Highways Department
Kowloon Region

Agreement No. CE 30/96

Flyover and Footbridge Schemes at Junction of Austin Road, Catham Road & Cheong Wan Road

Feasibility Study Assignment

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FINAL

MAUNSELL CONSULTANTS ASIA LTD

in association with

MVA Asia Ltd
EHS Consultants Ltd
Urbis Ltd

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

1.1 Background

Maunsell Consultants Asia Ltd. has been commissioned by the Kowloon Region of Highways Department to undertake a feasibility study assignment under the Consultancy Agreement No. CE 30/96 - "Flyover and Footbridge Schemes at Junction of Austin Road, Chatham Road and Cheong Wan Road - Feasibility Study' with specialist inputs being provided by the following sub-consultants:

- MVA Asia Ltd. - Traffic Impact Assessment
- EHS Consultants Ltd. - Environmental Impact Assessment
- Urbis Ltd. - Landscaping and Visual Impact Assessment

The Flyover and Footbridge Schemes (the Project) were originally proposed in the Tsim Sha Tsui Study in 1987 and were subsequently reviewed by other studies including the Hung Hom Bypass and Princess Margaret Road Link Feasibility Study in 1992 and the Hung Hom Density Study in 1993. The findings of these studies support the implementation of the schemes to relieve congestion at the Chatham Road South/ Austin Road/ Cheong Wan Road junctions.

A Preliminary Project Feasibility Study (PPFS) for the proposed schemes was carried out in 1995 and have examined a number of options involving various combinations of footbridge/ pedestrian subway and flyover/underpass. The findings of the PPFS indicate that a combination of flyover and footbridge link is preferred over other options involving underpass and pedestrian subway, and thus the recommendation of the PPFS to build the flyover and footbridge option has been reflected in the Brief of the Assignment.

A key component of the Feasibility Study is a separate Environmental Impact Assessment (EIA) Study. This final EIA Report has been prepared to meet the requirements of Clause 6.3.8.1.3 of the Study Brief.

1.2 Purpose of the EIA

The Brief states that the purpose of the EIA is to provide information on the nature and extent of environmental impacts arising from the construction and operational phases of the Project and all related activities. Such information will have to contribute to decision on : -

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

(ii) the conditions and requirements for the detailed design, construction, and operation of the proposed Project; and

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

2. PROJECT DESCRIPTION

2.1 The Endorsed Option of Flyover Scheme

The Options Report submitted in August, 1997 as part of the Assignment has reviewed 3 options of Flyover and Footbridge Schemes required under Section 6.1(g) of the Brief. It has concluded that Option 2 should be adopted as the preferred option for further detailed engineering study, EIA, TIA and DIA at the subsequent stages of the Assignment.

This recommendation was endorsed at the Project Steering Group Meeting on 8 August, 1997. Therefore, this report has been focussed on this endorsed option for detailed assessments.

2.2 Scope of the Project

This EIA addresses the potential environmental impacts associated with the construction and operational phases of the proposed Flyover and Footbridge Scheme (the endorsed option) which involve the following engineering works to be carried out under CE30/96.

(i) construction of a flyover, approximately 550m long, including the ramps connecting to the ground level roads;

(ii) construction of footbridges, approximately 250m long, including the access ramps, staircases and covers;

(iii) provision for future connection to the planned walkway system in Tsim Sha Tsui East;

(iv) construction of a retaining wall, approximately 100m long from Gascoigne Road, along the new boundary of the Gun Club Hill Barracks;

(v) tree felling and reprovision of landscaping area;

(vi) modification to the layout of ground level roads; and

(vii) modification to the existing traffic signals, road markings and traffic signs.

2.3 The Study Area

The boundary of the Study Area for the purpose of this EIA (noise impact) is 300m on either side and along the full stretch of the proposed Flyover and Footbridge Scheme (the endorsed option). Except for landscape impact and air pollution assessments, the study area shall generally be defined by a distance of 500m from the proposed Scheme.

However, all noise and air sensitive uses that will share a view of the proposed flyover scheme are considered directly affected. Only the first layer of sensitive receivers that are situated close to the Project are selected for the assessment. Those behind are shielded and are therefore likely to be impacted to a lesser extent.

Information on the study area, the environs and the proposed Flyover and Footbridge Scheme are shown in Figure 2-1 to Figure 2-5.

817 800 N
818 000 N
818 200 N
818 400 N
818 600 N
818 800 N
836 000 E
836 200
836 400
836 600 E

300m Study Area

300m Study Area

CHATHAM ROAD SOUTH
AUSTIN ROAD
GASCOIGNE ROAD
CHEONG WAN ROAD
PRINCESS MARGARET ROAD
HONG CHONG ROAD
SALISBURY ROAD
GRANVILLE ROAD
KIMBERLEY ROAD
JOHNSTON ROAD
HONG KONG MUSEUM OF HISTORY
PLANNED ELEVATED WALKWAY BY OTHERS
PODIUM
JOGGING TRAIL
HONG KONG POLYTECHNIC UNIVERSITY
SWIMMING POOL
GUN CLUB HILL BARRACKS

REV. 改訂	DESCRIPTION 內容	BY 由	CHKD 核對	APPROVED 批准	DATE 日期

Highways Department
Kowloon Region

FLYOVER AND FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD CHATHAM ROAD AND CHEONG WAN ROAD - FEASIBILITY STUDY

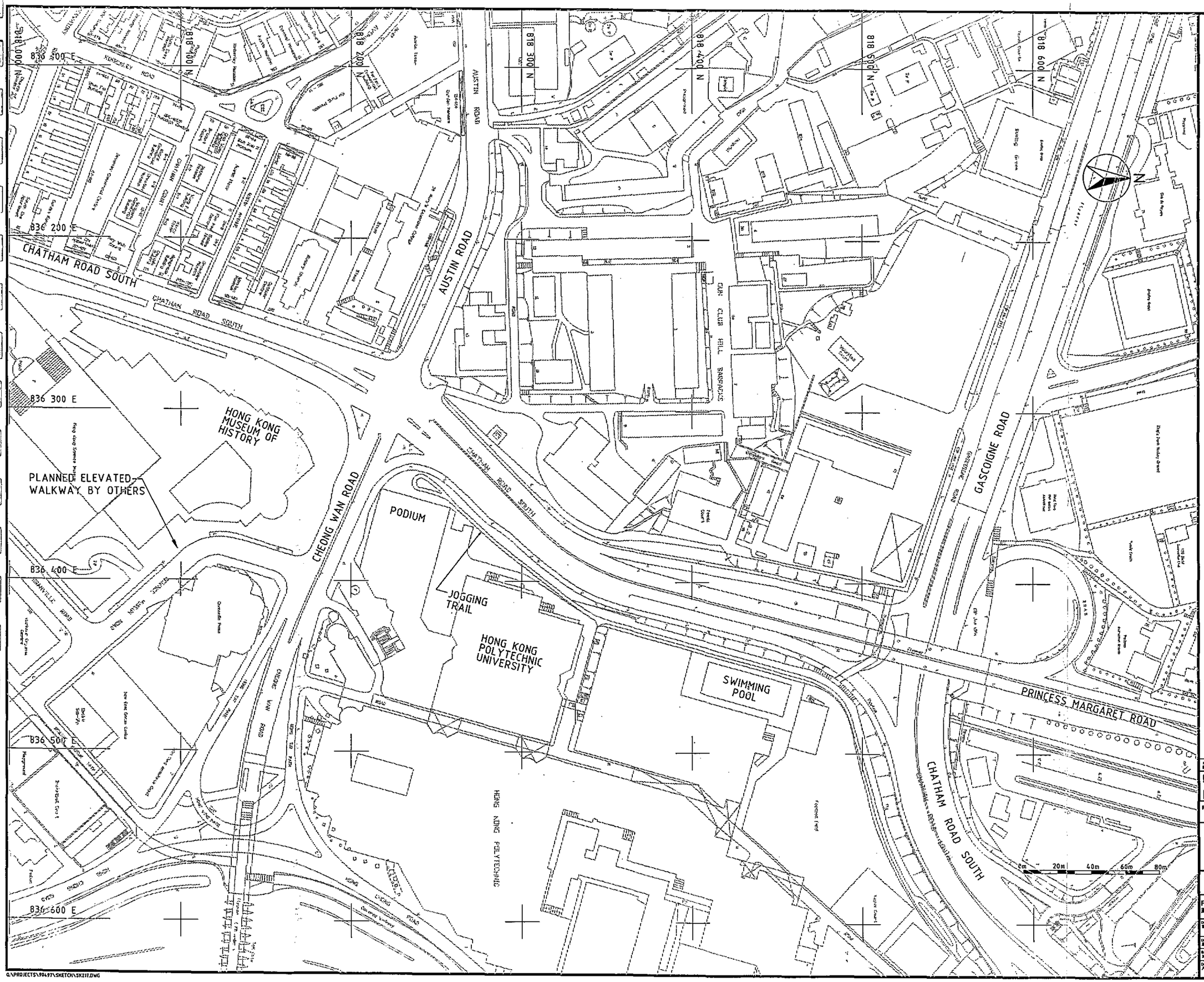
THE STUDY AREA

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

FIGURE NO. 圖紙編號 2.1

DESIGNED BY 設計 | CONTRACT NO. 合約編號 | DATE OF ISSUE 發出日期
DRAWN BY 繪圖 TAM | STATUS 狀況
SCALE 比例 1:3000
DIMENSIONS ARE IN 尺寸單位 MILLIMETRES

D:\PROJECTS\90497\SKETCH\SK223.DWG



Highways Department
Kowloon Region

FLYOVER AND FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD CHATHAM ROAD AND CHEONG WAN ROAD - FEASIBILITY STUDY

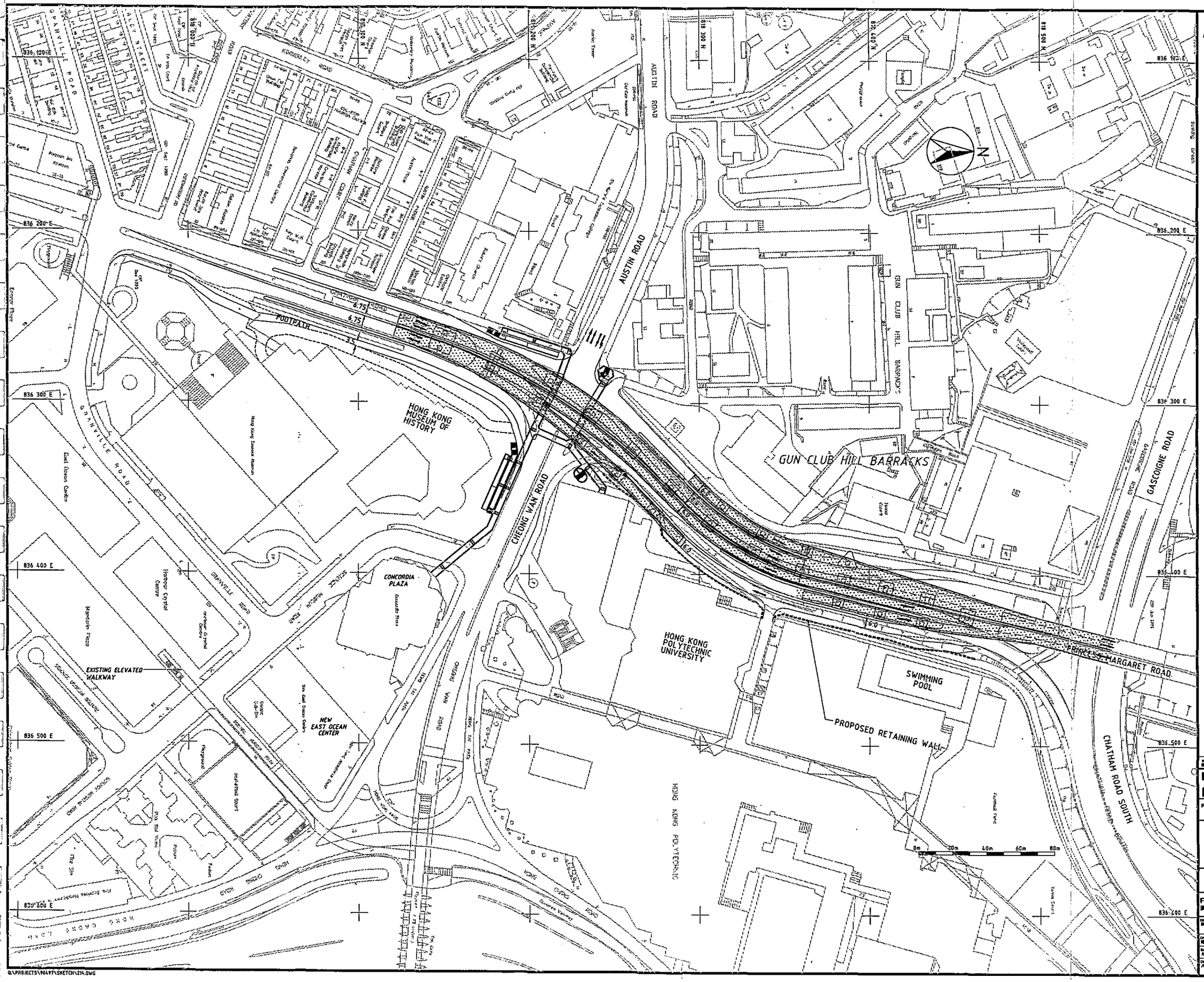
THE ENVIRONS IN THE VICINITY

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

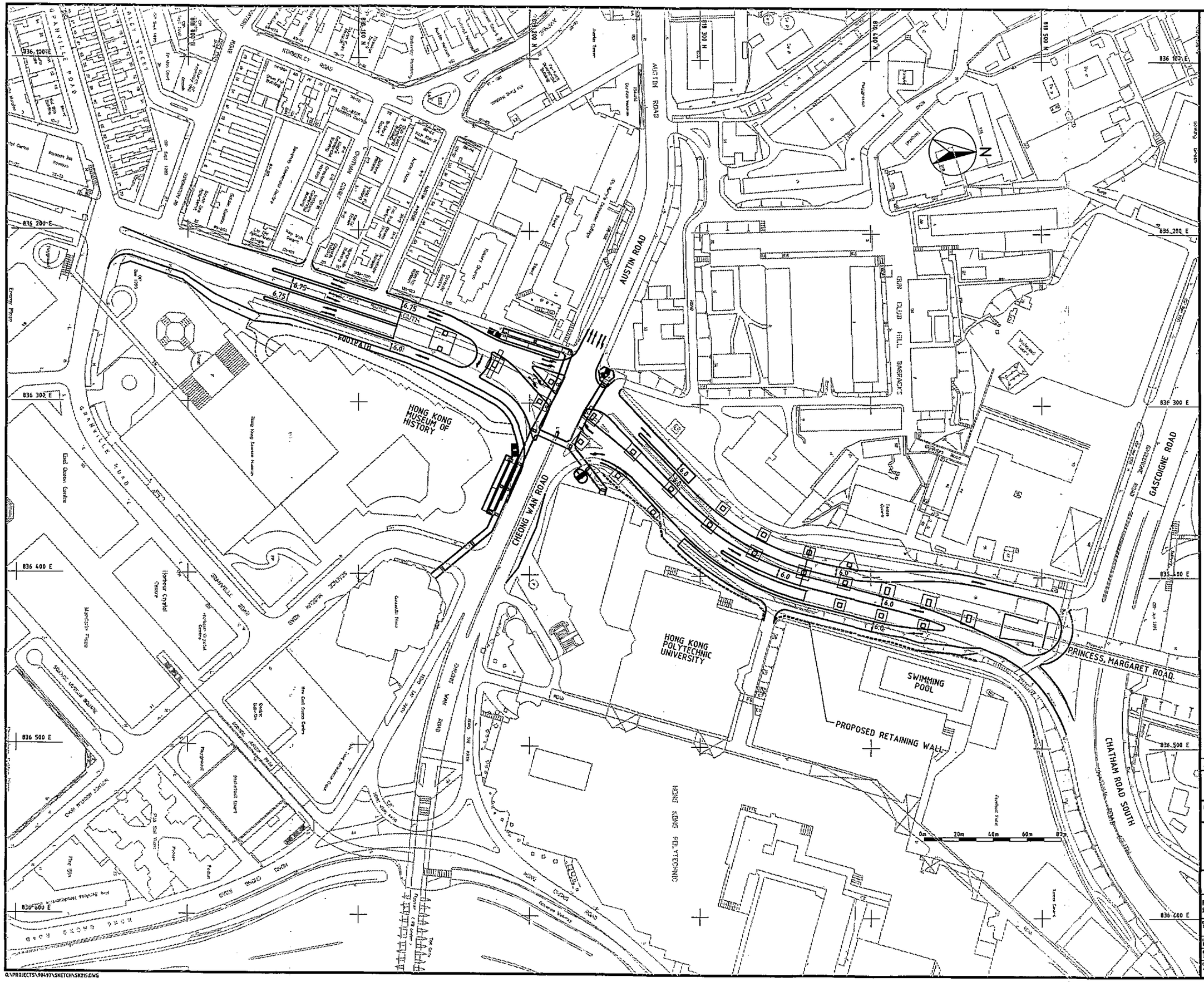
FIGURE NO. 2.2

DESIGNED BY
DRAWN BY
SCALE 1:2000
DIMENSIONS ARE IN MILLIMETRES
CONTRACT NO.
DATE OF ISSUE
STATUS FINAL

Q:\PROJECTS\99497\SKETCH\SK217.DWG



Q:\PROJECTS\90697\SKETCH\214.DWG



Highways Department
Kowloon Region

FLYOVER AND FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD CHATHAM ROAD AND CHEONG WAN ROAD - FEASIBILITY STUDY

ROAD LAYOUT AT GROUND LEVEL

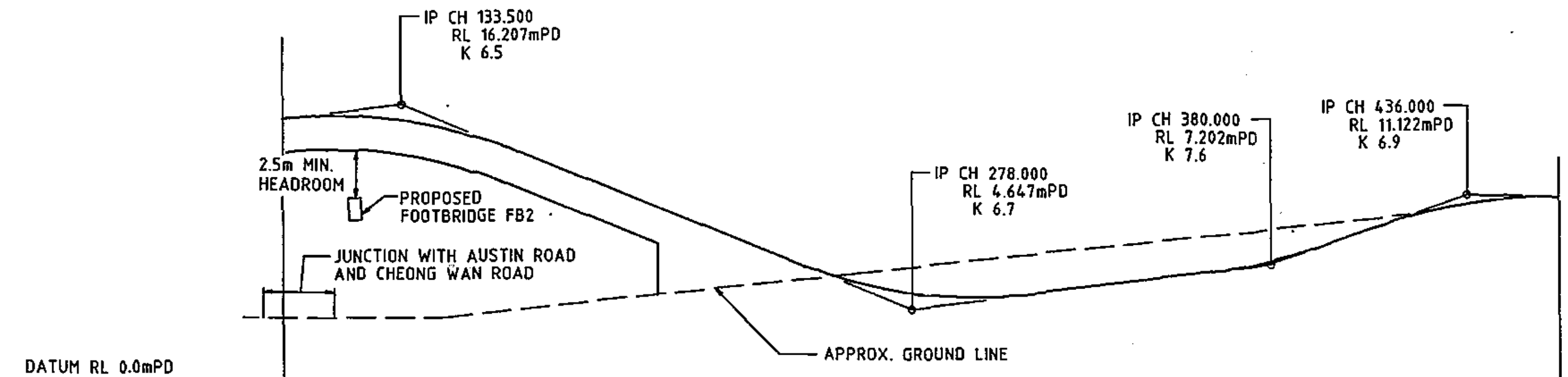
MAUNSELL CONSULTANTS ASIA LTD
茂盛(亞洲)工程顧問有限公司

FIGURE NO. 2.4

DESIGNED BY
DRAWN BY TAM
SCALE AS SHOWN
DIMENSIONS ARE IN MILLIMETRES

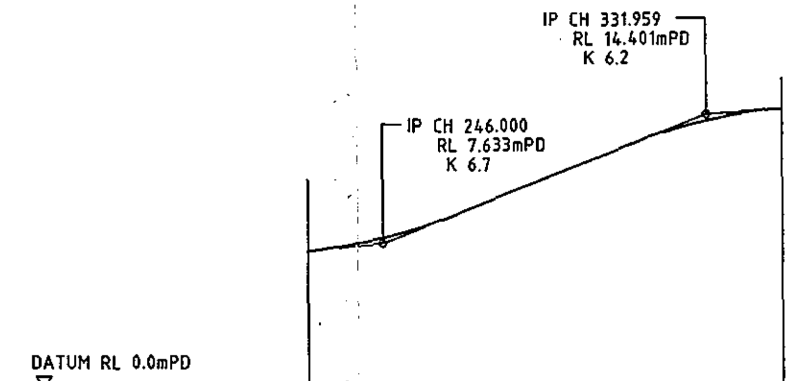
CONTRACT NO.
DATE OF ISSUE
STATUS

Q:\PROJECTS\90497\SKETCH\SK215.DWG



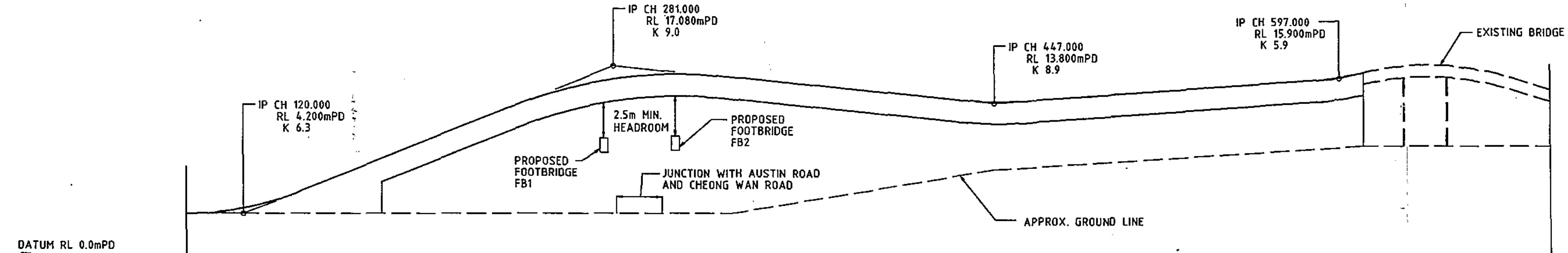
CHAINAGE	100.000	150.000	167.000	200.000	243.000	250.000	300.000	313.000	350.000	363.000	397.000	410.000	450.000	462.000
LEVEL	+15.436	+14.665	+13.527	+10.887	+7.447	+6.924	+5.325	+5.524	+6.451	+6.776	+8.392	+9.302	+10.948	+10.992
VERTICAL PROFILE	67.0 VC		-8.000%			70.0 VC		+2.505%		34.0 VC	+7.0%	52.0 VC		

VERTICAL PROFILE ALONG SETTING OUT LINE M210
SCALE HORI 1 : 1000
VERT 1 : 200



CHAINAGE	226.000	250.000	266.000	300.000	311.959	350.000	351.959
LEVEL	+7.253	+8.139	+9.208	+11.885	+12.826	+14.650	+14.681
VERTICAL PROFILE	40.0 VC		+7.874%		40.0 VC		

VERTICAL PROFILE ALONG SETTING OUT LINE M220
SCALE HORI 1 : 1000
VERT 1 : 200



CHAINAGE	95.000	100.000	145.000	150.000	200.000	236.000	250.000	300.000	326.000	350.000	400.000	432.000	450.000	462.000	500.000	550.000	587.000	600.000	607.000
LEVEL	+4.200	+4.220	+6.200	+6.600	+10.600	+13.480	+14.491	+16.330	+16.191	+15.717	+14.729	+14.096	+13.923	+14.010	+14.542	+15.242	+15.760	+16.086	+16.380
VERTICAL PROFILE	50.0 VC		+8.000%				90.0 VC		-1.976%			30.0 VC		+1.400%			20.0 VC		EXISTING BRIDGE

VERTICAL PROFILE ALONG SETTING OUT LINE M200
SCALE HORI 1 : 1000
VERT 1 : 200

Highways Department
Kowloon Region

FLYOVER AND FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD CHATHAM ROAD AND CHEONG WAN ROAD - FEASIBILITY STUDY

THE VERTICAL PROFILE

SHEET 1 OF 2

MAUNSELL CONSULTANTS ASIA LTD

DRG. NO. 2.5

DESIGNED BY SCHAN
DRAWN BY SCHAN
SCALE AS SHOWN
DIMENSIONS ARE IN METRES

G:\PROJECTS\90497\SKETCH\SK214.DWG

2.4 The Potential Environmental Impacts

Potential environmental impacts envisaged during the construction and operational phases are largely as follows : -

Table 2-1 Environmental Issues Envisaged During the Construction and Operational Phase

Construction Phase	Operational Phase
Construction Noise Impact	Traffic Noise Impact
Air (fugitive dust) Quality Impact	Air (vehicular emission) Quality Impact
Visual and Landscape Impact	Visual and Landscape Impact
	Land Use Impact

2.5 The Construction Program

According to the current programme, the construction is scheduled to commence in October 2000 for completion in 36 months, i.e. 2003.

3. CONSTRUCTION NOISE IMPACT

3.1 Introduction

This section deals with the possible noise impact that may arise from the construction of the Flyover and Footbridge Scheme on neighbouring sensitive uses.

It is recognised that contractors undertaking the Project shall be responsible for minimising the noise impacts on the surroundings and complying with the Noise Control Ordinance. They are also responsible for the application of construction noise permits (CNP) for carrying out of construction works during the restricted hours. This study would therefore allow an earlier appreciation of the possible problems and identification of the necessary mitigation measures rather than restricting flexibility in carrying out the works.

Although the assumptions made on the construction of the Project may be subject to changes when it is to be carried out in the future, the assessment can still serve as a test on the surmountability of the issue and hence mitigation measures, if necessary, can be identified and specified in the future works contract.

A copy of EPD's "Recommended Pollution Control Clauses for Construction Contracts" for control of construction noise has been given in Appendix I for reference.

3.2 Legislation and Assessment Criteria

Construction noise is controlled under the Noise Control Ordinance (NCO) which prohibits the use of powered mechanical equipment (PME) during the restricted hours (7 p.m. to 7 a.m. on normal weekdays and any time on a public holiday, including Sunday) without a valid Construction Noise Permit (CNP) from the Authority. The criteria and procedures for issuing such a permit are specified in the "Technical Memorandum on Noise From Construction Works Other than Percussive Piling" (TM1).

However, effective from 1 November, 96, the use of specified powered mechanical equipment (SPME) for carrying out of construction work other than percussive piling and/ or the carrying out of prescribed construction work (PCW) within a designated area are also brought under control. The relevant technical details are provided in the Technical Memorandum on Noise from Construction Work in Designated Areas (TM2).

Percussive pilling is also controlled similarly by a noise permit system described in "Technical Memorandum On Noise From Percussive Piling" (TM3) which aims at restricting the number of hours during which piling can be conducted.

For the present case, no percussive piling will be expected but the works site falls within the designated areas gazetted by Planning, Environment and Lands Branch (Plan No.: EPD/NP/KLN-01). Hence TM1 and TM2 shall apply for control of construction works during the restricted hours.

The noise criteria during the restricted hour (19:00-23:00) for construction activities involving the use of PME will be the Acceptable Noise Level, (ANL) prescribed in TM1. In determining the ANL for that area, the Area Sensitivity Rating (ASR) of C mentioned in TM1 is chosen for the category of Urban Area directly affected by the influencing factor - the Chatham Road. The appropriate ANL is 70 dB(A).

There is however no statutory control of construction noise outside the restricted hours, EPD's guideline[2] of 75 dB(A) [$L_{A,eq}$ (30 min)] will be adopted.

In brief, the relevant noise criteria applicable to the present situation are tabulated as follows : -

Table 3-1 Construction Noise Criteria

Time Period	Noise Criteria
Non-restricted hours (0700 - 1900 hours)	**(non-statutory requirement)**
All domestic premises	75 dB(A) [L_A, eq (30 min.)]
/Educational institutions	70 dB(A) [L_A, eq (30 min.)]
(during examination)	65 dB(A) [L_A, eq (30 min.)]
Restricted hours (Designated Area)	**(statutory requirement)**
Not involving the use of SPME nor carrying out of PCW	
All days during 1900 - 2300 hours and whole day during Sundays and Public Holidays (not involving the use of SPME nor the carrying out of PCW)	70 dB(A) [L_A, eq (5 min.)]
All days during night-time (2300 to 0700 hours)	55 dB(A) [L_A, eq (5 min.)]
Involving the use of SPME or carrying out of PCW	
All days during 1900 - 2300 hours and whole day during Sundays and Public Holidays	55 dB(A) [L_A, eq (5 min.)]
All days during night-time (2300 to 0700 hours)	40 dB(A) [L_A, eq (5 min.)]

[2]Practice Note for Professional Persons, PN2/93" issued by the Professional Persons Environmental Consultative committee (ProPECC) in June 1993.

3.3 Noise Sensitive Receivers

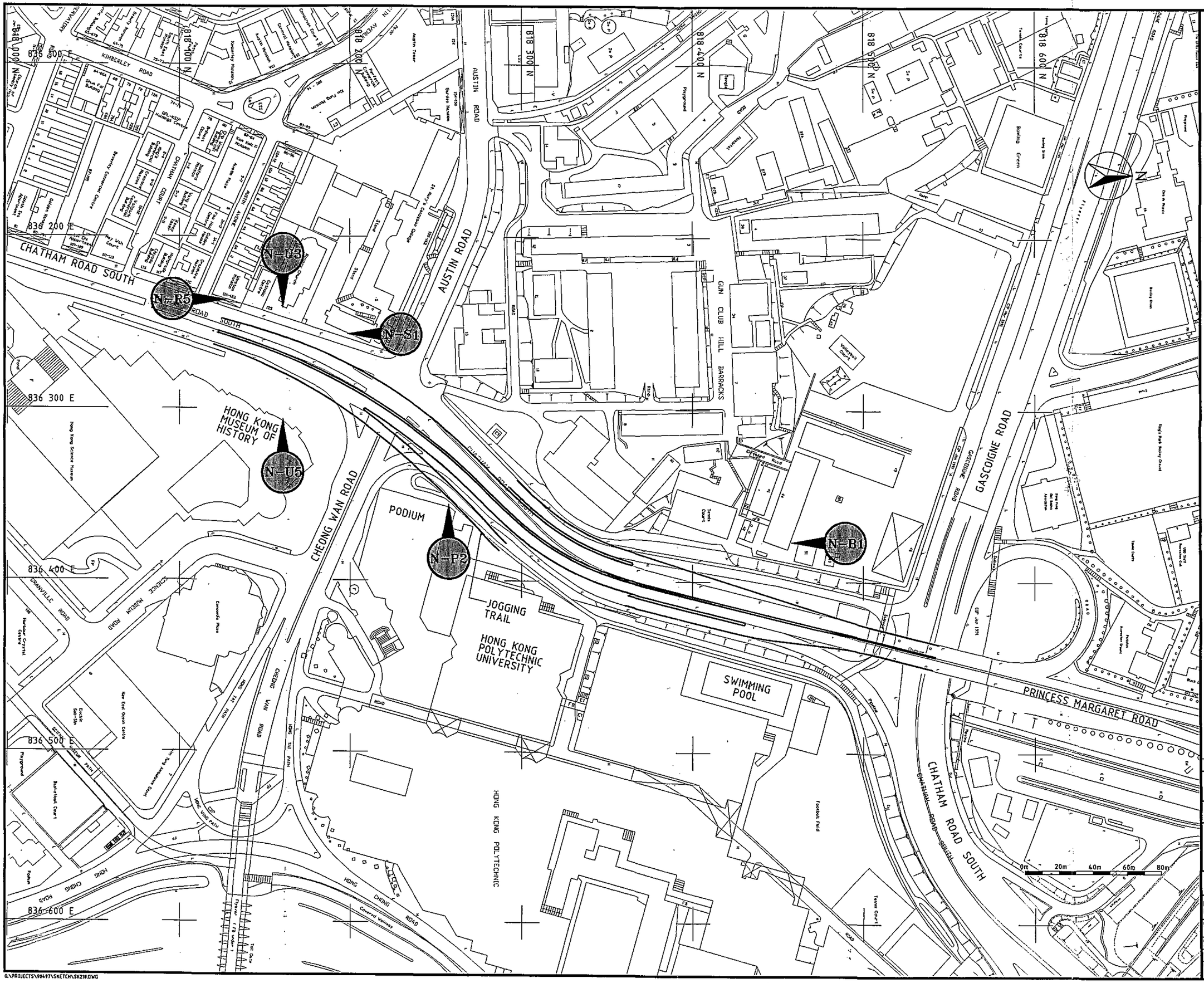
Representative sensitive uses immediately close to the Flyover and Footbridge Scheme have been selected for construction noise prediction. They include : -

- Quarters of the Gun Club Hill Barracks;
- Hong Kong Polytechnic University;
- St. Mary's Canossian College;
- Rosary Church;
- Winston Mansion - one of the commercial/ residential blocks along Chatham Road South;
- Hong Kong Museum of History;

All assessment points have been taken at 1.2m above the floors of each storey and 1m away from the facades of buildings. Only the lower representative floor was considered in the prediction as it would reflect the worst impact at that NSR. Detailed information on the location and nature of use of the NSRs is tabulated below and shown in Figure 3-1.

Table 3-2 Information on NSRs selected for Prediction of Construction Noise

NSR	Description	Representative floors	Representative floors, mPD
B1	Gun Club Hill Barracks	1/F - Quarters	10.5
P2	HKPU - Phase 3A Administration Wing Chung Sze Yuen Building	1/F - Studio, lab	8.4
S1	St. Mary's Canossian College	2F	12.3
U3	Rosary Church	G/F	4.3
R5	Winston Mansion - one of the commercial/residential blocks along Chatham Road South	2F, residential uses	11.3
U5	Hong Kong Museum of History	G/F	5.3



NO. 號數	DESCRIPTION 內容摘要	DR. 繪	CK. 核	APPROVED 認可人	DATE 日期

Highways Department

Kowloon Region

FLYOVER AND FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD CHATHAM ROAD AND CHEONG WAN ROAD - FEASIBILITY STUDY

LOCATION OF SELECTED NSRs FOR CONSTRUCTION NOISE PREDICTION

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

FIGURE NO. 圖紙編號 3.1

DESIGNED BY 設計		CONTRACT NO. 合約編號	DATE OF ISSUE 發出日期
DRAWN BY 繪圖	TAM	STATUS 狀況	
SCALE 比例	1:2000		
DIMENSIONS ARE IN 尺寸單位	MILLIMETRES	© COPYRIGHT RESERVED 版權所有	

Q:\PROJECTS\80497\SKETCH\SK210.DWG

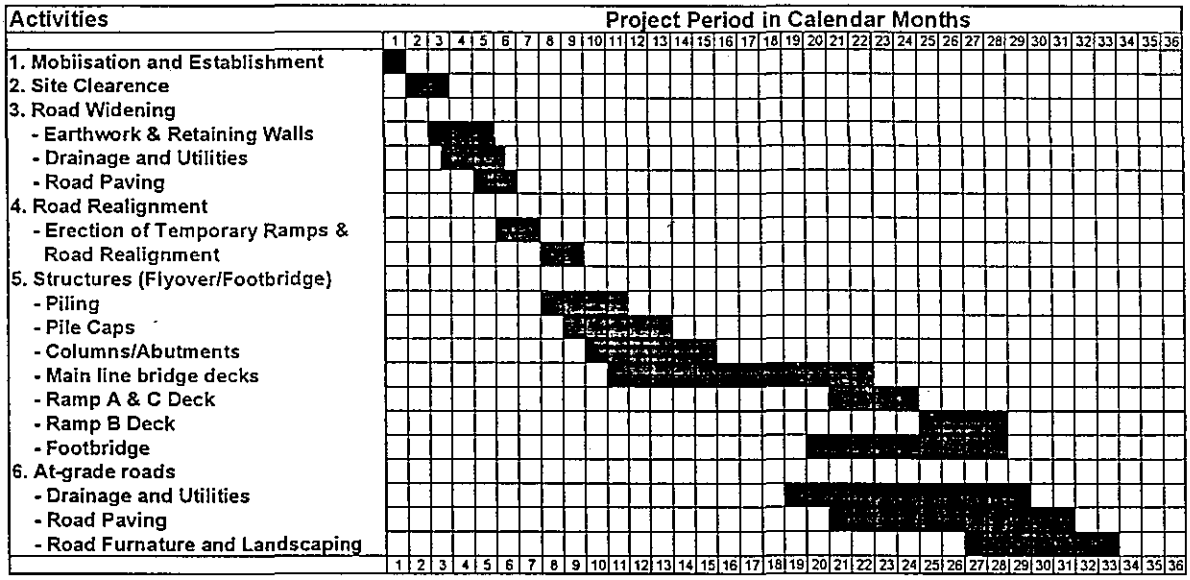
3.4 Construction Activities and Schedules

Assumptions made on the construction activities, schedule, equipment and methodology are only conceptual at this early stage to facilitate noise assessment. It will be the responsibility of the Contractor to carry out the construction planning and undertake the works at the contract implementation stage. Appropriate construction methods and techniques will generally be adopted by the Contractor in accordance with their available resources.

The anticipated construction sequence is shown in Table 3-3. It is envisaged that the overall construction period will last for 33 months. Major construction works will include the following : -

1. widening of Chatham Road south on the east side verge including construction of concrete retaining walls.
2. construction of flyover including the ramps connecting to ground level and footbridges including access ramps, staircases and covers.
3. modification to layout of at-grade roads.

Table 3-3 The Construction Program



Road widening and modification will be formed by excavation/ filling of the existing ground to the required formation level. Where the road will encroach upon the Hong Kong Polytechnic University, construction of a conventional concrete retaining wall will be required.

Bored piling is expected along the elevated structure at all column/ abutment locations. Up to two piling rigs, located at adjacent column sites, are expected to be operating at any one time. Pile cap construction will proceed for the caps, fixing reinforcements, concreting, concrete breaking and backfilling. Columns will be built to support the road structure. Work will involve fixing the reinforcement, erecting formwork, and concreting.

The parapets of the elevated structure will also be cast in-situ following the deck construction. In-situ works require the erection of temporary formwork and falsework first. Reinforcement will then be placed, and concrete will be delivered by mixer trucks and placed using concrete pumps. The elevated roads will be finished with a bituminous surface.

Drainage will be laid along the modified road sections. The establishment of drainage culverts will require excavation of the drainage trench alongside the road into which pre-cast concrete pipes will be lowered. Road construction will then be followed by laying road pavements.

3.5 Construction Equipment

Until a contractor is appointed, full details of the type and utilisation of construction equipment will not be known exactly. Typical types and number of powered mechanical equipment (PME) needed for various construction activities are assigned and shown in Table 3-4. PMEs that will likely be used concurrently have been grouped within the same work stage.

Not every PME is assumed to operate all the time when they are on site. Therefore a typical % on-time is assumed for each PME based on experience in actual site practice so that the noise prediction would be a realistic one. Consequently, the effective sound power levels for each construction activity can be quantified and listed in the table overleaf.

3.6 Approach and Methodology

The impact of construction noise at the various NSRs has been predicted according to the procedures laid down in the TM1 mentioned in Section 3.2.

Obviously, the noise impact would be highest when works are being carried out close to the NSRs and, when the works area are gradually shifting away, the noise would tend to diminish.

Taking into consideration of the characteristics of an elongated work site and its dependence on the work program and time, realistic noise impact has been predicted. Time series of the impact at each of the NSRs have been plotted so that the variation within the whole works period can be reflected.

The noise prediction has been based on the following assumptions : -

(a) the assumed construction program, items of PME to be used and numbers needed for each of the construction activities have been assigned as in Table 3-3 and Table 3-4;

(b) each items of PME has been assigned a Sound Power Level (SWL) extracted from the values given in TM1 and a "% on time" so that the effective sound power level (SWL') can be calculated for each construction activities;

(c) the group of PME is assumed to operate at notional source positions which coincide with a point midway between the centreline of future flyover alignment and the kerb lying on the same straight line as the NSR;

(d) Noise impact at each NSR were then corrected for distance attenuation [-6 dB(A) for doubling the distance] , noise shielding [-5 dB(A) correction] and the effect of facade reflection [+ 3 dB(A)] to give a Corrected Noise Level (CNL);

(e) Whenever the noise criteria given in Table 3-1 are exceeded, progressively effective mitigation measures have been proposed to alleviate the impact.

Table 3-4 Typical PME to be Used in Different Construction Stages

Phasing	Construction Activities	PME	TM Reference Number	Nos. used	SWL,d B(A)	% on time	Correction dB(A)	Effective SWL Leq30 (dB(A)
Phase I	**Mobilisation and Establishment**							
1.1	Mobilisation and	Mobile crane	CNP 048	1	112	10%	-10.0	102.0
	Establishment	Excavator	CNP 081	1	112	30%	-5.2	106.8
		Dump truck	CNP 067	1	117	30%	-5.2	111.8
							Total	**113.3**
Phase II	**Site Clearance**							
2.1	Site Clearance	Mobile Crane	CNP 048	1	112	20%	-7.0	105.0
		Excavator	CNP 081	1	112	50%	-3.0	109.0
		Dump Truck	CNP 067	1	117	50%	-3.0	114.0
							Total	**115.6**
Phase III	**Road Widening**							
3.1	Earthwork &	Mobile Crane	CNP 048	1	112	30%	-5.2	106.8
	Retaining Walls	Excavator	CNP 081	1	112	70%	-1.5	110.5
		Dump Truck	CNP 067	1	117	70%	-1.5	115.5
		Bored Piling Rig	CNP 164	1	115	30%	-5.2	109.8
		Concrete Mixer Truck	CNP 044	1	109	50%	-3.0	106.0
		Vibratory Pokers	CNP 113	1	113	50%	-3.0	110.0
							Total	**118.7**
3.2	Drainage and Utilities	Mobile Crane	CNP 048	1	112	30%	-5.2	106.8
		Excavator	CNP 081	1	112	70%	-1.5	110.5
		Dump Truck	CNP 067	1	117	70%	-1.5	115.5
							Total	**117.1**
3.3	Road paving	Compactor	CNP 050	1	105	70%	-1.5	103.5
		Road Roller	CNP 185	1	108	70%	-1.5	106.5
		Asphat Paver	CNP 004	1	109	50%	-3.0	106.0
							Total	**110.3**
Phase IV	**Road Realignment**							
4.1	Erection of	Mobile Crane	CNP 048	1	112	30%	-5.2	106.8
	Temporary Ramps	Excavator	CNP 081	1	112	30%	-5.2	106.8
	& Road Realignment	Concrete Mixer Truck	CNP 044	1	109	20%	-7.0	102.0
		Vibratory Pokers	CNP 170	1	113	20%	-7.0	106.0
							Total	**111.8**
4.2	Demolition of	Mobile Crane	CNP 048	1	112	30%	-5.2	106.8
	Existing Ramps	Excavator	CNP 081	1	112	70%	-1.5	110.5
		Dump truck	CNP 067	1	117	70%	-1.5	115.5
							Total	**117.1**
Phase V	**Structures (Flyover/ Footbridge)**							
5.1	Piling	Mobile Crane	CNP 048	1	112	30%	-5.2	106.8
		Bored Piling Rig	CNP 164	1	115	70%	-1.5	113.5
		Concrete Mixer Truck	CNP 044	1	109	70%	-1.5	107.5
		Vibratory Pokers	CNP 170	1	113	70%	-1.5	111.5
							Total	**116.7**
5.2	Pile Caps	Mobile Crane	CNP 048	1	112	30%	-5.2	106.8
		Excavator	CNP 081	1	112	70%	-1.5	110.5
		Dump truck	CNP 067	1	117	70%	-1.5	115.5
		Concrete Mixer Truck	CNP 044	1	109	70%	-1.5	107.5
		Vibratory Pokers	CNP 170	1	113	70%	-1.5	111.5
							Total	**118.5**
5.3	Columns / Abutments	Mobile Crane	CNP 048	1	112	50%	-3.0	109.0
		Excavator	CNP 081	1	112	30%	-5.2	106.8
		Dump truck	CNP 067	1	117	30%	-5.2	111.8
		Concrete Mixer Truck	CNP 044	1	109	70%	-1.5	107.5
		Vibratory Pokers	CNP 170	1	113	70%	-1.5	111.5
							Total	**116.7**
5.4	Bridge Decks	Mobile Crane	CNP 048	1	112	70%	-1.5	110.5
		Excavator	CNP 081	1	112	30%	-5.2	106.8
		Dump truck	CNP 067	1	117	30%	-5.2	111.8
		Concrete Mixer Truck	CNP 044	1	109	70%	-1.5	107.5
		Vibratory Pokers	CNP 170	1	113	70%	-1.5	111.5
		Concrete Pump Truck	CNP 047	1	109	70%	-1.5	107.5
							Total	**117.5**
Phase VI	**At Grade Roads**							
6.1	Drainage and Utilities	Mobile Crane	CNP 048	1	112	30%	-5.2	106.8
		Excavator	CNP 081	1	112	70%	-1.5	110.5
		Dump Truck	CNP 067	1	117	70%	-1.5	115.5
							Total	**117.1**
6.2	Road Paving	Compactor	CNP 050	1	105	70%	-1.5	103.5
		Road Roller	CNP 185	1	108	70%	-1.5	106.5
		Aspalt Paver	CNP 004	1	109	50%	-3.0	106.0
							Total	**110.3**
6.3	Road Furniture and	Mobile Crane	CNP 048	1	112	50%	-3.0	109.0
	Landscaping	Excavator	CNP 081	1	112	30%	-5.2	106.8
		Dump Truck	CNP 067	1	117	30%	-5.2	111.8
							Total	**114.4**

3.7 The Un-mitigated Construction Noise Impact

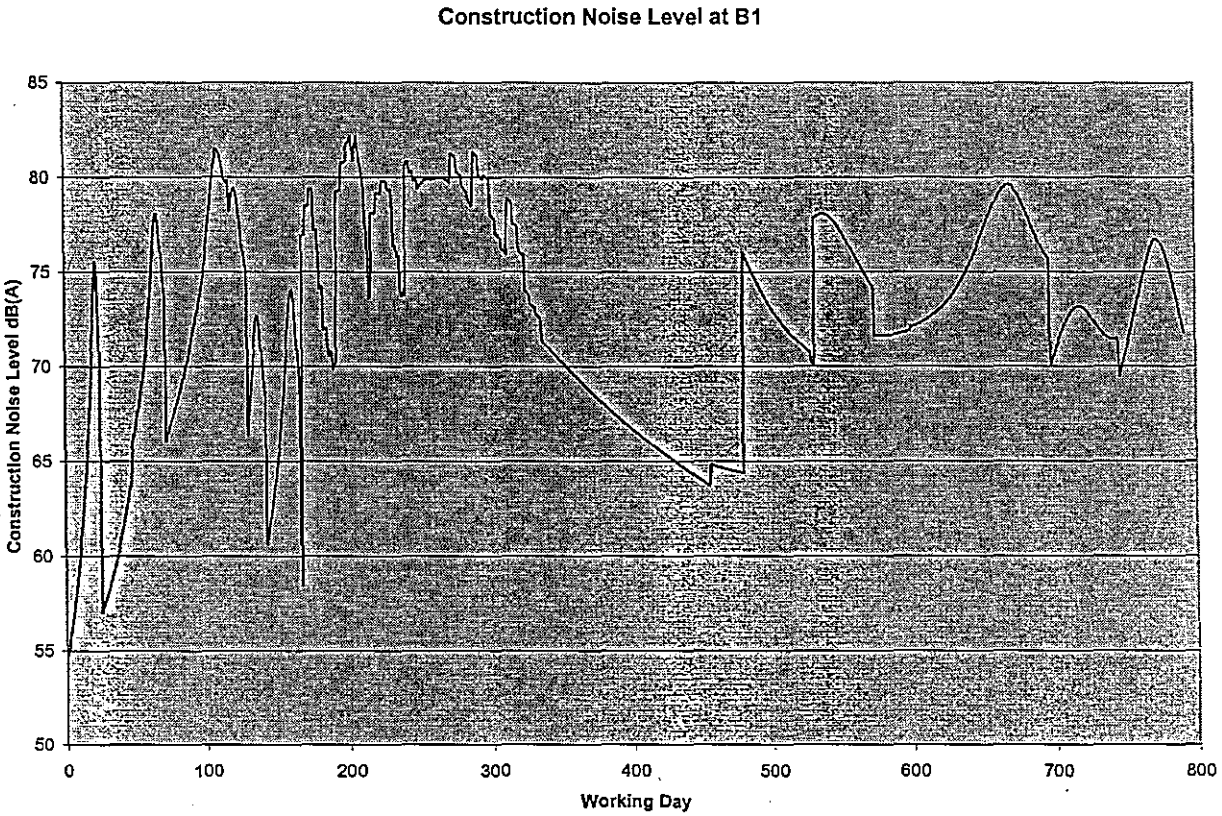
Figure 3-2 and Figure 3-4 show the cumulative noise levels at the selected NSRs resulting from concurrent construction activities of the Project.

The range of noise exceedance and % of time exceeded are summarised in the following table.

Table 3-5 *Range of Exceedance in the Predicted Unmitigated Construction Noise Level above the Daytime Noise Guideline of 75 dB(A)*

NSRs	Range of exceedance in construction noise level, dB(A) above the daytime criterion	% of time (working days) with noise exceedance
B1	1 - 7	29%
P2	1 - 17	53%
S1	1 - 11	44%
U3	1 - 12	35%
R5	1 - 14	30%
U5	1 - 10	42%

Figure 3-2 Unmitigated Construction Noise Impact at B1 & P2



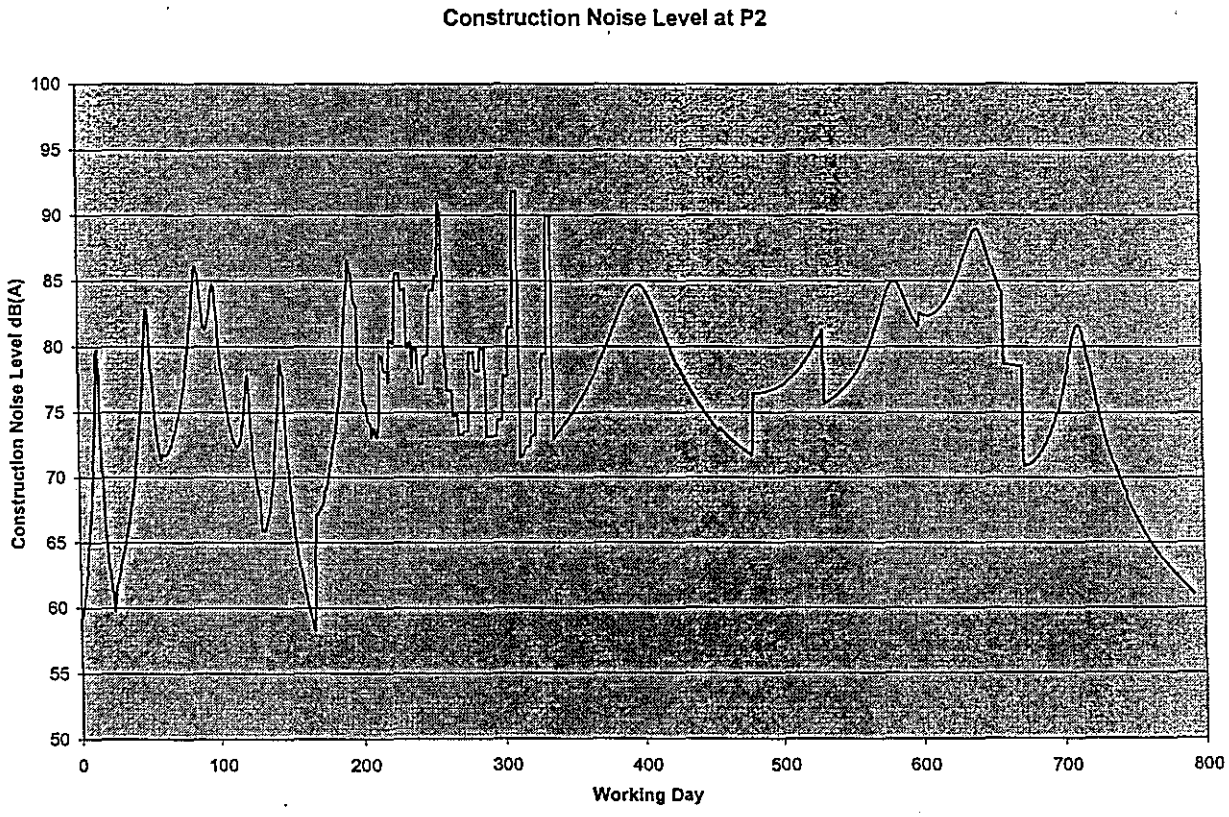
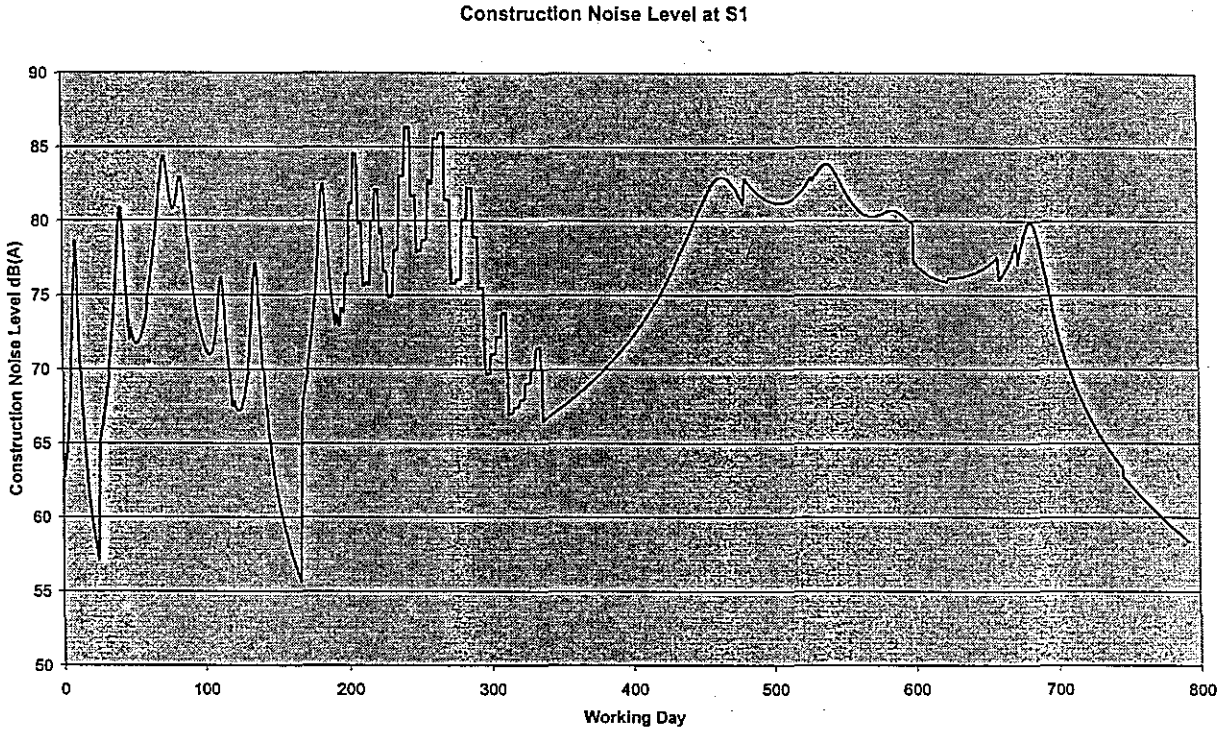


Figure 3-3 Unmitigated Construction Noise Impact at S1 & U3



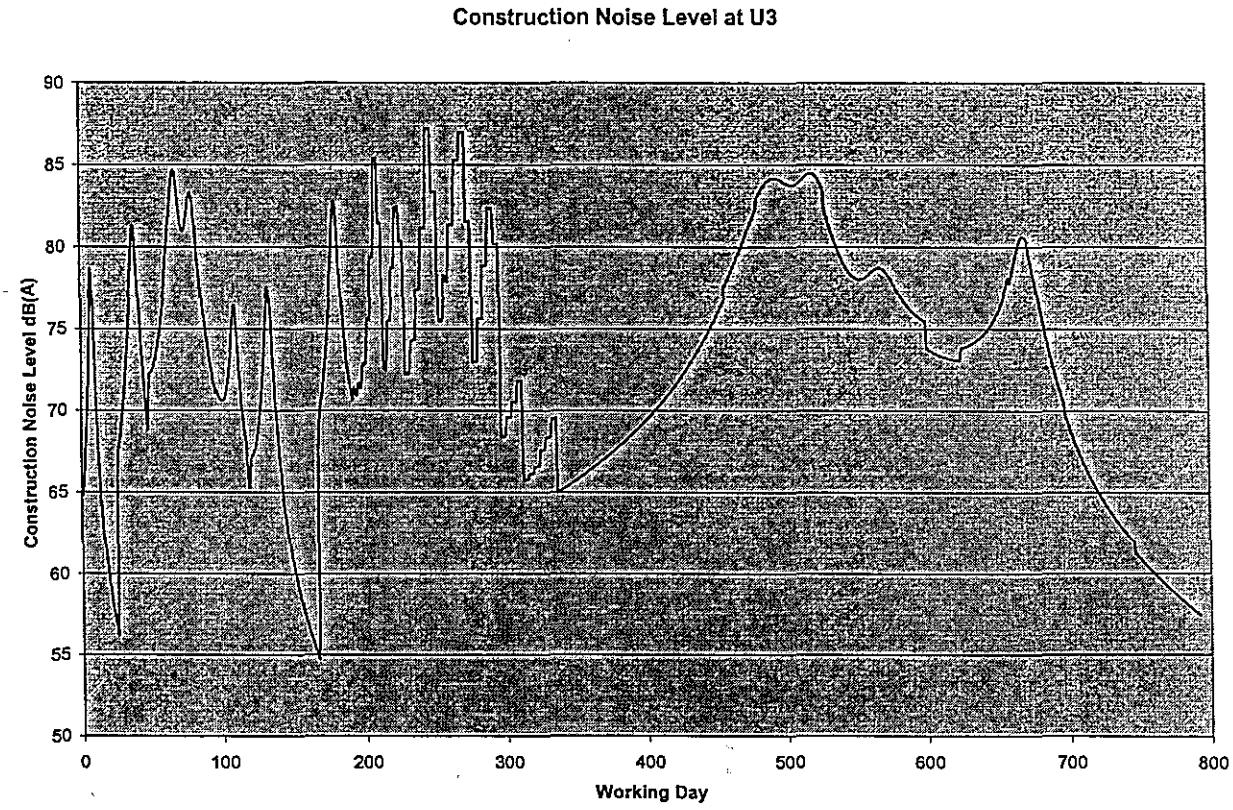
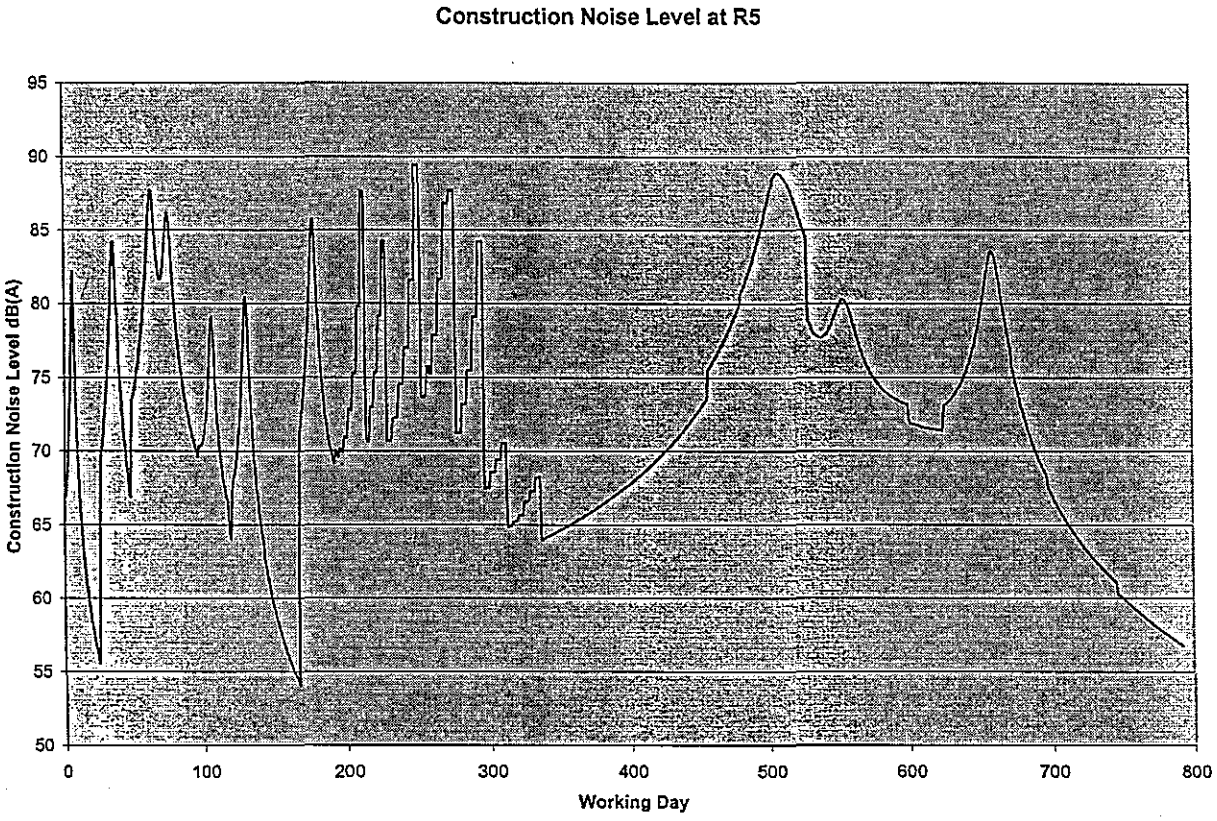
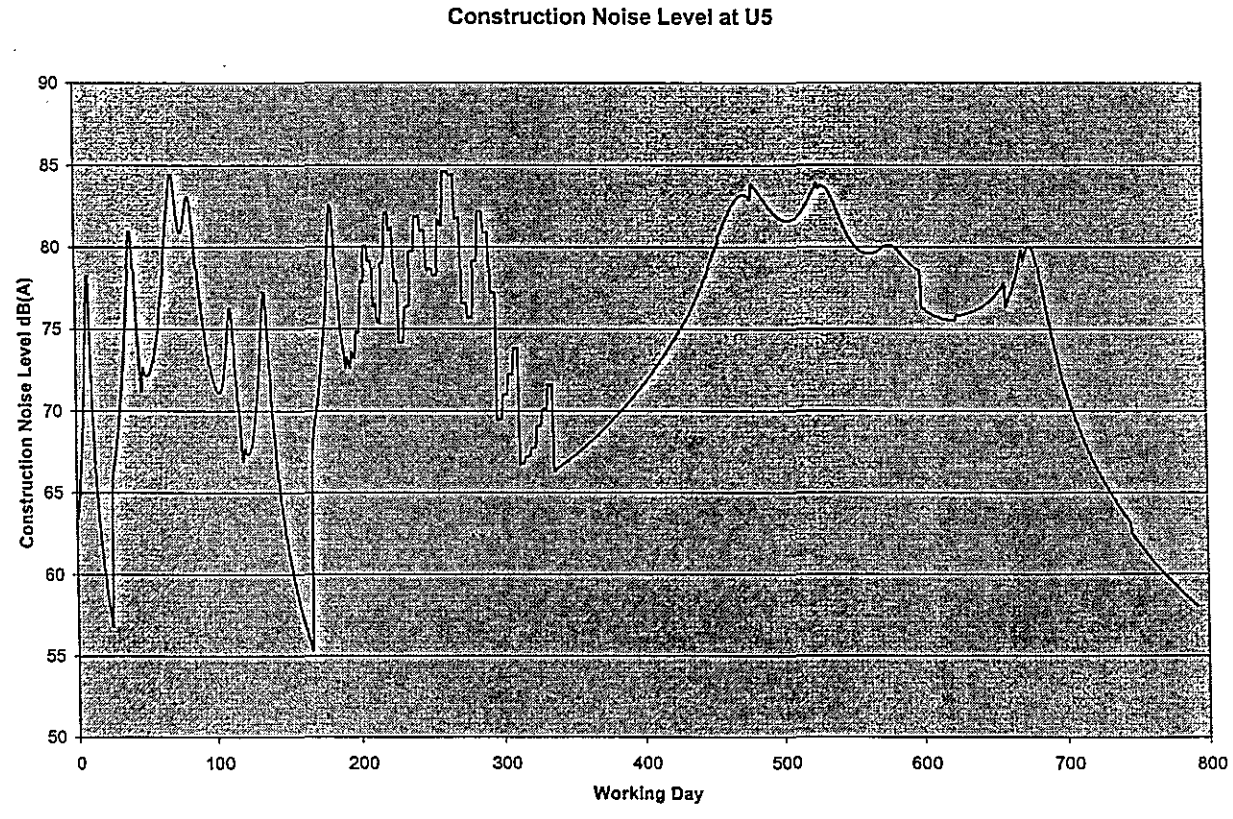


Figure 3-4 Unmitigated Construction Noise Impact at R5 & U5





3.8 Mitigation Measures

It is obvious from the previous section that all unmitigated noise impact will likely exceed the noise criterion for non-restricted hours at most of the NSRs selected.

Judging from the exceedance of noise in the range of 1 to 17 dB(A) at some of the NSRs, mitigation at source should be the most effective way to reduce the impact. There are 3 ways in doing that viz. : -

1. by use of quiet plants and working methods to mitigate at source;
2. by use of mobile noise barriers along the path of noise propagation;
3. by good site practice to limit noise emissions at source;

3.8.1 Use of Quiet Plants and Working Methods

Silenced plants are models that are quieter than those noise levels given in TM1 for the same piece of equipment. Examples of sound power levels (SWL) for specific silenced PME, which are known to be available, are given below : -

Table 3-6 Noise Attenuation Achievable at Source by Using Silenced PME

PME	SWL of silenced PME	Reduction in SWL as compared to values given in TM1
Bored Piling Rig	110 dB(A) max	-5
Dump Truck	110 dB(A) max	-7
Excavator	105 dB(A) max	-7
Mobile Crane	105 dB(A) max	-7
Poker	110 dB(A) max	-3

These silenced equipment are available in Hong Kong and has to be validated and demonstrated to EPD when a construction noise permit is applied. The reduced SWL is attributed to better noise insulation and machine design and does not necessarily imply sacrifice in machine capacity.

To make it enforceable, the above mitigation measures will have to be implemented by making them a requirement in the works contract

3.8.2 Mobile Noise Barriers

Mobile noise barriers can be effective in screening noise from reaching sensitive receivers, particularly for the low level sensitive uses in this case. 3m high mobile barriers with skid footing and a small cantilevered upper portion can be located within a few meters of stationary plants and within about 5m of more mobile plant such as bulldozers and excavators etc. Length of the barriers should be about 3 times that of the PME in order to be effective.

Based on the NSR heights and the site geometry in this case, it is estimated that barriers can achieve a noise reduction of 5 dB(A). The noise screening benefit applied for each plant in this assessment includes : -

- mobile crane
- bored piling machine
- bulldozer
- Concrete Mixer Truck
- excavator
- road roller and asphalt paver.

Together with the 5 dB(A) attenuation achievable by use of noise barrier for low-rise NSRs, it is envisaged that a combination of use of quiet plants and mobile noise barriers can achieve a net reduction of noise level of some 8 - 15 dB(A) and should help the level of noise exceedance estimated in Section 3.7.

3.8.3 Good Site Practice

Good site practice and noise management can significantly reduce the impact of a construction site's activities on nearby NSRs. Although the reduction in noise level is not readily predictable and quantified, the following measures should be useful during each phase of construction : -

- only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme;
- machines that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;
- silencer and mufflers on construction equipment should be utilised and should be properly maintained during the construction programme;
- noisy activities can be scheduled to minimise exposure of nearby NSRs to high levels of construction noise. For example, noisy activities can be scheduled for midday or at times coinciding with periods of high background noise (such as during peak traffic hours);
- mobile plant should be sited as far away from NSRs as possible; and
- material stockpiles and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities.

The effectiveness of the above-mentioned practice are difficult to quantify. Whilst they would provide some attenuation, they cannot be assumed to guarantee a significant level of noise reduction.

3.9 The Mitigated Impact

The mitigated impacts resulting from use of quiet plants and mobile barriers are shown in Figure 3-5 to Figure 3-7.

The range of noise exceedance and % of time exceeded are summarised in the following table.

Table 3-7 Range of Exceedance in the Predicted Mitigated Construction Noise Level above the Daytime Noise Criterion of 75 dB(A)

NSRs	Range of exceedance in construction noise level, dB(A) above the daytime criterion	% of time (working days) with noise exceedance
B1	0	0 %
P2	1 - 8	14.9 %
S1	1 - 2	9.3 %
U3	1 - 3	9.5 %
R5	1 - 6	11.2 %
U5	1 - 2	7.6 %

It is obvious from the above that the use of quiet plants and mobile barriers can significantly lower the noise impact at all NSRs. The percentage of time with noise exceedance would be much reduced. The exceedance will be in the range of 1 to 8 dB(A) but only for a very short period of time - 0 to 14.9 % of 792 working days (approx.).

3.10 Conclusion

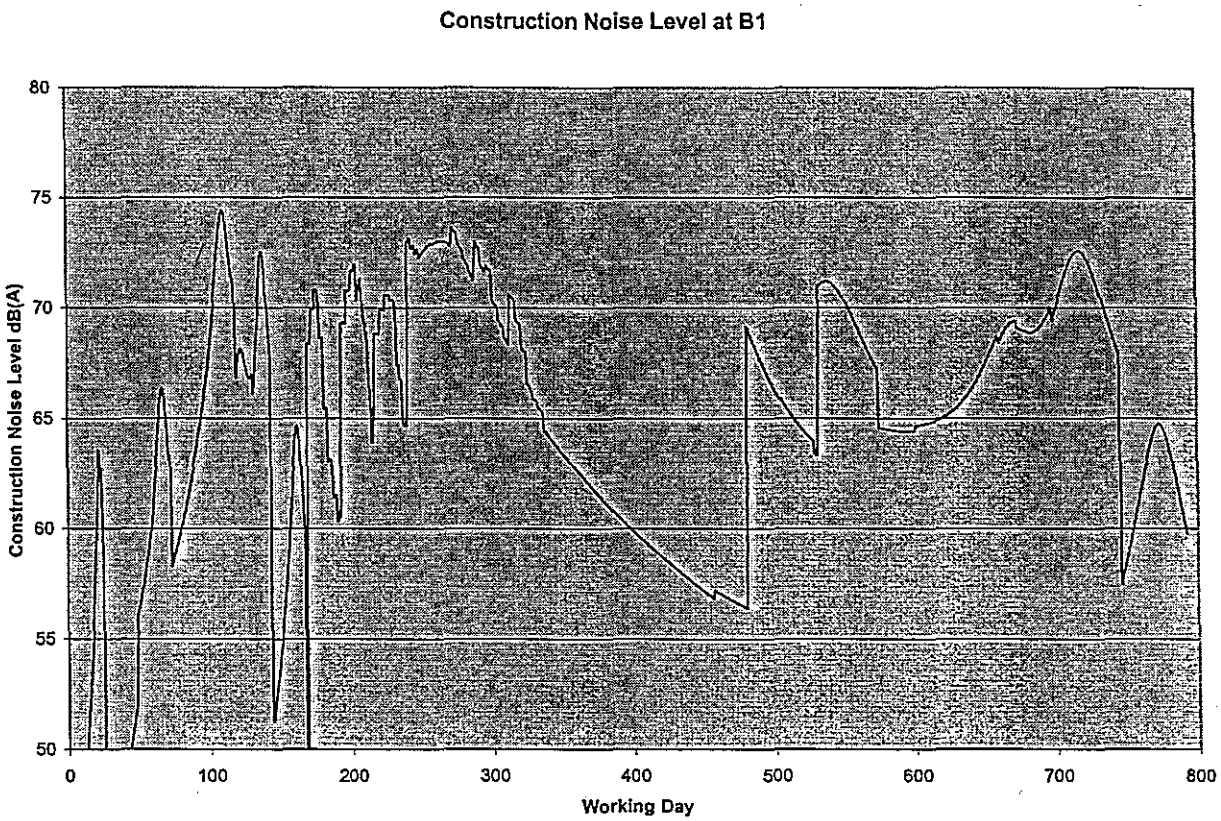
The potential impact of construction noise has been conservatively predicted with assumptions of a typical construction schedule and combinations of powered mechanical equipment. Whilst the contractor may prefer to use different types and numbers of plant, the above assessment is based on the most likely working methods and is considered realistic.

The assessment has predicted that the unmitigated noise impact at most of the NSRs could exceed the maximum guideline level of 75 dB(A) during the non-restricted hours by 1-17 dB(A) for a period less than 53 % of the whole working period (792 working days). This is particularly the case when there is construction works being carried out in front of the sensitive receivers. Obviously, it can be implied that it would almost be impossible to carry out the works during the restricted hours.

Some sorts of mitigation measures have been recommended, including the use of quiet plants and erection of mobile noise barrier close to the plants. The impacts then predicted are likely to reduce to 0-8 dB(A) of noise exceedance at some of the sensitive uses for short period of time - 0-14.9 % of whole working period.

As such, construction noise impact is generally surmountable and should not be a concern to all those sensitive uses that are already noise insulated.

Figure 3-5 Mitigated Construction Noise Impact at B1 & P2



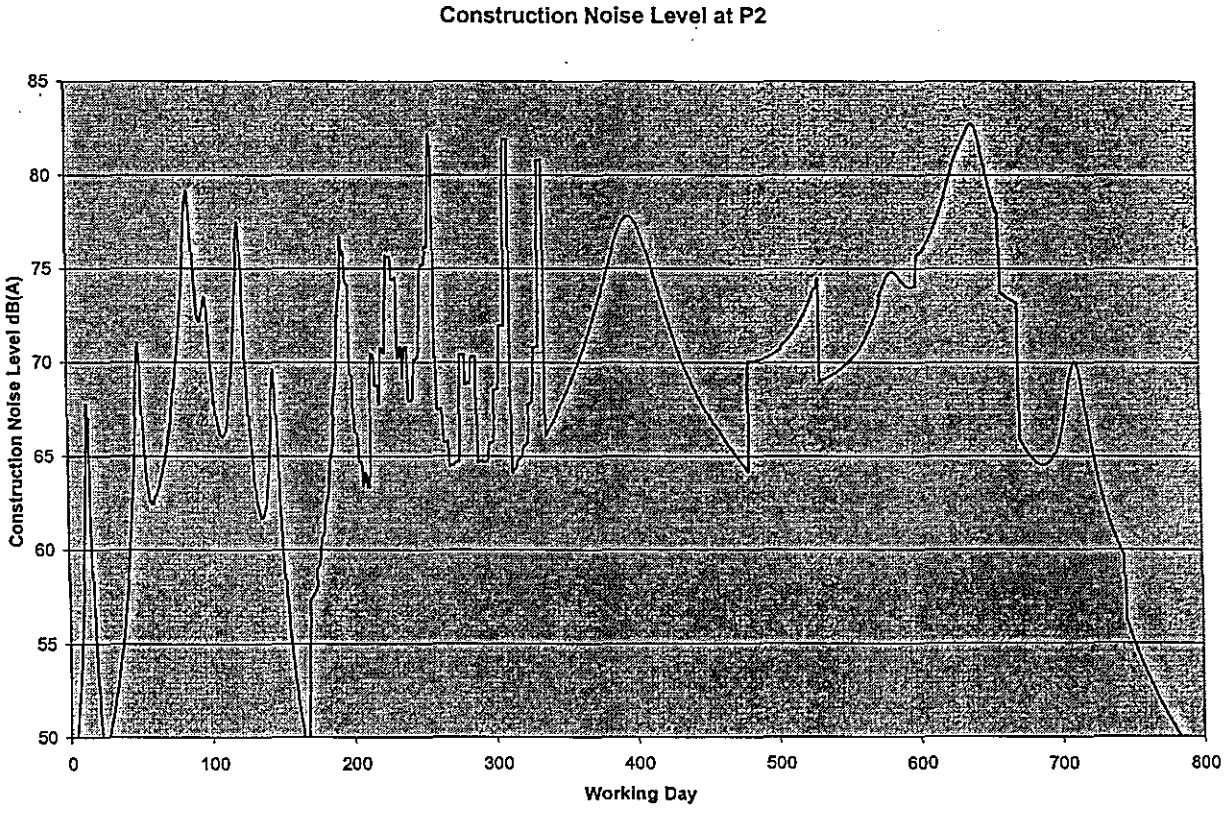
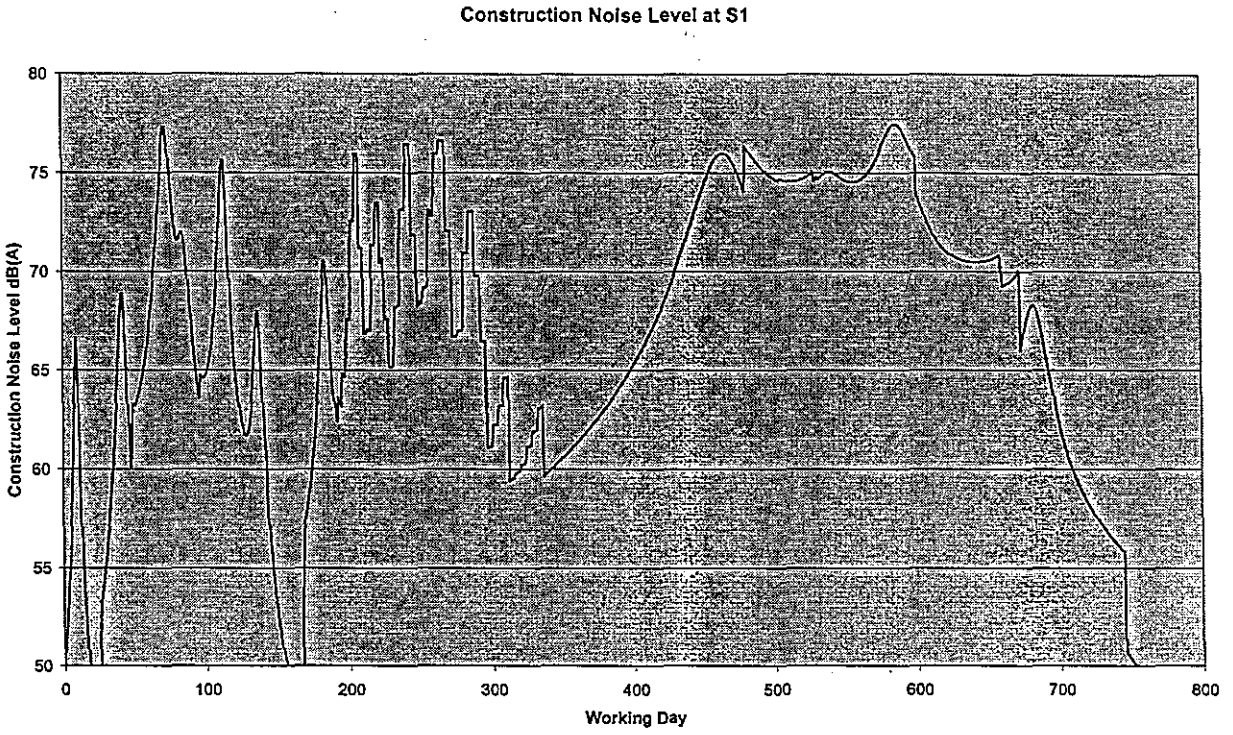


Figure 3-6 Mitigated Construction Noise Impact at S1 & U3



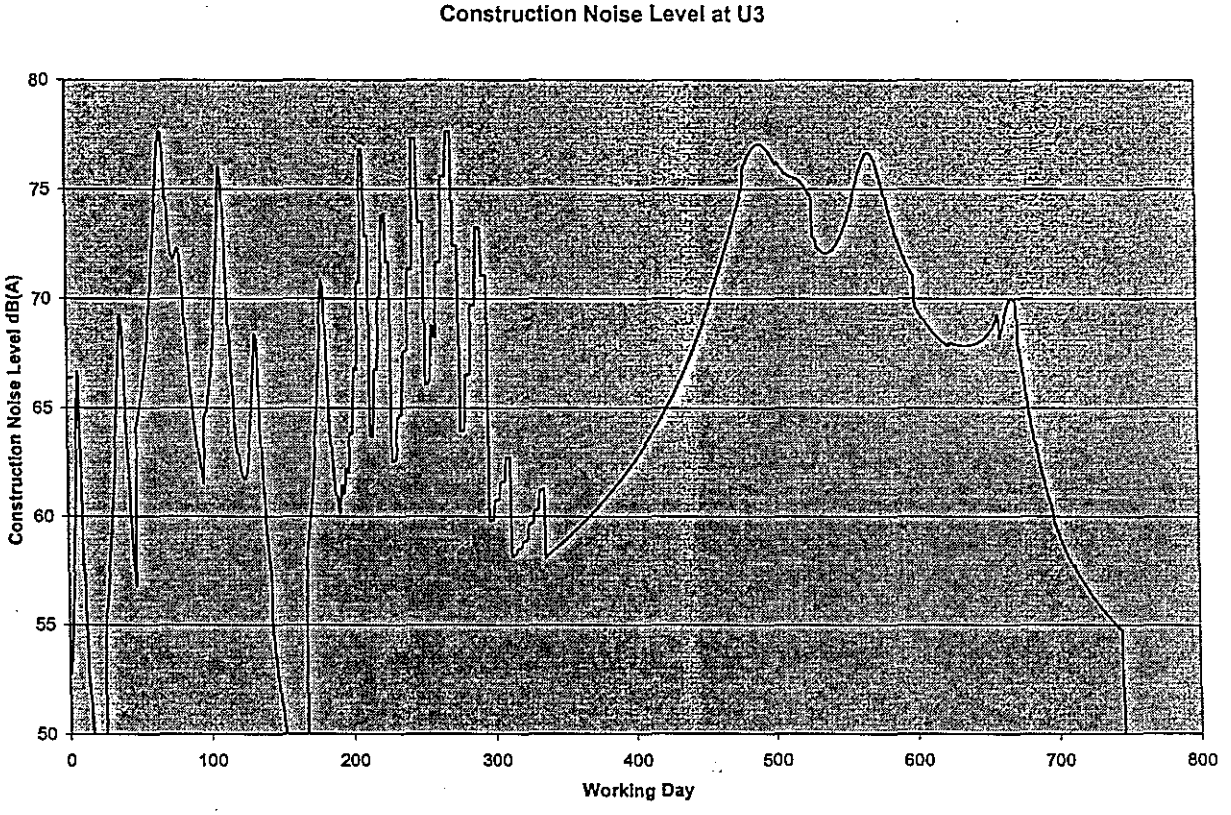
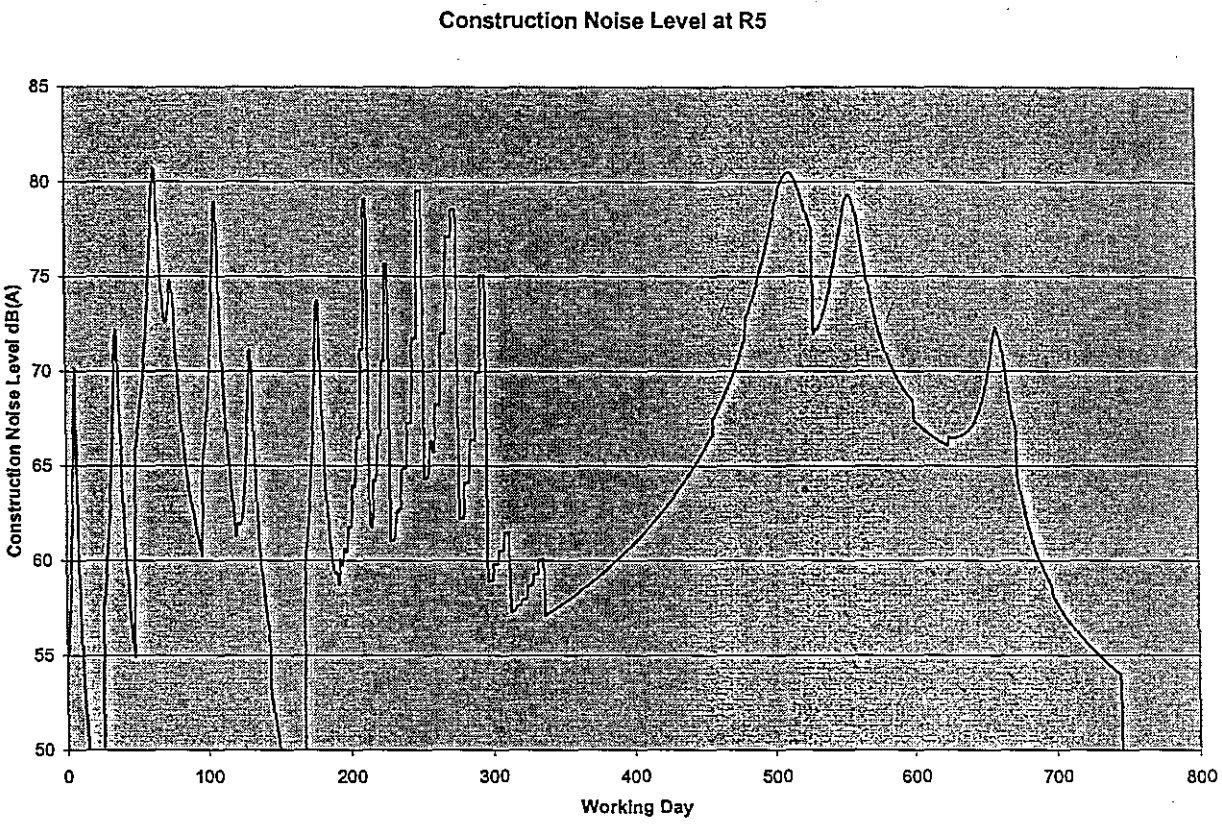
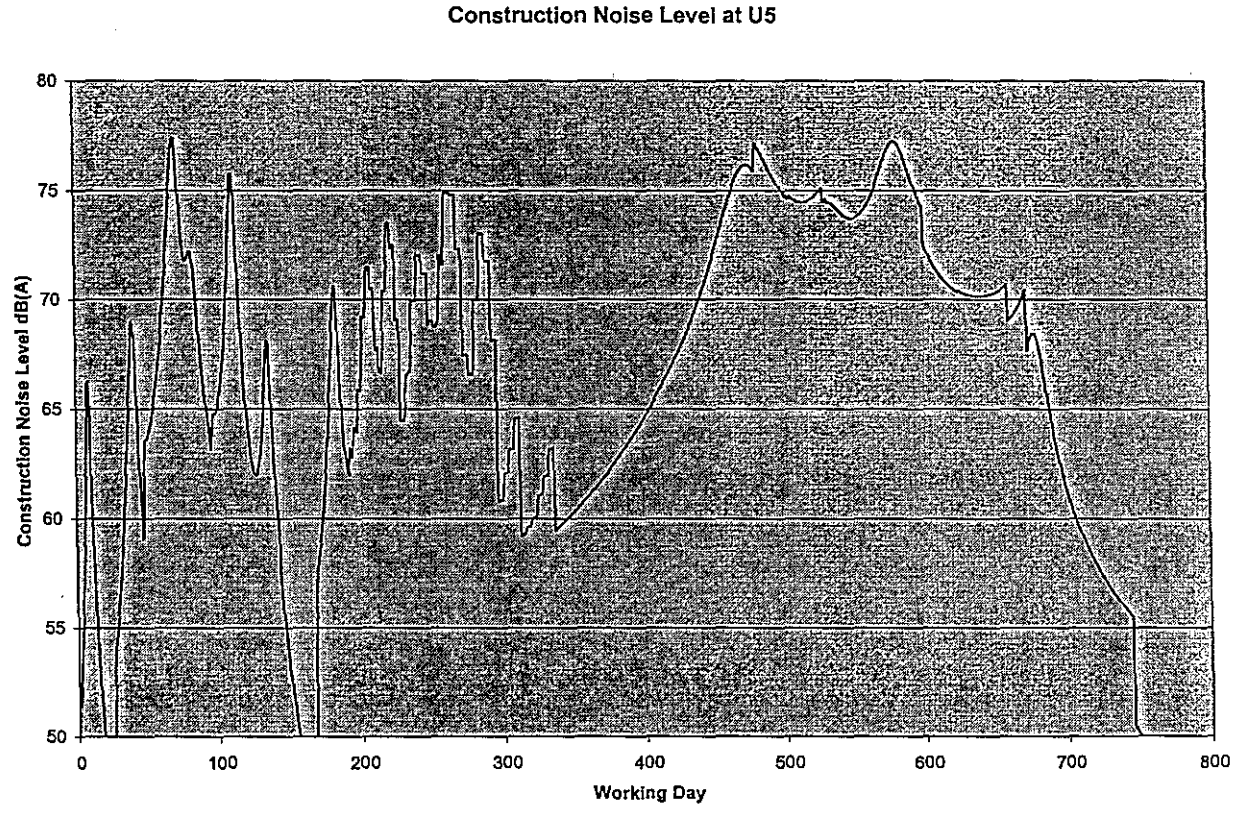


Figure 3-7 Mitigated Construction Noise Impact at R5 & U5





4. AIR QUALITY IMPACT DURING THE CONSTRUCTION PHASE

4.1 Introduction

Air quality in the vicinity of Flyover and Footbridge Scheme is likely to be affected by construction works which involve some dusty activities. Areas on both sides of the Project would be the immediate air sensitive receivers.

In the absence of a concrete construction schedule and equipment lists for the intended road works, assessment of the dust impact has been based upon reasonably assumed construction activities and schedules which are in line with the existing practices but with due consideration of the local situation and constraints.

It is worth pointing out that achieving the Air Quality Objectives (AQO) for fugitive dust (TSP) and the maximum 1-hour guideline level shall be the responsibility of the prospective contractor undertaking the construction works. This assessment only serves to predict the worst situation that might end up with construction activities of the Project and to avoid late focus on the issue.

4.2 Legislation and Air Quality Objectives (AQO)

The main item of legislation relevant to air pollution from construction sites is the Air Pollution Control Ordinance Cap. 311. In addition, the Air Pollution Control Order 1986 (Air Control Zones, Declaration) Air Control Objectives is relevant. Under these regulation, the Air Quality Objectives for dust or Total Suspended Particulates (TSP) and Respirable Suspended Particulates (RSP) are specified. Besides, EPD has adopted an acceptable maximum hourly level of TSP to be 500 $\mu g/m^3$ for major construction projects.

Relevant Air Quality Objectives (AQO) for RSP and TSP have been extracted from Chapter 9, "Environment", of the Hong Kong Planning Standards and Guidelines (HKPSG) as below : -

Table 4-1 Air Quality Objectives

Pollutant	Pollutants concentration in $\mu g/m^3$			
	Averaging Time			
	1 hour (i)	8 hours (ii)	24 hours (ii)	1 year (iii)
TSP	N.A.	N.A.	260	80
RSP	N.A.	N.A.	180	55

(i) Not to be exceeded more than 3 times per year

(ii) Not to be exceeded more than once per year

(iii) Arithmetic means

N.B. concentrations are measured at 298 K and 101.325 kPa (one atmospheric pressure)

For the present case in question, TSP has been predicted and compared with the maximum hourly guideline level and the respective AQO for the 24-hour averaging period.

4.3 Ambient Air Quality

The ambient air quality in the area is typical of an urban area which is dominated by vehicular emissions. There is no industry or other substantial construction activity taking place in the vicinity that would affect the air quality there.

Air quality data recorded at the Sham Shui Po air quality monitoring station are considered representative of the study area and are therefore taken as the background level for estimation of the cumulative impacts.

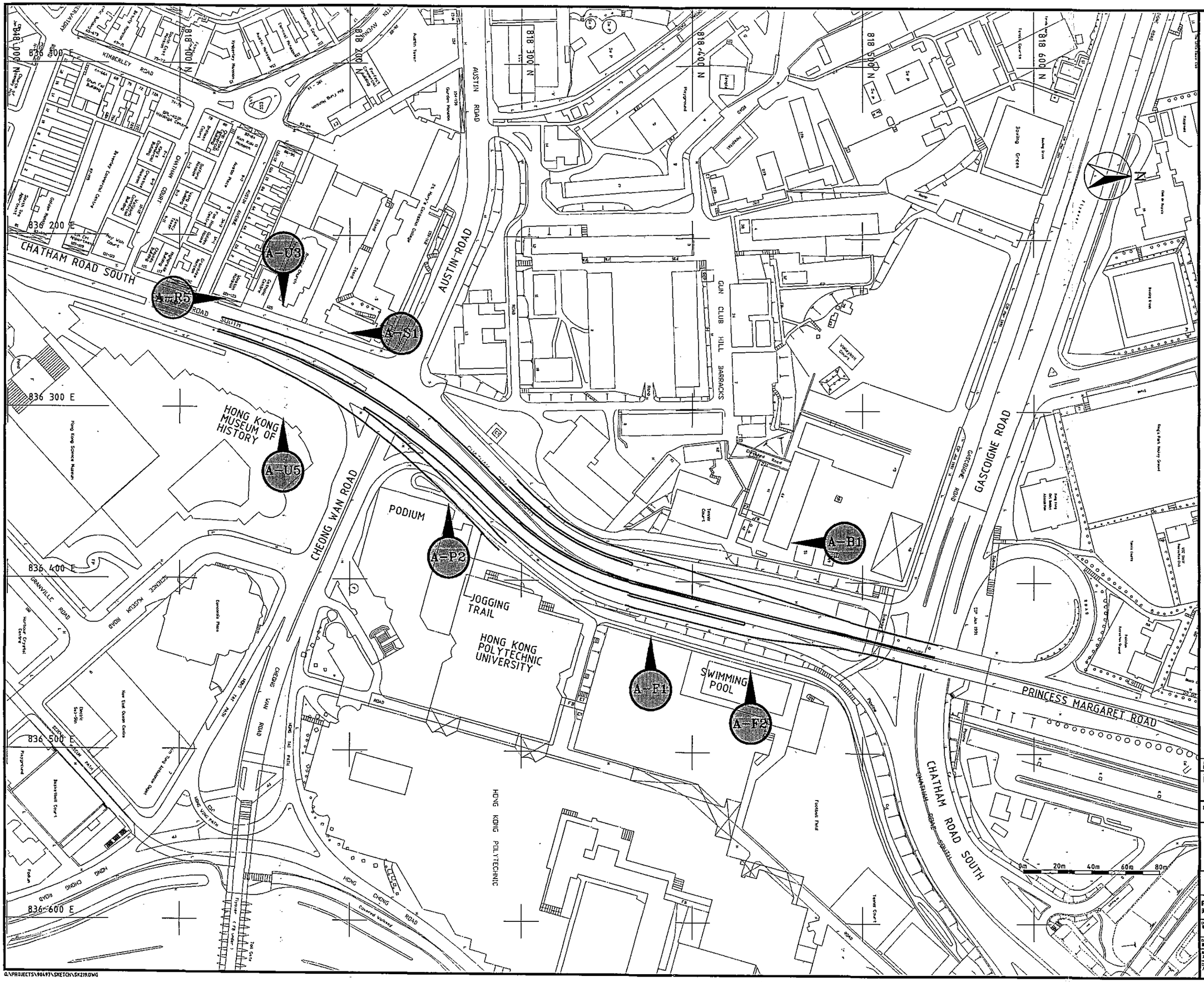
From EPD's publication - "Air Quality in Hong Kong, 1996", the annual average TSP concentration for Sham Shui Po has been recorded as 101 $\mu g/m^3$. This will be used as ambient level for the study area.

4.4 Air Sensitive Receivers

A total of 8 nos. of representative air sensitive receivers (ASRs) have been chosen as shown in Figure 4-1 and tabulated in Table 4-2 to represent the most affected locations of interest. All ASRs have been taken at 1.5 m above the floor of each storey.

Table 4-2 ASR for Fugitive Dust Impact Assessment

ASR	Description	Representative floors	Representative floors, mPD
A-B1	Gun Club Hill Barracks - Quarters	1/F / 2F / 3F (G/F is workshop)	10.5 / 13.5 / 16.5
A-F2	HKPU - Swimming pool	ground level (active)	4.8
A-F1	HKPU - Shaw Sports Complex	Roof - Tennis Court (active)	24.6
A-P2	HKPU - Phase 3A, Chung Sze Yuen Building	Podium (passive)	12.0
A-S1	St. Mary's Canossian College	GF / 1F / 2F	4.3 / 8.8 / 12.3
A-U3	Rosary Church	G/F	4.3
A-R5	Winston Mansion - one of the commercial/residential blocks along Chatham Road South	2F, 3F, 4F (residential)	11.3, 14.3, 17.3
A-U5	Hong Kong Museum of History	GF (A/C air intake)	5.3



REV.	DESCRIPTION	DES.	CHECKED	APPROVED	DATE

Highways Department
Kowloon Region

FLYOVER AND FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD CHATHAM ROAD AND CHEONG WAN ROAD - FEASIBILITY STUDY

LOCATION OF SELECTED ASRs FOR FUGITIVE DUST IMPACT ASSESSMENT

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

FIGURE NO. 圖形編號 4.1

DESIGNED BY 設計	CONTRACT NO. 合約編號	DATE OF ISSUE 發出日期
DRAWN BY 繪圖 TAM	STATUS 狀況 ASR	
SCALE 比例 1:2000		
DIMENSIONS ARE IN 尺寸單位 MILLIMETRES		

Q:\PROJECTS\906497\SKETCH\SK219.DWG

4.5 Potential Sources of Impact

The likely air quality impacts arising from the Project will be related to dust nuisance, and gaseous emissions from construction plants and vehicles. SO_2 and NO_2 will be emitted from the diesel-powered equipment used, but the amount of such emissions would be limited and will unlikely to breach the AQO. The major air quality impact during the construction phase of the Project would therefore be contributed from various dust-generating activities.

4.6 Potential Sources of Fugitive Dust Emission

The impact of fugitive dust on air sensitive receivers depends primarily on the drift distance of dust particles which are in turn governed by the initial injection height, the terminal settling velocity, atmospheric turbulence and settling rates of the particulates under both calm and windy conditions.

Particles with size greater than 30 μm tend to settle out within a few meters of the source under typical wind conditions; smaller particles have much slower rates of settling, and are therefore more readily affected by wind turbulence.

With reference to the assumed construction activities given in Table 3-3 of Section 3.4, the major dust emitting processes during the various construction stages are expected to come from the following main processes : -

- excavation/ earthworks for road alignment and site formation;
- vehicle movement on unpaved haul roads on site; and
- material handling.

Excavation and Earthworks

As the site topography will be generally maintained, large scale excavations or earthworks would be unnecessary. It is assumed that only the first 0.5m of the existing carriageway along the proposed flyover alignment will need to be excavated and formed.

Vehicles Movement over Site Roads

Dust generation from vehicular movement in the works area could be a concern. The emission factor for dust emission may be highly variable, but determining factors include vehicle speed and weight, surface silt loading, moisture content, etc.

Material Handling

Excavated materials or spoil have to be removed from the construction site by dump trucks for disposal and hence considerable dust emissions could result during the loading and unloading of friable debris.

Because of the need to minimise construction noise impact on the surroundings, the working hours will be restricted to 0700 to 1900 hours only. Therefore the impact of fugitive dust has been predicted in this period only.

4.7 Assessment Methodology

4.7.1 General

Numerical modelling has been employed to predict the level of fugitive dust at the selected ASRs. The short-term impact viz., the hourly averaged values and the 24-hour averages will be predicted and superimposed onto the background level of TSP given in Section 4.3.

4.7.2 Fugitive Dust Model (FDM)

The dispersion of dust from the road widening works will be studied and modelled using the computer software *"Fugitive Dust Model (FDM)"* developed by Trinity Consultants Inc. The model is based on the principle of Gaussian dispersion and is widely recognised by HKEPD and USEPA for that purpose The model is designed to predict fugitive dust concentration from point, area, and volume sources. In this case, dust emissions from excavation and material handling will be modelled as point sources, whilst dust generation from vehicular movement on access roads will be considered as line sources.

4.7.3 The Emission Factors

As mentioned in Section 4.6, the following dominating dusty processes will be modelled : -

- excavation/ earthworks for road alignment and site formation;
- vehicle movement on unpaved haul roads on site; and
- material handling.

Relevant or comparable emission factors for these activities have been adapted from the USEPA AP-42 Compilation of Air Pollutant Emissions Factors[3] will be used. Detailed derivation of dust emission rates for the construction works are given in Appendix II.

4.7.4 Particle Size Distribution

The potential drift distance of dust particulate is governed by the emission height, the degree of atmospheric turbulence and the particulate terminal settling velocity which depend on the particle size.

It will be assumed that 80% of particulates are of size equal to 30 μm and the remaining 20% are respirable with size less than 10 μm. Average dust density of 2500 kg/m^3 will be assumed in the prediction.

4.7.5 Meteorological Data

The level of emission depends upon the way in which the nature and location of the emission sources interacts with a number of key meteorological elements such as wind speed and direction, temperature, rainfall, Pasquill stability classes, and cloud cover etc. With increasing wind speeds, emitted pollutants are mixed to a greater extent with the ambient air, leading to higher dilution. However, higher wind speed coupled with ground surface turbulence can increase the rate of dust generated from various processes.

[3]"Compilation of Air Pollutant Emission Factors - Volume 1: Stationary Point and Area Sources" AP-42 Fourth Edition, US Environmental Protection Agency, Office of Air Quality Planning and Standards. September 1985.

Apart from the mixing heights, hourly meteorological data (year 1996) from the Hong Kong Observatory Headquarter's Weather Station has been used in the modelling. Parameters used included : -

- hourly wind direction;
- hourly wind speed with minimum assumed as 1m/s;
- hourly Pasquill stability class (A to F);
- hourly ambient air temperature (K); and
- morning and afternoon daily mixing height (m) at Hong Kong Observatory Weather Station.

The workings hours will be scheduled within the period of 0700 - 1900 hours only so as to minimise the impact of construction noise - another constraint. To restrict the calculation of dust impact within the period of 0700 - 1900, meteorological data outside that period have been trimmed to suppress the calculation.

4.8 Results

4.8.1 The Predicted Impacts

The unmitigated (cumulative, with background concentrations) highest level of TSP at the selected ASRs have been predicted and given in Table 4-3 below.

Table 4-3 Unmitigated (Cumulative) TSP Level Predicted at the Selected ASRs, μg/m³

ASRs	Concentration of TSP (μg/m³)	
	1-hr Average	24-hr Average
A-B1-1/F	257	123
A-B1-2/F	470	137
A-B1-3/F	156	112
A-F2	290	164
A-F1	112	103
A-P2	351	147
A-S1-G/F	685	178
A-S1-1/F	248	137
A-S1-2/F	141	111
A-U3	526	177
A-R5-2/F	151	111
A-R5-3/F	134	106
A-R5-4/F	123	104
A-U5	636	173

The predicted hourly dust levels at the ASRs range from 112 μg/m³ to 685 μg/m³. The 1-hour TSP criteria will be exceeded at A-S1-G/F, A-U3 and A-U5 only because the ASR is close to the dust emission level. Mitigation measures are therefore necessary to reduce the dust emission at source. However, compliance with the AQO (24-average) is expected at all sensitive uses.

4.9 Mitigation Measures

If the construction work is likely to cause unacceptable dust impact on the selected ASRs, dust mitigation measures will be implemented to alleviate the impact. The following dust control measures will usually be adopted as good construction practice to minimise dust nuisance.

- frequent watering for particularly dusty construction areas;
- side enclosure and covering where practicable of any aggregate or other dusty material storage piles to reduce emissions;
- all dusty vehicle loads transported to, from and between site locations will be covered by tarpaulin sheets;
- establishment and use of vehicle wheel and body washing stations at exit points of site and public roads, combined with cleaning of public roads where necessary and practical;
- where practicable, routing of vehicles and positioning of dust generating construction plant at maximum possible separation distances from ASRs;
- use of regular watering, with complete coverage, in dry periods to reduce dust emissions from unpaved roads;
- imposition speed limits of 5km/hr for vehicles on access roads; and
- instigation of a programme to monitor the construction process in order to enforce controls and modify methods of work if dusty conditions arise.

With a proper control system, dust emission of material handling and drilling could be reduced by 70%, as stated in US EPA AP-42. Assuming a smaller dust control efficiency of 60% for the effective dust control measures recommended above, the dust levels at the worst impacted ASRs will be substantially reduced and should be able to comply with the relevant AQO. Table 4-4 presents the mitigated hourly and 24-hour averages at the affected ASRs.

Table 4-4 Mitigated (cumulative) TSP Level predicted at the selected ASR, $\mu g/m^3$

ASRs	Concentration of TSP ($\mu g/m^3$)	
	1-hr Average	24-hr Average
A-S1-G/F	434	142
A-U3	344	142
A-U5	408	139

It can be seen that the mitigated dust levels at the ASRs could be considerably reduced and will comply with the dust criteria.

4.10 Conclusion

A quantitative assessment of the likely fugitive dust impact arising from construction of the Flyover and Footbridge Scheme has been completed and revealed impacts with no exceedance of the relevant Air Quality Objectives (24-hour average) and the 1-hour guideline level when suitable dust suppression measures have been implemented.

5. TRAFFIC NOISE IMPACT DURING THE OPERATIONAL PHASE

5.1 Introduction

This section addresses the impact of traffic noise expected during the operational phase of the proposed Flyover and Footbridge Scheme as shown in Figure 2-3.

Scenarios in year 2000 (immediately prior to construction of the Project) and year 2018 (15 years after commissioning in 2003) have been compared. The do-nothing scenario in Year 2018 (i.e. without the Project) has also been explored to see the difference.

Direct noise mitigation measures have been recommended to alleviate the impact on surrounding sensitive uses. Only if direct mitigation measures fail to fully mitigate the impact, the remaining affected dwellings will be checked if they are eligible for noise insulation under the relevant ExCo directive.

5.2 The Study Area

The study area shown in Figure 2-1 embraces all noise sensitive uses within 300m on either side of the proposed Flyover and Footbridge Scheme and from both ends. Representative noise sensitive uses have been selected in the Study Area and quantitatively assessed to evaluate the impact.

5.3 General Approach and Methodology

Prediction of road traffic noise has been done in accordance with the U.K. Department of Transport's procedure "Calculation of Road Traffic Noise" at representative NSRs selected within the study area in Figure 2-1.

Scenarios considered include :-

- noise impact in Year 2000 before construction of the Project;
- noise impact in 2018 without the Project;
- unmitigated noise impact in 2018 with the Project;
- mitigated noise impact in 2018 with the Project;

In accordance with Clause 6.3.5.2.1 of the Brief, the scenario in Year 2018, which has the maximum traffic projection within the 15 years period upon commencement of operation of the proposed Flyover in 2003, has been assessed and compared. The do-nothing scenario in Year 2018 (i.e. without the Project) has also been studied.

Traffic noise impact has been assessed and compared to the noise criteria recommended in the HKPSG as tabulated below : -

Table 5-1 Road Traffic Noise Criteria (HKPSG)

Sensitive Uses	Noise Criteria, L_{10} (1-hr) dB(A)
All domestic premises including temporary housing accommodation	70
Education institutions including kindergartens and nurseries	65

N.B. The above noise criteria apply to uses which rely on opened windows for ventilation and to be viewed as the maximum permissible noise levels at the external facade. (Source : HKPSG Table 4-1.)

These noise criteria have been used as the target level above which the impact is considered significant and warrants practicable direct noise mitigation measures be implemented to alleviate the impact. Only when reasonable and practicable direct mitigation measures are exhausted, the residual impacts will then be assessed to see if the affected uses entitle noise insulation as a last resort.

The criteria for eligibility for noise insulation as a result of new roads built in the vicinity are as below: -

1. the predicted overall noise level from the 'new road' together with other traffic noise sources in the vicinity must be above 70 dB(A) L_{10} (peak hour) (i.e. the 2018 unmitigated scenario in this case), and
2. the predicted overall noise level shall be at least 1.0 dB(A) more than the prevailing traffic noise level at the time before the road works begin. (i.e. 2018 post-project scenario vs. 2000 baseline scenario), and
3. the contribution to the increase in the predicted overall noise level from the 'new road' must be at least 1.0 dB(A). (i.e. 2018 noise impact from Flyover and Footbridge Scheme plus existing roads vs. 2018 noise impact due to existing roads only)

Eligible ones will have to be presented to ExCo for consideration under the ExCo directive "Equitable Redress for Persons Exposed to Increase Noise resulting from the use of New Roads."

5.4 Noise Sensitive Receivers

In accordance with the definitions given in the HKPSG for noise sensitive uses, a number of representative noise sensitive receivers (NSR) have been identified in the Study Area for this assessment. They include : -

- Quarters of the Gun Club Hill Barracks;
- St. Mary's Canossian College;
- Rosary Church;
- Winston Mansion, May Wah Court and Golden Mansion - commercial/ residential blocks along Chatham Road South.

Although the Hong Kong Polytechnic University and the Hong Kong Museum of History are also noise sensitive, the HKPSG noise criteria are not applicable to them as they do not rely on opened windows for ventilation.

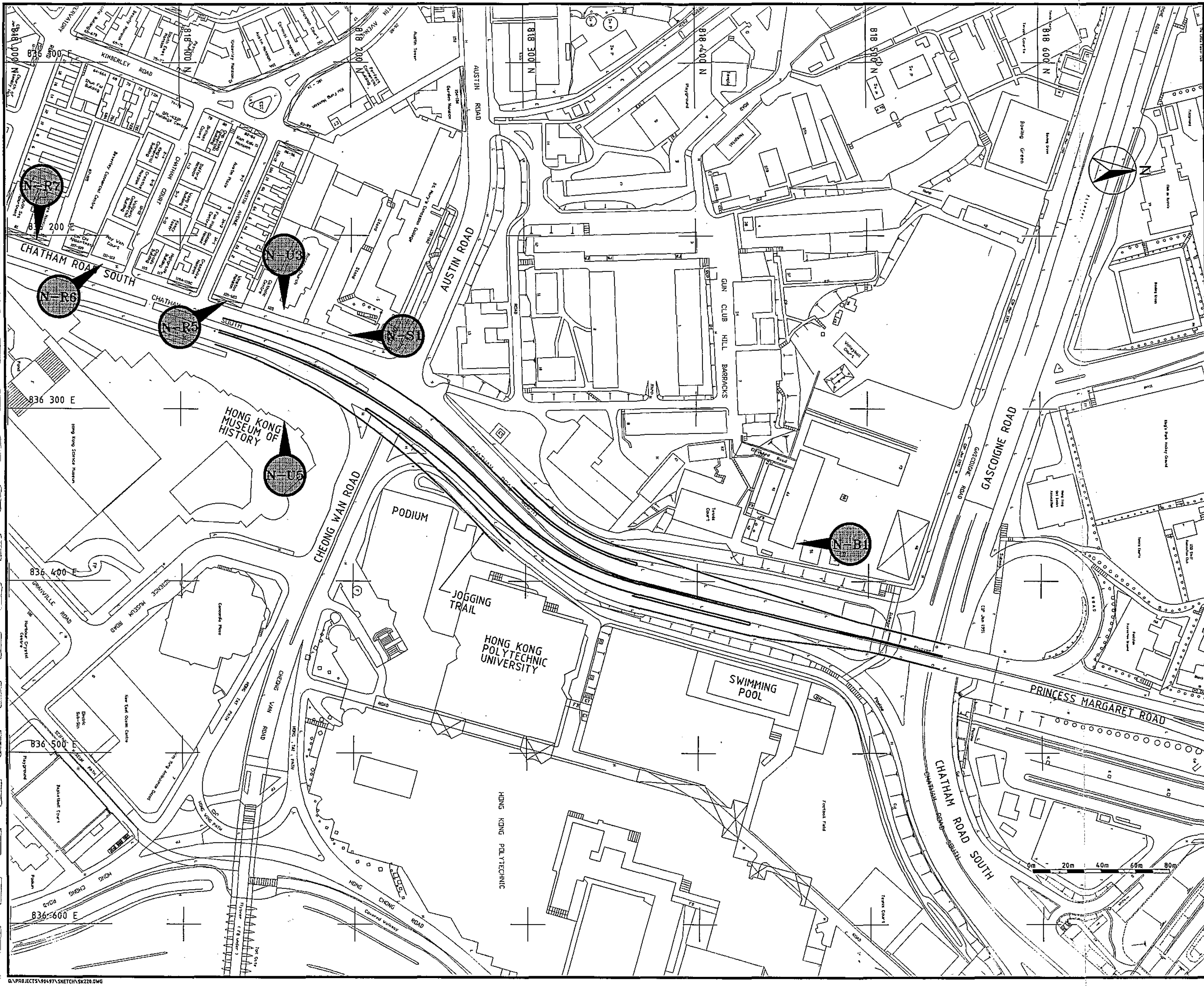
Locations of the selected noise sensitive receivers are shown in Figure 5-1.

Assessment points are taken at 1.2 m above the floors of each storey and 1m away from facades of openable windows. Table 5-2 below shows the information pertaining to the selected NSRs.

Table 5-2 Selected Noise Sensitive Receivers for Noise Prediction

NSR	Description	Representative floors	Representative floors, mPD	Noise Criteria
B1	Gun Club Hill Barracks - Quarters	1/F - 5/F	10.5 to 22.5 at interval of 3.0	70
R5	Winston Mansion	2/F - 16/F, residential uses	11.3 to 53.3 at interval of 3.0	70
R6	May Wah Court	4/F - 16/F, residential uses	17.3 to 53.3 at interval of 3.0	70
R7	Golden Mansion	2/F - 14/F, residential uses	11.3 to 47.3 at interval of 3.0	70
S1	St. Mary's Canossian College	G/F, 1/F, 2/F	4.3 / 8.8 / 12.3	65
U3	Rosary Church	G/F	4.3	65*

* - Derived noise criteria based the nature of sensitive uses inside the building (not recommended in HKPSG explicitly)



Highways Department
Kowloon Region

FLYOVER AND FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD CHATHAM ROAD AND CHEONG WAN ROAD - FEASIBILITY STUDY

LOCATIONS OF REPRESENTATIVE NSRs SELECTED FOR TRAFFIC NOISE IMPACT ASSESSMENT

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

FIGURE NO. 圖號 5.1

DRAWN BY TAM
SCALE 1:2000
DIMENSIONS ARE IN MILLIMETRES

© COPYRIGHT RESERVED 版權所有

Q:\PROJECTS\90497\SKETCH\SK220.DWG

5.5 Features Considered and Assumptions made in the Noise Prediction

Inherent features that will contribute to reduction of noise impact has been considered and listed below : -

1. screening effect of 0.75m safety fence wall along the edges of flyover;
2. screening effect of the proposed Flyover to at grade roads;

5.6 Traffic Flows

In the noise prediction, relevant lengths of the roads were divided into segments. Details on the flow, allowed speed and % of heavy vehicles of these road segments were collected and tabulated as follows. Please refer to Table 5-3 to Table 5-5 for the road segments concerned.

Table 5-3 Road Characteristics (Year 2018 with Flyover and Footbridge Scheme)

Road segments	Total Flow (veh/h)	% of Heavy vehicles	Speed (kph)	Road surface
1.1	2855	15.9	70	Impervious
1.2	2855	15.9	70	Impervious
1.3	1430	22.2	70	Impervious
1.4	395	14.0	50	Impervious
1.5	460	15.4	50	Impervious
1.6	2460	15.9	70	Pervious
1.7	965	21.2	70	Pervious
1.8	580	20.7	50	Impervious
1.9	1550	22.2	70	Pervious
2.1 EB	5499	18.5	70	Impervious
2.1 WB	5958	21.3	70	Impervious
2.2 EB	7196	24.0	70	Impervious
2.2 WB	6868	24.0	70	Impervious
2.3	630	18.9	50	Impervious
2.4	1430	21.3	50	Impervious
2.5	395	14.0	50	Impervious
2.6	460	18.9	50	Impervious
2.7	580	21.2	50	Impervious
2.8	965	15.4	50	Impervious
2.9 EB	1120	16.5	50	Impervious
2.9 WB	2055	16.9	50	Impervious
2.10 EB	1740	21.9	50	Impervious
2.10 WB	1560	23.4	50	Impervious
2.11 NB	1500	33.6	50	Impervious
2.11 SB	1265	43.5	50	Impervious
2.12 NB	3960	26.2	50	Impervious
2.12 SB	2815	28.6	50	Impervious

Table 5-4 Road Characteristics (Year 2018 without Flyover and Footbridge Scheme)

Road segments	Total Flow (veh/h)	% of Heavy vehicles	Speed (kph)	Road surface
3.1	2855	15.9	70	Impervious
3.2	2855	15.9	70	Impervious
3.3	1430	22.2	70	Impervious
3.4 EB	5499	18.5	70	Impervious
3.4 WB	5958	21.3	70	Impervious
3.5 EB	7161	24.0	70	Impervious
3.5 WB	6868	24.0	70	Impervious
3.6	630	18.9	50	Impervious
3.7	1430	21.3	50	Impervious
3.8 EB	1120	16.5	50	Impervious
3.8 WB	2055	16.9	50	Impervious
3.9 NB	3485	26.2	50	Impervious
3.9 SB	2860	28.6	50	Impervious
3.10 EB	1740	21.9	50	Impervious
3.10 WB	1560	23.4	50	Impervious
3.11 NB	3960	26.2	50	Impervious
3.11 SB	2815	28.6	50	Impervious

Table 5-5 Road Characteristics (Year 2000 without Flyover and Footbridge Scheme)

Road segments	Total Flow (veh/h)	% of Heavy vehicles	Speed (kph)	Road surface
3.1	1079	10.7	70	Impervious
3.2	654	10.2	70	Impervious
3.3	1041	17.4	70	Impervious
3.4 EB	3743	21.8	70	Impervious
3.4 WB	4070	20.8	70	Impervious
3.5 EB	4733	22.1	70	Impervious
3.5 WB	4965	22.1	70	Impervious
3.6	182	16.6	50	Impervious
3.7	1038	21.3	50	Impervious
3.8 EB	685	14.1	50	Impervious
3.8 WB	1431	15.0	50	Impervious
3.9 NB	2211	9.7	50	Impervious
3.9 SB	1691	16.9	50	Impervious
3.10 EB	944	19.0	50	Impervious
3.10 WB	884	21.5	50	Impervious
3.11 NB	1339	21.4	50	Impervious
3.11 SB	1012	21.4	50	Impervious

These traffic flow figures were predicted by the project traffic consultant - MVA Asia Ltd. and has been agreed by the Transport Department. The relevant letter is given in Appendix III.

Figure 5-2 Road Sections on Flyover and those At Grade (With Flyover and Footbridge Scheme)

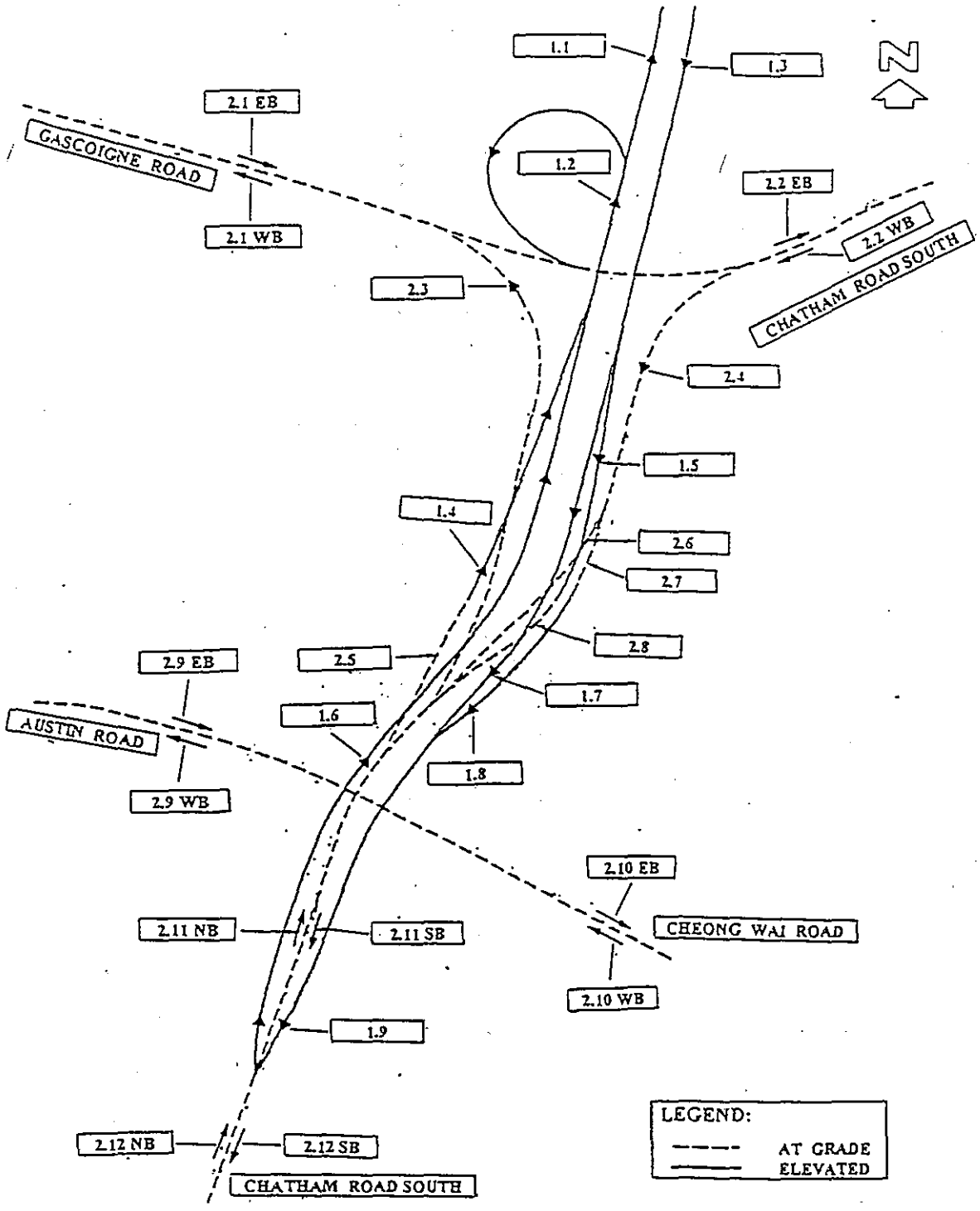
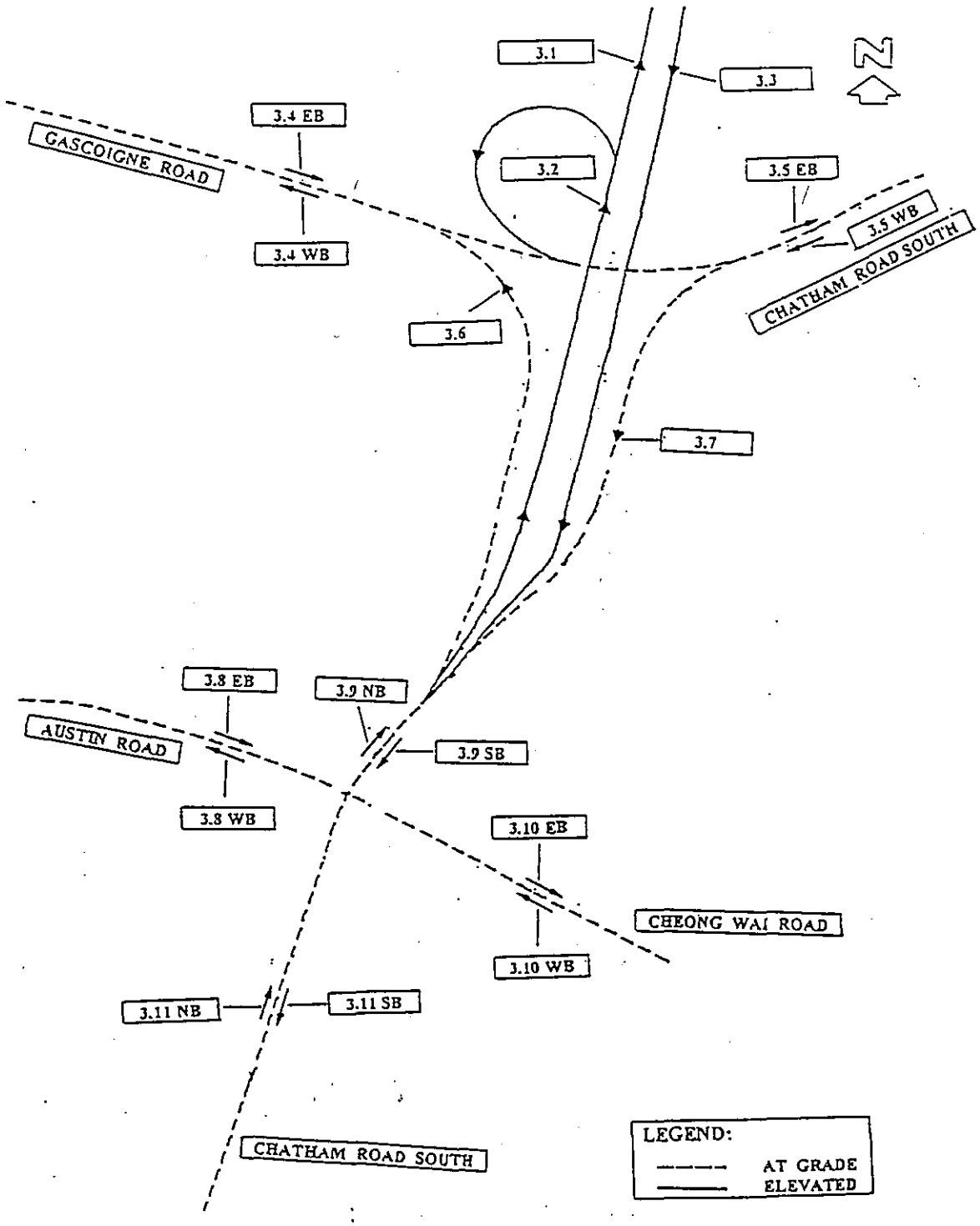


Figure 5-3 At-Grade Road Sections (Without Flyover and Footbridge Scheme)



5.7 Predicted Traffic Noise Impact

5.7.1 Comparison of Noise Impacts With and Without the Project

The predicted noise impacts are tabulated below: -

Table 5-6 Predicted Un-mitigated Traffic Noise Impact for Various Scenarios, dB(A)

Floor\ NSR	U3			S1			B1			R5		
	(i)	(ii)	(iii)	(i)	(ii)	(iii)	(i)	(ii)	(iii)	(i)	(ii)	(iii)
G/F	80	85	83	80	85	82	-	-	-	-	-	-
1F	- /	-	-	80	85	83	73	76	75	-	-	-
2F or P	-	-	-	80	85	83	76	79	77	81	86	86
3F	-	-	-	-	-	-	77	80	79	80	86	86
4F	-	-	-	-	-	-	77	80	79	80	85	83
5F	-	-	-	-	-	-	77	80	79	79	84	83
6F	-	-	-	-	-	-	-	-	-	78	84	82
7F	-	-	-	-	-	-	-	-	-	78	83	82
8F	-	-	-	-	-	-	-	-	-	78	83	81
9F	-	-	-	-	-	-	-	-	-	77	82	81
10F	-	-	-	-	-	-	-	-	-	77	82	81
11F	-	-	-	-	-	-	-	-	-	76	82	80
12F	-	-	-	-	-	-	-	-	-	76	81	80
13F	-	-	-	-	-	-	-	-	-	76	81	80
14F	-	-	-	-	-	-	-	-	-	76	81	80
15F	-	-	-	-	-	-	-	-	-	75	81	79
16F	-	-	-	-	-	-	-	-	-	75	80	79

where (i) denotes the impact in Year 2000 without the Project

(ii) denotes the un-mitigated impact in Year 2018 without the Project

(iii) denotes the un-mitigated impact in Year 2018 with the Project

It is obvious from the above that the noise impact in year 2018 (without scheme) will increase by 3 - 6 dB(A) above that in year 2000 (without scheme) due to natural growth of traffic in 18 years in that corridor.

With the proposed Flyover and Footbridge Scheme in place, the 2018 unmitigated impact will generally be 1 - 3 dB(A) lower than the 2018 without scheme scenario. This is because the flyover would divert part of the traffic from the at-grade roads and bring about noise reduction by providing partial screening to noise from the at-grade roads at some sensitive uses when compared with the do-nothing scenario.

In all cases, the noise levels are all above the noise criteria given in Table 5-1. Noise mitigation measures are obviously necessary to reduce the impact.

5.7.2 Relative Noise Contribution due to the Project in Year 2018

The relative contributions of noise impact from existing and new roads in 2018 that constitute the overall unmitigated impact are tabulated below: -

Table 5-7 The Predicted Un-mitigated Noise Impact at Various NSRs, dB(A)

	N-1/3			N-S1			N-S1			N-R5			N-R6			N-R7		
Floor	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
G/F	82.9	82.5	72.6	82.5	82.2	70.7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1/F	-	-	-	82.5	82.1	72.5	74.5	73.3	68.2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2/F	-	-	-	82.6	81.8	75.0	76.9	76.0	69.6	85.2	81.5	82.7	N/A	N/A	N/A	85.9	85.7	73.3
3/F	-	-	-	-	-	-	78.5	77.5	71.6	85.2	81.0	83.1	N/A	N/A	N/A	85.2	84.9	72.9
4/F	-	-	-	-	-	-	78.7	77.6	72.3	84.7	80.1	82.8	83.6	81.0	80.1	84.5	84.2	72.5
5/F	-	-	-	-	-	-	79.2	77.6	74.1	84.3	79.7	82.5	83.1	80.6	79.6	83.8	83.5	72.2
6/F	-	-	-	-	-	-	-	-	-	83.9	79.4	82.0	82.7	80.2	79.2	83.2	82.9	71.8
7/F	-	-	-	-	-	-	-	-	-	83.6	79.1	81.6	82.3	79.8	78.7	82.7	82.4	71.4
8/F	-	-	-	-	-	-	-	-	-	83.2	78.8	81.2	82.0	79.5	78.3	82.2	81.9	71.1
9/F	-	-	-	-	-	-	-	-	-	82.9	78.6	80.8	81.7	79.2	78.0	81.8	81.5	70.7
10/F	-	-	-	-	-	-	-	-	-	82.6	78.6	80.4	81.3	78.9	77.6	81.5	81.1	70.4
11/F	-	-	-	-	-	-	-	-	-	82.3	78.4	80.0	81.1	78.7	77.3	81.1	80.7	70.1
12/F	-	-	-	-	-	-	-	-	-	82.0	78.2	79.7	80.8	78.4	77.0	80.8	80.4	69.9
13/F	-	-	-	-	-	-	-	-	-	81.8	78.0	79.4	80.5	78.1	76.7	80.5	80.1	69.6
14/F	-	-	-	-	-	-	-	-	-	81.5	77.8	79.1	80.2	77.9	76.4	80.2	79.8	69.4
15/F	-	-	-	-	-	-	-	-	-	81.2	77.6	78.8	80.0	77.7	76.2	-	-	-
16/F	-	-	-	-	-	-	-	-	-	81.0	77.4	78.5	79.8	77.5	75.9	-	-	-

where I denotes the overall un-mitigated noise level;

II denotes the noise level contributed by existing roads

II denotes the noise level contributed by new roads

5.8 Recommendation of Noise Mitigation Measures

Results given in the previous section have indicated that the unmitigated noise impact in Year 2018 would generally exceed the HKPSG noise criteria although the newly proposed roads (the Flyover) will only cause an increase in the overall noise impact by a relatively insignificant portion at some of the sensitive uses.

It is obvious that the noise impact attributed to the new roads (the proposed Flyover) at the Rosary Church, the St. Mary's Canossian College and the Golden Mansion are negligible [less than 1 dB(A)] when compared to those from the existing roads. Hence there would be no further scope of reducing the noise impact at these NSRs by direct noise mitigation measures applied to the noise sources.

On the noise impact on Gun Club Hill Barracks (Quarters), Winston Mansion and the May Wah Court, the incremental change due to the new roads are relatively higher [1.1 - 4.7 dB(A)] and hence warrants the use of direct noise mitigation measures to reduce the impact further.

The paragraphs below discuss the various possible direct noise mitigation measures and evaluate qualitatively each of which in light of their acceptability in various aspects of consideration. Efficacy of the preferred options will be quantified once they are shortlisted for further selection.

1. Alternative road alignment

Three options of flyover schemes have been discussed at the outset of the study and the present alignment has been considered the most desirable one.

2. Use of Low Noise Road Surface (LNRS)

The use of LNRS on roads carrying smooth high speed traffic (speed no less than 70 kph) is normally adopted for road safety reasons. This will have an add-on benefit to reduce the noise impact at source.

Hence, LNRS is proposed as a direct noise mitigation measure on the main stream of the flyover carrying traffic at a speed of 70 kph.

3. Road-side Noise Barrier

Road-side noise barrier will be effective only if it is close to the noise. The best location is to erect the noise barrier along the edge of the flyover (main span or the ramps) to partially screen off the noise.

There are however some design criteria which have to be observed, viz. : -

- sightline requirement for safety reasons;
- horizontal clearance requirements stipulated in Table 27 of the "Structures Design Manual for Highways and Railways".

This mitigation measure appears to be applicable to the present situation to screen off part of the noise from the deck. However, structural integrity and visual impact may have to be considered in deciding the maximum practicable barrier height.

Possible location of noise barriers would be along the climbing lanes near the Rosary Church where it should help to reduce the noise impact on the Winston Mansion and other residential buildings further down the road.

4. Noise Enclosure

Noise enclosure (partial or total) can eradicate the noise problem at source. However, it has to be long enough to be effective. Besides, some problems will arise from use of noise enclosure, such as : -

- air pollution problem inside 'tunnel (total or partial enclosure)' and at portals;
- difficulties of fire fighting on deck and possible limitation on use of road by DG vehicles;
- visual impact;
- mechanical ventilation may be needed for long sections;
- a high structure is required to accommodate double-deckers;

These problems will be carefully addressed if noise enclosure is to be considered.

5. Noise Insulation (Indirect noise mitigation measures)

This is always regarded as a last resort if the above options of direct measures fail to mitigate the residual impacts fully and the affected existing sensitive uses are proved to be eligible for noise insulation based on the 3 criteria mentioned in Section 5.3 and approved by the ExCo on the merits of the case presented.

5.9 The Mitigated Impact

To begin with, 2 options of direct noise mitigation measures are proposed with the efficacy evaluated in the following paragraphs.

1. Mitigation Option 1 : with low noise road surfacing only, (LNRS);
2. Mitigation Option 2 : with LNRS and 5m high roadside noise barrier near the Winston Mansion

5.9.1 Use of LNRS

With the 1st mitigation option, the efficacy and noise impact on Gun Club Hill Barrack (quarters)(B1), Winston Mansion (R5) and May Wah Court (R6) are : -

Table 5-8 Mitigated Noise Impact (by Mitigation Option 1- LNRS) at Various NSRs, dB(A)

	N-B1			N-R5			N-R6		
Floor	I	II	III	I	II	III	I	II	III
G/F	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1/F	74.0	73.3	65.8	N/A	N/A	N/A	N/A	N/A	N/A
2/F	76.5	76.0	67.1	83.9	81.5	80.2	N/A	N/A	N/A
3/F	78.1	77.5	69.1	83.8	81.0	80.6	N/A	N/A	N/A
4/F	78.3	77.6	69.9	83.2	80.1	80.3	82.6	81.0	77.6
5/F	78.5	77.6	71.4	82.9	79.7	80.0	82.2	80.6	77.1
6/F	-	-	-	82.5	79.4	79.5	81.8	80.2	76.7
7/F	-	-	-	82.1	79.1	79.1	81.4	79.8	76.2
8/F	-	-	-	81.8	78.8	78.7	81.1	79.5	75.8
9/F	-	-	-	81.5	78.6	78.3	80.8	79.2	75.5
10/F	-	-	-	81.3	78.6	77.9	80.4	78.9	75.1
11/F	-	-	-	81.0	78.4	77.5	80.2	78.7	74.8
12/F	-	-	-	80.7	78.2	77.2	79.9	78.4	74.5
13/F	-	-	-	80.5	78.0	76.9	79.6	78.1	74.2
14/F	-	-	-	80.2	77.8	76.6	79.4	77.9	73.9
15/F	-	-	-	80.0	77.6	76.3	79.2	77.7	73.7
16/F	-	-	-	79.8	77.4	76.0	78.9	77.5	73.4

where I denotes the overall mitigated noise level by use of LNRS

II denotes the noise level contributed by existing roads

III denotes the mitigated noise level contributed by new roads

The noise impact on the Gun Club Hill Barracks (quarters) will come down after the use of LNRS on the flyover deck (main stream) and the relative contribution due to the new roads (the Flyover) will drop to negligible level. Further direct noise mitigation measures will therefore be no longer effective as far as the Gun Club Hill Barracks (quarters) are concerned.

On the Winston Mansion and May Wah Court, the relative noise contribution from new roads are still high, further mitigation measures are thus investigated.

5.9.2 Use of Road-side Noise Barrier

The use of LNRS and a 108m (L) x 5m (H) noise barrier as shown in Figure 5-4 are proposed. A sensitivity test has indicated that a barrier of this length and location would be an optimised solution. The mitigated impact and the efficacy are as tabulated below : -

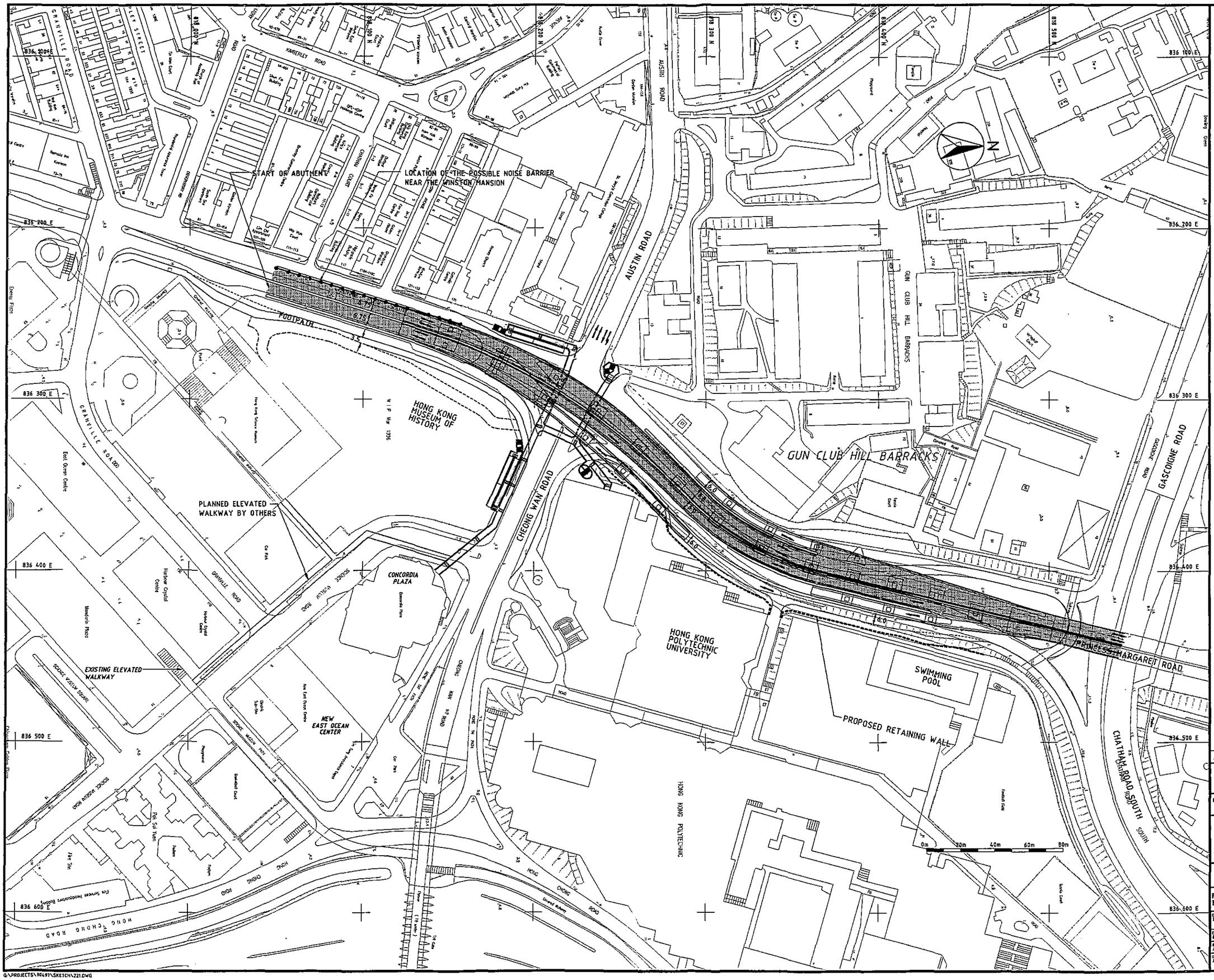
Table 5-9 Mitigated Noise Impact (by Mitigation Option 2 - LNRS + 5m noise barrier) at Various NSRs, dB(A)

	N-R5			N-R6		
Floor	I	II	III	I	II	III
G/F	N/A	N/A	N/A	N/A	N/A	N/A
1/F	N/A	N/A	N/A	N/A	N/A	N/A
2/F	81.9	81.5	71.4	N/A	N/A	N/A
3/F	81.5	81.0	71.5	N/A	N/A	N/A
4/F	80.6	80.1	71.6	81.2	81.0	68.5
5/F	80.3	79.7	71.7	80.9	80.6	68.5
6/F	80.1	79.4	71.9	80.5	80.2	68.6
7/F	79.9	79.1	72.0	80.1	79.8	68.7
8/F	79.7	78.8	72.2	79.9	79.5	68.9
9/F	79.6	78.6	72.5	79.6	79.2	69.1
10/F	79.6	78.6	72.9	79.3	78.9	69.1
11/F	79.5	78.4	73.2	79.2	78.7	69.3
12/F	79.2	78.2	72.6	78.9	78.4	69.4
13/F	79.2	78.0	73.0	78.7	78.1	69.7
14/F	79.0	77.8	73.1	78.6	77.9	70.1
15/F	78.9	77.6	73.3	78.3	77.7	69.7
16/F	78.8	77.4	73.4	78.1	77.5	69.0

where I denotes the overall mitigated noise level by use of LNRS + 5m road-side noise barrier

II denotes the noise level contributed by existing roads

III denotes the mitigated noise level contributed by new roads



LEGEND :

LOCATION OF POSSIBLE NOISE BARRIER NEAR WINSTON MANSION

LOW NOISE ROAD SURFACE

REV. 修訂	DESCRIPTION 內容摘要	DR. 繪	CHECKED 核對	APPROVED 批准人	DATE 日期

Highways Department
Kowloon Region

FLYOVER AND FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD CHATHAM ROAD AND CHEONG WAN ROAD - FEASIBILITY STUDY

LOCATION OF THE POSSIBLE NOISE BARRIER NRAR THE WINSTON MANSION

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

FIGURE NO. 圖紙編號 5.4

DESIGNED BY 設計	CONTRACT NO. 合約編號	DATE OF ISSUE 發出日期
DRAWN BY 繪圖	STATUS 圖紙狀況	
SCALE 比例 AS SHOWN		
DIMENSIONS ARE IN 尺寸單位 MILLIMETRES	© COPYRIGHT RESERVED 版 權 所 有	

Q:\PROJECTS\80497\SKETCH\221.DWG

The above indicates that neither the mitigated impact can achieve the HKPSG criterion nor the contribution from new roads has come down to an acceptable level at the Winston Mansion. It is proposed further that LNRS and 108m (L) x 5m (H) noise barrier with a cantilevered portion extending 2.3m inward (effective height = 7.3m) be used and as shown in Figure 5-5.

The noise impact and efficacy then calculated are : -

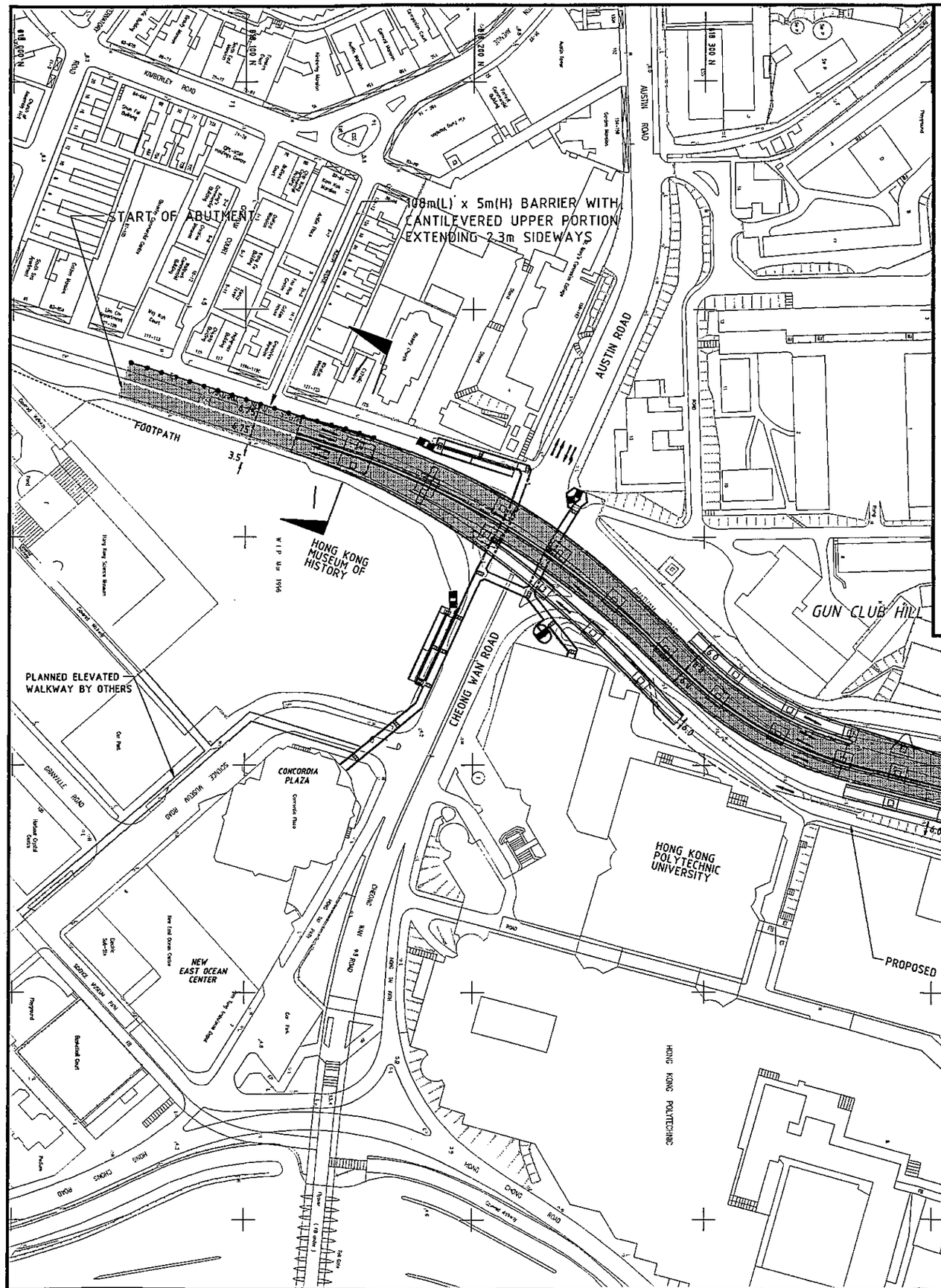
Table 5-10 Mitigated Noise Impact (by Mitigation Option 2 - LNRS + 7.3m noise barrier) at Winston Mansion (N-R5), dB(A)

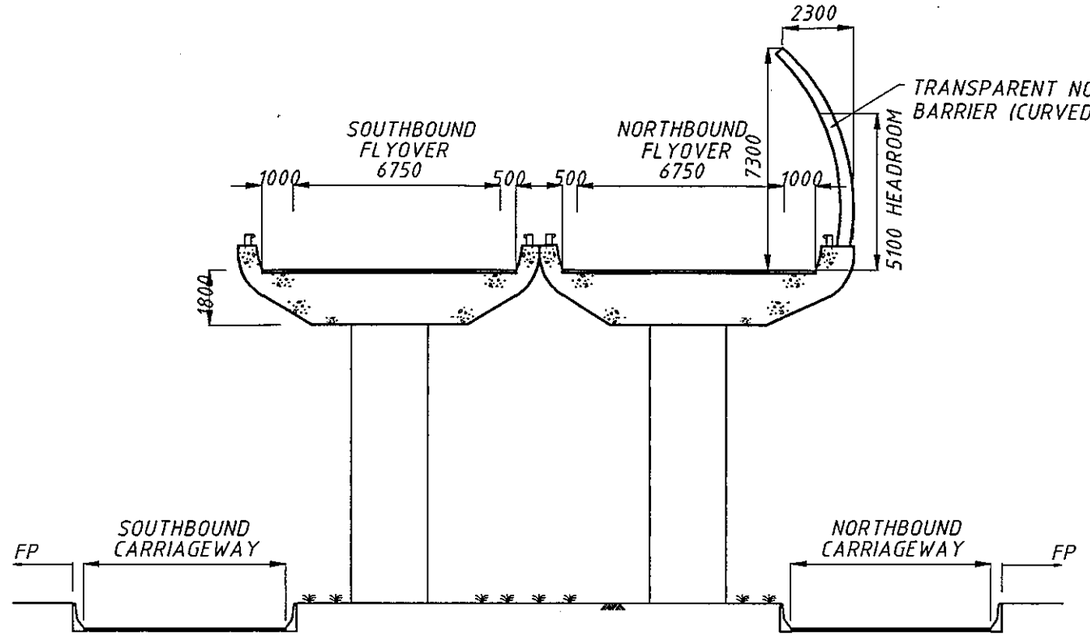
	N-R5		
Floor	I	II	III
G/F	N/A	N/A	N/A
1/F	N/A	N/A	N/A
2/F	81.8	81.5	70.5
3/F	81.4	81.0	70.4
4/F	80.5	80.1	70.2
5/F	80.1	79.7	69.9
6/F	79.9	79.4	69.7
7/F	79.6	79.1	69.5
8/F	79.3	78.8	69.4
9/F	79.1	78.6	69.3
10/F	79.0	78.6	69.2
11/F	78.8	78.4	69.2
12/F	78.7	78.2	69.1
13/F	78.5	78.0	69.1
14/F	78.3	77.8	69.1
15/F	78.1	77.6	69.2
16/F	78.0	77.4	69.2

where I denotes the overall mitigated noise level by use of LNRS + 7.3m road-side noise barrier

II denotes the noise level contributed by existing roads

III denotes the mitigated noise level contributed by new roads





SECTION 1 - 1

SACLE : 1 : 200

LEGEND :

LOCATION OF RECOMMENDED NOISE BARRIER NEAR WINSTON MANSION

LOW NOISE ROAD SURFACE

REV. 修訂	DESCRIPTION 內容摘要	DR. 繪圖	CHECKED 核對	APPROVED 批准	DATE 日期

Highways Department
Kowloon Region

FLYOVER AND FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD CHATHAM ROAD AND CHEONG WAN ROAD - FEASIBILITY STUDY

LOCATION OF THE RECOMMENDED ROAD-SIDE BRAAIERS ADJACENT TO WINSTON MANSION

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

FIGURE NO. 圖表編號 5.5

DESIGNED BY 設計	CONTRACT NO. 合約編號	DATE OF ISSUE 發出日期
DRAWN BY 繪圖 TAM	STATUS 狀況	
SCALE 比例 AS SHOWN		
DIMENSIONS ARE IN 尺寸單位 MILLIMETRES	© COPYRIGHT RESERVED 版權所有	

G:\PROJECTS\980497\SKETCH\222.DWG

5.10 The Recommended Mitigation Options

The foregoing sections has evaluated the relative efficacy of the various noise mitigation measures. The followings direct noise mitigation measures are therefore finally recommended : -

1. LNRS on main span of flyover; and
2. a 108m (L) x 5m (H) noise barrier with a cantilevered portion extending 2.3m inward adjacent to Winston Mansion.

With these measures and in the 2018 unmitigated scenario, the number of dwellings in the study area that is expected to be directly benefited is around 148 although they will not be mitigated down to the HKPSG criterion. [i.e. 70 dB(A)]

5.11 The Ultimate Mitigated Noise Impact

After the implementation of all the noise mitigation measures proposed in Section 5.11, the mitigated noise impact at each selected NSR would be : -

Table 5-11 The Ultimate Mitigated Noise Impact at All Selected NSRs, dB(A)

Floor\ NSR	B1	S1	U3	R5	R6	R7
G/F	-	82	83	-	-	-
1/F	74	82	-	-	-	-
2/F	77	82	-	82	-	86
3/F	78	-	-	81	-	85
4/F	78	-	-	80	81	84
5/F	79	-	-	80	81	84
6/F	-	-	-	80	80	83
7/F	-	-	-	80	80	83
8/F	-	-	-	79	80	82
9/F	-	-	-	79	79	82
10/F	-	-	-	79	79	81
11/F	-	-	-	79	79	81
12/F	-	-	-	79	79	81
13/F	-	-	-	78	78	80
14/F	-	-	-	78	78	80
15/F	-	-	-	78	78	-
16/F	-	-	-	78	78	-

5.12 Discussion

It has been demonstrated that the Rosary Church, the St. Mary's Canossian College and the Golden Mansion will be subject to noise impacts which are dominated by the existing roads and hence no direct noise mitigation measures can be implemented at the flyover to reduce the impact further. Other means of indirect noise mitigation measures such as noise insulation at these two sensitive uses are therefore more appropriate.

For the Gun Club Hill Barracks (Quarters), the use of LNRS has been proved to be the optimum direct measures to reduce noise. For the Winston Mansion, the optimum direct noise mitigation measures would be LNRS together with a noise barrier of length 108m and a effective height of 7.3m to be erected as shown in Figure 5-5.

In all cases, the noise criteria at all NSRs are still not fully met. The residual impacts are high. The gain in noise attenuation from the adopted direct noise mitigation measure is only marginal for some of the NSRs. Hence mitigation by noise insulation appears to be the last resort.

However, upgrading of the existing level of noise insulation will depend on their eligibility for noise insulation under the relevant ExCo directive mentioned in Section 5.3. This has been elaborated in the next section.

5.13 Eligibility for Noise Insulation

Even after the application of direct noise mitigation measures, viz. the use of LNRS and a 108m(L) x 7.3m(H) noise barrier close to R5, there are still residual noise impacts at all NSRs. Since reasonable and practicable solutions have been exhausted, noise insulation may deem to be necessary for those still affected and are eligible.

Indirect technical remedies (noise insulation) for uses affected by 'new' roads will be considered on the merits of individual cases when presented to ExCo for consideration. The eligibility for such based on implementation of the proposed mitigation measure has been assessed and presented below : -

Table 5-12 Eligibility for Noise Insulation (With the adopted LNRS + 108m (L) x 7.3m (H) Noise Barrier near Winston Mansion)

NSR	Floor	Prevailing Noise Levels	2016 Predicted Overall Noise Levels (with New Existing Roads)	Predicted Noise Levels (Existing Roads)	Predicted Noise Levels New Roads	Meet HKPSG Criteria	Meet Noise Insulation Criteria 1	Meet Noise Insulation Criteria 2 (>= prevailing +3)	Meet Noise Insulation Criteria 3 (>= existing +3)	Eligible for Noise Insulation ?
B1	1/F	73.1	74.0	73.3	65.8	no	yes	no	no	no
	2/F	75.9	76.5	76.0	67.1	no	yes	no	no	no
	3/F	77.1	78.1	77.5	69.1	no	yes	no	no	no
	4/F	77.2	78.3	77.6	69.9	no	yes	yes	no	no
	5/F	77.3	78.5	77.6	71.4	no	yes	yes	no	no
U3	G/F	80.0	82.5	82.5	69.8	no	yes	yes	no	no
R5	2/F	81.0	81.8	81.5	70.5	no	yes	no	no	no
	3/F	80.0	81.4	81.0	70.4	no	yes	yes	no	no
	4/F	80.0	80.5	80.1	70.2	no	yes	no	no	no
	5/F	79.0	80.1	79.7	69.9	no	yes	yes	no	no
	6/F	78.0	79.9	79.4	69.7	no	yes	yes	no	no
	7/F	78.0	79.6	79.1	69.5	no	yes	yes	no	no
	8/F	78.0	79.3	78.8	69.4	no	yes	yes	no	no
	9/F	77.0	79.1	78.6	69.3	no	yes	yes	no	no
	10/F	77.0	79.0	78.6	69.2	no	yes	yes	no	no
	11/F	76.0	78.8	78.4	69.2	no	yes	yes	no	no
	12/F	76.0	78.7	78.2	69.1	no	yes	yes	no	no
	13/F	76.0	78.5	78.0	69.1	no	yes	yes	no	no
	14/F	76.0	78.3	77.8	69.1	no	yes	yes	no	no
	15/F	75.0	78.1	77.6	69.2	no	yes	yes	no	no
	16/F	75.0	78.0	77.4	69.2	no	yes	yes	no	no
R6	4/F	78.9	81.2	81.0	67.4	no	yes	yes	no	no
	5/F	78.3	80.8	80.6	67.2	no	yes	yes	no	no
	6/F	77.7	80.4	80.2	67.1	no	yes	yes	no	no
	7/F	77.2	80.0	79.8	67.0	no	yes	yes	no	no
	8/F	76.7	79.7	79.5	66.9	no	yes	yes	no	no
	9/F	76.3	79.4	79.2	66.9	no	yes	yes	no	no
	10/F	75.9	79.2	78.9	66.8	no	yes	yes	no	no
	11/F	75.6	79.0	78.7	66.8	no	yes	yes	no	no
	12/F	75.2	78.7	78.4	66.8	no	yes	yes	no	no
	13/F	74.9	78.4	78.1	66.8	no	yes	yes	no	no
	14/F	74.7	78.2	77.9	66.7	no	yes	yes	no	no
	15/F	74.4	78.0	77.7	66.7	no	yes	yes	no	no
	16/F	74.2	77.8	77.5	66.7	no	yes	yes	no	no

5.14 Conclusion

Traffic noise impact arising from the proposed Flyover and Footbridge Scheme has been quantitatively assessed for various scenarios in year 2018 and the baseline scenario in year 2000.

It has been found that the noise impact in year 2018 (without scheme) will increase by 3 - 6 dB(A) above the baseline scenario in year 2000 (without scheme) due to natural growth of traffic on the roads.

With the proposed Flyover and Footbridge Scheme in place, the 2018 unmitigated impact will generally be 1 - 3 dB(A) lower than the 2018 scenario (without scheme). This is because the flyover would divert part of the traffic from the at-grade roads and provide partial screening of noise from below.

It was found that the noise impact at the Rosary Church and St. Mary Canossian College will be dominated by the existing roads, thus rendering further direct noise mitigation at source no longer effective for them.

It was found further that the optimum direct mitigation measure for the Gun Club Hill Barracks (quarters) will be the use of low noise road surface (LNRS) on the main stream of the flyover deck while those for the Winston Mansion will have to be more substantial.

In such case, LNRS and a roadside noise barrier of length 108m and effective height of 7.3m close to the Winston Mansion is considered necessary and optimum.

With these measures in place, about 148 dwellings are estimated to be benefited to some degree although none of them can be fully mitigated down to the HKPSG criteria.

Eventually, there will still be residual impacts and hence warrants noise insulation as a last resort to mitigate the noise. Except for the St. Mary's Canossian College which has been noise insulated under a school insulation program, other noise sensitive uses have gone through tests of their eligibility for noise insulation under the relevant ExCo directive. Results given in the previous section has indicated that all of the affected NSRs are dominated by noise from existing roads and hence will not be eligible for noise insulation.

In conclusion, noise impact in the vicinity of the Study Area will be higher if the proposed Flyover and Footbridge Scheme is not built. The noise impacts arising from the Project can be mitigated by direct means - low noise road surfacing and strategically located noise barrier. The contribution from the Project will then be mitigated to an extent that it will no longer be significant when compared with the noise impact arising from the existing roads. An optimum solution is considered reached in combating noise impact from the Flyover and Footbridge Scheme.

6. AIR QUALITY IMPACT DURING THE OPERATIONAL PHASE

6.1 Introduction

This section deals with the potential impact of vehicular emissions arising from traffic on the Flyover and Footbridge Scheme and at-grade roads which are close to a number of air sensitive uses in the vicinity.

The impact of vehicular emissions has been predicted using the model "CALINE4" developed by Trinity Consultants, Inc.. The model is based on Guassian dispersion of air pollutants and is recognised by HKEPD and USEPA for that purpose.

Air pollutants of concern include Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), and Respirable Suspended Particulate (RSP).

6.2 Legislation and Air Quality Objectives (AQO)

The main item of legislation relevant to air pollution is the Air Pollution Control Ordinance Cap. 311. In addition, the Air Pollution Control Order 1986 (Air Control Zones, Declaration) and Air Control Objectives are relevant. Under these regulations, the Air Quality Objectives for Carbon Monoxide (CO), Nitrogen Dioxide (NO_2), and Respirable Suspended Particulate (RSP) are specified.

The criteria for assessment are based upon the Hong Kong Air Quality Objectives (AQO) for air pollutants given in Chapter 9, "Environment", of the Hong Kong Planning Standards and Guidelines (HKPSG) for air pollution control. The standards used in the assessment are tabulated below : -

Table 6-1 Air Quality Objectives

Pollutant	Pollutants concentration in $\mu g/m^3$			
	Averaging Time			
	1 hour (i)	8 hours (ii)	24 hours (ii)	1 year (iii)
CO	30,000	10,000	N.A.	N.A.
RSP	N.A.	N.A.	180	55
NO_2	300	N.A.	150	80

(i) Not to be exceeded more than 3 times per year

(ii) Not to be exceeded more than once per year

(iii) Arithmetic means

N.B. all concentrations are calculated under the condition of 298 K and 101.325 kPa (one atmospheric pressure)

6.3 Background Air Quality

The Flyover and Footbridge Scheme will be located in an area which is primarily commercial and residential. Vehicular emissions are considered the major sources of air pollution.

The annual average air quality data recorded at the monitoring station at Sham Shui Po (1996) has been used as the background levels for this assessment since the area type is largely comparable to the study area.

Table 6-2 Air Quality Data measured at Sham Shui Po (1996)

Pollutant	Pollutants concentration in $\mu g/m^3$		
	Averaging Time		
	highest 1 hour	highest 24 hour	1 year
RSP	no measurement	125	59
NO_2	327	168	62

For estimation of the cumulative impacts on the ASRs, the annual average value of 62 $\mu g/m^3$, and 59 $\mu g/m^3$ have been used as the background levels for NO_2 and RSP and superimposed onto the levels predicted by modelling to give the cumulative levels. CO, on the other hand, is not measured at the Sham Shui Po monitoring station but is considered negligible when compared with the hourly standard of 30,000 $\mu g/m^3$. Therefore no background levels has been added.

6.4 Air Sensitive Receivers (ASR)

A total of 8 nos. of representative air sensitive receivers (ASRs) have been selected to represent the most affected locations of interest in the assessment. All the ASRs have been taken at 1.5 m above the floor of each storey. They belong to the first few floors where the impact is supposed to be higher. Table 6-3 below shows the location of these ASRs.

Table 6-3 Air Sensitive Receivers

ASR	Description	Representative floors	Representative floors, mPD
A-B1	Gun Club Hill Barracks - Quarters	1/F / 2/F / 3/F	10.5 / 13.5 / 16.5
A-F2	HKPU - Swimming pool	ground level (active sport)	4.8
A-F1	HKPU - Shaw Sports Complex	Roof - Tennis Court (active sport)	24.6
A-P2	HKPU - Phase 3A, Chung Sze Yuen Building	Podium (passive)	12.0
A-S1	St. Mary's Canossian College	GF / 1F / 2F	4.3 / 8.8 / 12.3
A-U3	Rosary Church	G/F	4.3
A-R5	Winston Mansion - one of the commercial/residential blocks along Chatham Road South	2F, 3F, 4F (residential)	11.3, 14.3, 17.3
A-U5	Hong Kong Museum of History	GF (A/C fresh air intake)	5.3

6.5 Traffic Data

Traffic flow data during the PM peak hour (which are higher than those of the AM peak) on the flyover scheme and at-grade roads have been used in the assessment. It has taken into consideration of the fact that the Project will be commissioned in year 2003.

Besides, a sensitivity test has also confirmed that impacts in 2003 will be higher than those of the latter years up to 2018. This is because the higher emission factors have dominated the effect of higher flow.

The night-time traffic flow volume has been assumed to be 1/3 of the PM peak values for purpose of this assessment. This has been used in the estimation of 24 hour average of RSP level.

Other roads within the 500m envelope of the Project were also considered The road network involved, the corresponding flow data and traffic mix are given in Appendix IV. Please also refer to Figure 6-1 for identification of the major roads earmarked for the assessment.

6.6 Source Types and Emission Strength

Emission levels are dependent on a number of factors such as traffic volume, vehicle type, speed, age, operation mode of engines and the road characteristics.

In view of these complexity, the Fleet Average Emission Factors compiled by the Vehicular Emission Control Section of EPD in Nov., 95 has been adopted. Three major categories of vehicle types which are representative of vehicles on the roads are considered in the assessment viz. : -

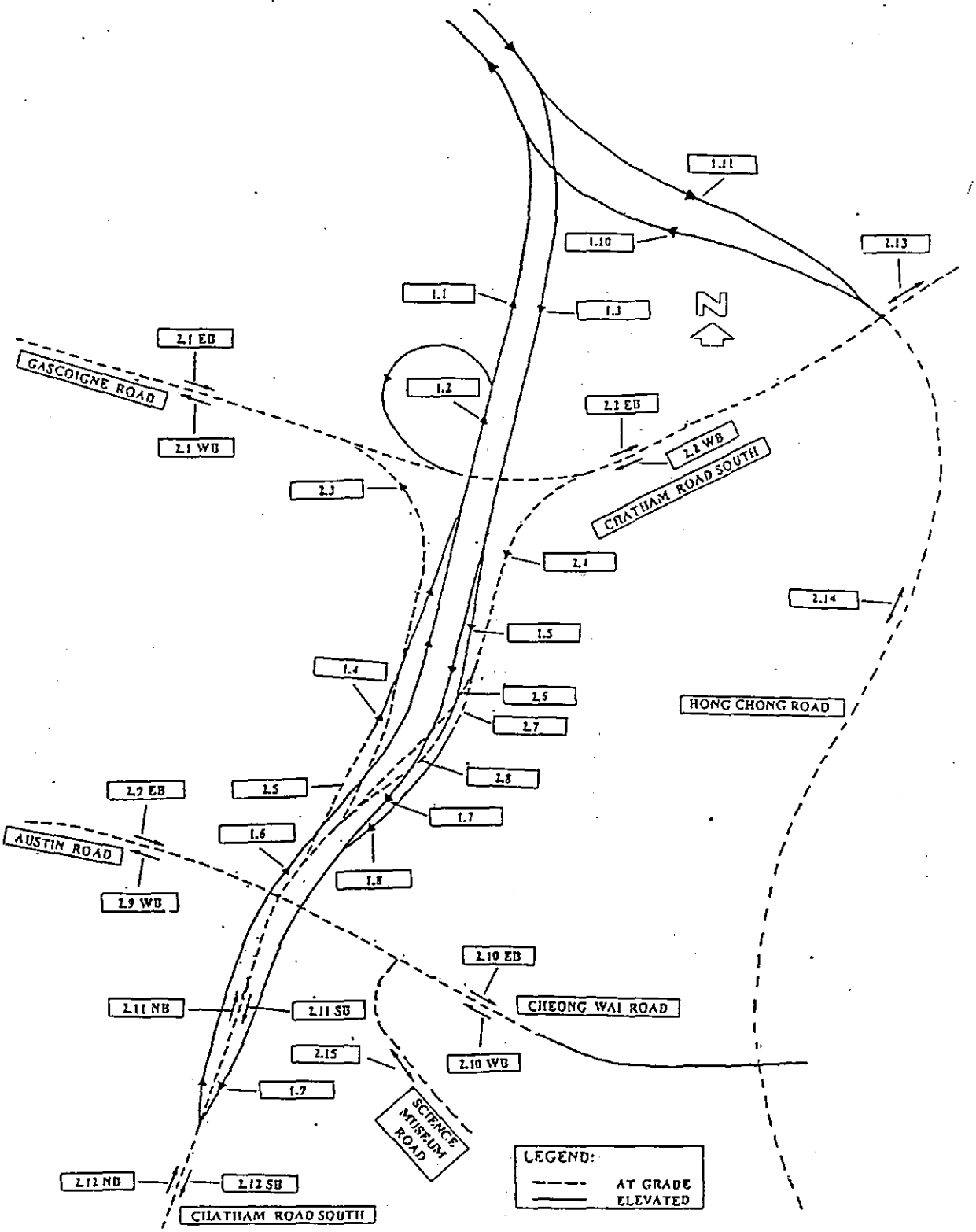
- Passenger Car (Petrol), (P/C - p)
- Light Goods Vehicle, (LGV- dl)
- Heavy Goods Vehicle, (HGV)

The tables below show the average emission factors adopted in the assessment

Table 6-4 Average Emission Factors for Year 2003

Vehicle Type	Average Emission Factors (g / veh-km) - EURO2 Model		
	CO	PM	NOx
Passenger Car (Petrol), (P/C - p)	2.39	0.026	0.90
Light Goods Vehicle (LGV - dl)	0.99	0.253	1.50
Heavy Goods Vehicle (HGV)	8.43	0.965	8.46

Figure 6-1 Roads Involved in the Prediction of Vehicular Emissions Impact



The weighted mean calculated from the individual emission factors of each vehicle type in the traffic mix were used as the overall emission strengths for day-time and night-time prediction as tabulated below : -

Table 6-5 Weighted Mean of Emission Factors for The Year 2003 (g/veh-km)

Roads	Weighted mean during different period of a day			
	PM Peak Hour			Night-time
	CO	PM	NOx	PM
Existing Flyover and Princess Margaret Rd. (Segment 1.2 + 1.3)	3.020	0.169	1.929	0.103
Proposed Flyover (Segment 1.4)	2.731	0.101	1.444	0.103
Proposed Flyover (Segment 1.5)	3.171	0.214	2.230	0.103
Proposed Flyover (Segment 1.6 + 1.7)	2.951	0.158	1.837	0.103
Proposed Flyover (Segment 1.6 + 1.9)	3.002	0.170	1.927	0.103
Proposed Flyover (Segment 1.8)	3.061	0.186	2.033	0.103
Existing Flyover (Segment 1.10)	4.316	0.481	4.134	0.103
Existing Flyover (Segment 1.11)	5.222	0.622	5.268	0.103
Gascoigne Road (Segment 2.1EB + 2.1WB)	3.488	0.257	2.591	0.103
Chatham Road South (Segment 2.2EB + 2.2WB)	3.585	0.256	2.631	0.103
Chatham Road South (Segment 2.2EB + 2.2WB -	3.600	0.256	2.636	0.103
Chatham Road South (Segment 2.3)	3.323	0.193	2.185	0.103
Chatham Road South (Segment 2.3 + 2.5)	2.966	0.138	1.739	0.103
Chatham Road South (Segment 2.4)	3.467	0.260	2.600	0.103
Chatham Road South (Segment 2.5)	2.731	0.101	1.444	0.103
Chatham Road South (Segment 2.6)	3.357	0.232	2.404	0.103
Chatham Road South (Segment 2.7)	3.061	0.186	2.033	0.103
Chatham Road South (Segment 2.8)	3.171	0.214	2.230	0.103
Chatham Road South (Segment 2.8 + 2.6)	3.290	0.225	2.341	0.103
Austin Road (Segment 2.9EB + 2.9WB)	3.127	0.189	2.076	0.103
Cheong Wan Road (Segment 2.10EB + 2.10WB)	3.514	0.229	2.458	0.103
Chatham Road South (Segment 2.11NB + 2.11SB)	4.327	0.360	3.500	0.103
Chatham Road South (Segment 2.12NB + 2.12SB)	3.543	0.250	2.578	0.103
Chatham Road South (Segment 2.13)	4.618	0.528	4.512	0.103
Hong Chong Road (Segment 2.14)	5.127	0.5849	5.032	0.103
Science Museum Road (Segment 2.15)	5.261	0.626	5.304	0.103

6.7 Meteorological Conditions for Dispersion Modelling

Typical meteorological conditions used in the modelling are : -

- Pasquill stability class D with a wind speed of 1m/s (D1) for daytime peak hour;
- Pasquill stability class F with a wind speed of 1m/s (F1) for night-time;
- average mixing height of 750m;
- standard derivation in wind direction of 5° and 12° for class F1 and D1 respectively;
- worst case wind direction predicted automatically by the model.

6.8 Further Assumptions in Modelling

- The proportion of RSP in vehicular emissions are assumed to be 100% of the particulate matters (PM) which are, in general, less than 10 μm in aerodynamic diameter.
- NO_x has been be modelled as an "inert gas' in the dispersion with a molecular weight of 46. 20% of the NO_x has been assumed to be NO_2 at the sensitive receivers.

6.9 Effect on Air Quality Impact due to Road-side Noise Barrier

As recommended in Section 5.10, a 108m (L) x 7.3m (H) noise barrier near the Winston Mansion will be erected along the edge of the flyover to provide adequate screening of traffic noise. In view of the presence of this noise barriers, the potential secondary air quality impact on the concerned ASRs has been assessed.

Similar input parameters and assumption have been used as in the open road options. In addition to that, the 'barrier effect' has been assessed by assuming that the road segments with the noise barrier are elevated roads which have the same level as top of the barriers. The elevation of the road segment with the proposed road-side noise barriers were therefore set at the elevation of the barrier top. The option "Fill" is set in the Caline4 modelling to simulate this effect of the vertical barriers sections.

6.10 Results

The predicted highest 1-hour cumulative [including the background and 'the barrier effect' of the adopted 108m (L) x 7.3m (H), high noise barrier] CO, NO_2 and RSP levels at the selected ASRs are tabulated below : -

Table 6-6 Predicted Highest 1-hour Cumulative Vehicular Emission Level ($\mu g/m^3$) of CO/ RSP/ NO_2 at the Selected ASRs (including the background levels for RSP and NO_2 only)

	PM Peak hour			Night-time
ASR	CO	RSP	NO_2	RSP
A-F2	1259	156	212	78
A-F1	687	106	137	67
A-B1 -1/F	1717	206	276	82
A-B1 -2/F	1717	197	269	80
A-B1 -3/F	1602	185	254	78
A-P2	1488	168	212	82
A-S1-GF	1488	163	212	83
A-S1-1F	1374	158	212	82
A-S1-2F	1374	152	212	80
A-U3	1717	181	250	86
A-R5 -2F	1717	181	250	89
A-R5 -3F	1488	165	250	86
A-R5 -4F	1374	152	212	82
A-U5	1145	139	175	80

The 24-hour average level RSP has been estimated be contributed by 2/3 of the day-time level and 1/3 of the night-time. Hence the results are : -

Table 6-7 Predicted Highest 24-hour Average Vehicular Emission Level ($\mu g/m^3$) of RSP at the Selected ASRs (including the background level)

	24-hour Average
ASR	RSP
A-F2	130
A-F1	93
A-B1 1/F	164
A-B1 2/F	158
A-B1 3/F	150
A-P2	139
A-S1-GF	137
A-S1-1F	133
A-S1-2F	128
A-U3	149
A-R5 -2F	151
A-R5 -3F	139
A-R5 -4F	129
A-U5	120

6.11 Discussion

The predicted highest 1-hour cumulative CO, NO_2 and RSP levels (day-time and night-time) at all the selected ASRs are listed in Table 6-6.

The range of pollutants levels (cumulative) at all ASRs for the highest 1-hour average are : -

CO	687 $\mu g/m^3$	to	1717 $\mu g/m^3$
NO_2	137 $\mu g/m^3$	to	276 $\mu g/m^3$
RSP	106 $\mu g/m^3$	to	206 $\mu g/m^3$

The range of RSP levels (cumulative) at all ASRs for the 24-hour average are : -

RSP	93 $\mu g/m^3$	to	164 $\mu g/m^3$

All these levels are well below the AQO (Table 6-1) for the 1-hour and 24-hour averaging periods (where appropriate) and are therefore acceptable.

6.12 Conclusion

Air quality impact due to vehicular emissions from the Flyover and Footbridge Scheme and at-grade roads in the vicinity has been quantitatively predicted. Results indicate a generally moderate level of impact which satisfies the AQO for all concerned pollutants for the 1-hour and 24-hour averaging periods. Hence the assessment confirms negligible health related impacts for both short term and long term scenarios.

7. VISUAL AND LANDSCAPE IMPACT

7.1 Landscape Context of Existing Site

The street encompassing the site, Chatham Road South is a two lane dual carriageway, fronted on both sides by a mixture of medium and high rise residential, commercial and institutional buildings. The streetscape in between the buildings is high in quality due to the presence of mature trees and planted areas interspersed in the many open spaces. Chatham Road South, Austin Road and Cheong Wan Road and their junction form a dominant element to the local streetscape constituting a major visual and physical separation of adjacent land uses.

St Mary's Canossian College and the Rosary Church lie to the south of Austin Road and face the junction. These buildings are of historical and architectural merit and constitute the visual focus of the junction. The residential blocks to their south create a well defined visual edge to Chatham Road South.

The Hong Kong Museum of Science and Technology (H.K.M.S.T.) is currently being extended. The new building will be the Hong Kong Museum of History (H.K.M.H.), it will be a modern complex forming the focus to the south east side of the junction. Existing mature trees along its boundary and down the central reservation of Chatham Road South form a dominant element, provide a sense of enclosure and reduce the scale and impact of the road.

Hong Kong Polytechnic University (H.K.P.U.) to the north-east of the junction is a modern purpose built complex with a consistency of form, materials and tone and provides a strong visual edge and backdrop. Mature planting along the Chatham Road South boundary provides a green buffer to the road.

The Gun Club Barracks to the north-west is a self-contained land use occupying an elevated position in relation to adjacent roads except in the north where the land falls away to a building platform below road level. The existing vegetated boundary forms a valuable green edge and visual screen to the highway and junction.

A description of all the trees within the site and its immediate context is given in the Tree Survey Report enclosed as Appendix V. The location of all the trees is shown on the Tree Survey Plan of the Tree Survey Report.

7.2 The Visual Envelope

The 'Visual Envelope' marks the approximate boundary of the zone of visual influence of the proposed development and is illustrated on Figure 7.2. The Visual Envelope may be solid as in building edges or diffuse as in vegetation screens where filtered views are possible. Visually Sensitive Receivers are those people within the Visual Envelope who would experience adverse visual impact from the development. Visual Impact is a function of one or a combination of :

- Visual Obstruction: where the receiver's views are physically blocked by the proposals;
- Visual Intrusion: where the receiver's views are affected by the proposed development or by users of the proposed development, (construction workers or drivers of vehicles for example);
- Loss of vegetation screens due to construction.

The key Visually Sensitive Receivers for the proposal are listed in Tables 7.4 and 7.5 and illustrated on Figure No. 7.2.

7.3 Sources of Landscape and Visual Impacts

The sources of landscape and visual impacts on the surrounding area during the construction and operation of the proposed flyover phase are shown below.

Construction Phase :

- excavations and earthworks;
- proposed footbridges and flyover structures and associated construction elements including formwork and scaffolding and materials;
- site hoardings;
- site buildings;
- site machinery including vehicles and cranes;
- loss of existing vegetation;
- construction lighting.

Operational Phase :

- elevated flyover and ramps;
- widened roads and realigned slip roads at ground level;
- footbridges;
- road lighting;
- increased vehicular traffic levels;
- loss of existing vegetation.

7.4 Landscape Impacts of the Works

7.4.1 Evaluation of Temporary Landscape Impacts during the Construction Phase.

Table 7.1 lists the temporary impacts on landscape and evaluates them as 'high', 'medium' or 'low'.

The construction period would last for an estimated 36 months and during this time there would be a high level of impact at street level mainly due to construction traffic and the relocation of existing vegetation. The disruption to footpaths during the widening of the carriageway will affect pedestrians, particularly those using the St. Mary's Canossian College and Rosary Church, students of the H.K.P.U. and visitors to the H.K.M.S.T. and the new H.K.M.H.

The removal of trees along the H.K.P.U. boundary and the central reservation and eastern footpath of Chatham Road South during the construction phase will temporarily reduce the amount of shade and screening available to pedestrians within the site and limit the amount of available open space resulting in a high impact on the landscape.

St. Mary's Canossian College and Rosary Church are buildings of townscape and historical value. There would be a high impact from the temporary obstruction of views to these buildings due to the hoardings and construction machinery, reducing their scenic value to the streetscape.

7.4.2 Evaluation of Permanent Landscape Impacts during the Operational Phase.

Figure 7.1 'Existing Conditions' illustrates existing vegetation as a benchmark for assessing the impact of vegetation losses due to construction. Table 7.3 lists permanent impacts on vegetation and rates them as 'high', 'medium' or 'low'. Permanent landscape impacts are rated as 'high', 'medium' and 'low' in Tables 7.1 and 7.2: The key impacts are illustrated on Figure 7.2, and are described below.

Twenty eight mature street trees from the central reservation along Chatham Road South, south of the junction will have to be relocated for the construction of the flyover. This will have a high impact on the character of the road and surrounding area resulting in a reduction in the quality of the landscape. However, the Tree Survey Report recommends transplanting these species elsewhere within the site, preferably within the soft landscape area in front of the new H.K.M.H. and in the Museum Plaza area as shown in Figure 7.4.

There will be disruption to a planted strip along the H.K.P.U. boundary resulting in a high level of landscape impact. Forty-five of the mature trees along the western boundary of the University site and fourteen newly planted small trees within the footpath on Chatham Road South, north of the junction will have to be relocated for the construction of the flyover. The Tree Survey Report recommends transplanting forty of the forty-five mature trees elsewhere within the site if possible. A suitable location would be the jogging track along the western boundary of the campus. The jogging track will be severed due to a new vehicular access into the University grounds and is unlikely to be used in future. This would recreate the original vegetation screen along the western boundary of the University campus. The remaining trees will be planted within the existing planted area adjacent to the abutment of the existing flyover at the northern end of the site. Self clinging plants will be planted along the base of the new retaining wall next to the campus swimming pool.

It is also recommended that the fourteen newly planted trees be relocated to the footpath adjacent to the Rosary Church on Chatham Road South.

There will be reduction in the width of the footpath in front of St. Mary's Canossian College and Rosary Church for the widening of the carriageway and the erection of the ramp for the footbridge. This will have a high impact on the landscape quality and will cause encroachment onto immediate setting and create a sense of enclosure around the front of the buildings. The Advisory Committee on the Appearance of Bridges and Associated Structures (A.C.A.B.A.S.) have strongly recommended the replacement of the footbridge ramp with a lift at the detailed design stage to reduce the impact on landscape quality in this area. However, according to the present policy, provision of ramp rather than lift is the preferred option because the former does not require long term maintenance and will not cause inconvenience to the public in case of mechanical breakdown. The provision of lift would be considered only if a ramp cannot be provided. Hence, ramps are recommended.

There will be no encroachment upon the 7m set back adjacent to the new H.K.M.H. for the widening of the carriageway and construction of new pedestrian footbridges. However, the new footbridge and pedestrian ramp will partly screen the northern facade of the new building. Additionally, twelve mature trees and four small trees will have to be removed for the widening of the carriageway and erection of the pedestrian footbridges. The Tree Survey Report recommends that the four small trees be transplanted elsewhere on the site, preferably within the proposed soft landscape area adjacent to the H.K.M.H. The removal of the trees will have an impact on the landscape quality and reduce the amount of ground level open space along the northern and western edges of the new building. However, it is proposed to replace the trees with new heavy standard trees at the end of the construction phase and this will substantially reduce the adverse landscape impact.

As a result of the elevated road structure and widening of Chatham Road South there will be increased separation of the western side of Chatham Road South from the eastern side. This will have an impact on pedestrian amenity due to the encroachment of the roads on the pedestrian environment and the loss of street planting. The construction of the flyover will reduce the amount of natural light reaching the existing street level and will appear as an enclosing element, effectively blocking out many of the views within and out of the study area at the junctions and along the road.

These changes will represent a worsening in the landscape quality of the area. However, substantial landscape mitigation measures will reduce the high impact to an acceptable level as discussed in the following sections.

7.5 Visual Impacts of the Works

7.5.1 Evaluation of Temporary Visual Impacts during the Construction Phase.

Temporary visual impacts are listed in Table 7.4 and are rated as 'high', 'medium' or 'low'.

Visually sensitive receivers in properties south of the Austin Road /Cheong Wan Road/Chatham Road South junction would experience a high visual impact during the relocation of mature street trees from the central reservation and eastern edge of Chatham Road South. Subsequently there would be greater visibility of the construction activity from the road widening, and erection of the structural elements of the flyover and footbridges particularly for the inhabitants and users of the lower floors along Chatham Road South. East -west views along Austin Road /Cheong Wan Road would be disrupted for the erection of the flyover structure and footbridges. However these impacts would be temporary, lasting only for the 36 month duration of the construction period.

At the H.K.P.U. north of the junction, the loss of existing vegetation screens along the east edge of Chatham Road South would have a high but temporary visual impact affecting users of the external spaces of the podium roof gardens, swimming pool and jogging trail. The proposed works site would encroach on the western boundary of the H.K.P.U. and temporarily truncate the jogging trail. The impact on the users of the University outdoor swimming pool would be exaggerated during the construction process due to the sunken nature of the pool in relation to the proposed flyover.

St. Mary's Canossian College would be particularly affected by the footbridge construction adjacent to its facade which incorporates colonnaded terraces and classroom windows. Users of the Rosary Church would only be affected whilst outside the building in the courtyard as the window design precludes views out. However, users of the Catholic Centre the main facade of the which faces north would experience a high level of visual intrusion of the existing streetscape during the construction phase.

Users of the Hong Kong Museum of Science and Technology (H.K.M.S.T.) would experience high visual impacts during the construction phase, particularly those in the new complex of the Museum of History directly adjacent to the Flyover. Views along all four roads crossing the junction would be obscured from the new Museum building due to the construction work resulting in a high level of visual impact.

7.5.2 Evaluation of Permanent Visual Impacts during the Operational Phase.

Permanent visual impacts during the construction phase are listed in Table 7.5 and are rated as 'high', 'medium' or 'low'

The main permanent visual impacts on the visually sensitive receivers of the site would be from the intrusion and obstruction of existing views caused by the widened road, the loss of existing vegetation screens and from the mass of the flyover and footbridge structures.

For pedestrians, the removal of trees from the central reservation and the eastern footpath of Chatham Road South would affect their visual perception of the street environment. However, the relocation of mature street trees to the landscape areas around the Museum of History would result in a medium visual impact on the southern section of the site.

The existing mature trees down the central reservation of Chatham Road South form an effective visual divide which reduces the perceived scale of the road. The mature street trees in the footpath adjacent to the new H.K.M.H. contribute to the 'green' character of the street . The trees screen the traffic and the high-rise buildings on the western side of Chatham Road from the courtyard open space of the H.K.M.S.T. The construction of the flyover and the subsequent loss of these trees would constitute a high visual impact at street level dramatically altering views in all directions particularly across Chatham Road South. However, new heavy standard trees planted within the eastern footpath along Chatham Road South will reduce the impact for pedestrians.

On the western side of the flyover from the May Wah Court residential block to the Rosary Church there would be a 7m high noise barrier. Although the noise barrier will be transparent, its height and that of the supporting uprights would increase the visual impact upon the adjacent properties.

The footbridges would constitute a high visual impact at St. Mary's Canossian College and on the northern boundary of the H.K.M.S.T. and the H.K.P.U.

The flyover and associated retaining structures would create a high visual impact on the western boundary of the H.K.P.U. where they would encroach on the existing vegetated boundary. The flyover level would be slightly higher than the podium level of the H.K.P.U. and users of this external space would experience substantial visual obstruction and intrusion. A high visual impact on the swimming pool would result from the loss of mature screening vegetation along the western boundary and the encroachment of the widened road and flyover. The relocation of the existing trees to the route of the jogging trail would reduce the impact from high to medium.

The effect of the flyover spanning the junction would have a substantial impact on the visual perception of the locality in general. The previously open vistas across the Austin Road/ Cheong Wan Road and Chatham Road Junction would be obstructed.

7.6 Mitigation of Landscape Impacts

The nature of the proposals and the limited area available within the existing road corridor makes the elevated structure impossible to screen. Landscape mitigation measures comprise environmental improvements to the area beneath the deck and to the adjacent pavement areas and the creative design of the structural elements of the elevated road at street level.

7.6.1 Mitigation of Temporary Landscape Impacts

Potential mitigation of temporary impacts could be achieved by adopting the following measures:

1. Re-routing of footpaths and the provision of well-defined temporary public access around the works site. Maintaining public access would not compensate for loss of pedestrian amenity during the construction period due to temporary surfaces and screens. However, pedestrian disruption should cease once the proposal is operational.
2. Minimising of damage to existing vegetation. Great care should be taken not to damage vegetation which could be retained as specified in the Tree Survey Report and that is in or close to the zone of construction activity. Careful and prompt transplanting of existing trees will minimise temporary landscape impacts. Vegetation to be transplanted should be clearly identified and marked on site at the outset of construction operations. The contract should include penalty clauses for the removal of vegetation identified for retention.

7.6.2 Residual Impacts

Table 7.1 rates the degree of residual impact after mitigation as 'high', 'medium' or 'low'.

Some of the temporary impacts on the identified above including the completed road structures would become permanent impacts once construction had finished.

The scale of the development limits the potential for effective mitigation during the construction phase however the transplanting of substantial existing vegetation to locations within or adjacent to the site at the start of the construction period will reduce the high level of impact and disruption.

7.6.3 Mitigation of Permanent Landscape Impacts

Mitigation of permanent landscape impacts are illustrated in Figure 7.4, shown on the perspective sketch in Figure 7.5 and described below:

i) Mitigation of vegetation loss could be achieved by compensatory planting where space allows using trees specified in the Tree Survey Report as suitable for transplanting or new plant material. This is especially important along the boundary of H.K.P.U. where the mature trees could be relocated to the jogging trail and to the existing planted area adjacent to the abutment of the existing flyover at the northern end of the site. Tree planting within the new footpath adjacent to the at grade sections of Ramp B would further help reduce the impact of the relocation of existing street trees. Climbing plants along the base of the retaining wall would also reduce the landscape impacts of the development from within the campus. The residual landscape impact would be reduced from high to medium in this area.

New heavy standard tree planting within the 3.5m wide footpath on the western side of Chatham Road South would in time mitigate the loss of existing trees. Additionally the relocation of some of the trees from the central reservation within the proposed planted strip in front of the Museum of History would reduce the overall landscape impact from high to medium.

Shrub planting under the elevated flyover structure where space and light permit would reduce the long term landscape impact of the scheme. The benefit of such planting would not be immediate but would improve with time.

ii) The pedestrian environment could also be improved by attention to the detailing of surfaces and railings.

iii) Careful consideration to sensitive design and detailing of the footbridge and flyover could reduce the visual weight of the structures and attention to appropriate surface finishes could increase visual interest for visually sensitive receivers. These design elements are particularly important for the Footbridge adjacent to St. Mary's Canossian College and Rosary Church.

7.6.4 Residual Landscape Impacts

1. The potential for mitigating the permanent landscape and impacts would be limited by the scale of the proposed developments and the associated land take.
2. Impacts due to encroachment cannot be mitigated.
3. Mitigation of vegetation loss could only be achieved where space allows replacement planting and requires time for the vegetation to mature.
4. The visual and physical separation of the western and eastern sides of Chatham Road South as perceived by the public could not be mitigated even though the crossing of the road may be eased by the introduction of the footbridge system.
5. Attempts to control obstruction and intrusion by screening would reduce the visual envelope of the receiver and hence their broader perception of the landscape.

7.7 Mitigation of Visual Impacts

7.7.1 Potential Mitigation of Temporary Visual Impacts

It could be achieved by adopting the following measures : -

- Screening of site works by hoardings;
- Surface treatment of site hoardings to enhance their visual interest;
- The locating of temporary buildings in least visually prominent locations;
- Efficient programming of the works to reduce duration of visual impact;
- Retention of existing vegetation within works site area where at all possible. This applies to the western boundary of the H.K.P.U.

7.7.2 Residual Temporary Visual Impacts

Table 7.1 rates the degree of residual impact after mitigation for the proposal as 'high', 'medium' and 'low'.

It would not be possible to fully screen the works due to their scale and elevation in relation to adjacent land uses. Site hoardings whilst effective in screening much construction activity constitute a visual barrier and generate obstruction themselves. The above mitigation measures would only partially reduce the visual obstruction and intrusion during the construction phase and the remaining negative visual impacts would be high though temporary.

7.7.3 Mitigation of Permanent Visual Impacts

Potential mitigation measures are illustrated on Figure 7.3 and include:

1. Gun Club Hill Barracks : enhancement of existing vegetation screen.
2. St. Mary's Canossian College : careful detailing of footbridge to reduce its visual weight, obstruction and intrusion.
3. Hong Kong Museum of History: compensatory street tree planting around the northern and western boundaries of the Museum to visually soften the hard built elements of the footbridge and flyover. Additionally the relocation of some of the trees from the central reservation to the Museum Plaza will reduce the visibility of the Flyover.
4. Hong Kong Polytechnic University roof gardens : enhanced perimeter planting to screen views out and into the site. Retaining Structures, external treatment in the form of textured, patterned and coloured finishes and provision for planting. Jogging trail, visual screen structure adjacent to road with planting. Swimming Pool, visual screen structure and planting between pool site and road.
5. Concordia Plaza and Austin Road : careful detailing of footbridge to reduce it's visual weight; compensatory street tree planting.
6. Roadside Planting : opportunities exist to plant areas adjacent to the proposed road layout, both between carriageways, on carriageway verges and beneath flyovers (light levels permitting). Effective planting could help soften the visually hard road structures.
7. Selection of appropriate road lighting fixtures with shields or hoods to direct light onto the road surface and reduce spillage onto adjacent landuses.
8. Treatment of engineering elements of the road structure :
   - The curving long profile of the flyover which rises to approximately 11m above existing road level to provide clearance for the proposed footbridges will be designed with large radius curves at the top of each ramp to provide a longitudinal profile that is generally elegant and flowing in appearance.
   - The flyover columns will be rectangular in cross section with curved edges and rise vertically to supporting the deck. The piers will have a textured finish and incorporate down pipes within the construction of the piers for the drainage of surface water.
   - Abutment walls will be finished with material to complement that adopted for the piers and to match the existing flyover abutment.
   - The parapet of the deck will be designed to be visually distinct from the deck structure to avoid the problems of staining to the underside of the deck. The parapet will also be curved in section to emphasise the rounding of the main structure.
   - The noise barriers will be curved in section to blend with the curved parapet. They will be transparent to minimise visual impact.
   - A central raised planter under the elevated road structure will be finished with a decorative treatment to add visual interest at ground level and provide space for compensation planting.
9. Treatment of engineering elements of the footbridge structures :
   - The parapet of the footbridges will be curved in section to emphasise the rounding of the structure and to match the shape of the flyover. The columns will be rectangular in cross section with curved edges.

7.7.4 Residual Permanent Visual Impacts

Table 7.5 rates the degree of residual visual impact after Mitigation for the proposal as 'high', 'medium' or 'low'.

The scale of the development and the associated land take limit the potential for effective mitigation and substantial residual visual impact to the visually sensitive receivers identified would remain. Mitigation by vegetation screens would improve with time but would never fully mitigate the visual impacts. Screening would alleviate the effects of visual obstruction and intrusion but would create enclosure in place of open aspects.

7.8 Conclusions

Landscape and Visual Environment

The new road will constitute a large element in a diverse landscape setting, and will result in significant landscape and visual impact both during the construction phase and the operational phase through loss of mature trees and open space and modification to the existing road network.

The enclosed nature of the existing landscape will mean that the visual envelope of the new road will be localised and the views of the road will be in the context of the existing residential commercial and institutional land uses. However, the previously open vistas across the Austin Road/ Cheong Wan Road and Chatham Road Junction would be permanently obstructed.

The potential for effective mitigation of the impacts identified would be limited due to the scale and the degree of land take and the lack of space between the development and the adjacent landuses.

The existing urban character of the site will become more concentrated as a result of the elevated road. The landscape improvements proposed however will enhance the pedestrian routes throughout the study area and substantially reduce the visual impact of the structure from street level.

7.9 Recommendations

Landscape and Visual Environment

To mitigate the assessed landscape and visual impacts of the scheme, as far as possible it is recommended that the following measures be adopted :

- Retention of all existing vegetation within the study area not directly affected by the works.
- Decorative paving and shade tolerant planting underneath new carriageways in combination with feature lighting and aesthetic treatment to the structural supports.
- The refinement of the alignments and configurations of all new carriageways, drainage channels and footpaths to minimise potential impacts.
- The method of construction of the new road structures will be examined in detail to minimise this impact, and to afford maximum protection to the other trees.

A competent landscape architect/arboriculturalist should be employed during the construction and maintenance periods of the contract to enforce the recommended landscape and visual impact mitigation measures. He/She will be responsible for the following tasks:

- the trees transplanting operation will be undertaken by a competent landscape contractor;
- all existing trees and vegetation within the study area which are not directly affected by the works will be retained and protected;

- the methods of protecting existing vegetation proposed by the contractor are acceptable and enforced;
- all landscaping works are carried out in accordance with the specification;
- the methods of transplanting the trees proposed by the contractor are feasible and being carried out under his/her supervision;
- the planting of heavy standard trees will be carried out properly and in the right season;
- the species of the new trees and vegetation to be planted are chosen correctly and in the right mix;
- the transplanted and newly planted trees are watered regularly and nourished; and
- the survival of transplanted and newly planted trees will be monitored for a 12-month establishment period.

TABLE 7.1 - SUMMARY OF TEMPORARY IMPACTS ON LANDSCAPE

LOCATION	DESCRIPTION	DEGREE OF IMPACT	RESIDUAL IMPACT AFTER MITIGATION
General Pedestrian Environment	The road widening and construction works impose on the existing pedestrian environment; broader views of the junction are obstructed; loss of vegetation deprives pedestrians of shade, screening & elements of natural colour & texture.	High	Medium
St. Mary's Canossian College & Rosary Church	Obstruction of facades of buildings of townscape & historical value by site hoardings, temporary buildings and construction plant ; visual prominence & value of buildings on corner reduced.	High	Medium
Hong Kong Museum of History.	Proximity of Flyover & Footbridge construction to boundary compromises setting by obstructing views of the new complex & reducing the surrounding open space.	High	Medium
Hong Kong Polytechnic University	Loss of mature vegetation buffer to west & encroachment of Flyover construction substantially compromises the setting & reinforces the dominance of Chatham Road South. Truncation, disruption and re-routing of jogging trail caused by construction activity	High	Medium

TABLE 7.2 - SUMMARY OF PERMANENT IMPACTS ON LANDSCAPE

LOCATION	DESCRIPTION	DEGREE OF IMPACT	RESIDUAL IMPACT AFTER MITIGATION
General Pedestrian Environment	The increased scale of the road & its elevated structure intrude on the existing pedestrian environment; channelled views along existing roads either side of the junction are obstructed; loss of vegetation deprives pedestrians of shade & elements of natural colour & texture.	High	Medium
Junction	Obstruction of existing cross-junction views; visual & physical separation of streetscape to west & east reinforced; dominance of road as element increased.	High	High
St. Mary's Canossian College & Rosary Church	Obstruction of facades of buildings of visual & historical value; visual prominence & value of buildings on corner reduced.	High	Medium
Hong Kong Museum of History	Proximity of Flyover & Footbridge to boundary compromises setting by obstructing views of the new complex & reducing the surrounding open space.	High	Medium
Hong Kong Polytechnic University	Loss of mature vegetation buffer to west & encroachment of Flyover substantially compromises the setting & reinforces the dominance of Chatham Road South. Jogging Trail truncated by southbound slip road; southern end of Jogging Trail covered by Footbridge; pedestrian amenity compromised.	High	Medium

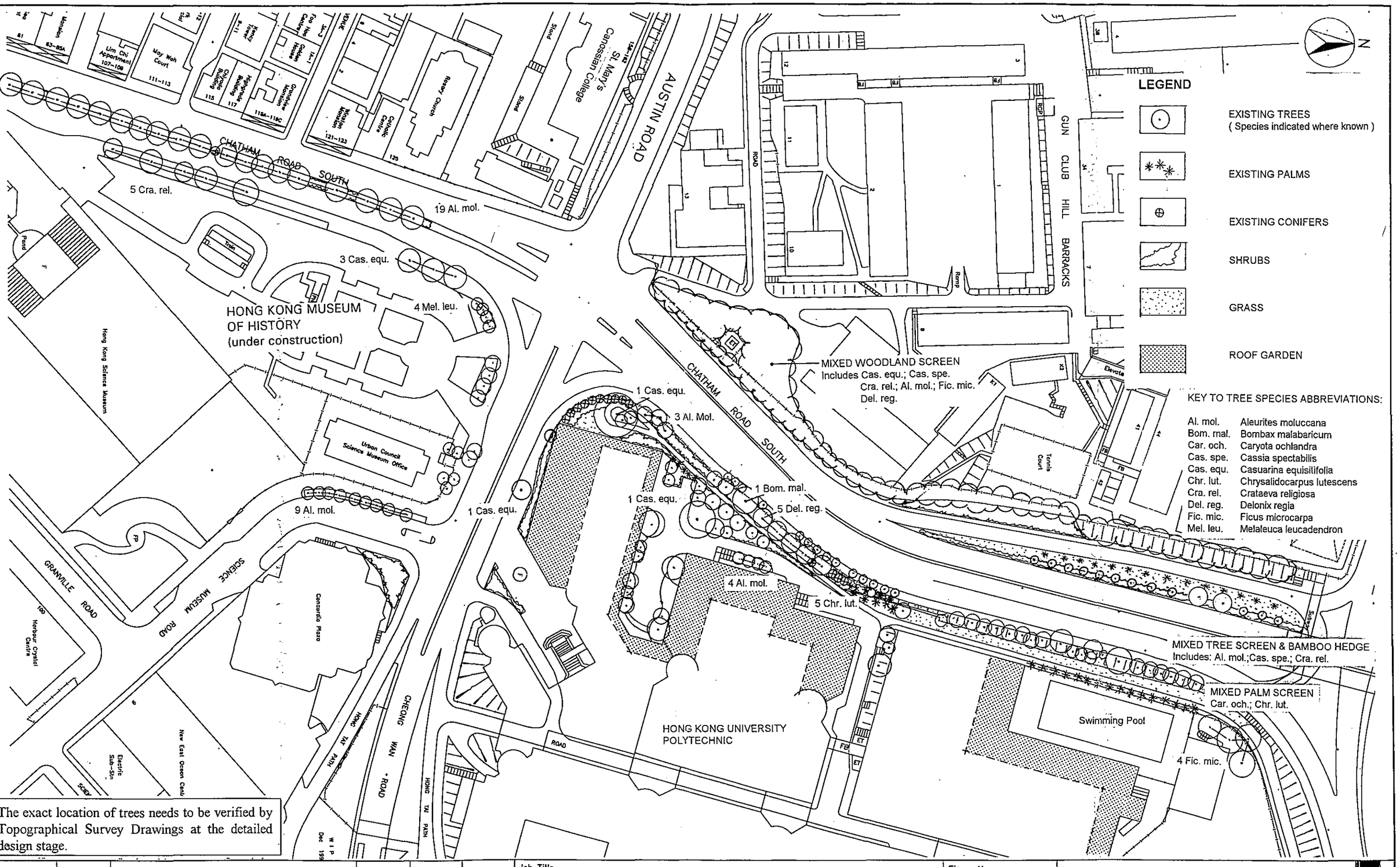
TABLE 7.3 SUMMARY OF PERMANENT IMPACTS ON VEGETATION

VISUALLY SENSITIVE RECEIVERS	DESCRIPTION	DEGREE OF IMPACT	RESIDUAL IMPACT AFTER MITIGATION
Gun Club Hill Barracks	Existing vegetation screen untouched (there is the potential for enhancing existing screen to reduce visual impacts).	None	None
Chatham Road South	i) Loss of mature central reservation trees. ii) Loss of mature street trees adjacent to Hong Kong Museum of Sci & Tech.	High High	High Medium
Cheong Wan Road	i) Loss of mature street trees adjacent to Hong Kong Museum of Sci. & Tech.	High	Medium
Hong Kong Polytechnic University	Loss of mature vegetation screen adjacent to Chatham Road South.	High	Medium

TABLE 7.4 - SUMMARY OF TEMPORARY IMPACTS ON VISUALLY SENSITIVE RECEIVERS

VISUALLY SENSITIVE RECEIVERS	DESCRIPTION	DEGREE OF IMPACT	RESIDUAL IMPACT AFTER MITIGATION
Gun Club Hill Barracks	Filtered views of construction site & footbridge through existing vegetation.	Low	Low
St. Mary's Canossian College	Direct views of Footbridge & Flyover construction; outlook obstructed; loss of privacy; loss of central street trees.	High	Medium
Rosary Church/Catholic Centre	Direct views of Flyover construction; outlook obstructed; loss of privacy; loss of central street trees	High	Medium
Commercial/Residential - west side Chatham Road South	Nos. 121-123: direct view of Flyover ramp construction; loss of privacy; loss of street trees. Nos. 81 - 119c: visual intrusion of road widening construction; loss of street trees.	High Medium	Medium Low
Pedestrians - on Chatham Road South	Increased visual impact of road widening & Flyover ramp construction; loss of central street trees; partial obstruction of Hong Kong Museum of Sci. & Tech. & H.K.P.U.	High	Medium
Pedestrians adjacent to Hong Kong Museum of History.	Direct views of Flyover construction to west - visual intrusion & obstruction (loss of mature street trees & central reservation trees); direct views of Footbridge construction to north - visual intrusion & obstruction (loss of mature street trees).	High	Medium
H.K.P.U. i) Building Interiors ii) Roof Gardens iii) Pedestrians	Direct views of Footbridge construction to south-west ; direct view of Flyover construction to west; obstruction of cross-junction views. Direct views of Footbridge construction to south-west; direct view of Flyover construction to west; obstruction of cross-junction views; visual intrusion from Flyover construction Boundary Footpath severed by southbound Flyover & Footbridge construction; direct views of Flyover to west & Footbridge to south; increased visual obstruction & intrusion; visual amenity reduced by loss of vegetation.	Medium High High	Medium Low High
Concordia Plaza	Direct views of Footbridge construction to west; direct views of Flyover to west; obstruction of cross-junction views.	Medium	Medium

TABLE 7.5 SUMMARY OF PERMANENT IMPACTS ON VISUALLY SENSITIVE RECEIVERS			
VISALLY SENSITIVE RECEIVERS	DESCRIPTION	DEGREE OF IMPACT	RESIDUAL IMPACT AFTER MITIGATION
Gun Club Hill Barracks	Filtered views of Flyover & Footbridge through existing vegetation	Low	Low
St. Mary's Canossian College	Direct views of Footbridge & Flyover with noise barrier; loss of privacy; loss of central street trees.	High	Medium
Rosary Church/Catholic Centre	Direct views of Flyover with noise barrier outlook obstructed; loss of privacy; loss of central street trees	High	Medium
Commercial/Residential - west side Chatham Road South	Nos. 121-123: direct view of Flyover ramp; loss of privacy; loss of street trees. Nos. 81 - 119c: visual intrusion of widened road; loss of street trees.	High Medium	Medium Low
Pedestrians -Chatham Road South	Increased visual impact of widened road & Flyover ramp with noise barrier; loss of central street trees; partial obstruction of Hong Kong Museum of History & H.K.P.U.	High	Medium
Pedestrians adjacent to Hong Kong Museum of History	Direct views of Flyover to west - visual intrusion & obstruction (loss of mature street trees & central reservation trees); direct views of Footbridge to north - visual intrusion & obstruction (loss of mature street trees).	High	Medium
H.K.P.U. i) Building Interiors ii) Roof Gardens iv) Pedestrians	 Direct views of Footbridge to south-west ; direct view of Flyover with noise barrier to west; obstruction of cross-junction views. Direct views of Footbridge to south-west; direct view of Flyover with noise barrier to west; obstruction of cross-junction views; visual intrusion from Flyover. Boundary Jogging Trail partially covered by southbound Flyover & Footbridge; direct views of Flyover to west & Footbridge to south; increased visual obstruction & intrusion; visual amenity reduced by loss of vegetation.	 Medium High High	 Low Medium Medium
Concordia Plaza	Direct views of Footbridge to west; direct views of Flyover to west; obstruction of cross-junction views.	Medium	Medium



The exact location of trees needs to be verified by Topographical Survey Drawings at the detailed design stage.

Amendment No.	Date	Description	Drawn by	Checked by	Approved by

Job Title
FLYOVER & FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD CHATHAM ROAD SOUTH & CHEONG WAN ROAD

Figure No. 7.1

Drawing Title
EXISTING CONDITIONS

Scale 1:7000

Drawn by	Checked by	Approved by	Date	Job. No.
			MAY 1997	MCA38

Urbis Limited
Planning, Urban Design, Landscape, Golf & Environmental Consultants
Urbis Limited, 11/F Siu On Centre, 188 Lockhart Road, Wan Chai, Hong Kong. Tel : 2802 3333 Fax : 2802 8662

WIDENED ROAD AND LOSS OF STREET TREES INCREASE VISUAL INTRUSION TO WEST & EAST OF CHATHAM ROAD SOUTH

ROSARY CHURCH & ST. MARY'S CANOSSIAN COLLEGE - TOWNSCAPE ELEMENTS OF HIGH VISUAL & HISTORIC VALUE

DIRECT VISUAL OBSTRUCTION & INTRUSION BY FLYOVER AT WINSTON MANSION, CATHOLIC CENTRE & ROSARY CHURCH

DIRECT VISUAL OBSTRUCTION & INTRUSION BY FLYOVER & FOOTBRIDGE AT ST. MARY'S CANOSSIAN COLLEGE

836 200 E

ELEVATED FLYOVER AND FOOTBRIDGES REINFORCE THE PHYSICAL AND VISUAL SEPARATION OF WESTERN AND EASTERN TOWNSCAPE. EXISTING CLEAR VIEWS AT JUNCTION OBSTRUCTED.

LOSS OF EXISTING MATURE TREES FROM CENTRAL RESERVATION

836 300 E

LOSS OF EXISTING MATURE STREET TREES

RAISED FLYOVER INCREASES VISUAL INTRUSION TO GUN CLUB HILL BARRACKS WITH POSSIBLE SECURITY IMPLICATIONS

VISUAL OBSTRUCTION & INTRUSION TO RECEIVERS WITHIN HONG KONG MUSEUM OF SCIENCE & TECH.

LOSS OF EXISTING MATURE STREET TREES BY FOOTBRIDGE CONSTRUCTION

NO PHYSICAL IMPACT ON EXISTING VEGETATION SCREEN

PARTIAL LOSS OF VEGETATED VERGE TO EXISTING FLYOVER

836 400 E

VISUAL OBSTRUCTION AND INTRUSION OF LOWER FACADE OF CONCORDIA PLAZA BY FOOTBRIDGE

VISUAL INTRUSION & OBSTRUCTION TO USERS OF H.K.P.U. ROOF GARDENS & & BUILDINGS BY FLYOVER

836 500 E

VISUAL INTRUSION TO RECEIVERS WITHIN H.K.P.U. BUILDINGS

VISUAL INTRUSION & OBSTRUCTION TO USERS OF H.K.P.U. SWIMMING POOL

LOSS OF EXISTING MATURE TREE SCREEN TO EDGE OF H.K.P.U.

836 600 E

818 000 N | 818 100 N | 818 200 N | 818 300 N | 818 400 N | 818 500 N | 818 600 N | 818 700 N

CHATHAM ROAD SOUTH | AUSTIN ROAD | CHEONG WAN ROAD | GUN CLUB HILL BARRACKS | CHATHAM ROAD NORTH | GRANVILLE ROAD | HONG KONG MUSEUM OF SCIENCE | HONG KONG CONVENTION & EXHIBITION CENTRE | PRINCESS MARGARET ROAD

N

LEGEND

- VISUAL ENVELOPE - DIRECT VIEWS BY SENSITIVE VISUAL RECEIVERS
- VISUAL ENVELOPE - FILTERED VIEWS BY SENSITIVE VISUAL RECEIVERS
- IMPACT ON EXISTING VEGETATION (Note: only affected vegetation is shown. For location of all existing vegetation refer to Dwg. No. 1.0)
- PHYSICAL IMPACT ON FOOTPATHS
- KEY FEATURES

Amendment No.	Date	Description	Drawn by	Checked by	Approved by

Job Title
FLYOVER & FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD CHATHAM ROAD SOUTH & CHEONG WAN ROAD

Figure No. 7.2

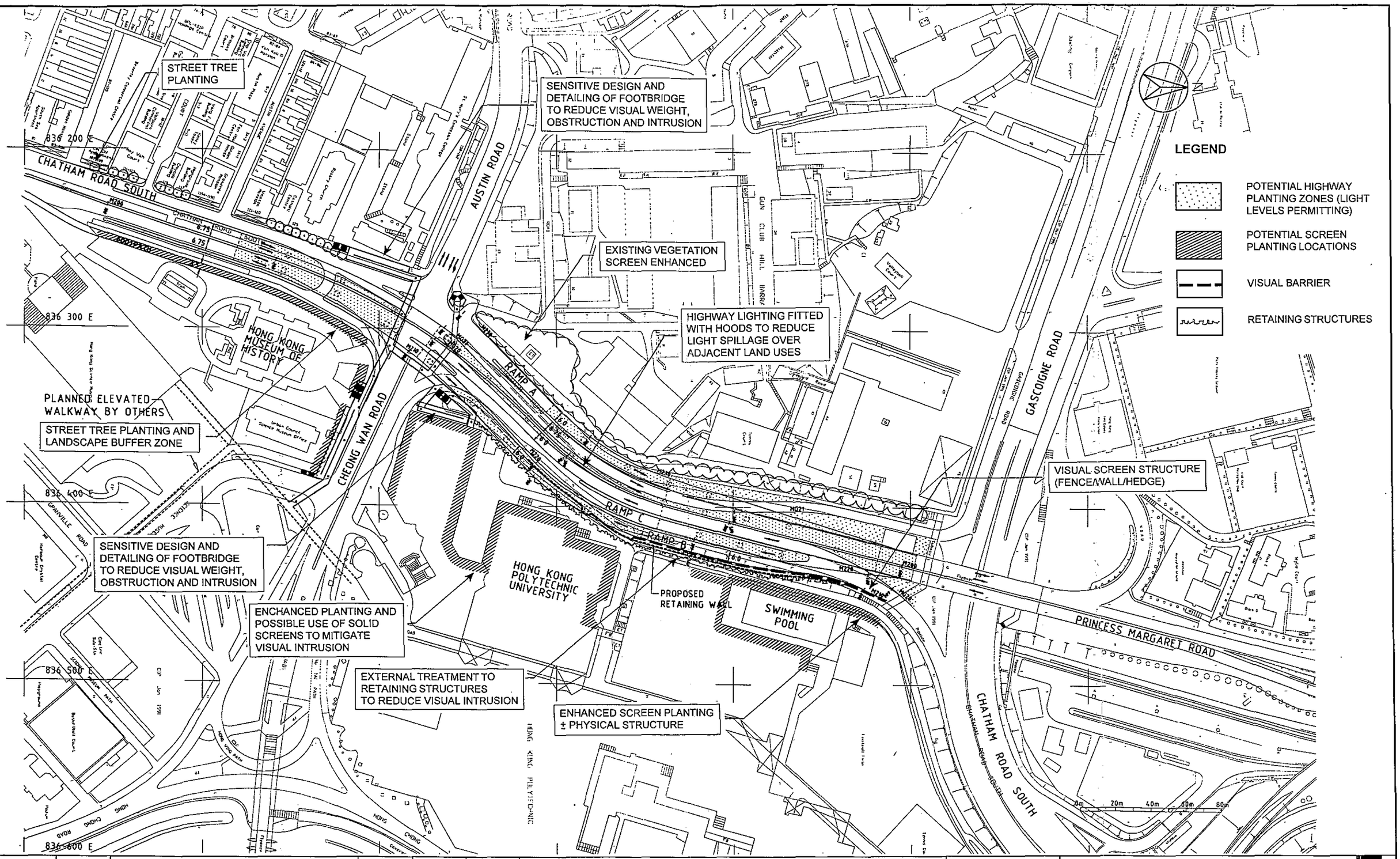
Drawing Title
LANDSCAPE AND VISUAL ASSESSMENT

Scale 1:2000

Drawn by	Checked by	Approved by	Date	Job. No.
			MAY 1997	MCA38

Urbis Limited
Planning, Urban Design, Landscape, Golf & Environmental Consultants
Urbis Limited, 11/F Siu On Centre, 188 Lockhart Road, Wan Chai, Hong Kong. Tel : 2802 3333 Fax : 2802 8662

MY_XREFS MY_DWG 1:1:96



Amendment No.	Date	Description	Drawn by	Checked by	Approved by

Job Title
FLYOVER & FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD CHATHAM ROAD SOUTH & CHEONG WAN ROAD

Drawing Title
MITIGATION OF PERMANENT VISUAL IMPACTS

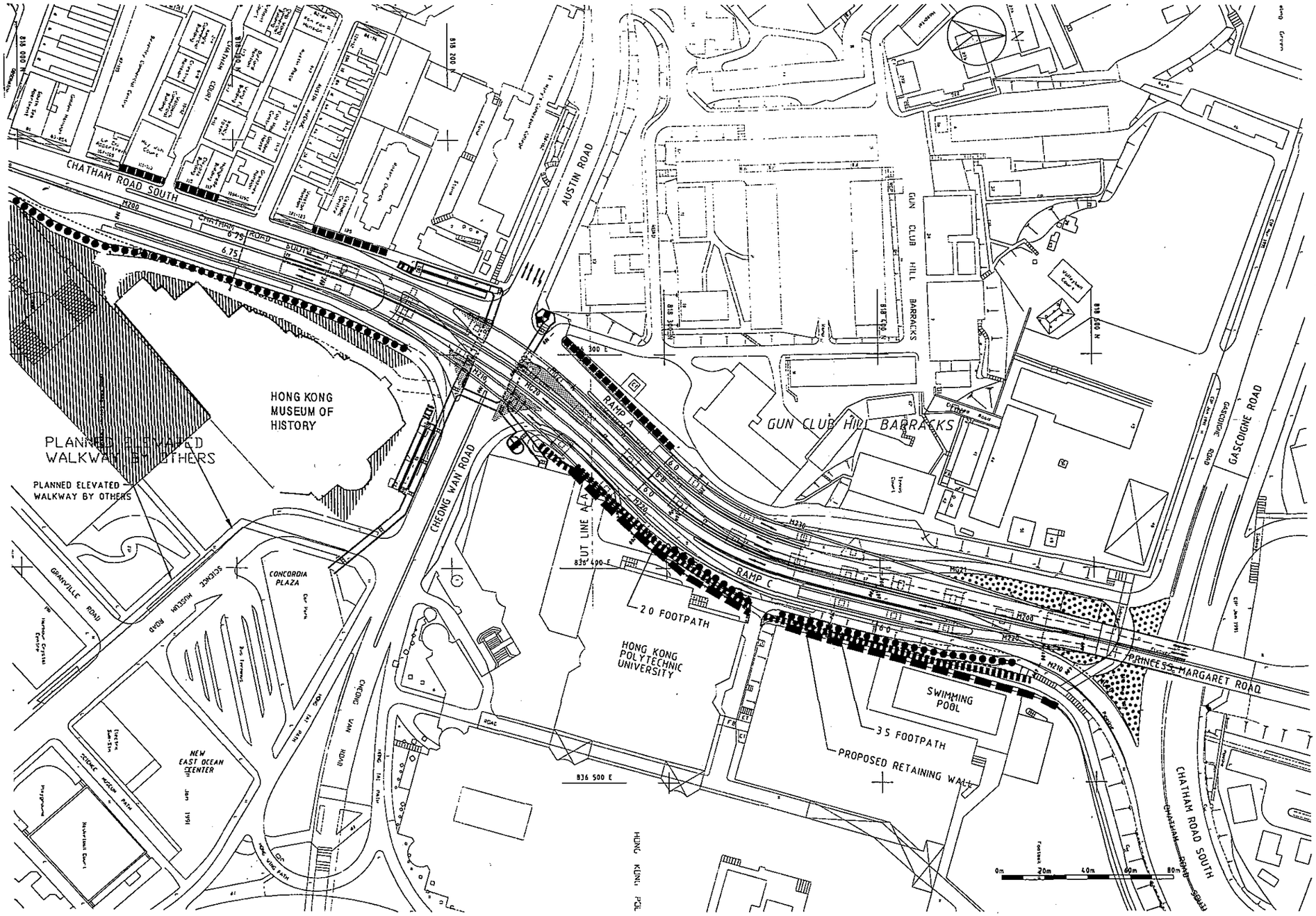
Drawn by	Checked by	Approved by	Date
			AUG. 1997

Figure No. 7.3

Scale 1: 2000

Job. No. MCA38

Urbis Limited 雅邦
Planning, Urban Design, Landscape, Golf & Environmental Consultants
Urbis Limited, 11/F Siu On Centre, 188 Lockhart Road, Wan Chai, Hong Kong. Tel : 2802 3333 Fax : 2802 8662



LEGEND

- PLANTING UNDER FLYOVER (SHADE TOLERANT)
- NEWLY PLANTED SMALL TREES TRANSPLANTED FROM FOOTPATH ADJACENT TO H.K.P.U. TO FOOTPATH ADJACENT TO ROSARY CHURCH
- NEW EXTRA HEAVY STANDARD TREES PLANTED WITHIN FOOTPATH ADJACENT TO NEW MUSEUM OF HISTORY
- MATURE TREES TRANSPLANTED FROM EMBANKMENT OF HONG KONG POLYTECHNIC UNIVERSITY TO FORMER JOGGING TRAIL
- MATURE TREES TRANSPLANTED FROM EMBANKMENT OF HONG KONG POLYTECHNIC UNIVERSITY TO EXISTING LANDSCAPED AREA
- CLIMBING PLANTS ALONG RETAINING WALL
- MATURE TREES TRANSPLANTED FROM CENTRAL RESERVATION OF CHATHAM ROAD SOUTH TO SCIENCE MUSEUM PLAZA OR INCORPORATED WITHIN SOFT LANDSCAPE AREA IN FRONT OF MUSEUM OF HISTORY

Amendment No.	Date	Description	Drawn by	Checked by	Approved by

Job Title
FLYOVER & FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD, CHATHAM ROAD SOUTH & CHEONG WAN ROAD

Drawing Title
MITIGATION OF PERMANENT LANDSCAPE IMPACTS

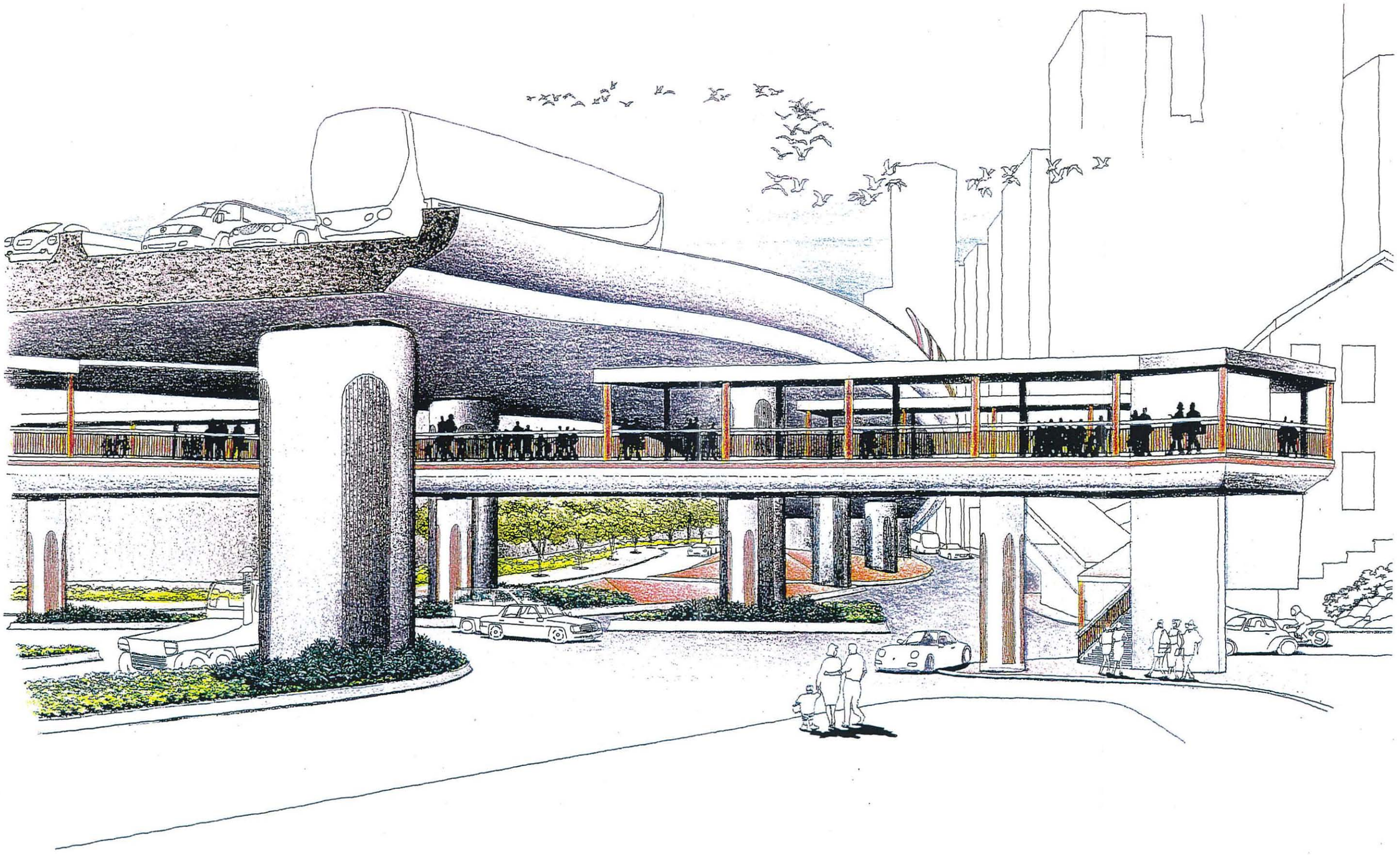
Drawn by	Checked by	Approved by	Date
			DEC 1997

Figure No. 7.4

Scale 1:2,000

Job. No. MCA 38

Urbis Limited
Planning, Urban Design, Landscape, Golf & Environmental Consultants
Urbis Limited, 11/F Siu On Centre, 188 Lockhart Road, Wan Chai, Hong Kong. Tel : 2802 3333 Fax : 2802 8662



Amendment No.	Date	Description	Drawn by	Checked by	Approved by

Job Title
FLYOVER & FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD, CHATHAM ROAD SOUTH & CHEONG WAN ROAD

Figure No.
7.5

Drawing Title
PERSPECTIVE SKETCH OF FLYOVER

Scale

Drawn by	Checked by	Approved by	Date	Job. No.
			DEC 1997	MCA 38

雅邦
Urbis Limited
Planning, Urban Design, Landscape, Golf & Environmental Consultants
Urbis Limited, 11/F Siu On Centre, 188 Lockhart Road, Wan Chai, Hong Kong. Tel : 2802 3333 Fax : 2802 8662

MY_XREFS MY_DWG 1-1-94

8. LAND USE IMPACT

8.1 Introduction

This section examines the base land use planning assumptions pertaining to the assignment and key land use interfaces generated by the flyover and footbridge scheme. The principal key issues are outlined below:

- Land use and urban planning considerations with regard to the impact on the existing and planned development context within the vicinity of the proposed flyover and footbridge;
- Review of existing and proposed pedestrian linkages for the area; and
- Resumption required to implement the proposed scheme.

8.2 Planning and Land Use Context

8.2.1 General

The Kowloon Planning Area No. 1 - Tsim Sha Tsui Outline Zoning Plan No. S/K1/10 (06 December 1996) allocates land along the proposed scheme to Open Space use (O), Government/ Institution/Community use (G/IC), Commercial uses (C) and Other Specified Uses (OU) related to cultural functions such as the Hong Kong Science Museum and Hong Kong Museum of History (under construction), and military functions such as the Gun Club Hill Barracks (Figure 8.1).

8.2.2 Detailed Urban and Land Use Context

Road Network

As described in the previous chapter, Chatham Road South is a two-lane dual carriageway running north to south. It is fronted on both its eastern and western edges by a mixture of medium and high rise residential, commercial and institutional buildings. The junction formed by these roads is one of the major junctions along Chatham Road South, from both traffic and townscape standpoints.

Chatham Road South provides a major link between Tsim Sha Tsui and Jordan. Vehicular traffic on this road enters/leaves the study area in the northern portion via an interchange linking to Gascoigne Road and Princess Margaret Road; in the southern portion of the study area from its junction with Granville Road; and from other distributor roads further south, such as Cameron Road, Prat Avenue, Mody Road and Salisbury Road. Smaller side streets also feed into Chatham Road South, including Austin Avenue and Observatory Road.

Austin Road and Cheong Wan Road provide access between Tsim Sha Tsui and Hung Hom via On Hong Road and Hong Chong Road.

Chatham Road South effectively separates the greater Tsim Sha Tsui area from Tsim Sha Tsui East. While the district as a whole is characterised by largely commercial land use interspersed with G/IC uses and open spaces, the greater TST area to the immediate west of Chatham Road South is generally typified by densely spaced, small-sized, moderately aged building stock, with densely spaced streets and alleys and few open space areas. TST East on the other hand, is a reclamation area that was completed in 1980/81. It is typified by larger, newer developments; a wider, more strategically planned road network; and a clearer open space and community facilities framework.

St. Mary's Canossian College and Rosary Church

St Mary's Canossian College and Rosary Church are located at the south-east corner of the junction of Chatham Road South, Austin Road and Cheong Wan Road. They lie within a G/IC zone, are of historical and architectural merit and contribute to the townscape prominence of the junction. A commercial zone lies to the immediate south, with towers forming a development edge along Chatham Road South rising from 16 to 20 storeys in height. Commercial activities are, however, generally limited to the lower storeys with residential uses occupying the higher floors.

Hong Kong Museum of Science and Technology/ (New) Hong Kong Museum of History

The Hong Kong Museum of Science and Technology (HKMST) and the new Hong Kong Museum of History (HKMH) are within an OU zone to the south-east of the junction across Chatham Road South. An extension to the HKMST is ongoing as is the construction of the new HKMH. The latter is scheduled to be completed by the end of 1997. Locating these two developments together on one site is anticipated to strengthen this area's role as a major community complex and destination. The complex will have its own local open space/plazas. The building envelopes are anticipated to help to further define the south-east edge of the aforementioned junction.

Hong Kong Polytechnic University

Hong Kong Polytechnic University (HKPU) lies within a G/IC zone to the north-east of the junction. A narrow zone of open space runs along its western edge abutting Chatham Road South. The HKPU is a large complex and a strong presence in the local urban context. It also serves as a development face on the north-east edge of the junction and as a district edge to north-east TST.

Gun Club Hill Barracks

The Gun Club Hill Barracks to the north-west of the junction lies in an OU zone abutting the northern district boundary of TST. The buildings within the complex also bear some architectural merit. The Barracks however are located on an elevated platform, separated from the road by high stone wall and steep slopes, and thus are not easily viewed from street level. As with HKPU, the barracks are a large complex and complete the development edge to the junction on the north-east.

Concordia Plaza/New East Ocean Centre

Concordia Plaza/New East Ocean Centre lies within a G/IC zone on Cheong Wan Road to the immediate east of the Museum complex. The development comprises one high-rise tower block, one low-rise tower block and a podium containing a public transport interchange at grade.

8.3 Land Use Interfaces and Impacts

The implementation of the proposed flyover and footbridge scheme will require acquisition of strips of land along the western edge of Hong Kong Polytechnic University and fronting the new Hong Kong Museum of History. The extent of land resumption is shown on Figure 8.2. These and other anticipated interfaces or impacts are discussed in greater detail below.

8.3.1 St. Mary's Canossian College and Rosary Church

Although the proposed scheme does not encroach into the college or church sites, would result in the reduction of the footpath in front of the College to accommodate the required widening of Chatham Road South and the construction of the proposed footbridge spanning the junction beneath the flyover. The reduced footpath arising from the introduction of the footbridge structure is anticipated to have an effect on pedestrian flows at this corner. Pedestrians moving solely at grade would have a narrower pavement area with which to negotiate the corner.

8.3.2 Hong Kong Museum of Science and Technology

No planning interfaces between the proposed scheme and the HKMST are anticipated.

8.3.3 Hong Kong Museum of History

Several portions of the new HKMH building (under construction) have been designed to lie within a 7 metre open space setback. As recommended in the Tree Survey Report, the mature trees within the central reserve of Chatham Road South are proposed to be transplanted within the soft landscape area along the northern and western sides of the Museum as the proposed footpath adjacent to the HKMH has to be utilised for temporary road re-alignment during the construction stage. Permission from Urban Services Department (USD) would be required in this regard.

The proposed widening of Chatham Road South encroaches upon a portion of the required 6 metre wide Emergency Vehicular Access (EVA) for the HKMH. Temporary reduction of the EVA from 6m wide to 4m also would require agreement from Fire Services Department (FSD).

The proposed footbridge spanning the junction avoids a cable reserve located to the north of the HKMH. However, as with St. Mary's College and Rosary Church, the footbridge structure is anticipated to impede pedestrian flows at pavement level along Cheong Wan Road.

Pedestrian flows to the museum complex come from the direction of either Granville Road or of Austin Road. The main entries of the two museums on this site face the Granville Road junction. The footbridge system, as proposed, brings pedestrians only to the northern end of the HKMH and not along Chatham Road South. This would be inconvenience for pedestrians going to the HKMH coming from the direction of Austin Road. Earlier engineering proposals considered the provision of ramps down Chatham Road South from the footbridge structure at the corner of Cheong Wan Road and Chatham Road. This however conflicted with the EVA requirements along this side of the HKMH, and was considered unfeasible.

8.3.4 Hong Kong Polytechnic University

The area of land proposed for resumption under the scheme lies within the zone of open space along the western edge of HKPU, and is under University management (private lot). It is currently occupied by a slope with a retaining wall along its toe. At the toe of the wall is a jogging track.

Temporary occupation of a strip of land along the western side of HKPU is also necessary to provide working space for the construction of the proposed retaining wall and the sewer diversion.

The implementation of the proposed flyover scheme will require the transplanting of the mature trees and vegetation on the slope and the resumption of a significant portion of the jogging track along Chatham Road South. In addition, the jogging track will also be severed by the introduction of a new vehicular entry to the University, the provision of which is requested by the University. It is proposed to connect the remainder of the jogging trail into a green belt for the transplantation of the trees identified in the Tree Survey Report. The reprovision or reinstatement of the jogging trial would be subject to negotiation between Government and HKPU.

The proposed footbridge connection is envisaged to connect to the HKPU building fronting the junction at a level above grade. Provision has been made in the aforementioned building to allow this link. The proposed connection would facilitate the stronger integration of pedestrian movement across the junction to the University area, and of the University complex within the larger urban fabric of TST.

8.3.5 Gun Club Hill Barracks

The proposed scheme does not encroach into the Barracks site.

8.3.6 Concordia Plaza/ New East Ocean Centre

In the proposed scheme, the footbridge network from the Chatham Road South/Austin Road/Cheong Wan Road junction will be extended eastwards along Cheong Wan Road, and terminating at Concordia Plaza. Provision has been made in the Concordia Plaza development to allow for this connection. The northern corner of the Plaza will be temporarily occupied for the construction of the proposed footbridge to tie in with the built-in connection on the Plaza. Permission from the owner will be required.

It is anticipated that this proposed footbridge connection would help integrate the pedestrian flows from the Chatham Road South area with the public transport interchange within Concordia Plaza/New East Ocean Centre. Long-term plans by Government envisage the extension of the footbridge network along Science Museum Road to link to the developments closer to the TST East waterfront.

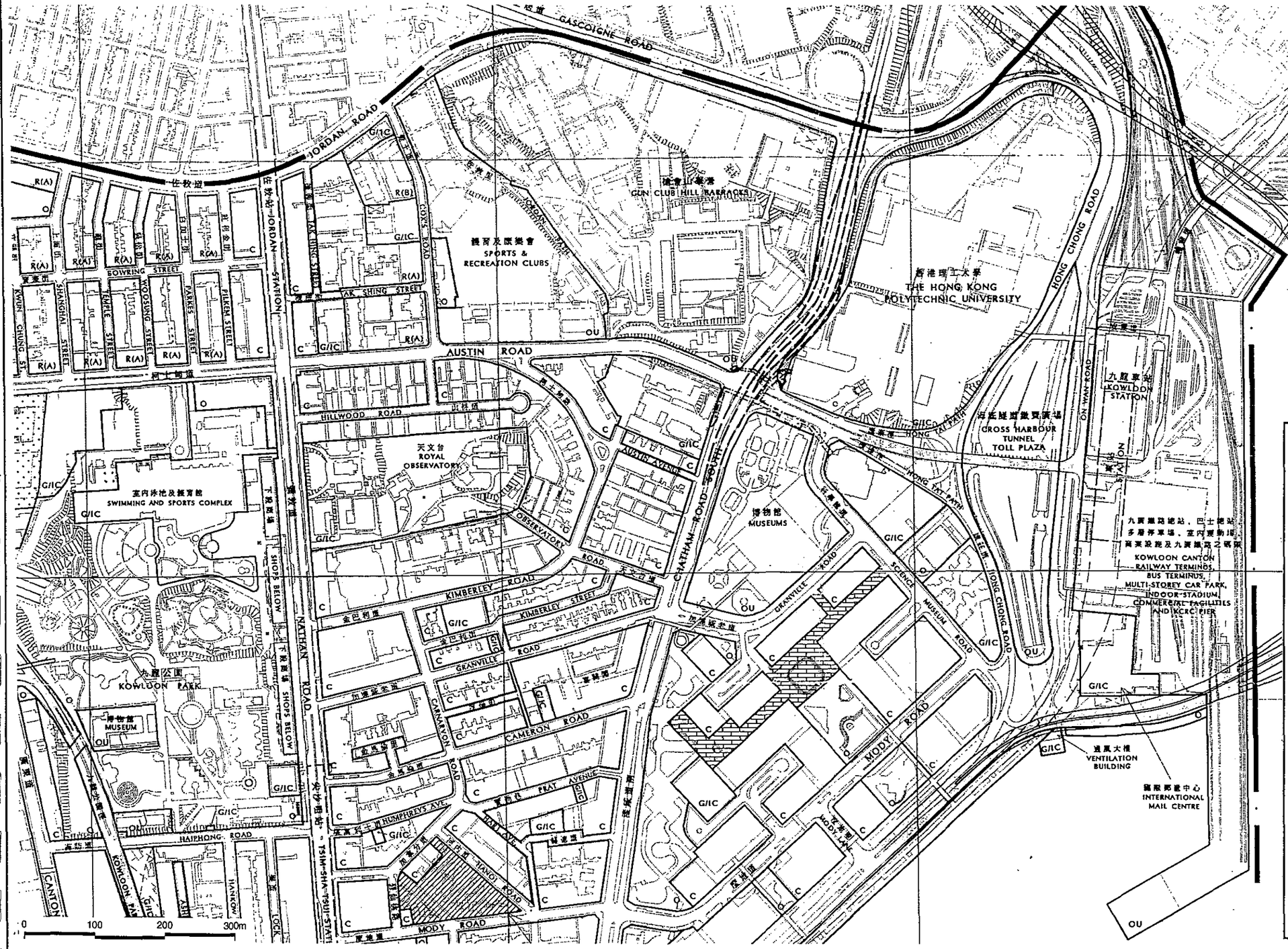
8.4 Summary of Planning and Land Use Impacts

The proposed flyover and footbridge scheme through this area of Tsim Sha Tsui is anticipated to create a range of physical impacts on existing and planned land uses, impacts upon local circulation and impacts with cultural and historically sensitive developments. The last item has been discussed in detail within the previous section: Visual and Landscape Impact. The planning and land use impacts of the scheme are summarized below.

It is envisaged that land acquisition is unavoidable due to limited space in the area. The land use impacts and their likely planning implications are as follows:

- Land would be required along the frontage of the new Hong Kong Museum of History. As this is Government land, acquisition of the land *per se*, is not anticipated to be difficult. The road widening would encroach upon the proposed EVA serving the building and is proposed to be temporarily reduced from 6m to 4m. The mature trees along the central reservation of Chatham Road South are proposed to be transplanted within HKMH amenity area.

- Land resumption would be required along the western edge of Hog Kong Polytechnic University. Land along the western and southern boundaries of HKPU would also be temporarily required for works areas. Details of reprovisioning/reinstating the affected jogging trial would be subject to later negotiations between Government and HKPU.
- It is considered that the proposed footbridge scheme is the best solution given other land use, landscape, visual and engineering constraints and considerations. The proposal also appears to conform with Government's long-term intentions to create a more integrated footbridge network in TST East. Considerable effort has been made to minimise the planning, land use and landscape impacts. If the scheme parameters as stipulated by Transport Department and Highways Department are to be met, the current scheme represents the best option.



圖例
NOTATION

ZONES		用途分區
COMMERCIAL	C	商業
COMPREHENSIVE DEVELOPMENT AREA	CDA	綜合發展區
RESIDENTIAL (GROUP A)	R(A)	住宅(甲類)
RESIDENTIAL (GROUP B)	R(B)	住宅(乙類)
GOVERNMENT / INSTITUTION / COMMUNITY	G/IC	政府/團體/社區
OPEN SPACE	O	康樂用地
OTHER SPECIFIED USES	OU	其他指定用途

COMMUNICATIONS		交通
MASS TRANSIT RAILWAY AND STATION	MTR STATION	地下鐵路及車站
MAJOR ROADS AND JUNCTIONS		主要道路及路口
ELEVATED ROADS		高架道路
PEDESTRIAN PRECINCTS / STREETS		行人專用區或街道
PROPOSED FLYOVER		
PROPOSED FOOTBRIDGE		

MISCELLANEOUS		其他
BOUNDARY OF PLANNING SCHEME		規劃範圍界線
URBAN DEVELOPMENT CORPORATION DEVELOPMENT SCHEME PLAN AREA		土地發展公司發展計劃範圍

土地用途及面積一覽表
SCHEDULE OF USES AND AREAS

Amendment No.	Date	Description	Drawn by	Checked by	Approved by

Job Title
FLYOVER AND FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD, CHATHAM ROAD SOUTH AND CHEONG WAN ROAD

Figure No.
8.1

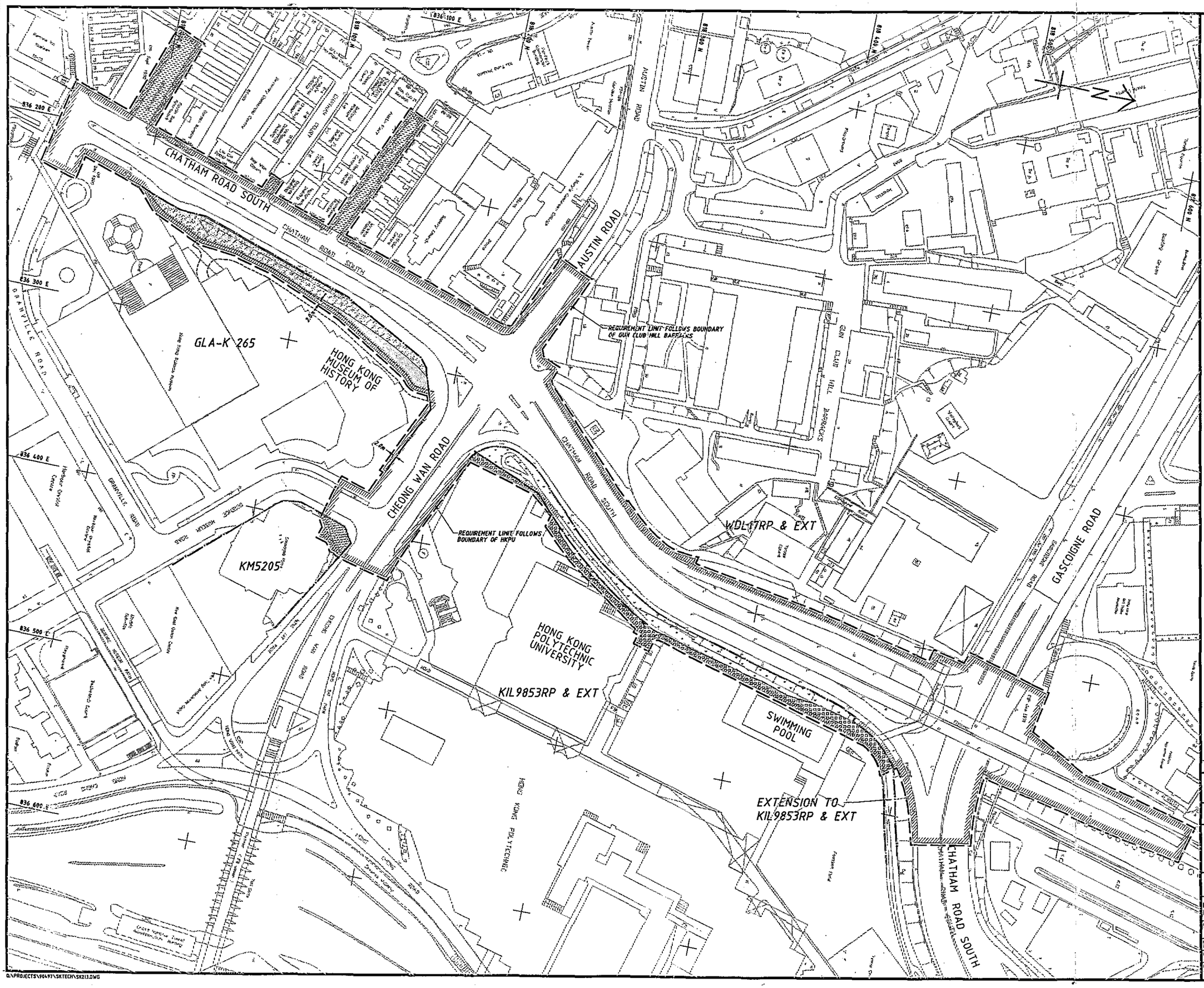
Drawing Title
EXTRACT FROM KOWLOON PLANNING AREA NO.1-TSIM SHA TSUI OUTLINE ZONING PLAN NO. S/K1/10 (06 DECEMBER 1996)

Scale
1:5,000

Drawn by	Checked by	Approved by	Date	Job. No.
			19 NOV. 97	MCA38

Urbis Limited 雅邦
Planning, Urban Design, Landscape, Golf & Environmental Consultants
Urbis Limited, 11/F Siu On Centre, 188 Lockhart Road, Wan Chai, Hong Kong. Tel : 2802 3333 Fax : 2802 8562

MY_XREFS MY_DWG 3.3.98



Highways Department
Kowloon Region

FLYOVER AND FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD CHATHAM ROAD AND CHEONG WAN ROAD - FEASIBILITY STUDY

LAND REQUIREMENT PLAN

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

DRG. NO. 8.2

DESIGNED BY
CONTRACT NO.
DATE OF ISSUE
DRAWN BY
STATUS
SCALE 1 : 1000
DIMENSIONS ARE IN METRES

Q:\PROJECTS\90497\SKTECH\SK213.DWG

9. EM & A REQUIREMENT

The necessity for EM&A are evaluated in this section.

The NCO criteria for construction noise will not be applicable to this case as the works will not be carried out during the restricted hours. The noise limit of 75 dB(A) during the non-restricted hour will be observed. All noise sensitive receivers in the vicinity of the site, except NSR R5 (Winston Mansion), are equipped with central air conditioning and the noise impact on these receivers will not be a concern. As to R5, even without the construction project, the background traffic noise impact in year 2000 will reach 81 dB(A). Since the mitigated construction noise impact will be about 1 - 6 dB(A) above the 75 dB(A) criterion and is therefore comparable to the background level.

The impact of fugitive dust has been confirmed to be acceptable in Section 4.9. The mitigated impact at all the affected ASRs would fall below the acceptable maximum hourly level of 500 $\mu g/m^3$ of TSP. Moreover, all the concerned ASRs do not rely on openable windows as primary means of ventilation and hence would be practically unaffected.

As the EIA did not predict any insurmountable impacts during the construction phase and the impacts are either comparable to the background or already acceptable, it is considered that environmental monitoring & audit are not necessary and are not recommended.

10. CONCLUSION

An EIA for the proposed Flyover and Footbridge Scheme has been conducted for the construction and operational phases and revealed trivial insurmountable impacts reported in the foregoing sections.

The impact of construction noise has been considered likely to exceed the daytime guideline level of 75 dB(A) for a short period of time when the works are being done close to the sensitive uses. However, such uses are already noise insulated and should unlikely be affected. Works during the restricted hours are considered not possible given the high level of construction noise compared with the stringent statutory noise standard during that period.

Fugitive dust impact has been predicted to be generally surmountable by incorporation of suitable mitigation measures such as wetting of exposed earth surface.

The impact of operational traffic noise has been predicted to exceed the noise criteria at various sensitive uses within the Study Area of the Project. Several options of direct noise mitigation measures have been proposed and the efficacy assessed in each case but none of them are considered sufficient to fully mitigate the impact.

Yet, the use of low noise road surface for the main stream of the flyover and a 108m (L) x 7.3m (H) noise barrier have been recommended as the optimum solution to mitigate the noise impact directly from the Flyover and Footbridge Scheme. With these measures in place, the relative contribution in noise impact attributed to the proposed Flyover would be negligible. The eligibility test for noise insulation to those commercial/residential buildings still with residual impact has confirmed that they would not be affected by the Project significantly to warrant such.

The HKPU and the Museum of History are noise insulated and does not rely on opened windows as the primary means of ventilation. Thus, they are not considered to be practically affected by the noise. For the St. Mary's Canossian College, earlier noise insulation works have provided the college with double-glazed windows and air conditioning and is thus well protected from further road traffic noise increase due to the additional flyover.

On the impact of air quality due to vehicular emissions, no unacceptable level has been predicted.

Visual and landscape impact have also been assessed and require suitably tailored-made mitigation measures to soften the impacts. Tree felling, on the other hand is considered inevitable and will be mitigated by compensatory plantings. An environmental monitoring and auditing will be carried out by a competent landscape architect during the construction and maintenance periods of the contract.

Land acquisition is also inevitable to allow room for implementation of the Project.

It is considered that, all impacts relating to the environment, visual and landscape quality, and land acquisition have been addressed in this report. It is an acknowledge fact that the implementation of traffic improvement schemes would often have an impact on the environment to a greater or lesser extent. With suitable mitigation measures incorporated, the Project would impose an acceptable level of impacts on the surroundings and is therefore justifiable.

The implementation schedule of recommended mitigation measures is shown in Appendix VI.

APPENDIX I

Recommended Pollution Control Clauses for Construction Contracts

RECOMMENDED POLLUTION CONTROL CLAUSES for CONSTRUCTION CONTRACTS

The Recommended Pollution Control Clauses (RPCC) are generally good engineering practice to minimize inconvenience and environmental nuisance to nearby residents and other sensitive receivers. Some modifications may be necessary to suit specific site conditions.

1. AVOIDANCE OF NUISANCE

(a) All works are to be carried out in such a manner as to cause as little inconvenience as possible to nearby residents, property and to the public in general, and the Contractor shall be held responsible for any claims which may arise from such inconvenience.

(b) The Contractor shall be responsible for the adequate maintenance and clearance of channels, gullies etc. and shall also provide and maintain such pedestrian and vehicular access as shall be directed within the works site.

(c) Water shall be used to prevent dust rising and the Contractor shall take every precaution to prevent the excavated materials from entering into the public drainage system.

(d) The Contractor shall carry out the Works in such a manner as to minimize adverse impacts on the environment during execution of the Works.

2. NOISE POLLUTION CONTROL

Clauses that should be included in the contract

To comply with Environmental Protection Legislation

(a) The Contractor shall comply with and observe the Noise Control Ordinance and its subsidiary regulations in force in Hong Kong.

To provide sound level meter

(b) The Contractor shall provide an approved integrating sound level meter to IEC 651 : 1979 (Type 1) and 804 : 1985 (Type 1) and the manufacturer's recommended sound level calibrator for the exclusive use of the Engineer at all times. The Contractor shall maintain the equipment in proper working order and provide a substitute when the equipment are out of order or otherwise not available.

The sound level meter including the sound level calibrator shall be verified by the manufacturers every two years to ensure they perform the same levels of accuracies as stated in the manufacturer's specifications. That is to say at the time of measurements, the equipment shall have been verified within the last two years.

Non-statutory noise control

(c) In addition to the requirements imposed by the Noise Control Ordinance, to control noise generated from equipment and activities for the purpose of carrying out any construction work other than percussive piling during the time period from 0700 to 1900 hours on any

day not being a general holiday (including Sundays), the following requirements shall also be complied with:

(i) The noise level measured at 1m from the most affected external facade of the nearby noise sensitive receivers from the construction work alone during any 30 minute period shall not exceed an equivalent sound level (Leq) of 75 dB(A).

(ii) The noise level measured at 1m from the most affected external facade of the nearby schools from the construction work alone during any 30 minute period shall not exceed an equivalent sound level (Leq) of 70 dB(A) [65 dB(A) during school examination periods].

The Contractor shall liaise with the schools and the Examination Authority to ascertain the exact dates and times of all examination periods during the course of the contract.

(Guidance note :-

Sub-clause (c) (ii) can be deleted if the schools are either :-

1) more than 800m away from the Construction Site with no obstructions in between.

2) more than 300m away from the Construction Site with obstructions in between that can effectively screen off the construction noise.)

(iii) Should the limits stated in the above sub-clauses (i) and (ii) be exceeded, the construction shall stop and shall not recommence until appropriate measures acceptable to the Engineer that are necessary for compliance have been implemented.

Any stoppage or reduction in output resulting from compliance with this clause shall not entitle the Contractor to any extension of time for completion or to any additional costs whatsoever.

Housekeeping clauses to promote noise consciousness at site

(d) Before the commencement of any work, the Engineer may require the methods of working, equipment and sound-reducing measures intended to be used on the Site to be made available for inspection and approval to ensure that they are suitable for the project.

(e) The Contractor shall devise, arrange methods of working and carry out the Works in such a manner so as to minimise noise impacts on the surrounding environment, and shall provide experienced personnel with suitable training to ensure that these methods are implemented.

(Guidance note:-

The noise reduction methods include scheduling of works; Siting of facilities; Selection of quiet equipment; and Use of purpose-built acoustic panels and enclosures.)

(f) The Contractor shall ensure that all plant and equipment to be used on site are properly maintained in good operating condition and noisy construction activities shall be effectively sound-reduced by means of silencers, mufflers, acoustic linings or shields, acoustic sheds or screens or other means to avoid disturbance to any nearby noise sensitive receivers.

(g) Notwithstanding the requirements and limitations set out in clause (c) above and subject to compliance with clauses (e) and (f) above, the Engineer may upon application in writing by the Contractor, allow the use of any equipment and the carrying out of any construction activities for any duration provided that he is satisfied with the application which, in his opinion, to be of absolute necessity and adequate noise insulation has been provided to the educational institutions to be affected, or of emergency nature, and not in contravention with the Noise Control Ordinance in any respect.

<u>Contract clauses to be considered when the construction site is not far away from noise sensitive receivers</u>

(h) No excavator mounted breaker shall be used within 125m from any nearby noise sensitive receivers. The Contractor shall use hydraulic concrete crusher whenever applicable.

(Guidance note :-

This should be encouraged for demolition contracts where the site is less than 125m from nearby noise sensitive receivers. Quieter hydraulic concrete crushers will be expected to meet the relevant noise limits in the contracts.)

(i) The only equipment that shall be allowed on the Site for rock drilling works will be quiet drilling rigs with a sound power level not exceeding 110 dB(A). Conventional pneumatically driven drilling rigs are specifically prohibited.

(Guidance note :-

This should be encouraged for site formation contracts where the site is less than 250m from nearby noise sensitive receivers. The 110 dB(A) sound power level specified for the drilling rigs may be relaxed if the site is more than 141m from nearby noise sensitive receivers.)

(j) Do not operate the _____ during the period from _____ to _____ in locations _____.

(Guidance notes :-

1) Whatever equipment or processes to be inserted in the first blank shall be determined by the Engineer who is aware of the constraints involved in the site conditions and the specific method of construction.

2) This clause will be particularly useful in situations where there are many schools around the site.)

(k) Provide air-conditioners to _____.

(Guidance notes :-

1) The blank is there for specific premises identified for each site. It is very likely that educational institutes will be considered most often.

2) A judgement need to be made having regards to the cost of providing air-conditioning and the delay to the project that would have otherwise resulted due to the imposition of other controls. It is therefore appropriate that this clause be used in conjunction with clause (h).)

(l) For the purposes of the above clauses, any domestic premises, hotels, hostel, temporary

housing accommodation, hospital, medical clinic, educational institution, place of public worship, library, court of law, performing arts centre or office building shall be considered a noise sensitive receiver.

Other useful contract clauses related to noise control

(m) The Contractor shall, when necessary, apply as soon as possible for a construction noise permit in accordance with the Noise Control (General) Regulations, display the permit as required and copy to the Engineer.

(Guidance note :-

This clause is suitable where percussive piling or nightwork is anticipated.)

** Note:*

Clauses (a), (b), (c)(i), (c)(iii), (d) to (g) and (m) should be incorporated. The remaining ones should be incorporated where appropriate.

3. DUST SUPPRESSION MEASURES

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

(b) The Contractor shall at his own cost, and to the satisfaction of the Engineer, install effective dust suppression equipment and take such other measures as may be necessary to ensure that at the Site boundary and any nearby sensitive receiver the concentration of air-borne dust shall not exceed 0.5 milligrams per cubic meter, at standard temperature (25°C) and pressure (1.0 bar) averaged over one hour, and 0.26 milligrams per cubic metre, at standard temperature (25°C) and pressure (1.0 bar) averaged over 24 hours.

(c) In the process of material handling, any material which has the potential to create dust shall be treated with water or sprayed with wetting agent.

(d) Where dusty materials are being discharged to vehicle 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 should be provided for this enclosure and vented to a fabric filter system.

(e) Any vehicle with an open load carrying area used for moving materials which have the potential to create dust shall have 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. The tarpaulin shall be properly secured and shall extend at least 300mm over the edges of the side and tail boards.

(f) Stockpiles of sand and aggregate greater than $20m^3$ shall be enclosed on three sides, with walls extending above the pile and 2 meters beyond the front of the pile. In addition, water sprays shall be provided and used both to dampen stored materials and when receiving raw material.

(g) The Contractor shall frequently clean and water the site to minimize the fugitive dust emissions.

(h) The Contractor shall restrict all motorized vehicles to a maximum speed of 8 km per hour

and confine haulage and delivery vehicles to designated roadways inside the site. Areas of roadway longer than 100m where movement of motorized vehicles exceeds 100 vehicular movements/day or as directed by the Engineer shall be furnished with a flexible pavement surfacing..

(i) Wheel washing facilities shall be installed and used by all vehicles leaving the site. No earth, mud, debris, dust and the like shall be deposited on public roads. Water in the wheel cleaning facility shall be changed at frequent intervals and sediments shall be removed regularly. The Contractor shall submit details of proposals for the wheel cleaning facilities to the Engineer prior to construction of the facility. Such wheel washing facility shall be usable prior to any earthworks excavation activity on the Site. The Contractor shall also provide a hard-surfaced road between washing facility and the public road.

(j) Conveyor belts shall be fitted with windboards, and conveyor transfer points and hopper discharge areas shall be enclosed to minimize emission of dust. All conveyors carrying materials which have the potential to create dust shall be totally enclosed and fitted with belt cleaners.

(k) Cement or pulverised fuel ash delivered in bulk shall be stored in closed silos fitted with high level alarm indicator. The high level alarm indicators shall be interlocked with the filling line such that in the event of the hopper approaching an overfull condition, an audible alarm will operate, and after 1 minute the pneumatic line to the filling tanker will close.

(l) All air vents on cement silos shall be fitted with fabric filters provided with either shaking or pulse-air cleaning mechanisms. The fabric filter area shall be determined using the air to cloth ratio (0.01 - 0.03 m/s) or the filtering velocity.

(m) Weigh hoppers shall be vented to suitable filter.

(n) 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.

(o) For dry mix batching, the process should be done in total enclosure with exhaust to fabric filter.

(p) All cement and concrete trucks are to be effectively washed down after loading and prior to leaving the works.

(q) The Contractor shall provide and operate two high volume air samplers and associated equipment and shelters in accordance with the USA standard Title 40, Code of Federal Regulations, Chapter 1 (Part 50) Appendix B. Sampling shall be carried out 1 day in every 6 days at 10 No. sampling points on the Site boundary for such periods and in a manner as instructed by the Engineer. The samplers, equipment and shelters shall be constructed so as to be transferable between sampling points to enable monitoring of "dust in air" levels at any sampling point required by the Engineer. The Contractor shall provide all necessary protection fences and the like at sampling points. Testing and analysis of sampled materials shall be carried out by a laboratory approved by the Engineer.

NOTES :

1) Discretion should be exercised to select the appropriate clauses from above for different situations. The following are some suggestion :

i)	*Construction sites without concrete batching*	*delete 3(k) to 3(q)*

ii)	*Small works area and storage of material*	*delete 3(h) to 3(q)*
iii)	*Very simple case*	*delete 3(b) to 3(q)*

2) Item 3(c) is not applicable to the handling of cement and the like.

3) Item 3(q) should only be used in cases where there is likely to be dust impact for a considerable period of time e.g. reclamation, borrowing activities etc.

4) The Contractor should note that concrete batching in the main urban area is not normally allowed.

4. CONSENT TO EQUIPMENT AND PROCESSES

(a) The Contractor shall not install any furnace, boiler or other plant or equipment or use any fuel that might in any circumstance produce smoke or any other air pollutions without the prior consent of the Engineer. Unless specifically instructed by the Engineer, the Contractor shall not light fires on site for the burning of debris or any other matter.

(b) The Contractor's attention is drawn to the Air Pollution Control Ordinance and its subsidiary legislation, particularly the Air Pollution (Furnaces, Ovens and Chimneys) (Installation and Alteration) Regulations and the Air Pollution Control (Smoke) Regulations.

5. REMOVAL OF WASTE MATERIAL

(a) 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 site onto any adjoining land or allow any waste mater or refuse to be deposited anywhere within the site or onto any adjoining land and shall have all such matter removed from the site.

(b) The Contractor shall be liable for any damages caused to adjoining land through his failure to comply with clause 5(a).

(c) 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.

(d) The Contractor shall be responsible for adequately maintaining any existing site drainage system at all times including removal of solids in sand traps, manholes and stream beds.

(e) Any proposed stream course and nullah temporary diversions shall be submitted 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 or as agreed by the Engineer after the permanent drainage system has been completed.

(f) The Contractor shall furnish, for the Engineer's information, particulars of the Contractor's arrangements for ensuring that material from any earthworks does not wash into the drainage system. If at any time such arrangements prove to be ineffective the Contractor shall take such additional measures as the Engineer shall deem necessary and shall remove all silt which may have accumulated in the drainage system whether within the Site or not.

(g) The Contractor shall segregate all inert construction waste material suitable for reclamation

or land formation and shall dispose of such material at such public dumping area(s) as may be specified from time to time by the Director of Civil Engineering Services.

(h) All non-inert construction waste material deemed unsuitable for reclamation or land formation and all other waste material shall be disposal of at a public landfill.

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

Any dredged material shall be disposed of at an approved marine dumping ground. One of the approved marine dumping grounds is the Gazetted Marine Dumping Ground at the __ _____. The Contractor shall apply to relevant authorities under the Dumping at Sea Act for a marine dumping licence.

6. DISCHARGE INTO SEWERS AND DRAINS

(a) 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 Engineer 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. The design of such treatment works shall be submitted to the Engineer for approval not less than one month prior to the commencement of construction or as agreed by the Engineer.

(b) If any office, site canteen or toilet facilities is erected, foul water effluent shall be directed to a foul sewer or to a sewage treatment facility either directly or indirectly by means of pumping or other means approved by the Engineer.

(c) The Contractor's attention is drawn to the Buildings Ordinance and to the Water Pollution Control Ordinance.

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

(a) All Contractor's 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.

(b) Pollution avoidance measures shall include but not be limited to the following :

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

(ii) Cutterheads of suction dredgers shall be suitable for the material being excavated and designed to minimise overbreak and sedimentation around the cutter;

(iii) Where trailing suction hopper dredgers for dredging of marine mud are in use, overflow from the dredger and the operation of lean mixture overboard systems shall not be permitted, unless expressly approved by the Engineer in consultation with Environmental Protection Department;

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

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

(vi) Marine works shall cause no visible foam, oil, grease, scum, litter or other objectionable matter to be present on the water within the site or dumping grounds;

(vii) Barges and hopper dredgers shall be fitted with tight-fitting seals to their bottom openings to prevent leakage of material;

(viii) Excess material shall be cleaned from the decks and exposed fittings of barges and hopper dredgers before the vessel is moved;

(ix) Loading of barges and hoppers shall be controlled to prevent splashing of dredged material into the surrounding water, and barges or hoppers shall not be filled to a level that will cause overflowing of material or polluted water during loading or transportation; and

(x) Adequate freeboard shall be maintained on barges to ensure that decks are not washed by wave action.

(8) SPECIAL PROCEDURES FOR THE AVOIDANCE OF POLLUTION DURING DREDGING, TRANSPORTATION AND DISPOSAL OF DESIGNATED CONTAMINATED MARINE MUD)

(a) Uncontaminated mud shall not be dumped other than in dumping grounds as may be approved for the purpose by the Director of Environmental Protection and in accordance with the Dumping at Sea Act (Overseas Territories) Order 1975. Contaminated mud shall not be dumped in gazetted dumping grounds. If it cannot be left in situ, it should be disposed of by specific methods as directed by the Director of Environmental Protection. The Contractor shall be responsible for obtaining all necessary licences for these operations.

Notes : The Engineer shall ensure that the Contractor has access to Works Branch Technical Circular No. 22/92 "Marine Disposal of Dredged Mud"; EPD Technical Circular No. 1.1.92 "Classification of Dredged Sediments for Marine Disposal"; and Fill Management Committee Paper FMC/58 (6.10.92) "General Allocation Conditions for Marine Borrow Areas and Mud Disposal Sites".

(b) When dredging, transporting and disposing of designated contaminated marine mud, the Contractor shall implement additional special procedures for the avoidance of pollution which shall include but not be limited to be following :

(i) Dredging of designated contaminated marine mud shall only be undertaken by a suitable grab dredger using a closed watertight grab; and

(ii) Transport of designated contaminated marine mud shall be by split barge of not less than 750 m^2 capacity well maintained and capable of rapid opening and discharge at the disposal site.

(iii) Discharge from split barges shall be placed in the designated special dumping pit by bottom dumping, at a location within the pit to be specified, from time to time, by the Secretary of the Fill Management Committee (FMC) and Geotechnical Engineering Office of Civil Engineering Department;

(iv) The dumping vessel shall be stationary throughout the dumping operation, discharges shall be undertaken rapidly, and the hoppers shall then immediately be

closed; any material adhering to the sides of the hopper shall not be washed out of the hopper and the hopper shall remain closed until the barge next returns to the disposal site;

(v) Any substance which is found dumped by the Contractor outside the designated dumping ground shall be removed.; and

(vi) providing and maintaining functional marker buoys at the corners of the pit.

(c) Silt Curtains

(i) The Contractor will be responsible for designing, agreeing with the Engineer, and installing silt curtains where required to achieve the water quality requirements and the protection of water quality at any water intakes;

(ii) Silt curtains shall be formed from tough, abrasion-resistant permeable membranes suitable for the purpose, supported on floating booms in such a way as to ensure that the ingress of turbid waters to the enclosed water shall be restricted;

(iii) The boom of the curtain shall be formed and installed in such a way that tidal rise and fall are accommodated and that the ingress of turbid waters is limited. The removal and reinstallation of such curtains during typhoon conditions shall be as agreed with the Director of Marine; and

(iv) The Contractor shall regularly inspect the silt curtains and shall ensure that they are adequately moored and marked to avoid danger to marine traffic.

9. PREVENTION OF EROSION

Sections of permanent cut slope excavation at final cut face grade larger than 100 sq.m. shall be hydroseeded within one week of completion or as agreed by the Engineer.

Environmental Assessment Division
Environmental Protection Department
Prepared on 10.3.94

[ID.STD-CON.D] {E(RA)1(STANDARD) disk}

APPENDIX II

Emission Factors for TSP Modelling

Table A2-2 Dust emission from loading and unloading of materials

Emission factor for truck loading (kg/Mg), E =		k(0.0016)(U/2.2)1.3/ (M/2)1.4		
where	k =	particle size multiplier (dimensionless) =		0.74
	U =	mean wind speed (m/s) =		1.0
	M =	material moisture content (%) =		2.0
Emission factor for loading each truck =		0.0004	kg/Mg	
Capacity of each truck =		12.50	Mg	
Number of loadings in an hour =		6		
Total amount of soil, spoil or construction material handled =		75	Mg/hr	
Emission rate =		0.01	g/s	
Point source			***fficiency of suppressio***	***Emission rate (g/s)***
at 1.5m above gd	*(Assume at the nearest worksite)*		0.0%	0.009
			Total	0.009

Table A2-3 Dust emission from Excavation (Aggregate Drop Operation)

Emission factor for excavation (kg/Mg), E =			k(0.0016)(U/2.2)1.3/ (M/2)1.4
where	k =	particle size multiplier (dimensionless) =	0.74
	U =	mean wind speed (m/s) =	1.0
	M =	material moisture content (%) =	2.0
Emission factor for excavation =		0.0004	kg/Mg
		30	m3/hr/excavator
no. of excavator =		4	
max. excavation rate =		75	Mg/hr
Emission factor for excavation =			g/s
Point source		***Efficiency of suppression***	***Emission rate (g/s)***
ground level	*(Assume at the nearest worksite)*	0.0%	0.009
			0.009

A2 DERIVATION OF EMISSION FACTORS

Emission factors were based on USEPA "Compilation of Air Pollution Emission Factors (AP-42)" for use in FDM models.

The average dust density of 2,500 kg/m^3 was assumed. Two classes of particulate size, viz. 10μm (20%) and 30μm (80%) were also assumed.

The followings have been used in deriving the appropriate emission factors for use on the FDM model. Mean vehicle speed on unpaved road has been assumed to be 5 kph which is reasonable as it is close to villages and pedestrian in the vicinity.

Table A2-1 Dust Emission from unpaved road with dust mitigation measures

Dust emission from unpaved road (without dust mitigation measures)
(USEPA AP-42 Section 11.2.1)

Emission factor for industrial unpaved road (kg/v-km), E = k(1.7)(s/12)(S/48)(W/2.7)0.7(w/4)0.5

where	k =	particle size multiplier (dimensionless) =	0.8
	s =	silt content of road surface materials (%) =	4.8
	S =	mean vehicle speed (km/hr) =	5
	W =	mean vehicle weight (Mg) =	8 unladen
	W =	mean vehicle weight (Mg) =	24 laden
	w =	mean number of wheels =	10

Emission factor from industrial unpaved road (kg/v-km or g/v-m)) = 0.1916 unladen
Emission factor from industrial unpaved road (kg/v-km or g/v-m)) = 0.4135 laden

Line Source

Label	*X1*	*Y1*	*X2*	*Y2*	*Distance (m)*	*Veh/hr*	*Efficiency of suppression*	*Emission rate/m (g/m/s)*	*Emission rate (g/s)*
AB	*836210.0*	*818014.5*	*836303.7*	*818228.8*	233.8	1	0.0%	0.000053	0.01245
BC	*836303.7*	*818228.8*	*836399.1*	*818356.0*	159.1	1	0.0%	0.000053	0.00847
CD	*836399.1*	*818356.0*	*836434.3*	*818514.8*	162.7	1	0.0%	0.000053	0.00866
								0.000160	0.02958

APPENDIX III

TD's Approval Letter on Traffic Data used Noise Assessment

運 輸 署

TRANSPORT DEPARTMENT

本署檔號 Our Ref.: ( ) in KR 146/193/S-78
來函檔號 Your Ref.:
電 話 Tel.: 2399 2511

29. OCT 1997

Maunsell Consultants Asia Ltd
601 World Commerce Centre,
Harbour City,
11 Canton Road,
Kowloon.
(Attn.: Mr. Dickson LO)

Dear Sirs,

Agreement No. CE 30/96
Flyover and Footbridge Schemes at Junction of
Austin Road, Chatham Road and Cheong Wan Road - Feasibility Study

Draft Environmental Impact Assessment (EIA) Report

I refer to Highways Department's memo of 13 October 1997 enclosing a copy of the subject report to this office, and would advise that I have no comment on the same.

Yours faithfully,

(C.Y. TUNG)
for Assistant Commissioner
for Transport/Urban

c.c. CHE/K

交通工程部（九龍） Traffic Engineering (Kln) Division
九龍旺角聯運街三十號旺角政府合署八樓
8th Floor Mongkok Government Offices 30 Luen Wan Street Mong Kok Kowloon
傳真 Fax (852)2397 8046

APPENDIX IV

Traffic Flow and Mix Adopted in Impact Assessment

Existing Flyover (Section 1.2)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	82.3	1,844	85.0	635
Light Goods Vehicle (LGV -dl)	7.5	168	9.0	67
Heavy Goods Vehicle (HGV)	10.2	228	6.0	45
Total	100	2,240	100	747

Existing Flyover (Section 1.3)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	67.6	862	85.0	361
Light Goods Vehicle (LGV -dl)	15.0	191	9.0	38
Heavy Goods Vehicle (HGV)	17.4	222	6.0	26
Total	100	1,275	100	425

Proposed Flyover(Section 1.4)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	88.2	423	85.0	136
Light Goods Vehicle (LGV -dl)	5.0	24	9.0	14
Heavy Goods Vehicle (HGV)	6.8	33	6.0	10
Total	100	480	100	160

Proposed Flyover(Section 1.5)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	68.6	244	85.0	101
Light Goods Vehicle (LGV -dl)	15.0	53	9.0	11
Heavy Goods Vehicle (HGV)	16.4	58	6.0	7
Total	100	355	100	119

Proposed Flyover(Section 1.6)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	78.4	1,376	85.0	497
Light Goods Vehicle (LGV -dl)	10.0	176	9.0	53
Heavy Goods Vehicle (HGV)	11.6	204	6.0	35
Total	100	1,756	100	585

Proposed Flyover(Section 1.7)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	78.4	721	85.0	261
Light Goods Vehicle (LGV -dl)	10.0	92	9.0	28
Heavy Goods Vehicle (HGV)	11.6	107	6.0	18
Total	100	920	100	307

Proposed Flyover (Section 1.8)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	73.5	309	85.0	119
Light Goods Vehicle (LGV -dl)	12.5	53	9.0	13
Heavy Goods Vehicle (HGV)	14.0	59	6.0	8
Total	100	421	100	140

Existing Flyover (Section 1.9)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	73.5	1,022	85.0	394
Light Goods Vehicle (LGV -dl)	12.5	174	9.0	42
Heavy Goods Vehicle (HGV)	14.0	195	6.0	28
Total	100	1,391	100	464

Existing Flyover (Section 1.10)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	20.0	443	85.0	628
Light Goods Vehicle (LGV -dl)	35.0	775	9.0	66
Heavy Goods Vehicle (HGV)	45.0	997	6.0	44
Total	100	2,215	100	738

Existing Flyover (Section 1.11)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	20.0	221	85.0	313
Light Goods Vehicle (LGV -dl)	35.0	387	9.0	33
Heavy Goods Vehicle (HGV)	45.0	497	6.0	22
Total	100	1,105	100	368

Gascoigne Road (Segment 2.1EB)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	64.7	2,679	85.0	1,173
Light Goods Vehicle (LGV -dl)	13.5	559	9.0	124
Heavy Goods Vehicle (HGV)	21.8	903	6.0	83
Total	100	4,141	100	1,380

Gascoigne Road (Segment 2.1WB)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	65.7	3,200	85.0	1,380
Light Goods Vehicle (LGV -dl)	13.5	657	9.0	146
Heavy Goods Vehicle (HGV)	20.8	1,013	6.0	97
Total	100	4,870	100	1,623

Chatham Road South (Segment 2.2EB)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	67.9	3,684	85.0	1,537
Light Goods Vehicle (LGV -dl)	10.0	543	9.0	163
Heavy Goods Vehicle (HGV)	22.1	1,199	6.0	109
Total	100	5,426	100	1,809

Chatham Road South (Segment 2.2WB)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	67.9	3,850	85.0	1,607
Light Goods Vehicle (LGV -dl)	10.0	567	9.0	170
Heavy Goods Vehicle (HGV)	22.1	1,253	6.0	113
Total	100	5,670	100	1,890

Chatham Road South (Segment 2.3)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	78.4	251	85.0	91
Light Goods Vehicle (LGV -dl)	5.0	16	9.0	10
Heavy Goods Vehicle (HGV)	16.6	53	6.0	6
Total	100	320	100	107

Chatham Road South (Segment 2.4)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	63.7	694	85.0	309
Light Goods Vehicle (LGV -dl)	15.0	164	9.0	33
Heavy Goods Vehicle (HGV)	21.3	232	6.0	22
Total	100	1,090	100	364

Chatham Road South (Segment 2.5)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	88.2	423	85.0	136
Light Goods Vehicle (LGV -dl)	5.0	24	9.0	14
Heavy Goods Vehicle (HGV)	6.8	33	6.0	10
Total	100	480	100	160

Chatham Road South (Segment 2.6)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	68.6	422	85.0	175
Light Goods Vehicle (LGV -dl)	12.5	77	9.0	18
Heavy Goods Vehicle (HGV)	18.9	116	6.0	12
Total	100	615	100	205

Chatham Road South (Segment 2.7)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	73.5	309	85.0	119
Light Goods Vehicle (LGV -dl)	12.5	53	9.0	13
Heavy Goods Vehicle (HGV)	14.0	59	6.0	8
Total	100	421	100	140

Chatham Road South (Segment 2.8)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	68.6	224	85.0	101
Light Goods Vehicle (LGV -dl)	15.0	53	9.0	11
Heavy Goods Vehicle (HGV)	16.4	58	6.0	7
Total	100	335	100	119

Austin Road (Segment 2.9EB)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	78.4	639	85.0	231
Light Goods Vehicle (LGV -dl)	7.5	61	9.0	24
Heavy Goods Vehicle (HGV)	14.1	115	6.0	16
Total	100	815	100	271

Austin Road (Segment 2.9WB)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	72.5	1,138	85.0	445
Light Goods Vehicle (LGV -dl)	12.5	196	9.0	47
Heavy Goods Vehicle (HGV)	15.0	236	6.0	31
Total	100	1,570	100	523

Cheong Wan Road (Segment 2.10EB)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	73.5	992	85.0	383
Light Goods Vehicle (LGV -dl)	7.5	101	9.0	41
Heavy Goods Vehicle (HGV)	19.0	257	6.0	27
Total	100	1,350	100	451

Cheong Wan Road (Segment	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	73.5	842	85.0	324
Light Goods Vehicle (LGV -dl)	5.0	57	9.0	34
Heavy Goods Vehicle (HGV)	21.5	246	6.0	23
Total	100	1,145	100	381

Chatham Road South (Segment 2.11NB)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	53.9	418	85.0	220
Light Goods Vehicle (LGV -dl)	7.5	58	9.0	23
Heavy Goods Vehicle (HGV)	38.6	299	6.0	16
Total	100	775	100	259

Chatham Road South (Segment 2.11SB)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	63.7	481	85.0	214
Light Goods Vehicle (LGV -dl)	7.5	57	9.0	23
Heavy Goods Vehicle (HGV)	28.8	217	6.0	15
Total	100	755	100	252

Chatham Road South (Segment 2.12EB)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	68.6	1,732	85.0	715
Light Goods Vehicle (LGV -dl)	10.0	253	9.0	76
Heavy Goods Vehicle (HGV)	21.4	540	6.0	51
Total	100	2,525	100	842

Chatham Road South (Segment 2.12WB)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	68.6	1,471	85.0	608
Light Goods Vehicle (LGV -dl)	10.0	215	9.0	64
Heavy Goods Vehicle (HGV)	21.4	459	6.0	43
Total	100	2,145	100	715

Chatham Road South (Segment 2.13)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	20.0	1649	85.0	2336
Light Goods Vehicle (LGV -dl)	35.0	2886	9.0	247
Heavy Goods Vehicle (HGV)	45.0	3710	6.0	165
Total	100	8,245	100	2,748

Hong Chong Road (Segment 2.14)	PM Peak Hour		Night-time period	
Vehicle Type	%	Volume (veh/h)	%	Volume (veh/h)
Passenger Car (Petrol), (P/C - p)	17.7	1939	85.0	3105
Light Goods Vehicle (LGV -dl)	30.0	3288	9.0	329
Heavy Goods Vehicle (HGV)	52.3	5733	6.0	219
Total	100	10,960	100	3,653

Science Museum Road (Segment 2.15)	PM Peak Hour		Night-time period	
Vehicle Type	**%**	**Volume (veh/h)**	**%**	**Volume (veh/h)**
Passenger Car (Petrol), (P/C - p)	10.0	58	85.0	163
Light Goods Vehicle (LGV -dl)	34.5	198	9.0	17
Heavy Goods Vehicle (HGV)	55.5	319	6.0	12
Total	100	575	100	192

Appendix V

Tree Survey Report

Contents

1. TREE SURVEY

A tree survey of the existing trees within the study area has been carried out as shown in Drawing Nos. 1.0 to 6.0. Their locations are marked in Drawings Nos. 7.0 and 8.0.

An assessment of the trees is summarised in Table No. 1.0.

It is recommended that 72 nos. of the existing trees affected by the proposed flyover and footbridge schemes should be transplanted to locations within the site and its immediate surrounds if possible.

TABLE NO. 1 - EXISTING TREES ASSESSMENT SCHEDULE

Project Name : Agreement No.CE 30/96 - Flyover and Footbridge Schemes at Junction of i/o Austin Road, Chatham Road and Cheong Wan Road

Urbis Limited

Planning, Urban Design, Landscape, Golf & Environmental Consultants

Job No : MCA38

Date : 26 September 1997

TREE NO	BOTANICAL NAME	SURVEY SIZE			EXISTING CONDITION			SURVIVAL RATE AFTER TRANSPLANT			PHOTO NO.	RECOMMENDATIONS
		HEIGHT	DIA.	SPREAD	GOOD	FAIR	BAD	HIGH	MEDIUM	LOW		
1	Aleurites moluccana	6	0.3	5	x				x		1	Transplant within site if possible
2	Aleurites moluccana	6	0.3	5	x				x		1	Transplant within site if possible
3	Aleurites moluccana	6	0.3	5	x				x		1	Transplant within site if possible
4	Aleurites moluccana	6	0.3	5	x				x		1	Transplant within site if possible
5	Aleurites moluccana	6	0.6	5	x				x			Transplant within site if possible
6	Aleurites moluccana	6	0.6	5	x				x			Transplant within site if possible
7	Aleurites moluccana	6	0.3	5	x				x			Transplant within site if possible
8	Aleurites moluccana	6	0.6	5	x				x			Transplant within site if possible
9	Aleurites moluccana	6	0.6	5	x				x			Transplant within site if possible
10	Aleurites moluccana	6	0.3	5	x				x			Transplant within site if possible
11	Aleurites moluccana	6	0.6	5	x				x		2	Transplant within site if possible
12	Aleurites moluccana	6	1.0	5	x				x		2	Transplant within site if possible
13	Aleurites moluccana	6	0.1	5	x				x		2	Transplant within site if possible
14	Aleurites moluccana	6	0.2	5	x				x		2	Transplant within site if possible
15	Aleurites moluccana	6	0.2	5	x				x		3	Transplant within site if possible
16	Aleurites moluccana	6	0.3	5	x				x		3	Transplant within site if possible
17	Aleurites moluccana	6	0.2	5	x				x		3	Transplant within site if possible
18	Aleurites moluccana	6	0.6	5	x				x		3	Transplant within site if possible
19	Aleurites moluccana	6	0.6	5	x				x		3	Transplant within site if possible
20	Aleurites moluccana	9	0.3	5	x				x		4	Transplant within site if possible
21	Aleurites moluccana	9	0.9	5	x				x		4	Transplant within site if possible

TABLE NO. 1 - EXISTING TREES ASSESSMENT SCHEDULE

Project Name : Agreement No.CE 30/96 - Flyover and Footbridge Schemes at Junction of i/o Austin Road, Chatham Road and Cheong Wan Road

Urbis Limited

Planning, Urban Design, Landscape, Golf & Environmental Consultants

Job No : MCA38

Date : 26 September 1997

TREE NO	BOTANICAL NAME	SURVEY SIZE			EXISTING CONDITION			SURVIVAL RATE AFTER TRANSPLANT			PHOTO NO.	RECOMMENDATIONS
		HEIGHT	DIA.	SPREAD	GOOD	FAIR	BAD	HIGH	MEDIUM	LOW		
22	Aleurites moluccana	9	0.9	5	x				x		4	Transplant within site if possible
23	Aleurites moluccana	9	0.9	5	x				x		5	Transplant within site if possible
24	Aleurites moluccana	9	0.9	5	x				x		5	Transplant within site if possible
25	Aleurites moluccana	9	0.9	5	x				x		5	Transplant within site if possible
26	Aleurites moluccana	9	0.9	5	x				x		6	Transplant within site if possible
27	Aleurites moluccana	7	0.6	5	x				x		6	Transplant within site if possible
28	Aleurites moluccana	7	0.6	5	x				x		6	Transplant within site if possible
29	Crateva religiosa forst	6	1.0	7	x					x	7	Transplant within site if possible
30	Crateva religiosa forst	6	1.0	7	x					x	7	Transplant within site if possible
31	Crateva religiosa forst	6	1.0	7	x					x	8	Transplant within site if possible
32	Crateva religiosa forst	6	1.0	7	x					x	8	Transplant within site if possible
33	Crateva religiosa forst	6	1.0	7	x					x	8	Transplant within site if possible
34	Crateva religiosa forst	6	1.0	7	x					x	8	Transplant within site if possible
35	Casuarina equisetifolia	10	1.0	5		x				x	10	Fell
36	Casuarina equisetifolia	10	0.9	5		x				x	10	Fell
37	Casuarina equisetifolia	10	0.6	5		x				x	10	Fell
38	Melaleuca leucadendron	6	0.2	3		x				x	11	Transplant within site if possible
39	Melaleuca leucadendron	6	0.2	3		x				x	11	Transplant within site if possible
40	Melaleuca leucadendron	6	0.2	3		x				x	11	Retain
41	Melaleuca leucadendron	6	0.2	3		x				x	11	Retain
42	Melaleuca leucadendron	6	0.2	3		x				x	11	Transplant within site if possible

TABLE NO. 1 - EXISTING TREES ASSESSMENT SCHEDULE

Urbis Limited
Planning, Urban Design, Landscape, Golf & Environmental Consultants

Project Name : Agreement No.CE 30/96 - Flyover and Footbridge Schemes at Junction of i/o Austin Road, Chatham Road and Cheong Wan Road

Job No : MCA38

Date : 26 September 1997

TREE NO	BOTANICAL NAME	SURVEY SIZE			EXISTING CONDITION			SURVIVAL RATE AFTER TRANSPLANT			PHOTO NO.	RECOMMENDATIONS
		HEIGHT	DIA.	SPREAD	GOOD	FAIR	BAD	HIGH	MEDIUM	LOW		
43	Melaleuca leucadendron	6	0.2	3		x				x	11	Transplant within site if possible
44	Casuarina equisetifolia	10	0.9	5		x				x	12	Retain
45	Casuarina equisetifolia	10	0.9	5		x				x	13	Retain
46	Casuarina equisetifolia	10	0.9	5		x				x	14	Fell
47	Sapium sebiferum	6	0.3	5		x				x	14	Fell
48	Celtis sinensis	8	0.5	6		x			x		15	Retain
49	Litsea spp.	10	0.6	3			x			x	15	Fell
50	Celtis sinensis	6	0.5	3		x			x		15	Retain
51	Ficus elastica	7	1.0	15		x			x		16	Retain
52	Bauhinia variegata	4	0.3	3		x			x		17	Retain
53	Platanus acerifolia	10	0.3	4		x				x	18	Retain
54	Platanus acerifolia	10	0.3	4		x				x	18	Retain
55	Albizia lebbek	5	0.3	5		x			x		19	Transplant within site if possible
56	Celtis sinensis	3	0.3	5		x			x		20	Retain
57	Casuarina equisetifolia	10	1.0	8		x				x	20	Retain
58	Aleurites moluccana	7	0.6	5		x			x		21	Transplant within site if possible
59	Aleurites moluccana	5	0.3	6		x			x		21	Transplant within site if possible
60	Celtis sinensis	4	0.3	4		x			x		21	Transplant within site if possible
61	Celtis sinensis	6	0.4	5		x			x		22	Transplant within site if possible
62	Celtis sinensis	4	0.2	3		x			x		22	Transplant within site if possible
63	Celtis sinensis	5	0.5	6		x			x		23	Transplant within site if possible

TABLE NO. 1 - EXISTING TREES ASSESSMENT SCHEDULE

Project Name : Agreement No.CE 30/96 - Flyover and Footbridge Schemes at Junction of i/o Austin Road, Chatham Road and Cheong Wan Road

Urbis Limited
Planning, Urban Design, Landscape, Golf & Environmental Consultants

Job No : MCA38

Date : 26 September 1997

TREE NO	BOTANICAL NAME	SURVEY SIZE			EXISTING CONDITION			SURVIVAL RATE AFTER TRANSPLANT			PHOTO NO.	RECOMMENDATIONS
		HEIGHT	DIA.	SPREAD	GOOD	FAIR	BAD	HIGH	MEDIUM	LOW		
64	Celtis sinensis	7	0.9	6		x			x		23	Transplant within site if possible
65	Delonix regia	7	0.7	8		x			x		23	Transplant within site if possible
66	Delonix regia	7	0.6	8	x				x		24	Transplant within site if possible
67	Delonix regia	7	0.6	8	x				x		24	Transplant within site if possible
68	Delonix regia	7	0.6	8	x				x		24	Transplant within site if possible
69	Delonix regia	7	0.6	8	x				x		24	Transplant within site if possible
70	Melia azedarach	5	0.1	4		x				x	26	Fell
71	Bombax malabaricum	10	0.6	5	x				x		27	Transplant within site if possible
72	Litsea spp.	5	0.2	3		x				x	28	Fell
73	Leucaena glauca	5	0.1	3		x			x		28	Transplant within site if possible
74	Crateva religiosa forst	5	0.2	5		x			x		29	Transplant within site if possible
75	Crateva religiosa forst	6	0.6	6		x			x			Transplant within site if possible
76	Aleurites moluccana	8	0.6	5		x			x		30	Transplant within site if possible
77	Aleurites moluccana	8	0.6	5		x			x		30	Transplant within site if possible
78	Crateva religiosa forst	5	0.6	8		x			x		32	Transplant within site if possible
79	Cassia spp	2	0.1	2			x		x		32	Fell
80	Celtis sinensis	5	0.1	3		x			x		33	Transplant within site if possible
81	Melia azedarach	8	1.0	10		x				x	33	Fell
82	Crateva religiosa forst	4	0.6	5		x			x		33	Transplant within site if possible
83	Crateva religiosa forst	4	0.1	5		x			x		33	Transplant within site if possible
84	Crateva religiosa forst	6	0.6	4		x			x		33	Transplant within site if possible

TABLE NO. 1 - EXISTING TREES ASSESSMENT SCHEDULE

Project Name : Agreement No.CE 30/96 - Flyover and Footbridge Schemes at Junction of i/o Austin Road, Chatham Road and Cheong Wan Road

Urbis Limited
Planning, Urban Design, Landscape, Golf & Environmental Consultants

Job No : MCA38

Date : 26 September 1997

TREE NO	BOTANICAL NAME	SURVEY SIZE			EXISTING CONDITION			SURVIVAL RATE AFTER TRANSPLANT			PHOTO NO.	RECOMMENDATIONS
		HEIGHT	DIA.	SPREAD	GOOD	FAIR	BAD	HIGH	MEDIUM	LOW		
85	Crateva religiosa forst	4	0.1	3		x			x		34	Transplant within site if possible
86	Crateva religiosa forst	4	0.1	3		x			x		34	Transplant within site if possible
87	Crateva religiosa forst	4	0.1	3		x			x		34	Transplant within site if possible
88	Crateva religiosa forst	4	0.1	3		x			x		34	Transplant within site if possible
89	Crateva religiosa forst	4	0.2	5		x			x		34	Transplant within site if possible
90	Melia azedarach	9	1.0	5		x				x	34	Fell
91	Leucaena glauca	3	0.1	3		x			x		34	Transplant within site if possible
92	Crateva religiosa forst	4	0.1	4		x			x		34	Transplant within site if possible
93	Crateva religiosa forst	4	0.1	4		x			x		34	Transplant within site if possible
94	Leucaena glauca	4	0.1	4		x			x		34	Transplant within site if possible
95	Crateva religiosa forst	5	0.2	4		x			x		34	Transplant within site if possible
96	Crateva religiosa forst	5	0.15	4		x			x		34	Transplant within site if possible
97	Leucaena glauca	5	0.15	4		x			x		34	Transplant within site if possible
98	Leucaena glauca	5	0.15	4		x			x		34	Transplant within site if possible
99	Leucaena glauca	5	0.15	4		x			x		34	Transplant within site if possible
100	Leucaena glauca	5	0.15	4		x			x		37	Transplant within site if possible
101	Lagerstroemia speciosa	5	0.15	4		x			x		38	Retain
102	Lagerstroemia speciosa	2	0.2	6		x			x		38	Retain
103	Archontophoenix alexandrae	3	0.1	2.5		x			x		38	Retain
104	Roystonea regia	3	0.2	2.5		x			x		38	Retain
105	Archontophoenix alexandrae	3.5	0.1	2.5		x			x		38	Retain

TABLE NO. 1 - EXISTING TREES ASSESSMENT SCHEDULE

Project Name : Agreement No.CE 30/96 - Flyover and Footbridge Schemes at Junction of i/o Austin Road, Chatham Road and Cheong Wan Road

Urbis Limited

Planning, Urban Design, Landscape, Golf & Environmental Consultants

Job No : MCA38

Date : 26 September 1997

TREE NO	BOTANICAL NAME	SURVEY SIZE			EXISTING CONDITION			SURVIVAL RATE AFTER TRANSPLANT			PHOTO NO.	RECOMMENDATIONS
		HEIGHT	DIA.	SPREAD	GOOD	FAIR	BAD	HIGH	MEDIUM	LOW		
106	Archontophoenix alexandrae	3.5	0.15	2.5		x			x		38	Retain
107	Roystonea regia	3.5	0.2	2.5		x			x		38	Retain
108	Archontophoenix alexandrae	3.5	0.15	2.5		x			x		38	Retain
109	Archontophoenix alexandrae	3.5	0.1	2.5		x			x		38	Retain
110	Roystonea regia	3.5	0.2	2.5		x			x		39	Retain
111	Archontophoenix alexandrae	3.5	0.1	2.5		x			x		39	Retain
112	Roystonea regia	3.5	0.2	2.5		x			x		39	Retain
113	Archontophoenix alexandrae	3.5	0.1	2.5		x			x		39	Retain
114	Roystonea regia	3.5	0.2	2.5		x			x		40	Retain
115	Archontophoenix alexandrae	3.5	0.1	2.5		x			x		40	Retain
116	Roystonea regia	3.5	0.2	2.5		x			x		40	Retain
117	Archontophoenix alexandrae	3.5	0.2	2.5		x			x		40	Retain
118	Archontophoenix alexandrae	3.	0.15	2		x			x		40	Retain
119	Archontophoenix alexandrae	2.5	0.15	2		x			x		40	Retain
120	Celtis sinensis	7	0.6	5		x			x		37	Transplant within site if possible

1-4

Photo 1

11-14

Photo 2

15-19

Photo 3

20-22

Photo 4

22-25

Photo 5

26-28

Photo 6

29-30

Photo 7

Tree Survey Photographs
Sheet 1 of 6

Amendment No.	Date	Description	Drawn by	Checked by	Approved by

Job Title: FLYOVER & FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD, CHATHAM ROAD SOUTH & CHEONG ROAD

Drawing No.: 1.0

Drawing Title: TREE SURVEY: PHOTOGRAPHS SHEET 1 OF 6

Scale:

Drawn by | Checked by | Approved by | Date SEPT. 1997 | Job. No. MCA 38

雅邦 Urbis Limited
Planning, Urban Design, Landscape, Golf & Environmental Consultants
Urbis Limited, 11/F Siu On Centre, 188 Lockhart Road, Wan Chai, Hong Kong. Tel : 2802 3333 Fax : 2802 8662

MY_XREFS MY_DWG 1:1.91

31-34

Photo 8

31-34

Photo 9

35-37

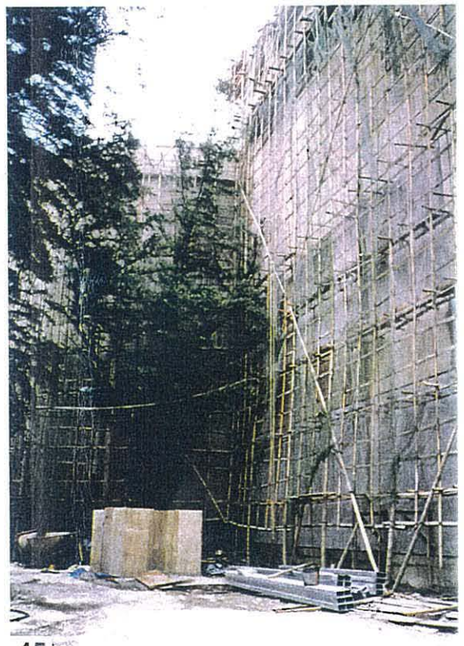
Photo10

38-43

Photo 11

44

Photo 12



45

Photo 13

46-47

Photo 14

Tree Survey Photographs
Sheet 2 of 6

Amendment No.	Date	Description	Drawn by	Checked by	Approved by

Job Title
FLYOVER & FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD, CHATHAM ROAD SOUTH & CHEONG ROAD

Drawing Title
TREE SURVEY: PHOTOGRAPHS
SHEET 2 OF 6

Drawn by | Checked by | Approved by | Date SEPT. 1997

Drawing No. 2.0

Scale

Job. No. MCA 38

Urbis Limited
Planning, Urban Design, Landscape, Golf & Environmental Consultants
Urbis Limited, 11/F Siu On Centre, 188 Lockhart Road, Wan Chai, Hong Kong. Tel : 2802 3333 Fax : 2802 8662

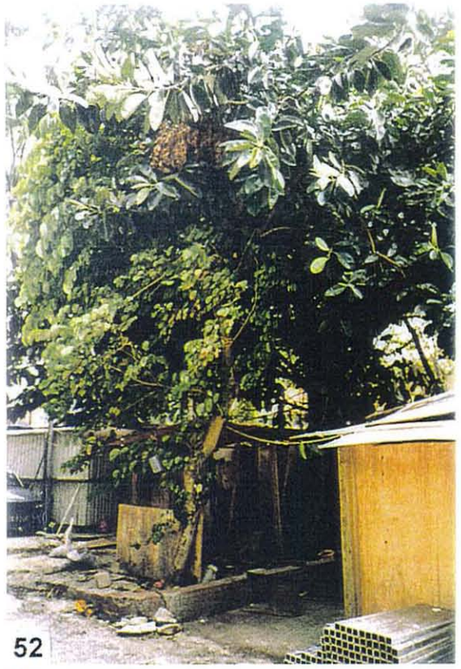
MY_XREFS MY_DWG 1-1-94

48-50

Photo 15

51

Photo 16



52

Photo 17

53-54

Photo 18

55

Photo 19

55-57

Photo 20

58-60

Photo 21

Tree Survey Photographs
Sheet 3 of 6

Amendment No.	Date	Description	Drawn by	Checked by	Approved by

Job Title
FLYOVER & FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD, CHATHAM ROAD SOUTH & CHEONG ROAD

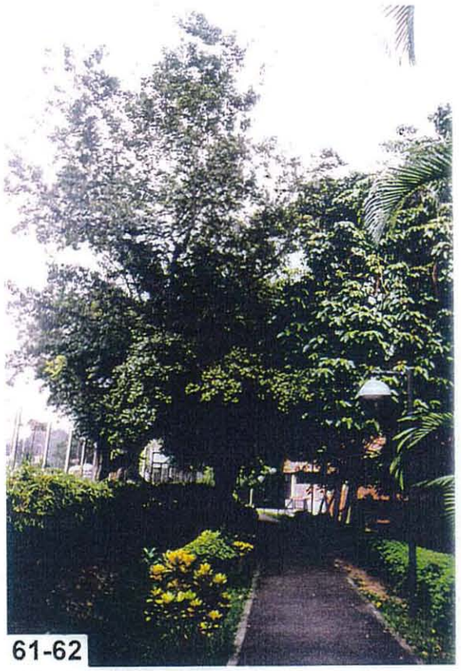
Drawing No. 3.0

Drawing Title
TREE SURVEY: PHOTOGRAPHS
SHEET 3 OF 6

Scale

Drawn by	Checked by	Approved by	Date	Job. No.
			SEPT. 1997	MCA 38

雅邦 Urbis Limited
Planning, Urban Design, Landscape, Golf & Environmental Consultants
Urbis Limited, 11/F Siu On Centre, 188 Lockhart Road, Wan Chai, Hong Kong. Tel : 2802 3333 Fax : 2802 8662



61-62

Photo 22

63-65

Photo 23

66-69

Photo 24

68-69

Photo 25

70

Photo 26

71

Photo 27

72-73

Photo 28

Tree Survey Photographs
Sheet 4 of 6

Amendment No.	Date	Description	Drawn by	Checked by	Approved by

Job Title
FLYOVER & FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD, CHATHAM ROAD SOUTH & CHEONG ROAD

Drawing No. 4.0

Drawing Title
TREE SURVEY: PHOTOGRAPHS
SHEET 4 OF 6

Scale

Drawn by	Checked by	Approved by	Date	Job. No.
			SEPT. 1997	MCA 38

雅邦 Urbis Limited
Planning, Urban Design, Landscape, Golf & Environmental Consultants
Urbis Limited, 11/F Siu On Centre, 188 Lockhart Road, Wan Chai, Hong Kong. Tel : 2802 3333 Fax : 2802 8662

MY_XREFS MY_DWG 1-1-96


74

Photo 29


76-77

Photo 30


76-77

Photo 31


78-79

Photo 32


80-84

Photo 33

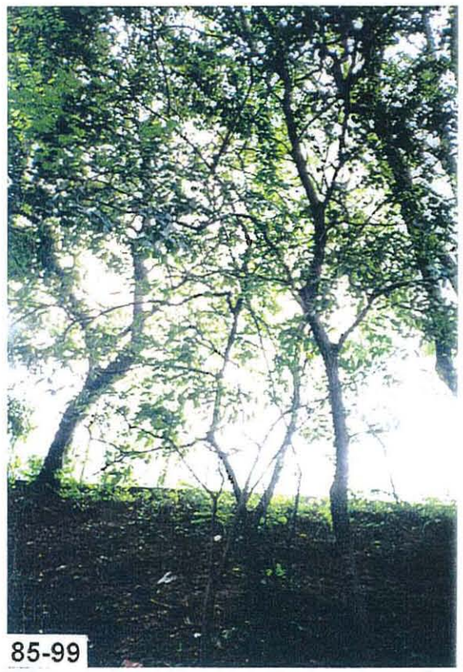

85-99

Photo 34


90-92

Photo 35

Tree Survey Photographs
Sheet 5 of 6

Amendment No.	Date	Description	Drawn by	Checked by	Approved by

Job Title
FLYOVER & FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD, CHATHAM ROAD SOUTH & CHEONG ROAD

Drawing No. 5.0

Drawing Title
TREE SURVEY: PHOTOGRAPHS
SHEET 5 OF 6

Scale

Drawn by	Checked by	Approved by	Date	Job. No.
			SEPT. 1997	MCA 38

雅邦 Urbis Limited
Planning, Urban Design, Landscape, Golf & Environmental Consultants
Urbis Limited, 11/F Siu On Centre, 188 Lockhart Road, Wan Chai, Hong Kong. Tel : 2802 3333 Fax : 2802 8662

MY_XREFS MY_DWG 1-1-96

93-96
Photo 36

97-100, 120
Photo 37

101-109
Photo 38

110-113
Photo 39

114-119
Photo 40

Tree Survey Photographs
Sheet 6 of 6

Amendment No.	Date	Description	Drawn by	Checked by	Approved by

Job Title
FLYOVER & FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD, CHATHAM ROAD SOUTH & CHEONG ROAD

Drawing No. 6.0

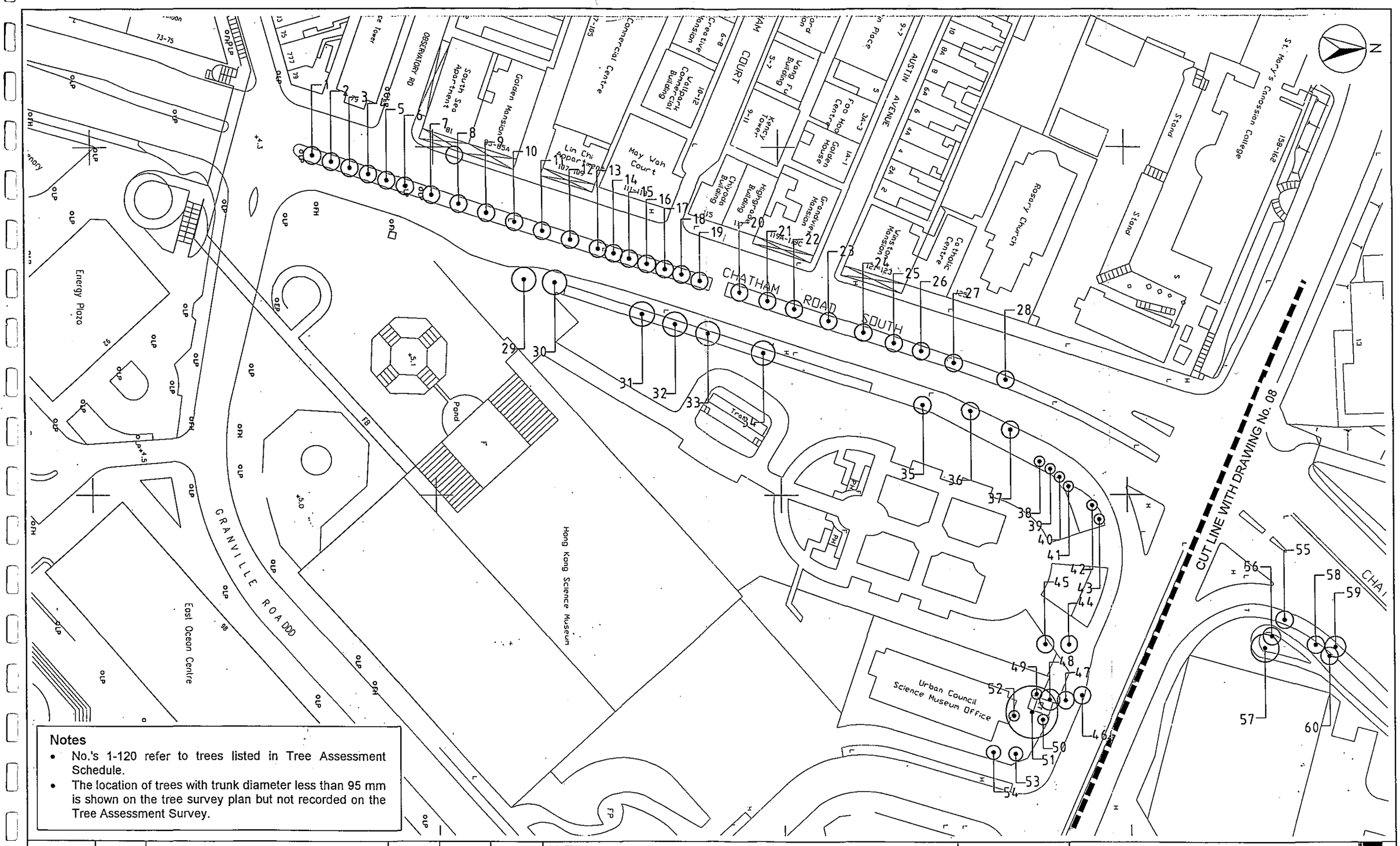
Drawing Title
TREE SURVEY: PHOTOGRAPHS
SHEET 6 OF 6

Scale

Drawn by	Checked by	Approved by	Date	Job. No.
			SEPT. 1997	MCA 38

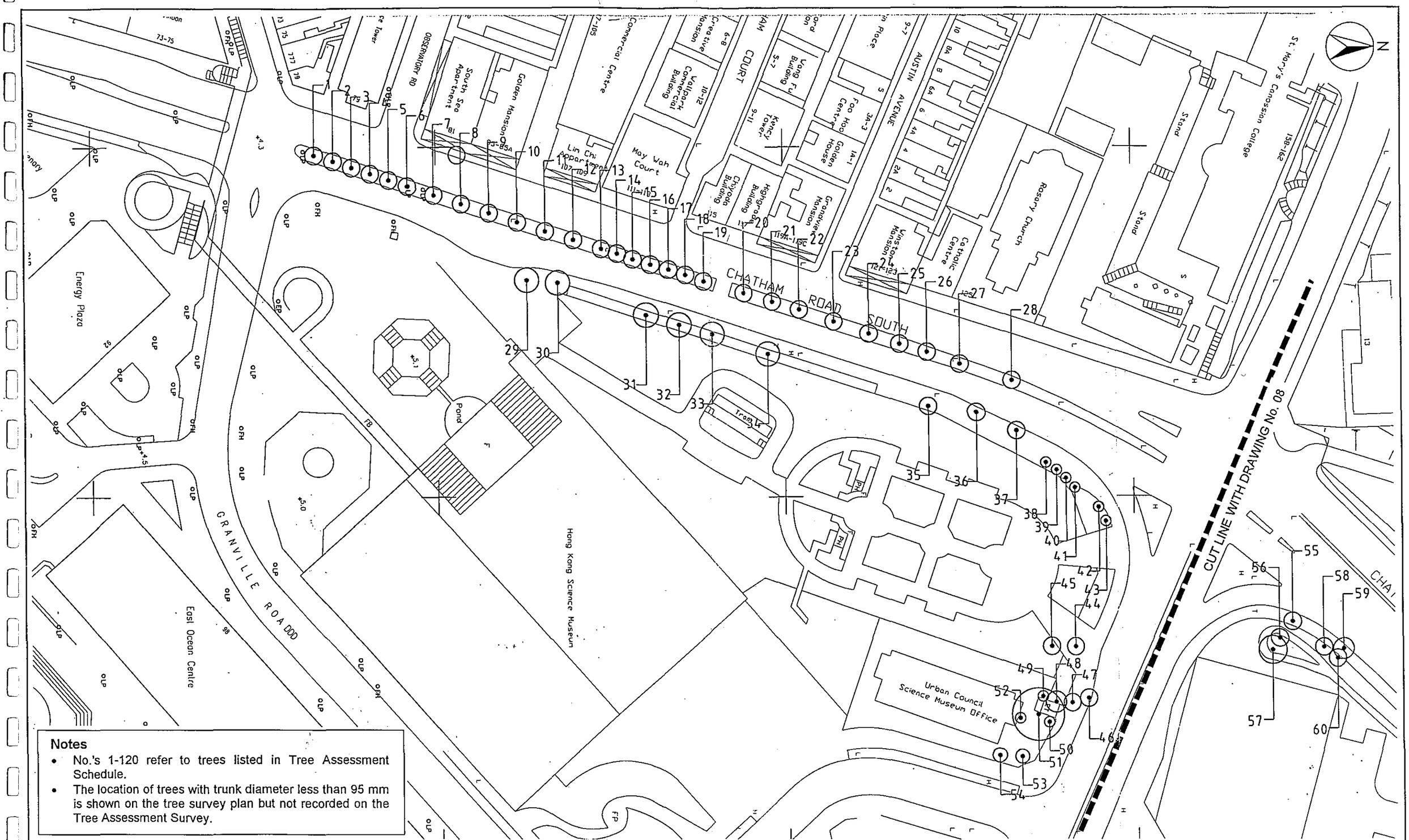
雅邦 Urbis Limited
Planning, Urban Design, Landscape, Golf & Environmental Consultants
Urbis Limited, 11/F Siu On Centre, 188 Lockhart Road, Wan Chai, Hong Kong. Tel : 2802 3333 Fax : 2802 8662

MY_XREFS MY_DWG 1-1-96



Job Title: FLYOVER & FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD, CHATHAM ROAD SOUTH & CHEONG ROAD	Drawing No. 7.0
Drawing Title: TREE SURVEY: PLAN	Scale 1:1000

雅邦



Amendment No.	Date	Description	Drawn by	Checked by	Approved by

Job Title: FLYOVER & FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD, CHATHAM ROAD SOUTH & CHEONG ROAD

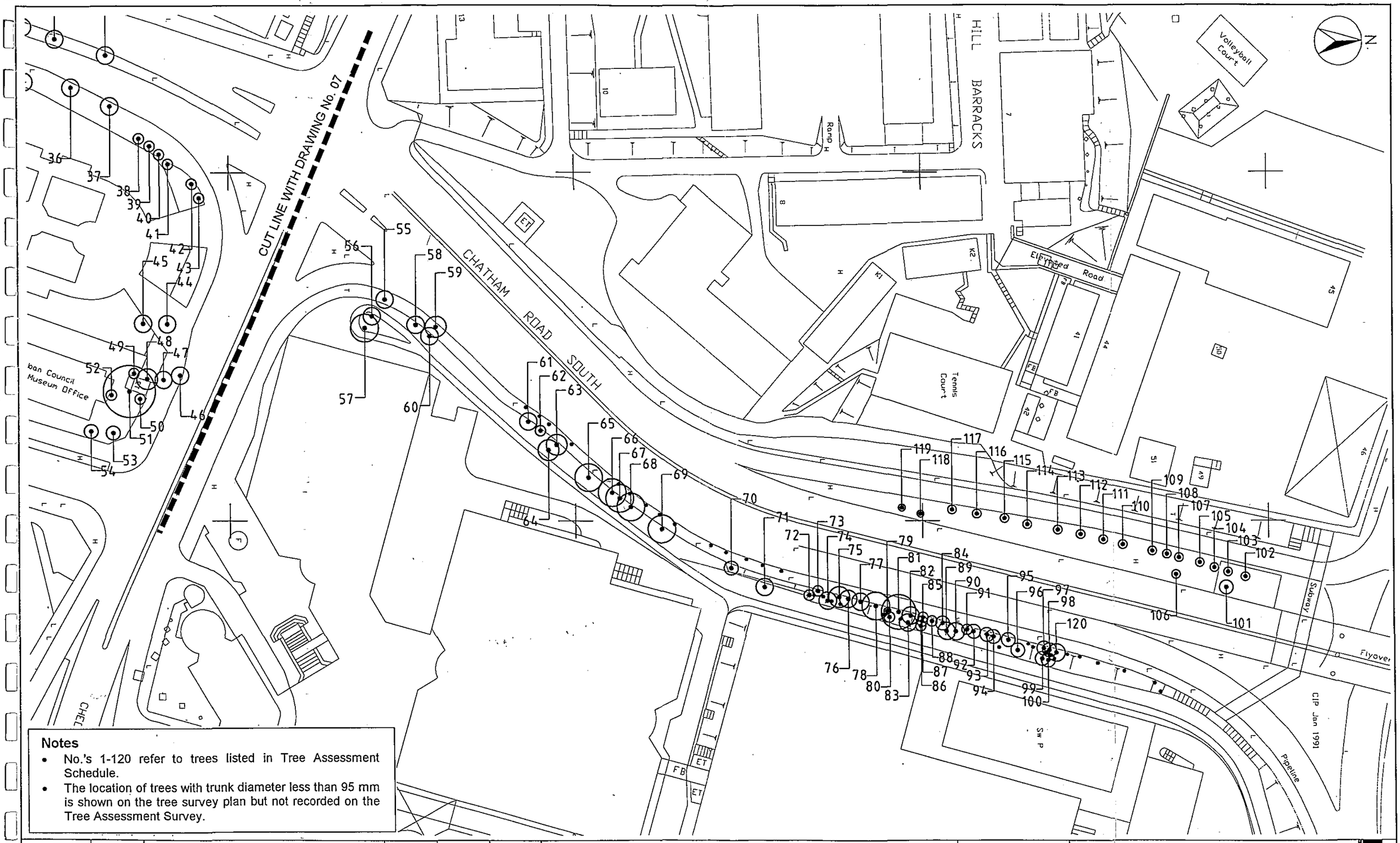
Drawing No.: 7.0

Drawing Title: TREE SURVEY: PLAN SHEET 1 OF 2

Scale: 1:1000

Drawn by	Checked by	Approved by	Date	Job. No.
			SEPT. 1997	MCA 38

Urbis Limited
Planning, Urban Design, Landscape, Golf & Environmental Consultants
Urbis Limited, 11/F Siu On Centre, 188 Lockhart Road, Wan Chai, Hong Kong. Tel : 2802 3333 Fax : 2802 8562



Notes

- No.'s 1-120 refer to trees listed in Tree Assessment Schedule.
- The location of trees with trunk diameter less than 95 mm is shown on the tree survey plan but not recorded on the Tree Assessment Survey.

Amendment No.	Date	Description	Drawn by	Checked by	Approved by

Job Title: FLYOVER & FOOTBRIDGE SCHEMES AT JUNCTION OF AUSTIN ROAD, CHATHAM ROAD SOUTH & CHEONG ROAD

Drawing No.: 8.0

Drawing Title: TREE SURVEY: PLAN SHEET 2 OF 2

Scale: 1:1000

Drawn by	Checked by	Approved by	Date	Job. No.
			SEPT. 1997	MCA 38

Urbis Limited
Planning, Urban Design, Landscape, Golf & Environmental Consultants
Urbis Limited, 11/F Siu On Centre, 188 Lockhart Road, Wan Chai, Hong Kong. Tel : 2802 3333 Fax : 2802 8662

Appendix VI

Implementation Schedule

IMPLEMENTATION SCHEDULE

EIA* Ref	EM&A Log Ref	Environmental Protection Measures*	Location/ Timing	Implementation Agent	Implementation Stages			
					Des	C	O	Dec
Section 3.8	N/A	Use of quiet construction plants as a requirement of works contract	Construction site	Highways Department/ Contractors	✓	✓		
Section 3.8	N/A	Erection of mobile noise barrier to alleviate construction noise	close to noise sources	Contractors		✓		
Section 3.8	N/A	Only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme	Construction site	Contractors		✓		
Section 3.8	N/A	Machines that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum	Construction site	Contractors		✓		
Section 3.8	N/A	Silencer and mufflers on construction equipment should be utilized and should be properly maintained during the construction period	Construction site	Contractors		✓		
Section 3.8	N/A	Noisy activities can be scheduled to minimize exposure of nearby NSRs to high levels of construction	Construction site	Contractors		✓		
Section 3.8	N/A	Mobile plant should be sited as far away from NSRs as possible	Construction site	Contractors		✓		
Section 3.8	N/A	Materials stockpiles and other structures should be effectively utilized, where practicable, to screen noise from on-site construction activities	Construction site	Contractors		✓		
Section 4.9	N/A	Frequent watering	dusty area	Contractors		✓		
Section 4.9	N/A	Side enclosure and covering of dusty material storage piles	dusty material storage piles	Contractors		✓		
Section 4.9	N/A	Cover all dusty vehicle loads by tarpaulin sheets	N/A	Contractors		✓		
Section 4.9	N/A	Establishment of washing stations and cleaning of public roads	exits points of site and public roads	Contractors		✓		
Section 4.9	N/A	Routing of vehicles and positioning of dust generating construction plant at maximum possible separation distances from ASRs	N/A	Contractors		✓		
Section 4.9	N/A	Regular watering with complete coverage in dry periods	dusty area	Contractors		✓		
Section 4.9	N/A	Imposition speed limits of 5km/hr for vehicles on access roads	N/A	Contractors		✓		

EIA* Ref	EM&A Log Ref	Environmental Protection Measures*	Location/ Timing	Implementation Agent	Implementation Stages			
					Des	C	O	Dec
Section 5.14, Figure 5.5	N/A	Low noise road surfacing (LNRS)	main stream of the flyover	Highways Department	✓	✓		
Section 5.14, Figure 5.5	N/A	Noise barrier of length 108m and effective height of 7.3m	close to the Winston Mansion	Highways Department	✓	✓		
Section 7.6, Figure 7.4	N/A	Re-routing of footpaths and provision of well-defined temporary public access.	Works Site/Construction period	Contractors		✓		
Section 7.6, Figure 7.4	N/A	Minimizing damage to existing vegetation, careful and prompt transplanting of existing trees.	Central reserve, western side of HK Museum of History and HK Polytechnic University/construction period	Contractors		✓		
Section 7.6, Figure 7.4	N/A	Compensatory planting by transplanting existing or new heavy standard trees.	Western boundary of HK Polytechnic University and HK Museum of History, western footpath of Chatham Road South/construction period	Contractors		✓		
Section 7.6, Figure 7.4		Climbing plants	Along the base of the proposed retaining wall along the western side of HK Polytechnic University/construction period	Contractors		✓		
Section 7.6, Figure 7.4	N/A	Shrub planting	under the flyover/construction period	Contractors		✓		
Section 7.7, Figure 7.3	N/A	Screening of site works by hoardings/safety fences and surface treatment of hoardings.	Hoardings are required along HK Polytechnic University and HK Museum of History/construction period	Contractors		✓		
Section 7.7, Figure 7.3	N/A	Retention of existing vegetation where possible	western boundary of HK Polytechnic University/construction period	Contractors		✓		
Section 7.7, Figure 7.3	N/A	Enhancement of existing vegetation screen	Gun Club Hill Barracks/construction period	Contractors		✓		
Section 7.7, Figure 7.3	N/A	Compensatory street tree planting	along the northern and western boundaries of HK Museum of History/construction period	Contractors		✓		
Section 7.7, Figure 7.3	N/A	Enhanced perimeter planting	HK Polytechnic University roof gardens, jogging trail and in front of swimming pool/construction period	Contractors		✓		
Section 7.7, Figure 7.3	N/A	Roadside planting	areas adjacent to carriageway, on carriageway verge, between carriageways and beneath flyovers/construction period	Contractors		✓		

* All recommendations and requirements resulted during the course of EIA/EA Process including ACE and/or accepted public comment to the proposed project.
** Des = Design, C = Construction, O = Operation, Dec = Decommissioning