study area are responsible for what are termed the "Prevailing Noise Levels". In the case of the traffic noise assessment, these flows establish the baseline conditions (ie those existing before the commencement of the construction of the WKR and it's road network) against which the predicted noise impacts are assessed. The results of traffic surveys carried out by MVA in 1993 and 1994 have been used to model the prevailing noise levels.

2.09 Traffic flows surveyed in Man Cheong Street in August 1993 were considered to be substantially elevated by the presence of construction and other traffic using the temporary access to the WKR from Man Cheong Street. This being a temporary condition, it is not considered representative of the baseline conditions. Therefore, the noise contribution from traffic on this road has been ignored because in the absence of the access to the WKR low traffic flows would exist compared to other nearby roads and, thus, would not contribute significantly to the overall noise levels at the sensitive receivers.

2.10 The traffic flows used to model the noise levels in year 2011 are given in Appendix B together with those from the traffic surveys carried out in 1993/94. Reference to the road layout reference numbers are those used in the traffic noise modelling (see *Section 6 Figures 6.3 to 6.9*).

Mitigation Options

2.11 The mitigation measures which it was agreed would be considered in the study are noise barriers 3 metres and 5 metres in height, low noise road surfacing (friction course) and enclosures. Indirect mitigation is considered a last resort solution only to be adopted if the use of direct mitigation measures are not shown to be effective in achieving the Hong Kong Planning Standards and Guidelines.

2.12 The assessment of the effectiveness of mitigation measures must take account of any practical constraints or other considerations which would otherwise limit their application in the design and construction of the new roads.

Low Noise Road Surfacing

2.13 There are no practical constraints to the laying of open textured surfacing material (friction course) which is known to provide positive attenuation effects although there is concern that increased maintenance is required and that the initial reduction in noise generation decreases with time. Given that further research/trials are being carried out by Highways Department with a view to improving its long term performance, it is thought appropriate to consider the use of the material as a possible mitigation measure in view of its environmental benefits.

Noise Barriers

2.14 To achieve the maximum possible benefit from a barrier it is necessary to site the barrier as close to the noise source as possible, i.e. immediately behind the road kerb. However, because of the need to maintain minimum clearances from the carriageway, as required in the Transport Planning & Design Manual (TPDM), a minimum set back from the kerbline of 1 metre is recommended. This would not only satisfy the minimum clearance specified but would also allow for street lighting columns and certain road signs to be erected between the wall and road kerb while still providing the minimum 500mm clearance. Generally route signs would have to be mounted on a gantry.

2.15 Other traffic engineering considerations which will restrict the location of the barriers at or close to road junctions include the need to provide adequate visibility splays for motorists approaching junctions and adequate sightlines for motorists approaching pedestrian crossings.

2.16 Typical visibility splays and sight lines at road junctions to comply with the requirements of Chapters 3 & 4 of the TPDM are shown in Figure 2.5. Whilst locating barriers mid-way between kerb and the back of the footpath might satisfy the visibility requirement this would interfere with pedestrian movements, sterilise part of the footpath for future utilities and create safety concerns, and, as a consequence, assessments are based on locating the noise barriers at the back of the footpath at these locations. This situation will apply to the junctions of Roads D6 and D2, road D2 and D7, Road D10 and D1 and Road D1 and Road D11. (See Figures 2.6 & 2.7).

2.17 In respect of Road D2, a further consideration is the need to provide adequate sight lines to the bus lay by on the eastbound carriageway (see Figure 2.5). It is proposed that a minimum sight line of 50m is provided at these locations which is similar to that required for pedestrian crossings. In view of the proximity of the junction with road D7 and the design requirement to provide an additional traffic lane for left turning traffic into road D7, the alignment of the noise barrier has been set at the back of the footpath along the entire length of road D2 near to Nam Cheong Estate. This is considered the most practical option under the circumstances.

2.18 Although not included in the present roadworks design footbridges are proposed at the junctions of Roads D2 and D6 and Roads D2 and D7. At this location continuous mitigation would be provided by partial cover of the footpaths.

2.19 In general terms, the provision of barriers should not pose any significant difficulties to the future installation of utilities based on the information already to hand and is not considered a limiting factor.

2.20 Typical details of both 3 metre and 5 metre high barriers have been developed adopting acoustic panels or lightweight grass reinforced concrete sculptured panels and these are shown in Figures 2.8, 2.9 and 2.10. Typical perspectives are shown in Figures 2.11 and 2.12.

Enclosures

2.21 Although the provision of enclosures produce significant reductions in traffic noise levels at road side receivers, other considerations such as fire fighting, emergency operations, lighting, ventilation and their effects on signage may well limit there practical application in many instances.

2.22 In accordance with the Codes of Practise for minimum fire services installations for tunnels, dynamic smoke extraction systems are required where tunnels exceed 230 metres in length. As a consequence, the costs of enclosures would become significant if considered on a wide application. It must also be acknowledged that the tunnel effect of enclosures will create changes in light conditions which could cause difficulties to drivers. In addition, since pedestrians would have to walk inside the enclosures this could create adverse psychological effects, particularly at night time.

2.23 In the case of Man Cheong Street access for fire appliances to the facades of buildings would not be affected were enclosures provided. At Nam Cheong Estate, access for fire appliances is provided via the internal roads in the estate. At present the option exists for fire appliances to use road D6 to access the facade of the nearby building which would be lost were partial or full enclosures considered. However, access could be made available for fire appliances via the old access road to the public cargo working area from within the estate although this would require modification to existing ground levels. Distances between junctions are also such that for fully sealed enclosures forced ventilation would not be required except on road D7. Given the minimum headroom requirement of 5.1m and footpath widths of not less than 5m, the option should still exist to provide certain roadsigns.However, where gantry signs are required it would be necessary to increase the height of the structures, thereby adding to the adverse visual impact of these structures. In addition, enclosures are expensive to construct and maintain and pose constraints on utilities installations and future road widening. Typical details of a partial enclosure are shown in Figures 2.13 and 2.14

Indirect Mitigation

2.24 Provision of insulation and air conditioning has not been ruled out for the purposes of this study although for the older estates such as Man Cheong Street, there may be additional considerations in order to maintain appropriate ventilation to kitchens/bathrooms where old gas heaters have been installed. A detailed survey would need to be carried out to fully investigate the modifications necessary should this option be considered as the only viable solution.

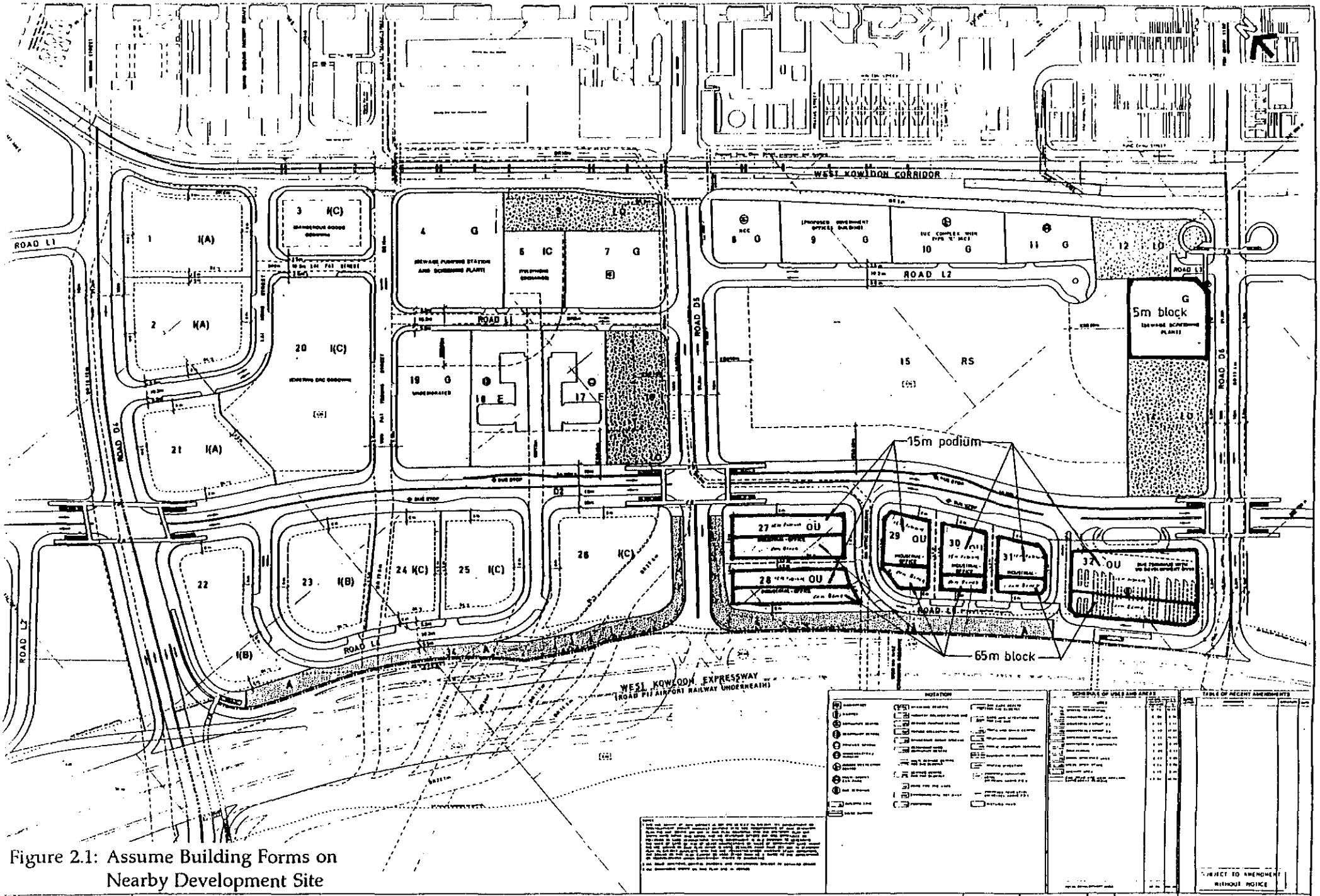


Figure 2.1: Assume Building Forms on Nearby Development Site

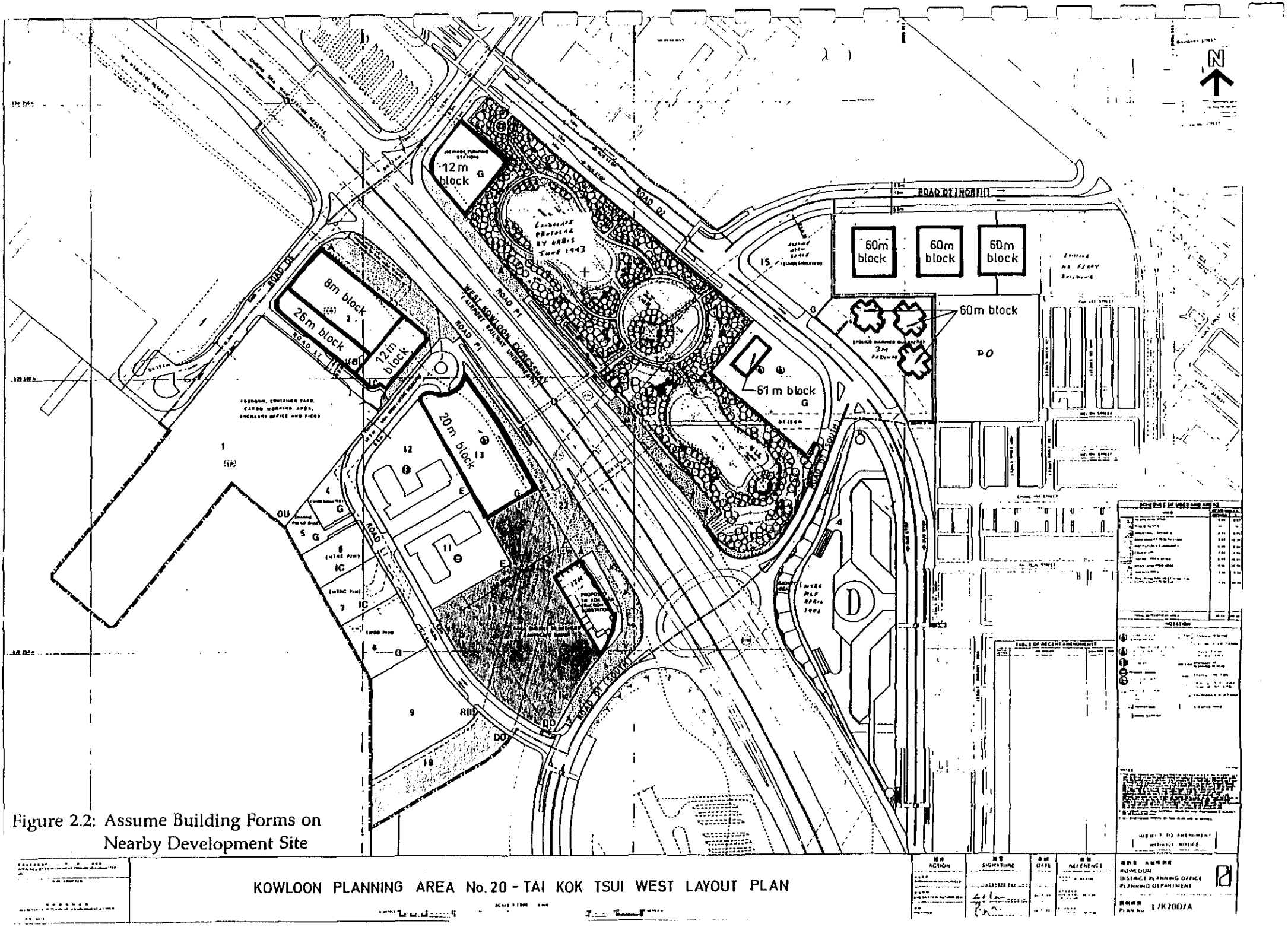


Figure 2.2: Assume Building Forms on Nearby Development Site

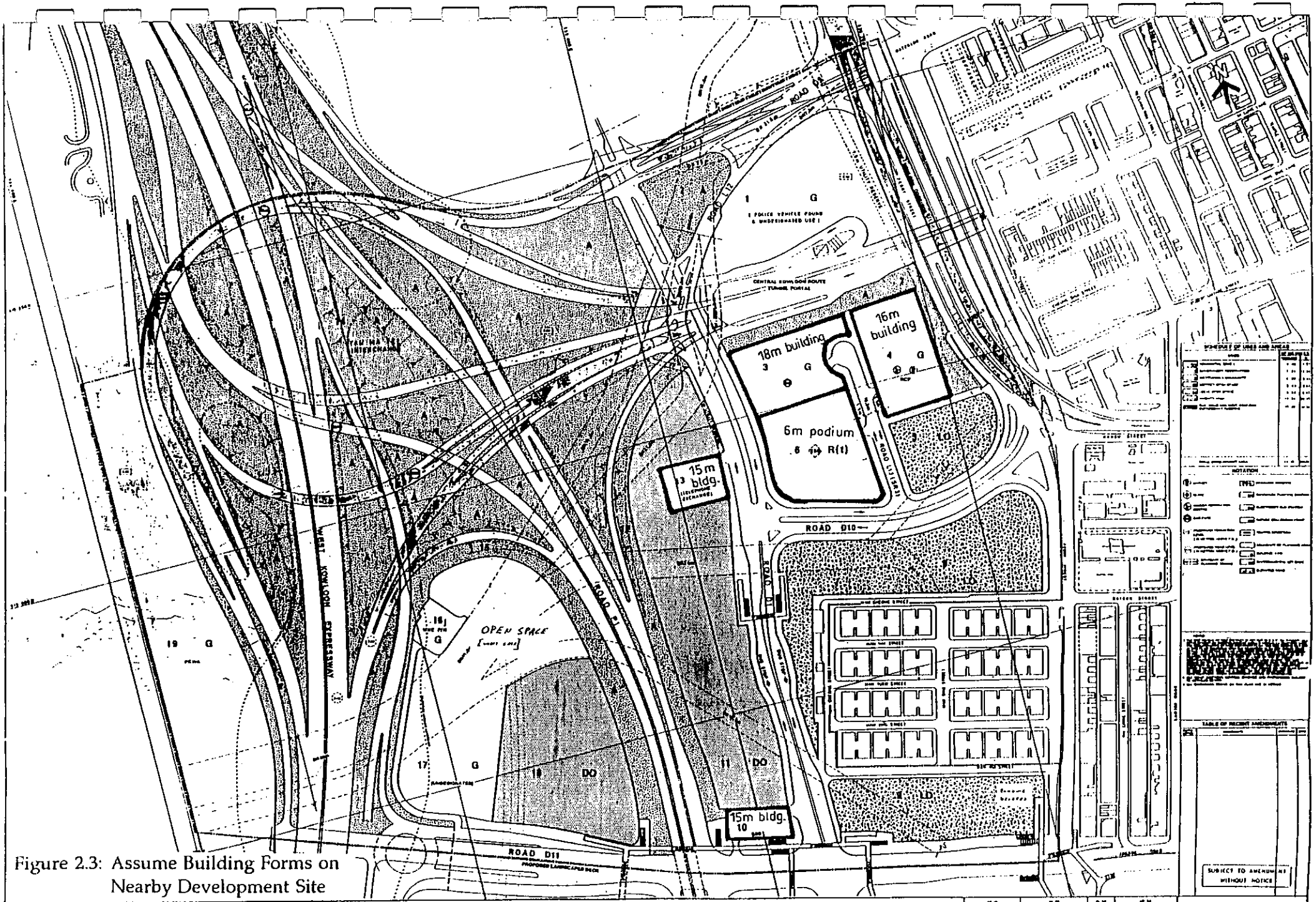


Figure 2.3: Assume Building Forms on Nearby Development Site

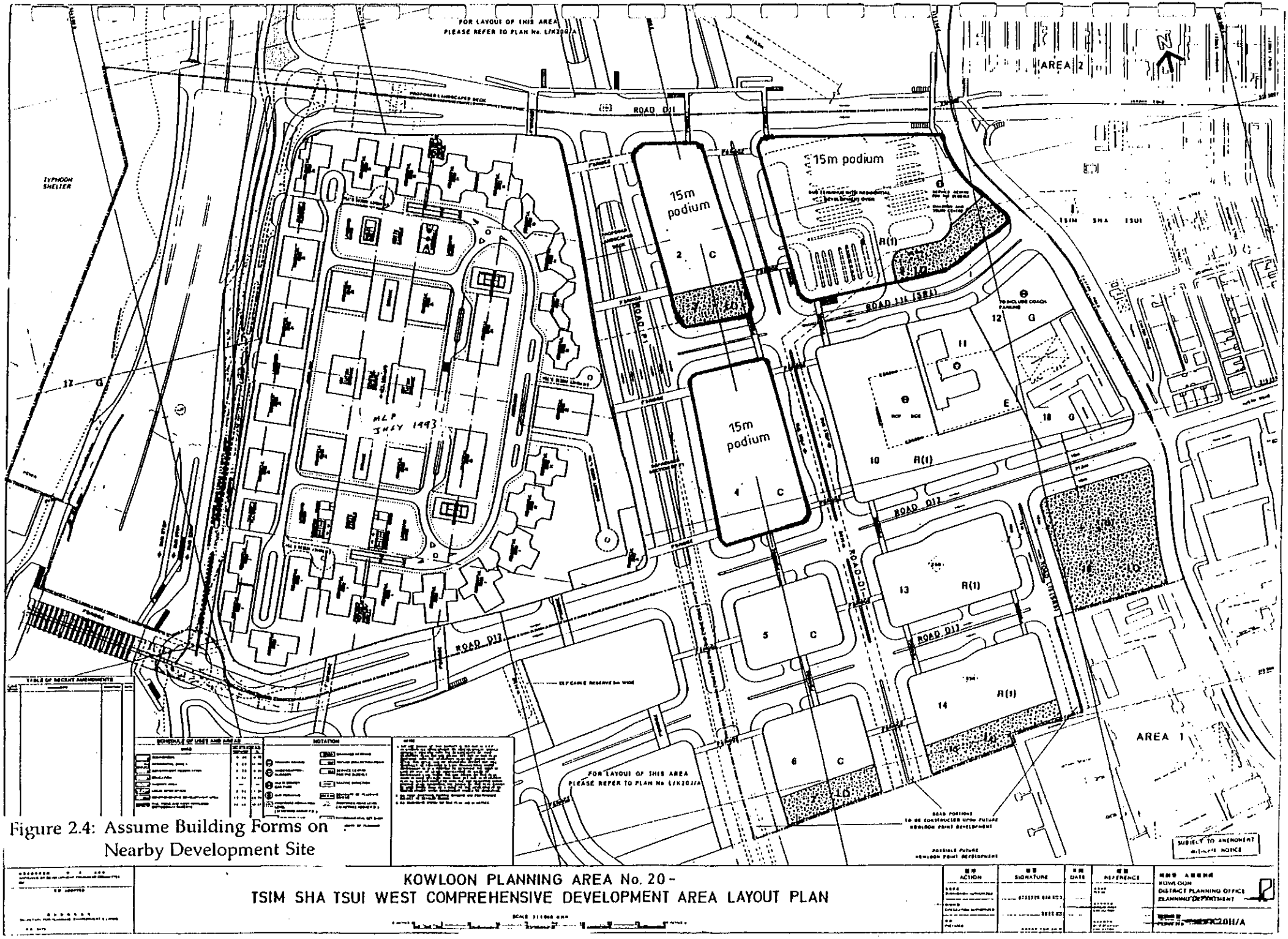
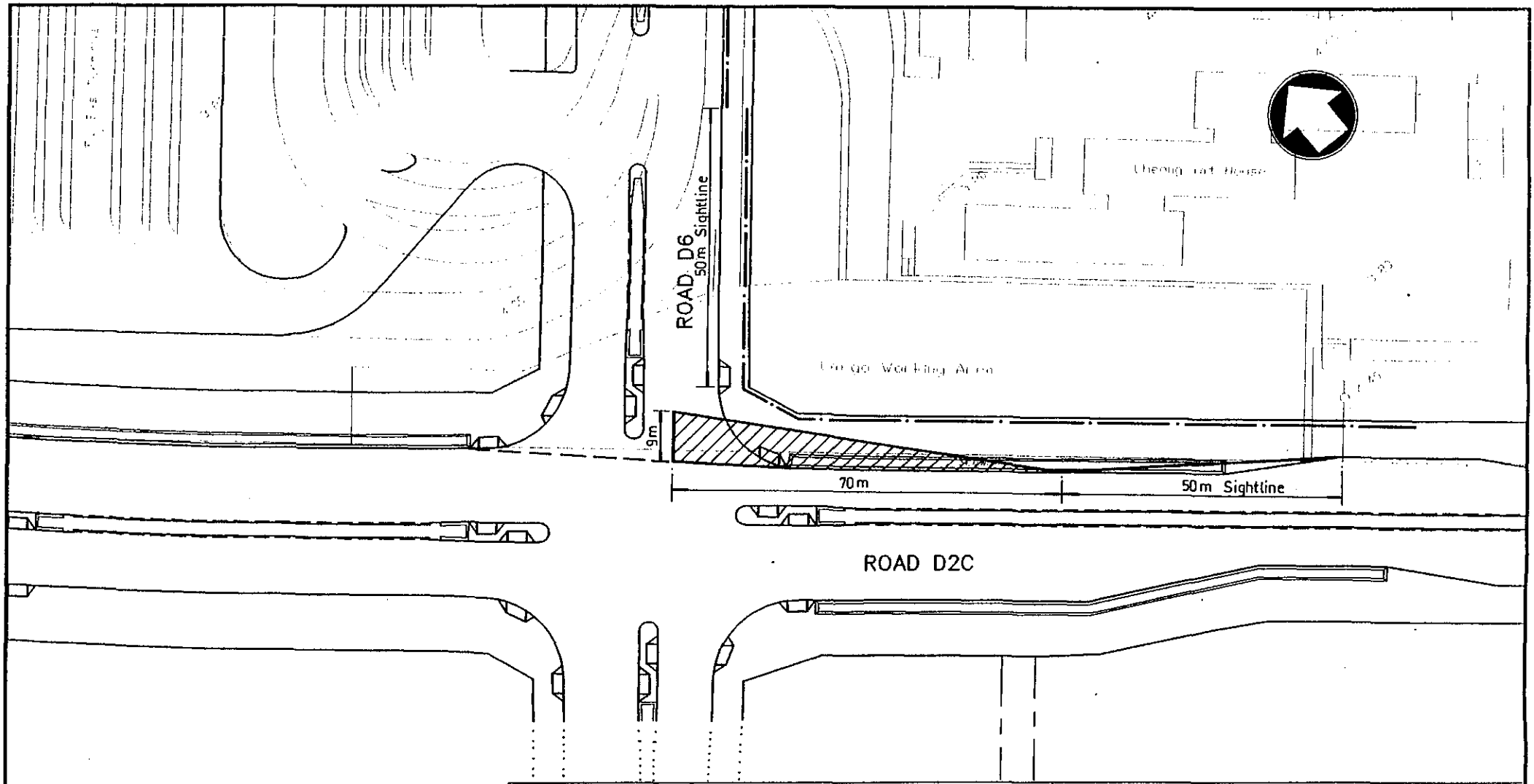


Figure 2.4: Assume Building Forms on Nearby Development Site



LEGEND:-

Noise barrier

Visibility splay

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WEST KOWLOON RECLAMATION

FOCUSED EIA ON ROADWORKS
TYPICAL VISIBILITY SPLAY AND
SIGHTLINE REQUIREMENT

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Scale 1:1000

Figure 2.5

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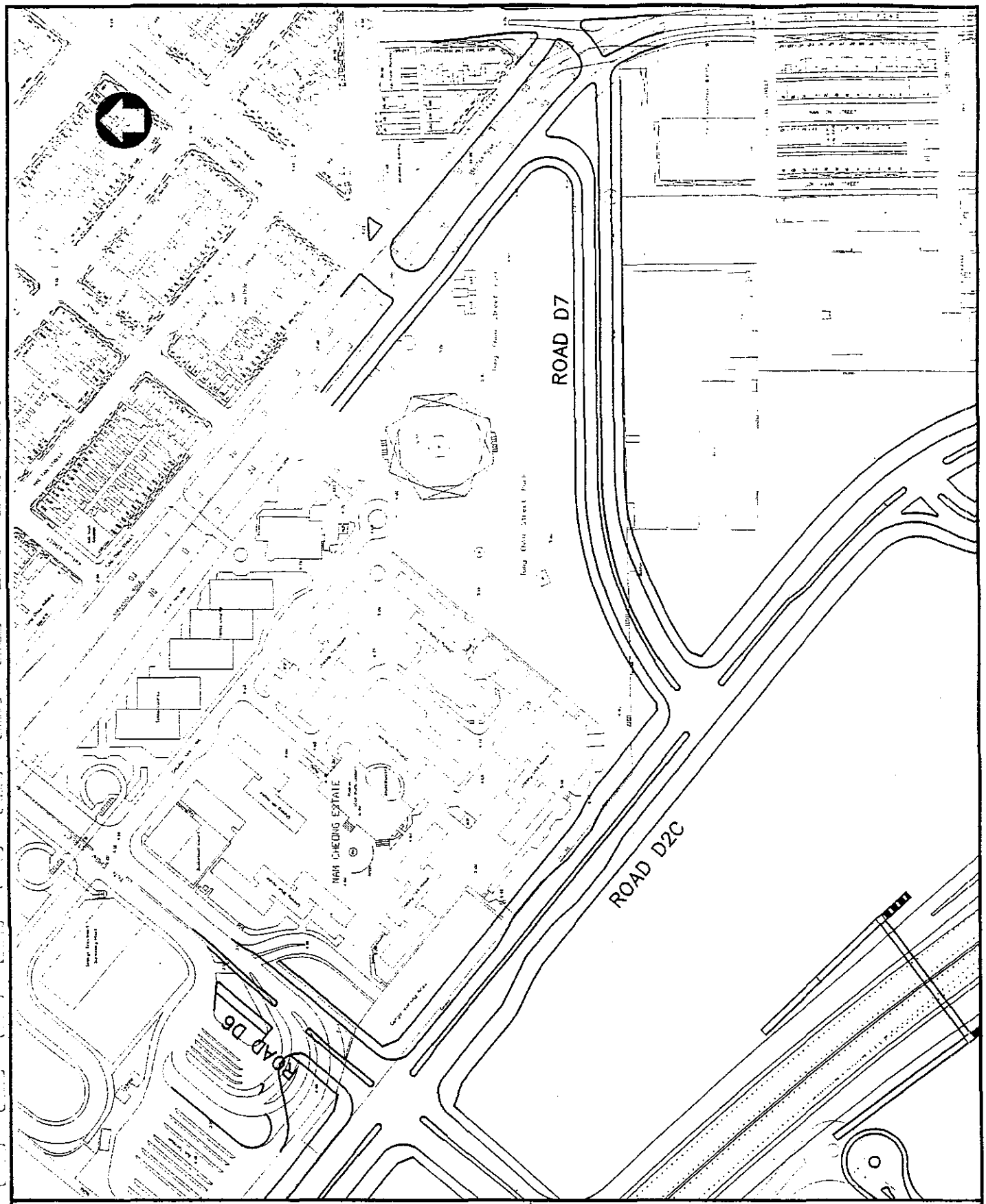

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KOWLOON DEVELOPMENT OFFICE

WEST KOWLOON RECLAMATION

FOCUSED EIA ON ROADWORKS

ROAD LAYOUT

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Scale 1 : 3000

Figure 2.6

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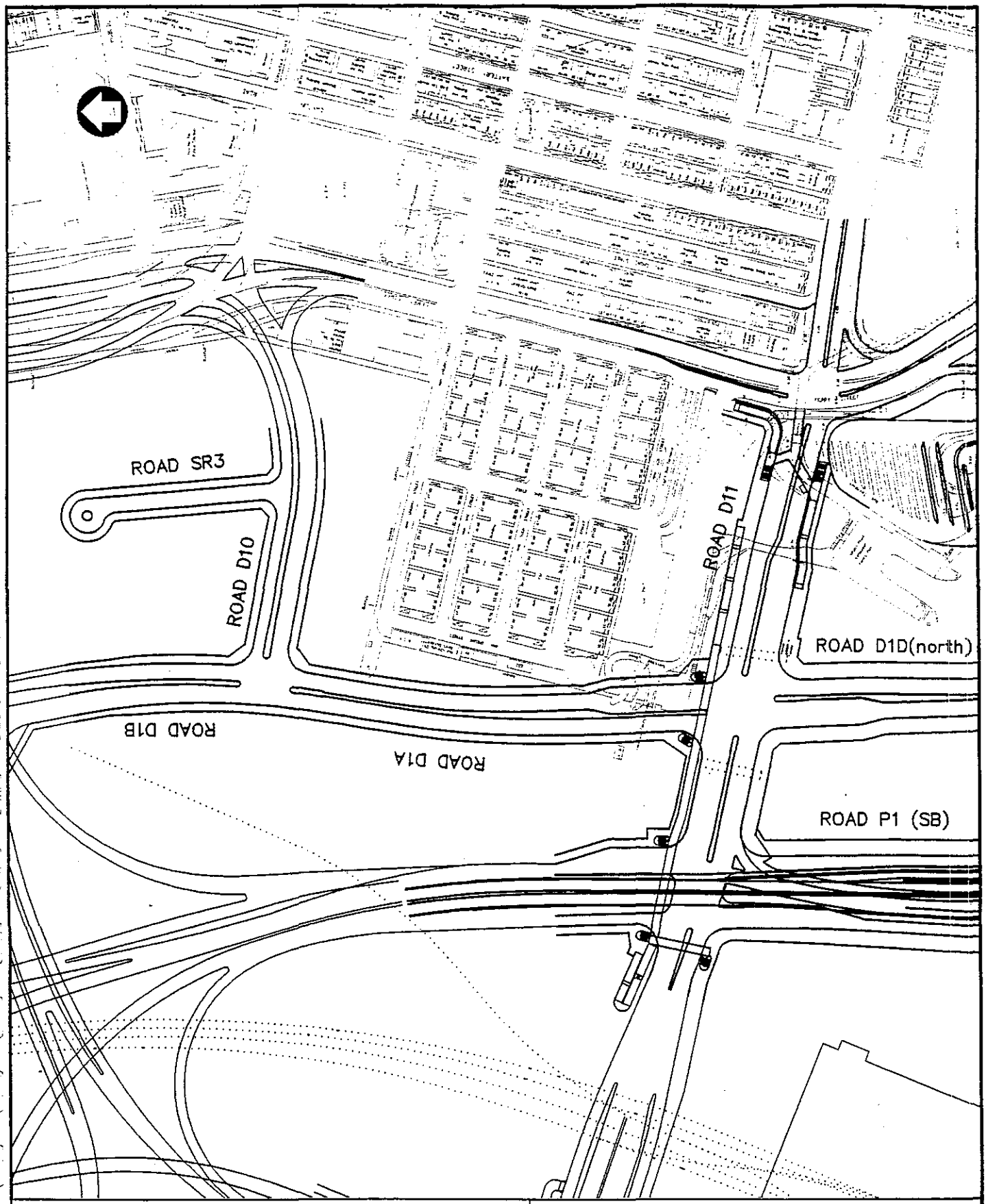

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WEST KOWLOON RECLAMATION

FOCUSED EIA ON ROADWORKS

ROAD LAYOUT

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Scale 1 : 3000

Figure 2.7

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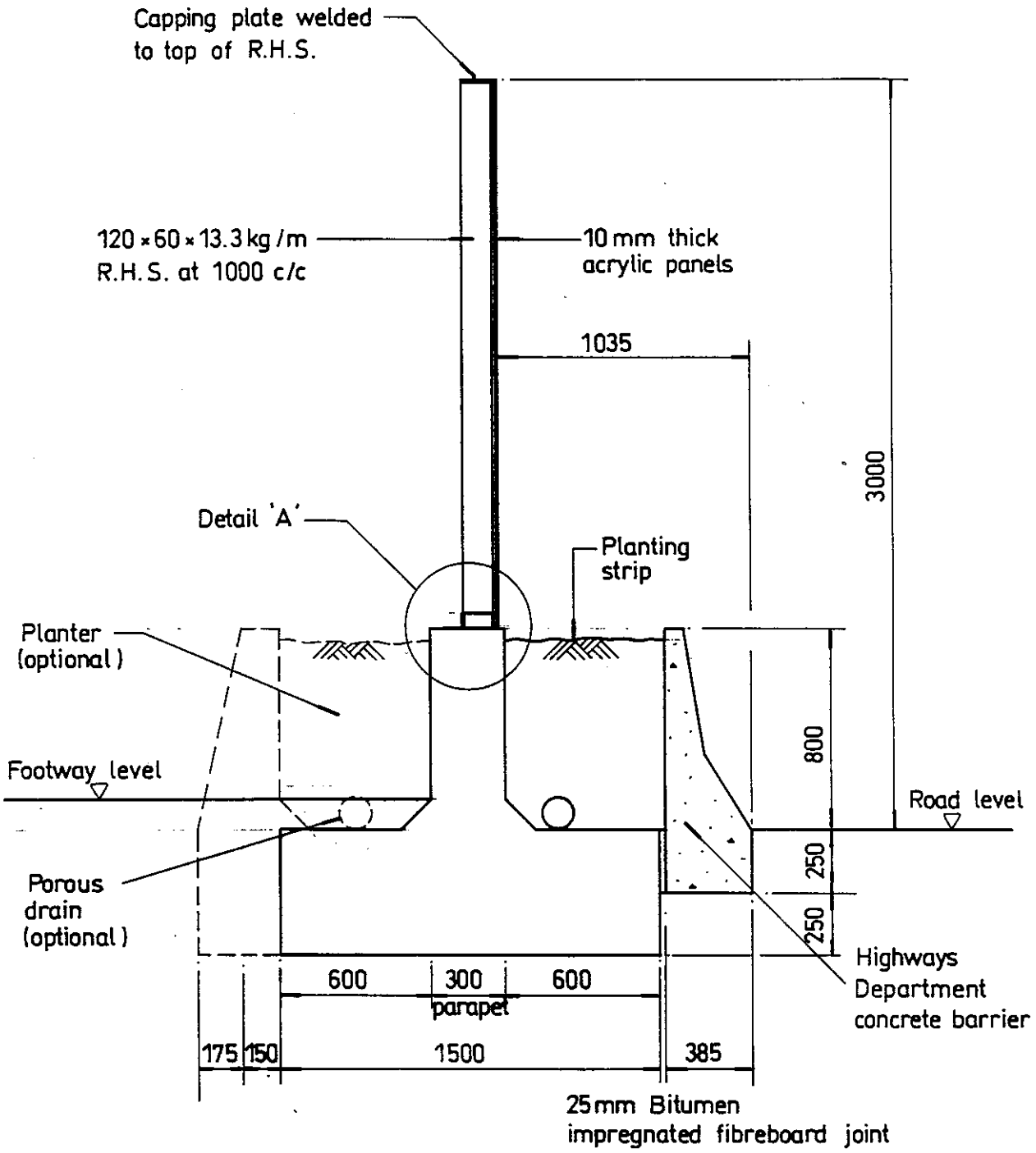

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WEST KOWLOON RECLAMATION

FOCUSED EIA ON ROADWORKS
THREE METRE NOISE BARRIER
OPTION 1 - VISION PANELS
TYPICAL SECTION

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Scale 1:25

Figure 2.8

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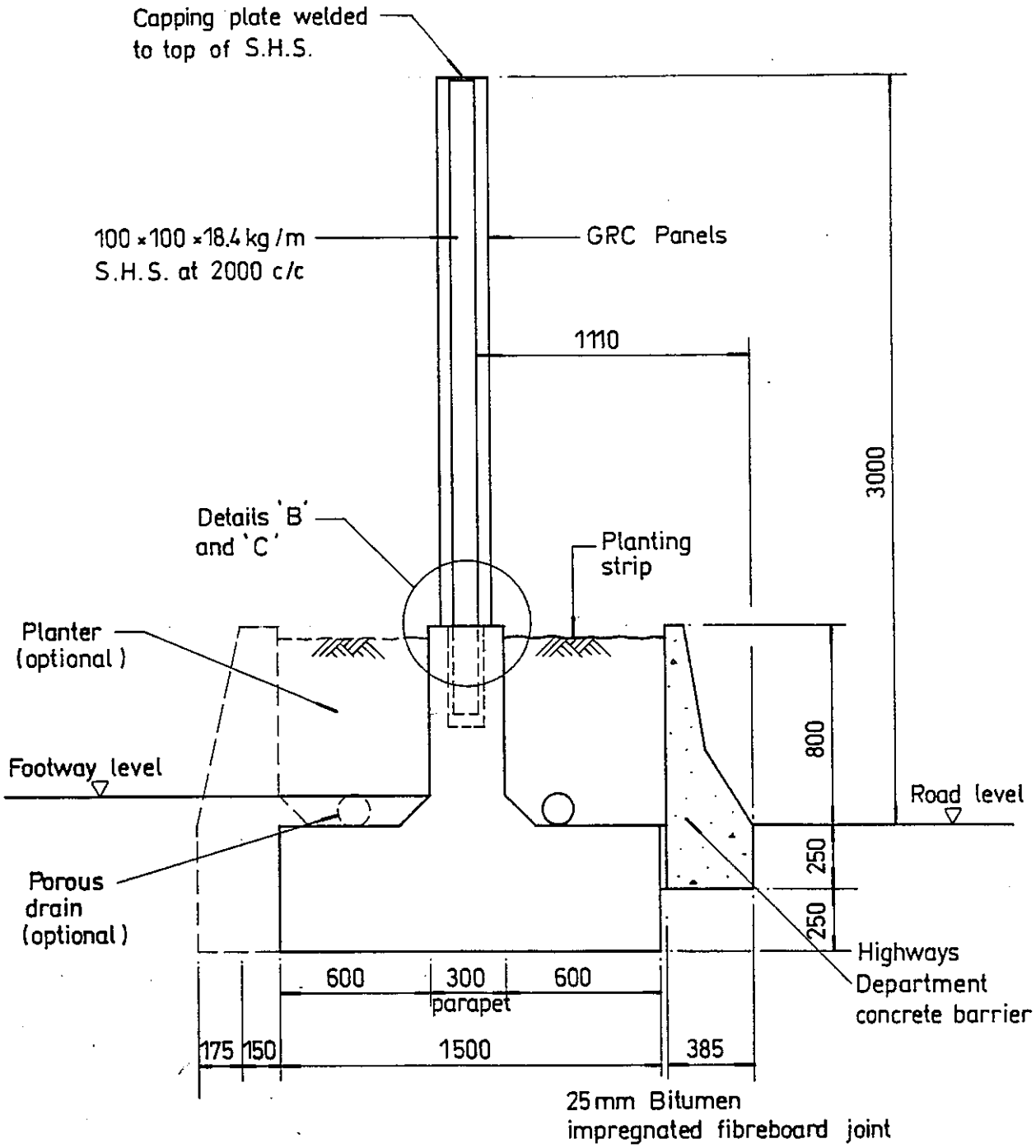

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WEST KOWLOON RECLAMATION

FOCUSED EIA ON ROADWORKS
THREE METRE NOISE BARRIER
OPTION 2 - GRC PANELS
TYPICAL SECTION

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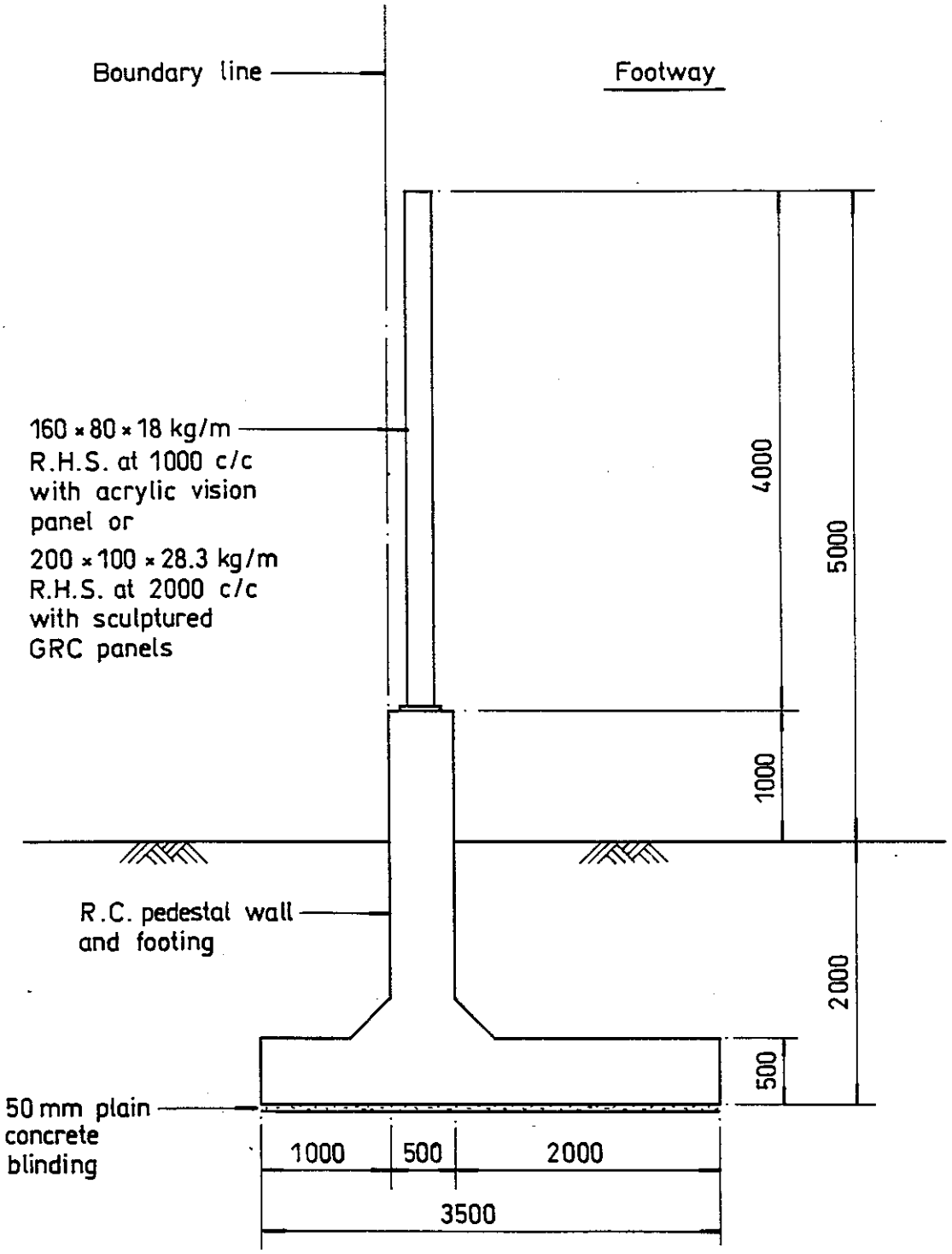
Scale

Figure 2.9

Rev.



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WEST KOWLOON RECLAMATION

FOCUSED EIA ON ROADWORKS
FIVE METRE NOISE BARRIER
TYPICAL SECTION

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Scale 1 : 50

Figure 2.10

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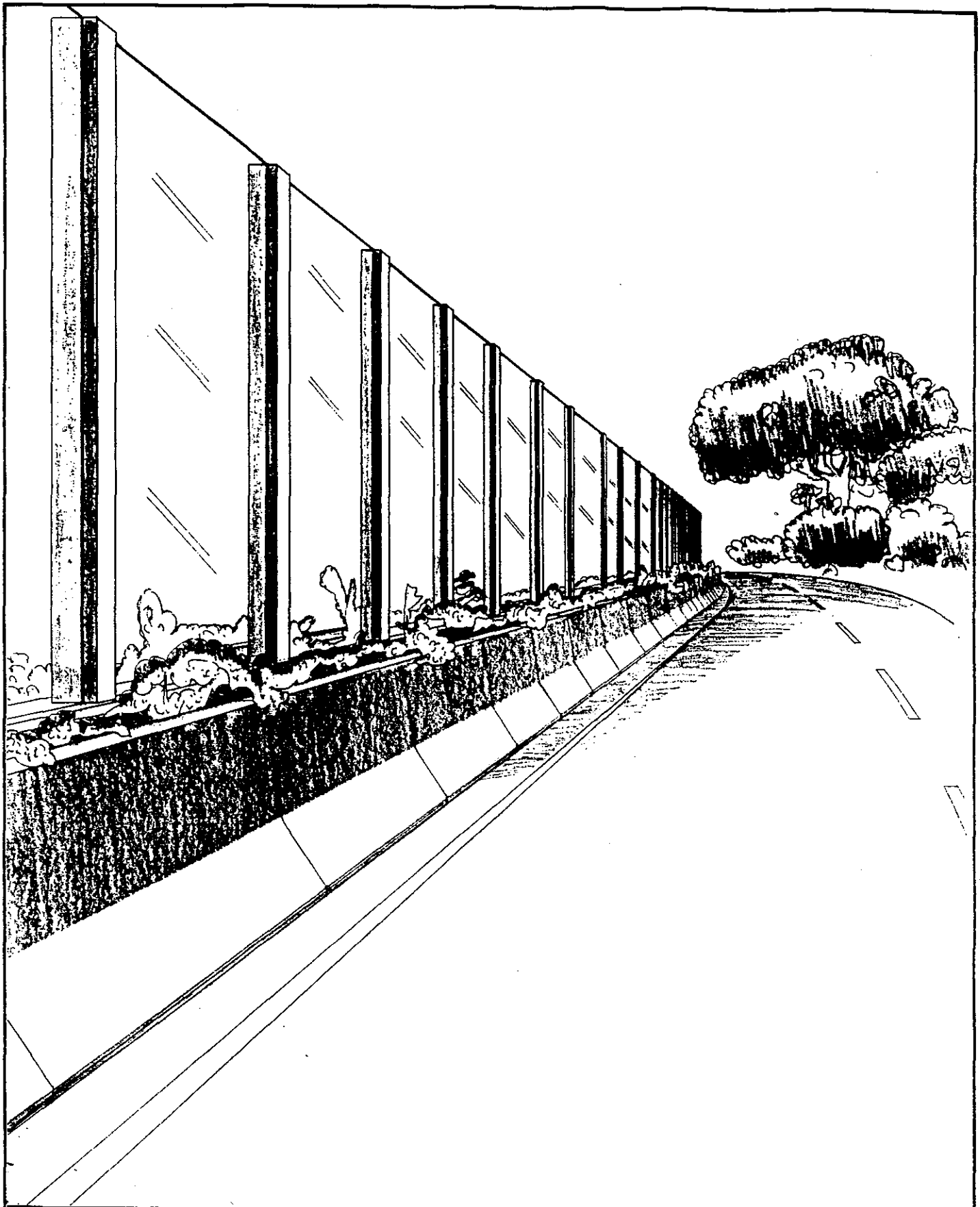

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KOWLOON DEVELOPMENT OFFICE

WEST KOWLOON RECLAMATION

FOCUSED EIA ON ROADWORKS
THREE METRE NOISE BARRIER
OPTION 1 - VISION PANELS
PERSPECTIVE VIEW

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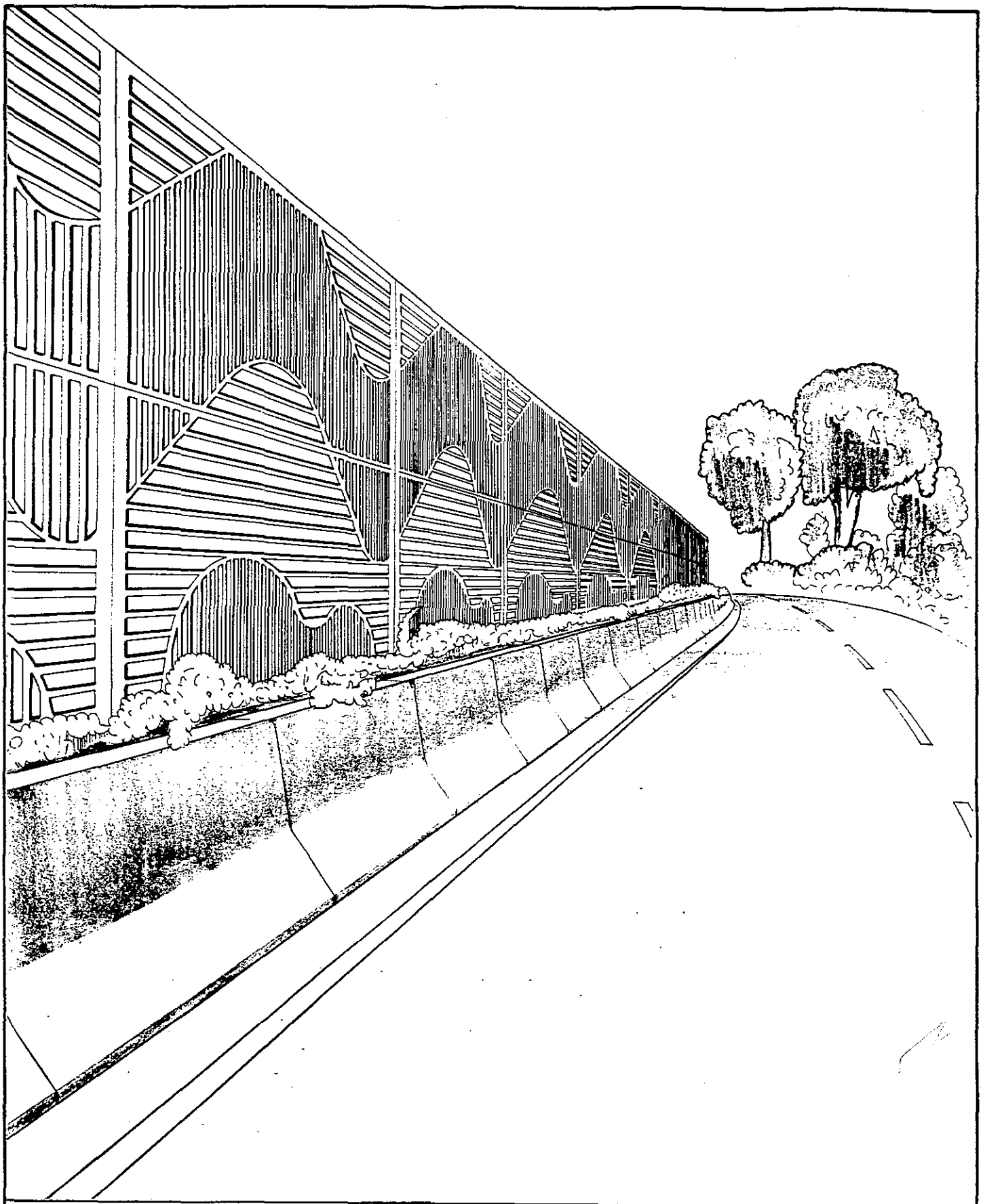
Scale —

Figure 2.11

Rev.



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KOWLOON DEVELOPMENT OFFICE

WEST KOWLOON RECLAMATION

FOCUSED EIA ON ROADWORKS
THREE METRE NOISE BARRIER
OPTION 2 - GRC PANELS
PERSPECTIVE VIEW

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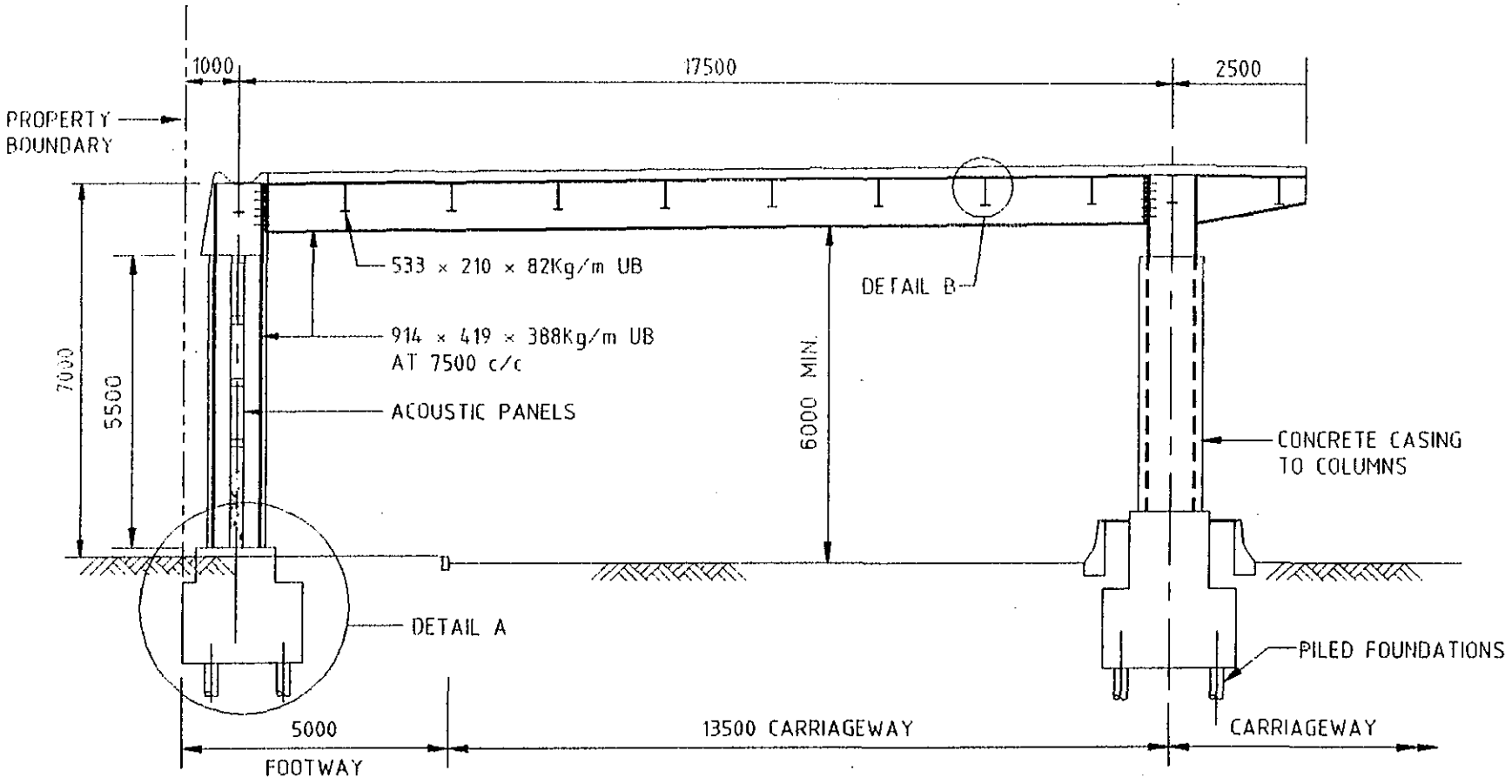
Scale —

Figure 2.12

Rev.



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WEST KOWLOON RECLAMATION

FOCUSED EIA ON ROADWORKS
PARTIAL ENCLOSURE
TYPICAL SECTION

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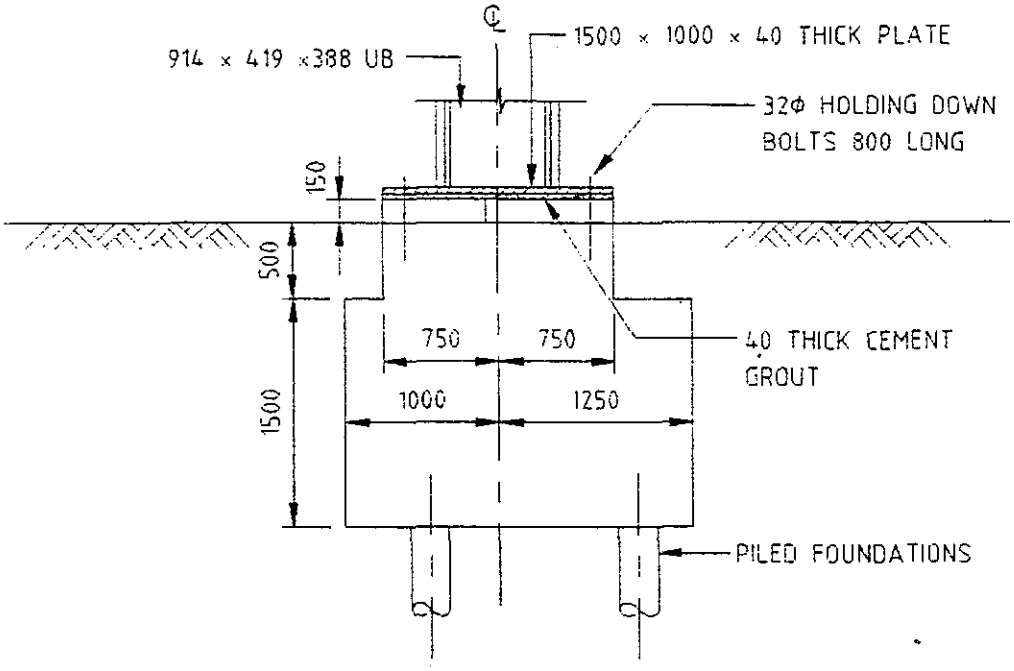
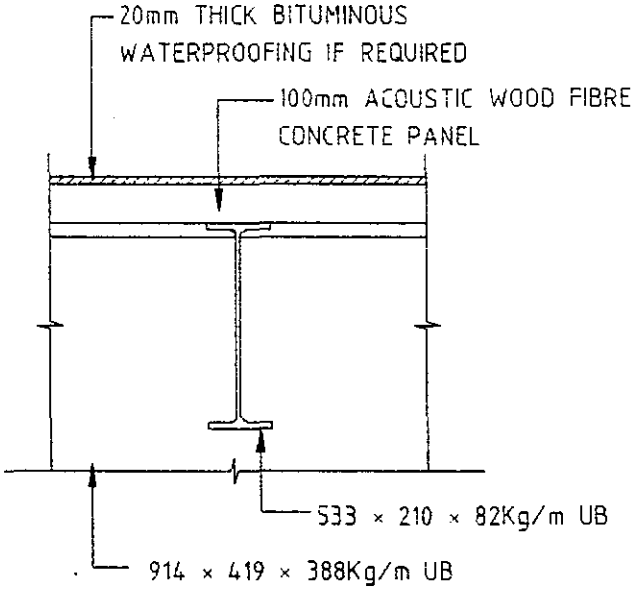
Scale 1 : 125

Figure 2.13

Rev.



DETAIL A
1:50



DETAIL B
1:20

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WEST KOWLOON RECLAMATION

FOCUSED EIA ON ROADWORKS
PARTIAL ENCLOSURE
DETAILS A & B

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Figure 2.14

3.PROJECT DESCRIPTION

Introduction

3.01 The roadworks under this project include roads D1A/1-2, D1B, D10, SR3, D11/1-3, P1(NB)/1 (part only), SR4, D2C/1-3, D2D/1-2, D7/2, NR17, D2B, D2A, D6, D12(part only), D7/1, CR1, NR10, NR9(part), P1, and roads SR1 and SR2, the general locations of which are shown in Figure 1.1 and more specifically in Figures 3.1-3.5. These roads will be constructed in phases, the initial works being included in Contracts WK22/94 and WK23/94. Only the works included in these Contracts are within the environs of the sensitive receivers agreed at the commencement of the study and consequently the study is confined to an assessment of the potential impacts associated with these works only. Impacts associated with the construction of roads D12, SR1 & SR2, for example, are not necessary in view of their remoteness to the existing residential developments. The anticipated programmes for the aforementioned contracts are as follows:

	Contract Start	**Contract Completion**
Contract WK22/94 - Southern Area Roads	03/95	05/97
Contract WK23/94 - Northern Area Roads	08/95	05/97

3.02 Contracts WK22/94 and WK23/94 comprise construction of local and distributor roads including pedestrian subways and footbridges, foul sewers and stormwater box culverts and pipes. Under contract WK22/94 a large volume of marine fill material will be left in place by the preceding reclamation contract and will be removed in stages during the Contract.

Areas and Types of Construction Activities

3.03 The construction works in the vicinity of the three regions of sensitive receivers considered in this study have been divided into six areas numbered 1 to 6 as follows:

- Area 1 : North and West of Man Cheong Estate;
- Area 2 : South of Man Cheong Estate, and North of Road SR4;
- Area 3 : Road SR4;
- Area 4 : North and West of Nam Cheong Estate;
- Area 5 : South of Nam Cheong Estate; and
- Area 6 : West of Wong Tai Street.

These areas are shown in *Figures 3.1 to 3.5*.

3.04 Within each of these areas a number different phases of construction work will be required to construct the roads, culverts, footbridges, and subways, as follows:

a) Road Construction :
1) Road Formation
2) Sewerage and drainage pipe construction
3) Utility installation
4) Road pavement

b) Culvert Construction :
1) Excavation and sheet piling
2) Construction of culvert
3) Backfilling

c) Footbridge construction :
1) Bored piling
2) Pile caps columns and abutment walls construction
3) Superstructure

d) Subway construction :
1) Demolition
2) Excavation and sheet piling
3) Construction of subway
4) Backfilling

3.05 Hence a particular construction activity can be uniquely referenced, for example

activity a1.1 : Road construction, area '1', road formation work.

This referencing system is used extensively in the remainder of the report.

Construction Programme

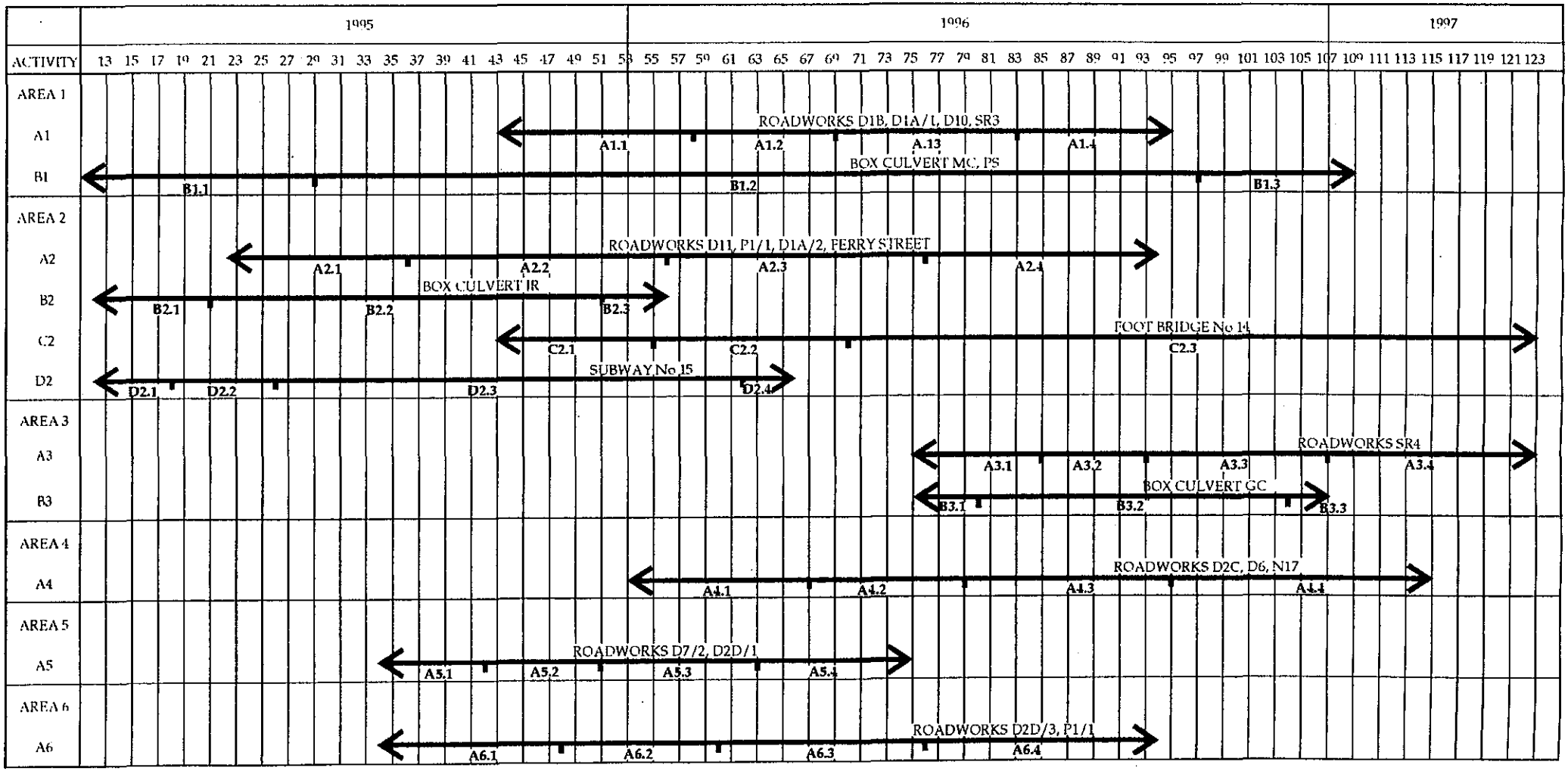
3.06 The commencement of works on site is constrained by the reclamation works being carried out under other contracts. These works will be completed in phases which require the road works to be phased accordingly. The majority of the roads are ACP funded and are required to be completed in the last quarter of 1996 to tie in with the completion of the West Kowloon Expressway. Other roads are required to serve development sites and provide utility corridors and are not required to be completed until the second quarter 1997. Contract WK23/94 is for roads north of Cherry Street to Water Boat Dock near Mei Foo Sun Chuen.

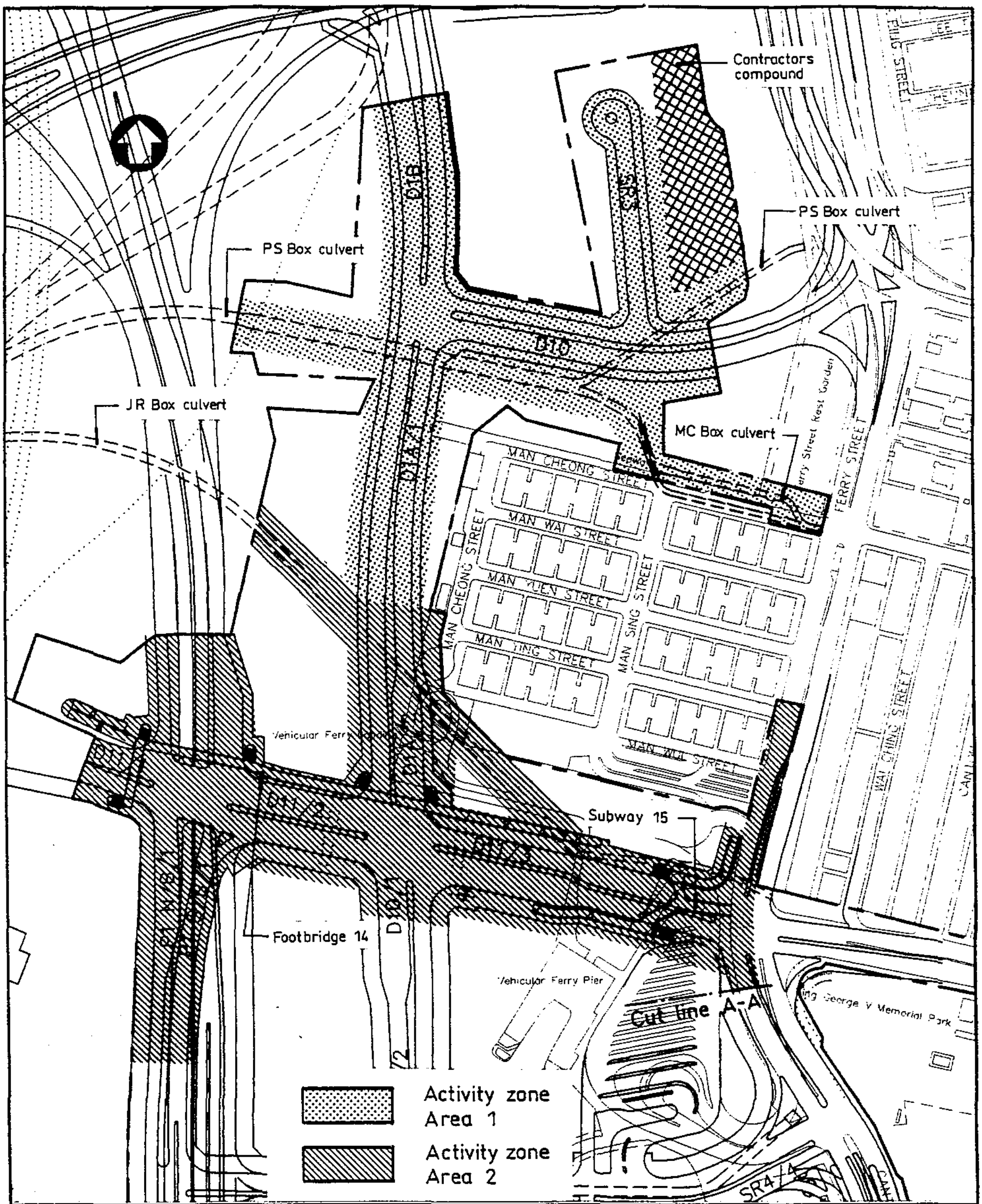
3.07 At any one time during the construction period there may be several areas of construction activity in progress. It is therefore necessary to consider the likely construction programme to establish the periods in which most activities will be occurring simultaneously, so as to consider the worst case with regard to noise and dust emissions from the whole site. An indicative construction programme given in *Table 3.1* overleaf. This programme is based on the best information available at this time but can only be taken as indicative because the Contractors will be at liberty to develop their own proposed methods of working to make best use of plant and resources.

3.08 It can be seen that within the anticipated two year construction period there are several periods where construction activity will be more intense with several activities in progress simultaneously. In order to simplify the noise and air assessments and to be sure to identify the worst case impacts, this assessment concentrates on these periods of intense activity.

3.09 It is anticipated that the works will be limited to daytime (0700 to 1900 hours) periods, Monday to Saturday, although it is possible that Sunday working may be required occasionally.

Table 3.1 - Indicative construction programme





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FOCUSED EIA ON ROADWORKS

AREA 1 AND 2

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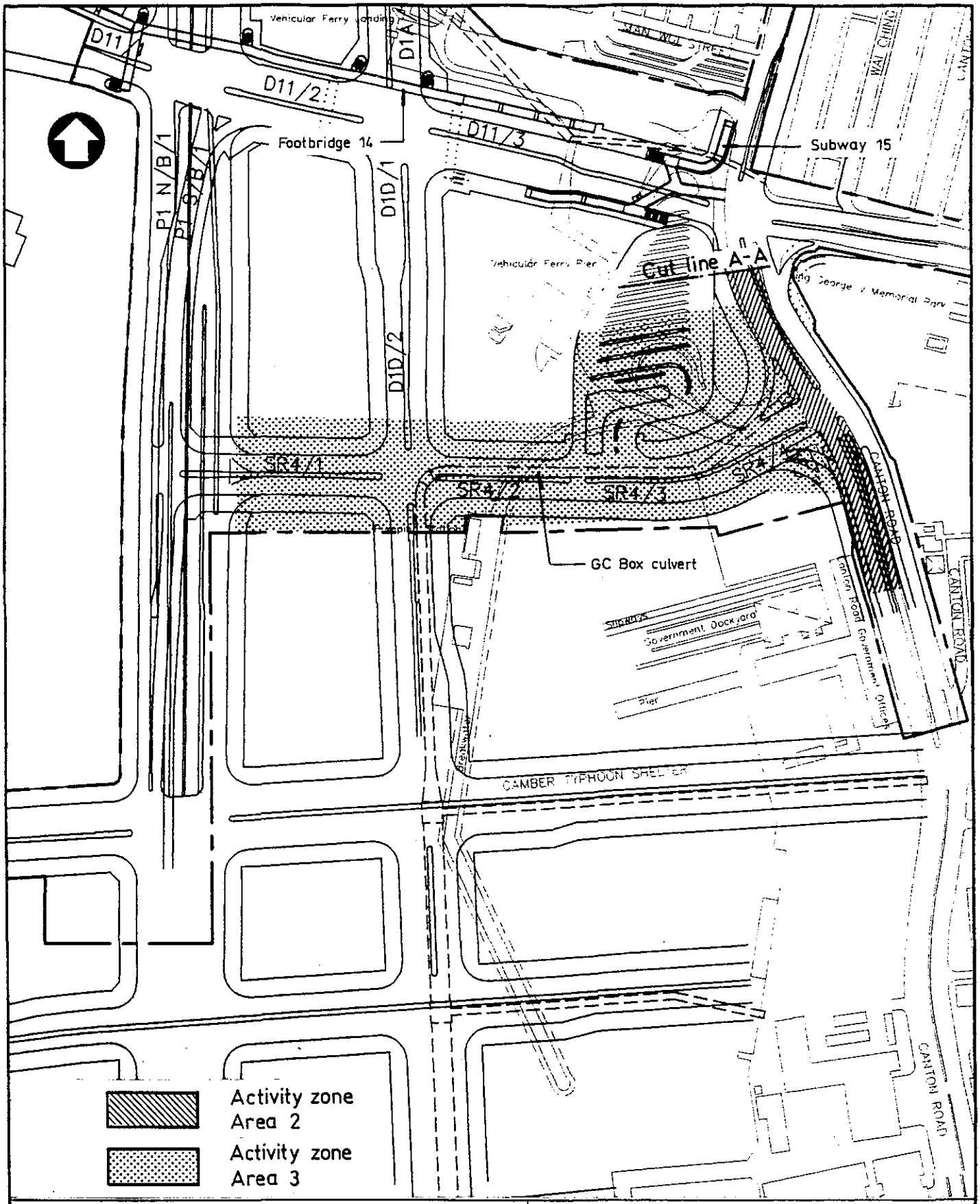
Figure 3.1



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WEST KOWLOON RECLAMATION

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AREA 2 AND 3

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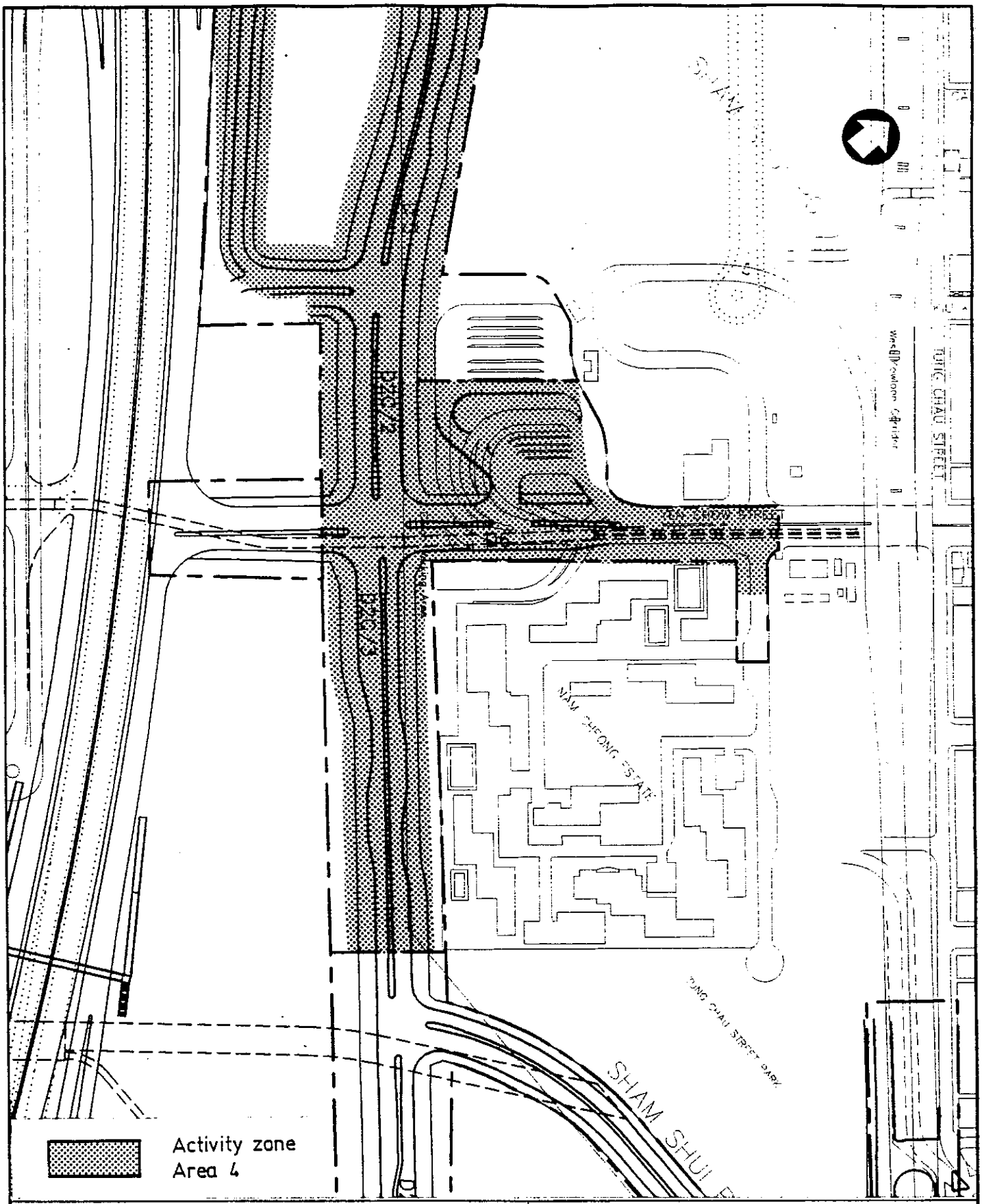
Figure 3.2



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WEST KOWLOON RECLAMATION

FOCUSED EIA ON ROADWORKS

AREA 4

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Figure 3.3

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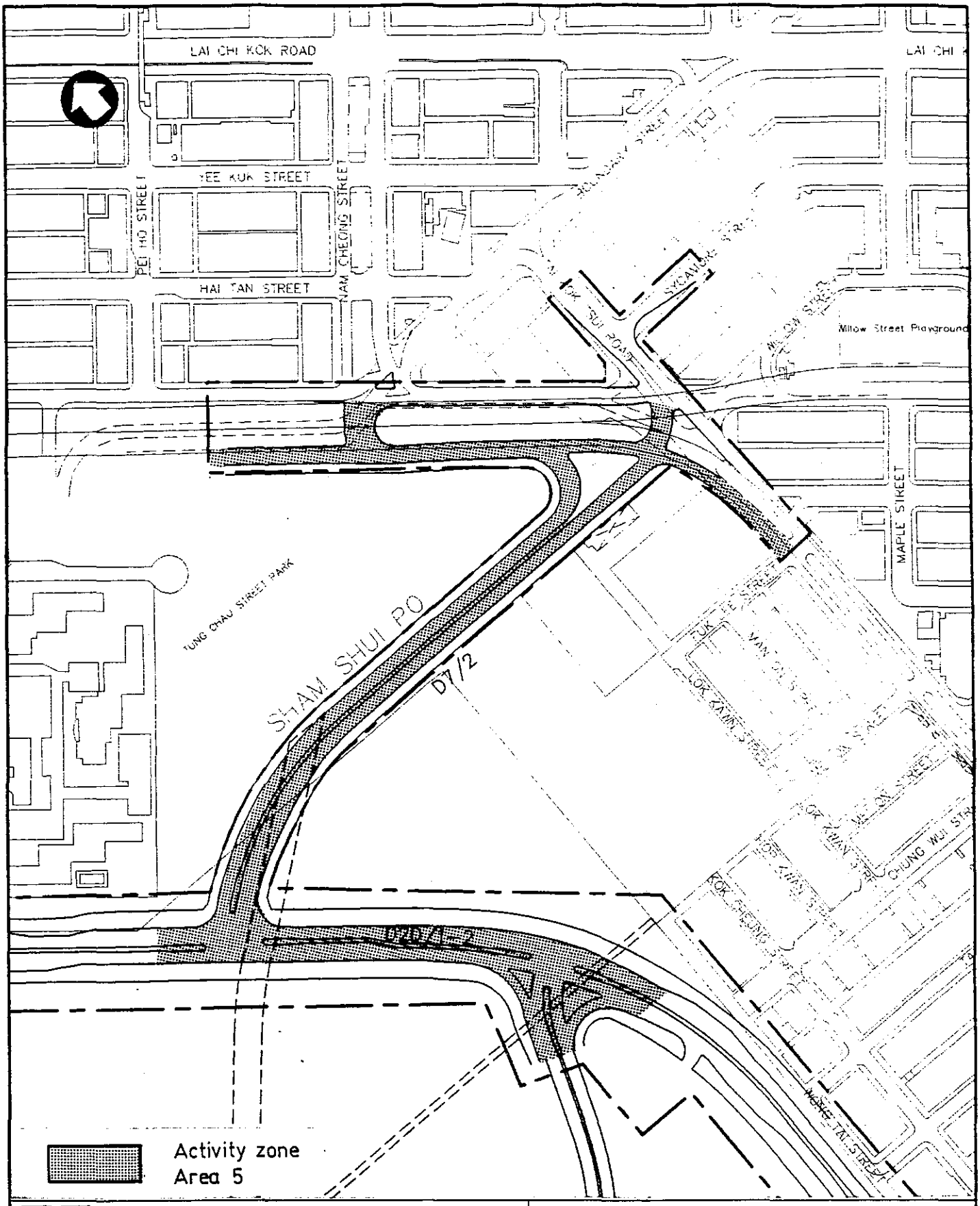

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WEST KOWLOON RECLAMATION

FOCUSED EIA ON ROADWORKS

AREA 5

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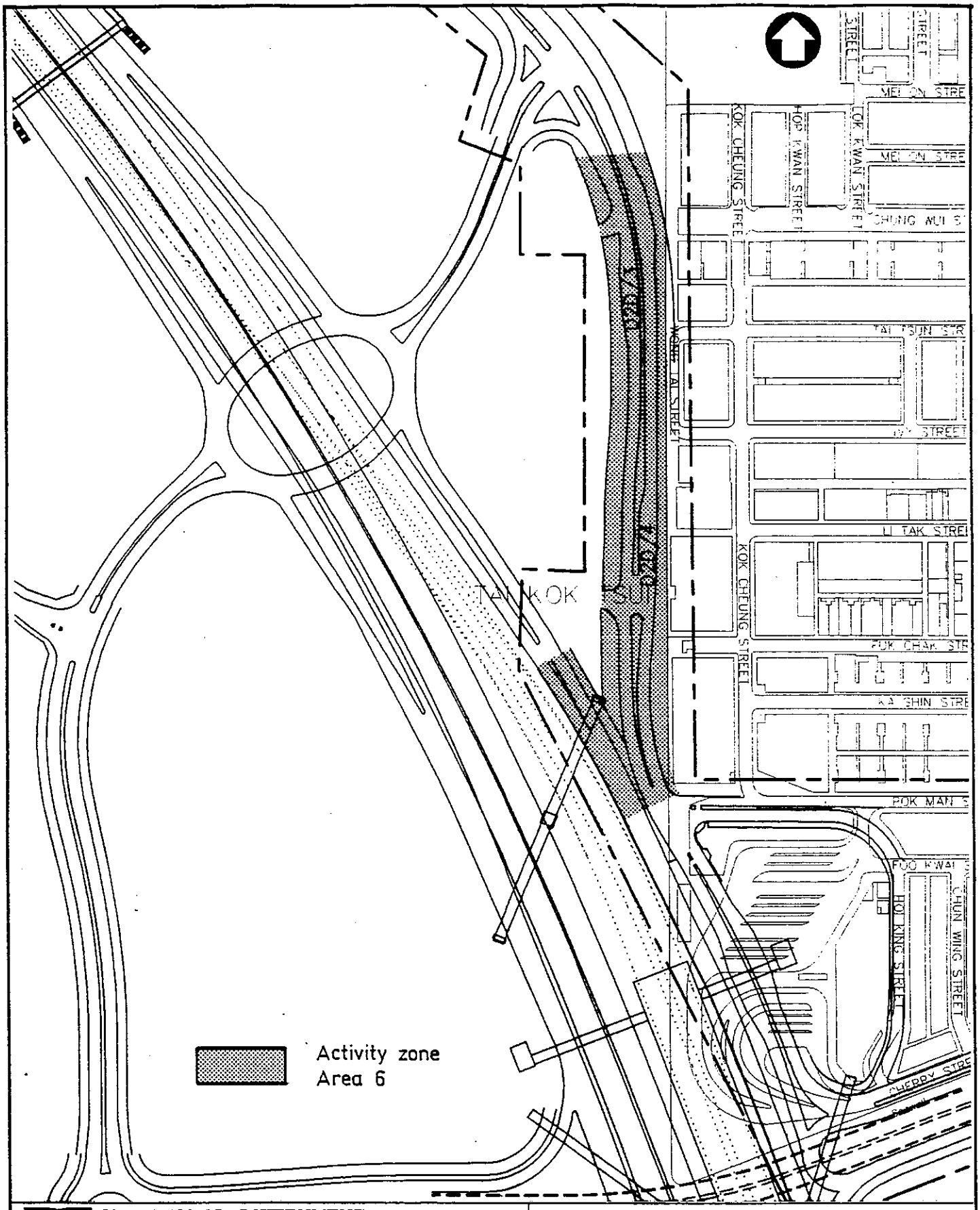
Figure 3.4



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WEST KOWLOON RECLAMATION

FOCUSED EIA ON ROADWORKS

AREA 6

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Figure 3.5

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4.CONSTRUCTION NOISE

Introduction

4.01 This section predicts the likely noise levels from the proposed works based on estimates of the construction plant to be used and the phasing of the proposed works. The predictions are compared against noise impacts assessment criteria, and where impacts are predicted noise mitigation measures are recommended.

Noise Sensitive Receivers

4.02 This study considers noise impacts at three existing residential areas; Nam Cheong Estate, Wong Tai Street, and Man Cheong Street. The 5 NSRs in Nam Cheong Estate, referenced as A1 to A5, and the two in Wong Tai Street, referenced as B1 and B2, are shown in *Figure 4.1 Northern Area NSR Locations*. Similarly, the severn NSRs in Man Cheong Street, referenced C1 to C7, are shown in *Figure 4.2, Southern Area NSR Locations*. It was agreed at the commencement of the study that the assessment would consider the impacts at these locations only. These locations were chosen to be representative of the three groups of NSRs of interest, so that the impacts at them can be used to discuss the impacts at the whole of the three residential areas.

Assessment Methodology

4.03 A methodology for assessing noise from the construction of the proposed West Kowloon Reclamation roadworks has been developed based on the *Technical Memorandum on Noise From Construction Work Other Than Percussive Piling* (TM1). In general, the methodology is as follows:

- locate NSRs that may be affected by the worksite;
- calculate distance attenuation to NSRs from worksite notional noise source point;
- predict construction noise levels at NSRs in the absence of any mitigation measures; and,
- calculate maximum total site sound power (SWL) level for construction activities such that $L_{Aeq,30min}$ noise levels at NSRs comply with appropriate noise criteria.

4.04 The practicability of achieving the aforementioned maximum total site sound power level is then considered since this might offer a preferred form of mitigation. Other mitigation measures are then considered and recommended as appropriate.

4.05 In Hong Kong the control of construction noise outside of daytime, weekday working hours (0700-1900, Monday through Saturday) is governed by the Noise Control Ordinance (NCO) and the subsidiary TM1 and TM2. These TMs establish the permitted noise levels for construction work depending upon working hours and the existing noise climate. If construction work on Sundays is necessary to meet the required construction programme a Construction Noise Permit (CNP) must be obtained and noise levels must comply with the requirements of the NCO.

4.06 The NCO criteria for the control of noise from powered mechanical equipment (PME) are dependant upon the type of area containing the NSR rather than the measured background noise level. In this case the majority of the NSRs have an *Area Sensitivity Rating* of 'C', according to TM1. The South West facades of Nam Cheong Estate and the West facades of dwellings on Man Cheong Street, however have Area Sensitivity Ratings B. The NCO requires that noise levels from construction at affected NSRs be less than a specified *Acceptable Noise Level* which depends on the area sensitivity rating. The Acceptable Noise Level for area sensitivity ratings 'B' and 'C' on Sundays during the day (0700 to 1900 hours) are $L_{Aeq.\ 5\ mins}$ 65 and 70 dB respectively.

4.07 Although the NCO does not provide for the control of construction activities during normal working hours (0700 to 1900 hours, Monday to Saturday), a limit of $L_{Aeq.\ 30\ min}$ 75 dB is proposed in the "*Practice Note For Professional Persons, PN2/93*" issued by the *Professional Persons Environmental Consultative Committee* (ProPECC) in June 1993. This limit has been applied on major construction projects in recent years, and is now generally accepted in Hong Kong, and will therefore be adopted in this study.

4.08 The distance correction for each NSR with respect to each construction activity is calculated from the distance of the NSR from the worksite notional noise source point. In most cases the notional source point is easily established in accordance with TM1. However areas 1 and 4 are worksites that include perpendicular roads running along two sides of Nam Cheong Estate and Man Cheong Street, and for these the notional source point is not obvious. In these cases the worksite is divided into two areas, and the notional source point is assumed to be that for only the portion of the works area in front of the NSR. The other portion will be completely screened from the NSR and is ignored. It is assumed that no more than half of the plant within the whole area will be located within this portion, and thus a 3 dB correction is made to the total plant sound power level.

4.09 The noise predictions consider the noise contributions from the various activities that may occur simultaneously (as derived from the Indicative Construction Programme) in the 6 working areas. Working areas that are over 300 m from the NSR, or for which the NSR is completely screened by buildings, will have insignificant noise contributions and are ignored.

Sources Of Impact

4.10 The main source of construction operation which have the potential to cause impacts at nearby NSRs fall into four main categories, namely road, culvert, footbridge and subway construction and are discussed in *Section 2.2*. For each category there are different phases of work associated with each construction as described in *Section 2.2*. The types and quantity of Powered Mechanical Equipment (PME) that are assumed to operate during the construction of each phase are outlined in *Table 4.1* to *Table 4.6*. No percussive piling is expected.

Table 4.1 Plant Inventories Area 1

Activity Ref	Activity	Plant	Number	TM Ref Number	Sound Power Level (dB)
a1 Road Construction (Road D1B, D1A/1, D10, SR3)					
a1.1	Road formation and earthworks	Trucks	5	CNP 141	112+7
		Excavators	1	CNP 081	112
		Grader	1	CNP 104	113
		Loader	3	CNP 081	112+5
		Roller	2	CNP 185	108+3
					Total 123
a1.2	Sewerage and drainage pipe construction	Excavators	2	CNP 081	112+3
		Trucks	1	CNP 141	112
		Vibrator	1	CNP 170	113
		Concrete Mixer	1	CNP 045	96
					Total 118
a1.3	Utility installation	Excavator	2	CNP 081	112+3
		Trucks	2	CNP 141	112+3
		Vibrator	1	CNP 170	113
					Total 119
a1.4	Road pavement + misc	Paver	1	CNP 184(1)	111
		Roller	2	CNP 185	108+3
		Trucks	4	CNP 141	112+6
					Total 119
Area b1 Culvert Construction (Box culvert MC, PS)					
b1.1	Excavation and Sheet piling	Excavator	1	CNP 081	112
		Loader	1	CNP 081	112
		Truck	2	CNP 141	112+3
		Roller	1	CNP 185	108
		Light crane	1	CNP 049	95
					Total 118
b1.2	Construction of culvert	Vibrator	2	CNP 170	113+3
		Concrete pump	1	CNP 047	109
		Concrete mixer			
		Light crane	1	CNP 046	96
			1	CNP 049	95
					Total 117
b1.3	Backfilling	Excavator	1	CNP 081	112
		Roller	1	CNP 185	108
		Truck	1	CNP 141	112
					Total 116

(1) Assumed paver activity similar to road planner or miller

Table 4.2 *Plant Inventories Area 2*

Activity Ref	Activity	Plant	Number	TM Ref Number	Sound Power Level (dB)
a2 Road Construction (Road D11, P1/1, D1A/2, Ferry Street)					
a2.1	Road formation and earthworks + demolition	Truck	3	CNP 141	112+5
		Excavators	1	CNP 081	112
		Grader	1	CNP 104	113
		Loader	2	CNP 081	112+3
		Roller	2	CNP 185	108+3
					Total 121
a2.2	Sewerage and drainage pipe construction	Excavator	2	CNP 081	112+3
		Truck	1	CNP 141	112
		Vibrator	1	CNP 170	113
		Concrete mixer	1	CNP 049	96
					Total 118
a2.3	Utility installation	Excavator	2	CNP 081	112+3
		Truck	2	CNP 141	112+3
		Vibrator	1	CNP 170	113
					Total 119
a2.4	Road pavement + misc	Paver	1	CNP 184[1]	111
		Roller	2	CNP 185	108+3
		Truck	4	CNP 141	112+6
					Total 119
b2 Culvert Construction (Box culvert JR)					
b2.1	Excavation and sheet piling	Excavator	1	CNP 081	112
		Loader	1	CNP 081	112
		Truck	2	CNP 141	112+3
		Roller	1	CNP 185	108
		Light crane	1	CNP 049	95
					Total 118
b2.2	Construction of culvert	Vibrator	2	CNP 170	113+3
		Concrete pump	1	CNP 047	109
		Concrete mixer	1	CNP 046	96
		Light crane	1	CNP 049	95
					Total 117
b2.3	Backfilling	Excavator	1	CNP 081	112
		Roller	1	CNP 185	108
		Truck	1	CNP 141	112
					Total 116

c2 Footbridge Construction (Footbridge no. 14)

c2.1	Bored Piling	Bored Piling rigs	3	CNP 164	115+5
		Concrete mixer	1	CNP 046	96
		Vibrator	1	CNP 170	113
					Total 121
c2.2	Pile caps columns + abutment walls construction	Concrete mixer	2	CNP 046	96+3
		Concrete pump	2	CNP 047	109+3
		Vibrator	2	CNP 170	113+3
					Total 118
c2.3	Superstructure	Concrete mixer	2	CNP 046	96+3
		Concrete pump	1	CNP 047	109
		Vibrator	2	CNP 170	113+3
		Crane (mobile)	2	CNP 048	112+3
					Total 119

d2 Subway Construction (Subway no. 15)

d2.1	Demolition of existing subway + pavement	Breaker	2	CNP 028	122+3
		Excavator	1	CNP 081	112
		Truck	1	CNP 141	112
					Total 125
d2.2	Excavation and sheet piling	Excavator	1	CNP 081	112
		Loader	1	CNP 081	112
		Truck	1	CNP 141	112
		Roller	1	CNP 185	108
		Light crane	1	CNP 049	95
					Total 117
d2.3	Construction of subway	Concrete pump	1	CNP 047	109
		Concrete mixer	1	CNP 046	96
		Vibrator	2	CNP 170	113+3
		Crane	1	CNP 049	95
					Total 117
d2.4	Backfilling	Excavator	1	CNP 081	112
		Roller	1	CNP 185	108
		Truck	1	CNP 141	112
					Total 116

(1) Assumed paver activity similar to road planner or miller

Table 4.3 Plant Inventories Area 3

Activity Ref	Activity	Plant	Number	TM Ref Number	Sound Power Level (dB)
a3 Road Construction (Road SR4, bus terminus modification)					
a3.1	Road formation and earthworks	Truck	3	CNP 141	112+5
		Excavator	1	CNP 081	112
		Grader	1	CNP 104	113
		Loader	2	CNP 081	112+3
		Roller	1	CNP 185	108
					Total 121
a3.2	Sewerage and drainage pipe construction	Excavator	1	CNP 081	112
		Truck	1	CNP 141	112
		Vibrator	1	CNP 170	113
		Concrete mixer	1	CNP 046	96
					Total 117
a3.3	Utility installation	Excavator	2	CNP 081	112+3
		Truck	2	CNP 141	112+3
		Vibrator	1	CNP 170	113
					Total 119
a3.4	Road Pavement + misc	Paver	1	CNP 184(1)	111
		Roller	2	CNP 185	108+3
		Truck	3	CNP 141	112+5
					Total 119
Area b3 Culvert Construction (Box culvert GC)					
b3.1	Excavation and sheet piling	Excavator	1	CNP 081	112
		Loader	1	CNP 081	112
		Truck	2	CNP 141	112+3
		Roller	1	CNP 185	108
		Light crane	1	CNP 049	95
					Total 118
b3.2	Construction of Culvert	Vibrator	2	CNP 170	113+3
		Concrete pump	1	CNP 047	109
		Concrete mixer Light crane	1	CNP 046	96
			1	CNP 049	95
					Total 117
b3.3	Backfilling	Excavator	1	CNP 081	112
		Roller	1	CNP 185	108
		Truck	1	CNP 141	112
					Total 116

(1) Assumed paver activity similar to road planner or miller

Table 4.4 Plant Inventories Area 4

Activity Ref	Activity	Plant	Number	TM Ref Number	Sound Power Level (dB)
Area a4 Road Construction (D2C, D6, N17)					
a4.1	Road formation and earthworks	Truck	2	CNP 141	112+3
		Excavator	1	CNP 081	112
		Grader	1	CNP 104	113
		Loader	1	CNP 081	112
		Roller	2	CNP 185	108+3
					Total 120
a4.2	Sewerage and drainage pipe construction	Excavator	1	CNP 081	112
		Truck	1	CNP 141	112
		Vibrator	1	CNP 170	113
		Concrete mixer	1	CNP 046	96
					Total 117
a4.3	Utility installation	Excavator	2	CNP 081	112+3
		Truck	2	CNP 141	112+3
		Vibrator	1	CNP 170	113
					Total 119
a4.4	Road pavement + misc	Paver	1	CNP 184(1)	111
		Roller	2	CNP 185	108+3
		Truck	3	CNP 141	112+5
					Total 119

(1) Assumed paver activity similar to road planner or miller

Table 4.5 Plant Inventories Area 5

Activity Ref	Activity	Plant	Number	TM Ref Number	Sound Power Level (dB)
a5 Road Construction (D7/2, D2D/1, D2D/2)					
a5.1	Road formation and earthworks	Truck	2	CNP 141	112+3
		Excavator	1	CNP 081	112
		Grader	1	CNP 104	113
		Loader	1	CNP 081	112
		Roller	1	CNP 185	108
					Total 120
a5.2	Sewerage and drainage pipe construction	Excavator	1	CNP 081	112
		Truck	2	CNP 141	112
		Vibrator	1	CNP 170	113
		Concrete mixer	1	CNP 046	96
					Total 117
a5.3	Utility installation	Excavator	2	CNP 081	112+3
		Truck	2	CNP 141	112+3
		Vibrator	1	CNP 170	113
					Total 119
a5.4	Road pavement + misc	Paver	1	CNP 184 (1)	111
		Roller	2	CNP 185	108+3
		Truck	3	CNP 141	112+5
					Total 119

(1) Assumed paver activity similar to road planner or miller

Table 4.6 Plant Inventories Area 6

Activity Ref	Activity	Plant	Number	TM Ref Number	Sound Power Level (dB)
a6 Road construction (Road D2D/3, P1/1)					
a6.1	Road formation and earthworks	Truck	1	CNP 141	112
		Excavator	1	CNP 081	112
		Grader	1	CNP 104	113
		Loader	1	CNP 081	112
		Roller	2	CNP 185	108+3
					Total 119
a6.2	Sewerage and drainage pipe construction	Excavator	2	CNP 081	112+3
		Truck	1	CNP 141	112
		Vibrator	1	CNP 170	113
		Concrete mixer	1	CNP 045	96
					Total 118
a6.3	Utility installation	Excavator	2	CNP 081	112+3
		Truck	2	CNP 141	112+3
		Vibrator	1	CNP 170	113
					Total 119
a6.4	Road pavement + misc	Paver	1	CNP 184(1)	111
		Roller	2	CNP 185	108+3
		Truck	4	CNP 141	112+6
					Total 119

(1) Assumed paver activity similar to road planner or miller

Prediction And Assessment Of Impacts

4.11 The distances from the notional source point of each activity to the NSRs are given in *Table 4.7* and *Table 4.8* below. The corrected facade noise levels associated with each activity at each receivers have also been predicted with the distance attenuation taking into account. No screening corrections have been assumed for the predicted noise levels and for simplicity any activities that do not have a direct line of sight from the NSR have been ignored.

Table 4.7 Southern Area , minimum distances to NSRs and the corresponding Noise Levels (dB)

Activity	North west facade of Man Cheong Estate (C3)	West facade of Man Cheong Estate (C4)	South west facade of Man Cheong Estate (C5)
a1.1	70m/78 (2)	120m/73 (2)	-
a1.2	70m/73 (2)	120m/68 (2)	-
a1.3	70m/74 (2)	120m/69 (2)	-
a1.4	70m/74 (2)	120m/69 (2)	-
b1.1	55m/78	165m/69	-
b1.2	55m/77	165m/68	-
b1.3	55m/76	165m/67	-
a2.1	-	90m/77	90m/77
a2.2	-	90m/74	90m/74
a2.3	-	90m/75	90m/75
a2.4	-	90m/75	90m/75
b2.1	-	30m/83	50m/79
b2.2	-	30m/82	50m/78
b2.3	-	30m/81	50m/77
c2.1	-	120m/74	130m/74
c2.2	-	120m/71	130m/71
c2.3	-	120m/72	130m/72
d2.1	-	-	200m/74
d2.2	-	-	200m/66
d2.3	-	-	200m/66
d2.4	-	-	200m/65
a3.1	-	-	280m/67
a3.2	-	-	280m/63
a3.3	-	-	280m/65
a3.4	-	-	280m/65
b3.1	-	-	265m/64
b3.2	-	-	265m/63
b3.3	-	-	265m/62

(2) Area 1 is divided into two portions, each of which is assigned an equal noise level 3 dB less than the total for all plant in the area 1, see above.

Table 4.8 Northern Area, minimum distances to NSRs and the corresponding Noise Levels (dB)

Activity	North west facade of Nam Cheong Estate (A1)	South-west facade of Nam Cheong Estate (A3)	South-east facade of Nam Cheong Estate (A4)	West facade of residential buildings at Wong Tai Street (B1)	West facade of residential buildings at Wong Tai Street (B2)
a4.1	40m/80 (1)	40m/80 (1)	-	-	-
a4.2	40m/77 (1)	40m/77 (1)	-	-	-
a4.3	40m/79 (1)	40m/79 (1)	-	-	-
a4.4	40m/79 (1)	40m/79 (1)	-	-	-
a5.1	-	150m/71	100m/75	100m/75	170m/70
a5.2	-	150m/68	100m/72	100m/72	170m/67
a5.3	-	150m/70	100m/74	100m/74	170m/69
a5.4	-	150m/70	100m/74	100m/74	170m/69
a6.1	-	420m/62	420m/62	50m/80	10m/93(2)
a6.2	-	420m/61	420m/61	50m/79	10m/93(2)
a6.3	-	420m/62	420m/62	50m/80	10m/94(2)
a6.4	-	420m/62	420m/62	50m/80	10m/94(2)

(1) Area 4 is divided into two portions, each of which is assigned an equal noise level 3 dB less than the total for all plant in the area 4, see above.

(2) Construction works in this area are expected to be no longer than a few weekss in duration

4.12 As the time scale of these construction activities will take place during the two year period, there will be times when the construction are most intense. In order to look at the cumulative effect of these activities, the worst period have been assessed with reference to the construction programme *(Table 2.1)* and the worst case cumulative noise levels for each receivers are given in *Table 4.9* below.

Table 4.9 Noise Levels For Worst Case Concurrent Activity

NSR and approximate period	Activity	Duration (wk)	Noise Levels ($L_{Aeq, 30\ minute}$ dB)	Total Noise Level ($L_{Aeq, 30\ minute}$ dB)
NW of Nam Cheong Estate (A1) wk53-wk65 (1/96-3/96)	a4.1	14	80	80
SW of Nam Cheong Estate (A3) wk53-wk75 (1/96-5/96)	a4.1, a5.3, a6.2	8	80, 70, 61	80
	a4.1, a5.3, a6.3	6	80, 70, 62	80
	a4.2, a5.4, a6.3	8	77, 70, 62	78
SE of Nam Cheong Estate (A4) wk34-wk75 (9/95-5/96)	a5.1, a6.1	8	75, 62	75
	a5.2, a6.1	6	72, 62	72
	a5.2, a6.2	3	72, 61	72
	a5.3, a6.2	10	74, 61	74
	a5.3, a6.3	6	74, 62	74
	a5.4, a6.3	8	74, 62	74
Wong Tai Street (B1) wk34-wk75 (9/95-5/96)	a5.1, a6.1	8	75, 80	81
	a5.2, a6.1	6	72, 80	81
	a5.2, a6.2	3	72, 79	80
	a5.3, a6.2	10	74, 79	80
	a5.3, a6.3	6	74, 80	81
	a5.4, a6.3	8	74, 80	81
Wong Tai Street (B2) wk34-wk75 (9/95-5/96)	a5.1, a6.1	8	70, 94[1]	94[1]
	a5.2, a6.1	6	67, 94[1]	94[1]
	a5.2, a6.2	3	67, 93[1]	93[1]
	a5.3, a6.2	10	69, 93[1]	93[1]
	a5.3, a6.3	6	69, 94[1]	94[1]
	a5.4, a6.3	8	69, 94[1]	94[1]
NW of Man Cheong Estate (C3) wk43-wk95 (11/95-11/96)	a1.1, b1.2	15	78, 77	81
	a1.2, b1.2	11	73, 77	78
	a1.3, b1.2	14	74, 77	79
	a1.4, b1.2	12	74, 77	79

W of Man Cheong Estate	a1.1, b1.2, a2.2, b2.2,	8	73, 68, 74, 82, 74	**84**
(C4)	c2.1	4	73, 68, 74, 81, 74	**83**
wk43-wk56	a1.1, b1.2, a2.2, b2.3,			
(11/95-2/96)	c2.1	11	68, 68, 75, 71	**78**
		2	69, 68, 75, 71	**78**
wk57-wk94	a1.2, b1.2, a2.3, c2.2	5	69, 68, 75, 72	**78**
(2/96-11/96)	a1.3, b1.2, a2.3, c2.2	5	69, 68, 75, 72	**78**
	a1.3, b1.2, a2.3, c2.3	12	69, 68, 75, 72	**78**
	a1.3, b1.2, a2.4, c2.3			
	a1.4, b1.2, a2.4, c2.3			
SW of Man Cheong Estate	a2.2, b2.2, c2.1, d2.3	8	74, 78, 74, 66	**81**
(C5)	a2.2, b2.3, c2.1, d2.3	5	74, 77, 74, 66	**80**
wk43-wk56				
(11/95-2/96)	a2.3, c2.2, d2.3	7	75, 71, 66	**77**
	a2.3, c2.2, d2.4	4	75, 71, 65	**77**
wk56-wk66				
(2/96-4/96)	a2.4, c2.3, a3.1, b3.1	5	75, 72, 67, 64	**77**
	a2.4, c2.3, a3.1, b3.2	5	75, 72, 67, 63	**77**
wk75-wk107	a2.4, c2.3, a3.2, b3.2	8	75, 72, 63, 63	**77**
(6/96-11/96)				

(2) Construction works in this area are expected to be no longer that a few weeks in duration

4.13 One particularly noise activity that will occur alone at the beginning of the construction programme is activity d2.1, the demolition of the existing subway and pavements in Area 2. The unmitigated noise level at the NSR C7 in Man Cheong Street, at a distance of 80 m, is $L_{Aeq,\ 30\ mins}$ 82 dB.

Mitigation Measures

4.14 It can be seen from the above that construction noise has the potential for significant daytime noise impacts at most NSRs, with noise levels of up to 84 dB predicted for periods of some weeks, and up to 94 dB for short durations at one NSR location. Therefore mitigation measures are required, and the following forms of mitigation are considered.

1) Good site practice to limit noise emissions at source;

2) Avoiding simultaneous noisy activities;

3) Selecting quiet plant and working methods;

4) Reducing the numbers of plant operating in critical areas close to NSRs;

5) Constructing temporary noise barriers;

4.15 The Contractor may develop his own package of mitigation measures to meet the required noise standards, but the following illustrates one such package to demonstrate one approach to mitigation that would be adequate.

Good site practice

4.16 Good site practice and noise management can significantly reduce the impact of a construction site's activities on nearby NSRs. To provide significant noise reduction on site, the following measures should be followed during each phase of construction:

- only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme;
- machines and plant (such as trucks) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;
- plant known to emit noise strongly in one direction, should, where possible, be orientated so that the noise is directed away from nearby NSRs;
- silencers or mufflers on construction equipment should be utilised and should be properly maintained during the construction programme;
- mobile plant should be sited as far away from NSRs as possible; and
- material stockpiles and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities.

The noise benefits of these techniques are difficult to quantify, and whilst they would provide some attenuation, they cannot be assumed to guarantee a significant level of noise mitigation.

Avoiding simultaneous noisy activities

4.17 In this case the construction programme is tight, and it is not considered reasonable to restrict the contractor's working programme.

Selecting quiet plant and working methods

4.18 The Contractor may be able to obtain particular models of plant that are quieter than the noise levels given in TM1. The benefits achievable in this way will depend on the details of the contractors chosen methods of working, and it is considered too restrictive to specify that a contractor has to use specific items of plant for the construction operations. It is therefore both preferable and practical to specify an overall plant noise performance specification to apply to the total sound power level of all plant on the site so that the contractor is allowed some flexibility to select plant to suit his needs.

4.19 Quiet plant is defined as PME whose actual sound power level is less than the value specified in TM1 for the same piece of equipment. Examples of SWLs for specific silenced PME, which are known to exist, are given below:

Bulldozer:	110 dB(A) max;
Breaker (Hand):	110 dB(A) max;
Poker Vibrator:	110 dB(A) max;
Bored Piling Rig:	110 dB(A) max;
Dump Truck:	110 dB(A) max;
Excavator:	105 dB(A) max;
Loader:	105 dB(A) max;
Lorry:	105 dB(A) max;
Concrete Pumps:	105 dB(A) max;
Mobile Crane:	105 dB(A) max;
Compressors:	100 dB(A) max;
Generators:	100 dB(A) max; and,
Water Pumps:	88 dB(A) max.

4.20 It should be noted that various types of silenced equipment can be found in Hong Kong, however, EPD, when processing a CNP application, will apply the noise levels contained in the relevant statutory TM unless the noise emission of a particular piece of equipment can be validated by certificate or demonstration.

4.21 Referring the above list to the plant inventories given in *Tables 4.1 to 4.7* it is reasonable to assume that the sound power levels derived in those tables based on the TM data can be reduced by at least 3 dB(A).

4.22 It is therefore recommended that quiet plant be employed to achieve plant noise performance specifications 3 dB below the sound power levels given in *Tables 4.1 to 4.7.*

4.23 Activity d2.1, demolition of existing subway and pavement, is predicted to produce high plant sound power levels and particular attention will be required to mitigate impacts at C7 in Man Cheong Street. The total site sound power level should be further reduced from 122 dB to 118 dB. This ensures that this phase of work (at the beginning of the construction programme) produces an acceptable noise levels of $L_{Aeq,\ 30\ minutes}$ 75 at receiver C7 in Man Cheong Street.

4.24 Activity b2.2, the construction of the culvert in area two, which is very close to the NSRs has potential for impacts and the total plant sound power level should be further reduced to achieve a maximum of 112 dB. Some activities in area 6 will be very close to NSR B1 and B2, albeit for relatively short period of time, and in area 6, for work within 60 m of the NSRs a total sound power level should be further reduced to achieve a maximum of 110 dB. This will probably require the number of plant operating in this area to be restricted. To reduce the effect of cumulative impacts at NSRs B1 and B2, the total sound power level of plant in area 5 operating concurrently with works in area 6 should be reduced to achieve a maximum of 115 dB.

Reducing the numbers of plant operating in critical areas close to NSRs

4.25 In general the numbers of plant should be left to the choice of the Contractor so that in combination with the selection of quiet plant, the 3 dB reduction in the total plant noise level, or the site specific maximum site sound power levels, as described above, can be achieved.

Constructing temporary noise barriers

4.26 An analysis of the effectiveness of noise barriers of between 3 and 5 m high, located on the site boundaries between noisy construction activities and NSRs, has shown that up to 5 dB of screening can be achieved (estimated in accordance with TM1). It should be possible for the contractor to provide site hoardings to achieve this, providing the barriers have no openings or gaps and have a superficial density of at least 10 kg m^{-2}.

4.27 The following Tables (4.10 & 4.11) indicate the screening effects for worst case receiver heights.

Table 4.10 Barrier screening effect for NSRs (Northern Area)

Activity	NW of Nam Cheong Estate (A1)	SW of Nam Cheong Estate (A3)	SE of Nam Cheong Estate (A4)	Wong Tai Street (B1)	Wong Tai Street (B2)	Barrier type and Location
a4 : Road construction in Area 4	5 dB	5 dB	-	-	-	5 m high barriers south of D6, east of D2C
a6 : Road construction in Area 6	-	-	-	5 dB	-	5 m high barrier east of D2D/3, close to plant
a6 : Road construction in Area 6	-	-	-	-	10 dB	3 m mobile barrier close to plant (see below)

Table 4.11 Screening effects for NSRs (Southern Area)

Activity	NW of Man Cheong street (C3)	W of Man Cheong street (C4)	SW of Man Cheong Street (C5)	Barrier type and location
a1 : Road Construction in Area 1	5 dB	5 dB	-	3 m high barrier south of D10
b1 : Culvert construction in Area 1	5 dB	5 dB	-	3 m high barrier south of culvert MC + PS
a2 ; Road construction in Area 2	-	5 dB	5 dB	5 m high barrier east of D1A/2, and 3 m barrier north of D11
b2 : Culvert construction in Area 2	-	5 dB	5 dB	5 m high barrier north of culvert JR
c2 : Footbridge construction on Area 2	-	5 dB	5 dB	3 m high barrier north of footbridge

4.28 The barriers should be in place for the duration of the works in that area, with the exception of mobile barriers in area 6. These 3 m high mobile barriers are only required for plant operating within 30 m of the NSRs, and must be positioned close to the plant to achieve the required 10 dB(A) attenuation because of the proximity and height of the NSRs. These barriers must be positioned so that they totally obscure the line of site from the plant noise source to the NSR.

4.29 The combination of these barriers, quiet plant achieving the total plant noise specification of either 3 dB less than those in *Tables 4.1 to 4.7* or as specified above for particularly difficult

areas, would result in the noise levels given in *Table 4.12* below.

Table 4.12 Mitigated Noise Levels

NSR	Activity	Maximum Mitigated Noise Levels ($L_{Aeq, period}$ dB)	Maximum Mitigated Total Noise Level ($L_{Aeq, period}$ dB)
NW of Nam Cheong Estate (A1) wk53-wk65 (1/96-3/96)	a4.1	72	72
SW of Nam Cheong Estate (A3) wk53-wk75 (1/96-5/96)	a4.1, a5.3, a6.2	72, 67, 58	73
	a4.1, a5.3, a6.3	72, 67, 59	73
	a4.2, a5.4, a6.3	69, 67, 59	71
SE of Nam Cheong Estate (A4) wk34-wk75 (9/95-5/96)	a5.1, a6.1	72, 59	72
	a5.2, a6.1	69, 59	69
	a5.2, a6.2	69, 58	69
	a5.3, a6.2	71, 58	71
	a5.3, a6.3	71, 59	71
	a5.4, a6.3	71, 59	71
Wong Tai Street (B1) wk34-wk75 (9/95-5/96)	a5.1, a6.1	70, 70	73
	a5.2, a6.1	69, 70	73
	a5.2, a6.2	69, 70	73
	a5.3, a6.2	70, 70	73
	a5.3, a6.3	70, 70	73
	a5.4, a6.3	70, 70	73
Wong Tai Street (B2) wk34-wk75 (9/95-5/96)	a5.1, a6.1	65, 75	75
	a5.2, a6.1	64, 75	75
	a5.2, a6.2	64, 75	75
	a5.3, a6.2	65, 75	75
	a5.3, a6.3	65, 75	75
	a5.4, a6.3	65, 75	75
NW of Man Cheong Street (C3) wk43-wk95 (11/95-11/96)	a1.1, b1.2	70, 69	73
	a1.2, b1.2	65, 69	70
	a1.3, b1.2	66, 69	71
	a1.4, b1.2	66, 69	71

W of Man Cheong Estate (C4)	a1.1, b1.2, a2.2, b2.2, c2.1	65, 60, 66, 72, 66	**74**
wk43-wk56	a1.1, b1.2, a2.2, b2.3, c2.1	65, 60, 66, 73, 66	**75**
(11/95-2/96)			
wk57-wk94			
(2/96-11/96)	a1.2, b1.2, a2.3, c2.2	60, 60, 67, 63	**70**
	a1.3, b1.2, a2.3, c2.2	61, 60, 67, 63	**70**
	a1.3, b1.2, a2.3, c2.3	61, 60, 67, 64	**70**
	a1.3, b1.2, a2.4, c2.3	61, 60, 67, 64	**70**
	a1.4, b1.2, a2.4, c2.3	61, 60, 67, 64	**70**
SW of Man Cheong Estate	a2.2, b2.2, c2.1, d2.3	66, 70, 66, 63	**73**
(C5)	a2.2, b2.3, c2.1, d2.3	66, 69, 66, 63	**73**
wk43-wk56			
(11/95-2/96)			
wk56-wk66	a2.3, c2.2, d2.3	67, 63, 63	**70**
(2/96-4/96)	a2.3, c2.2, d2.4	67, 63, 62	**69**
wk75-wk107	a2.4, c2.3, a3.1, b3.1	67, 64, 64, 61	**71**
(6/96-11/96)	a2.4, c2.3, a3.1, b3.2	67, 64, 64, 60	**70**
	a2.4, c2.3, a3.2, b3.2	67, 64, 60, 60	**70**

4.30 It can be seen from this table that the package of mitigation measures described above would result in compliance with the daytime noise assessment criterion of $L_{Aeq,\ 30\ minutes}$ 75 dB at all NSRs. This demonstrates one recommended package of effective mitigation measures that could be employed by the Contractor. However, it may be preferable to allow the Contractor to develop his own mitigation package to demonstrate the same level of mitigation can be achieved.

4.31 If construction work is required in restricted hours in daytime or evenings (including Sundays), further mitigation will be required to reduce noise levels by an additional 5 or 10 dB, as appropriate for the effected NSR. Such work would require the granting of a Construction Noise Permit by the EPD, and the Contractor would be required to demonstrate that compliance with the $L_{Aeq,\ 5\ minutes}$ 65 or 70 dB level, as appropriate to the NSR, would be achieved. It is likely that this would require further reductions in the numbers of plant operating, limitations to only the quieter construction activities, or the selection of particularly quiet equipment.

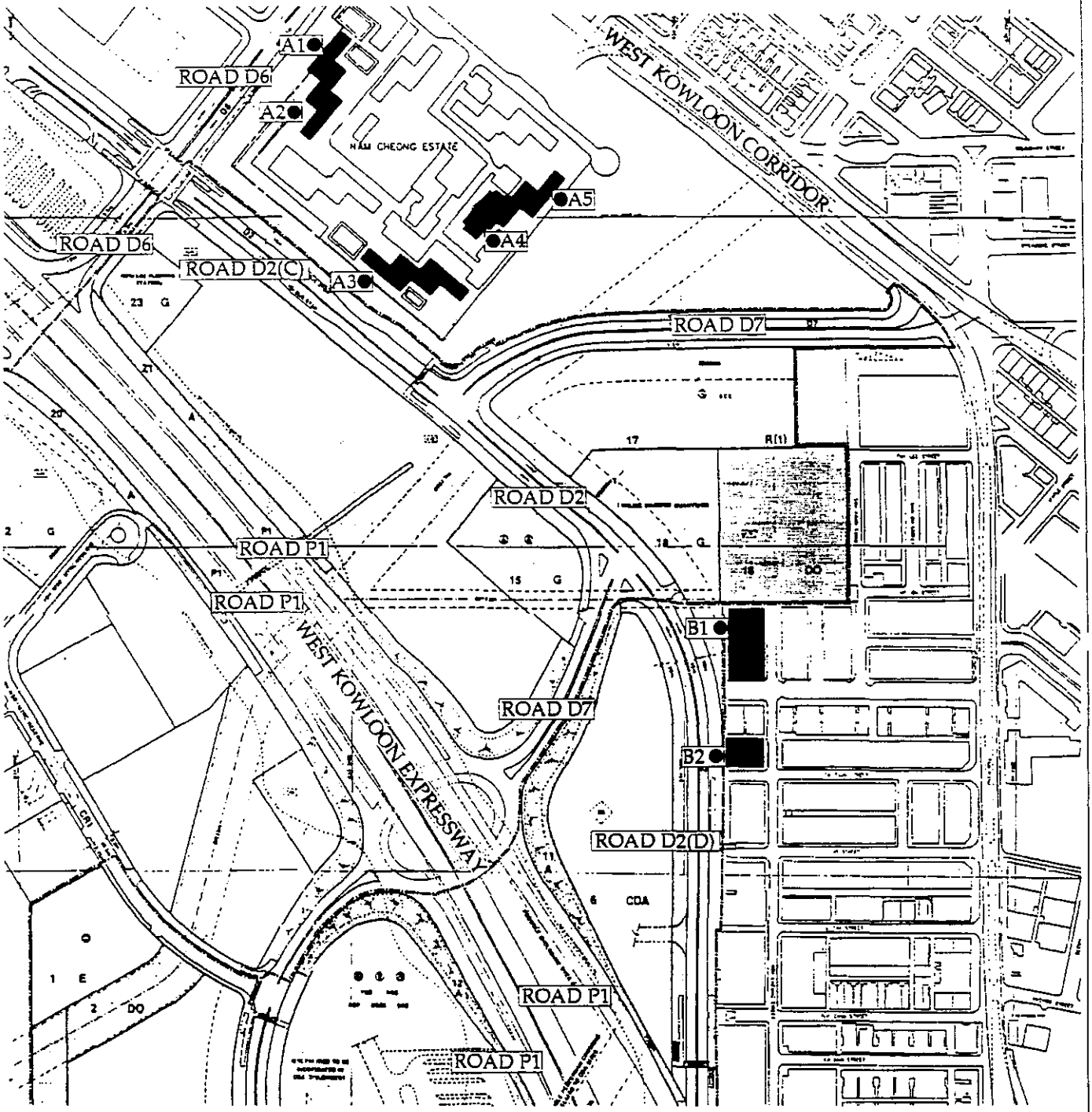


FIGURE 4.1 - NORTHERN AREA NSR LOCATIONS

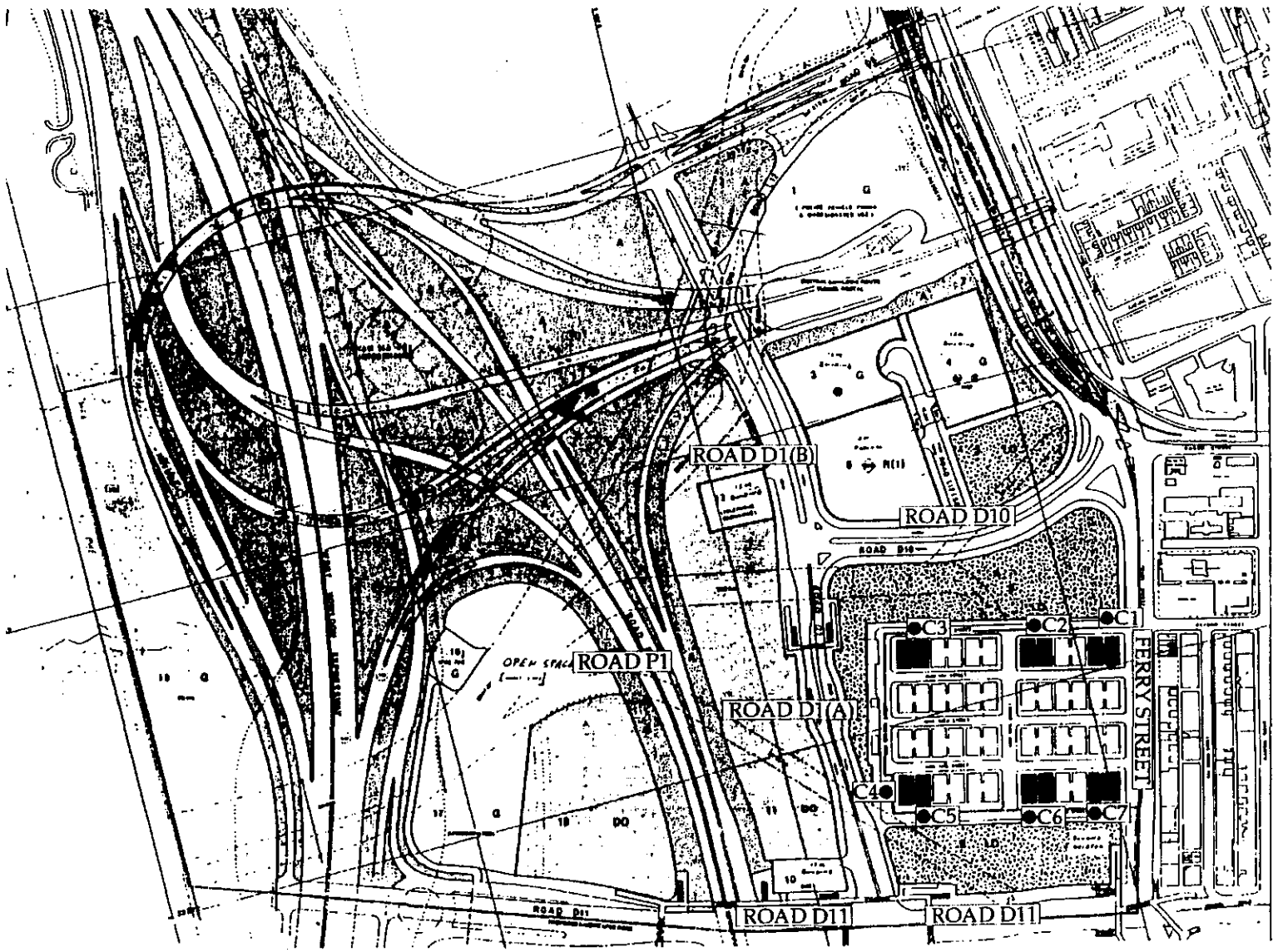


FIGURE 4.2 - SOUTHERN AREA NSR LOCATIONS

5.CONSTRUCTION DUST

INTRODUCTION

5.01 This Section addresses the air quality impacts during the construction of the roadwork in West Kowloon Reclamation Area. The Section is largely concerned with identifying the likely impacts of dust, particularly during the handling and transportation of stockpile materials. Measures for the mitigation of the air quality impacts are also recommended.

Assessment Criteria

5.02 The limits of ambient dust levels are laid down in the Hong Kong Air Quality Objectives (HKAQO) (see *Table 4.2a*). The objectives for dust are based on two averaging periods of 24 hours and one year.

Table 5.2a Hong Kong Air Quality Objectives ($\mu g\ m^{-3}$)

	Averaging Time (i)	
	24 Hours (ii)	*1 Year (iii)*
Total (iv) Suspended Particulates (TSP)	260	80
Respirable (v) Suspended Particulates (RSP)	180	55

Note: (i) Measured at 298°K (25°C) and 101.325 kPa (one atmosphere).
(ii) Not to be exceeded more than once per year.
(iii) Arithmetic means.
(iv) Total suspended particulate means suspended particles in air with a nominal aerodynamic diameter of 30 μm and smaller.
(v) Respirable suspended particulate means suspended particles in air with a nominal aerodynamic diameter of 10 μm and smaller.

5.03 In addition to these objectives, an hourly TSP limit of 500 $\mu g\ m^{-3}$ is generally used. This limit is not statutory, but has been employed as an evaluation criterion in EIA studies for many construction projects in Hong Kong, and has been enforced through contractual clauses.

Air Sensitive Receivers (ASRs)

5.04 The air sensitive receivers have be identified in accordance with *Hong Kong Planning Standards and Guidelines* (HKPSG). There are three ASRs at the Southern Site and four ASRs at and Northern Site. The identified ASRs in the study areas are residential premises. They are summarized in *Table 4.3a* and their locations are shown in *Figure 5.1 and 5.2.*

Table 5.3a Identified ASRs

Area	ASR	Location
Southern Area	S2	Man Cheong Street
	S3	Man Cheong Street
	S4	Wan Wui Street
Northern Area	N1	Nam Cheong Estate
	N2	Nam Cheong Estate
	N3	Nam Cheong Estate
	N5	Wong Tai Street

Potential Sources of Impact

5.05 Details of the construction activities have be summarised in *Section* 2.2. The major activities involved construction of road, culvert, bridge and subway. During the construction periods, excavation will be required on site and number of trucks will be involved in transportation of excavated materials. The movement of trucks and required equipment on site will generate fugitive dust and increase the ambient dust level. Handling of excavated materials during road construction and culvert construction is also likely to be a dust source. Storage of excavated materials is not envisaged for this project but there are marine fill storage for other contracts in the Southern Site. The dust levels from the passive storage of fill should be relatively minor compared to the active construction activities at site and unpaved haul roads.

Assessment Methodology

5.06 Particles of 30-100μm in diameter are likely to undergo impeded settling while particles of size 0-30μm (i.e. total suspended particulates, TSP) pose the most significant nuisance. TSP concentrations will therefore be assessed. The assessment will focus on the potential dust impacts from the works area within 300m from the ASRs. The construction activities at each area vary throughout the construction period (see *Table 2.1*). Dust levels will be modelled for the period with the most construction activities at site as shown in *Table 4.5a*.

Table 5.5a Construction Activities at Peak Construction Period

ASR	Area	Activities	No. of Vehicle Movement
S2	1	a1, b1	23
S3	1,2	a1, a2, b1, b2, c2, d2	18
S4	2,3	a2, a3, b2, b3, c2, d2	17
N1	4	a4	12
N2	4,5	a4, a5	12
N3	5	a5	12
N5	6	a6	15

Dispersion Model

5.07 The Fugitive Dust Model (FDM) was used for predicting the likely dust impacts from the construction sites. The potential dust impacts from the construction of roads and associated activities were estimated at the identified ASRs. One category of dust size (0-30 μm) was assumed in modelling exercise.

Meteorological Input

5.08 Sequential meterological data from Royal Observatory were used for assessing the dust impacts at real-time meterological conditions. The input data include wind speed, wind direction and mixing height of 1991 at Cheung Sha Wan. The real-time temperature data of 1991 at Royal Observatory was employed as no temperature data were recorded at Cheung Sha Wan Station. The expected working period is between 0800 to 1800 and meterological data of the corresponding period were selected for modelling.

Dust Emission Rates

5.09 The dust emission rate from construction activities is dependent on the total area of the works sites where construction activities are taking place, and the levels of the activities. Estimations of emission factors have been made in accordance with the *US EPA - Compilation of Air Pollutant Emission Factors, AP-42, 4th Edition, 1985.* This assessment focuses on dust emissions from general construction activities including handling of excavated materials, wind erosion on the unpaved area and vehicle movements over unpaved haul roads. The emission factors for these dust sources are shown in *Table 4.5b.*

Table 5.5b Emission Factors of the Identified Dust Sources

Construction Activities	Emission Factors	Remarks
Handling of excavated materials	0.0034 (kg/Mg)	Assume silt content of 1.6% and moisture content of 0.7% as based on USEPA AP-42, Vol1, Table 11.2.3-1 for stone quarrying and processing. Drop Height of 1.5 m and dumping devise capacity of 0.5 m^3 were assumed.
Wind erosion over unpaved area	0.42 (kg/day/hectare)	Assume silt content of 1.6%. The number of days with more than or equal to 0.25 mm of precipitation per year was assumed to be 100 days. It has been assumed that the percentage frequency is about 2% (based on wind data from Cheung Sha Wan Station) that the unobstructed mean wind speed exceeds 5.4 m s^{-1}.
Trucks movements on unpaved haul road	2574 g veh^{-1} km^{-1}	Assume typical silt content of 10%, vehicle speed of 20 kph and vehicle weight of about 25 tonnes. 10 wheels per vehicle were assumed.

Hourly TSP Impact

5.10 The model predictions were made on hourly basis for different activities. The highest predicted TSP levels will be presented in this report. The occurrence frequency of such worst case is important in interpreting the impacts on the sensitive receivers. Infrequent occurrence of the predicted worst case will pose dust impact of less significance. These prediction results were compared to the recommended hourly limit of 500 $\mu g\ m^{-3}$ for compliance.

Daily TSP Impact

5.11 Averaging periods are limited to 1 hour, 8 hours, 24 hours and long term in FDM. The daily TSP levels were modelled on 8-hourly basis considering the morning stable meterological condition and the typical daytime condition. The daily average was estimated by multiplying the 8-hour TSP impact by a conversion factor. 8-hour average is firstly converted into 10-hour average considering 10 working hours. The conversion to daily average is basically the portion of time per day with construction activities. As such, the worst case daily TSP impact could be about half of the 8-hour TSP concentration.

Background TSP and Cumulative Impacts

5.12 In order to estimate the cumulative impact, the background level of 100 $\mu g\ m^{-3}$ is assumed based on the air quality monitoring at Sham Shui Po. This background TSP level will be used together with the modelling results to determine the cumulative impact.

Prediction and Assessment of Impacts

Without Mitigation

5.13 The predicted hourly and daily TSP levels at the ASRs are shown in *Table 4.6a*. The cumulative impacts at ASRs including the background are predicted to exceed the AQO and the recommended hourly criteria. The cumulative 1-hour TSP and 24-hour TSP are predicted to be highest at ASR S3 which are 1400 and 474 $\mu g\ m^{-3}$ respectively. The dust levels arising from handling of excavated materials and wind erosion at site are a few tens micrograms. The main dust source is haul road dust for which hourly TSP levels are predicted to be in range of 417 and 12787$\mu g\ m^{-3}$. The dust impacts in the study area will be significant without effective mitigation measures. However, it should be noted that these TSP levels are predicted for the worst case that maximum construction activities at sites and with poorest dispersion. Nevertheless, mitigation measures are necessary to minimise the dust impacts as far as possible.

Table 5.6a Predicted TSP Levels at ASRs in $\mu g\ m^{-3}$ (Without Mitigation)

ASR	Haul Road		Handling of Excavated Materials		Cumulative Impact (including background)	
	Hourly Average	Daily Average	Hourly Average	Daily Average	Hourly Average	Daily Average
S2	614	178	32.6	9.6	724	284
S3	1278	367	20.3	6.6	1400	474
S4	566	177	9.5	3.1	675	280
N1	894	264	9.8	1.9	1001	366
N2	772	238	29.4	5.1	881	341
N3	417	111	2.1	0.7	520	212
N5	1117	341	12.3	3.5	1229	444

With Mitigation

5.13 The effectiveness of some dust suppression measures have evaluated. In predicting the likely amount of dust suppression, it has been assumed that there will be 70% reduction of haul road dust as the following measures are considered:

- 50%[4]reduction through frequent surface watering and compacting on the haul roads.
- 50% reduction in dust emission potential from vehicle movements over unpaved haul roads by restricting speed to 10 kph.

[4] Jutze, G.A., K. Aetell, Jr., and W. Parker. Investigation of Fugitive Dust-Sources Emissions and Control. Publication No. EPA-450/3-74-046a. June 1974.

50% reduction of fugitive dust from handling of excavated materials can also be achieved by frequent surface watering on the work area.

5.14 Considering the dust reduction by taking the dust suppression mitigation, the cumulative and individual dust impacts were predicted and the results are shown in *Table 4.6b*. The ambient dust levels can be much reduced that the hourly and daily TSP levels were below the recommended level of 500μg m^{-3} and AQO criteria of 260μg m^{-3}. The dust impacts after the mitigation measures would become more acceptable.

Table 5.6b Predicted TSP Levels at ASRs in $\mu g\ m^{-3}$ With Mitigation

ASR	Haul Road		Handling of Excavated Materials		Cumulative Impact (including background)	
	Hourly Average	Daily Average	Hourly Average	Daily Average	Hourly Average	Daily Average
S2	184	53	16.3	4.8	301	158
S3	383	110	10.2	3.3	494	213
S4	170	53	4.8	1.5	274	155
N1	268	79	4.9	1.0	373	180
N2	232	71	14.7	2.5	346	174
N3	125	33	1.1	0.3	226	134
N5	335	102	6.2	1.8	441	204

Mitigation Measures

5.15 In order to control the dust impacts to the ASRs, there are a number of mitigation measures which have to be implemented on site. The mitigation measures are particularly for controlling the dust generation from vehicle movements, handling of excavated material and stockpiles.

Vehicle Dust

5.16 On-site unpaved roads that are frequently used should be regularly compacted and the road surface should be kept clear of loose material. Water spraying should also be used to control dust.

5.17 Vehicles should be restricted to designated routes and have a speed limit of 10 kph.

5.18 Wheel-wash troughs and hoses should be provided at traffic exits from the site to minimise the quantity of material deposited on public roads.

Excavation and Handling of materials

5.19 Water spraying should be used to control dust.

5.20 Reduce the dropping height during excavation and dumping of excavated materials.

Stockpiled Materials

5.21 Water spray facilities should be provided and used for damping the stockpile materials.

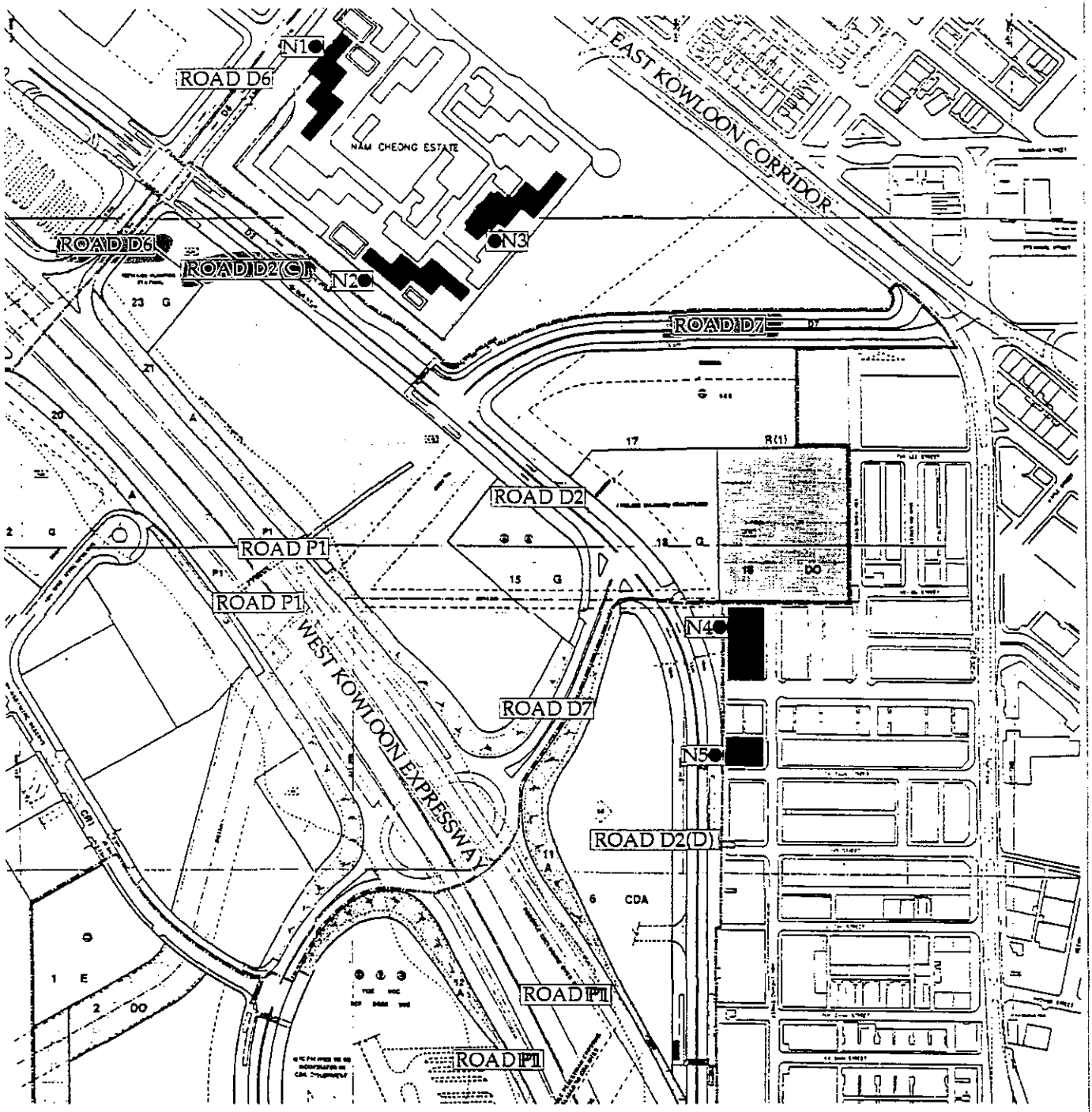


FIGURE 5.1 - NORTHERN AREA ASR LOCATIONS

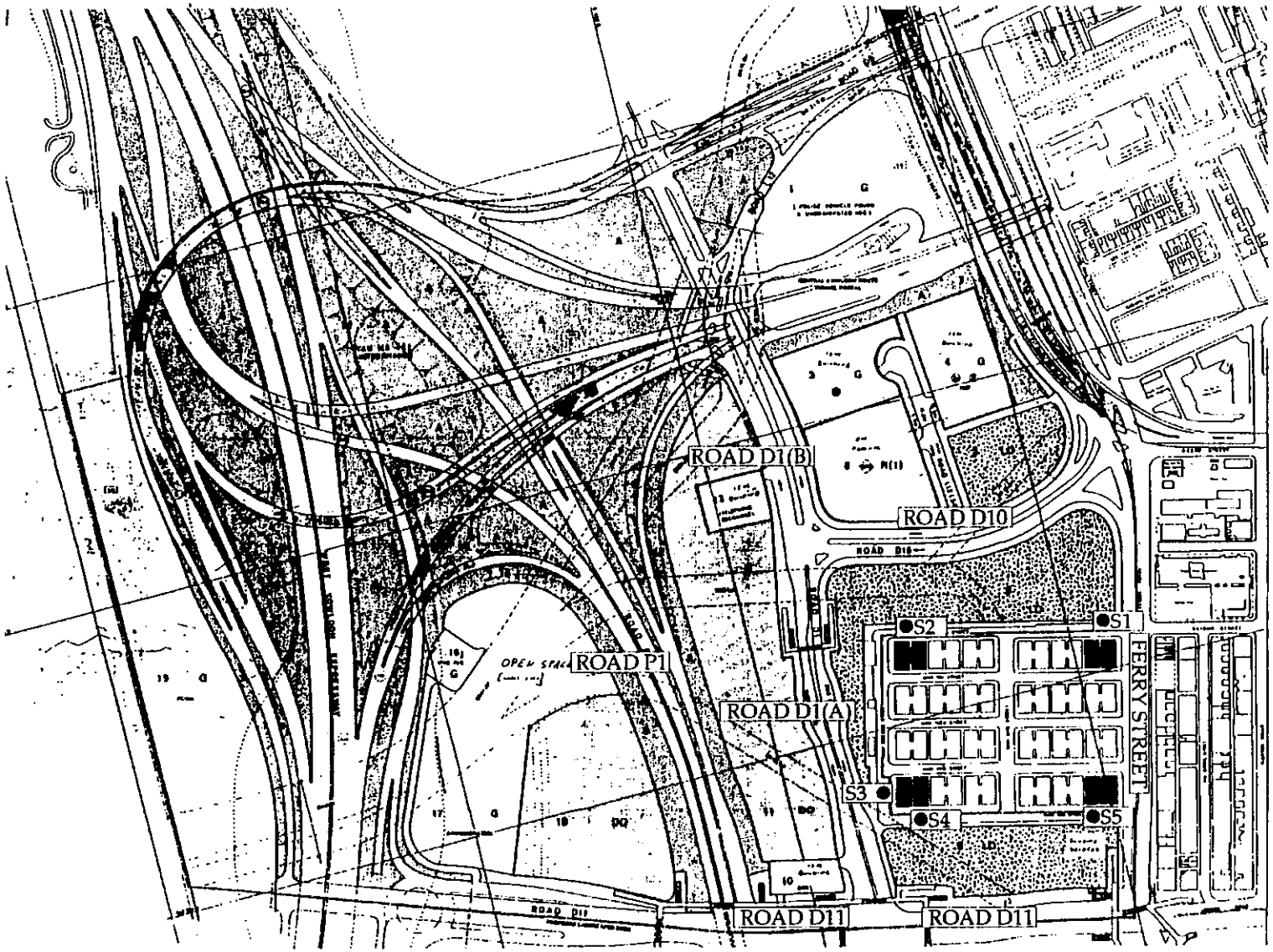


FIGURE 5.2 - SOUTHERN AREA ASR LOCATIONS

6.OPERATIONAL NOISE ASSESSMENT

Introduction

6.01 Future traffic on the new roads to be constructed on the southern section of the WKR has the potential to impact existing noise sensitive receivers (NSRs) along the old waterfront areas. These impacts are assessed by predicting the traffic noise levels for 2011 conditions and comparing them with the Hong Kong Planning Standards And Guidelines (HKPSG) $L_{A10,\ peak\ hour}$ 70 dB traffic noise planning guideline, and the prevailing noise levels (ie the baseline conditions). A detailed noise model of the road network is used to investigate the noise contributions from all roads affecting the NSRs of interest and to test the effectiveness of various mitigation measures applied to these roads.

Existing Noise Climate

6.02 The prevailing traffic noise levels, modelled from the existing traffic flows described in *Section 2*, are reported with the future noise levels in the *Assessment Of Impacts* section below.

Noise Sensitive Receivers

6.03 This study considers noise impacts at three existing residential areas; Nam Cheong Estate, Wong Tai Street, and Man Cheong Street. The 5 NSRs in Nam Cheong Estate, referenced as A1 to A5, and the two in Wong Tai Street, referenced as B1 and B2, are shown in *Figure 6.1 Northern Area NSR Locations*. Similarly, the severn NSRs in Man Cheong Street, referenced C1 to C7, are shown in *Figure 6.2, Southern Area NSR Locations*. It was agreed at the commencement of the study that because of the limited time available to complete the assessment, the study should be limited to considering the impacts at these locations only. These locations were chosen to be representative of the three groups of NSRs of interest, so that the impacts at them can be used to discuss the impacts at the whole of the three residential areas.

Noise Assessment Methodology

6.04 The traffic noise model was digitised from the road gazette layout plans 285/E/R0.11 and R0.12 at 1:2000 scale, dated May 1994, and other current information and drawings, including the land use and planning assumptions for adjacent sites as described earlier.

6.05 The surrounding road scheme was divided up into 453 road segments, each of which was assigned one of 223 road layouts. A road layout defines the road width, surface type, traffic conditions and (if applicable) the height and location of roadside barriers. The segmentation process was carried out in accordance with CRTN procedures and the noise model was built using the HFANoise traffic noise model which fully implements CRTN procedures and methodologies. Hard ground as defined in CRTN was assumed throughout the study area except for landscaped areas. All other features that could add noise screening or reflection to the modelling process were included.

6.06 The section of road P1 just North of road D11 in the Southern area was modelled in a retained cutting as will be the case in 2011 to allow road P1 to underpass road D11. South of D11, P1 will be in a cutting with slip roads climbing up to grade level. This part of P1 is screened from Man Cheong Street by the commercial block immediately to the East (assumed to comprise tower blocks above a 15m podium). A sensitivity test showed that the exact configuration of P1 and the slip roads in this area does not affect the noise levels predicted at Man Cheong Street because the road is well screened. This portion of P1 was, however, included in the model, but for simplicity it was modelled at grade.

6.07 *Figures 6.3 to 6.9* show the digitised road scheme as HFANoise graphical outputs. The road layout numbers are included and are referenced to describe the location of noise barriers and enclosures later in this report.

6.08 The 2011 PM Peak hour traffic flows and the existing traffic flows (as described in *Section 2*) are given in *Appendix B* referenced to the HFANoise road layouts numbers. Also shown in this Appendix are the % heavy vehicles, road surface type, and traffic speed. Road surfaces are assumed to be standard wearing course except where friction course has been specified in current design information, and the section of Friction Course on the West Kowloon corridor. One additional area of friction course has been assumed; on road P1 to the South of the Yau Ma Tei interchange. In view of the traffic design speeds, and environmental benefits to adjacent developments this assumption is considered reasonable. The traffic speeds are taken from the WKE report, as described in *Section 2*.

6.09 Traffic noise impacts are assessed against two criteria. The HKPSG $L_{A10,\ peak\ hour}$ 70 dB guideline level is used as the target level for all 'direct' forms of mitigation (ie those that can be applied to the road itself). Any predicted level above this is considered to constitute a significant impact. If effective and practical direct mitigation measures cannot be designed, residual impacts are assessed against a second criterion to consider if, as a last resort, the affected NSR should qualify for noise insulation. This criterion would have to be exceeded (when rounded to the nearest 0.1 dB) for the NSR to qualify for insulation. This 'noise insulation criterion' embodies the conditions specified in paragraph 6 of the UK CRTN methodology as applied to Hong Kong, such that the assessment criterion would be exceeded if all three of the following conditions are met.

i) The combined expected maximum traffic noise level, ie the overall noise level, from the new or altered roads together with other traffic in the vicinity is not less than the specified noise level ($L_{A10,\ peak\ hour}$ 70 dB).

ii) The overall noise level is at least 1.0 dB(A) more than the prevailing noise level (the prevailing noise level being the total traffic noise level existing before the works to construct or improve the road begin).

iii) The contribution to the increase in the overall noise level from the new or altered road is at least 1.0 dB

6.10 In order to discuss these conditions all roads are described as either 'existing' ie unaltered by the new roadworks except for possibly taking additional traffic, or 'new' which in the context of this report describes all roads that are completely new or are substantially altered by the proposed works (eg widened). It is assumed that existing roads cannot be mitigated by direct measures such as noise barriers, whereas new roads can be designed to incorporate such mitigation measures, within the constraints described in *Section 2*.

6.11 *Tables 6.1 and 6.2* give the prevailing noise levels, the noise levels from the existing roads, and the two assessment criteria for each of the NSRs in the northern and southern areas.

6.1 Northern Area Prevailing Noise Levels and Assessment Criteria (1) (Noise Levels in $L_{A10,\ peak\ hour}$ (dB))

NSR	Prevailing Traffic Noise Level	Noise Levels From Existing Roads in 2011	Noise Impact Assessment Criterion	Noise Insulation Criterion
(A) Nam Cheong Estate				
A1 (NW)	72.7 / 71.0	67.9 / 69.9	70	73.6 / 71.9
A2 (NW)	67.7 / 66.9	55.6 / 64.2	70	70 / 70
A3 (SW)	54.0 / 55.6	39.8 / 53.6	70	70 / 70
A4 (SE)	56.4 / 59.8	58.7 / 62.1	70	70 / 70
A5 (SE)	60.5 / 65.3	66.3 / 69.2	70	70 / 70
(B) Wong Tai Street				
B1	54.1 / 57.5	49.3 / 53.6	70	70 / 70
B2	52.8 / 55.7	43.4 / 51.7	70	70 / 70

(1) first floor/ top floor.

6.2 Southern Area, Prevailing Noise Levels And Assessment Criteria[1] (Noise Levels in $L_{A10,\ peak\ hour}$ (dB))

NSR	Prevailing Traffic Noise Levels	Noise Levels from Existing Roads in 2011	Noise Impact Assessment Criterion	Noise Insulation Criterion
(C) Man Cheong Street				
C1 (NE)	74.5 / 72.3	74.2 / 72.3	70	75.4 / 73.2
C2 (N)	69.7 / 69.8	69.3 / 69.8	70	70.2 / 70.7
C3 (NW)	66.2 / 66.8	65.0 / 66.4	70	70 / 70
C4 (W)	< 40 / 48.4	< 40 / 58.2	70	70 / 70
C5 (SW)	65.3 / 64.7	64.8 / 64.3	70	70 / 70
C6 (S)	69.4 / 68.0	69.0 / 68.4	70	70.0 / 70
C7 (SE)	76.5 / 72.1	76.4 / 72.7	70	77.4 / 73.6

(1) first floor/ top floor.

Assessment Of Noise Impacts

6.12 The predicted noise levels for the 2011 conditions are given in *Tables 6.3 and 6.4* for the Northern and Southern areas, along with the noise insulation criteria (the noise impact criterion is always 70 dB and is omitted for simplicity), and the predicted noise levels for six noise mitigation scenarios. These mitigation measures are described and discussed below under *Noise Mitigation Measures*.

6.13 At Nam Cheong Estate the predicted noise levels with no mitigation are above the 70 dB level at almost all NSRs at both assessment heights, implying that the majority of the dwellings on the NW, SW, and SE sides of the estate will be impacted. The highest exceedance is 8 dB on the NW side of the estate nearest to the existing West Kowloon Corridor.

6.14 At Wong Tai Street no impacts are predicted. The hotel complex to be built in the MTRC Tai Kok Tsui Station Related Development Site D provides effective screening of the NSRs from the heavily trafficked WKE and P1 roads.

6.15 At Man Cheong Street all NSRs are impacted by at least 2 dB, with the highest impacts of up to 8 dB at the NSRs nearest to the existing Ferry Street.

6.16 It is clear that mitigation measures should be considered at Nam Cheong Estate and Man Cheong Street to reduce these impacts to acceptable levels.

Table 6.3 Northern Area Predicted 2011 Traffic Noise Impacts And Mitigation Options (Noise Levels in $L_{A10,\ peak\ hour}$ at first floor and top floor [1] level (dB))

NSR	No Mitigation	Noise Insulation Criterion	Mitigation 1 LNRS	Mitigation 2 LNRS + 3 m barriers	Mitigation 3 LNRS + 5 m barriers	Mitigation 4 As M3 + 7m high earth bund in DO	Mitigation 5 LNRS + semi-enclosures	Mitigation 6 LNRS + full enclosures on roads
(A) Nam Cheong Estate								
A1 (NW)	78.3/76.4	73.6/71.9	76.2/74.7	70.2/74.6	69.6/74.3	69.6/74.3	71.0/71.9	68.9/70.9
A2 (NW)	74.5/74.1	70/70	72.3/72.2	65.6/71.8	65.0/70.0	65.0/70.0	67.9/69.2	63.0/66.8
A3 (SW)	74.4/73.1	70/70	72.2/71.4	65.9/71.3	64.9/71.2	63.5/71.2	67.5/68.8	61.4/67.0
A4 (SE)	69.5/70.2	70/70	67.9/69.1	64.8/68.3	64.7/67.4	64.6/67.3	66.3/67.9	62.2/65.4
A5 (SE)	71.0/72.5	70/70	70.1/71.8	68.5/71.2	68.5/70.9	68.4/70.9	69.0/70.4	67.2/70.0
(B) Wong Tai Street								
B1	69.9/70.1	70/70						
B2	70.0/69.3	70/70						

(1) First floor/top floor.

Table 6.4 Southern Area Predicted 2011 Traffic Noise Impacts And Mitigation Options (Noise Levels in $L_{A10,\ peak\ hour}$ at first floor and top floor [1] level (dB))

NSR	No Mitigation	Noise Insulation Criterion	Mitigation 1 LNRS	Mitigation 2 LNRS + 3 m barriers	Mitigation 3 LNRS + 5 m barriers	Mitigation 4 As M3 + 7m high earth bund in DO	Mitigation 5 LNRS + 3 full enclosures	Mitigation 5A LNRS + semi-enclosure on D1	Mitigation 6 LNRS + full enclosures
(C) Man Cheong Street									
C1 (NE)	75.2/74.0	75.4/73.2	74.8/73.5	74.4/73.2	74.3/73.0	74.3/73.0	74.3/72.9	74.8/73.5	74.3/72.8
C2 (N)	72.7/73.1	70.6/70.7	71.6/72.3	69.8/71.8	69.8/71.4	69.6/71.4	69.6/71.1	71.4/72.3	69.5/70.9
C3 (NW)	74.0/74.2	70/70	72.1/72.9	68.3/72.6	68.0/72.0	67.2/72.0	66.9/70.5	71.1/72.3	66.0/69.6
C4 (W)	77.5/75.6	70/70	75.2/73.9	72.0/73.8	71.8/73.7	71.2/73.7	66.5/70.2	67.6/70.2	61.4/67.2
C5 (SW)	75.4/74.8	70/70	73.3/73.2	72.4/73.0	72.4/72.7	72.2/72.7	69.7/69.9	71.5/71.9	65.2/67.3
C6 (S)	74.7/74.3	70/70	73.3/73.0	72.6/72.6	72.5/72.4	72.5/72.5	71.0/70.8	73.1/72.7	69.4/63.6
C7 (SE)	78.0/75.4	77.4/73.6	77.5/74.7	77.4/74.5	77.4/74.4	77.3/74.4	77.0/73.7	77.4/74.6	76.5/73.2

Noise Mitigation Measures

6.17 This section describes how the different roads around Nam Cheong Estate and around Man Cheong Street contribute to the overall noise at the NSRs, and considers a progressively extensive set of mitigation measures for each area aimed at reducing the noise contribution from the various offending roads.

6.18 In order to target the mitigation measures at the most significant road segments, the unmitigated contributions from each of the road segments in the vicinity, have been considered, and are summarised in *Tables 6.5 and 6.6* below, for the northern and southern areas respectively. There are some small road segments such as link roads and roundabouts that are not included in the noise contributions listed in these tables.

Table 6.5 Noise Contributions From Different Roads In The Northern Area Nam Cheong Estate with No Mitigation

NSR	WKC & others	D2	D6	D7	P1	WKE
A1 (NW)	67.9/69.9	64.8/65.1	77.6/74.5	-	50.7/53.8	49.3/54.5
A2 (NW)	55.6/64.2	67.2/66.9	73.3/72.1	-	50.9/54.8	50.8/55.5
A3 (SW)	39.8/53.6	73.7/71.2	60.5/60.5	57.8/57.8	59.2/63.0	55.6/58.3
A4 (SE)	58.7/62.1	63.9/63.7	-	65.5/65.0	50.9/54.3	44.3/52.5
A5 (SE)	66.3/69.2	62.7/63.0	-	65.8/65.4	52.5/55.4	48.2/52.0

Table 6.6 Noise Contributions From Different Roads In The Southern Area Man Cheong Street with No Mitigation

NSR	Ferry Street	D11	D10	D1	P1	WKE & Yau Ma Tei Inter-change
C1 (NE)	74.2/72.2	-	67.1/66.5	59.7/59.7	43.4/48.2	54.2/63.5
C2 (N)	69.1/69.6	-	68.8/67.8	62.2/62.1	35.7/49.2	55.3/69.6
C3 (NW)	64.8/66.1	-	70.1/68.8	69.9/69.1	53.8/57.3	57.3/67.0
C4 (W)	-	63.2/63.7	58.3/58.2	75.9/72.9	57.1/65.3	57.3/66.6
C5 (SW)	64.8/64.3	70.3/69.9	-	71.0/72.4	55.6/63.4	50.7/59.5
C6 (S)	69.0/68.4	71.3/70.7	-	67.1/66.6	57.9/61.0	47.5/57.2
C7 (SE)	76.9/72.7	70.8/70.1	-	64.4/63.9	56.5/59.5	47.7/55.7

73.8/74.0

76.3/74.8

6.19 The seven mitigation scenarios studied can be summarised as follows. The locations of low noise road surfaces (ie friction course), barriers, and enclosures are described with reference to the HFANoise road layout numbers, e g road layouts L12 and L312 form part of road D2 to the North East of Nam Cheong Estate (see *Figures 6.3 to 6.9*). *Figures 6.10 and 6.11* show the locations of the low noise surfaces and barriers for the northern and southern areas, and *Figures 6.12 and 6.13 and 6.14* show the locations of the semi-enclosures modelled in mitigation 5 and 5A for the northern and southern areas.

Table 6.7 Summary Of Mitigation Measure Packages

Mitigation Package		Northern Area; Nam Cheong Estate	Southern Area; Man Cheong Street
M1	Low Noise Road Surfaces (LNRSs)	LNRS on D6 : L12, L312, L13 LNRS on D2 : L8, L10, L11 LNRS on D7 : L330, L30	LNRS on D10 : L160, L360 LNRS on D1(A) : L157, L357, L457 LNRS on D1(B) : L156 LNRS on D1(D) : L158 LNRS on D11 : L167 LNRS on D11 : L164, L364
M2	LNRS and 3 m barriers	LNRS + 3 m barriers as for M1	LNRS as for M1 3 m barriers on D10 : L160, L360 3 m barriers on D1(A) : L357, L157 3 m barriers on D11 : L164
M3	LNRS and 5 m barriers	LNRS + 5 m barriers as for M1	LNRS + 5 m barriers as for M2
M4	LNRS, 5 m barriers and earth bunding	LNRS + 5 m barriers as for M1 Earth bund in DO space West of Estate	LNRS + 5 m barriers as for M2 Earth bund in DO area 11
M5	LNRS, and semi-enclosures or full enclosures	LNRS as M1, and new section of Tung Chau Street : L20, L23 Semi-enclosures on D6 : L12, L312 Semi-enclosures on D2(C) : L10 Semi-enclosures on D7 : L330, L30	LNRS as M1 Enclosure on D10 : L160, L360 Enclosure on D1 : L157, L357, L457 Enclosure on D11 : L164, L364
M5A	LNRS, and one semi-enclosure		LNRS as M1 Semi-enclosure on D1 : L157
M6	LNRS, and full enclosures	LNRS as M1 Enclosures on D6 : L12, L312, L13 Enclosures on D2 : L8, L10, L11 Enclosures On D7 : L330. L30 Enclosures on Dx : L51, L22, L23	LNRS a M1 Enclosures as M5 + Enclosures on D1(B) : L156 Enclosures on D1(D) : L158 Enclosures on D11 : L167 Enclosures on P1 : L188 Enclosures on P1 : L151 Enclosures on D11 : L173 Enclosures on Yau Ma Tei I/C : L150, L152

'L' denotes HFANoise Road Layout number.

6.20 *Mitigation 1 ; Low Noise Road Surfaces (LNRS)* is considered a practical mitigation option. Friction course material reduces noise levels from the particular local road by 2.5dB (speed 50 kph) but this effect is diluted by the contribution from other more distant roads so that overall noise levels in most cases are reduced by between 1 and 2 dB. This is a useful noise benefit and is assumed to be achievable although cognizance should be given to the comments in Section 3 of the report. Further mitigation measures are added to this option to investigate additional noise benefits.

6.21 *Mitigation 2 ; Low Noise Road Surface and 3m barriers* adds 3m high noise barriers to the Mitigation 1 scenario, as indicated in *Table 6.8*. In general the barriers are located at 1m from the kerb except where site lines and other practical consideration make this impossible. The practical constraints to the barrier location are described in *Section 3*, and in many cases mean that barriers within about 50m of road junctions must be located at the back of the pedestrian footpath (*figures 6.10 and 6.11* show approximate barrier locations). In this location their effectiveness is greatly reduced. Barriers are modelled on the 'D' roads around the NSR areas, extending along these roads as far as necessary to maximise the noise benefit achieved (ie beyond junctions etc).

6.22 The two impacted areas have NSR building heights of 15 and 18 floors. The location of the 'D' roads close to these buildings is such that top floor NSRs will look down onto the roads at a steep angle, and consequently the 3m noise barriers will have limited effect, even at the preferred, 1m from kerb location. At lower floors useful noise benefit is achieved. At Nam Cheong Estate all first floor level NSRs come into compliance with the traffic noise assessment criterion, but at Man Cheong Street first floor NSRs show exceedances of generally up to 2dB. However, at upper floors 3m noise barriers show less than 0.5dB improved mitigation in all cases. In brief, 3m barriers are useful at lower floors, but they are not very effective for the top floors in either NSR area.

6.23 *Mitigation 3 ; Low Noise Road Surface and 5m barriers* increases the barrier heights to 5m for the same barrier locations as Mitigation 2. This has the effect of increasing the noise benefit achieved at upper floors by about no more than about 0.3dB in most cases.

6.24 It can be noted at this stage, that the noise levels at Man Cheong Street are generally higher than at Nam Cheong Estate. This is particularly noticeable at first floor level when barriers are included on nearby roads, and can be attributed to the higher noise contributions from more distant roads, see *Tables 6.5 and 6.6.*

6.25 *Mitigation 4 ; Low Noise Road Surface, 5m barriers and earth bunding* adds landscaped bunding to the District Open (DO) spaces to the West of both NSR areas. These are assumed to take the form of earth bunds created by a slope of gradient about 1 in 3 rising from reclamation level next to Road P1 to a height of 7m, over a distance of about 20m. *Tables 6.3 and 6.4* show that this type of mitigation offers no additional noise benefit, and it is therefore not considered further.

6.26 *Mitigation 5 ; Low Noise Road Surfaces, and semi-enclosures* ; considers the effect of enclosing 'D' roads around the NSR areas. It is estimated that enclosures could not be used within about 20 m of road junction, (measured from the extended kerb line), and this is modelled accordingly. Semi-enclosures form a total cover over the nearside carriageway at a height of about 7 m (see *Section 2*) and in some cases the horizontal structure is extended to overhand the far side carriageway. The following paragraphs describe the semi-enclosures modelled in each case.

6.27 At Man Cheong Street, Mitigation 5 models full enclosures on the three adjacent D roads, and it is found that even with these in place, the 70 dB criterion is exceeded at most NSR locations at top floor level, and the noise insulation criterion is exceeded at four NSR locations on the North and South facades. These results show that enclosures cannot mitigate impacts at the northern and southern facades of Man Cheong Street. (Mitigation 6 illustates this point further by adding to the extent of the full enclosures, and covering road junctions). Mitigation 5A illustrates how a single semi-enclosure on road D1 can mitigate impacts at NSR C4 which is taken as representative of the NSRs on the western facades. This semi-enclosure has been modified to establish the minimum extent of the far side carriageway overhang that is required to achieve compliance at C4. The overhang modelled under Mitigation 5A extends 1.2m from the central reservation. For Mitigation 5A, facades on the North and South of the estate would qualify for noise insulation.

6.28 At Nam Cheong Estate three semi-enclosures have been modelled. These stop short of road junctions by 20 m as for full enclosures, and the overhangs have been optimised to establish the minimum overhang that offers as much mitigation as a full enclosure. In this case the optimal overhangs are 5.4 m on road D6, no overhang on road D2, and 5.0 m overhang on road D7. The total length of semi-enclosure is about 650 m and the length of low noise road surfacing required is approximately 1400m. To model this configuration the relevant roads have been divided into two separated carriageways (beyond the road segmentation requirements of CRTN), and it is assumed that the traffic flow will be divided equally for the two directions of flow. (This leads to some discrepancies with the modelling results for first floor level for barrier mitigation options, but since barriers are not effective at top floors the modelling has not been revised for those options.) An additional section of low noise road surface is also included in Mitigation 5, on the new section of Tung Chau Street running to the West of the West Kowloon Corridor (about 500 m in length, see *Figure 6.12*). The effect of these semi-enclosures and the low noise road surfaces, as seen in *Table 6.3*, is to mitigate noise levels to below the 70 dB noise assessment criterion (when rounded to the nearest whole dB) at all NSRs except A1. At A1 noise levels up to 71.9 dB are predicted at the top floor, but since this is within the noise insulation criterion, no noise insulation would be required, and the combination of semi-enclosures and low noise road surfaces is considered to represent a package of direct mitigation measures which would satisfy the noise mitigation criteria at Nam Cheong Estate. However, adverse aspects such as the visual intrusion and hindrance to utility installations (mentioned in para. 2.23) as well as restrictions that will be placed on road widening, traffic aids and the likely adverse security and psychological effects should be taken into consideration with this noise mitigation package.

6.29 *Mitigation 6 ; Full Enclosures On 'D' roads and 'P' roads* ; adds further enclosures to those included in Mitigation 5. The enclosures are also assumed to be feasible over road junctions. Mitigation 6 is used to show that for Man Cheong Street, even with the noise contribution from nearby roads completely mitigated, noise from more distant roads produced noise levels above the traffic noise assessment criterion at several NSR locations (see *Table 6.4*), and thus indirect mitigation should be considered.

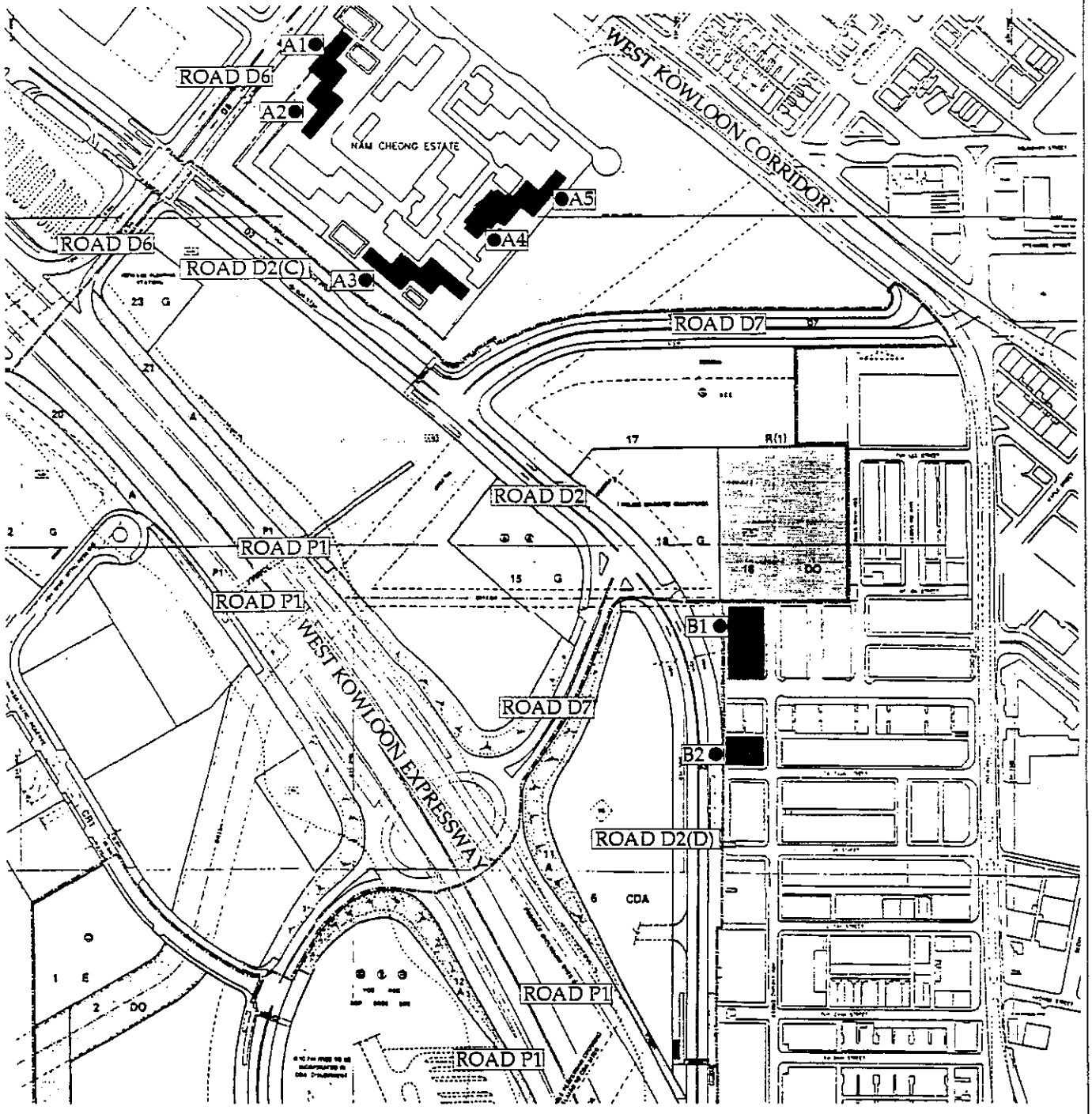


FIGURE 6.1 - NORTHERN AREA NSR LOCATIONS

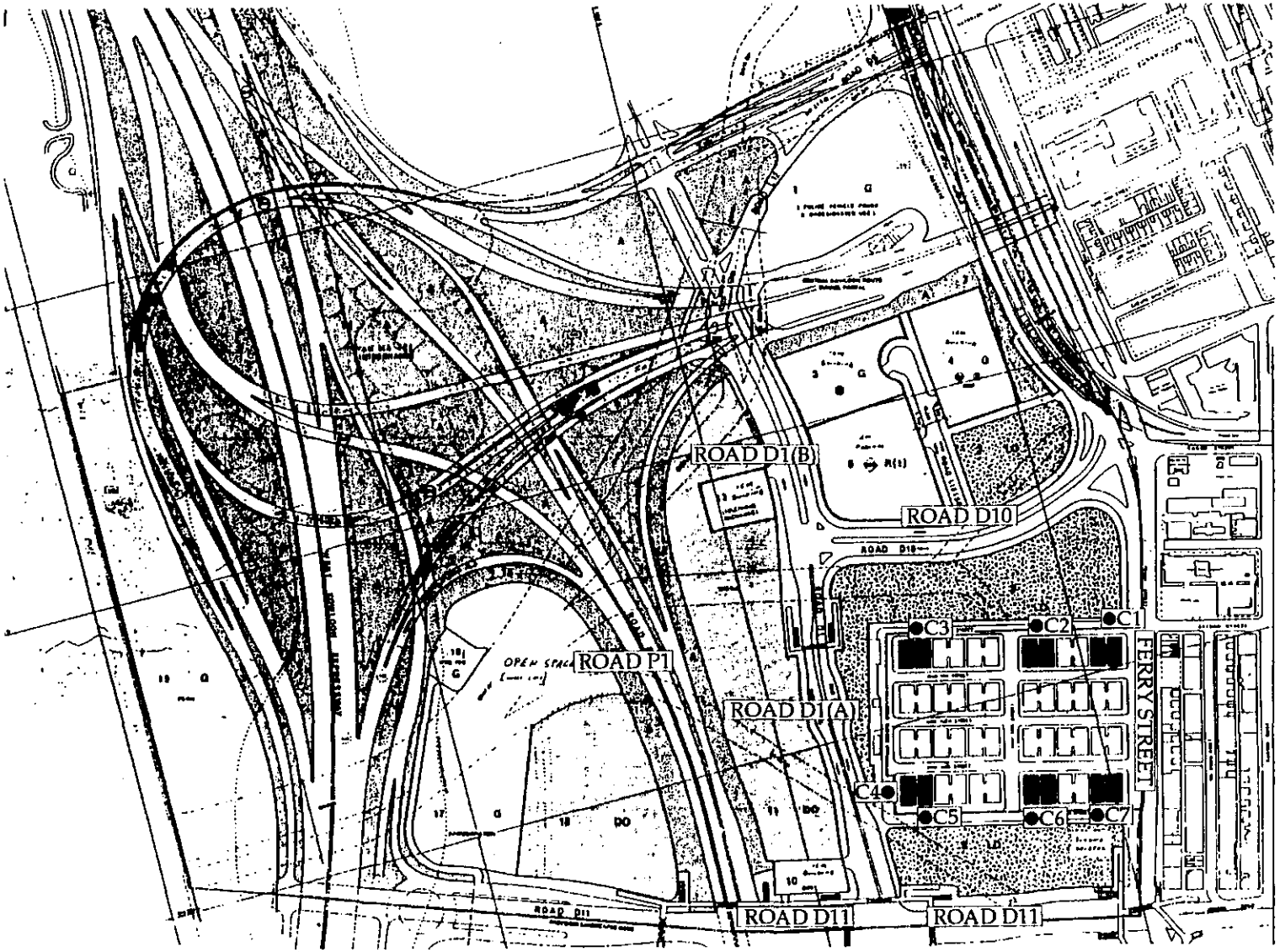


FIGURE 6.2 - SOUTHERN AREA NSR LOCATIONS

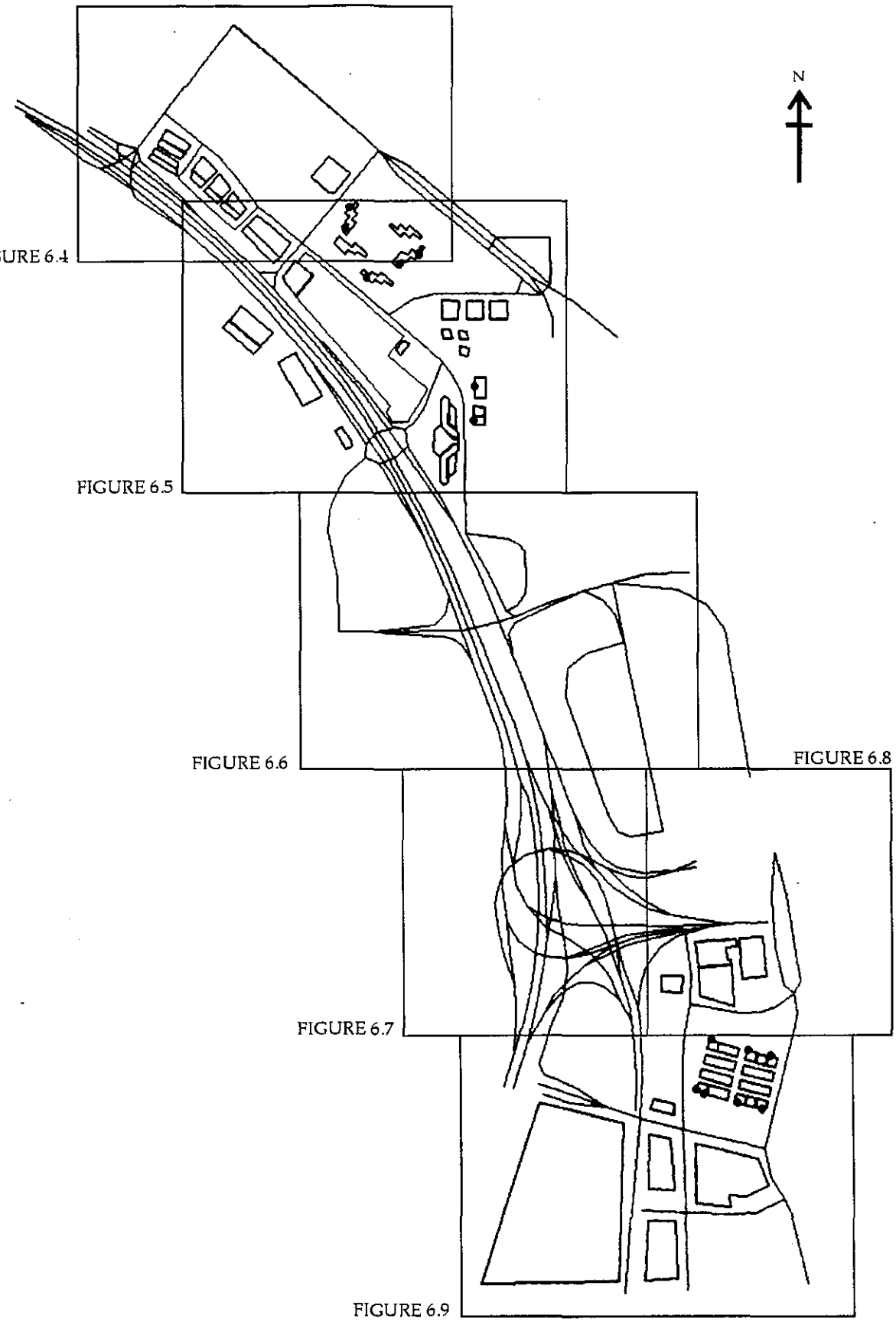


FIGURE 6.3 - KEY PLAN

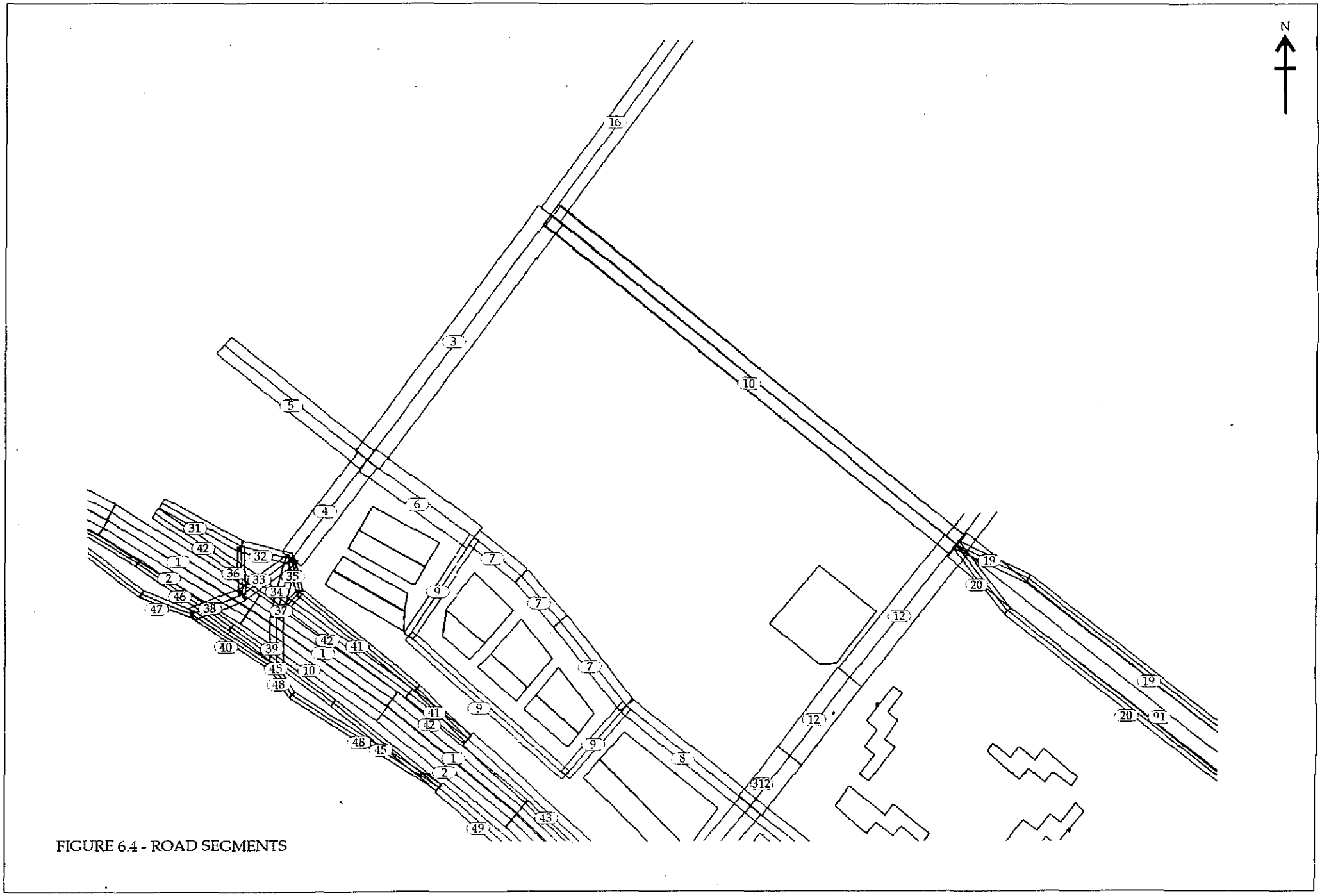


FIGURE 6.4 - ROAD SEGMENTS

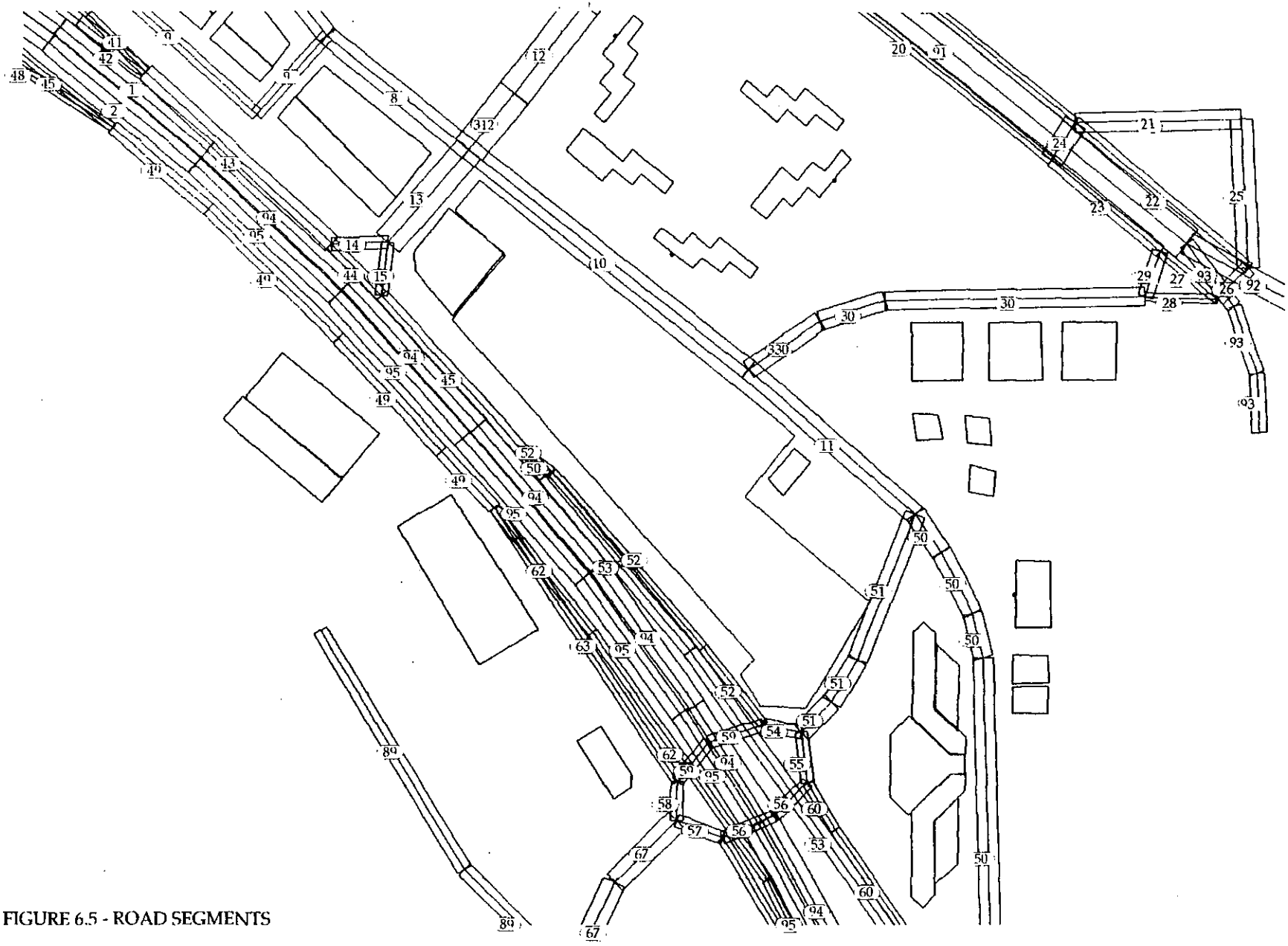


FIGURE 6.5 - ROAD SEGMENTS

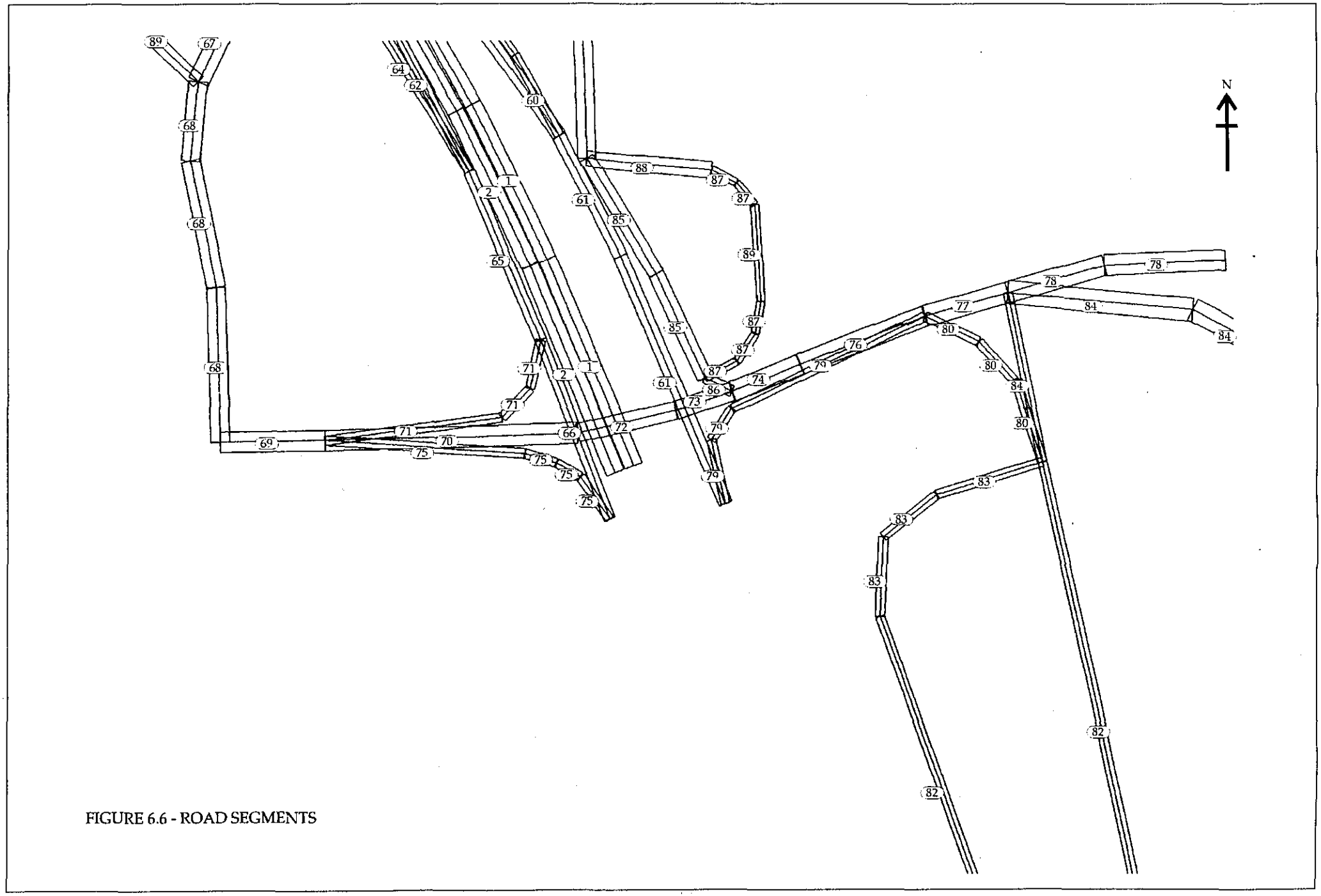


FIGURE 6.6 - ROAD SEGMENTS

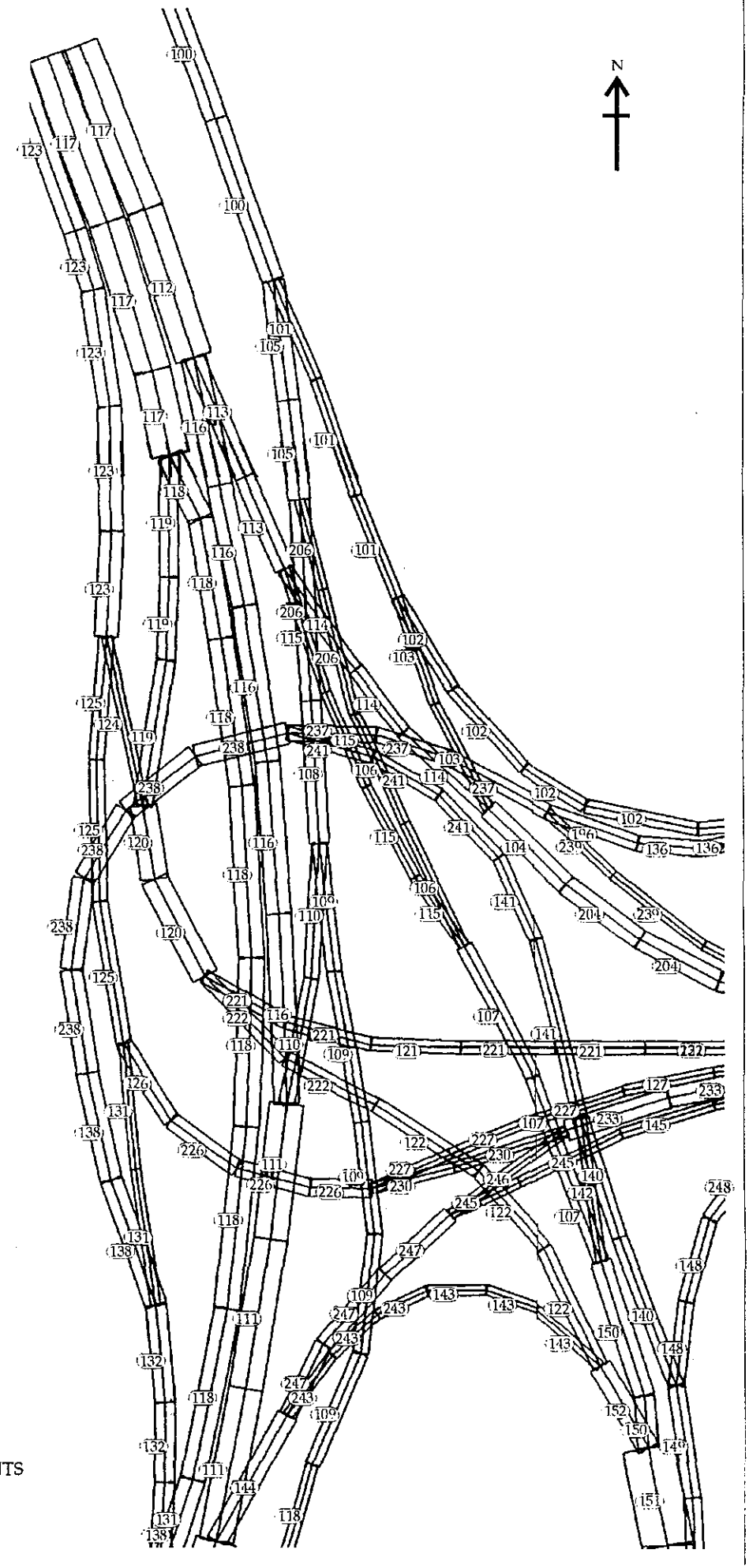


FIGURE 6.7 - ROAD SEGMENTS

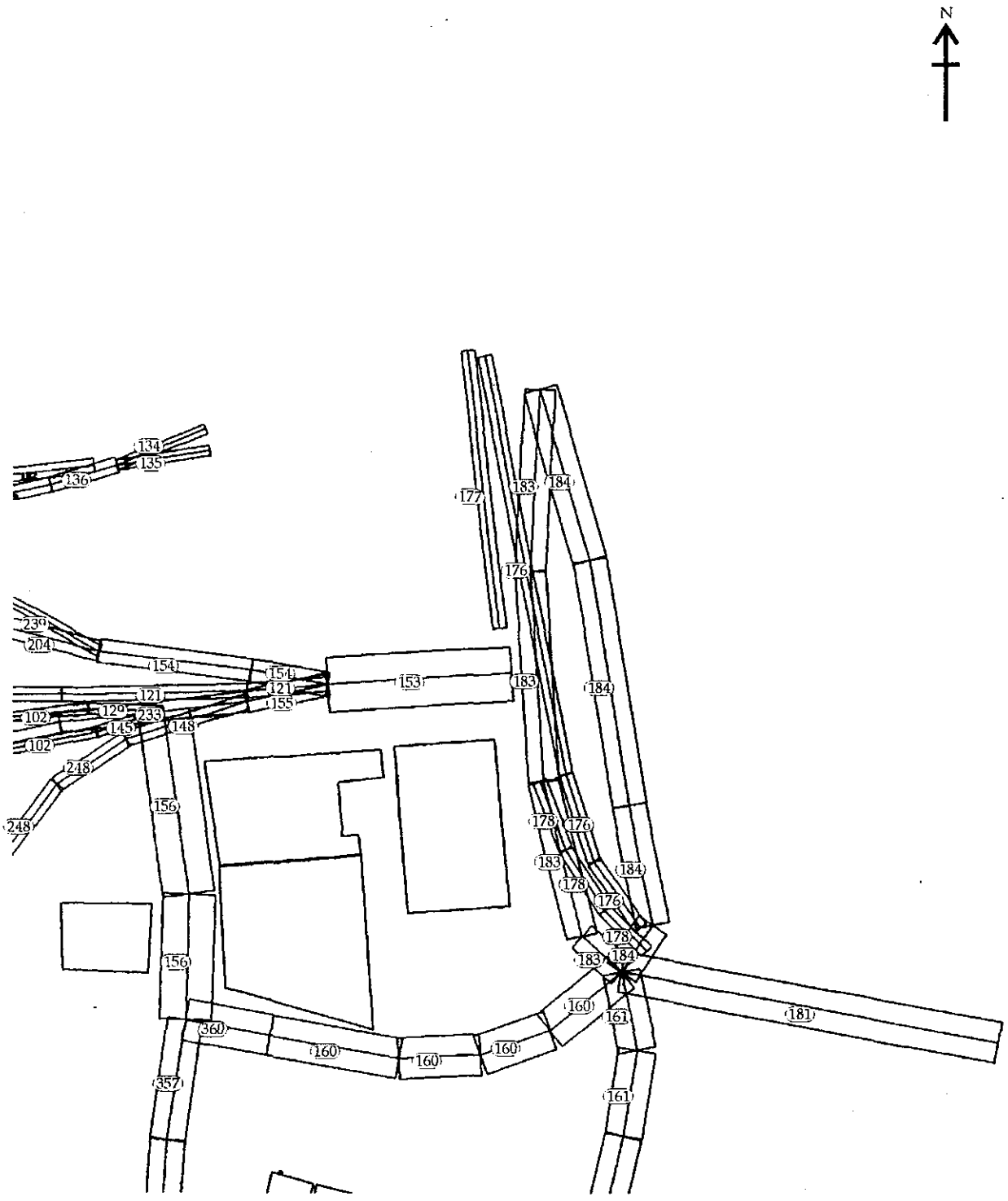


FIGURE 6.8 - ROAD SEGMENTS

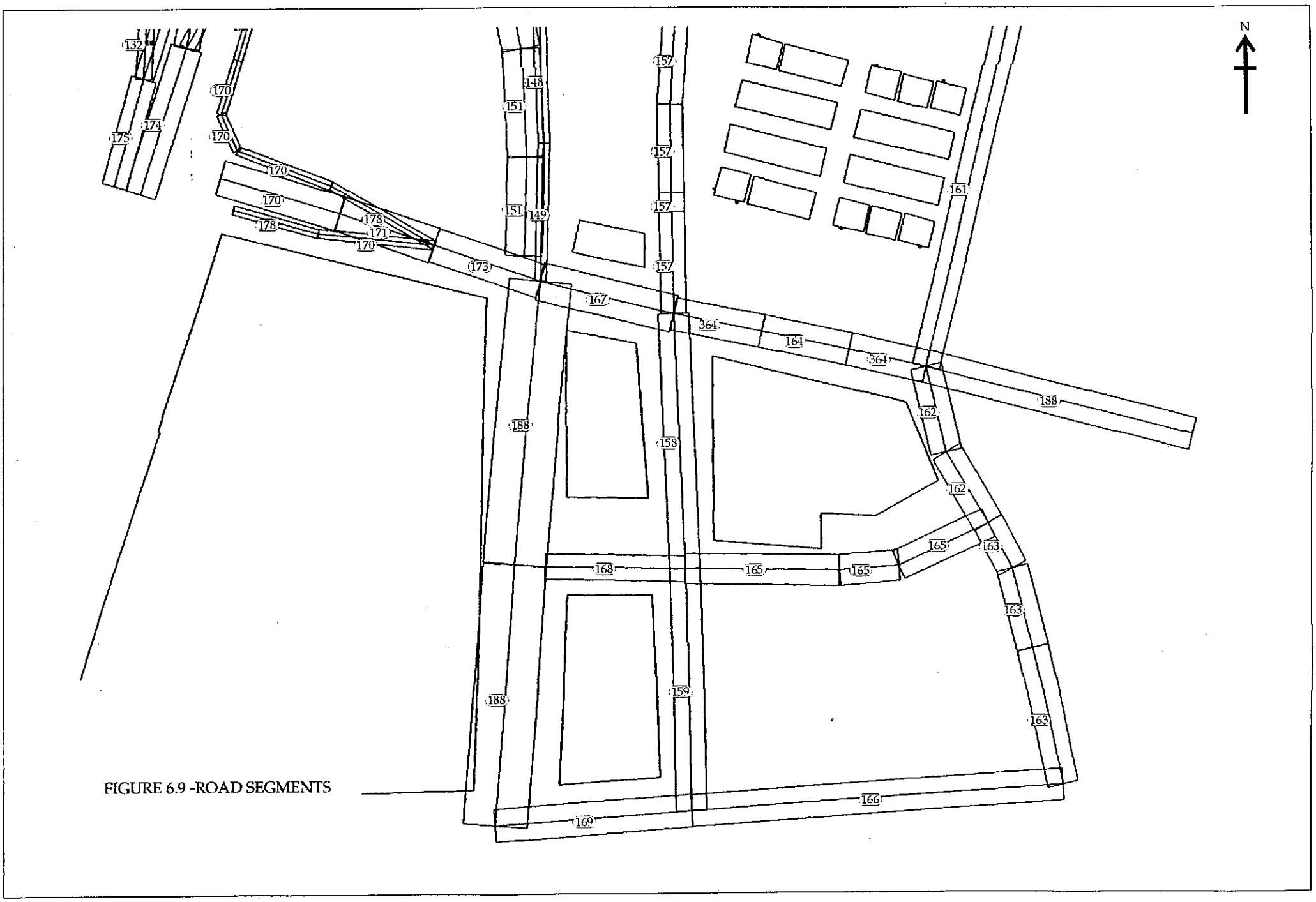
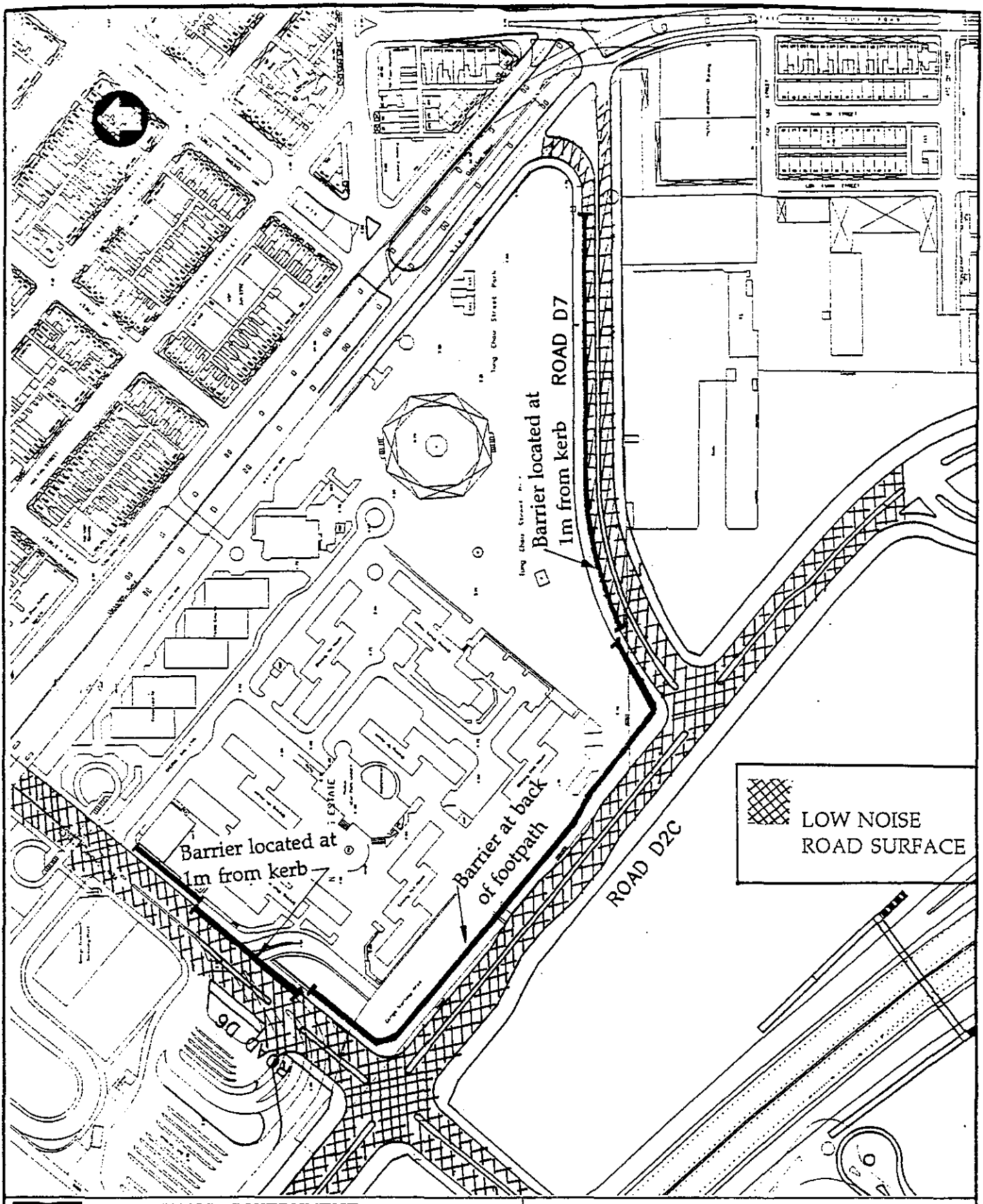


FIGURE 6.9 -ROAD SEGMENTS



HONG KONG GOVERNMENT
TERRITORY DEVELOPMENT DEPARTMENT
KOWLOON DEVELOPMENT OFFICE

WEST KOWLOON RECLAMATION

WKR NORTHERN AREA

LOCATION OF MITIGATION PACKAGE

M1, M2, M3

Consultants
Mott MacDonald Hong Kong Ltd.
in association with
L.G. Mouchel & Partners (Asia)
Urbis Travers Morgan Ltd.
ERM (HONG KONG) MVA Asia, Leigh & Orange Ltd.,
Dredging Research Ltd.
First Pacific Davies (Hong Kong) Ltd.

Mott MacDonald
Tel No. 828 5757
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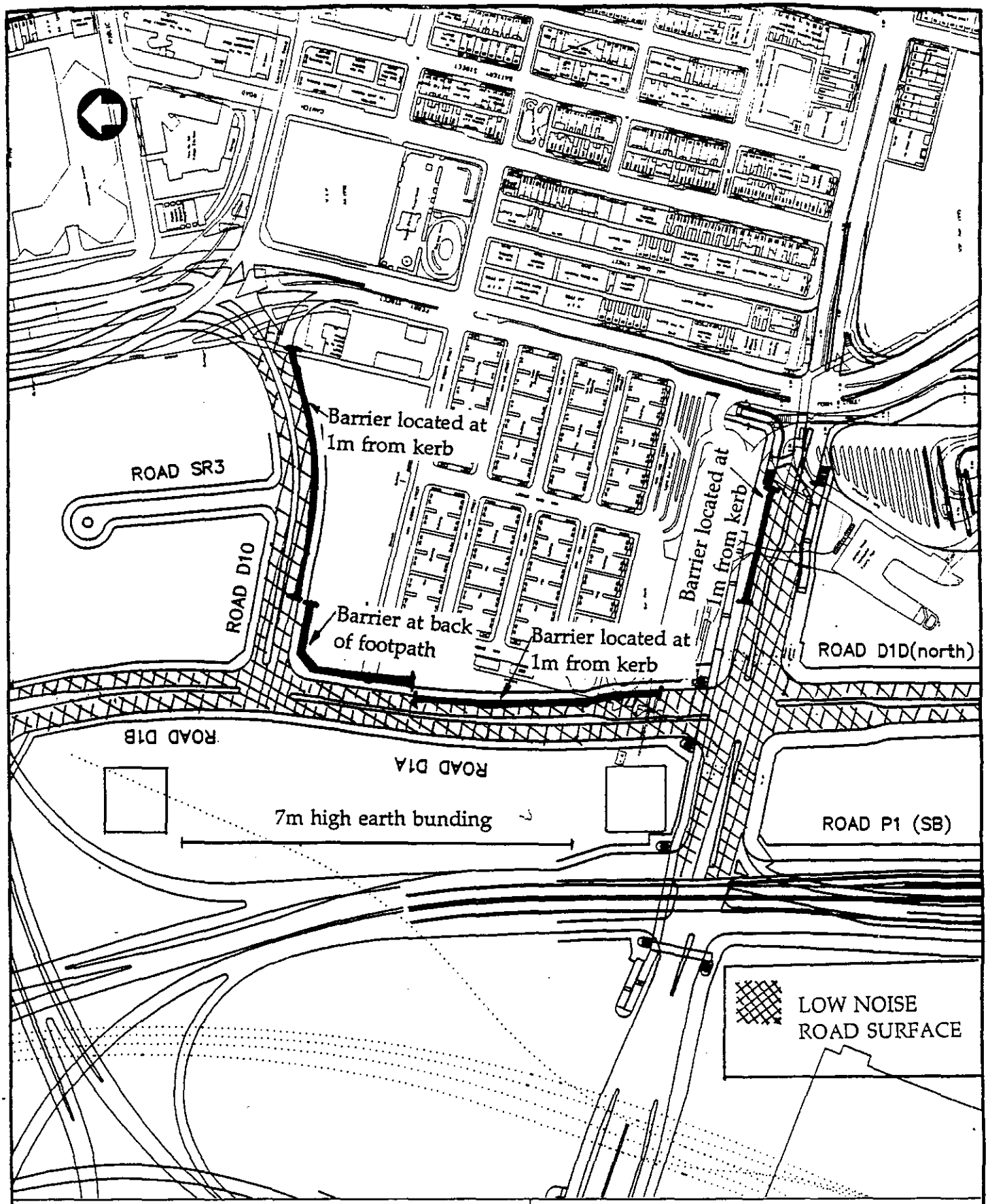
Scale 1 : 3000

Figure 6.10

Rev.



HONG KONG GOVERNMENT
TERRITORY DEVELOPMENT DEPARTMENT
KOWLOON DEVELOPMENT OFFICE

WEST KOWLOON RECLAMATION

WKR SOUTHERN AREA

LOCATION OF MITIGATION PACKAGE

M1, M2, M3, M4

Consultants
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Urbis Travers Morgan Ltd.
ERM (HONG KONG) MVA Asia, Leigh & Orange Ltd.,
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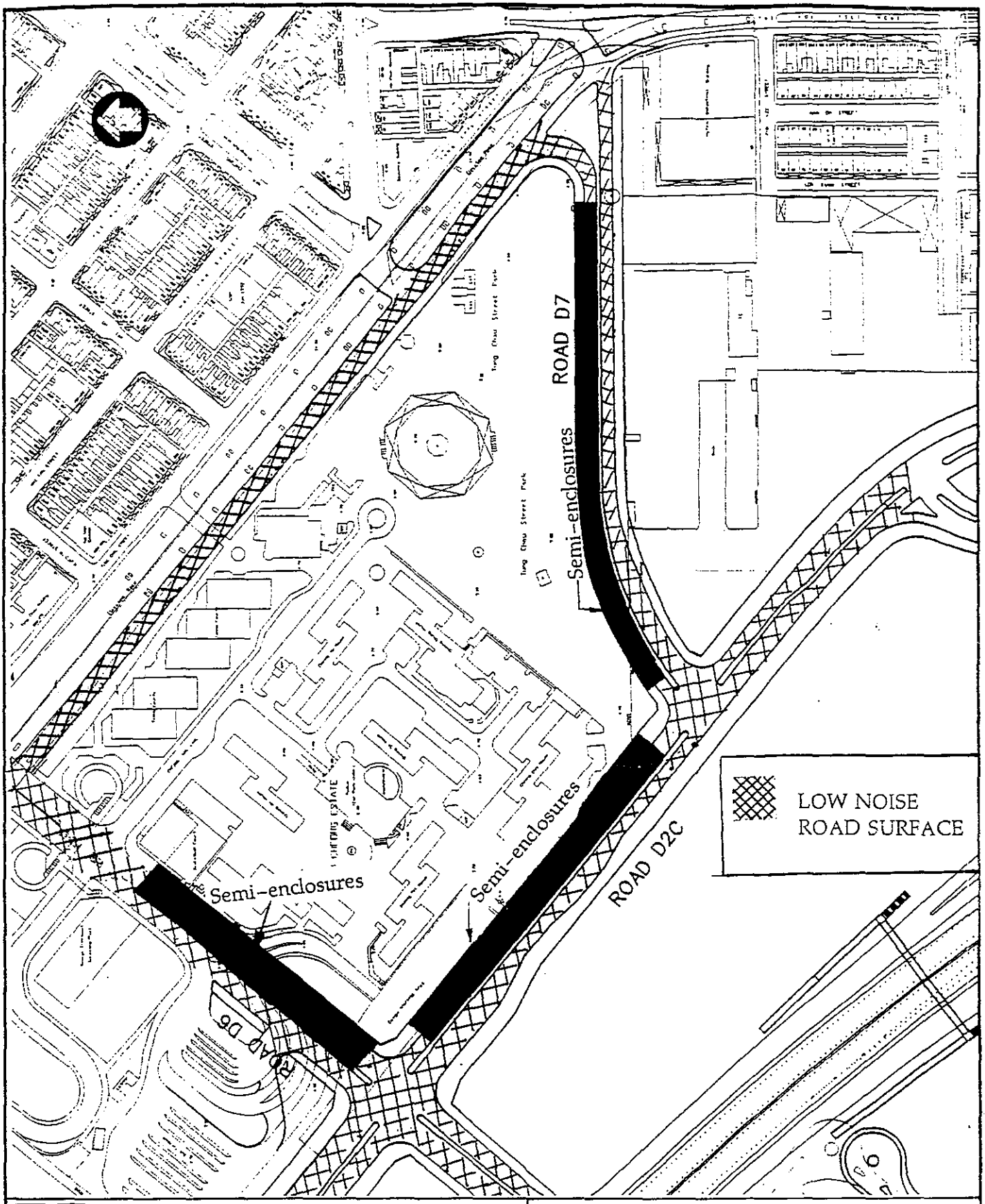
Scale 1:3000

Sketch No. Figure 6.11

Rev.



HONG KONG GOVERNMENT
TERRITORY DEVELOPMENT DEPARTMENT
KOWLOON DEVELOPMENT OFFICE

WEST KOWLOON RECLAMATION

WKR NORTHERN AREA
LOCATION OF SEMI-ENCLOSURES
(MITIGATION M5)

Consultants
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Urbis Travers Morgan Ltd.
ERM (HONG KONG) MVA Asia, Leigh & Orange Ltd.,
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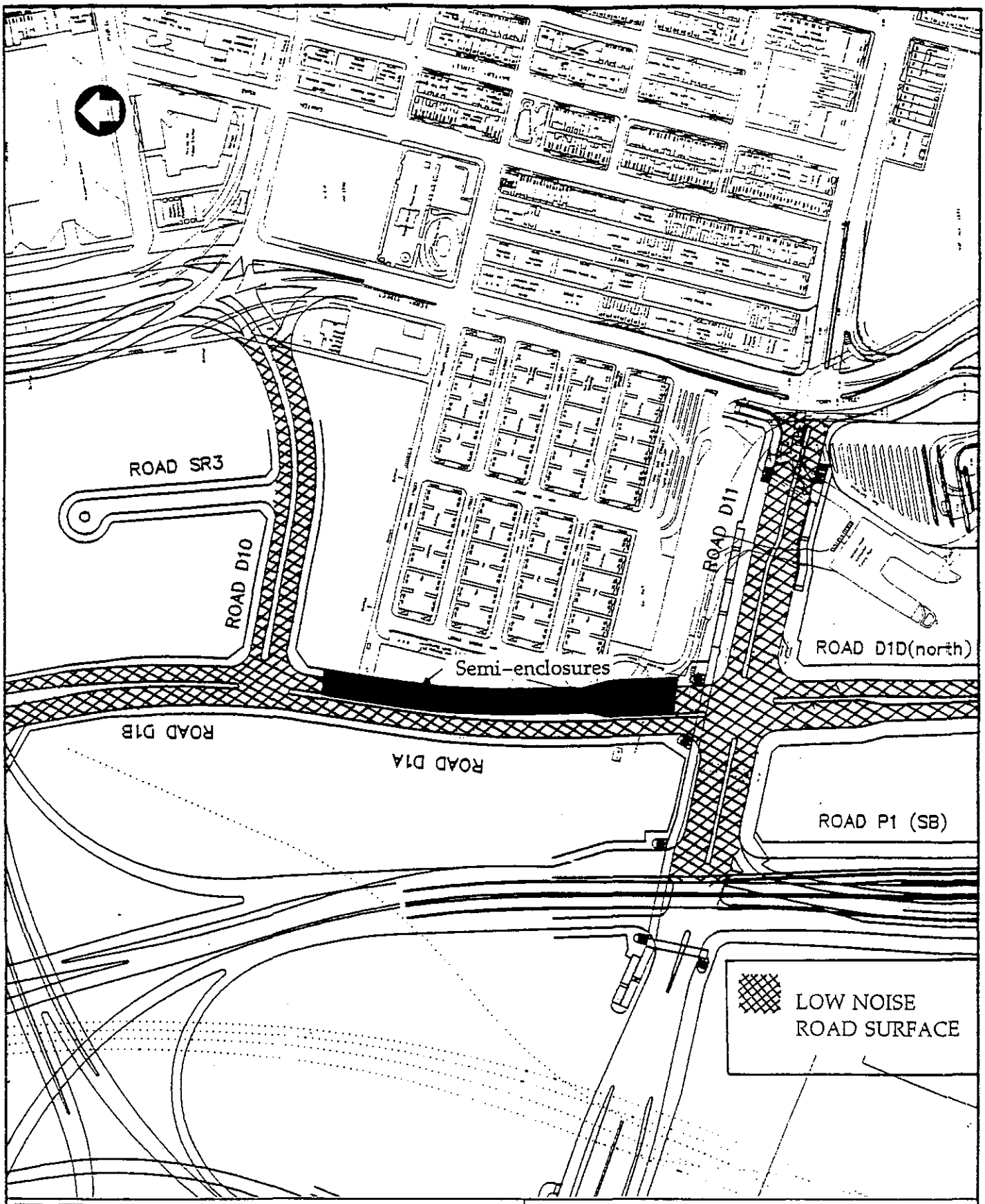
Figure 6.12

Rev.



HONG KONG GOVERNMENT
TERRITORY DEVELOPMENT DEPARTMENT
KOWLOON DEVELOPMENT OFFICE

WEST KOWLOON RECLAMATION

WKR SOUTHERN AREA

LOCATION OF SEMI-ENCLOSURES

Consultants
Mott MacDonald Hong Kong Ltd.
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Urbis Travers Morgan Ltd.
ERM (HONG KONG) MVA Asia, Leigh & Orange Ltd.,
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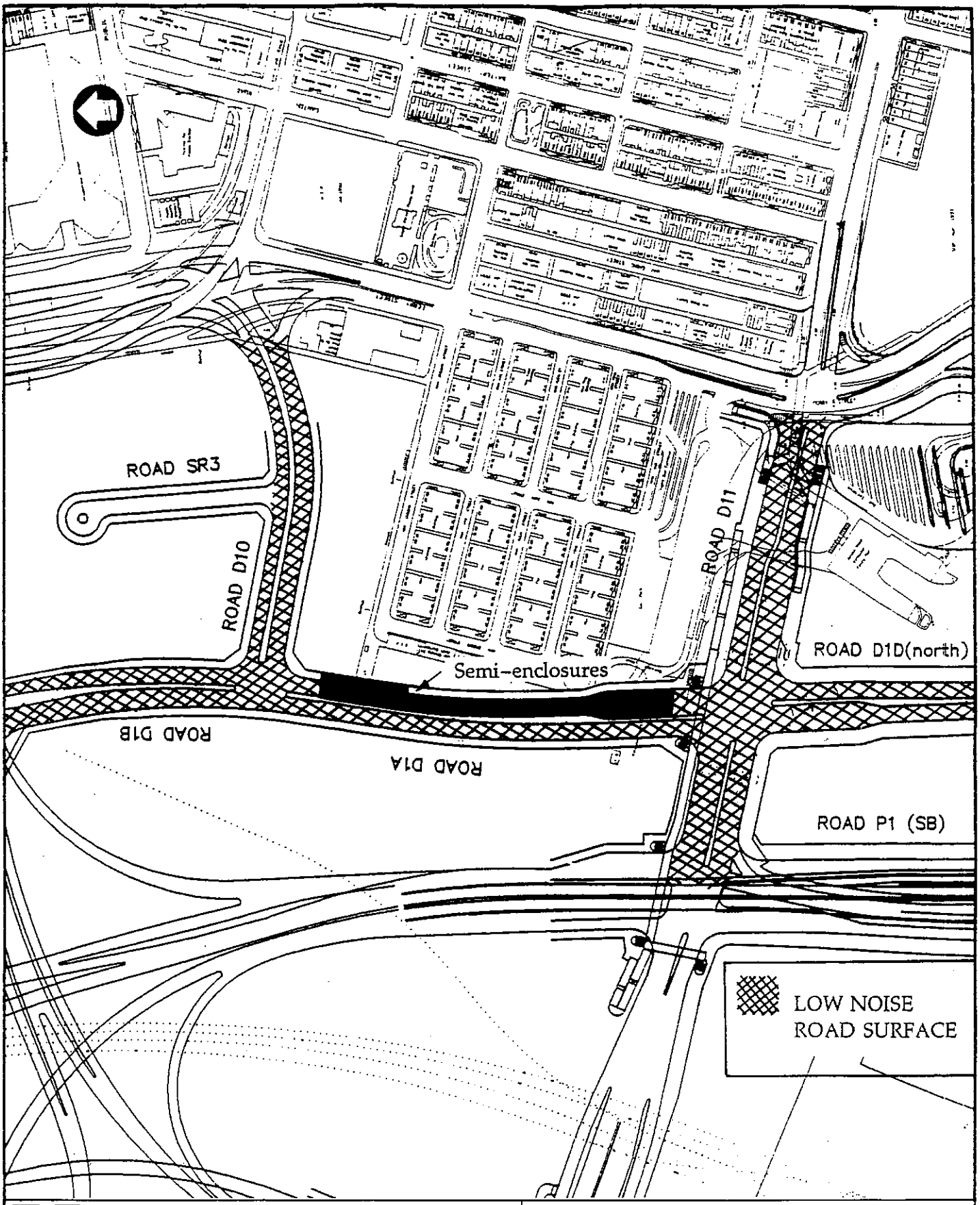
Scale 1 : 3000

Figure 6.13

Rev.



HONG KONG GOVERNMENT
TERRITORY DEVELOPMENT DEPARTMENT
KOWLOON DEVELOPMENT OFFICE

WEST KOWLOON RECLAMATION

WKR SOUTHERN AREA

LOCATION OF SEMI-ENCLOSURES

Consultants
Mott MacDonald Hong Kong Ltd.
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Figure 6.14

Rev.

7.OPERATIONAL AIR QUALITY ASSESSMENT

Introduction

7.01 This section assesses the potential air quality impacts on the existing residential developments from the proposed road infrastructure to service the West Kowloon Reclamation area.

7.02 The existing residential developments would be affected by the proposed road infrastructure were identified and they are Nam Cheong Estate, residential blocks at Wong Tai Street (future Road D2(D)) and Man Cheong Street. The location of the existing residential developments are shown in *Figures 5.1 and 5.2.*

Existing Air Quality

7.03 The existing air quality of the area is mainly affected by vehicle emissions from the nearby road networks.

7.04 The nearest monitoring station to the three identified residential areas is Sham Shui Po air monitoring station operated by EPD. It is expected that the air quality of the three identified ASRs is similar to that monitored at the EPD's station as given in *Table 5.1.*

Table 7.1 Annual Average and Maximum Daily Pollutant Levels Recorded at EPD's Monitoring Station during 1993

	CO	NO_2	TSP	RSP
Sham Shui Po				
Annual average	N.A.	N.A.	(120)	(70)
Maximum Daily	N.A.	N.A.	210	180
AQO				
Annual average	80	80	80	55
Daily	150	350	260	180

Note: (1) Figure in ***bracket*** denotes exceedance of the AQO.

Source: Hong Kong Environment 1994.

7.05 It can be noted from the above table that the annual average TSP and RSP levels have exceeded the AQO, mainly due to vehicle emissions and construction activities in the West Kowloon Reclamation area.

7.06 The EPD's monitoring data indicate that the identified residential developments are likely to be affected by vehicle emissions from nearby road network and construction activities associated with the West Kowloon Reclamation.

Future Air Quality

7.07 It is expected that the future air quality (ie. 2011) of the study area will be mainly affected by the West Kowloon Expressway (WKE) and West Kowloon Corridor (WKC). The predicted pollutant concentrations from the operation of the WKE and WKC at the three residential developments identified for this study are shown in *Table 7.2*.

7.08 It should be borne in mind that the predicted pollutant concentrations at the identified receptors are under different worst case wind directions, and this would not necessarily correspond to the worst case wind direction identified in this study.

Table 7.2 Air Quality Impacts from West Kowloon Expressway (WKE) and West Kowloon Corridor (WKC)

ASR	Pollutant Concentration ($\mu g\ m^{-3}$)		
	CO (1-hour)	NO_2 (1-hour)	TSP (1-hour)
Nam Cheong Estate			
WKC[1]	700	100	159
WKE[2]	2,000	150	N.A.
Wong Tai Street			
WKC[1]	374	55	85
WKE[2]	3,000	150	N.A.
Man Cheong Street			
WKC[1]	244	41	63
WKE[2]	2,000	130	N.A.

Note: (1) West Kowloon Corridor - Yau Ma Tei Section Phase II, Traffic Review and Environmental Assessment Study, Draft Final Report - Vol. 3, WP5 - Environmental Assessment, February 1992. Maunsell Consultants Asia Ltd.

(2) West Kowloon Expressway, Volume 3 - Environmental Assessment. June 1991, Freeman Fox Maunsell.

7.09 The pollutant concentrations predicted from the operation of WKC and WKE at the receptors were not summed to indicate the overall background air quality as the worst case meteorological conditions (ie wind direction) will be different from different source locations with respect to the ASRs. Therefore, the maximum predicted pollutant levels were used as an indication of the potential future background air quality at the residential developments as a conservative approach. It should also be noted that as the emission factors used for these two studies (WKE and WKC) have not taken the latest emission control stipulated by EPD, the predicted pollutant concentrations are thus very conservative.

Air Sensitive Receivers

7.10 The selected air sensitive receivers (ASRs) are shown in *Figures 7.1 and 7.2.*

Air Quality Assessment Methodology

7.11 The principal legislation for the management of air quality is the Air Pollution Control Ordinance (APCO) (Cap 311). The whole of the Hong Kong Territory is covered by the Hong Kong Air Quality Objectives (HKAQOs) which stipulate the statutory limits of some typical air pollutants and the maximum allowable numbers of exceedance over specific periods. The HKAQOs are shown in *Table 7.3* below.

Table 7.3 Hong Kong Air Quality Objectives

Pollutant	Concentration in micrograms per cubic metre (i)			
	Averaging Time			
	1 Hour (ii)	8 Hours (iii)	24 Hours (iii)	1 Year (iv)
Total Suspended Particulates (TSP)			260	80
Respirable Suspended Particles (v) (RSP)			180	55
Nitrogen Dioxide (NO_2)	300		150	80
Carbon Monoxide (CO)	30,000	10,000		

Note:

(i) Measured at 298°K (25°C) and 101.325 kPa (one atmosphere).
(ii) Not to be exceeded more than three times per year.
(iii) Not to be exceeded more than once per year.
(iv) Arithmetic means.
(v) Respirable suspended particulates means suspended particles in air with a nominal aerodynamic diameter of 10 micrometres and smaller.

7.12 Traffic related air quality impacts from the proposed road infrastructure on the proposed redevelopment by the year 2011 were predicted at the existing residential areas using the EPD approved mobile source dispersion model, CALINE4.

7.13 The selected assessment points are shown in *Figure 5.1 and 5.2*

7.14 Typical worst case meteorological conditions assumed are:

•	Wind Speed	2 m s^{-1}
•	Wind Direction	worst-case (wind direction that will lead to maximum pollutant concentrations)
•	Stability Class	D
•	Mixing Height	500 m

7.15 In urban areas, surface wind tends to vary considerably in direction. The variability of wind directions at street level is even greater due to mechanical turbulence created by vehicle movements. Hence, a 20 degree standard deviation was used in the model to represent a worst-case situation.

7.16 CALINE4 has a nitrogen dioxide (NO_2) option which allows direct prediction of NO_2 using an oxides of nitrogen (NO_x) emission factor. Background concentrations of nitrogen monoxide (NO), NO_2 and Ozone (O_3) are the limiting factors to NO/NO_2 conversion and are required for input to the prediction model. However, no representative O_3 data are available for the study area, for the year 2011. Therefore, NO_x were assessed as noble gas and a 20% conversion efficiency of NO_x to NO_2 was used in the assessment as agreed with EPD.

7.17 *Tables 7.4 to 7.6* show the traffic composition and afternoon peak hour traffic flows for the year 2011 for road alignments considered for Nam Cheong Estate, ASRs at Wong Tai Street and Man Cheong Street respectively. The road layout numbers used are the same as those described in the noise assessment section.

Table 7.4 Traffic Composition and Traffic Flow for PM Peak (%) - Nam Cheong Estate

Road (Layout No.)	Traffic Composition (%)				Traffic Flow (veh/hour)	Speed (kph)
	Private Car/Taxi	Light Goods Vehicle	Heavy Goods Vehicle	Bus/Coach		
L17	50	18	20	12	2150	50
L12	50	18	20	12	2150	50
L13	50	20	25	5	1250	50
L18	60	20	17	3	2550	50
L19	60	25	12	3	1125	50
L20	60	25	12	3	1125	50
L23	64	19	7	10	1750	50
L22	65	20	7	8	850	50
L24	64	19	7	10	100	50
L21	60	20	18	2	400	50
L7	53	27	12	8	1200	50
L8	60	20	8	12	2400	50
L10	60	15	14	11	1150	50
L11	65	10	12	13	1950	50
L30	65	15	13	7	1150	50

Source: MVA Asia Limited.

Table 7.5 Traffic Composition and Traffic Flow for PM Peak (%) - Wong Tai Street

Road (Layout No.)	Traffic Composition (%)				Traffic Flow (veh/hour)	Speed (kph)
	Private Car/Taxi	Light Goods Vehicle	Heavy Goods Vehicle	Bus/Coach		
L50	72	8	4	16	1150	20
L51	55	15	20	10	2200	50
L60	60	15	15	10	1100	45
L55	60	15	15	10	1100	45
L61	60	15	18	7	2750	50
L53	60	15	22	3	1700	50

Source: MVA Asia Limited.

Table 7.6 Traffic Composition and Traffic Flow for PM Peak (%) - Man Cheong Street

Road (Layout No.)	Traffic Composition (%)				Traffic Flow (veh/hour)	Speed (kph)
	Private Car/Taxi	Light Goods Vehicle	Heavy Goods Vehicle	Bus/Coach		
L161	58	17	18	7	2850	50
L162	73	12	6	9	3100	50
L164	47	8	10	35	2750	50
L158	58	7	10	25	1750	50
L157	60	10	5	25	2150	50
L156	58	12	5	25	1750	50
L160	60	10	10	20	1450	50
L167	70	10	15	5	3850	50
L149	70	10	16	4	100	50

Source: MVA Asia Limited.

7.18 Impacts from vehicle emissions primarily depend on the emission rate of the pollutants, traffic volume and the meteorological conditions (ie wind direction and wind speed). It is likely that by the year 2011 most petrol-driven vehicles will have been replaced by new vehicles satisfying the Air Pollution Control (Vehicle Design Standards) (Emission) Regulation 1991. New vehicle emission control technology, such as catalytic convertor, is required to be installed in new petrol driven vehicles registered on or after 1st January 1992 in order to achieve the required standards which reduces carbon monoxide (CO), NO_x and hydrocarbons emission by 80%-90%.

7.19 The emission rates of certain pollutants such as lead, CO, NO_x and hydrocarbon will be greatly reduced. Since 1st April 1991 unleaded petrol has been made available.

7.20 *Table 7.7* shows the calculated emission factors based on the Air Pollution Control (Vehicle Design Standards)(Emission) Regulation 1991 and the EURO II standards for diesel engine goods vehicles. The composite emission factors as shown in *Tables 7.8 to 7.10* were derived from *Table 7.7* and the traffic mix (*Tables 7.4 - 7.6*) expected for the year 2011.

Table 7.7 Emission Factors for Each Vehicle Type[4]

Vehicle Type	Speed (kph)	Emission Factors (g/veh-mi)		
		CO	NO_x	Particulates
Private Car/Taxi[1]	85	4.86	1.97	0.45
	70	7.32	1.86	0.45
	50	12.61	1.89	0.45
	45	14.45	1.93	0.45
	20	28.53	2.35	0.45
Light Goods Vehicle[2] (LGV)	85	2.06	3.07	0.42
	70	1.96	2.63	0.42
	50	2.43	2.45	0.42
	45	2.69	2.47	0.42
	20	6.12	2.98	0.42
Heavy Goods Vehicle (HGV)	85	6.17	12.48	0.91
	70	6.19	10.32	0.91
	50	7.95	9.70	0.91
	45	8.85	9.89	0.91
	20	19.61	13.35	0.91
Coach/Bus[3]	85	6.62	15.16	1.44
	70	6.64	12.53	1.44
	50	8.53	11.79	1.44
	45	9.49	12.01	1.44
	20	21.03	16.22	1.44

Note: (1) All vehicles were assumed to be petrol driven private car for the estimation of CO and NO_x emission factors; and all vehicles were assumed to be diesel driven for the estimation of particulate emission factors, to give the worst case.
(2) Assumed 30% of the LGV are petrol driven and 70% are diesel driven.
(3) Emission factors for large public bus are used to give the worst case.
(4) This set of emission factors are based on EPD's emission factors estimated from the US EPA MOBILE IV program and EPD's plan for vehicle emissions control.

Table 7.8 Composite Emission Factors (g/vhe-mi) - Nam Cheong Estate

Road (Layout No.)	Speed (kph)	Composite Emission Factors (g/veh-mi)		
		CO	NO_x	Particulates
L17	50	9.36	4.74	0.66
L12	50	9.36	4.74	0.66
L13	50	9.20	4.45	0.61
L18	50	9.66	3.63	0.55
L19	50	9.38	3.27	0.53
L20	50	9.38	3.27	0.53
L23	50	9.94	3.53	0.58
L22	50	9.92	3.34	0.56
L24	50	9.94	3.53	0.58
L21	50	9.65	3.61	0.55
L7	50	8.97	3.77	0.58
L8	50	9.71	3.82	0.60
L10	50	9.98	4.16	0.62
L11	50	10.50	4.17	0.63
L30	50	10.18	3.68	0.57

Table 7.9 Composite Emission Factors (g/veh-mi) - Wong Tai Street

Road (Layout No.)	Speed (kph)	Composite Emission Factors (g/veh-mi)		
		CO	NO_x	Particulates
L50	20	25.18	5.06	0.62
L51	50	9.74	4.53	0.64
L60	45	11.35	4.21	0.61
L55	45	11.35	4.21	0.61
L61	50	9.96	4.07	0.60
L53	50	9.94	4.00	0.58

Table 7.10 Composite Emission Factors (g/veh-mi) - Man Cheong Street

Road	Speed (kph)	Composite Emission Factors (g/veh-mi)		
		CO	NO_x	Particulates
L161	50	9.75	4.08	0.60
L162	50	10.74	3.32	0.56
L164	50	9.90	6.18	0.84
L158	50	10.41	5.16	0.74
L157	50	10.34	4.81	0.72
L156	50	10.13	4.82	0.72
L160	50	10.31	4.71	0.69
L167	50	10.69	3.61	0.57
L149	50	10.68	3.59	0.56

Table 7.11 summarises the predicted air quality impacts from vehicle emissions on the existing residential areas. In the assessment a conversion factor of 0.4 was used to convert 1 hour dust concentration to 24 hours average dust concentration, basing on the assumption of 10 hours constant peak hour traffic per day as a worst case.

Table 7.11 Vehicle Emissions Impacts

Assessment Point	Height (m above ground)	Wind Direction	Pollutant Concentrations ($\mu g\ m^{-3}$)			
			CO (1-hour)	NO_2 (1-hour)	RSP (1-hour)	RSP (24-hour)
Nam Cheong Estate						
N1	4.2	18	433	42	30	12
	6.2	19	376	36	26	10
	8.2	21	319	30	21	8
	10.2	23	274	24	17	7
N2	4.2	296	262	22	17	7
	6.2	296	239	21	16	6
	8.2	298	217	20	15	6
	10.2	299	206	18	13	5
N3	4.2	342	182	17	12	5
	6.2	342	182	16	11	4
	8.2	342	181	16	11	4
	10.2	341	181	15	11	4
Residential blocks at Wong Tai Street						
N4	4.2	196	718	50	31	12
	6.2	195	650	41	26	10
	8.2	193	570	45	28	11
	10.2	192	513	46	29	12
N5	4.2	198	821	59	37	15
	6.2	196	695	59	36	14
	8.2	193	593	48	30	12
	10.2	191	523	44	28	11

Assessment Point	Height (m above ground)	Wind Direction	Pollutant Concentrations ($\mu g\ m^{-3}$)			
			CO (1-hour)	NO_2 (1-hour)	RSP (1-hour)	RSP (24-hour)
Residential blocks at Man Cheong Street						
S1	4.2	59	490	42	31	12
S2	4.2	210	319	30	22	9
S3	4.2	215	547	62	38	15
S4	4.2	226	490	46	33	13
S5	4.2	271	627	50	38	15
AQO			30,000	300		180

7.21 It can be noted from the comparison of the worst case scenario with AQOs, *Table 5.11*, that vehicle emissions from new road network to service West Kowloon Reclamation area will not pose significant air quality impacts on the existing residential developments.

7.22 West Kowloon Corridor and West Kowloon Expressway are the two main roads in the study area. These two roads are distanced from the identified ASRs or are screened from the ASRs. However, high pollutant concentrations were predicted in the previous studies (WKE and WKC) with high traffic volumes (as shown in *Table 7.3*). The future background pollutant concentrations at the study area would largely raised from these roads.

7.23 With the consideration of these potential future background air quality, the levels of CO, NO_2 and RSP at the ASRs would be elevated. However, the cumulative impacts from all the near-by and distanced roads are still below the AQO and the air quality impacts are therefore at an acceptable level.

Air Quality Mitigation Measures

7.24 During the operational phase of the proposed road infrastructure to service West Kowloon Reclamation area, no significant air quality impacts will result at the existing residential developments even when impacts from the WKC and WKE were considered. Therefore no mitigation measures are required.

8.COST ESTIMATES

8.01 Based on the details provided in Section 2 of the report the estimated unit costs for the various mitigation measures are tabulated below.

Table 8.1 Estimated Unit Costs of Mitigation Measures

Description	(HK$)
Noise Barrier :	
Three meter high :-	
a) with acoustic panels	$13,500/lin.m.
b) with GRC panels	$12,500/lin.m.
Five metre high :	
a) with acoustic panels	$20,500/lin.m.
b) with GRC panels	$19,500/lin.m.
Enclosures	
Full/partial enclosure	$13,500/m² of plan area
Indirect Mitigation	
Double glazing and air conditioning	$27,000*/flat
Energy costs	$6,000/flat/year
Maintenance cost	$3,000/flat/every 6 years
Low noise road surfacing	
30mm thick friction course	$50/m²

Note: * Unit rate is based on the estimated cost of insulation work to those dwellings along Connaught Road West and Des Voeux Road West affected by the Western Harbour Crossing.

9.CONCLUSIONS AND RECOMMENDATIONS

Traffic Noise

9.01 This study has generated an extensive model of the proposed and existing roads around the three areas of existing sensitive receivers at Nam Cheong Estate, Wong Tai Street in Tai Kok Tsui, and Man Cheong Street. The model has predicted prevailing noise levels and noise levels for the assessment year of 2011, and has revealed that significant noise impacts are expected at Nam Cheong Estate and Man Cheong Street. No impacts are expected at the residential dwellings in Wong Tai Street.

9.02 Prevailing noise levels and noise contributions from existing roads in 2011 are significantly above the traffic noise assessment criterion at sensitive receivers on the eastern side of both Man Cheong Street, and also, but to a lesser extent, at Nam Cheong Estate. This has the effect of increasing the extent of mitigation required on the new roads because the noise contribution from the existing roads cannot be mitigated.

9.03 A series of mitigation measures have been considered for the new roads to reduce noise impacts to acceptable levels in the two impacted areas. The environmental benefit and the practical difficulties associated with each type of mitigation have been assessed resulting in the following general conclusions:

- Low noise road surfaces in the form of friction course (or some future improved design of pavement surface) offer a useful noise benefit and are an effective and practical mitigation measure that should be installed on the local 'D' roads around Nam Cheong Estate and Man Cheong Street;

- Noise barriers 3m or 5m in height cannot be located in the ideal location against the kerb because of sightline/visibility requirements, which in combination with the height and proximity of the top floor receivers looking over the local roads, renders them not effective as a single solution in both receiver areas.

- At Man Cheong Street, noise contributions from distant proposed roads and existing roads are such that even if total enclosures are provided on local roads to the north and south the traffic noise assessment criterion cannot be achieved. However, if an enclosure is provided to the local road to the west the traffic noise assessment criterion can be achieved on the west facade.

- Setting aside cost and technical considerations, semi-enclosures together with low noise road surfacing would be capable of avoiding traffic noise impacts at Nam Cheong Estate.

9.04 In considering the best practical measures to be adopted, it is necessary to balance the respective merits of the options taking all factors into account. Although enclosures provide the necessary mitigation at Nam Cheong Estate, considerations of cost alone would pre-empt their selection since they would be extremely expensive when compared to the costs of indirect mitigation, and could not therefore be considered as cost effective. It should also be noted that whilst the analysis has identified the impacts at the chosen receivers within the estate, not all facades have been modelled. Since it is not practical to cover junctions there may be dwellings which could be exposed to unacceptable noise levels. Enclosures are also visually intrusive and, as described in Section 2 of the report, have wider ramifications for both pedestrians and motorists alike. Indirect mitigation, i.e. noise insulation, also poses additional recurrent costs to residents for the life expectancy of the dwellings which may prove a burden to residents.

9.05 In terms of cost, the provision of semi-enclosures at Nam Cheong Estate together with low noise road surfacing is estimated to be of the order of HK$189 million compared to the cost of indirect measures which are estimated to be of the order of HK$20 million. The latter figure would, however, require further study taking due cognisance of the comments in Section 2 of the Report. At Man Cheong Street the cost of insulation and air conditioning is estimated to be of the order of HK$45 million and, as in the case of Nam Cheong Estate, a further detailed study would be required to establish the exact number of dwellings impacted and the accurate cost of the indirect measures.

9.06 On review of all factors discussed both in this Section and Section 2 of the report, the most practical and cost effective measure to mitigate the impacts identified at both Man Cheong Street and Nam Cheong Estate would be insulation and air conditioning since this would provide a single solution to the impacts identified. **This mitigation measure is therefore recommended.**

Air Quality

9.07 The study has included detailed air quality modelling of the pollutants that will be introduced from the traffic on the proposed road network, and has concluded that no significant air quality impacts will occur.

Construction Noise

9.08 In the absence of any mitigation measures, construction noise impacts are predicted at all sensitive receivers. These would result due to the proximity of the works and the cumulative effect of different construction activities within the large area covered by the Contracts occurring simultaneously. The study has considered the worst case cumulative effects and has identified a variety of mitigation measures that would be effective in mitigating these impacts. These include 'quiet plant', on site noise management, a series of 3m and 5m static and mobile noise barriers along the boundary of works areas and, in particular areas, specific limitations on the source noise levels of plant in operation. The study has shown that a combination of these measures can achieve compliance with the daytime $L_{Aeq,\ 30\ minutes}$ 75 dB assessment criterion, and would ensure that impacts were avoided.

9.09 However, it must be noted that this assessment is based on assumed construction periods and items of plant for the various construction activities which may well differ from that proposed by the Contractors. It would therefore be preferable for the Contractors to develop their own mitigation measures based on their choice of equipment and working methods and for each to demonstrate, prior to construction, that the daytime $L_{eq,30\ minutes}$ 75 dB assessment criterion will be satisfied, or if not, to propose their own package of mitigation measures. It is recommended that appropriate clauses be included in the contract Specifications for both Contracts WK22/94 and WK23/94 to meet these requirements.

9.10 Noise impacts of construction working on Sundays (which may be required if the programming of the works becomes difficult), have not been considered in detail. However, for Sunday working the Contractor will be required to achieve a further 5-10 dB of mitigation in accordance with the requirements of the Noise Control Ordinance, and he will be required to demonstrate that this can be achieved in order to obtain a Construction Noise Permit from the EPD.

9.11 Although it is outside the scope of this study to consider environmental monitoring and auditing requirements, **it is recommended that in view of the potential for significant noise impacts at the majority of NSRs, a noise monitoring and auditing programme covering the whole of the construction phase should be implemented.** This should be carried out either by the project proponent or by the Environmental Protection Office (ENPO 1). The results should be processed by ENPO 1 to allow consideration of cumulative impacts from other construction works on the WKR.

Construction Dust

9.12 In the absence of any mitigation measures, dust impacts are predicted at all sensitive receivers. These would results mainly from the large numbers of truck movements within the construction area. Mitigation measures in the form of a variety of watering procedures and limiting the speeds of trucks on unpaved haul roads to 10 kph would control these impacts to acceptable levels. It is recommended that appropriate clauses be included in aforementioned contract Specifications.

9.13 **It is recommended that in view of the potential for significant dust impacts at the majority of ASRs, an air quality monitoring and auditing programme should be implemented,** in a similar way to that described for noise above.

APPENDIX A

West Kowloon Reclamation Roadworks
Focussed EIA Study Brief

1. Background

Territory Development Department carried out an Environmental Study (Planning) as part of the Planning and Urban Design Study for West Kowloon Reclamation in June 1991. The Study outlined the potential impacts of air, noise, water quality and hazards and suggested a broad scheme of mitigation measures.

2. Purposes

The purpose of this Focussed EIA Study is to provide information on the nature and extent of the potential noise and air quality impacts arising from the construction and operation of the proposed project and all related activities taking place concurrently. This information will contribute to decision on :

(i) the overall acceptability of any adverse noise and air consequences that are likely to arise as a result of the proposed project;

(ii) the conditions and requirements for detailed design, construciton and operation of the proposed project; and

(iii) the acceptability of residual impacts after the proposed mitigation measures are implemented.

3. Objectives

The objectives of this study are :

3.1 to describe the proposed project and associated works together with the requirements for carrying out the proposed project;

3.2 to determine the noise and air impacts on sensitive receivers and potential affected uses based on the latest layout plan and traffic data;

3.3 to propose the provision of mitigation measures so as to minimize pollution and nuisance during construction and operation of the project;

3.4 to identify the nature and extent of potential noise and air quality impacts associated with the mitigation measures recommended in the study and to propose methods to minimize the identified impacts;

4. Technical Requirements

The focussed EIA Study shall include the following tasks :

4.1 Carry out the necessary background studies to identify, collect and analyse existing information relevant to this study.

4.2 Identify the sensitive receivers from the exisiting land-uses.

4.3 Assess and evaluate the net and cumulative noise impacts during construction and operation of the project and propose noise mitigation measures to minimize noise impacts to an acceptable level. Assessment of cumulative road traffic noise impact should consider all new roads on the West Kowloon Reclamation area including West Kowloon Expressway, road P1, Yau Ma Tei Interchange, the local roads, as well as the existing roads in the vicinity of the West Kowloon Reclamation area.

4.4 (i) Review the air quality impacts of the roads in light of the latest traffic data and road alignment and Outline Development Plans and provide quantitative assessment of the net and cumulative traffic and air quality impacts.

(ii) Assess the air quality impacts of the noise mitigation measures (such as barriers) recommended in the noise impact assessment of this Study.

(iii) Propose measures to mitigate air quality impacts to acceptable level.

5. Liaison and Administration

5.1 The Consultant shall liaise with relevant Government departments and agencies, and all other parties involved in this and any other projects or developments likely to be affected by this project.

5.2 The Consultant should make himself/herself available to be present in Advisory Council on the Environment (ACE), DB and/or any public consultation meeting(s) (if required).

6. Reporting Requirements

A report on the Focussed EIA Study with a one-page Executive Summary, which fully satisfies the requirements of this brief, shall be submitted to the Director of Environmental Protection for approval.

APPENDIX B

WEST KOWLOON RECLAMATION SOUTHERN SECTION
TRAFFIC DATA FOR PREVAILING NOISE LEVELS

HEA Road Noise description of data file West Kowloon Reclamation Southern Section

Number of Road Layout Definitions = 108

Layout	Flow	Speed	%Heavy	Texture Depth	Surface Type	Elevated	Oneway	A->B	Central Reserve	Road Width	Category
161	2689.00	50.00	30.00	1.50	Imp/Bit	No	No	N/A	0.00	22.00	Unaltered
162	3793.00	50.00	13.00	1.50	Imp/Bit	No	No	N/A	0.00	25.00	Unaltered
163	3793.00	50.00	13.00	1.50	Imp/Bit	No	No	N/A	0.00	25.00	Unaltered
176	2850.00	50.00	10.00	1.50	Imp/Bit	Yes	Yes	A->B	N/A	8.00	Unaltered
177	2850.00	50.00	10.00	1.50	Imp/Bit	Yes	Yes	B->A	N/A	8.00	Unaltered
178	2850.00	50.00	10.00	1.50	Imp/Bit	Yes	Yes	B->A	N/A	8.00	Unaltered
180	2750.00	50.00	25.00	1.50	Imp/Bit	No	No	N/A	3.00	26.00	Unaltered
181	1450.00	50.00	25.00	1.50	Imp/Bit	No	No	N/A	0.00	24.00	Unaltered
182	432.00	50.00	34.00	1.50	Imp/Bit	No	No	N/A	0.00	8.00	Unaltered
183	1937.00	50.00	20.00	1.50	Imp/Bit	No	Yes	B->A	N/A	18.00	Unaltered
184	1431.00	50.00	11.00	1.50	Imp/Bit	No	Yes	A->B	N/A	20.00	Unaltered
185	1034.00	50.00	34.00	1.50	Imp/Bit	Yes	Yes	B->A	N/A	8.00	Unaltered
186	1034.00	50.00	24.00	1.50	Imp/Bit	Yes	Yes	A->B	N/A	8.00	Unaltered

Number of Text Strings = 0

WEST KOWLOON RECLAMATION SOUTHERN SECTION
TRAFFIC DATA FOR 2011 CONDITION

HFA Road Noise description of data file West Kowloon Reclamation Southern Section

Number of Road Layout Definitions = 115

Layout	Flow	Speed	%Heavy	Texture Depth	Surface Type	Elevated	OneWay	A->B	Central Reserve	Road Width	Category
100	3300.00	50.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	13.00	New
101	950.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	7.00	New
102	500.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	8.00	New
103	500.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	6.00	New
104	2550.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	12.00	New
105	2750.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	13.00	New
106	500.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	6.00	New
107	1550.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	9.00	New
108	1700.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	12.00	New
109	1000.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	9.00	New
110	700.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	9.00	New
111	1900.00	70.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	20.00	New
112	4300.00	70.00	25.00	1.50	Per/Bit	No	Yes	A->B	N/A	22.00	New
113	3150.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	12.00	New
114	2100.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	9.00	New
115	1100.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	6.00	New
116	1200.00	70.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	15.00	New
117	4350.00	70.00	25.00	1.50	Per/Bit	No	Yes	B->A	N/A	22.00	New
118	1550.00	70.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	15.00	New
119	2700.00	45.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	11.00	New
120	3500.00	45.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	16.00	New
121	1500.00	45.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	9.00	New
122	2050.00	45.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	9.00	New
123	3350.00	50.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	14.00	New
124	850.00	45.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	6.00	New
125	2100.00	45.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	9.00	New
126	1150.00	45.00	30.00	1.50	Per/Bit	No	Yes	B->A	N/A	10.00	New
127	500.00	45.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	6.00	New
129	500.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	6.00	New
131	900.00	45.00	35.00	1.50	Per/Bit	No	Yes	B->A	N/A	6.00	New
132	3900.00	45.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	12.00	New
134	775.00	45.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	6.00	New
135	775.00	45.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	6.00	New
136	1150.00	45.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	9.00	New
138	3000.00	45.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	13.00	New
139	500.00	50.00	20.00	1.50	Imp/Bit	No	No	N/A	0.00	13.00	New
140	350.00	45.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	9.00	New
141	650.00	45.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	8.00	New
142	300.00	45.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	6.00	New
143	440.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	6.00	New
144	1540.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	12.00	New
145	1850.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	6.00	New
148	650.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	9.00	New
149	100.00	50.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	10.00	New
150	1850.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	12.00	New
151	4350.00	50.00	20.00	1.50	Per/Bit	No	No	N/A	0.00	30.00	New
152	2050.00	45.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	13.00	New

153	6400.00	45.00	20.00	1.50	Imp/Con	No	No	N/A	0.00	32.00	New
154	3350.00	45.00	20.00	1.50	Imp/Con	No	Yes	B->A	N/A	14.00	New
155	1550.00	45.00	20.00	1.50	Imp/Con	No	Yes	A->B	N/A	13.00	New
156	1750.00	50.00	30.00	1.50	Imp/Con	No	No	N/A	0.00	30.00	New
157	2150.00	50.00	30.00	1.50	Imp/Con	No	No	N/A	0.00	20.00	New
158	1750.00	50.00	35.00	1.50	Imp/Con	No	No	N/A	0.00	24.00	New
159	1700.00	50.00	35.00	1.50	Imp/Bit	No	No	N/A	0.00	24.00	New
160	1450.00	50.00	30.00	1.50	Imp/Con	No	No	N/A	0.00	24.00	New
161	2850.00	50.00	25.00	1.50	Imp/Bit	No	No	N/A	0.00	22.00	Unaltered
162	3100.00	50.00	15.00	1.50	Imp/Bit	No	No	N/A	0.00	25.00	New
163	3100.00	50.00	15.00	1.50	Imp/Bit	No	No	N/A	0.00	25.00	New
164	2750.00	50.00	25.00	1.50	Imp/Con	No	No	N/A	3.00	26.00	New
165	1150.00	50.00	20.00	1.50	Imp/Bit	No	No	N/A	3.00	24.00	New
166	3000.00	50.00	15.00	1.50	Imp/Bit	No	No	N/A	2.00	25.00	New
167	3850.00	50.00	20.00	1.50	Imp/Con	No	No	N/A	3.00	30.00	New
168	500.00	50.00	5.00	1.50	Imp/Bit	No	No	N/A	3.00	20.00	New
169	3000.00	50.00	15.00	1.50	Imp/Bit	No	No	N/A	2.00	26.00	New
170	600.00	50.00	15.00	1.50	Imp/Bit	No	Yes	A->B	N/A	7.00	New
171	2000.00	50.00	15.00	1.50	Per/Bit	No	No	N/A	0.00	26.00	New
172	400.00	50.00	15.00	1.50	Imp/Bit	No	Yes	B->A	N/A	7.00	New
173	3000.00	50.00	15.00	1.50	Per/Bit	No	No	N/A	2.00	27.00	New
174	3550.00	70.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	24.00	New
176	2850.00	50.00	10.00	1.50	Imp/Bit	Yes	Yes	A->B	N/A	8.00	Unaltered
177	2850.00	50.00	10.00	1.50	Imp/Bit	Yes	Yes	B->A	N/A	8.00	Unaltered
178	2850.00	50.00	10.00	1.50	Imp/Bit	Yes	Yes	B->A	N/A	8.00	Unaltered
180	2750.00	50.00	25.00	1.50	Imp/Bit	No	No	N/A	3.00	26.00	Unaltered
230	900.00	45.00	20.00	1.50	Per/Bit	Yes	Yes	B->A	N/A	6.00	New
181	1450.00	50.00	25.00	1.50	Imp/Bit	No	No	N/A	0.00	24.00	Unaltered
183	1300.00	50.00	20.00	1.50	Imp/Bit	No	Yes	B->A	N/A	18.00	Unaltered
233	90.00	45.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	12.00	New
184	1200.00	50.00	20.00	1.50	Imp/Bit	No	Yes	A->B	N/A	20.00	Unaltered
188	6100.00	50.00	20.00	1.50	Per/Bit	No	No	N/A	0.00	50.00	New
204	2550.00	45.00	20.00	1.50	Per/Bit	Yes	Yes	A->B	N/A	12.00	New
206	500.00	45.00	20.00	1.50	Per/Bit	Yes	Yes	A->B	N/A	6.00	New
208	1700.00	45.00	20.00	1.50	Per/Bit	Yes	Yes	A->B	N/A	12.00	New
221	1500.00	45.00	20.00	1.50	Per/Bit	Yes	Yes	B->A	N/A	8.00	New
222	2050.00	45.00	20.00	1.50	Per/Bit	Yes	Yes	B->A	N/A	9.00	New
226	1150.00	45.00	30.00	1.50	Per/Bit	Yes	Yes	B->A	N/A	10.00	New
246	450.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	6.00	New
237	1350.00	45.00	20.00	1.50	Per/Bit	Yes	Yes	B->A	N/A	9.00	New
227	500.00	45.00	20.00	1.50	Per/Bit	Yes	Yes	B->A	N/A	6.00	New
239	800.00	45.00	20.00	1.50	Per/Bit	Yes	Yes	B->A	N/A	6.00	New
247	1450.00	45.00	20.00	1.50	Per/Bit	Yes	Yes	A->B	N/A	10.00	New
230	500.00	50.00	20.00	1.50	Imp/Bit	No	Yes	A->B	N/A	6.00	New
233	500.00	50.00	20.00	1.50	Imp/Bit	Yes	Yes	A->B	N/A	12.00	New
237	500.00	50.00	20.00	1.50	Imp/Bit	Yes	Yes	A->B	N/A	9.00	New
238	500.00	50.00	20.00	1.50	Imp/Bit	Yes	Yes	A->B	N/A	13.00	New
239	500.00	50.00	20.00	1.50	Imp/Bit	Yes	Yes	A->B	N/A	6.00	New
241	500.00	50.00	20.00	1.50	Imp/Bit	Yes	Yes	A->B	N/A	8.00	New
243	1850.00	45.00	20.00	1.50	Per/Bit	Yes	Yes	A->B	N/A	6.00	New
245	1850.00	45.00	20.00	1.50	Per/Bit	Yes	Yes	A->B	N/A	6.00	New
246	1850.00	50.00	20.00	1.50	Imp/Bit	Yes	Yes	A->B	N/A	6.00	New
247	1850.00	50.00	20.00	1.50	Imp/Bit	Yes	Yes	A->B	N/A	10.00	New
248	1850.00	45.00	20.00	1.50	Per/Bit	Yes	Yes	A->B	N/A	9.00	New

Number of Text Strings = 0

WEST KOWLOON RECLAMATION NORTHERN SECTION
TRAFFIC DATA FOR PREVAILING NOISE LEVELS

HFA Road Noise description of data file West Kowloon Reclamation Northern Section

Number of Road Layout Definitions = 117

Layout	Flow	Speed	%Heavy	Texture Depth	Surface Type	Elevated	OneWay	A->B	Central Reserve	Road Width	Category
12	516.00	50.00	49.00	1.50	Imp/Bit	No	No	N/A	3.00	27.00	Unaltered
17	2150.00	50.00	45.00	1.50	Imp/Con	No	No	N/A	2.00	23.00	Unaltered
18	280.00	50.00	21.00	1.50	Imp/Con	No	No	N/A	0.00	22.00	Unaltered
19	140.00	50.00	21.00	1.50	Imp/Con	No	Yes	A->B	N/A	8.00	Unaltered
20	140.00	50.00	21.00	1.50	Imp/Con	No	Yes	B->A	N/A	8.00	Unaltered
90	3963.00	50.00	26.00	1.50	Per/Bit	Yes	No	N/A	0.00	22.00	Unaltered
91	4107.00	50.00	25.00	1.50	Per/Bit	Yes	No	N/A	0.00	28.00	Unaltered
92	2053.00	50.00	25.00	1.50	Per/Bit	Yes	Yes	A->B	N/A	18.00	Unaltered
93	0.00	50.00	0.00	1.50	Imp/Bit	Yes	Yes	A->B	N/A	12.00	Unaltered
312	516.00	50.00	49.00	1.50	Imp/Bit	No	No	N/A	3.00	27.00	Unaltered

Number of Text Strings = 0

WEST KOWLOON RECLAMATION NORTHERN SECTION
TRAFFIC DATA FOR 2011 CONDITION

HFA Road Noise description of data file West Kowloon Reclamation Northern Section

Number of Road Layout Definitions = 117

Layout	Flow	Speed	%Heavy	Texture Depth	Surface Type	Elevated	OneWay	A->B	Central Reserve	Road Width	Category
1	4300.00	70.00	25.00	1.50	Per/Bit	Yes	Yes	A->B	N/A	16.00	New
2	4350.00	70.00	25.00	1.50	Per/Bit	Yes	Yes	B->A	N/A	16.00	New
3	2700.00	50.00	30.00	1.50	Imp/Con	No	No	N/A	3.00	27.00	New
4	3050.00	50.00	30.00	1.50	Imp/Con	No	No	N/A	3.00	22.00	New
5	1500.00	50.00	20.00	1.50	Imp/Con	No	No	N/A	3.00	20.00	New
6	1200.00	50.00	20.00	1.50	Imp/Con	No	No	N/A	3.00	24.00	New
7	1200.00	50.00	20.00	1.50	Imp/Con	No	No	N/A	2.00	16.00	New
8	2400.00	50.00	20.00	1.50	Imp/Bit	No	No	N/A	2.00	16.00	New
9	500.00	50.00	15.00	1.50	Imp/Con	No	Yes	B->A	N/A	10.00	New
10	1150.00	50.00	25.00	1.50	Imp/Bit	No	No	N/A	2.00	16.00	New
11	1950.00	50.00	25.00	1.50	Imp/Con	No	No	N/A	2.00	16.00	New
12	2150.00	50.00	30.00	1.50	Imp/Bit	No	No	N/A	3.00	27.00	New
13	1250.00	50.00	30.00	1.50	Imp/Bit	No	No	N/A	3.00	24.00	New
14	100.00	50.00	20.00	1.50	Imp/Con	No	Yes	B->A	N/A	10.00	New
15	100.00	50.00	20.00	1.50	Imp/Con	No	Yes	A->B	N/A	10.00	New
16	2700.00	50.00	30.00	1.50	Imp/Con	No	No	N/A	2.00	21.00	Unaltered
17	2150.00	50.00	30.00	1.50	Imp/Con	No	No	N/A	2.00	23.00	Unaltered
18	2550.00	50.00	40.00	1.50	Imp/Con	No	No	N/A	0.00	22.00	Unaltered
19	1125.00	50.00	40.00	1.50	Imp/Con	No	Yes	A->B	N/A	8.00	Unaltered
20	1125.00	50.00	40.00	1.50	Imp/Con	No	Yes	B->A	N/A	8.00	Unaltered
21	400.00	50.00	20.00	1.50	Imp/Con	No	Yes	B->A	N/A	15.00	New
22	850.00	50.00	15.00	1.50	Imp/Con	No	Yes	A->B	N/A	10.00	New
23	1750.00	50.00	15.00	1.50	Imp/Con	No	Yes	B->A	N/A	10.00	New
24	100.00	50.00	20.00	1.50	Imp/Con	No	Yes	A->B	N/A	16.00	New
25	1100.00	50.00	25.00	1.50	Imp/Con	No	Yes	A->B	N/A	18.00	New
94	4300.00	70.00	25.00	1.50	Per/Bit	Yes	Yes	A->B	N/A	16.00	New
26	100.00	50.00	20.00	1.50	Imp/Con	No	Yes	A->B	N/A	12.00	New
27	1750.00	50.00	15.00	1.50	Imp/Con	No	Yes	B->A	N/A	8.00	New
28	1500.00	50.00	20.00	1.50	Imp/Con	No	Yes	B->A	N/A	7.00	New
29	250.00	50.00	15.00	1.50	Imp/Con	No	Yes	A->B	N/A	12.00	New
30	1150.00	50.00	20.00	1.50	Imp/Bit	No	No	N/A	0.00	15.00	New
31	1050.00	45.00	35.00	1.50	Per/Bit	No	Yes	A->B	N/A	10.00	New
32	1000.00	45.00	35.00	1.50	Per/Bit	No	Yes	A->B	N/A	10.00	New
33	1700.00	45.00	35.00	1.50	Per/Bit	No	Yes	A->B	N/A	11.00	New
34	950.00	45.00	35.00	1.50	Per/Bit	No	Yes	B->A	N/A	11.00	New
35	650.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	6.00	New
36	50.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	6.00	New
37	50.00	45.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	6.00	New
38	1700.00	45.00	35.00	1.50	Per/Bit	No	Yes	A->B	N/A	12.00	New
39	950.00	45.00	35.00	1.50	Per/Bit	No	Yes	B->A	N/A	12.00	New
40	150.00	50.00	35.00	1.50	Per/Bit	No	Yes	B->A	N/A	6.00	New
41	650.00	45.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	7.00	New
42	1950.00	50.00	35.00	1.50	Per/Bit	No	Yes	A->B	N/A	10.00	New
43	50.00	50.00	35.00	1.50	Per/Bit	No	Yes	A->B	N/A	15.00	New
44	2560.00	50.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	10.00	New
45	2560.00	50.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	11.00	New
46	1650.00	50.00	35.00	1.50	Per/Bit	No	Yes	B->A	N/A	7.00	New
47	1850.00	50.00	35.00	1.50	Per/Bit	No	Yes	B->A	N/A	7.00	New

48	1100.00	50.00	35.00	1.50	Per/Bit	No	Yes	B->A	N/A	7.00	New
49	2850.00	50.00	35.00	1.50	Per/Bit	No	Yes	B->A	N/A	11.00	New
50	1150.00	20.00	0.00	1.50	Imp/Bit	No	No	N/A	2.00	16.00	New
51	2200.00	50.00	30.00	1.50	Imp/Bit	No	No	N/A	2.00	16.00	New
52	800.00	45.00	20.00	1.50	Imp/Bit	No	Yes	A->B	N/A	8.00	New
53	1700.00	50.00	25.00	1.50	Per/Bit	No	Yes	A->B	N/A	12.00	New
54	800.00	45.00	20.00	1.50	Imp/Bit	Yes	Yes	B->A	N/A	10.00	New
55	1100.00	45.00	25.00	1.50	Imp/Bit	Yes	Yes	A->B	N/A	10.00	New
56	300.00	45.00	20.00	1.50	Imp/Bit	Yes	Yes	A->B	N/A	10.00	New
57	1100.00	45.00	20.00	1.50	Imp/Bit	Yes	Yes	A->B	N/A	10.00	New
58	850.00	45.00	25.00	1.50	Imp/Bit	Yes	Yes	A->B	N/A	10.00	New
59	300.00	45.00	20.00	1.50	Imp/Bit	Yes	Yes	A->B	N/A	10.00	New
60	1100.00	45.00	25.00	1.50	Imp/Bit	No	Yes	A->B	N/A	8.00	New
61	2750.00	50.00	25.00	1.50	Per/Bit	No	Yes	A->B	N/A	12.00	New
62	2100.00	50.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	8.00	New
63	850.00	45.00	25.00	1.50	Imp/Bit	No	Yes	B->A	N/A	8.00	New
64	1100.00	45.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	8.00	New
65	3150.00	50.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	10.00	New
66	1450.00	50.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	10.00	New
67	1500.00	50.00	30.00	1.50	Imp/Bit	No	No	N/A	1.00	18.00	New
68	1250.00	50.00	35.00	1.50	Imp/Bit	No	No	N/A	2.00	16.00	New
69	1850.00	50.00	35.00	1.50	Per/Bit	No	No	N/A	1.00	18.00	New
70	1450.00	50.00	20.00	1.50	Imp/Bit	No	No	N/A	1.00	18.00	New
71	1000.00	50.00	20.00	1.50	Per/Bit	No	Yes	B->A	N/A	8.00	New
72	1450.00	50.00	20.00	1.50	Imp/Bit	Yes	No	N/A	2.00	16.00	New
73	1450.00	50.00	20.00	1.50	Imp/Bit	Yes	No	N/A	2.00	16.00	New
75	400.00	50.00	20.00	1.50	Imp/Con	No	Yes	B->A	N/A	8.00	New
76	2600.00	50.00	30.00	1.50	Per/Bit	No	No	N/A	1.00	18.00	New
77	2600.00	50.00	30.00	1.50	Per/Bit	No	No	N/A	1.00	18.00	New
78	2600.00	50.00	30.00	1.50	Imp/Bit	No	No	N/A	1.00	18.00	New
79	420.00	50.00	20.00	1.50	Per/Bit	No	Yes	A->B	N/A	8.00	New
80	300.00	50.00	30.00	1.50	Imp/Con	No	Yes	B->A	N/A	8.00	New
81	350.00	50.00	30.00	1.50	Imp/Bit	No	Yes	A->B	N/A	8.00	New
82	200.00	50.00	100.00	1.50	Imp/Bit	No	No	N/A	0.00	8.00	New
83	900.00	50.00	10.00	1.50	Imp/Bit	No	No	N/A	0.00	8.00	New
84	3100.00	50.00	15.00	1.50	Imp/Bit	No	No	N/A	0.00	20.00	New
85	1100.00	50.00	20.00	1.50	Imp/Bit	No	No	N/A	2.00	14.00	New
86	1100.00	50.00	20.00	1.50	Imp/Con	No	No	N/A	0.00	10.00	New
87	1100.00	50.00	20.00	1.50	Imp/Con	No	Yes	A->B	N/A	7.00	New
88	1100.00	50.00	20.00	1.50	Imp/Con	No	No	N/A	0.00	14.00	New
89	300.00	50.00	25.00	1.50	Imp/Con	No	No	N/A	0.00	12.00	New
90	4250.00	50.00	25.00	1.50	Per/Bit	Yes	No	N/A	0.00	22.00	Unaltered
91	6800.00	50.00	25.00	1.50	Per/Bit	Yes	No	N/A	0.00	28.00	Unaltered
92	3400.00	50.00	25.00	1.50	Per/Bit	Yes	Yes	A->B	N/A	18.00	Unaltered
93	3400.00	50.00	25.00	1.50	Imp/Bit	Yes	Yes	A->B	N/A	12.00	Unaltered
94	4300.00	70.00	25.00	1.50	Per/Bit	Yes	Yes	A->B	N/A	16.00	New
95	4300.00	70.00	25.00	1.50	Per/Bit	Yes	Yes	B->A	N/A	16.00	New

Number of Text Strings = 0

APPENDIX C

WEST KOWLOON RECLAMATION
FOCUSED EIA ON ROADWORKS
OPERATIONAL PHASE
COMMENTS AND RESPONSES

	Comments	Responses
(1)	**Yau Tsim Mongkok District Office (letter dated 1/11/94 ref. (58) in YTMDO/M2/22/791)** I wish to inform that I have no comments on the above report.	Noted.
(2)	**Transport Department, Port & Airport Development Branch (letter dated 3/11/94, ref. CT/PAD 182/18 XXII).** I have the following comments on the subject report.	
(a)	The use of full or semi-enclosures is not supported from the road safety and traffic operation viewpoints, and should only be considered when all other alternatives have been exhausted. The main disadvantages are :-	
(i)	The tunnel effect (even for semi-enclosures) results in sudden changes in light conditions and affect the drivers' eyesight;	Noted, please see Conclusions and Recommendations in Final Report
(ii)	Restriction on sightlines and visibility distances;	
(iii)	Restriction on the use of traffic aids;	
(iv)	Adverse effects on road maintenance and utility works;	
(v)	Restriction on future road widening; and	
(vi)	Visual, psychological and security implications, particularly on pedestrians.	

	Comments	Responses
(b)	The Consultants should illustrate how the enclosures would be integrated with the footbridges to be provided at the junctions of D2C/D6 and D2C/D7.	The preferred configuration and programme requirements for the footbridges have yet to be confirmed. Detailed integration of the two structures will require careful study and would be addressedin the detailed design.
(c)	The location and visibility of direction signs affected by the enclosures need to be addressed at an early stage.	Agreed, if enclosures are to implemented the detailed design would have to address this issue.
(d)	Has the air quality/ventilation requirement for semi-enclosures been checked ?	Air quality is not expected to be a problem since they are open on one side. See also comments from EPD, Strategic Assessment Group.
(e)	The support columns at the back of footpaths would also require protection from vehicle collision.	Noted, however, since pedestrians would be walking in the same area, it would be preferable to locate protective barriers at the back of the road kerb, thereby providing additional protection.
(f)	As shown in Fig. 3.9, footpaths would be narrowed down to about 3m. The Consultants should check whether this width is sufficient, particulary at bus stops.	In accordance with the TPDM a 3.5m wide footpath would be satisfactory for residential high density frontages and at bus stops which is achievable on the roads in question.
(g)	The Police and FSD should also be consulted.	Please see response to HyD.
(3)	**Environmental Protection Department (letter dated 4/11/94, ref. EP1/K20/43)**	
(a)	S4.08	
	Assumption of low noise surfacing on the tunnel approach to the Central Kowloon Route and on road P1 at the South of the Yau Ma Tei interchange is yet be accepted by HyD and PM/K before the predicted noise levels can be considered realistic.	We understand friction course has been recommended for this section of P1, and can be accommodated. This will therefore be assumed. We understand friction course may not be acceptable on the tunnel approach to the Cental Kowloon route, and standard wearing coarse will therefore be assumed.
(b)	Table 4.2	
	(i) Presumably, 'Nam Cheong Estate' should read 'Man Cheong Street'.	Noted, amended.

Comments		Responses
	(ii) The noise insulation criterion for C7 should be 77.4/73/6 dB(A) instead of 77.3/73.6 dB(A) with reference to the prevailing traffic noise levels.	Noted, these figures should read 77.4/73.0 and will be amended.
(c)	Table 4.3	
	(i) It is difficult to see why some predicted noise levels with Mitigation 5 are higher than the corresponding figures with Mitigation 4, given that Mitigation 5 is more extensive than Mitigation 4. Please review the calculation and clarify.	Para. 4.28 refers, and describes how for mitigation 5, different road segmentation was used, beyond CRTN requirements. As agreed it is not considered necessary to modify the modelling for mitigation 1 - 4 since they are not recommended as effective.
	(ii) In the light that LNRS has in fact been applied on WKC, please also review the prevailing noise levels, noise contribution from existing roads at year 2011, and the noise insulation criteria in addition to the predicted total noise levels [ref. (f)].	Noted, the noise insulation criteria for NSR's will reduce. The Final Report will be revised accordingly.
(d)	Table 4.6	
	It is difficult to visualise the location and the extent of noise mitigation measures by making cross reference to the road segment numbers. Whilst ERM has provided some figures [ref. (c)] showing the noise mitigation measures, the figures are not comprehensive since the following measures are not included :	
	(i) earth bund in M4 and enclosures in M6 for Nam Cheong Estate; (ii) enclosures in M5 & M6 for Man Cheong Estate.	} The figures in ref. C will be revised to include a figure for each of the two Option 5 mitigation measures in the Final Report.
	Please supplement the outstanding information and also advise the revised length of semi-enclosure on D6 [ref. (f)].	

Comments		Responses
(e)	Table 6.1 This table should be commented by the relevant works departments.	 Noted.
(f)	S7.04	
	(i) According to Table 4.4, Mitigation 6 is the most effective package but is still insufficient to bring the noise levels down at all NRSs down to the noise insulation criteria, not to mention the noise impact assessment criterion. However, Mitigation 6 which includes enclosures covering roads as well as junctions is not considered practicable.	Noted, as reported.
	(ii) Judging from the predicted noise levels for Mitigation 5 in Table 4 LNSR + enclosure on D1 should be sufficient to protect the west facing facades (represented by C4) which are not affected by traffic noise from the existing roads. As such, enclosure on road (excluding junction) and LNRS are considered to be the best practicable. It is inappropriate to conclude that no direct mitigation measures are available for the west facing facades and the above measures should be further examined.	The Consultants had been targeting a mitigation package for the whole estate. However, modelling has shown that this is indeed the case, and mitigation 5 will be amended to demonstrate this in the Final Report. The recommendations will however, remain as indirect mitigation on the west facade (C4) for reasons given elsewhere in the report.

Comments		Responses
(iii)	As can be seen from column 'Mitigation 5' in Table 4.4, enclosures on roads D10 & D11 (excluding junctions) are insufficient to bring the noise levels at all NSRs at the north facing and south facing facades, which are affected by traffic noise from the existing roads, down to the noise insulation criteria. I would therefore have no objection to noise insulation for protection of these facades. However, I would like to remind tall relevant parties that ExCo's approval must be obtained for any provision of noise insulation. Having said that, I still support LNRS on these roads since they would affect the adjacent planned residential developments in addition to the existing NSRs at Man Cheong Street.	Noted. LNRS will be recommended on these roads, to help mitigate the insulated dwellings, in case the residents choose to open the windows. The benefit to planned residential development is noted, but is outside the scope of this study.

Comments			Responses
(g)	S7.05		
	(i)	My above comment (f)(i) also applies.	Noted, report amended.
	(ii)	No definite recommendation for Nam Cheong Estate has been provided. Supplement is required.	Noted, insulation will be recommended, as explained in the SMG meeting no. 3. See also supplementary text in Final Report.
	(iii)	Taking into account my above comment (c)(ii). Mitigation 5 can reduce the noise impact at all representative NSRs except A1 & A5 (top floor) to the noise impact assessment criterion [ref. (f)]. At A1 (top floor) & A5 (top floor), the mitigated levels are not far away from the noise insulation criteria. Extension of the semi-enclosures on D6 and D7 to cover greater portions of the far side carriageways should be considered with a view to avoiding provision of noise insulation/to maintain an open window environment.	Mitigation 5 has been adjusted to consider a full solution. It transpires that in view of the reduction in the noise insulation criterion levels (your comment c(ii) applies) 100% compliance can be achieved by semi-enclosures and this revised mitigation 5 package will be reported in the Final Report.
	(iv)	The recommended semi-enclosures D6 & D7 should be absorptive on the sides facing th roads to minimise reflection of noise as there are planned noise sensitive developments on the other sides of the roads.	This will be noted in the Final Report, and it will be recommended that the detailed design of the semi-enclosures should consider this point and noise levels for pedestrians inside the semi enclosures.
Comments on ERM's facsimile ref. C1265 WKR Focused EIA dated 31st October 1994			
(a)		I learnt from ERM that these two tables have been worked out for the unmitigated scenarios. Please clearly specify this point in the report.	Noted, report amended.
(b)		Further to ref. (f), please revise Table 4.5.	Noted, report amended.

Comments	Responses
As can be seen from my comments on the attached sheets, there is a lot of outstanding works yet to be carried out in the assessment. In particular, there is no definite recommendation of mitigation measures for Nam Cheong Estate. Furthermore, I do not consider that the recommended mitigation measure for Man Cheong Street is the best practical. I would not be in a position to endorse the report till all the above issues have been cleared.	See comments above.
(4) Kowloon Development Office, West Kowloon Reclamation Project Division, Territory Development Department (letter dated 3/11/94, ref. (33) in UAK2/4/15 Pt. 11) I refer to your above letter dated 28th October 1994 and would like to offer the following comments with regard to the Draft Final Report for the EIA - Operational Phase : (i) Para. 2.10 Traffic flows in Appendix B used in modelling the prevailing noise level is year 2011. However, para. 2.08 states that the current traffic condition on existing road are responsible for the 'Prevailing Noise Level'. Please clarify.	As stated in para 2.08 survey data from 1993/94 has been used to determine the "Prevailing Noise Levels" Para. 2.10 will be amended accordingly.
(ii) Para. 3.13 Enclosures apart from being visually intrusive, expensive to construct the maintain and limiting the available footpath area for utilities could also create security and psychological problems, which should be reflected in the report.	Please see amendments in Final Report.
(iii) Figure 3.6 The foundation is shown to intrude into the boundary line which land encroachment should not be assumed	Detailed design of the wall would address this point but would not alter the findings.

Comments		Responses
(iv)	Para. 4.03 The 4th sentence should simply reflect on the NSRs agreed at the commencement of the study. The reference to 'limited time available' is unnecessary and should be deleted.	 Reference deleted in Final Report.
(v)	Para. 4.10 The section of Road D6 adjacent to Nam Cheong Estate is, in fact, part of the present Yen Chow Street. Is this considered as an existing road in the study ?	 Road D6 is assumed to be a new road since it will be modified in part and connected to road D2 in the future.
(vi)	Para. 4.18 Table 4.5 does not give the noise contributions from different roads in the Northern Area. This information does not appear to be included in the report. Please advise on the noise impact of the new local roads to be built under this project on the NSR's at Nam Cheong Estate.	 Please see additional table in the Final Report.
(vii)	Figures No. 4.4 - 4.9 The road link no. in the figures cannot be read.	 Figures No. 4.4 - 4.9 have been amended in the Final Report.
(5)	**Highways (Kowloon) Region, Highways Department (letter dated 3/11/94, ref. KH4/4/23 IX)** My comments on the Draft Final Report are as follows :-	
(1)	Table 2.4, design speed should be included in the table for reference.	Noted, table amended
(2)	para. 3.03, what measures will be taken if the material used in this project is found unacceptable when the trial is completed ?	As stated in para. 3.03, its use as a potential mitigation measure is still considered appropriate for this study.

	Comments	Responses
(3)	Para. 3.11, para. 3.13 and para. 7.05, has the proposal been approved by D of FS ?	Consideration of enclosures has addressed the relevant codes and fire fighting requirements. Final approval would be sought if enclosures are to be provided.
(4)	Fig. 3.4 and Fig. 3.5 :	
	(a) Calculations should be submitted to this Region to justify stability of the proposed structure is adequate.	This information would be submitted on detailed design. At this stage the study only requires preliminary design details.
	(b) Allowance should be made to have sufficient depth for footway pavement slab, drainage channel, manholes etc. to be placed on top of the footing.	Noted.
	(c) Allowance should also be made for utilities to pass through the footing i.e. from footway to carriageway.	Noted.
	(d) Gully cleansing would be difficult. Agreement from DUS should be sought.	Agreement would be sought when proceeding with the detailed design although this aspect is not considered insurmountable.
(5)	Fig. 3.6, wall footing should not be placed within private lot and lot owners should be consulted and informed of the proposed barrier which may affect their frontage.	Please see response to Kowloon Development Office, TDD.
(6)	Fig. 3.9 and Fig. 3.10, drainage details should also be considered in the foundation detailing. Allowance should be made for utilities to pass through foundation.	Noted.
(7)	Para. 7.05, estimated annual maintenance cost should be included for reference.	Estimated recurrent expenditure is provided in the Final Report.

Comments	Responses
(6) Director of Housing (letter dated 3/11/94, ref. HD(D)7/3/KN20 IV) My comments are as follows :-	
(i) Table 2.2 At the beginning of 1994, the population in the proposed public housing estates in WKR was programmed as the following. Please amend the table. **Estate** — **Population** Public Rental (North) 14000 persons (South) 10930 Home Ownership (South) 7180 **Total 32110 Persons**	The change in populations are noted, however, these changes would not alter the conclusions.
(ii) Table 4.2 Please clarify whether the NSRs in this table refer to those in Man Cheong Street.	Noted. 'Nam' will be corrected to 'Man'.
(iii) Para. 7.05 HD could accept the effective at source noise mitigation measure and would not be in favour of providing noise insulation and air conditioners to rental public housing for financial and social reasons. While giving rough cost comparison between the noise mitigation measure package M5 and providing noise insulation and air conditioners for dwellings, a total cost including all installation, maintenance and recurrent costs for life expectancy of the dwellings should be explicitly stated. It is important to bear in mind that the energy cost and the recurrent cost would be the major burden for such provision, but not the initial installation cost.	Noted. As stated in the Report, it is recommended that a further detailed study be carried out to determine these costs.

Comments	Responses
(7) **Government Secretariat, New Airport, Project Co-ordination Office (refer dated 2/11/94 ref. NAP/T3/7/13(2)** We refer to your draft final report on the captioned EIA and would comment as follows :-	
1. At Nam Cheong Estate, a combination of low noise road surfaces and three semi-enclosures are proposed with the implications of costs, maintenance and the visual intrusion disregarded. NAPCO firmly believe that these factors must be taken into account to arrive at a pragmatic solution and these semi-enclosures can in no way be considered practical on these distributor roads.	Noted.
2. We therefore consider that indirect mitigation measures using secondary glazing and air conditioning should be recommended.	Noted. Please see recommendations in Final Report.

	Comments	Responses
(8)	**Strategic Assessment Group (SAG), Environmental Protection Department (facsimile dated 2/11/94 ref. EPH/K20/43)**	
(1)	I refer to Mott MacDonald's letter dated 28/10/94 with the captioned Draft Final Report. It's noted that there would be a number of noise barriers and semi-enclosures proposed as a result of the noise impact assessment. Though the noise barriers or the semi-enclosures would unlikely cause increase in air pollutant levels at the predicted sensitive receivers, it might increase the levels on the opposite side of the barriers or the semi-enclosures due to the reflection at the barriers and the semi-enclosure. As a result, it might constrain the future developments in the WKR areas. Would the Consultant please clarify.	Noted, the erection of semi-enclosures may imply a small increase in set back requirements in adjacent planned sites due to air quality impacts. The effects would however, be small, and are beyond the scope of this study. They should be considered in the forthcoming comprehensive study for the WKR.
(2)	The Consultant is also required to confirm that there would not be total enclosures for the roads. Otherwise, the EIA should also assess the ventilation issue inside the total enclosures and as well as the air quality impacts at the ends of the total enclosures.	Confirmed

WEST KOWLOON RECLAMATION
FOCUSED EIA ON ROADWORKS
CONSTRUCTION PHASE
COMMENTS AND RESPONSES

Comments		Responses
1.	**Environmental Protection Department, Noise Policy Group (as tabled at SMG meeting no. 3 on 12/11/94)**	
(A)	**S2.04**	
	It is noted that no construction of road enclosures for mitigation of operational noise has been included in the activities. The Consultants are required to indicate whether the conclusion will change if construction of road enclosures is taken into consideration in the captioned report.	The conclusion would be unlikely to change, but it should be noted the road enclosures are not recommended in this study.
(b)	**S3.06**	
	2nd sentence : The south west building facades of Nam Cheong Estate, west facades of residential buildings along Man Cheong Street should have an ASR of 'B' rather than 'C'.	Noted, amended.
(c)	**Tables 3.6 on P.14**	
	Presumably, this table should be Table 3.6.	Noted, amended.
(d)	**Tables 3.8 & 3.9** .	
	It is noted that the assessed NSR at Wong Tai Street is B1 rather than B2 which is closest to Area 6. The predicted noise levels at Wong Tai Street thus do not reflect the worst scenario.	Noted, supplementary assessment and mitigation for B2 will be included in the Final Report.
(e)	**Tables 3.10 & 3.12**	
	Please refer to my above comment (d). I am sceptical about the effectiveness of 5m high noise barrier on site boundary of Area 6 for protection of B2.	Noted, a 5m barrier would not be effective, other mitigation measures will be included in the Final Report.

Comments		Responses
(f)	**S3.31**	
	To cover the whole periods of restricted hours in daytime or evening and the different ASRs for the affected NSRs, the 1st sentence should be amended to read 'If construction work is required in restricted hours in daytime or evening further mitigation will be required to reduce noise levels by additional 5 or 10 dB(A) as appropriate for the affected NSRs'.	Noted, amended.
	Pertaining to the different ASRs, the 2nd sentence should be amended to read '..... the L_{Asq} 70 or 65 dB(A) level would be achieved as appropriate for the affected NSRs'.	Noted, amended.
(2)	**Environmental Protection Department, Air Policy Group (facsimile dated 141/11/94 refer EP refers)**	
(i)	Would you please clarify why sensitive receptors S1, S5 and N4 are not included in the construction dust impact assessment.	The worst case receptors have been studied. Impacts at S1, S5 and N4 will be less than those assessed.
(ii)	Some typo errors in Section 4.6, "374 μgm^{-3}" should read "474 μgm^{-3}" and "1117 μgm^{-3}" should read "1278 μgm^{-3}".	Noted, amended.
(3)	**Transport Department, Port & Airport Development Branch (letter dated 12/11/94 ref. CT/PAD142/18 XXI)**	
(a)	**Para. 3.26 and Table 3.10** - Para. 3.26 stated that there should be no openings or gaps in the temporary noise barriers. This requirement would however be unachievable where frontage access to adjoining development is required, e.g. south of D6 for activity a4.	As discussed at SMG meeting No. 3 on 14th November 1994, openings may be provided but this should be by using 'solid' gates rather than an open chain link type.

	Comments	Responses
(b)	**Para. 4.17 and 5.5** - I cannot see how the speed of trucks can be limited to 10 kph, by an 'appropriate' clause in the contract specification or otherwise.	Enforcement of any stipulated speed restriction would be the responsibility of the site staff which has worked effectively in the past.
(4)	**Yau Tsim Mong Kok District Office (letter dated 14/11/94, ref. (3) in YTMO/M 2/22/791 II)** I have no comments on the draft final report.	 Noted.
(5)	**Highways Department, Highways (Kowloon) Region letter dated 14/11/94, ref. KH4/4/23** My comments on the captioned report are as follows :-	
(1)	Para. 3.26, it would be useful to give examples for material that has the required density. It would be very difficult, if not impossible, to keep the barriers without any opening.	A typical example would be 25mm thick hardwood. As discussed at SMG meeting No. 3 on 14/11/94, openings in the form of gates may be provided, but this should be by using 'solid' gates rather than open chain link type.
(2)	Tables 3.10 and 3.11, can the proposed barriers be shown in Figures 2.1 to 2.5 ?	The use and final locations of barriers will be dependent on the Contractors own proposals but it is expected that these will be within or at the boundary of the works site.
(3)	Will the temporary noise barrier have any effect on the construction of the permanent works ?	No significant effects are anticipated.