

Issue No : 1  
Issue Date : October 2009  
Project No. : 822

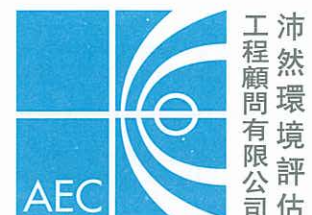
**EXPERT EVALUATION OF AIR  
VENTILATION FOR PROPOSED  
PUBLIC HOUSING DEVELOPMNT  
AT TSUENG KWAN O AREA 65B  
AND ITS SOUTH SPACE**

Report Prepared by :  
**Allied Environmental Consultants Ltd.**

**COMMERCIAL-IN-CONFIDENCE**

**Allied Environmental Consultants Limited**  
Acousticians & Environmental Engineers

1001, Shanghai Industrial Investment Building, 48 Hennessy Rd., Wanchai, H.K.  
Tel: (852) 2815 7028 Fax: (852) 2815 5399 Email: info@aechk.com



Issue No : 1  
Issue Date : October 2009  
Project No. : 822

**EXPERT EVALUATION OF AIR  
VENTILATION FOR PROPOSED  
PUBLIC HOUSING DEVELOPMNT  
AT TSUENG KWAN O AREA 65B  
AND ITS SOUTH SPACE**

Report Prepared by :  
**Allied Environmental Consultants Ltd.**

**COMMERCIAL-IN-CONFIDENCE**

Author:



\_\_\_\_\_  
Anthea Ng  
BSc(Hons) LEEDAP

Checked and  
Approved:



\_\_\_\_\_  
Grace M. H. Kwok  
BEng(Hons) MHKIETA MHKIOA  
MIAIA MRAPA MISWA LEEDAP

This report has been prepared by Allied Environmental Consultants Limited with all reasonable skill, care and diligence within the terms of the Agreement with the client, incorporating our General Terms and Conditions of Business and taking account of the resources devoted to it by agreement with the client.

We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.

This report is confidential to the client and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies upon the report at their own risk.

## TABLE OF CONTENTS

<b>LIST OF TABLES</b>	<b>4</b>
<b>LIST OF PLATES</b>	<b>4</b>
<b>LIST OF FIGURES</b>	<b>4</b>
<b>AIM</b>	<b>5</b>
<b>1 Introduction</b>	<b>5</b>
1.1 Background	5
1.2 Surrounding Built Environment	5
<b>2 Site Wind Availability Data</b>	<b>6</b>
2.1 Wind Data from MM5	6
2.2 Wind Data from Hong Kong Observatory	8
<b>3 Expert Evaluation for Air Ventilation Assessment</b>	<b>10</b>
3.1 Existing Wind Condition	10
3.2 Condition with Proposed Building	13
<b>4 Conclusion</b>	<b>15</b>

### **LIST OF TABLES**

<b>Table 1</b>	Summary of the Most Probable Wind Directions which Exceed 75% of a Year
<b>Table 2</b>	Summary of MM5 Data from 8 Most Probable Wind Directions
<b>Table 3</b>	Site Wind Availability Data of Tseung Kwan O, HKO, Jan-Dec 2007

### **LIST OF PLATES**

<b>Plate 1</b>	Wind Rose of Grid (34, 26)
<b>Plate 2</b>	Locations of wind stations in Hong Kong
<b>Plate 3</b>	Wind Rose Diagram of HKO Data
<b>Plate 4</b>	Wind Flow into South Tseung Kwan O during Summer and Non-summer Period
<b>Plate 5</b>	The Wind Flow Patterns in Non-summer period
<b>Plate 6</b>	The Wind Flow Pattern in Summer Period
<b>Plate 7</b>	The Wind Flow Pattern with Proposed Development during Summer and Non-summer Period

### **LIST OF FIGURES**

<b>Figure 1</b>	Site Location Plan
<b>Figure 2</b>	Master Layout Plan

## AIM

To conduct an Expert Evaluation of air ventilation as per the Technical Circular No. 1/06 (TC) using to qualitatively predict the wind environment of the site and determine the effects from the surrounding buildings and topography. The Expert Evaluation also recommends whether further studies are required.

## 1 INTRODUCTION

Allied Environmental Consultants Limited (AEC) has been appointed by Housing Authority to undertake an air ventilation study for the proposed public housing development located at Tsueng Kwan O Area 65B.

### 1.1 BACKGROUND

The subject site is located to south of Po Yap Road in the Tsueng Kwan O Town Center South area as shown on *Figure 1*. The development site consists of three residential complex buildings, and its southern open space area. The site area is approximately 23,092 m<sup>2</sup>. The building heights for the proposed development will be no more than 100 mPD which includes the roof and water tower structure. The master layout plan is indicated in *Figure 2*.

As the site is currently vacant and there are no buildings or infrastructure at the site, comparison of the current situation with the proposed development indicates that the development footprint may have the potential to affect the air ventilation performance in the immediate vicinity of the subject site.

The effect on wind environment in the surrounding areas of the subject development shall be elaborated by comparing the wind velocity ratio simulated for the before and after-development scenarios in the Initial Study.

### 1.2 SURROUNDING BUILT ENVIRONMENT

The adjacent land use is predominantly residential, with residential tower blocks located to the west and north of the project area. Two educational institutes are located to the south of the project area.

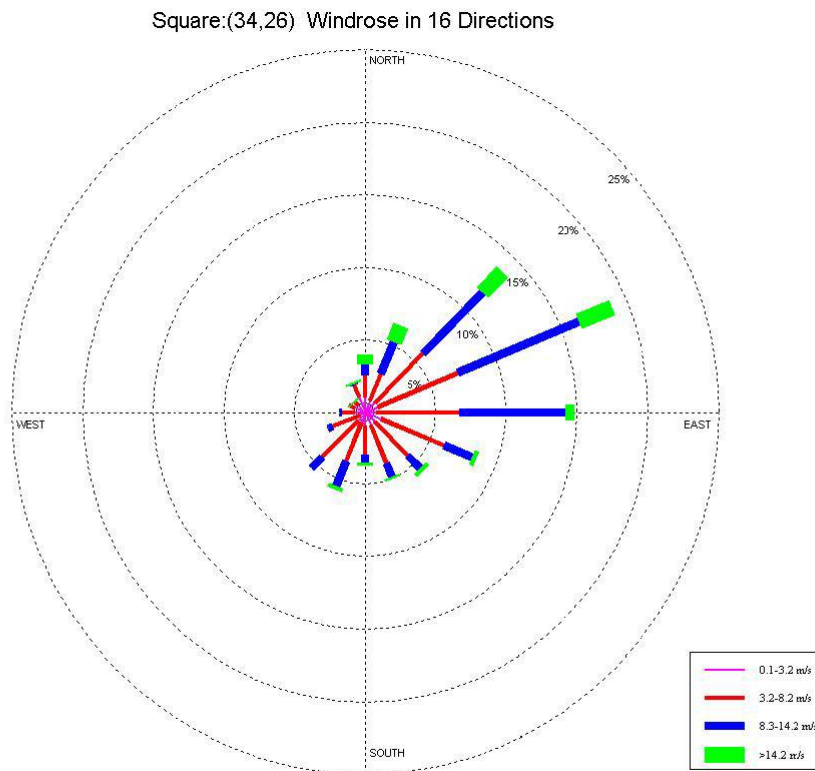
According to the site wind availability data provided published by the Hong Kong Planning Department, the dominant wind direction is from the east to northeast. As infrastructure and buildings located to the east of subject site are at a low elevation, this can potentially result in increased wind permeability.

## 2 SITE WIND AVAILABILITY DATA

### 2.1 WIND DATA FROM MM5

The assumption of wind data refers to the “Site Wind Availability Data” published by the Planning Department [1] which is simulated by Fifth-Generation NCAR/ Penn State Mesoscale Model (MM5), as recommended in “Technical Guide for Air Ventilation Assessment for Developments in Hong Kong” [2] published by Housing, Planning and Lands Bureau (HPLB) and Environment, Transport and Works Bureau (ETWB). It indicates wind velocity ranges from 0 to 22m/s from 16 wind directions, predicted at the nearest grid (34, 26) to the site and at 596m above the terrain level. The eight most probable wind directions which exceed 75% of a year at this grid are summarized in **Table 1** and the wind velocity was summarized in **Table 2**. The wind rose diagram of MM5 data is shown in **Plate 1**.

Plate 1 Wind Rose of Grid (34, 26)



The following eight wind directions which exceed 75% of a year were chosen for modeling.

Table 1 Summary of the Most Probable Wind Directions which Exceed 75% of a Year

Prevailing Wind Direction	Degree of Wind Direction	Probability
NNE	22.5 <sup>0</sup>	6.2%
NE	45 <sup>0</sup>	13.4%
ENE	67.5 <sup>0</sup>	18.4%
East	90 <sup>0</sup>	14.6%
ESE	112.5 <sup>0</sup>	8%
SE	135 <sup>0</sup>	5.6%
SSW	202.5 <sup>0</sup>	5.7%
SW	225 <sup>0</sup>	5.3%
	<b>Total Probability:</b>	77.2%

Table 2 Summary of the Wind Velocity of the 8 Most Probable Wind Directions

Velocity infinity (m/s)	NNE	NE	ENE	East	ESE	SE	SSW	SW
0 to 1	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
1 to 2	0.002	0.003	0.004	0.002	0.003	0.003	0.002	0.003
2 to 3	0.003	0.004	0.003	0.005	0.005	0.004	0.004	0.003
3 to 4	0.006	0.009	0.009	0.008	0.007	0.006	0.005	0.004
4 to 5	0.006	0.009	0.012	0.009	0.007	0.006	0.005	0.007
5 to 6	0.004	0.011	0.012	0.013	0.009	0.008	0.006	0.008
6 to 7	0.002	0.008	0.014	0.014	0.012	0.008	0.006	0.009
7 to 8	0.003	0.01	0.013	0.013	0.012	0.006	0.006	0.007
8 to 9	0.003	0.008	0.015	0.013	0.01	0.004	0.007	0.005
9 to 10	0.005	0.009	0.013	0.02	0.008	0.004	0.005	0.003
10 to 11	0.004	0.01	0.013	0.02	0.003	0.002	0.004	0.001
11 to 12	0.004	0.01	0.019	0.014	0.001	0.002	0.002	0.001
12 to 13	0.004	0.012	0.019	0.006	0.002	0	0.002	0.001
13 to 14	0.003	0.009	0.013	0.004	0	0.001	0.001	0
14 to 15	0.002	0.009	0.011	0.002	0	0.001	0	0
15 to 16	0.001	0.003	0.006	0.001	0	0	0	0
16 to 17	0.001	0.003	0.003	0.001	0	0	0	0
17 to 18	0.002	0.002	0.002	0	0	0	0.001	0

18 to 19	0.002	0.001	0	0	0	0	0	0
19 to 20	0.002	0.001	0	0	0	0	0	0
20 to 21	0.001	0.001	0	0	0	0	0	0
21 to 22	0.001	0	0.001	0	0	0	0	0
22 to 23	0	0.001	0.001	0	0	0	0	0
23 to 24	0	0	0.001	0	0	0	0	0

Note: Height of Anemometer is 596mPD.

## 2.2 WIND DATA FROM HONG KONG OBSERVATORY

The assumption of wind data refers to the wind stations of Hong Kong Observatory (HKO) which can be found in the area of Tseung Kwan O. The locations of the wind stations are shown on *Plate 2*. The elevation of anemometer at HKO Tseung Kwan O Station is 52mPD while the ground level is 38mPD. The wind rose diagram of HKO data is shown in *Plate 3*. The site wind availability is studied as in *Table 3*.

Plate 2 Locations of wind stations in Hong Kong

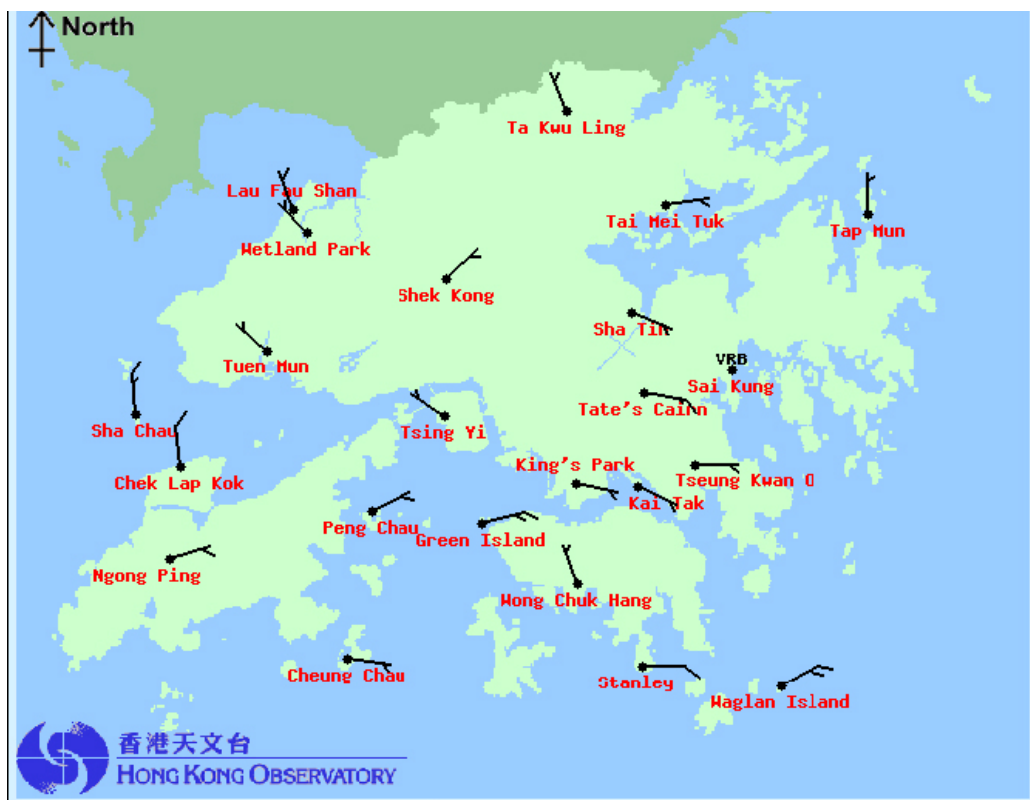




Plate 3 Wind Rose Diagram of HKO Data

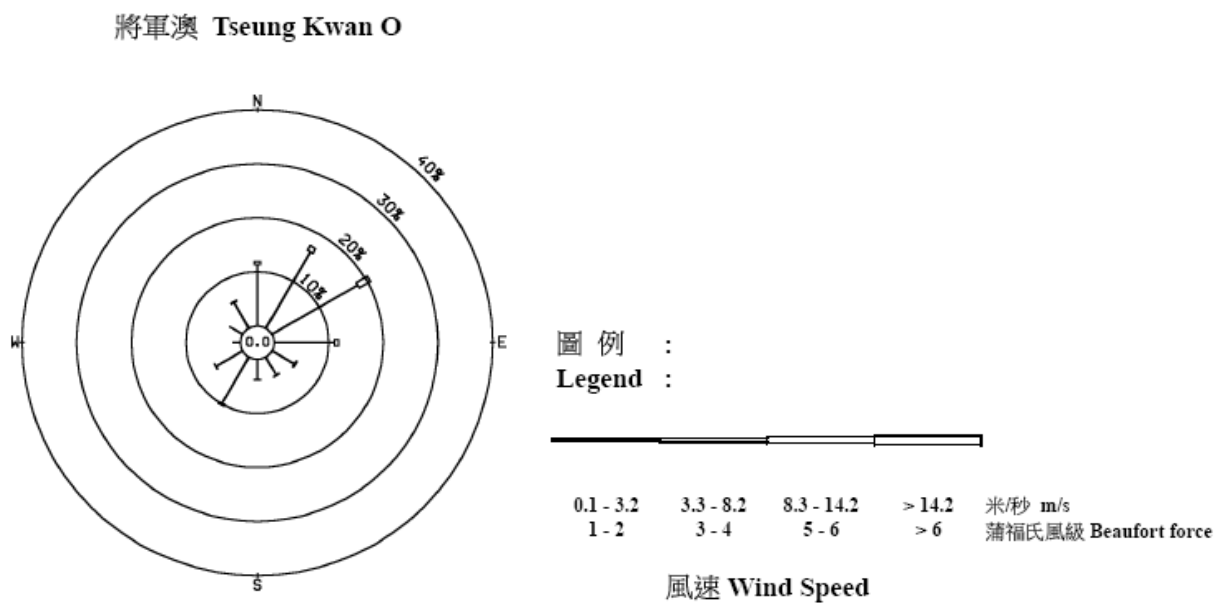


Table 3 Site Wind Availability Data of Tseung Kwan O, HKO, Jan-Dec 2007

Wind Direction	Frequency of Occurrence (Dec – Feb)	Frequency of Occurrence (Mar – May)	Frequency of Occurrence (Jun – Aug)	Frequency of Occurrence (Sep – Nov)	Total Annual Frequency
N	12.1%	9.8%	0%	14.3%	9.6%
NNE	35.2%	19.5%	2.8%	19.8%	20.3%
NE	3.3%	1.2%	0%	4.4%	2.4%
ENE	31.9%	26.8%	2.8%	33.0%	24.8%
E	12.1%	4.9%	8.5%	9.9%	9.0%
ESE	0%	0%	7.0%	0%	1.5%
SE	0%	1.2%	7.0%	4.4%	3.3%
SSE	0%	2.4%	0%	2.2%	1.2%
S	1.1%	3.6%	5.6%	1.1%	2.7%
SSW	1.1%	19.5%	40.8%	2.2%	14.3%
SW	0%	0%	12.7%	1.1%	3.0%
WSW	0%	2.4%	11.3%	1.1%	3.3%
W	0%	0%	0%	1.1%	0.3%
WNW	0%	0%	0%	3.3%	0.9%
NW	0%	0%	0%	0%	0%
NNW	2.2%	8.5%	1.4%	2.2%	3.6%

The wind data from HKO reveals the wind pattern during summer and non-summer periods. In *table 3*, the pattern of wind availability from June to August (summer) is apparently different from the other three periods. A higher probability of South-South-West (SSW) wind is indicated in summer, while the other columns show low probability of SSW wind. Therefore, SSW wind is the most prevailing wind direction in summer. For the non-summer period, East-north-east is the most prevailing wind direction.

As the wind data from HKO is the resultant wind dissipated by actual topographical situations of surrounding, wind data from MM5 is adopted to do simulation.

### 3 EXPERT EVALUATION FOR AIR VENTILATION ASSESSMENT

#### 3.1 EXISTING WIND CONDITION

The existing area is occupied by medium-density and high-rise buildings. Tseung Kwan O Plaza is located to the north of site with heights range from 13mPD to 143mPD (2 to 46 storeys). The Grandiose is located to the north-west of the site with heights range from 19mPD to 176mPD (3 to 57 storeys). Bauhinia Garden is located to the west of the site with heights of 125mPD (40 storeys). Tseung Kwan O Methodist School with 19mPD (4 storeys) and Evagel College with 26mPD (6 storeys) are located to the south of the site.

Although the area is medially occupied, wind can be highly permeable though the currently vacant subject site. Po Yap Road and Chi Shin Street can serve as wind corridors. Moreover, the orientation of streets are regular, it facilitates air penetrates along streets.

During non-summer period, the prevailing wind directions are North-East and East-North-East. The north easterly winds enter the south Tseung Kwan O through Chiu Shun Road between the hilly forms of Pak Shing Kok and Hang Hou. Po Yap Road acts as the main wind corridor delivering wind to south and west part of the area. The vacant space of the subject site facilitates wind penetration.

During summer period, the prevailing wind direction is South-South-West. The southern winds flow into south Tseung Kwan O without obstructions by hilly formations or tall building structures. Chi Shin Street serves as the main wind corridor delivering wind to east and north part of the area. The vacant space of the subject site facilitates wind penetration.

The prevailing wind flow into south Tseung Kwan O during summer and non-summer period is indicated in *Plate 4*. The wind penetration in the wind corridors formed by major roads is indicated in *Plate 5* during non-summer period and *Plate 6* during summer period.

Plate 4 Wind Flow into South Tseung Kwan O during Summer and Non-summer Period

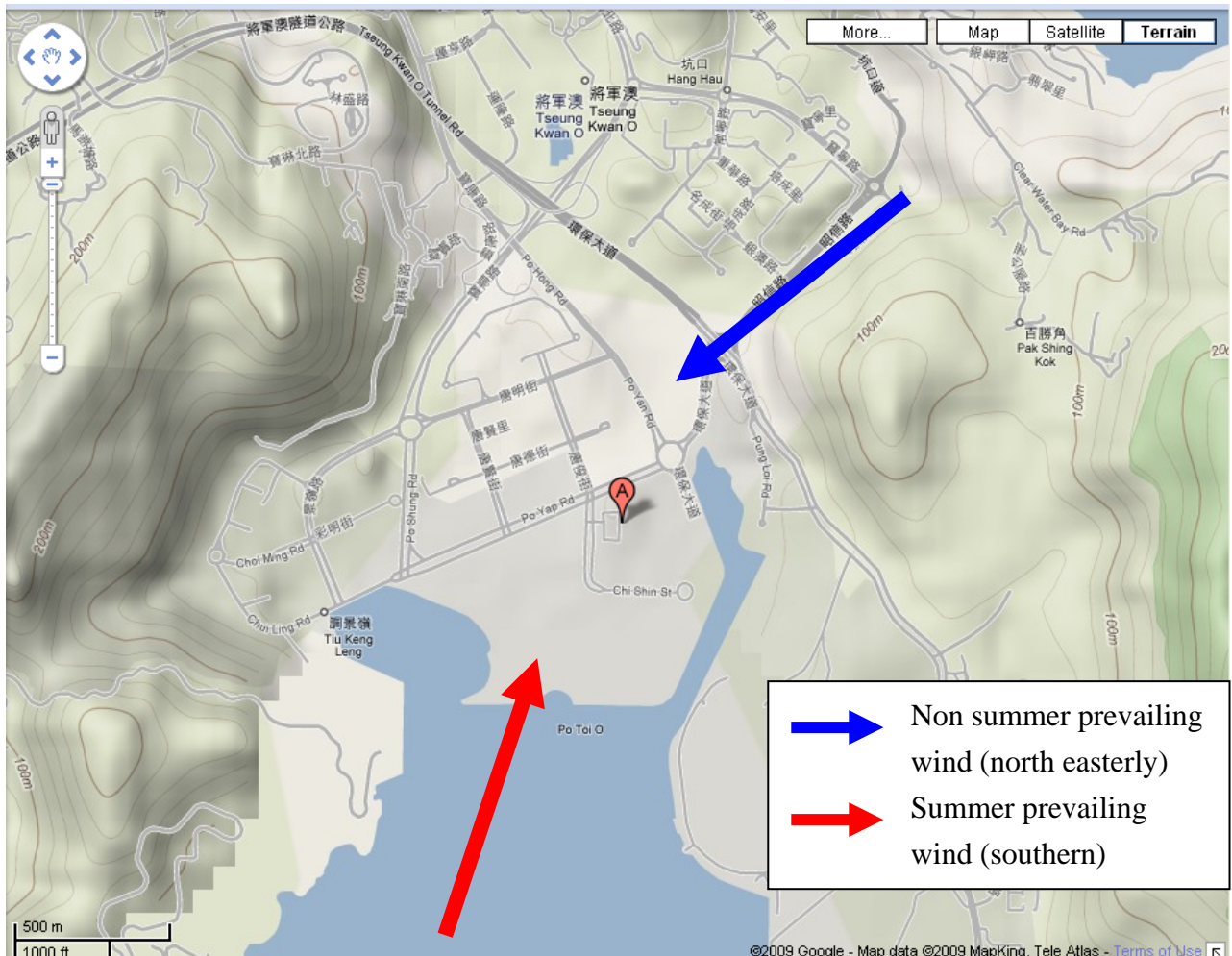


Plate 5 The Wind Flow Patterns in Non-summer period

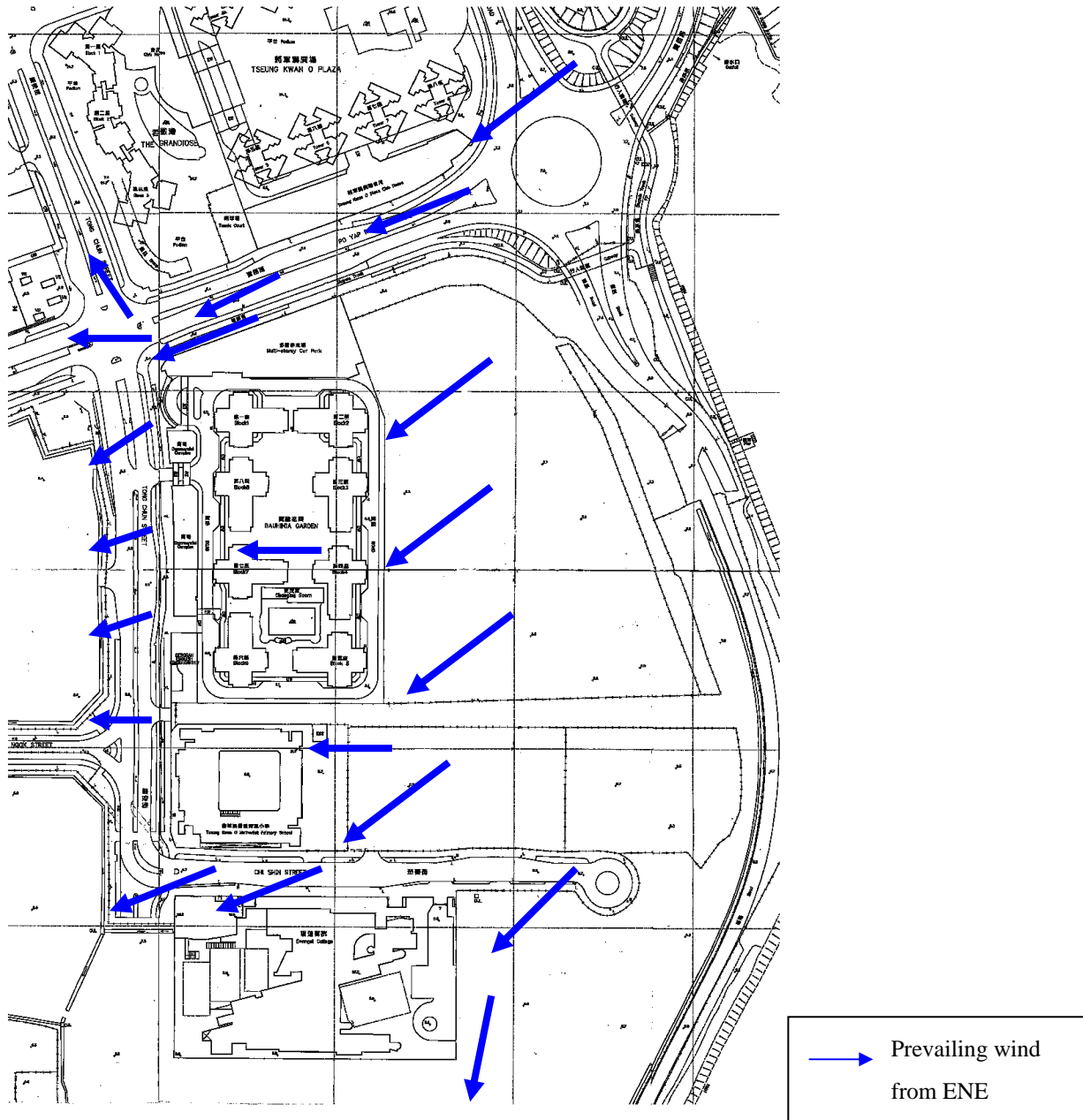
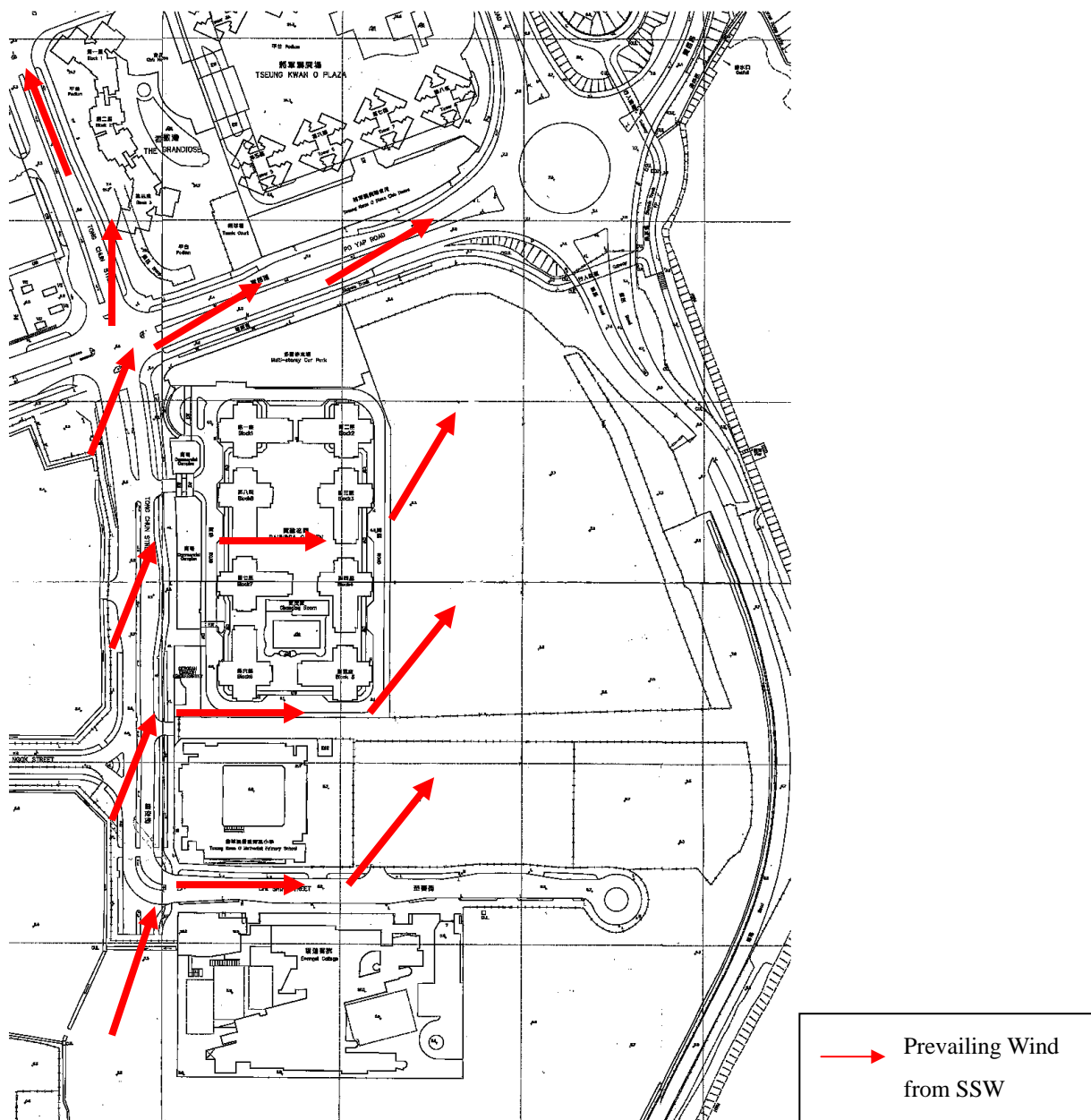


Plate 6 Wind Flow Pattern in Summer Period



### 3.2 CONDITION WITH PROPOSED BUILDING

The wind environment of Tsung Kwan O is built up by its unique urban morphology. The area is made up of wide streets, high density buildings, large low level podiums and open spaces. The new development shall be designed to harmonize the surrounding environment and allow wind penetration to the neighbour.

The proposed development has incorporated the following design measures to allow desirable wind penetration:

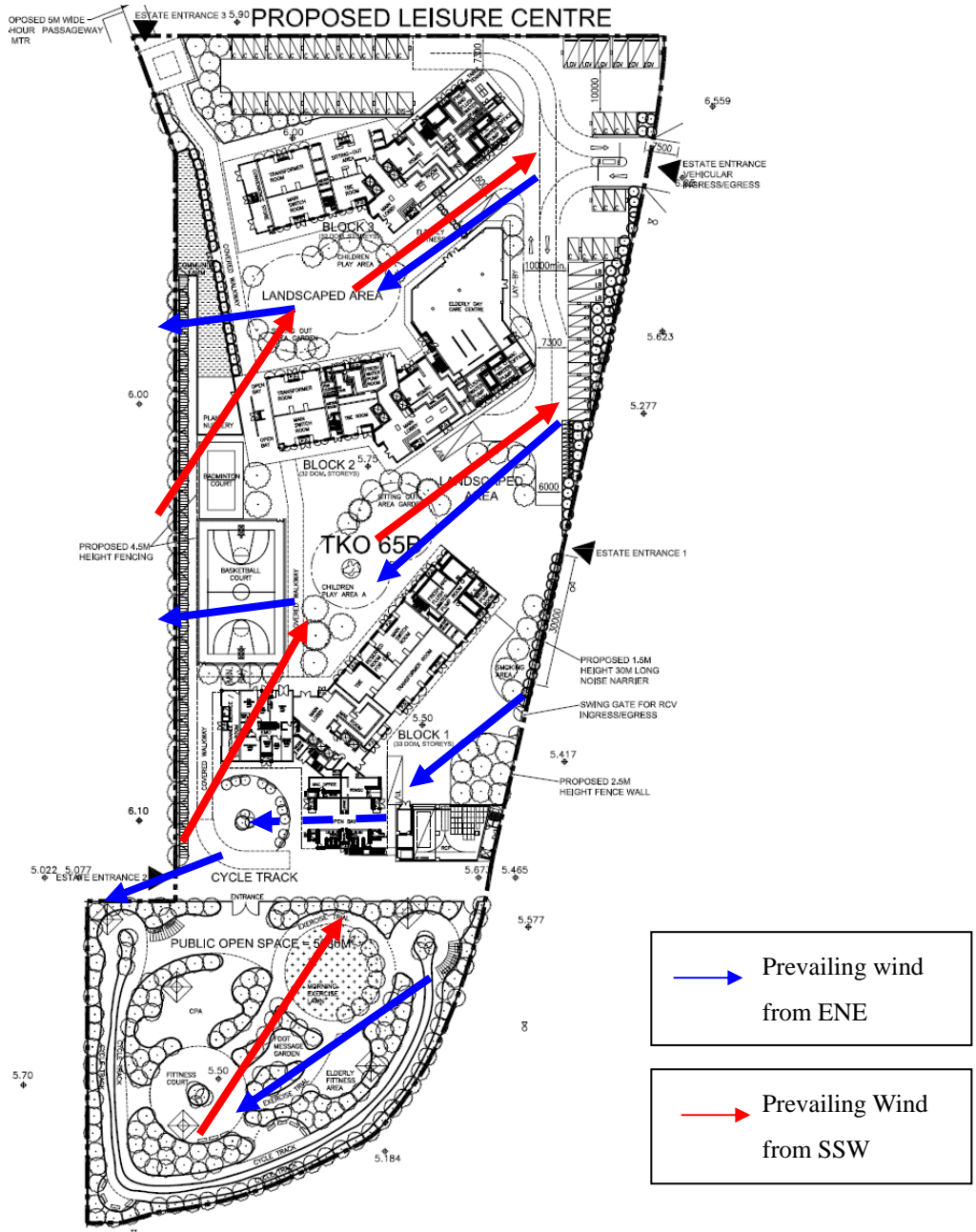
1. Orientation: The orientations of the three residential complexes take advantage to the prevailing wind from ENE in non-summer period. The complexes orientates in a downwind position, so that wind blows easily from east to west.
2. Improve permeability: The proposed housing development shall consist of two big separations between buildings. The separation of buildings will be about 25m, which is equivalent to 37 % of the building width. The separations become wide wind corridor allowing wind penetration to surrounding areas.
3. Open Space: There is an open space at southern part of site. No obstruction by tall building structure on south facilitates summer wind penetration.
4. Openings at Ground Floor: Openings at Ground Floor in Block 1 allows wind flow to neighbouring open space area.

During non-summer period, the buildings to the south and west of subject development would be the sensitive receivers to air ventilation impact. The north-easterly winds blows through the downwind orientations of the proposed buildings. The set back from Bauhinia Garden and the schools on south allows a wide wind corridor for the north easterly wind flow. Therefore, the impact on air ventilation from north easterly winds during non-summer period is not anticipated.

During summer period, the buildings to the north of subject development would be the sensitive receivers to air ventilation impact. The separations between buildings allow southern wind penetrates to the north of subject site easily. The openings on ground floor in block 3 direct southern winds to the northern neighbourhoods.

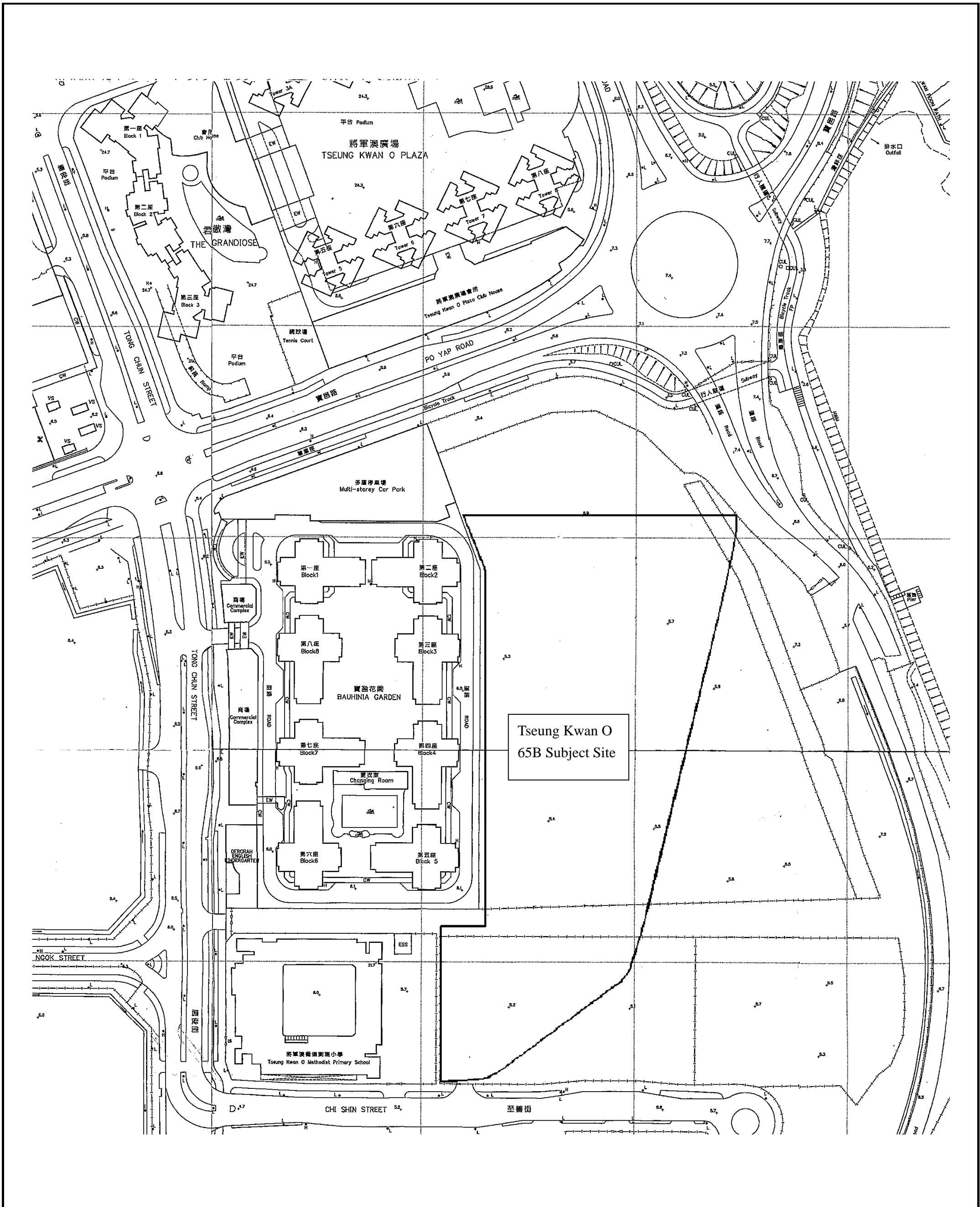
The wind flow pattern with proposed buildings during summer and non-summer period are demonstrated in *Plate 7*.

Plate 7 Wind Flow Pattern with Proposed Development during Summer and Non-summer Period



#### 4 CONCLUSION

The main wind corridors - Po Yap Road and Chi Shin Road shall not be blocked and kept wide after the public housing development for wind penetration. Moreover, in view of the wind responsive design of consisting of orientation for prevailing wind penetration, improving wind permeability by block separations, open spaces and open bay on ground floor, the impact on wind penetration to surroundings shall be minimized. Further study by modeling is recommended to evaluate the air ventilation after development quantitatively in the initial study.

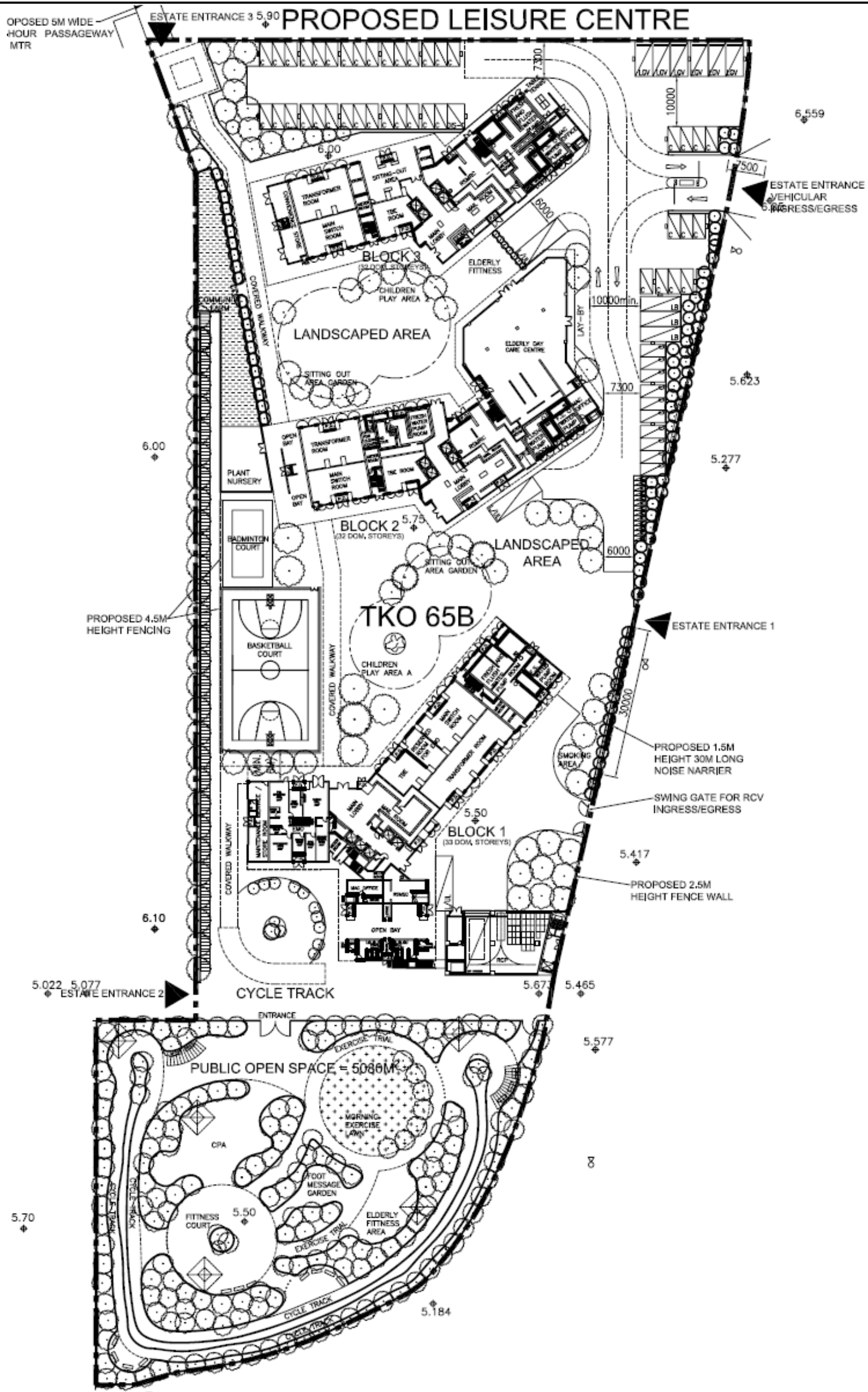


**AIR VENTILATION EXPERT EVALUATION FOR PROPOSED DEVELOPMENT OF PUBLIC RENTAL HOUSING DEVELOPMENT  
AT TSUENG KWAN O AREA 65B AND ITS SOUTHERN SPACE  
Site Location**

Figure No.	1	Rev:	0
Scale	NTS	Date	10/09







**AIR VENTILATION EXPERT EVALUATION FOR PROPOSED DEVELOPMENT OF PUBLIC RENTAL HOUSING DEVELOPMENT  
AT TSUENG KWAN O AREA 65B AND ITS SOUTHERN SPACE  
Master Layout Plan**

Figure No.	2	Rev:	0
Scale	NTS	Date	10/09

