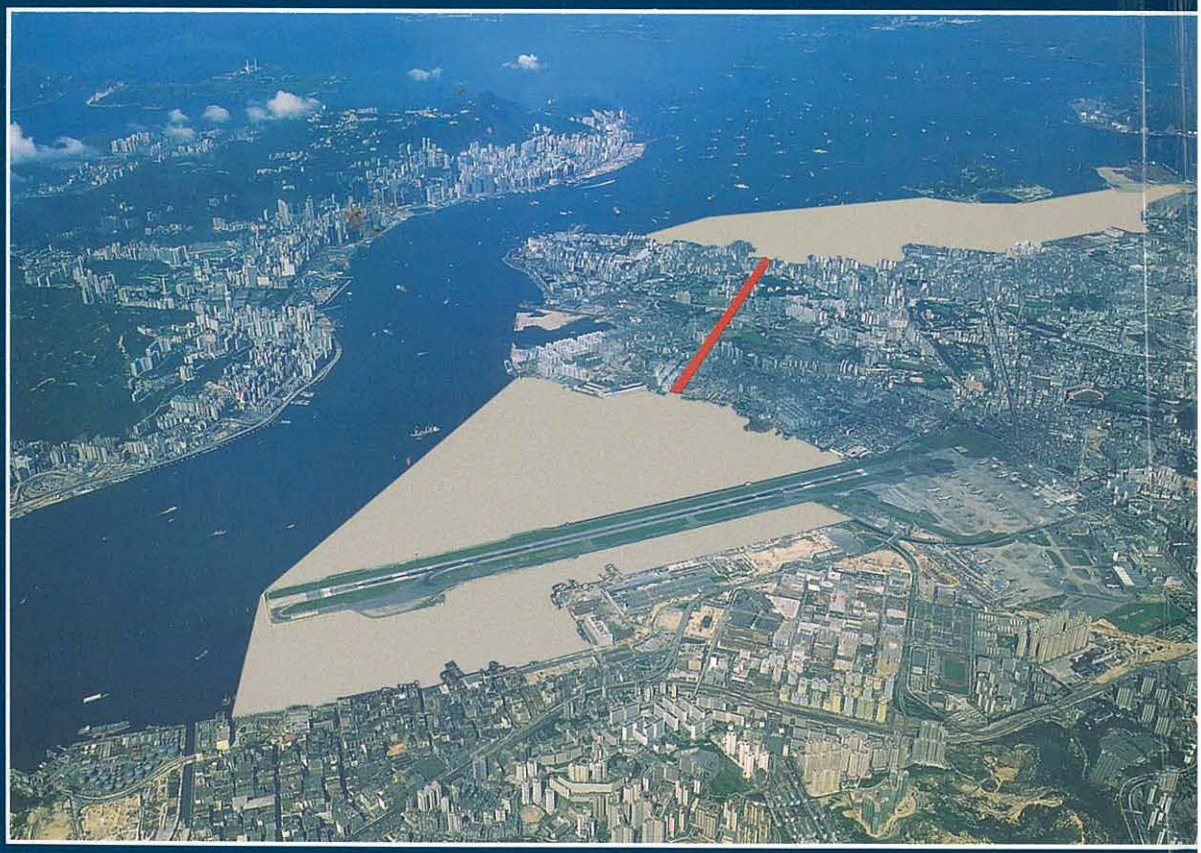
Highways Department - Western Harbour Link Office

Central Kowloon Route Study

Final Report

Volume 3

Planning, Environmental and Urban Landscape Assessment



May 1993

Parsons Brinckerhoff Maunsell Consultants

in association with

MVA Asia · Shankland Cox · CES (Asia) · Chesterton Petty

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Contents

FINAL REPORT

VOLUME 3

PLANNING, ENVIRONMENTAL AND URBAN LANDSCAPE ASSESSMENT

Contents

Page

Appendices

3. Urban Landscape Assessment

Figures

Introduction and Summary

INTRODUCTION AND SUMMARY

1. This volume of the Final Report contains the Planning Assessment (Chapter 1), Environmental Assessment (Chapter 2) and Urban Landscape Assessment (Chapter 3) for the proposed Central Kowloon Route. Volumes 1 & 2 of the Final Report contain the engineering feasibility and preliminary design report and drawing.

2. STRATEGIC DEMAND FOR THE CENTRAL KOWLOON ROUTE

Figures Nos. 001 & 002 show the proposed alignment for the Central Kowloon Route and its relationship with the future strategic road network.

The need to improve strategic east-west road links across Kowloon has been identified in several previous studies including the Central Kowloon Traffic Study, West Kowloon Reclamation Transportation Study and the West Kowloon Expressway Study. A broad corridor for a cross Kowloon route was identified in these studies.

During the course of this study it has become evident the Central Kowloon Route will be an integral part of planned redevelopments of lower grade urban areas on the Kowloon peninsula and will be vital for development of the proposed Kowloon Bay reclamation.

3. SUMMARY OF VOLUME 3

a. Planning Assessment

1) *Future Land Use*

a) The long-term negative effects of the CKR western approaches on land use will be minimal given that:

- the plan of the West Kowloon Reclamation has been amended to satisfactorily accommodate the route;
- the schools at Tung Kun Street will be retained;
- placing the route underground will allow redevelopment along the lines recommended in the West Kowloon Development Statement.

b) The underground route will avoid impacting the schools on Wylie Road, the Oi Man Estate and the Ko Shan Theatre.

c) The recommended route for the CKR through the eastern approaches will have limited land-use impact in the long term. Approaches to minimise construction impacts to Ko Shan Park will be incorporated into the detail design. Further, implementation of the CKR will provide positive stimulus to redevelopment in areas where the normal operation of the market has been frustrated to date.

2) *Physical Constraints*

Construction of the Housing Society's Six Streets Redevelopment on Tung Kun Street and of the building at 52 Wing Kwong Street are in progress at the time of issuance of this Report. Topographic surveys of the construction should be undertaken to establish these physical constraints more exactly.

3) *Outstanding Planning Issues*

Whilst the recommended route for the CKR has clearly satisfied planning objectives in both minimising land-use impacts and facilitating renewal, there remains a number of outstanding issues to be resolved prior to implementation. These issues include:

a) the means by which the CKR route can be protected;

b) agency involvement in the redevelopment schemes.

b. Environmental Assessment

1) *Noise*

a) The decision to route the CKR in tunnel for most of its length provides, by far, the most effective noise mitigation solution for minimising impacts to existing receivers.

b) The noise contribution from the CKR to residential zoned area of the West Kowloon reclamation (WKR) is potentially in exceedance of planning criteria although not over the whole area and only at higher floors. Before commencing detail design, a review of planned, or then existing, sensitive uses on the WKR should be undertaken to ascertain if noise mitigation (such as providing a pervious road surface) will be appropriate.

2) *Air Quality*

a) None of the identified permanent and non-permanent Air Sensitive Receptors in the existing land at west and east portals and mid-vent building are estimated to exceed the limit for Air Quality Objectives (AQOs).

b) The operational air quality impact at west portal reclamation area is estimated to be within the acceptable levels of AQOs.

c) Prior to commencing detail design, a review of the then existing and planned sensitive receptors should be undertaken. If necessary, the three vent stacks (west portal, Fat Kwong Street, and east portal) could be shifted or raised to improve the estimated air quality at the sensitive receptors.

3) *Water Quality*

A possible tunnel spoil disposal option would be to use the material to form a small reclamation in Kowloon Bay as an advance relcmation for the future Kowloon Bay reclamation. The reclamation would be approximately 3Ha. This disposal option will have considerable cost advantages. This option is still only conceptual, and it is not proposed to undertake a full water quality assessment at this stage. However, if it is

decided to form the reclamation with tunnel spoil, the water quality impacts should be reviewed.

c. **Urban Landscape Assessment**

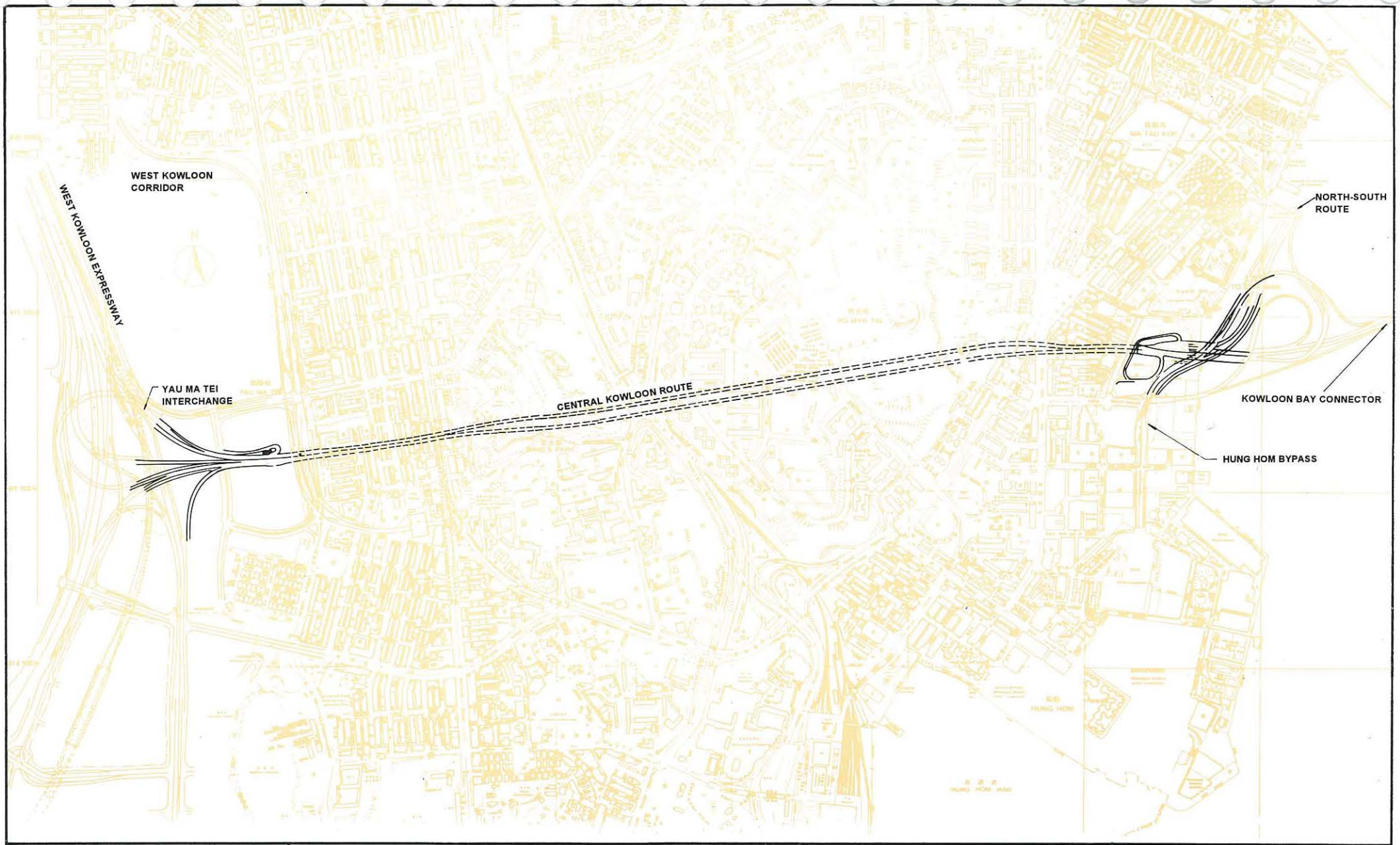
1) There would be significant visual impact on the residents and users of the neighbouring buildings and streets from the loss of building, the excavation and engineering works and the reconstruction of the buildings. This impact would be limited to the construction period and no significant long term impact is anticipated once reconstruction is completed.

2) In the section between Yau Ma Tei at Nathan Road and Ko Shan Park, the proposed route would be in twin driven tunnels and would have no effect on the townscape or visual impact of the areas above. The only structure in this area would be the vent building sited at Fat Kwong Street. The design of the proposed ventilation building is largely dependant on the nature of the future residential development in the area and the future playing fields, but would be designed as an architectural feature to integrate it into the surrounding building form. At a more detail stage, however, it would be important to consider the composition of the building elements and its appearance on the skyline.

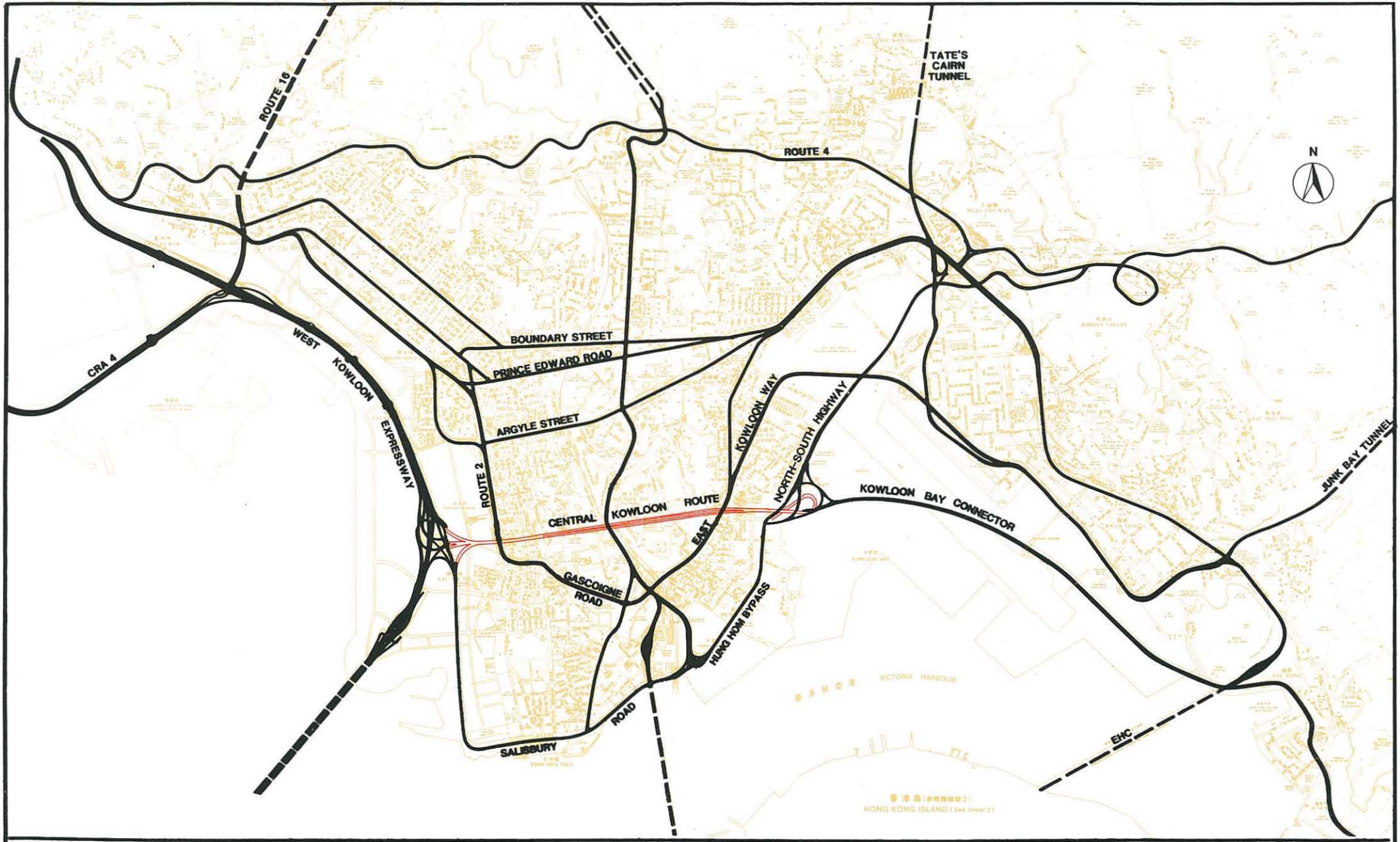
3) The Ko Shan Park space would be reconstructed in its present layout of footpaths, seating areas and planting beds, with the use of some semi-mature trees to increase the immediate impact of the replacement planting, to compensate for those that would be lost. There should be no long term visual impact in the park area.

4) There would be views from the existing buildings to the north and west of the area of the tunnel portal and toll plaza, although the portal and plaza would be set well down below ground levels and seen against a backdrop of the reclamation development. Dense tree and shrub planting is proposed in the areas immediately around the new roads and on the embankments of the roads leading to and from the tunnel, in order to screen future ground level views from the reclamation side, to break up the extent of the hard paved road space and to provide a suitable landscape setting for the road.

5) One of the CKR phasing options involves locating a temporary toll plaza to the north of the proposed route and would cut across the corner of the existing Hoi Sham Park, requiring a small landscape strip and ornamental wall to be removed. The temporary plaza would be in use for some four or five years. The works would not affect the facilities within the park, but would have a significant temporary visual impact on its users. It is proposed that the temporary plaza, if required, would be bounded by a decorative wall, which should effectively screen the whole of construction works.



Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study Key Plan	FIGURE NO 001	SCALE 0 50 100 200m DATE April 1993



Parsons Brinckerhoff Maunsell Consultants	**Central Kowloon Route Study** **Kowloon Road Network**	FIGURE NO **002**	SCALE 0 300 600m DATE April 1993

Planning Assessment 1

1. PLANNING ASSESSMENT

1.1 INTRODUCTION

1.1.1 The planning assessment complements other project workstreams in determining how best to integrate the CKR with existing and planned land use along its route. Following the qualitative assessment of alternative alignments at an early stage of the Study, it was clear that a combination of mined and cut-and-cover tunnel through the urban area would be far superior, on planning and other grounds, to elevated or ground-level alternatives. Having established that basic principle, the remainder of the Study has been concerned with refining the alignment of the CKR based in par on the following planning objectives:

a) minimise demolition, particularly of modern buildings, community facilities and building of historic or architectural interest;

b) minimise impact on existing and planned open space;

c) minimise blighting effect on redevelopment potential;

d) minimise impact on existing and planned land use including the Land Development Corporation Scheme K101;

e) minimise visual impact;

f) maximise opportunities for urban renewal.

1.1.2 We believe that the recommended route for the CKR fulfils these planning objectives and can both be satisfactorily integrated into the urban area and facilitate renewal along sections of its route.

1.1.3 Following this introduction, Paragraphs 1.2 and 1.3 review land use in the western and eastern approaches and identify planning constraints and opportunities. Redevelopment concepts are proposed to illustrate how the CKR could aid in restructuring land use in the Yau Ma Tei North and To Kwa Wan areas. Paragraph 1.4 concludes with some outstanding issues which will need to be addressed prior to implementation.

1.2 WESTERN APPROACHES

1.2.1 Land-use Review

1.2.1.1 Existing Land Use

a) Existing land use is illustrated on Figure No. 1.1 for a broad corridor containing the western approaches to the CKR. The majority of land use within this corridor is residential, typically under 12 storeys high with retail floorspace at ground level. The 1991 Census records a population of some 31,289 persons within the route corridor. There are concentrations of workshops within the residential area, particularly in Reclamation Street and the western end of Pitt Street. The area is also characterised by street markets, selling both wet and dry goods on Canton Road, the night market at Temple Street and traditional Chinese shops around Shanghai Street. Within the residential area, there are scattered open spaces and some community facilities of which there is a particular concentration to the south of the route corridor at Public Square Street. There are also a number of scattered commercial buildings

within the residential area, particularly to the north of Waterloo Road, although the majority of both office and retail uses occupy prime sites along Nathan Road. Employment within the corridor is estimated to be some 10,600 persons with the majority in office employment.

b) To the south of Waterloo Road, the area contains a number of G/IC facilities including a wholesale fruit market, cinema and cooked food stall adjacent to Waterloo Road. Immediately to the south of the wholesale fruit market are three primary schools at Tung Kun Street, namely: Tung Koon District Society Fong Shu Chuen School, Wanchai Church Kei To School, and Yau Ma Tei Catholic Primary School. The Housing Society's Six Streets Scheme lies to the south of the three primary schools, and Phase I of the scheme is now substantially complete.

c) To the east, Nathan Road is again dominated by high-rise residential and commercial buildings with G/IC facilities lying further east. The G/IC uses comprise the meteorological station in King's Park and a number of colleges including Wah Yan College, Lutheran College and Church, YMCA and True Light College. Immediately behind the commercial spine along Nathan Road, lies the Hong Kong Telecom telephone exchange and Salvation Army quarters.

d) There are a total of some 315 buildings within the broad route corridor of which 147 (46.7 per cent) buildings are under 7 storeys in height, 75 (23.8 percent) buildings are between 7 and 12 storeys in height and 93 (29.5 per cent) over 12 storeys. The height of buildings correlates well with age which shows a similar profile with over 51 per cent of buildings having been built before 1967. The area has a high proportion of inadequate living quarters, a high degree of sharing, an age structure heavily skewed toward the older age ranges, non-conforming uses in residential buildings and shortfalls in G/IC facilities and open space.

1.2.1.2 Planned Land Use

a) Planned land use is illustrated on Figure No. 1.2 and is derived from the uses shown on Outline Zoning Plan (OZP) S/K2/3, Metroplan, the West Kowloon Development Statement, the ODP for the West Kowloon Reclamation and future activities of the Land Development Corporation. The basic planning intention as illustrated on the OZP is to promote the Nathan Road corridor as a commercial spine, maintain existing residential and G/IC uses and relocate non-conforming uses, principally the wholesale fruit market at Waterloo Road.

b) The Metroplan Selected Strategy provides the land-use framework for the Metro Area to the year 2011. Although non-statutory, the guidelines and proposals contained in Metroplan are being translated into more detailed Development Statements, the findings of which will eventually be translated into departmental Outline Development Plans and statutory Outline Zoning Plans. Metroplan identifies much of the Study Area as being in need of major improvement, renewal or redevelopment and targets these areas for reduction of densities and restructuring of land use. Within these areas, Metroplan identifies high priority action areas, and these have recently been reassessed and redefined within the context of the West Kowloon Development Statement.

c) The Statement identifies eight action areas within the route corridor, five of which (Coms 08 - 12) are for commercial developments along Nathan Road and Waterloo Road intended to reduce population in the area and shield noise-sensitive receivers behind. PIAs 55 and 56 occupy similar sites to the Land Development Corporation's (LDC) Scheme K101 and are intended primarily for residential, G/IC and open space uses. PIA 57 falls directly along the recommended route of the CKR and is a comprehensive-scale residential scheme maximising benefits within the Study Area.

d) The Metroplan Guidelines for District Planning contain a number of sub-objectives for movement corridors, of which the two most relevant to the current case are:

1) to provide for attractive landscape treatment at key city gateways and alongside trunk roads and railways. In particular, promote green "parkways" along major movement corridors with mass tree planting and earth mounding;

2) to minimise the visual and environmental impact of new road corridors through intensive landscape buffering.

e) These objectives are reflected in the Metro Design Context which shows structural open space along the route of the CKR linking the West Kowloon Reclamation with King's Park and through to the Kowloon Bay Reclamation.

f) Construction of the West Kowloon Reclamation will represent a significant addition to the Study Area. Following the DPC meeting of 9th January 1992, the Outline Development Plan for the southern section of the West Kowloon Reclamation was amended to accommodate the preferred alignment of the CKR. Planned uses on the Reclamation adjacent to the CKR include an Indoor Recreation Centre, a multi-storey carpark and a general Government designation. The ODP indicates that the southern section of the reclamation will be completed by March 1997 with infrastructure programmed to meet demand for development.

g) There is a longstanding proposal to relocate the fruit market from its current site to the Western Kowloon Reclamation although the actual programming of the relocation has not yet been determined. The OZP shows the site zoned for G/IC uses and open space, and it was originally intended to be allocated to a secondary school and a divisional police station. It is understood, however, that the fruit market will form part of a LDC scheme together with the adjoining block on Reclamation Street and the area at Yunnan Lane designated CDA.

h) Discussions with the LDC have revealed that the development content and layout of the scheme will only be firmed up once the alignment of the CKR has been finalised. Conceptual designs produced initially for the scheme illustrate two options in response to assumed alternative alignments for the CKR. Both options show office and hotel uses at Yunnan Lane linked to an office and hotel development over Reclamation Street to the north of Waterloo Road. In one option, the fruit market site is redeveloped to residential use and, in the other option, the site is developed for ground level open space and G/IC facilities.

i) Both in general terms, therefore, and in respect to the programming and layout of the LDC scheme K101, the alignment of the CKR will clearly be an important factor in achieving renewal in the Yau Ma Tei area.

1.2.2 Planning Constraints and Opportunities

1.2.2.1 In the early stages of the Study, a comprehensive analysis of building plots was conducted to establish land use and building height, age and condition. The analysis is reproduced in Working Paper 2 Route Selection Constraints and Issues and was used as the basis for route selection on planning grounds. The initial assessment of route options for the western approaches in Discussion Paper "Qualitative Comparison of Western Attematives", November 1991, clearly favoured the recommended tunnel option. See Appendix 1.1 for a partial summary of the assessment.

1.2.2.2 Buildings have been categorised according to the degree of constraint they will impose on the routing of the CKR (see Table 1.1). Those buildings which are modern, tall and in good condition impose a high level of constraint, and buildings which are old, low and in poor condition impose less of a constraint. Of this basis, buildings have been grouped into three categories:

- Category 'A': low level of constraint;
- Category 'B': medium level of constraint;
- Category 'C': high level of constraint.

1.2.2.3 This basic categorisation has been amended to account for buildings which are low-rise, but which should nevertheless be regarded as constraints. Such buildings include schools and other community facilities, Buildings of Historic or Architectural Interest, telephone exchanges, electricity substations and the like. Such building constraints are listed in Table 1.1 and shown on Figure No. 1.3. The constraints plan also indicates those buildings which may be low-rise and in poor condition, but which have an extant planning permission, plots where construction is in progress, and those plots which are currently vacant, but have building consent. Other constraints include major planned and ongoing developments such as the Housing Society's Six Streets Scheme, the LDC's Scheme K101 and the West Kowloon Reclamation. Although theoretically a constraint, the ODP for the West Kowloon Reclamation has been amended to satisfactorily accommodate the CKR.

1.2.2.4 The recommended route will require demolition of four category C buildings on Nathan Road and three such buildings on Arthur Street. The route avoids demolition of the three primary schools at Tung Kun Street and avoids disruption to open space, utilities or historic buildings.

1.2.2.5 In a more general sense, the blighting effect of the route will be minimised given that it will pass in cut-and-cover tunnel through this section of the Study Area. Further on the positive side, it is likely that implementation of the CKR will stimulate renewal in Yau Ma Tei North along the lines recommended in Metroplan and the West Kowloon Development Statement (see Paragraph 1.2.3).

1.2.2.6 Since the original assessment was conducted, private sector redevelopment has been monitored in the area through the Monthly Statistics produced by Building and Lands Department. The Statistics reveal that a 24-storey commercial building on Temple Street has recently received its Occupation Permit. Similarly, permission to commence work has recently been given for another commercial site on Temple Street. Although neither of these buildings lie on the recommended route of the CKR, this type of activity nonetheless raises the issue of route protection.

Table 1.1 Western Approaches Planning Constraints

TPU	SB	Street	No.	Age	Height	Rank	Category	Condition	Building Use
220	26	Waterloo Rd	25	--	--	--	--	Fair	Hospital / Primary School
220	27	Nathan Rd	554 - 556 A	1972	14	10	C	Sound	Resident / Comm.
220	27	Nathan Rd	558 - 560	1987	21	12	C	Sound	Resident / Comm.
220	28	Nathan Rd	528	1974	13	10	C	Sound	Resident / Comm.
220	28	Nathan Rd	530	1969	17	10	C	Sound	Resident / Comm.
220	28	Nathan Rd	532-538	1973	22	10	C	Sound	Resident / Comm.
220	28	Tung Fong St	4	--	--	--	--	--	Vacant Site
220	28	Tung Fong St	6-8A	1979	24	12	C	Sound	Resident / GF: Comm.
220	28	Waterloo Rd	19	1981	13	12	C	Sound	Resident / GF: Comm.
220	28	Waterloo Rd	17	1975	14	10	C	Sound	Resident / GF: Comm.
220	29	Waterloo Rd	23D	1979	19	12	C	Sound	YMCA
225	4	Waterloo Rd	16-24A	1978	24	12	C	Sound	Resident / GF: Comm.
225	5	Portland St	1-5	--	--	--	--	--	Garden
225	5	Portland St	11-13	--	--	--	--	--	Vacant site
225	5	Yunnan Lane	6-8	--	--	--	--	--	Vacant site
225	6	Nathan Rd	503-507	1970	16	10	C	Sound	Resident / Comm.
225	6	Nathan Rd	509-511A	1967	15	10	C	Sound	Resident / Comm.
225	6	Nathan Rd	513	1972	12	10	C	Fair	Resident / Comm.
225	6	Nathan Rd	515-517	1982	22	12	C	Sound	Resident / Comm.
225	6	Nathan Rd	521-523	1967	14	10	C	Sound	Resident / Comm.
225	6	Portland St	10-16	1979	22	12	C	Sound	Resident / GF: Comm.
225	6	Portland St	18-26	1977	23	10	C	Sound	Resident / GF: Comm.
225	7	Tung Kun St	43	1970	6	5	A	Sound	School
225	7	Tung Kun St	45	1968	5	5	A	Sound	School
225	7	Tung Kun St	41	1968	8	8	B	Sound	School
225	8	Reclamation St	202-214A	1990	25	12	C	Sound	Resident / GF: Comm.
225	10	Shanghai St	317-325	--	--	--	--	--	Garden
225	11	Temple St	7-13	1982	22	12	C	Sound	Resident / GF: Comm.
225	12	Temple St	2-8	1981	12	11	C	Sound	Resident / GF: Comm.
225	13	Arthur St	7-10	1948	3	1	A	Poor	Vacant Building
225	13	Arthur St	46-58	1986	25	12	C	Sound	Resident / GF: Comm.
225	13	Man Ming Lane	4-6	1986	25	12	C	Sound	Resident / GF: Comm.
225	13	Nathan Rd	487-489	1967	15	10	C	Sound	Resident / Comm.
225	13	Nathan Rd	483-485A	1965	14	10	C	Fair	Resident / Comm.
225	13	Nathan Rd	473	1970	14	10	C	Sound	Hotel
225	14	Ching Ping St	24-34	1958	6	3	A	Poor	Vacant building
225	15	Cheung Shui St	41-55	1991	30	12	C	Sound	Resident
225	15	Lee Tat St	40-42	1991	30	12	C	Sound	Resident
225	15	Lee Tat St	44-46	1991	30	12	C	Sound	Resident
225	15	Lee Tat St	48-54	1991	30	12	C	Sound	Resident
225	16	Canton Rd	629-639	1991	30	12	C	Sound	Resident
225	16	Cheung Shui St	40-62	1991	30	12	C	Sound	Resident
225	16	Ching Ping St	2-12	1991	30	12	C	Sound	Resident
225	16	Public Square St	37-55	1991	30	12	C	Sound	Resident
225	17	Canton Rd	662-672	--	--	--	--	--	Public Square
225	17	Reclamation St	149-151	--	--	--	--	--	Vacant Site
225	17	Reclamation St	145-147	--	--	--	--	--	Vacant Site
225	17	Reclamation St	143	--	--	--	--	--	Vacant Site
225	17	Reclamation St	137-141	1987	24	12	C	Sound	Resident / GF: Comm.
225	18	Reclamation St	172-176	1976	9	11	C	Sound	Resident / GF: Comm.
225	18	Shanghai St	287-297	1978	23	10	C	Sound	Resident / GF: Comm.
225	19	Shanghai St	298-300	1988	7	11	C	Sound	Resident / GF: Comm.
225	19	Temple St	29-35	1986	24	12	C	Sound	Resident / GF: Comm.
225	20	Temple St	26-28	--	--	--	--	--	CIP
225	22	Shanghai St	276	--	--	--	--	--	CIP

Table 1.1 Western Approaches Planning Constraints (Cont'd)

TPU	SB	Street	No.	Age	Height	Rank	Category	Condition	Building Use
225	22	Shanghai St	270-274	--	--	--	--	--	CIP
225	22	Shanghai St	278-284	1982	23	12	C	Sound	Resident / GF: Comm.
225	22	Shanghai St	262-268	--	--	--	--	--	CIP
225	22	Temple St	45-57	1974	22	10	C	Sound	Resident / GF: Comm.
225	23	Temple St	36-40	1978	11	11	C	Sound	Resident / GF: Comm.
225	23	Temple St	46-54	1986	16	12	C	Sound	Resident / GF: Comm.
225	24	Arthur St		--	--	--	--	--	Playground
225	24	Nathan Rd	469-471	1977	21	10	C	Sound	Commercial
226	1	Waterloo Rd.	56	1952	4	3	A	Sound	Kowloon Wah Yan College
226	1	Waterloo Rd.	56	1955	1	3	A	Sound	Kowloon Wah Yan College
226	1	Waterloo Rd.	56	1968	4	5	A	Sound	Kowloon Wah Yan College
226	1	Waterloo Rd.	56	1990	4	11	C	Sound	Kowloon Wah Yan College
226	2	Nathan Rd	524B	1963	1	3	A	Sound	Electricity Sub-station
226	2	Nathan Rd	524A	1962	6	3	A	Sound	Telephone Exchange
226	2	Nathan Rd	474	1980	23	12	C	Sound	Resident / GF: Comm.
226	2	Nathan Rd	476-478	1987	18	12	C	Fair	Resident / GF: Comm.
226	2	Nathan Rd	480	1982	16	12	C	Sound	Resident / GF: Comm.
226	2	Nathan Rd	490-492	1976	23	10	C	Sound	Commercial
226	2	Nathan Rd	494-496	1974	24	10	C	Sound	Commercial
226	2	Nathan Rd	498-500	1974	23	10	C	Sound	Commercial
226	2	Nathan Rd	518-520	1978	23	10	C	Sound	Commercial
226	2	Nathan Rd	522	1983	23	10	C	Sound	Commercial
226	2	Waterloo Rd.	44	1972	10	8	B	Sound	Ambulance Depot
226	2	Waterloo Rd.	42	1971	10	8	B	Sound	Fire Station
226	3	Cliff Rd.	2	1965	6	3	A	Sound	Newman College
226	3	Cliff Rd.	4	1979	18	12	C	Sound	Caritas Bianchi Lodge
226	3	Kings Park Rise		P	--	--	--	--	Metreological Station
226	3	Kings Park Rise		--	--	--	--	--	Kings Park / Resevoir
226	3	Waterloo Rd	52	1964	7	4	A	Sound	Lutherian Middle School
226	3	Waterloo Rd	54	1967	5	5	A	Sound	Memorial Methodist Church
226	3	Waterloo Rd	54A	1974	6	5	A	Sound	True Light Girls College
226	3	Waterloo Rd	50	1963	3	3	A	Sound	Truth Luterian Church
226	3	Wing Sing Lane	11	1984	17	12	C	Sound	Salvation Army Headquarters
226	5	Cliff Rd	1	--	--	--	--	--	Vacant Building
226	5	Cliff Rd	3	--	--	--	--	--	Vacant Site
226	5	Nathan Rd	456A-454	1982	12	12	C	Sound	Resident / GF: Comm.
226	5	Nathan Rd	466-472	1978	22	12	C	Sound	Resident / GF: Comm.
226	5	Public Square St	80	1968	6	3	A	Fair	School
226	5	Public Square St	81	1982	12	12	C	Sound	Resident / GF: Comm.
228	25	Canton Rd	887-889	1985	22	12	C	Sound	Resident / GF: Comm.
228	25	Canton Rd	885-867	1978	24	12	C	Sound	Resident / GF: Comm.
228	25	Canton Rd	847-865	1984	22	12	C	Sound	Resident / Commercial
228	25	Canton Rd	835-845	1981	22	12	C	Sound	Resident / GF: Comm.
228	25	Dundas St	2-8	1983	26	12	C	Sound	Resident / GF: Comm.
228	25	Ferry St	220	1979	30	12	C	Sound	Resident / GF: Workshop
228	25	Ferry St	240	1979	30	12	C	Sound	Resident / GF: Workshop
228	25	Ferry St	252	1978	27	10	C	Sound	Resident / GF: Workshop
228	25	Lee Yip St	14-18	1972	23	10	C	Sound	Resident / GF: Workshop
228	25	Tung On St	33-41	--	--	--	--	--	Garden / Playground
228	25	Tung On St	1-13	--	--	--	--	--	CIP
228	25	Tung On St	2-4	1986	6	11	C	Sound	Resident / GF: Workshop
228	25	Tung On St	10-22	1990	25	12	C	Sound	Resident / GF: Comm.
228	25	Tung On St	40-48	1990	23	12	C	Sound	Resident / GF: Comm.
228	25	Tung On St	23 - 31	1990	24	12	C	Sound	Resident / GF: Comm.
228	25	Tung On St	17-21	1986	21	12	C	Sound	Resident / GF: Comm.

Table 1.1 Western Approaches Planning Constraints (Cont'd)

TPU	SB	Street	No.	Age	Height	Rank	Category	Condition	Building Use
228	31	Shanghai St	395-397	1984	22	12	C	Sound	Resident / GF: Comm.
228	31	Shanghai St	381-385	1987	22	12	C	Sound	Resident / GF: Comm.
228	32	Portland St	61-63	1983	15	12	C	Sound	Resident / GF: Comm.
228	33	Nathan Rd	557-559	1977	20	10	C	Sound	Resident / Comm.
228	33	Nathan Rd	547-555	1988	23	12	C	Sound	Resident / Comm.
228	34	Canton Rd	831A-831L	1972	23	10	C	Sound	Resident / GF: Comm.
228	34	Tak Cheong Lane	8-14	1990	25	12	C	Sound	Resident / GF: Comm.
228	34	Tak Cheong Lane	1-9	1978	24	10	C	Sound	Resident / GF: Workshop
228	34	Waterloo Rd	1M,N,P,R,S	1963	18	10	C	Fair	Resident / GF: Comm.
228	35	Canton Rd	800	--	--	--	--	--	CIP
228	35	Canton Rd	802-812	1983	24	12	C	Sound	Resident / GF: Workshop
228	35	Reclamation St	187A	--	--	--	--	--	CIP
228	35	Reclamation St	187	--	--	--	--	--	CIP
228	35	Reclamation St	189B-191A	1977	14	10	C	Sound	Resident / GF: Comm.
228	36	Reclamation St	234-236	1974	1	5	A	--	Electricity sub-station
228	37	Portland St	47-53	--	--	--	--	--	Garden
228	37	Portland St	39-41	1981	6	11	C	Sound	Resident / GF: Comm.
228	37	Shanghai St	362	1981	6	11	C	Sound	Resident / GF: Comm.
228	37	Shanghai St	372-378A	1971	13	10	C	Sound	Resident / GF: Comm.
228	38	Nathan Rd	525-543A	1970	21	10	C	Sound	Resident / Comm.
228	38	Portland St	62-66	1981	22	12	C	Sound	Resident / GF: Comm.

Recent Planning Applications

Location			Date	Status
TPU	SB	Street / No.		
225	13	Arthur St	5-6	Building Plans Approved
228	34	Pitt St	2-14	01/06/1990 Building Plans Approved
228	36	Shanghai St	377-379	01/05/1981 Building Plans Approved
228	37	Portland St	55-59	01/05/1990 Building Plans Approved
228	38	Portland St	68-70	01/11/1990 Building Plans Approved

This list of recent planning applications does not include sites where construction is already in progress or vacant sites.

Ranking:

Rank 1: pre 1956; 1 - 6 storeys
Rank 2: pre 1956; 7 - 12 storeys
Rank 3: 1956 - 1966: 1 - 6 storeys
Rank 4: 1956 - 1966: 7 - 12 storeys
Rank 5: 1967 - 1978: 1 - 6 storeys
Rank 6: pre 1956: 12 + storeys
Rank 7: 1956 - 1966: 12 + storeys
Rank 8: 1967 - 1978: 7 - 12 storeys
Rank 9: 1978 +; 1 - 6 storeys
Rank 10: 1967 - 1978: 12 + storeys
Rank 11: post 1978; 7 - 12 storeys
Rank 12: post 1978; 12 + storeys

These rankings are combined into three categories

Category A (Rank 1 - 6): low constraint
Category B (Rank 7 - 9): medium constraint
Category C (Rank 10 - 12): strong constraint

1.2.3 Redevelopment Concept

1.2.3.1 The decision to construct the CKR in a cut-and-cover tunnel through Yau Ma Tei largely removes the blighting effect of the route. In fact, the resumption and limited demolition required to construct the tunnel could actually facilitate restructuring providing rebuilding takes place to an appropriate plan. Beyond the immediate vicinity of the western approaches development area, the tunnel runs deep and will be constructed using mined-rock techniques. Throughout this portion of its length, there will be little or no disturbance to existing buildings or landuses, and there are not any development opportunities.

1.2.3.2 A redevelopment concept for the western approaches has been identified initially from the amalgamation of those sites which will have to be resumed to allow construction of the CKR. A number of site-assembly options have been identified and are illustrated on Figure 1.4. The options range from piecemeal sites either side of a reinstated Tung Kun Street (Option 1) to the assembly of more comprehensive sites with Tung Kun Street relocated slightly to the north of its current position (Option 2), to the complete removal of a section of Tung Kun Street (Option 3). This latter option provides the greatest potential site area and flexibility in design, and so has been adopted as the basis for the concept.

1.2.3.3 The concept draws upon Government's stated planning intention for the area in developing commercial uses around the Yau Ma Tei MTR station and the Nathan Road corridor. Comprehensive-scale residential schemes are proposed in keeping with the recommendations of the West Kowloon Development Statement and are connected with a 6-metre landscaped spine connecting the West Kowloon Reclamation with King's Park. Some 600 new flats will be provided as the result of the scheme together with 850 sq m of open space (550 sq m at ground level). The proposed redevelopment scheme could be used in part by the LDC for rehousing purposes to aid in the process of renewal in the Yau Ma Tei North area. It should be noted that more extensive schemes have been identified in the Study Area in the West Kowloon Development Statement and by the LDC. The redevelopment concept shown here confines itself to redevelopment over the CKR. The concept could be extended, however, to form part of more comprehensive schemes.

1.2.3.4 Tables 1.2 to 1.7 illustrate the development parameters for each of the six sites, A to F. The overall scheme is illustrated in both plan and section form on Figure No. 155 in Volume 2. Area A lies on the corner of Reclamation Street and Tung Kun Street and has been extended slightly to allow construction of a viable development on the site. Areas B,C and D lie progressively eastward along Tung Kun Street and are intended primarily for residential development. The schools at Tung Kun Street are retained and their long-term environment enhanced through amenity planting. Two further development sites are indicated either side of Nathan Road and are intended for commercial use acting to shield noise-sensitive uses behind and reduce residential population in the area in line with Metroplan. These sites open up the possibility of enhancing pedestrian linkages across Nathan Road, either through the Yau Ma Tei MTR station (see Volume 1, Paragraph 7.4.4) or as an elevated footbridge (See Figure No. 1.5).

1.2.3.5 Plot ratios for each of the development sites have been calculated using the current Building (Planning) Regulations assuming that the Airport Height Restrictions have been lifted. Whilst the plot ratios differ slightly from those put forward under the ambit of Metroplan, permissible floorspace will have to be reviewed in any case following the recommendations of the Review of Building Density and Height Restrictions in Kowloon and New Kowloon.

Table 1.2 Site A Development Parameters

Predominant use	**Residential**
Site class	B
Site area	160 m^2
Plot ratio	
• residential	7.4
• retail	1.0
• total	8.4
GFA	
• residential	1,184 m^2
• retail	160 m^2
• total	1,344 m^2
Site coverage	
• podium	100%
• tower	37.5%
Building height	
• podium	1 storey
• tower	20 storeys
• total	21 storeys

Description

The replacement building for the site on the corner of Reclamation Street and Tung Kun Road will have a twenty storey residential tower block set on a single level podium, for commercial and retail outlets. The shop facade of the podium will continue on from the line of the existing shop fronts along Reclamation Street, and so help to preserve the townscape quality of the streetscape, while the tower will relate to the scale and form of the adjacent Six Streets Housing Development.

Table 1.3 Site B Development Parameters

Predominant use	**Residential**
Site class	A
Site area	1,017 m^2
Plot ratio	
• residential	6.47
• retail	1.00
• total	7.47
GFA	
• residential	6,580 m^2
• retail	1,017 m^2
• total	7,597 m^2
Site coverage	
• podium	73%
• tower	33.33%
Building height	
• podium	2 storeys
• tower	20 storeys
• total	22 storeys

Description

The buildings either side of Hi Lung Lane within Site B will be replaced by a single two storey podium deck of commercial and retail development supporting three linked twenty storey residential towers. The facade of the podium base would link into the existing facades of the adjacent buildings on Reclamation and Shanghai Streets to maintain the twonscape character of the street space. The tower blocks would have a more open form than the existing buildings and will allow more light to reach street level. Along the north side the building would be set back some 5 metres to allow the development of a landscaped pedestrian corridor. This space will link directly into the existing open space on Shanghai Street and would allow for pedestrian movement as part of the overall east/west link. The corridor would include tree planting to provide shade, and some informal seating areas. The north east corner of the podium deck has been left open for landscape planting which would help to emphasise the green open space at street level.

Table 1.4 Site C Development Parameters

Predominant use	**Residential**
Site class	A
Site area	1,196 m^2
Plot ratio	
• residential	6.47
• retail	1.00
• total	7.47
GFA	
• residential	7,738 m^2
• retail	1,196 m^2
• total	8,934 m^2
Site coverage	
• podium	73%
• tower	33.33%
Building height	
• podium	2 storeys
• tower	19 storeys
• total	21 storeys

Description

The existing buildings within Site C would be replaced by a similar two storey podium deck of commercial and retail development supporting an extended linked residential tower nineteen storeys high. The podium base facade would be designed to link into those of the adjacent buildings on Shanghai Street and temple Street, to reflect the townscape character at street level. The tower blocks would be set back from the podium edge to allow more light to reach street level. A 5 metre wide landscaped pedestrian corridor would be created along the north side the building as an extension to that on Site B. This space would be a link in the east/west pedestrian movement and would include tree planting to provide shade, and some informal seating areas. The north west corner of the podium deck would not be built on but used instead for landscape planting to match that on the deck on Site B and so concentrate the new planting around the existing green open space on Shanghai street.

Table 1.5 Site D Development Parameters

Predominant use	**Residential**
Site class	A
Site area	1,196 m^2
Plot ratio	
• residential	6.47
• retail	1.00
• total	7.47
GFA	
• residential	7,738 m^2
• retail	1,196 m^2
• total	8,934 m^2
Site coverage	
• podium	73%
• tower	33.33%
Building height	
• podium	2 storeys
• tower	19 storeys
• total	21 storeys

Description

The existing buildings within Site D would be replaced by a building with a two storey podium deck of commercial and retail development, and two linked nineteen storey residential towers above. The facade of the podium base would create a visual link with those of the adjacent buildings on Temple Street and Arthur Street, and would be designed to reflect the twonscape character of the street. The tower blocks would have a more open form than the existing buildings and would increase the amount of light at ground level. The 5 metre wide landscaped pedestrian corridor along the north sides of Sites B and C would be continued alongside Site D. The space would form part of the wider east/west pedestrian route and would be planted with trees to provide shade.

Table 1.6 Site E Development Parameters

Site E1		Site E2	
Predominant use	**Residential**	**Predominant use**	**Commercial**
Site class	A	Site class	A
Site area	261 m^2	Site area	1,169 m^2
Plot ratio			
• residential	6.47	**Plot ratio**	15
• retail	1.00		
• total	7.47		
GFA			
• residential	1,688.7 m^2	**GFA**	17,535 m^2
• retail	261 m^2		
• total	1,947.7 m^2		
Site coverage		**Site coverage**	
• podium	100%	• podium	100%
• tower	33.33%	• tower	60%
Building height		**Building height**	
• podium	2 storeys	• podium	3 storeys
• tower	19 storeys	• tower	20 storeys
• total	21 storeys	• total	23 storeys

Description

The existing buildings within Site E would be replaced by two separate buildings. In the central part of the site a three storey commercial and retail podium would support a central commercial tower block twenty storeys high. On the north side of the site along Arthur Street a smaller building would be developed with a two storey commercial and retail podium deck, with a single nineteen storey residential tower above. The facade of the commercial tower would be designed to tie in visually with the scale and form of the adjacent buildings along Nathan Road, although it would be set back from the edge to allow more light to reach street level. The smaller building would be in the form of some of the newly constructed blocks and would be designed to reflect the townscape of the street. The low podium base would create a visual link with those of the facades of adjacent buildings on Arthur Street, and the lighter more open tower blocks above. The east/west pedestrian corridor along the north sides of Sites D would be continued inside the commercial building, at second floor level, linking into an elevated walkway across Nathan Road to new building opposite.

Table 1.7 Site F Development Parameters

Predominant use	**Residential**
Site class	A
Site area	846 m^2
Plot ratio	15
GFA	12,690 m^2
Site coverage	
• podium	100%
• tower	60%
Building height	
• podium	3 storeys
• tower	20 storeys
• total	23 storeys

Description

A new commercial building would be constructed to replace the existing buildings on Nathan Road within Site F. A three storey podium deck of commercial and retail space would support a twenty storey commercial tower. The facade of the podium and tower would be designed to tie in visually with the scale and form of the adjacent buildings but would be set slightly back to allow more light to reach road level. The podium deck of the building would extend further back into the site to create more useable space. The east/west pedestrian corridor running through the elevated walkway across Nathan Road from the new building opposite, would be extended to link into the existing footpath network in the Kings Park area.

1.2.4 Summary

1.2.4.1 The long-term negative effects of the CKR on land use will be limited given that: the plan of the West Kowloon Reclamation has been amended to satisfactorily accommodate the route; the LDC Scheme K101 and Housing Society's Six Streets Scheme will be avoided; the schools at Tung Kun Street will be retained; and submerging the route will allow redevelopment along the lines recommended in the West Kowloon Development Statement.

1.2.4.2 In more general terms, constructing the CKR in cut-and-cover will remove the potentially blighting effect of the route on an area badly in need of renewal. The particular redevelopment scheme proposed will provide some 600 new flats, 850 sq m of open space and will link with the West Kowloon Reclamation and King's Park by means of a landscaped spine.

1.3. EASTERN APPROACHES

1.3.1 Land-use Review

1.3.1.1 Existing Land Use

a) Existing land use within the To Kwa Wan area is illustrated on Figure No. 1.6. The majority of land use is medium-rise residential with retail or workshop uses at ground level, although there are significant industrial buildings at Chi Kiang Street, Kai Ming Street and Bailey Street. The 1991 Census records the population as being some 42,000 persons within the route corridor, and there are over 4000 jobs, mostly in industrial employment. The area includes significant areas of open space at Ko Shan and Hoi Sham Parks and the garden between Kowloon City Road and To Kwa Wan Road. Ko Shan Park includes an outdoor amphitheatre which stages events on a regular basis. Hoi Sham Park includes both active and passive recreation facilities and is well-used. The area also includes a street market at Hung Fook Street.

b) There is a total of 529 sites within the Study Area of which 162 buildings (30.6%) are less than 7 storeys high, 308 (57.2%) are between 7 and 12 storeys high and 59 (11.2%) are over 12 storeys. The majority of buildings were constructed before 1967 (88%) and many are in poor condition.

c) The corridor contains significant areas of land under temporary uses, including the To Kwa Wan Reclamation and, to the west of Chatham Road North, an area of low-rise workshops opposite Ko Shan Park.

1.3.1.2 Planned Land Use

a) Planned land use is illustrated on Figure No. 1.7. To Kwa Wan will be affected by the major reclamation works currently under study in the South-east Kowloon Development Statement (SEKDS) which will also identify action areas within the Hung Hom/ Ma Tau Kok area. As currently envisaged under Metroplan, the Kai Tak/Kowloon Bay area will accommodate some 260,000 persons by 2006 and provide for a major commercial centre, low-density industry and port uses. The timing of the SEKDS Study means that the CKR interchange at Kowloon Bay can be satisfactorily integrated into the land-use plan for the area.

b) Like Yau Ma Tei, the To Kwa Wan area had been identified in Metroplan as being in need of renewal. Problems in this area include the presence of non-conforming uses in residential buildings and the environmental effects of industrial and residential buildings being in close proximity. Studies commissioned by the LDC have identified a variety of schemes within the To Kwa Wan area, including a comprehensive-scale commercial/residential scheme between Bailey Street and To Kwa Wan Road.

c) The Study Area is covered by Outline Zoning Plans S/K9/5 and S/K10/6. Areas where the designated use differs markedly from the existing use are on the To Kwa Wan Reclamation, which is largely given over to temporary uses and is intended primarily to provide the landfall for the intersection of the North-South Highway. The OZP shows substantial areas of district open space on the Reclamation to the east of Bailey Street, as an extension to Hoi Sham Park, and one secondary and one primary school. A District Community Centre is shown on the Outline Development Plan to the south-east of Bailey Street. To the east of the planned community centre is an existing Government depot. Further to the east again is a Government site designated as an extension to the sewage treatment plant, which is understood to have no fixed programme.

1.3.2 Planning Constraints and Opportunities

1.3.2.1 Planning constraints have been identified in the same manner as for the western approaches through a building plot survey of age, height, condition and use. The resulting data base is reproduced in Working Paper 2 Route Section Constraints and Issues. Figure No. 1.8 and Table 1.8 indicate the location of the planning constraints derived from the survey.

1.3.2.2 In terms of planning constraints, there is more flexibility in the eastern approaches to the CKR in respect to Category C buildings. There are, however, large areas of open space at Ko Shan Park, Hoi Sham Park and Chatham Road North which must be accounted for in addition to significant planned uses.

1.3.2.3 The recommended alignment for the CKR will cause temporary disruption to Ko Shan Park, but this is not viewed as a permanent constraint. Similarly, it is believed that the planned Urban Council facilities at Ko Shan Road ("G" Site) will be constructed so as to allow the CKR to pass underneath it, and so are not regarded as a planning constraint. Between To Kwa Wan Road and the To Kwa Wan Reclamation, there are very few Category C buildings aside from one substantial block at Kai Ming Street. The most significant constraints comprise planned uses or those under construction. Most significant of these is the residential block at Wing Kwong Street which is currently under construction. Discussions have been held with the concerned parties regarding the planned extension to the To Kwa Wan Sewage Treatment Plant which will accommodate the CKR in its planned layout. It is believed that the planned schools on the To Kwa Wan Reclamation, will be reprovisioned on the Kowloon Bay Reclamation and the District Community Centre avoided.

1.3.2.4 The land-use structure and content of the Kowloon Bay Reclamation is currently under Study in the South-east Kowloon Development Statement (SEKDS). Since SEKDS is still at an early stage of preparation, it is believed that the CKR interchange will be satisfactorily integrated with development on the reclamation.

1.3.2.5 Since the original assessment was conducted, private sector redevelopment has continued in the area and comprises a demolition order for a site on the corner of Ma Tau Wai Road and Shek Tong Street and the commencement of construction of a residential building at Wing Kwong Street. The site will contain a 21-storey development of 20,278 GFA.

Table 1.8 Eastern Approaches Planning Constraints

TPU	SB	Street	No	Age	Height	Rank	Category	Condition	Building Use
241	25	Chi Kiang St	50A-46	1977	23	10	C	Sound	Resident / GF:Comm.
241	25	Ma Tau Wai Rd	292	--	--	--	--	--	Vacant
241	26	Ko Shan Rd	Park	--	--	--	--	--	Ko Shan Rd Park
241	27	Ko Shan Rd	89-107	1974	19	10	C	Fair	Resident--Public Hsg Est / GF:Comm.
241	27	Ko Shan Rd	109-111	1974	25	10	C	Fair	Resident--Public Hsg Est / GF:Comm.
241	28	An Hui St	2	1984	7	11	C	Sound	Resident
241	28	Ma Tau Wai Rd	262-270	1967	17	10	C	Fair	Resident / GF:Comm.
241	29	An Hui St	9	1959	1	3	A	Fair	Electricity sub-station
241	29	Kiang Hsi St	2	--	--	--	--	--	Church
241	29	Ma Tau Wai Rd	238-240	1984	25	12	C	Sound	Resident / GF:Comm.
241	30	Ko Shan Rd	Pgd	--	--	--	--	--	Ko Shan Rd Playground
241	31	Chatham Rd North	465-487	--	--	--	--	--	Vacant/Temporary structure
241	31	Ko Shan Rd	CPk	--	--	--	--	--	Car park (Temporary)
241	31	Ko Shan Rd	72-88	1979	28	12	C	Fair	Resident / GF:Workshop & Comm.
241	32	Chatham Rd North	441-449	--	--	--	--	--	CIP
241	32	Chatham Rd North	435-439	1984	26	12	C	Sound	Resident / GF: Comm.
241	32	Chatham Rd North	451-455	1988	25	12	C	Sound	Resident / GF: Comm.
241	32	Ko Shan Rd	26A-D	1981	24	12	C	Sound	Resident / GF: Workshop
241	32	Ko Shan Rd	32-38	1983	23	12	C	Fair	Resident / GF:Workshop
241	32	Shansi St	3	1981	24	12	C	Fair	Resident / GF:Workshop
242	44	Ha Heung Rd	5-19	1976	14	10	C	Fair	Resident / GF:Comm.
242	46	Chi Kiang St	18	1972	12	8	B	Fair	Industrial
242	46	Chi Kiang St	20	1972	14	10	C	Fair	Industrial
242	46	Chi Kiang St	22	1973	16	10	C	Fair	Resident / GF:Comm.
242	46	To Kwa Wan Rd	237	1972	15	10	C	Fair	Resident / GF:Comm.
242	46	Yuk Yat St	1A	1974	13	10	C	Sound	Factory
242	49	To Kwa Wan Rd	Gdn	--	--	--	--	--	Rest Gdn
242	50	Chi Kiang St	19	1974	3	6	A	Fair	Industrial
242	50	Chi Kiang ST	25-27	1972	16	10	C	Fair	Resident/GF:Comm.
242	50	Chi Kiang St	21-23	1967	13	10	C	Fair	Industrial
242	50	Ngan Hon St	11-19	1973	13	10	C	Fair	Resident / GF:Comm.
242	50	Ngan Hon St	21-39	1972	16	10	C	Fair	Resident / GF:Comm. (Chi Kiang St 25-27)
242	50	Ngan Hon St	41	1971	13	10	C	Fair	Factory
242	50	To Kwa Wan Rd	33	1971	12	8	B	Fair	Industrial
242	50	To Kwa Wan Rd	35-41	1974	15	10	C	Fair	Resident / GF:Comm.
242	52	Yuk Yat St	Gdn	--	--	--	--	--	Hoi Sham Park
243	1	Chatham Rd North	484-492	1985	15	12	C	Sound	Resident / GF:Comm.
243	1	Ma Tau Wai Rd	182-186	1977	13	10	C	Sound	Resident / GF:Comm.
243	2	Gillies Ave	661-673	1967	13	10	C	Fair	Resident / 3F:Comm.
243	2	San Lau St	7	1967	13	10	C	Fair	Resident
243	3	Chatham Rd North	397	--	--	--	--	--	CIP near completion
243	3	Chatham Rd North	399	--	--	--	--	--	CIP near completion
243	3	Chatham Rd North	415	1989	24	12	C	Sound	Resident--new
243	3	Chatham Rd North	417	1989	24	12	C	Sound	Resident--new
243	3	Chatham Rd North	419	1989	24	12	C	Sound	Resident--new
243	3	Chatham Rd North	421	1989	24	12	C	Sound	Resident--new
243	3	Chatham Rd North	423-433	1985	27	12	C	Sound	Resident / GF:Comm.
243	3	Ko Shan Rd	2	1980	23	12	C	Sound	Resident / GF:Comm.
243	3	Ko Shan Rd	4-8A	1981	24	12	C	Sound	Resident / GF:Comm.
243	4	Shun Yung St	10	1975	13	10	C	Sound	Resident
243	6	Gillies Ave	140	1963	5	3	A	Sound	Telephone Exchange/Post Off.
243	6	Ma Tau Wai Rd	176	1974	1	6	A	Fair	Electricity sub-station
243	6	Pak Kung St	Tmp	1945	1	1	A	Poor	Temple
243	7	Chatham Rd North	436-450	1984	14	12	C	Sound	Resident / GF:Comm.
243	7	Pak Kung St	16-12	1981	13	12	C	Sound	Resident + Comm. + Off.

Table 1.8 Eastern Approaches Planning Constraints (Cont'd)

TPU	SB	Street	No.	Age	Height	Rank	Category	Condition	Building Use
243	7	San Wai St	15-19	1981	12	11	C	Fair	Resident / 1F:Comm.
243	9	Chatham Rd North	Pgd	--	--	--	--	--	Playground
243	9	Hok Yuen St	21	1966	7	5	A	Sound	Primary School
243	9	Wo Chung St	Pgd	--	--	--	--	--	Playground
243	10	Hok Yuen St	14	1958	4	3	A	Sound	Primary School
244	3	Hung Fook St	10-14	1974	15	10	C	Fair	Resident / GF:Comm.
244	22	Bailey St	24-28	1973	17	10	C	Fair	Resident / GF:Comm.
244	22	Bailey St	30-36A	1973	17	10	C	Fair	Resident / GF:Comm.
244	22	Hok Yuen St	2G	1979	13	12	C	Fair	Industrial Bldg
244	22	Sung Kit St	95-105	1973	17	10	C	Fair	Resident / GF:Workshop
244	23	Sung Chi St	20-30	1973	16	10	C	Fair	Resident / GF:Workshop
244	23	Sung Chi St	32-36	1975	16	10	C	Fair	Resident / GF:Workshop
244	26	Hok Yuen St	13	1979	13	12	C	Sound	Industrial
244	26	Hok Yuen St East	1	1979	13	12	C	Sound	Industrial
244	26	Hok Yuen St East	2	1985	13	12	C	Sound	Industrial
244	26	Hok Yuen St East	4	1987	13	12	C	Sound	Industrial
244	26	Hok Yuen St East	20	1987	13	12	C	Sound	Industrial
244	26	Hung Hom Rd		1989	13	12	C	Sound	Industrial new completion

Recent Planning Applications

Location			Date	Status
TPU	SB	Street / No.		
241	28	Chi Kiang St 41-43	01/04/1991	Building Plans Approved
241	32	Ko Shan Rd 28-30	01/01/1991	Consent to Commence Work
243	1	Ma Tau Wai Rd 190-194	01/05/1991	Building Plans Approved
243	3	Ko Shan Rd 10-16	01/08/1990	Building Plans Approved
243	9	Chatham Rd / Hok Yuen St	01/10/1984	Building Plans Approved
244	8	Wing Kwong St 52	01/01/1991	Building Plans Approved
244	20	Bailey St 23	01/04/1991	Demolition Order Issued
244	26	Bailey St / Sung On St	01/06/1989	Building Plans Approved

This list of recent planning applications does not include sites where construction is already in progress or vacant sites.

Ranking:

Rank 1: pre 1956; 1 - 6 storeys
Rank 2: pre 1956; 7 - 12 storeys
Rank 3: 1956 - 1966: 1 - 6 storeys
Rank 4: 1956 - 1966: 7 - 12 storeys
Rank 5: 1967 - 1978: 1 - 6 storeys
Rank 6: pre 1956: 12 + storeys
Rank 7: 1956 - 1966: 12 + storeys
Rank 8: 1967 - 1978: 7 - 12 storeys
Rank 9: 1978 +; 1 - 6 storeys
Rank 10: 1967 - 1978: 12 + storeys
Rank 11: post 1978; 7 - 12 storeys
Rank 12: post 1978; 12 + storeys

These rankings are combined into three categories

Category A (Rank 1 - 6): low constraint
Category B (Rank 7 - 9): medium constraint
Category C (Rank 10 - 12): strong constraint

1.3.3 Redevelopment Concept

1.3.3.1 The redevelopment concept for the eastern approaches is based initially on alternative ways of amalgamating the sites which will have to be resumed to allow construction of the CKR. Two basic alternatives have been explored based on minimum and maximum site areas (See Figure No. 1.9). The latter provides the greater site area and flexibility in design and so has been adopted for the purposes of the design concept (Figure No. 1.10).

1.3.3.2 The concept draws upon the Metroplan intention to reduce population within the area and promote renewal.

1.3.3.3 Tables 1.9 to 1.12 illustrate the development parameters for each of the four sites, A to D. Site A lies between Ma Tau Wai Road and Chatham Road North. It is suggested that the site be rezoned from R(A) to C and developed for commercial use. The commercial zoning would be appropriate given the proximity of the site to a major traffic artery and would also lend itself to provision of an elevated pedestrian link to Site B between Wing Kwong and Ma Tau Wai Roads thereby facilitating the distribution of pedestrians from the major public transport corridor to the residential areas and street markets behind.. It is also suggested that Site B be rezoned to commercial use to screen noise-sensitive uses behind.

1.3.3.4 The remaining sites (C and D) are given over to residential use with open space allocated opposite the To Kwa Wan Reclamation to avoid air-quality impacts on residential development at the tunnel portal. The space would link with the proposed extension to Hoi Sham Park and the scheme as a whole will facilitate movement among the Park, the Urban Council facilities at Chatham Road North and Ko Shan Park.

1.3.3.5 Plot ratios for each of the development sites have been calculated using the current Building (Planning) Regulations assuming that the Airport Height Restrictions have been lifted. Whilst the plot ratios differ slightly from those put forward under the ambit of Metroplan, permissible floorspace will have to be reviewed in any case following the recommendations of the Review of Building Density and Height Restrictions in Kowloon and New Kowloon.

1.3.4 Summary

1.3.4.1 The recommended route for the CKR through the eastern approaches will have limited land-use impact in the long term. On the positive side, implementation of the CKR will provide the stimulus to redevelopment in areas where the normal operation of the market has been frustrated to date.

Table 1.9 Site A Development Parameters

Predominant use	**Commercial**
Site class	B
Site area	1,005 sq m
Plot ratio	15
GFA	15,075 sq m
Site coverage	
• podium	100%
• tower	62.5%
Building height	
• podium	3 storeys
• tower	19 storeys
• total	22 storeys

Description

The building on Site A will comprise a 22-storey commercial block including a 3-storey podium. An elevated pedestrian link will be provided to Site B to facilitate movement across Ma Tau Wai Road. The site will require rezoning from its current designation as R(A).

Table 1.10 Site B Development Parameters

Site B1		Site B2	
Predominant use	**Commercial**	**Predominant use**	**Residential**
Site class	C	Site class	B
Site area	1,055 sq m	Site area	2,626 sq m
Plot ratio	15	**Plot ratio**	
		• residential	7.4
		• retail	1.0
		• total	8.4
GFA	15,825 sq m	**GFA**	
		• residential	19,440 sq m
		• retail	2,627 sq m
		• total	22,067 sq m
Site coverage		**Site coverage**	
• podium	100%	• podium	100%
• tower	65%	• tower	37.5%
Building height		**Building height**	
• podium	3 storeys	• podium	2 storeys
• tower	18 storeys	• tower	20 storeys
• total	21 storeys	• total	22 storeys

Description

Site B will have two basic components - one commercial and one residential. The commercial block will be 21 storeys high and will shield the noise-sensitive uses behind. Residential development will comprise three towers on a two-storey commercial podium. Consideration could be given to pedestrianising Kai Ming Street.

Table 1.11 Site C Development Parameters

Predominant use	**Residential**
Site class	C
Site area	3,080 sq m
Plot ratio	
• residential	8.3
• retail	1.0
• total	9.3
GFA	
• residential	25,564 sq m
• retail	3,080 sq m
• total	28,644 sq m
Site coverage	
• podium	100%
• tower	40%
Building height	
• podium	2 storeys
• tower	21 storeys
• total	23 storeys

Description

Site C will comprise four residential blocks on a two-storey retail podium with associated landscaping. The development will incorporate a heavily landscaped corridor linking through to Hoi Sham Park.

Table 1.12 Site D Development Parameters

Predominant use	**Residential**
Site class	C
Site area	1,720 sq m
Plot ratio	
• residential	8.3
• retail	1.0
• total	9.3
GFA	
• residential	14,276 sq m
• retail	1,720 sq m
• total	15,996 sq m
Site coverage	
• podium	80%
• tower	40%
Building height	
• podium	2 storeys
• tower	21 storeys
• total	23 storeys

Description

Site D will comprise three residential blocks on a commercial podium with 340 sq m of open space at ground level. The blocks would be sufficiently set back from the tunnel portal to avoid air-quality impacts.

1.4 OUTSTANDING ISSUES

1.4.1 Introduction

1.4.1.1 Whilst the recommended route for the CKR has clearly satisfied planning objectives in both minimising land-use impacts and facilitating renewal, there remains a number of outstanding issues to be resolved prior to implementation. These issues include:

a) the means by which the CKR route can be protected;

b) agency involvement in the redevelopment schemes.

1.4.2 Route Protection

1.4.2.1 Section 4(1) of the Town Planning Ordinance states that draft plans may show or make provision for "streets, railways and other main communications". Theoretically, therefore, the Ordinance makes provision for route protection although the actual form of this protection on the OZP will require further investigation. It is possible that the CKR route could be incorporated on the appropriate plans at the same time as the OZPs are amended to account for the findings of the Review of Building Density and Height Restrictions in Kowloon and New Kowloon. An alternative means of route protection would be to designate the area as a Comprehensive Development Area (CDA) under the Ordinance. This method would, however, run the risk of incurring public objections given the response to the CDA designation at Waterloo Road/Yunnan Lane.

1.4.3 Redevelopment

1.4.3.1 The redevelopment concepts illustrated in this Volume show how rebuilding can take place spanning the CKR in cut-and-cover tunnel. Given that the CKR runs through areas designated for action by the Land Development Corporation, there clearly is scope for LDC involvement in addition to that of the private sector. The sites could form part of wider LDC schemes or provide rehousing blocks to facilitate the renewal process.

Parsons Brinckerhoff
Maunsell Consultants

Central Kowloon Route Study : Preliminary Design

Existing Land Use - Western Approaches

FIGURE NO

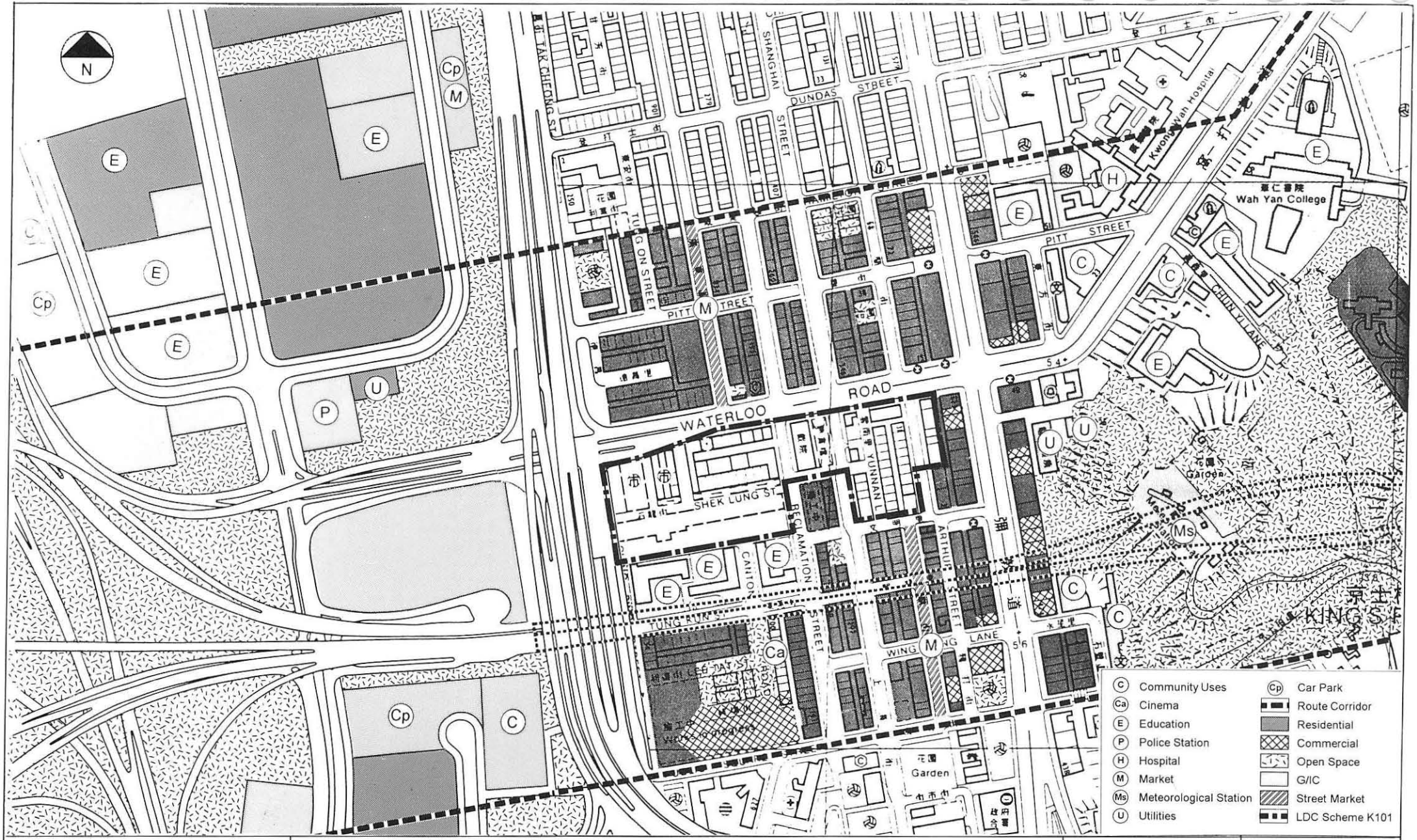
1.1

SCALE

0 20 40 80m

DATE

April 93



Parsons Brinckerhoff
Maunsell Consultants

Central Kowloon Route Study : Preliminary Design

Future Land Use - Western Approaches

FIGURE NO
1.2

SCALE
0 20 40 80m

DATE
April 93

Parsons Brinckerhoff
Maunsell Consultants

Central Kowloon Route Study : Preliminary Design

Planning Constraints - Western Approaches

FIGURE NO.

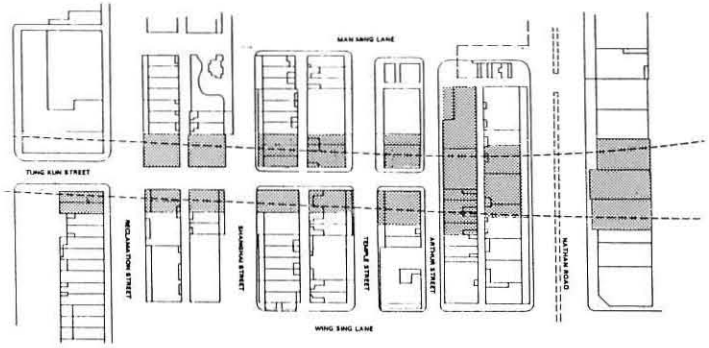
1.3

SCALE

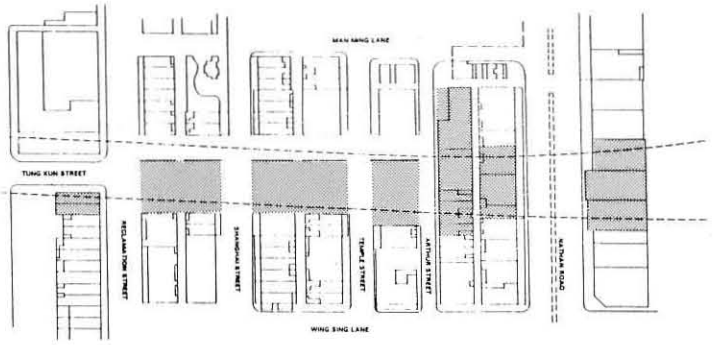
0 20 40 80m

DATE

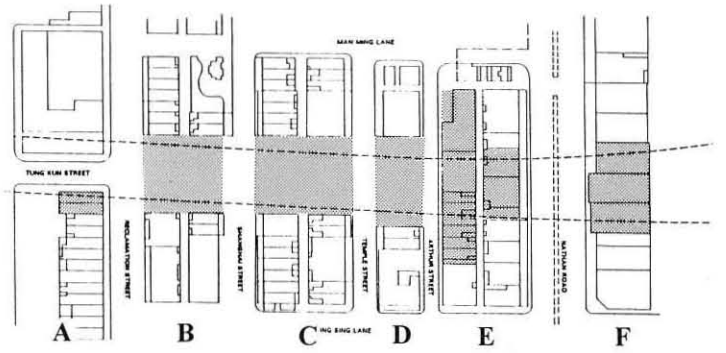
April 93



Option 1: Developable area-4,159m²

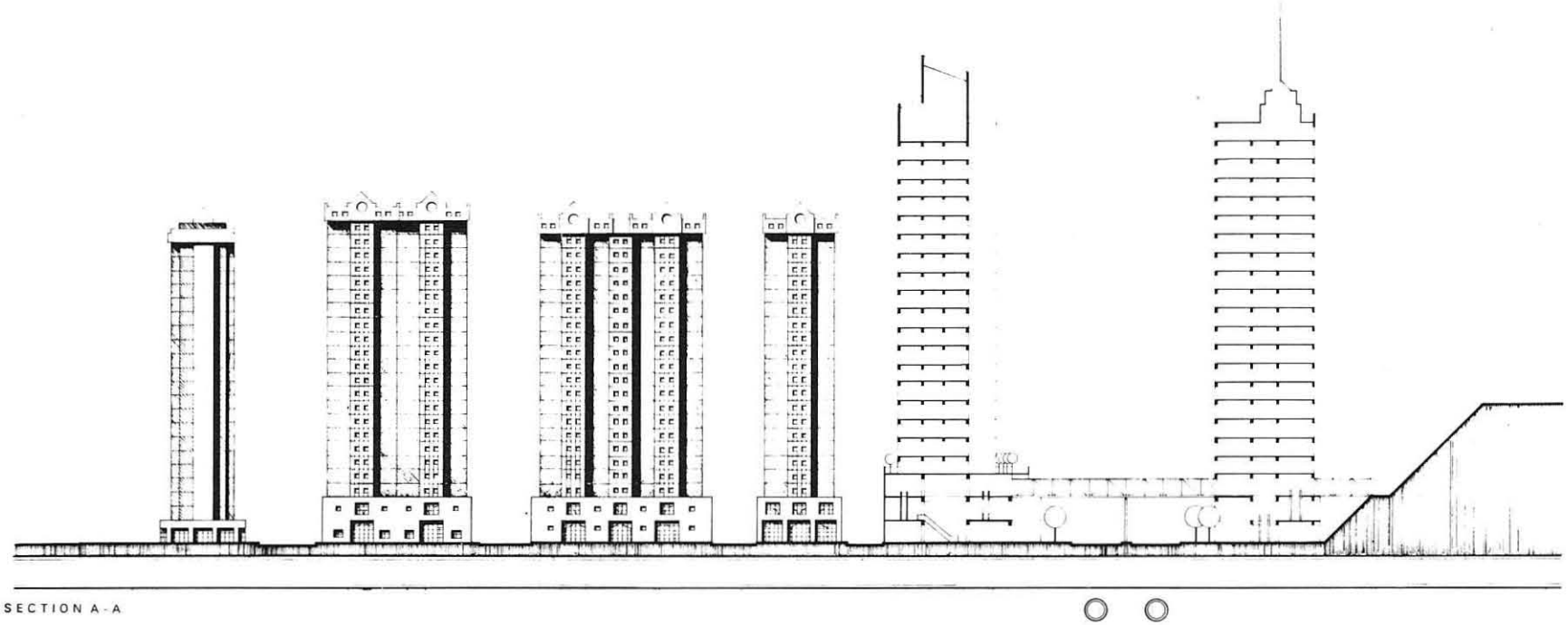


Option 2: Developable area-4,692m²

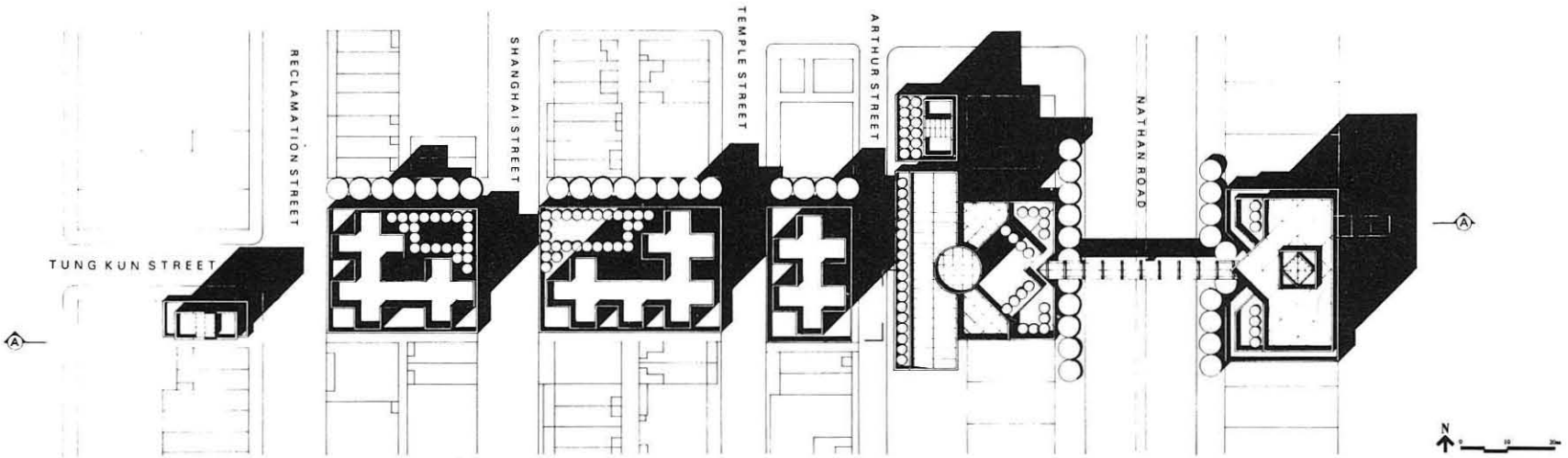


Option 3: Developable area-5,265m²

Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Site Assembly Options - Western Approaches	FIGURE NO. 1.4	SCALE DATE APRIL 93

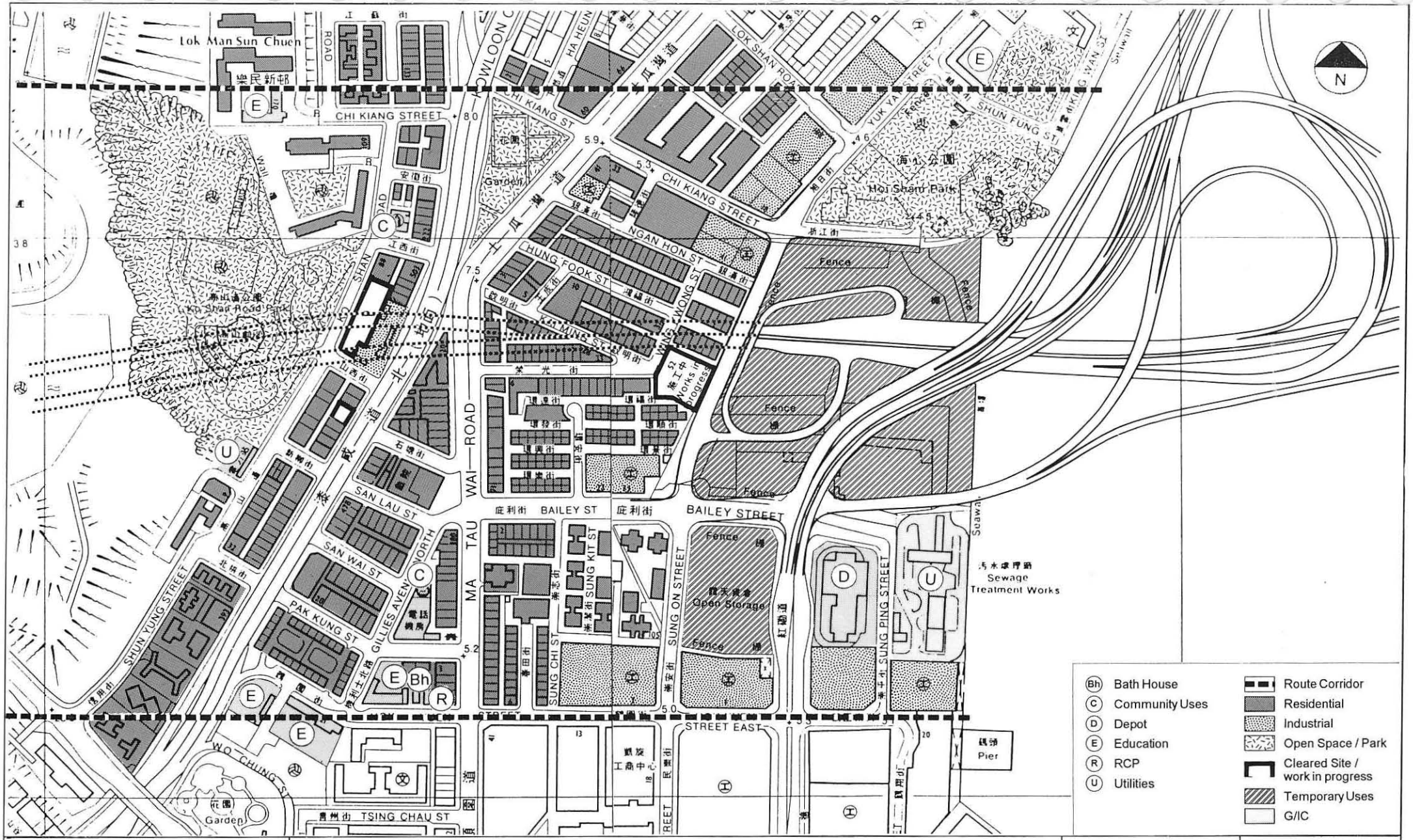


SECTION A-A



REDEVELOPMENT CONCEPT

Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Redevelopment Concept – Western Approaches	FIGURE NO. 1.5	SCALE 0 5 10m DATE April 93



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Central Kowloon Route Study : Preliminary Design
Existing Land Use - Eastern Approaches

FIGURE NO.
1.6

SCALE
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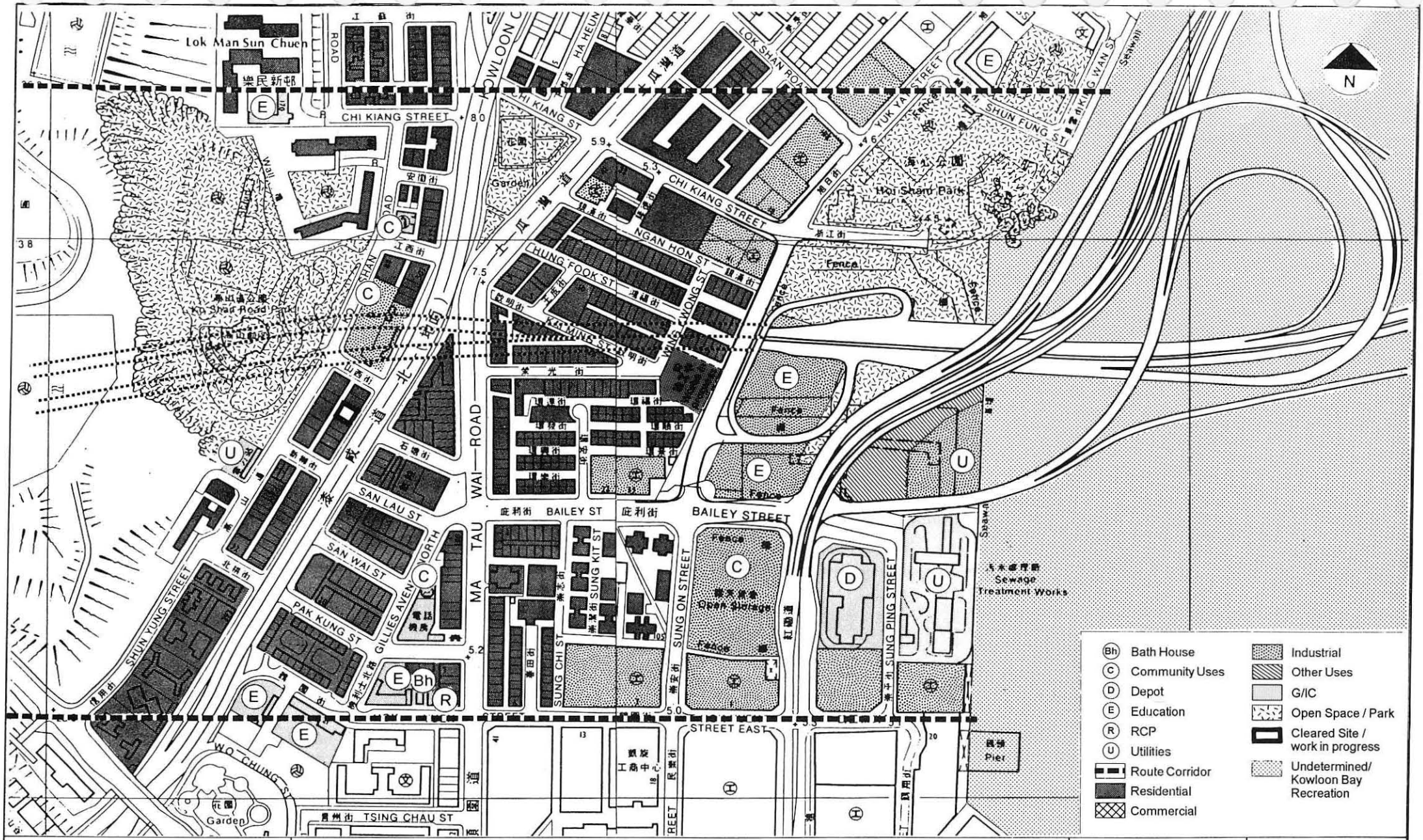
DATE
April 93



Parsons Brinckerhoff
Maunsell Consultants

Central Kowloon Route Study : Preliminary Design

Future Land Use - Eastern Approaches

FIGURE NO.

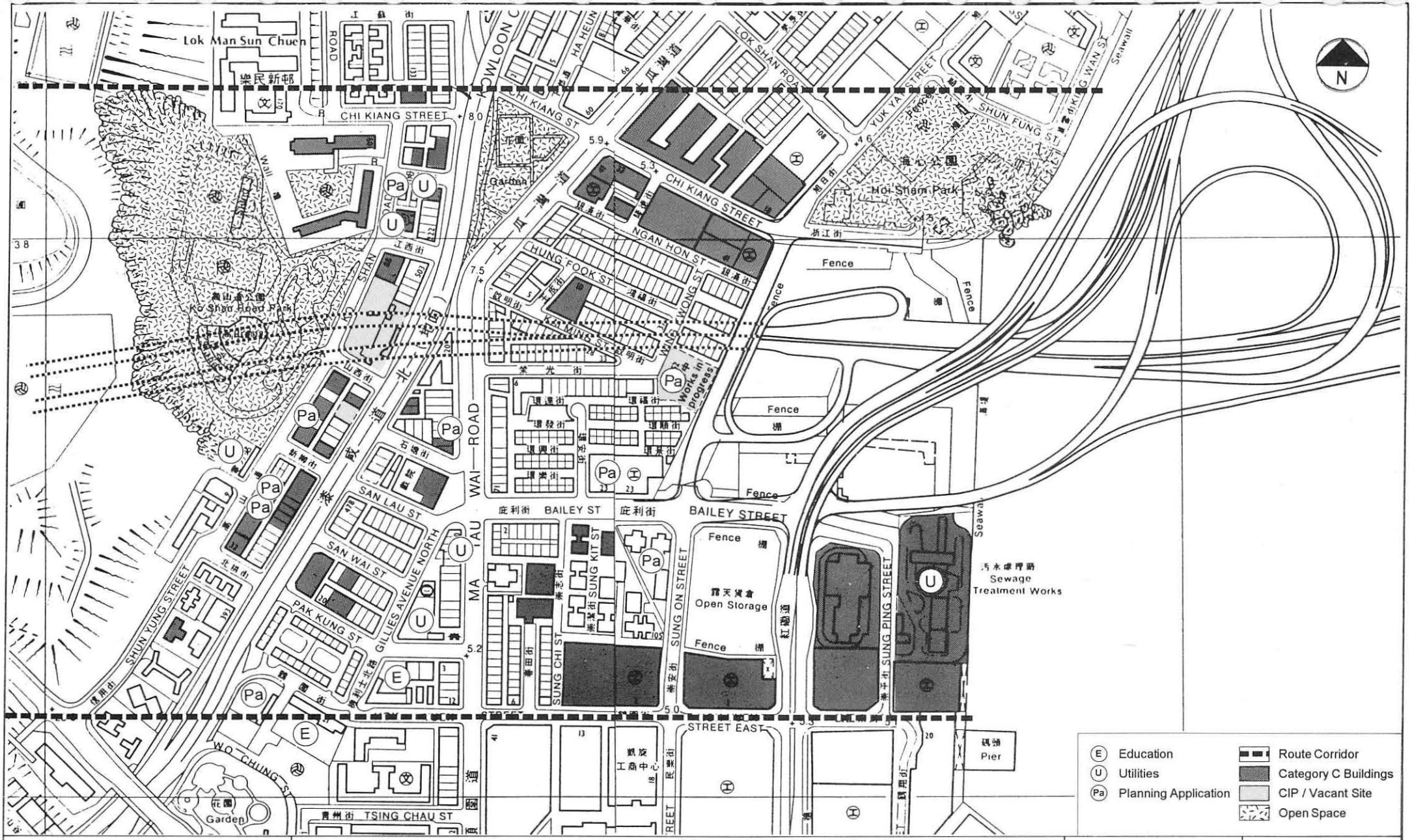
1.7

SCALE

0 20 40 80m

DATE

April 93



Parsons Brinckerhoff
Maunsell Consultants

Central Kowloon Route Study : Preliminary Design

Planning Constraints - Eastern Approaches

FIGURE NO.

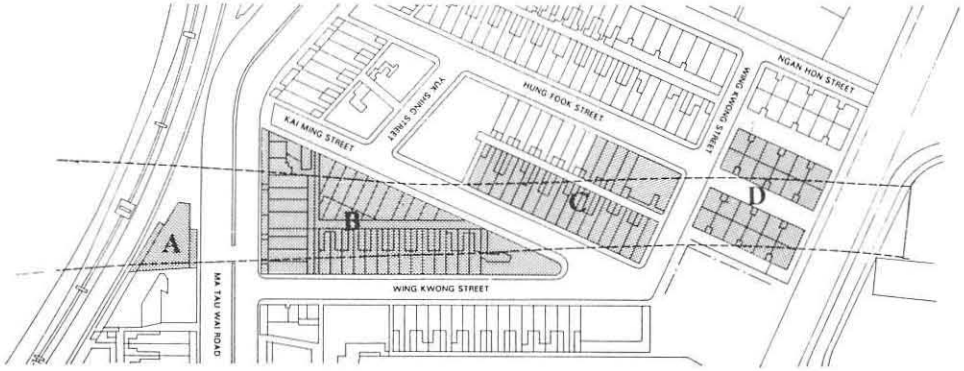
1.8

SCALE

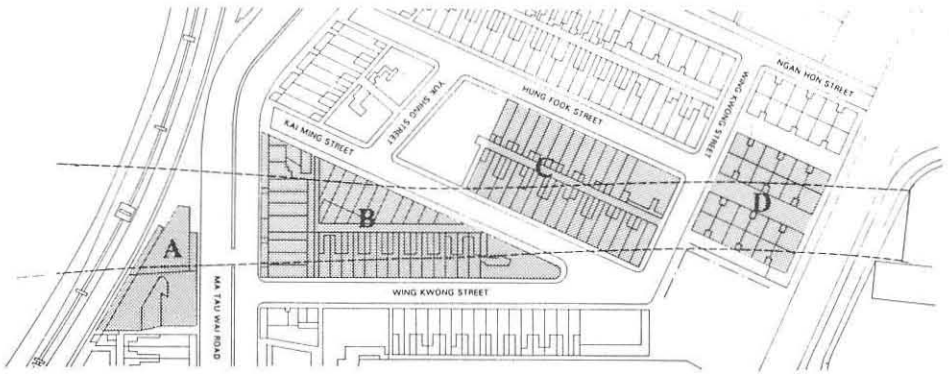
0 20 40 80m

DATE

April 93

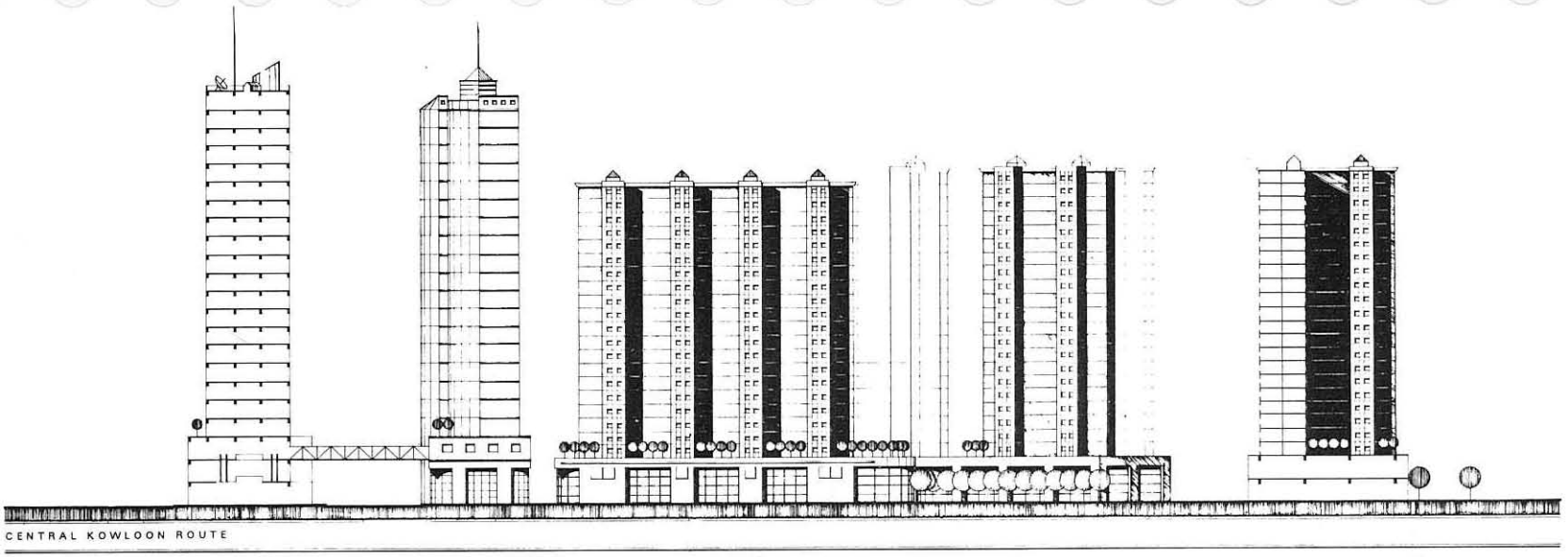


Option 1: Developable area-8,960m²



Option 2: Developable area-9,486m²

Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Site Assembly Options - Eastern Approaches	FIGURE NO. 1.9	SCALE DATE APRIL 93



SECTION B-B

REDEVELOPMENT CONCEPT

Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Redevelopment Concept - Eastern Approaches	FIGURE NO. 1.10	SCALE DATE April 93

Appendix 1.1 INITIAL ASSESSMENT OF WESTERN APPROACHES

A.1 This Appendix presents the alignment options considered in the Discussion Paper 'Qualitative Comparison of Western Alternatives', November 1991. The options comprised the following :

Option 1 : elevated structure directly over Waterloo Road.

Option 2 : elevated structure offset to the south of Waterloo Road.

Option 3 : elevated structure 55m to the south of Waterloo Road.

Option 4 : elevated structure immediately to the south of the Wholesale Fruit Market.

Option 5a : elevated structure to the north of Tung Kun Street.

Option 5b : submerged structure below Tung Kun Street.

A.2 Of these options, 5b was considered to be by far the best on planning grounds. Whilst still requiring the demolition of category C buildings, the option has a number of advantages including no negative visual impact; limited blighting; little landtake; no relocation of utilities; does not constrain LDC scheme K101; and does not affect Housing Society's Six Street Scheme. It was originally thought that the alignment would require demolition of the schools at Tung Kun Street; however, subsequent to the discussion paper, an engineering solution was found that the schools can be retained, an additional advantage.

A.3 Alignment Option 5b became the basis for the recommended alignment which is the subject of the planning appraisal presented in the main body of the Report.

Environmental Assessment 2

2. ENVIRONMENTAL ASSESSMENT

2.1 INTRODUCTION

2.1.1 Background

2.1.1.1 The Second Comprehensive Transport Study (CTS-2), completed in 1989, proposed improvements to Route 4 by 1996, to increase traffic capacity on the East-West routes across Kowloon by the year 2001. However, the Central Kowloon Traffic Study (CKTS) and the West Kowloon Reclamation Transport Study (WKRTS) concluded later that the additional East-West capacity would be required by 2001 even with the CTS-2 proposals in operation particularly since major developments were envisaged by Metroplan in both West and East Kowloon.

2.1.1.2 The WKRTS proposed a new dual two lane urban trunk route, the Central Kowloon Route (CKR) as an alternative to upgrading existing routes with capacity limitations. The CKR will connect the West Kowloon Expressway (WKE) through the centre of Kowloon (in tunnel) to the planned North-South Highway (NSH) in To Kwa Wan. The primary function of the CKR is to provide a trunk road across the centre of Kowloon and leave ground level roads to deal with the traffic within broad metro districts.

2.1.2 Objectives of the Assessment

2.1.2.1 The broad objectives of this report are to assess the environmental impacts arising from the construction and operation of the CKR on existing and future sensitive receivers. A detailed Environmental Assessment (EA) Brief was appended to the main study Brief and is reproduced in Appendix 2.1. The objectives are as follows:

a) to describe the proposed developments and related facilities for their development;

b) to identify and describe the elements of the community and environment likely to be affected by the proposed development;

c) to minimise pollution and nuisance arising from the development and its operation and environmental disturbance during construction and operation of the project;

d) to identify and evaluate the net environmental impacts and cumulative effects expected to arise during the construction and operation of the development in relation to the existing and planned community and neighbouring land uses;

e) to identify methods, measures and standards to be included in the design, which may be necessary to mitigate these impacts and reduce them to acceptable levels;

f) to recommend environmental monitoring and audit requirements necessary to ensure the effectiveness of the environmental protection measures adopted;

g) to identify any additional studies which may be necessary to fulfil the objectives or requirements of this Environmental Assessment.

2.1.3 Scope of Work

2.1.3.1 The Environmental Assessment was carried out in two stages. An initial assessment was made in order to provide input to the CKR preliminary design and to assist in route selection. The final Environmental Assessment was carried out on the selected CKR route.

2.1.4 Background to the Environmental Assessment

2.1.4.1 The environmental problems associated with the development of this major road scheme were considered during the initial stages of the project, to assist with decision making processes with regard to both horizontal and vertical route alignment. In particular, environmental considerations were extremely important in the decision to use cut-and-cover tunnel through both West and East Kowloon, where sensitive receivers would otherwise have been subjected to unacceptably high traffic noise levels. A summary of this preliminary assessment was presented in a discussion paper regarding the choice of western alignment. The option of an open road section through east Kowloon from Ma Ta Wai Road was considered, but did not receive support from many Government Departments; the option was not considered further.

2.2 DESCRIPTION OF THE ROUTE ALIGNMENT

2.2.1 The CKR will connect in the west with the WKE and the Reclamation Primary Distributor (Road P1). The eastern end will have connections with the NSH, To Kwa Wan/Hung Hom and new routes serving Kowloon Bay Reclamation with a possible connection through to a long term route from Tseung Kwan O.

2.2.2 The selected alignment runs elevated from the Yau Ma Tei Interchange dropping to the portal of the cut-and-cover tunnel to the west of the West Kowloon Corridor. This tunnel section will run under Tung Kun Street, joining the mined tunnel at Kings Park. The tunnel advances to Ko Shan Park where the route continues in cut-and-cover tunnel to emerge onto the To Kwa Wan Reclamation to the south of Hoi Sham Park. The toll plaza will be located here. The road then joins to the interchange with the NSH.

2.2.3 The route alignment is shown in the drawings in Volume 2. The Key Plan and Kowloon Road Network are reproduced in this volume as Figure Nos. 001 and 002 in the Introduction and Summary, and Figures 2.1-2.3 depicting the western and eastern portion of the route, are reproduced in this Chapter.

2.3 LEGISLATION AND PLANNING STANDARDS AND GUIDELINES

2.3.1 Legislative and guideline controls were endorsed by the CKR Working Groups and are reproduced below for reference.

Air

2.3.1.1 The Air Pollution Control Ordinance (Cap. 311, 1983) provides powers for controlling air pollutants from a variety of stationary and mobile sources, including fugitive dust emissions from construction sites, and encompasses a number of Air Quality Objectives (AQO). Currently AQOs stipulate concentrations for a range of pollutants, of which Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), Total Suspended and Respirable Particulates (TSP/RSP) are relevant to this Study. These are listed in Table 2.3.1. An Air Pollution Control (Amendment) Bill was gazetted in May 1992, which will substantially increase EPD's power of enforcement.

Table 2.3.1 Hong Kong Air Quality Objectives

Parameter	Maximum Average Concentration μgm^{-3}			
	1-Hour	8-Hour	24-Hour	*Annual
CO	30000	10000		
NO_2	300		150	80
TSP	500**		260	80
RSP		180	55	

* Not to be exceeded more than once per year

** In addition to the above established legislative controls, it is generally accepted that an hourly average TSP concentration of 500 μgm^{-3} should not be exceeded. Such a control limit is particularly relevant to construction work and has been imposed on a number of construction projects in Hong Kong in the form of contract clauses.

2.3.1.2 Hong Kong Planning Standards and Guidelines, (HKPSG) provides non-statutory guidelines for buffer distances between major roads and sensitive receivers (in particular active recreational areas) to minimise the potential air quality impacts.

2.3.1.3 The Road Traffic Control Ordinance (Cap. 374, 1985) provides for the control of polluting emissions from motor vehicles in two ways:

- o vehicles must be designed to meet emission standards;
- o vehicles must be constructed and maintained so as not to emit excessive smoke.

Recent amendments provide controls for certain classes of vehicles registered after January 1992.

2.3.2 Noise

2.3.2.1 The Noise Control Ordinance (NCO) provides the statutory framework for noise control. The NCO defines statutory limits which will apply to the construction of the Central Kowloon Route and operation of the ventilation buildings. In addition, EPD has stated that, for better planning and in order not to contravene the NCO, consideration should be taken of the HKPSG, although these have no statutory basis. As well as setting out guidelines for planning practice with respect to noise, the HKPSG present the only published limits on traffic noise in Hong Kong.

2.3.2.2 Three technical memoranda (TM) are made under the NCO, and they define the technical means for the assessment of noise. Together, the NCO and the TM provide a mechanism for assessing noise levels and the statutory power to control noise. The HKPSG suggest planning standards (noise assessment criteria) with reference to the NCO limits, with safety margins to prevent total noise levels creeping above acceptable levels, and to other criteria where considered applicable.

Construction

2.3.2.3 The NCO divides construction noise into activities involving powered mechanical equipment, excluding percussive piling, and percussive piling activity. The criteria for the assessment of noise from construction are therefore similarly divided.

a) Activity other than Percussive Piling

2.3.2.4 Under the Technical Memorandum on 'Noise from Construction Work other than Percussive Piling', noise from activity excluding piling is not restricted during the period 0700-1900 hours (but is restricted for whole day, evening and night on Public Holidays and Sundays). However, the Government White Paper 'Pollution in Hong Kong - A Time to Act' has signalled a desire to improve the noise environment in Hong Kong whenever reasonably practical. To this end, EPD has suggested a daytime general construction noise limit of 75 dB(A) $L_{eq\ (5\text{-}min)}$, see Table 2.3.2). This limit should be assumed to apply during the construction planning and contract tender assessment stages; it is understood that the limit has no statutory significance with respect to Construction Noise Permits. The applicability of the maximum daytime noise level depends upon existing noise levels; if the ambient noise level is demonstrated to be already greater than 75 dB(A), then EPD may recommend a daytime general construction noise limit of not higher than 5 dB(A) above the recorded ambient noise level.

2.3.2.5 Between 1900 and 0700 hours and all day on Sundays and public holidays, activity is prohibited unless a permit is obtained. A permit will be granted provided the Corrected Noise Level (CNL) at the noise sensitive receivers is equal to or less than the Acceptable Noise Level (ANL). Basic Noise levels (BNL) are assigned depending upon the Area Sensitivity Rating (ASR). For the Central Kowloon Route, NSRs are likely to be assigned an ASR of either B or C; and the corresponding BNLs for evening and night time periods are given in Table 2.3.2.

Table 2.3.2 Construction Noise Criteria for Activity Other Than Percussive Piling

Basic Noise Level				
$L_{Aeq\ (5\ mins)}$	$L_{Aeq\ (5\ mins)}$			
Daytime (all ASRs)	Evening ASR 'B'	Evening ASR 'C'	Night ASR 'B'	Night ASR 'C'
75 *	65	70	50	55

* Recommended, but not statutory

b) Percussive Piling

2.3.2.6 Under a separate TM on 'Noise from Percussive Piling', piling is prohibited between 1900 and 0700 hours and on Sundays and Public Holidays, unless permission is granted by the Governor in Council. Between 0700 and 1900 hours, piling is allowed under permit, subject to noise level limits (termed Acceptable Noise Levels - ANLs). If the noise level is expected to exceed these limits, restricted hours of operation are included in the permit. Table 2.3.3 summarises the ANLs criteria.

Table 2.3.3 Construction Noise Criteria for Percussive Piling Activity

Noise Sensitive Receiver	Acceptable Noise Levels ($L_{Aeq\ 5\ mins}$)	
	Day 0700 - 1900	Night 1900 - 0700
without windows	100	Prohibited
with central A/C	90	Prohibited
with windows (but without central A/C)	85	Prohibited

Note

10 dB(A) shall be deducted from the above when the NSRs are hospitals, schools or law courts, or other NSRs which are considered by the Authority to be particularly sensitive to noise.

Fixed Sources

2.3.2.7 The Technical Memorandum for the Assessment of Noise from Places Other than Domestic Premises or Construction Sites provides the statutory control mechanism for the noise from the CKR ventilation buildings, and any other fixed sources of noise. The TM provides a method for determining the Area Sensitivity Rating (ASR) of a receiver, and the Acceptable Noise Level (ANL). Table 2.3.4 shows the criteria for selection of ASR, and Table 2.3.5 shows ANLs.

Table 2.3.4 Area Sensitivity Ratings

Type of Area	Degree to which NSR is affected by IF *		
	Not Affected	Indirectly Affected	Directly Affected
1) Rural area, including country parks or village type developments	A	B	B
2) Low density residential area consisting of low-rise or isolated high-rise developments	A	B	C
3) Urban area	B	C	C
4) Area other than those above	B	B	C

*Influencing Factor, eg. major road, industrial area, airport.

Table 2.3.5 Acceptable Noise Levels (ANLs) Effective from the Date 3 Years After Section 13 of the Ordinance Comes into Operation

Time Period	ASR A	ASR B	ASR C
Day (0700 to 1900)	60	65	70
Evening (1900 to 2300)			
Night (2300 to 0700)	50	55	60

Road Traffic

2.3.2.8 The HKPSG define maximum desirable traffic noise levels for receivers affected by road traffic noise. These guideline levels are given in Table 2.3.6. It should be noted that these limits have no statutory basis.

Table 2.3.6 Road Traffic Noise Criteria

Noise Sensitive Receiver	Noise Level Limit ($L_{A10\ peak\ hour}$)
Dwelling	70
Technical Institute/School	65
Hospital	55

2.3.3 Water

2.3.3.1 The discharge of liquid effluents to coastal waters is controlled by the Water Pollution Control Ordinance (Cap. 358) and a Technical Memorandum (TM), 'Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters', that establishes effluent standards that apply to different receiving water bodies. All effluents covered by this TM are required to be licensed. It is understood that construction site runoff now requires licensing, where the discharge is to a gazetted Water Quality Zone (WQZ), but discharges from roads and tunnels do not, hence the TM does not apply to the latter. It should also be noted that the Victoria Harbour WQZ is not yet gazetted. However, it is considered appropriate that some form of environmental standards should be assigned to the runoff from the proposed road and tunnel in order to minimise the potential impact on receiving water bodies from this source.

Table 2.3.7 Standards for Effluents Discharged into the Inshore Waters of Victoria Harbour Water Control Zone (All Units in mg/l Unless Otherwise Stated; All Figures are Upper Limits Unless Otherwise Indicated)

Determinand \ Flow rate (m^3/day)	≤10	>10 and ≤200	>200 and ≤400	>400 and ≤600	>600 and ≤800	>800 and ≤1000	>1000 and ≤1500	>1500 and ≤2000	>2000 and ≤3000	>3000 and ≤4000	>4000 and ≤5000	>5000 and ≤6000
Ph (Ph units)	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9	6-9
Temperature (°C)	40	40	40	40	40	40	40	40	40	40	40	40
Colour (lovibond units) (25 mm cell length)	1	1	1	1	1	1	1	1	1	1	1	1
Suspended solids	50	30	30	30	30	30	30	30	30	30	30	30
BOD	50	20	20	20	20	20	20	20	20	20	20	20
COD	100	80	80	80	80	80	80	80	80	80	80	80
Oil & Grease	30	20	20	20	20	20	20	20	20	20	20	20
Iron	15	10	10	7	5	4	2.7	2	1.3	1	0.8	0.6
Boron	5	4	3	2.7	2	1.6	1.1	0.8	0.5	0.4	0.3	0.2
Barium	5	4	3	2.7	2	1.6	1.1	0.8	0.5	0.4	0.3	0.2
Mercury	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Cadmium	0.1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Other toxic metals individually	1	1	0.8	0.7	0.5	0.4	0.25	0.2	0.15	0.1	0.1	0.1
Total toxic metals	2	2	1.6	1.4	1	0.8	0.5	0.4	0.3	0.2	0.14	0.1
Cyanide	0.2	0.1	0.1	0.1	0.1	0.1	0.05	0.05	0.03	0.02	0.02	0.01
Phenols	0.5	0.5	0.5	0.3	0.25	0.2	0.13	0.1	0.1	0.1	0.1	0.1
Sulphide	5	5	5	5	5	5	2.5	2.5	1.5	1	1	0.5
Total residual chlorine	1	1	1	1	1	1	1	1	1	1	1	1
Total nitrogen	100	100	100	100	100	100	80	80	50	50	50	50
Total phosphorus	10	10	10	10	10	10	8	8	5	5	5	5
Surfactants (total)	20	15	15	15	15	15	10	10	10	10	10	10
E. coli (count/100 ml)	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000	5000

2.3.4 Solid Waste Disposal

2.3.4.1 Waste collection and disposal is covered by the Waste Disposal Ordinance (Cap. 354). This ordinance will provide a licensing system for the disposal of wastes and for the control of certain prescribed wastes by regulation. Under the terms of the Ordinance, construction waste is classified as a trade waste, and, as such, the contractor will be responsible for its disposal.

2.3.4.2 In future, there may be legislative controls on disposal of construction waste, with a view to charging for disposal of private sector waste. These controls would provide incentives for recycling of construction waste, which is shortly to undergo pilot scale tests at Tseung Kwan O. This is discussed further in Section 2.8.

2.4 CONSTRUCTION METHODS

2.4.1 Construction methods were assessed with regard to feasibility of alignment options. For the purposes of this Report, assumptions were made as to the most probable construction techniques.

2.4.2 For the purposes of construction dust and noise assessment, the cut-and-cover tunnelling was assumed to be undertaken using the diaphragm wall method, rather than sheet piling and excavation. The former method has environmental advantages in that a large amount of work takes place under the protection of the roof slab, with the consequent reduction in noise and improved dust containment.

2.4.3 Activities have been identified for each stage of the cut-and-cover tunnel excavation and construction. These include the following:

a) demolition of existing buildings
b) construction of diaphragm walls
c) excavation to roof slab
d) construction of roof slab
e) excavation under roof slab
f) backfilling over roof slab
g) road construction (sub-base preparation and surfacing).

2.4.4 The majority of mined tunnel spoil will probably be removed at the east portal, but may also take place at the eastern interface of the rock tunnel and cut-and-cover tunnel. Spoil from hillside excavation east of Nathan Road will be removed at the west rock tunnel portal. Environmental impacts arise from the transportation of material off site; the methods of removal and transport will be independent of the construction methods adopted. There is a possibility that tunnel spoil will be used to form a small reclamation in Kowloon Bay.

2.4.5 It should be noted that there are no plans to use percussive piling, mainly in response to environmental considerations.

2.4.6 A more detailed construction programme is given in Volume 1, Chapters 14 and 15.

2.5 AIR QUALITY

2.5.1 Construction

General

2.5.1.1 The greatest potential air quality impact during the construction of CKR will result from dust emissions. Vehicle and plant exhaust emissions are not considered to constitute a significant source of air pollutants.

2.5.1.2 Possible dust sources are:

- o demolition of existing buildings;
- o site preparation;
- o excavations;
- o wind erosion of work areas;
- o material transfer to and from trucks;
- o vehicle/plant movements on unpaved roads and over the site.

Sensitive Receivers

2.5.1.3 Demolition of buildings within the construction corridor will be limited to the minimum number practical. It is possible that sensitive receivers will be very close to the works. Air quality dispersion models tend to produce unreliable results when receivers are very close to the source, so for the purposes of this assessment, contours of dust levels were produced, rather than specific levels at individual receivers. The contours indicate areas that may be exposed to potentially high dust levels.

Existing and Future Background Conditions

2.5.1.4 The majority of the CKR is likely to be constructed between the years 1997 and 2001. By that period, the West Kowloon Reclamation should be substantially complete, along with the major infrastructure of the West Kowloon Expressway, the Western Harbour Crossing and the West Kowloon Corridor. There may be construction activity on the Reclamation, but estimation of background dust levels so far into the future is not possible. However, a considerable amount of data will have been collected by the West Kowloon Reclamation Environmental Project Office (ENPO).

Assessment Methodology

2.5.1.5 Dust levels arising from construction work may be estimated using USEPA Compilation of Air Pollutant Emission Factors (AP-42). In order to make predictions of air quality impacts, the following information is required; site area, nature of activity, quantities of stockpiled materials, vehicle movements to and from the site, vehicle speed over the site, silt content of excavated material and rainfall data. The basic emission categories are: dust from vehicles movements on unpaved roads, dust from material movement and dust from the erosion of the site. The PAL2.1 dispersion model was used for the dispersion modelling to assess the effects on the sensitive receivers. This was considered to be the most suitable model because of the ability to combine line sources (ie. the main construction corridor) and area sources (ie. batching activities).

2.5.1.6 For the purposes of this assessment, the following assumptions were made:

a) The diaphragm wall method of tunnel construction was assumed, as described in Paragraph 2.4.2.

b) All tasks related to cut-and-cover tunnelling occur simultaneously over the tunnel corridor.

c) The corridor was considered to be a 30m wide strip running from the interface with the mined tunnel to the portal.

d) Works areas were assumed to be at the portals and the interfaces of the mined and cut-and-cover sections.

e) The assessment was undertaken assuming concrete batching would take place on the reclamations at both east and sections. An additional assessment was undertaken assuming a high degree of emission controls on the batchers.

f) Worst-case 1-hour average TSP concentrations were calculated.

g) Temporary toll plaza and permanent administration buildings construction dust emissions were assessed using the general construction dust emission factor given in AP-42 (117 $kgday^{-1}ha^{-1}$).

h) Impacts from demolition were not assessed quantitatively (See Paragraph 2.5.1.19).

2.5.1.7 Meteorological conditions of wind speed 2ms^{-1}, stability category D and a mixing layer height of 500m were adopted for the analysis. Selection of wind speed represents a compromise between low speed (and hence decreased dispersion but possible settling of particulates) and a higher wind speed which will result in greater dispersion of particulates and increased dust generation.

2.5.1.8 The dust emissions were calculated using the methodology as given in AP-42. It was assumed that the whole area would be worked simultaneously; however, since this is not likely to occur in practice, the results will be conservative. Dust emission factors are given in Tables 2.5.1 - 2.5.2.

Table 2.5.1 West Kowloon Cut-and-cover Tunnel Construction Dust Emission Factors

Activity	Emission (kg day^{-1})
Diaphragm Walls	26.0
Initial Excavation	32.5
Top Slab Formation	17.8
Bulk Excavation Under Slab	16.1
Formation of Base Slab	N/A (under slab)
Backfilling	23.2
Road Surface Finishing	23.2
Road - Portal to Interchange	16
Mined Tunnel Spoil Removal	1.3
Concrete Batching (Uncontrolled/Controlled)	45/4.5

Table 2.5.2 East Kowloon Cut-and-cover Tunnel Construction Dust Emission Factors

Activity	Emission (kg day^{-1})
Diaphragm Walls	22.6
Initial Excavation	21.8
Top Slab Formation	14.8
Bulk Excavation Under Slab	11.6
Formation of Base Slab	N/A (under slab)
Backfilling	23.2
Surface Road Finishing	23.2
Connecting Roads	19
Mined Tunnel Spoil Removal	1.3
Concrete Batching (Uncontrolled/Controlled)	45/4.5
Temporary Toll Plaza/building Construction	82

2.5.1.9 The demolition phase will take from 2-3 months to complete. Quantification of demolition dust impacts was not undertaken because a suitable assessment methodology does not appear to be available. However, due to the confined nature of the area, the need to demolish blocks adjacent to structures that will remain, the demolition will have to be carefully controlled. Buildings will require comprehensive shrouding for safety reasons, which will have the benefit of significantly controlling dust emissions.

Impact on Receivers

2.5.1.10 Figures 2.4 - 2.7 represent points of worst case dust concentrations. It should be noted that the contours do not define areas subject to high dust levels, but represent a series of worst-case mutually exclusive events, depending on wind direction.

West Kowloon

2.5.1.11 The guideline 500 μgm^{-3} may be exceeded at the Six Streets Redevelopment Scheme. However, Hong Kong winds are predominantly from the east so the conditions leading to the exceedances will be rare. Long term meteorological data from the Royal Observatory show that westerly winds of speed 2 ms^{-1} or less and neutral stability will occur on average for 70 hours per year. Given that construction will be over approximately 18 months, the probability of occurrence of the meteorological conditions that could lead to exceedance of the guideline is equivalent to 110 hours during this period (about one hour every five days). However, worst-case meteorological conditions will not necessarily coincide with maximum levels of construction activity or may occur during periods with no construction activity, so occurrences of high dust concentrations will probably be less frequent than 110 hours.

East Kowloon

2.5.1.12 The guideline 500 μgm^{-3} may be exceeded around the portal area if there are no controls on dust emissions, particularly from the concrete batcher. However, if reasonable controls are adopted, nuisance should be reduced significantly.

Control and Mitigation

2.5.1.13 Because of potentially high levels of dust arising from the construction of the cut-and-cover tunnels and the toll plaza, it is recommended that mitigation measures are adopted where practical.

2.5.1.14 Watering of exposed site surfaces is the most commonly selected dust control method, but the effectiveness depends on the degree of coverage and frequency of application. Up to 50% reduction in dry dust emissions can be achieved by twice daily watering with complete coverage. Other methods which can be employed include screening and enclosure of particularly dusty work areas, where this is practical.

2.5.1.15 Common control methods employed include coverage with hard-core, watering and traffic control regulations. It should be noted that no unpaved site roads of greater than 100m are anticipated.

2.5.1.16 The following measures should be adopted where applicable:

- o use of regular watering, with complete coverage, in dry periods to reduce dust emissions from unpaved roads;
- o imposition of speed controls for vehicles on unpaved site roads; 8 kmh^{-1} being the limit recommended by EPD;
- o use of frequent watering for particularly dusty static construction areas;
- o tarpaulin covering of all dusty vehicle loads transported to, from and between exposed site locations;
- o establishment and use of vehicle wheel and body washing stations at exit point of site and public roads, combined with cleaning of public roads where necessary and practical;

- o where feasible, routing of vehicles and positioning of construction plant at maximum possible separation distance from sensitive receptors;

- o high standard of emission controls on concrete batching.

2.5.1.17 Specimen contract clauses for dust reduction are provided in Appendix 2.5.

Monitoring Requirements

2.5.1.18 Although the dust levels from construction are potentially high, monitoring for the purposes of dust minimisation would present practical difficulties in terms of establishing safe, suitable monitoring locations. The value of monitoring is limited with respect to always being retrospective, and because of other influencing factors from other activities in the area. It is recommended that regular visual inspections should be undertaken by the Engineer or representative to establish whether activities are generating large quantities of dust. The Engineer should ascertain if good working practices for dust minimisation are implemented and maintained. Discussions could then be held with the contractor to establish the cause of the nuisance and to find ways to prevent future occurrences.

2.5.1.19 It should be noted that EPD at present frequently requires monitoring at major construction sites. This is undertaken using high volume dust samplers over a 24 hour period at a frequency of once every six days. EPD Air Policy Group has indicated that this would be a requirement for this project. Should the future policy require such a monitoring program, it can be incorporated into contract documentation as a project requirement.

2.5.2 Operation - Introduction

2.5.2.1 The main sources of pollutants during operation of CKR are the traffic emissions from the surrounding surface road networks and the vent stacks. A high proportion of goods vehicles, 61% in terms of pcu (private car unit) or 56% in terms of number of vehicles, is expected using CKR during peak hour at year 2011. Paragraph 2.5.6 shows the prediction of traffic mix composition at peak hour of design year 2011. The nitrogen oxides, NOx, emission is the major issue of air pollutants.

2.5.2.2 Six tunnel ventilation schemes were studied in the previous Working Papers. By examining the tunnel air velocities, the distribution of vitiated air and portal emissions, Scheme F was selected as the base for further study. The scheme was revised with additional vent stacks at both tunnel portals to mitigate the air quality impact to the portal neighbourhood.

2.5.2.3 The objectives of this operational air quality assessment are:

a) to determine the extent of impact to the surrounding areas at portals and mid-vent buildings,

b) to identify the impact to existing nearby buildings, and

c) to provide an air quality guideline for future development of reclamation areas at two portals.

2.5.2.4 At the start of the project, the design of ventilation system and operational air impact were based on the emission factors of PIARC 1987 standard B at year 2000. All the Working Papers were prepared according to this standard. Recently, the PIARC 1991 was published and distributed worldwide. Upon the request from EPD, the design standard was replaced by PIARC 1991 in this Final Report. It should be pointed out that the vehicular emission rates of NOx in PIARC 1991 are much higher than those of PIARC 1987. The design of ventilation system and air quality modelling were revised to cope with the change.

2.5.3 Air Sensitive Receptors (ASRS)

West Kowloon Portal

2.5.3.1 The West Portal is located at the future reclamation at the existing Yau Ma Tei Typhoon Shelter Waterfront. Yau Ma Tei Catholic Primary School and Six Streets Redevelopment are one block away about 100m to east of tunnel portal. Those locations are identified as ASRs with numbers R1, R2 and D5 in Figure 2.8.

2.5.3.2 The west portal vent stack will be constructed about 130m to west of portal either on ground level or on top of a multi-storey car park under planning.

Fat Kwong Street Mid-Vent Building

2.5.3.3 The vent building is proposed to be located in the Fat Kwong Street Temporary Housing Area shown in Figure 2.9. The area is planned as a reservoir area with possible open space on the top. The building is designed to install tunnel ventilation fans, power sub-station and electrical equipment rooms and an exhaust vent stack on top. The existing neighbourhood residential blocks, namely, Chun Man Court, Oi Man Estate and Valley Road Estate, are selected as ASRs. It is also noted that a residential building of 11 storey high is planned to be constructed at the corner of Fat Kwong Street and Sheung Lok Street 80m to northeast of Vent Building. It is also considered as a potential ASR in the study.

East Kowloon Portal

2.5.3.4 The East Portal is located at the working sites of reclamation area. Existing nearby buildings are situated west in 30m proximity from the proposed tunnel portals. Those buildings are identified as ASRs with numbers R1 and R2 in Figure 2.10. Although, the existing Hoi Sham Park located north of CKR approach road should not be considered as permanent ASRs under the current policy, it is also identified as screening ASRs with numbers A4 to A8. They will be subject to the impact from CKR and adjacent surface road networks. The east portal vent stack is proposed to be constructed about 100m to east of portal.

Approach

2.5.3.5 Recognised ASRs of existing buildings and artificial ASRs for screening purposes are assessed individually and they are designated with numbers. For the future reclamations at the west and east portals, air quality predictions are based on the general vicinity by reference to the distance from the portals. The prediction of air quality in these reclamation areas serves as a general guideline to the future development.

2.5.4 Criteria of Assessment

The criteria of the air quality impact assessment are in compliance with those of the Hong Kong Air Quality Objectives. Table 2.5.3 gives the maximum permissible concentration of airborne pollutants. Of the pollutants listed, carbon monoxide (CO), nitrogen dioxide (NO_2), and Respirable Suspended Particulates (RSP) are regarded as pollutants from vehicles and selected for the assessment.

2.5.5 Assessment Methodology

2.5.5.1 The major hazardous components of vehicular emissions are CO and NOx. The vehicular emission rates inside the tunnels and from adjacent road networks are based on the recommendations of PIARC 1991. The traffic volume flow is in connection with the prediction at design year 2011. The air dispersion modelling are simulated on the basis of the predicted traffic flow at design year, and not the tunnel maximum throughput capacities.

2.5.5.2 Prediction of the air quality impact of vehicular emissions is based on several factors including background pollutant level, traffic flow characteristics (traffic speed and volume, vehicle type, emission rates of pollutants), ventilation system design (distribution of pollutants at tunnel portals and vent building) and dispersion characteristics (wind speed, prevailing wind direction, tunnel portal geometry and the configuration of vent building).

2.5.5.3 In general, the predictions are based on worst-case conditions. In the absence of exact locations of ASRs on the future reclamations at the west and east portals, predictions are based on the general vicinity and will not relate to specific locations, except by reference to the distance from the portals.

2.5.5.4 The CALINE4 software is used to simulate the line sources of the main alignment and slip roads. This is the latest software in a series of line source air quality models developed by the California Department of Transportation. It is based on the Gaussian diffusion theory and employs a mixing zone concept to characterize the pollutant dispersion over the roadway. The option on NO_2 is skipped. A conversion factor of 0.2 is applied for NOx to NO_2 as advised by EPD.

2.5.5.5 The Industrial Source Complex (ISC) Dispersion Model, part of the UNAMAP Version 6 software package, is used to simulate the dispersion of pollutants NOx, CO and RSP from vertical vent stacks. This model combines and enhances various dispersion model algorithms into a set of two computer programs (short-term ISCST and long-term ISCLT) that can be used to predict air quality levels of emission from different types of sources associated with an industrial source complex.

2.5.5.6 In the absence of detailed hourly meteorological data for a whole year, all predictions of modelling focus on the short term 1-hour concentration. The daily and yearly values are estimated with reference to the variation of traffic flow, calculated 1-hour concentration, and available meteorological information.

Table 2.5.3 Hong Kong Air Quality Objectives

Pollutant	Concentration in micrograms per cubic metre (i)					Health effects of pollutant at elevated ambient levels
	Averaging Time					
	1 Hour (ii)	8 Hours (iii)	24 Hours (ii)	3 Months (iv)	1 Year (iv)	
Sulphur dioxide	800		350		80	Respiratory illness; reduced lung function; morbidity and mortality rates increase at higher levels.
Total Suspended Particulates			260		80	Respirable fraction has effects on health.
Respirable Suspended Particulates (v)			180		55	Respiratory illness; reduced lung function; cancer risk for certain particles; morbidity and mortality rates increase at higher levels.
Nitrogen Dioxide	300 (0.16)		150 (0.08)		80 (0.04)	Respiratory irritation; increased susceptibility to respiratory infection; lung development impairment.
Carbon Monoxide	30000 (26.2)	10000 (8.7)				Impairment of coordination; deleterious to pregnant women and those with heart and circulatory conditions.
Photochemical Oxidants (as Ozone) (vi)	240					Eye irritation; cought; reduced athletic performance; possible chromosome damage.
Lead				1.5		Affects cell and body processes; likely neuropsychological effects, particularly in children; likely effects on rates of incidence of heart attacks, strokes and hypertension.

Legend :

(i) Measured at 298° K (25° C) and 101.325kPa (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.
(vi) Photochemical oxidants are determined by measurement of ozone only.
(vii) Figures in brackets are parts per million (ppm).

2.5.6 Traffic Flow Predictions

2.5.6.1 The predicted hourly traffic flows for CKR in year 2011 with HK$15 (1986$) toll are as follows:

Hourly Traffic Flows (pcu)

	am peak hour	pm peak hour	Daily
Westbound	1100	1600	
Eastbound	2500	2550	
Total two-way	3600	4150	49000

2.5.6.2 The prodicted traffic composition mix during AM peak hour of CKR is:

Vehicle Type	Percentage in terms of Total no. of vehicles
Private	
Motorcycle	3.2
Private car	24.0
Taxi	7.2
Passenger van	2.4
Private bus	3.2
Total Private	40
Goods	
Light goods	20.2
Heavy goods	35.8
Total Goods	56
Public Transport	
PLB	0.8
Franchised Bus	3.2
Total Public Transportation	4

Traffic flow by vehicle mode :

	Peak hour	8 p.m. - midnight
Private	40%	56%
Goods	56%	41%
Public Transportation	4%	3%

2.5.6.3 The predicted average tunnel traffic during the day, is as follows:

	% p.m. peak	Westbound (pcu/hr)	Eastbound (pcu/hr)
5 a.m. - 8 p.m.	: 63%	1010	1610
8 p.m. - 12 midnight	: 47%	750	1200
12 midnight - 5 a.m.	: 9%	145	230

2.5.6.4 Traffic composition mix during peak hour at Eastern and Western Approach Road Networks:

	Percentage in terms of no. of vehicles (%)	
	Eastern Approach	Western Approach
Private	43	82
Goods	41	14
Public Transportation	16	4

2.5.7 Meteorological Conditions

2.5.7.1 There are no meteorological monitoring stations at the two proposed tunnel portals. Actually the portals are located in new reclamation areas where no systematic weather data have been taken. With major interchange road networks connected, the portals are located in open areas without adjacent high buildings.

2.5.7.2 The orientation of East Portal is similar to Hong Kong International Airport (Kai Tak). Topographically, the East Portal is close to the Airport without major obstruction in between and both are open areas. The meteorological conditions of the East Portal and Kai Tak are considered similiar. The meterological data of Hong Kong International Airport is therefore adopted as reference for East Portal. For consistency and convenience, it is also used for West Portal.

2.5.7.3 The record of meteorological data over 5 years from January 1986 to December 1990 taken at Hong Kong International Airport is shown in the Table 2.5.4.

2.5.7.4 In view of the meteorological data and the Air Quality Objectives (AQO) requirements in one hour exposure criteria, parameters are generally selected to reflect the worst case conditions.

Table 2.5.4 Meteorological Data

a.

Stability Class	Percentage of Occurrence (%) Wind Speed (m/s) 0.5-1.0	1.1-2.0	2.1-4.0	4.1-6.0	6.1-10.0	Others	Total
A	62	38	0	0	0	0	100
B	16	16	52	15	0	1	100
C	0	3	43	38	16	0	100
D	3	3	25	44	23	2	100
E	0	13	76	11	0	0	100
F	48	27	20	0	0	5	100
Total	9	8	35	31	15	2	100

b.

Stability Class	Percentage of Occurrence (%)
A	0.1
B	4.9
C	13.4
D	54.3
E	13.0
F	14.3

c. Prevailing Wind Directions : East and Southeast, (70° to 160° inclusive) 61% of time occurrence.

2.5.8 Vehicle Emissions

2.5.8.1 The emission factors of vehicles are based on the recommendations of PIARC 1991 and agreed with EPD. The following classification in PIARC 1991 of emission factors were employed in the air modelling:

a) Passenger cars (99% petrol engine) FTP75

b) Taxi and 2.5 ton vans (100% diesel for taxis) FTP75

c) Goods vehicles (100% diesel engine) US Transient 88

2.5.8.2 The average particulates emission factors of Hong Kong Vehicles at year 2001 advised by EPD are shown in Table 2.5.5. All the particulates emitted from vehicles are assumed to be less than 10 micrometer and therefore categorized as RSP.

2.5.8.3 The total tunnel vehicular emission is based on the traffic prediction at design year 2011 in Paragraph 2.5.6. The total vehicular emission within the tunnel was calculated and is included in Appendix 2.3.

2.5.8.4 Under the peak hour operation at year 2011, the ventilation system is designed to discharge the pollutants to ambient through the vent stacks at two tunnel portals and Fat Kwong Street Vent Building. The distribution of pollutants at these vent stacks are estimated at 70km/h design speed as follows:

Vent Stacks	Percentage of distribution	NOx	RSP
West Portal	35%	3.4 g/s	0.35 g/s
Fat Kwong Street	25%	2.4 g/s	0.25 g/s
East Portal	40%	3.9 g/s	0.4 g/s
Total	100%	9.7 g/s	1.0 g/s

2.5.8.5 Only negligible amount of pollutants dragged by the moving vehicles will escape through portals. The tunnel air velocity at portals are designed to flow inward to prevent the discharge of tunnel pollutants to ambient from portals by increasing the exhaust capacities of vent stacks. The problem of portal emission is therefore eliminated. (Also, see Paragraph 2.5.9.6.)

Table 2.5.5 FLEET AVERAGE PARTICULATES EMISSION FACTORS, g/km

Year	2001	1996	1992
Motor Cycle (Petrol)	0.032	0.032	0.031
Private Car (Petrol)	0.032	0.032	0.031
Private Car (Diesel)	0.238	0.422	0.557
Taxi (Diesel)	0.261	0.261	0.600
Public Bus (Diesel)	1.585	1.606	1.624
Private Bus (Diesel)	1.064	1.182	1.280
Public Light Bus (Diesel)	0.378	0.626	0.726
Private Light Bus (Diesel)	0.276	0.503	0.624
Light Goods Vehicle $\leq$ 2.5 ton GVW (Petrol)	0.035	0.035	0.035
Light Goods Vehicle $\leq$ 2.5 ton GVW (Diesel)	0.237	0.418	0.586
Light Goods Vehicle 2.5T < GVW $\leq$ 5.5T (Petrol)	0.035	0.036	0.035
Light Goods Vehicle 2.5T < GVW $\leq$ 5.5T (Diesel)	0.394	0.575	0.669
Medium Goods Vehicle (Diesel)	1.154	1.241	1.285
Heavy Goods Vehicle (Diesel)	1.157	1.235	1.276

Assumptions :
1) No Inspection & Maintenance Effect
2) Gross emissions assumed
3) Implementation of US88 HDV emission standard in 1995

2.5.8.6 Many factors affect the amount of air pollutants emitted from motor vehicles. These include the fuel (primarily diesel or gasoline) used, the percentages of the different types of vehicles (private car, goods vehicles, buses, etc.) on the roadway networks, the age distribution of the vehicles, weight of vehicles, the requirement for emission control devices, and even ambient temperature. The traffic mix composition of vehicles are analysed in Paragraph 2.5.6. The analysis indicates that the percentage of diesel motor vehicles is 57.39%, with average weight of 8434 kg and overall 1.584 pcu per vehicle for CKR.

2.5.8.7 The tunnel gradient and vehicle speed are other factors influencing the rate of pollutant emission. These are taken into account as per the recommendations of PIARC 1991.

2.5.8.8 The composite emission factors of CO, NO_2 and particulates as input to the CALINE4 model are listed below. These emission factors are used to calculate the pollutant levels at western and eastern approaches of CKR.

Composite emission factor for NOx at 70 km/h is (from Paragraph 2.5.8.3) :

$$\frac{251 \text{ (g/h-veh)} \times 1.5}{70 \text{ (km/h)}} \times 1.61 \text{ (km/mile)} = 8.66 \text{ g/mile/veh}$$

Composite emission factor for NOx at 60 km/h is

$$\frac{251 \text{ (g/h-veh)}}{60 \text{ (km/h)}} \times 1.61 \text{ (km/mile)} = 6.73 \text{ g/mile/veh}$$

Summary of Composite Emission Factors for CO, NOx and Particulates

	Emission Factors (g/mile/veh)			
	CO	NOx		
Traffic Links	70km/h	<60km/h	70km/h	RSP
Central Kowloon Route	3.38	6.73	8.66	0.90
Western Approach	3.38	2.58	3.32	0.39
Eastern Approach	3.38	5.67	7.30	0.73

2.5.8.9 It is assumed that the free-flow traffic speed of main roads and slip roads connected to Western Harbour Crossing, West Kowloon Expressway, Central Kowloon Route, North-South Highway, NSH Elevated Route and Kowloon Bay Connector is 70km/h. Other traffic links speeds are 50km/h. For calculation purposes, the vehicles are assumed to reduce speed to 50km/h at toll plaza area. This assumption is reasonable because a substantial percentage of vehicles will be going through auto-toll lanes and because NOx emissions per length of road are relatively constant at speeds of 60km/h and below.

2.5.9 Air Dispersion Modelling

Surface Roads Emission

2.5.9.1 The connecting road networks at West and East Kowloon are being planned to provide express artery transportation links. The air quality affected by the vehicle emissions is a major concern. Mathematical air dispersion modelling is used as a tool to quantify the air quality impact.

2.5.9.2 The CALINE4 mathematical model is used to simulate the road links as line sources. The peak hour traffic volume of these road links (based on a $15 toll in 1986$) at the portals are used for worst case simulation. The composite emission factors are shown in Paragraph 2.5.8.8.

2.5.9.3 The worst case meteorological conditions for the surface air dispersion modelling used are as follows:

a) Pollutant : NOx
b) Wind Speed : 1 m/s
c) Stability Class : D
d) Wind Direction : Worst angle calculated by CALINE4
e) Wind Directional Variability : 20° advised by EPD
f) NOx to NO_2 conversion factor : 0.2

It should be noted that wind speed of 1m/s represents an extreme worst case scenario and should only be used when wind data show that a substantial percentage of such a wind speed is present.

Vent Stacks Discharge

2.5.9.4 Stacks provide effective atmospheric dispersion of gaseous and particulate pollutants with acceptable ground-level concentrations. Emissions are characterised by their velocity, mass, momentum and buoyancy. Trajectories of the jet emission are determined in part by the momentum, the discharge velocity and meteorological conditions. In order to avoid entrapment of the effluent plume in the vortex of adjacent buildings, the stack discharge velocity is selected to be 15m/s. The discharge velocity can be increased to further enhance the air dispersion, if necessary, but higher energy cost is needed to cover the increased pressure loss.

2.5.9.5 For worst case study of 1-hour exposure at peak hour, the following corresponding parameters are used in the simulations:

a)	Pollutant	: NOx
b)	Wind Speed	: 1m/s, 2m/s, 4m/s, 8m/s
c)	Stability Class	: D
d)	Stack Discharge Velocity	: 15m/s
e)	NOx to NO2 conversion factor	: 0.2
f)	Source Type	: Stack point source, 10m above ground
g)	Modelling Software	: ISCST
h)	Criteria (1 hour exposure limit)	: 0.16ppm NO_2

Portal Emissions

2.5.9.6 CKR is ventilated with total exhaust concept at vent stacks and with fresh air supply from either side or overhead ducts. In order to minimize the air quality impacts from tunnel portals, the vent stack exhaust is increased to extract all the tunnel air to ambient. By increasing the capacities of vent stack exhaust, no vitiated tunnel air is expected to escape from the tunnel except for a very small and negligible amount dragged by the running vehicles. The portal emissions are therefore eliminated. (Also, see Paragraph 2.5.8.5.)

Persistence Factors

2.5.9.7 The air dispersion modellings performed are based on short term air quality of one hour under the input meteorological conditions and peak traffic volume flow. It is not usually feasible to directly predict pollutant concentrations for each of the time periods (especially for mobile source analysis) because, in addition to changing meteorological conditions over these time periods, traffic conditions also change. To account for these changes, persistence factors are usually used. These factors take into account the fact that over several hours or even a year (as distinct from a single hour) vehicle volumes will fluctuate downwards from the peak, vehicle speeds may vary, and meteorological conditions including wind speeds and wind directions will change to some degree as compared with the very conservative assumptions used for the single maximizing hour.

2.5.9.8 The AQOs specified that the maximum allowable exposure limit of NO_2 for 1-hour, 24-hour and 1-year are either 300, 150 and 80 microgram per cubic meter or 0.16, 0.08 and 0.04 ppm respectively. If the 24-hour and 1-year persistence factors are less than 0.5 and 0.26 respectively, the air quality at air receptors fulfilling the requirement of 1-hour exposure limit will also comply with the requirements of 24-hour and 1-year limits.

Stack Plume Persistence Factors

2.5.9.9 For stack plume dispersion, the persistence factors for daily and annual conversion from hourly value are estimated according to the daily traffic volume profile and the varying wind speed and wind direction. Since the stack plume rise is sensitive to the stability classes, the advantage of light traffic volume at night is not considered. During the day time of 15 hours, the average traffic volume is 63% of the peak hour and the persistence factor corresponding to the traffic volume is calculated as (0.63x15+9)/24=0.77. In addition, with the occurrence of the prevailing wind directions of east and southeast (covering 90° in total) in Table 2.5.7.3, the corresponding persistence factor is 0.61. Taking into account of wind direction variation under a particular wind angle, the persistence factor should be less than 0.61. The overall persistence factor for traffic volume and wind direction is therefore less than 0.77x0.61=0.47. The 24-hour allowable limit is 50% of the 1-hour limit; the multiplication of 47% to the 1-hour calculated limit from simulation indicates that every location, which meets the criteria of 1-hour limit, automatically meets the 24-hour limit. The persistence of wind speed and the reduced percentage of goods vehicle in the traffic mix at night are not taken into account in the evaluation. Should they be included, the actual value of exposure is substantially decreased.

2.5.9.10 In consideration of persistence factor for 1-year exposure limit. the conservative persistence factors of wind direction 0.61 and wind speed 0.35 (for wind speed 2.1 to 4.0 m/s range) are applied. The overall persistence factor is equal to 0.61x0.35=0.21 and is acceptable for 1-year exposure limit. The persistence of traffic volume is not taken into account for conservative estimation.

Surface Dispersion Persistence Factors

2.5.9.11 The concentration of surface dispersion is relatively insensitive to the stability classes. Direct application of the daily traffic flow variation is therefore employed. The peak hour and daily traffic flow are predicted as 4150 and 49000 pcu respectively. The corresponding persistence factor is therefore equal to 49000/4150/24=0.49 by assuming the traffic volume profiles at Western and Eastern Approaches surface road network same as that of CKR. The corresponding persistance factor is less than 0.5, and thus every ASRs acceptable to 1-hour exposure limit is in compliance with the requirement of daily exposure limit. The persistence of wind angle, wind speed and dropping of percentage of goods vehicle in traffic mix at night over a day have not been considered for additional contingency.

2.5.9.12 In addition to the traffic flow persistence factor, the consideration of the varying wind speed and wind direction and the probability of the occasion of the coincident occurrence of those parameters over a year must be included. It is apparent that the coincidence persistence factor over a year would be less than 50%. The overall persistence factor of yearly exposure is therefore lower than 26%. It is concluded that every ASR acceptable to 1-hour exposure limit also complies with the yearly exposure limit.

Operation at Night (Stack Plume)

2.5.9.13 The air dispersion modellings for stack plume rise are performed at peak hour traffic in day time. Stack effluents are subject to the random fluctuations of the weather, especially longitudinal and latitudinal variations in wind speed, local convective mixing, topographically forced eddies and atmospheric stability. The atmospheric condition tends to become stable during midnight. In consideration of the dispersion at night, the traffic volume at night is required. It is predicted that both the traffic volume and percentage of goods vehicle in the traffic mix would drop at night. The traffic volume between the period 8pm to 12 midnight is expected to be 47% of that of peak hour. In addition, the drop in the percentage of goods vehicle cause 22% extra reduction in NOx emission. The NOx emission at night is therefore reduced to 36% of peak hour. Mathematical modelling at night is not necessary as the modellings in day time peak hour have sufficiently and reasonably revealed the effect of effluents dispersion to environment.

Carbon Monoxide

2.5.9.14 The composite emission factors of CO, as given in Paragraph 2.5.8.8, are in the same order of magnitude of NOx for all the traffic links. Assuming a conversion factor of 20% from NOx to NO_2, the scale factors of CO for Western and Eastern Approaches are listed in the following. By multiplying the scale factor to the NO_2 concentration, the concentration of CO at the ASRs can be obtained. The 1-hour exposure limits of CO and NO_2 are 300 and 30,000 ug/m3 respectively according to AQOs. Since the ratio of 1-hour CO to NO_2 concentration in HKAQO is 100, the ASRs fulfilling the NO_2 1-hour concentration requirement would also satisfy the CO 1-hour concentration limit.

Location	Emission ratio of CO to NOx	Scale Factor of CO concentration
Western Approach	1.02	5.09
Eastern Approach	0.46	2.32

Respirable Suspended Particulates (RSP)

2.5.9.15 Similar to the results of CO pollutants, the daily RSP concentrations at ASRs can be derived from the results of NO_2 predictions with persistence factors described in Paragraphs 2.5.9.11 and 2.5.9.12. The scale factors of RSP for CKR, Western and Eastern Approaches are listed below:

Location	Emission ratio of RSP to NOx	Scale factor of RSP concentration
CKR	0.10	0.52
Western Approach	0.12	0.59
Eastern Approach	0.10	0.50

2.5.9.16 Any particulate within the range of sizes from 0 to 10 microns is categorized as RSP. The corresponding settling velocity is 0.3cm/s. The settling velocity is so small that the RSP can be simulated as gaseous dispersion, and direct application of concentration ratio to NOx is used. The 1-year exposure limits of RSP and NO_2 are 80 and 55 ug/m^3 according to AQOs. Since the ratio of 55/80 = 0.69 is higher than the scale factors of RSP concentration, the operational RSP pollution emitted from the vehicle engine is predicted fulfilling the requirement of AQOs.

2.5.9.17 According to the recent air quality survey results of year 1991 presented by Environmental Protection Department, the annual RSP background levels at Kwun Tong and Mong Kok are 66μg/m^3 and 59μg/m^3 respectively. These values exceed the limits of AQOs. The primary source of NO_2 comes from the operation of vehicle engine on the roads. Unlike CO and NO_2, particulates are generated by many sources, e.g. the engines of vehicles, construction sites, the fugitive dust from the running trucks, natural atmosphere, etc. Especially for conditions in Hong Kong, the particulates generated from the construction sites and the fugitive dust from trucks are expected to be more than from the vehicle engine. Investigation of operational vehicle engine RSP alone cannot indicate the full picture of impact of RSP to environment.

2.5.10 Impact Analyses

Portal Emissions

2.5.10.1 At the beginning of the study, several ventilation schemes were considered for comparison. One of them was to discharge the vitiated tunnel air through tunnel portals. Figures 2.11 and 2.12 illustrate the affected areas under the portal emissions at West and East Portals respectively. The large envelopes 'A' represent the affected areas exceeding the standard of 1-hour NO_2 exposure limit when all the tunnel air was assumed discharged through portals.

2.5.10.2 To test the sensitivity of tunnel emissions and refine the ventilation scheme, one-third of the tunnel air was discharged through portals and the balance directed to the vent stacks. The affected areas are displayed by envelopes 'B'. The affected areas were still too large to be acceptable. Finally, the idea of tunnel portal discharge was ruled out, and total exhaust of tunnel air through vent stacks at portals and mid-vent building was adopted.

2.5.10.3 The envelopes 'A' and 'B' shown in the figures are based on open areas without obstruction to the airflow. This theoretical situation is appropriate only for areas where high rise buildings are not expected. For existing land where high rise buildings exist everywhere, the air dispersion will be disrupted and blocked. The actual concentration therefore will be lower, and the envelopes will be smaller.

Surface Roads Emissions Background

2.5.10.4 The modelling is based on an assumption that the background level at the ASR locations is mainly contributed by the traffic links within approximate 200m from the ASRs. The sources of NO_2 are primarily coming from the emissions of vehicles, and no other source is considered. The effective dispersion of effluent plumes of vent stacks at portals does not affect the background pollutant level. The plume rise modellings show that the predicted maximum NO_2 concentration level at ground surface is only about 2 ppb at 2500 m from a 10 m tall (above ground) vent stack.

2.5.10.5 Figures 2.13 and 2.14 show the results of air quality of ASRs at Western and Eastern Approaches respectively. The "dotted" road links are modelled as the sources of vehicle emissions. The corresponding 2011 traffic volumes ($15 toll in 1986$) of the road links are shown in Figures 2.15 and 2.16. The composite emission rates are shown in Paragraph 2.5.8.8.

Western Approach

2.5.10.6 Figure 2.13 and Table 2.5.6 tabulate the results of air impact to the ASRs. The air quality at ASR nos R1, R2 and D5 are within the requirements of AQOs and therefore acceptable. Detail breakdown of the contribution of the pollutant sources find that the NO_2 at these ASRs mainly come from the adjacent WKC roads rather than CKR approach roads. The highest NO_2 hourly concentration of 0.12 ppm is found at the ground level of Six Streets Redevelopment area (ASR D5). The maximum NO_2 hourly concentrations at Yau Ma Tei Catholic Primary School are 0.11 and 0.12 ppm for ASR R1 and R2 at ground level respectively.

2.5.10.7 The air quality environment of the new reclamation area at the west portal is found acceptable in the air dispersion modellings. The NO_2 level contributed from the CKR approach road and the adjacent West Kowloon Corridor (WKC) to east and the future road D1 to west are in general within the requirement of 0.16ppm NO_2 1-hour exposure of AQOs. The lower NO_2 concentration in comparsion with higher value obtained at the Eastern Approach is due to the lower percentage of goods vehicle in the West Kowloon traffic mix.

Eastern Approach

2.5.10.8 To evaluate the air impact at ground level of existing land from the traffic of CKR eastern approach roads and the adjacent North-South Highway, the locations of Hoi Sham Park to north and two buildings along the future Yuk Yat Street extension to west of tunnel portal are selected for analyses, because of their proximity to the roads. Figure 2.14 and Table 2.5.7 show the results of the analyses performed by CALINE4 air dispersion modellings. The impact to the ASRs no. R1, R2 and A4 to A8 are within the limit of AQOs and the air quality at those ASRs are acceptable. No mitigation measure is required for those areas.

2.5.10.9 For the new reclamation area between the Hoi Sham Park and CKR approach roads, the air quality of ASRs highlighted with black circles in Figure 2.14 are found to exceed the 1-hour AQO limit. Detail analyses of the wind angles to which highest level of NO_2 are calculated indicate that the main sources of pollutants are coming from the CKR approach road and the adjacent North- South Highway. Because of heavy industrial transportation activities, there will be a relatively high proportion of goods vehicle in the traffic mix at Eastern Approach, which is the main reason for the higher levels. In general, the area within 20 m proximity from the main roads, CKR and North- South Highway, are exposed to higher pollutant level. The locations of unacceptable NO_2 level are usually confined within these areas. To further evaluate the distribution of pollutant emission from CKR approach road, three additional simulations at receptor grid line 4 transverse to the CKR main line with three selected wind directions were performed, and the results are shown in Figure 2.17.

Table 2.5.6 Maximum NO_2 hourly pollutant level at Western Approach

No.	ASR Location(Height)	NO_2 concentration (ppm)	Wind Direction (Degree)
1.	A1	0.07	52
2.	A2	0.07	39
3.	A3	0.07	145
4.	A5	0.09	244
5.	B1	0.09	125
6.	B2	0.10	134
7.	B3	0.09	141
8.	B4	0.10	151
9.	B5	0.10	257
10.	C1	0.14	115
11.	C2	0.14	124
12.	C4	0.13	251
13.	C5	0.11	265
14.	D3	0.12	29
15.	D4	0.11	289
16.	D5	0.12	279
17.	E1	0.10	42
18.	E2	0.10	36
19.	E3	0.10	19
20.	E4	0.08	9
21.	F1	0.07	329
22.	F2	0.07	25
23.	F3	0.07	15
24.	F4	0.07	11
25.	F6	0.07	289
26.	R1(0m)	0.11	252
	(4m)	0.10	252
	(8m)	0.09	253
27.	R2(0m)	0.12	265
	(4m)	0.11	265
	(8m)	0.10	265

Notes :

1. The height of ASR is at ground level unless otherwise specified.
2. The wind directions shown above are the directions of wind which cause the highest pollutant level at the ASRs.
3. Wind direction convention : 0° wind blow from North
   90° wind blow from East
4. See note no. 5 of Table 2.5.7 for ASR A5.

Table 2.5.7 Maximum NO_2 hourly pollutant level at Eastern Aproach

No.	ASR Location(Height)	NO_2 concentration (ppm)	Wind Direction (Degree)
1.	A1	0.08	116
2.	A2	0.10	163
3.	A3	0.07	121
4.	A4	0.07	126
5.	A5	0.07	126
6.	A6	0.08	183
7.	A7	0.08	189
8.	A8	0.09	194
9.	A9	0.10	203
10.	A10	0.12	209
11.	B2	0.12	117
12.	B3	0.08	119
13.	B4	0.08	121
14.	B5	0.09	123
15.	B6	0.09	124
16.	B7	0.09	192
17.	B8	0.10	196
18.	B9	0.12	207
19.	C1	0.10	108
20.	C3	0.10	113
21.	C4	0.10	116
22.	C5	0.11	116
23.	C6	0.11	117
24.	C7	0.11	196
25.	C8	0.13	199
26.	C9	0.15	212
27.	D1	0.12	100
28.	D3	0.15	106
29.	D4 *	0.16	108
30.	D5 *	0.17	108
31.	D6 *	0.18	109
32.	D8 *	0.19	205
33.	D9 *	0.22	219
34.	E1	0.13	86
35.	E2	0.13	82
36.	E3	0.15	80
37.	E4 *	0.17	79
38	E6 *	0.23	79
39.	F1	0.13	80
40.	F2	0.11	79

Table 2.5.6 Maximum NO_2 hourly pollutant level at Western Approach

No.	ASR Location(Height)	NO_2 concentration (ppm)	Wind Direction (Degree)
1.	A1	0.07	52
2.	A2	0.07	39
3.	A3	0.07	145
4.	A5	0.09	244
5.	B1	0.09	125
6.	B2	0.10	134
7.	B3	0.09	141
8.	B4	0.10	151
9.	B5	0.10	257
10.	C1	0.14	115
11.	C2	0.14	124
12.	C4	0.13	251
13.	C5	0.11	265
14.	D3	0.12	29
15.	D4	0.11	289
16.	D5	0.12	279
17.	E1	0.10	42
18.	E2	0.10	36
19.	E3	0.10	19
20.	E4	0.08	9
21.	F1	0.07	329
22.	F2	0.07	25
23.	F3	0.07	15
24.	F4	0.07	11
25.	F6	0.07	289
26.	R1(0m)	0.11	252
	(4m)	0.10	252
	(8m)	0.09	253
27.	R2(0m)	0.12	265
	(4m)	0.11	265
	(8m)	0.10	265

Notes :

1. The height of ASR is at ground level unless otherwise specified.
2. The wind directions shown above are the directions of wind which cause the highest pollutant level at the ASRs.
3. Wind direction convention : 0° wind blow from North
   90° wind blow from East
4. See note no. 5 of Table 2.5.7 for ASR A5.

Table 2.5.7 Maximum NO_2 hourly pollutant level at Eastern Aproach

No.	ASR Location(Height)	NO_2 concentration (ppm)	Wind Direction (Degree)
1.	A1	0.08	116
2.	A2	0.10	163
3.	A3	0.07	121
4.	A4	0.07	126
5.	A5	0.07	126
6.	A6	0.08	183
7.	A7	0.08	189
8.	A8	0.09	194
9.	A9	0.10	203
10.	A10	0.12	209
11.	B2	0.12	117
12.	B3	0.08	119
13.	B4	0.08	121
14.	B5	0.09	123
15.	B6	0.09	124
16.	B7	0.09	192
17.	B8	0.10	196
18.	B9	0.12	207
19.	C1	0.10	108
20.	C3	0.10	113
21.	C4	0.10	116
22.	C5	0.11	116
23.	C6	0.11	117
24.	C7	0.11	196
25.	C8	0.13	199
26.	C9	0.15	212
27.	D1	0.12	100
28.	D3	0.15	106
29.	D4 *	0.16	108
30.	D5 *	0.17	108
31.	D6 *	0.18	109
32.	D8 *	0.19	205
33.	D9 *	0.22	219
34.	E1	0.13	86
35.	E2	0.13	82
36.	E3	0.15	80
37.	E4 *	0.17	79
38	E6 *	0.23	79
39.	F1	0.13	80
40.	F2	0.11	79

Table 2.5.7 (Cont'd)

No.	ASR Location(Height)	NO_2 concentration (ppm)	Wind Direction (Degree)
41.	F3	0.13	79
42.	F4	0.14	78
43.	F9 *	0.17	31
44.	F10	0.14	18
45.	G2	0.12	76
46.	G3	0.14	74
47.	G7 *	0.20	44
48.	G8 *	0.17	37
49.	G9	0.13	26
50.	G10	0.11	14
51.	H1	0.11	74
52.	H2	0.13	70
53.	H3 *	0.17	66
54.	H6 *	0.18	41
55.	H7	0.15	37
56.	H8	0.13	32
57.	H9	0.11	23
58.	R1(0m)	0.15	104
	(4m)	0.13	104
	(8m)	0.11	103
59.	R2(0m)	0.14	83
	(4m)	0.12	83
	(8m)	0.10	83

Notes :

1. The height of ASR is at ground level unless otherwise specified.

2. The wind directions shown above are the direction of wind which cause the highest pollutant level at the ASRs.

3. Wind direction convention : 0° wind blow from North
   90° wind blow from East

4. The ASR marked with an asterisk indicates the concentration exceeding the AQOs 1-hour limit of 0.16ppm NO_2.

5. ASRs No. A4 to A8 inclusive are non-permanent and used for screening purposes.

Vent Stacks Discharge

2.5.10.10 The vent stack vertical discharge is a very effective solution in controlling air pollution. When tunnel air returns to the ground, it is diluted to a level of pollution which is much less than the criteria. The vent stacks at west and east portals are situated away from the portals and surrounding buildings in open areas. In general , the height of vent stack should be as high as reasonable to discharge the pollutants. Figure 2.18 illustrates the extent of impact by the exhaust of vent stacks.

2.5.10.11 The envelopes shown in Figure 2.18 are superimposed with the pollutant concentration contributed from the surrounding surface roads regarded as background level. For simplicity, the background concentrations are selected as 0.05ppm at levels 10m above stack and 0.02ppm at levels higher than 50m. The actual concentrations are lower as compared with the results of background Surface Roads Emissions modelling.

West Portal Stack

2.5.10.12 The results of the stack dispersion modelling are shown in envelope 'B' of Figure 2.18. Assuming it is cylindrical symmetry along the axis of vertical stack, a circular envelope is developed to represent the low air quality zone. Within the envelope, the one-hour exposure limit of 0.16ppm NO2 is exceeded under coincident occurrence of the input meteorological conditions consistency for one hour during peak hour traffic. It is expected this coincident occasion will be seldom. Outside the envelope, the air quality impact from the operation of the CKR is considered environmentally acceptable by Hong Kong Air Quality Objectives requirements.

2.5.10.13 The location of the vent stack cannot be determined at the moment. It is subject to the future development on the new reclamation area. However, the vent stack will be kept at least 150m away from the existing Six Streets Redevelopment area and Yau Ma Tei Catholic Primary School on east to preserve the air quality of these premises. The vent stack discharge point should be higher than any surrounding buildings. Should amenity facilities, e.g. multi-storey carpark, be constructed in vicinity of the CKR portal, the vent stack could be integrated on the top of the facilities.

Fat Kwong Street Vent Stack

2.5.10.14 Figure 2.18 envelope 'A' depicts the low quality envelope due to exhaust from mid-vent stack at peak hour.

2.5.10.15 The location of the Fat Kwong Street Vent Building is selected in the Fat Kwong Street Temporary Housing Area at a high alitude level from the surrounding area. The height of the vent building plus the vent stack is about 50m above the ground level which is higher than any existing buildings in 250m distance. With reference to the low quality envelope A shown in Figure 2.18 for mid-vent building, it is expected that the environment of surrounding existing buildings will not be affected by the vent stack exhaust.

2.5.10.16 In addition to normal uni-directional operation inside the tunnel, bi-directional traffic in one tunnel tube will be operated for maintenance purposes or under special emergency condition. The traffic volume at the typical maintenance periods between 12:00 midnight to 5 a.m. is predicted to be 9% of the peak hour traffic.

2.5.10.17 During bi-directional traffic in one tunnel tube, most of the pollutants will be discharged at the mid-vent stack without the aid of the portal vent stacks. Also, the bi-directional operation will restrict the vehicle speed to under 50km/hr, instead of 70km/hr. The emission of nitrogen oxides from vehicle running at 50km/hr is 77% of those running at 70km/hr. In addition, the reduction of goods vehicles in the traffic flow at night will result in 22% further decrease in nitrogen oxides emissions. In normal operation, the bi-directional traffic will only occur after midnight, and the

corresponding traffic volume is expected to be 9% of the peak hour. The overall nitrogen oxide emission from CKR during bi-directional traffic at night is therefore estimated about 5% of that at peak hour. Air pollution at this particular time is not considered as a problem and is not further discussed in the Study.

East Portal Stack

2.5.10.18 Similar to the West Portal Stack, the results of the low air quality envelope are shown in Figure 2.18 envelope 'C'.

2.5.10.19 The vent stack at east portal is planned to be constructed northwest of the toll plaza beside the road (see Figure 2.10). There is no high-rise building in vicinity. The existing high rise buildings are located 120m to west and northwest of vent stack. The envelope 'C' in Figure 2.18 shows that a building 120m away from the stack will not be affected if the height of building is under 90m. The suggested location of vent stack is thus acceptable, and the air quality of the existing buildings complies with the requirements of AQOs.

2.5.11 Summary

2.5.11.1 Many factors affect the amount of air pollution emitted from motor vehicles. These include the type of fuel, the age distribution of the vehicles, the operational thermal state of the engines, ambient temperature and the requirement for emission control devices. In addition, the authority regulation will also act as a guideline to the vehicle manufacturers. The emission factors used in this report are based on PIARC 1991.

2.5.11.2 The meteorological conditions of wind speed and wind direction are changing constantly. For the conservative approach, it is usual to use the worst case conditions for air dispersion modelling. However, the occasion of coincident occurrence of those conditions at peak hour traffic is seldom. The stack plume rise dispersion takes into account wind speeds from 1 m/s to 8 m/s, while the surface level dispersion uses a low wind speed of 1 m/s in modellings.

2.5.11.3 The ventilation system of CKR is designed with reference to the maximum throughput capacities of 7,200 pcu per hour two-way at speed 70 km/h. The operational air quality impact study is however based on the predicted traffic volume at design year 2011.

2.5.11.4 The percentage of goods vehicle in the traffic composition mix is high. NOx emission is identified as the primary problem, as the most stringent criterion of NO_2 to be achieved in the 1-hour exposure limit in AQOs. The air dispersion modellings only consider the NOx emission. To calculate the levels of CO and RSP, the scale factors shown in Paragraphs 2.5.9.14 and 2.5.9.15 shall be multiplied to the NO_2 concentration.

2.5.11.5 The air discharge velocity of the vent stacks is designed at 15 m/s. The extent of plume rise from stack is mainly determined by the ambient conditions (wind speed, stability class) and stack discharge velocity. To further reduce the size of low air quality envelopes, the plume rise can be raised to higher level by increasing the stack discharge speed at the expense of operating cost, if necessary. It provides a flexible option in the future.

2.5.11.6 The vent stacks should be designed higher than all the surrounding structures within 100m distance to avoid the phenomenon of downwash. Downwash could cause pollutants concentrated on the ground level in the vortex downstream of the stack. Higher discharge velocity would reduce the possibility of downwash. Practically the vent stack should be erected as high as aesthetically acceptable.

2.5.11.7 Downwash of the effluent plume (into the low-pressure region in the wake of a stack induced by the adjacent buildings) will bring localized high concentrations of pollutants to the ground. In general, a building is considered sufficiently close to a stack to cause wake effects when the distance between the stack and the nearest part of the building is less than or equal to five times the lesser of the height or the projected width of the building.

2.5.11.8 None of the identified permanent and non-permanent ASRs in the existing land at west and east portals and mid-vent building are found to exceed the limit of AQOs. Neither mitigation measure nor redevelopment restriction are required in view of operational air quality impacts.

2.5.11.9 The operational air quality impact at West Portal reclamation area are found within the acceptable level of AQOs. It is estimated the future development there will not be restricted from the air quality requirements as a result of CKR.

2.5.11.10 Some areas within 20m proximity from the main roads at East Portal reclamation are found exceeding the 1-hour NO_2 exposure limit. Those areas are identified in black circles in Figure 2.14. Areas in such close proximity to main roads will also be exposed to high level of noise disturbance from the road vehicles. However, most of the areas at East Portal are within the acceptable level of AQOs. The future development planning at East Portal, especially the South East Kowloon Development Statement, should take the air quality requirement into account.

2.5.11.11 Future development over the areas surrounding the vent stacks should note Paragraphs 2.5.11.6 and 2.5.11.7.

2.6 NOISE

2.6.1 Construction

General

2.6.1.1 The construction of the CKR will involve six separate construction elements comprising:

- o demolition of buildings along the route alignment
- o road section from the CKR western portal to the Yau Ma Tei interchange
- o cut-and-cover tunnel sections through West and East Kowloon
- o mined tunnel section through Central Kowloon
- o road sections, associated buildings and temporary toll plaza. Future noise from construction of permanent toll plaza.

2.6.1.2 Construction of the cut-and-cover tunnel sections and the road sections was considered in detail because of the close proximity to residential areas and the high noise levels likely to be experienced. In addition, a broad assessment was undertaken of the noise impacts associated with construction of the toll plaza area, administration and workshop buildings and temporary ramps. The recommendation is that this latter assessment is reviewed at detailed design, when more detailed data will be available. The mined tunnel construction is an inherently quiet operation and is not considered in detail here.

Existing and future background

2.6.1.3 The CKR will be constructed through the densely populated old residential areas of west and east Kowloon. The main sources of existing noise in these areas are a combination of traffic and aircraft noise.

2.6.1.4 A background noise monitoring program was undertaken to determine the existing noise levels in the west and east Kowloon urban areas. The 5 minute L_{eq} was monitored at a number of locations. Results indicate that noise levels are around 80 dB(A) close to the major roads, and around 70 dB(A) in the urban areas not directly subject to traffic noise. Noise levels of around 60 dB(A) were measured at Ko Shan Theatre and on the To Kwa Wan Reclamation. The full results are provided in Appendix 2.4. If there is a requirement to set a daytime construction noise limit, background monitoring would have to be conducted closer to the construction period. For a general discussion of existing noise in relation to traffic refer to Section 2.6.2.

Sensitive Receivers

West Kowloon

2.6.1.5 The western end of the CKR will comprise a road section of approximately 200 m in length exiting the western cut-and-cover tunnel section onto an area of reclamation. Currently there are no sensitive receivers in the vicinity, although the area approximately 90m to the south of the CKR has been zoned residential. The nearest future existing sensitive receivers will be the housing blocks currently under construction as part of the Six Streets Redevelopment Scheme.

2.6.1.6 The west section of cut-and-cover tunnel will traverse a dense residential area of West Kowloon. The noise sensitive receivers (NSRs) will comprise mainly old residential blocks on the streets running perpendicular to the CKR, such as Reclamation Street and Temple Street. Some of these blocks will need to be demolished as part of the excavation program, which may include a strip of buildings 15m either side of the tunnel corridor. Whilst these older blocks will be poorly insulated against noise impacts, the orientation of the facades and high building density in the area limits the angle of view of construction activities and provides shielding. This will not be the case for the Six Streets Redevelopment Scheme. The relatively open aspect of the area, following demolition of existing blocks, means that certain facades will be relatively exposed to construction activities. Some facades may be only a few metres from the edge of the tunnel corridor.

2.6.1.7 A list of the properties most affected by the construction is given below:

Yau Ma Tei Catholic Primary School
Tun Kun District Society Fong Shu School
Wanchai Church Kei To School
Six Streets Redevelopment Scheme
183,188 Reclamation Street
188,288-301,310,313 Shanghai Street
10,15,20,25 Temple Street
4-6,7 Arthur Street
4,8,9,481-479 Nathan Road
Caritas Bianchi Lodge
Salvation Army HQ

For the purposes of this study, seven representative receivers were selected for detailed analysis and are listed in Table 2.6.1.

Table 2.6.1 Representative Sensitive Receivers - West Kowloon

Receiver	Address
NSR C1	Six Streets Redevelopment Scheme
NSR C2	Tung Kun District School
NSR C3	178 Reclamation Street
NSR C4	188 Reclamation Street
NSR C5	15 Temple Street
NSR C6	25 Temple Street
NSR C7	Caritas Bianchi Lodge

The locations of the receivers are shown in Figure 2.19.

East Kowloon

2.6.1.8 The eastern end of the CKR will comprise a road section leading to the toll plaza, approximately 170 m in length. North of the road are largely industrial buildings; the nearest sensitive receivers are therefore the residential blocks to the south-west, west of Yuk Yat Street. However, most facades are well shielded by surrounding buildings or are facing away from the construction area.

2.6.1.9 The east section of the cut-and-cover tunnel will also traverse a densely populated area of Kowloon east of Ko Shan Road, and construction will involve the demolition of a strip of existing residential blocks. Unlike the western section of the tunnel, the remaining blocks will run parallel with the CKR with their facades directly facing the tunnel excavation area. These NSRs will therefore have a generally direct line of sight to construction activities, and surrounding buildings will provide limited shielding. The nearest NSRs are only a few metres from the tunnel corridor.

2.6.1.10 A list of properties most affected by the construction of the CKR is given below:

Ko Shan Theatre
127A, 109 Ma Tau Wai Road
2,4,8,6-16,18,20,22,24,26,28,30,32,34,36,38,40,42,44,46,48,96,116,114,112,52and 54a Wing Kwong Street
1-5,127c,127d Kai Wing Street
15,16,18,20,22-30,37,39,51 Hung Fook Street

For the purposes of this study, six representative receivers were selected for detailed analysis and are listed in Table 2.6.2.

Table 2.6.2 Representative Sensitive Receivers - East Kowloon

Receiver	Address
NSR C8	Ko Shan Theatre
NSR C9	489 Chatham Road
NSR C10	205 Ma Tau Wai Road
NSR C11	24 Wing Kwong Street
NSR C12	30 Hung Fook Street
NSR C13	96 Wing Kwong Street

The locations of the receivers are shown in Figure 2.20.

Methodology

Demolition Phase

2.6.1.11 Demolition is difficult to assess quantitatively; the impacts are dependent on the duration of the activity. Typically the method used is to break the building from the top using a hydraulic breaker placed on the roof of the building. Material is lowered to the ground in chutes, or more frequently via the lift shafts. The waste is then loaded into trucks for off-site disposal. There may be use of occasional use of cutting equipment. For lower buildings, the breaker may be used at ground level, reaching upwards to break up the concrete. Nuisance essentially occurs from operation of the hydraulic breakers, which have a Sound Power level up to 122 dB(A). Other techniques are adopted overseas, such as using hydraulic shears and grabs, these are available in Hong Kong, but their use is not wide spread. The use of such equipment is recommended.

Cut-and-cover Tunnel

2.6.1.12 It was assumed, for the purposes of this assessment, that diaphragm walling rather than sheet piling will be the preferred construction technique for the cut-and-cover tunnel. Construction noise will result from a sequence of activities that have been identified for each stage of the tunnel excavation and construction. These activities include the following:

a) construction of diaphragm walls
b) excavation to roof slab
c) construction of roof slab
d) excavation under roof slab
e) backfilling over roof slab
f) road construction (sub-base preparation and surfacing).

2.6.1.13 Whilst some of these activities may be concurrent, it is not possible at this stage to predict the precise locations and scheduling of the different activities. Therefore, for the purposes of this assessment, noise impacts from each individual activity have been considered separately. Equipment usage data was identified and used to calculate the basic noise level for each activity, see Table 2.6.3. It should be noted that the predicted plant for each activity has been assumed to be working simultaneously. In reality, some of the equipment, such as the breakers for diaphragm wall construction, will only be used occasionally, as required.

2.6.1.14 Maximum noise levels will be experienced when construction equipment is located at the closest point to the NSRs. However, these maximum levels will be experienced for a short period only. There will be some attenuation with distance as the activity progresses away from the receiver. Similarly, receivers which are shielded by other buildings or by their perpendicular orientation only experience noise impacts when the activity is within the angle of view. To estimate the likely duration of elevated noise levels, the period of time in which noise levels greater than 75 dB(A) will be experienced at each receiver, was calculated. The distance required to attenuate the noise from each activity to 75 dB(A) at the NSR was converted to an equivalent tunnel length. From the estimated rate of progression of each construction activity (m day^{-1}), the duration for which noise levels would exceed 75 dB(A) was thus obtained. This methodology is only approximate, but provides some indication of the length of time receivers may be subject to nuisance.

2.6.1.15 Assumptions used for this assessment are as follows:

a) Sound Power Levels used for identified plant, or nearest equivalent, are taken from the 'Technical Memorandum on Noise from Construction Work'.

b) Noise levels for lorries rather than dump trucks were used for calculation purposes for road-going vehicles. It was assumed that the dump trucks would be used as on-site vehicles only.

c) There will be no noise impacts from excavation work under the roof slab.

d) All equipment was considered to be grouped in the middle of the tunnel construction corridor with the exception of the diaphragm walling equipment which was considered to be located at the edges of the tunnel corridor.

e) Excavation of the diaphragm wall progresses at a rate of 3 m of tunnel length per day.

f) Maximum noise levels from diaphragm walling with the breaker in operation are unlikely to be experienced for an extended period of time.

g) Excavation to the roof slab progresses at a rate of 10 m of tunnel length per day.

h) Construction of the roof slab progresses at a rate of 20 m of tunnel length per day.

i) Backfilling onto the roof slab progresses at a rate of 20 m of tunnel length per day.

j) Road resurfacing progresses at a rate of 20 m of tunnel length per day.

Table 2.6.3 Basic Noise Levels from Individual Construction Activities for Cut-and-cover Tunnel Sections

Equipment		Number	Identification	Sound Power Level dB(A)
1.	Diaphragm Walling[i]			
	Rigs	2	CNP048	112
	Back-actors	1	CNP081	112
	Lorries	1	CNP141	112
	Breaker[ii]	1	CNP027	122
		Sub-total		122 [iii]
				118 [iv]
2.	Bulk Excavation			
	Excavators	2	CNP081	112
	Lorries	2	CNP141	112
	Bentonite filtering plant	1	CNP162	105
	Hydraulic extractor	1	CNP163	90
		Sub-total		118
3.	Roof Slab			
	Crane	1	CNP048	112
	Concrete lorry mixer	6	CNP044	109
	Pumps	2	CNP047	109
	Vibrators	8	CNP050	105
		Sub-total		120
4.	Excavation under roof	--	--	N/A
5.	Backfilling over roof			
	Lorries	2	CNP067	117
	Bulldozer	1	CNP141	112
	Rollers	2	CNP186	108
		Sub-total		121
6.	Road Resurfacing			
	Lorries	2	CNP141	112
	Back actor	1	CNP081	112
	Roller	1	CNP186	108
		Sub-base Sub-total		117
	Asphalt paver	1	CNP004	109
	Lorries	2	CNP141	112
	Roller	2	CNP186	108
		Black top Sub-total		117

(i) equipment required for construction of one side of diaphragm wall only
(ii) occasional use only
(iii) noise level with breaker in operation
(iv) noise level without breaker in operation

Approach Roads

2.6.1.16 From a typical equipment schedule for construction of a road section, a worst-case month was identified. Table 2.6.4 lists the number of equipment items which it has been assumed may be operating at a given time in the worst-case month.

Table 2.6.4 Basic Noise Levels from Typical Equipment for Road Construction

Equipment	Number	Identification	Sound Power Level dB(A)
Concrete truck mixers	1	CNP044	109
Lorries	7	CNP141	112
Vibrators	4	CNP170	113
Concrete Pump	2	CNP047	109
Total			123

Toll Plaza and Associated Works

2.6.1.17 From a typical equipment schedule for general construction, a worst case was identified, which would occur during earth works and general excavation. Table 2.6.5 lists the number of equipment items which it has been assumed may be operating at any given time.

Table 2.6.5 Basic Noise Levels from Typical Equipment for Earth Works

Equipment	Number	Identification	Sound Power Level dB(A)
Excavators	2	CNP081	115
Dump Trucks	4	CNP067	123
Total			124

Impacts on receivers

West Kowloon

2.6.1.18 From Table 2.6.3, it can be seen that construction of the diaphragm wall, with or without the breaker in operation, is potentially the noisiest construction activity, followed by backfilling over the roof slab. The maximum noise levels are given in Table 2.6.6, and duration of time when noise levels are likely to exceed 75 dB(A) at each of the NSRs are presented in Table 2.6.7. Maximum noise levels are likely to be experienced at the NSRs as a result of diaphragm walling, range from 92 to 98 dB(A), whilst the breaker is in operation, and from 88 to 94 dB(A) without the breaker. The duration for which noise levels exceed 75 dB(A) during diaphragm wall construction, when the breaker is used, range from 22 days to approximately 44 days.

2.6.1.19 Summing the contributions from the individual activities, the receivers with facades exposed to a greater length of the construction corridor will be exposed to noise levels above 75 dB(A) range from 38 to 76 days. Receivers, such as NSRs C3, C4, C5 and C6, are well shielded by the surrounding blocks and will be exposed to excessive construction noise for a relatively short duration only. These NSRs are representative of many of the residential blocks north and south of the western section of the tunnel.

Table 2.6.6 Maximum Noise Levels at Receivers - West Kowloon

Receiver	Maximum Noise Level dB(A)	
	With Breaker	Without Breaker
NSR C1	94	90
NSR C2	98	94
NSR C3	97	93
NSR C4	97	93
NSR C5	97	93
NSR C6	97	93
NSR C7	92	88

Table 2.6.7 Estimated Duration Noise Levels Exceed 75 dB(A) Due to Construction of Cut-and-cover Tunnel Section - West Kowloon

Construction Activity	Duration noise exceeds 75 dB(A) (days) at the receivers						
	NSR C1	NSR C2	NSR C3	NSR C4	NSR C5	NSR C6	NSR C7
1. Diaphragm Walling	33	44	22	22	22	22	43
2. Excavation to roof slab	8	12	6	6	6	6	11
3. Construction of roof slab	5	7	4	4	4	4	7
4. Excavation under slab	N/A	N/A	N/A	N/A	N/A	N/A	N/A
5. Backfilling over roof slab	6	8	4	4	4	4	8
6. Road construction	4	5	2	2	2	2	5
Total duration construction noise exceeds 75 dB(A)	56	76	38	38	38	38	73

N/A Not Applicable

2.6.1.20 Whilst the receivers will be protected from noise from the mined tunnelling operation, there may be some noise impacts resulting from movement of excavated material from the site. The Most spoil will be generated from hillside excavation, to the east of Nathan Road, and approximately 10% of the mined tunnel spoil will be removed at the west. Haulage may be undertaken as a 24 hour operation, but because of the possible noise nuisance from the night time activity, this may be reviewed should there be complaints from local residents. The adoption of 24 hour material hauling reduces the need to double handle tunnel spoil, and reduces the construction period by one year.

2.6.1.21 From Table 2.6.4 the basic sound power level resulting from construction of the elevated road will be approximately 123 dB(A), although data on equipment is only provisional at this stage. The blocks at the Six Streets Redevelopment Scheme, currently under construction, will be at least 100 m from the construction activity. This is equivalent to a noise attenuation of -48 dB(A), which results in a basic noise level of 75 dB(A) at the sensitive receiver. It is not known whether there will be any future sensitive receivers constructed on the reclamation before construction work begins. If is the case it is likely that any blocks less than 100 m from the construction will be subjected to noise levels above 75 dB(A) for some of the construction period.

2.6.1.22 The area around the interface of the cut and cover/mined tunnel interface, close to the Salvation Army Headquarters will be subject to noise for longer periods than indicated. The construction work in this area involves a considerable amount of excavation into the hill-side. However, the adoption of good working practices should minimise nuisance in this area.

East Kowloon

2.6.1.23 The maximum noise levels are given in Table 2.6.8, and duration of time when noise levels are likely to exceed 75 dB(A) at each of the NSRs are presented in Table 2.6.9. Maximum noise levels are likely to be experienced at the NSRs as a result of diaphragm walling, range from 84 to 97 dB(A), whilst the breaker is in operation, and from 80 to 93 dB(A) without the breaker. The duration for which noise levels exceed 75 dB(A) during diaphragm wall construction, when the breaker is used, range from 20 days to approximately 46 days.

2.6.1.24 The receivers with facades exposed to a greater length of the construction corridor will be exposed to noise levels above 75 dB(A) range from 33 to 70 days.

Table 2.6.8 Maximum Noise Levels at Receivers - East Kowloon

Receiver	Maximum Noise Level dB(A)	
	With Breaker	Without Breaker
NSR C8	94	90
NSR C9	88	84
NSR C10	84	80
NSR C11	86	82
NSR C12	97	93
NSR C13	96	92

Receivers immediately opposite the eastern side of the tunnel section will experience little or no shielding from construction noise impacts. The residential blocks on streets further away from the corridor will be shielded to a large extent or will experience some degree of distance attenuation.

Table 2.6.9 Estimated Duration Noise Levels Exceed 75 dB(A) Due to Construction of Cut-and-cover Tunnel Section - East Kowloon

Construction Activity	Duration noise exceeds 75 dB(A) (days) at the receivers					
	NSR C8	NSR C9	NSR C10	NSR C11	NSR C12	NSR C13
1. Diaphragm Walling	19	31	20	41	35	37
2. Excavation to roof slab	5	8	4	10	9	10
3. Construction of roof slab	3	5	3	7	6	6
4. Excavation under slab	N/A	N/A	N/A	N/A	N/A	N/A
5. Backfilling over roof slab	4	6	4	8	6	7
6. Road construction	2	3	2	4	4	4
Total duration construction noise exceeds 75 dB(A)	33	53	33	70	60	64

N/A Not Applicable

2.6.1.25 Whilst the receivers will be protected from noise from the mined tunnelling operation, there may be some noise impacts resulting from movement of excavated material from the site. Most of the mined tunnel spoil will be removed at the east tunnel portal. It is estimated that eight lorry movements per hour over a 24 hour period will be required. The construction period may be extended to four years, which would remove the need for 24 hour of-site haulage of spoil. The material could be used to form a small reclamation or stock piled at night for day time removal. If no night time activity outside the tunnel was permitted, construction time would be increased to five years.

2.6.1.26 During construction of the toll plaza area and associated works, the maximum Sound Power Level is estimated to be 124 dB(A) during the earthworks phase. In accordance with the methodology given in TM, this could result in noise levels of approximately 78 dB(A).

Mitigation measures

2.6.1.27 Although there are no statutory controls on daytime construction noise, discussions with Noise Policy Group of the EPD has indicated that the maximum desirable noise levels at identified NSRs are 75 dB(A) or 5 dB(A) above the ambient background level. During construction of the cut-and-cover tunnels, peak noise levels of up to 98 dB(A) may be experienced at the nearest NSRs. However, these high levels will only be experienced for short periods only, when the breaker is working directly opposite a receiver, at close distance. The duration for which noise levels will exceed the guideline of 75 dB(A) for representative NSRs has thus been estimated. The results indicate that the 75 dB(A) guideline will be exceeded for up to 76 days at the worst affected NSR over the construction period. The main bulk of the construction activity for the cut-and-cover tunnel will be conducted underneath the roof slab, and any noise impacts effectively mitigated. Whilst the noise impacts will therefore be relatively short-term, efforts should be made to reduce noise levels to the minimum practicable.

2.6.1.28 Techniques available for reducing noise from construction activities include the following:

a) employment of silenced and supersilenced equipment

b) employment of quieter techniques (eg. shears and grabs for demolition)

c) acoustic screening of individual plant items to reduce noise at source

d) acoustic screening of receivers from direct line of sight of construction activity

e) operational limitations imposed on the contractor in the form of contract clauses

2.6.1.29 The use of silenced equipment is a practical means of mitigating noise impacts. This may be specified in contract clauses, although in Hong Kong there is reluctance to be too specific in contract clauses.

2.6.1.30 Many of the residential blocks, particularly those affected by construction of the western section of the cut-and-cover tunnel, are already well shielded from construction noise. Only those receivers nearest to the tunnel construction corridor, for both western and eastern sections, will experience significant noise impacts. However, acoustic screening of these receivers would not appear to be justified in this case because of the limited period in which noise levels are likely to exceed the noise guideline.

2.6.1.31 Because of the difficulties in achieving a daytime construction noise limit, (due to the close proximity of sensitive receivers) it is recommended instead that contractors comply with good working practices and use suitable well-maintained plant and equipment. This operational condition may be imposed on the contractor in the form of contract clauses. Typically these would follow

the sample specifications given in 'A Practical Guide for the Reduction of Noise from Construction Works', EPD, 1989. Example contract specifications are provided in Appendix 2.5.

2.6.1.32 Demolition impacts may be reduced by adopting an alternative technique. Hydraulic shears and grabs are used elsewhere in the world, but these techniques are not widely used in Hong Kong. It is likely that these would cause less nuisance impact than breakers (although actual data are not currently available). It is recommended that preference is given to contractors willing to adopt alternative demolition techniques at the tender stage.

2.6.1.33 The three schools adjacent to the construction corridor in West Kowloon require special consideration. The original proposal was to reprovision the schools to a nearby site, however this did not meet with the requirements of Director of Education. In terms of minimising disruption during construction, this would have provided the most satisfactory solution. The schools will be subject to nuisance due to the need to work within a few metres of the premises. A number of measures were identified to minimise impacts at the schools, there are described as follows:

a) The most effective mitigation measure is to schedule work during vacation periods where possible, and avoid work during examination periods. Because there are unlikely to be particular time constraints on the construction period, this would appear to be a practical solution. Time restrictions could form part of contract requirements.

b) EPD has indicated that buildings should be insulated to mitigate against construction noise impacts. This would be beneficial in reducing nuisance. There is no general precedent in Hong Kong for provision of insulation to mitigate against construction impacts, but in this case Highways Department has indicated that the required insulation will be provided.

2.6.1.34 Ko Shan Theatre, being open air, could also be subject to some disturbance. Discussions were held with USD to discuss measures to minimise disruption to the park and theatre operations. It is recommended that the construction period is extended to four years, so 24-hour off-site haulage of tunnel spoil in the vicinity of the theatre is not required. This would not disrupt evening performances at the theatre.

Monitoring Requirements

2.6.1.35 The only statutory requirements for monitoring are defined within the Noise Control Ordinance, in relation to application for Construction Noise Permits. Normally contract documentation for projects of this scale require provision of noise monitoring equipment for use at the works areas. This would be a recommendation for this project. It is recommended that the Contractor undertakes noise monitoring on a number of occasions each week and submits the results to the Engineer for inspection. If the monitoring indicates that noise levels are noticeably in excess of background levels, then action should be taken to determine the source of the problems and to find methods for noise reduction.

2.6.2 Operation

General

2.6.2.1 For most of its length, the CKR will be in tunnel and hence will have no adverse noise impacts on receivers. The use of cut-and-cover tunnels through West and East Kowloon virtually eliminates potential traffic noise nuisance in these areas. The potential problem areas are around the tunnel portals and approach roads to the west and east interchanges, where receivers may be adversely affected by noise.

2.6.2.2 Evaluation of noise mitigation measures is an integral part of the assessment, hence there is no separate section on mitigation. Noise reduction measures are included with the discussion of impacts on receivers.

2.6.2.3 Various options for alignment and interchange were considered for the western and eastern approaches. The chosen alignments, as endorsed by the Steering Group and DPC, were used for the assessment.

Existing and Future Background Conditions

2.6.2.4 The existing noise levels over the future tunnel will be of no relevance. The western portal will be on the West Kowloon Reclamation, which has not yet been formed, so the existing noise levels as generated in the Yau Ma Tei Typhoon Shelter are not considered to provided useful or useable information. Data will be available from the West Kowloon Reclamation ENPO which is due to begin monitoring operations in the near future. Monitoring as undertaken for the WKC Study at the Yau Ma Tai Catholic Primary School showed that the day time $L_{eq\ (1\text{-hour})}$ was in the range 75-82 dB(A) and the $L_{(10\text{-peak hour})}$ was 87 dB(A).

2.6.2.5 The eastern portal will be on the To Kwa Wan Reclamation, close to Hoi Sham Park. A noise monitoring program was undertaken to measure noise levels on the To Kwa Wan reclamation. As expected, measured noise levels were relatively low, $L_{eq\ (30\ min)}$ was in the range 50-65 dB(A). Full results are given in Appendix 2.4.

West Kowloon - West Kowloon Reclamation

2.6.2.6 Noise levels at zoned residential areas on the new reclamation will be subject to noise from the major roads in the area, particularly road D1, the interchange and the WKC. The WKE Environmental Assessment indicates that areas of land to both the north and south of the interchange, between the WKE and the WKC, may be subject to facade noise levels above the HKPSG guideline limit.

2.6.2.7 The WKC Environmental Assessment indicated that the proposed development areas may be subject to noise levels above the HKPSG guideline limit from the WKC alone. The combined effects of the WKE and WKC mean that areas of the reclamation will be subject to noise levels above the guideline, even if comprehensive mitigation programs are undertaken. The emerging CKR will add an additional noise source to the north of an area already surrounded by major roads.

West Kowloon - Existing Land

2.6.2.8 The dominant future noise source will be the WKC, running north-south above Ferry Street. The proposed WKC was subject to an Environmental Assessment which indicated noise levels at local receivers are potentially high. With no mitigation on the WKC, predicted noise levels at the Six Streets Redevelopment Scheme would be a maximum of 79.4 dB(A); the additional contribution from the CKR would be unnoticeable. The use of strategic barriers (the agreed mitigation measure) reduces the noise from the WKC, but the maximum level at the Six Streets Development would be 74.6 dB(A); even with these measures the CKR noise contribution would still be negligible. Considerable efforts were made to reduce impacts from the WKC, but given the constraints in the area, it is likely to be the dominant noise source in the area.

East Kowloon - Existing Land

2.6.2.9 The buildings to the east face onto the To Kwa Wan reclamation. There are no major roads in the area; the buildings are not currently subject to high levels of traffic noise. In future, the North-

South Highway will run approximately 120m to the east of the existing buildings. This is likely to be the dominant noise source, as indicated by the Central Kowloon Traffic Study.

East Kowloon - Kowloon Bay Reclamation

2.6.2.10 The existing situation is of no relevance. The future land development on the new reclamation is still at a very early stage, and only broad Metroplan requirements have been considered. No assessments have been carried out to establish the possible future noise sources. This area is currently under consideration as part of the South East Kowloon Study.

Sensitive Receivers

West Kowloon

2.6.2.11 The alignment of the cut-and-cover tunnel is virtually fixed as per the Steering Group and DPC decisions. The east-bound portal emerges approximately 100m to the west of existing sensitive receivers. The west-bound portal has been moved 30m west to allow for the ventilation requirements. The portal emerges approximately 130m to the west of existing sensitive receivers. Noise predictions were made at the Six Streets Redevelopment Scheme, at the three blocks closest to the WKC, for a number of floor levels. Other existing (1992) buildings in West Kowloon were not considered to be affected by the CKR, because of distance attenuation and noise domination from other sources in the area. The locations of the receivers are shown on Figure 2.21.

2.6.2.12 Analysis was also undertaken for points on the new reclamation, at varying distances from the CKR, to assess the possible potential impacts on proposed residential areas. Noise contour plots over the area were produced. There is a residential zoned area to the north of the CKR, the closest point being approximately 270m from the CKR. Given this distance and the likely shielding by buildings in the intervening non-sensitive land, it is not considered that the CKR will impose noise constraints in this area.

East Kowloon

2.6.2.13 The To Kwa Wan area contains mainly older type housing blocks close to the proposed route. Blocks above the corridor will be demolished. A small number of buildings will be affected by noise from the portal area, these are 54/54A Wing Kwong Street, 26 Wan Fuk Street, 26 Wan Shun Street and the new residential block on Wing Kwong Street. These receivers are shown in Figure 2.22.

2.6.2.14 The current ODP for To Kwa Wan reclamation (D/K9/1B) shows two schools planned on the existing reclamation, one in the path of the CKR. No other sensitive uses are shown on the reclamation. The plan is currently under revision, but not yet on general circulation. The assessment assumes that schools will not be located in this area.

2.6.2.15 The CKR is planned for 2001; it is possible that some redevelopment may take place before road construction, and is probable that there will be considerable redevelopment following the road construction. On this basis, the existing receiver positions may also represent future buildings; hence higher floor levels than currently exist were used for the analysis.

2.6.2.16 There are currently no definite land use plans for the Kowloon Bay Reclamation. Metroplan provides broad indications of planning requirements. Residential areas should be sufficiently far away to be unaffected by the CKR. Detailed planning should take account of noise constraints imposed by the CKR and NSH with regard to residential zoning.

Assessment Methodology

2.6.2.17 Calculations were carried out using the UK Department of Transport 'Calculation of Road Traffic Noise', 1988 (CRTN).

2.6.2.18 Peak hour vehicle flows for the year 2011 were used for the assessment in accordance with the requirements of the Brief. The flows are shown in Table 2.6.10. The vehicle composition used for the assessment was based on 63% HGVs, and a PCU/Veh conversion factor of 1.65.

Table 2.6.10 Traffic Flows

Direction	Flow (PCU/hr) *
Westbound	1600
Eastbound	2550

* Assumes $15 toll

2.6.2.19 The west and east speed of traffic emerging from the tunnel portals and approaching the interchanges at both the sections was taken as 55 km/h. Adjustments were made for gradient in accordance with the CRTN methodology. The road surface was assumed to be impervious bitumen/concrete.

Impact on Receivers and Associated Mitigation Requirements

West Kowloon - Existing (1992)

2.6.2.20 The Six Streets Redevelopment Scheme comprises five residential blocks of 28 storeys. Table 2.6.11 shows the noise contribution from the CKR at different floor heights.

Table 2.6.11 Noise Levels at the Six Streets Redevelopment Scheme (See Fig. 2.21)

Floor	NSR O1	NSR O2	NSR O3
1	43.8	47.9	48.6
6	58.9	61.3	60.4
11	61.4	63.6	63.4
16	61.0	64.5	64.3
21	60.4	65.0	65.2
26	59.9	65.3	65.6

2.6.2.21 The noise contribution from the CKR is below WP1 criteria of 70 dB(A) for all facades and floors. The lower floors, in particular, are relatively unaffected by the CKR because of shielding of the road emerging from the portal by the structures of the WKC.

2.6.2.22 Taken in isolation, the CKR will not cause adverse noise nuisance at the Six Streets Redevelopment Scheme. However, these blocks may be subject to high noise levels from the WKC. The noise from the CKR will be negligible in comparison with other noise sources in the area.

2.6.2.23 The decision to route the western approach of the CKR in cut-and-cover tunnel, rather than on elevated roads, provides by far the most effective noise mitigation solution for reduction of impacts to existing receivers. Because of the dominance of the noise contribution from the WKC, further mitigation of noise from the CKR to protect existing (1992) buildings in West Kowloon would not appear to provide a noticeable improvement to residents.

West Kowloon - Future

2.6.2.24 Analysis was undertaken for points on the new reclamation, at varying distances from the CKR, to assess the possible potential impacts on proposed residential areas. The results are shown on the contour plots, see Figures 2.23 - 2.26. For the purposes of this assessment, it was assumed that there would be shielding from the proposed carpark block and sports facility. The heights of the shielding structures were taken as 20m mpD, and the building length was taken as 100m. It must be stressed that these are assumptions for the purpose of this noise assessment only, there are no preliminary designs for this building. This situation will need to be reviewed closer to the detailed design stage.

2.6.2.25 The noise contribution from the CKR to the residential zoned area on the reclamation is potentially in exceedance of the WP1 criteria (70 dB(A)), although not over the whole area and only at higher floor levels.

2.6.2.26 Given the constraints placed on the development sites by the surrounding roads ie. WKE, WKC and CKR, the most effective mitigation would be achieved by suitable site layout and building design. Developers and architects must be fully aware of the noise constraints placed on these sites to enable site layouts to incorporate 'sacrificial' non-sensitive uses to protect residents, or to employ self-protecting buildings designs. Highways Department has expressed willingness to provide a pervious road surface should this be considered necessary. This would reduce calculated noise levels by approximately 2.5 dB(A) which would remove constraints on the residential area due to CKR road traffic noise.

2.6.2.27 With the above assumptions, a building height of 30-35 metres would be required to reduce constraints to a minimum, if this was the sole mitigation measure. Further noise reduction would be achieved by increasing the length, and hence the shielding effect, of the carpark building. It should be noted that the provision and design of this building do not form part of the CKR scheme.

East Kowloon

2.6.2.28 Predicted noise levels at sensitive receivers are shown in Tables 2.6.12 - 2.6.15. The current proposal is to locate the administration building and the workshop such that a barrier is formed between the toll plaza and the residential buildings to the south. The workshop and administration building height was assumed to be 10m (approximately 9m MPD). This arrangement has particular benefit for noise reduction at the new residential block currently under construction.

2.6.2.29 The assessment demonstrates that there should be no adverse noise impacts at sensitive receivers, provided mitigation is provided in the form of a 5m barrier to the north of the road, or pervious surfacing is used.

Table 2.6.12 Potential Impacts on the Existing Sensitive Receivers with no Mitigation (See Fig. 2.22)

Floor	NSR O4	NSR O5	NSR O6	NSR O7
1	69.3	49.9	49.1	51.6
3	70.9	52.1	50.7	54.7
5	71.3	54.7	52.4	58.7
7	71.5	57.9	54.4	63.1
9	71.7	61.1	56.9	66.7
11	71.6	63.4	59.4	67.9
13	*	*	*	68.4
15	*	*	*	68.6
17	*	*	*	68.5
19	*	*	*	68.3
21	*	*	*	68.1

* Buildings not greater than 12 storeys

Table 2.6.13 Potential Impacts on the Existing Sensitive Receivers with a 4m Barrier to the North of the Road (See Fig. 2.22)

Floor	NSR O4	NSR O5	NSR O6	NSR O7
1	64.1	49.9	49.1	51.6
3	67.2	52.1	50.7	54.7
5	69.5	54.7	52.4	58.7
7	70.0	57.9	54.4	63.1
9	70.2	61.1	56.9	66.7
11	70.1	63.4	59.4	67.9
13	*	*	*	68.4
15	*	*	*	68.6
17	*	*	*	68.5
19	*	*	*	68.3
21	*	*	*	68.1

Table 2.6.14 Potential Impacts on the Existing Sensitive Receivers with a 5m Barrier to the North of the Road (See Fig. 2.22)

Floor	NSR O4	NSR O5	NSR O6	NSR O7
1	61.7	49.9	49.1	51.6
3	65.5	52.1	50.7	54.7
5	68.5	54.7	52.4	58.7
7	69.6	57.9	54.4	63.1
9	69.8	61.1	56.9	66.7
11	69.8	63.4	59.4	67.9
13	*	*	*	68.4
15	*	*	*	68.6
17	*	*	*	68.5
19	*	*	*	68.3
21	*	*	*	68.1

Table 2.6.15 Potential Impacts on the Existing Sensitive Receivers with Pervious Macadam on the Road Surface (See Fig. 2.22)

Floor	NSR O4	NSR O5	NSR O6	NSR O7
1	66.8	47.4	46.6	49.1
3	68.4	49.6	48.2	52.2
5	68.8	52.2	49.9	56.2
7	69.0	55.4	51.9	60.6
9	69.2	58.6	54.4	64.2
11	69.1	60.9	56.9	65.4
13	*	*	*	65.9
15	*	*	*	66.1
17	*	*	*	66.0
19	*	*	*	65.8
21	*	*	*	65.6

2.6.2.30 The toll plaza may cause adverse impacts in the form of nuisance. The slowing, braking and acceleration of vehicles would cause more annoyance to local residents than traffic moving at a constant speed. In particular, braking heavy vehicles could cause particular annoyance to local residents. However, these issues relate to poor vehicle maintenance and poor driving technique; it is beyond the scope (or ability) of this project to solve such problems.

2.6.2.31 Should future traffic conditions alter, due to changes in toll structure or collection methods, there are a number of additional measures that may be adopted to prevent noise levels exceeding the criteria. Building heights and barrier heights may be increased, or pervious road surfacing may be provided.

Ventilation Building Noise Impacts

2.6.2.32 Ventilation building noise is subject to the terms of the Noise Control Ordinance. Hence, there are noise criteria that must be met as a statutory requirement. Failure to meet these limits would result in penalties for the operators of the facilities. The required criteria should form part of the specification for the design and construction of the facilities.

2.6.2.33 Assessment of ventilation building noise was undertaken in order to establish the performance requirements. This was undertaken in accordance with the Technical Memorandum for the Assessment of Noise from Places Other than Domestic Premises, Public Places or Construction Sites. Detailed assessment could not be undertaken because details of these buildings will not be produced until detailed design. The buildings must meet statutory noise criteria, these requirements will form part of the design criteria of the buildings. The measures required to achieve this are a matter for the detailed design.

West Kowloon

2.6.2.34 The residential buildings will be approximately 100m from the ventilation building. An Area Sensitivity Rating C is considered to be appropriate, since these receivers are in an urban area, influenced by noise from the WKC and the WKE.

2.6.2.35 The tunnel will be operating 24 hours per day, therefore the night-time ANL of 60 dB(A), as given in Table 3 of the Technical Memorandum should be applied. However, it should be noted that ventilation fans are likely to be running at maximum levels only in times of high traffic flows, ie, the morning and evening peak hours. At other times, fans will be operating below maximum level.

5.2.4 As the receivers may be 100m from the ventilation building, a distance attenuation factor of 40 dB(A) can be applied, compared with the noise level at 1m from the building. Therefore, the noise generated by the ventilation building should be a maximum of 100 dB(A) at 1m. However, without noise measurements, corrections for tonality, impulsiveness and intermittency cannot be made, which potentially could increase the Corrected Noise Level by 15 dB(A). The maximum acceptable ventilation building source noise may therefore be reduced to 85 dB(A). The necessary measures for noise reduction should be incorporated during detailed design of the ventilation building, in order to meet this level.

Fat Kwong Street

2.6.2.36 The residential buildings may be only 30m from the ventilation building. An Area Sensitivity Rating B is considered to be appropriate, since these receivers are in an urban area.

2.6.2.37 The night-time ANL of 55 dB(A), as given in Table 3 of the Technical Memorandum should be applied.

2.6.2.38 As the receivers may be only 30m from the ventilation building, a distance attenuation factor of 29 dB(A) can be applied, compared with the noise level at 1m from the building. Therefore, the noise generated by the ventilation building should be a maximum of 84 dB(A) at 1m. However, the CNL could increase by 15 dB(A). The maximum acceptable ventilation building source noise may therefore be as low as 69 dB(A). The necessary features for noise reduction should be incorporated during detailed design of the ventilation building, in order to meet this level.

East Kowloon

2.6.2.39 The residential buildings will be approximately 100m from the ventilation building. An Area Sensitivity Rating C is considered to be appropriate, since these receivers are in an urban area and will be directly affected by noise from the CKR and NSH. The night-time ANL of 60 dB(A), as given in Table 3 of the Technical Memorandum should be applied.

2.6.2.40 As the receivers will be approximately 100m from the ventilation building, a distance attenuation factor of 40 dB(A) can be applied, compared with the noise level at 1m from the building. Therefore, the noise generated by the ventilation building should be a maximum of 100 dB(A) at 1m. However, the CNL could increase by 15 dB(A). The maximum acceptable ventilation building source noise may therefore be 85 dB(A). The necessary features for noise reduction should be incorporated during detailed design of the ventilation building, in order to meet this level.

2.7 WATER QUALITY

2.7.1 Construction

General

2.7.1.1 The main impact of concern during the construction phase would be site runoff which could contain suspended solids emanating from excavation and backfilling of the tunnel trench. These suspended solids could cause chemical, biological, physical and aesthetic impacts on the marine water. These effects subsequently could lead to ecological impacts on marine fauna. Operational impact could result from discharge of tunnel drainage containing solids and chemicals. With adequate protection measures, however, normal drainage would not be expected to cause significant impact.

2.7.1.2 A possible tunnel spoil disposal option is to use the material to form a small reclamation in Kowloon Bay. The reclamation would be approximately 3 Ha. This disposal option has considerable cost advantages. At this stage this disposal route is still only conceptual; it is not proposed to undertake a full water quality assessment, however if it is later decided to form the reclamation, the water quality impacts should be reviewed.

Existing and Future Background Conditions

2.7.1.3 Average conditions of water quality in terms of levels of biochemical oxygen demand (BOD), dissolved oxygen (DO), turbidity and suspended solids are acceptable in Victoria Harbour. The growing population and industrial activities around this area, however, has caused the water quality to decline, particularly in respect of elevated suspended solids. An important issue is serious sediment contamination by heavy metals, organic micro-pollutants, and organic pollutants due to huge quantities of domestic sewage and industrial effluents discharged into the water body. Contents of these pollutants are generally among the highest levels in comparison with those in other watercourses.

2.7.1.4 According to water monitoring data 1989 by EPD, contents of heavy metals such as chromium and copper in the sediments were extremely high in Kowloon Bay, reaching to 54 - 110 $mgkg^{-1}$ d.s. and 220 -750 $mgkg^{-1}$ d.s. respectively. Organic micro-pollutants, i.e. PAH and PCB, were also recorded as high as 2.2 $mgkg^{-1}$ d.s (Kowloon Bay) and 330 μgkg^{-1} d.s (Yau Ma Tei) respectively. This is due to discharges of processing waste water and contaminated storm water from industrial areas around the Harbour.

2.7.1.5 High levels of total organic carbon (TOC), above 2.5% of dry solids, total nitrogen (TN), more than 2000 $mgkg^{-1}$ d.s, and total phosphorous (TP), more than 800 $mgkg^{-1}$ d.s, from deposition of large amount of organic pollutants were noticed. These organic contaminants caused oxygen

depletion throughout the water column and extreme anaerobic condition (Eh values less than 350 mV) in the bottom. This phenomenon was particularly evident during summer, (i.e. DO level only reached 10 to 30 percent saturation), because of the effects of stratification in the water column which prevented replenishment of oxygen from the surface, and the occurrence of greater rate of organic decay because of the warmer temperature.

2.7.1.6 Between now and 2001-2011, there will be intensive reclamation and construction works on both shores. Water quality, particularly suspended solids loading, is therefore likely to decline during this period. The implementation of amended Water Pollution Control Ordinance and Stage 1 of the Strategic Sewage Disposal Scheme in 1995 (involving primary treatment and discharge through a long outfall to the South West of Stonecutters Island), however, should both contribute to improve water and sediment quality. However, the improvement in sediment quality will take longer time because of the reservoir of accumulated pollutants over long period of time.

Sensitive Receivers

2.7.1.7 Within the immediate vicinity, there are no sensitive biotic receivers such as mariculture zones or fish spawning grounds. The nearest marine zone is located in the proposed Water Buffer Control Zone at Ma Wan. This fish culture zone is located at sufficient distance from the work area that it is unlikely to be affected by this project. The main sensitive receiver is the marine water in Victoria Harbour.

Impact on Receivers

2.7.1.8 During construction of the CKR, marine water in Victoria Harbour may be affected by drainage from a number of sources:

- rainfall runoff containing quantities of excavation and fill materials from the construction areas
- water runoff from concrete batching plants for dust suppression, damping paved areas, and washing of truck exteriors and mixer truck interiors
- maintenance pumping from the tunnel approaches during excavation and formation
- uncontrolled discharges of sewage
- accidental discharges of petroleum and other chemicals used on the construction sites.

2.7.1.9 The most likely pollutant from the above sources will be suspended solids. Such solids have the potential to cause blockage in the drainage system and, create temporary increases in turbidity, discoloration, biochemical oxygen demand, and nutrient levels in immediate receiving marine waters especially during heavy rainfall. The elevated turbidity in the receiving water could reduce solar radiation for photosynthesis.

2.7.1.10 Another potential turbidity problem could result from accidental release of bentonite. Bentonite is a colloidal suspension of finely ground clay in water. It will be used for the support of tunnel walls during excavations if the diaphragm wall method of construction of cut-and-cover tunnel is adopted.

2.7.1.11 Effluent from washroom and toilet facilities provided at construction works areas would cause increases in BOD, nutrient and faecal bacteria loadings in this already impacted area if uncontrollable discharges were to occur. This action is undesirable.

2.7.1.12 Accidental spillage, leakage, or indiscriminate disposal of fuel, oils, lubricants, paint, water proofing agents and hydraulic fluid would cause contamination of marine water. Some chemicals can be toxic to fauna, and may persist in sediments.

2.7.1.13 The extent of the impacts, however, would depend on the quantity and composition of any discharge. The overall potential effect because of discharge of suspended solids should be relatively small.

2.7.1.14 The possible formation of the reclamation using tunnel spoil may have adverse water quality impacts. The tentative proposal would be to form a sea wall with the larger pieces of rock, then infill using tunnel spoil. The reclamation would proceed relatively slowly, it is estimated that the quantity of material dumped would be 700-1000m^3day^{-1}. There are no proposals to dredge the marine mud, given the large time span, the reclamation would settle naturally. This would eliminate a potential source of suspended solids and remove the need for mud disposal. The dumped rock will contain fines, which will be displaced as material is dumped. It is likely that this will increase suspended solids concentrations around the reclamation.

Control and Mitigation

2.7.1.15 During the construction phase, the key environmental issue in relation to water quality is the prevention of chemicals, sewage, and solids derived from excavation and fill materials from entering the harbour water via the drainage system.

2.7.1.16 Precautions must be taken so no major spillages will occur. Large volumes of fuel, oil, paint and other chemicals used on the construction sites should be stored in properly secured containers, and kept within bunded areas.

2.7.1.17 Uncontrolled discharge of waste water should be avoided. Effluent should be channelled to a public sewer.

2.7.1.18 To minimise volume of solids from construction sites entering receiving water prior to and during the construction of paved surfaces, all the runoff from the sites including concrete batching plants should be channelled to series of purpose built sediment traps or basins with appropriate flow velocity to permit most of particles to be deposited. These basins should be cleaned on regular basis to dig the muds out so as to maintain their solid removal efficiency, because accumulation of settled solids can gradually reduce volume of tanks.

2.7.1.19 When the approach roads and toll plaza have been constructed, suspended solids generated would be considerably reduced, and would mainly arise from washing of vehicles or wheel wash facilities. It may therefore be possible to directly connect storm runoff from the paved roads to the storm water drains. Water from the washing down of vehicles, however, should still be collected to allow sedimentation of suspended solids.

2.7.1.20 Collected water after treatment could be recycled to use for further dust suppression and rinsing purposes.

2.7.1.21 If bentonite is used, a recycling unit should be adopted as standard.

2.7.1.22 Sample contract clauses are given in Appendix 2.5, should these be required.

Monitoring Requirements

2.7.1.23 At this stage, there are no proposals for monitoring. Should reclamation and dredging be required as part of this project, the monitoring requirements will be reviewed.

2.7.2 Operation

Sensitive Receivers

2.7.2.1 The discussion in Section 2.7.1.7 is also applicable to the operation of the CKR.

Impact on Receivers

2.7.2.2 The operational phase impacts on water quality should be significantly less than the construction stage. The expected problem will be that from the discharge of tunnel drainage including rainwater carried in vehicles or water from tunnel cleaning and the operation of fire hydrants. The likely contaminants from these sources consist of:

- o accumulated sediments from tunnel approach roads;
- o chemicals (including possibly environmentally persistent chemicals or wastes), dripping and spilling from motor vehicles.

2.7.2.3 The quantity of pollutants present in CKR runoff would not be expected to be different from those found in any other urban runoff. The discharge of this runoff generally would be unlikely to produce any quantifiable adverse effects. The dangerous material generated from spillage from road traffic accidents would be anticipated to be infrequent, but is difficult to predict and assess. Its impact would depend on the quantity and composition of any spillage.

Control and Mitigation

2.7.2.4 The key concern of minimising water quality impacts on marine water course in the operation phase would be the prevention of chemicals and suspended solids from escaping into the water.

2.7.2.5 Sumps normally are installed as part of tunnel drainage system to collect water flowing from the tunnel. Water pollution control devices can be adopted within the design of the collection sumps to reduce the concentrations of pollutants, i.e. suspended solids and oil, prior to their discharges to the harbour. The suspended solids could be removed by reducing the velocity in adjacent sumps to allow the large materials to settle down. Oil and petrol could be separated by installing oil interceptors or similar equipment in the sumps.

Monitoring Requirements

2.7.2.6 No long term monitoring of road runoff would be required within the framework of this study.

2.8 SOLID WASTE DISPOSAL

2.8.1 Existing Disposal Routes

2.8.1.1 Currently wastes from Central Kowloon are disposed of to one of two landfills, Pillar Point or Junk Bay (Tseung Kwan O) Landfill. In future, it is likely that waste will be disposed of in the new strategic landfill SENT when this is commissioned.

2.8.2 Construction Phase

2.8.2.1 The current construction program for the CKR is estimated to be approximately 3 years commencing in 1998. This will involve demolition of existing residential buildings south of Waterloo Road and east of Ma Tau Wai Road, construction of a mined tunnel section under Princess Margaret Road and two cut-and-cover tunnel sections west and east of the mined tunnel.

2.8.2.2 The main wastes arising during construction include:

- o Demolition waste
- o Excavated waste from tunnel sections
- o Employee domestic waste
- o Maintenance and repair waste.

2.8.2.3 Building demolition waste typically consists of concrete (20%), reinforced concrete (33%), dirt/soil/mud (12%), rock/rubble (12%), ferrous metal (3.5%) and other miscellaneous components. Currently the only recycled material is ferrous scrap, usually in the form of reinforcements bars which has a secondary market in Hong Kong. There are no existing markets for other materials, or facilities for separation. The majority of the waste is landfilled. EPD has stated that it is expected that most construction waste, after sorting at source, will be disposed of at public dumps after the commencement of the Wastes Diversion Scheme. The 'Study on Recycling of Construction Waste Received at Landfills', Donohue/JRP Pacific Ltd, March 1992, commissioned by the Environmental Protection Department described the options available for processing construction wastes, methods of implementing such schemes and potential markets for recyclable products. The proposals will presumably influence future Government policy on the issue of waste recycling. It is not possible to predict the 1998 situation with regard to recycling opportunities, particularly as such schemes tend to be led by market forces or influenced by political initiatives.

2.8.2.4 There will also be a significant quantity of excavated fill or rock from construction of the tunnel sections. The section of mined tunnel, running from the Kings Park eastwards to Ko Shan Road Park, will give rise to approximately 300 000 m^3 of mined rock, based on an average factor of 2005 m^2 per metre of rock tunnel. However this should be considered a resource rather than a waste arising and may be utilised directly as land borrow material or further processed as aggregate. Recent attempts have been made to match the needs of contractors requiring fill and those seeking disposal routes, but these have proved problematic, particularly with respect to timing. It is likely that the material from the CKR mined tunnel will be disposed of in public dump sites. The Fill Management Committee are not able to advise as to possible disposal locations so far in advance.

2.8.2.5 A possible tunnel spoil disposal option is to use the material to form a small reclamation in Kowloon Bay. The reclamation would be approximately 3 Ha. This disposal option has considerable cost advantages, estimated to save about two million dollars. There are environmental benefits in terms of noise, because of the reduction in haul vehicles using local roads. The reclamation may cause temporary deterioration in water quality, should this option be adopted, water quality impacts should be reviewed in more detail.

2.8.2.6 The shallower cut-and-cover tunnel sections will also give rise to a significant quantity of excavated material. This will comprise old reclamation fill of variable quality. The cut-and-cover construction technique involves excavation of the tunnel section with the area above the tunnel roof backfilled to ground level. Depending on the construction techniques, sections for the diaphragm walls may need to be excavated. The surplus fill excavated is estimated to be approximately 140,000 m^3 (assuming that part of the fill excavated will be used for backfilling) if the diaphragm wall technique is used. Depending on the quality of the excavated material, it may also be disposed of to public dump sites.

2.8.2.7 There will be a small stream of domestic waste generated by construction workers over the duration of the project. Special provisions for this waste should not be required. Establishment or utilisation of an existing Refuse Collection Point should give sufficient provision for the collection and short-term storage of domestic waste.

2.8.2.8 The quantities of maintenance and repair wastes generated are not likely to be significant, but may include potentially hazardous materials such as waste fuel, lubricants, or cleaning solvents. The contractor will be responsible for the disposal of hazardous materials and will also need to comply with the requirements of the Dangerous Goods Ordinance and the Chemical Waste Regulations (under the Waste Disposal Ordinance).

2.8.3 Operation

2.8.3.1 There should be no significant waste arising following construction of the CKR.

2.9 VISUAL IMPACT

Included in Chapter 3, Urban Landscape Assessment.

2.10 CONCLUSIONS

2.10.1 Construction

2.10.1.1 The diaphragm wall technique for construction of cut-and-cover tunnel has environmental advantages over the sheet piled method. Much of the excavation and concreting will take place below the top slab, thus shielding receivers from plant noise, and containing dust.

2.10.1.2 In West and East Kowloon, there could be high levels of dust generated, with some residential properties subject to occasional exceedances of the recommended limit. However, these occurrences will be rare and can be minimised by the adoption of standard good working practices by the contractor.

2.10.1.3 The main noise impacts will arise from construction of the cut-and-cover tunnel sections. The diaphragm wall technique is preferred on the basis of noise impacts, to the sheet piling method. Whilst high maximum noise levels may be experienced at some receivers as a result of construction of the cut-and-cover tunnel, these levels will be infrequently experienced. In addition, many of the receivers affected by construction in West Kowloon are well shielded from noise impacts because of the high building density and orientation of the facades. The receivers in East Kowloon will be worse affected because of their greater exposure. In West Kowloon, it has been estimated that noise levels greater than 75 dB(A) will be experienced for up to 76 days at the worst affected receivers and up to 70 days East Kowloon. Efforts should be made to reduce noise to the minimum practicable, through adoption of quieter equipment and acoustic shielding of certain plant; however, because of the limited duration of excessive noise, acoustic insulation of the NSRs is not considered to be warranted. Construction of the mined tunnel is an inherently quiet operation.

2.10.1.4 Twenty four hour off-site spoil haulage can be avoided by extending the construction period to four years. The use of material to form a reclamation will remove the requirement for off-site haulage.

2.10.1.5 Demolition impacts may be reduced by adopting alternative techniques, such as hydraulic shears and grabs, if such equipment is available.

2.10.1.6 The use of bentonite presents potential impacts on water bodies, because of loss or accidental spillage. However, good working practices should minimise the risk. Release of suspended solids into the drainage system should be avoided with the use of suitable silt traps.

2.10.1.7 Should the mined tunnel spoil be used to form reclamation, there may be adverse water quality impacts. This should be reviewed closer to the time of construction.

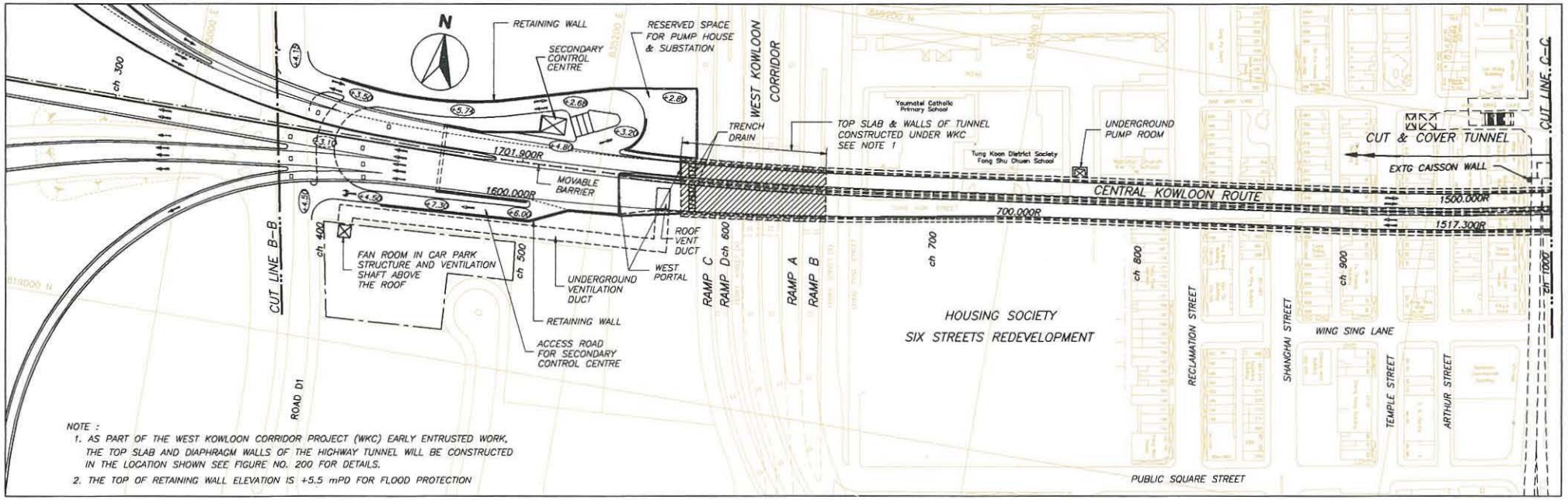
2.10.2 **Operation**

2.10.2.1 The noise impacts from this road have been virtually eliminated by the decision to use cut-and-cover tunnels through East and West Kowloon. At the West Kowloon Reclamation, noise levels will be high because of the WKE and WKC. The additional contribution from the CKR may cause a slight constraint at the zoned residential area, but this can be overcome with suitable building design, or the use of pervious road surfacing. At East Kowloon, the positions of the administration and workshop buildings provide effective shielding of existing sensitive receivers to the south of the tunnel. To the north there may be a requirement of a 5m noise barrier, or to surface the road with pervious macadam. EPD has requested that the noise impact from the interim traffic arrangement is addressed in a future Study.

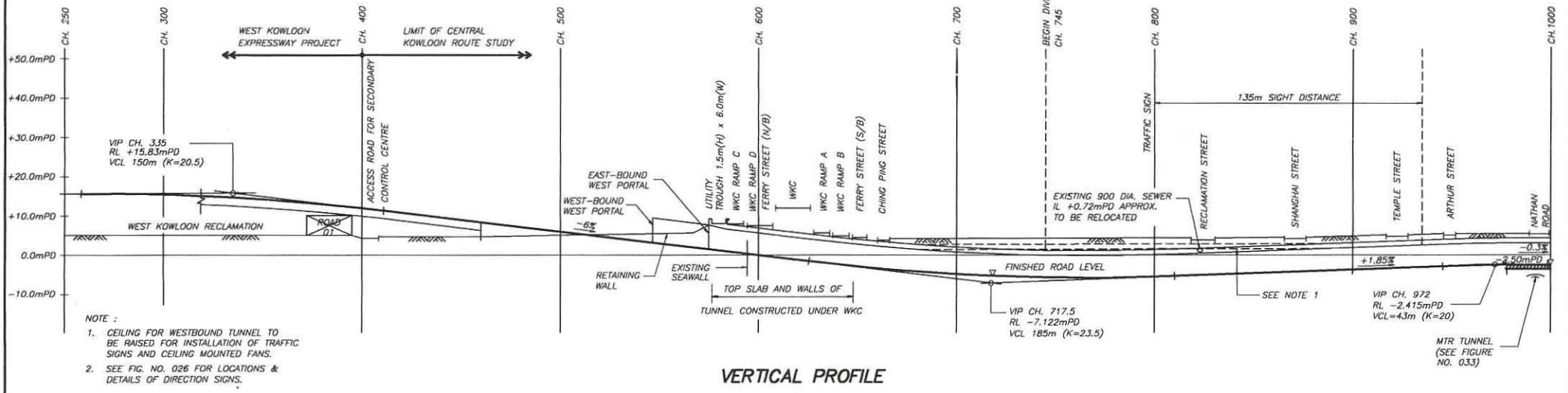
2.10.2.2 None of the identified permanent and non-permanent ASRs in the existing land at the west and east portals and mid-vent buildings are found to exceed the limit of the AQOs. Neither mitigation measure nor redevelopment restriction are required in view of operational air quality impacts.

2.10.2.3 The operational air quality impacts at the West Portal area are found to be within acceptable levels. It is estimated that the future developments will not be restricted due to air quality requirements as a result of the CKR.

2.10.2.4 There are no specific water quality or solid waste disposal problems associated with this road.



PLAN



VERTICAL PROFILE

Parsons Brinckerhoff

Maunsell Consultants

Central Kowloon Route Study : Preliminary Design

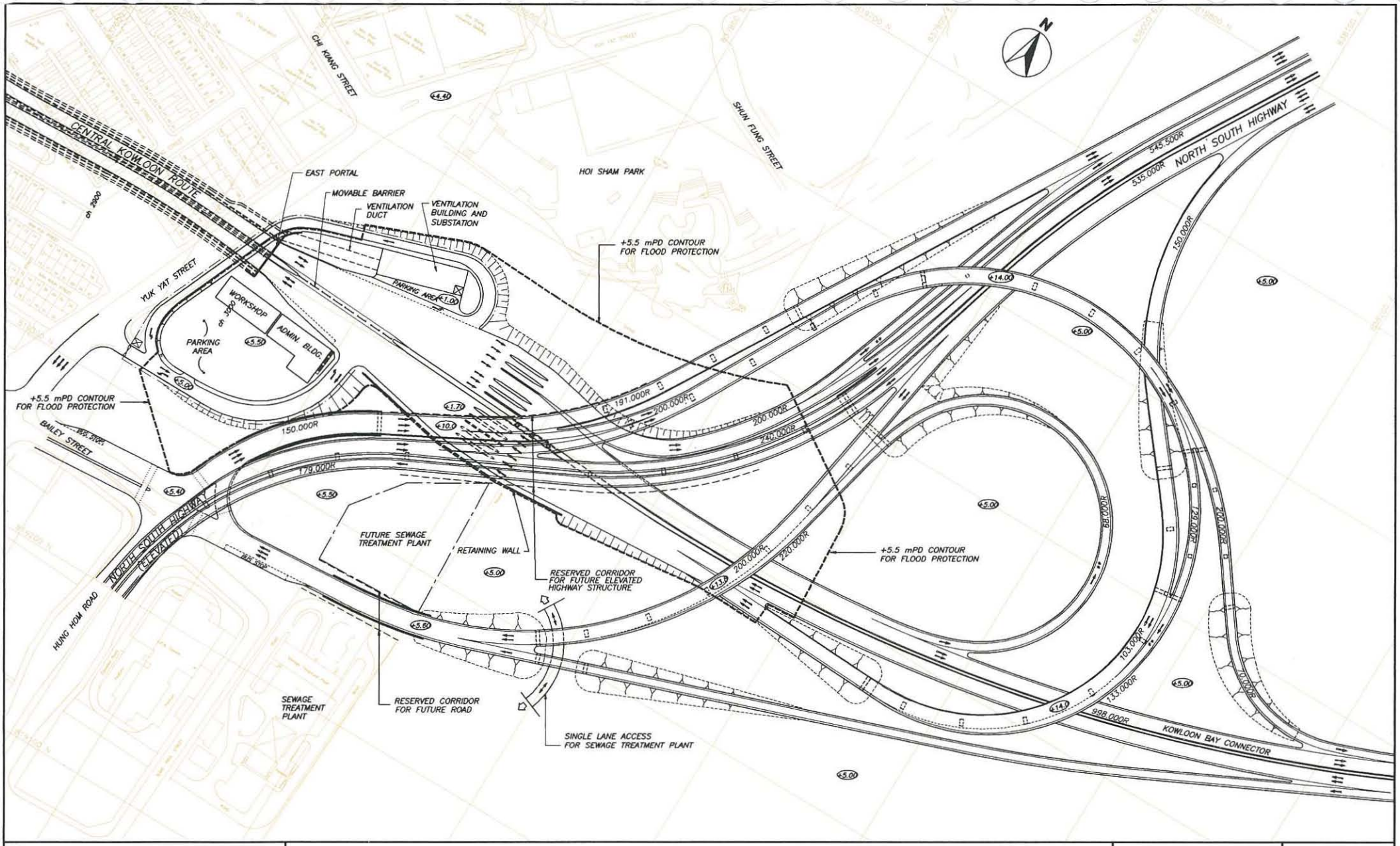
General Site Layout Plan (Sheet 2 of 6)

FIGURE NO. 2.1

SCALE
HOR : 0 10 20 40m
VERT: 0 5 10 20m

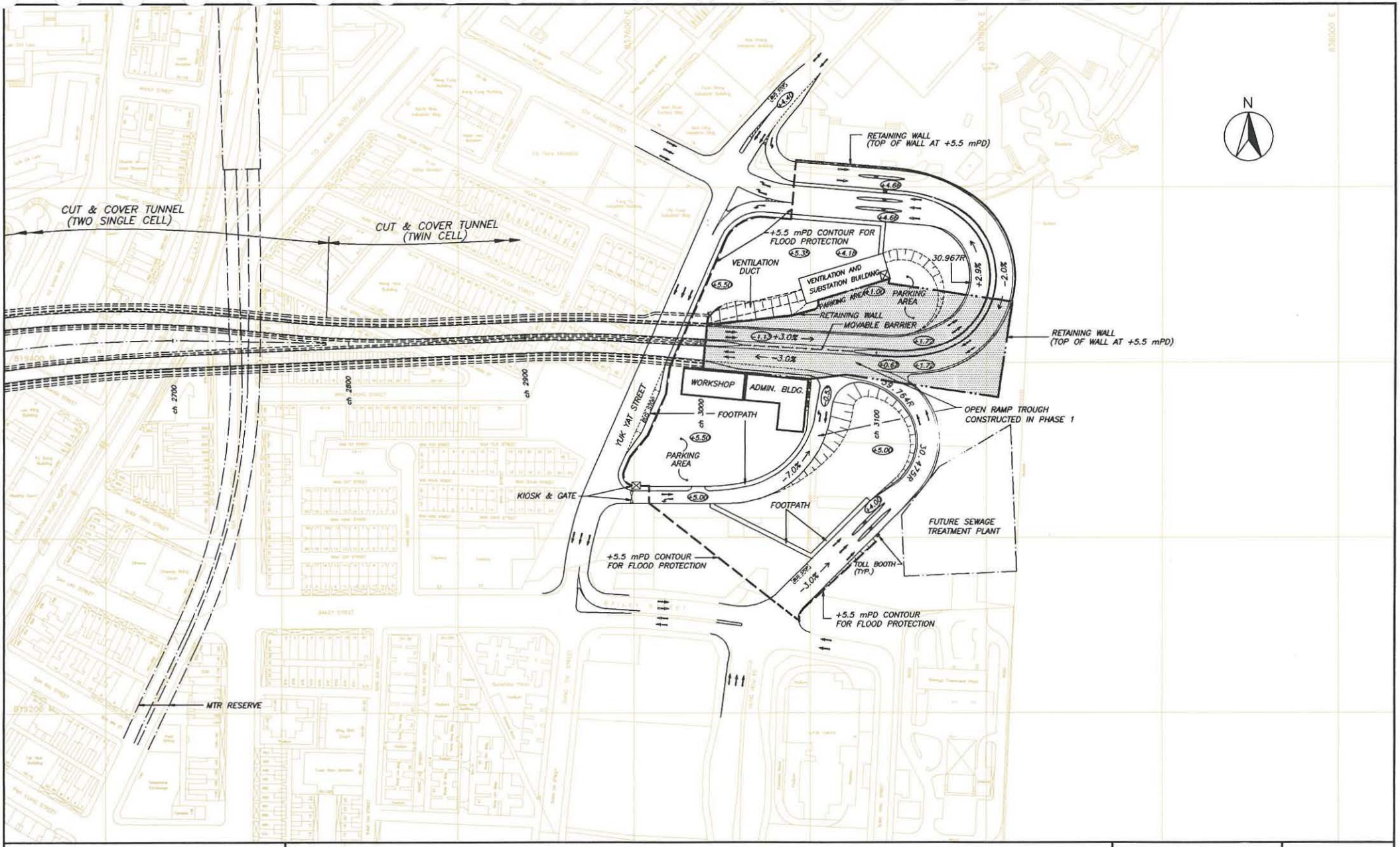
DATE APRIL 93

Date: 15/8/1992
Cad Ref.: FIG2-1
Plot Scale: 1 = 2.00 FOR A3



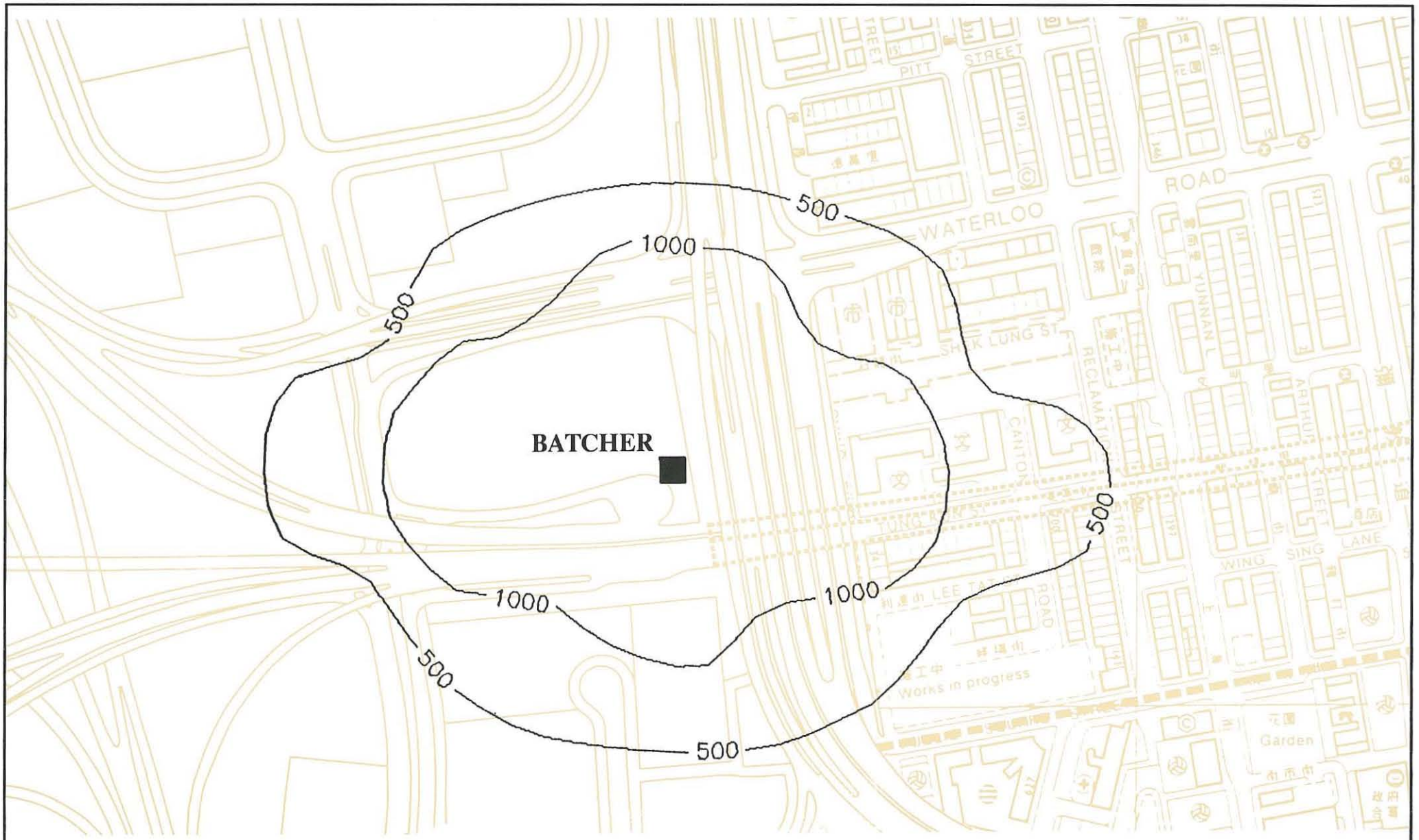
Parsons Brinckerhoff **Maunsell Consultants**	**Central Kowloon Route Study : Preliminary Design** **General Site Layout Plan (Sheet 6 of 6)**	**FIGURE NO.** **2.2**	**SCALE** 0 10 20 40m **DATE** **APRIL 93**

Date: 9/4/1993
Cad Ref.: FIG2-2
Plot Scale: 1 = 2.00 FOR A3

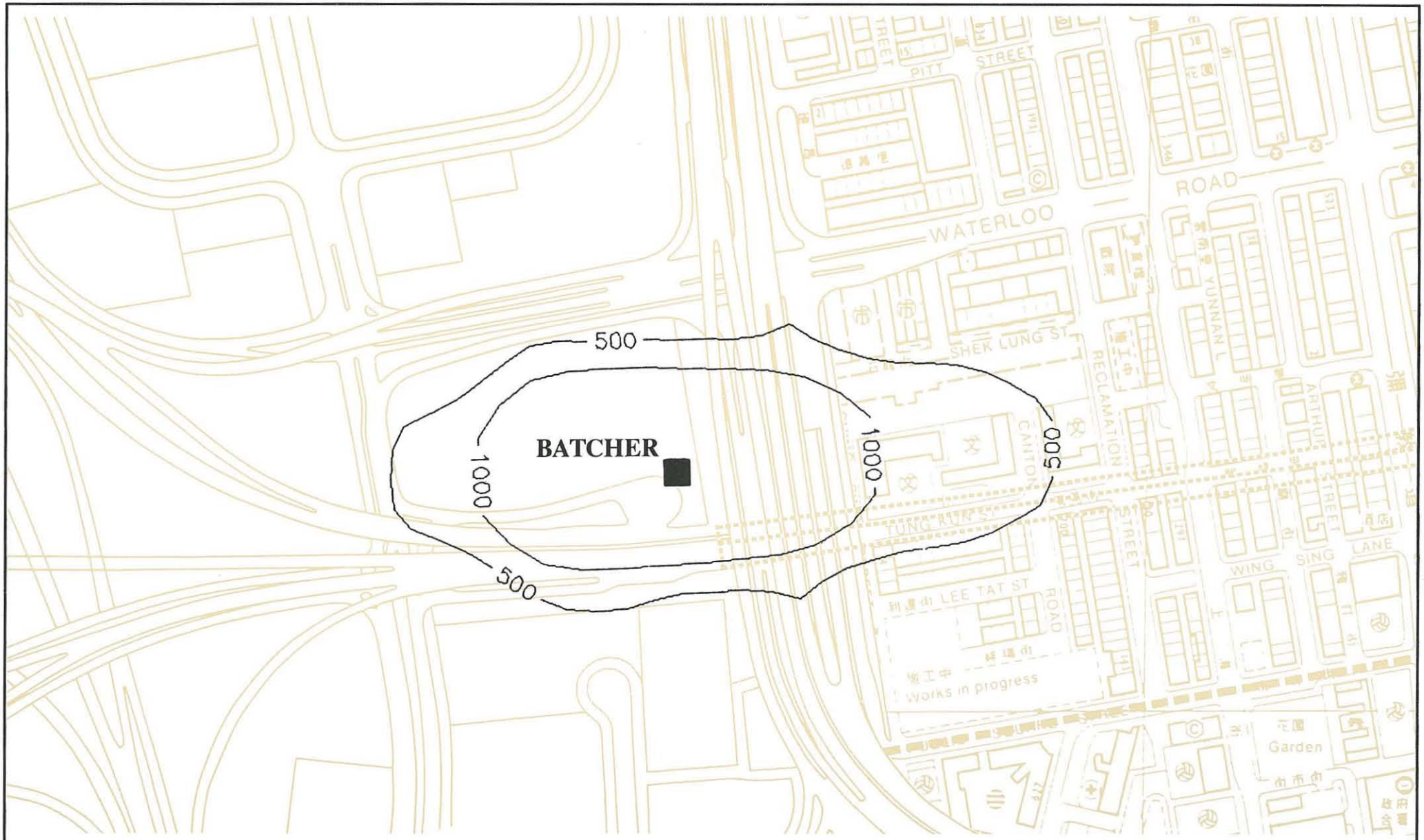


Parsons Brinckerhoff **Maunsell Consultants**	**Central Kowloon Route Study : Preliminary Design** **Phase 1 - General Layout for East Portal Area**	**FIGURE NO.** **2.3**	**SCALE** 0 10 20 40m **DATE** **APRIL 93**

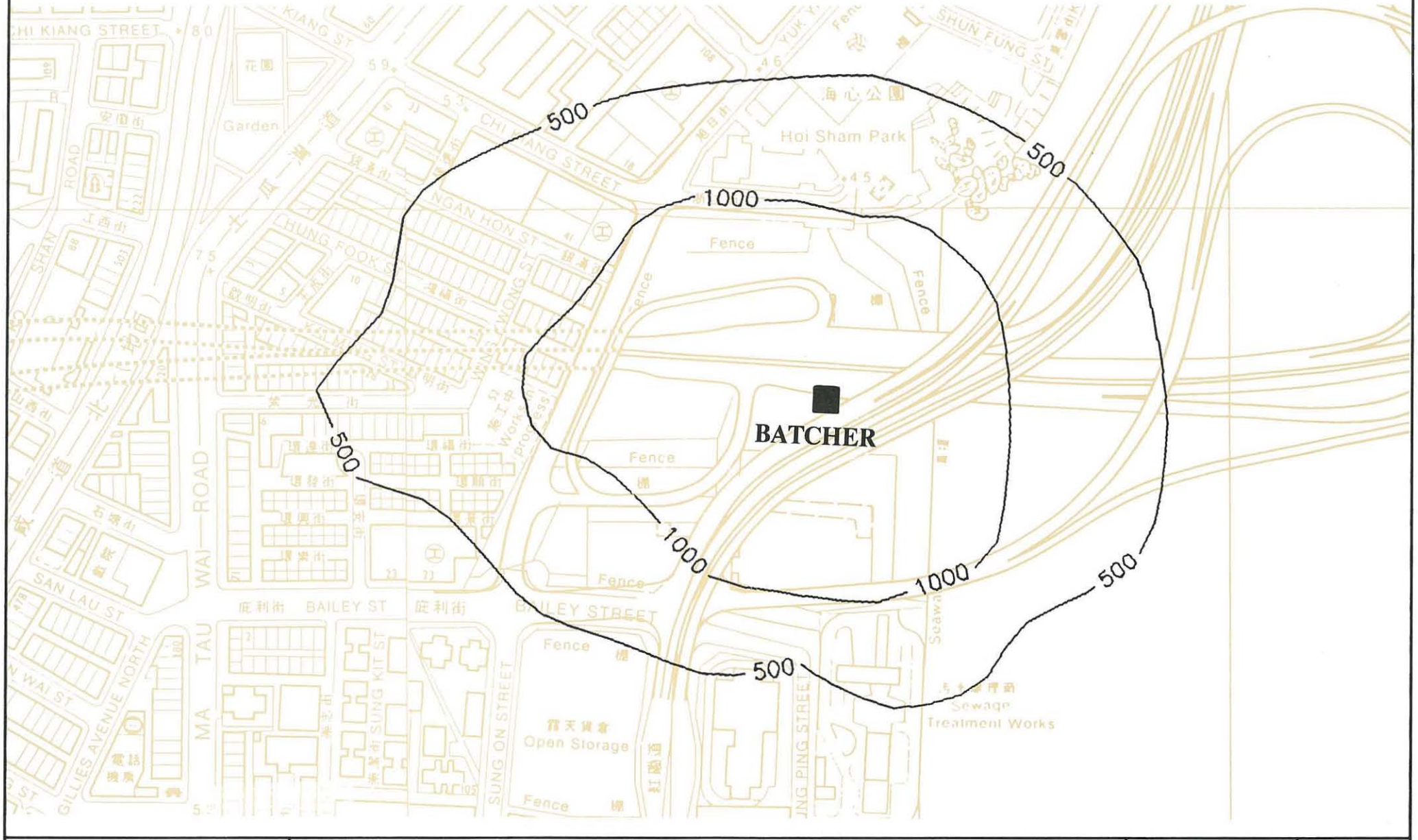
Date: 17/8/1992
Cad Ref.: FIG2-3
Plot Scale: 1 = 2.00



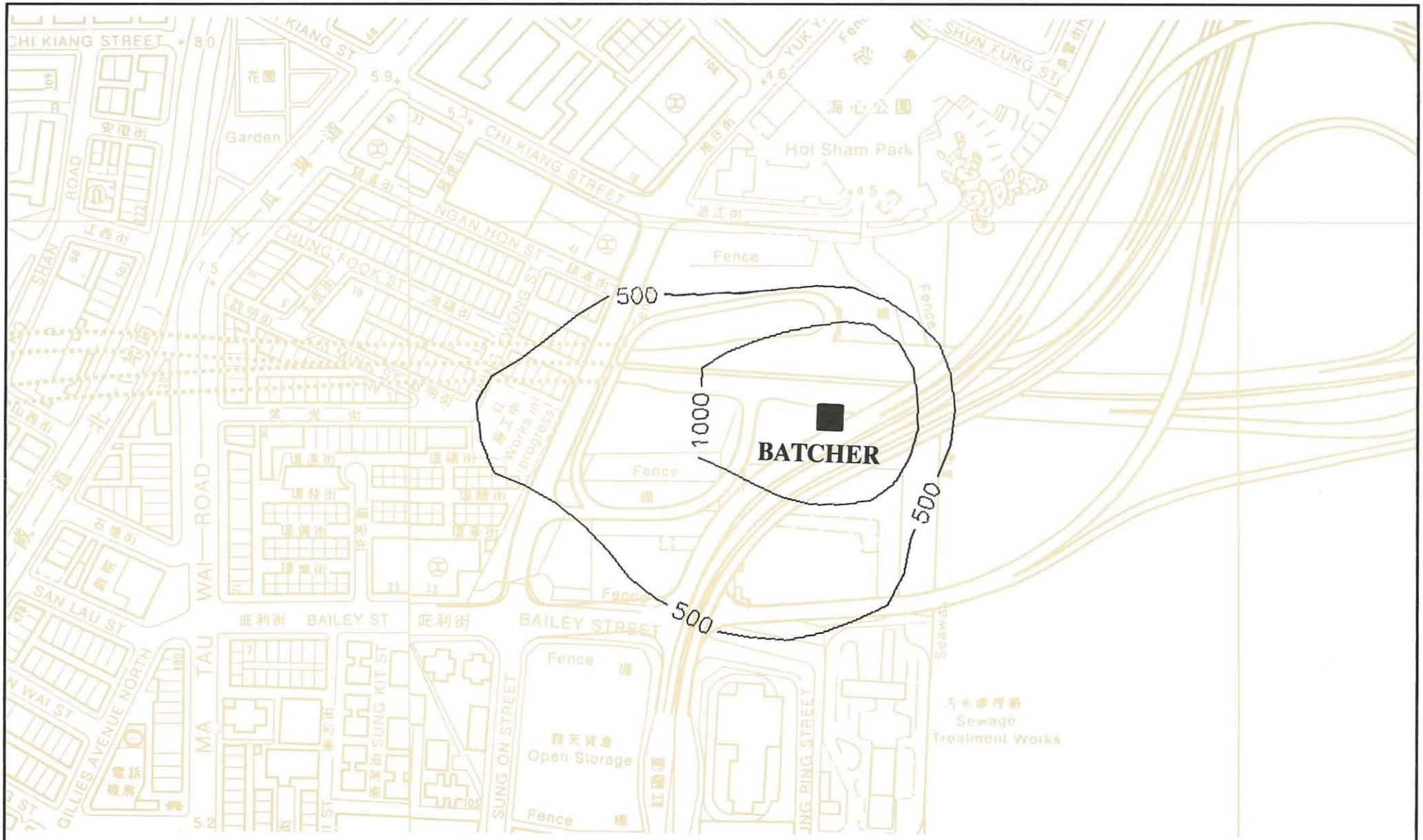
Parsons Brinckerhoff **Maunsell Consultants**	**Central Kowloon Route Study :** **Worst Case 1-hour Average Dust Concentration Contours (μgm³) at West Kowloon** **Assuming Uncontrolled Concrete Batching**	FIGURE NO. **2.4**	SCALE **N.T.S.** DATE **APRIL 93**



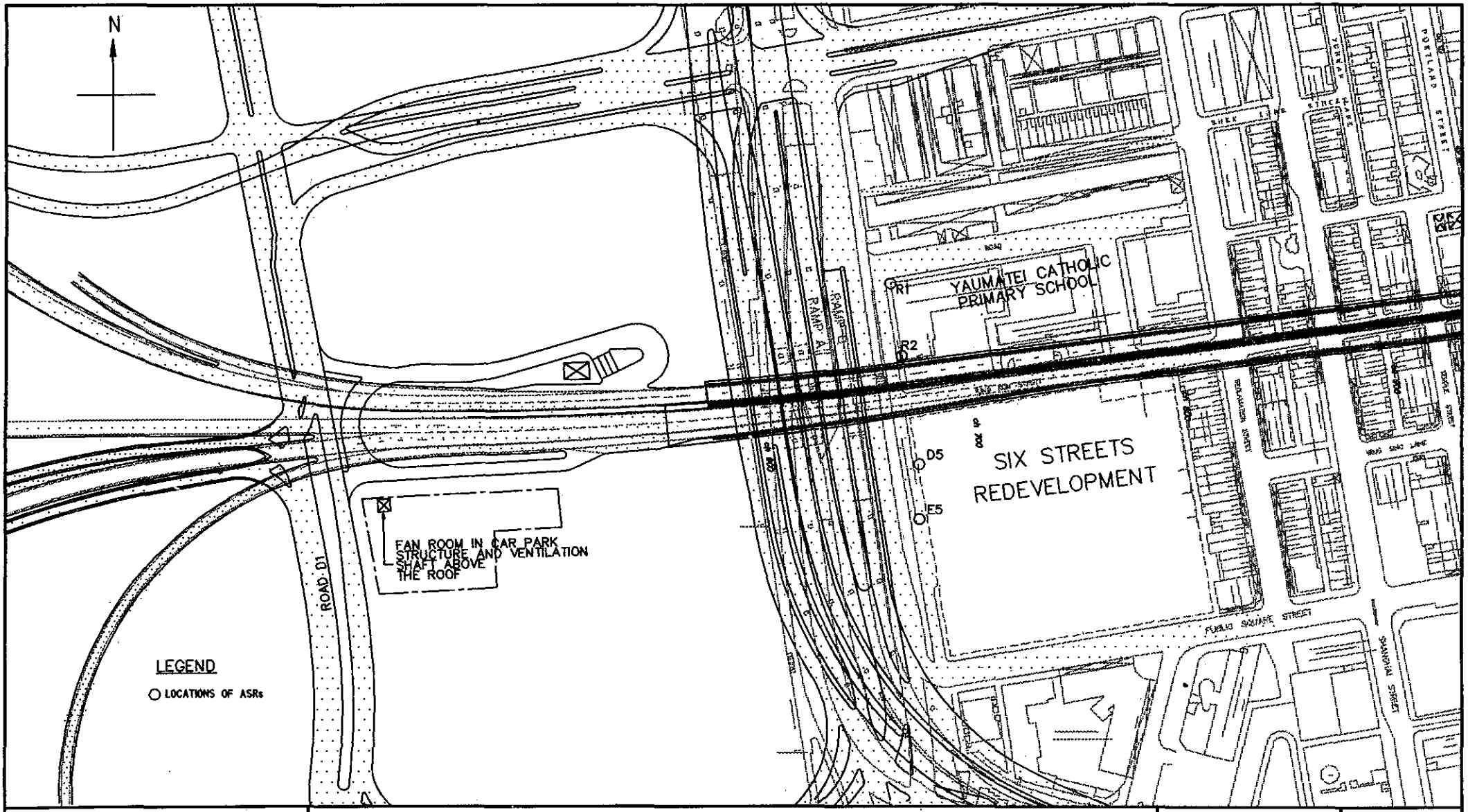
Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Worst Case 1-hour Average Dust Concentration Contours (μgm³) at West Kowloon Assuming Controlled Concrete Batching	FIGURE NO. 2.5	SCALE N.T.S. DATE APRIL 93



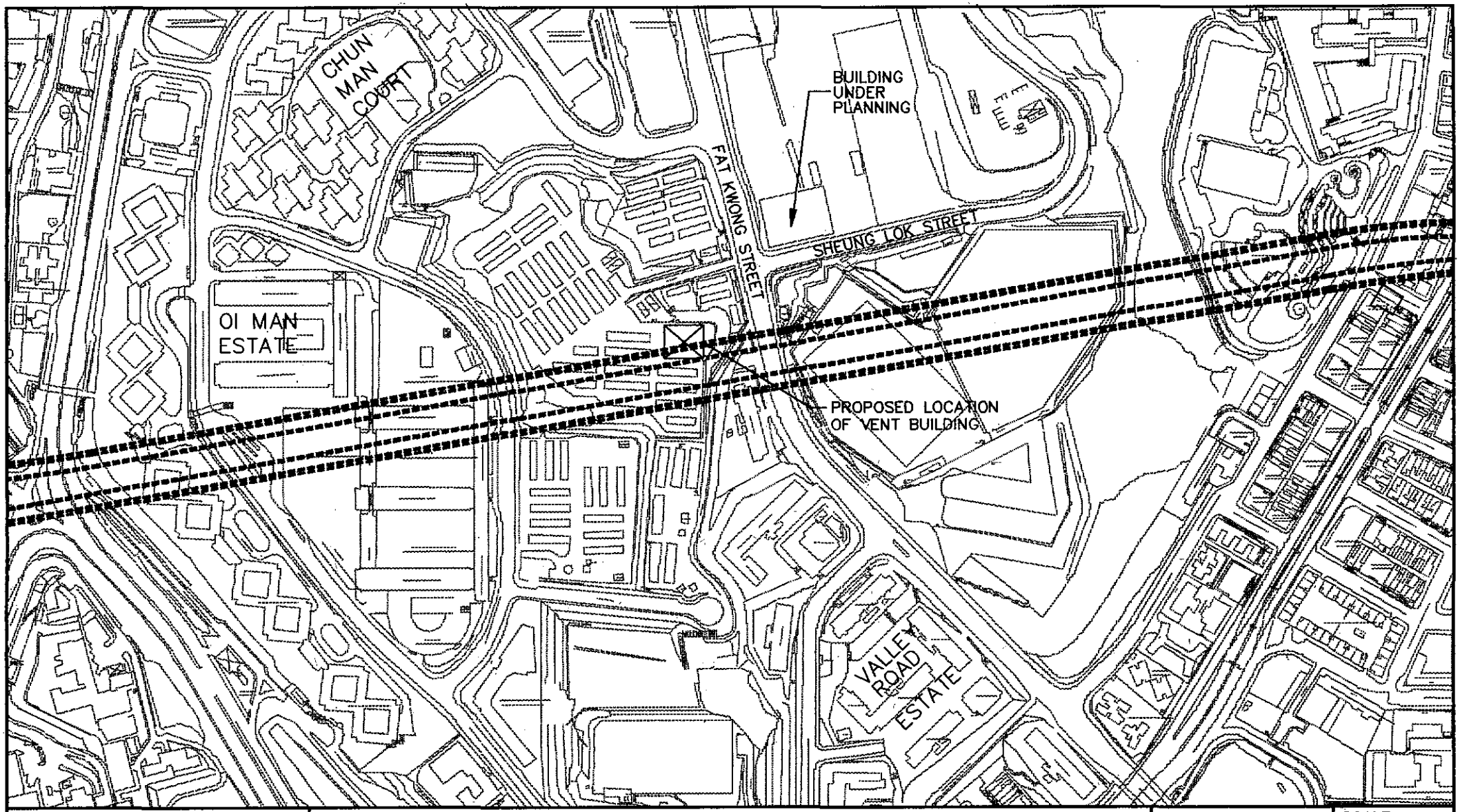
Parsons Brinckerhoff Maunsell Consultants	**Central Kowloon Route Study :** **Worst Case 1-hour Average Dust Concentration Contours (μgm³) at East Kowloon Assuming Uncontrolled Concrete Batching**	FIGURE NO. 2.6	SCALE N.T.S. DATE APRIL 93



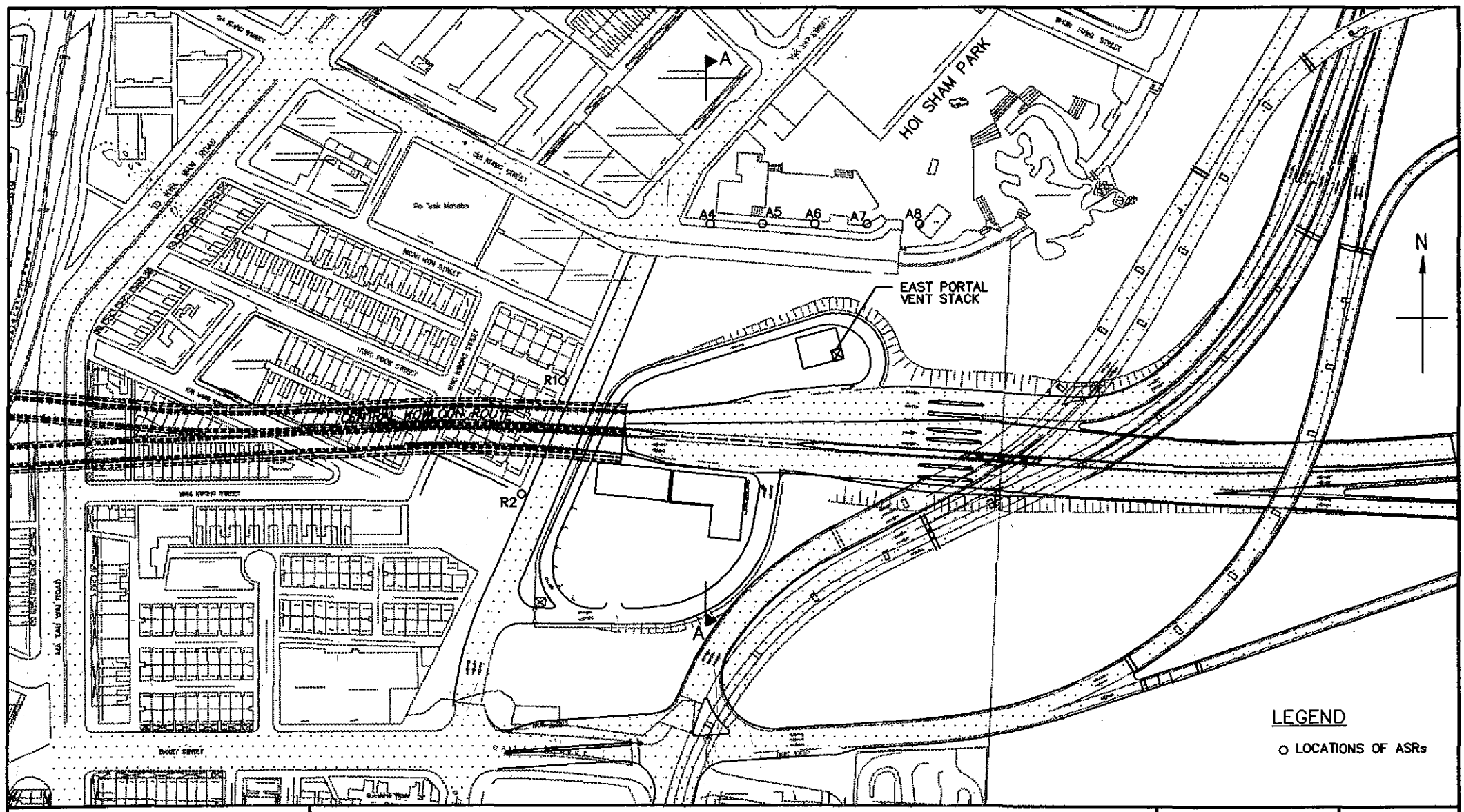
Parsons Brinckerhoff **Maunsell Consultants**	**Central Kowloon Route Study :** **Worst Case 1-hour Average Dust Concentration Contours (μgm^{-3}) at East Kowloon** **Assuming Controlled Concrete Batching**	**FIGURE NO.** **2.7**	**SCALE** **N.T.S.** **DATE** **APRIL 93**



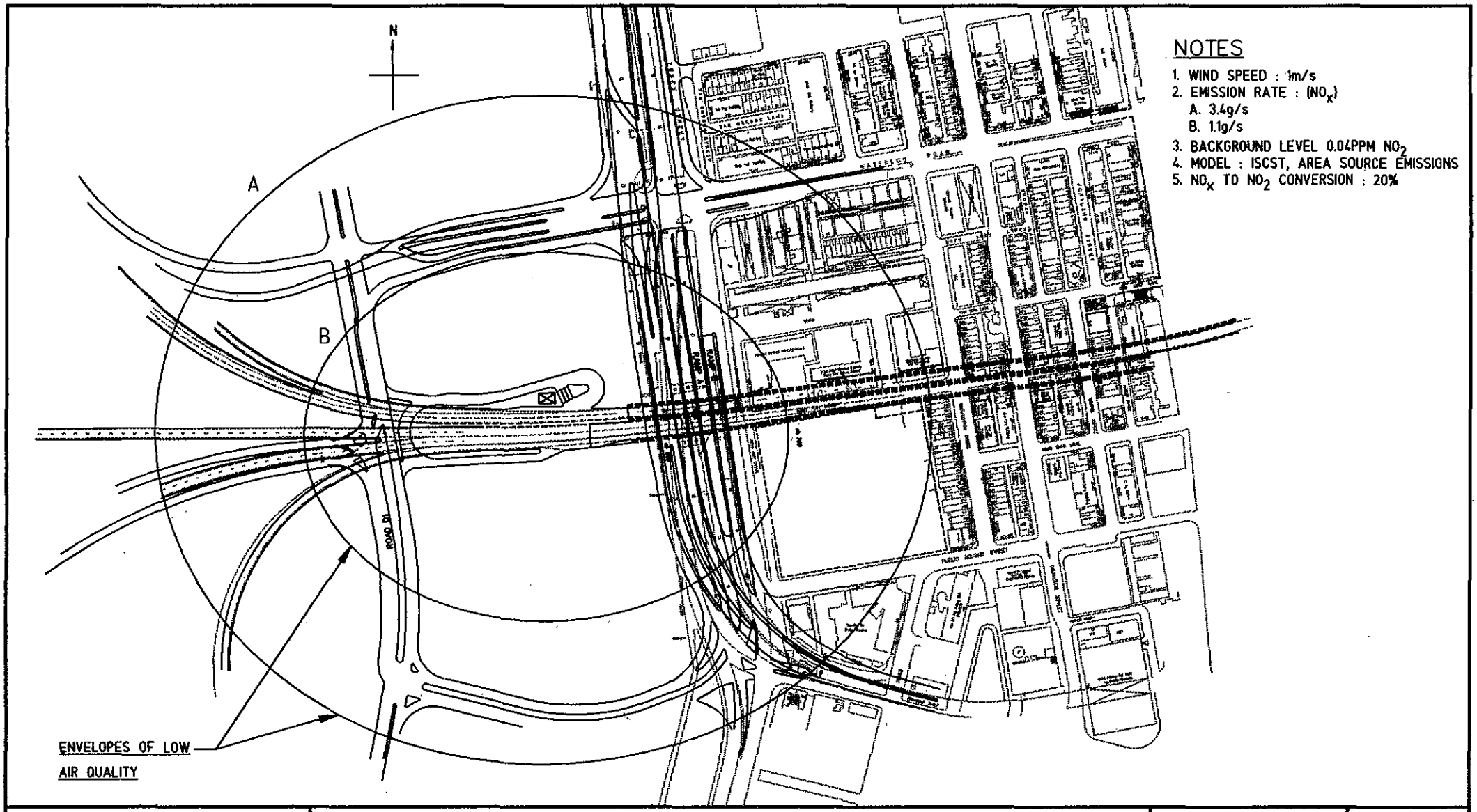
Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Western Approach – Layout of ASRs	FIGURE NO. 2.8	SCALE 1 : 2500 DATE April.,93



Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Fat Kwong Street – Proposed Location Of Vent Building	FIGURE NO. 2.9	SCALE 1 : 4000 DATE April.,93



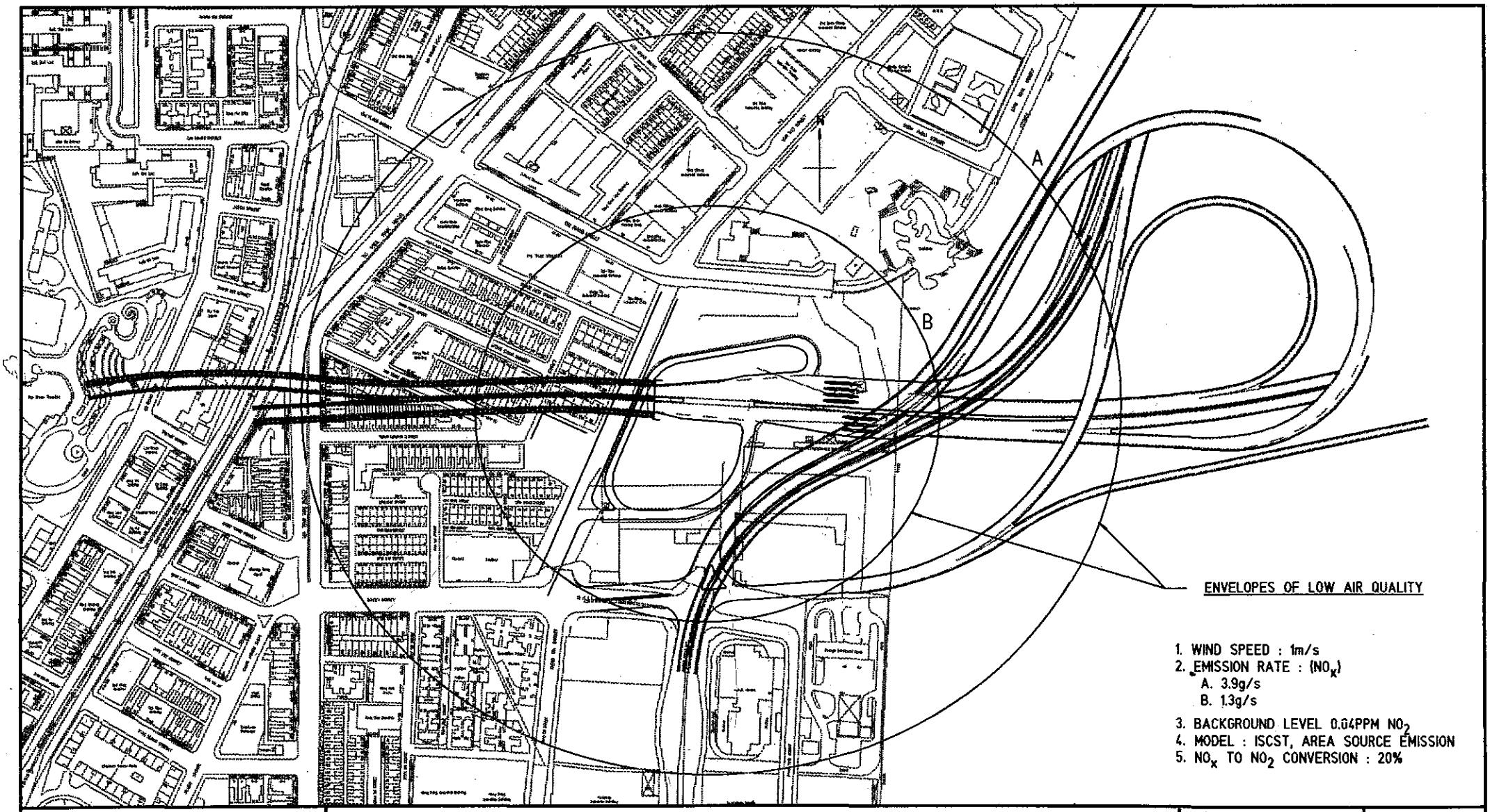
Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Eastern Approach – Layout of ASRs	FIGURE NO. 2.10	SCALE 1 : 2500 DATE April.,93



NOTES

1. WIND SPEED : 1m/s
2. EMISSION RATE : (NO_x)
   A. 3.4g/s
   B. 1.1g/s
3. BACKGROUND LEVEL 0.04PPM NO_2
4. MODEL : ISCST, AREA SOURCE EMISSIONS
5. NO_x TO NO_2 CONVERSION : 20%

Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design West Portal – Emissions At 1m/s Wind Speed	FIGURE NO. 2.11	SCALE 1 : 4000 DATE April.,93



Parsons Brinckerhoff
Maunsell Consultants

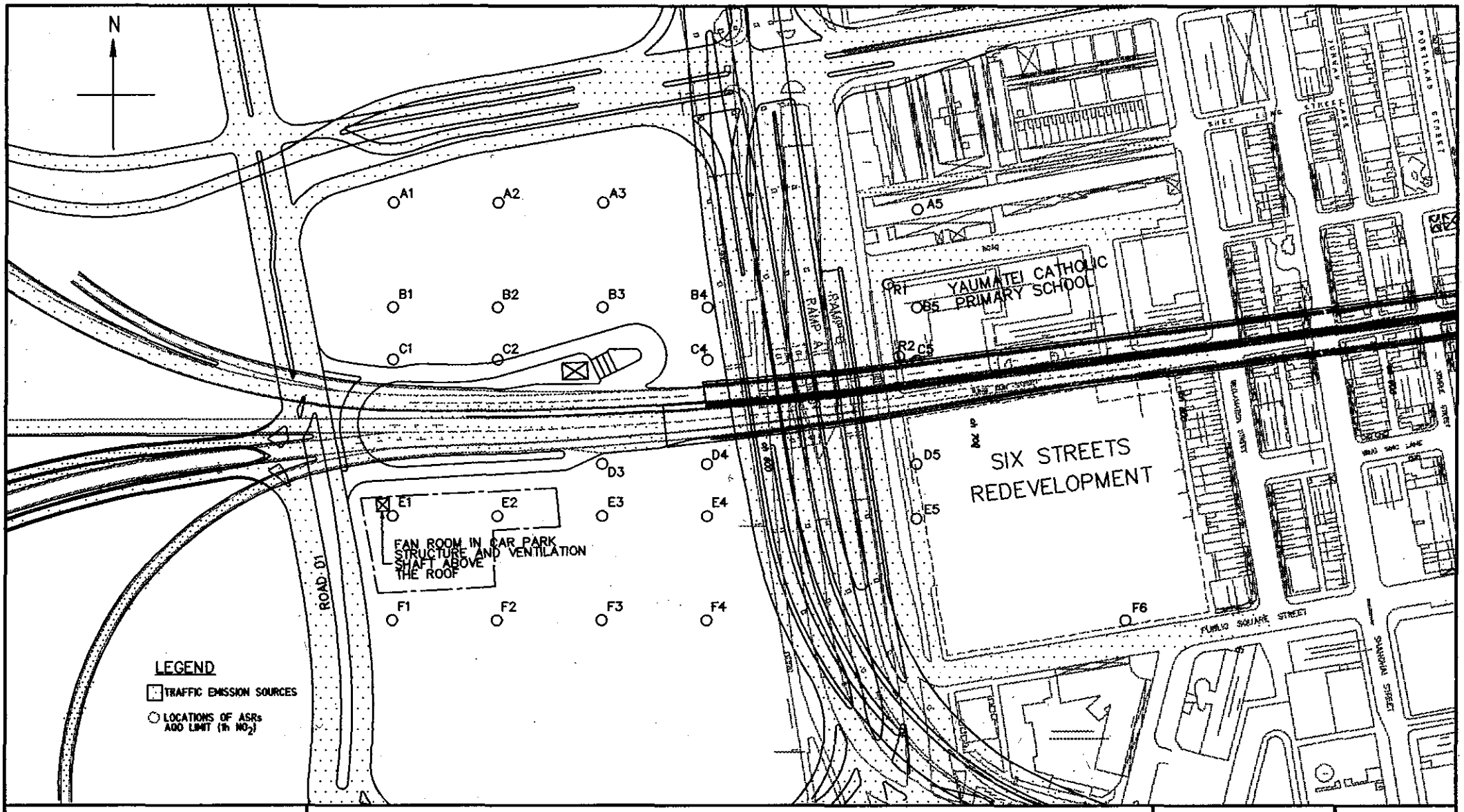
Central Kowloon Route Study : Preliminary Design

East Portal – Emissions at 1m/s Wind Speed

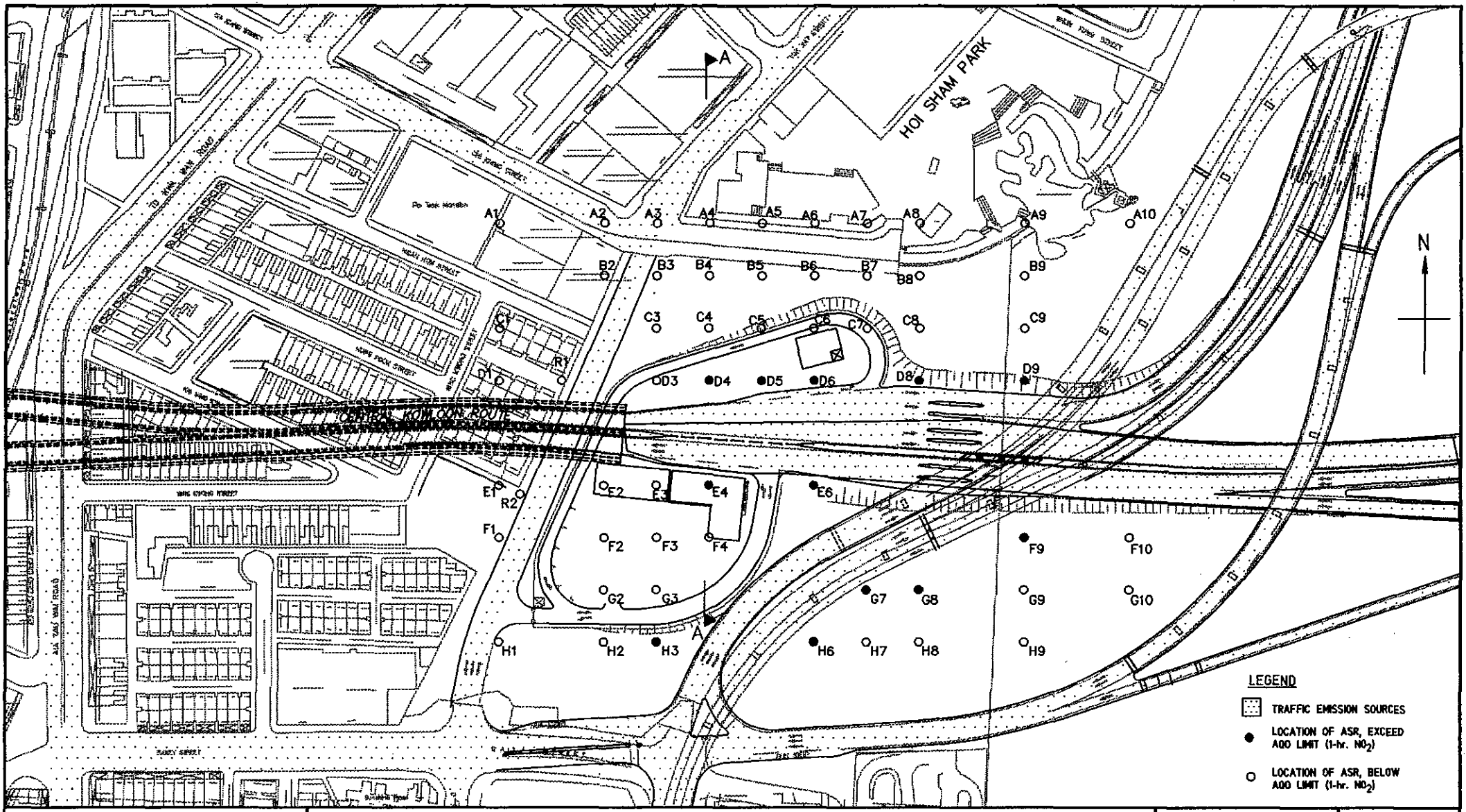
FIGURE NO.
2.12

SCALE
1 : 4000

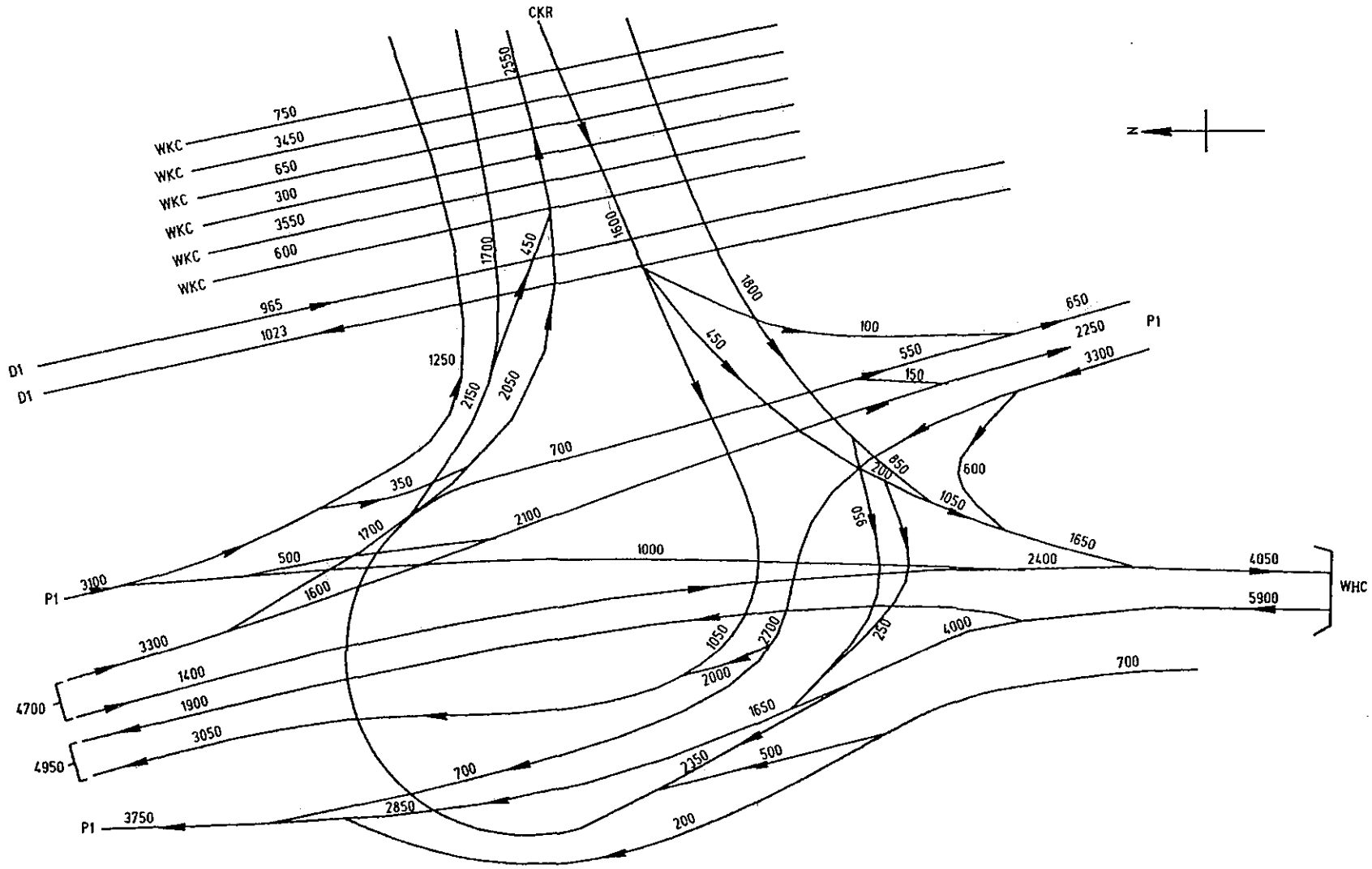
DATE
April.,93



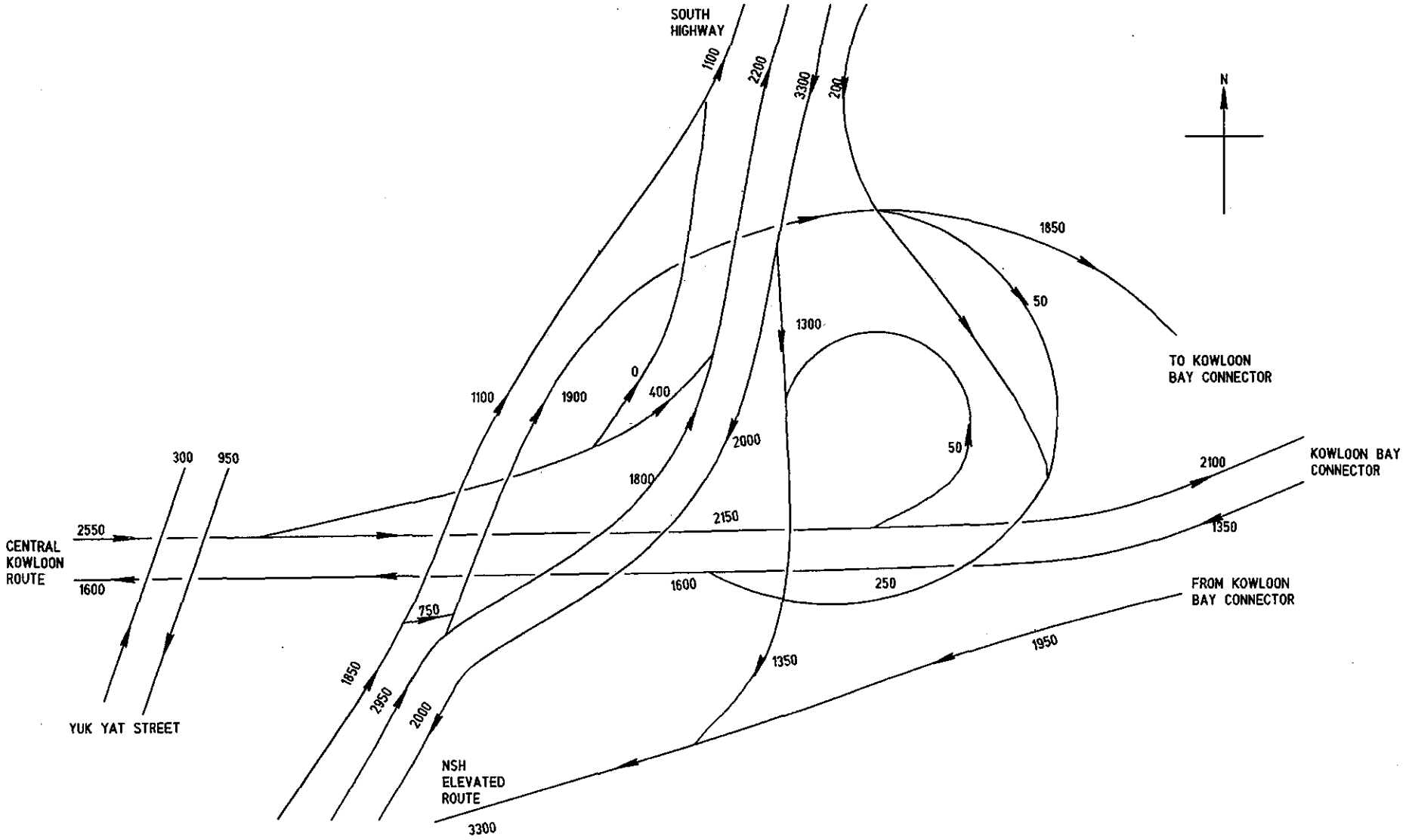
Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Western Approach – Layout of ASRs and Traffic Links	FIGURE NO. 2.13	SCALE 1 : 2500 DATE April.,93



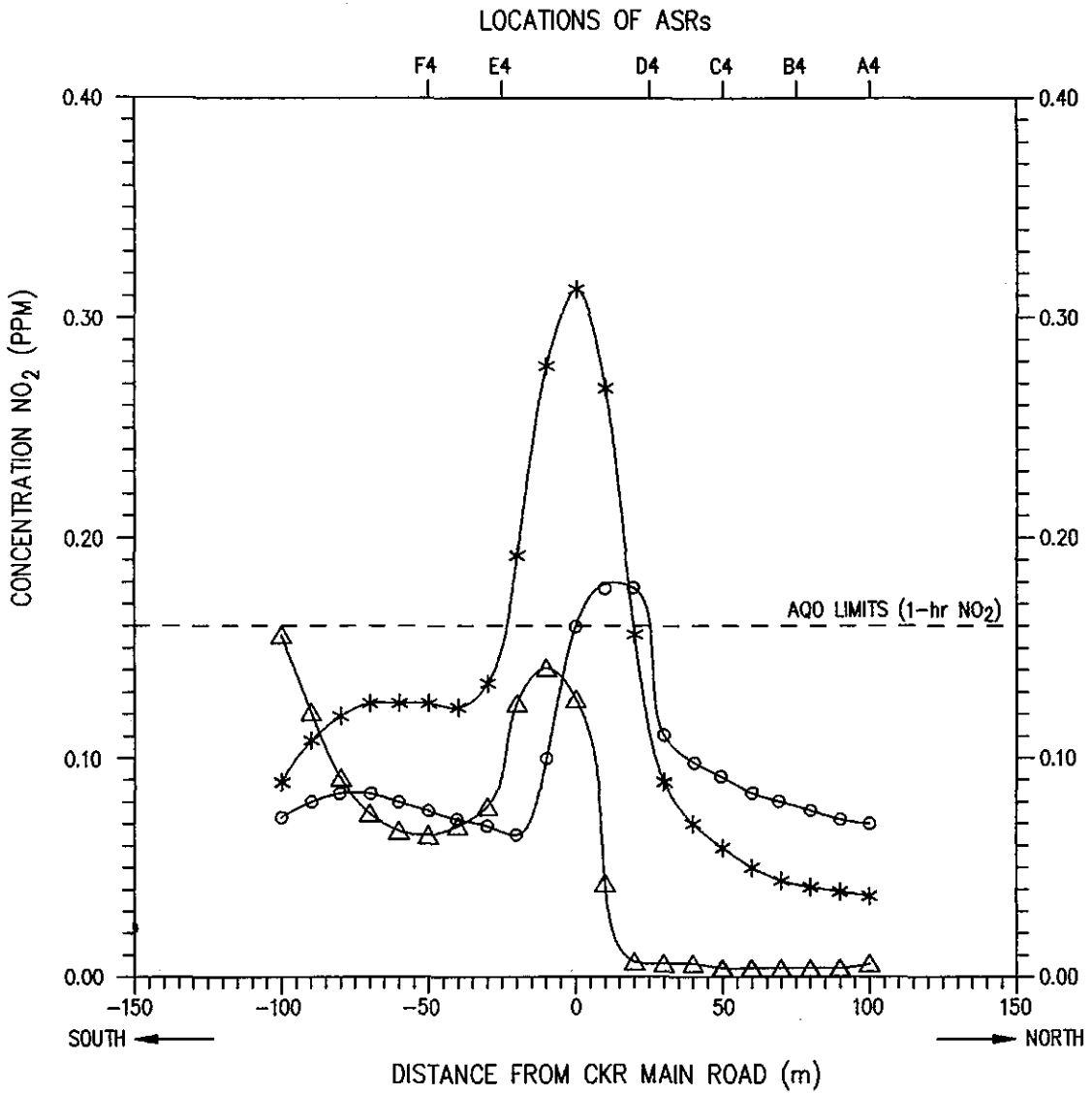
Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Eastern Approach – Layout of ASRs and Traffic Links	FIGURE NO. 2.14	SCALE 1 : 2500 DATE April.,93



Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Western Approach – 2011 pm Peak Hour Traffic Flows	FIGURE NO. 2.15	SCALE NIL DATE April.,93



Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Eastern Approach – 2011 pm Peak Hour Traffic Flows	FIGURE NO. 2.16	SCALE NIL DATE April.,93



LEGEND

WIND DIRECTION

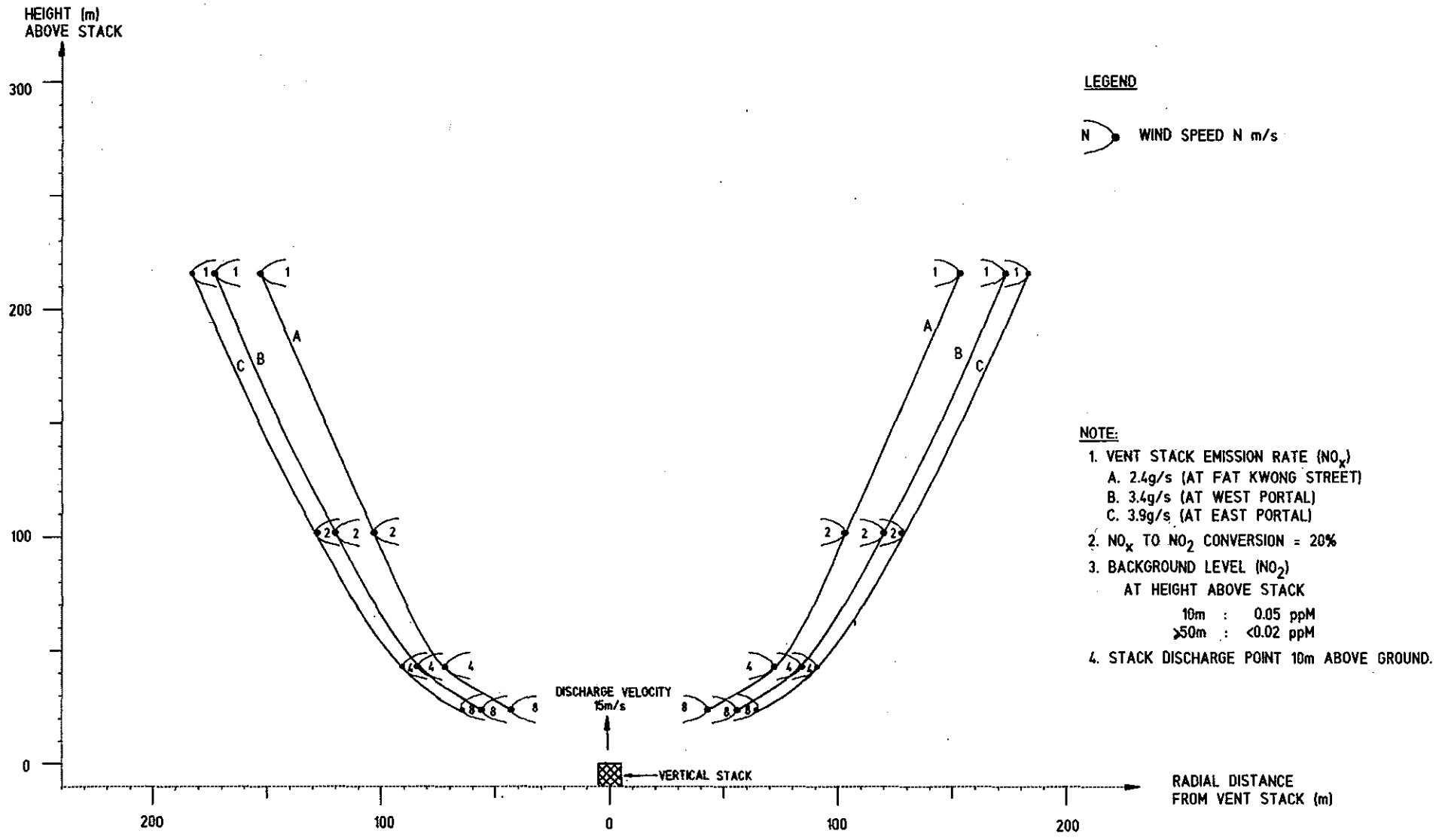
△ 45°

✳ 90°

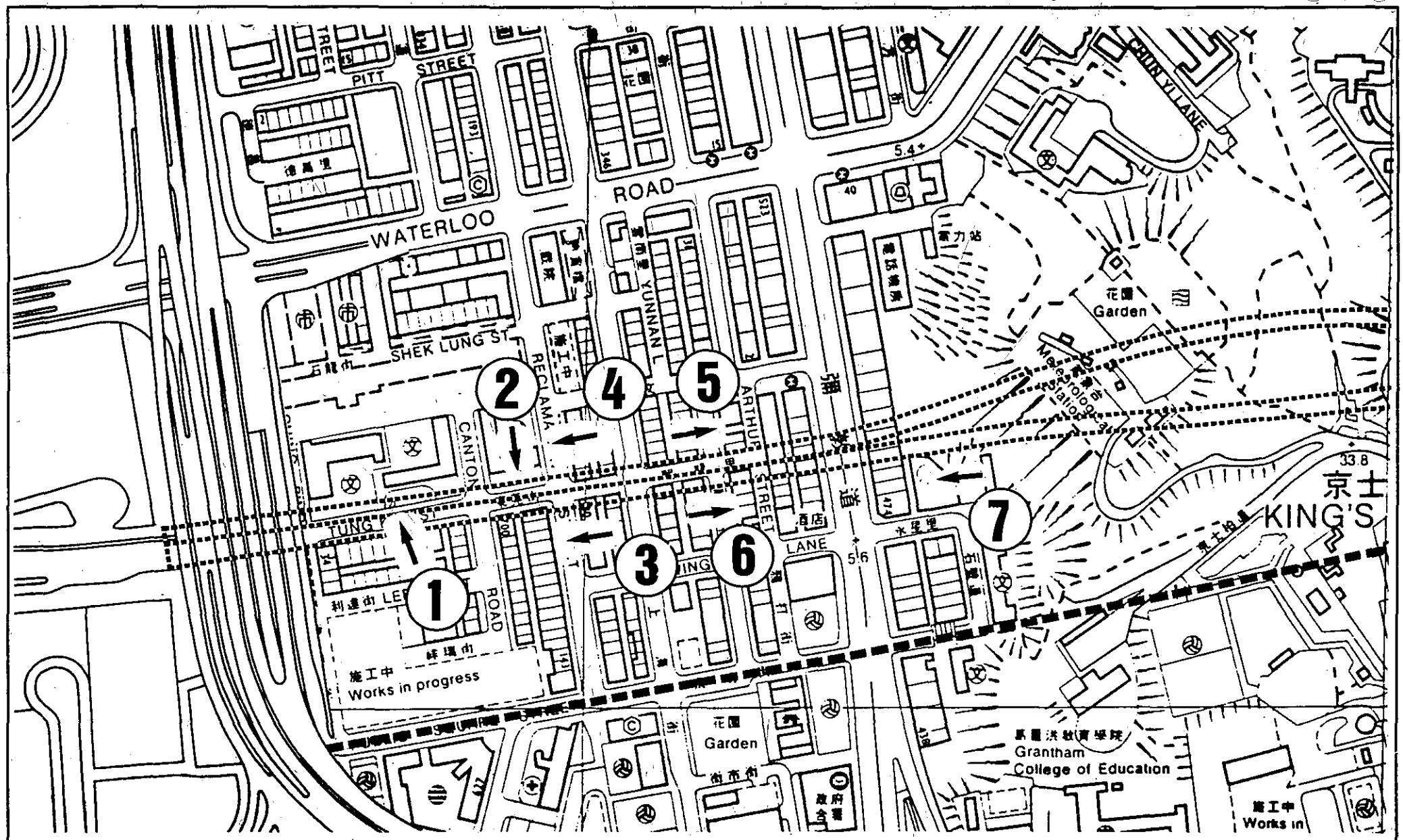
○ 135°

NOTE: REFER TO FIGURE NO. 2.14 FOR RECEPTOR GRID LINE 4

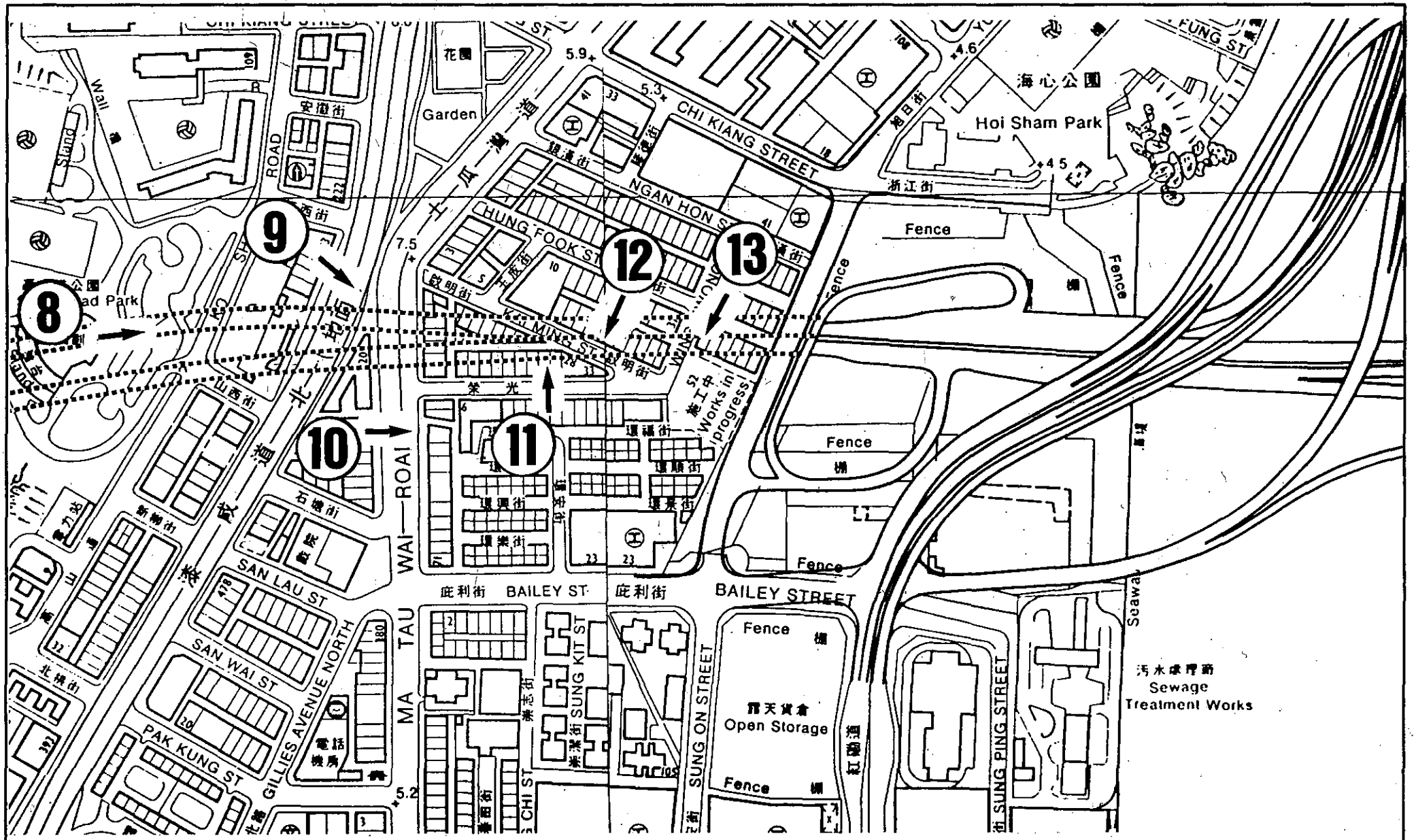
Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Eastern Approach – Predicted Concentration Level At Grid Line 4	FIGURE NO. 2.17	SCALE NIL DATE April.,93



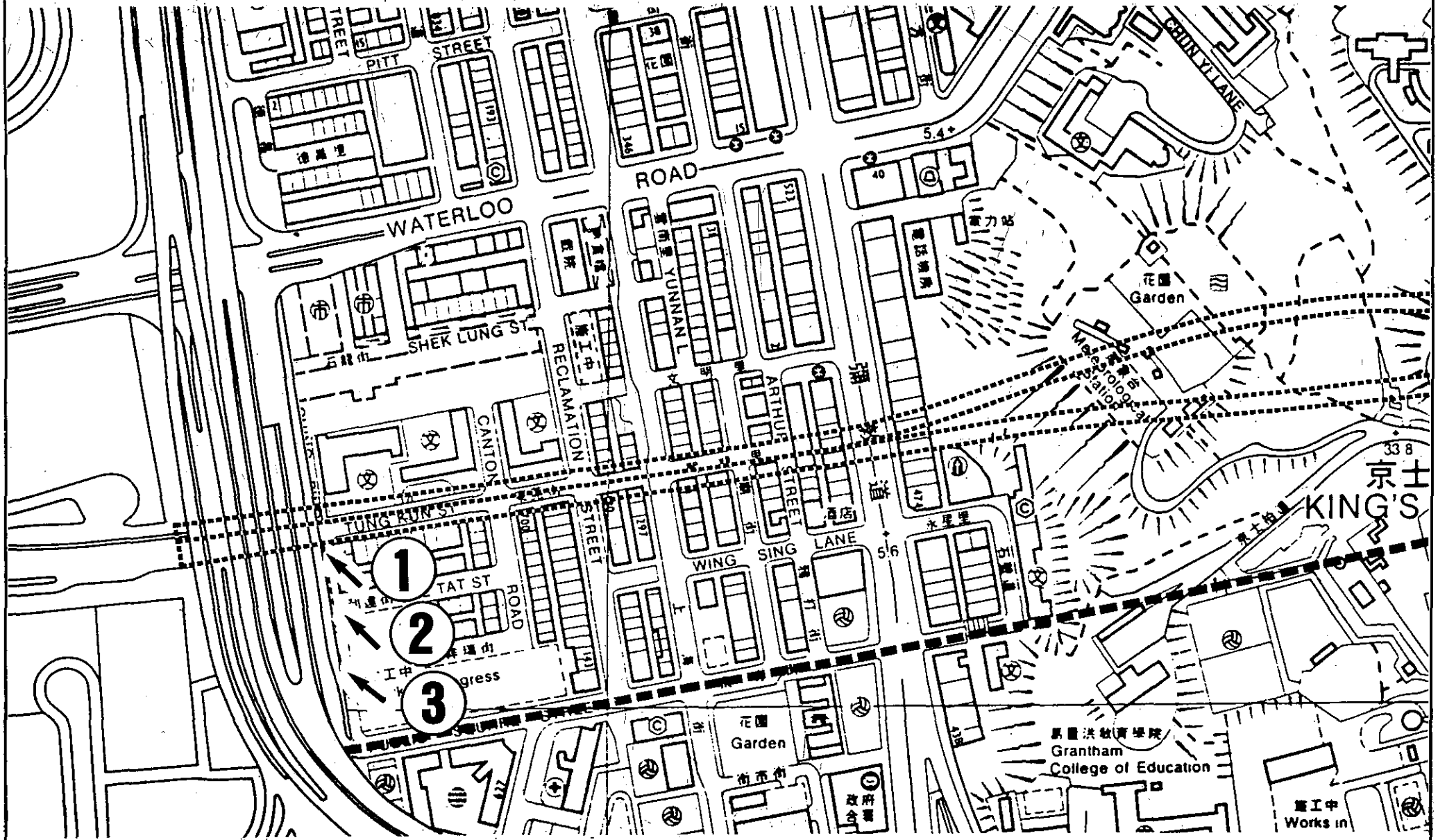
Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Envelopes of AQO Limits – Vent stack Emissions	FIGURE NO. 2.18	SCALE NIL DATE April., 93



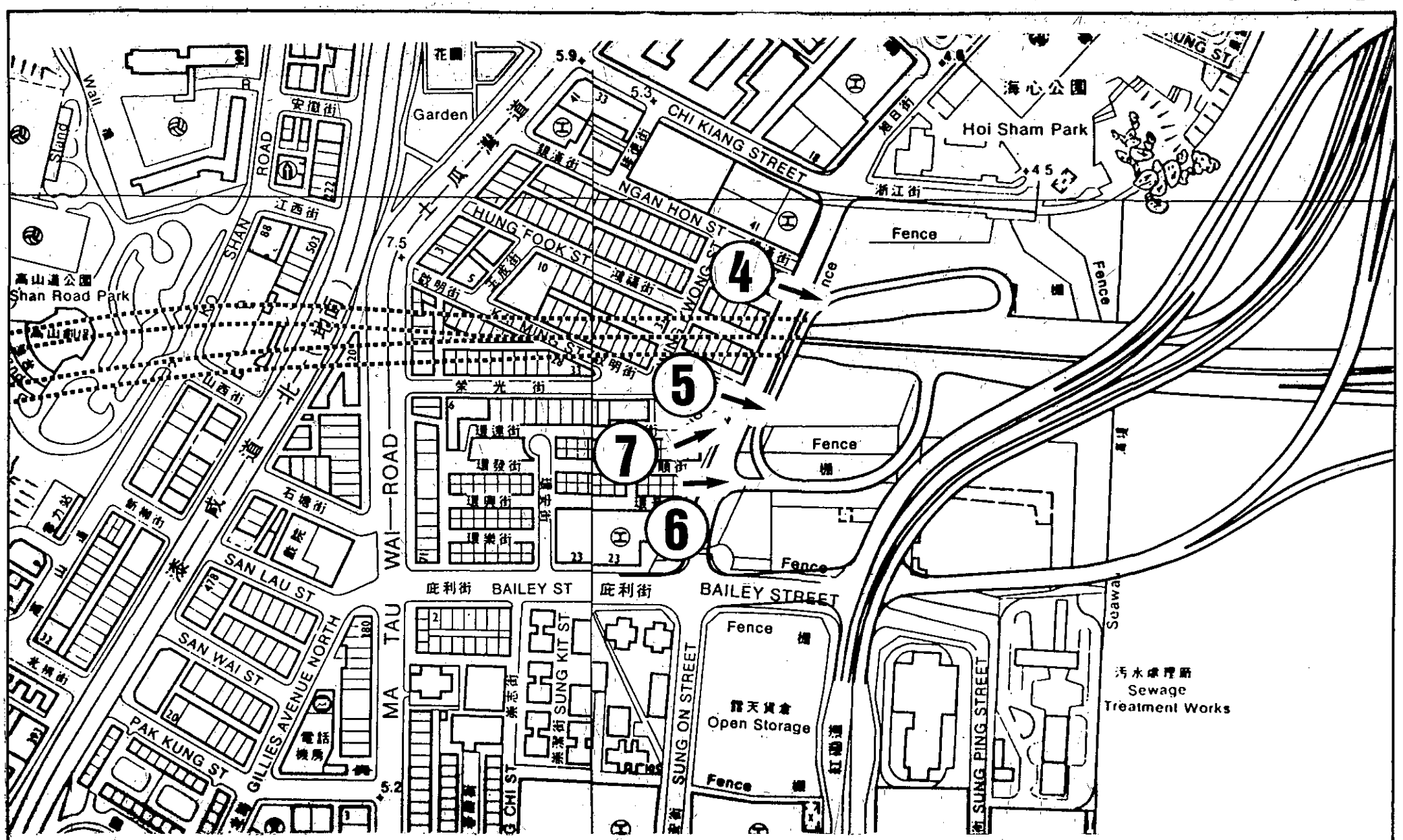
Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Noise Sensitive Receivers (Construction Phase) West Kowloon	FIGURE NO. 2.19	SCALE DATE APRIL 93



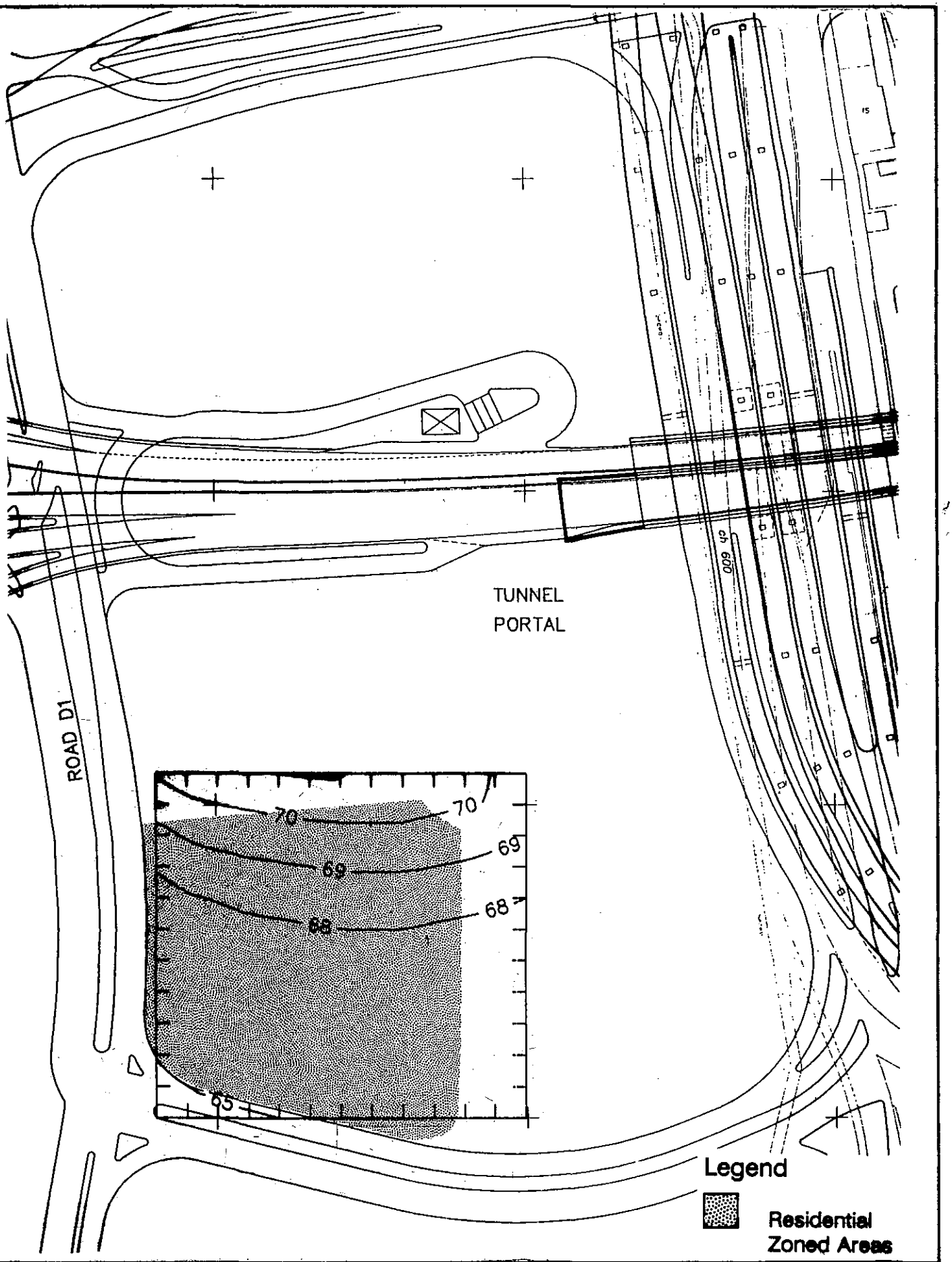
Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Noise Sensitive Receivers (Construction Phase) East Kowloon	FIGURE NO. 2.20	SCALE DATE APRIL 93



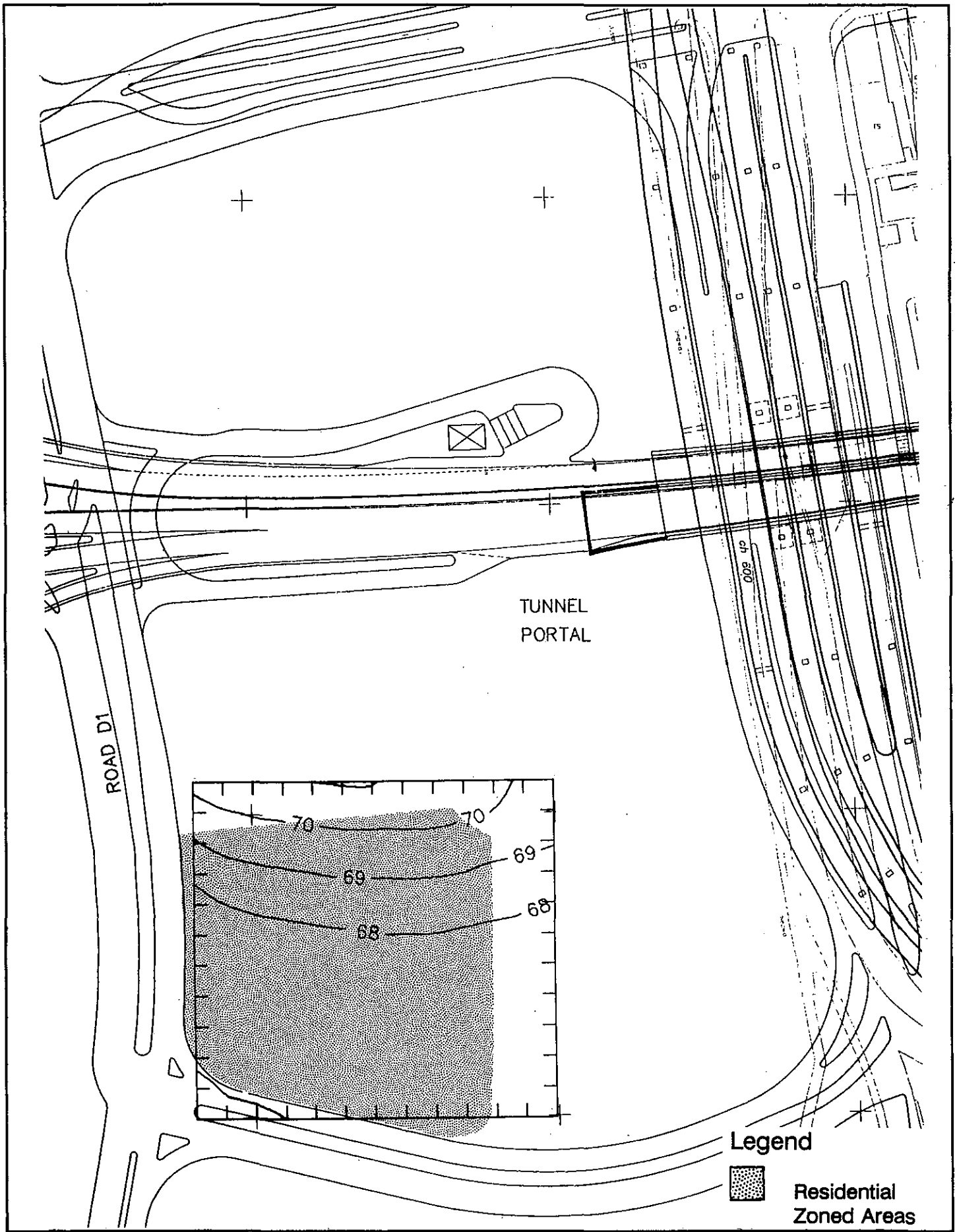
Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Noise Sensitive Receivers (Operational Phase) West Kowloon	FIGURE NO. 2.21	SCALE — DATE APRIL 93



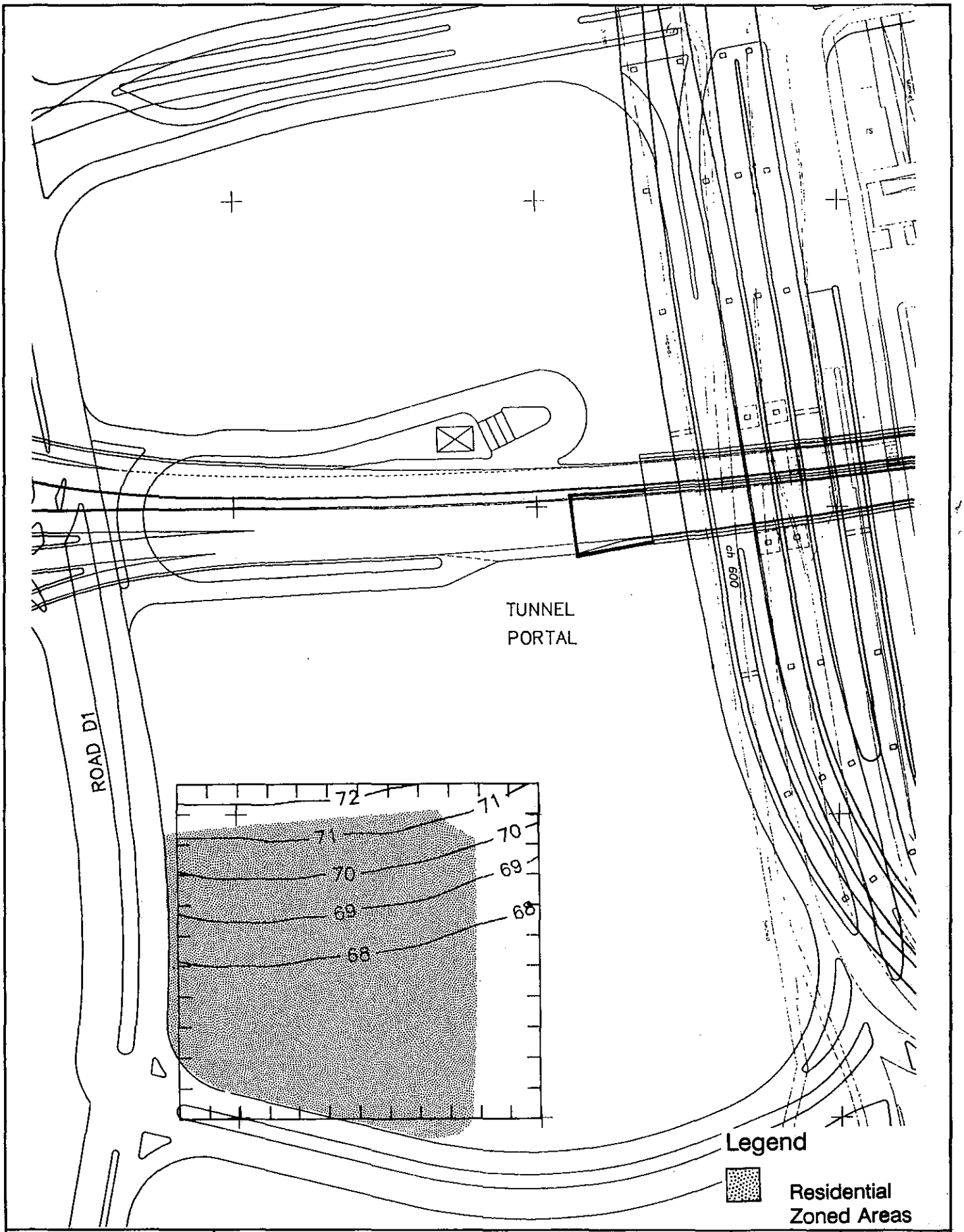
Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Noise Sensitive Receivers (Operational Phase) East Kowloon	FIGURE NO. 2.22	SCALE DATE APRIL 93



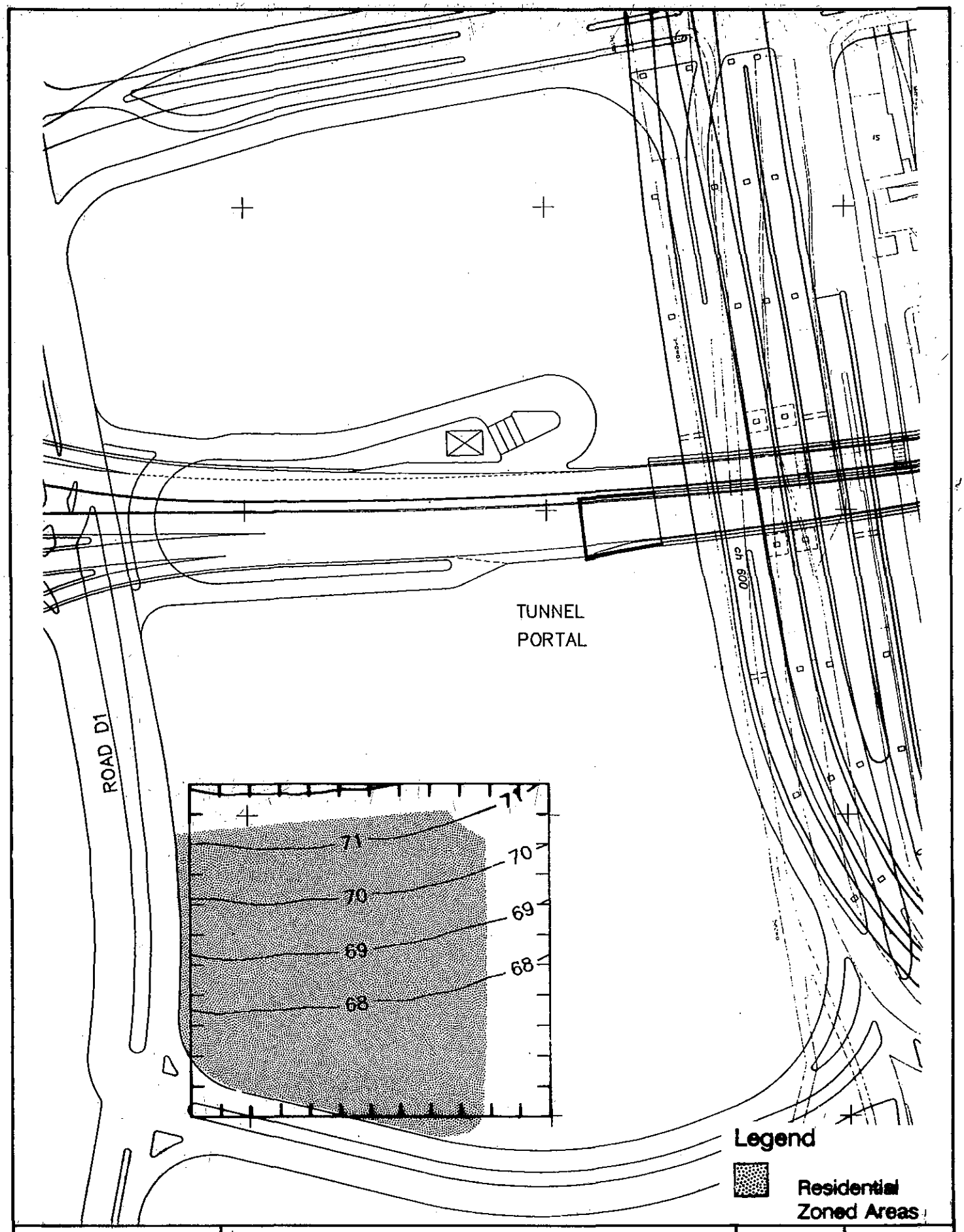
Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : West Kowloon Reclamation Noise Contours - 1st Floor Level	FIGURE NO. 2.23	SCALE N.T.S. DATE APRIL 93



Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : West Kowloon Reclamation Noise Contours - 6th Floor Level	FIGURE NO. 2.24	SCALE N.T.S. DATE APRIL 93



Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : West Kowloon Reclamation Noise Contours - 16th Floor Level	FIGURE NO. 2.25	SCALE N.T.S. DATE APRIL 93



Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : West Kowloon Reclamation Noise Contours - 26th Floor Level	FIGURE NO. 2.26	SCALE N.T.S. DATE APRIL 93

Appendix 2.1

The Environmental Assessment Brief

AGREEMENT NO. CE 58/90
CENTRAL KOWLOON ROUTE STUDY
ENVIRONMENTAL ASSESSMENT
SCOPE OF WORK

PURPOSE OF THE ENVIRONMENTAL ASSESSMENT

1.1 The purpose of the assessment is to provide information on the nature and extent of potential environmental impacts associated with the proposed Central Kowloon Route. This information will contribute to decisions on :-

(i) the acceptability of any adverse environmental consequences that are likely to arise from the construction and operation of the development and related facilities; and

(ii) conditions for the design, construction and operation of the project.

OBJECTIVES OF THE ENVIRONMENTAL ASSESSMENT

2.1 The objectives of the assessment are as follows :-

(i) to describe the proposed development and related facilities for their development;

(ii) to identify and describe the elements of the community and environment likely to be affected by the proposed development;

(iii) to minimize pollution and nuisance arising from the development and its operation and environmental disturbance during construction and operation of the project;

(iv) to identify and evaluate the net environmental impacts and cumulative effects expected to arise during the construction and operation of the development in relation to the existing and planned community and neighbouring land uses;

(v) to identify methods, measures and standards to be included in the design, which may be necessary to mitigate these impacts and reduce them to acceptable levels;

(vi) to recommend environmental monitoring and audit requirements necessary to ensure the effectiveness of the environmental protection measures adopted;

(vii) to identify any additional studies which may be necessary to fulfil the objectives or requirements of this Environmental Assessment.

REQUIREMENTS OF THE ENVIRONMENTAL ASSESSMENT STUDY

3.1 The assessment shall consist of the following :-

(i) an **Initial Assessment Working Paper** which

(a) satisfies the requirements of objective in para. 2.1(i) and para. 2.1(ii);

(b) provides an initial assessment and evaluation of the environmental impacts arising from the project sufficient to identify those issues which are of key concern to the project or which are likely to influence decisions on the project;

(c) identifies any monitoring studies necessary to provide a baseline profile of existing environmental quality, particularly for those parameters likely to be affected by the project; and

(d) proposes a detailed programme of investigation able to meet all other objectives of the assessment.

(ii) an **Environmental Assessment Working Paper** covering those issues of key concern identified through the Initial Assessment Working Paper or the review of the Initial Assessment Working Paper by the Director of Environmental Protection (DEP);

(iii) any reasonable revisions or supplements to the above as might be required to be carried out by the DEP; and

(iv) an **Executive Summary** in English and Chinese of the environmental assessment highlighting the major aspects of the project, perceived issues of public concern, recommendations for implementation and the basis for these, as well as their implications. It is intended that the information contained therein should assist the Government with any requirement for public consultation.

TECHNICAL REQUIREMENTS OF THE ENVIRONMENTAL ASSESSMENT STUDY

The Environmental Assessment Study shall include, but shall not necessarily be limited to the following tasks :-

4.1 *Construction Phase Assessment*

4.1.1 **Noise Impact Study**

Task 1 : Identification of Representative Sensitive Receivers

From a consideration of existing and future land-use in the Study area prepare schedules and plans identifying representative sensitive receivers. Locations of representative sensitive receivers shall be agreed with EPD. Noise sensitive receivers should include those described in the Environment Chapter of the Hong Kong Planning Standards & Guidelines. The future land-users should be those who will occupy the land by the time construction works commence.

Task 2 : Analysis of Construction Activities

From a knowledge of the likely type, sequence and duration of construction activities required for project implementation, identify those activities likely to have an impact on noise sensitive receivers.

Task 3 : Assessment of Construction Noise Level

Identify interactions between sensitive receivers and construction activities to determine the extent of potentially unacceptable construction noise impacts. The assessment should follow the requirements contained in all Ordinances and their Regulations governing the control of construction noise currently in force in Hong Kong and follow guidelines advised by the Director of Environmental Protection.

Tasks 4 : Proposal for Noise Control Measures

Formulate appropriate noise control measures for inclusion in contract documentation.

4.1.2 **Air Pollution Study**

Task 1 : Identification of Representative Sensitive Receivers

From a consideration of existing and future land use in the study area, prepare plans identifying representative sensitive receivers in the vicinity of the proposed project (including off-site works areas). The locations are to be agreed with EPD.

Task 2 : Analysis of Construction Activities

Identify those construction activities likely to cause potential dust (or other air pollutant) problems to sensitive receivers.

Task 3 : Air Pollution Impact Assessment

As far as is practical, assess the air pollution level at the sensitive receivers due to the proposed project (including constructional traffic arising) using a dispersion model to be agreed with the Director of Environmental Projection.

Task 4 : Proposal for Air Pollution Control Measures

Recommend appropriate air pollution control measures for consideration in the design.

4.1.3 **Water Quality Impact Study**

Task 1 : Identification of Sensitive Receivers

From the proposed route alignments identify the watercourse/water bodies which may be affected.

Task 2 : Analysis of Construction Activities

From a knowledge of the likely type, sequences and duration of construction activities required for project implementation, identify those activities likely to have an impact on the affected watercourse/water bodies.

Task 3 : Assessment of Water Pollution Problems

Identify interactions between sensitive receivers and construction activities to determine the adverse effects (if any) of construction on water quality of watercourse/water bodies. This should include the impact of any proposed dredging and reclamation activities, and marine spoil disposal.

Task 4 : Proposals for Water Pollution Control Measures

Recommend appropriate mitigation and control measures for inclusion in contract documentation. Where appropriate, make suggestions for practical mitigation measures and monitoring for compliance.

4.1.4 **Construction Waste Impacts**

Task 1 : Analysis of Construction Activities

Identify the quantity, quality and timing of arising of wastes and surplus excavated materials produced as a result of the construction activities.

Task 2 : Proposal for Waste Handling and Disposal

Recommend suitable waste handling and disposal measures including reuse of surplus excavated materials.

Operation Phase Assessment

4.2.1 **Traffic Noise Impact Study**

Task 1 : Identification of Representative Sensitive Receivers

Identify representative noise sensitive receivers, as described in the Environment Chapter of the Hong Kong Planning Standards & Guideline (HKPSG), for both existing and planned uses. Locations of representative noise sensitive receivers are to be agreed with EPD.

Task 2 : Calculation of Future Noise Levels

Calculate future road traffic noise using the methods described in the U.K. Department of the Transport's publication "Calculation of Road Traffic Noise" (1988) published by H.M. Stationery Office. Calculations are to be based on traffic projections for the design year which is defined as the year 2011.

Future traffic noise is to be calculated at the nearest facade of any existing building classified as a noise sensitive receiver. For planned developments, representative points are to be selected as shown on draft Layout Plans. Noise contours in L10 (1 hr) should be presented on a plan of suitable scale showing the noise sensitive receivers as identified in Task 1 above. Traffic at the hour of peak traffic flow shall be used in the calculation. Quantitative assessment at the identified NSRs for each alignment shall be compared against the criteria set out in the HKPSG. The potential noise impact of each proposed alignment on existing and planned NSRs shall be quantified by estimating the total number of dwellings and/or classrooms that will be exposed to levels above the HKPSG criteria.

Task 3 : Presentation of Existing Noise Level

Measure existing noise levels in L10 (1 hr), Leq (1 hr) and L90 (1 hr) at the identified Noise Sensitive Receivers and present them on a plan of suitable scale. This information may be required in the context of Task 5.

Task 4 : Assessment of Need for Noise Amelioration Measures

Assess the need for noise amelioration measures in relation to the extent to which an existing or planned building classified as a noise sensitive receiver would be subjected to a predicted traffic noise level in the design year which is 1 dB(A) or more in excess of the maxima recommended in the HKPSG. The appropriateness of this criteria is dependent on the results of Task 3 above and will be advised by the Director of Environmental Protection.

Task 5 : Proposals for Noise Amelioration Measures

Propose traffic noise amelioration measures for each situation where the predicted traffic noise level exceeds the HKPSG maxima, or appropriate criteria as advised by DEP. In the case where an existing building is already subject to noise levels equal to, or in excess of, the recommended maximum, measures to avoid (as far as possible) deterioration of the situation are to be put forward. For planned noise sensitive developments, indications of the form of suitable measures to be incorporated in the project should be shown for further development in subsequent detail design.

4.2.2 Air Pollution Modelling Study

Task 1 : Identification of Sensitive Receivers

Form a consideration of existing and future land-use in the study area, prepare plans identifying sensitive receivers within 50 m of the proposed project.

Task 2 : Assess Air Pollution Impact

Assess the air pollutant levels at the sensitive receivers due to the proposed projects using dispersion model to be agreed with the Director of Environmental Projection.

The report should contain sample calculations and input parameters used in the modelling.

Task 3 : Assessment of Air Pollution Impact from Tunnel Portals and Approaches Roads

Assess the air pollution impacts within 300 m of any tunnel portals and 200 m on either side of the tunnel approach roads using a dispersion model. The consultant shall agree the assessment methodology with the Director of Environmental Protection prior to commencing this task.

Task 4 : Proposal for Amelioration Measures

Propose cost effective amelioration measures in situations where the predicted air pollution levels exceed the Hong Kong Air Quality Objectives.

4.2.3 **Water Quality Impact Study**

Task 1 : Assessment of Water Pollution Impact

Assess the adverse effects, if any, of the traffic and the route alignments, infrastructures and facilities on the water quality of the watercourse/water bodies traversed by the route. This should include surface runoff and spillages due to accidents. The route alignments need to be modelled for water quality impacts on water bodies. Water quality modelling should be undertaken using models/techniques to be agreed with the Director of Environmental Protection.

Task 2 : Proposals for Amelioration Measures

Recommend appropriate cost effective amelioration measures to minimize any adverse effects identified in Task 1.

4.2.4 **Visual and Landuse Impacts**

Task 1 : Assessment of Visual Impacts

Assess the visual impacts, if any, caused by the proposed project.

Task 2 : Assessment of the Implication on Land Use

Assess the implications on land use in the vicinity of the project (including works areas), both the long and short terms implications have to be assessed.

Task 3 : Proposals for Mitigation Measures

Recommend appropriate cost effective mitigation measures such as landscaping, to minimize any adverse effects identified in Tasks 1 and 2 above.

Special attention should be paid to minimize the restraints on the development potential of the area in the vicinity of the project.

4.3 *Monitoring and Post-Project Audit Requirements*

4.3.1 **Environmental Monitoring**

Define environmental monitoring requirements including any necessary programme for baseline, construction impact and compliance monitoring.

4.3.2 **Post-Project Audit**

Formulate environmental audit requirements including any necessary compliance and post-project audit programmes to review the environmental monitoring data. Assess compliance with regulatory requirements, policies and standards and identify any remedial works required to redress unacceptable consequential or unanticipated environmental impacts.

PROPOSED ADMINISTRATION

5.1 The Environmental Assessment will be managed by an Environmental Study Management Group chaired by the Director of Environmental Protection or his representative. The Environmental Study Management Group shall provide advice to the Steering Group of the Study.

5.2 In accordance with LWB TC 9/88, if there is any disagreement on the findings of the Environmental Assessment or on the necessary environmental protection and pollution control measures, the issue will be referred to SPEL who will resolve the differences in consultation with the appropriate Branches and Departments.

Appendix 2.2

Abbreviations

Appendix 2.2 ABBREVIATIONS

AQO	Air Quality Objective
ASR	Area Sensitivity Rating
BNL	Basic Noise Level
CESD	Civil Engineering Services Department
CKR	Central Kowloon Route
CKTS	Central Kowloon Traffic Study
CTS-2	The Second Comprehensive Transport Study
EA	Environmental Assessment
EPD	Environmental Protection department
HGV	Heavy Goods Vehicle
HKPSG	Hong Kong Planning Standards and Guidelines
NCO	Noise Control Ordinance
NSH	North South Highway
NSR	Noise Sensitive Receiver
PCU	Passenger Car Unit
TM	Technical Memorandum
TSP	Total Suspended Solids
WHC	Western Harbour Crossing
WKC	West Kowloon Corridor
WKE	West Kowloon Expressway
WKRTS	West Kowloon Reclamation transport Study

Appendix 2.3

Vehicular Emissions Calculations

Appendix 2.3

VEHICULAR EMISSION CALCULATIONS

	Westbound Tunnel		Eastbound Tunnel	
Tunnel Length (m)	Gradient (%)	PIARC 91 Gradient Factor	Gradient (%)	PIARC 91 Gradient Factor
142	6	2	-6	0.437
255	-1.85	0.768	1.85	1.308
58	0.3	1.05	-0.3	0.962
630	1.5	1.25	-1.5	0.812
1080	-0.88	0.89	0.88	1.146
253	0.3	1.05	-0.3	0.962

The gradients were slightly revised after the calculation of emissions, and, by inspection, it was ascertained the change in gradients would not significantly revise the calculated emissions.

Vehicle Categories :

	Weight (ton)	Percentage (%)	PIARC 91 NOx Emission at 60 km/h (g/h-veh)
A. Petrol Engine		43	40
B. Diesel Engine			
type 1	2	10	40
type 2	3.34	5	220
type 3	6.85	33	400
type 4	24.55	9	968

a. Composite emission factor of NOx at 60 km/h = 251 g/h-veh.

b. Speed factor at 70 km/h = 1.5 (PIARC 91).

cont'd.

APPENDIX 2.3
cont'd.

c. Vehicle density at 70 km/h (1800 pcu/hr per lane) is

$$\frac{1800 \text{ (pcu/hr)}}{1.584 \text{ (pcu/veh)} \times 70 \text{ (km/h)}} = 16.23 \text{ veh/km}$$

d. Average gradient factor for Westbound Tunnel is

$$\frac{142 \times 2 + 255 \times 0.768 + 311 \times 1.05 + 630 \times 1.25 + 1080 \times 0.89}{2418} = 1.0567$$

e. Average gradient factor for Eastbound Tunnel is

$$\frac{142 \times 0.437 + 255 \times 1.308 + 311 \times 0.962 + 630 \times 0.812 + 1080 \times 1.146}{2418} = 1.0108$$

f. Predicted traffic flow at peak hour of year 2011 are 1600 and 2550 pcu/hr for Westbound and Eastbound Tubes respectively.

g. Maximum NOx emission rate at peak hour of Westbound Tube is

$$\frac{251}{3600} \times 1.5 \times 16.23 \times 1.0567 \times 2.418 \text{ (km)} \times 2 \text{ (lanes)} \times \frac{1600}{1800 \times 2} = 3.86 \text{ g/s}$$

h. Maximum NOx emission rate at peak hour of Eastbound Tube is

$$\frac{251}{3600} \times 1.5 \times 16.23 \times 1.0108 \times 2.418 \text{ (km)} \times 2 \text{ (lanes)} \times \frac{2550}{1800 \times 2} = 5.88 \text{ g/s}$$

i. Total NOx emission at peak hour of year 2011 is

$3.86 + 5.88 = 9.7$ g/s

Summary of Pollutants Emitted at year 2011 :

Pollutants	Maximum Emission Rate
NOx	9.7g/s at maximum design speed of 70km/h
CO	13.3g/s at idling speed (tunnel congestion)
RSP	1.0 g/s

Appendix 2.4

Noise Monitoring

Appendix 2.4 NOISE MONITORING

24-hour Monitoring - To Kwa Wan

Introduction

The sound level meter was set up on an open area adjacent to the eastern end of Ngan Hon Street, To Kwa Wan as shown in Figure A2.4.1.

The 24 hour noise monitoring started at 5:15 pm of 6.10.92 to 5:19 pm of 7.10.92. There were delays during two periods (record numbers 0014 and 0030) due to battery changing.

Monitored Parameters

Leq (30 min) was adopted to indicate the noise impact. In addition maximum peak level, L_1, L_{10}, L_{50}, L_{90} & L_{99} values for the 30 minute periods were also recorded. The measurements were continuous over 24 hours.

Instrumentation

The sound level meter was a Bruel & Kjaer Type 2231 installed with a Statistical Analysis Module BZ7115.

The sound level meter was calibrated by a Sound Level Calibrator Type 4230 with calibration sound pressure level 94 dB at 1kHz before measurement.

The sound level meter was set up at 1.2m above ground and 12m from the facade of the building at the end of Ngan Hon Street.

The sound level meter was set at Frontal, Fast Response and A-weighted.

Results

Table A2.4.1 shows the results of each 30 minute period.

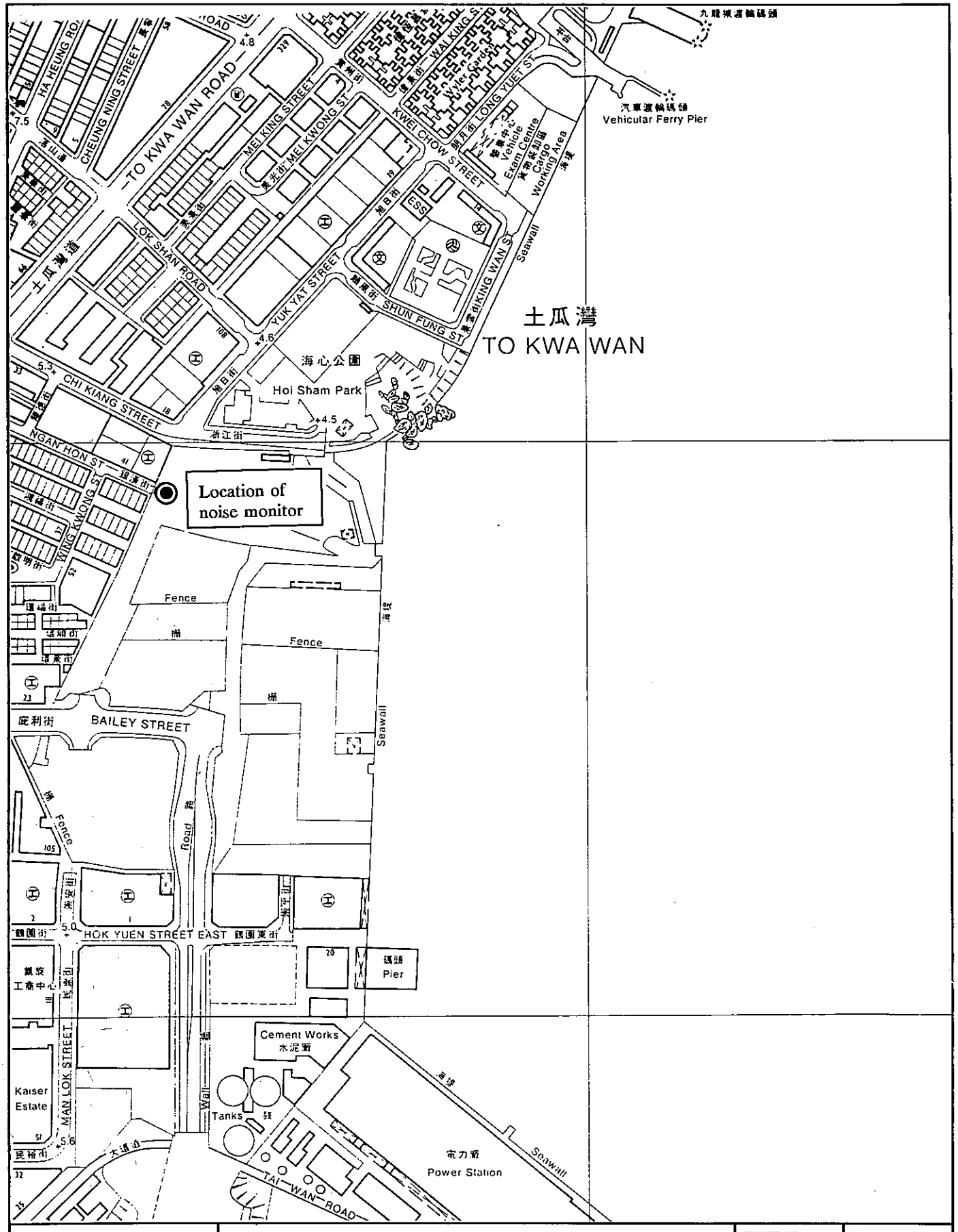
Figure A2.4.2 shows the variation of Leq (30 min) throughout the 24 hour monitoring period.

Table A2.4.1 Noise Monitoring Results for East Kowloon [dB(A)]

No.	Date	Time	L_{max}	L_1	L_{10}	L_{50}	L_{90}	L_{99}	L_{eq}	Time
1	06-Oct-92	17:45	114.0	78.1	69.1	62.1	60.6	60.1	69.0	30
2	06-Oct-92	18:15	106.6	72.6	65.1	60.6	59.6	59.1	63.9	30
3	06-Oct-92	18:45	110.7	76.1	66.1	60.6	59.6	58.6	64.8	30
4	06-Oct-92	19:15	98.1	76.6	66.1	60.1	59.6	59.1	65.0	30
5	06-Oct-92	19:45	98.8	71.6	63.1	59.1	55.6	54.6	61.5	30
6	06-Oct-92	20:16	109.1	75.1	67.1	56.6	54.6	54.1	63.7	30
7	06-Oct-92	20:46	93.5	69.1	64.6	56.1	54.1	53.6	60.5	30
8	06-Oct-92	21:16	88.2	68.6	58.1	54.6	53.6	52.6	57.9	30
9	06-Oct-92	21:46	91.8	71.1	62.6	55.1	53.6	52.6	60.3	30
10	06-Oct-92	22:17	100.1	73.1	66.1	55.1	53.1	52.6	62.2	30
11	06-Oct-92	22:47	106.4	72.6	65.1	55.1	53.1	52.1	61.7	30
12	06-Oct-92	23:17	88.7	68.1	58.6	53.6	52.6	51.6	57.3	30
13	06-Oct-92	23:47	91.5	70.6	60.1	53.1	51.6	51.1	58.6	30
14	07-Oct-92	00:18	100.0	75.1	62.6	53.1	51.6	50.6	62.3	30
15	07-Oct-92	00:48	104.5	77.1	66.6	55.1	51.6	50.6	64.8	30
16	07-Oct-92	01:18	94.5	66.6	58.1	52.1	51.1	50.6	56.1	30
17	07-Oct-92	01:48	112.5	68.1	60.6	52.1	51.1	50.1	58.1	30
18	07-Oct-92	02:18	86.7	61.6	53.1	51.6	51.1	50.1	52.8	30
19	07-Oct-92	02:49	89.6	62.1	52.6	51.1	50.6	50.1	53.0	30
20	07-Oct-92	03:19	85.6	52.6	51.6	50.6	49.6	*	50.7	30
21	07-Oct-92	03:49	84.5	56.1	51.6	50.1	49.6	*	50.7	30
22	07-Oct-92	04:19	108.1	58.1	51.6	50.1	*	*	51.6	30
23	07-Oct-92	04:50	96.9	64.1	51.6	50.1	49.6	*	54.7	30
24	07-Oct-92	05:20	95.0	60.1	51.6	50.1	*	*	51.5	30
25	07-Oct-92	05:50	97.2	61.6	51.6	50.1	49.6	*	53.5	30
26	07-Oct-92	06:20	101.6	56.1	53.1	50.6	49.6	*	57.4	30
27	07-Oct-92	06:51	94.1	66.1	55.6	51.6	50.6	50.1	55.0	30
28	07-Oct-92	07:21	103.5	59.6	54.6	52.6	52.1	51.1	53.8	30
29	07-Oct-92	07:51	115.8	61.1	57.1	55.1	53.6	52.6	59.4	30
30	07-Oct-92	08:21	104.9	71.1	63.6	58.6	56.1	55.1	61.4	30

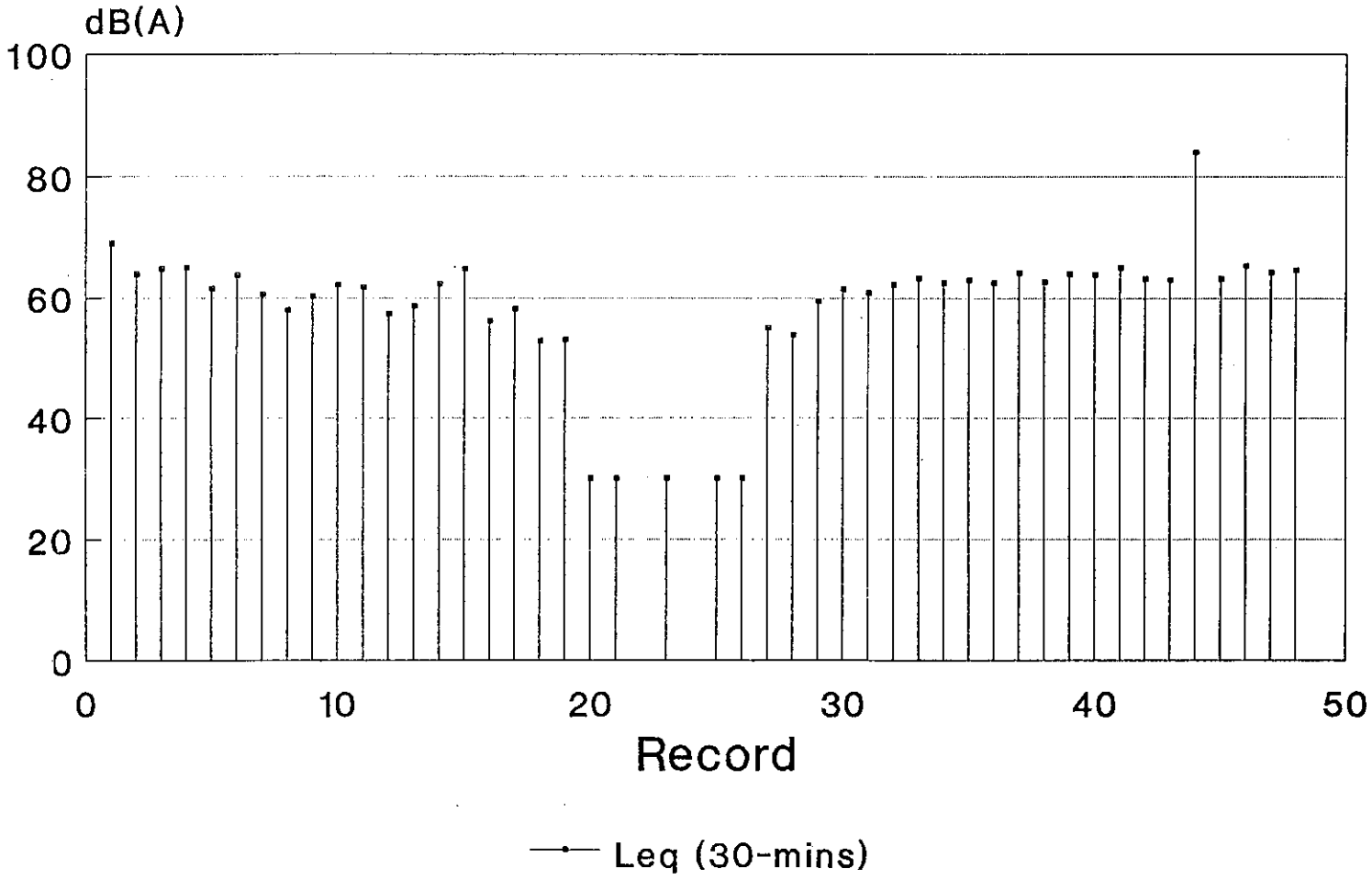
No.	Date	Time	L_{max}	L_1	L_{10}	L_{50}	L_{90}	L_{99}	L_{eq}	Time
31	07-Oct-92	08:52	92.7	68.1	62.1	59.6	58.6	58.1	60.8	30
32	07-Oct-92	09:22	105.4	70.6	63.6	60.6	59.6	58.6	62.2	30
33	07-Oct-92	09:52	98.2	74.1	64.1	60.6	59.6	59.1	63.2	30
34	07-Oct-92	10:22	105.1	68.1	63.6	61.6	60.6	60.1	62.5	30
35	07-Oct-92	10:53	93.4	69.6	64.6	62.1	60.6	60.1	63.0	30
36	07-Oct-92	11:23	93.0	68.6	64.1	61.6	60.6	60.1	62.5	30
37	07-Oct-92	11:53	94.7	73.6	66.1	61.6	60.6	60.1	64.1	30
38	07-Oct-92	12:23	91.8	71.1	65.6	60.6	59.6	59.6	62.7	30
39	07-Oct-92	12:53	97.2	74.6	65.6	60.6	59.6	59.6	63.9	30
40	07-Oct-92	13:24	93.4	72.1	67.1	61.1	60.1	59.6	63.8	30
41	07-Oct-92	13:54	105.9	75.1	68.1	61.6	60.1	59.6	65.0	30
42	07-Oct-92	14:24	91.4	71.6	65.6	61.1	60.1	59.6	63.1	30
43	07-Oct-92	14:54	98.0	70.6	65.6	61.1	60.1	59.6	63.0	30
44	07-Oct-92	15:25	124.0	75.6	67.6	62.1	60.6	60.1	84.0	30
45	07-Oct-92	15:55	103.3	70.1	65.6	61.6	60.6	60.1	63.1	30
46	07-Oct-92	16:25	120.5	73.6	67.1	62.1	61.1	60.6	65.3	30
47	07-Oct-92	16:55	94.8	71.1	66.1	62.6	61.6	61.1	64.2	30
48	07-Oct-92	17:26	107.9	73.1	66.6	62.1	61.6	60.6	64.6	30

* Not Available



Parsons Brinckerhoff Maunsell Consultants	**Central Kowloon Route Study : 24-Hour Noise Monitoring Location**	FIGURE NO. **A2.4.1**	SCALE **N.T.S.** DATE **APRIL 93**

Leq (30-mins)
24-hour Monitoring - East Kowloon



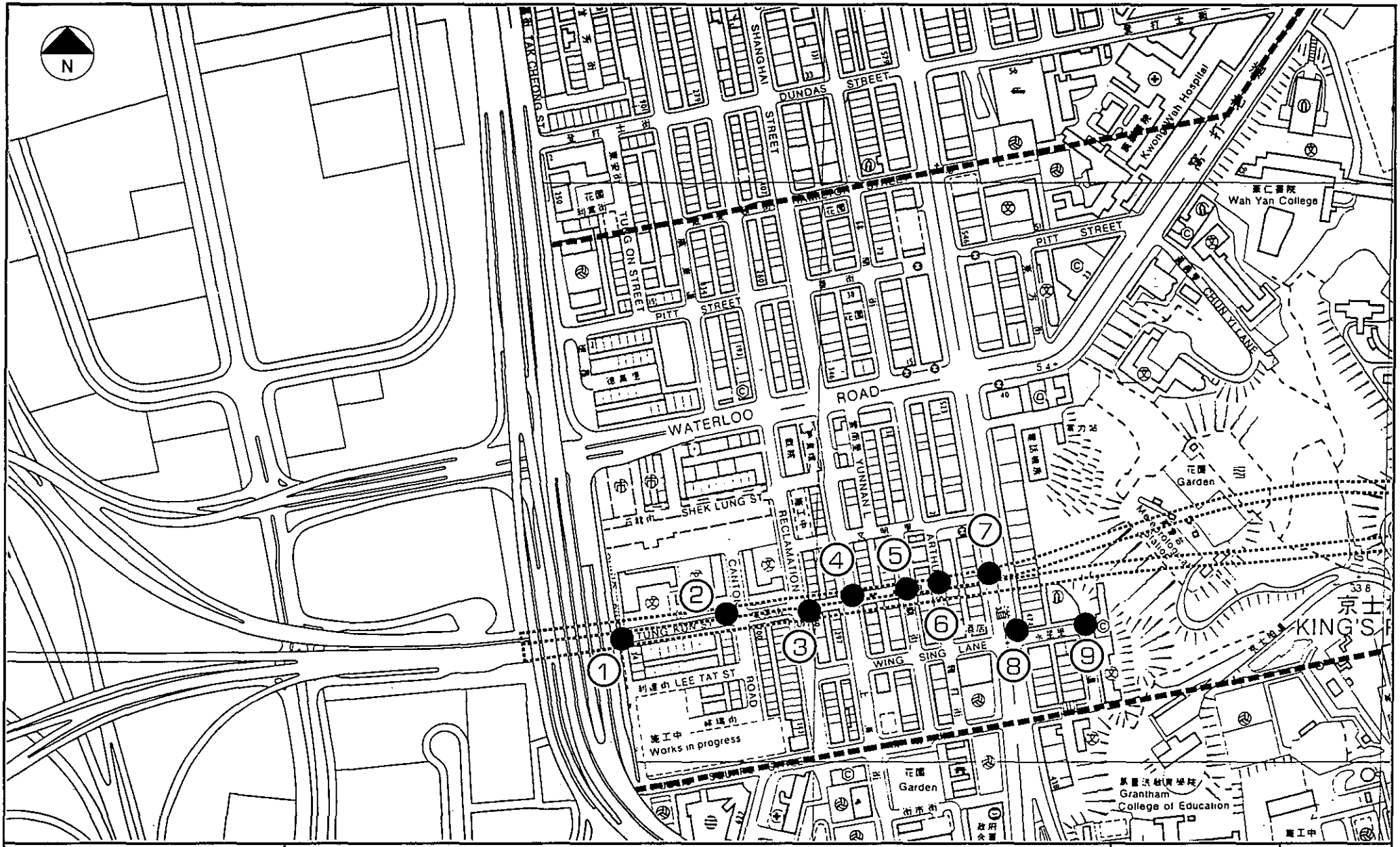
Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : 24-Hour Monitoring - East Kowloon	FIGURE NO. A2.4.2	SCALE N.T.S. DATE APRIL 93

Background Monitoring in West and East Kowloon

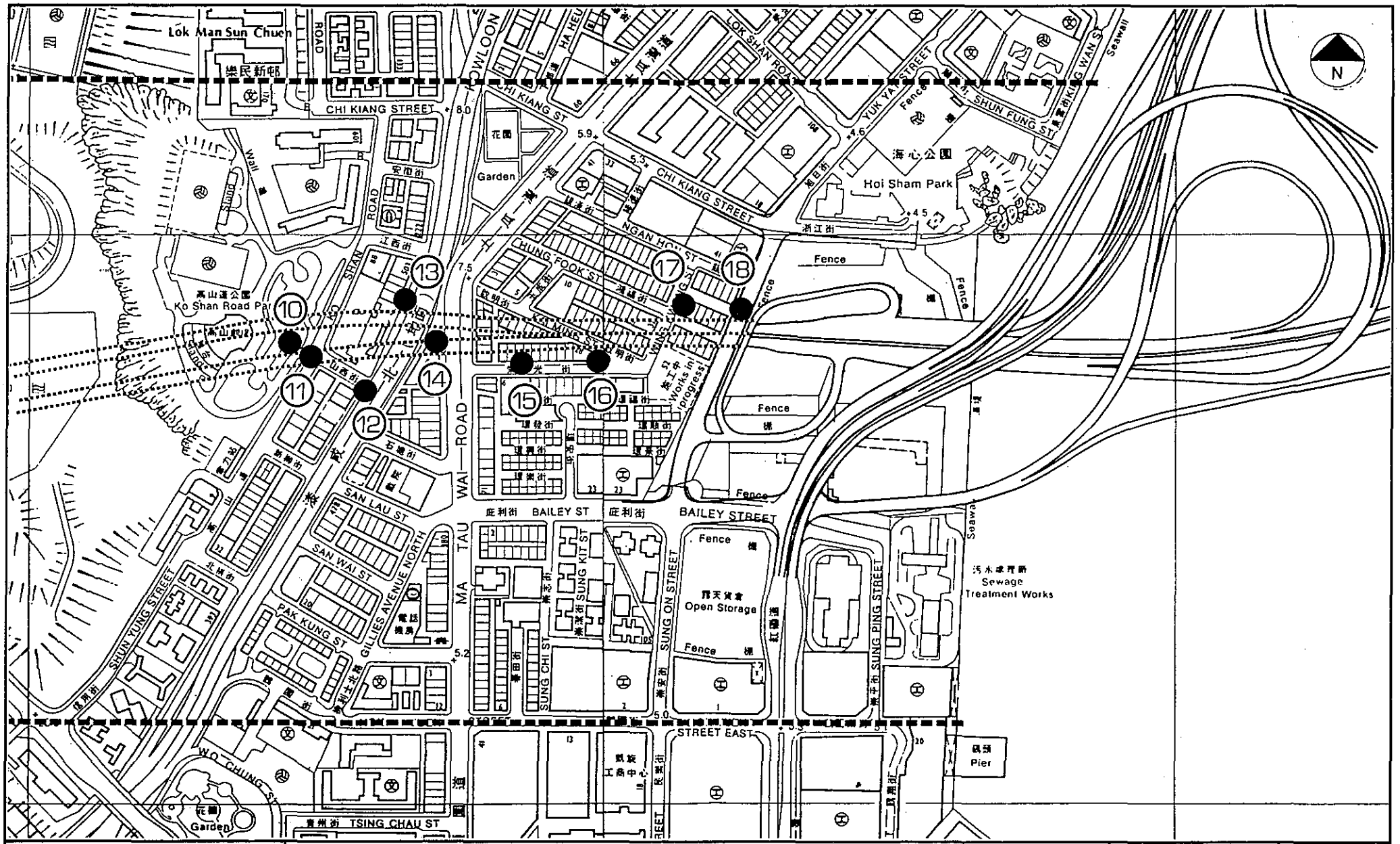
A number of 5-minute L_{eq} levels were monitoring in West and East Kowloon. The locations of the monitoring points are shown in Figures A2.4.3 and A2.4.4. The monitoring results are given in Table A2.4.2.

Table A2.4.2 Monitoring Results for West and East Kowloon

No.	Location	L_{eq}(5 min) dB(A)	Remarks
1	Tung Kun Street - Ching Ping Street	72.1	
2	Tung Kun Street - Canton Road	68.0	
3	Tung Kun Street - Reclammation Street	73.3	
4	Hi Lung Lane - Shanghhai Street	74.8	
5	Hi Lung Lane - Temple Street	71.0	
6	Hi Lung Street - Arthur Street	70.9	
7	Nathan Road No.487 (HK Bank)	80.9	Heavy Traffic
8	Nathan Road - Wing Sing Lane	80.9	Heavy Traffic
9	Wing Sing Lane - Cliff Road	72.9	
10	Ko Shan Road Park	62.6	
11	Ko Shan Road Park - Shan Shi Street	69.3	
12	Shan Shi Street - Chatham Road	82.0	Heavy Traffic
13	Chatham Road - Ma Tau Wai Road	79.7	Heavy Traffic
14	Ma Tau Wai Road - Chatham Road	79.1	Heavy Traffic
15	Wing Kwong Street No.2	70.9	
16	Wing Kwong Street No.33B	71.6	
17	Wing Kwong Street - Hung Fung Street	71.1	
18	Crown Land Behind Wing Kwong Street	62.5	



Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Background Noise Monitoring Locations - West Kowloon	FIGURE NO. A2.4.3	SCALE N.T.S. DATE APRIL 93



Parsons Brinckerhoff **Maunsell Consultants**	**Central Kowloon Route Study :** **Background Noise Monitoring Locations - East Kowloon**	FIGURE NO. **A2.4.4**	SCALE **N.T.S.** DATE **APRIL 93**

Appendix 2.5

Sample Specification Clauses for Environmental Protection

SAMPLE SPECIFICATION CLAUSES FOR

ENVIRONMENTAL PROTECTION

1. AVOIDANCE OF NUISANCE

(i) The Contractor shall be responsible for ensuring that no earth, rock or debris is deposited on public or private rights of way as a result of his operations, including any deposits arising from the movement of plant or vehicles. The Contractor shall provide a vehicle cleaning facility at the exits from the works areas where excavated material is hauled, to the approval of the Engineer and to the requirements of the Commissioner of Police.

(ii) The Contractor shall ensure that existing stream courses and drains within and adjacent to works areas are kept safe and free from any debris and any excavated materials arising from the Works. The Contractor shall ensure that chemicals and concrete agitator washings are not deposited in watercourses.

(iii) Water and waste products arising on works areas shall be collected, removed from works areas via a suitable and properly designed temporary drainage system and disposed of at a location and in a manner that will cause neither pollution nor nuisance.

(iv) The Contractor shall construct, maintain, remove and reinstate as necessary temporary drainage works and take all other precautions necessary for the avoidance of damage by flooding and silt washed down from the Works. He shall also provide adequate precautions to ensure that no spill or debris of any kind is allowed to be pushed, washed down, fall or be deposited on land or the seabed adjacent to works areas.

(v) In the event of any spoil or debris from construction works being deposited on adjacent land or seabed or any silt washed down to any area, then such spoil, debris or material and silt shall be immediately removed and the affected land or seabed and areas restored to their natural state by the Contractor to the satisfaction of the Engineer.

Air Quality

2. GENERAL REQUIREMENTS

(i) The Contractor shall undertake measures to prevent dust nuisance as a result of his activities. Any air pollution control system installed shall be operated whenever the plant is in operation.

(ii) The Contractor shall not install any furnace, boiler or other similar plant or equipment using any fuel that may produce air pollutants without the prior written consent of the Director of Environmental Protection (DEP) pursuant to the Air Pollution Control Ordinance.

(iii) The Contractor shall not burn debris or other materials on the works areas.

(iv) The Contractor shall implement dust suppression measures which shall include, but not be limited, to the following:

(a) Stockpiles of sand and aggregate greater than 20 m^3 for use in concrete manufacture shall be enclosed on three sides, with walls extending above the pile and 2 m beyond the front of the pile.

(b) Effective water sprays shall be used during the delivery and handing of all raw sand and aggregate, and other similar materials, when dust is likely to be created and to dampen stored materials during dry and windy weather.

(c) Areas where there is a regular movement of vehicles shall have all-weather surfaces to a standard agreed with the Engineer and be kept clear of loose surface material.

(d) If used, conveyor belts shall be fitted with windboards, and conveyor transfer points and hopper discharge areas shall be enclosed to minimise dust emission. Conveyors carrying materials which have the potential to create dust shall be totally enclosed and fitted with belt cleaners.

(e) Cement and other such fine grained material delivered in bulk shall be stored in closed silos fitted with a high level alarm indicator. The high level alarm indicators shall be interlocked with the filling line so that in the event of the hopper approaching an overfull condition, an audible alarm will operate and the pneumatic line to the filling tanker will close.

(f) Air vents on cement silos shall be fitted with suitable fabric filters provided with either shaking or pulse-air cleaning mechanisms. the fabric filter area shall be determined using an air-cloth ration (filtering velocity) of 0.01 - 0.03 m/s.

(g) Weigh hoppers shall be vented to a suitable filter.

(h) The filter bags in the cement silo dust collector must be thoroughly shaken after cement is blown into the silo to ensure adequate dust collection for subsequent loading.

(i) The provision of adequate dust suppression plant including water bowsers with spray bars or means of applying surface chemical treatment, the details of which shall be submitted to and approved by the Engineer.

(j) If formed as part of this Contract, areas of reclamation shall be completed, including final compaction, as quickly as possible consistent with good practice to limit the creation of wind blown dust.

(k) Unless otherwise approved by the Engineer the Contractor shall restrict all motorised vehicles on the work areas to a maximum speed appropriate to the quality of the haul roads and confine haulage and delivery vehicles to designed roadways inside the work areas.

(l) The Contractor shall arrange blasting techniques so as to minimise dust generation.

(v) At any concrete batching plant or crushing plant being operated on the work areas the following additional conditions shall be complied with:

(a) Where dusty materials are being discharged to vehicles from a conveying system at a fixed transfer point, a three-sided roofed enclosure with a flexible curtain across the entry shall be provided. Exhaust fans shall be provided for this enclosure and vented through a suitable fabric filter system.

(b) Any vehicle with an open load carrying area used for moving potentially dust producing materials shall properly fitting side and tail boards. Materials having the potential to create dust shall not be loaded to a level higher than the side and tail boards, and shall be covered by a clean tarpaulin in good condition. The tarpaulin

shall be properly secured and shall extend at least 300 mm over the edges of the side and tail boards.

(c) The Contractor shall frequently clean and water the concrete batching plant and ancillary areas in minimise any dust emissions.

(d) Dry mix batching shall be carried out in a totally enclosed area with exhaust to suitable fabric filters.

3. OPERATING MINERAL WORKS (CRUSHING PLANTS) ON WORK AREAS

The Contractor will not be allowed to operate Mineral Works (Crushing Plant) on the works areas.

4. MONITORING OF DUST (TSP) LEVELS

General Requirements

(i) The Contractor shall carry out the Works in such a manner as to minimise dust emissions during execution of the Works.

(ii) The Engineer may require equipment intended to be used on the Works to be made available for inspection and approval to ensure that it is suitable for the project.

(iii) The Contractor shall devise and arrange methods of working to minimise dust emissions, and shall provide experienced personnel with suitable training to ensure that these methods are implemented.

(iv) Before the commencement of the Works, the Contractor shall submit to the Engineer the proposed methods of working.

(v) After commencement of the Works if the equipment or work methods are believed by the Engineer to be causing serious air pollution impacts, remedial proposals shall be drawn up by the Contractor and, once approved by the engineer, implemented. In developing these remedial measures, the Contractor shall inspect and review all dust sources that may be contributing to the pollution impacts. Where such remedial measures include the use of additional or alternative equipment such equipment shall not be sued on the Works until approved by the Engineer. Where remedial measures include maintenance or modification of previously approved equipment such equipment shall not be used on the Works until such maintenance or modification is completed and the adequacy of the maintenance or modification is demonstrated to the satisfaction of the Engineer.

(vi) If the Engineer finds that approved remedial measures are not being implemented and that serious impacts persist, he may direct the Contractor to cease related parts of the Works until the measures are implemented. No claims by the Contractor shall be entertained in connection with such a direction.

(vii) The Contractor shall provide two high volume air samplers and associated equipment and consumables and shelters in accordance with Part 50 of Chapter 1 Appendix B of Title 40 of the Code of Federal Regulations of the USA within one week of the commencement of the Works. The samplers, equipment and shelters shall be constructed so as to be transferable between monitoring stations.

(viii) The Contractor shall construct suitable access, at each monitoring station in areas to be directed by the Engineer. Alternative locations may be necessary if difficulties arise in obtaining access, or if the locations become unsuitable.

The exact location and direction of the monitoring equipment at each monitoring station shall be agreed with the Engineer. Monitoring stations points shall be free from local obstructions or sheltering, subject to practical consideration.

(ix) The dust (TSP) levels will be measured by the "High Volume Method for total suspended particulars" as described by the United States Environmental Protection Agency in 40 LFR Part 50.

(x) The Engineer will carry out baseline monitoring prior to the commencement of major construction works to determine and agree with the Contractor ambient dust (TSP) levels at each specified monitoring station. The baseline monitoring will be carried out for a period of at least two weeks, with measurements to be taken every day at each monitoring station.

(xi) Impact monitoring during the course of the Works will normally by undertaken at any one or more of the monitoring stations as determined by the undertaking the monitoring and processing of the results. The contractor will be responsible for monitoring and processing the data. These should be submitted to the Engineer for approval.

(xii) Should the impact monitoring record dust levels which are indicative of a deteriorating situation so that closer monitoring is reasonably indicated, then the Engineer may instruct the Contractor to undertake daily impact monitoring at any one or more of the monitoring stations until the results indicate an improving and acceptable level of air quality.

5. ACTION ON CONSTRUCTION DUST (TSP) LEVELS

(i) Where the Engineer determines that the recorded dust (TSP) level is significantly greater than the levels established in the baseline survey, the Engineer will direct the Contractor to take effective remedial measures including, but not limited to, reviewing dust source and modifying working procedures.

(ii) The Contractor shall inform the Engineer of all steps taken. Written reports and proposals for action shall be passed to the Engineer by the Contractor whenever the Engineer determines that air quality monitoring shows that the recorded dust (TSP) level is significantly greater than the levels established in the baseline survey or breaching the Air Quality Objectives, or accepted guidelines.

(iii) If the Engineer finds that approved remedial measures are not being implemented and that serious impacts persist, he may direct the Contractor to cease related parts of the Works until the measures are implemented. No claims by the Contractor shall be entertained in connection with such a direction.

Water Pollution Control and Water Quality Monitoring

6. GENERAL REQUIREMENTS

(i) The Contractor shall carry out the Works in such a manner as to minimise adverse impacts on the water quality during the execution of the Works. In particular he shall arrange his method of working to minimise the effects on the water quality within the works areas, adjacent to the works areas, on the transport routes to and from the works areas and at the loading, and dumping areas.

(ii) If marine plant is used on the Works, it shall be inspected by the Engineer to ensure that the plant is suitable for the project and can be operated to achieve the water quality requirements (WQRs) detailed in Clause 8 of this appendix. The Contractor shall provide facilities to the Engineer for inspecting or checking such vessels and shall not use such vessels or plant for

the Works without the approval of the Engineer. The Engineer may require the Contractor to carry out trials of any plant or vessels to prove their suitability.

(iii) The Contractor shall devise and arrange methods of working to minimise water pollution and to meet the WQRs and shall provide experienced personnel with suitable training to ensure that these methods are implemented.

(iv) Before the commencement of the Works, the Contractor shall submit to the Engineer the proposed methods of working.

(v) After commencement of the Works, if the plant or work methods are believed by the Engineer to be causing serious water pollution impacts, the Contractor shall proposed remedial measures which may include, but not be limited to, the pollution avoidance measures outlined in clause 10 of this appendix. Where such remedial measures include the use of additional or alternative plant such plant shall not be sued on the Works until approved by the Engineer. Where remedial measures include maintenance or modification of previously approved plant, such plant shall not be used on the Works until such maintenance or modification is completed and the adequacy of the maintenance or modification is demonstrated to the satisfaction of the Engineer.

(vi) If the Engineer finds that approved remedial measures are not being implemented and that serious impacts persist, he may direct the Contractor to cease related parts of the Works until the measures are implemented. No claims by the Contractor shall be entertained in connection with such a direction.

7. DEFINITIONS

(i) For use in this contract only, the following definition is used:-

(a) unsuitable material - material taken from the area of the Works, (including borrow areas), which is unsuitable for use as fill material. The material may include builders debris, spoil and hard material dumped by others.

8. WATER QUALITY REQUIREMENTS - APPLICABLE IF THERE IS TO BE RECLAMATION FORMATION AS PART OF THE WORKS

The Contractor shall minimise adverse impacts resulting from the dumping operations on water quality. To achieve these requirements the Contractor shall design and implement methods of working that:-

(a) minimise loss of material during transport of fill material;

(b) prevent discharge of fill material except at approved locations;

(c) prevent the avoidable reduction, due to the Works, of the dissolved oxygen content of the water adjacent to the Works;

9. WATER QUALITY MONITORING EQUIPMENT - APPLICABLE IF THERE IS TO BE RECLAMATION FORMATION AS PART OF THE WORKS

(i) The Contractor shall provide the following equipment within one week of the commencement of the Contract:-

(a) Dissolved oxygen and temperature measuring equipment

The instrument shall be a portable, weatherproof dissolved oxygen measuring instrument complete with cable, sensor, comprehensive operation manuals, and be operable from a DC power source. It shall be capable of measuring:-

* a dissolved oxygen level in the range of 0-20 mg/L and 0-200% saturation; and

* a temperature of 0-45 degree Celsius

It shall have a membrane electrode with automatic temperature compensation complete with a cable of not less than 30 m in length. Sufficient stocks of spare electrodes and cable shall be maintained for replacement where necessary. (YSI model 58 meter, YSI 5739 probe, YSI 5795A submersible stirrer with reel and cable or similar approved).

(b) Turbidity Measurement instrument

A portable, weatherproof turbidity-measuring instrument complete with cable, sensor and comprehensive operation manuals. The equipment shall be operable from a DC power source. It shall have a photoelectric sensor capable of measuring turbidity between 0-100 NTU and be complete with a cable at least 30 m long. (Partech Turbidimeter Model 7000 3RP mark 2 or similar approved).

(c) Suspended Solids Sampling Equipment

A 12 volt DC powered peristaltic pump equipped with a Tygon tubing of at least 30 m length.

(d) Thermometer

A laboratory standard certified mercury thermometer with an accuracy of at least 0.5 degree Celsius.

(e) Water Depth Detector

A portable, battery-operated echo sounder. This unit can either be handheld or affixed to the bottom of the work boat if the same vessel is to be used throughout the monitoring programme. (Seafarer 700 or similar approved).

(f) 12V batteries and 200V/12V Battery charger.

(ii) Monitoring instruments shall be checked, calibrated and certified by an approved accredited laboratory before use on the Works and subsequently re-calibrated at 3-month intervals throughout all stages of the water quality monitoring. Response of sensors an electrodes should be checked with certified standard solutions before each use. The turbidity meter shall be calibrated to establish the relationship between turbidity readings (in NTU) and levels of suspended solids (in mg/L).

10. GENERAL PROCEDURES FOR THE AVOIDANCE OF POLLUTION DURING TRANSPORTING, AND DUMPING

(i) The Contractors' equipment shall be designed and maintained to minimise the risk of silt and other contaminants being released into the water column or deposited in other than designated locations.

(ii) Pollution avoidance measures shall include but are not limited to the following:-

(a) mechanical grabs shall be designed and maintained to avoid spillage and shall seal tightly while being lifted;

(b) vessels shall be sized so that adequate clearance is maintained between vessels and the sea bed at all states of the tide to ensure that undue turbidity is not generated by turbulence from vessel movement or propeller wash;

(c) pipe leakages are to be repaired promptly and plant is not to be operated with leaking pipes;

(d) the marine works shall cause no visible foam, oil, grease, scum, litter or other objectionable matter to be present on the water within the work areas or dumping grounds;

(e) barges shall be fitted with tight fitting seals to their bottom openings to prevent leakage of material;

(f) excess material shall be cleaned from the decks and exposed fittings of barges before the vessel is moved;

The engineer may monitor vessels transporting material to ensure that no dumping outside the approved location takes place and that loss of material does not take place during transportation. The Contractor shall provided all reasonable assistance to the Engineer for these purposes.

(3) The Contractor shall ensure that material is disposed of at the approved locations. He will be required to ensure accurate positioning of vessels before discharge and will be required to submit and agree proposals with the Engineer for positional control at disposal sites. Disposal in designated marine dumping grounds shall be in accordance with conditions of a licence issued by the DEP under the Dumping at Sea Act (Overseas Territories) Order 1975. Floatable and certain contaminated material (as defined by DEP) will not be acceptable at marine dumping grounds and will require other method of disposal.

11. REMOVAL OF WASTE MATERIAL

(i) Notwithstanding the provisions of the GCC the Contractor shall not permit any sewage, waste water or effluent containing sand, cement, silt or any other suspended or dissolved material to flow from the works areas onto any adjoining land or allow any waste matter or refuse to be deposited anywhere within the works areas or onto any adjoining land and shall have all such matter removed from the works areas.

(ii) The Contractor shall be responsible for temporary training, diverting or conducting of open streams or drains intercepted by any works and for reinstating these to their original courses on completion of the Works.

(iii) The Contractor shall submit any proposed stream course and nullah temporary diversions to the Engineer for agreement one month prior to such diversion works being commenced. Diversions shall be constructed to allow the water flow to discharge without overflow, erosion or washout. The area through which the temporary diversion runs is to be reinstated to its original condition when the temporary diversion is no longer required.

(iv) The Contractor shall segregate inert construction waste material suitable for reclamation or land formation and shall dispose of such material at a public dumping area(s).

(v) Non-inert construction waste material deemed unsuitable for reclamation or land formation and other waste material shall be disposed of at a public landfill.

(vi) The Contractor's attention is drawn to the Waste Disposal Ordinance, the Public Health and Municipal Services Ordinance and the Water Pollution Control Ordinance.

12. DISCHARGE INTO SEWERS AND DRAINS

(i) The Contractor shall not discharge directly or indirectly (by runoff) or cause or permit or suffer to be discharged into any public sewer, storm-water drain, channel, stream-course or sea, any effluent or foul or contaminated water or cooling or hot water without the prior consent of the relevant Authority who may require the Contractor to provide, operate and maintain at the Contractor's own expense, within the premises or otherwise, suitable works for the treatment and disposal of such effluent or foul or contaminated or cooling or hot water.

(ii) If any office, site canteen or toilet facilities is erected, foul water effluent shall, subject to paragraph 12(i) above, be directed to a foul sewer or to a sewage treatment facility.

(iii) The Contractor's attention is drawn to the Buildings Ordinance, the Water Pollution Control Ordinance and the Technical Memorandum "Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters."

Noise Pollution Control

13. GENERAL REQUIREMENTS

(i) The Contractor shall consider noise as an environmental constraint in his planning and execution of the Works.

(ii) The Contractor shall take all necessary measures to ensure that the operation of mechanical equipment and construction processes on or off the works areas will not cause any unnecessary and excessive noise which may disturb any occupant of any nearby dwellings, schools, hospitals, or premises with similar sensitivity to noise. The Contractor shall submit to the Engineer for his consent details of the Contractor's equipment including methods of use and construction operations together with proposed measures for limiting noise therefrom which shall include, inter alia, the use of silencers, mufflers, acoustic linings or shields, or acoustic sheds (this will apply in particular to the tunnel portals) or screens and shall be based upon the best reasonable practice. Information on the types and models of silenced equipment and acoustic treatment for unsilenced equipment shall be included. The contractor shall use such measures and shall maintain plant and silencing equipment in good condition so as to minimise the noise emission during construction works.

(iii) Hand-held breakers used by the Contractor shall comply with the standards specified in EEC Technical Directive 84/537, and portable compressors shall comply with the standards specified in EEC Technical Directive 84/533.

(iv) The Engineer may require equipment intended to be used on the works to be made available for inspection and approval to ensure that it is suitable for the project.

(v) The Contractor shall devise and arrange methods of working to minimise noise impacts, and shall provide experienced personnel with suitable training to ensure that these methods are implemented.

(vi) Before the commencement of the Works the Contractor shall submit to the Engineer the proposed methods of working.

(vii) After commencement of the Works if the equipment or work methods are believed by the Engineer to be causing serious noise pollution impacts, the equipment or work methods shall be inspected and remedial proposals drawn up by the Contractor and, once approved by the Engineer, implemented. In developing these remedial measures, the Contractor shall review all construction noise sources that may be contributing to the pollution impacts, and propose changes to scheduling of activities, installation of plant soundproofing, provision of alternative plant, erection of sound barriers around part of the works areas or the location of construction noise sources, or any other measures that may be effective in reducing noise. Where such remedial measures include the use of additional or alternative equipment, such equipment shall not be used on the Works until approved by the Engineer. Where remedial measures include maintenance or modification of previously approved equipment such equipment shall not be used on the Works until such maintenance or modification is completed and the adequacy of the maintenance or modification is demonstrated to the satisfaction of the Engineer.

(viii) If the Engineer finds that approved remedial measures are not being implemented and that serious impacts persist, he may direct the Contractor to cease related parts of the Works until the measures are implemented. No claims by the Contractor shall be entertained in connection with such a direction.

14. PERMITTED NOISE LEVELS

(i) In the event that the Contractor intends to carry out works of a type and during periods ("the Restricted Periods") to which Section 6 of the Noise Control Ordinance applies, the Contractor shall apply for and obtain a Construction Noise Permit and thereafter shall comply with the conditions which may be imposed in relation thereto.

(ii) Work will be permitted during "the Restricted Periods" subject to:

(a) the Contractor complying with its obligations under paragraph 13 above.

(b) the Contractor making an application for an obtaining a Construction Noise Permit in due time and in due form; and

(c) the contractor not causing the cancellation or adverse variation of such Construction Noise Permit as may be issued by reason of the generation of noise in excess of the limits set out in Technical memorandum on Noise from Construction Work for the identified NSRs.

15. NOISE MONITORING AND COMPLIANCE AUDIT REPORTING

(i) Monitoring equipment and methodology shall comply with the Technical Memorandum on Noise from Construction Work other than Percussive Piling, issued under section 9 of the Noise Control Ordinance. Monitoring will be carried out throughout the construction period by the Contractor under the supervision of the Engineer. The data will be provided to the Engineer on a regular basis, or as requested.

(ii) A monthly summary of monitoring data will be prepared by the Engineer. This will include an interpretation of the significance of the monitoring results. The monthly summary shall also identify any additional mitigation measures taken by the Contractor as a result. A copy of the summary report shall be made available for inspection by the Director of Environmental Protection at his request and by the Contractor.

(iii) the Contractor shall provide within one week of the commencement of the Contract one portable sound level meter complying with International electrotechnical Commission Publications 651 : 1979 (Type 1) and 804 : 1985 (Type 1) (Bruel & Kjaer Typen 2221 or

similar approved) complete with tripods. These meters will be used by the Contractor or Engineer for noise monitoring.

(iv) The Engineer will, prior to commencement of major construction works, carry out baseline monitoring to determine baseline noise levels. The baseline monitoring will be carried out for a period of at least one week, with measurements to be taken every day at locations and to a schedule determined by the Engineer. From these measurements baseline noise levels (L_{eq} (5 min)) will be calculated. The target level for maximum construction noise levels will be 5 dB(A) above the measured background.

Urban Landscape Assessment 3

3. URBAN LANDSCAPE ASSESSMENT

3.1 WEST KOWLOON RECLAMATION AREA

3.1.1 Existing Townscape and Views

3.1.1.1 The proposed route would run due east from its crossing over the proposed Road D1 on the West Kowloon Reclamation Site to a tunnel portal located approximately at the existing harbour wall along Ferry Street (Figure No. 3.1).

3.1.1.2 Further to the west, the proposed route would form a junction with the future north/south route which would run parallel to the existing waterfront. The impact of this junction and other routes would be considered within their appropriate assessment studies.

3.1.1.3 The area is currently part of the Yau Ma Tei Typhoon Anchorage, and a large number of small commercial and freight vessels are docked there. The seascape is typical of a working port harbour that can be found in many areas of Hong Kong (Figure No. 3.2).

3.1.1.4 The area is overlooked by the large residential tower blocks of the existing Six Streets Redevelopment Scheme (Phase I) and later on by Phase II and by tower blocks. To the north along Ferry Street and on Waterloo Road, there are further residential blocks. These buildings would be at least 250 metres from the tunnel portal and most views of it would be at an oblique angle.

3.1.1.5 There are rooms on the west side of the Catholic Primary School on Tung Kun Street which look directly out over the harbour in this area.

3.1.1.6 The extent and layout of the roads and future development on the reclamation site has yet to be determined, though a broad indication is given in the West Kowloon Reclamation Outline Development Plan. The site immediately to the north of the tunnel approaches has been reserved for Government development. In the area to the south, there is further Government Development Land including a proposed indoor sports hall adjacent to the tunnel portal, a proposed carpark and also land set aside for residential use.

3.1.1.7 These proposed land uses are to be set within a wide belt of district and local open spaces which in turn link into the large area of amenity space in and around the proposed junction.

3.1.1.8 There are only limited views of the harbour from ground level in the side streets to the east of Ferry Street due to the elevated carriageway and associated road structures.

3.1.1.9 The character of this waterfront area is largely based on the interest and activity in the typhoon anchorage. The large scale buildings and road structures give the area a sterile appearance. The future townscape quality would depend largely on the nature of the development of the reclamation site, which will replace the harbour.

3.1.2 Description of the Proposed Route

3.1.2.1 For this section, only some 200m in length, the proposed route would descend from a height of some 7m over road D1 to enter the tunnel some 7m below finished ground level.

3.1.2.2 Short side roads will link Road D1 to the tunnel portal area, with a holding area for larger vehicles on the north side. The whole road layout will have an approximate width of 55 to 60 metres, as it approaches the tunnel.

3.1.3 Impact on Townscape and Visual Impact

3.1.3.1 There would be direct views from the west facing apartments of the Six Streets Redevelopment Scheme looking down onto the tunnel approach area. The visual impact on these views is not likely to be significant though as they would be partially screened by the new buildings, and because the works would be seen in the context of the existing highway structures along Ferry Street, and against the backdrop of the reclamation development.

3.1.3.2 From the Catholic Primary School looking to the west along the line of the route, the views down into the harbour area will be replaced by views of the tunnel approach area, although these views would be largely blocked by the new elevated road structure on the West Kowloon Corridor. The proposed route would not add significantly to the composition of the view and would not have a significant visual impact.

3.1.3.3 It is not possible to accurately assess the visual impact of the proposed route and tunnel portal in views on future residential areas or users of the open spaces or sports facilities. In broad terms, however, some north facing apartments in the residential areas identified would have views down into the tunnel approach area.

3.1.3.4 Views are likely to be limited to the higher storey apartments as the route would tend to be screened at lower levels by intervening buildings and landscape planting immediately adjacent to the tunnel portal area. Any new housing development is likely to be completed after the proposed route and its presence can be compensated for in the design of the buildings, if deemed necessary.

3.1.3.5 The impact on the quality of the townscape is not likely to be significant in the context of the changes resulting from the reclamation works.

3.1.4 Proposed Mitigation

3.1.4.1 The visual impact on the school could be screened in part by the erection of a barrier along the west frontage of Ferry Street, although this would be effective only in first or second floor views. However, as any barrier would itself constitute a visual intrusion and would obscure long range views to the west, it is recommended that the height of the barrier should be restricted to, say 2.5 metres. The face of the barrier on both sides would have a decorative finish to help blend it into the surrounding landscape.

3.1.4.2 Dense tree and shrub planting is recommended on the embankments between the slip roads leading to and from the tunnel area, and above the retaining wall on both sides, in order to screen future ground level views from the reclamation side, to break up the extent of the hard paved road space in established views and to create a less harsh landscape setting (Figure 3.3).

3.1.4.3 The retaining walls and the tunnel portal would be designed with a decorative architectural finish, in order to create a more attractive and interesting surrounding to the tunnel approach.

3.4.1.4 To reduce the visual impact of the structures needed to ventilate the tunnel, a ventilation duct has been incorporated along the southern side of the tunnel approach to connect to a ventilation shaft which would be designed as part of the new carpark building along this side. This would avoid the need for additional building or structures around the tunnel portal.

3.2 YAU MA TEI

3.2.1 Existing Townscape and Views

3.2.1.1 Between the tunnel portal on Ferry Street and the beginning of the rock tunnel on the west side of Kings Park, the line of the proposed route passes through Yau Ma Tei district along the line of Tung Kun Street and Hi Lung Lane (Figure No. 3.1).

3.2.1.2 The buildings of the area are set in regular pattern of streets on a broad north-south axis, parallel to the waterfront. The route crosses under the primary roads of Ferry Street, on the waterfront, and Nathan Road to the east, and between these two, the secondary roads of Reclamation Street, Shanghai Street and Temple Street.

3.2.1.3 Between Ferry Street and Reclamation Street, the street blocks are large and the area is relatively open (Figure No. 3.4). On the north side of Tung Kun Street there are three six-storey school blocks set in a limited area of open space, bounded by a high wall with a green fringe of climbers and tree planting. Beyond this there is a large area adjacent to Waterloo Road, including the existing wholesale market area, which has been identified by L.D.C. for redevelopment.

3.2.1.4 The open building site to the south is the site of the current Six Streets HOS Phase II building development which will provide an extension of the completed Phase I development. This consists of several twenty-eight storey residential tower blocks with apartments facing to the north and to the west.

3.2.1.5 Ferry Street carries very little through traffic and, at between 15 to 16 metres wide, it is used for vehicle storage and transfer of goods.

3.2.1.6 The townscape of the area is similar to much of the immediate waterfront, with larger developments mixed in with smaller residential blocks, community buildings and market areas, and has little unity and, in consequence, has little identifiable townscape character or quality.

3.2.1.7 Between Reclamation and Nathan Road there is a denser pattern of side streets (Figure No. 3.1). The street facades are composed largely of older, plain concrete apartment blocks, typically 6 to 8 storeys high, with some newer tile finished block of between 12 and 24 storeys high, set back from the street, and occasional small pockets of open space.

3.2.1.8 The numerous additions of extra rooms, balconies and roof spaces to the facades of the older buildings, the ubiquitous advertising signs stretching far out into the street and the infill of new and modernised blocks gives the streetscape a complex and eclectic townscape character.

3.2.1.9 The ground and first floors to nearly all the blocks are devoted to commercial use with individual retail and manufacturing outlets in each building. The upper floors of the buildings are mainly residential apartments.

3.2.1.10 There is an intense use of the street throughout the area where half shops and lean-to's form shelter to more commercial activity. The street activity is encouraged by the open stalls of the occasional street markets and the presence of many delivery vans and cars parked at the kerbside.

3.2.1.11 Reclamation Street, Shanghai Street, and Temple Street, are some 16-18m wide, but with many buildings having upper storey extensions over the 3m wide pavements, the width is effectively reduced in places to the road width of 10-12 metres (Figure No. 3.5).

This is wide enough to accommodate both the pedestrian and vehicular traffic. The side street, Hi Lung Lane, is much narrower at some 9m width and has a more enclosed, even claustrophobic appearance (Figure No. 3.6). It is used principally as car parking areas and pedestrian through routes and is frequently too blocked to carry much through traffic (Figure No. 3.7).

3.2.1.12 The introduction of taller building towers has not adversely affected the character of the street as seen from ground level as they are set back from the street facade on podium decks, which has maintained the essential character of the streetscape.

3.2.1.13 The character of the townscape in this area is repeated in many commercial districts within Kowloon. There is an irregular pattern and a dense texture to the building facades. None of the buildings adjacent to the alignment can be noted as being of particular value in terms of age, rarity or architectural quality. They combine to give a varied townscape that is easily able to accept change. Visual interest is concentrated in the activity within the street and emphasised by the presence of so many colourful advertising gantries and shops fronts.

3.2.1.14 From the ground, first and second floors of nearly all buildings, there are good views of the activity in the street, but above this level, the view is increasingly of the building opposite. Due to the narrowness of the street, the oblique views up and down the street are limited to a few building widths.

3.2.1.15 Views in the street are concentrated at ground level and are often limited by the presence of parked cars and street vendors, with the view up to the skyline obstructed by the multitude of advertising signs.

3.2.1.16 Nathan Road is a much wider primary road with over 30 metres between building facades. The buildings are typically 12 to 24 storeys high, concrete apartment blocks with continuous bands of windows, with many recently constructed or refurbished blocks. There is a similar concentration of advertising signs adorning the building facades, and obscuring the skyline (Figure No. 3.4).

3.2.1.17 The heavy traffic on Nathan Road precludes much of the pedestrian activity seen in the side streets, and limits interest to the immediate shop fronts. The street has a uniformity of character along its length, but the domination of vehicular traffic gives it a more harsh appearance and a lower quality of townscape.

3.2.2 Description of the Proposed Route

3.2.2.1 The proposed route, in this section, would be formed by a limited cut-and-cover operation to form the cover slab, and then by tunnelling underneath from the reclamation end. This method of working has been chosen to limit the length of time the construction work would have an impact on the existing community and to allow reconstruction work to take place as quickly as reasonable.

3.2.2.2 The physical impact on the area would be confined to the removal of buildings and structures, including the streets, affected by the engineering works. The buildings would be reconstructed over the new tunnel in a similar form to those that exist at present.

3.2.2.3 The construction of the new route along Tung Kun Street would result in the removal of the area of the street together with the open space in front of the three school buildings. These buildings and those being constructed within the Six Streets Phase II development would not be physically affected by the works.

3.2.2.4 East of Reclamation Street the engineering works of the new route would result in the removal of two or three apartment block buildings from either side of Hi Lung Lane.

3.2.2.5 As the route crosses Nathan Road some five buildings, from either frontage, within a block of a dozen or so similar buildings, would need to be removed.

3.2.2.6 To the east of Nathan Road, the route would quickly enter bored tunnel as the ground rises sharply, and the construction disturbance would be confined to the excavation and re-profiling of the existing slope area.

3.2.3 Visual Impact during Construction

3.2.3.1 There would be visual impact on the residents and users of the neighbouring buildings and streets arising from the loss of buildings, the excavation and engineering work to form the cover slab, and the reconstruction of the buildings.

3.2.3.2 Between Ferry Street and Reclamation Street, residents in the lower floors of the Six Streets Scheme residential towers would have views down onto the top of the excavation work. Apartments higher than say the seventh and eighth floors would have only oblique views of the street, with more direct views to the north out over Yau Ma Tei, and to the west over the new reclamation site.

3.2.3.3 The three schools, on the opposite side of Tung Kun Street, have direct views of the works from all south-facing rooms. The removal of the boundary wall and associated trees and wall climber plants, which serve to screen the street in part, would increase the impact of the construction works.

3.2.3.4 In views from all these buildings, there would be a significant visual impact during construction with the existing quiet streetscape replaced by clear views of the excavation works. There would, however, be no long term visual impact with the street and the open space area around the school reconstructed.

3.2.3.5 Between Reclamation Street and Nathan Road, the visual impact of the construction work along Hi Lung Lane would be relatively limited for such a highly populated area. Only residents of apartments in the three or four buildings closest to the route on either side, would have direct views of the construction works. Due to the narrowness of the streets, apartments further away would have only oblique views of less than, say, 45 degrees from the window face, and their views across the street would not be affected.

3.2.3.6 Apartments in buildings adjacent to the proposed route would suffer a high level of visual impact during the construction period with the loss of neighbouring buildings opening up views along the line of the works.

3.2.3.7 There would be a significant visual impact at ground level on the users of the adjoining streets on both sides of the route.

3.2.3.8 As the route crosses Nathan Road there would be a similar visual impact on residents of apartments in buildings adjacent to the route and on pedestrians at street level.

3.2.3.9 Only a limited amount of mitigation of the visual impact during the construction period would be possible. The erection of hoarding would screen views at street level, but would not benefit apartments on higher floors.

3.2.4 Reconstruction and Long Term Impacts

3.2.4.1 Tung Kun Street would need to be rebuilt to give access, though not necessarily at it existing width, as the access onto Ferry Street is now reduced. A narrower road would allow a belt of trees

to be established along the pavement in front of the school to provide greater screening to the school sites and more shade and shelter to pedestrians. It would also serve as a green link into the built-up area from the future open space areas on the reclamation site.

3.2.4.2 Building reconstruction will only be required in this area along Hi Lung Lane and to the Nathan Road frontages. Hi Lung Lane gives access only to those buildings that would need to be removed. It is, therefore, not essential for it to be reconstructed in its present position, if at all. The opportunity will exist to develop the area of the road and link the blocks either side into more coherent units.

3.2.4.3 The proposed reconstruction would consist of a number of residential tower blocks set on regular two and three floor podium decks, similar to the recently constructed blocks in the area. This form of building would continue the existing street frontage in the lower levels with the attendant advertising signs, shop fronts and street activity, but with lighter more open development above.

3.2.4.4 The reconstruction buildings would not detract from the existing townscape due to the presence of many new blocks and the proposed development in adjacent areas. Their concentration along a single line, however, would increase the importance of providing that they are of an appropriate scale form and texture.

3.2.4.5 To help encourage pedestrian movement, the layout of the new buildings would incorporate a walkway route, broadly along the line of Hi Lung Lane, widening out in some areas to allow for a limited amount of tree planting and open space. This would provide some shade and shelter at street level and visually help to break up the mass of the building form.

3.2.4.6 Two larger scale building developments are proposed for the Nathan Road frontages, in the same form and scale as the existing buildings to maintain the typical street scene.

3.2.4.7 The building reconstruction along Nathan Road would not be likely to have a significant impact on the townscape because many of the existing buildings are new. Once the affected buildings have been reconstructed, it is anticipated that there would be no long term visual impact on the residents and users of the area.

3.2.4.8 The reconstruction would provide the opportunity to improve pedestrian access through the introduction of an elevated walkway link across Nathan road. This could be extended through the new developments to the west, along the line of Hi Lung Lane, and at a high level link into King's Park to the east.

3.2.4.9 It would be possible in this manner to develop pedestrian access through the reconstruction development from the reclamation site to King's Park, and thereby encourage activity at street activity, and be a vital part in maintaining the existing townscape character.

3.3 CENTRAL KOWLOON

3.3.1 Existing Townscape and Views

3.3.1.1 In the section between Yau Ma Tei at Nathan Road and Ko Shan Park, the proposed route would be in twin driven tunnels and would have no effect on the townscape or visual impact of the areas above.

3.3.1.2 The only structure in this section would be a building at Fat Kwong Street to vent the air from the tunnels to discharge above the level of the surrounding buildings.

3.3.1.3 The proposed site for the ventilation building would be at top of the hill, on the west side of Fat Kwong Street. The site is part of a temporary housing estate. The area is scheduled for a reservoir and playing field on top of the reservoir. Further down the hill to the south lies the large Valley Road Estate and to the east is a large open space area along Sheung Lok Street.

3.3.1.4 One of the blocks of the Valley Road Estate lies close to the proposed site. Most of the blocks have no view of the site being located below the ground level of the site and screened by the other apartment blocks.

3.3.2 Description of the Proposed Route

3.3.2.1 The overall size of the proposed building would be determined by the size of the new development around it. It would have a plan area of approximately 30 x 24 metres up to a height of 8.5 metres, reducing to 30 x 17 metres up to a height of 30 metres. Above this there would be a vent tower, 6.5 x 7.5 metres in plan area. Its height would depend on the size and form of adjacent development, but the building would not exceed an overall height of 50 metres. The exact form of the building would be determined at a later stage.

3.3.3 Impact on Townscape and Visual Impact

3.3.3.1 As it is likely that the proposed development would be incorporated into a wider redevelopment of the area, it is difficult to assess its specific impact on the townscape. The potential height of the building and its prominent location would make it an important element in the new skyline, especially in longer distance views.

3.3.3.2 The building would, however, have no significant impact on the residents of the Valley Road Estate or the surrounding area, and is unlikely to be visible from much of the open space due to the presence of many roadside trees.

3.3.4 Proposed Mitigation

3.3.4.1 The design of the proposed ventilation building is largely dependant on the nature of the future residential development in the area and the future playing fields, but would be designed as an architectural feature to integrate it into the surrounding building form. At a more detail stage, however, it would be important to consider the composition of the building elements and its appearance on the skyline.

3.4 HUNG HOM

3.4.1 Existing Townscape and Views

3.4.1.1 Between the end of the rock tunnel and the tunnel portal at the edge of the East Kowloon Reclamation, the route will pass in cut-and-cover tunnel underneath the open space in Ko Shan Park, the corner of Shansi Street and Ko Shan Road, the corner of Ma Tau Wai Road and Chatham Road North, and finally under the blocks of buildings along Wing Kwong Street and Ka Ming Street (Figure No. 3.8).

3.4.1.2 The open space park area has been constructed around the Ko Shan open-air theatre to form a quiet landscape setting. Set at the bottom of a larger slope the park is relatively self-contained with a number of sitting out areas, viewing points and a system of paths and open paved areas (Figure No. 3.9).

3.4.1.3 The area between Ko Shan Road and Ma Tau Wai Road is dominated by the elevated road structure running along Chatham Road North, and underneath is given over largely to the traffic on the other primary roads beneath (Figure No. 3.10). Pedestrians use this space only to cross through the area from one of the busy shopping areas further up the streets or to wait at bus stops under the flyover.

3.4.1.4 The area adjacent to the proposed route, between Chatham Road North and Ko Shan Road has a number of single storey structures which house repair garages and small manufacturing units. The Urban Council are proposing to redevelop this site as an Urban Services Department Building. To the north and south there are several high rise residential tower blocks between 24 and 28 storeys high set on two or three level podiums of commercial and retail development. The apartments look directly down onto this area, the elevated carriageway, and Ko Shan Theatre and Park alongside.

3.4.1.5 Between Ma Tau Wai Road and the edge of the Reclamation site there is a dense regular pattern of side streets that run parallel to Ma Tau Wai Road and To Kwa Wan Road. The building facades on both sides of the streets are composed of six to eight storey plain faced concrete apartment buildings, decorated with numerous additions of extra rooms, structures, balconies, and roof spaces and with the ubiquitous advertising signs stretching far out across the street. There are a few larger factory buildings of a similar height in adjacent streets, but there are relatively few new buildings within this area. This type of facade continues throughout the adjacent streets giving a distinctive and regular townscape character. The streets are narrow at some 12 to 13 metres wide giving the area a dense, enclosed appearance (Figure No. 3.11).

3.4.1.6 The ground floor of nearly all the buildings is devoted to commercial use with individual retail or manufacturing outlets in each building. The use of the street space is intensified by the presence of street markets in Kai Ming and Yuk Shing Streets (Figure No. 3.9). Permanent trading stalls have been erected across the width of the Kai Ming Street (which is now closed to access from Ma Tau Wai Road), blocking all views of the building facades from street level, except from some distance.

3.4.1.7 The intensity of the use of the street is emphasised by the large number of commercial lorries and vans either servicing the shops and market stalls or being attended to by the many vehicle repair shops at the corner of Kai Ming and Wing Kwong Streets (Figure No. 3.12).

3.4.1.8 The upper floors of most of the buildings are residential apartments. The windows of these apartments give views out over the street directly onto the buildings opposite. The view of the street becomes more oblique from the top floors due to the height and the presence of so many small scale structures (Figure No. 3.9).

3.4.2 Description of the Proposed Route

3.4.2.1 The proposed route would be in cut-and-cover in this section using the same method of working as in the Yau Ma Tei section, with limited excavation and cover slab construction, followed by excavation underneath from the reclamation site tunnel portal and reconstruction above.

3.4.2.2 The physical impact will be confined to the removal of the buildings and structures including the streets affected by the engineering works. The buildings would be reconstructed over the new tunnel in a similar form to these that exist at present.

3.4.2.3 The construction works would result in the excavation of a belt some 50m wide through the lower side of the park area, affecting a number of seating areas, footpaths and some semi-mature tree and shrub planting beds.

3.4.2.4 The single storey buildings, or a subsequent Urban Council Development between Ko Shan Road and Chatham Road North would have to be cleared. The triangular corner building between Chatham Road North and Ma Tau Wai Road would similarly need to be removed and the adjacent road spaces lifted. The multi-storey residential towers on the south side of Shansi Street and the elevated road structure would not be affected by the works.

3.4.2.5 The construction of the proposed route would require the removal of all the buildings in the triangular block between Wing Kwong Street and Kai Ming Street, approximately half those between Kai Ming Street and Hang Fook Street, at the eastern end, and two of the three blocks on the east side of Wing Kwong Street.

3.4.2.6 The permanent street market area on Kai Ming Street and the buildings and street space along Yuk Shing Street would be untouched. The larger Wong Teck building would not need to be removed though its one storey podium extension would need to be taken down; it could be replaced at the end of the construction period.

3.4.3 Visual Impact during Construction

3.4.3.1 There would be significant visual impact on the residents and users of the neighbouring buildings and streets from the loss of building, the excavation and engineering works and the reconstruction of the buildings. This impact would be limited to the construction period and no significant long term impact is anticipated once reconstruction is completed.

3.4.3.2 There would be a very significant visual impact on the users of the unaffected areas of the park and shops along Shansi Street and Ko Shan Road close to the construction work.

3.4.3.3 The visual impact on residents of the high-rise buildings on Shansi Street and Kiang Hsi Street is likely to be significant on the lower floors, being progressively less significant with increasing height. They would have direct views down onto the workings as they cut through the park totally changing the existing view.

3.4.3.4 The excavation of the proposed route across the two main roads and the removal of the corner building would result in a similar visual impact on pedestrians and on residents of the apartments in buildings in the three or four blocks to the south of the route, along Ma Tau Wai Road. These would have direct views of the workings. Due to the narrowness of the street, apartments further along would only have oblique views of less than say 45° from the window face and their views out would be unaffected, for the most part. However, in the context of the two main roads at ground level and the elevated structure, the visual impact would not be significant.

3.4.3.5 In the area to the east of Ma Tau Wai Road, the townscape character of the immediate area would be completely changed, with the works temporarily leaving one-sided, half streets around an open building site, and encouraging pedestrian and trade activities to move into neighbouring areas. The visual impact is likely to be very significant with the views from apartments on the south side of Wing Kwong Street, the west end of Kai Ming Street and those on Hang Fook Street radically altered. The views of the buildings opposite would be replaced by the excavation work, with further oblique views being opened up along the street to the main roads to the west and reclamation area to the east.

3.4.3.6 The visual impact of the works in all these areas during construction could be screened in part from street and lower storey levels by screen hoardings, but not from higher levels as the immediate impact of the removal of the buildings could not be mitigated.

3.4.4 Reconstruction and Long Term Impacts

3.4.4.1 The Ko Shan Park space would be reconstructed in its present layout of footpaths, seating areas and planting beds, with the use of some semi-mature trees to increase the immediate impact of the replacement planting, to compensate for those that would be lost. There should be no long term visual impact in the park area.

3.4.4.2 The Urban Council's development of the "G" Site between Ko Shan Road and Chatham Road North is likely to be designed to take account of the new route and thereby avoid as much reconstruction work as possible.

3.4.4.3 The corner building between Chatham Road North and Ma Tau Wei Road, occupies a visually important position at the confluence of three major traffic routes. Its location is important as a landmark building and its reconstruction should respect this and the importance of pedestrian movement at this street corner.

3.4.4.4 The reconstruction of the corner building between Chatham Road North and Ma Tau Wai Road would be a single commercial block in a bold triangular form to reflect its location. The ground and first floors would be treated to provide sufficient space and shelter for pedestrians as they moved round this corner. It is also proposed to form an elevated walkway link from this building, across Ma Tau Wai Road to the new building on Wing Kwong Street to ease pedestrian access and encourage use of the reconstructed areas.

3.4.4.5 A new commercial block, set on a three storey podium deck is proposed along Ma Tau Wai Road with the existing building facades on either side. Behind this the reconstruction development would be in the form of three blocks. Their layout would be based on the existing street pattern, and street width which forms an important element in the present townscape character, and relates to the neighbouring main roads. The blocks would consist of three storey podiums supporting residential towers above. The podium facades would help to maintain the scale and character of the street, with the lighter more open tower development above.

3.4.4.6 Kai Ming Street would be retained, but with the eastern half closed to traffic in order to promote pedestrian through route that would link up with the reclamation site and the development to the west. It would also allow for tree planting to create shade and shelter along the street. In addition, the layout of the block to the east of Wing Kwong Street would include an area of open space as the focus of views along the street and to help soften the appearance of the built form.

3.5 EAST KOWLOON RECLAMATION AREA

3.5.1 Existing Townscape and Views

3.5.1.1 The proposed route would run east from the tunnel portal to the rear of the existing buildings on Wing Kwong Street as far as the waterfront, which is the approximate limit of the study area (Figure No. 3.8).

3.5.1.2 Beyond this, the route would continue east across the East Kowloon Reclamation Site forming a junction with a north-south route that will run up the west side of the reclamation area. The impact of these future routes and their proposed junction will be considered within their appropriate assessment studies.

3.5.1.3 The area between Wing Kwong Street and the existing waterfront is flat and open and was until recently under temporary use as a container storage and clock facility. It is currently occupied by the main works area for the reclamation project. There are no permanent structures or significant

vegetation in this area. It is encircled by the existing apartment and commercial developments, on Wing Kwong Street to the west on Yuk Yat Street to the north, and on Bailey Street to the south.

3.5.1.4 Several sites to the south are undergoing redevelopment, including an ASD depot and sewage works on Sung Ping Street and mixed commercial and residential development on the site of the decommissioned power station.

3.5.1.5 To the north there is more industrial and commercial blocks of a similar style, 6-8 storeys high, with the existing Hoi Sham Park open space on Yuk Yat Street, which may be extended in the future to the south. It is only some one hundred metres from the line of the route.

3.5.1.6 Residents of second floor apartments and above in many of these buildings have clear views out across the works site to the airport beyond. Only at ground level are the views limited by the existing site hoarding.

3.5.1.7 The extent and layout of the roads and future development on the reclamation site has yet to be determined, through a broad indication of the type of development is given in Metroplan.

3.5.2 Description of the Proposed Route

3.5.2.1 The proposed route will rise slowly in retained cut from approximately 7 metres below ground at the tunnel portal, to toll plaza area some 150 metres to the east. The plaza area will be broadly level at about 3 metres below ground level.

3.5.2.2 A new road will be built across the top of the portal connecting Sung On Street to Yuk Yat Street. A service road will be constructed around the tunnel to connect the existing road network to the plaza level. A new workshop and administration building would be constructed within the loop of this service road, along the south side of the proposed route.

3.5.2.3 A separate, two storey ventilation building would be constructed on the north side of the toll plaza, some 120 metres from the existing buildings.

3.5.3 Impact on Townscape and Visual Impacts

3.5.3.1 There would be views from the existing buildings to the north and west of the area of the tunnel portal and toll plaza, although the portal and plaza would be set well down below ground levels and seen against a backdrop of the reclamation development.

The greatest impact would be on apartments in the blocks at the eastern end of Ngan Hon Street and Wan Shun Street, though even these would have only oblique views down onto the proposed route. Views from the south would be partly screened by the new workshop and administration buildings.

3.5.3.3 It is difficult to assess the visual impact of the tunnel portal in views from future residential towers and ground level users, on the reclamation area. In a broad context, west facing apartments would have some views into the plaza area and tunnel portal. All views would be across the line of the route as the area directly to the east, along the line is likely to be occupied by the future junction.

3.5.3.4 In these views, the tunnel portal and toll plaza would be seen across the proposed junction and against the existing commercial and residential development and are unlikely to have a significant visual impact.

3.5.3.5 In the long term, users of the existing Hoi Sham Park would have partial views of the proposed route. However, most of the traffic would be screened by the retained cut. Additional screening

could be incorporated into the retaining wall and adjacent areas (possibly part of the park extension) to screen all such views of CKR.

3.5.3.6 A temporary toll plaza sited to the north of the proposed route would cut across the corner of the existing Hoi Sham Park, requiring a small landscape strip and ornamental wall to be removed. The temporary plaza is likely to be in use for some four or five years. These works would not affect the facilities within the park, but would have a significant visual impact on its users. It is proposed that the temporary plaza would be bounded by a temporary decorative wall in this period, which should effectively screen the whole of construction works.

3.5.4 Mitigation

3.5.4.1 The visual impact of the tunnel and toll plaza from street level could be screened by the use of barriers over the top of the portal and earth mounding to either side. A decorative architectural finish would be designed for these as well as the tunnel portal and adjacent retaining walls in order to create a more interesting and varied setting.

3.5.4.2 Dense tree and shrub planting is proposed in the areas immediately around the new roads and on the embankments of the roads leading to and from the tunnel, in order to screen future ground level views from the reclamation side, to break up the extent of the hard paved road space and to provide a suitable landscape setting for the road.

3.5.4.3 The landscape mitigation proposals are shown in two phases. Phase 1 planting would be the short term planting works around the tunnel and temporary plaza (Figure No. 3.13). Phase 2 planting would be for the long-term after much of the future roadworks are complete.

3.5.4.4 While much of the planting in Phase 1 would be retained as the basis for the long-term Phase 2 planting, some of it would need to be cleared, and it is recommended that the plants involved could be retained in a temporary nursery for use when the engineering works were complete.

3.5.4.5 Two options are shown for the long-term Phase 2. Option 1 shows the area to the north of the tunnel approach developed as an extension to the existing Hoi Sham Park, providing wider opportunities for both passive and active recreation in the area as well as increasing the extent of the planting screening views of the road from the north (Figure No. 3.14). Option 2 shows the development of commercial lots between along the highway boundary and a minimum width of screen planting in the reinstate area of the park (Figure No. 3.15).

3.6 SUMMARY

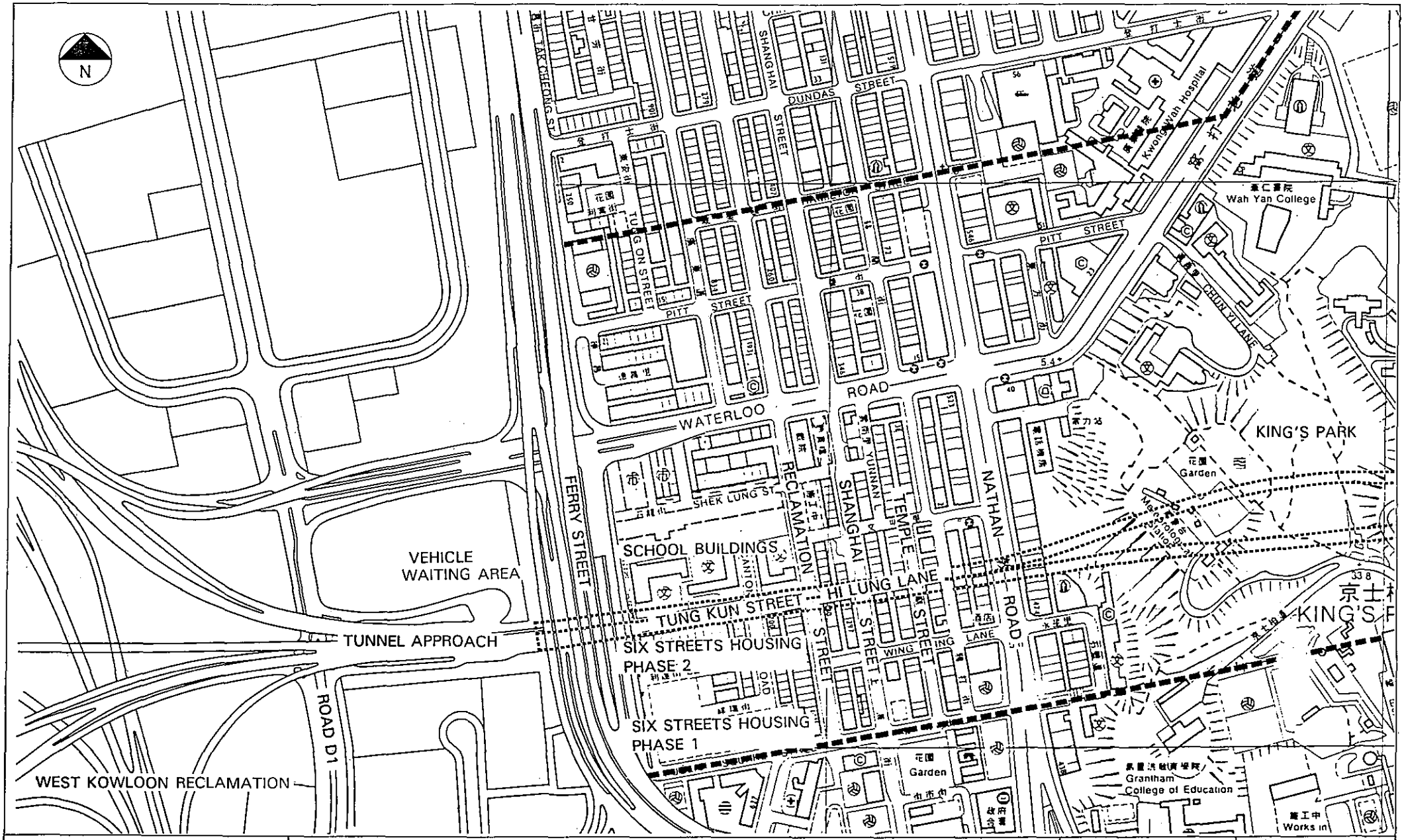
3.6.1 There would be significant visual impact on the residents and users of the neighbouring buildings and streets from the loss of building, the excavation and engineering works and the reconstruction of the buildings. This impact would be limited to the construction period and no significant long term impact is anticipated once reconstruction is completed.

3.6.2 In the section between Yau Ma Tei at Nathan Road and Ko Shan Park, the proposed route would be in twin driven tunnels and would have no effect on the townscape or visual impact of the areas above. The only structure in this area would be the vent building sited at Fat Kwong Street. The design of the proposed ventilation building is largely dependant on the nature of the future residential development in the area and the future playing fields, but would be designed as an architectural feature to integrate it into the surrounding building form. At a more detail stage, however, it wold be important to consider the composition of the building elements and its appearance on the skyline.

3.6.3 The Ko Shan Park space would be reconstructed in its present layout of footpaths, seating areas and planting beds, with the use of some semi-mature trees to increase the immediate impact of the replacement planting, to compensate for those that would be lost. There should be no long term visual impact in the park area.

3.6.4 There would be views from the existing buildings to the north and west of the area of the tunnel portal and toll plaza, although the portal and plaza would be set well down below ground levels and seen against a backdrop of the reclamation development. Dense tree and shrub planting is proposed in the areas immediately around the new roads and on the embankments of the roads leading to and from the tunnel, in order to screen future ground level views from the reclamation side, to break up the extent of the hard paved road space and to provide a suitable landscape setting for the road.

3.6.5 A temporary toll plaza sited to the north of the proposed route would cut across the corner of the existing Hoi Sham Park, requiring a small landscape strip and ornamental wall to be removed. The temporary plaza is likely to be in use for some four or five years. These works would not affect the facilities within the park, but would have a significant visual impact on its users. It is proposed that the temporary plaza would be bounded by a temporary decorative wall in this period, which should effectively screen the whole of construction works.

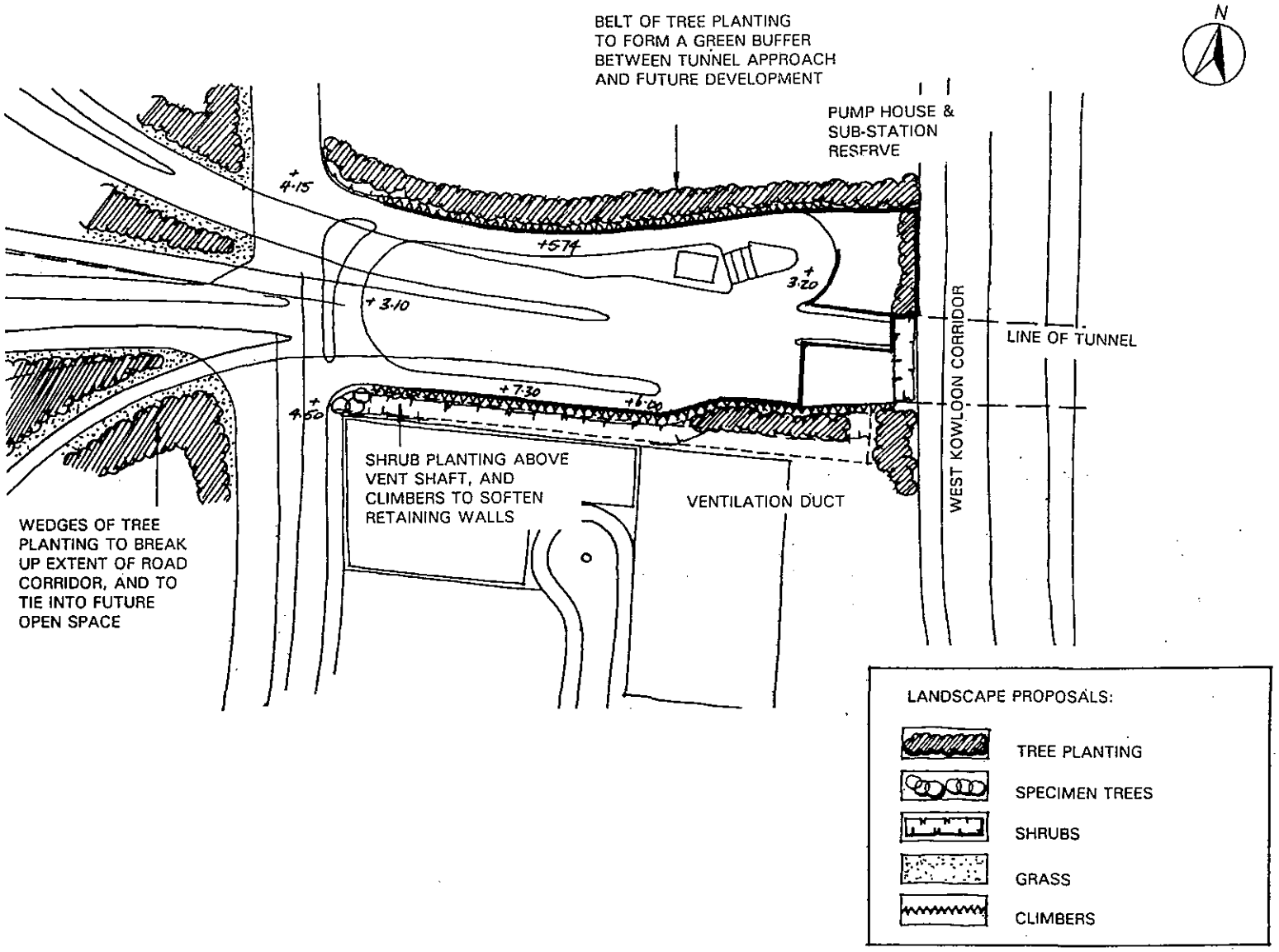


Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Existing Townscape - Yau Ma Tei and West Kowloon Reclamation	FIGURE NO. 3.1	SCALE 0 20 40 80m DATE APRIL 1993

View to the North along Ferry Street and Proposed West Kowloon Reclamation Site

View South over East Kowloon Reclamation Site

Parsons Brinckerhoff Maunsell Consultants	**Central Kowloon Route Study: Preliminary Design**	FIGURE NO. **3.2**	SCALE DATE **April 1993**



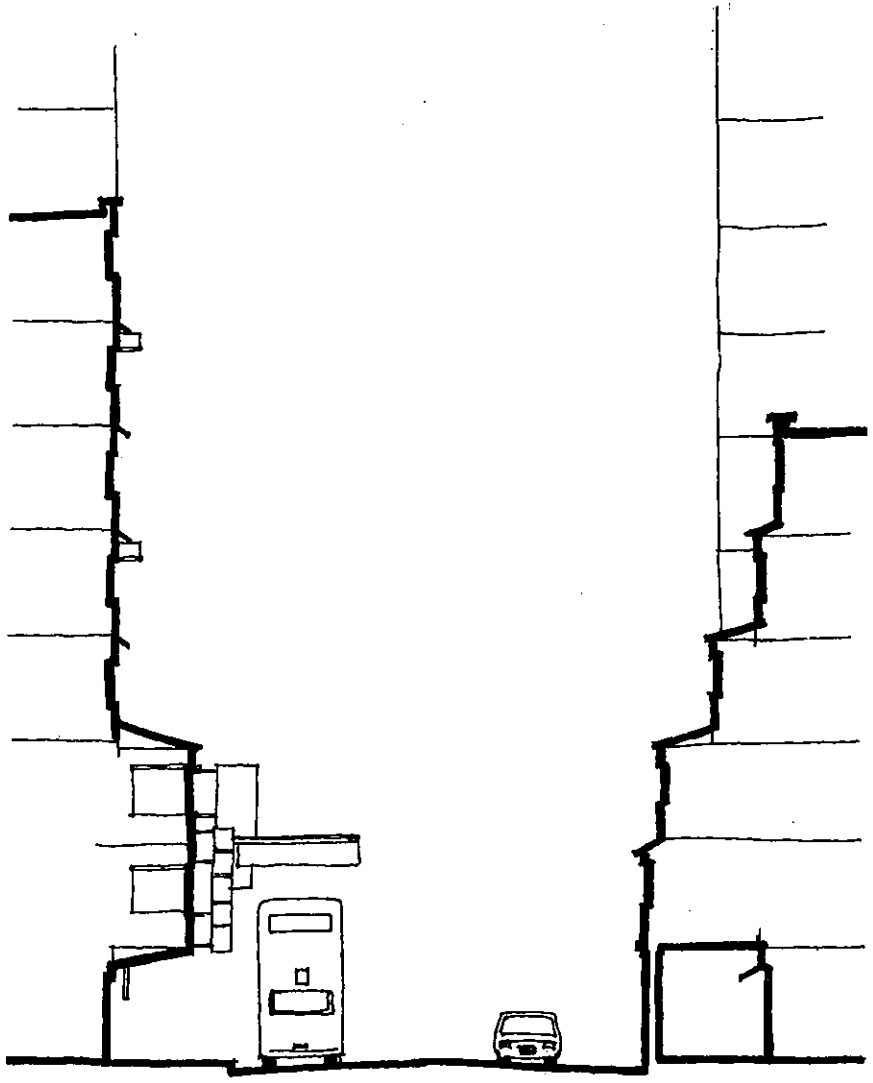
Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Proposed Landscape Masterplan West Kowloon Reclamation	FIGURE NO. 3.3	SCALE 0 10 20 40m DATE APRIL 1993

Nathan Road

Shanghai Street

Tung Kun Street

Parsons Brinckerhoff Maunsell Consultants	**Central Kowloon Route Study: Preliminary Design**	FIGURE NO **3.4**	SCALE DATE **April 1993**



New buildings, with two and three storey podiums supporting twenty storey residential towers

Townscape character concentrated on activity within street space

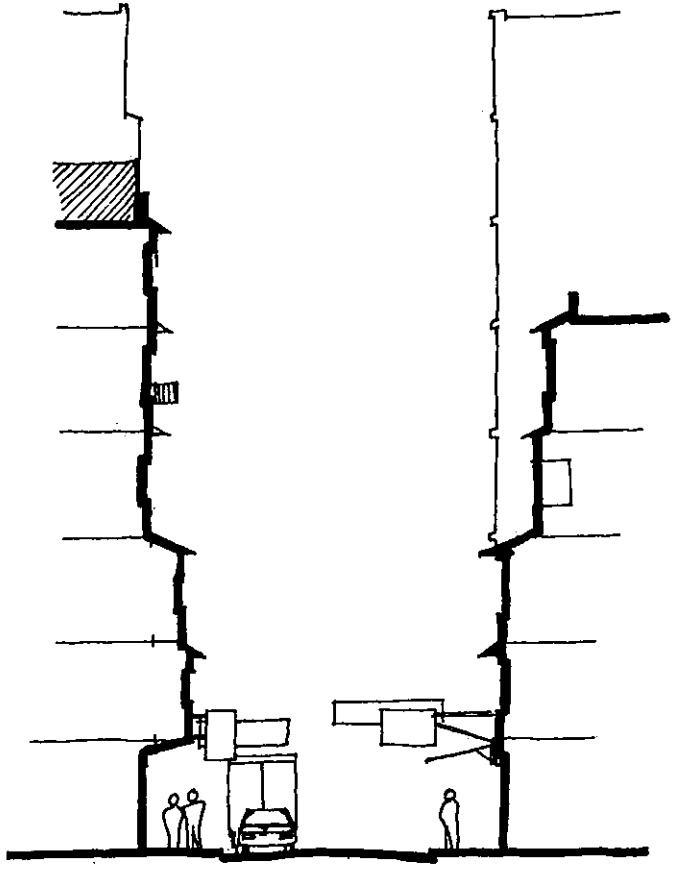
Buildings extended over pavement space

Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Existing Townscape - Cross-section through Shanghai Street	FIGURE NO. 3.5	SCALE DATE APRIL 1993

Existing buildings vary in height from three to eight storeys

Addition of advertising signs, balconies, air conditioners, clothes lines etc. give building facades a distinctive character

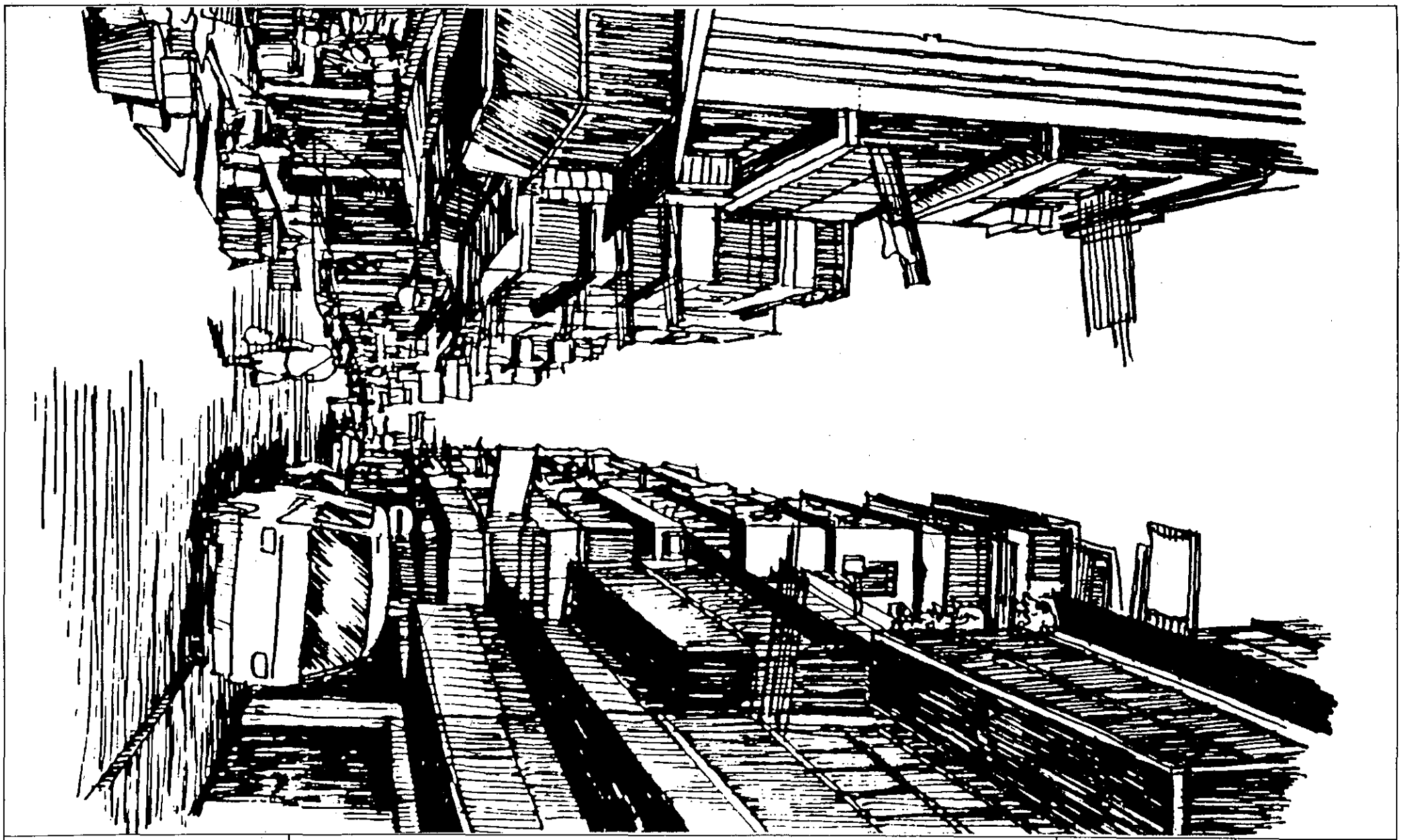
Street vendors and parked vehicles space for pedestrians and through traffic



Cross-section of street is very narrow giving dark enclosed appearance at street level

Townscape character concentrated on activity within street space

Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Existing Townscape - Cross-section through Hi Lung Lane	FIGURE NO. 3.6	SCALE DATE APRIL 1993



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Central Kowloon Route Study : Preliminary Design

Existing Townscape - Perspective view of existing street scene looking west along Hi Lung Lane

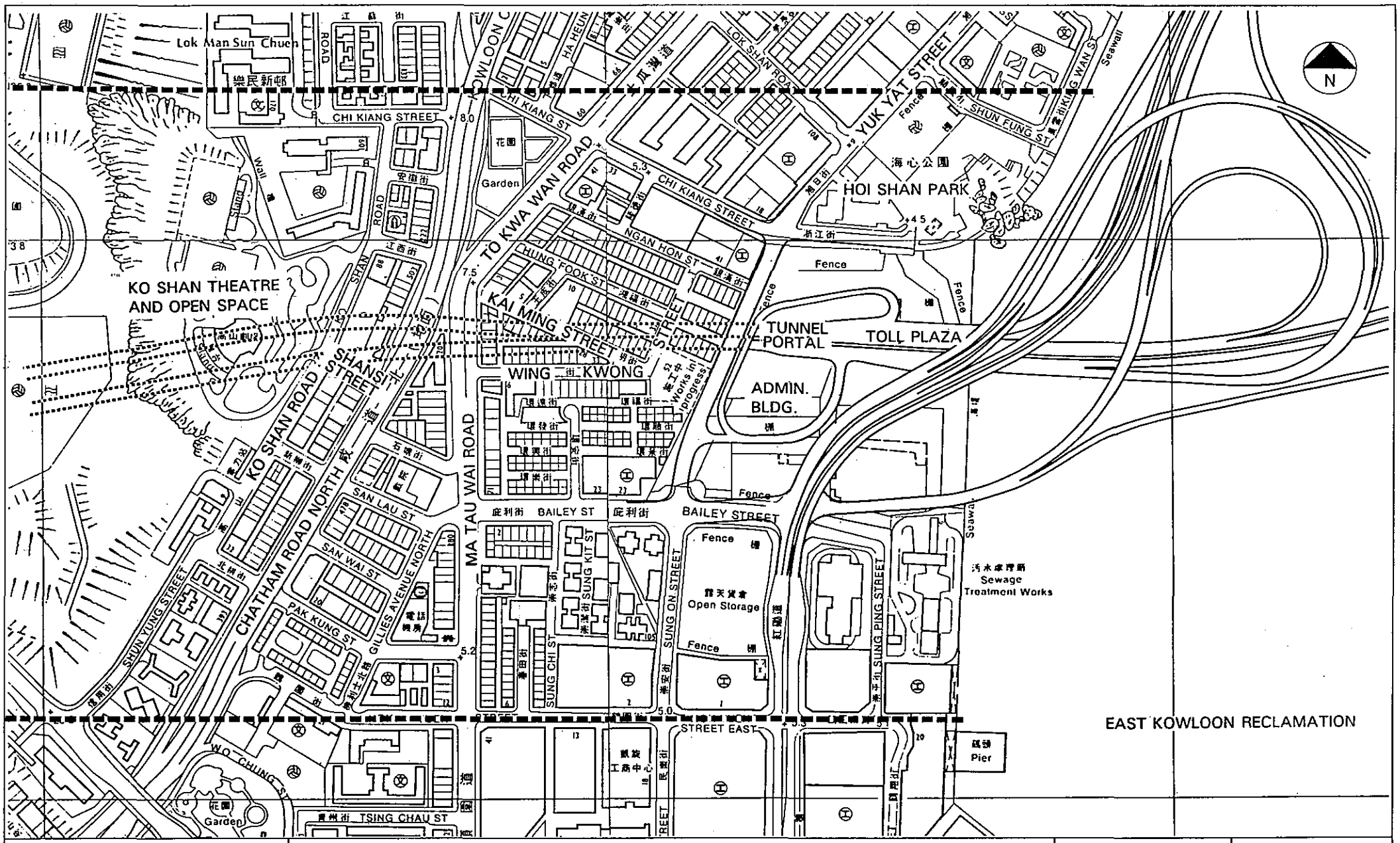
FIGURE NO.

3.7

SCALE

DATE

APRIL 1993



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Central Kowloon Route Study : Preliminary Design
Existing Townscape – Hung Hom and
East Kowloon Reclamation

FIGURE NO.
3.8

SCALE
0 20 40 80m

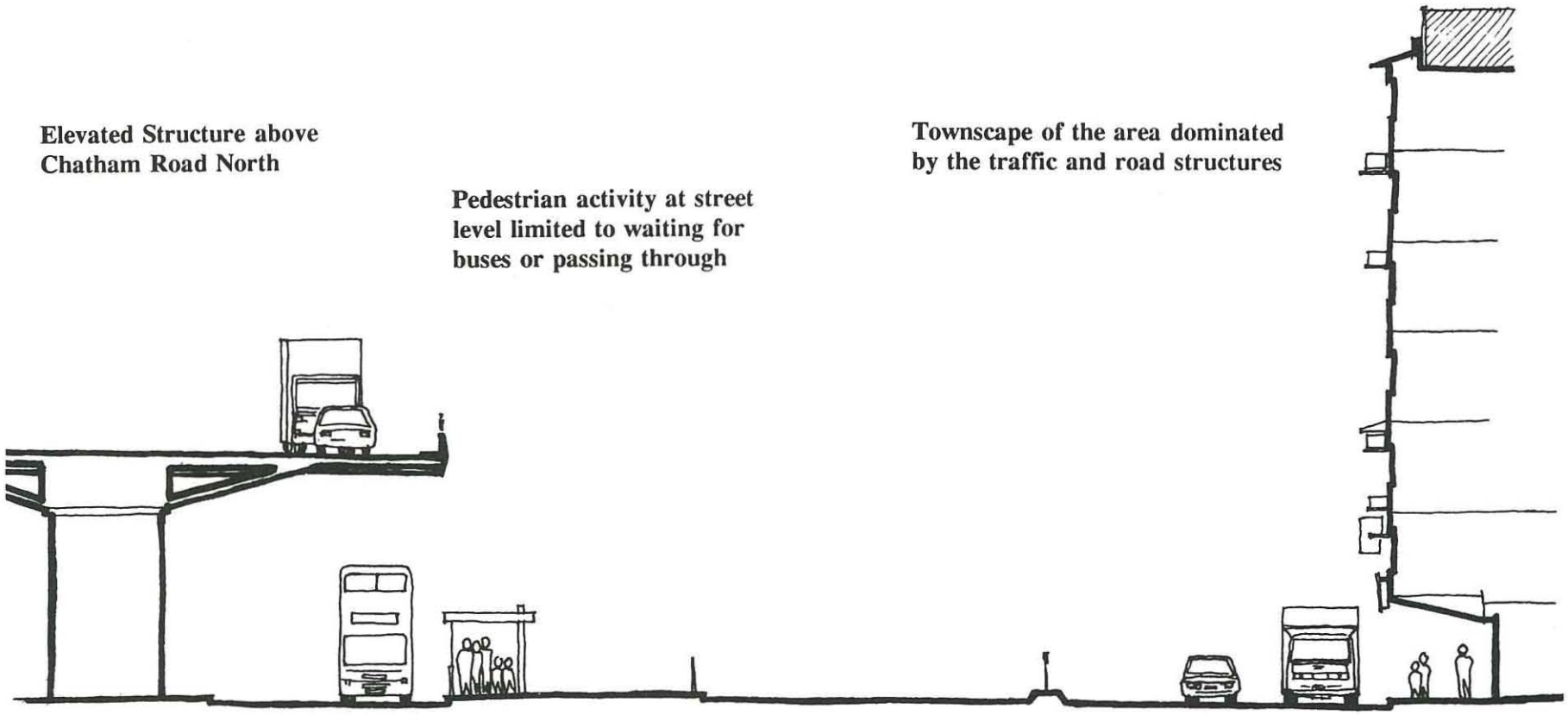
DATE
APRIL 1993

Ko Shan Theatre, Open Space

Yuk Shing Street, Market

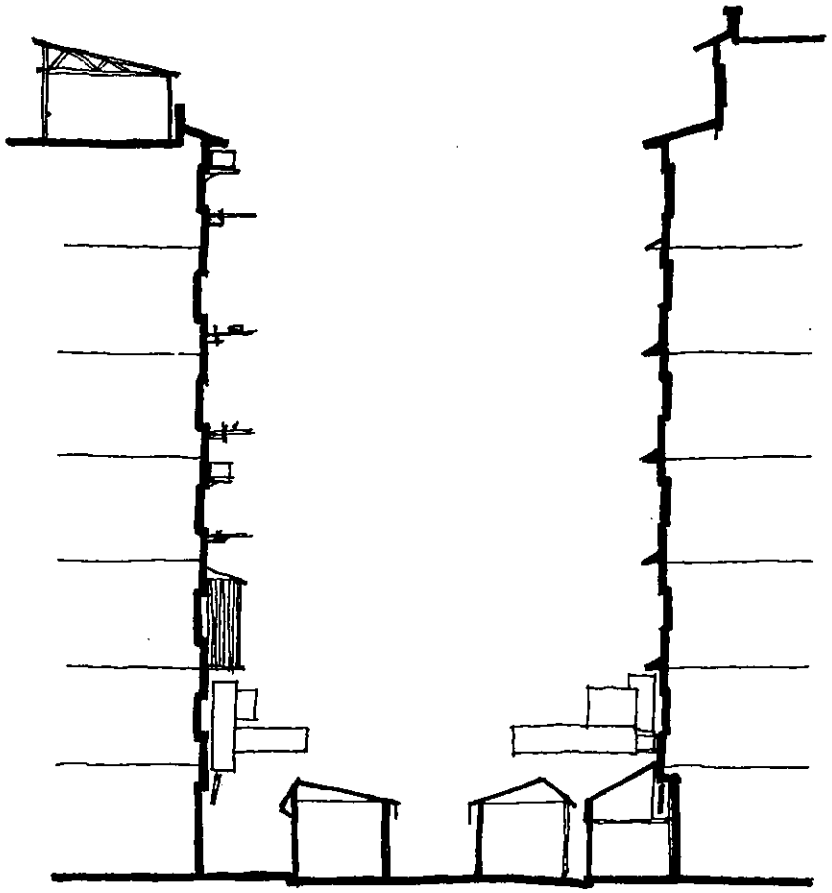
Wing Kwong Street

Parsons Brinckerhoff Maunsell Consultants	**Central Kowloon Route Study: Preliminary Design**	FIGURE NO **3.9**	SCALE DATE **April 1993**



Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Existing Townscape - Cross-section through Ma Tau Wei Road	FIGURE NO. 3.10	SCALE DATE APRIL 1993

Roof space developed as an extra room on many buildings



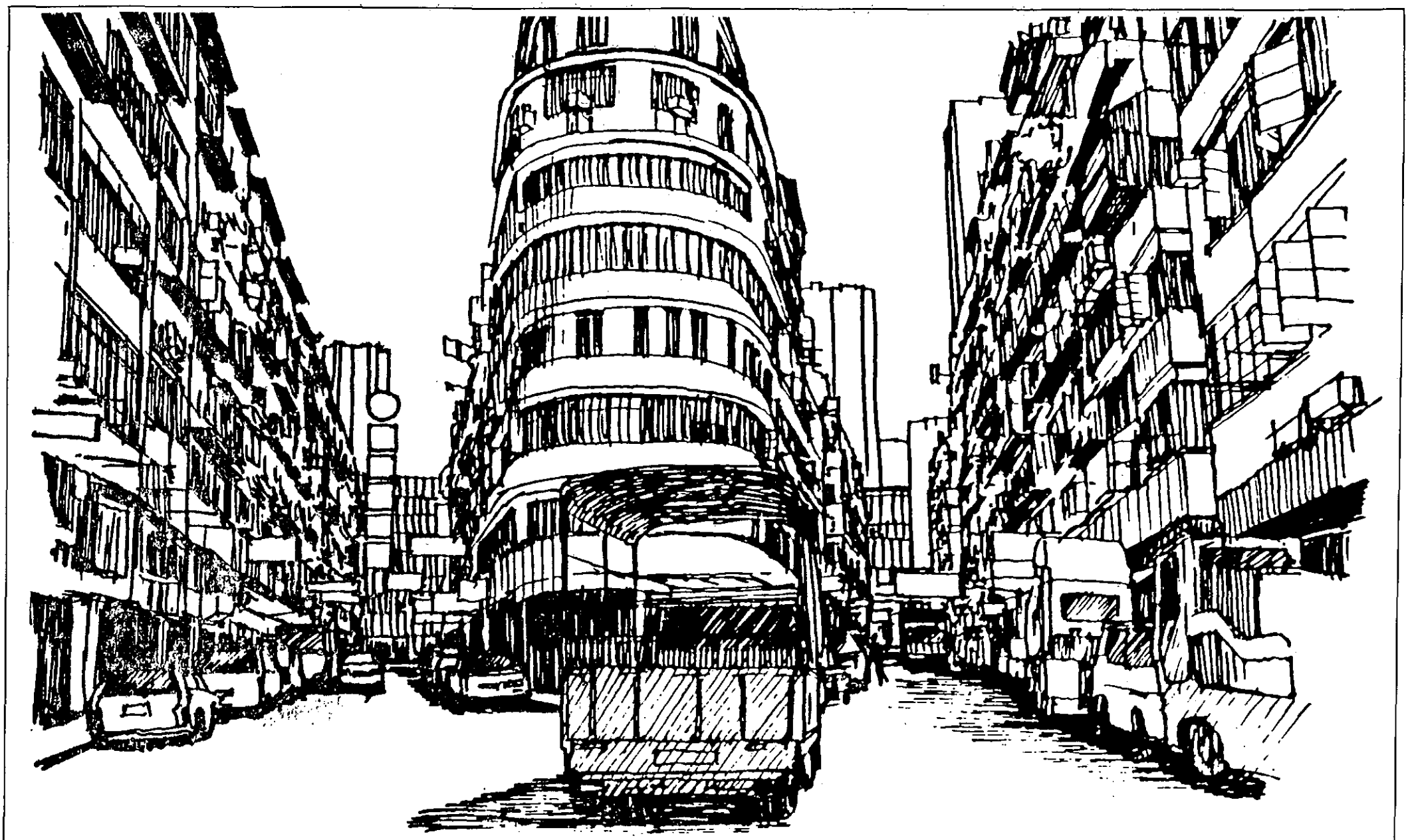
Existing buildings vary in height from six to eight storeys

Addition of advertising signs, balconies, air conditioners, clothes lines etc. give building facades a distinctive character

Townscape character concentrated on activity within street space

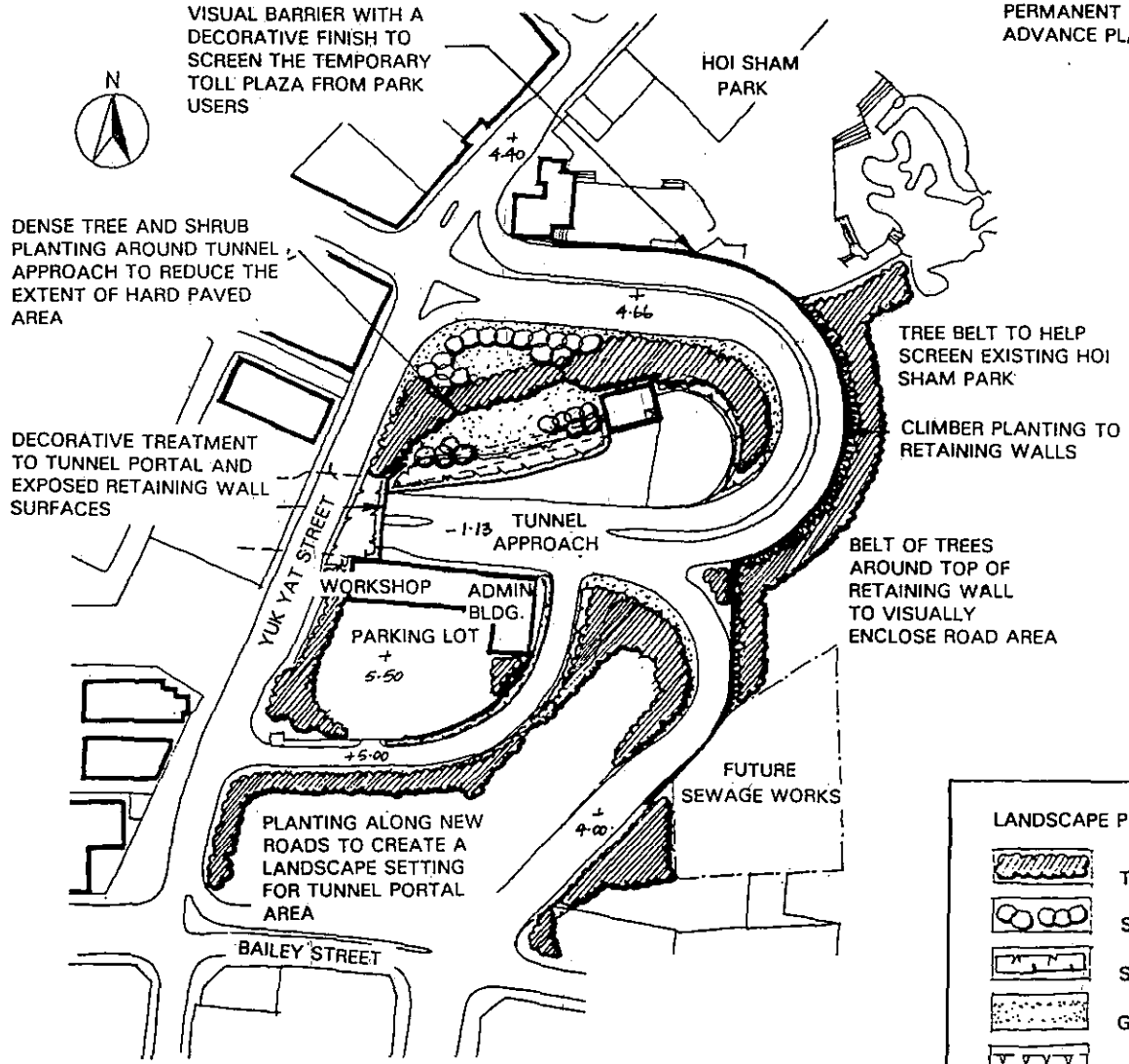
Stalls in permanent street market obscure view of buildings from ground level

Parsons Brinckerhoff Maunsell Consultants	Central Kowloon Route Study : Preliminary Design Existing Townscape - Cross-section through Kai Ming Street	FIGURE NO. 3.11	SCALE DATE APRIL 1993

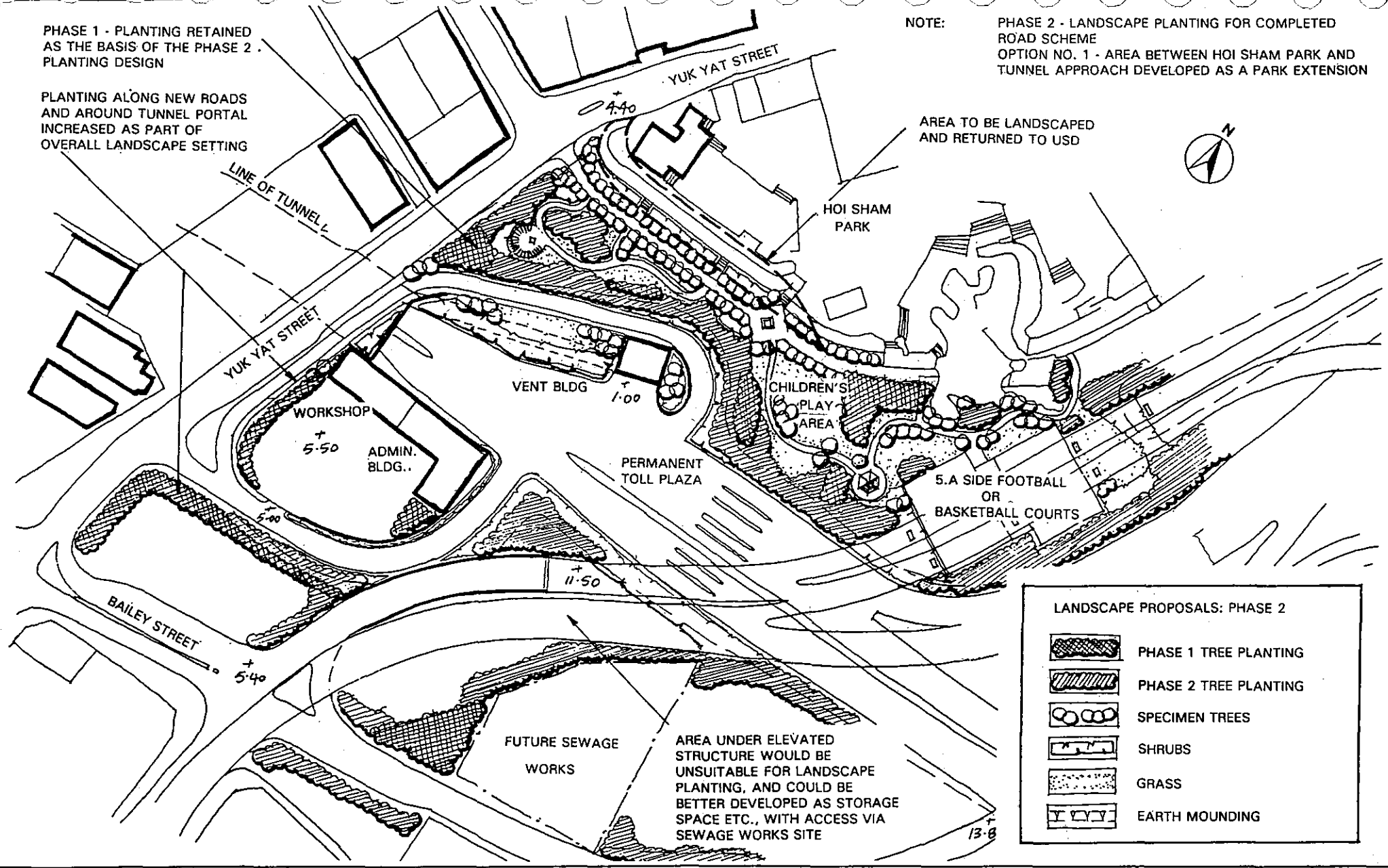


Parsons Brinckerhoff Maunsell Consultants	**Central Kowloon Route Study : Preliminary Design** **Existing Townscape - Perspective view of existing townscape from the corner of Kai Ming Street and Wing Kwong Street**	FIGURE NO. **3.12**	SCALE DATE **APRIL 1993**

NOTES: PHASE 1 - PLANTING TO SCREEN TUNNEL PORTAL AREA, AND CONSTRUCTION OF PERMANENT TOLL PLAZA, TO ACT AS ADVANCE PLANTING TO FINISHED SCHEME



Parsons Brinckerhoff **Maunsell Consultants**	Central Kowloon Route Study : Preliminary Design Proposed Landscape Masterplan East Kowloon Reclamation - Phase 1	FIGURE NO. **3.13**	SCALE 0 10 20 40m DATE **APRIL 1993**



Parsons Brinckerhoff

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Central Kowloon Route Study : Preliminary Design

Proposed Landscape Masterplan
East Kowloon Reclamation - Phase 2, Option 1

FIGURE NO.

3.14

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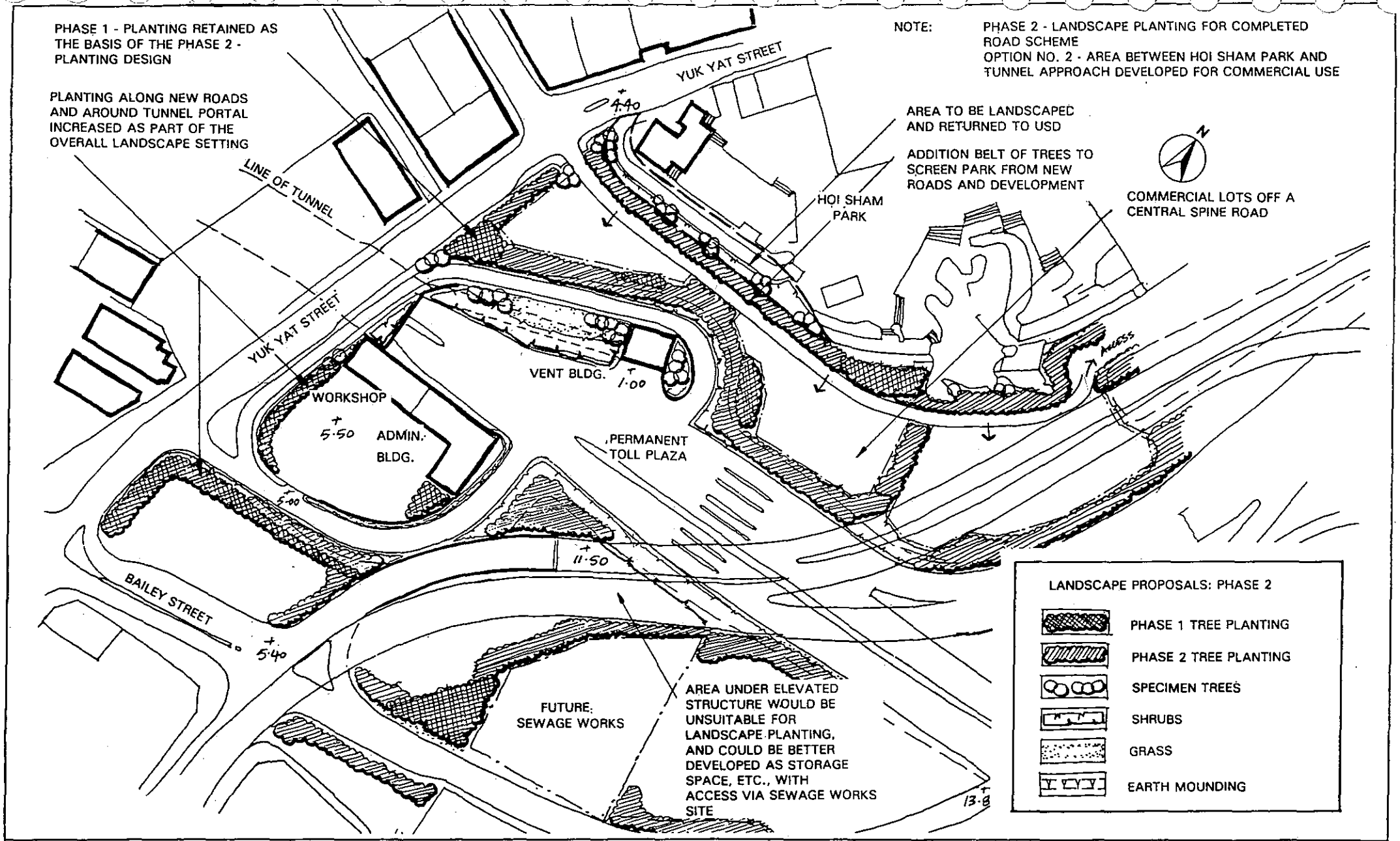
APRIL 1993



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Central Kowloon Route Study : Preliminary Design

Proposed Landscape Masterplan
East Kowloon Reclamation - Phase 2, Option 2

FIGURE NO.

3.15

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APRIL 1993