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INITIAL STUDY

Report Prepared by:
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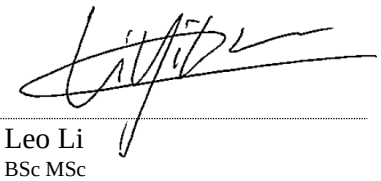

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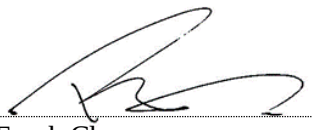

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SUMMARY

AVA Initial study of the Proposed Public Housing Development at Queen's Hill Site 1, Fanling is conducted in accordance with the Air Ventilation Assessment (AVA) methodology given in the *Technical Circular No. 1/06* issued jointly by Housing, Planning and Lands Bureau and Environment, Transport and Work Bureau (*Technical Guide*).

The proposed development is a Public Rental Housing (PRH) and Subsidized Sale Flat (SSF) development is currently occupied by various building structures and facilities, including football pitches and temporary houses of Queen's Hill former military camp. The existing surrounding developments of the subject sites are mainly villages with 2-4 storey residential houses, storage houses, and low-rise structures of Queen's Hill (Ex-Burma Lines) Barrack. The topography within the site varies with a slope of about 14mPD at the west to 30mPD at the east.

The proposed development, with approximately 136,500 m^2 application site area, comprises of 13 domestic blocks (Block 1-7; Block A-E), 3 basement car parks, a retail centre, a covered Public Transport Terminus (PTT), an Integrated Community Hall and Social Welfare Block (ICHSWB), a Property Service Apartment (PSA) Office converted from an existing officer's mess of the barrack, 2 primary schools and multiple gardens and ball courts.

The PRH development comprises of 7 domestic blocks, namely Block 1-7; and the SSF development comprises of 6 domestic blocks, namely Block A-E, providing a total of approximately 12,000 residential units.

The AVA Initial Study is to assess air ventilation performance of the building design and its impacts to the surrounding pedestrian accessible locations. Computational Fluid Dynamic (CFD) modelling is used for quantitative ventilation performance evaluation. There are two design schemes being reviewed in this Initial AVA Study:

1. Baseline Scheme: to evaluate the ventilation performance with the proposed development Scheme 54 is in place.

2. Proposed Scheme: to further evaluate the ventilation performance with the proposed development Scheme 77 is in place.

The Proposed Scheme has maintained good design features from the Base Scheme, and also incorporates additional features to increase wind permeability. These features of maximizing setback distance, building separation and empty bays at G/F for every high rise domestic blocks have been provided as far as practicable to minimize impact to the surroundings and maintain

overall wind environment. Addition air paths which favor summer prevailing ESE wind are provided which are shown to enhance the local wind environment in the Subject Site.

With reference to data from MM5 data from the Planning Department and HKO automatic weather station data, the wind directions for the Subject Site and the surrounding areas representative of the prevailing situation are determined to be mainly ENE, E, NE, ESE, NNE, SE, SSW and SSE among which ENE is the annual prevailing wind and ESE is the summer prevailing wind. These 8 of 16 wind directions account for approximately 78% of the wind occurrence. These wind directions are adopted in the Initial Study respectively.

The assessment result shows that the wind environment at the surrounding is maintained to a level comparable to the Base Scheme where the Proposed Scheme with a noticeable enhancement under summer condition.

1 INTRODUCTION

1.1 Purpose of the Report

1.1.1 A number of developments including public rental housing, subsidized sale flats, schools, a public transport terminus, car parks, a retail centre, an integrated community hall and social welfare block, and a Property Service Apartment (PSA) Office converted from an existing officer's mess of the barrack are proposed for the proposed public housing development at Queen's Hill Site 1, Fanling (Subject Site) on the Approved Lung Yuek Tau and Kwan Tei South Outline Zoning Plan (OZP) No. S/NE-LYT/17. An Air Ventilation Assessment was conducted to fulfil Section 9.2.5 of the Explanatory Statement of Approved OZP No. S/NE-LYT/17 and Section 5.13 of the Planning Brief of the development.

1.2 Project Background

1.2.1 The site encompasses an area of 136,500 m^2. The Base Scheme and Proposed Scheme comprise of the following developments:

- Domestic towers
- Basement car parks
- Retail centre
- Schools
- Public transport terminus
- An integrated community hall and social welfare block
- A PSA office converted from an existing officer's mess of the barrack
- Gardens and ball courts

1.2.2 Allied Environmental Consultants Limited (AEC) was commissioned by HKHA to carry out an Air Ventilation Assessment Initial Study (AVA-IS) to quantitatively assess the effectiveness of the good design features of the Proposed Scheme for facilitating rezoning of the site. The AVA-IS was carried out according to the air ventilation assessment framework as set out in *Technical Circular No. 1/06* issued jointly by Housing, Planning and Lands Bureau and Environment, Transport and Work Bureau (*Technical Guide*).

1.3 Objective

1.3.1 The objective of the AVA-IS is to quantitatively compare two schemes, namely, 'Base Scheme' and 'Proposed Scheme' in terms of their air ventilation performance within the site and its surroundings using the methodology of the AVA, based on Technical Guide.

1.4 Scope of Study

1.4.1 The objective of this study is to evaluate the wind performance of the Development. The scope of the study includes as follows:

- To give a general pattern and a rough quantitative estimation of wind performance at the pedestrian level reported using Wind Velocity Ratio (VR)
- To refine of the project design and/or design options by applying wind VR as indicator of the wind performance for the AVA, and reporting all VR of test points.
- To further define the 'focuses', wind flow around the different options of block layout simulated using computer model for different times of the year.
- To quantitatively evaluate the ventilation performance of mitigation measures considered.

1.5 Project Details

1.5.1 The project is located at Queen's Hill Site 1, Fanling. The subject site encompasses an area of approximately 136,500 m^2 with a plot ratio 6.0. The location of the site is illustrated in ***Figure 1***. The west portion of the subject site is the Public Rental Housing (PRH) development. The east portion of the subject site is the Subsidized Sale Flat (SSF) development.

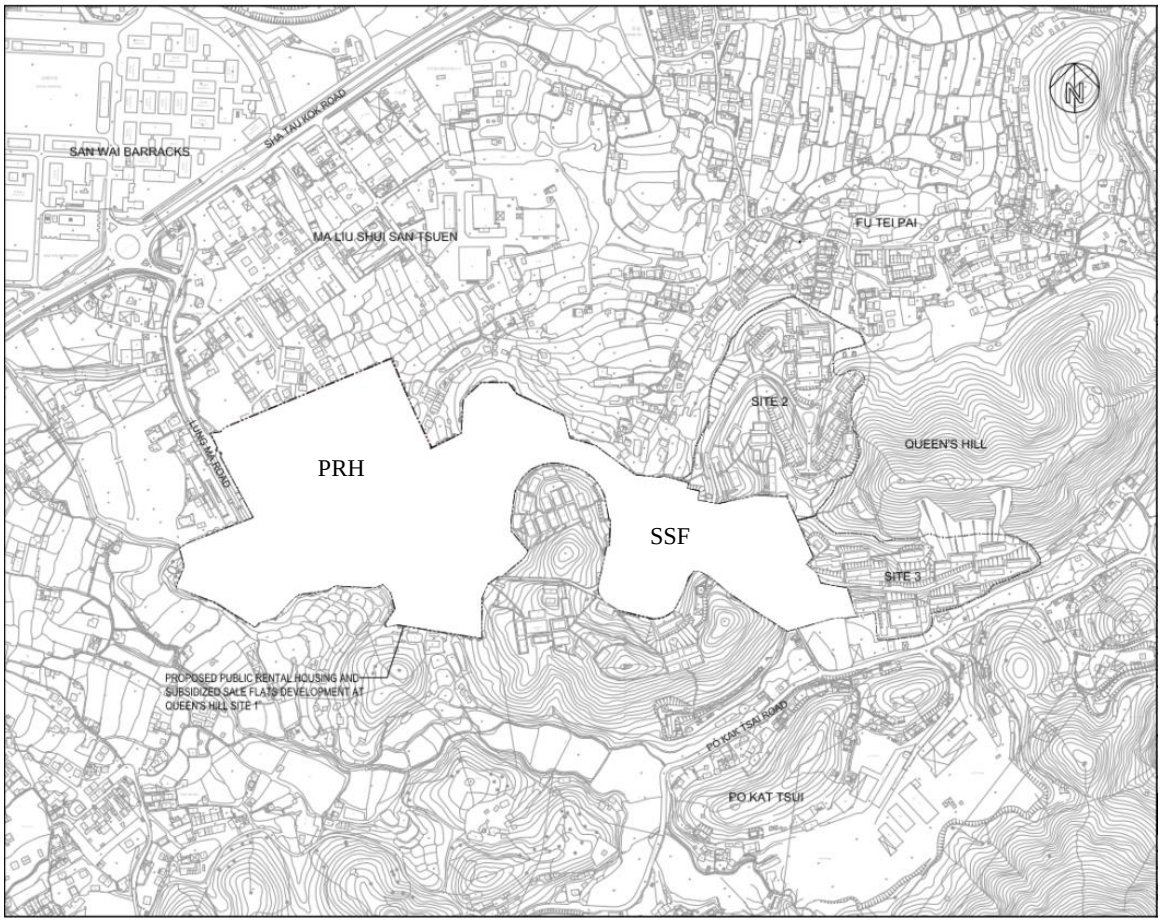


Figure 1 Location Plan of Subject Site

1.5.2 The existing surrounding developments of the subject sites are mainly villages with 2-4 storey residential houses, storage houses, and low-rise structures of former Queen's Hill (Ex-Burma Lines) Barrack.

2 SCHEME DESIGN

2.1 Design Parameters

2.1.1 The Subject Site encompasses approximately 136,500 m^2. The Base Scheme development comprises of 15 domestic blocks (Block 1-8; Block A-G), 3 basement car parks, a retail centre, a Public Transport Terminus (PTT), an Integrated Community Hall and Social Welfare Block (ICHSWB), 2 schools and multiple gardens and ball courts.

2.1.2 The Proposed Scheme comprises of 13 domestic blocks (Block 1-7; Block A-E), 3 basement car parks, a retail centre, a covered Public Transport Terminus (PTT), an Integrated Community Hall and Social Welfare Block (ICHSWB), A PSA office converted from an existing officer's mess of the barrack, 2 schools and multiple gardens and ball courts.

2.1.3 The detail parameters of Base Scheme and Proposed Scheme are shown in ***Table 1*** while master layout plans of Base Scheme and Proposed Scheme are shown in ***Figure 2*** and ***Figure 3***. For the master layout plans of Base Scheme and Proposed Scheme, please refers to Appendix A and Appendix B respectively.

Table 1 Comparison of the Development Parameters of Base Scheme and Proposed Scheme

Scheme Development		**Base Scheme**	**Design Scheme**
Overall	Site Area (m^2)	Approx.133,000 m^2	Approx.136,500 m^2
	Plot Ratio	6 (overall)	6.0 (overall)
	GFA (m^2)	Domestic: 474,900 Non-domestic: 17,900	Domestic: 515900 Non-domestic: 40,300
	No. of Flat	11,048	12,071
	Design Population	33,800	34475
	No. of Domestic Block	15	13
PRH & SSF	Building Height (Main Roof) (mPD)	Max.140.0 Block 1=137.0 Block 2=137.0 Block 3=132.0 Block 4=132.0 Block 5=140.0 Block 6=140.0 Block 7=140.0 Block 8=139.0	Max.143.0 Block 1=137.5 Block 2=137.5 Block 3=140.4 Block 4=141.8 Block 5=143.0 Block 6=143.0 Block 7=143.0 Block A=141.3

Scheme Development		Base Scheme	Design Scheme
		Block A=120.0 Block B=130.0 Block C=130.0 Block D=120.0 Block E=112.0 Block F=100.0 Block G=85.0	Block B=141.3 Block C=141.3 Block D=138.6 Block E=138.6 Block F=100.1
	Building Podium Height (mPD)	Nil	Block 3=33.9 Others: Nil
	No. of Domestic Storeys	Ranged from 17 – 40	Ranged from 22 – 40
Retail Block	Building Height (mPD)	29.3	36.1
	No. of Storeys	2	3
PTT	Building Height (mPD)	N/A	35
	No. of Storeys	N/A	1
ICHSWB	Building Height (mPD)	52.9	42.8
	No. of Storeys	8	7
School	Building Height (mPD)	32	29
	No. of Storeys	5	5
PSA Office	Building Height (mPD)	N/A	30.0
	No. of Storeys	N/A	1

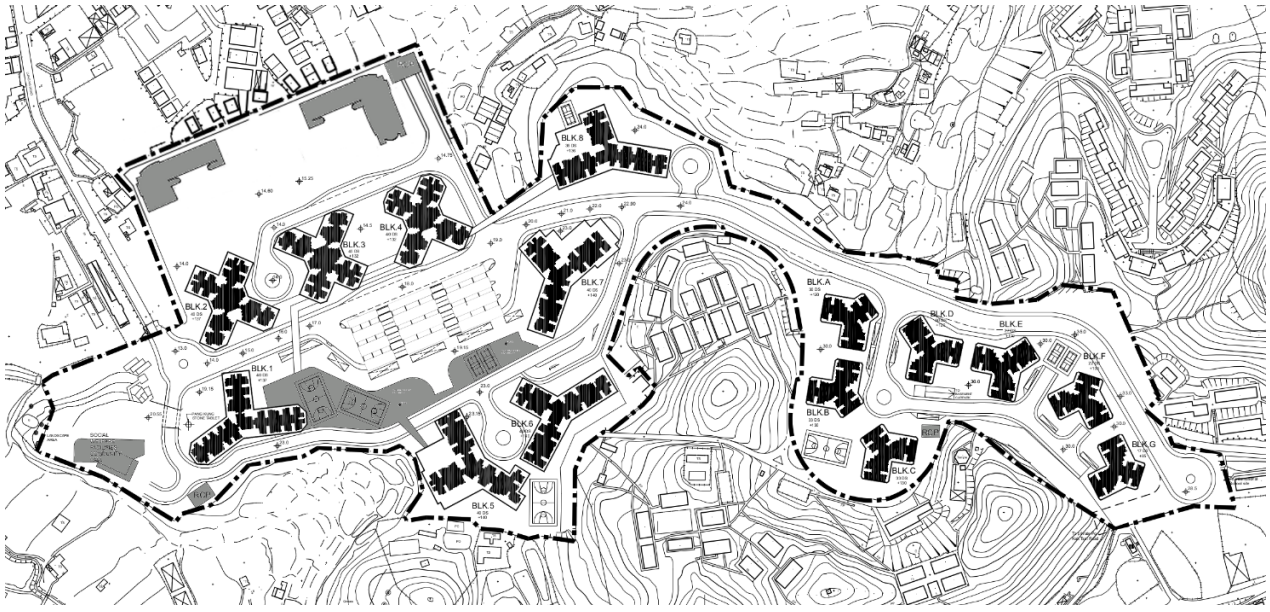


Figure 2 Master Layout Plan of Base Scheme Development

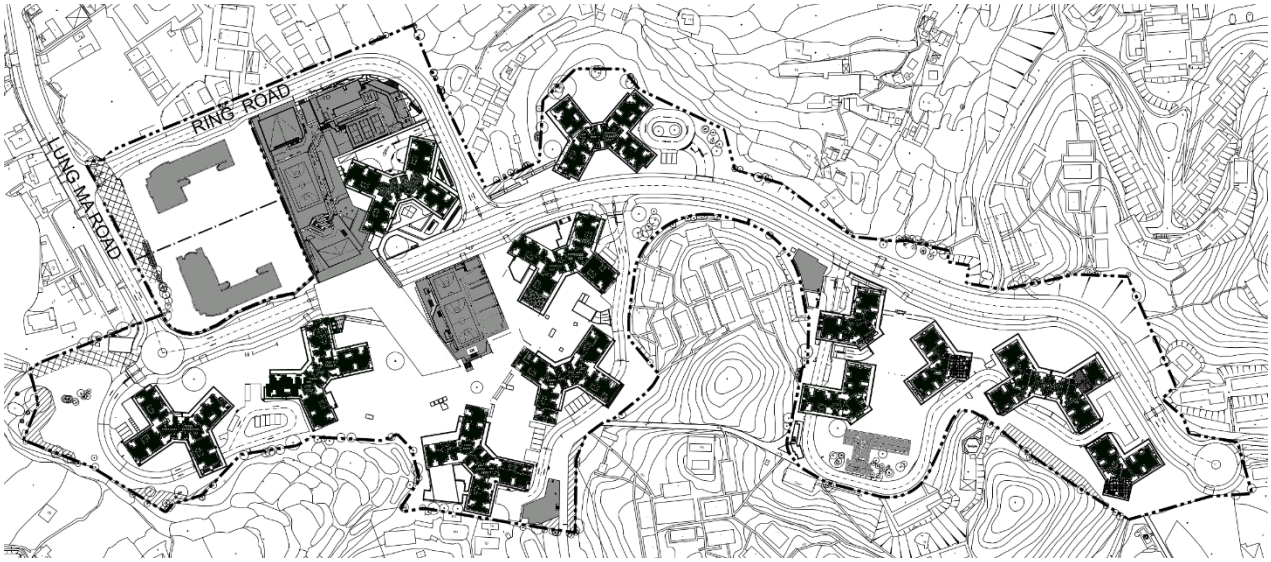


Figure 3 Master Layout Plan of Base Scheme Development

2.2 Air Ventilation Features

Wind Corridors & Air Paths

2.2.1 Comparison of the Base Scheme and Proposed Schemes regarding air ventilation are described in the following paragraphs. The air paths described are indicated in ***Figure 4***.

- *Wind Corridor of 100m between SSF and PRH site*

2.2.2 The PRH and SSF portion under both Base Scheme and Proposed Scheme is separated to the west and east side respectively, leaving a wind corridor of over 100m between the two portions, which allows wind to penetrate across north and south of the Subject Site.

- *Air Path above Retail Facility*

2.2.3 Building separations under the Base Scheme allows wind to flow across Air Path B (37m) above the retail facility in the Subject Site. Similarly in the Proposed Scheme, the Air Path B is maintained and slightly enlarged to 40m.

- *Air Path along the Main Road*

2.2.4 The Main Roads of PRH and SSF under both Base Scheme and Proposed Scheme act as air paths (Air Path A and Air Path C of 20m and 26m respectively) which facilitates the air flow under north-eastern and south-eastern winds. Air Path C is further widened to 28m in the Proposed Scheme.

- *Air Path between Block 5 & Block 6*

2.2.5 In addition, building separation between Block 1 and 2; Block 5 and 6 allows two air paths of Air Path D (20m) and Air Path E (21m) respectively. These air paths are expected to enhance the wind permeability of the Subject Site under south-eastern wind.

- *Other Air Paths*

2.2.6 Under the Base Scheme, Air Path H is created between schools and domestic blocks which allows winds to penetrate. However, to avoid accumulation of air pollutants and nuisance from traffic noise, the PTT is re-located to the north under the Proposed Scheme. As a result, Air Path H is not available under the Proposed Scheme. Instead, the structures including the schools, PTT and ICHSWB in PRH are setback from the north boundary of PRH under the Proposed Scheme. The setback creates an Air Path G (18m), which allows wind to flow between the Subject Site and Ma Liu Shui San Tsuen to the downstream area.

2.2.7 In the SSF portion, Air Path I is available under the Base Scheme which allows winds to penetrate. Under the Proposed Scheme, the air path is no longer exist as merging of two

blocks, namely Block D and Block E. However, an Air Path F (16m) is created which allows wind to penetrate.

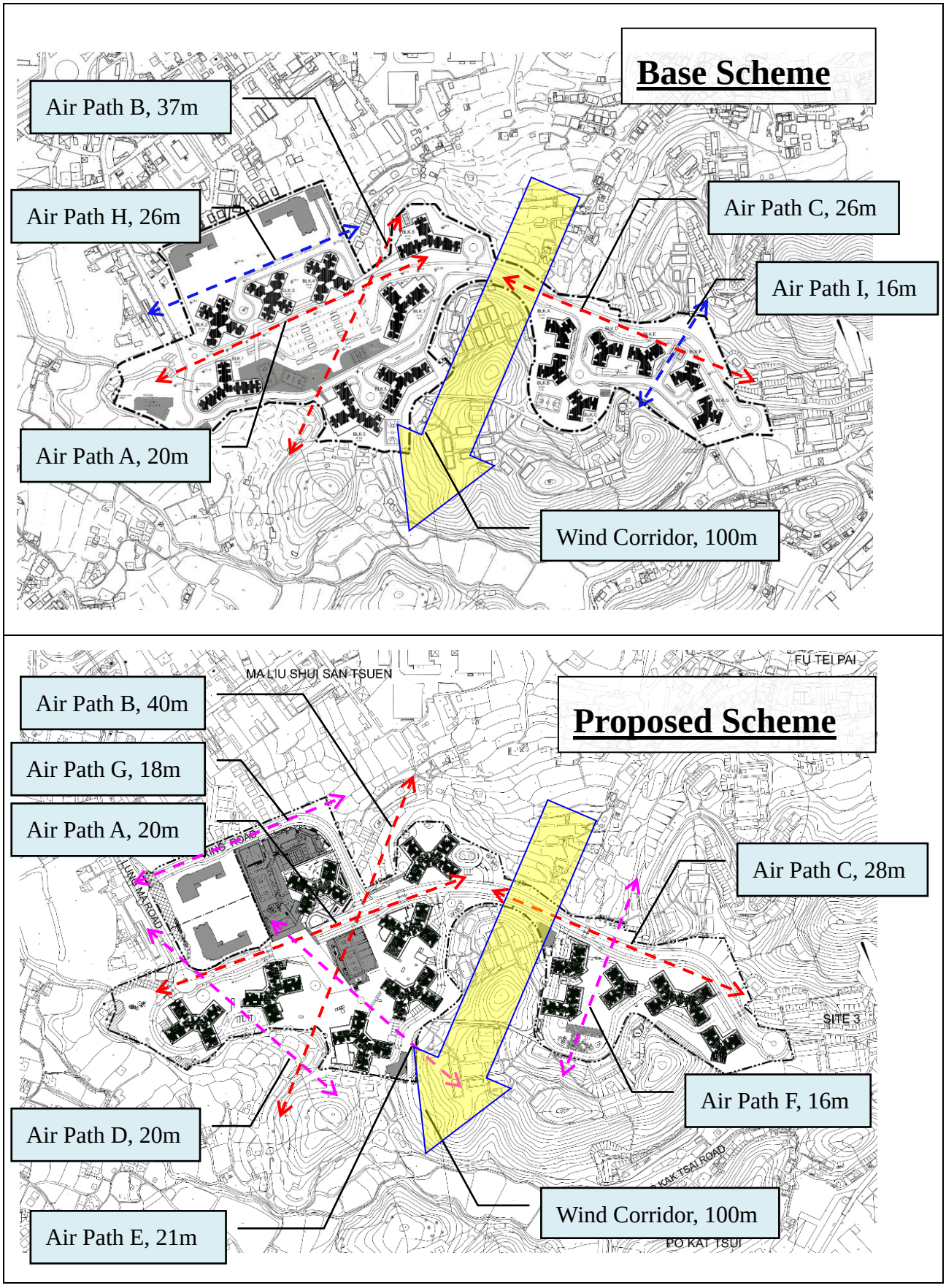


Figure 4 Air Paths under annual and summer wind in Base Scheme and Proposed Scheme

Building Setback

2.2.8 Due to a reduction of number of residential blocks at the SSF site under the Proposed Scheme from 7 to 6, setback distance from the site boundary is increased to allow more wind to flow into and across the development to adjacent areas. Comparing with Base Scheme, these building setbacks are increased from 30m to 42m; 26m to 34m from the north boundary and 13m to 42m from the south boundary as shown in ***Figure 5***. The increase in setback from the north boundary could enlarge the width of Air Path C. Hence more wind is channelled across Air Path C to downstream areas under summer ESE wind.

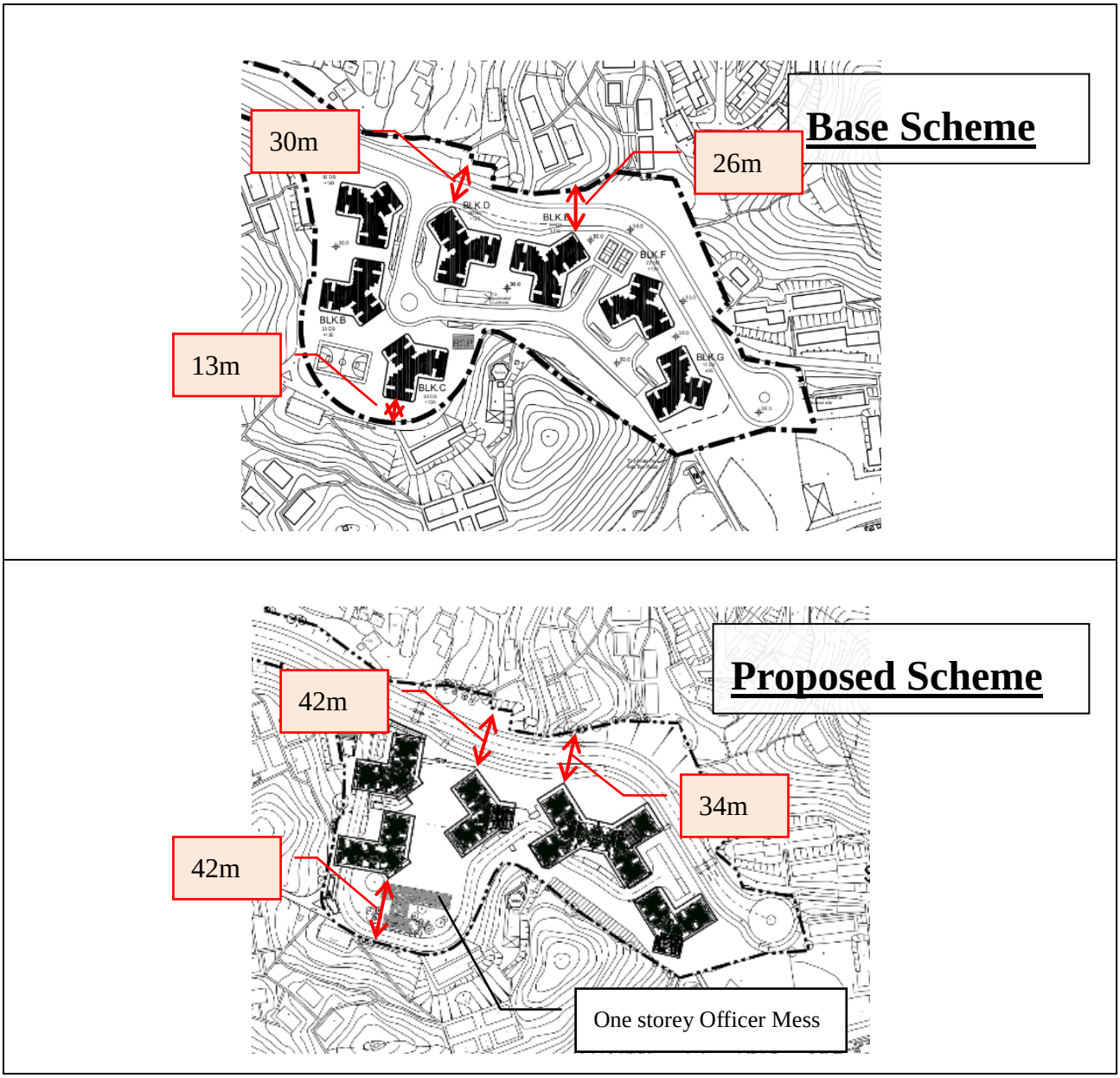


Figure 5 Building Setback at SSF in Base Scheme and Proposed Scheme

2.2.9 Due to the relocation of PTT to the north, Block 2 in the Base Scheme is relocated to the west of the Subject Site next to Block 1. Hence, the setback distance of Block 1 from the west site boundary is reduced from 103m in the Base Scheme to 67m in the Proposed Scheme. The building setback distance is shown in ***Figure 6***.

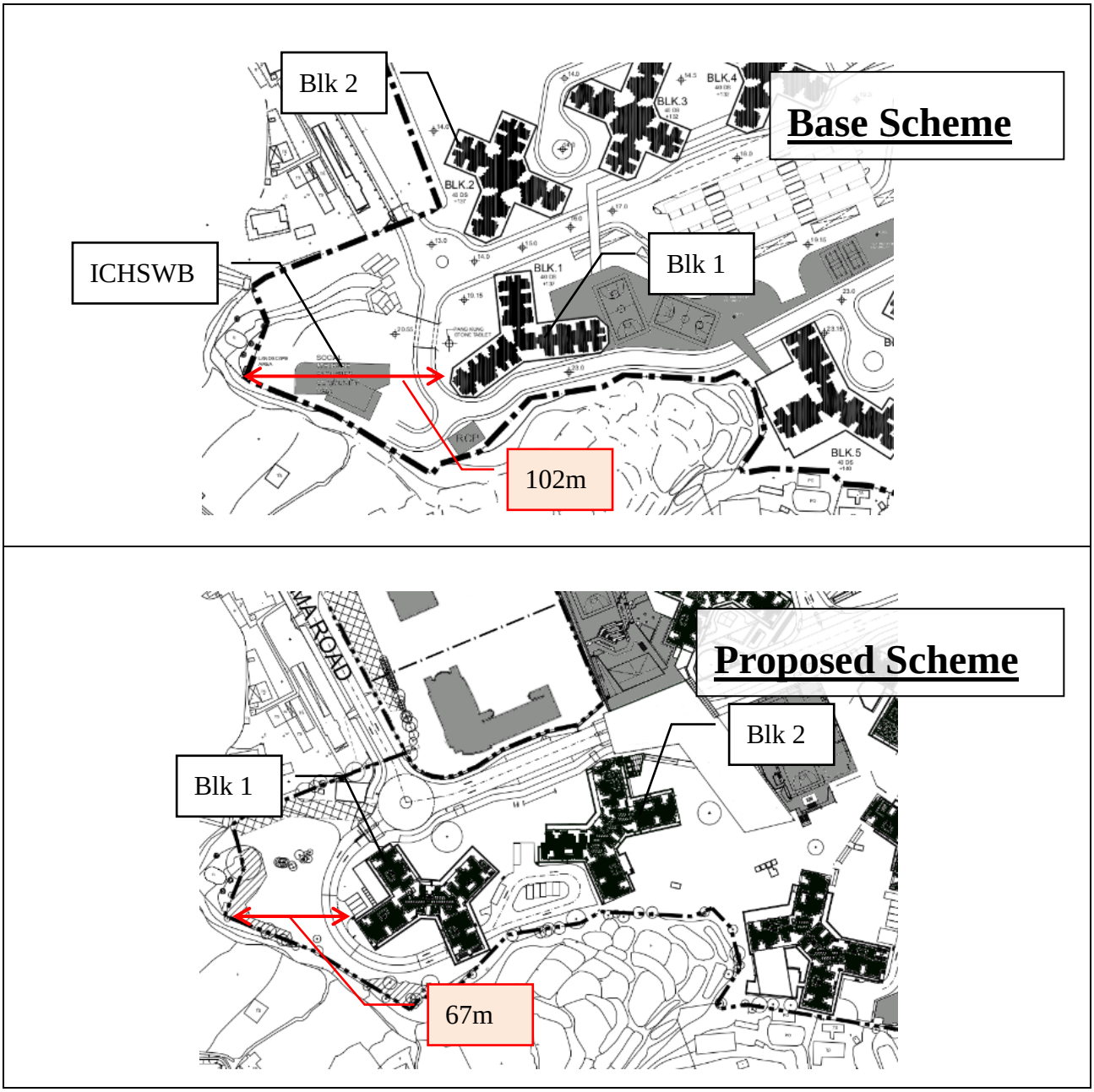


Figure 6 Building Setback of Block 1 in Base Scheme and Proposed Scheme

Permeable Structures

- *Empty Bays at Low Level*

2.2.10 The Proposed Scheme has applied extensive empty bays at G/F at all high-rise domestic towers. The empty bays are maximized to G/F – 2/F at the NE and SW wing of Block 5 and Block 6 respectively to facilitate Air Path E under summer prevailing wind. The extensive application of empty bays is expected to enhance ventilation at pedestrian level at local areas within the development. The locations of empty bays are indicated in ***Figure 7.***

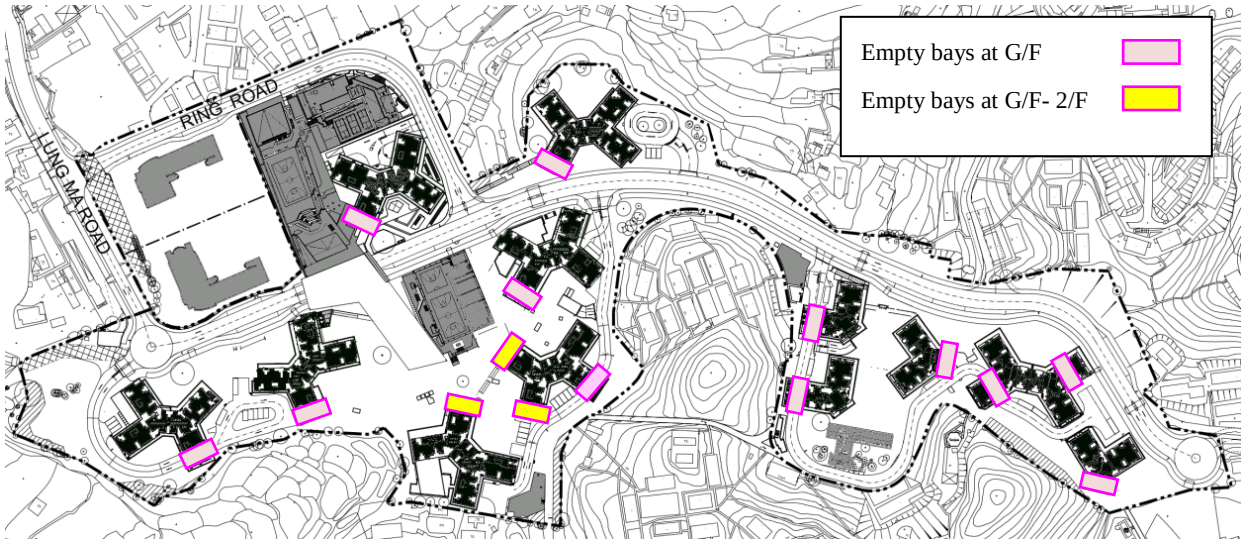


Figure 7 Locations of Low Level Empty Bays in the Proposed Scheme

Stepping Height Profile at SSF Site

2.2.11 Stepping height profile is adopted in the residential block in SSF site. Under the Base Scheme, Block C, D, E, F and G are arranged in a descending height level which from C to G. Under the Proposed Scheme, similar arrangement is adopted at Block C, D&E and F. This feature is expected to help catch winds from the E and ESE to the pedestrian level within the site.

3 SITE WIND ENVIRONMENT

3.1 General

3.1.1 Wind availability of the site is essential information to the investigation of the effects of the Proposed Development on the surrounding pedestrian wind environment. According to the *Technical Guide*, it is recommended that wind data from nearby weather station(s), simulated wind data or experimental site wind data should be referenced. Two sets of wind data will be referenced in this study, namely wind data from MM5 simulation data published by the Planning Department and the Ta Gwu Ling Automatic Weather Station operated by the HK for the annual wind rose and summer wind rose respectively.

3.2 Wind Data from MM5

The *"Site Wind Availability Data"* published by the Planning Department, simulated by Fifth-Generation NCAR / Penn State Mesoscale Model (MM5), is taken into consideration in this AVA Initial Study. ***Figure 8*** shows the annual wind rose of grid (26, 40) which is the nearest grid to the site, at an elevation of 596mPD.

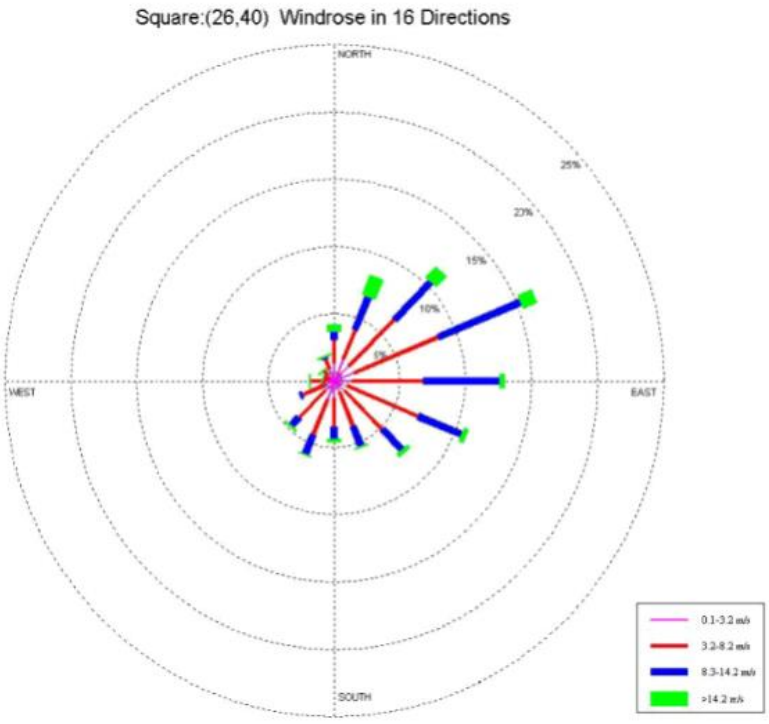


Figure 8 Annual Wind Rose of Square (26,40), MM5 Data from the Planning Department

3.2.1 According to the provided wind speed and wind probability data, the most probable wind direction is ENE, which accounts for 16.3% of the annual wind occurrence at 596mPD. The eight most frequent wind directions are East northeast (ENE), East (E), Northeast (NE), East-southeast (ESE), North northeast (NNE), Southeast (SE), South southwest (SSW) and South southeast (SSE) which account for approximately 78% accumulative annual wind occurrence. ***Table 2*** summarizes the percentage of annual occurrence of the corresponding wind directions at 596mPD

Table 2 Percentage Occurrence of Directional Winds at 596mPD

Wind Angle (°)	Wind Direction	Wind Speed at 596mPD (m/s)	Percentage Occurrence
67.5	ENE	8.1	16.3%
90	E	8.0	12.8%
45	NE	7.8	11.4%
112.5	ESE	6.9	10.7%
22.5	NNE	8.5	8.3%
135	SE	6.6	7.4%
202.5	SSW	5.5	5.9%
157.5	SSE	6.5	5.3%
225	SW	5.7	4.7%
180	S	5.5	4.5%
0 or 360	N	6.3	4.1%
247.5	WSW	4.7	2.8%
337.5	NNW	2.8	2.0%
270	W	3.9	1.9%
315	NW	2.3	1.2%
292.5	WNW	3.7	0.9%

3.3 Wind Data from Hong Kong Observatory

3.3.1 As MM5 data only presents annual wind occurrence, the HKO wind data from the nearest weather station is referenced to investigate the summer prevailing wind direction.

3.3.2 The nearest HKO automatic weather station is located in Ta Kwu Ling which is approximately 3km north of the project site

3.3.3 According to the Wind Rose diagrams in ***Figure 9*** below, ESE is the prevailing wind in summer.

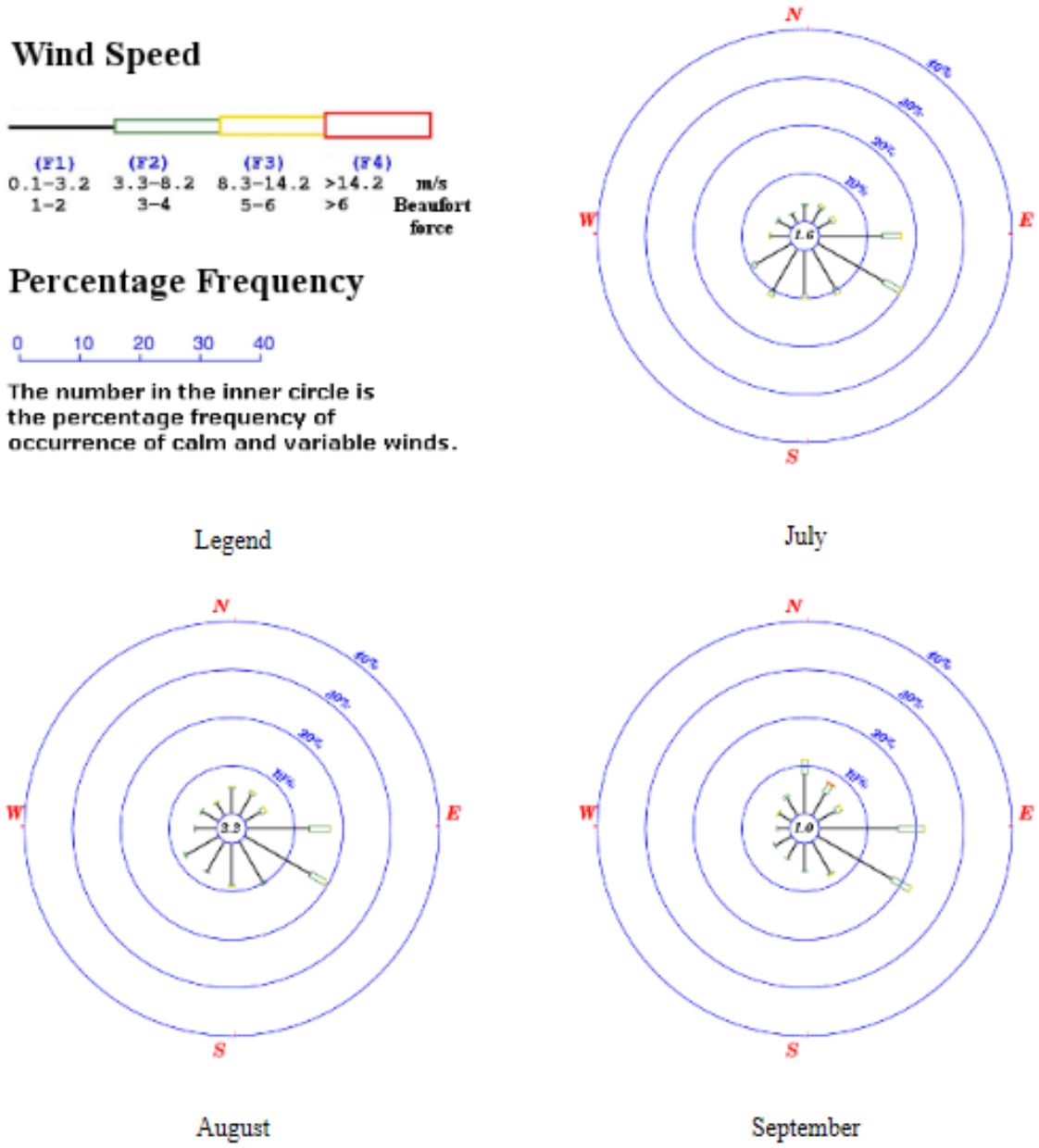


Figure 9 Wind Rose from HKO Ta Kwu Ling Weather Station

4 SITE INFORMATION

4.1 Surrounding Development

4.1.1 The subject site is located at west of Queen's Hill Site 1, Fanling. The surrounding developments are mainly low to mid-rise village house and storage facilities. The subject site is surrounded by scattering groups of low-rise apartments in Ma Liu Shui Tsuen to the north, Kwan Tei to the north east and Lung Yeuk Tau Village to the west. The existing surrounding developments of the subject sites are mainly villages with 2-4 storey residential houses, storage houses, and low-rise structures of former Queen's Hill (Ex-Burma Line) Barrack.

4.1.2 Two planned developments are committed near the subject site, namely Site 2 and Site 3, which will be included as surrounding developments. Site 2 is another housing site, which located at north of proposed SSF site, whereas Site 3 will be an international school site which located at east of proposed SSF site.

4.1.3 The surrounding developments are summarized in ***Table 3***. Their locations are indicated in ***Figure 10.***

4.2 Road Pattern

4.2.1 About 300m to the northwest of the subject site is Sha Tau Kok Road Lung Yeuk Tau Portion, which is a primary distributor. Lung Ma road, which branches from it, brings traffic to the west of the subject site.

4.2.2 Since the buildings along the road are low-rise and scattered. The road pattern is expected to have minimal impact on the oncoming land breezes and prevailing wind.

4.3 Topography

4.3.1 Due to the absence of bulky structures in the vicinity, hill ranges are the main influencing factors of wind availability at the subject site.

4.3.2 The topography within the site varies with a slope of about 14mPD at the west to 30mPD at the east.

4.3.3 North and north east of the site is a relatively flat open area where villages scattered. East, southeast and south of the site are surrounded by hills and mountains. These hills include Queen's Hill (85mpd), Tai Leng Pei (170 mpd), Ko Po Shan (60mpd), Shek Au Shan (277 mpd) and Lung Shan (390mpd). Lamb Hill (130 mpd) is located to the north of the subject site.

Table 3 Summary of Surrounding Developments

	Name	Development
1	Ma Liu Shui San Tsuen	Village houses
2	Kwan Tei Tsuen	Village houses
3	Fu Tei Pai	Village houses
4	Tai Wo	Village houses
5	Site 3 (Planned International School Site)	Future international school development which consists of 2 nos of school buildings of about 7-storey tall.
6	Po Kat Tsai	Village houses
7	San Wai Barracks	Military camps
8	Sun Wai	Village houses
9	Sun Uk Tsuen	Village houses
10	Wing Ning Wai	Village houses
11	Wing Ning Tsuen	Village houses
12	Tung Kok Wai	Village houses
13	Ma Wat Tsuen	Village houses
14	Tsz Tong Tsuen	Village houses
15	Area A	Village houses along Lung Ma Road
16	Area B	Abandoned structures of the former barrack with no pedestrian access
17	Area C	Village houses in northern side of the project site, nearby Kwan Tei Tsuen
18	Area D	Scattered low-rise houses between Lung Yuek Tau and the subject site
19	Site 2 (Planned Private Housing Site)	Future housing development which consists of about 21 nos of domestic blocks of about 15-storey tall.

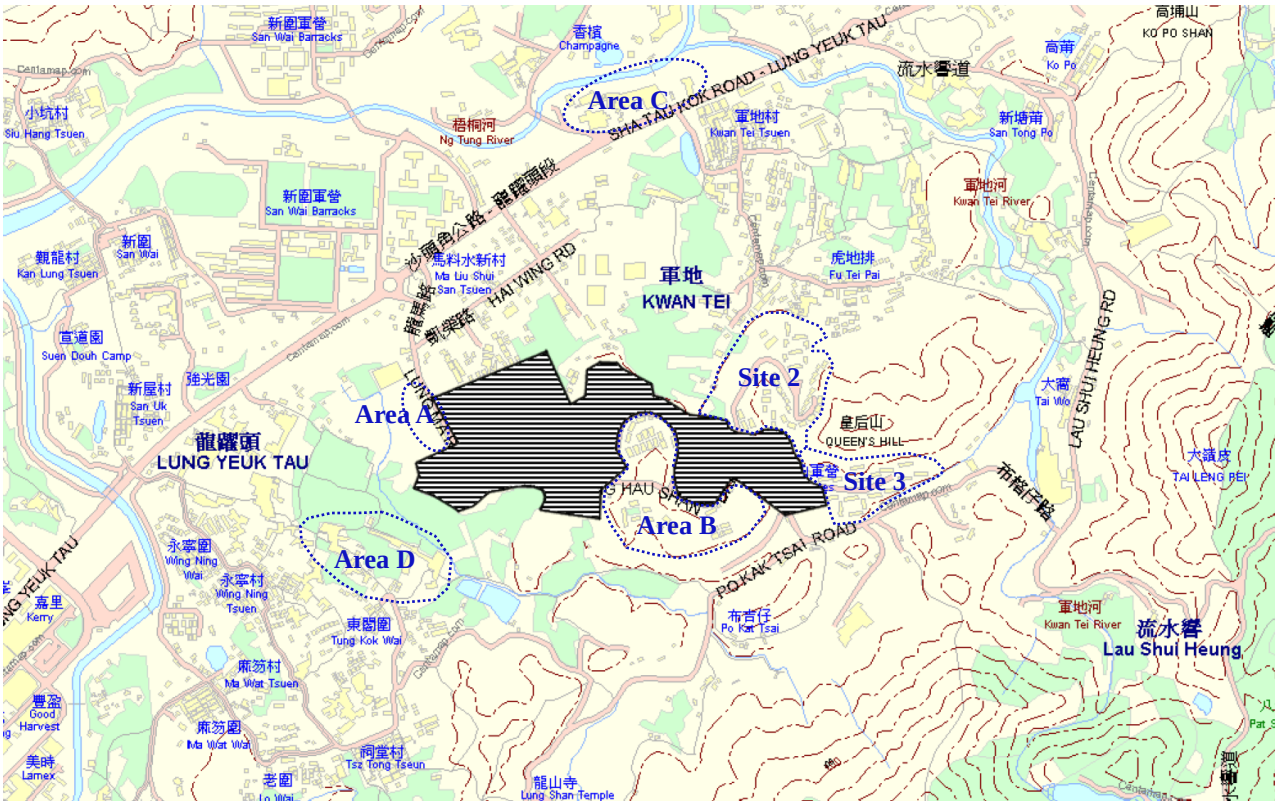


Figure 10 Locations of Surrounding Developments

5 ASSESSMENT AREAS & SURROUNDING AREAS

5.1.1 It is recommended in the *Technical Guide* that the Assessment Area and Surrounding Area of the Project should include the Project's surrounding of up to a perpendicular distance *H* and 2*H* respectively from the Project boundary, while *H* being the height of the tallest building of the Proposed Development.

5.1.2 The highest buildings on the project site are Block 5, Block 6 and Block 7. The top roof reaches 155m above Principle Datum (mPD) while the ground floor stands at 25.2mPD. The height (H) of it is about 130m. Hence 2H of the building is 260m.

5.1.3 Nonetheless, as prominent topographical features exist at the east and south of the subject site, the Surrounding Area and Assessment Area are enlarged to capture more realistic wind performance. An Assessment Area with a perpendicular distance of 200m from the Project Boundary, a Surrounding Area with a perpendicular distance of 500m from Project Boundary has been adopted in the AVA Initial Study. The extents of both areas are indicated in ***Figure 11***.

Figure 11 Extent of Assessment Area and Surrounding Area

6 MODELLING TOOL AND ASSUMPTIONS

6.1 Geometry and Domain Setting

6.1.1 In the AVA Initial Study, three-dimensional models of the site and the surrounding built environment are constructed to simulate the wind performance of the design options. Related wind speeds around the development are assessed by setting up a geometry model of the development with surrounding building structures.

6.1.2 A domain covering the Surrounding Areas is constructed. Top view and side view of the representation of the computational domain are shown in ***Figure 12*** and ***Figure 13*** respectively. The size of the computational domain of the 3D model is illustrated below:

x-direction (L) = 3400m;
y-direction (W) = 3400m; and
z-direction (H) = 900m

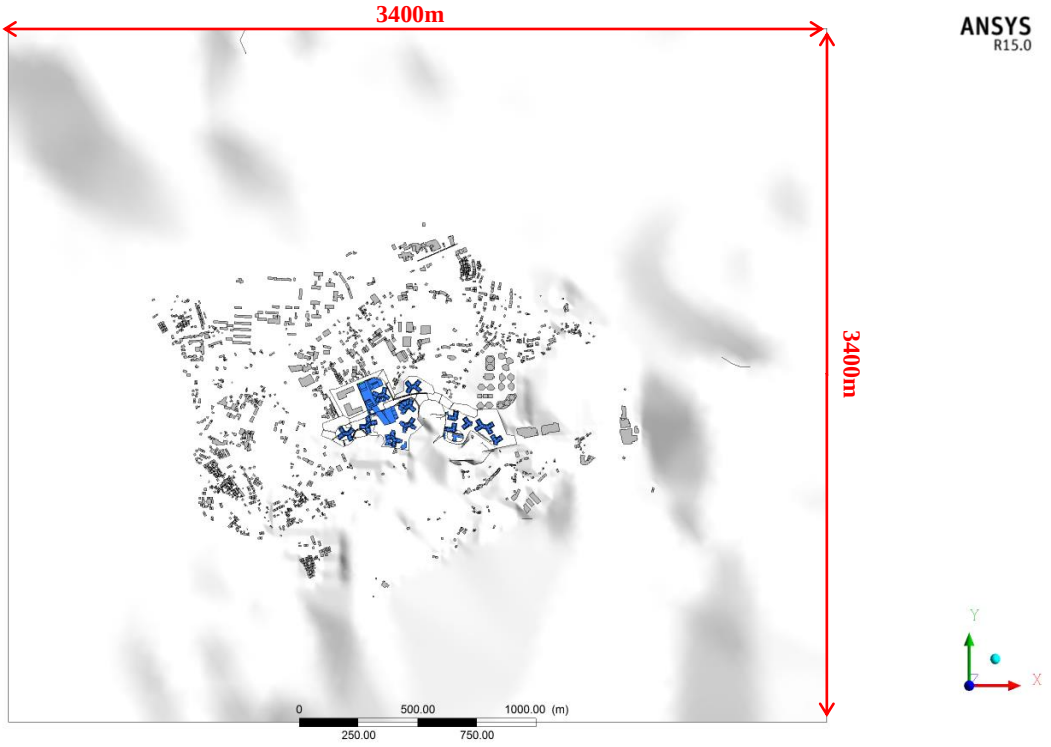


Figure 12 Top View of Domain Dimension

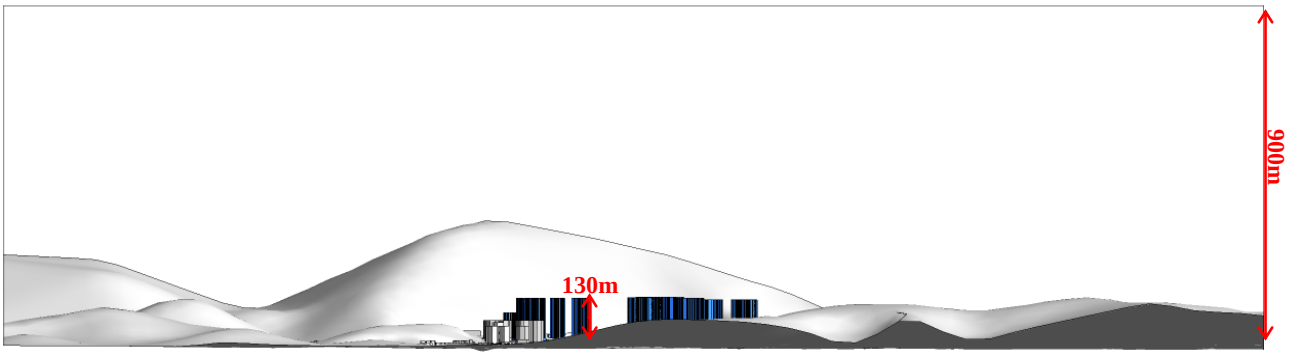


Figure 13 Side View of Domain Dimension

6.2 Mesh Setting

6.2.1 Unstructured grid is constructed by *ANSYS ICEM CFD* and the grid size can be manually adjusted in the aforesaid meshing tools. Within the assessment area, cells located across the *x*-axis and *y*-axis are positioned with smaller intervals than those located further from the site location in order to produce a more precise result at higher resolution where it is required.

6.2.2 The CFD model is developed with the combination of tetrahedral and prism cells. Approximately 18.7 million cells are constructed for the study. The grid arrangement within the assessment height of 2m above ground has been refined to facilitate the pedestrian wind environment study. In order to improve accuracy, smaller gird has been adopted in order to achieve a higher resolution at low levels of z-axis and thus capable of resolving small scale height structures and changes in topography at pedestrian level. The expansion ratio between two consecutive cells approximates 1.2. Four prism layers at prism ratio of 0.5 are created at 2m above ground to increase modelling accuracy at pedestrian level. ***Figure 14*** and ***Figure 15*** shows the mesh size and prism layer respectively.

6.3 Turbulence Model

6.3.1 *ANSYS FLUENT* offers an unparalleled breadth of turbulence models such as k-epsilon turbulence model and the Reynolds Stress Model (RSM). In this study, the realizable k-epsilon model and a second order discretization scheme are adopted for simulation. Common computational fluid dynamics equations are also used in the analysis. A symmetry condition is prescribed at the lateral and top boundary of the 3D model. The convergence criterion adopted being the sum of the normalized absolute residuals less than 1×10^{-3}.

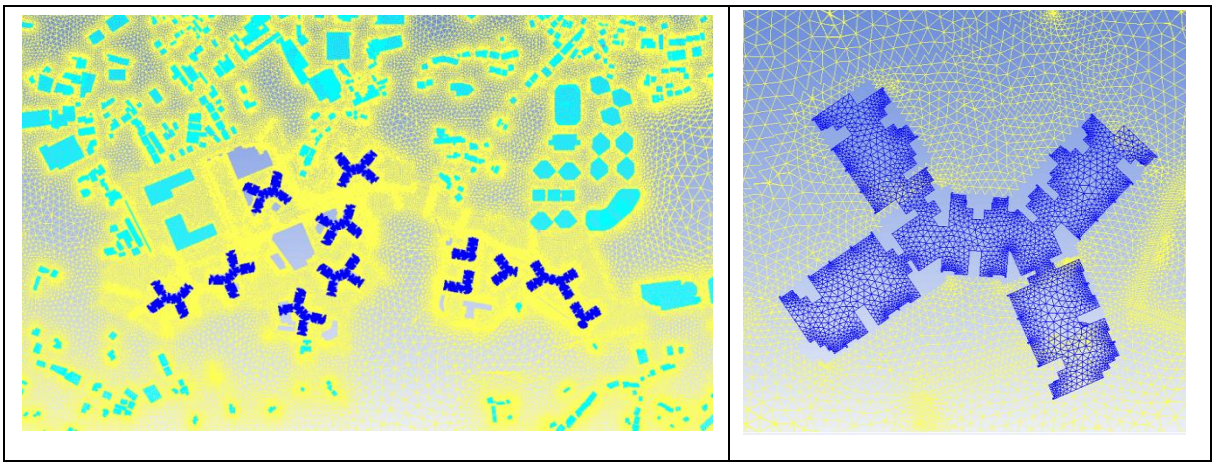


Figure 14 CFD Mesh Model

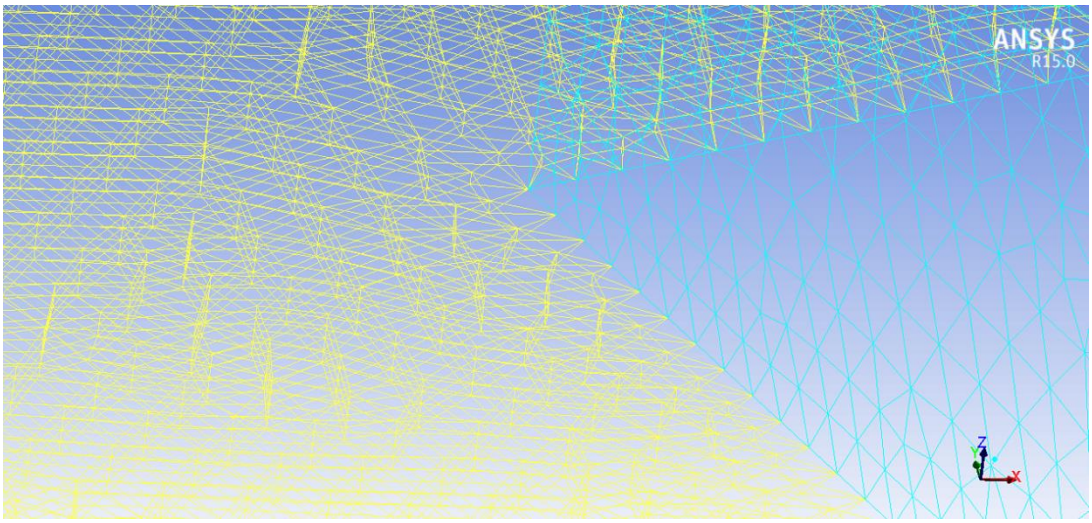


Figure 15 CFD Prism Layer

6.4 Numeric Scheme Setting

6.4.1 ANSYS FLUENT offers an unparalleled breadth of turbulence models such as k-epsilon turbulence model and the Reynolds stress model (RSM). In this study, the realizable k-epsilon model and a second order discretization scheme are adopted for simulation.

6.4.2 FLUENT uses iterative methods to solve the algebraic system of equations. The termination criterion is usually based on the residuals of the corresponding equations. The termination criterion of 0.001 has been used in this study.

6.4.3 The boundary conditions under various winds are tabulated in ***Table 4***.

Table 4 Summary of Boundary Conditions under Various Winds

Wind Directions	East	North	South	West	Top	Terrain
E	Velocity inlet	Symmetry	Symmetry	Pressure outlet	Symmetry	Wall
ENE	Velocity inlet	Velocity inlet	Pressure outlet	Pressure outlet	Symmetry	Wall
NE	Velocity inlet	Velocity inlet	Pressure outlet	Pressure outlet	Symmetry	Wall
NNE	Velocity inlet	Velocity inlet	Pressure outlet	Pressure outlet	Symmetry	Wall
ESE	Velocity inlet	Pressure outlet	Velocity inlet	Pressure outlet	Symmetry	Wall
SE	Velocity inlet	Pressure outlet	Velocity inlet	Pressure outlet	Symmetry	Wall
SSE	Velocity inlet	Pressure outlet	Velocity inlet	Pressure outlet	Symmetry	Wall
SSW	Pressure outlet	Pressure outlet	Velocity inlet	Velocity inlet	Symmetry	Wall

6.5 Wind Profile

6.5.1 The vertical discretization of the velocity profile is being approximated using a wind profile power law, which is a function of ground roughness and height

$$U_Z = U_G\left(\frac{z}{z_G}\right)^{\alpha}$$

where

U_G = reference velocity at height Z_G
Z_G = reference height
Z = height above ground
U_Z = velocity at height z

6.5.2 The wind velocity at the top boundary layer is obtained from Mesoscale Model (MM5) published by PlanD. The alpha coefficient α is related to the ground roughness, which is determined by terrain types. With reference to the power law exponent suggested by Givoni (1998)[1], the alpha coefficient α is set at 0.22 for all the prevailing wind directions as the terrain crossed by the approaching wind is considered as suburban.

6.5.3 ***Figure 16*** shows the wind profile of the 8 most probable wind directions which account for 78% occurrence of wind over a year at the site. Each wind profile is plotted with reference to the wind profile power law. Wind velocity at each elevation between 0 to 600m is approximated using the wind profile power law as indicated above.

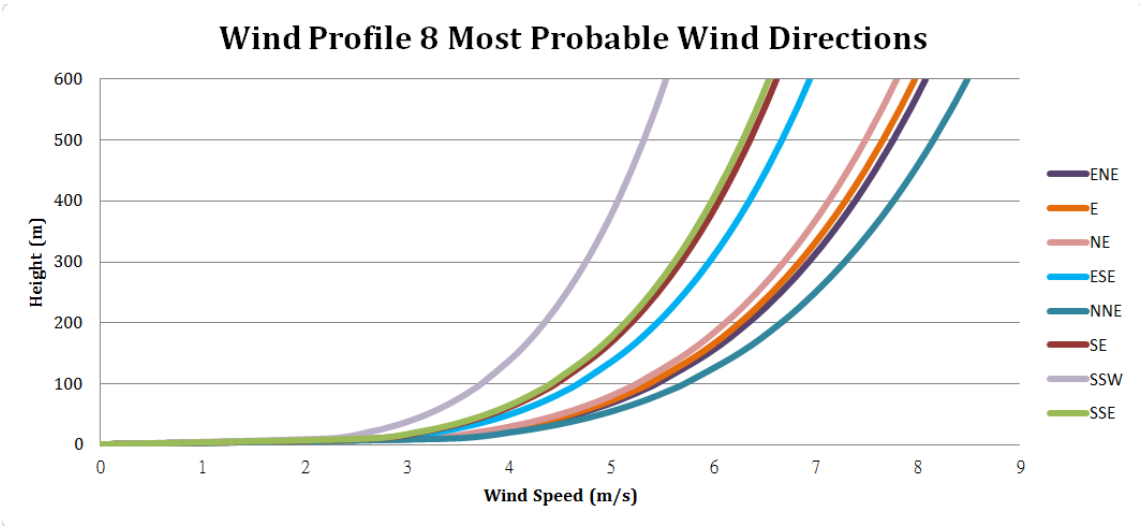


Figure 16 Wind Characteristics of the 8 Most Probable Wind Direction

6.6 Wind Velocity Ratio

6.6.1 Wind Velocity Ratio (*VR*) should be used as an indicator of wind performance for the AVA. It indicates how much of the wind availability of a location could be experienced and enjoyed by pedestrians. The higher the wind Velocity Ratio, the less likely would be the impact of the Proposed Developments on the wind availability.

6.6.2 According to Paragraph 3 of *Technical Guide*, Wind Velocity Ratio is defined as follows

$$VR_w = \frac{V_p}{V_\infty}$$

where

V_p is the wind velocity at the pedestrian level (2m above ground) after taking into account

[1] Givoni B. 1998. General Modifications of Wind Field by Urbanization. *Climate Considerations in Building and Urban Design*. John Wiley and Sons.

the effects of buildings; and

V_{∞} is the wind availability of the site, i.e. wind velocity at the top of the wind boundary layer. MM5 data are used to determine velocity at infinity level for the Project site.

6.6.3 The assessment on the overall wind performance of the current situation and the Proposed Development were analyzed by comparing the weighted wind Velocity Ratio (VR_w) to account for wind coming from the 8 wind directions. VR_w is the sum of the Wind Velocity Ratio of wind from direction *i* (VR_i) multiplied by the probability (F_i) of wind coming from that direction.

$$VRi = \frac{V_{pi}}{V_{\infty i}} \qquad VR_w = \sum_{i=1}^{16} Fi \times VRi$$

where

V_{pi} is the wind velocity at the pedestrian level (2m above ground) when wind comes from direction *i*; and

$V_{\infty i}$ is the wind availability of the site, when wind comes from direction *I;*

F_i is the frequency occurrence of wind from direction *i*, eight wind directions are considered;

VR_w is the wind Velocity Ratio.

6.6.4 The normalized weighting (F_i) for each wind direction under annual and summer prevailing conditions is in ***Table 5***.

Table 5 Weighted Occurrence Frequency (Fi) of Prevailing Wind Directions

Wind Direction	Occurrence frequency	Normalized weighting (Fi)
ENE	16.3%	20.9%
E	12.8%	16.4%
NE	11.4%	14.6%
ESE	10.7%	13.7%
NNE	8.3%	10.6%
SE	7.4%	9.5%
SSW	5.9%	7.6%
SSE	5.3%	6.8%
Total	**78.1%**	**100%**

6.7 Test Points

6.7.1 Test Points are the assessment locations where Wind Velocity Ratios (*VRs*) at 2m above ground level are reported. The criteria of choosing Test Points are stipulated in paragraph 28 of the *Technical Guide*. Perimeter Test Points and Overall Test Points were selected within the Assessment Area so as to assess the impact on the immediate vicinity and local areas respectively. All test points are elevated at 2m above ground.

6.7.2 Perimeter Test Points were distributed to assess the resultant wind environment that can be frequently accessed by pedestrians. Test Points in this group were selected at around 10 m to 50 m interval along the boundary of the site, and were named with prefix "PP" (i.e. PP-001, PP-002…). Overall Test Points were positioned in the open spaces, on the streets and places at the Assessment Areas which are frequently accessed by pedestrians. Test points in this group are named with prefix "OP" (i.e. OP-001, OP-002…). There are a total of 48 perimeter test points and 209 overall test points assigned to the assessment.

6.7.3 ***Figure 17*** shows the location of the designated Perimeter Test Points in purple and Overall Test Points in orange for the purpose of this AVA Initial Study. The numbering of each test point is shown in detail in ***Appendix C***. The VR of test points under 8 most probable winds is provided in ***Appendix D***.

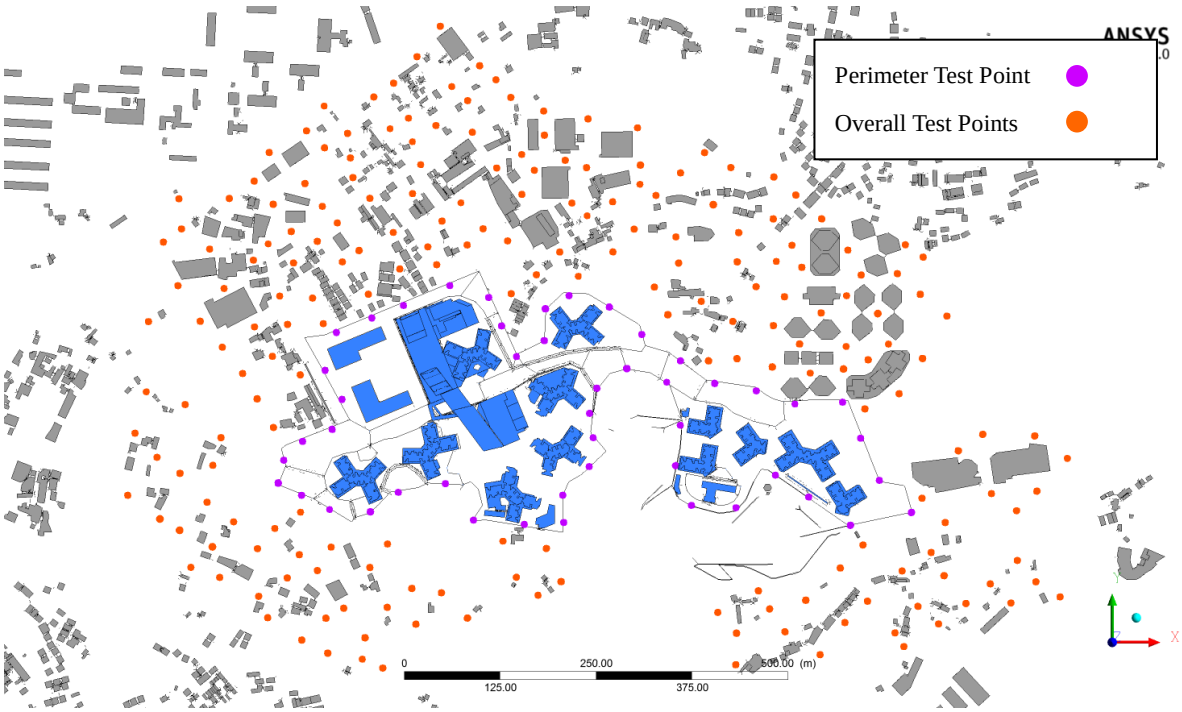


Figure 17 Perimeter Test Points and Overall Test Points

7 RESULT

7.1 General

7.1.1 In this AVA Initial Study, wind environment at pedestrian level (2m above ground) is simulated under the 8 most probable wind directions in both the Base Scheme and Proposed Scheme.

7.1.2 Pedestrian-level wind Velocity Ratios (*VRs*) are simulated for each Test Point under the 8 most probable wind directions in both Schemes. Furthermore, the *VRs* simulated under each wind direction are averaged taking into account wind probability to determine the weighted wind velocity ratio (VR_w) of the Base Scheme and Proposed Scheme. The VR of test points under 8 most probable winds is provided in ***Appendix D***. Vector and contour plot of velocity ratio under 8 most probable winds are shown in ***Appendix E***.

7.2 Local Air Ventilation Assessment

7.2.1 Local spatial average Velocity Ratios (*LVRs*) are evaluated for each wind direction by considering the average *VR* modelled at all Overall Test Points and Perimeter Test Points. Weighted Local spatial average Velocity Ratios (LVR_w) are also determined after taking into account wind probability of the 8 assessed wind directions. ***Table 6*** summarizes the *LVR* and LVR_w results for both the Base Scheme and Proposed Schemes under the 8 most probable wind directions.

Table 6 Analysis of Average LVR between Base Scheme and Proposed Scheme

Wind Directions	Average LVR (Base Scheme)	Average LVR (Proposed Scheme)	Difference	Difference (%)
E (90°)	0.203	0.207	0.00	2.0%
ENE (67.5°)	0.234	0.225	-0.01	-3.8%
ESE (112.5°)	0.137	0.152	0.02	11.2%
NE (45°)	0.233	0.227	-0.01	-2.8%
NNE (22.5°)	0.234	0.238	0.00	1.6%
SE (135°)	0.219	0.201	-0.02	-8.0%
SSE (157.5°)	0.221	0.228	0.01	3.2%
SSW (202.5°)	0.196	0.207	0.01	5.6%
LVR_w	**0.210**	**0.210**	0.00	**0.01%**

7.2.2 The result shows a small increase of LVR_w of +0.01% in the Proposed Scheme. Hence, the ventilation performance at pedestrian level at the surrounding developments under the Proposed Scheme is expected to be similar to that under the Base Scheme in the weight average wind condition.

7.2.3 It is found that the LVR values show changes ranging from -8.0% to +11.2% across different wind directions. The LVR value of the Proposed Scheme is 3.8% lower under annual prevailing ENE wind, while it is 11.2% higher under summer prevailing ESE wind. It indicates that the Proposed Scheme design favours ventilation under the summer prevailing wind condition.

7.3 Site Air Ventilation Assessment

7.3.1 Site spatial average Velocity Ratios (*SVR*) are evaluated for each wind direction by considering the average Velocity Ratio modelled at all Perimeter Test Points at ground level along the boundary of the Subject Site which are accessible by pedestrians. Weighted Site spatial average Velocity Ratios (SVR_w) are also determined after taking into account wind probability of the 8 assessed wind directions. The *SVR* and SVR_w results as well as the percentage changes for both the Base and Proposed Schemes are summarized in ***Table 7*** below.

Table 7 Analysis of Average SVR between Base Scheme and Proposed Scheme

Wind Directions	Average LVR (Base Scheme)	Average LVR (Proposed Scheme)	Difference	Difference (%)
E (90º)	0.234	0.256	0.02	9.1%
ENE (67.5º)	0.286	0.256	-0.03	-10.5%
ESE (112.5º)	0.158	0.183	0.02	15.8%
NE (45º)	0.257	0.249	-0.01	-3.3%
NNE (22.5º)	0.284	0.270	-0.01	-4.9%
SE (135º)	0.277	0.236	-0.04	-14.8%
SSE (157.5º)	0.281	0.268	-0.01	-4.5%
SSW (202.5º)	0.277	0.262	-0.01	-5.4%
SVR_w	**0.254**	**0.246**	-0.01	**-3.16%**

7.3.2 The result shows a slight decrease of SVR_w of -3.16%. It indicates a slight decrease in ventilation performance at pedestrian level at the immediate surroundings near the Subject Site boundary in the weight average wind condition.

7.3.3 It is found that the SVR values show changes ranging from -14.8% to +15.8% across different wind directions. The SVR value of the Proposed Scheme is 10.5% lower under annual prevailing ENE wind, while it is 15.8% higher under summer prevailing wind. It indicates that the Proposed Scheme design favours ventilation under the summer prevailing wind condition.

7.4 Velocity Ratio at Surrounding Developments

7.4.1 With reference to Section 4.1, concerned surrounding developments within the assessment boundary include Ma Liu Shui San Tsuen, Po Kat Tsai, Site 2, Site 3, Area A and Area D. Other developments are either out of assessment boundary or are expected to have no pedestrian activities. The ventilation performance of the concerned developments is separately investigated. The test points at these developments are listed in ***Table 8*** below.

Table 8 Summary of Test Points for Surrounding Concerned Developments

Concerned Developments	Test Points
Ma Liu Shui San Tsuen	1-33, 35-45, 48-56, 61-70, 77-83, 88-91, 95-101
Po Kat Tsai	179-182, 186-190, 193-198, 202-212
Area A	44-45, 57-58, 71-72, 85
Area D	86-87, 92-94, 102-105, 112-114, 117-119, 124-128, 135-138, 146-148, 156-157
Site 2	139-142, 149-153, 158-163, 166-170, 171-178
Site 3	183-185, 191-192, 199-201

7.4.2 The velocity ratio under annual prevailing ENE wind and summer prevailing ESE wind are obtained and tabulated in ***Table 9*** below.

Table 9 Summary of VR for Surrounding Concerned Developments

Developments	VR (Base Scheme)		VR (Proposed Scheme)	
	Annual	Summer	Annual	Summer
Ma Liu Shui San Tsuen	0.201	0.093	0.212	0.097
Po Kat Tsai	0.318	0.168	0.304	0.175
Area A	0.106	0.097	0.103	0.086
Area D	0.211	0.176	0.160	0.213
Site 2 (Planned Private Housing Site)	0.196	0.155	0.208	0.164
Site 3 (Planned International School Site)	0.480	0.190	0.486	0.210

Annual Prevailing Wind Condition

7.4.3 Ma Liu Shui San Tsuen is located at the upstream area of the Subject Site. It receives a slightly higher VR in the Proposed Scheme due to the larger building setback distance from the Ma Liu Shui San Tsuen. It allows wind from Air Path G to reach Ma Liu Shui San Tsuen, especially at the southern part of the village.

7.4.4 Po Kat Tsai is located at the downstream area of the Subject Site. Under Base Scheme, Air Path I could allow wind to penetrate across the SSF site and reach Po Kat Tsai. Nonetheless, Air Path I is not available in Proposed Scheme. Hence, Po Kat Tsai receives a lower VR in the Proposed Scheme.

7.4.5 Area A and Area D are located immediate downstream of the Subject Site. Under the Base Scheme, Air Path H allows wind to penetrate the Subject Site to reach Area A while the same air path is not available under the Proposed Scheme due relocation of PPT. Hence, a lower VR is resulted under the Proposed Scheme. For Area D, which is also located at the southwest of the subject site, due to a larger building setback distance of Block 1 at the west of PRH site under the Base Scheme, it could receive higher VR.

7.4.6 Site 2 is located at the upstream areas of the Subject Site. It receives a higher VR in the Proposed Scheme. Due to the larger building setback distance of domestic block from the north boundary of the SSF site, Air Path C is able to divert more wind to penetrate the west part of Site 2. Hence, a higher VR is achieved.

7.4.7 Site 3 is located at the upstream of the Subject Site. Minimal impact from the proposed development is expected. Similar VR is achieved under Base Scheme and Proposed Scheme.

Summer Prevailing Wind Condition

7.4.8 Ma Liu Shui San Tsuen is located at the downstream area of the Subject Site. It receives a slightly higher VR in the Proposed Scheme. It is mainly due to the reduction of building footprint of the north-most domestic block (Block 8 in the Base Scheme; Block 4 in the Proposed Scheme) which allows more wind across the domestic block to Ma Liu Shui San Tsuen. In addition, the wider Air Path C also diverts more wind to reach the east part of Ma Liu Shui San Tsuen.

7.4.9 Po Kat Tsai is located at the upstream area of the Subject Site. It receives a slightly higher VR in the Proposed Scheme under annual prevailing wind. It is due to the larger setback distance from the south boundary of SSF site which enhances the local wind environment. Hence, more wind is available at the south of the SSF site.

7.4.10 Area A is located immediate downstream of the Subject Site. Due to a larger building setback distance of domestic block at the west of PRH site under the Base Scheme, more wind can along the site boundary and reach Area A.

7.4.11 Area D is located upstream of the Subject Site. Air path D diverts with from the south to reach the site. The increased air permeability also allows more wind to flow along the southwest site boundary. Hence, wind availability of Area D, which is located at the southwest of the Subject Site, is enhanced.

7.4.12 Site 2 is located northeast of the Subject Site. It receives a higher VR in the Proposed Scheme. It is mainly due to the larger building setback distance of domestic block from the north boundary of the SSF site, Air Path C is able to divert more wind to reach the southwest and west part of Site 2. Hence, a higher VR is achieved.

7.4.13 Site 3 is located at the east of the Subject Site. It receives a higher VR in the Proposed Scheme. It is mainly due to the larger building setback distance of domestic block from the south boundary of the SSF site. It allows more wind to flow from the east to the south of the SSF site.

Summary of Annual and Summer Prevailing Wind Condition

7.4.14 Under the annual prevailing wind condition, the VR in Ma Liu Shui San Tsuen, Site 2 and Site 3 are enhanced while the VR in Po Kat Tsai, Area A and Area D are reduced.

7.4.15 Under the summer prevailing wind condition, the VR in Ma Liu Shui San Tsuen, Po Kat Tsai, Area D, Site 2 and Site 3 are enhanced while the VR in Area A is reduced.

7.4.16 In general, it is expected that the VR in most surrounding developments are enhanced in the Proposed Scheme under summer prevailing conditions.

8 DIRECTIONAL ANALYSIS

8.1 ENE & NE Wind

8.1.1 The wind flow patterns of ENE wind and NE wind across the assessment area are similar. Hence, the directional analyses of ENE and NE wind are discussed together in the following paragraphs.

8.1.2 The ENE and NE winds would flow from Kwan Tei and reach the PRH site while winds would flow between Site 2 and Site 3 and reach the SSF site. The wind corridor channels prevailing winds across the Subject Site to downstream areas. Wind is diverted and flow along Air Path A and Air Path C from the east to west across the Subject Site. The wind flow pattern is illustrated in ***Figure 18*** and ***Figure 19***.

8.1.3 As discussed in Section 2.2, PTT is relocated from the centre of PRH site in the Base Scheme to the north in the PRH site in the Proposed Scheme. The change is brought about to mitigate the potential accumulation of air pollutants and impact of traffic noise in the Base Scheme design where an open PTT is surrounded in close proximity by domestic towers. Under the Proposed Scheme, the PTT is changed to a covered PTT and moved to the north. As such, traffic noise is effectively shielded from most domestic tower and air pollutants are controlled by mechanical system. In addition, the bus route could be limited between the PRH site entrance (i.e. roundabout at the west) and the PTT entrance (south of the PTT) which would further reduce the traffic noise nuisance generated from the road.

8.1.4 However, such relocation does not allow Air Path H in the Base Scheme to be maintained. Instead, a building setback is allowed from the north site boundary, which creates Air Path G. Under the Base Scheme, Air Path H channels prevailing ENE and NE from Kwan Tei to Area A between the school site and domestic tower. Meanwhile, under the Proposed Scheme, Air Path G channels winds from Kwan Tei to the north part of Area A. Since Air Path H is wider then Air Path G, the VR at Area A in the Base Scheme is higher than that in the Proposed Scheme.

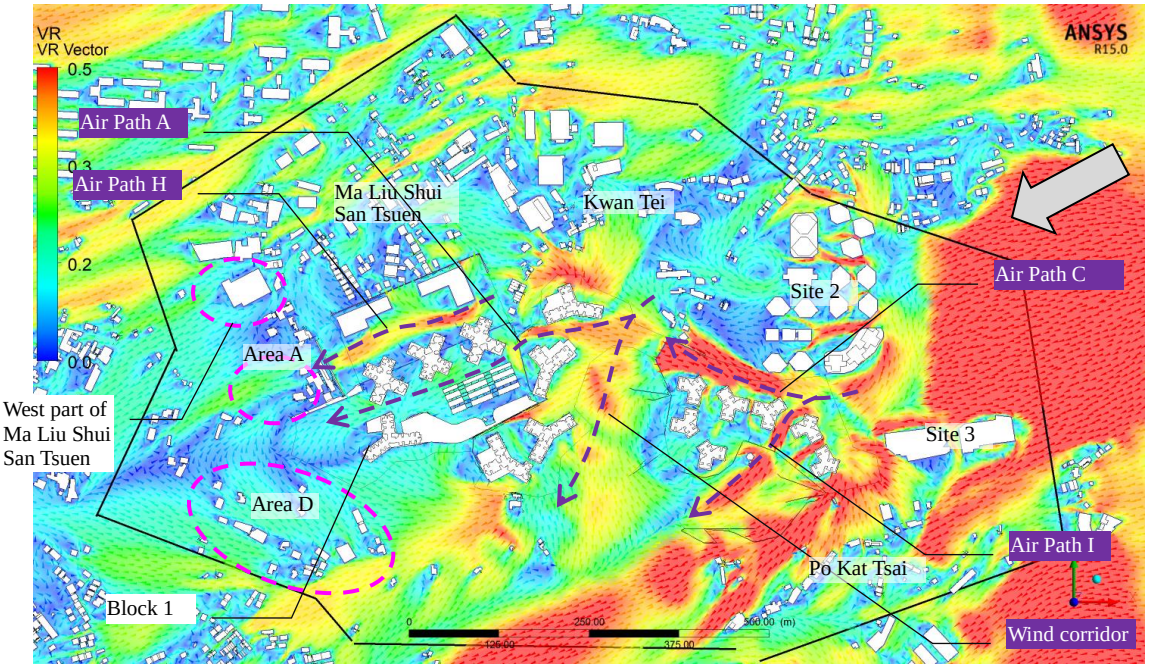
8.1.5 Nevertheless, Air Path G in the Proposed Scheme increases the air permeability between the Subject Site and Ma Liu Shui San Tsuen. As a result the west part of Ma Liu Shui San Tsuen is slightly enhanced.

8.1.6 Area D located at the southwest of the Subject Site receives higher VR under the Base Scheme than Proposed Scheme. Since the setback distance of domestic block (Block 1) is larger under the Base Scheme than that under the Proposed Scheme, more wind is diverted to the southwest area of the Subject Site. As a result, wind availability at Area D is higher.

8.1.7 Po Kat Tsai is located at the downstream area of the Subject Site. Under Base Scheme, Air Path I could allow wind to penetrate across the SSF site and reach Po Kat Tsai. Nonetheless, Air Path I is not available in Proposed Scheme. Hence, Po Kat Tsai receives a lower VR in the Proposed Scheme.

8.1.8 In summary, the VR in the west of Ma Liu Shui is enhanced, while that in Po Kat Tsai, Area A and Area D is lower under the Proposed Scheme.

Base Scheme



Proposed Scheme

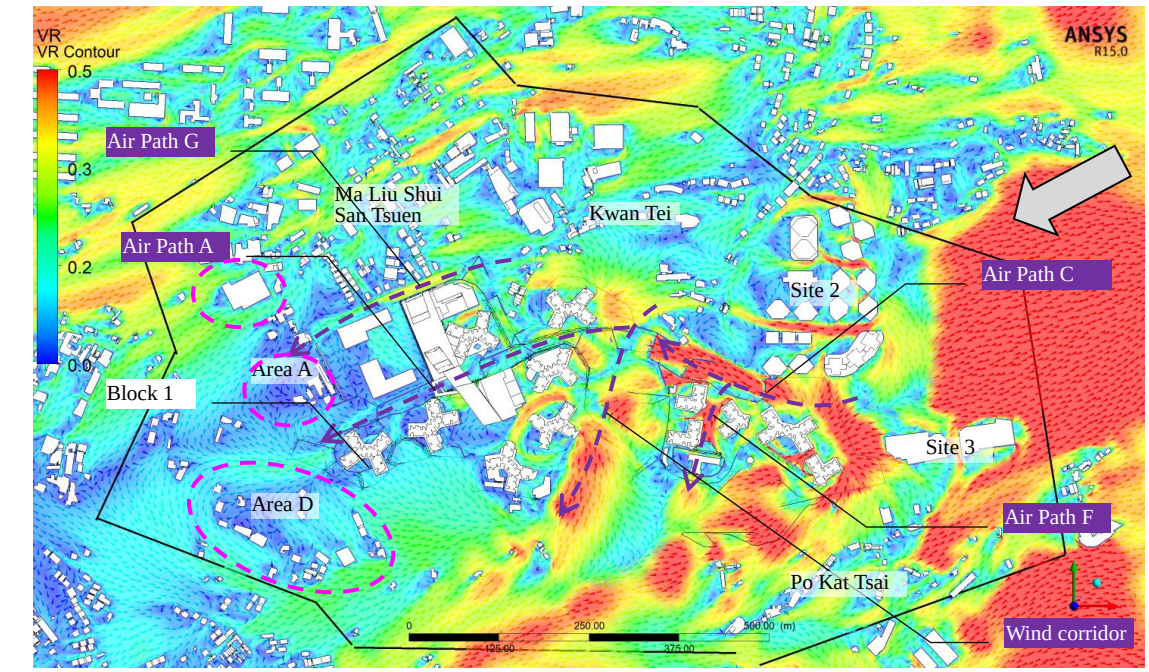
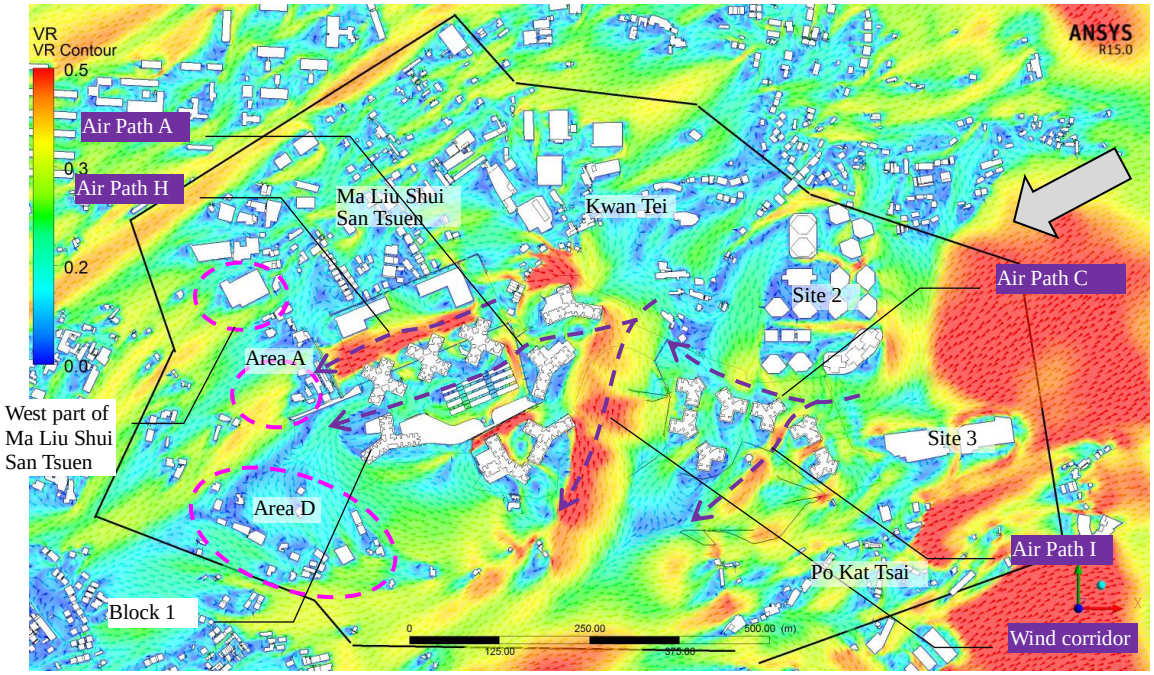


Figure 18 VR Contour under ENE Wind

Base Scheme



Proposed Scheme

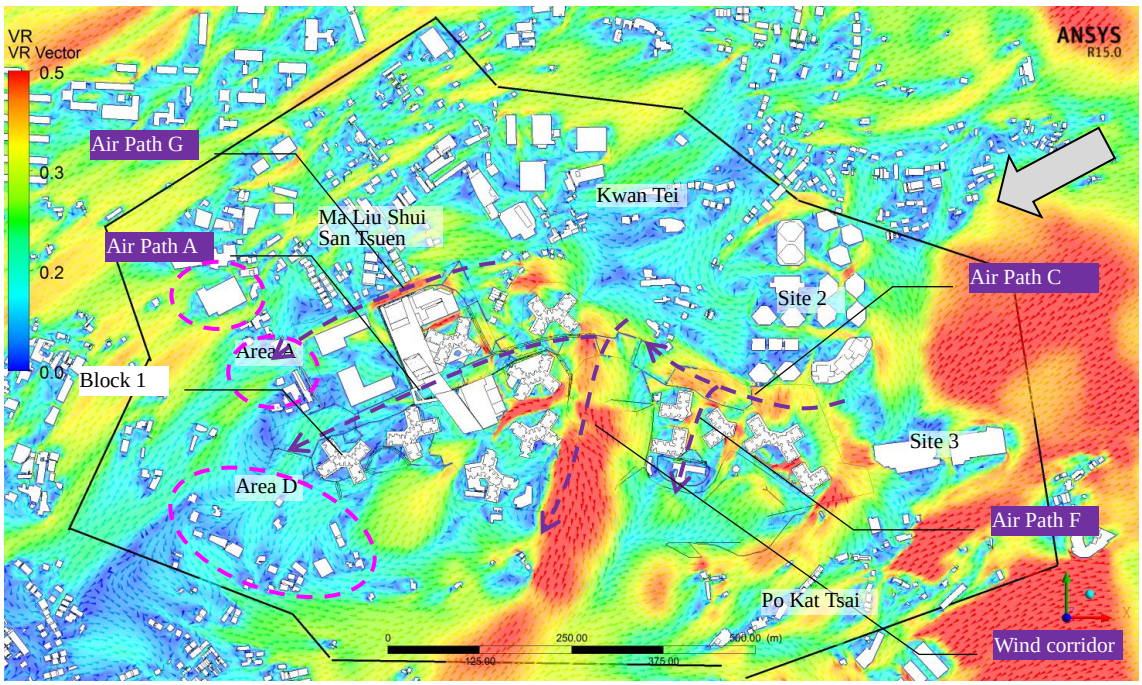


Figure 19 VR Contour under NE Wind

8.2 E Wind

8.2.1 The E wind flows across Kwan Tei and between Site 2 and Site 3 to reach the Subject Site. Wind is diverted and flow along Air Path A and Air Path C from the east to west across the Subject Site. The wind flow pattern is illustrated in ***Figure 20***.

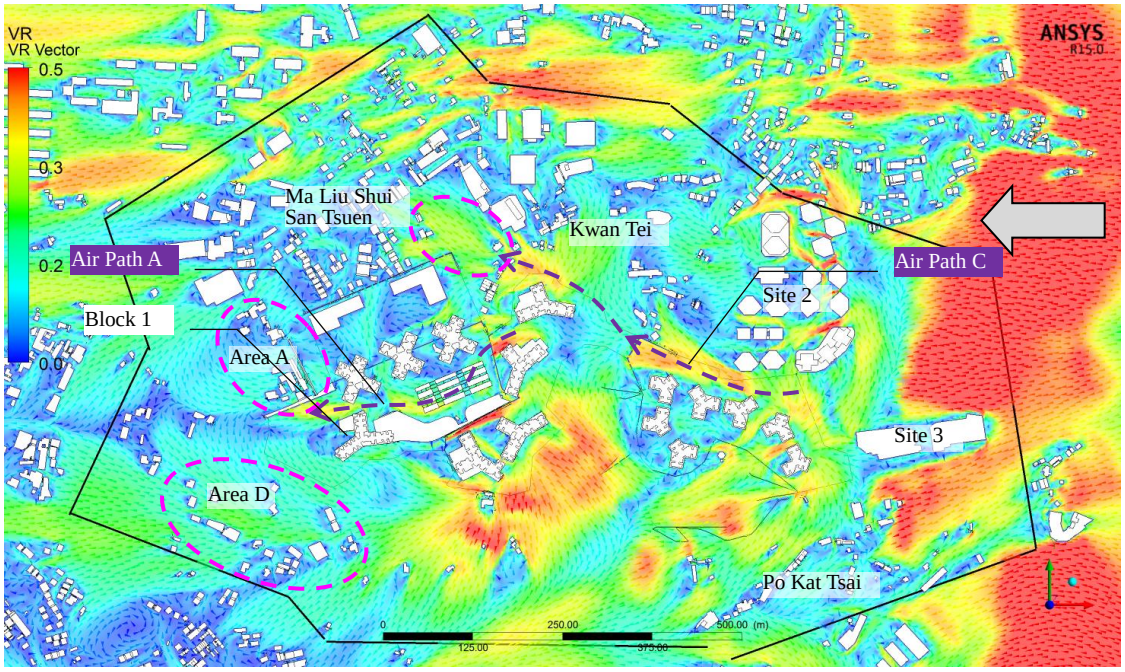
8.2.2 The VR at Air Path C is higher in the Proposed Scheme due to a larger building setback distance from Site 2. Prevailing wind would flow along Air Path C and diverts wind to the Ma Liu Shui San Tsuen. With a higher VR at Air Path C in the Proposed Scheme, more wind is brought to Ma Liu Shui San Tsuen. In addition, the Air Path G increases the air permeability between the Subject Site and Ma Liu Shui San Tsuen. Hence, the VR at Ma Liu Shui San Tsuen is higher in the Proposed Scheme. .

8.2.3 Area A receives wind from Air Path A under the Base Scheme while it receives wind from Air Path G under the Proposed Scheme. The VR at Area A in Base Scheme and Proposed Scheme are similar.

8.2.4 Area D located at the southwest of the Subject Site receives lower VR under the Proposed Scheme. As discussed in Section 2.2, the relocation of Block 2 in the Proposed Scheme reduces the building setback of domestic blocks in PRH from the site boundary to the west. As a result, less wind can flow along the west boundary to Area D under the Proposed Scheme.

8.2.5 In summary, the VR in Ma Liu Shui San Tsuen, especially at the east, is higher under the Proposed Scheme while the VR at Area D is slightly lower under the Proposed Scheme.

Base Scheme



Proposed Scheme

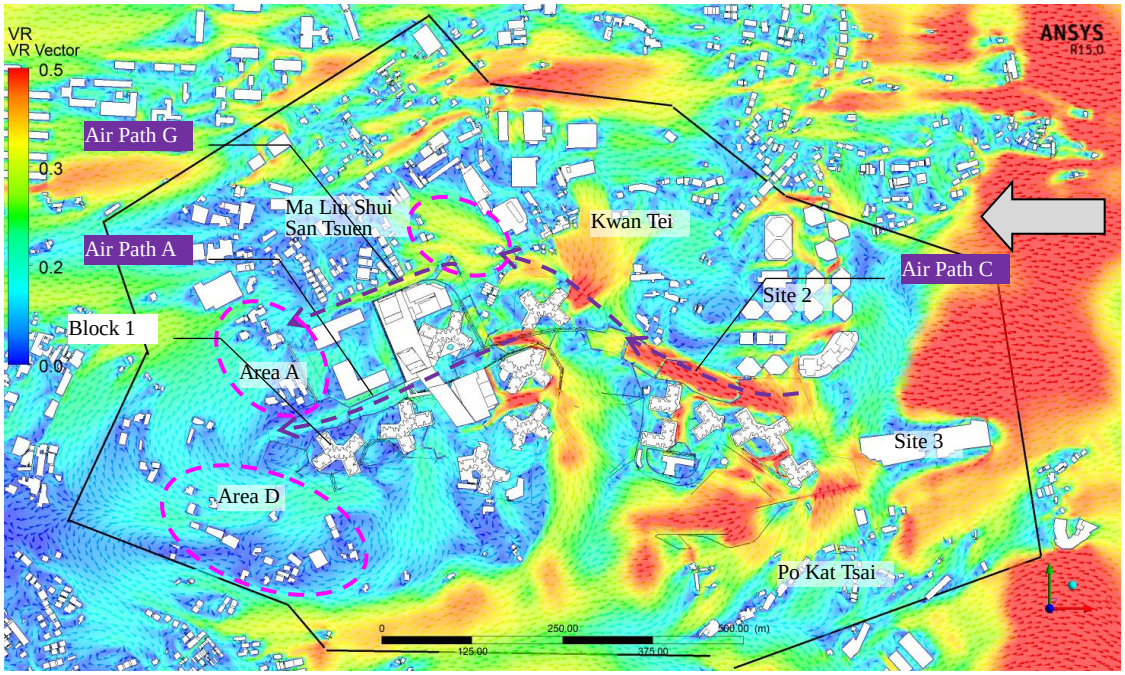


Figure 20 VR Contour under E Wind

8.3 ESE Wind

8.3.1 The ESE wind flows across Queen's Hill and Po Kat Tsai to reach the Subject Site. The wind corridor diverts south-eastern wind from the south to the north to reach Kwan Tei and Ma Liu Shui San Tsuen. The wind flow pattern is illustrated in ***Figure 21***.

8.3.2 Due to the larger setback distance of Block 4 from the site boundary to east in the Proposed Scheme, the wind flow along the wind corridor is facilitated. Hence, the VR at Kwan Tei is higher under the Proposed Scheme.

8.3.3 Wind flows along the wind corridor and diverted to east of Ma Liu Shui San Tsuen between Block 7 and Block 8 in Base Scheme. Similarly, the wind flow between Block 7 and Block 4 in the Proposed Scheme. Since the building separation of Block 4 and Block 7 aligns with the prevailing ESE wind, more wind is diverted between along this air path. Hence, a higher VR is resulted in the east of Ma Liu Shui San Tsuen under the Proposed Scheme.

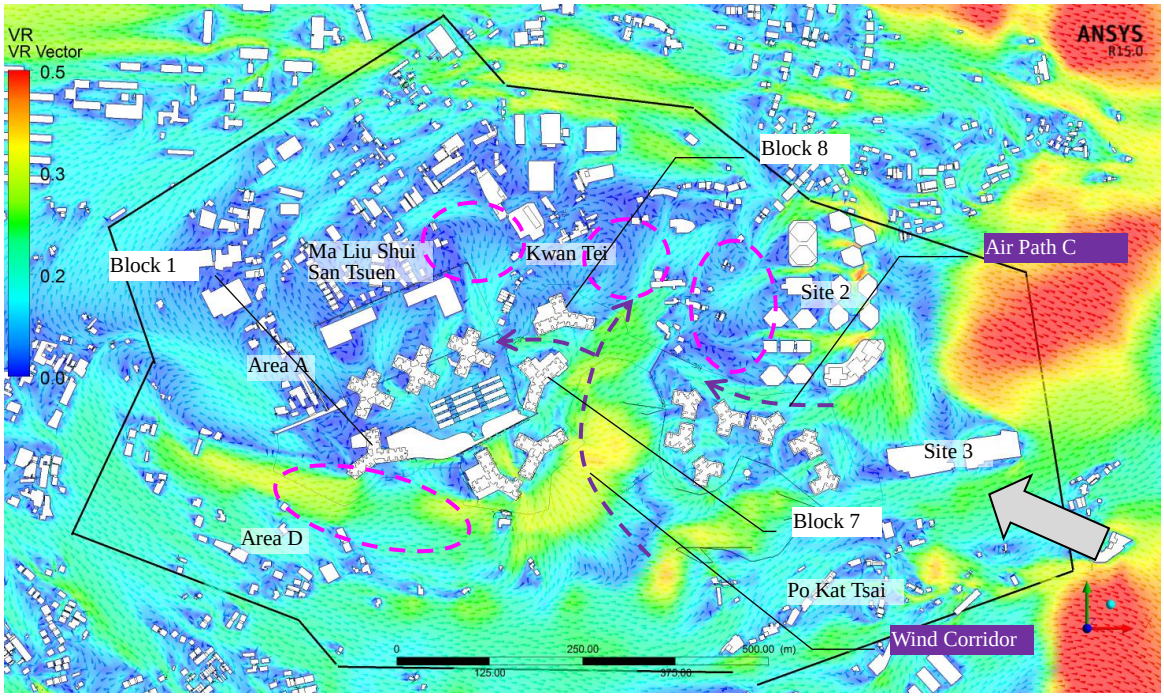
8.3.4 The VR at Air Path C is higher in the Proposed Scheme due to a larger building setback distance from Site 2. Prevailing wind would flow along Air Path C and diverts wind to the reach the west part of Site 2. Hence, the VR at the west part of Site 2 is higher under the Proposed Scheme.

8.3.5 Air Path D and Air Path E are additional air paths in the Proposed Scheme to facilitate the air permeability under south-eastern wind. Air Path D and Air Path E enhance wind permeability of the pedestrian level which allow more wind to flow into the Subject Site as well as the surrounding area of Area D. Hence, the VR at Area D is higher under the Proposed Scheme.

8.3.6 The VR at Area A is lower under the Proposed Scheme. As discussed in Section 2.2, the relocation of Block 2 in the Proposed Scheme reduces the building setback of domestic blocks in PRH from the site boundary to the west. As a result, less wind can flow along the west boundary to Area A under the Proposed Scheme.

8.3.7 In summary, the VR at Kwan Tei, east part of Ma Liu Shui San Tsuen, west part of Site 2 and Area D is higher under the Proposed Scheme. The VR at Area A is slightly lower under the Proposed Scheme.

Base Scheme



Proposed Scheme

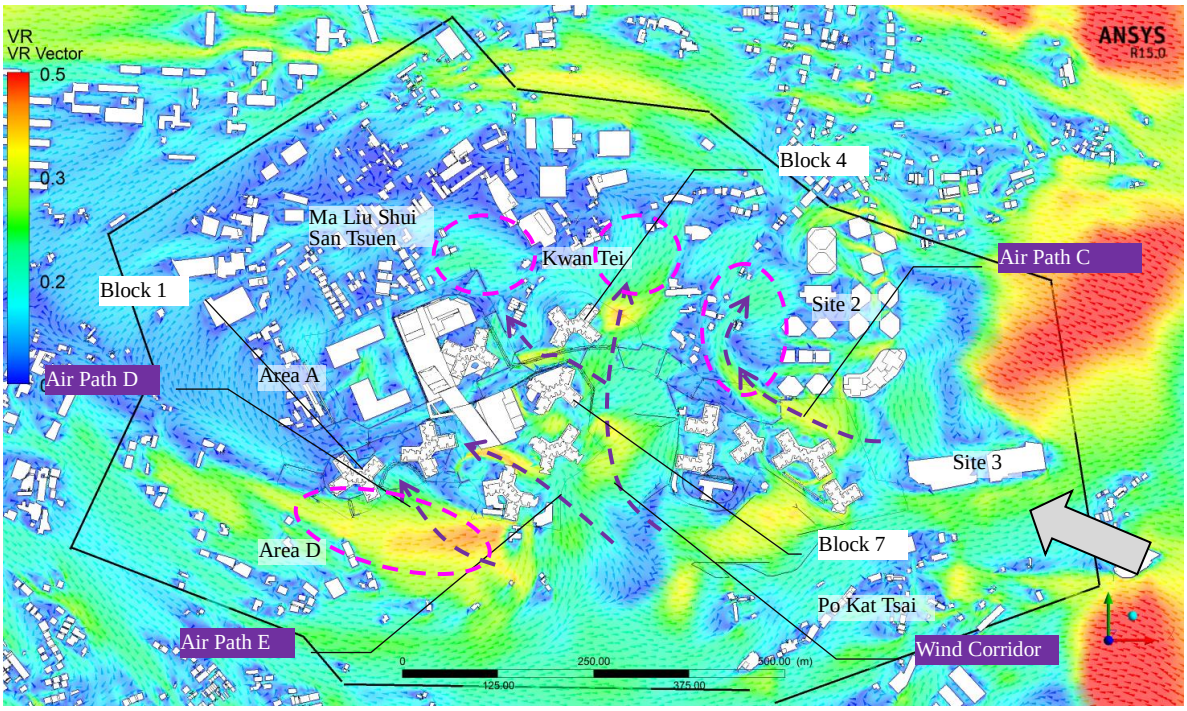


Figure 21 VR Contour under ESE Wind

8.4 NNE Wind

8.4.1 The NNE wind flows from Ma Liu Shui San Tsuen, Kwan Tei and Site 2 to the Subject Site. The wind corridor channels wind from Kwan Tei to the south of the Subject Site. The wind flow pattern is illustrated in ***Figure 22***.

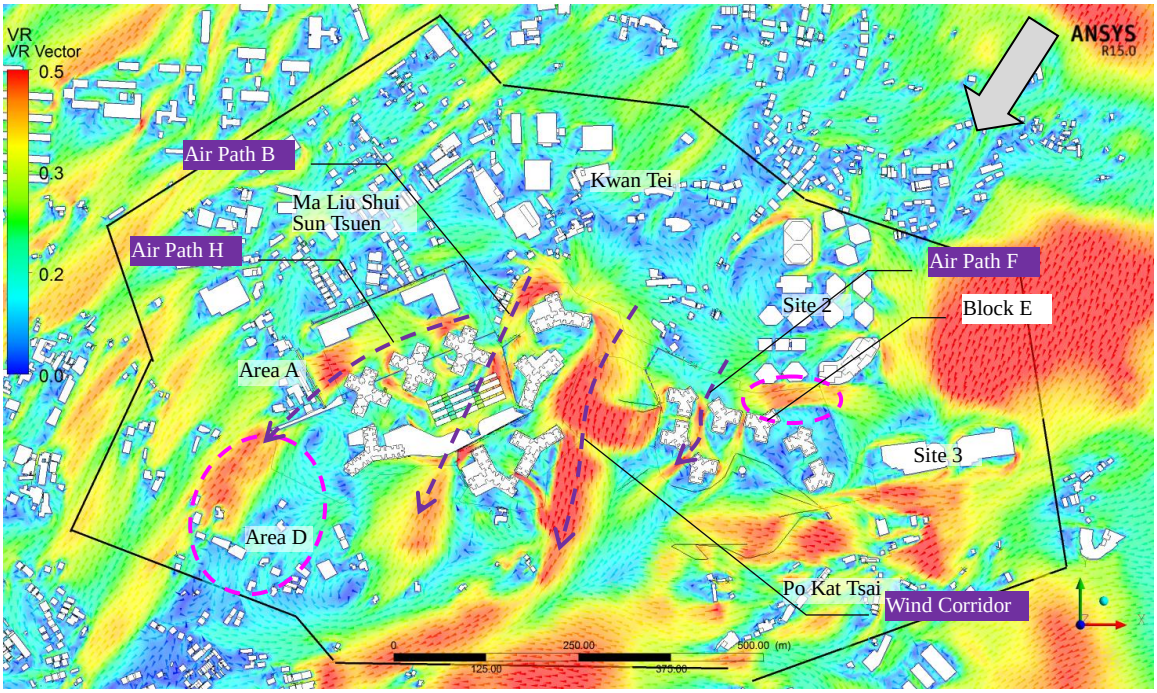
8.4.2 Air Path B allows wind to flow above the low-rise retail structure in the Subject Site from Kwan Tei to the east of Area D. Under the Proposed Scheme, wind could be diverted from the wind corridor and enters the Subject Site between Block 6 and Block 7. It is expected the local wind environment at Block 6 and Block 7 is enhanced under the Proposed Scheme.

8.4.3 Due to a larger setback distance between domestic blocks (Block D&E in the Proposed Scheme; Block E in the Base Scheme) and the north boundary of SSF site in the Proposed Scheme, more wind is diverted to the south of Site 2. Hence, the VR at the south of Site 2 is greater in the Proposed Scheme.

8.4.4 Air Path H in the Base Scheme channels wind across the Subject Site to Area D. Meanwhile, Air Path A in Proposed Scheme channels wind across the Subject Site to Area D. Since Air Path H in the Base Scheme is wider but located further north from Area D, the wind flow arrives at the north part of Area D with a higher VR. Air Path A in the Proposed Scheme is located closer to Area D. Hence it diverts wind to the centre of Area D. The VR at Area D is more evenly distributed under the Proposed Scheme.

8.4.5 In summary, the VR at south of Site 2 and the centre of Area D is higher under the Proposed Scheme while the north part of Area D receives lower VR under the Proposed Scheme.

Base Scheme



Proposed Scheme

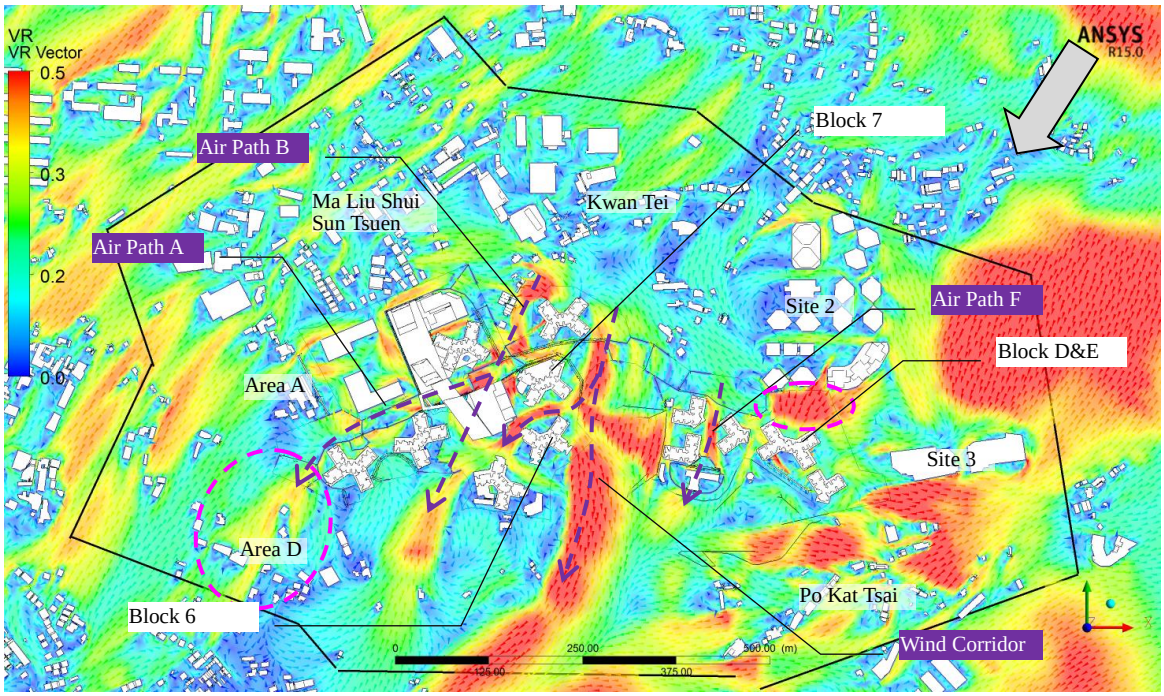


Figure 22 VR Contour under NNE Wind

8.5 SE Wind & SSE Wind

8.5.1 The wind flow patterns of SE wind and SSE wind across the assessment area are similar. Hence, the directional analyses of SE and SSE wind are discussed together in the following paragraphs. The wind flow pattern is illustrated in ***Figure 23*** and ***Figure 24***.

8.5.2 The SE and SSE winds flow from Queen's Hill at the south and Po Kat Tsai to the Subject Site. The wind corridor channel winds from Queen's Hill to Kwan Tei at the north of the Subject Site.

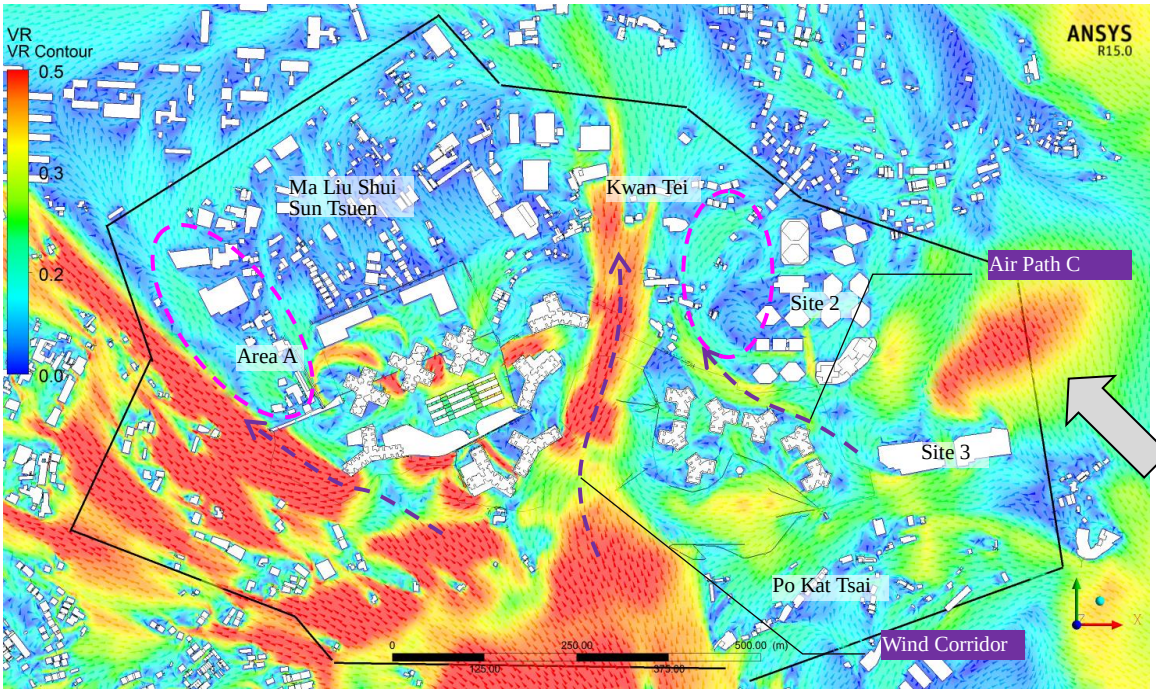
8.5.3 Air Path C diverts wind from Po Kat Tsai to Kwan Tei and the west of Site 2. As Air Path C is enlarged in the Proposed Scheme by a larger building setback distance of domestic blocks from the north boundary of the SSF site, more wind is diverted to the west of Site 2. Hence, a higher VR is resulted at the west of Site 2 in the Proposed Scheme.

8.5.4 Under SE wind, the setback distance of Block 1 from the west site boundary of PRH site in the Proposed Scheme is less than that in the Base Scheme. Hence, less wind is channelled along the west site boundary to Area A in the Proposed Scheme. As a result, the VR at Area A is lower in the Proposed Scheme.

8.5.5 Under SSE wind, Air Path D in the Proposed Scheme could channel wind across the the Subject Site from the southeast to Area D. As Air Path D is not available in the Base Scheme, The VR at Area A is higher under the Proposed Scheme.

8.5.6 In summary, under the Proposed Scheme, the VR at west of Site 2 is higher under both SE and SSE wind and the VR at Area A is lower under SE wind and higher under SSE wind.

Base Scheme



Proposed Scheme

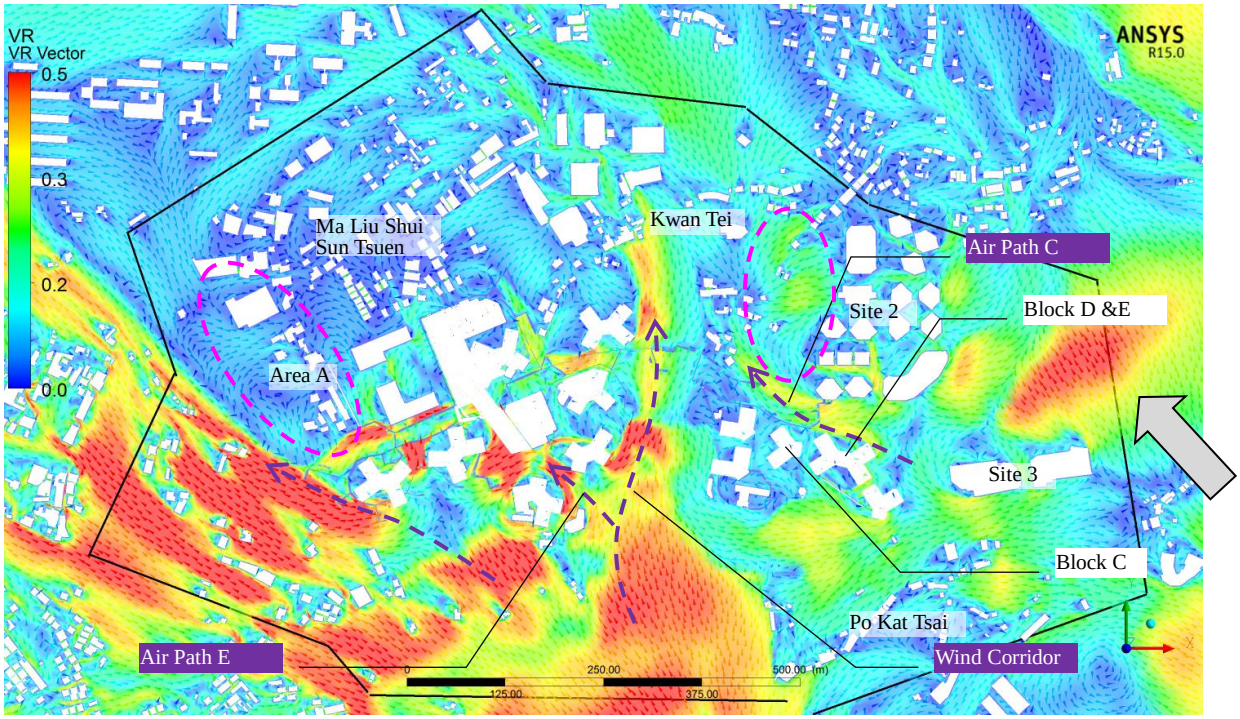
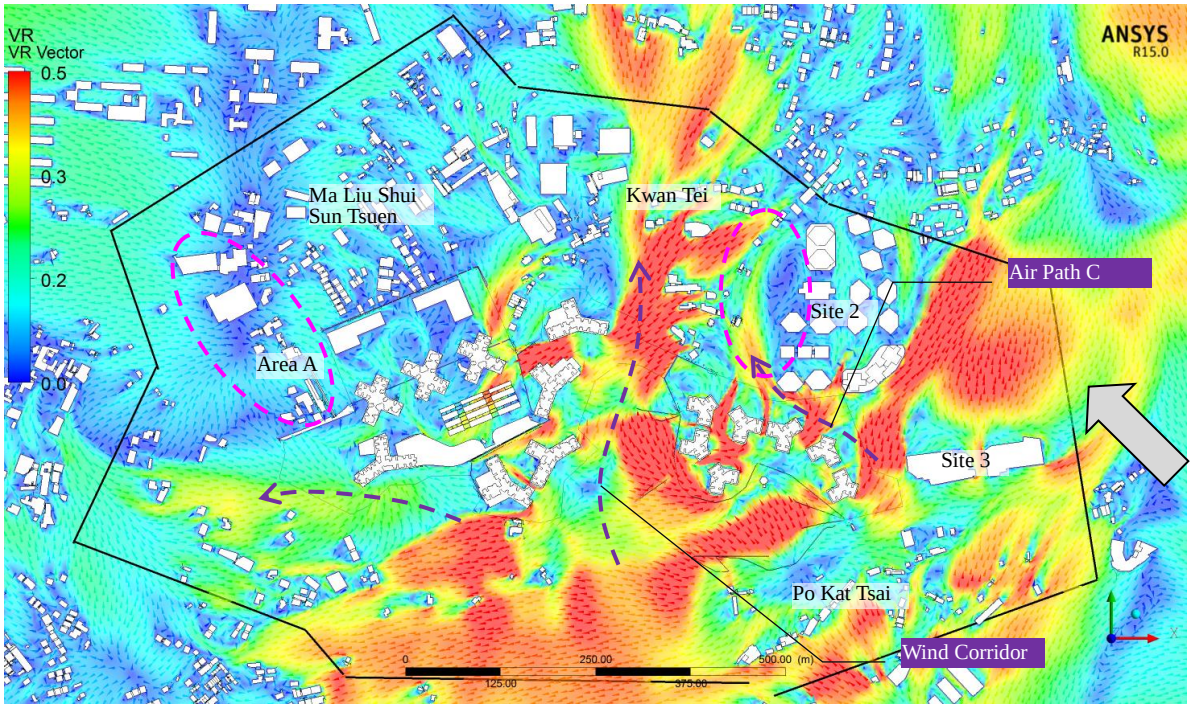


Figure 23 VR Contour under SE Wind

Base Scheme



Proposed Scheme

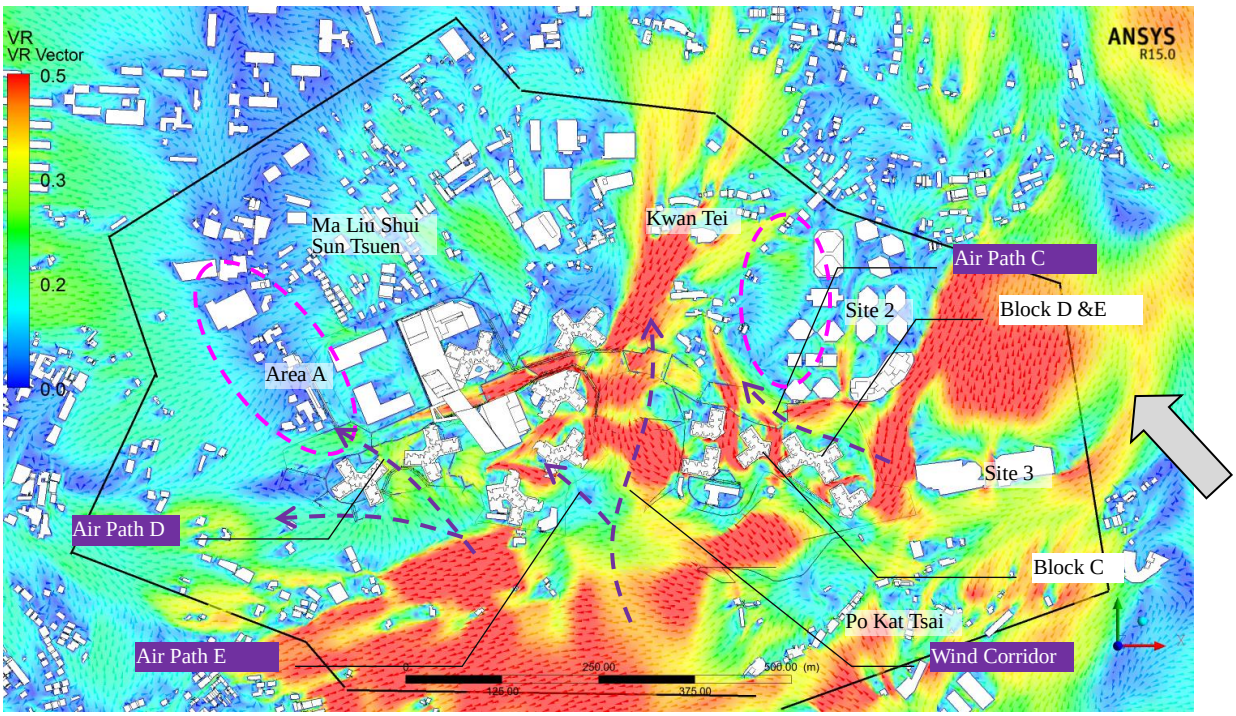


Figure 24 VR Contour under SSE Wind

8.6 SSW Wind

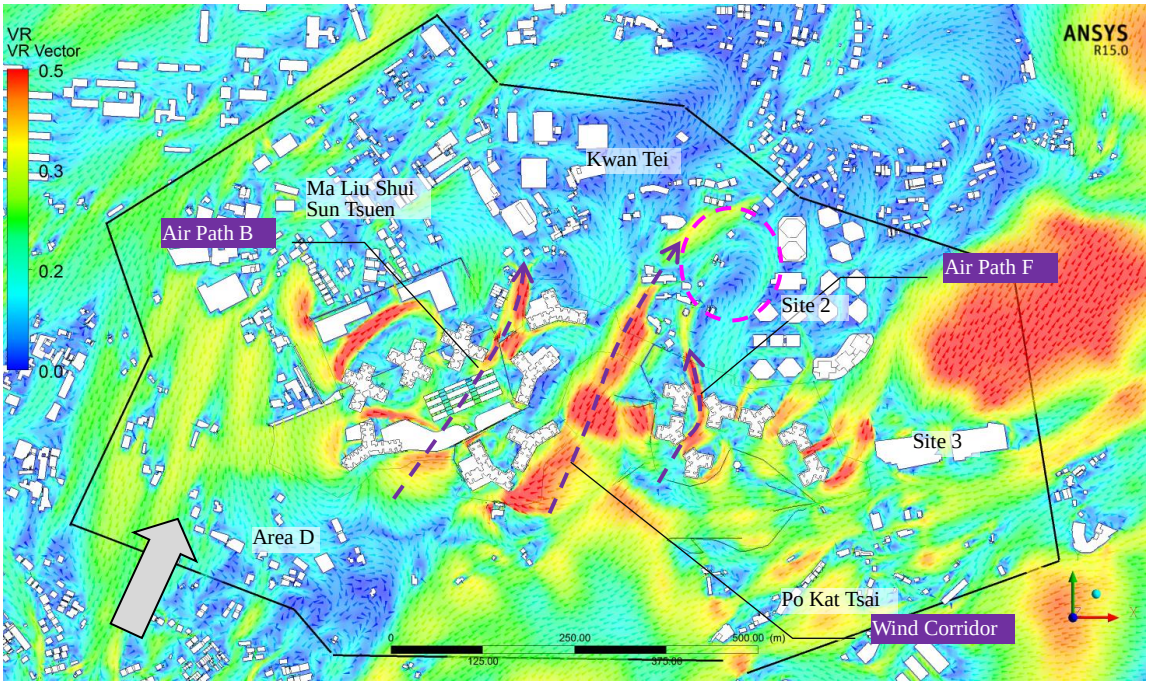
8.6.1 The SSW wind flows from Area D and Queen's Hill at the south to the Subject Site. The wind corridor channels south-western wind from Queen's Hill to Kwan Tei and Site 2. The wind flow pattern is illustrated in ***Figure 25***.

8.6.2 Air Path F in the Proposed Scheme is aligned with prevailing wind direction. Nonetheless, wind flow across the building separation between Block A and Block D in the Base Scheme is required to make more turns before flowing across the Subject Site. Therefore, Air Path F in the Proposed Scheme could channel more wind to Site 2.

8.6.3 Air Path B allows wind flow above the low-rise retail structure from Area D to Kwan Tei. The wind flow patterns along air paths and wind corridor are similar under both Base Scheme and Proposed Scheme.

8.6.4 In summary, the VR at Site 2 is higher under the Proposed Scheme.

Base Scheme



Proposed Scheme

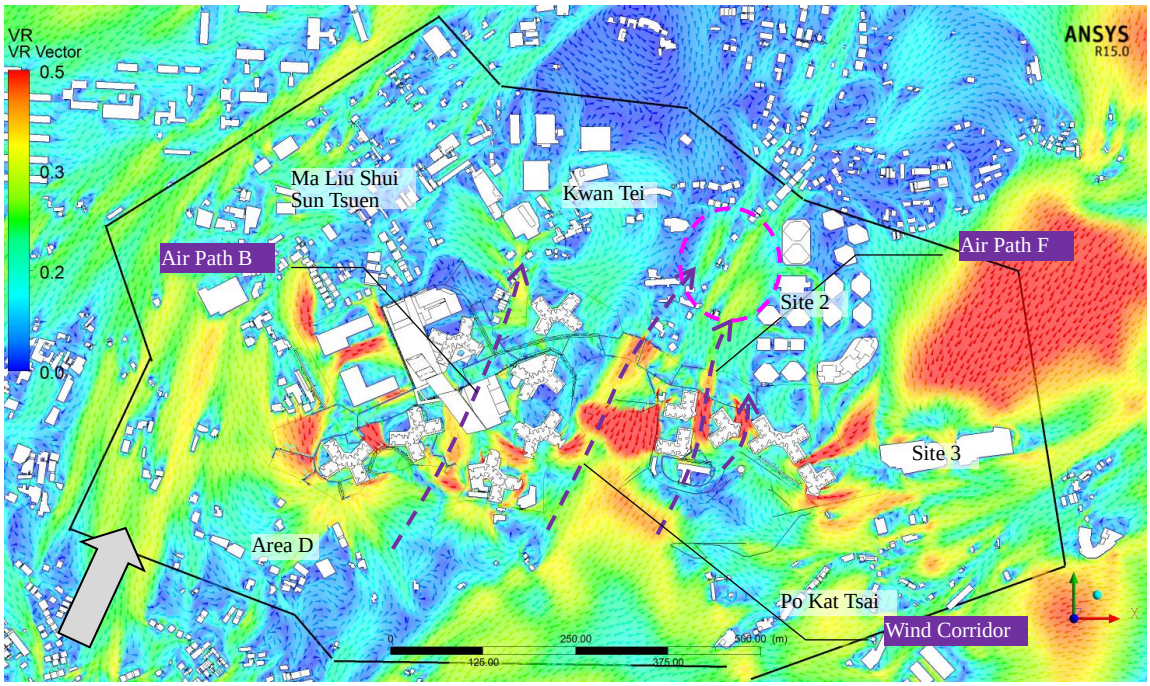


Figure 25 VR Contour under SSW Wind

9 CONCLUSION

9.1.1 In this AVA Initial Study, two scenarios, Base Scheme and Proposed Scheme for the subject site being assessed by CFD modelling in terms of ventilation performance are investigated.

9.1.2 Based on the result of wind rose analysis, the wind directions for the Subject Site and the surrounding areas representative of the prevailing situation are determined to be mainly ENE, E, NE, ESE, NNE, SE, SSW and SSE among which ENE is the annual prevailing wind and ESE is the summer prevailing wind. These 8 of 16 wind directions account for approximately 78% of the wind occurrence.

9.1.3 The Proposed Scheme has maintained good design features from the Base Scheme, and also incorporates additional features to increase wind permeability. These features includes:

- Maintain wind corridor between PRH and SSF sites
- Maintain air path above retail facilities
- Maintain air path at main roads
- Maximized air path between Block 5 and Block 6
- Maximized building separation distance at SSF site
- Maximized empty bays at G/F of every residential blocks
- Maintain stepping height profile at SSF site

9.1.4 According to the CFD modelling result, it concludes that weighted average LVR is maintained in the Proposed Scheme while the weighted average SVR is slightly lower in the Proposed Scheme. In terms of summer condition, it is found that both LVR and SVR are enhanced in the Proposed Scheme under summer prevailing wind.

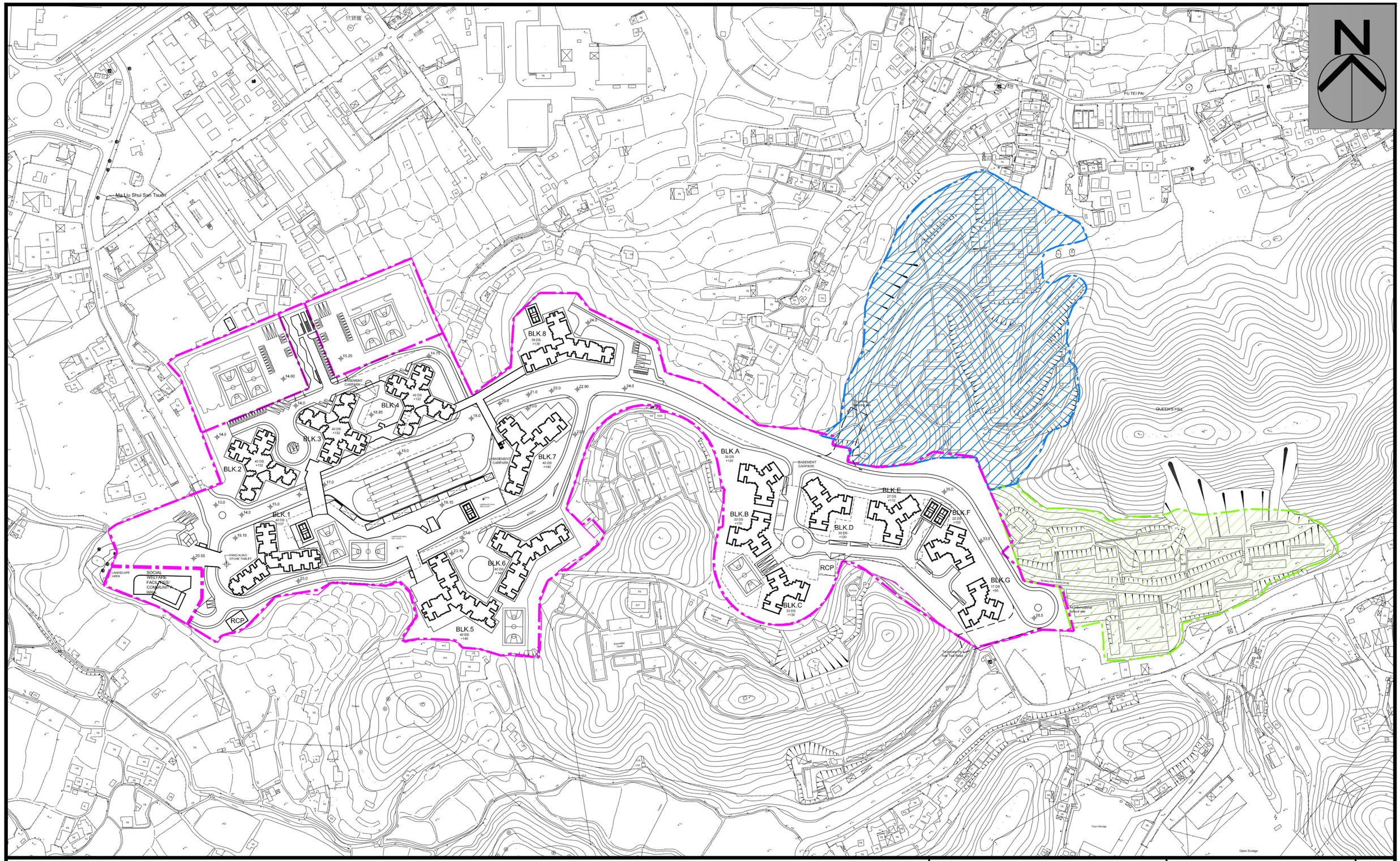
9.1.5 With the Proposed Scheme in place, the wind environment in Ma Liu Shui San Tsuen, Site 2 and Site 3 are enhanced under both annual and summer prevailing wind conditions. The wind environment in Po Kat Tsai and Area D in enhanced under summer prevailing wind condition yet impeded under annual prevailing wind condition. The wind environment in Area A is impeded under annual and summer prevailing wind conditions.

9.1.6 The reduction of wind availability at Area A and Area D is mainly due to the relocation of PTT in the Proposed Scheme, which is designed to avoid accumulation of air pollutants and nuisance from traffic noise. Nonetheless, additional air path north of the relocated PTT is created by the setback from north site boundary to minimized potential blockage of wind.

9.1.7 In conclusion, the wind environment at the surrounding is maintained to a level comparable to the Base Scheme where the Proposed Scheme with a noticeable enhancement under summer condition.

Appendix A

Site Layout Plan of Base Scheme



PROPOSED PUBLIC HOUSING DEVELOPMENT AT QUEEN'S HILL SITE, FANLING

REMARKS: FOR REFERENCE ONLY AND SUBJECT TO CHANGE WHEN NECESSARY.

DRAFT

DRAWING TITLE
SITE LAYOUT PLAN (SCHEME 54)
(AS AT 20140702)

DRAWING NO.
QH/SITE/A/S54/LO-01

SCALE 1:1500 (A1) , 1:3000 (A3)

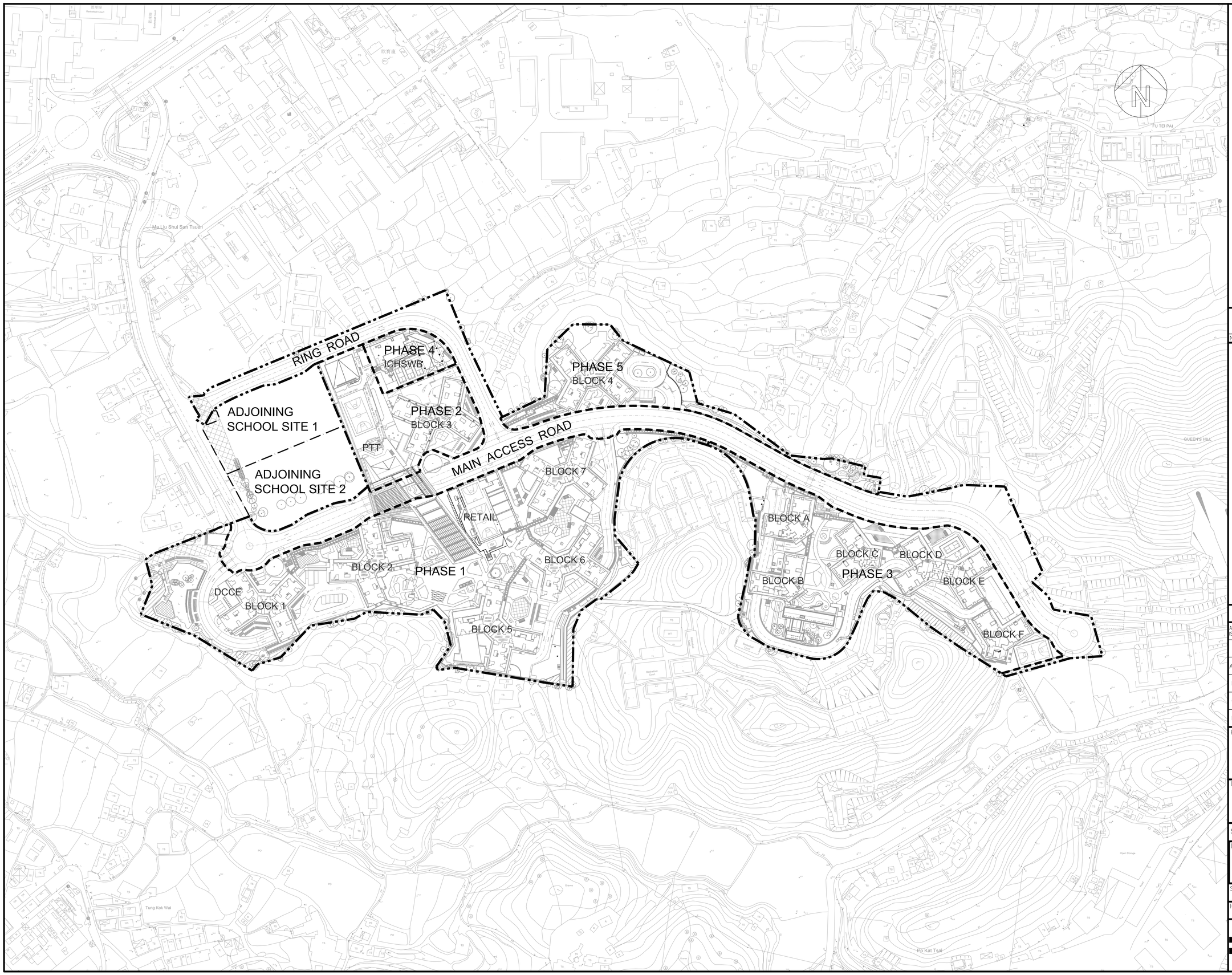
SOURCE

房屋署
HOUSING DEPARTMENT

DATE : 20140709

Appendix B

Site Layout Plan of Proposed Scheme



NOTES

LEGEND:

- SITE 1 BOUNDARY
- PHASE BOUNDARY

REVISIONS

NO	DESCRIPTION AND DATE	INITIAL AND DESIGNATION DWN	CKD	AUTH

	NAME AND POSITION	INITIAL	DATE
AUTHORIZED FOR ISSUE BY HD	P.K. CHIU CA/4		JAN, 17
	王欽祺(香港)有限公司 WONG & OUTAMS (HK) LTD		
AUTHORISED	ARTUR AU YEUNG Director		JAN, 17
ENDORSED	MING YUEN Senior Design Professional		JAN, 17
CHECKED	EVA CHAN Design Professional		JAN, 17
DRAWN	HUNG KWOK HUNG Technical Officer		JAN, 17

PROJECT

PUBLIC RENTAL HOUSING & SUBSIDIZED SALE FLATS DEVELOPMENT AT QUEEN'S HILL SITE 1 , FANLING

DRAWING TITLE

MASTER LAYOUT PLAN

SCALE 1:1500 (A1) 1:3000 (A3)

DRAWING NO.

NR08&10/D2/SITE/A/LO-002

SOURCE

ICU NO.

AutoCAD 2000 A1 594 x 841

A-57

HOUSING DEPARTMENT

K:\a2x2225\arch\cadm\DWRG\NR08&10_D2_SITE_A_LO-001-002.dwg 12/12/16 14:49:04, 1:1

Appendix C
Test Point Allocation

ANSYS
R15.0

Overall Test Points
Perimeter Test Points

0 250.00 500.00 (m)
125.00 375.00

Y
Z X

Appendix D

Velocity Ratio Results

VR of Test Points under 8 Most Probable Wind Directions

	Base Case								Design Case							
	E	ENE	ESE	NE	NNE	SE	SSE	SSW	E	ENE	ESE	NE	NNE	SE	SSE	SSW
O01	0.06	0.32	0.05	0.40	0.37	0.05	0.09	0.23	0.02	0.24	0.06	0.38	0.35	0.04	0.12	0.23
O02	0.22	0.09	0.07	0.24	0.34	0.06	0.12	0.20	0.27	0.09	0.19	0.07	0.26	0.11	0.13	0.24
O03	0.05	0.14	0.03	0.05	0.23	0.07	0.15	0.16	0.13	0.14	0.11	0.12	0.17	0.08	0.12	0.28
O04	0.16	0.24	0.12	0.18	0.23	0.10	0.17	0.07	0.19	0.25	0.12	0.19	0.25	0.12	0.07	0.06
O05	0.11	0.23	0.10	0.24	0.29	0.11	0.13	0.07	0.11	0.23	0.08	0.28	0.28	0.06	0.12	0.05
O06	0.24	0.19	0.10	0.21	0.20	0.07	0.12	0.33	0.20	0.22	0.08	0.28	0.23	0.08	0.10	0.31
O07	0.29	0.25	0.12	0.26	0.30	0.05	0.10	0.22	0.30	0.27	0.05	0.30	0.33	0.10	0.07	0.21
O08	0.13	0.24	0.04	0.18	0.17	0.07	0.06	0.20	0.14	0.27	0.05	0.20	0.16	0.03	0.04	0.18
O09	0.15	0.26	0.05	0.13	0.24	0.09	0.09	0.13	0.14	0.28	0.12	0.17	0.24	0.03	0.05	0.15
O10	0.20	0.28	0.03	0.22	0.21	0.17	0.15	0.26	0.18	0.30	0.10	0.25	0.19	0.08	0.15	0.30
O11	0.19	0.17	0.08	0.24	0.29	0.26	0.14	0.24	0.18	0.22	0.08	0.29	0.30	0.10	0.19	0.25
O12	0.28	0.26	0.19	0.41	0.26	0.14	0.13	0.28	0.32	0.29	0.17	0.35	0.25	0.14	0.05	0.31
O13	0.22	0.17	0.08	0.15	0.22	0.13	0.11	0.22	0.21	0.20	0.02	0.16	0.22	0.08	0.07	0.23
O14	0.19	0.16	0.03	0.31	0.37	0.14	0.03	0.20	0.20	0.19	0.03	0.19	0.38	0.08	0.03	0.23
O15	0.11	0.13	0.06	0.10	0.09	0.16	0.06	0.20	0.13	0.13	0.03	0.10	0.09	0.09	0.06	0.21
O16	0.14	0.20	0.08	0.22	0.25	0.15	0.07	0.26	0.12	0.19	0.04	0.21	0.29	0.08	0.06	0.27
O17	0.03	0.09	0.11	0.22	0.32	0.14	0.14	0.26	0.04	0.10	0.05	0.26	0.28	0.10	0.12	0.27
O18	0.09	0.17	0.11	0.26	0.34	0.13	0.16	0.25	0.10	0.18	0.09	0.28	0.29	0.11	0.14	0.26
O21	0.35	0.38	0.15	0.42	0.40	0.11	0.13	0.25	0.38	0.38	0.09	0.36	0.38	0.10	0.11	0.25
O22	0.39	0.28	0.28	0.34	0.24	0.11	0.11	0.17	0.36	0.28	0.29	0.33	0.24	0.10	0.11	0.18
O23	0.38	0.37	0.23	0.23	0.21	0.11	0.12	0.08	0.42	0.37	0.26	0.33	0.23	0.14	0.12	0.10
O24	0.17	0.17	0.13	0.13	0.12	0.10	0.10	0.15	0.07	0.19	0.10	0.13	0.16	0.07	0.15	0.17
O25	0.19	0.21	0.12	0.16	0.13	0.12	0.09	0.09	0.20	0.20	0.08	0.17	0.15	0.12	0.19	0.14
O26	0.21	0.13	0.07	0.15	0.18	0.07	0.03	0.29	0.25	0.12	0.04	0.16	0.19	0.09	0.14	0.31
O27	0.16	0.18	0.07	0.16	0.14	0.09	0.11	0.09	0.18	0.17	0.04	0.12	0.14	0.06	0.14	0.10
O28	0.13	0.31	0.09	0.20	0.17	0.10	0.12	0.10	0.13	0.27	0.05	0.24	0.16	0.07	0.09	0.07
O29	0.13	0.25	0.01	0.21	0.05	0.04	0.09	0.19	0.11	0.27	0.14	0.23	0.09	0.02	0.08	0.18
O30	0.09	0.28	0.08	0.21	0.24	0.09	0.05	0.21	0.08	0.28	0.10	0.27	0.25	0.03	0.06	0.21
O31	0.07	0.29	0.06	0.19	0.24	0.02	0.03	0.11	0.09	0.27	0.11	0.27	0.24	0.01	0.03	0.11
O32	0.18	0.12	0.01	0.17	0.13	0.04	0.05	0.16	0.20	0.20	0.09	0.22	0.21	0.03	0.03	0.14
O33	0.06	0.04	0.07	0.12	0.17	0.20	0.09	0.30	0.12	0.03	0.06	0.15	0.19	0.07	0.12	0.27
O34	0.18	0.18	0.10	0.41	0.35	0.37	0.13	0.29	0.25	0.26	0.06	0.39	0.41	0.37	0.21	0.34
O35	0.39	0.29	0.24	0.27	0.28	0.09	0.16	0.02	0.32	0.28	0.24	0.31	0.29	0.11	0.14	0.08
O36	0.31	0.31	0.17	0.30	0.27	0.11	0.08	0.17	0.35	0.28	0.14	0.25	0.27	0.09	0.18	0.14
O37	0.17	0.20	0.10	0.21	0.20	0.09	0.14	0.03	0.22	0.18	0.08	0.16	0.13	0.10	0.21	0.04
O38	0.26	0.38	0.10	0.31	0.29	0.08	0.13	0.09	0.35	0.38	0.06	0.33	0.29	0.11	0.16	0.08
O39	0.14	0.21	0.10	0.23	0.24	0.04	0.15	0.13	0.10	0.22	0.05	0.23	0.25	0.06	0.13	0.15
O40	0.14	0.24	0.11	0.25	0.26	0.10	0.18	0.23	0.13	0.23	0.13	0.26	0.27	0.07	0.14	0.22
O41	0.11	0.07	0.11	0.10	0.32	0.08	0.14	0.18	0.11	0.26	0.06	0.33	0.35	0.09	0.11	0.19
O42	0.05	0.11	0.08	0.12	0.21	0.04	0.07	0.20	0.02	0.16	0.06	0.23	0.22	0.03	0.06	0.19
O43	0.11	0.09	0.06	0.15	0.15	0.12	0.08	0.32	0.10	0.11	0.06	0.14	0.16	0.40	0.08	0.23
O44	0.20	0.09	0.06	0.26	0.27	0.05	0.05	0.30	0.23	0.20	0.08	0.31	0.28	0.05	0.04	0.27
O45	0.18	0.10	0.09	0.33	0.38	0.12	0.05	0.35	0.25	0.22	0.08	0.37	0.40	0.11	0.11	0.40
O46	0.12	0.18	0.07	0.29	0.40	0.67	0.11	0.32	0.20	0.16	0.07	0.34	0.45	0.40	0.18	0.34
O47	0.09	0.20	0.02	0.30	0.30	0.06	0.07	0.20	0.09	0.14	0.09	0.30	0.29	0.09	0.20	0.26
O48	0.40	0.26	0.30	0.20	0.23	0.15	0.12	0.21	0.36	0.23	0.33	0.18	0.23	0.10	0.12	0.21
O49	0.38	0.33	0.31	0.36	0.26	0.08	0.16	0.25	0.39	0.29	0.31	0.38	0.27	0.04	0.15	0.17
O50	0.31	0.33	0.12	0.25	0.27	0.08	0.18	0.11	0.38	0.40	0.12	0.29	0.24	0.07	0.14	0.18
O51	0.11	0.26	0.10	0.21	0.25	0.01	0.11	0.19	0.09	0.24	0.03	0.22	0.24	0.10	0.15	0.10
O52	0.02	0.16	0.03	0.09	0.16	0.04	0.03	0.25	0.04	0.16	0.05	0.10	0.16	0.03	0.04	0.18
O53	0.03	0.14	0.06	0.20	0.16	0.09	0.04	0.03	0.07	0.17	0.05	0.19	0.21	0.04	0.12	0.06
O54	0.20	0.23	0.03	0.32	0.18	0.07	0.15	0.11	0.12	0.26	0.11	0.31	0.18	0.02	0.16	0.06
O55	0.03	0.08	0.04	0.11	0.12	0.10	0.15	0.38	0.01	0.10	0.04	0.16	0.13	0.05	0.09	0.42
O56	0.15	0.09	0.06	0.16	0.22	0.15	0.10	0.26	0.14	0.10	0.08	0.20	0.28	0.02	0.06	0.24
O57	0.05	0.07	0.07	0.05	0.10	0.11	0.10	0.33	0.07	0.02	0.07	0.04	0.14	0.09	0.05	0.34
O58	0.08	0.04	0.11	0.17	0.24	0.11	0.07	0.30	0.12	0.05	0.06	0.17	0.27	0.08	0.11	0.30
O59	0.04	0.24	0.23	0.23	0.40	0.50	0.04	0.28	0.11	0.08	0.26	0.28	0.48	0.46	0.19	0.24
O60	0.19	0.01	0.21	0.14	0.31	0.53	0.22	0.33	0.08	0.10	0.20	0.15	0.32	0.54	0.13	0.33
O61	0.41	0.40	0.31	0.33	0.27	0.06	0.14	0.05	0.41	0.43	0.28	0.35	0.26	0.12	0.14	0.09
O62	0.21	0.21	0.08	0.22	0.20	0.05	0.09	0.11	0.31	0.27	0.11	0.25	0.19	0.18	0.12	0.12
O63	0.17	0.13	0.02	0.17	0.13	0.07	0.18	0.09	0.08	0.14	0.03	0.15	0.14	0.19	0.16	0.02
O64	0.09	0.03	0.01	0.03	0.03	0.04	0.20	0.11	0.04	0.02	0.01	0.09	0.05	0.09	0.13	0.11
O65	0.16	0.12	0.09	0.10	0.13	0.05	0.14	0.23	0.20	0.17	0.04	0.16	0.15	0.10	0.19	0.08

	Base Case								Design Case							
	E	ENE	ESE	NE	NNE	SE	SSE	SSW	E	ENE	ESE	NE	NNE	SE	SSE	SSW
O66	0.28	0.26	0.14	0.25	0.21	0.07	0.11	0.19	0.32	0.22	0.11	0.29	0.24	0.11	0.21	0.11
O67	0.13	0.19	0.02	0.19	0.17	0.11	0.06	0.07	0.14	0.13	0.06	0.22	0.25	0.02	0.19	0.10
O68	0.06	0.03	0.01	0.06	0.08	0.02	0.01	0.14	0.02	0.04	0.03	0.05	0.11	0.02	0.02	0.10
O69	0.06	0.16	0.03	0.12	0.11	0.03	0.07	0.16	0.04	0.05	0.02	0.15	0.15	0.09	0.13	0.21
O70	0.05	0.08	0.04	0.09	0.06	0.11	0.14	0.35	0.07	0.06	0.09	0.04	0.10	0.06	0.17	0.41
O71	0.13	0.12	0.06	0.22	0.24	0.07	0.10	0.20	0.10	0.11	0.05	0.13	0.23	0.06	0.06	0.20
O72	0.14	0.22	0.15	0.25	0.26	0.11	0.09	0.35	0.16	0.11	0.07	0.26	0.29	0.06	0.09	0.35
O73	0.13	0.20	0.07	0.33	0.26	0.65	0.05	0.22	0.12	0.08	0.10	0.25	0.24	0.55	0.14	0.21
O74	0.10	0.11	0.28	0.34	0.28	0.42	0.14	0.31	0.06	0.07	0.18	0.23	0.23	0.49	0.13	0.32
O75	0.15	0.04	0.27	0.33	0.25	0.59	0.22	0.32	0.13	0.06	0.28	0.19	0.30	0.56	0.11	0.37
O76	0.21	0.09	0.20	0.35	0.28	0.50	0.32	0.28	0.13	0.12	0.21	0.21	0.27	0.54	0.35	0.36
O77	0.29	0.33	0.27	0.30	0.23	0.25	0.09	0.06	0.29	0.39	0.26	0.26	0.22	0.07	0.10	0.06
O78	0.19	0.26	0.06	0.22	0.14	0.19	0.03	0.13	0.17	0.24	0.04	0.22	0.14	0.18	0.07	0.05
O79	0.12	0.16	0.05	0.16	0.14	0.09	0.14	0.07	0.08	0.17	0.03	0.14	0.13	0.09	0.14	0.20
O80	0.09	0.04	0.01	0.11	0.09	0.10	0.17	0.06	0.08	0.02	0.01	0.08	0.05	0.14	0.16	0.22
O81	0.26	0.15	0.04	0.28	0.13	0.09	0.14	0.12	0.31	0.22	0.09	0.28	0.19	0.10	0.26	0.19
O82	0.30	0.19	0.03	0.26	0.21	0.11	0.04	0.12	0.32	0.23	0.17	0.28	0.26	0.08	0.23	0.15
O83	0.33	0.33	0.03	0.27	0.27	0.06	0.04	0.11	0.30	0.28	0.15	0.31	0.32	0.08	0.16	0.04
O85	0.16	0.10	0.15	0.30	0.19	0.11	0.05	0.28	0.11	0.01	0.07	0.08	0.08	0.11	0.08	0.34
O86	0.18	0.09	0.23	0.31	0.41	0.62	0.34	0.23	0.14	0.12	0.31	0.17	0.23	0.58	0.26	0.22
O87	0.19	0.12	0.18	0.24	0.36	0.45	0.22	0.30	0.16	0.11	0.19	0.09	0.28	0.46	0.29	0.30
O88	0.27	0.26	0.24	0.29	0.21	0.37	0.38	0.04	0.24	0.27	0.25	0.26	0.23	0.25	0.36	0.02
O89	0.11	0.10	0.09	0.15	0.12	0.19	0.21	0.11	0.12	0.11	0.12	0.12	0.07	0.09	0.22	0.13
O90	0.19	0.22	0.06	0.29	0.27	0.07	0.08	0.09	0.12	0.22	0.03	0.28	0.20	0.16	0.15	0.20
O91	0.23	0.12	0.04	0.20	0.20	0.10	0.12	0.13	0.32	0.17	0.10	0.23	0.26	0.09	0.25	0.21
O92	0.21	0.13	0.21	0.08	0.46	0.63	0.36	0.20	0.16	0.08	0.31	0.15	0.22	0.58	0.32	0.23
O93	0.23	0.15	0.20	0.03	0.34	0.46	0.28	0.19	0.12	0.07	0.22	0.05	0.29	0.43	0.30	0.22
O94	0.22	0.23	0.20	0.18	0.31	0.50	0.23	0.19	0.09	0.14	0.19	0.15	0.29	0.57	0.24	0.17
O95	0.30	0.23	0.19	0.30	0.25	0.41	0.31	0.05	0.20	0.24	0.14	0.31	0.24	0.19	0.36	0.13
O96	0.11	0.26	0.09	0.19	0.22	0.43	0.36	0.07	0.16	0.26	0.07	0.18	0.24	0.18	0.39	0.07
O97	0.15	0.19	0.03	0.22	0.14	0.39	0.17	0.03	0.31	0.27	0.07	0.22	0.12	0.26	0.22	0.09
O98	0.10	0.11	0.05	0.03	0.04	0.13	0.10	0.13	0.12	0.15	0.06	0.03	0.07	0.13	0.06	0.14
O99	0.05	0.10	0.08	0.12	0.08	0.10	0.21	0.08	0.16	0.15	0.03	0.14	0.14	0.09	0.09	0.20
O100	0.19	0.22	0.06	0.33	0.21	0.15	0.31	0.04	0.30	0.29	0.13	0.37	0.23	0.10	0.01	0.33
O101	0.25	0.39	0.12	0.41	0.23	0.24	0.40	0.20	0.20	0.24	0.07	0.38	0.39	0.24	0.25	0.09
O102	0.16	0.13	0.28	0.10	0.12	0.61	0.28	0.23	0.11	0.08	0.34	0.11	0.39	0.57	0.18	0.31
O103	0.10	0.07	0.10	0.11	0.08	0.29	0.21	0.20	0.15	0.05	0.12	0.15	0.39	0.24	0.17	0.22
O104	0.24	0.17	0.21	0.13	0.06	0.60	0.23	0.15	0.15	0.05	0.21	0.13	0.36	0.57	0.23	0.15
O105	0.20	0.20	0.18	0.22	0.07	0.45	0.24	0.20	0.12	0.14	0.19	0.14	0.16	0.59	0.27	0.09
O106	0.21	0.15	0.25	0.08	0.03	0.13	0.32	0.02	0.21	0.17	0.23	0.11	0.10	0.15	0.20	0.04
O107	0.25	0.28	0.20	0.30	0.23	0.11	0.46	0.06	0.24	0.23	0.14	0.26	0.26	0.19	0.34	0.11
O108	0.09	0.20	0.05	0.28	0.24	0.07	0.13	0.08	0.20	0.19	0.07	0.22	0.27	0.15	0.10	0.11
O109	0.20	0.23	0.04	0.04	0.08	0.49	0.40	0.12	0.40	0.18	0.14	0.09	0.11	0.22	0.37	0.16
O110	0.26	0.32	0.04	0.20	0.17	0.37	0.09	0.12	0.42	0.15	0.12	0.14	0.11	0.40	0.14	0.14
O111	0.38	0.46	0.04	0.53	0.39	0.08	0.11	0.04	0.35	0.40	0.17	0.44	0.39	0.14	0.09	0.19
O112	0.19	0.17	0.15	0.13	0.14	0.37	0.25	0.11	0.15	0.10	0.21	0.14	0.28	0.38	0.18	0.22
O113	0.23	0.13	0.13	0.06	0.12	0.30	0.33	0.15	0.09	0.07	0.15	0.09	0.17	0.32	0.37	0.22
O114	0.13	0.19	0.12	0.21	0.04	0.29	0.24	0.02	0.02	0.12	0.17	0.05	0.24	0.39	0.32	0.07
O115	0.22	0.26	0.23	0.25	0.21	0.12	0.25	0.06	0.24	0.22	0.18	0.21	0.27	0.16	0.28	0.07
O116	0.02	0.03	0.07	0.11	0.04	0.12	0.45	0.02	0.05	0.12	0.06	0.02	0.07	0.15	0.31	0.06
O117	0.12	0.15	0.09	0.15	0.22	0.36	0.24	0.12	0.16	0.12	0.16	0.16	0.19	0.26	0.17	0.29
O118	0.23	0.12	0.12	0.13	0.14	0.31	0.27	0.12	0.12	0.10	0.10	0.11	0.14	0.31	0.28	0.23
O119	0.09	0.14	0.16	0.06	0.11	0.40	0.12	0.19	0.09	0.13	0.07	0.19	0.04	0.47	0.18	0.19
O120	0.09	0.09	0.13	0.08	0.04	0.11	0.16	0.13	0.09	0.09	0.13	0.07	0.07	0.11	0.17	0.08
O121	0.15	0.11	0.10	0.21	0.08	0.18	0.47	0.33	0.16	0.17	0.15	0.08	0.07	0.21	0.34	0.17
O122	0.05	0.05	0.14	0.13	0.08	0.17	0.53	0.14	0.26	0.10	0.12	0.16	0.04	0.10	0.49	0.09
O123	0.20	0.09	0.10	0.13	0.16	0.48	0.54	0.12	0.39	0.22	0.26	0.03	0.14	0.17	0.55	0.14
O124	0.13	0.21	0.17	0.23	0.31	0.17	0.20	0.10	0.06	0.20	0.37	0.27	0.13	0.19	0.16	0.29
O125	0.19	0.24	0.10	0.21	0.26	0.31	0.17	0.09	0.07	0.22	0.23	0.19	0.15	0.23	0.24	0.21
O126	0.15	0.36	0.20	0.28	0.10	0.46	0.37	0.06	0.08	0.28	0.18	0.19	0.12	0.41	0.50	0.08
O127	0.16	0.32	0.20	0.27	0.10	0.49	0.34	0.03	0.07	0.27	0.18	0.20	0.10	0.46	0.49	0.06
O128	0.16	0.37	0.20	0.35	0.11	0.49	0.37	0.02	0.26	0.24	0.24	0.25	0.10	0.48	0.47	0.08
O129	0.10	0.21	0.09	0.14	0.10	0.08	0.16	0.09	0.10	0.21	0.11	0.14	0.08	0.05	0.15	0.04

	Base Case								Design Case							
	E	ENE	ESE	NE	NNE	SE	SSE	SSW	E	ENE	ESE	NE	NNE	SE	SSE	SSW
O130	0.17	0.23	0.09	0.20	0.19	0.20	0.36	0.31	0.17	0.23	0.04	0.19	0.18	0.23	0.37	0.18
O132	0.22	0.16	0.07	0.20	0.20	0.20	0.42	0.17	0.20	0.14	0.19	0.18	0.17	0.23	0.27	0.28
O133	0.11	0.15	0.11	0.07	0.10	0.09	0.49	0.17	0.13	0.22	0.06	0.06	0.06	0.11	0.28	0.12
O134	0.16	0.18	0.22	0.20	0.22	0.38	0.49	0.45	0.19	0.28	0.20	0.18	0.19	0.20	0.45	0.35
O135	0.27	0.33	0.14	0.31	0.32	0.33	0.46	0.08	0.09	0.27	0.32	0.22	0.31	0.16	0.52	0.17
O136	0.25	0.32	0.19	0.21	0.25	0.51	0.26	0.03	0.11	0.25	0.10	0.14	0.26	0.46	0.41	0.13
O137	0.21	0.29	0.19	0.34	0.20	0.54	0.42	0.05	0.21	0.20	0.24	0.27	0.17	0.49	0.47	0.08
O138	0.18	0.35	0.20	0.35	0.21	0.46	0.44	0.03	0.35	0.22	0.24	0.29	0.12	0.44	0.51	0.05
O139	0.36	0.27	0.24	0.38	0.37	0.07	0.08	0.08	0.38	0.30	0.28	0.38	0.34	0.01	0.05	0.17
O140	0.23	0.05	0.19	0.02	0.08	0.14	0.13	0.16	0.15	0.07	0.14	0.12	0.09	0.13	0.22	0.18
O141	0.23	0.10	0.12	0.04	0.03	0.13	0.14	0.13	0.17	0.14	0.05	0.09	0.07	0.20	0.26	0.26
O142	0.25	0.14	0.09	0.11	0.11	0.11	0.29	0.11	0.18	0.22	0.20	0.18	0.11	0.26	0.13	0.27
O143	0.06	0.06	0.01	0.08	0.13	0.14	0.11	0.02	0.09	0.06	0.17	0.12	0.18	0.16	0.10	0.30
O144	0.30	0.47	0.03	0.08	0.08	0.29	0.12	0.23	0.21	0.35	0.04	0.29	0.16	0.29	0.11	0.25
O145	0.38	0.37	0.27	0.34	0.27	0.39	0.55	0.43	0.12	0.29	0.36	0.21	0.19	0.46	0.54	0.42
O146	0.30	0.33	0.15	0.30	0.22	0.54	0.43	0.06	0.14	0.25	0.29	0.26	0.25	0.49	0.49	0.09
O147	0.09	0.11	0.26	0.33	0.16	0.60	0.44	0.14	0.12	0.08	0.23	0.27	0.30	0.49	0.48	0.12
O148	0.17	0.23	0.18	0.31	0.30	0.56	0.44	0.07	0.37	0.19	0.23	0.29	0.18	0.52	0.48	0.13
O149	0.21	0.21	0.26	0.13	0.28	0.03	0.16	0.12	0.30	0.13	0.26	0.11	0.33	0.05	0.15	0.08
O150	0.22	0.06	0.02	0.13	0.05	0.10	0.05	0.18	0.18	0.05	0.07	0.07	0.02	0.12	0.17	0.18
O151	0.19	0.12	0.07	0.18	0.11	0.09	0.02	0.09	0.13	0.06	0.17	0.13	0.05	0.25	0.21	0.27
O152	0.13	0.10	0.07	0.23	0.20	0.11	0.07	0.14	0.06	0.13	0.14	0.17	0.06	0.16	0.13	0.26
O153	0.14	0.03	0.02	0.19	0.17	0.20	0.26	0.11	0.05	0.10	0.12	0.11	0.21	0.14	0.19	0.23
O154	0.41	0.15	0.22	0.09	0.07	0.26	0.27	0.14	0.23	0.19	0.22	0.12	0.12	0.24	0.28	0.11
O155	0.53	0.46	0.22	0.43	0.34	0.46	0.55	0.34	0.10	0.45	0.43	0.41	0.24	0.44	0.60	0.29
O156	0.19	0.21	0.22	0.21	0.22	0.49	0.43	0.42	0.21	0.23	0.18	0.23	0.15	0.42	0.41	0.14
O157	0.09	0.25	0.15	0.32	0.40	0.45	0.45	0.06	0.41	0.25	0.21	0.29	0.23	0.41	0.50	0.10
O158	0.12	0.20	0.24	0.23	0.29	0.08	0.30	0.12	0.11	0.17	0.19	0.18	0.23	0.14	0.19	0.15
O159	0.41	0.44	0.21	0.34	0.16	0.14	0.15	0.03	0.40	0.45	0.24	0.34	0.18	0.20	0.15	0.05
O160	0.03	0.14	0.07	0.08	0.09	0.05	0.15	0.18	0.12	0.10	0.06	0.02	0.13	0.04	0.03	0.26
O161	0.02	0.14	0.05	0.05	0.10	0.04	0.03	0.04	0.02	0.11	0.04	0.04	0.07	0.08	0.13	0.02
O162	0.36	0.12	0.26	0.23	0.16	0.03	0.05	0.14	0.32	0.49	0.23	0.18	0.21	0.09	0.11	0.21
O163	0.15	0.04	0.09	0.25	0.24	0.19	0.22	0.11	0.15	0.06	0.07	0.22	0.19	0.15	0.16	0.19
O164	0.41	0.21	0.17	0.43	0.40	0.40	0.21	0.15	0.18	0.38	0.17	0.43	0.26	0.38	0.21	0.18
O165	0.10	0.12	0.02	0.07	0.06	0.42	0.29	0.24	0.08	0.10	0.06	0.16	0.08	0.36	0.25	0.30
O166	0.14	0.12	0.13	0.18	0.25	0.13	0.15	0.09	0.12	0.09	0.21	0.22	0.24	0.21	0.07	0.16
O167	0.15	0.21	0.14	0.31	0.29	0.08	0.04	0.13	0.18	0.16	0.10	0.32	0.25	0.02	0.11	0.10
O168	0.21	0.25	0.11	0.20	0.10	0.04	0.09	0.07	0.14	0.17	0.11	0.13	0.17	0.09	0.14	0.13
O169	0.18	0.32	0.27	0.37	0.24	0.13	0.18	0.06	0.26	0.50	0.21	0.33	0.31	0.14	0.37	0.17
O170	0.14	0.09	0.13	0.12	0.04	0.21	0.11	0.16	0.25	0.15	0.25	0.03	0.04	0.18	0.17	0.10
O171	0.05	0.14	0.08	0.29	0.35	0.18	0.13	0.15	0.08	0.03	0.13	0.26	0.32	0.30	0.09	0.20
O172	0.42	0.54	0.34	0.35	0.22	0.12	0.06	0.09	0.41	0.55	0.30	0.35	0.26	0.18	0.08	0.09
O173	0.32	0.14	0.21	0.07	0.16	0.14	0.17	0.11	0.29	0.17	0.22	0.06	0.13	0.12	0.14	0.10
O174	0.26	0.11	0.17	0.02	0.23	0.28	0.19	0.20	0.26	0.20	0.13	0.12	0.11	0.23	0.35	0.22
O175	0.14	0.16	0.04	0.27	0.33	0.26	0.64	0.30	0.15	0.15	0.13	0.25	0.29	0.16	0.60	0.31
O176	0.32	0.37	0.26	0.42	0.39	0.37	0.69	0.35	0.25	0.34	0.14	0.39	0.33	0.41	0.71	0.25
O177	0.22	0.44	0.21	0.09	0.15	0.27	0.50	0.22	0.19	0.37	0.22	0.15	0.33	0.28	0.51	0.08
O178	0.20	0.44	0.24	0.27	0.42	0.19	0.18	0.21	0.29	0.36	0.19	0.25	0.45	0.23	0.30	0.19
O179	0.26	0.48	0.16	0.33	0.33	0.23	0.23	0.17	0.33	0.42	0.20	0.40	0.32	0.19	0.29	0.21
O180	0.18	0.29	0.11	0.21	0.07	0.38	0.24	0.29	0.17	0.23	0.08	0.24	0.08	0.38	0.28	0.29
O181	0.21	0.47	0.12	0.20	0.24	0.20	0.16	0.04	0.29	0.35	0.10	0.32	0.18	0.22	0.24	0.11
O182	0.24	0.33	0.18	0.36	0.45	0.03	0.32	0.38	0.21	0.34	0.23	0.32	0.47	0.27	0.29	0.32
O183	0.43	0.57	0.08	0.34	0.30	0.26	0.35	0.19	0.45	0.54	0.07	0.17	0.28	0.28	0.32	0.21
O184	0.20	0.50	0.07	0.30	0.16	0.09	0.17	0.15	0.10	0.45	0.13	0.18	0.15	0.10	0.29	0.28
O185	0.07	0.43	0.16	0.26	0.28	0.37	0.23	0.18	0.38	0.38	0.25	0.28	0.45	0.35	0.26	0.10
O186	0.32	0.54	0.16	0.26	0.45	0.28	0.20	0.30	0.46	0.42	0.19	0.43	0.48	0.26	0.30	0.44
O187	0.27	0.44	0.11	0.33	0.51	0.25	0.07	0.32	0.34	0.37	0.16	0.39	0.53	0.24	0.15	0.29
O188	0.26	0.45	0.14	0.29	0.35	0.20	0.09	0.41	0.28	0.38	0.15	0.30	0.24	0.19	0.13	0.34
O189	0.18	0.24	0.11	0.20	0.21	0.13	0.20	0.13	0.14	0.26	0.11	0.22	0.10	0.11	0.27	0.20
O190	0.25	0.49	0.17	0.33	0.21	0.35	0.31	0.35	0.26	0.27	0.17	0.30	0.27	0.38	0.26	0.34
O191	0.55	0.66	0.26	0.47	0.30	0.08	0.24	0.36	0.60	0.64	0.21	0.42	0.30	0.03	0.30	0.37
O192	0.22	0.32	0.21	0.36	0.31	0.29	0.26	0.17	0.25	0.46	0.28	0.25	0.38	0.28	0.35	0.19
O193	0.50	0.21	0.23	0.28	0.46	0.32	0.16	0.34	0.35	0.20	0.25	0.15	0.52	0.30	0.31	0.33

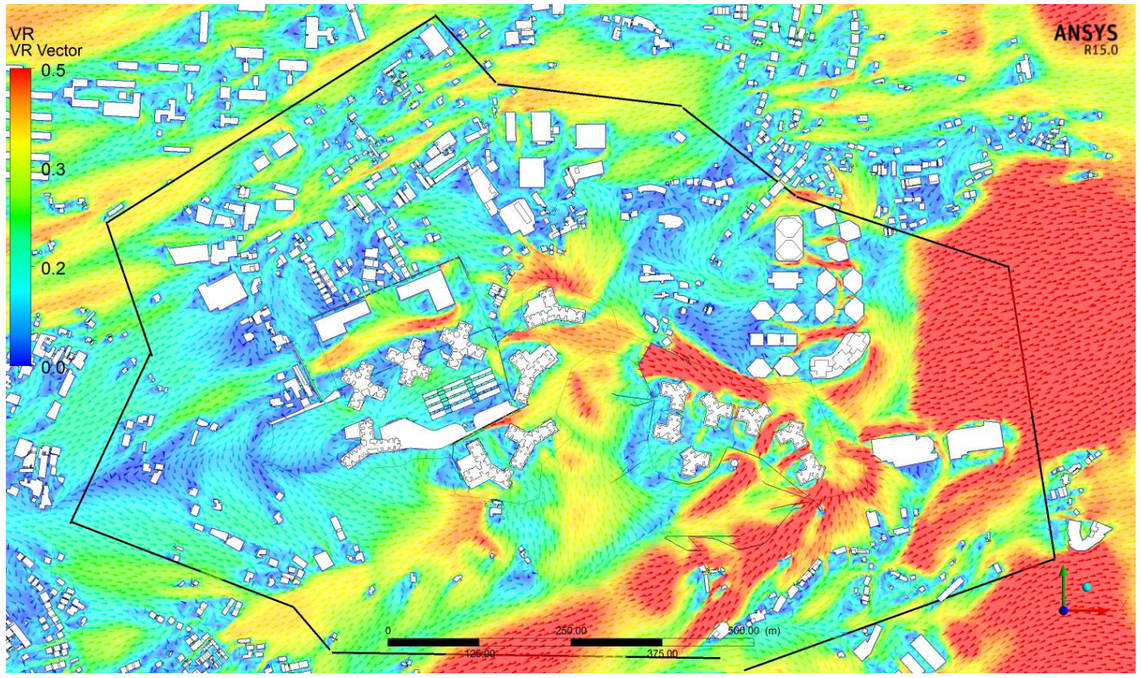
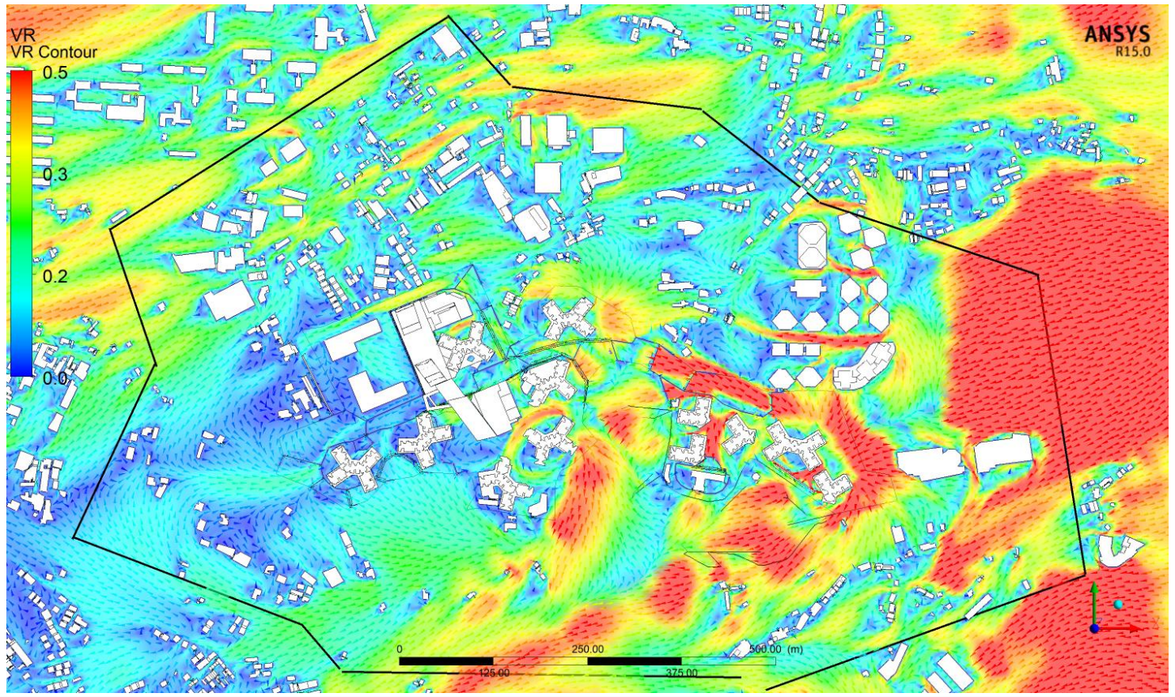
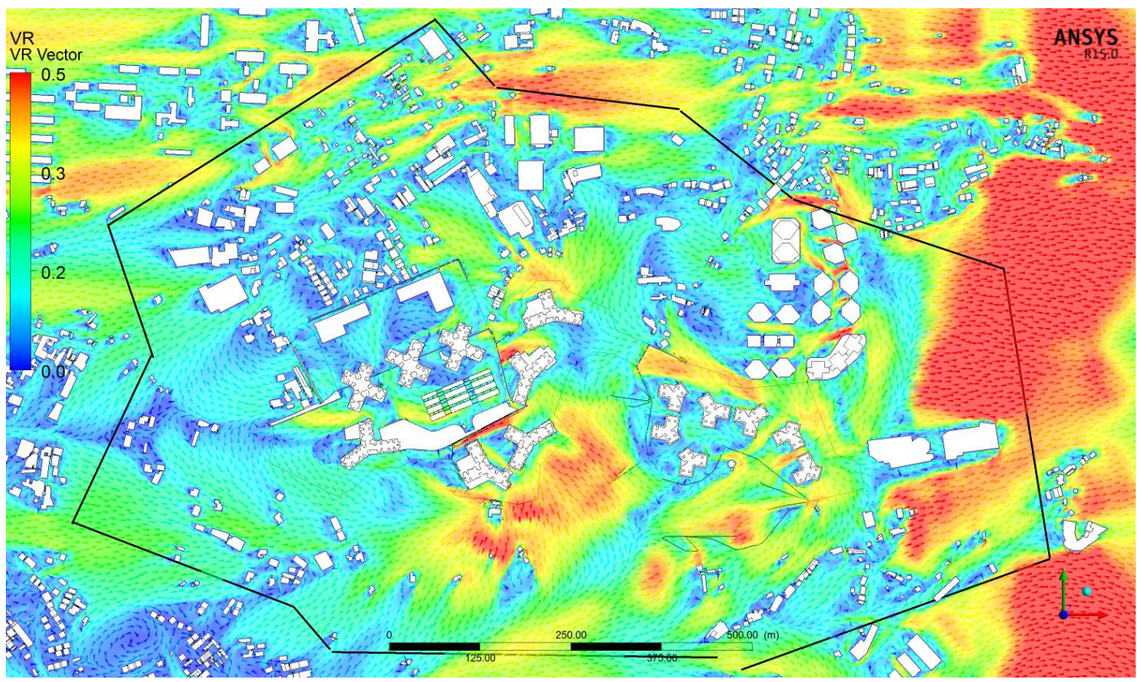
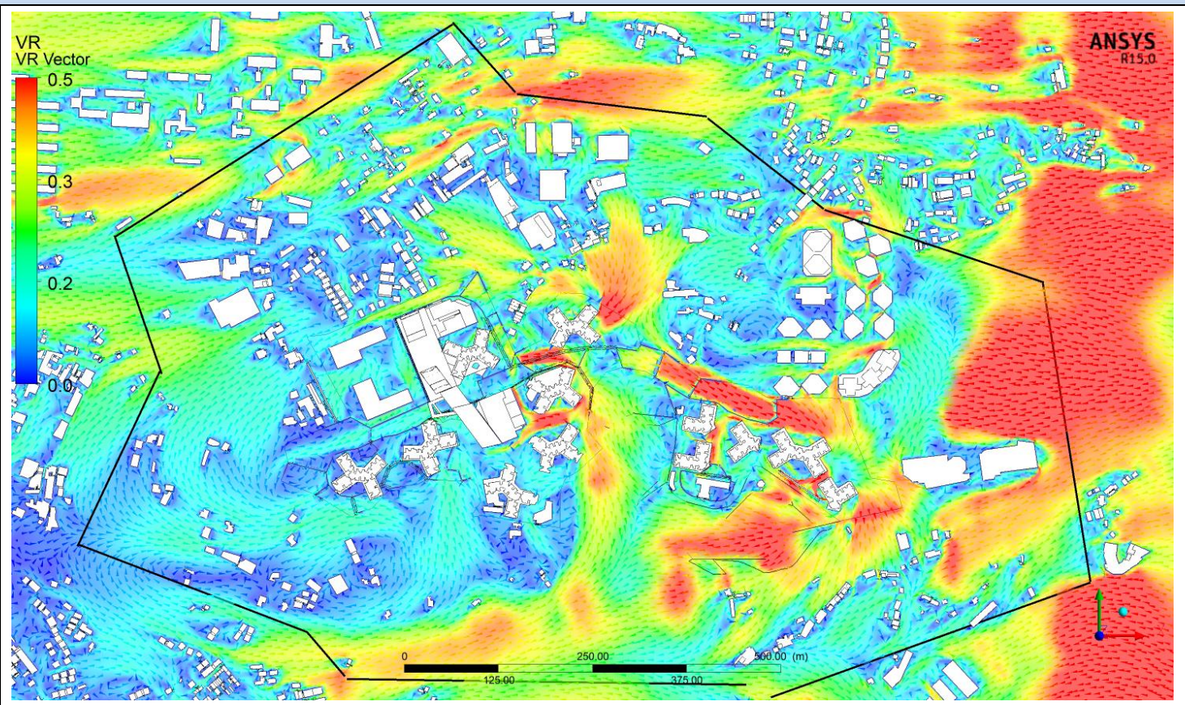
	Base Case								Design Case							
	E	ENE	ESE	NE	NNE	SE	SSE	SSW	E	ENE	ESE	NE	NNE	SE	SSE	SSW
O194	0.17	0.33	0.02	0.22	0.41	0.08	0.11	0.29	0.29	0.23	0.02	0.20	0.41	0.05	0.18	0.30
O195	0.07	0.26	0.08	0.11	0.20	0.03	0.23	0.20	0.18	0.16	0.06	0.13	0.25	0.07	0.39	0.32
O196	0.11	0.11	0.19	0.19	0.33	0.08	0.41	0.35	0.09	0.17	0.12	0.25	0.32	0.13	0.39	0.26
O197	0.15	0.11	0.12	0.25	0.31	0.07	0.33	0.35	0.15	0.23	0.15	0.32	0.30	0.05	0.30	0.28
O198	0.09	0.22	0.15	0.26	0.39	0.18	0.41	0.30	0.10	0.30	0.15	0.38	0.39	0.13	0.40	0.27
O199	0.38	0.33	0.23	0.33	0.27	0.13	0.10	0.14	0.39	0.44	0.23	0.33	0.34	0.14	0.07	0.12
O200	0.47	0.51	0.27	0.50	0.42	0.12	0.34	0.23	0.50	0.46	0.27	0.44	0.41	0.13	0.35	0.25
O201	0.45	0.52	0.24	0.41	0.34	0.17	0.29	0.29	0.42	0.52	0.25	0.40	0.38	0.17	0.33	0.23
O202	0.30	0.26	0.28	0.46	0.48	0.27	0.05	0.16	0.30	0.20	0.25	0.54	0.52	0.28	0.25	0.23
O203	0.12	0.23	0.15	0.22	0.27	0.11	0.40	0.19	0.14	0.26	0.16	0.28	0.28	0.08	0.39	0.21
O204	0.05	0.16	0.07	0.15	0.19	0.09	0.34	0.19	0.13	0.13	0.10	0.12	0.18	0.05	0.31	0.17
O205	0.38	0.39	0.10	0.41	0.30	0.02	0.38	0.27	0.36	0.42	0.12	0.39	0.37	0.05	0.41	0.28
O206	0.27	0.39	0.28	0.44	0.35	0.25	0.46	0.32	0.29	0.40	0.26	0.42	0.42	0.26	0.39	0.33
O207	0.28	0.39	0.33	0.43	0.31	0.27	0.38	0.22	0.31	0.43	0.27	0.44	0.37	0.25	0.38	0.21
O208	0.12	0.20	0.18	0.12	0.16	0.22	0.12	0.07	0.15	0.25	0.20	0.24	0.21	0.06	0.14	0.07
O209	0.18	0.32	0.21	0.32	0.33	0.07	0.16	0.33	0.23	0.37	0.24	0.39	0.37	0.06	0.18	0.31
O210	0.31	0.34	0.14	0.45	0.29	0.23	0.49	0.23	0.31	0.38	0.31	0.41	0.34	0.22	0.49	0.25
O211	0.20	0.16	0.28	0.22	0.17	0.18	0.25	0.06	0.15	0.25	0.24	0.13	0.26	0.20	0.14	0.04
O212	0.38	0.47	0.30	0.55	0.34	0.22	0.44	0.32	0.34	0.48	0.28	0.54	0.31	0.22	0.47	0.32
O213	0.18	0.08	0.08	0.15	0.21	0.31	0.57	0.13	0.27	0.09	0.19	0.03	0.20	0.16	0.58	0.13
P01	0.21	0.18	0.02	0.17	0.25	0.07	0.19	0.28	0.20	0.20	0.09	0.17	0.39	0.07	0.27	0.33
P02	0.26	0.27	0.08	0.15	0.25	0.05	0.14	0.28	0.28	0.28	0.09	0.14	0.22	0.05	0.04	0.31
P03	0.03	0.42	0.05	0.46	0.25	0.18	0.11	0.19	0.30	0.36	0.08	0.44	0.37	0.13	0.09	0.12
P04	0.11	0.48	0.14	0.44	0.40	0.11	0.08	0.09	0.36	0.28	0.14	0.39	0.39	0.11	0.10	0.02
P05	0.11	0.17	0.13	0.28	0.18	0.22	0.36	0.11	0.28	0.13	0.08	0.23	0.17	0.21	0.11	0.08
P06	0.35	0.16	0.11	0.34	0.08	0.15	0.22	0.28	0.29	0.17	0.17	0.24	0.15	0.24	0.10	0.15
P07	0.09	0.40	0.23	0.09	0.30	0.43	0.63	0.49	0.34	0.25	0.16	0.28	0.32	0.19	0.22	0.21
P08	0.23	0.15	0.07	0.07	0.30	0.10	0.09	0.32	0.16	0.06	0.08	0.26	0.37	0.04	0.09	0.18
P09	0.35	0.35	0.04	0.40	0.55	0.11	0.14	0.57	0.32	0.17	0.08	0.22	0.45	0.07	0.13	0.57
P10	0.38	0.49	0.06	0.60	0.46	0.12	0.09	0.08	0.33	0.39	0.11	0.43	0.46	0.10	0.06	0.08
P11	0.27	0.42	0.10	0.26	0.35	0.07	0.12	0.10	0.61	0.34	0.32	0.14	0.19	0.39	0.01	0.21
P12	0.17	0.34	0.26	0.34	0.37	0.50	0.55	0.23	0.19	0.37	0.24	0.28	0.31	0.22	0.53	0.08
P13	0.13	0.21	0.05	0.06	0.06	0.08	0.17	0.09	0.10	0.09	0.03	0.04	0.04	0.05	0.07	0.10
P14	0.42	0.58	0.14	0.13	0.19	0.25	0.13	0.47	0.55	0.59	0.04	0.40	0.16	0.20	0.40	0.09
P15	0.41	0.54	0.01	0.33	0.25	0.32	0.32	0.18	0.21	0.52	0.31	0.39	0.06	0.32	0.30	0.13
P16	0.37	0.50	0.20	0.30	0.46	0.35	0.52	0.27	0.54	0.53	0.33	0.38	0.46	0.38	0.50	0.06
P17	0.29	0.28	0.04	0.24	0.38	0.19	0.33	0.21	0.43	0.41	0.28	0.36	0.48	0.26	0.51	0.33
P18	0.39	0.25	0.05	0.23	0.02	0.14	0.41	0.20	0.38	0.51	0.24	0.33	0.33	0.09	0.32	0.12
P19	0.27	0.44	0.09	0.30	0.14	0.15	0.47	0.30	0.28	0.54	0.14	0.42	0.31	0.19	0.60	0.14
P20	0.13	0.53	0.18	0.32	0.47	0.27	0.34	0.21	0.44	0.31	0.24	0.33	0.50	0.26	0.44	0.37
P21	0.37	0.68	0.15	0.44	0.39	0.23	0.09	0.26	0.44	0.62	0.26	0.42	0.30	0.29	0.10	0.43
P22	0.27	0.37	0.14	0.24	0.06	0.28	0.46	0.34	0.45	0.25	0.23	0.11	0.09	0.22	0.20	0.21
P23	0.31	0.30	0.07	0.09	0.22	0.22	0.13	0.22	0.30	0.19	0.25	0.16	0.08	0.15	0.41	0.19
P24	0.11	0.29	0.20	0.02	0.21	0.14	0.36	0.39	0.08	0.20	0.07	0.10	0.18	0.08	0.28	0.02
P25	0.17	0.08	0.21	0.07	0.07	0.11	0.57	0.15	0.24	0.13	0.14	0.23	0.36	0.13	0.13	0.05
P26	0.07	0.11	0.18	0.23	0.11	0.17	0.62	0.25	0.05	0.23	0.22	0.30	0.45	0.19	0.65	0.53
P27	0.16	0.11	0.02	0.34	0.36	0.21	0.32	0.18	0.12	0.24	0.11	0.30	0.38	0.12	0.40	0.56
P28	0.19	0.19	0.14	0.31	0.31	0.31	0.48	0.32	0.28	0.36	0.17	0.22	0.26	0.08	0.30	0.42
P29	0.15	0.42	0.27	0.40	0.43	0.49	0.42	0.31	0.24	0.21	0.23	0.41	0.41	0.36	0.55	0.12
P30	0.15	0.36	0.30	0.43	0.52	0.28	0.38	0.19	0.33	0.37	0.25	0.31	0.39	0.07	0.55	0.11
P31	0.28	0.36	0.21	0.40	0.52	0.28	0.25	0.29	0.45	0.10	0.18	0.40	0.46	0.14	0.45	0.16
P32	0.34	0.29	0.20	0.37	0.42	0.20	0.36	0.15	0.42	0.28	0.29	0.39	0.34	0.48	0.55	0.18
P33	0.25	0.37	0.34	0.52	0.53	0.45	0.29	0.45	0.36	0.42	0.28	0.52	0.50	0.46	0.28	0.52
P34	0.34	0.25	0.27	0.07	0.07	0.27	0.18	0.48	0.11	0.14	0.22	0.08	0.27	0.35	0.20	0.16
P35	0.42	0.20	0.32	0.24	0.41	0.29	0.25	0.45	0.16	0.39	0.26	0.22	0.12	0.41	0.23	0.29
P36	0.30	0.25	0.25	0.24	0.07	0.10	0.47	0.42	0.12	0.10	0.26	0.15	0.05	0.24	0.34	0.42
P37	0.37	0.37	0.34	0.20	0.16	0.54	0.21	0.11	0.12	0.20	0.37	0.20	0.11	0.27	0.23	0.35
P38	0.11	0.24	0.08	0.29	0.37	0.52	0.16	0.43	0.18	0.18	0.08	0.22	0.22	0.35	0.28	0.42
P39	0.22	0.19	0.05	0.23	0.22	0.22	0.28	0.33	0.09	0.12	0.24	0.18	0.18	0.14	0.29	0.32
P40	0.18	0.18	0.25	0.24	0.14	0.41	0.26	0.21	0.17	0.13	0.29	0.11	0.13	0.33	0.16	0.37
P41	0.20	0.16	0.32	0.16	0.15	0.63	0.30	0.21	0.14	0.05	0.31	0.13	0.15	0.60	0.18	0.39
P42	0.19	0.03	0.33	0.12	0.17	0.70	0.26	0.29	0.09	0.15	0.21	0.15	0.37	0.64	0.07	0.37
P43	0.15	0.06	0.30	0.09	0.38	0.69	0.21	0.31	0.07	0.12	0.10	0.08	0.15	0.65	0.10	0.37

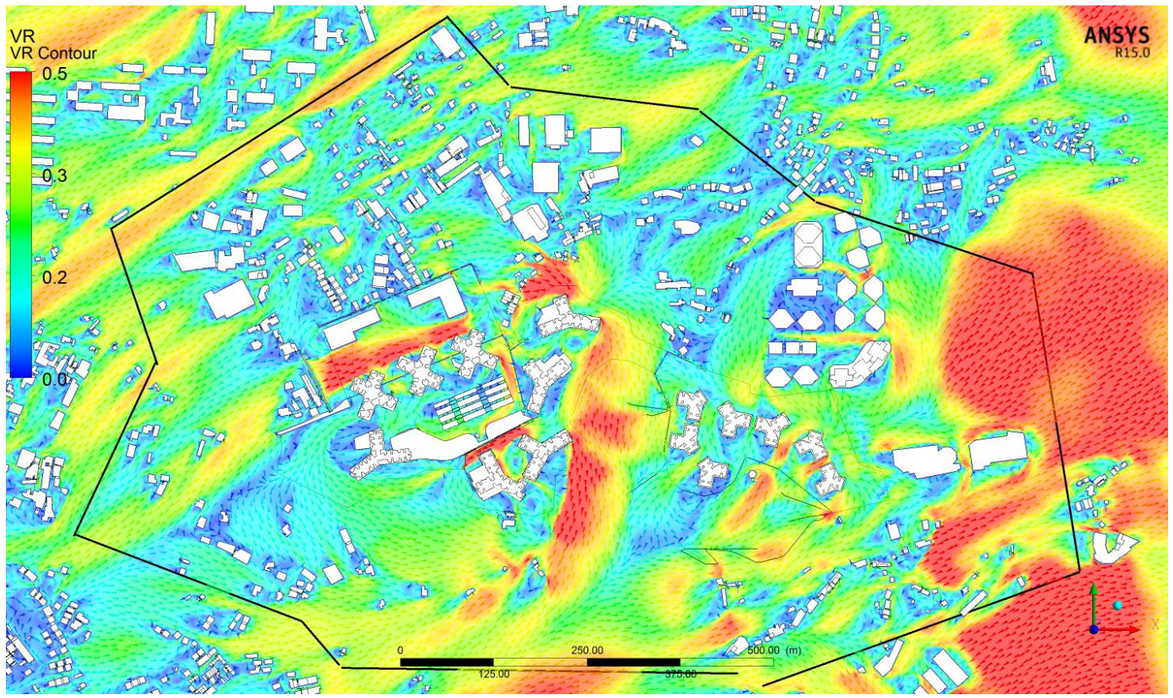
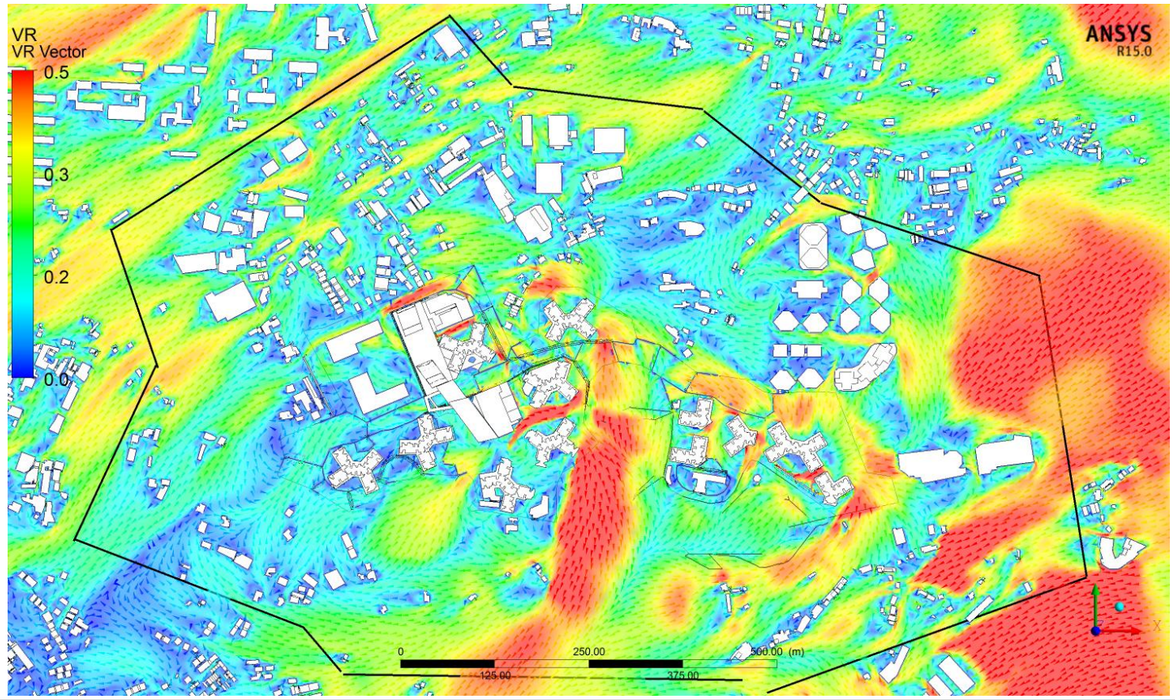
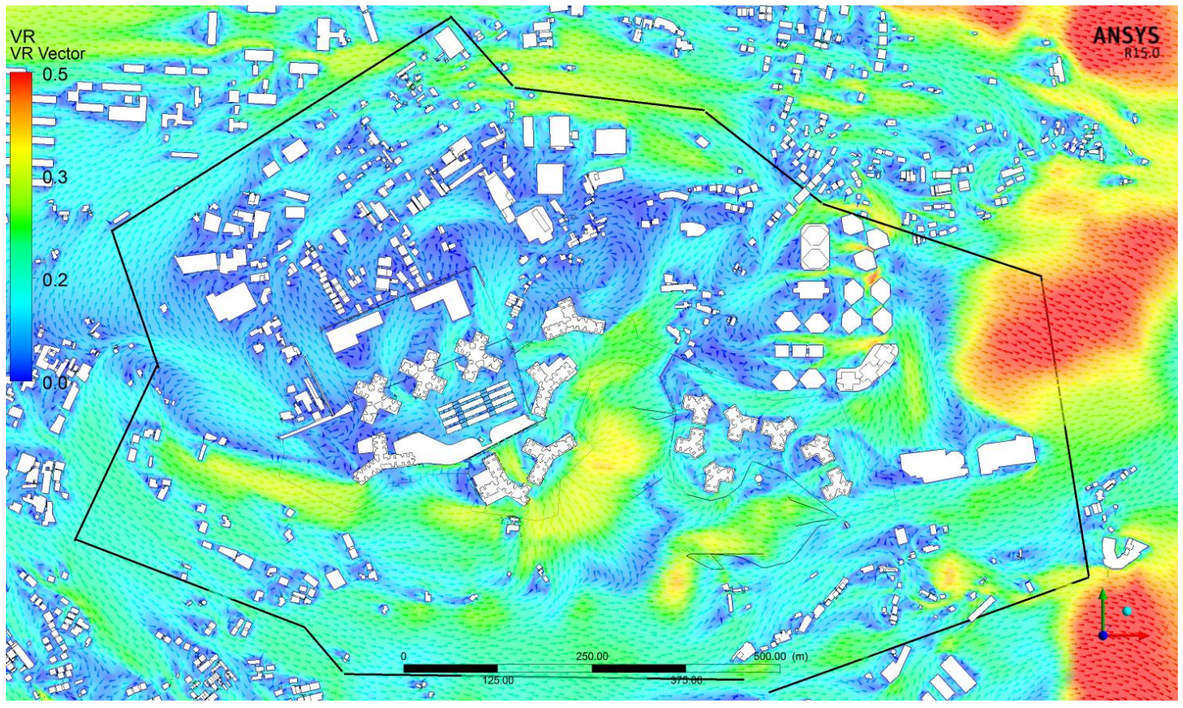
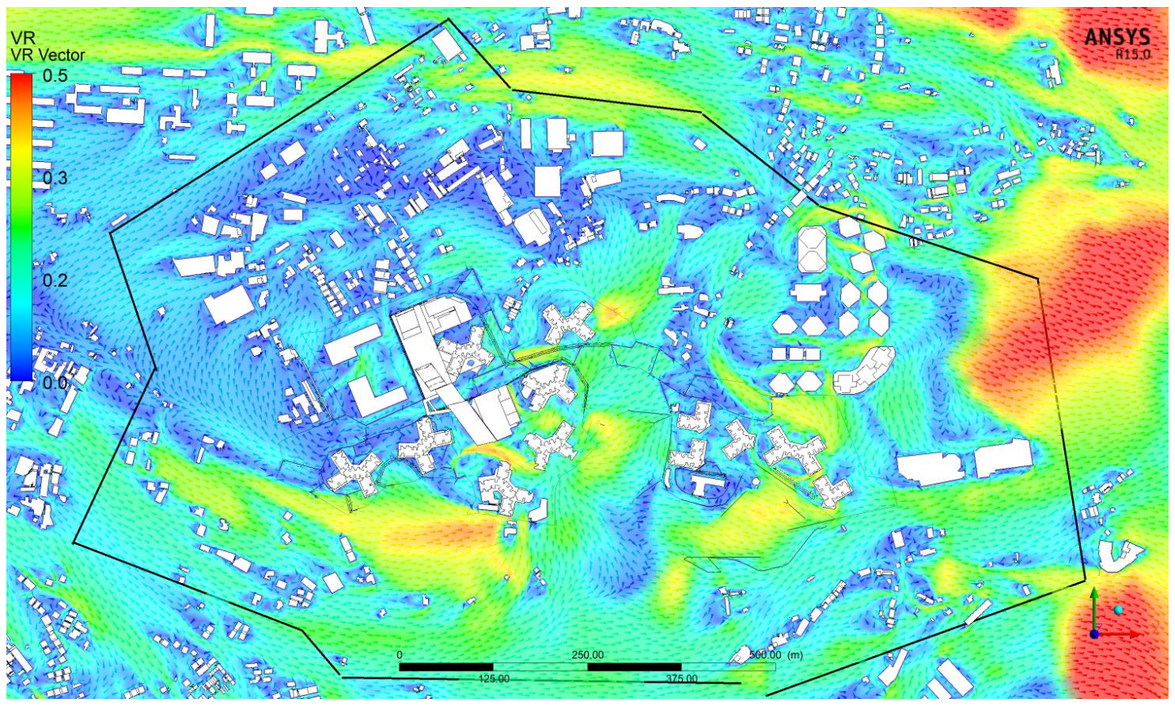
	Base Case								Design Case							
	E	ENE	ESE	NE	NNE	SE	SSE	SSW	E	ENE	ESE	NE	NNE	SE	SSE	SSW
P44	0.02	0.12	0.11	0.14	0.41	0.70	0.14	0.32	0.13	0.11	0.12	0.06	0.07	0.09	0.18	0.37
P45	0.21	0.09	0.10	0.15	0.33	0.42	0.13	0.31	0.06	0.08	0.08	0.12	0.10	0.08	0.21	0.49
P46	0.34	0.12	0.04	0.10	0.21	0.13	0.04	0.30	0.03	0.07	0.05	0.16	0.25	0.43	0.23	0.43
P47	0.17	0.12	0.17	0.45	0.42	0.20	0.16	0.41	0.18	0.08	0.08	0.09	0.20	0.16	0.14	0.37
P48	0.11	0.15	0.15	0.27	0.20	0.10	0.15	0.37	0.13	0.11	0.08	0.27	0.25	0.09	0.14	0.37

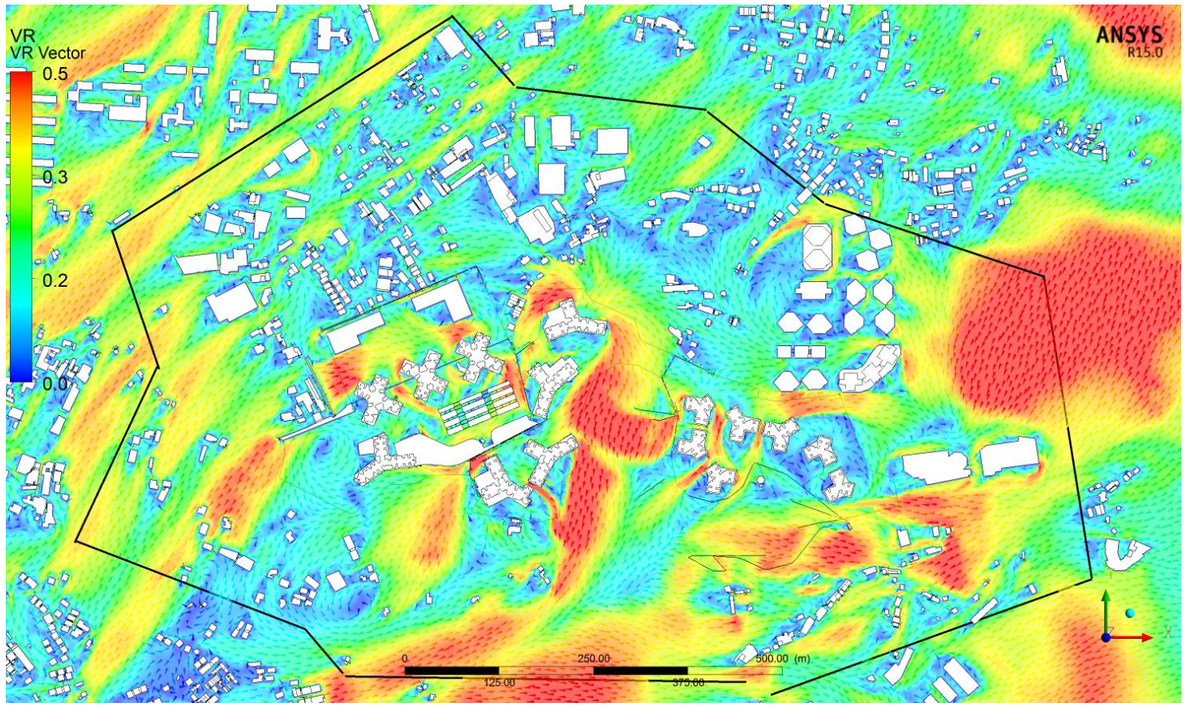
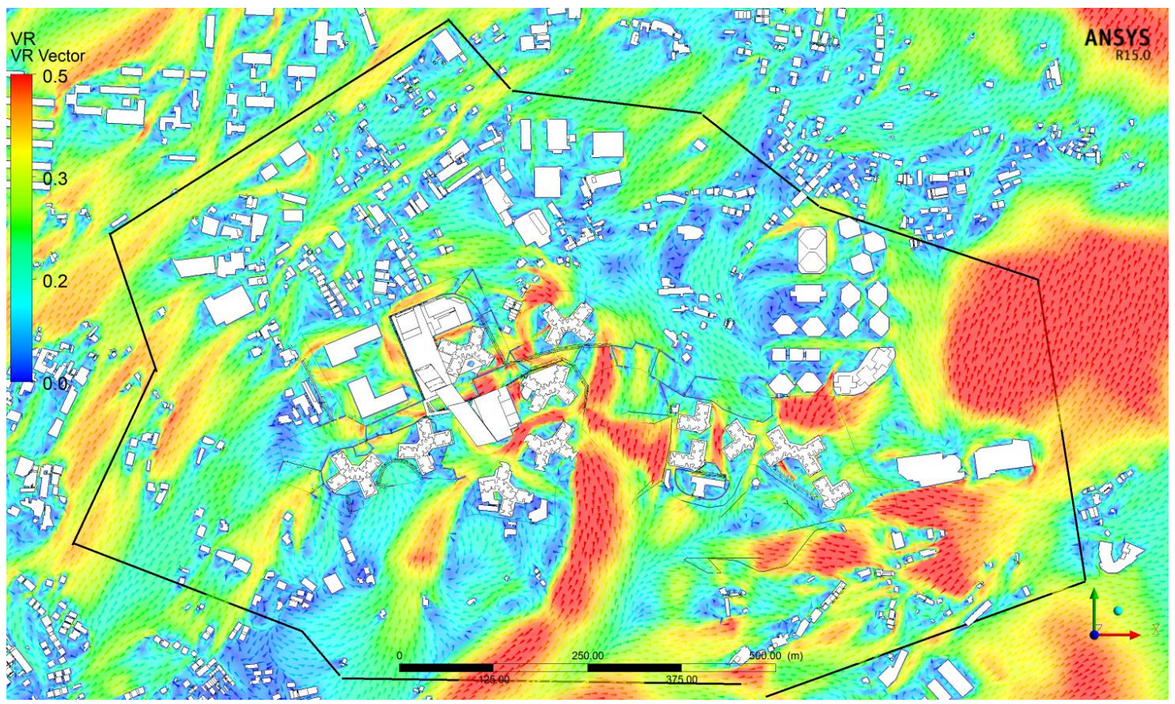
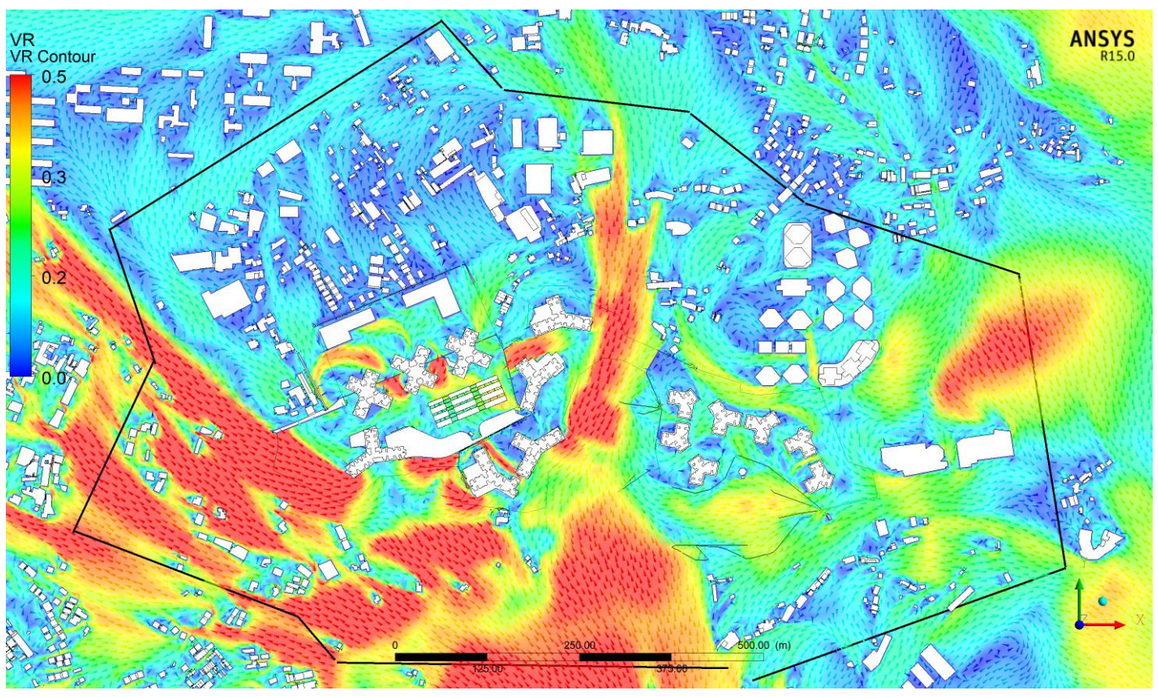
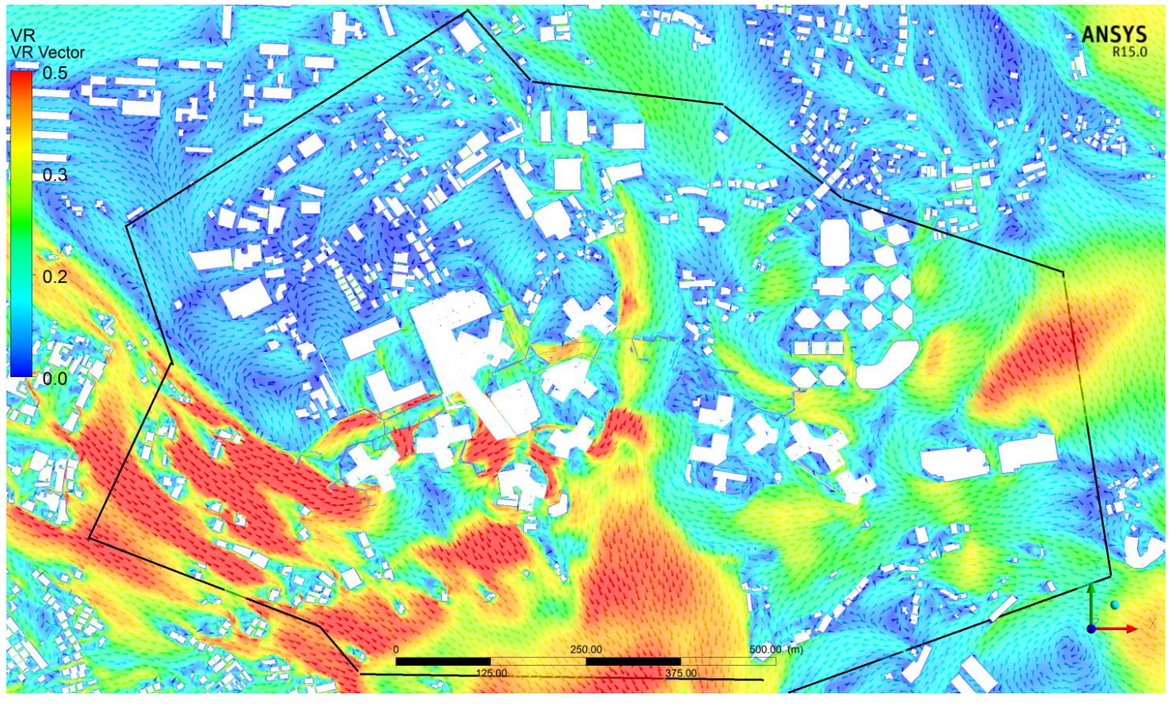
Appendix E
Velocity Ratio Contours

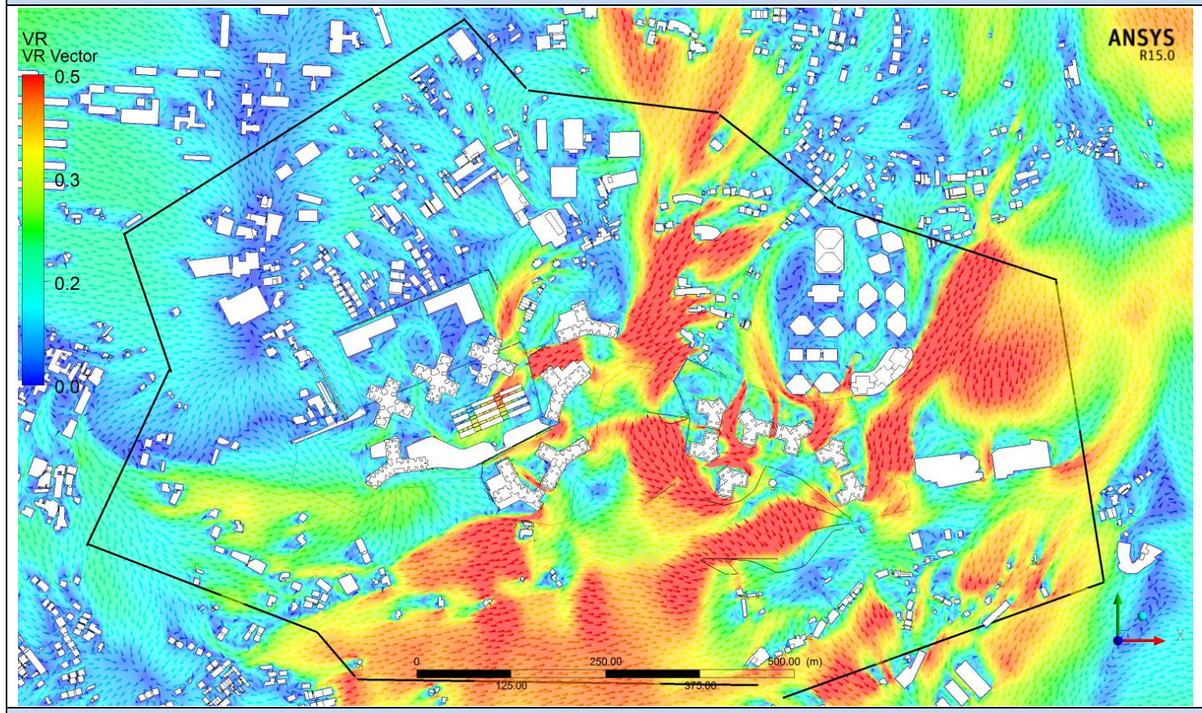
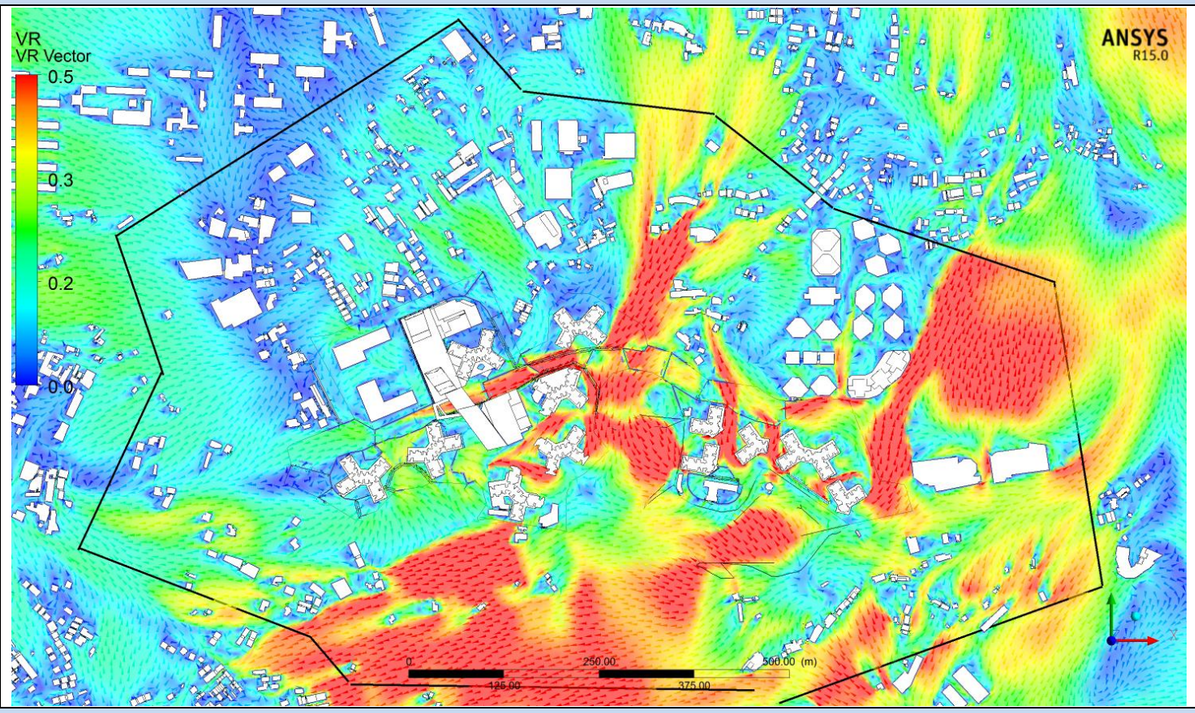
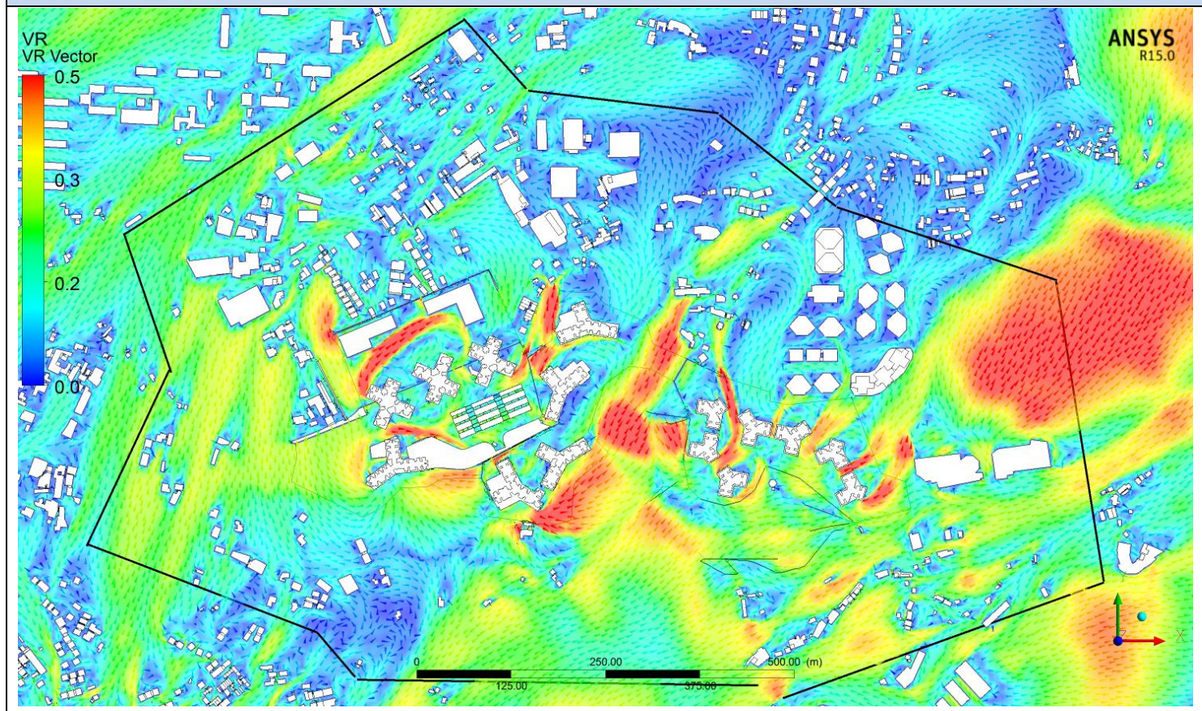
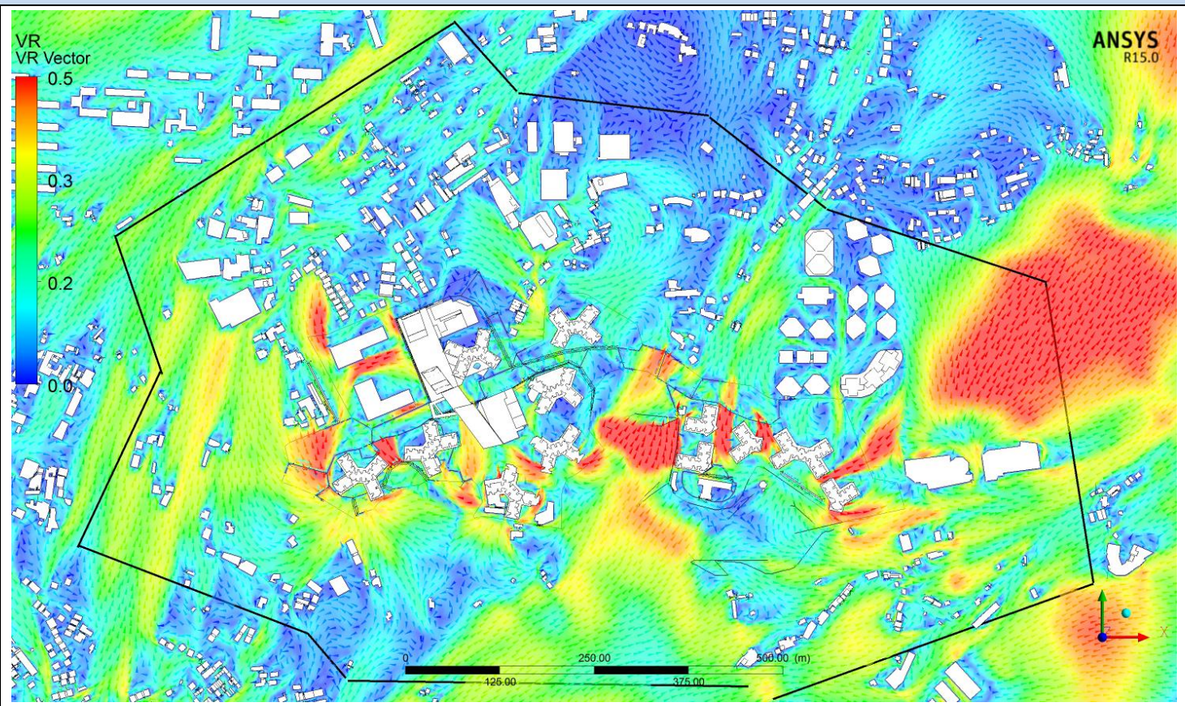
AVA-IS

VR Contour

Base Scheme	Proposed Scheme
ENE – 16.3% Occurrence	
	
E – 12.8% Occurrence	
	

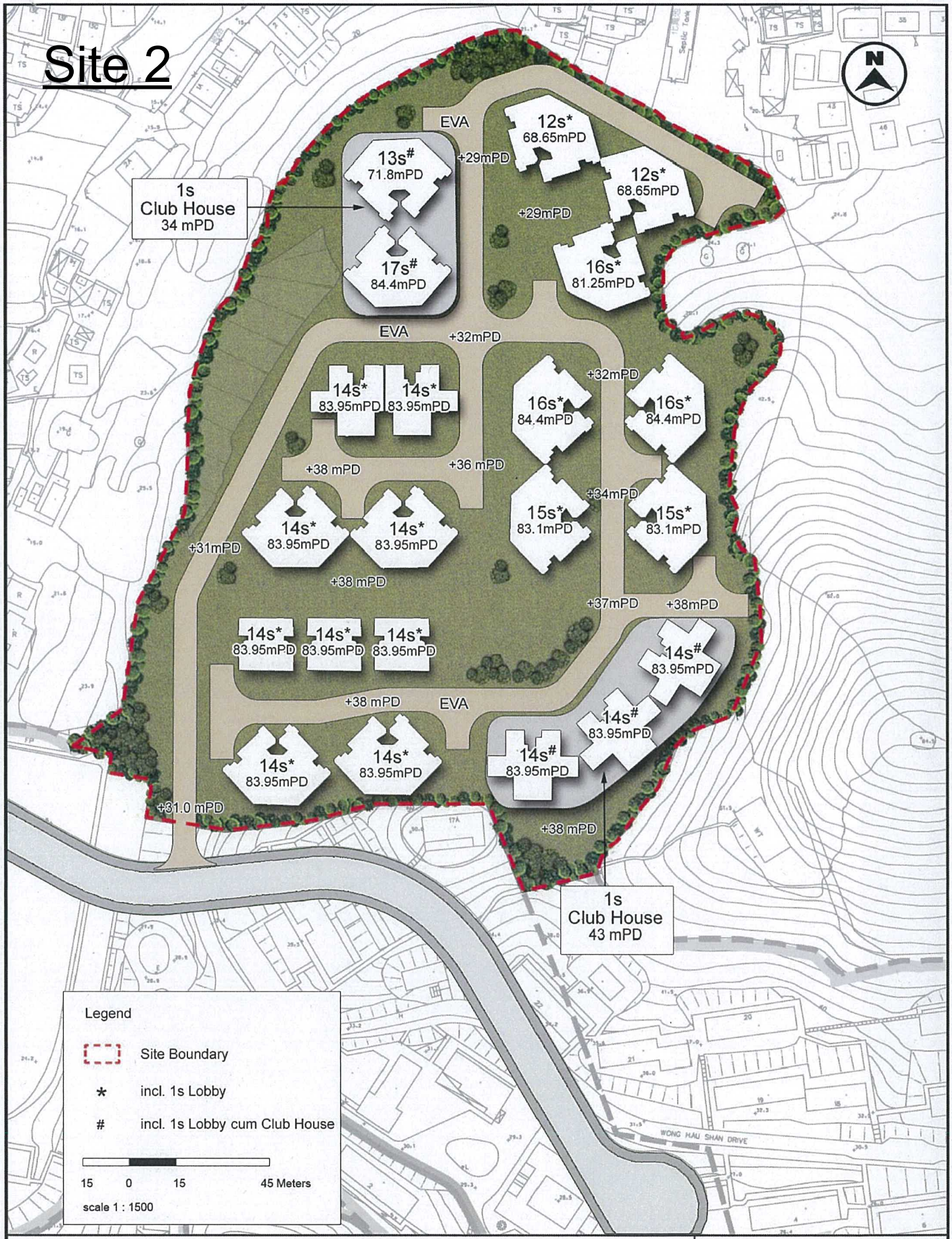
Base Scheme	Proposed Scheme
NE – 11.4% Occurrence	
	
ESE – 10.7% Occurrence	
	

Base Scheme	Proposed Scheme
NNE – 10.7% Occurrence	
	
SE – 10.7% Occurrence	
	

Base Scheme	Proposed Scheme
SSE – 10.7% Occurrence	
	
SSW– 10.7% Occurrence	
	

Appendix F

Site Layout Plan of Planned Developments



Potential Residential Development at Queen's Hill

Indicative Layout (P.R. 3.6)

PLANNING DEPARTMENT

File Ref.

24/04/2014

參考編號 REFERENCE No.	M/NE/15/17	繪圖 DRAWING 2

Potential International School Development at Queen's Hill Site

Indicative Layout (P.R. 1.3)

PLANNING DEPARTMENT

File Ref.

1/4/2014

參考編號 REFERENCE No.	M/NE/15/17	繪圖 DRAWING 3