Hong Kong Housing Authority

Proposed Comprehensive Public Rental Housing Development at North West Kowloon Reclamation Area Site 6

Air Ventilation Assessment - Initial Study

Issue | 1 June 2015

Job number --

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Document Verification

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Job title		Proposed Comprehensive Public Rental Housing Development at North West Kowloon Reclamation Area Site 6			**Job number** --
Document title		Air Ventilation Assessment - Initial Study			**File reference**
Document ref					
Revision	**Date**	**Filename**	NWKRS6_AVAreport_20150522_v4_issue.docx		
Draft 1	29 May 2015	**Description**	Draft 1		
			Prepared by	Checked by	Approved by
		Name	Various	Henry Au	Sui-Hang Yan
		Signature			
Issue	1 Jun 2015	**Filename**	NWKRS6_AVAreport_20150522_v4_issue.docx		
		Description	Issue		
			Prepared by	Checked by	Approved by
		Name	Various	Henry Au	Sui-Hang Yan
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		Filename			
		Description			
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Contents

1 Introduction

1.1 Background of Study

Ove Arup & Partners Hong Kong Ltd. (Arup) was commissioned by the Hong Kong Housing Authority (HKHA) to carry out an Air Ventilation Assessment (AVA) – Initial Study for the Proposed Comprehensive Public Rental Housing Development (Proposed Development) at North West Kowloon Reclamation Area (NWKR) Site 6. NWKR Site 6 is sandwiched between the Proposed Public Rental Housing (PRH) and Home Ownership Scheme (HOS) Developments at Sites 3 & 5 of Lin Cheung Road Site and the Proposed HOS development at Fat Tseung Street West (FTSW) Site.

NWKR Site 6 is zoned "Comprehensive Development Area" ("CDA") on the Approved South West Kowloon Outline Zoning Plan (OZP) No. S/K20/30. Planning permission from the Town Planning Board (TPB) for the comprehensive public housing development under Section 16 (S16) of the Town Planning Ordinance is required.

This AVA report has been prepared to support the said S16 application to evaluate the air ventilation impact to the surroundings due to the Proposed Development.

1.2 Objective of the Study

The objective of the study is to investigate the air ventilation performance of the Proposed Development using the methodology for Air Ventilation Assessment (AVA) as stipulated in the "Technical Circular No. 1/06 – Air Ventilation Assessments" (Technical Circular) and Annex A to the Technical Circular "Technical Guide for Air Ventilation Assessment for Developments in Hong Kong"(Technical Guide) jointly issued by Housing, Planning and Lands Bureau and Environmental, Transport and Works Bureau on 19th July 2006.

1.3 Scope of Study

The main scope of the study is to carry out an AVA Initial Study to assess the ventilation performance of the Proposed Development and surrounding environment. The deliverables of this study can be summarised as follows:

- Evaluation of the wind performance to gather the typical wind characteristics
- Identification of the general ventilation performance over the Assessment Area
- Assessment of air ventilation performance at focus areas

2 Background Information

2.1 Site and Surrounding Area Characteristics

The Proposed Development is located at Cheung Sha Wan which is on a relatively low topography and gradually increases towards the north where Lion Rock Mountain locates. The NWKR Site 6 is bounded by the West Kowloon Highway to the south, Sham Mong Road to the north, Hing Wah Street West to the west and Tonkin Street West to the east.

NWKR Site 6 is located in the midst of high-rise residential clusters, such as Aqua Marine, Fu Cheong Estate, Wing Cheong Estate and Hoi Lai Estate, etc. A committed development, namely Nam Cheong Station Development which is located at the east side of the site, has been taken into account in the assessment model. Future residential developments in FTSW Site, Sites 1, 2, 3, 4A and 5 of Lin Cheung Road Site were also modelled in the simulation. Sites 1, 2, 3, 4A and 5 of Lin Cheung Road Site consist of planned future buildings include social welfare block, hotel and residential buildings.

Figure 1 Aerial photo of the Proposed Development and surrounding area (Image Source: Google Earth)

2.2 Study Scenarios

Two schemes were compared in this AVA study, namely the Baseline Scheme and Proposed Scheme.

2.2.1 Baseline Scheme

The Baseline Scheme is formulated based on the planning parameters, permitted under the current OZP. It consists of 5 residential towers with building height ranges from around 112mPD to 115mPD. The podium with the height of around 11mPD are situated under these residential towers. A large Public Transport Interchange (PTI) is located at the SE portion of the site under Block 4, with a podium above of height around 18.95mPD. The PTI is semi-opened to facilitate wind penetration to leeward side. A 7-storey social welfare facilities block is located at the NW part of the site. Local air path and building separations are incorporated in the scheme to enhance the wind permeability.

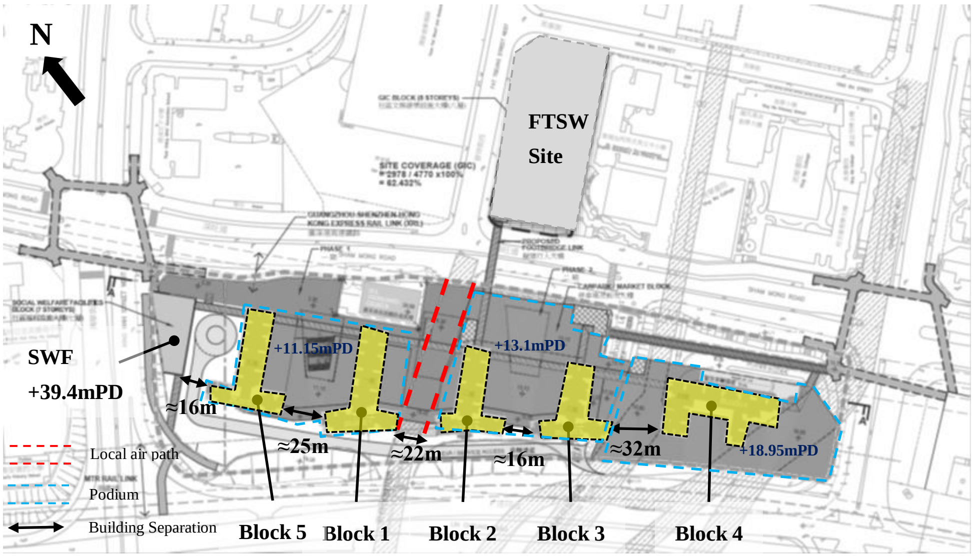


Figure 2 Master layout plan of Baseline Scheme for NWKR Site 6

The three-dimensional model of the baseline scheme at NWKR Site 6 is shown at Figure 3 to Figure 6 at different viewing angle.

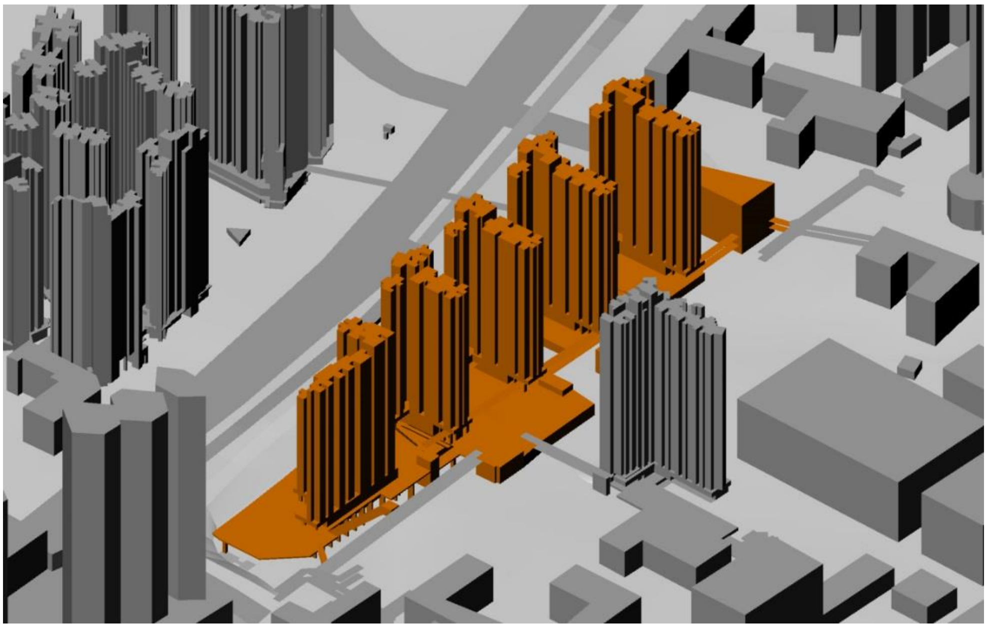


Figure 3 Easterly view of the Baseline Scheme for NWKR Site 6

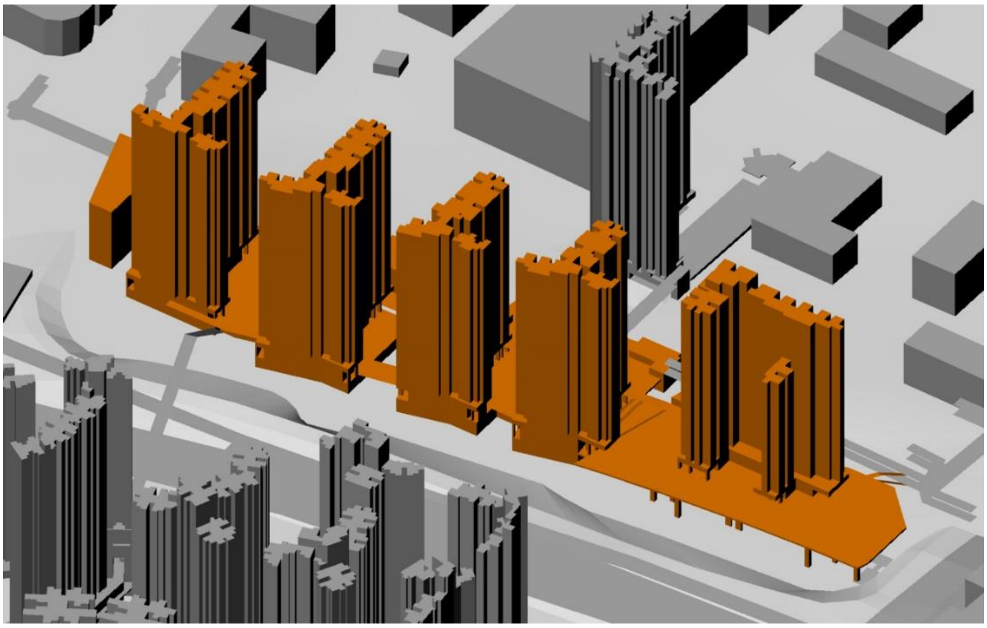


Figure 4 Southerly view of the Baseline Scheme for NWKR Site 6

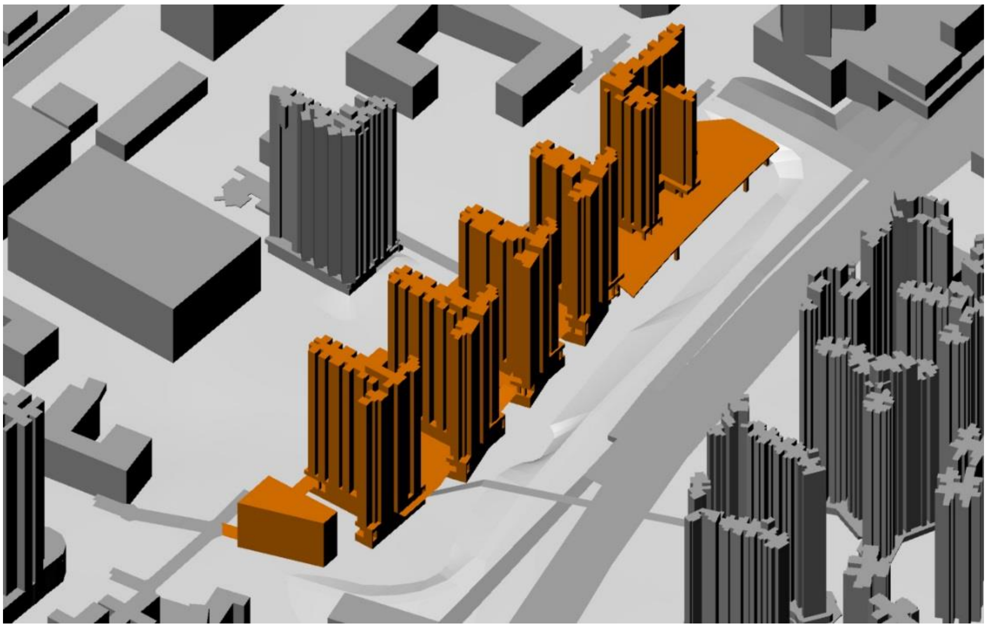


Figure 5 Westerly view of the Baseline Scheme for NWKR Site 6

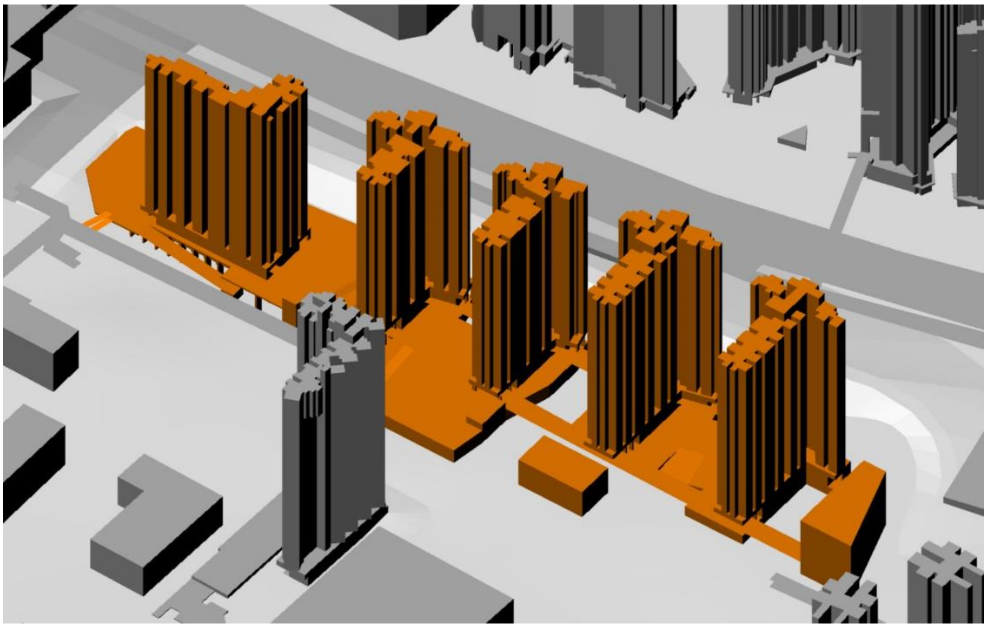


Figure 6 Northerly view of the Baseline Scheme for NWKR Site 6

2.2.2 Proposed Scheme

The Proposed Scheme consists of 4 high-rise residential tower, while Block 5 in the Baseline Scheme is replaced by a mid-rise GIC block, which has lower building height. The residential blocks height range from around 129mPD to 139mPD, while are permitted under the current OZP. Similarly, large podium block is situated under Block 1 and GIC with height of around 11mPD, while the podium height for Block 2 and 3 is around 13mPD. And the podium level for Block 4 is around 19mPD with PTI located below. The Proposed Scheme also incorporates the committed features in the Baseline Scheme, such as a 22m wide local air path between Block 1 & 2 and the provision of semi-opened design at PTI. To further mitigate the ventilation impact of Proposed Development, the Proposed Scheme has further enlarged building separation between Blocks 3 & 4.

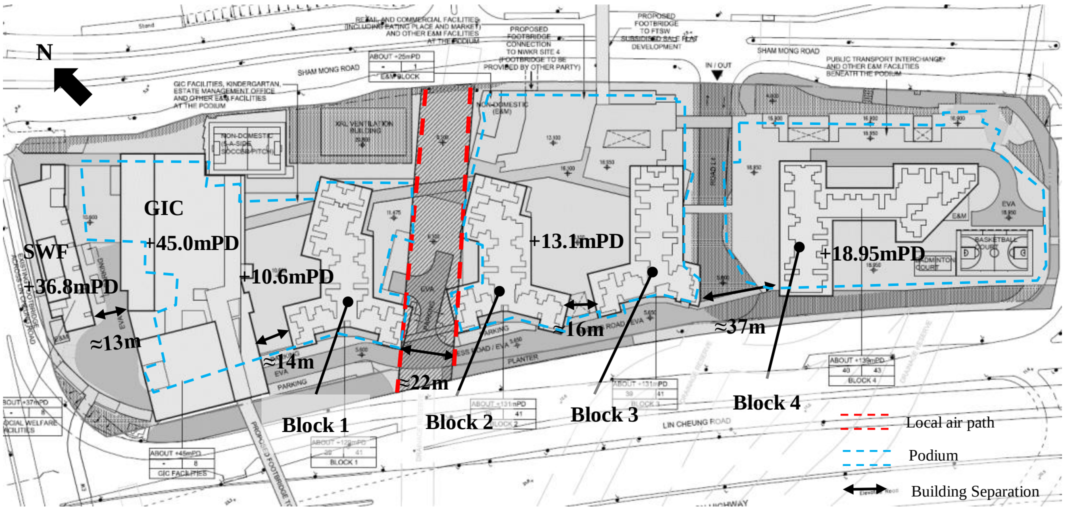


Figure 7 Master Layout plan of Proposed Scheme of NWKR Site 6

The three-dimensional model of the proposed scheme at NWKR Site 6 is shown at Figure 8 to Figure 11 at different viewing angle.

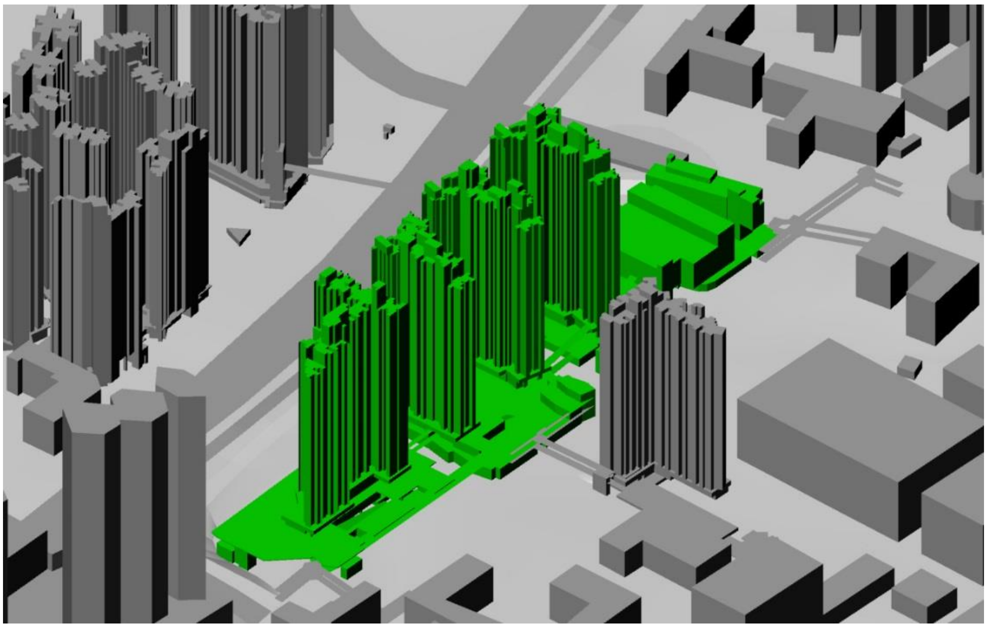


Figure 8 Easterly view of the Proposed Scheme for NWKR Site 6

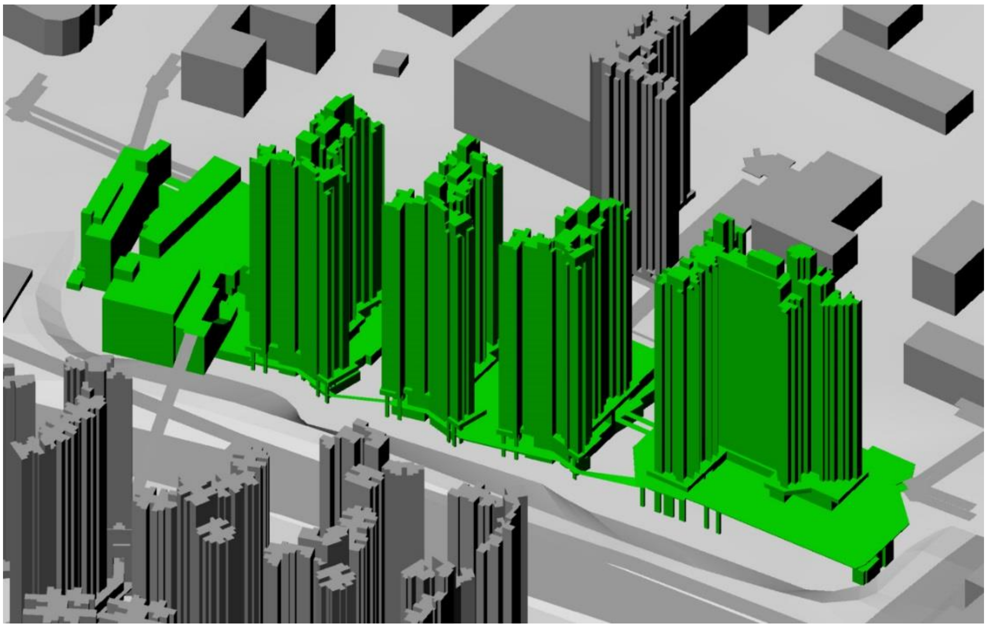


Figure 9 Southerly view of the Proposed Scheme for NWKR Site 6

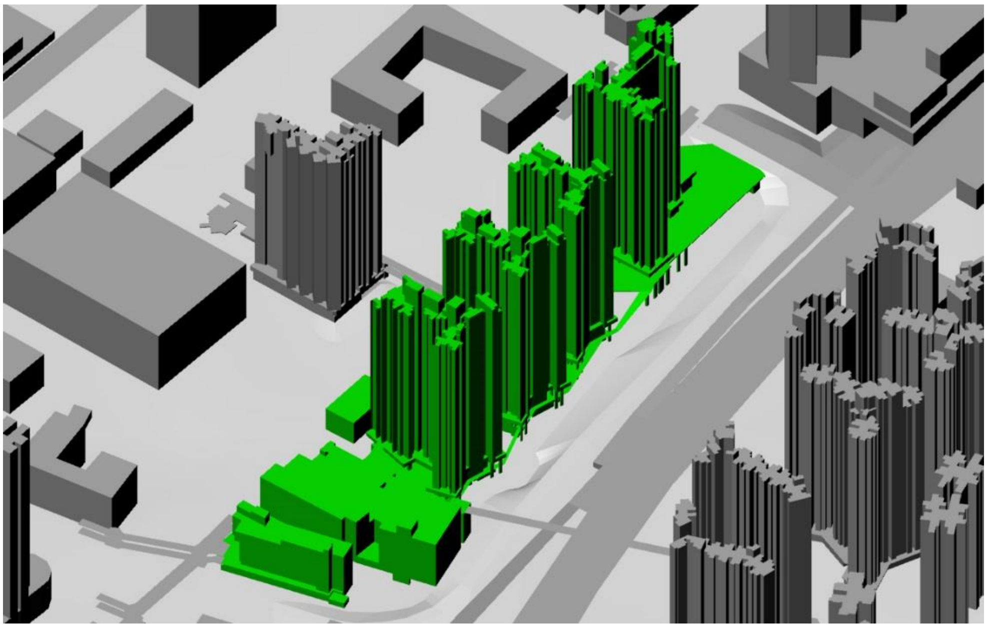


Figure 10 Westerly view of the Proposed Scheme for NWKR Site 6

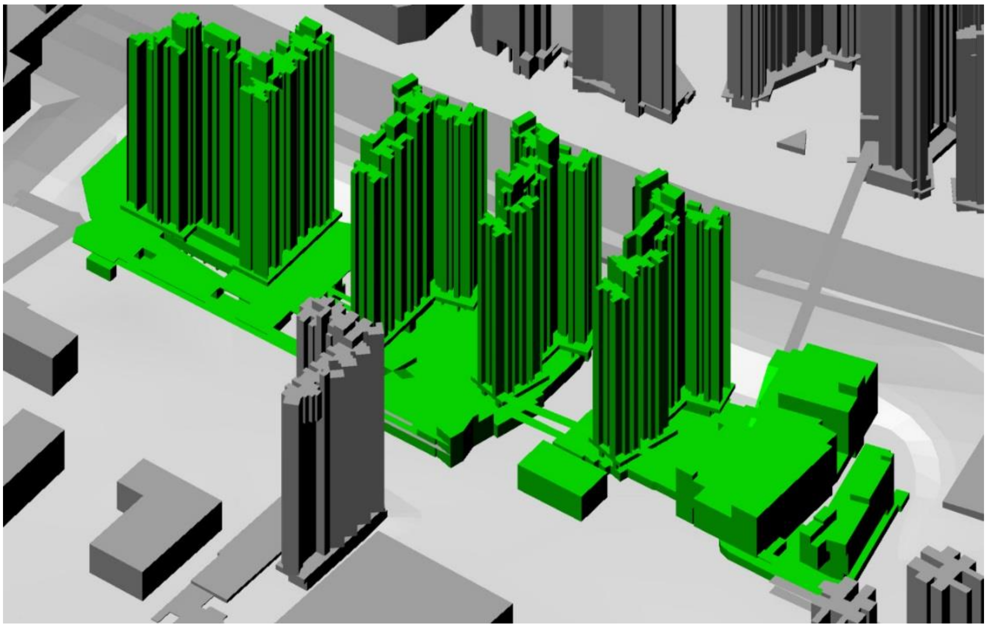


Figure 11 Northerly view of the Proposed Scheme for NWKR Site 6

3 Methodology

This study adopted the AVA methodology for Initial study as stipulated in Annex A of the Technical Circular on "Technical Guide for Air Ventilation Assessment for Developments in Hong Kong" (Technical Guide).

3.1 Wind Availability

Based on the methodology of AVA, the site wind availability data was obtained from the Urban Climatic Map (UCMap) Study for Cheung Sha Wan[1]. The wind rose demonstrating the frequency of occurrence of different wind directions under annual and summer conditions are shown in Figure 12.

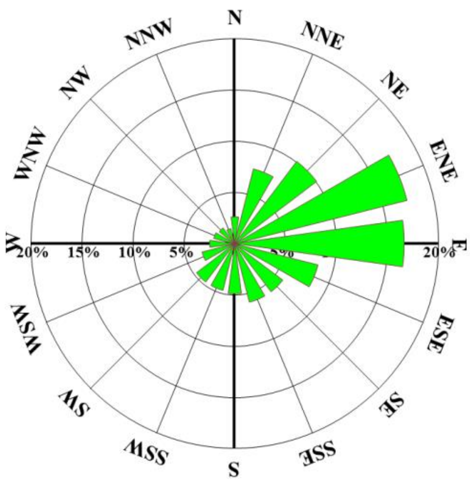
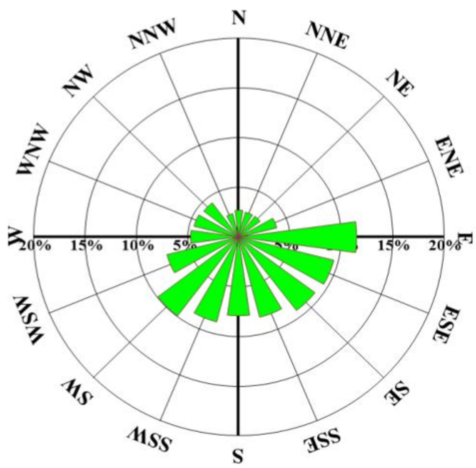
Annual (+450mPD)	Summer (+450mPD)
	

Figure 12 Wind rose for the Development under Annual and Summer Wind Condition

[1] Urban Climatic Map and Standards for Wind Environment – Feasibility Study, Department of Architecture, CUHK, 1/22/2009

3.1.1 Annual Prevailing Wind

Eight prevailing wind directions (highlighted in Red colour in Table 1) were considered in the AVA Initial Study which covers 76.6% of the total annual wind frequency. They are north-north-easterly (7.5%), north-easterly (10.1%), east-north-easterly (17.4%), easterly (16.6%), east-south-easterly (8.4%), south-easterly (5.9%), south-south-easterly (5.9%) and southerly (4.9%) winds.

Table 1 Annual wind frequency of the wind directions considered in this study

Wind Direction	N	NNE	NE	ENE	E	ESE	SE	SSE	
Frequency	2.6%	7.5%	10.1%	17.4%	16.6%	8.4%	5.9%	5.9%	
Wind Direction	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
Frequency	4.9%	4.7%	4.7%	3.3%	2.5%	2.1%	1.9%	1.5%	76.6%

** The wind frequency showing in red colour represents the selected winds for the CFD simulation.*

3.1.2 Summer Prevailing Wind

Nine prevailing wind directions (highlighted in Red colour in Table 2) were considered in the AVA Initial Study which covers 77.1% of the total summer wind frequency (from 1 June to 30 August). They are easterly (11.5%), east-south-easterly (9.5%), south-easterly (9.3%), south-south-easterly (8.3%), southerly (7.9%), south-south-westerly (8.8%), south-westerly (9.9%), west-south-westerly (7.2%) and westerly (4.7%) winds.

Table 2 Summer wind frequency of the wind directions considered in this study

Wind Direction	N	NNE	NE	ENE	E	ESE	SE	SSE	
Frequency	2.7%	2.6%	2.6%	3.8%	11.5%	9.5%	9.3%	8.3%	
Wind Direction	S	SSW	SW	WSW	W	WNW	NW	NNW	Sum
Frequency	7.9%	8.8%	9.9%	7.2%	4.7%	4.5%	4.3%	2.4%	77.1%

** The wind frequency showing in red colour represents the selected winds for the CFD simulation.*

3.1.3 Wind Profile

The vertical discretization of the velocity profile was approximated by using an exponential law, which is a function of ground roughness and height:

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

where
U_G = reference velocity at height z_G
Z_G = reference height
Z = height above ground
U_Z = velocity at height z
$\boldsymbol{n}$ = power law exponent

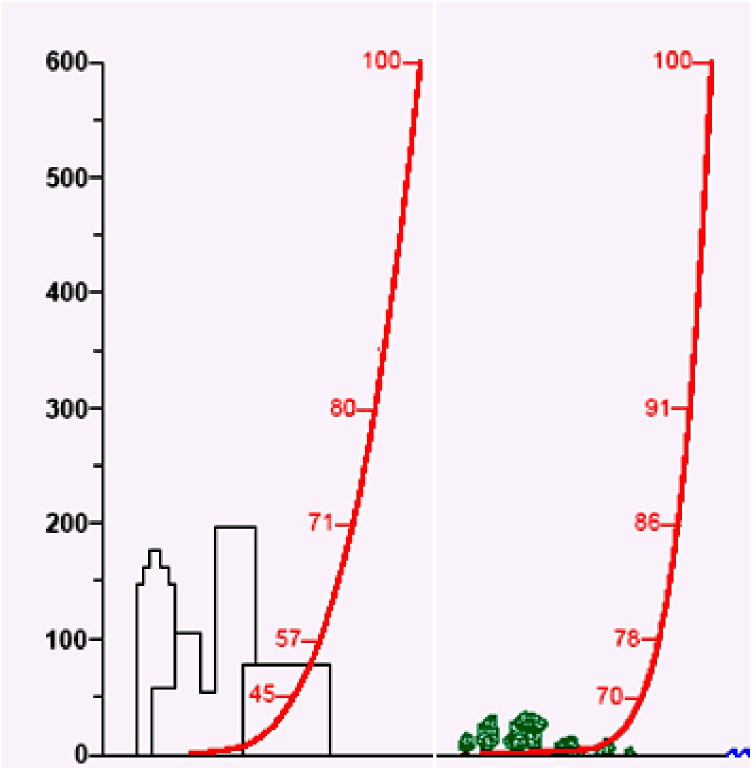


Figure 13 Wind Profile applied in the AVA Initial Study

The power ***n*** is related to the ground roughness. A larger value of the power **n** represents the higher roughness of the ground i.e. the dense city. Alternatively, smaller n represents the lower ground roughness i.e. the sea surface.

Terrain crossed by approaching wind	n-value
Sea and open space	~0.15
Suburban or mid-rise	~0.35
City centre or high-rise	~0.50

As the developments are located in the urban city and surrounded by medium rise building in NNE, NE, ENE, E, ESE, SE, SSE, S, SSW, SW, WSW and W directions, the *n*-value was assumed to be 0.35 for wind from these directions.

Furthermore, developments are facing the waterfront in S, SSW, SW and WSW directions, hence the n-value is assumed to be 0.15 for the wind from these directions.

Wind Direction	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W
n-value	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.15	0.15	0.15	0.15	0.35

Table 3 n-value for the prevailing wind directions

3.2 Study Area

3.2.1 Project Assessment Area and Surrounding Areas

With reference to the Technical Guide, the areas of evaluation and assessment should include all area measured in a belt up to 1H from the site boundary, where H is the height of the tallest building of the Proposed Development, around the site boundary.

The tallest building of the Proposed Development is about 140mPD. As requested from Planning Department, the Assessment Area was proposed to further extend to 2H, which is around 250m. Notwithstanding, in order to capture a more representative wind profile of the surrounding area of the Project Site, the Surrounding Area was proposed to be 1100m (~8H), which extended beyond a distance of 2H from the Project Site. The committed/planned development at the Cheung Sha Wan Wholesale Food Market Site 1, 2, 4, 4A, Site 3 & 5 of Lin Cheung Road Site and FTSW Site are thus included. The neighbouring elevated structures, such as West Kowloon Highway are also modelled in the Study.

Figure 14 Site boundary and Assessment Area for the study (Image Source: Google Earth)

3.2.2 Assessment Parameter

The Wind Velocity Ratio (VR) as proposed by the Technical Circular was employed to assess the ventilation performance of the Proposed Development and surrounding environment. Higher VR implies better ventilation. The calculation of VR is given by the following formula:

$$VR = \frac{V_p}{V_\infty} \qquad (1)$$

V_∞= the wind velocity at the top of the wind boundary layer (typically assumed to be around 596m above the centre of the site of concern, or at a height where wind is unaffected by the urban roughness below).

V_P= the wind velocity at the pedestrian level (2m above ground) after taking into account the effects of buildings.

The Average VR is defined as the weighted average VR with respect to the percentage of occurrence of all considered wind directions. This gives a general idea of the ventilation performance at the considered location on an annual basis.

3.3 Test Point for Local and Site Ventilation Assessment

Monitoring test points were evenly placed along the site boundary and within the Assessment Area of the Proposed Development to determine the ventilation performance. There are two types of test points in the study:

3.3.1 Perimeter Test Points

Perimeter test points are the points positioned on the site boundary of the Proposed Developments. In accordance with the Technical Circular for AVA, perimeter points are positioned at intervals of 10 – 15m alongside the site boundary. In total there are 42 perimeter test points within the Assessment Area.

3.3.2 Overall Test Points

Overall test points are those points evenly positioned in the open space on the streets and places where pedestrian frequently access within the Assessment Area. In total there are 143 overall test points within the Assessment Area.

Figure 15 shows the locations of all perimeter and overall test points within the Assessment Area.

Figure 15 Location of overall and perimeter points – Overall Plan (Image Source: Google Map)

3.4 Assessment Tools

Computational Fluid Dynamics (CFD) technique is utilized for this AVA initial study. The CFD software Star-CCM+ was used in this study. With the use of three-dimensional CFD method, the local airflow distribution can be visualised in detail. The air velocity distribution within the flow domain, being affected by the site-specific design and the surrounding buildings, had been simulated under the prevailing wind conditions round the year.

3.4.1 CFD Model

The size of the CFD model for this Study was approximately 5700m(L) x 5000m(W) x 1500m(H). The whole CFD domain covered the entire development and the surrounding buildings. The model also took information of the surrounding buildings and site topography via Geographical Information System (GIS) platform. Body-fitted unstructured grid technique was used to fit the geometry to reflect the complexity of the development geometry. A prism layer of 3m above ground (totally 6 layers and each layer is 0.5m) was incorporated in the meshing so as to better capture the approaching wind. The expansion ratio was 1.3 while the maximum blockage ratio is 3%.

Finer grid system (with the smallest grid size of 0.5m) was applied to the most concerned area based on preliminary judgement, while coarse grid system (grid size of more than 20m at location far away from the site) was applied to the area of surrounding buildings for better computational performance while maintaining satisfactory result.

3.4.2 Turbulence model

As highlighted in recent academic and industrial research literatures by CFD practitioners, the widely used standard k - ε turbulence model technique may not adequately model the effects of large scale turbulence around buildings and ignores the wind gusts leading to the relatively poor prediction in the recirculation regions around building. Therefore in this CFD simulation, realizable k – ε turbulence modelling method is applied. This technique provides more accurate representation of the levels of turbulence that can be expected in an urban environment.

3.4.3 Calculation Method

The Segregated Flow model solves the flow equations in a segregated manner. The linkage between the momentum and continuity equations adopted the predictor-corrector approach. A collocated variable arrangement and a Rhie-and-Chow-type pressure-velocity coupling combined with a SIMPLE-type algorithm. A higher order differencing scheme was applied to discretize the governing equations. The convergence criterion was set to 0.0005 on mass conservation. The calculation will repeat until the solution satisfied this convergence criterion.

The prevailing wind direction as mentioned in Section 3.1 was set at the inlet boundary of the model with wind profile as detailed in Section 3.1.3. The downwind boundary is set with a value of atmospheric pressure. The top and side boundaries are set in symmetry. In addition, to eliminate the boundary effects, the model domain was built beyond the Surrounding Area as required in the Technical Circular.

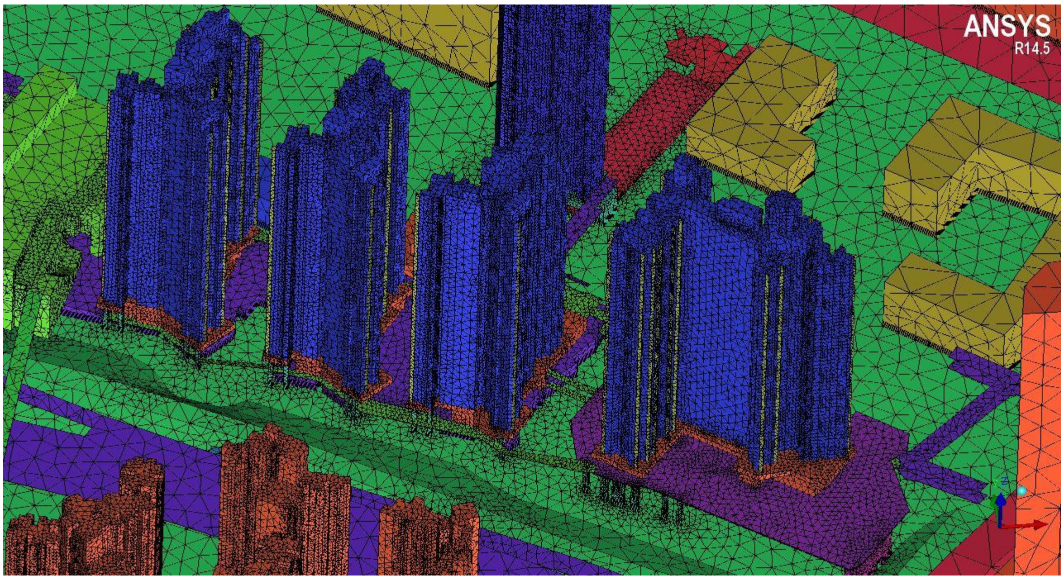


Figure 16 Mesh for CFD Analysis

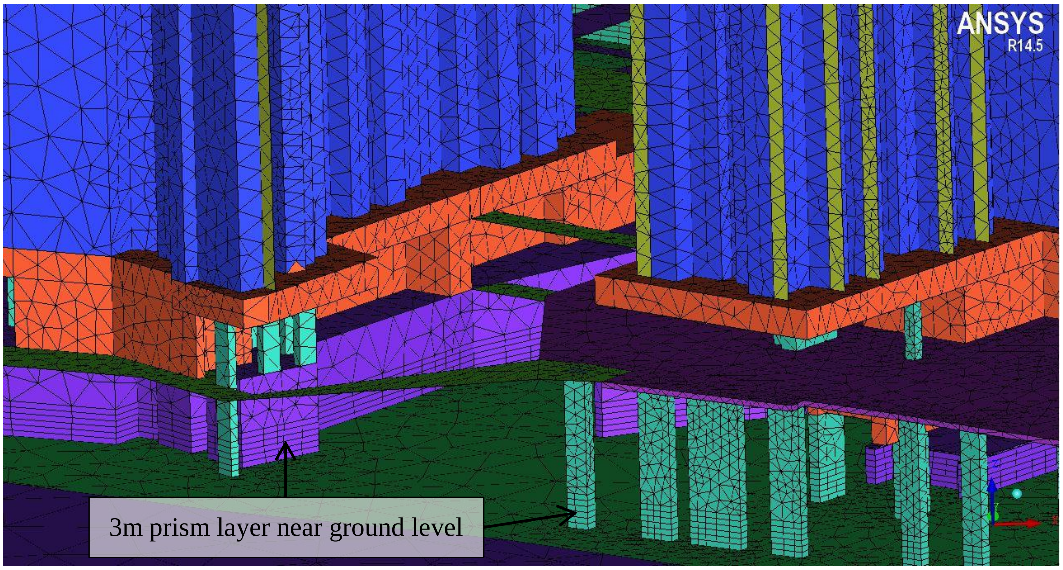


Figure 17 3m of prism layer

3.4.4 AVA study parameters

As specified in the Technical Circular, indicator of ventilation performance should be the Wind Velocity Ratio (VR), defined as the ratio of the wind velocity at the pedestrian level (2m above ground) to the wind velocity at the top of the wind boundary layer. Site Spatial-average Velocity Ratio (SVR) and a Local Spatial-average Velocity Ratio (LVR) should be determined. The details of the assessment result for the scheme would be presented in the next section.

Table 4 Terminology of the AVA Initial Study

Terminology	Description
Velocity Ratio (VR)	The velocity ratio (VR) represents the ratio of the air velocity at the measurement position to the value at the reference points.
Site Spatial-average Velocity Ratio (SVR)	The SVR represent the average VR of all perimeter test points at the site boundary which identified in the report.
Local Spatial-average Velocity Ratio (LVR)	The LVR represent the average VR of all points, i.e. perimeter and overall test points at the site boundary which identified in the report.

4 Results and Discussion

4.1 Annual Overall Pattern of Ventilation Performance

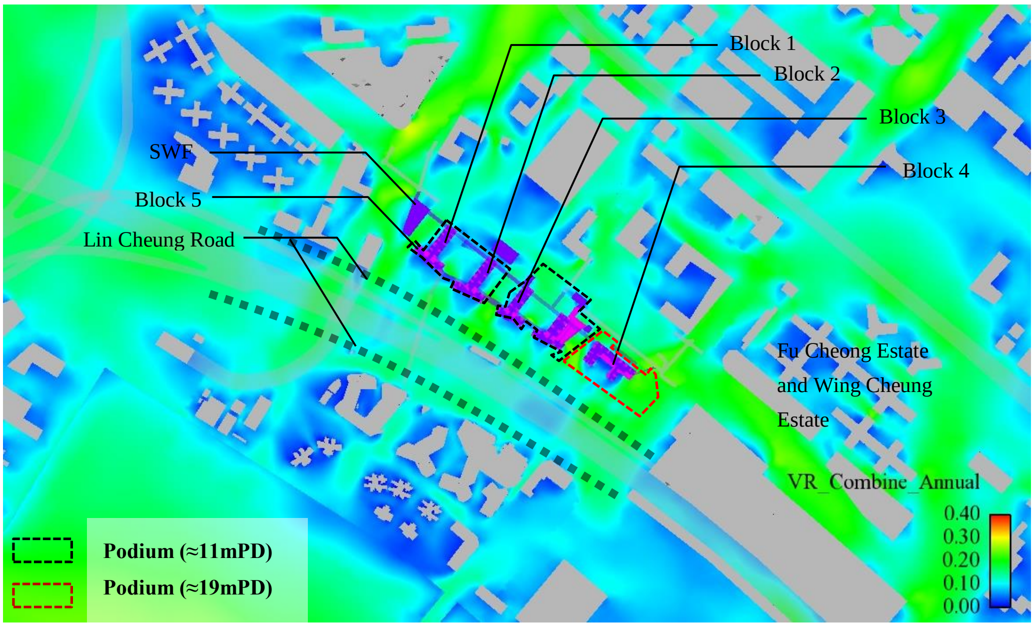


Figure 18 Contour Plot of Annual Average VR at 2m Pedestrian Level for Baseline Scheme

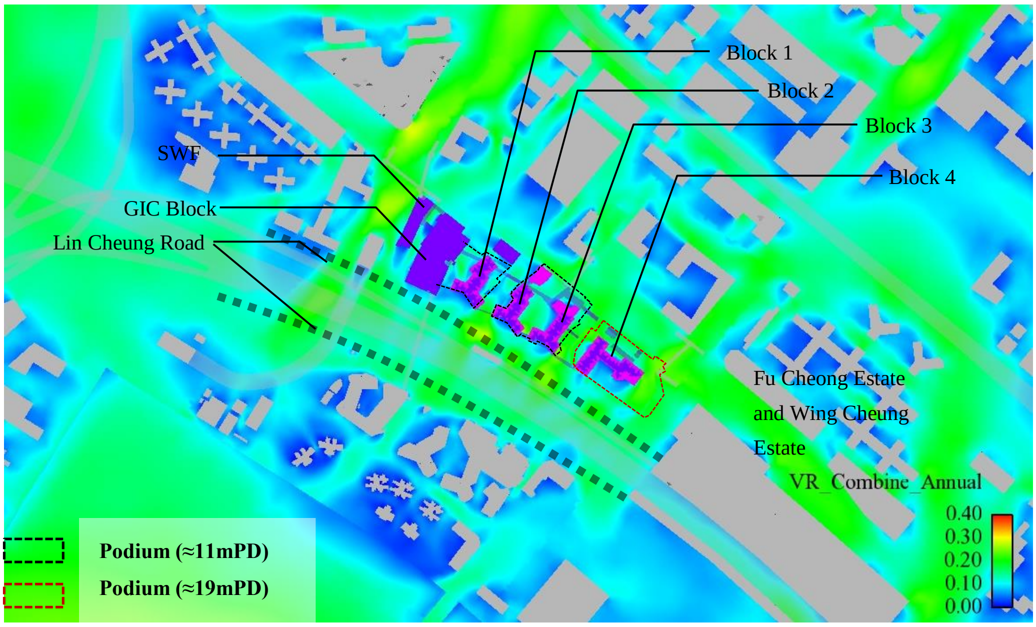


Figure 19 Contour Plot of Annual Average VR at 2m Pedestrian Level for Proposed Scheme

For the annual condition, eight wind directions were selected, accumulating to 76.6% in occurrence frequency. The integrated effect of these winds indicates the overall wind ventilation performance. Annual wind is dominated by E (16.6%) and ENE (17.4%) directions. The above contour plots show that:

- The prevailing wind mainly approaches from the ENE and E directions;
- The existing dense building developments in the upwind regions, such as Fu Cheong Estate and Wing Cheung Estate, shield the approaching winds;
- Relatively similar ventilation performance is observed between the two schemes;
- The high-rise residential Block 5 in the Baseline Scheme induces a slightly larger wake zone in the leeward region at some of the localized area on Lin Cheung Road as compared with the Proposed Scheme;
- The wider building separations between SWF and Block 5 under Baseline Scheme facilitate wind penetration from Sham Mong Road to the NW part of Lin Cheung Road and enhance the VR of that area; and
- The wider building separations between Blocks 3 and 4 under the Proposed Scheme facilitate wind penetration from Sham Mong Road to the SE part of Lin Cheung Road and enhance the VR of that area under NNE, NE, ENE and E wind conditions.
- The mid-rise GIC block under Proposed Scheme allow annual prevailing wind skim over the GIC block and toward the pedestrian level at bus depot under NE condition.

4.2 Summer Overall Pattern of Ventilation Performance

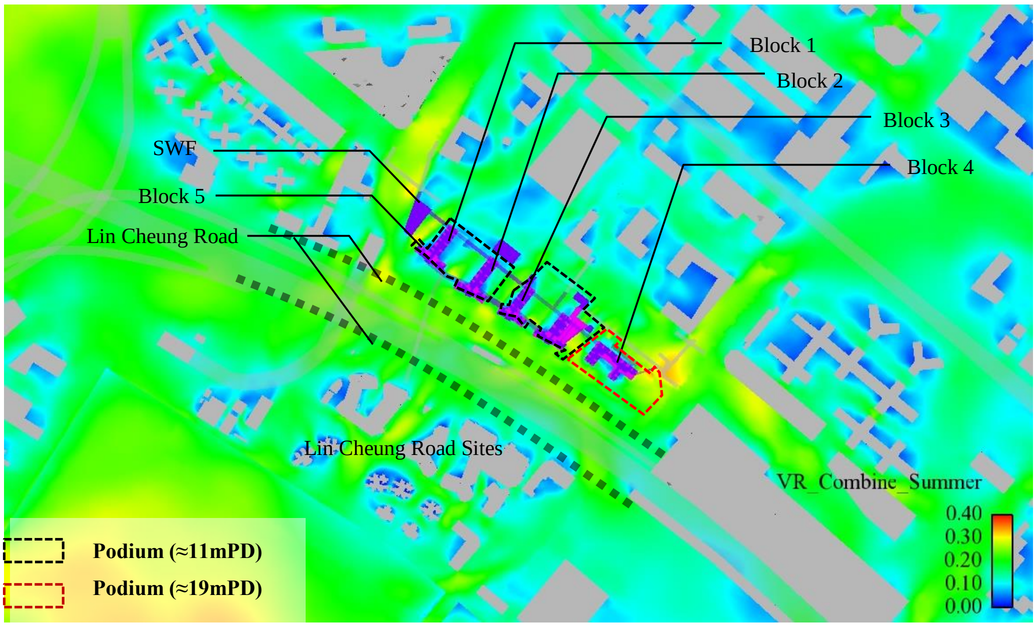


Figure 20 Contour Plot of Summer Average VR at 2m Pedestrian Level for Baseline Scheme

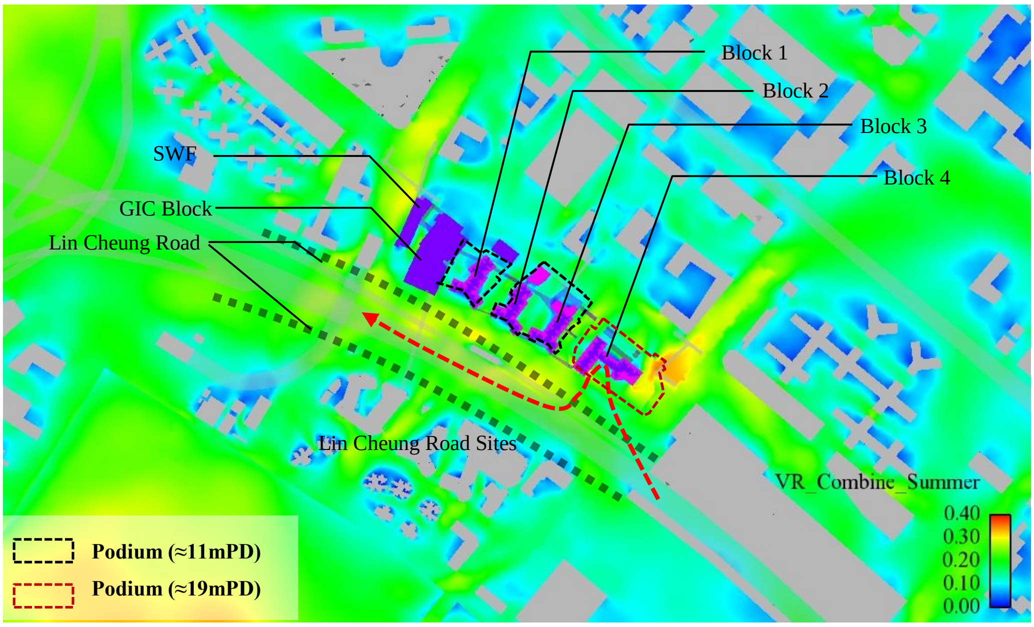


Figure 21 Contour Plot of Summer Average VR at 2m Pedestrian Level for Proposed Scheme

For the summer condition, nine wind cases were chosen, accumulating to 77.1% in occurrence frequency. The integration of the effect of these winds indicates the overall wind ventilation performance. During the summer, including June to August, the summer prevailing wind is dominated by E (11.5%) and SW (9.9%) winds. The above contour plots show that:

- The overall ventilation performance of the Baseline Scheme and Proposed Scheme is quite similar to one another;
- Summer prevailing wind mainly comes from the waterfront through Lin Cheung Road Sites 3 & 5 under S (7.9%), SSW (8.8%) and SW (9.9%) wind conditions;
- The low-rise GIC Block under Proposed Scheme allows summer prevailing wind skim over atop and ventilate the leeward regions, such as Yuen Fat Godown Carpark and FTSW under SSW, SW and WSW wind conditions;
- The wider building separations between SWF and Block 5 under Baseline Scheme facilitate wind penetration from Lin Cheung Road to the NW part of Sham Mong Road and enhance the VR of that area under SW, WSW and W wind conditions;
- The wider building separations between Blocks 3 and 4 under the Proposed Scheme facilitate wind penetration from of Lin Cheung Road to the Sham Mong Road near School Site and enhance the VR of those areas under S and SSW wind conditions; and
- The wider and taller building façade of Block 4 under the Proposed could capture more downwash wind to the pedestrian level of Lin Cheung Road and slightly enhances the ventilation of that area (red arrow in Figure 21).

5.1 SVR and LVR

The average Velocity Ratios of all test points are extracted. The results of all test points are presented in the Appendix A. According to the Technical Circular, the Velocity Ratio at each test point is assessed and the SVR and the LVR under the prevailing winds are determined and reported to assess the impact of the Proposed Development schemes to the wind environment. The SVR and LVR value of the test points are summarized as follows,

Table 5 Annual SVR and LVR of the Assessment Area for the Development Schemes

Annual	Baseline Scheme	Proposed Scheme
SVR	0.14	0.16
LVR	0.13	0.13

Table 6 Summer SVR and LVR of the Assessment Area for the Development Schemes

Summer	Baseline Scheme	Proposed Scheme
SVR	0.21	0.21
LVR	0.18	0.18

5.1.1 Site Air Ventilation Assessment

Under annual wind condition, the SVR for Baseline Scheme is 0.14 and the SVR for Proposed Scheme is 0.16. Under summer wind condition, the SVR for Baseline Scheme and Proposed Scheme is 0.21, respectively. The results indicate the Proposed Scheme achieve a better ventilation performance at the immediate surroundings of the developments under annual condition.

5.1.2 Local Air Ventilation Assessment

The LVR under annual wind condition for Baseline Scheme and Proposed Scheme is 0.13, respectively. The LVR under summer wind condition for Baseline Scheme and Proposed Scheme is 0.18. The results similar ventilation performance is achieved for local surroundings under both annual and summer condition.

5.2 Directional Analysis

5.2.1 NNE Wind Direction

The NNE wind contributes 7.5 % of the annual wind rose. The contour plots of VR value for Baseline Scheme and Proposed Scheme are shown in Figure 22 and Figure 23 respectively. The overall ventilation performance under NNE wind can be summarized as below:

- The majority of wind enters the site from Hing Wah Street West under both schemes.
- A slightly higher VR is found at NW part of Lin Cheung Road under Proposed Scheme
- A slightly higher VR is observed at the leeward side of SWF Bock under Baseline Scheme

Due to a larger building separation between SWF Block and Block 5 under Baseline Scheme, a portion of wind would flow through this gap and towards waterfront. On the other hand, narrower building separation between SWF and GIC Block, together with a building setback at podium level from Shum Mong Road in SWF Block under Proposed Scheme, more wind at podium level would divert to Hing Wah Street West and results a better ventilation performance. (Figure 26 and Figure 27).

As compared with the Baseline Scheme, a slightly larger building separation between Block 3 and 4 under Proposed Scheme would allow more prevailing wind flow across the Development and enhance the ventilation performance at SE part of Lin Cheung Road, which in that area (red arrow in Figure 23).

On the other hand, the building separation between SWF Block and Block 1 is slightly larger under Baseline Scheme, which allows more wind from Shum Mong Road penetrate to the immediate leeward region of SWF Block.

At the same time, a larger and taller building Block 5 create a larger low pressure zone at the leeward side at Lin Cheung Road. This low pressure zone will attract the air stream from building separation between Block 1 and 2 towards more westerly direction (black arrow in Figure 22). While the wind from Block 1 and 2 would flow towards waterfront area through the district wind corridor under Proposed Scheme (purple arrow in Figure 23).

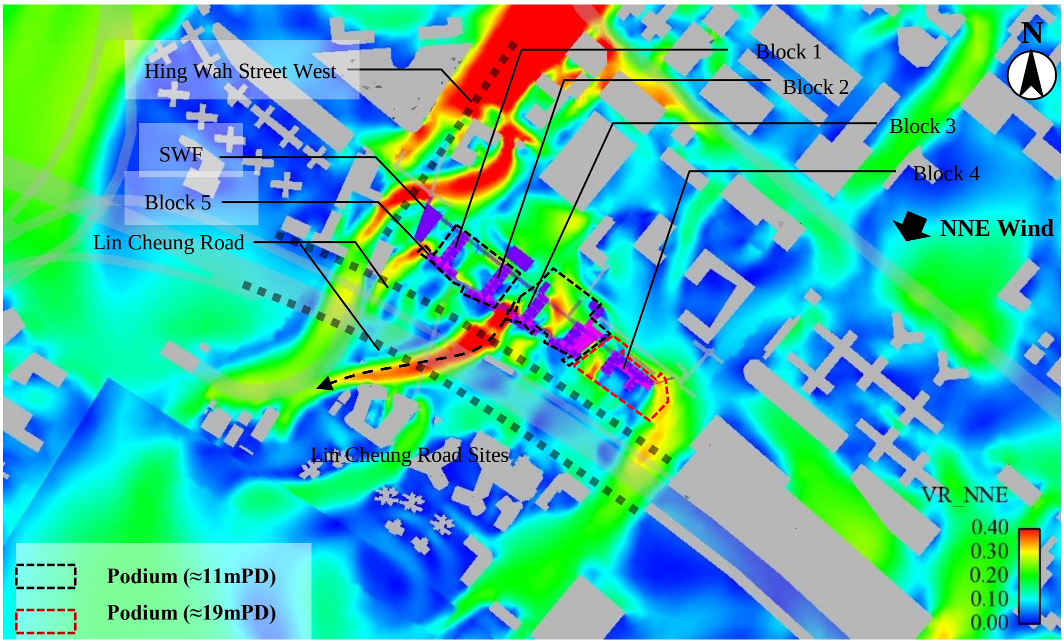


Figure 22 VR Contour Plot under NNE Wind of Baseline Scheme

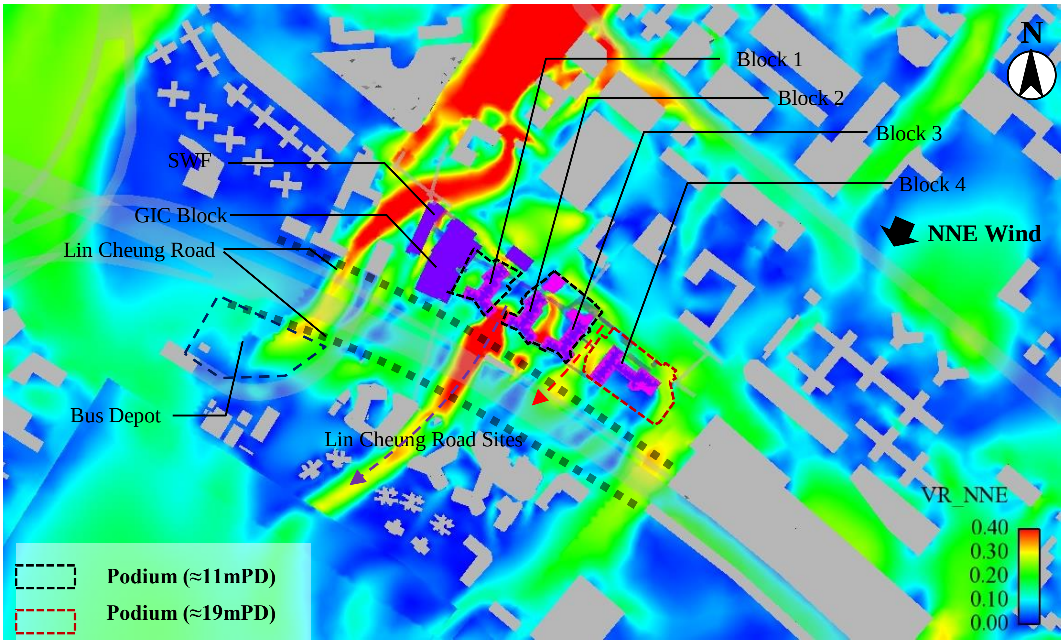


Figure 23 VR Contour Plot under NNE Wind of Proposed Scheme

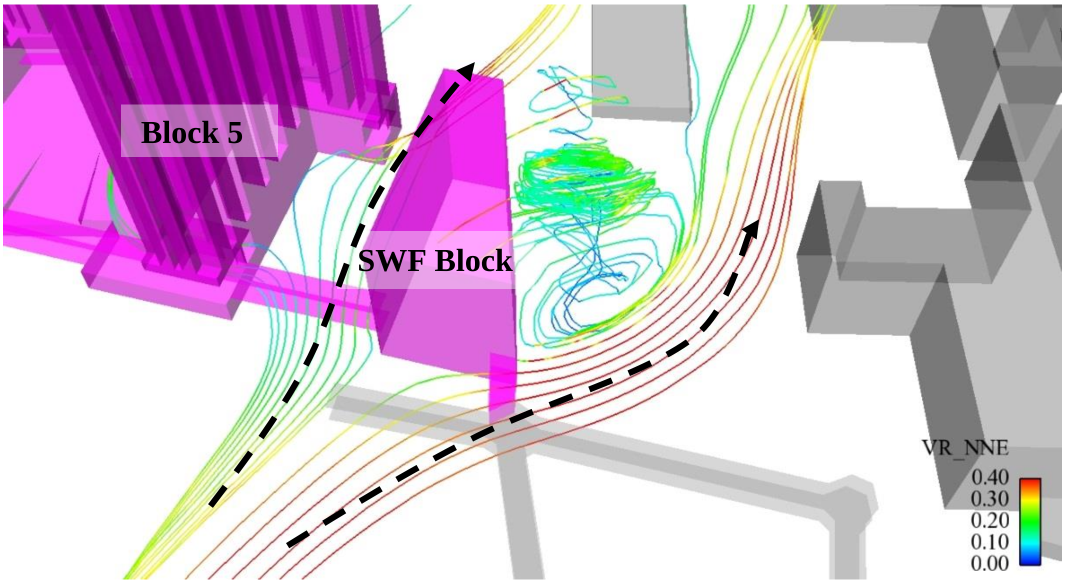


Figure 24 Streamline Plot near SWF Block under NNE Wind of Baseline Scheme

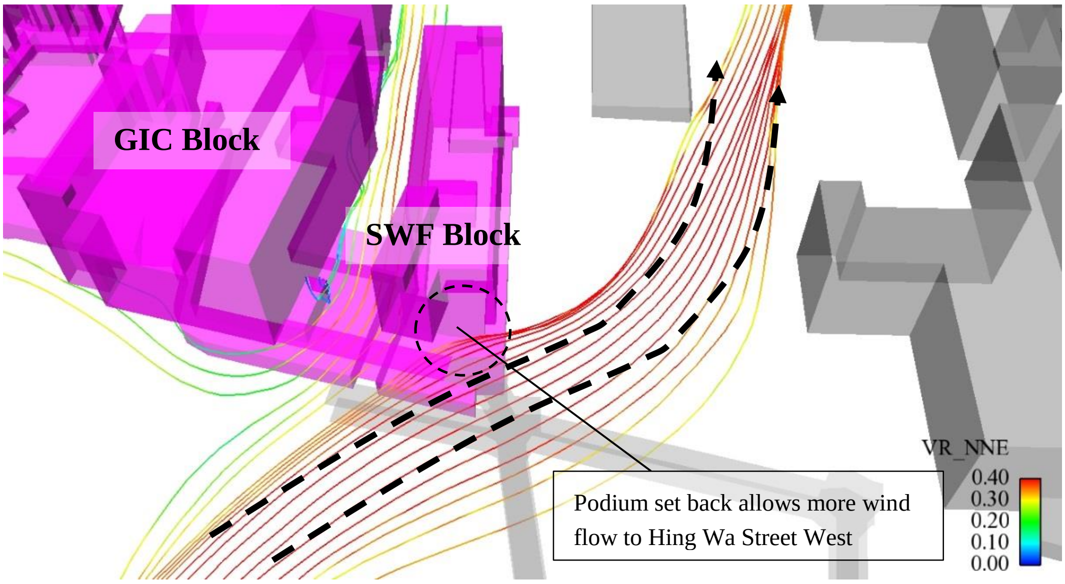


Figure 25 Streamline Plot near SWF Block under NNE Wind of Proposed Scheme

5.2.2 NE Wind

The NE wind contributes 10.1 % of the annual wind rose. The contour plots of VR value for Baseline Scheme and Proposed Scheme are shown in Figure 26 and Figure 27 respectively. The overall ventilation performance under NE wind can be summarized as below:

- Higher VR are found at Hing Wah Street West and Tonkin Street West under both scheme.
- Higher VR is found at Sham Mong Road and School Site area under Proposed Scheme.
- A slightly higher VR is observed at SE portion of Lin Cheung Road and Bus Depot under Proposed Scheme.

As compared with the Baseline Scheme, a higher VR is found along the Sham Mong Road under Proposed Scheme. The taller and wider Block 4 of the Proposed Scheme is more effective in terms of inducing downwash effect to Sham Mong Road and resulting in higher VR along the Road, as well as the School Site area (black arrow in Figure 27). For the Baseline Scheme, the downwash effect is less effective due to smaller building frontage and height.

Similar to NNE wind, narrower building separation between SWF and GIC Block, together with a building setback from Shum Mong Road in SWF Block under Proposed Scheme, more wind would divert to Hing Wah Street West and results a better ventilation performance (red arrow in Figure 27).

The ventilation performance of SE part of Lin Cheung Road is slightly better in the Proposed Scheme than the Baseline Scheme. The large building separation between Blocks 3 & 4 of the Proposed Scheme enhances the wind permeability and facilitate wind penetrate from Sham Mong Road to Lin Cheung Road (purple arrow in Figure 27). Thus, the aforementioned area has a slightly higher VR under the Proposed Scheme.

The building separation between SWF – Block 5 and Block 5 – Block 1 is wider under Baseline Scheme. More NE wind from Shum Mong Road will flow through these separations and results a slight higher VR at the immediate leeward regions of SWF and Block 5 (red arrow in Figure 26).

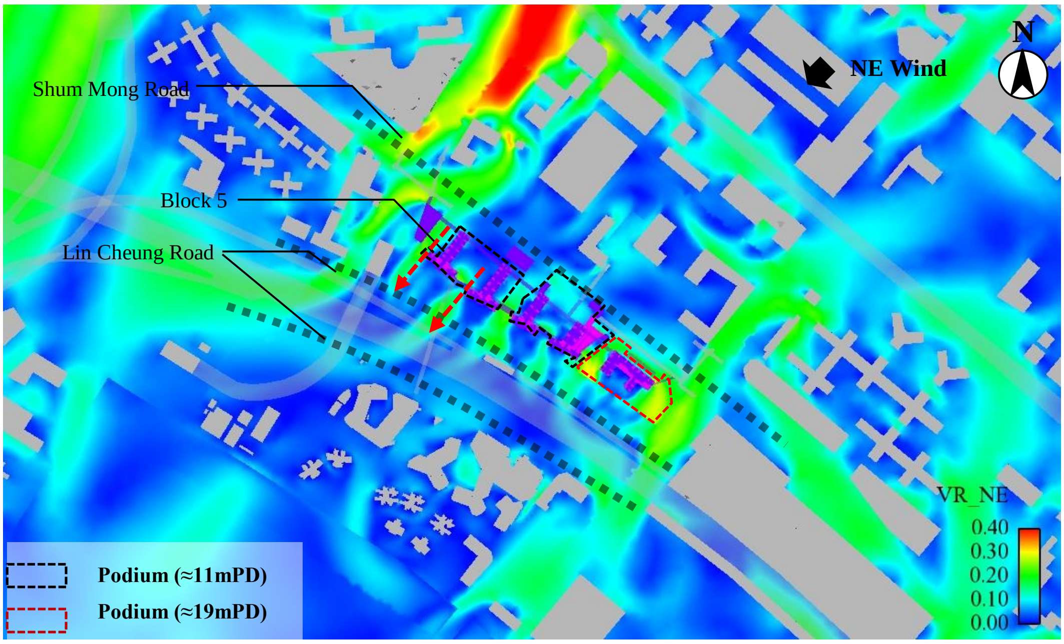


Figure 26 VR Contour Plot under NE Wind of Baseline Scheme

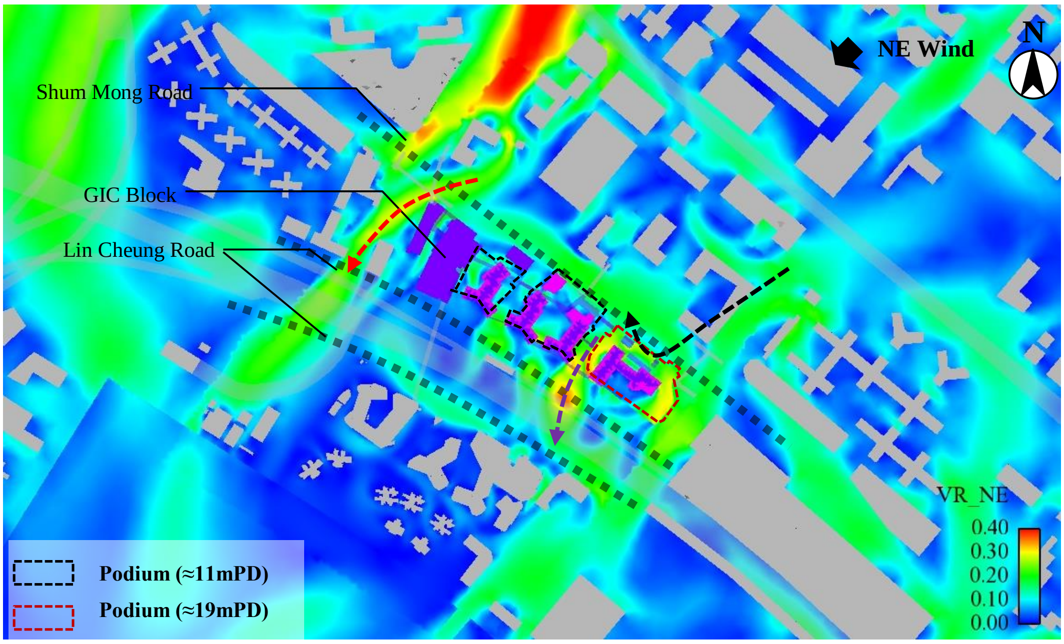


Figure 27 VR Contour Plot under NE Wind of Proposed Scheme

5.2.3 ENE Wind

The ENE wind contributes 17.4 % of the annual wind rose. The contour plots of VR value for Baseline Scheme and Proposed Scheme are shown in Figure 28 and Figure 29 respectively. The overall ventilation performance under ENE wind can be summarized as below:

- Higher VR are found at Hing Wah Street West and Tonkin Street West under both scheme.
- A slightly higher VR is found at Sham Mong Road and SE part of Lin Cheung Road under Proposed Scheme.
- A slightly worsen ventilation is found at the leeward side of GIC Block and Block 1 under Proposed Scheme.

Similar to NE wind, the larger building separation between Blocks 3 and 4 under Proposed Scheme facilitate wind penetrates from Sham Mong Road to SE part of Lin Cheung Road, which enhance the ventilation performance in that area (purple arrow in Figure 29). Also, the taller and wider Block 4 of the Proposed Scheme is more effective on downwash the prevailing wind to Sham Mong Road (black arrow in Figure 29). In this connection, both Sham Mong Road and SE part of Lin Cheung Road achieved a slightly higher VR under the Proposed Scheme.

On the other hand, the larger building separation between Blocks 1 and 5 under Baseline Scheme is more effective in terms of wind penetration from the NW part of Sham Mong Road to the Lin Cheung Road (Orange arrow in Figure 28). For the Proposed Scheme, the building separation between the GIC and Block 1 is less effective under this prevailing wind direction, while a larger wake zone is observed at the NW part of Lin Cheung Road.

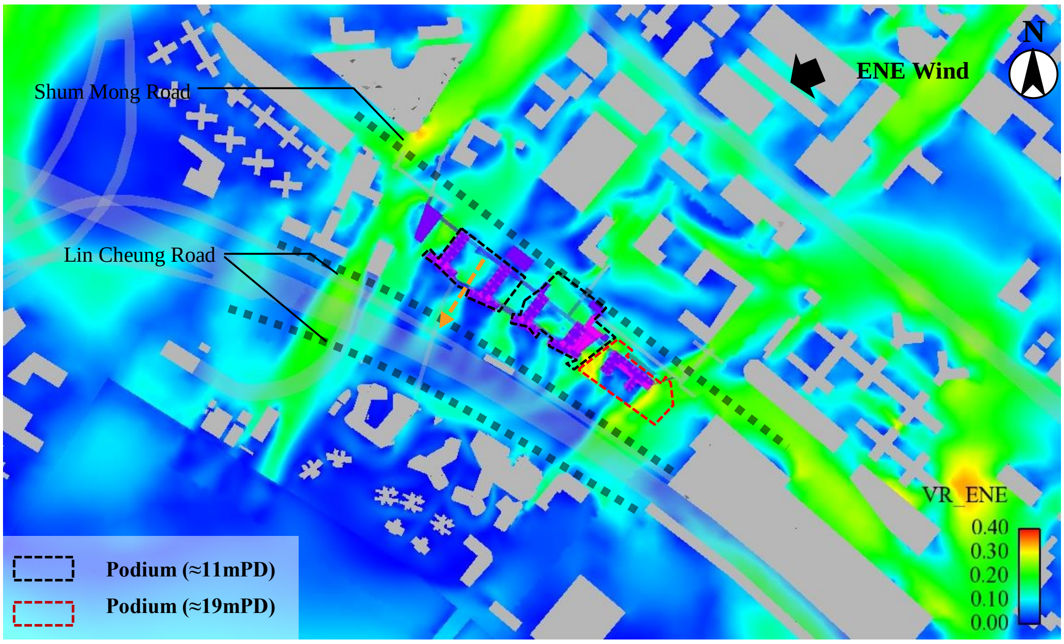


Figure 28 VR Contour Plot under ENE Wind of Baseline Scheme

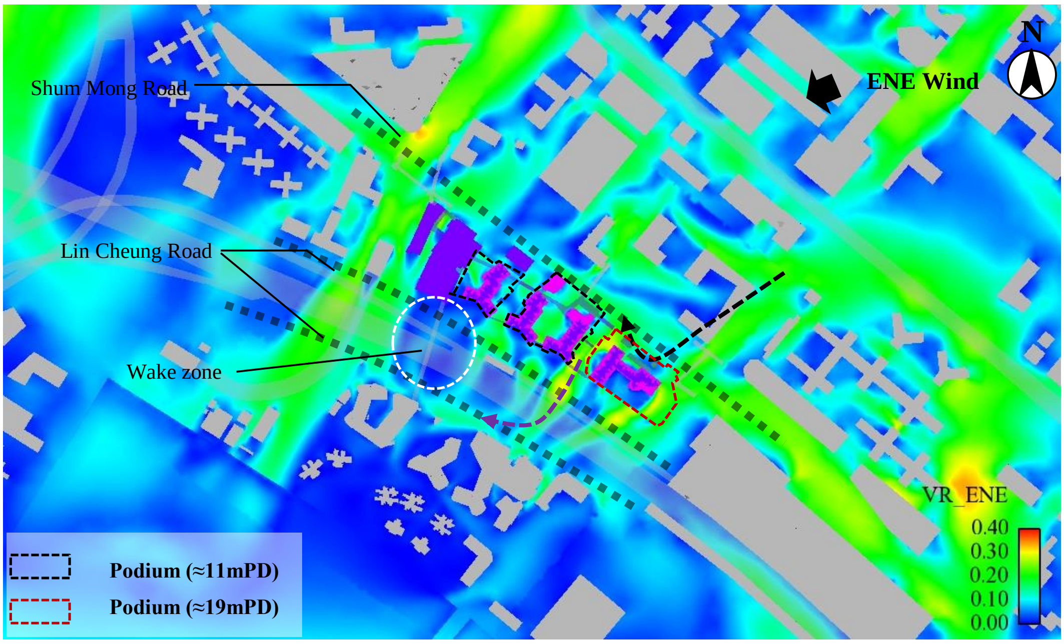


Figure 29 VR Contour Plot under ENE Wind of Proposed Scheme

5.2.4 E Wind

The E wind contributes 16.6 % and 11.5 % of the annual and summer wind rose, respectively. The contour plots of VR value for Baseline Scheme and Proposed Scheme are shown in Figure 30 and Figure 31 respectively. The overall ventilation performance under E wind can be summarized as below:

- The ventilation performance of the upwind surrounding developments are quite similar.
- Higher VR are observed at Tonkin Street West and Hing Wah Street West under both schemes.
- A slightly higher VR is observed at S part of Lin Cheung Road under Proposed Scheme.

The wider building separation between Blocks 3 and 4 under Proposed Scheme allow more wind penetrates to the S part of Lin Cheung Road. Thus, a relatively higher VR is observed at this area under Proposed Scheme (purple arrow in Figure 31).

The building separation between SWF Block and Block 5 under Baseline Scheme is also wider than Proposed Scheme, which facilitate more wind penetration towards NW part of Lin Sheung Road (Black arrow in Figure 30). The air steam joined the Hing Wah Street West air path (Red arrow in Figure 30) and travels toward SSW direction towards Bus Depot. For the Bus Depot, the wind upcoming wind comes from Hing Wah Street West under Baseline Scheme and Lin Cheung Road under Proposed Scheme. Therefore, the wind resources are similar and the VR results are comparable.

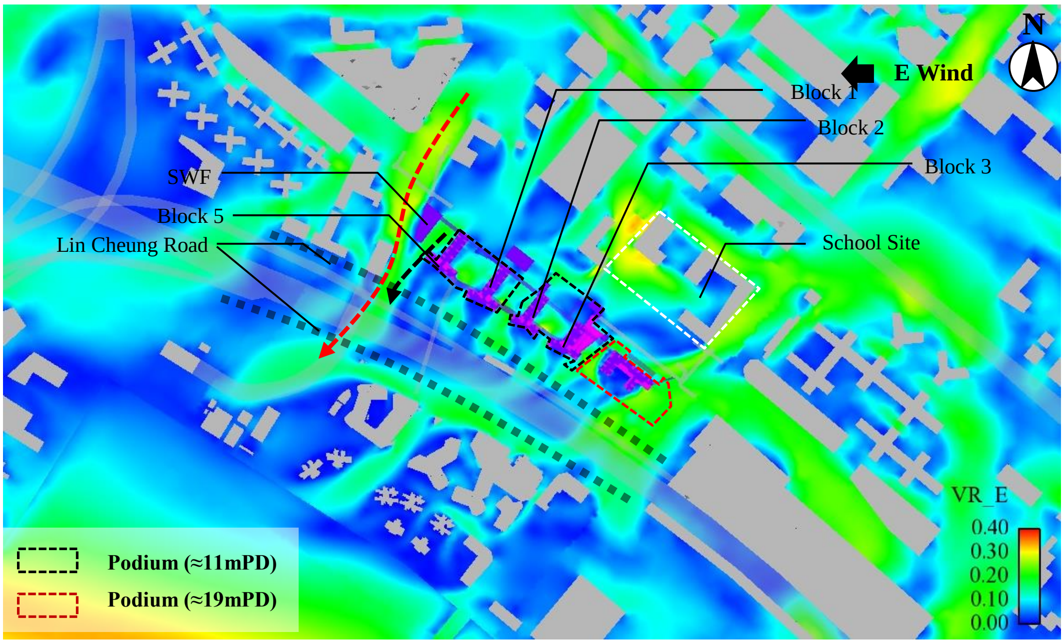


Figure 30 VR Contour Plot under E Wind of Baseline Scheme

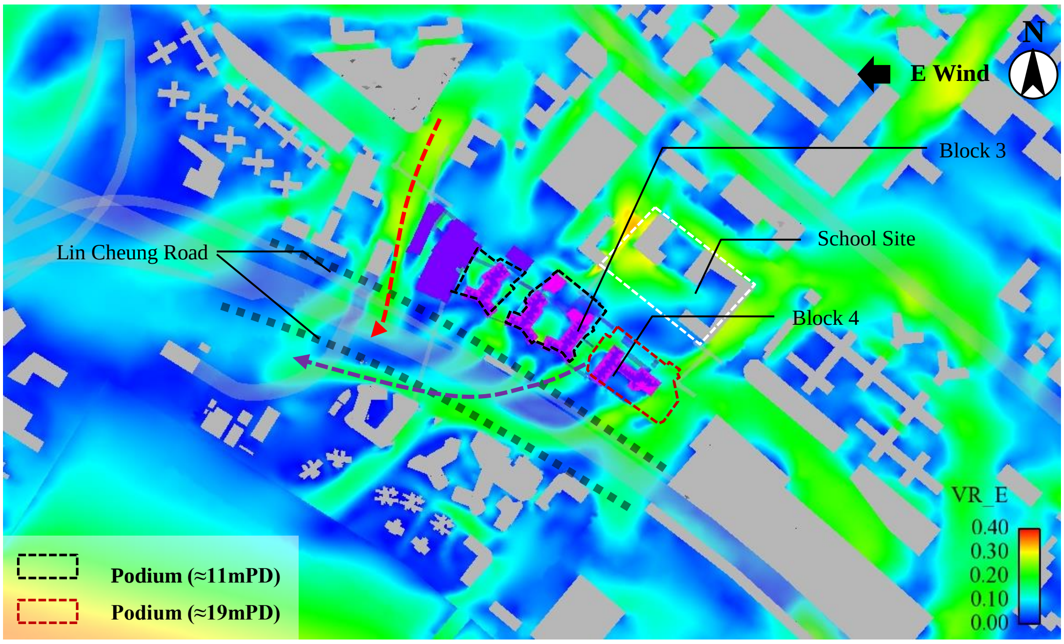


Figure 31 VR Contour Plot under E Wind of Proposed Scheme

5.2.5 ESE Wind Direction

The ESE wind contributes 8.4 % and 9.5 % of the annual and summer wind rose, respectively. The contour plots of VR value for Baseline Scheme and Proposed Scheme are shown in Figure 32 and Figure 33 respectively. The overall ventilation performance under ESE wind can be summarized as below:

- The overall ventilation performance is similar for both schemes except Lin Cheung Road.
- A slightly higher VR is observed at Lin Cheung Road under Proposed Scheme.

The approaching wind reaching to the site mainly comes from Shum Mong Road under both schemes (black arrow in Figure 32 and Figure 33). A larger building separation between Block 3 and 4 under Proposed Scheme allows more wind divert from Shum Mong Road to Lin Cheung Road (red arrow in Figure 33), resulting a relatively better ventilation performance at Lin Cheung Road under Proposed Scheme. Moreover, the high rise Block 5 under Baseline Scheme create a larger wake zone at the immediate leeward area near NW part of Lin Cheung Road when compared with the Proposed Scheme.

In contract, more wind would flow from Shum Mong Road to Lin Cheung Road through the larger building gap between SWF Block and Block 5 under Baseline Scheme Road (red arrow in Figure 32). This results a higher VR at the localised area of Lin Cheung Road near the SWF Block.

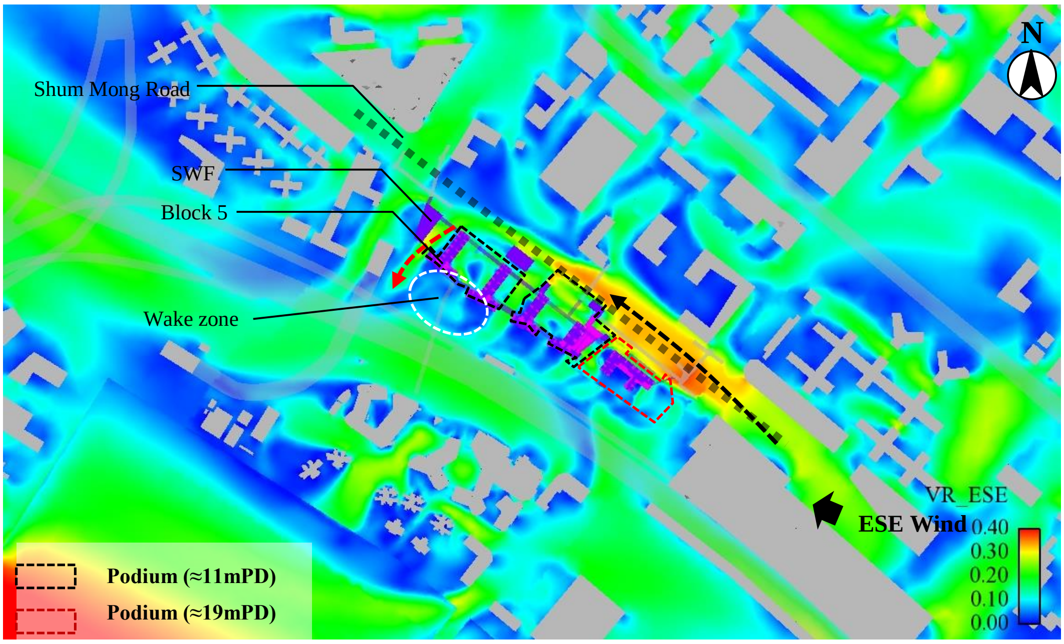


Figure 32 VR Contour Plot under ESE Wind of Baseline Scheme

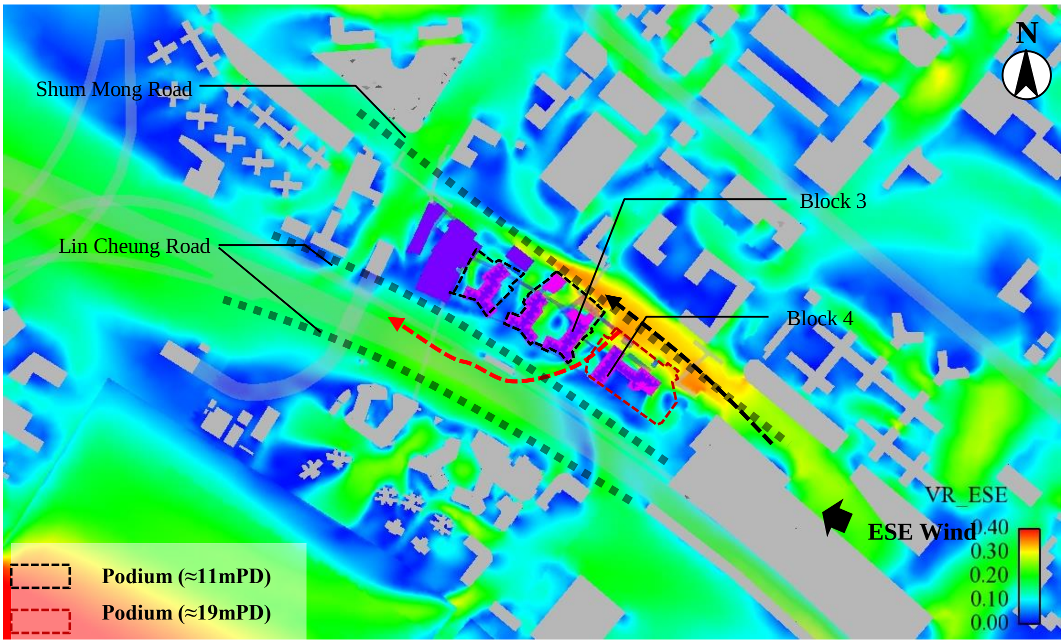


Figure 33 VR Contour Plot under ESE Wind of Proposed Scheme

5.2.6 SE Wind Direction

The SE wind contributes 5.9 % and 9.3 % of the annual and summer wind rose, respectively. The contour plots of VR value for Baseline Scheme and Proposed Scheme are shown in Figure 34 and Figure 35 respectively. The overall ventilation performance under SE wind can be summarized as below:

- The prevailing wind enters the project site from Shum Mong Road.
- A slightly higher VR is observed at part of the Lin Cheung Road near Site 6 under Proposed Scheme.

The approaching wind from Shum Mong Road would flow through SWF Block and Block 5 due to wider wind entrance and towards the NW side of Lin Cheung Road under Baseline Scheme and resulting a slightly higher VR result at the leeward region (red arrow in Figure 34). For Proposed Scheme, the gap between SWF and GIC Block is less effective for ventilation.

In the Proposed Scheme, the southern frontage of residential buildings would capture SE wind divert to Lin Cheung Road and further flow towards the west side (red arrow in Figure 35). Thus, a higher VR value is observed along Lin Cheung Road under Proposed Scheme.

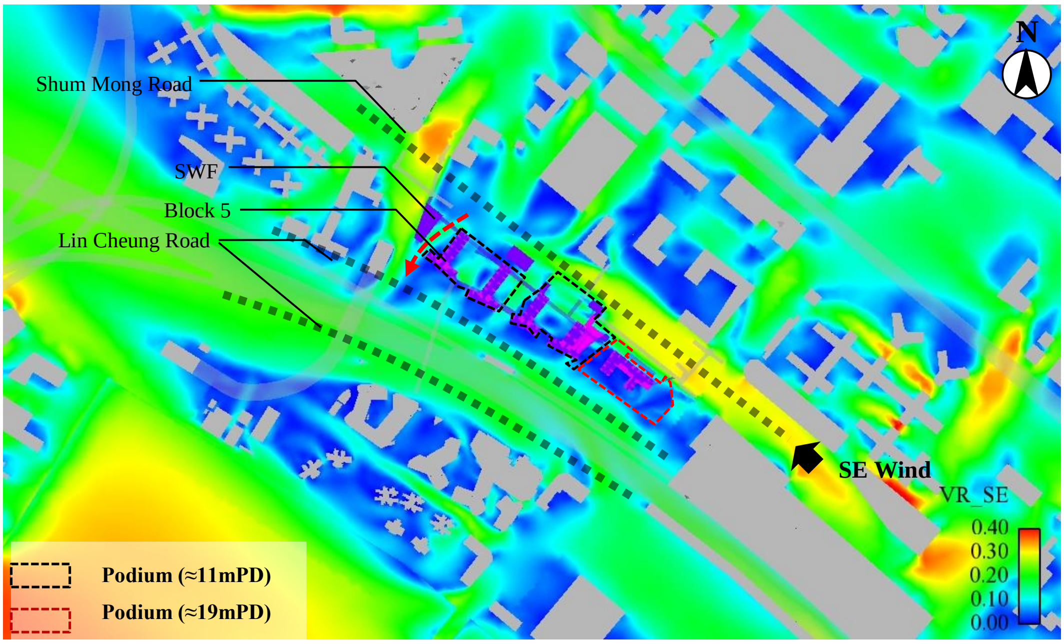


Figure 34 VR Contour Plot under SE Wind of Baseline Scheme

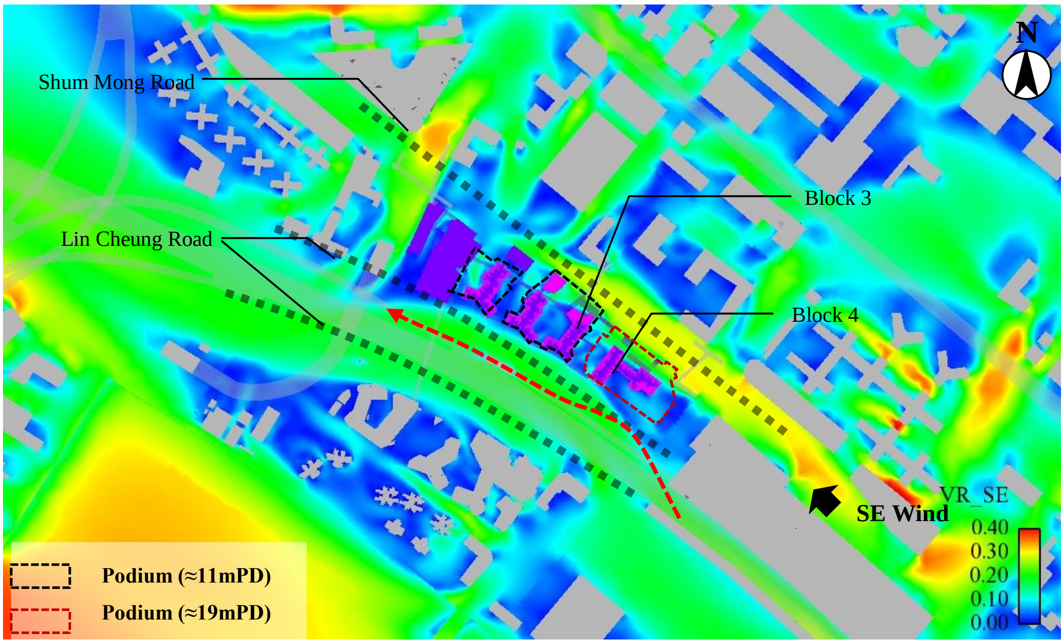


Figure 35 VR Contour Plot under SE Wind of Proposed Scheme

5.2.7 SSE Wind Direction

The SSE wind contributes 5.9 % and 8.3 % of the annual and summer wind rose, respectively. The contour plots of VR value for Baseline Scheme and Proposed Scheme are shown in Figure 36 and Figure 37 respectively. The overall ventilation performance under SSE wind can be summarized as below:

- A higher VR is found at Lin Cheung Road under Proposed Scheme
- A slightly higher VR is observed at localized area of Shum Mong Road near School site under Proposed Scheme.
- A slightly higher VR is observed at localized area of Shum Mong Road near Carpark under Baseline Scheme.

The stagger aligment between Block 3 and 4 under Baseline Scheme would cause a portion of wind from Lin Cheung Road diverted by Block 3 and flow through the building separation between Block 3 and 4 and towards Shum Mong Road (black arrow in Figure 36). Thus, Shum Mong Road near the FTSW Development has better VR result. While under Proposed Scheme, less wind would flow through this building separation. Instead, more wind would flow towards Lin Cheung Road and thus results a slightly higher ventilation performance (black arrow in Figure 37).

Block 4 in the Proposed Scheme has a taller building height and a larger building frontage facing the SE direction as compared to Baseline Scheme. More downwash wind would introduces and down to Shum Mong Road (red arrow in Figure 37 and Figure 38).

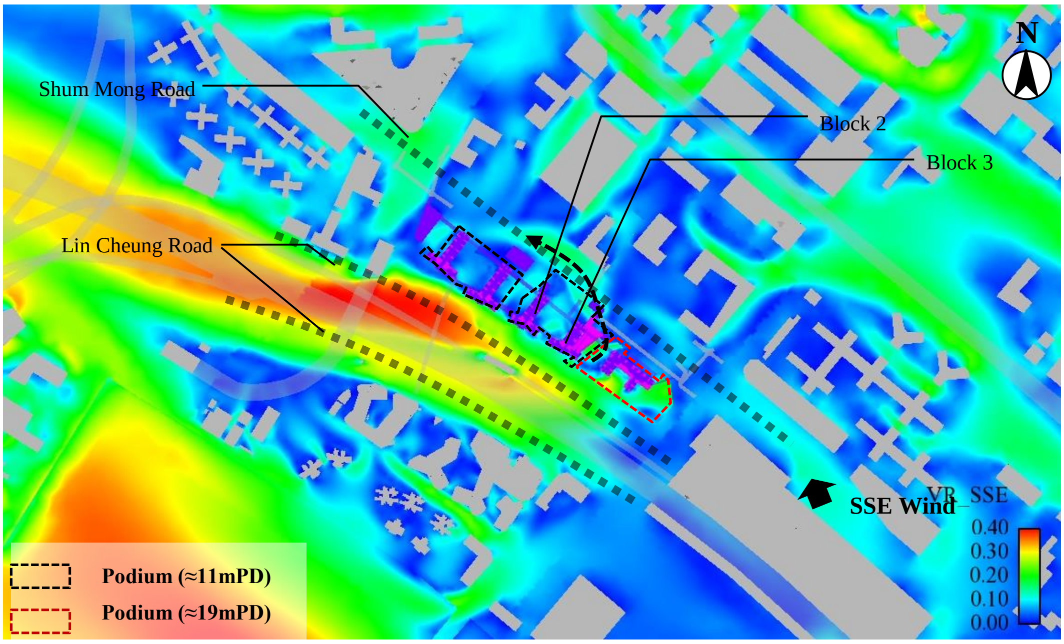


Figure 36 VR Contour Plot under SSE Wind of Baseline Scheme

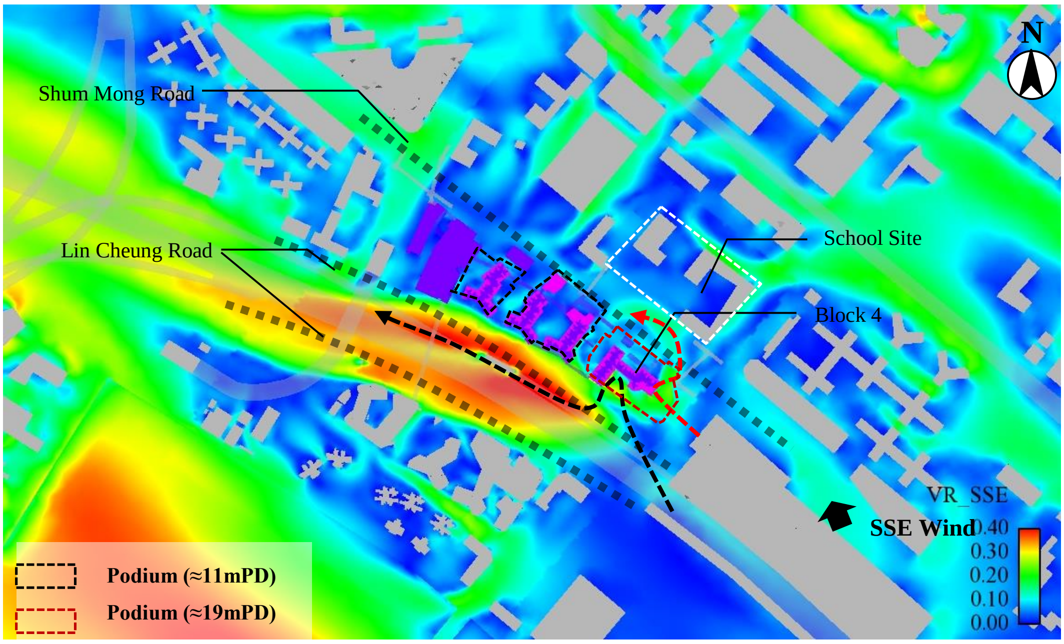


Figure 37 VR Contour Plot under SSE Wind of Proposed Scheme

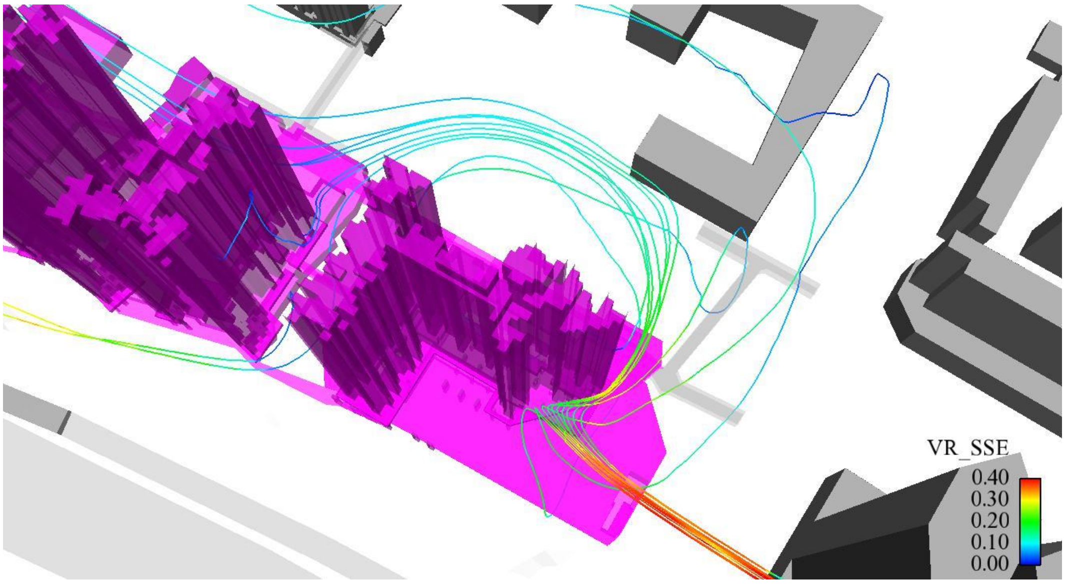


Figure 38 Streamline Plot Showing Downwash Effect to Shum Mong Road

5.2.8 S Wind Direction

The S wind contributes 4.9 % and 7.9 % of the annual and summer wind rose, respectively. The contour plots of VR value for S are shown in Figure 39 and Figure 40. The overall ventilation performance under S winds can be summarized as below:

- The prevailing wind enters the project site from the waterfront.
- A higher VR is found at Hing Wah Street West and Tak Ching Girls' Secondary School under Proposed Scheme
- A higher VR is found at Ying Wa College School Site area under Proposed Scheme
- A higher VR is observed at Tonkin Street West under Proposed Scheme

The lower GIC block under Proposed Scheme allows mid level wind skim over the GIC block and downwash to Hing Wah Street West and thus further divert to northern portion of Tak Ching Girls' Secondary School (red arrow in Figure 40).

Under the Baseline Scheme, Block 4 provide more setback from Tonkin Street West as compared with Proposed Scheme. The incoming wind would penetrate through the Development and towards north direction (green arrow in Figure 39 and Figure 43) at mid and high level.

For the Proposed Scheme, the larger and taller building frontage of Block 3 facilitate the capture of the incoming wind and further divert towards the North Kowloon Law court at mid and high level (black arrow in Figure 40 and Figure 42). Together with the slightly larger building frontage of Block 4 of the Development, wind would flow towards North Kowloon Law court direction (green arrow in Figure 40). The high-rise North Kowloon Law court then downwash the incoming wind and leads to a higher VR along Ying Wa Street under Proposed Scheme.

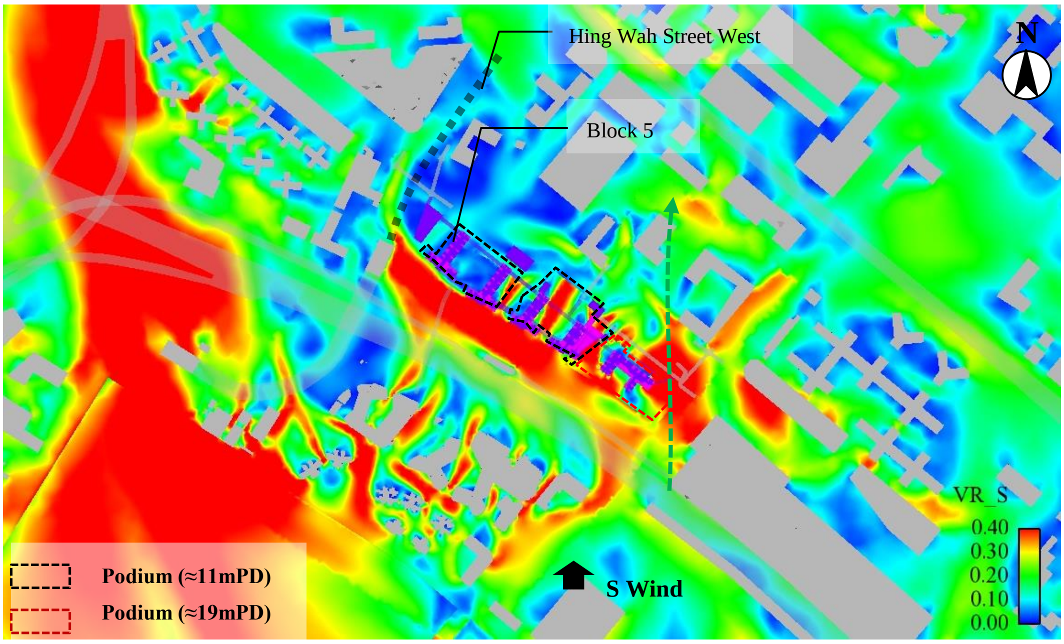


Figure 39 VR Contour Plot under S Wind of Baseline Scheme

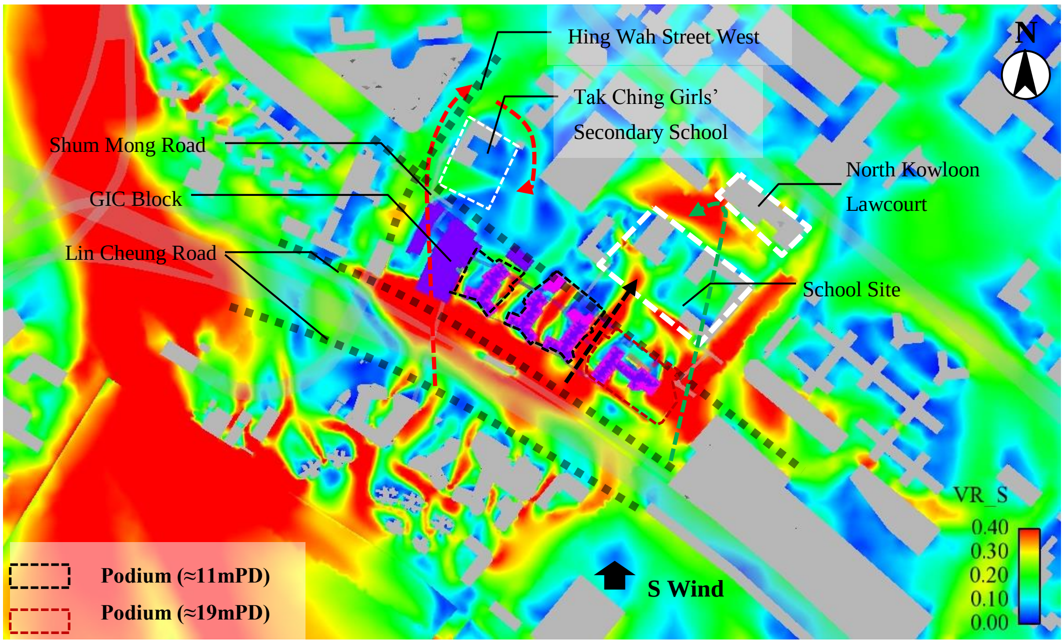


Figure 40 VR Contour Plot under S Wind of Proposed Scheme

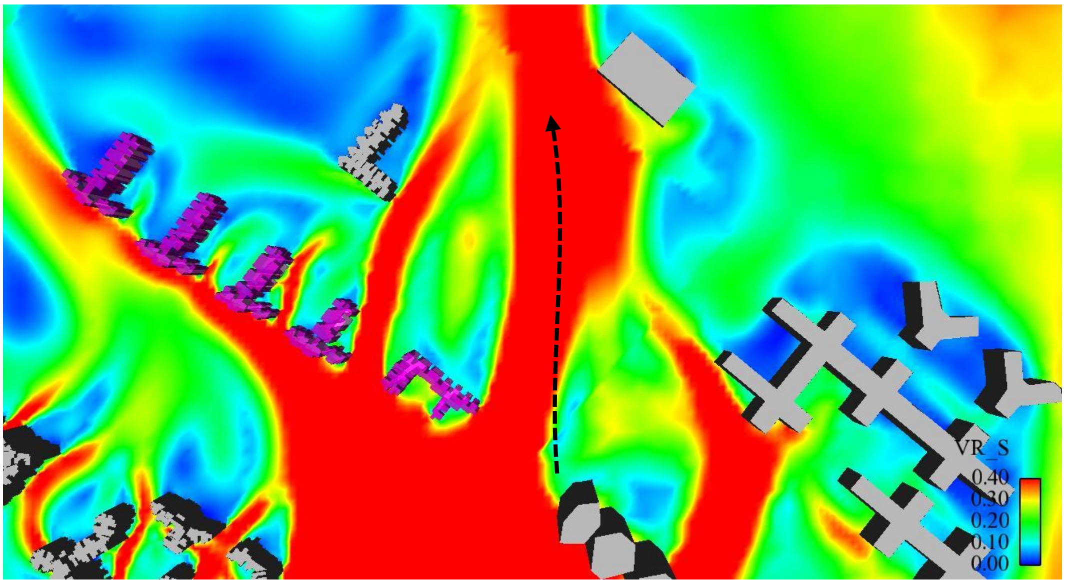


Figure 41 VR Contour Plot under S Wind of Baseline Scheme at Mid-level

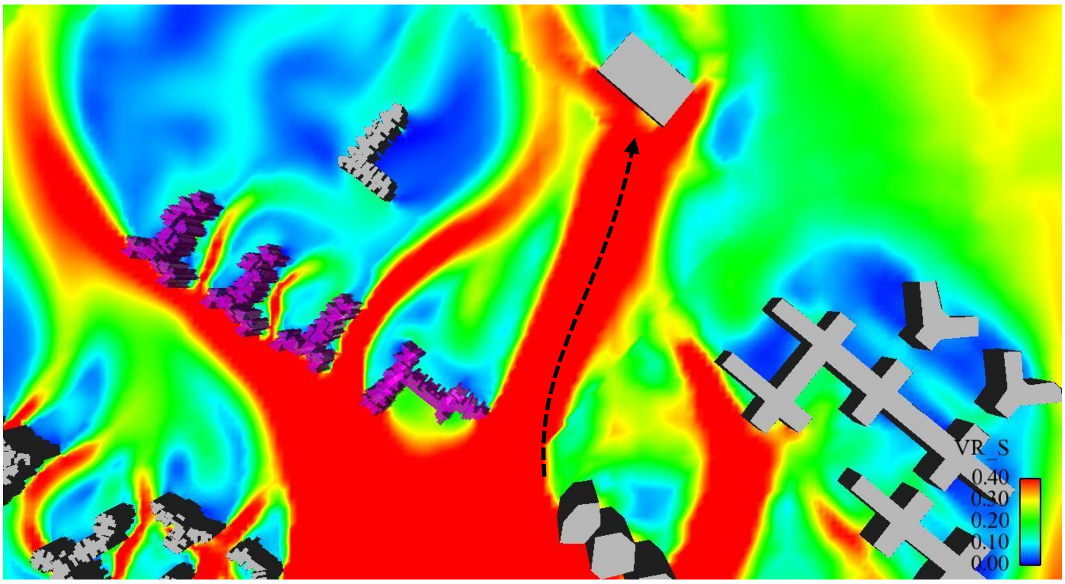


Figure 42 VR Contour Plot under S Wind of Proposed Scheme at Mid-level

5.2.9 SSW Wind Direction

The SSW wind contributes 8.8 % of the summer wind rose. The contour plots of VR value for SSW are shown in Figure 43 and Figure 44. The overall ventilation performance under SSW winds can be summarized as below:

- The prevailing wind mainly enters the project site from the waterfront through Lin Cheung Road Site Development.
- Higher VR is observed at Yuen Fat Godown Carpark and School Site under Proposed Scheme.
- A higher VR is found at Ying Wa Street under Baseline Scheme

Ying Wa Street also has a slightly higher VR under Baseline Scheme. This is due to the building block of Block 3 and 4 has a lower height, which allow high level wind skim over and downwash to Ying Wa Street resulting a higher VR result under Baseline Scheme (black arrow in Figure 43).

The mid-rise GIC Block of the Proposed Scheme allows the incoming wind skim over atop and downwashed to the Yuen Fat Godown Carpark and then further travel along FTSW (black arrow in Figure 44). On the contrary, the Block 5 of the Baseline Scheme is taller. It would shield the incoming wind and induce wind shadow at the Yuen Fat Godown Carpark. The larger building separation between Blocks 3 and 4 of the Proposed Scheme also facilitate the incoming wind penetrates from Lin Cheung Road to Sham Mong Road and further travel through the School Site (purple arrow in Figure 44). In this connection, Yuen Fat Godown Carpark, FTSW and School Site would achieved a slightly higher VR under Proposed Scheme.

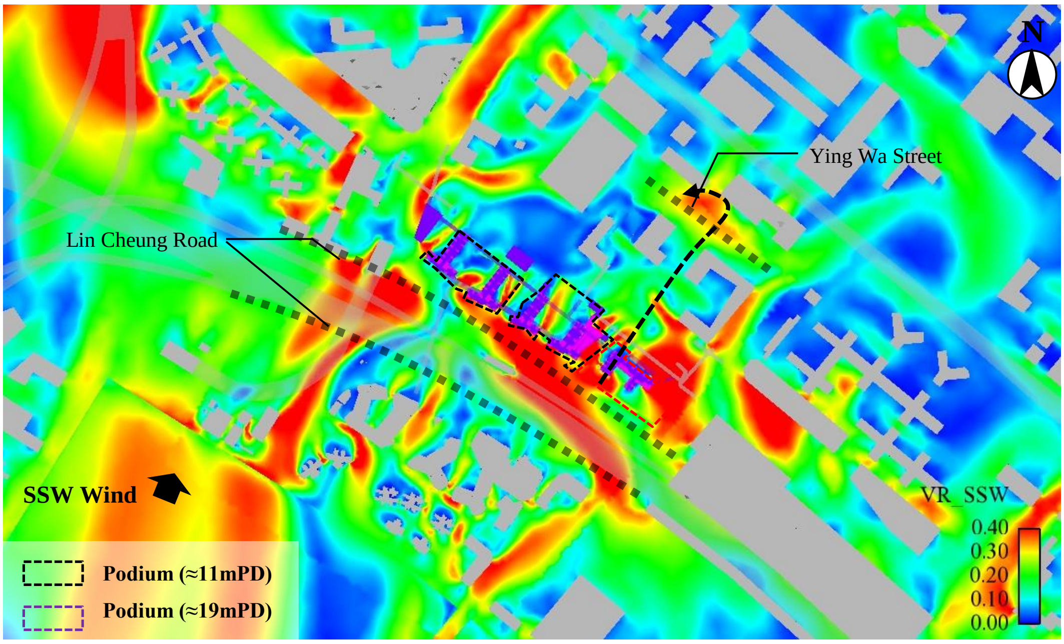


Figure 43 VR Contour Plot under SSW Wind of Baseline Scheme

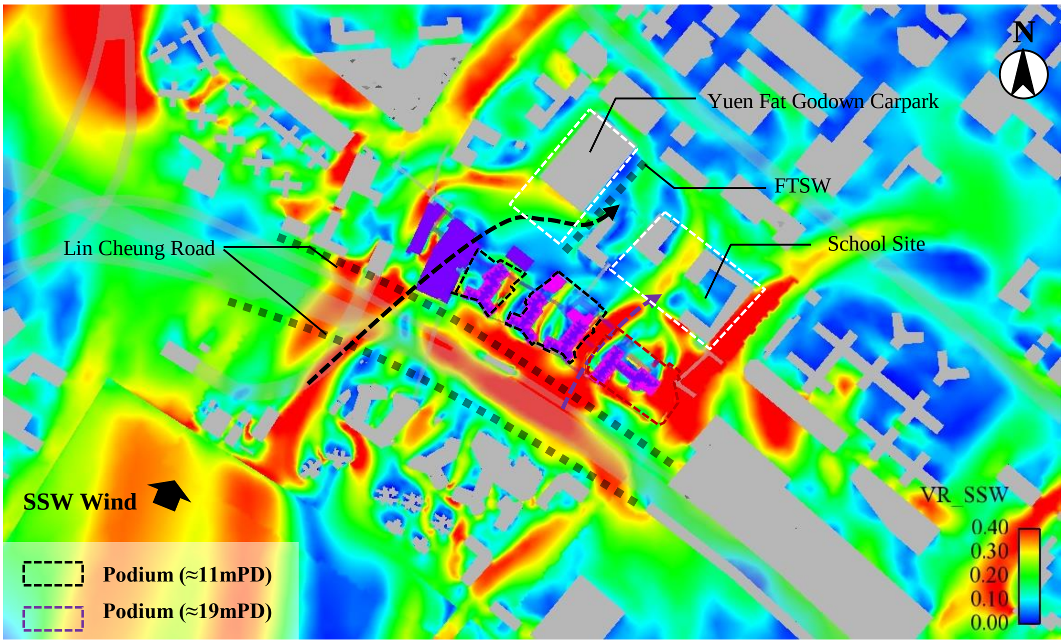


Figure 44 VR Contour Plot under SSW Wind of Proposed Scheme

5.2.10 SW and WSW Wind Direction

The SW and WSW wind contributes 9.9 % and 7.2 % of the summer wind rose respectively. The contour plots of VR value for Baseline Scheme and Proposed Scheme are shown in Figure 45 through Figure 48 respectively. The overall ventilation performance under SW & WSW wind can be summarized as below:

- The prevailing wind enters the project site from the waterfront.
- A slightly higher VR is observed at Yuen Fat Godown Carpark and FTSW under Proposed Scheme.
- A slightly higher VR is found at Sham Mong Road under Baseline Scheme.

The wider building separation at SWF - Block 5, Blocks 1 - 5 and Blocks 2 - 3 under Baseline Scheme facilitates the wind penetration from Lin Cheung Road to Sham Mong Road and resulting a slightly better ventilation performance along the street (black arrow in Figure 45 and Figure 47). On the other hand, under the Proposed Scheme, the lower GIC Block and larger building separation between Block 3 and 4 facilitates the wind penetration to further leeward region of the Development such as Yuen Fat Godown Carpark and School Site area.

In this connection, a slightly higher VR is observed at Yuen Fat Godown Carpark and similar VR for School Site area, while a slightly worsen VR is found at the Sham Mong Road under Proposed Scheme.

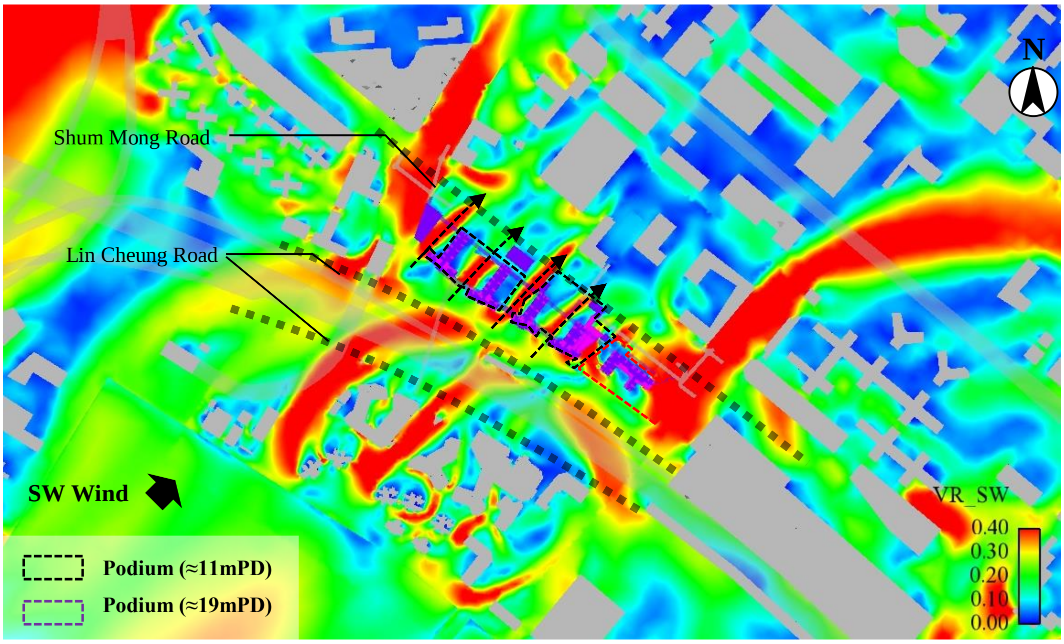


Figure 45 VR Contour Plot under SW Wind of Baseline Scheme

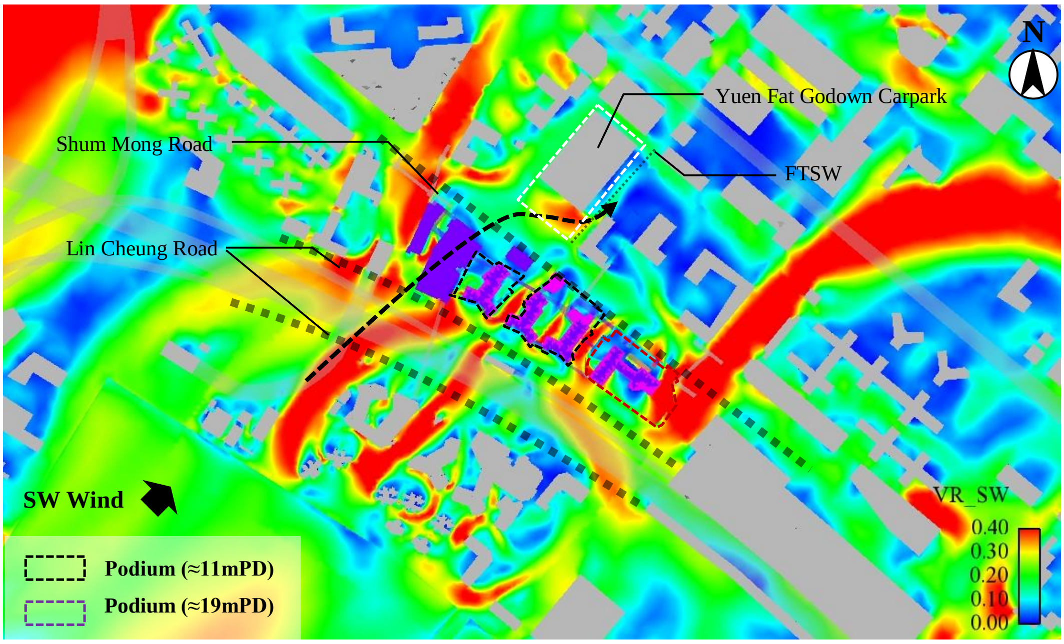


Figure 46 VR Contour Plot under SW Wind of Proposed Scheme

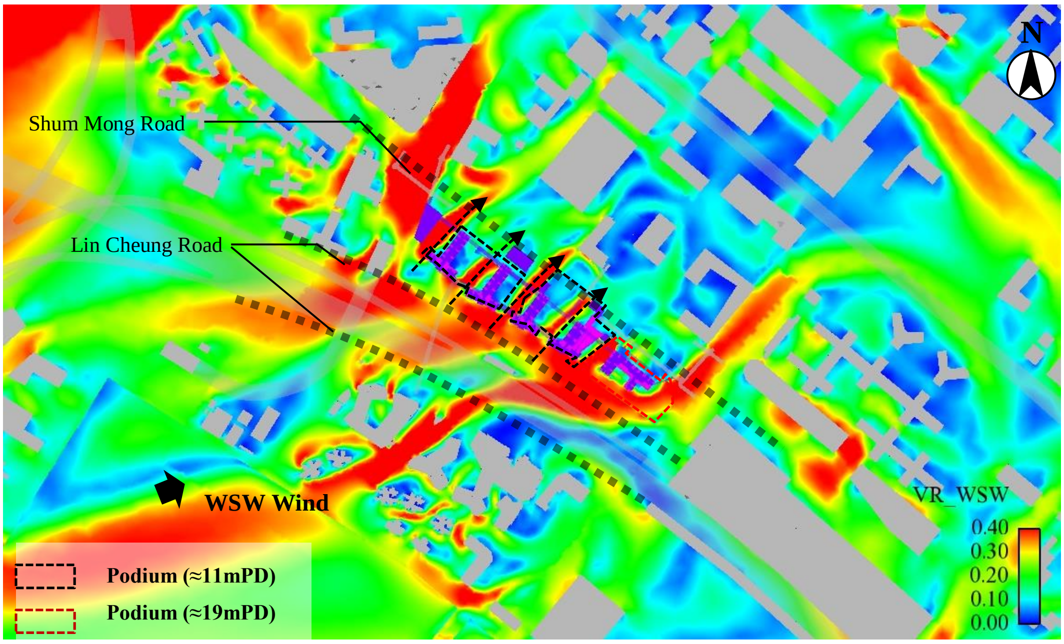


Figure 47 VR Contour Plot under WSW Wind of Baseline Scheme

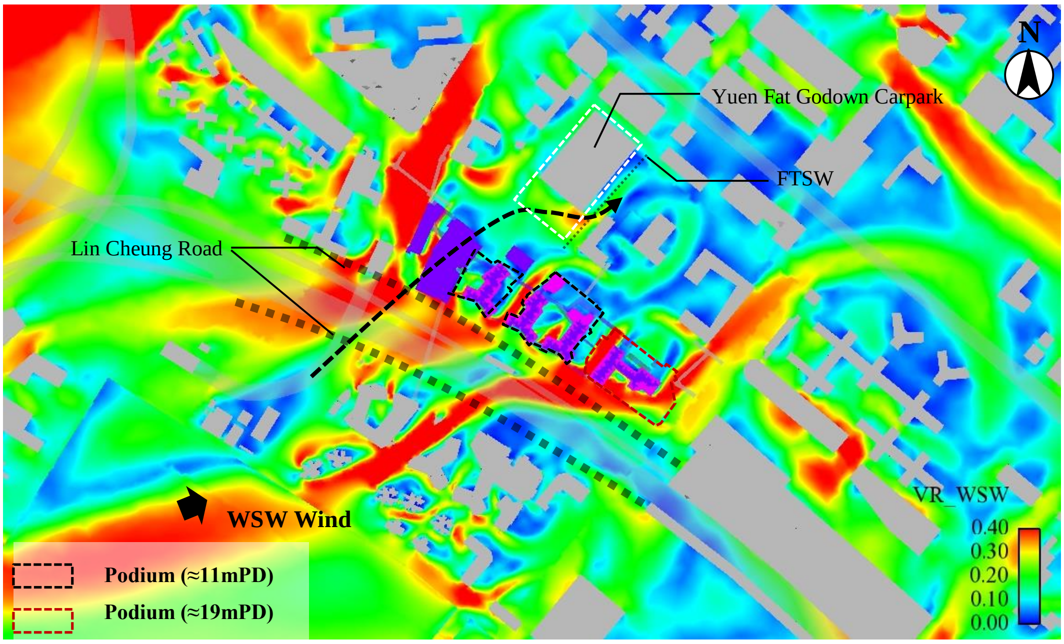


Figure 48 VR Contour Plot under WSW Wind of Proposed Scheme

5.2.11 W Wind Direction

The W wind contributes 4.7 % of the summer wind rose. The contour plots of VR value for Baseline Scheme and Proposed Scheme are shown in Figure 49 and Figure 50 respectively. The overall ventilation performance under W wind can be summarized as below:

- A higher VR result is found at FTSW and a portion of Shum Mong Road area near FTSW Development under Proposed Scheme
- The ventilation performance is better along Tonkin Street West and Ying Wa Street under Proposed Scheme
- A lower VR is observed at the leeward region of GIC block near Shum Mong Road under Proposed Scheme
- A higher VR is found at Yuen Fat Godown Carpark and Lai Hong Street under Baseline Scheme

The mid-rise GIC Block of the Proposed Scheme allows the incoming wind skim over atop and downwashed to the centre of Shum Mong Road and FTSW (black arrow in Figure 50). On the contrary, the Block 5 of the Baseline Scheme is much taller. It would capture the high-level wind and downwash to Lai Hong Street and Yuen Fat Godown Carpark. Together with the larger building separation between SWF and Block 5, slightly higher VR is observed at Yuen Fat Godown Carpark and Lai Hong Street under Baseline Scheme, while higher VR is found at FTSW and a portion of Lin Cheung Road.

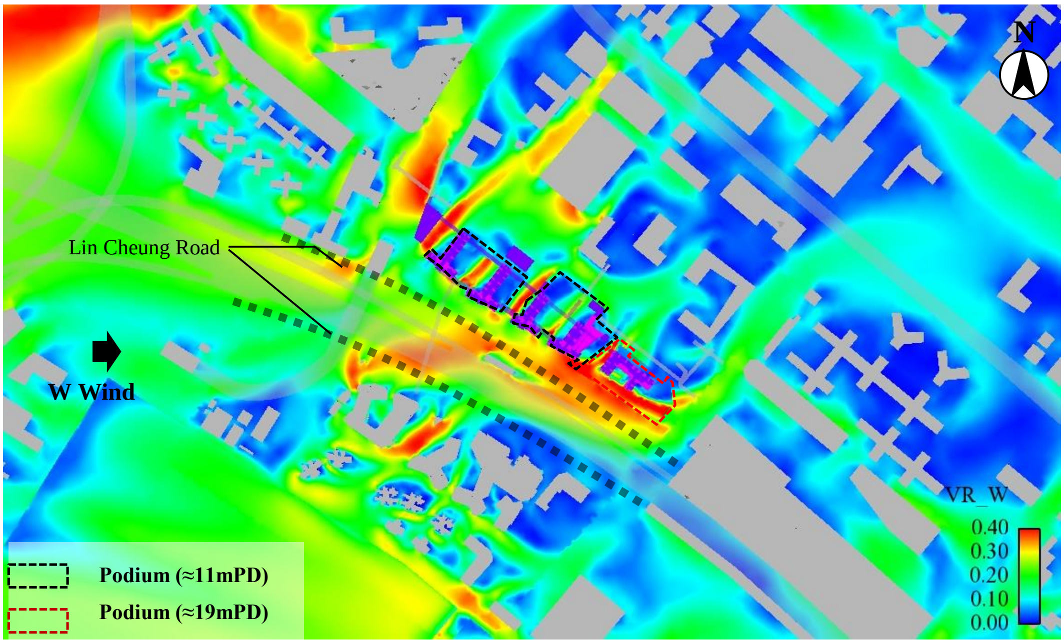


Figure 49 VR Contour Plot under W Wind of Baseline Scheme

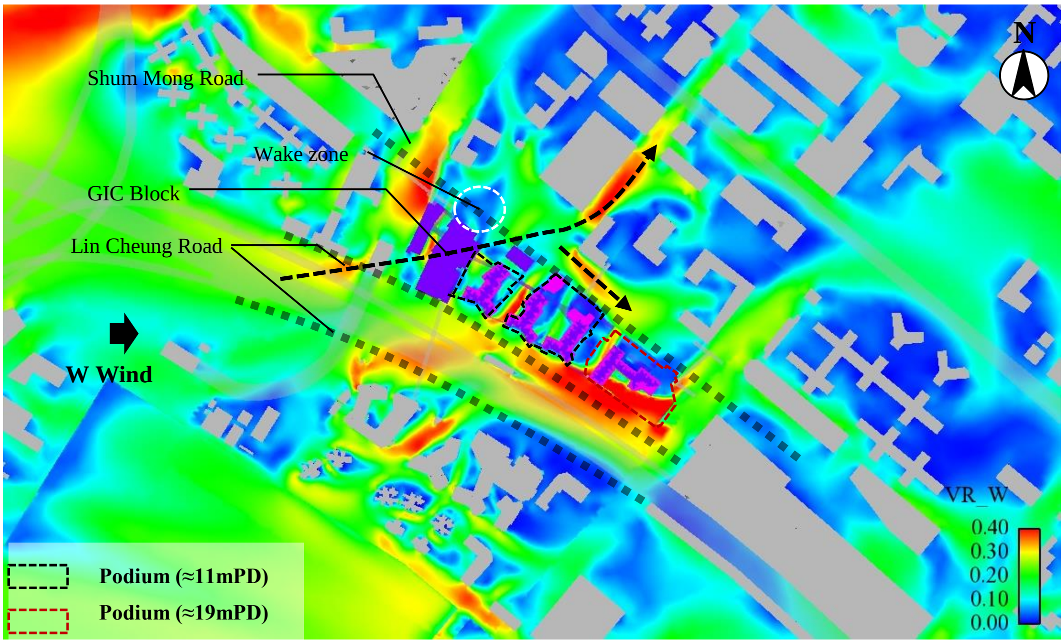


Figure 50 VR Contour Plot under W Wind of Proposed Scheme

5.3 Focus Area

The Focus Areas for frequent pedestrian access and activity zones are defined for the detailed analysis as follows:

1. Hing Wah Street West
2. Tack Ching Girls' Secondary School
3. Yuen Fat Godown Carpark
4. Lai Hong Street
5. Lai Fat Street
6. Fat Tseung Street West
7. Ying Wa Street
8. Fat Cheung Street West Development
9. Ying Wa College, Ying Wa Primary School, St. Margaret's Co-educational English Secondary and Primary School (School Site)
10. Fu Cheong Estate
11. Tonkin Street West
12. Sham Mong Road
13. Skh Saint Andrew’s Primary School & SKH St. Mary’s Church Mok Hing Yiu College
14. Hoi Lai Street
15. Hoi Lai Estate
16. Lin Cheung Road
17. Bus Depot
18. Lin Cheung Road Sites 3 & 5
19. Future Primary School
20. Future Road A

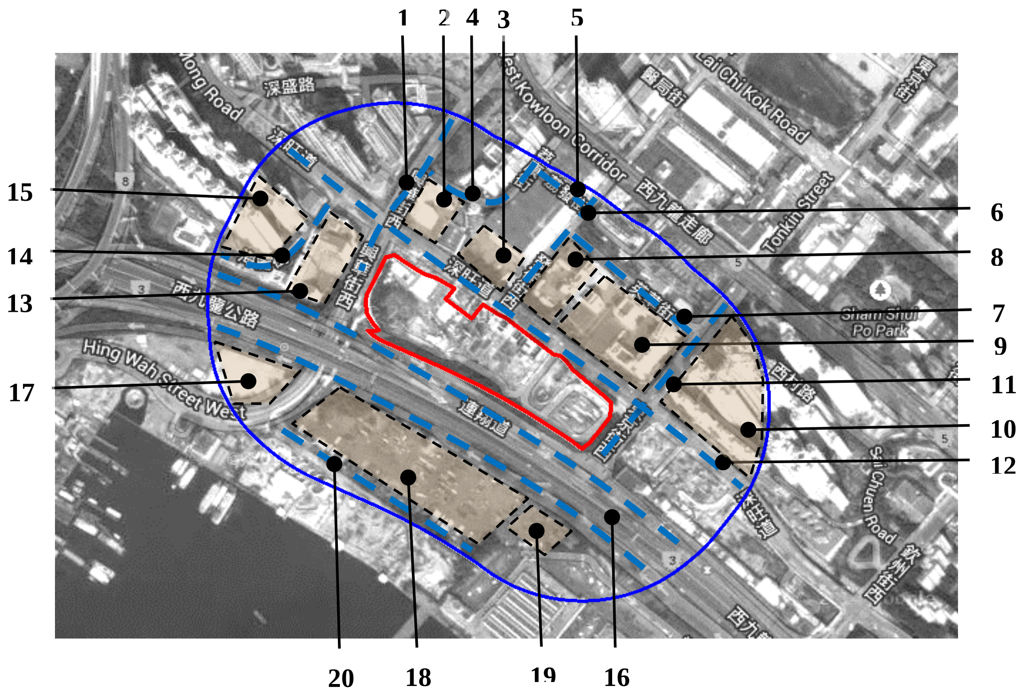


Figure 51 Focus Areas for the Study (Image Source: Google Earth)

5.3.1 Annual Wind Condition

Table 7 Average VR Results for Focus Areas of the Development Scheme under annual wind condition

Focus Areas		Test Points	Baseline Scheme	Proposed Scheme
1	Hing Wah Street West	O1-O5, P40-P42	0.19	0.22
2	Tack Ching Girls' Secondary School	O6-O9	0.08	0.09
3	Yuen Fat Godown Carpark	O10-O15	0.08	0.08
4	Lai Hong Street	O16-O20	0.15	0.15
5	Lai Fat Street	O21-O23	0.12	0.12
6	Fat Tseung Street West	O24-O30	0.12	0.12
7	Ying Wa Street	O31-O36	0.13	0.13
8	Fat Cheung Street West Development	O37-O40	0.15	0.15
9	Ying Wa College, Ying Wa Primary School,St. Margaret's Co-educational English Secondary and Primary School	O41-O48	0.11	0.11
10	Fu Cheong Estate	O49-O51	0.10	0.10
11	Tonkin Street West	O52-O57, P21-P24	0.18	0.18
12	Sham Mong Road	O58-O67, P2-P6, P10-P20	0.15	0.16
13	Skh Saint Andrew's Primary School & SKH St. Mary's Church Mok Hing Yiu College	O68-O71	0.10	0.10
14	Hoi Lai Street	O72-O76	0.11	0.11
15	Hoi Lai Estate	O77-O79	0.08	0.08
16	Lin Cheung Road	O80-O102, P25-P37	0.13	0.15
17	Bus Depot	O103-O107	0.13	0.14
18	Lin Cheung Road Sites 3 & 5	O108-O128	0.10	0.11
19	Future Primary School	O129-O134	0.09	0.09
20	Future Road A	O135-O143	0.10	0.10

Most of the Focus Areas show similar average VR values for both schemes, except Hing Wah Street West and Lin Cheung Road.

For Hing Wah Street West and Tack Ching Girls' Secondary School, the Proposed Scheme achieved a slightly higher VR. This is mainly because of the lower height of GIC block favour for the high level S winds skim over and downwash to the area and enhance the ventilation performance.

A slightly higher VR is found at Lin Cheung Road Sites 3 & 5 and Lin Cheung Road under the Proposed Scheme. This is mainly due to the wider building separation of Blocks 3 and 4 facilitate the wind penetration from Shum Mong Road, especially under NE and ENE wind directions.

5.3.2 Summer Wind Condition

Table 8 Average VR Results for Focus Areas of the Development Scheme under summer wind condition

Focus Areas		Test Points	Baseline Scheme	Proposed Scheme
1	Hing Wah Street West	O1-O5, P40-P42	0.24	0.25
2	Tack Ching Girls' Secondary School	O6-O9	0.10	0.11
3	Yuen Fat Godown Carpark	O10-O15	0.11	0.13
4	Lai Hong Street	O16-O20	0.15	0.14
5	Lai Fat Street	O21-O23	0.14	0.13
6	Fat Tseung Street West	O24-O30	0.12	0.14
7	Ying Wa Street	O31-O36	0.13	0.14
8	Fat Cheung Street West Development	O37-O40	0.12	0.11
9	Ying Wa College, Ying Wa Primary School,St. Margaret's Co-educational English Secondary and Primary School	O41-O48	0.11	0.11
10	Fu Cheong Estate	O49-O51	0.10	0.10
11	Tonkin Street West	O52-O57, P21-P24	0.25	0.27
12	Sham Mong Road	O58-O67, P2-P6, P10-P20	0.18	0.18
13	Skh Saint Andrew's Primary School & SKH St. Mary's Church Mok Hing Yiu College	O68-O71	0.14	0.14
14	Hoi Lai Street	O72-O76	0.20	0.20
15	Hoi Lai Estate	O77-O79	0.18	0.18
16	Lin Cheung Road	O80-O102, P25-P37	0.21	0.21
17	Bus Depot	O103-O107	0.20	0.20
18	Lin Cheung Road Sites 3 & 5	O108-O128	0.17	0.17
19	Future Primary School	O129-O134	0.14	0.14
20	Future Road A	O135-O143	0.18	0.18

The ventilation performance for most of the focus areas are similar except Yuen Fat Godown Carpark, Fat Tseung Street West and Tonkin Street West. It is also found that Lai Hong Street, Lai Fat Street and Fat Cheung Street West Development achieved a slightly higher VR under Baseline Scheme (approx. 0.01). Nevertheless, the difference in VR values is small and can consider their ventilation performance are comparable.

For Yuen Fat Godown Carpark and FTSW, the Proposed Scheme achieved a slightly higher VR. This is mainly because of the lower height of GIC block is favour for the high level SSW, SW and WSW wind skim over and downwash to the aforementioned areas and resulting a higher VR results.

Tonkin Street West has a higher average VR under Proposed Scheme. This is mainly because Block 4 provide more setback from Tonkin Street West in Baseline Scheme. The incoming wind would penetrate through the Development and towards north direction and less wind flow along Tonkin Street West compared with Proposed Scheme.

Lai Hong Street and Lai Fat Street has a slightly higher VR results under Baseline Scheme. This is mainly due to the wider building separation between SWF Block and Block 5 and the downwash effect of taller building height of Block 5 in Baseline Scheme allows more wind flow through and further penetrate to the areas. This effect can be found under W wind condition.

6 Wind Enhancement Features

6.1 Lower Building Height – GIC Block

Comparing Baseline and Proposed Schemes, the building height of GIC block in Proposed Scheme is lower than Block 5 in Baseline Scheme. The lower building height of the GIC Block allows the SW quarter prevailing wind skim over through the roof to the leeward regions. The high-level wind is then further downwashed by the Godown Building at the leeward side to the street level, which enhance ventilation environment of FTSW and Godown Carpark. On the contrast, Block 5 of the Baseline Scheme is taller and would block the incoming SW quarter wind.

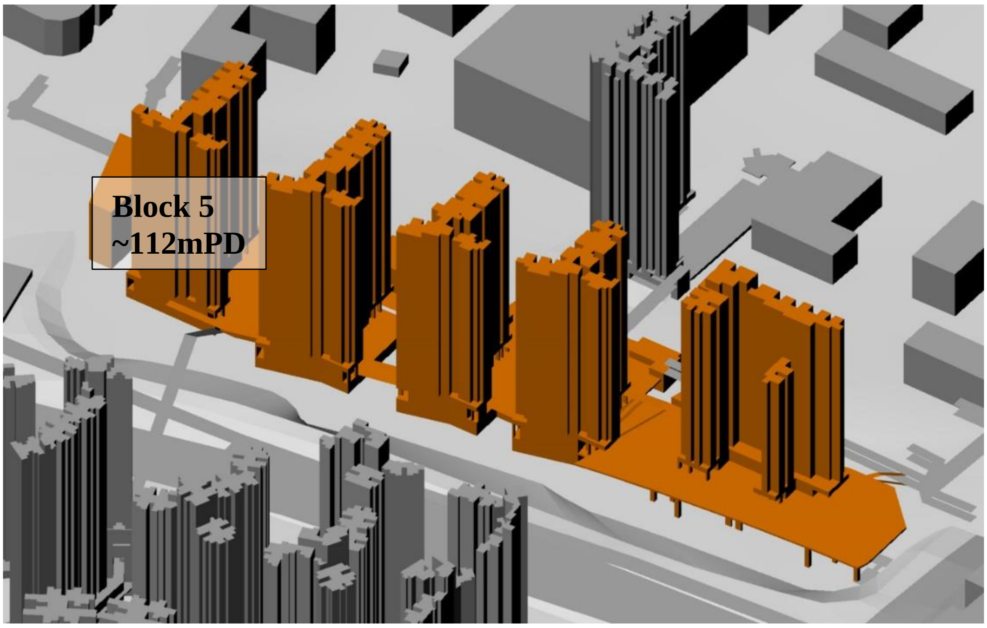


Figure 52 Block 5 of Baseline Scheme

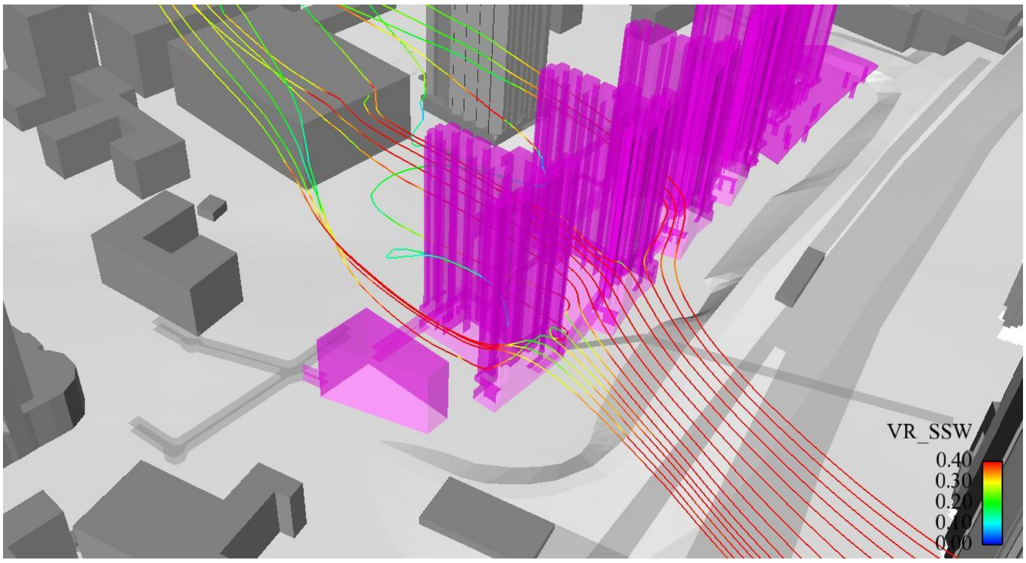


Figure 53 Streamline plot of SSW Wind under Baseline Scheme

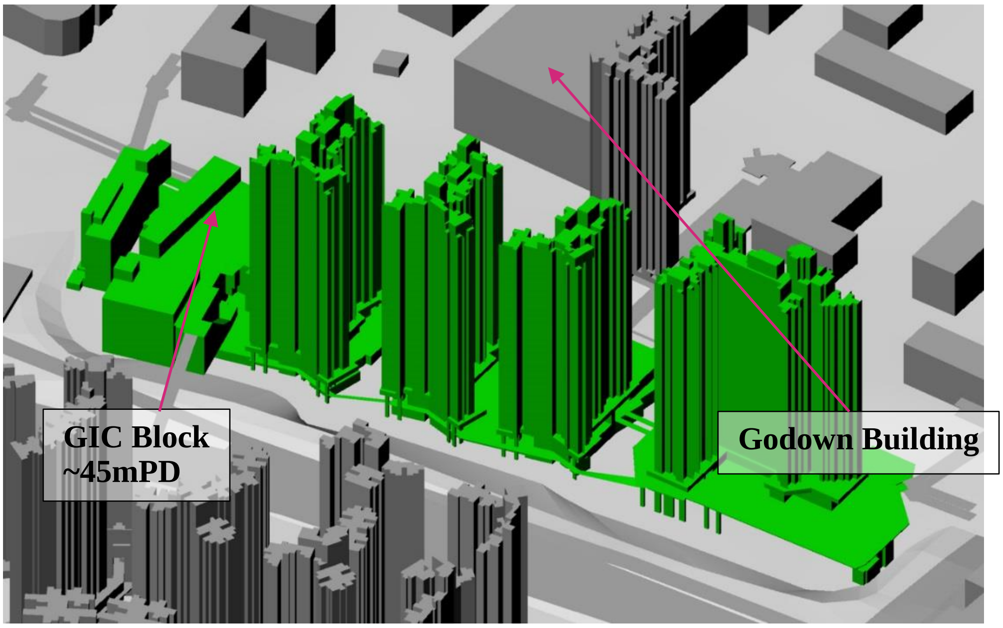


Figure 54 GIC Block and Godown Building of Proposed Scheme

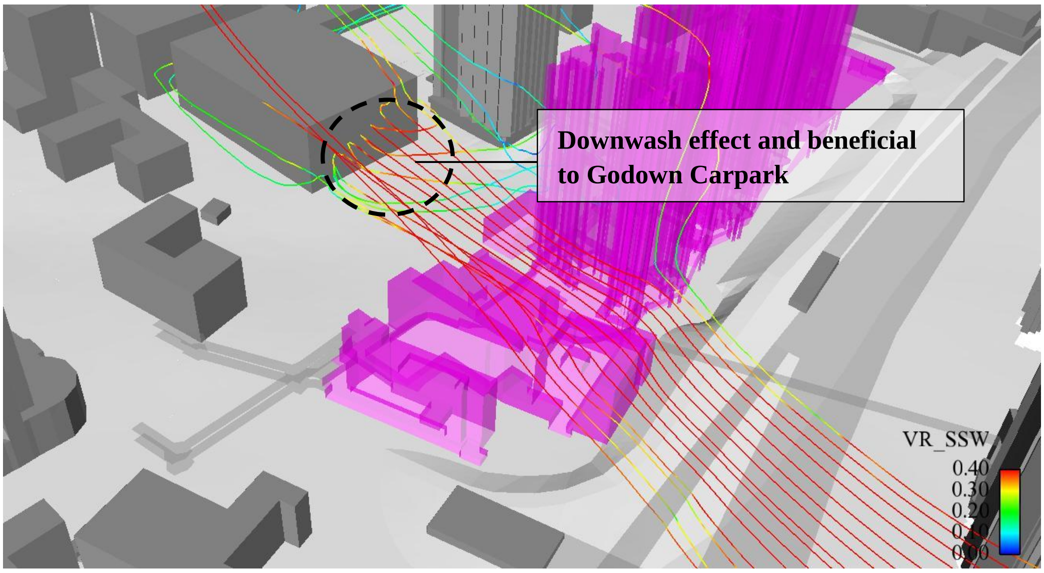


Figure 55 Streamline plot of SSW Wind under Proposed Scheme

6.2 Enlarged Building Separation – Blocks 3 and 4

Compared with Baseline Scheme, the Proposed Scheme has a larger building separation between Block 3 and Block 4 (from 32m to 37m). This design features allow the prevailing wind penetrate through the project site effectively and enhance the ventilation performance mainly for Lin Cheung Road under NE, ENE and S wind.

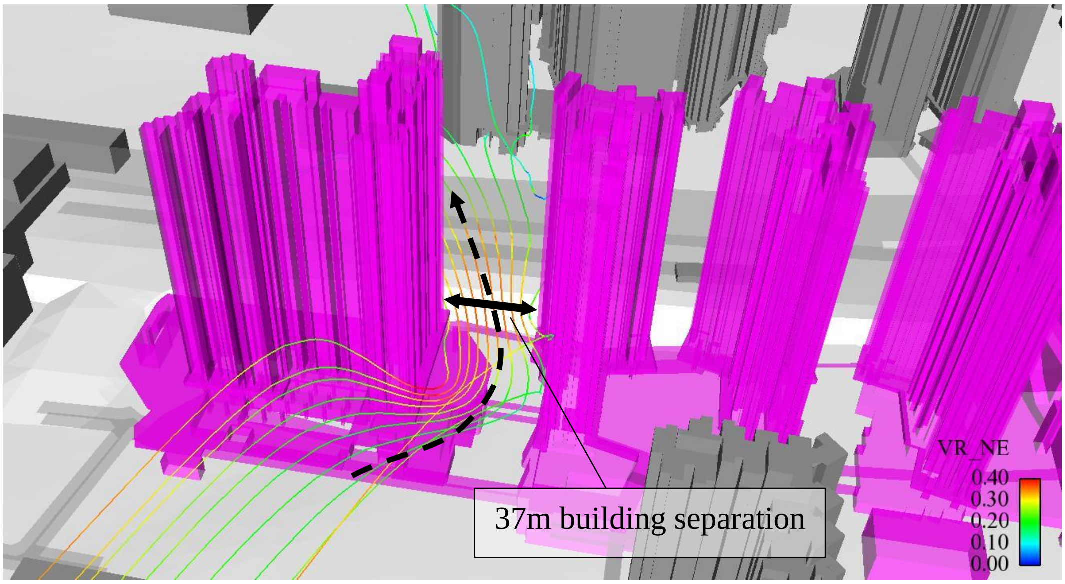


Figure 56 Streamline plot of the Proposed Scheme under NE Wind

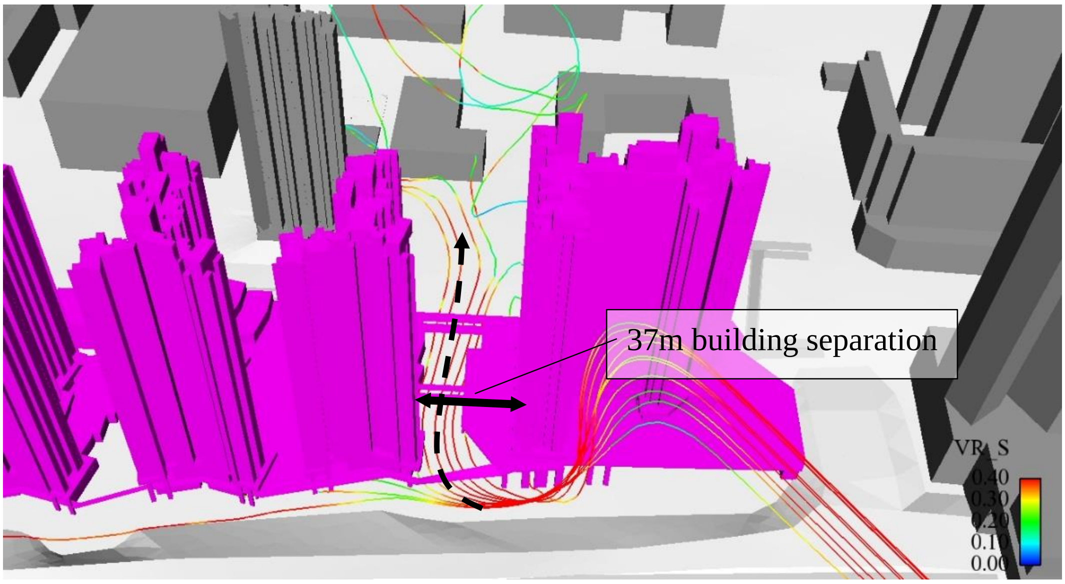


Figure 57 Streamline plot of the Proposed Scheme under S Wind

7 Conclusion

The Proposed Development at NWKR Site 6 is located at Cheung Sha Wan area and is bounded by the West Kowloon Highway to the south, Sham Mong Road to the north, Hing Wah Street West to the west and Tonkin Street West to the east. NWKR Site 6 is located in the midst of high-rise residential clusters, such as, Fu Cheong Estate, Wing Cheong Estate and Hoi Lai Estate, etc. To assess the ventilation performance of the areas within the Proposed Development and their immediate surroundings, an Air Ventilation Assessment (AVA) – Initial Study was conducted for the Proposed Development.

A series of CFD simulations using realizable k – ε turbulence model were performed based on the AVA methodology for the Initial Study as stipulated in the Technical Circular and Technical Guide. Eight wind directions were considered in annual wind condition, which covered 76.6% of wind availability in a year. Nine wind directions were considered in summer wind condition, which covered over 77.1% of wind availability in a year. The ventilation performance for the Proposed Developments at the site boundaries and within the Assessment Area was assessed.

By the Technical Circular, a total of 42 perimeter test points and 148 overall test points were selected to measure the Velocity Ratio and to assess the ventilation performance of the Proposed Developments in terms of SVR and LVR.

The major findings of this study could be summarized as follows:

Under annual condition, the SVR is 0.14 for Baseline Scheme and 0.16 for Proposed Scheme. The LVR is 0.13 for Baseline and Proposed Scheme. Under summer condition, the SVR is 0.21 for Baseline and Proposed Scheme, respectively. The LVR is 0.18 for both Baseline and Proposed Scheme;

In general, the overall ventilation performance under the Proposed Scheme in both annual and summer conditions is slightly better than that under the Baseline Scheme;

Under the annual wind condition, the ventilation performance at most of the focus areas are similar except the Proposed Scheme achieves a slightly higher VR at Hing Wah Street West and Lin Cheung Road.

Under the summer wind condition, the ventilation performance at most of the focus areas are also similar except the Proposed Scheme has achieved a slightly higher VR at Yuen Fat Godown Carpark, Fat Tseung Street West and Tonkin Street West, while slightly worsen at Lai Hong Street, Lai Fat Street and Fat Tseung Street West Development.

Appendix A

Velocity Ratio Table of the Test Points

A1 Baseline Scheme VR Tables

A1.1 Annual Condition

Table A7 VR value for the Perimeter Points of Baseline Scheme under Annual Condition

	NNE	NE	ENE	E	ESE	SE	SSE	S	Overall
	7.5%	10.1%	17.4%	16.6%	8.4%	5.9%	5.9%	4.9%	76.6%
P1	0.38	0.24	0.16	0.06	0.16	0.18	0.04	0.07	0.16
P2	0.35	0.20	0.13	0.06	0.07	0.06	0.05	0.03	0.12
P3	0.28	0.18	0.16	0.08	0.08	0.07	0.06	0.05	0.13
P4	0.20	0.10	0.16	0.09	0.10	0.06	0.06	0.10	0.11
P5	0.14	0.04	0.13	0.09	0.13	0.10	0.07	0.08	0.10
P6	0.19	0.05	0.07	0.08	0.23	0.05	0.11	0.12	0.10
P7	0.04	0.02	0.07	0.06	0.06	0.03	0.01	0.02	0.05
P8	0.17	0.03	0.02	0.04	0.04	0.04	0.02	0.19	0.06
P9	0.05	0.03	0.03	0.05	0.08	0.11	0.05	0.04	0.05
P10	0.18	0.01	0.08	0.07	0.24	0.18	0.15	0.06	0.11
P11	0.21	0.05	0.07	0.09	0.32	0.25	0.14	0.05	0.13
P12	0.08	0.09	0.13	0.18	0.34	0.28	0.12	0.07	0.16
P13	0.04	0.06	0.08	0.13	0.34	0.29	0.10	0.09	0.13
P14	0.06	0.04	0.03	0.13	0.33	0.29	0.03	0.09	0.11
P15	0.10	0.05	0.07	0.10	0.33	0.29	0.07	0.29	0.13
P16	0.09	0.07	0.09	0.05	0.33	0.29	0.01	0.29	0.13
P17	0.09	0.08	0.09	0.03	0.33	0.30	0.03	0.13	0.12
P18	0.11	0.09	0.09	0.04	0.33	0.30	0.08	0.41	0.14
P19	0.13	0.09	0.03	0.07	0.34	0.30	0.09	0.41	0.14
P20	0.14	0.20	0.20	0.16	0.37	0.31	0.04	0.41	0.21
P21	0.17	0.22	0.21	0.21	0.36	0.30	0.05	0.43	0.23
P22	0.21	0.25	0.17	0.22	0.09	0.11	0.05	0.41	0.19
P23	0.27	0.26	0.13	0.21	0.13	0.11	0.03	0.39	0.19
P24	0.30	0.25	0.14	0.20	0.11	0.05	0.07	0.34	0.18
P25	0.24	0.14	0.18	0.21	0.15	0.14	0.05	0.37	0.18
P26	0.18	0.07	0.26	0.24	0.17	0.18	0.11	0.33	0.20
P27	0.14	0.07	0.05	0.08	0.12	0.16	0.20	0.31	0.11
P28	0.14	0.14	0.07	0.09	0.09	0.18	0.27	0.34	0.13
P29	0.06	0.08	0.14	0.13	0.08	0.18	0.29	0.35	0.14
P30	0.19	0.15	0.12	0.16	0.10	0.19	0.30	0.39	0.17
P31	0.28	0.05	0.02	0.10	0.12	0.18	0.28	0.41	0.13
P32	0.14	0.15	0.17	0.17	0.09	0.16	0.30	0.43	0.18
P33	0.48	0.20	0.14	0.18	0.13	0.12	0.32	0.43	0.22
P34	0.46	0.09	0.02	0.04	0.08	0.12	0.35	0.44	0.14
P35	0.06	0.05	0.08	0.14	0.06	0.11	0.36	0.42	0.13
P36	0.21	0.19	0.11	0.06	0.07	0.12	0.39	0.39	0.16
P37	0.16	0.08	0.05	0.06	0.07	0.07	0.39	0.37	0.12

	NNE	NE	ENE	E	ESE	SE	SSE	S	Overall
P38	0.07	0.12	0.16	0.16	0.14	0.06	0.37	0.35	0.16
P39	0.33	0.04	0.17	0.24	0.06	0.22	0.16	0.51	0.20
P40	0.19	0.12	0.20	0.25	0.11	0.23	0.05	0.45	0.20
P41	0.20	0.10	0.14	0.26	0.08	0.27	0.01	0.04	0.15
P42	0.06	0.02	0.05	0.27	0.06	0.29	0.11	0.03	0.12

Table A 8 VR value for the Overall Points of Baseline Scheme under Annual Condition

	NNE	NE	ENE	E	ESE	SE	SSE	S	Overall
	7.5%	**10.1%**	**17.4%**	**16.6%**	**8.4%**	**5.9%**	**5.9%**	**4.9%**	**76.6%**
O1	0.45	0.27	0.24	0.06	0.13	0.16	0.08	0.21	0.19
O2	0.47	0.28	0.24	0.13	0.15	0.24	0.08	0.04	0.21
O3	0.43	0.34	0.27	0.22	0.18	0.29	0.09	0.11	0.25
O4	0.15	0.20	0.25	0.27	0.20	0.34	0.14	0.09	0.22
O5	0.10	0.15	0.09	0.25	0.16	0.27	0.14	0.02	0.15
O6	0.14	0.13	0.06	0.05	0.03	0.08	0.02	0.06	0.07
O7	0.42	0.22	0.14	0.06	0.05	0.10	0.07	0.02	0.14
O8	0.29	0.15	0.07	0.01	0.02	0.04	0.03	0.02	0.08
O9	0.14	0.05	0.02	0.05	0.05	0.13	0.04	0.02	0.05
O10	0.04	0.07	0.14	0.11	0.05	0.17	0.05	0.09	0.10
O11	0.13	0.09	0.12	0.13	0.11	0.17	0.05	0.12	0.12
O12	0.17	0.05	0.04	0.05	0.10	0.04	0.02	0.05	0.06
O13	0.12	0.05	0.03	0.03	0.04	0.01	0.02	0.04	0.04
O14	0.23	0.05	0.07	0.01	0.06	0.07	0.13	0.22	0.08
O15	0.29	0.02	0.04	0.04	0.07	0.05	0.03	0.01	0.06
O16	0.36	0.22	0.08	0.15	0.05	0.18	0.10	0.11	0.15
O17	0.19	0.13	0.08	0.22	0.09	0.27	0.17	0.13	0.15
O18	0.20	0.10	0.08	0.15	0.06	0.16	0.11	0.11	0.12
O19	0.41	0.19	0.10	0.14	0.12	0.19	0.09	0.12	0.16
O20	0.20	0.28	0.15	0.12	0.11	0.13	0.02	0.10	0.15
O21	0.05	0.08	0.16	0.07	0.12	0.14	0.09	0.07	0.10
O22	0.09	0.07	0.17	0.11	0.15	0.17	0.13	0.09	0.12
O23	0.14	0.05	0.14	0.16	0.11	0.14	0.09	0.05	0.12
O24	0.07	0.13	0.14	0.03	0.11	0.16	0.08	0.08	0.10
O25	0.12	0.03	0.15	0.09	0.13	0.19	0.09	0.10	0.11
O26	0.09	0.03	0.18	0.17	0.12	0.18	0.12	0.10	0.13
O27	0.07	0.05	0.15	0.16	0.08	0.20	0.12	0.14	0.13
O28	0.08	0.07	0.11	0.14	0.12	0.23	0.12	0.13	0.12
O29	0.27	0.08	0.08	0.16	0.09	0.22	0.09	0.01	0.12
O30	0.23	0.05	0.04	0.13	0.04	0.17	0.13	0.27	0.11
O31	0.09	0.03	0.06	0.16	0.09	0.07	0.02	0.19	0.09
O32	0.06	0.07	0.10	0.15	0.06	0.07	0.01	0.28	0.10
O33	0.15	0.08	0.04	0.16	0.14	0.11	0.08	0.31	0.12
O34	0.04	0.09	0.13	0.20	0.15	0.15	0.03	0.28	0.14
O35	0.07	0.11	0.21	0.22	0.11	0.06	0.09	0.18	0.15

	NNE	NE	ENE	E	ESE	SE	SSE	S	Overall
O36	0.01	0.17	0.21	0.22	0.16	0.18	0.18	0.09	0.17
O37	0.07	0.08	0.16	0.29	0.13	0.06	0.07	0.14	0.15
O38	0.07	0.03	0.10	0.24	0.14	0.03	0.06	0.22	0.12
O39	0.05	0.08	0.20	0.31	0.18	0.06	0.10	0.26	0.18
O40	0.09	0.12	0.19	0.24	0.16	0.12	0.06	0.18	0.16
O41	0.12	0.07	0.13	0.23	0.21	0.20	0.02	0.21	0.16
O42	0.08	0.09	0.19	0.30	0.01	0.02	0.03	0.12	0.14
O43	0.07	0.02	0.08	0.16	0.17	0.18	0.04	0.29	0.11
O44	0.03	0.07	0.17	0.28	0.03	0.03	0.04	0.14	0.13
O45	0.14	0.03	0.06	0.07	0.04	0.02	0.06	0.19	0.07
O46	0.07	0.04	0.06	0.10	0.02	0.03	0.03	0.04	0.06
O47	0.01	0.06	0.12	0.18	0.04	0.02	0.06	0.01	0.09
O48	0.04	0.06	0.10	0.12	0.04	0.05	0.02	0.15	0.08
O49	0.10	0.16	0.07	0.05	0.05	0.04	0.05	0.17	0.08
O50	0.10	0.14	0.06	0.05	0.04	0.10	0.01	0.14	0.07
O51	0.10	0.16	0.16	0.18	0.16	0.23	0.01	0.14	0.15
O52	0.08	0.14	0.17	0.15	0.14	0.15	0.14	0.18	0.14
O53	0.05	0.19	0.22	0.24	0.14	0.25	0.18	0.32	0.20
O54	0.09	0.21	0.20	0.24	0.09	0.23	0.01	0.30	0.18
O55	0.10	0.20	0.22	0.25	0.08	0.17	0.03	0.28	0.18
O56	0.09	0.18	0.20	0.21	0.11	0.12	0.01	0.31	0.17
O57	0.09	0.18	0.15	0.10	0.32	0.29	0.02	0.29	0.17
O58	0.06	0.08	0.03	0.04	0.12	0.14	0.07	0.20	0.07
O59	0.06	0.05	0.06	0.14	0.16	0.18	0.09	0.15	0.10
O60	0.02	0.09	0.13	0.16	0.15	0.20	0.13	0.12	0.13
O61	0.33	0.26	0.25	0.16	0.14	0.18	0.15	0.10	0.20
O62	0.20	0.04	0.08	0.08	0.26	0.14	0.15	0.16	0.12
O63	0.08	0.09	0.23	0.20	0.31	0.29	0.07	0.13	0.18
O64	0.09	0.04	0.23	0.19	0.27	0.28	0.09	0.34	0.19
O65	0.17	0.13	0.24	0.20	0.26	0.29	0.11	0.34	0.21
O66	0.21	0.17	0.27	0.23	0.28	0.33	0.12	0.19	0.23
O67	0.22	0.19	0.27	0.24	0.27	0.33	0.12	0.15	0.23
O68	0.01	0.03	0.08	0.12	0.09	0.13	0.08	0.15	0.08
O69	0.03	0.08	0.11	0.18	0.13	0.20	0.08	0.16	0.12
O70	0.14	0.13	0.06	0.11	0.03	0.07	0.07	0.05	0.09
O71	0.04	0.07	0.11	0.11	0.09	0.09	0.06	0.03	0.08
O72	0.08	0.11	0.11	0.08	0.08	0.12	0.07	0.22	0.10
O73	0.05	0.11	0.12	0.21	0.18	0.23	0.11	0.21	0.15
O74	0.07	0.06	0.06	0.16	0.13	0.20	0.09	0.07	0.11
O75	0.05	0.10	0.05	0.15	0.13	0.19	0.13	0.29	0.12
O76	0.03	0.06	0.03	0.07	0.09	0.11	0.10	0.28	0.08
O77	0.03	0.07	0.03	0.08	0.12	0.11	0.11	0.24	0.08
O78	0.03	0.04	0.03	0.04	0.13	0.12	0.14	0.19	0.07
O79	0.03	0.09	0.07	0.09	0.10	0.16	0.11	0.24	0.10

	NNE	NE	ENE	E	ESE	SE	SSE	S	Overall
O80	0.08	0.05	0.07	0.15	0.06	0.12	0.22	0.16	0.11
O81	0.04	0.07	0.07	0.07	0.07	0.12	0.23	0.19	0.09
O82	0.02	0.05	0.07	0.06	0.04	0.07	0.21	0.08	0.07
O83	0.25	0.18	0.22	0.06	0.15	0.11	0.21	0.15	0.16
O84	0.22	0.06	0.16	0.21	0.10	0.15	0.38	0.12	0.17
O85	0.30	0.26	0.13	0.17	0.12	0.10	0.02	0.27	0.17
O86	0.13	0.13	0.07	0.03	0.12	0.22	0.33	0.12	0.11
O87	0.06	0.09	0.02	0.08	0.15	0.22	0.31	0.07	0.10
O88	0.27	0.08	0.22	0.06	0.16	0.21	0.28	0.11	0.16
O89	0.13	0.07	0.12	0.13	0.16	0.18	0.29	0.08	0.13
O90	0.03	0.10	0.03	0.01	0.19	0.18	0.30	0.06	0.09
O91	0.38	0.01	0.03	0.08	0.20	0.18	0.29	0.29	0.14
O92	0.12	0.06	0.06	0.10	0.20	0.18	0.29	0.28	0.13
O93	0.11	0.07	0.08	0.13	0.20	0.18	0.27	0.09	0.13
O94	0.14	0.06	0.09	0.12	0.20	0.19	0.27	0.11	0.13
O95	0.13	0.01	0.06	0.09	0.17	0.19	0.25	0.28	0.12
O96	0.09	0.03	0.07	0.13	0.14	0.12	0.17	0.22	0.11
O97	0.12	0.11	0.12	0.06	0.05	0.06	0.14	0.09	0.09
O98	0.22	0.13	0.11	0.14	0.18	0.16	0.10	0.37	0.16
O99	0.21	0.18	0.10	0.14	0.17	0.16	0.06	0.29	0.15
O100	0.03	0.04	0.06	0.07	0.13	0.14	0.04	0.25	0.08
O101	0.02	0.05	0.04	0.04	0.14	0.14	0.02	0.25	0.07
O102	0.05	0.03	0.04	0.03	0.14	0.14	0.02	0.21	0.06
O103	0.15	0.12	0.10	0.03	0.14	0.21	0.28	0.34	0.14
O104	0.11	0.10	0.05	0.07	0.14	0.20	0.25	0.21	0.11
O105	0.17	0.09	0.19	0.11	0.17	0.19	0.25	0.07	0.15
O106	0.08	0.06	0.10	0.09	0.16	0.14	0.01	0.28	0.11
O107	0.23	0.04	0.16	0.15	0.14	0.12	0.01	0.36	0.15
O108	0.06	0.01	0.10	0.02	0.03	0.04	0.02	0.05	0.05
O109	0.35	0.05	0.09	0.08	0.11	0.13	0.05	0.05	0.11
O110	0.32	0.06	0.06	0.14	0.17	0.18	0.28	0.06	0.14
O111	0.28	0.06	0.09	0.14	0.18	0.17	0.25	0.38	0.16
O112	0.06	0.06	0.11	0.14	0.16	0.14	0.23	0.31	0.13
O113	0.13	0.09	0.13	0.19	0.16	0.10	0.21	0.06	0.14
O114	0.12	0.07	0.11	0.20	0.13	0.12	0.20	0.15	0.14
O115	0.15	0.04	0.07	0.14	0.16	0.16	0.22	0.06	0.12
O116	0.10	0.05	0.09	0.15	0.04	0.13	0.17	0.17	0.11
O117	0.05	0.04	0.12	0.06	0.11	0.13	0.15	0.24	0.10
O118	0.05	0.04	0.01	0.01	0.02	0.03	0.05	0.28	0.04
O119	0.23	0.06	0.04	0.12	0.16	0.01	0.01	0.35	0.11
O120	0.23	0.08	0.07	0.16	0.24	0.04	0.09	0.30	0.14
O121	0.12	0.08	0.06	0.07	0.08	0.06	0.07	0.14	0.08
O122	0.03	0.02	0.02	0.01	0.21	0.04	0.03	0.07	0.05
O123	0.02	0.11	0.03	0.09	0.18	0.05	0.02	0.38	0.09

	NNE	NE	ENE	E	ESE	SE	SSE	S	Overall
O124	0.01	0.05	0.04	0.08	0.17	0.03	0.06	0.42	0.09
O125	0.06	0.05	0.11	0.10	0.03	0.21	0.18	0.07	0.10
O126	0.05	0.10	0.02	0.05	0.21	0.25	0.22	0.45	0.12
O127	0.01	0.04	0.05	0.08	0.04	0.13	0.12	0.33	0.08
O128	0.05	0.04	0.06	0.10	0.05	0.11	0.08	0.29	0.08
O129	0.13	0.10	0.03	0.04	0.10	0.08	0.03	0.38	0.08
O130	0.03	0.08	0.02	0.04	0.06	0.05	0.04	0.16	0.05
O131	0.18	0.09	0.04	0.02	0.13	0.11	0.07	0.25	0.09
O132	0.19	0.05	0.04	0.06	0.13	0.10	0.04	0.40	0.10
O133	0.21	0.10	0.04	0.01	0.15	0.13	0.06	0.18	0.09
O134	0.23	0.13	0.08	0.10	0.15	0.15	0.06	0.28	0.13
O135	0.25	0.01	0.18	0.01	0.12	0.06	0.03	0.39	0.11
O136	0.04	0.03	0.05	0.04	0.15	0.07	0.05	0.17	0.06
O137	0.10	0.04	0.04	0.03	0.19	0.09	0.04	0.13	0.07
O138	0.01	0.05	0.04	0.06	0.19	0.11	0.13	0.51	0.10
O139	0.19	0.04	0.02	0.11	0.25	0.14	0.10	0.31	0.12
O140	0.03	0.06	0.01	0.05	0.11	0.22	0.22	0.45	0.10
O141	0.06	0.01	0.04	0.12	0.26	0.24	0.23	0.41	0.13
O142	0.03	0.04	0.04	0.09	0.24	0.21	0.21	0.14	0.11
O143	0.12	0.05	0.01	0.06	0.14	0.13	0.14	0.37	0.09

A1.2 Summer Condition

Table A 9 VR value for the Perimeter Points of Baseline Scheme under Summer Condition

	E	ESE	SE	SSE	S	SSW	SW	WSW	W	Overall
	11.5%	**9.5%**	**9.3%**	**8.3%**	**7.9%**	**8.8%**	**9.9%**	**7.2%**	**4.7%**	**77.1%**
P1	0.06	0.16	0.18	0.04	0.07	0.18	0.18	0.14	0.08	0.12
P2	0.06	0.07	0.06	0.05	0.03	0.16	0.20	0.24	0.13	0.11
P3	0.08	0.08	0.07	0.06	0.05	0.12	0.19	0.12	0.38	0.11
P4	0.09	0.10	0.06	0.06	0.10	0.06	0.30	0.35	0.20	0.14
P5	0.09	0.13	0.10	0.07	0.08	0.11	0.16	0.27	0.18	0.12
P6	0.08	0.23	0.05	0.11	0.12	0.10	0.22	0.03	0.16	0.12
P7	0.06	0.06	0.03	0.01	0.02	0.09	0.13	0.21	0.05	0.07
P8	0.04	0.04	0.04	0.02	0.19	0.18	0.13	0.15	0.08	0.09
P9	0.05	0.08	0.11	0.05	0.04	0.07	0.11	0.13	0.14	0.08
P10	0.07	0.24	0.18	0.15	0.06	0.03	0.42	0.38	0.07	0.18
P11	0.09	0.32	0.25	0.14	0.05	0.07	0.09	0.14	0.21	0.15
P12	0.18	0.34	0.28	0.12	0.07	0.11	0.13	0.10	0.25	0.18
P13	0.13	0.34	0.29	0.10	0.09	0.09	0.04	0.06	0.19	0.15
P14	0.13	0.33	0.29	0.03	0.09	0.23	0.19	0.16	0.18	0.18
P15	0.10	0.33	0.29	0.07	0.29	0.23	0.14	0.11	0.10	0.19
P16	0.05	0.33	0.29	0.01	0.29	0.25	0.33	0.09	0.19	0.20
P17	0.03	0.33	0.30	0.03	0.13	0.15	0.20	0.16	0.14	0.16

	E	ESE	SE	SSE	S	SSW	SW	WSW	W	Overall
P18	0.04	0.33	0.30	0.08	0.41	0.38	0.32	0.07	0.07	0.23
P19	0.07	0.34	0.30	0.09	0.41	0.43	0.43	0.04	0.13	0.26
P20	0.16	0.37	0.31	0.04	0.41	0.41	0.50	0.47	0.02	0.31
P21	0.21	0.36	0.30	0.05	0.43	0.41	0.52	0.41	0.12	0.32
P22	0.22	0.09	0.11	0.05	0.41	0.39	0.49	0.35	0.34	0.27
P23	0.21	0.13	0.11	0.03	0.39	0.41	0.47	0.28	0.21	0.25
P24	0.20	0.11	0.05	0.07	0.34	0.38	0.42	0.15	0.34	0.22
P25	0.21	0.15	0.14	0.05	0.37	0.21	0.29	0.04	0.28	0.19
P26	0.24	0.17	0.18	0.11	0.33	0.26	0.29	0.31	0.31	0.24
P27	0.08	0.12	0.16	0.20	0.31	0.32	0.33	0.41	0.33	0.24
P28	0.09	0.09	0.18	0.27	0.34	0.41	0.31	0.43	0.33	0.26
P29	0.13	0.08	0.18	0.29	0.35	0.43	0.11	0.38	0.31	0.23
P30	0.16	0.10	0.19	0.30	0.39	0.44	0.13	0.31	0.35	0.25
P31	0.10	0.12	0.18	0.28	0.41	0.43	0.28	0.27	0.34	0.25
P32	0.17	0.09	0.16	0.30	0.43	0.39	0.38	0.30	0.34	0.27
P33	0.18	0.13	0.12	0.32	0.43	0.28	0.22	0.38	0.36	0.25
P34	0.04	0.08	0.12	0.35	0.44	0.23	0.36	0.39	0.34	0.24
P35	0.14	0.06	0.11	0.36	0.42	0.17	0.41	0.36	0.31	0.25
P36	0.06	0.07	0.12	0.39	0.39	0.19	0.36	0.33	0.27	0.23
P37	0.06	0.07	0.07	0.39	0.37	0.43	0.27	0.40	0.26	0.24
P38	0.16	0.14	0.06	0.37	0.35	0.50	0.36	0.44	0.26	0.28
P39	0.24	0.06	0.22	0.16	0.51	0.35	0.37	0.40	0.26	0.28
P40	0.25	0.11	0.23	0.05	0.45	0.09	0.28	0.31	0.11	0.21
P41	0.26	0.08	0.27	0.01	0.04	0.22	0.40	0.42	0.23	0.22
P42	0.27	0.06	0.29	0.11	0.03	0.34	0.47	0.49	0.34	0.26

Table A 10 VR value for the Overall Points of Baseline Scheme under Summer Condition

	E	ESE	SE	SSE	S	SSW	SW	WSW	W	Overall
	11.5%	**9.5%**	**9.3%**	**8.3%**	**7.9%**	**8.8%**	**9.9%**	**7.2%**	**4.7%**	**77.1%**
O1	0.06	0.13	0.16	0.08	0.21	0.37	0.36	0.25	0.16	0.20
O2	0.13	0.15	0.24	0.08	0.04	0.39	0.41	0.38	0.20	0.22
O3	0.22	0.18	0.29	0.09	0.11	0.38	0.45	0.47	0.25	0.27
O4	0.27	0.20	0.34	0.14	0.09	0.30	0.46	0.51	0.32	0.29
O5	0.25	0.16	0.27	0.14	0.02	0.23	0.41	0.52	0.37	0.26
O6	0.05	0.03	0.08	0.02	0.06	0.31	0.32	0.21	0.03	0.13
O7	0.06	0.05	0.10	0.07	0.02	0.25	0.24	0.32	0.03	0.13
O8	0.01	0.02	0.04	0.03	0.02	0.11	0.11	0.16	0.13	0.06
O9	0.05	0.05	0.13	0.04	0.02	0.13	0.11	0.10	0.02	0.07
O10	0.11	0.05	0.17	0.05	0.09	0.12	0.20	0.19	0.23	0.13
O11	0.13	0.11	0.17	0.05	0.12	0.31	0.18	0.26	0.26	0.17
O12	0.05	0.10	0.04	0.02	0.05	0.06	0.21	0.09	0.19	0.08
O13	0.03	0.04	0.01	0.02	0.04	0.06	0.03	0.09	0.24	0.05
O14	0.01	0.06	0.07	0.13	0.22	0.05	0.11	0.18	0.20	0.10
O15	0.04	0.07	0.05	0.03	0.01	0.03	0.30	0.24	0.33	0.11

	E	ESE	SE	SSE	S	SSW	SW	WSW	W	Overall
O16	0.15	0.05	0.18	0.10	0.11	0.07	0.06	0.28	0.33	0.13
O17	0.22	0.09	0.27	0.17	0.13	0.06	0.11	0.29	0.32	0.17
O18	0.15	0.06	0.16	0.11	0.11	0.11	0.20	0.26	0.33	0.15
O19	0.14	0.12	0.19	0.09	0.12	0.18	0.23	0.23	0.11	0.16
O20	0.12	0.11	0.13	0.02	0.10	0.09	0.18	0.21	0.04	0.12
O21	0.07	0.12	0.14	0.09	0.07	0.16	0.15	0.22	0.16	0.13
O22	0.11	0.15	0.17	0.13	0.09	0.15	0.12	0.17	0.14	0.13
O23	0.16	0.11	0.14	0.09	0.05	0.19	0.17	0.25	0.19	0.15
O24	0.03	0.11	0.16	0.08	0.08	0.05	0.02	0.05	0.09	0.07
O25	0.09	0.13	0.19	0.09	0.10	0.15	0.18	0.24	0.16	0.14
O26	0.17	0.12	0.18	0.12	0.10	0.11	0.05	0.10	0.12	0.12
O27	0.16	0.08	0.20	0.12	0.14	0.07	0.07	0.07	0.06	0.11
O28	0.14	0.12	0.23	0.12	0.13	0.03	0.05	0.06	0.08	0.11
O29	0.16	0.09	0.22	0.09	0.01	0.05	0.17	0.19	0.29	0.14
O30	0.13	0.04	0.17	0.13	0.27	0.05	0.13	0.07	0.18	0.13
O31	0.16	0.09	0.07	0.02	0.19	0.20	0.05	0.05	0.08	0.10
O32	0.15	0.06	0.07	0.01	0.28	0.30	0.05	0.06	0.07	0.12
O33	0.16	0.14	0.11	0.08	0.31	0.31	0.08	0.07	0.06	0.15
O34	0.20	0.15	0.15	0.03	0.28	0.31	0.08	0.11	0.03	0.16
O35	0.22	0.11	0.06	0.09	0.18	0.22	0.09	0.12	0.03	0.13
O36	0.22	0.16	0.18	0.18	0.09	0.09	0.07	0.01	0.01	0.12
O37	0.29	0.13	0.06	0.07	0.14	0.05	0.06	0.08	0.02	0.11
O38	0.24	0.14	0.03	0.06	0.22	0.16	0.06	0.11	0.03	0.12
O39	0.31	0.18	0.06	0.10	0.26	0.03	0.08	0.05	0.02	0.13
O40	0.24	0.16	0.12	0.06	0.18	0.12	0.07	0.05	0.04	0.12
O41	0.23	0.21	0.20	0.02	0.21	0.16	0.08	0.07	0.06	0.15
O42	0.30	0.01	0.02	0.03	0.12	0.11	0.03	0.05	0.04	0.09
O43	0.16	0.17	0.18	0.04	0.29	0.20	0.11	0.11	0.17	0.16
O44	0.28	0.03	0.03	0.04	0.14	0.17	0.12	0.14	0.14	0.12
O45	0.07	0.04	0.02	0.06	0.19	0.14	0.11	0.15	0.07	0.09
O46	0.10	0.02	0.03	0.03	0.04	0.07	0.16	0.05	0.15	0.07
O47	0.18	0.04	0.02	0.06	0.01	0.22	0.10	0.07	0.11	0.09
O48	0.12	0.04	0.05	0.02	0.15	0.15	0.14	0.13	0.13	0.10
O49	0.05	0.05	0.04	0.05	0.17	0.11	0.15	0.28	0.07	0.10
O50	0.05	0.04	0.10	0.01	0.14	0.05	0.06	0.24	0.05	0.08
O51	0.18	0.16	0.23	0.01	0.14	0.08	0.17	0.09	0.08	0.13
O52	0.15	0.14	0.15	0.14	0.18	0.25	0.43	0.26	0.14	0.21
O53	0.24	0.14	0.25	0.18	0.32	0.25	0.48	0.35	0.15	0.27
O54	0.24	0.09	0.23	0.01	0.30	0.13	0.51	0.37	0.16	0.23
O55	0.25	0.08	0.17	0.03	0.28	0.22	0.52	0.40	0.17	0.24
O56	0.21	0.11	0.12	0.01	0.31	0.31	0.53	0.40	0.15	0.24
O57	0.10	0.32	0.29	0.02	0.29	0.25	0.47	0.37	0.06	0.25
O58	0.04	0.12	0.14	0.07	0.20	0.35	0.12	0.31	0.27	0.17
O59	0.14	0.16	0.18	0.09	0.15	0.44	0.14	0.12	0.19	0.18

	E	ESE	SE	SSE	S	SSW	SW	WSW	W	Overall
O60	0.16	0.15	0.20	0.13	0.12	0.19	0.20	0.21	0.11	0.17
O61	0.16	0.14	0.18	0.15	0.10	0.17	0.30	0.39	0.23	0.20
O62	0.08	0.26	0.14	0.15	0.16	0.05	0.14	0.10	0.19	0.14
O63	0.20	0.31	0.29	0.07	0.13	0.12	0.32	0.26	0.26	0.22
O64	0.19	0.27	0.28	0.09	0.34	0.32	0.14	0.16	0.02	0.21
O65	0.20	0.26	0.29	0.11	0.34	0.45	0.36	0.24	0.09	0.27
O66	0.23	0.28	0.33	0.12	0.19	0.13	0.23	0.36	0.09	0.23
O67	0.24	0.27	0.33	0.12	0.15	0.26	0.20	0.42	0.10	0.24
O68	0.12	0.09	0.13	0.08	0.15	0.30	0.19	0.18	0.13	0.15
O69	0.18	0.13	0.20	0.08	0.16	0.30	0.23	0.28	0.20	0.19
O70	0.11	0.03	0.07	0.07	0.05	0.19	0.14	0.16	0.17	0.11
O71	0.11	0.09	0.09	0.06	0.03	0.23	0.19	0.21	0.15	0.13
O72	0.08	0.08	0.12	0.07	0.22	0.40	0.33	0.36	0.23	0.20
O73	0.21	0.18	0.23	0.11	0.21	0.46	0.37	0.36	0.23	0.26
O74	0.16	0.13	0.20	0.09	0.07	0.31	0.27	0.40	0.28	0.21
O75	0.15	0.13	0.19	0.13	0.29	0.25	0.25	0.29	0.14	0.20
O76	0.07	0.09	0.11	0.10	0.28	0.20	0.22	0.15	0.09	0.14
O77	0.08	0.12	0.11	0.11	0.24	0.26	0.29	0.29	0.16	0.18
O78	0.04	0.13	0.12	0.14	0.19	0.14	0.23	0.29	0.18	0.15
O79	0.09	0.10	0.16	0.11	0.24	0.23	0.28	0.37	0.22	0.19
O80	0.15	0.06	0.12	0.22	0.16	0.04	0.17	0.20	0.21	0.14
O81	0.07	0.07	0.12	0.23	0.19	0.16	0.21	0.31	0.29	0.17
O82	0.06	0.04	0.07	0.21	0.08	0.21	0.30	0.28	0.28	0.16
O83	0.06	0.15	0.11	0.21	0.15	0.45	0.45	0.43	0.36	0.25
O84	0.21	0.10	0.15	0.38	0.12	0.48	0.36	0.44	0.26	0.27
O85	0.17	0.12	0.10	0.02	0.27	0.27	0.31	0.09	0.13	0.17
O86	0.03	0.12	0.22	0.33	0.12	0.22	0.25	0.35	0.21	0.20
O87	0.08	0.15	0.22	0.31	0.07	0.26	0.26	0.35	0.16	0.20
O88	0.06	0.16	0.21	0.28	0.11	0.37	0.29	0.36	0.16	0.22
O89	0.13	0.16	0.18	0.29	0.08	0.43	0.42	0.24	0.27	0.24
O90	0.01	0.19	0.18	0.30	0.06	0.07	0.32	0.34	0.34	0.19
O91	0.08	0.20	0.18	0.29	0.29	0.21	0.17	0.34	0.32	0.22
O92	0.10	0.20	0.18	0.29	0.28	0.32	0.05	0.20	0.27	0.20
O93	0.13	0.20	0.18	0.27	0.09	0.12	0.35	0.34	0.16	0.20
O94	0.12	0.20	0.19	0.27	0.11	0.02	0.06	0.21	0.16	0.14
O95	0.09	0.17	0.19	0.25	0.28	0.19	0.27	0.03	0.02	0.17
O96	0.13	0.14	0.12	0.17	0.22	0.24	0.05	0.08	0.03	0.13
O97	0.06	0.05	0.06	0.14	0.09	0.26	0.17	0.28	0.08	0.13
O98	0.14	0.18	0.16	0.10	0.37	0.41	0.38	0.31	0.04	0.24
O99	0.14	0.17	0.16	0.06	0.29	0.37	0.37	0.33	0.10	0.22
O100	0.07	0.13	0.14	0.04	0.25	0.27	0.23	0.19	0.13	0.16
O101	0.04	0.14	0.14	0.02	0.25	0.20	0.25	0.08	0.12	0.14
O102	0.03	0.14	0.14	0.02	0.21	0.14	0.21	0.14	0.10	0.12
O103	0.03	0.14	0.21	0.28	0.34	0.23	0.27	0.35	0.15	0.22

	E	ESE	SE	SSE	S	SSW	SW	WSW	W	Overall
O104	0.07	0.14	0.20	0.25	0.21	0.20	0.24	0.34	0.13	0.19
O105	0.11	0.17	0.19	0.25	0.07	0.37	0.28	0.32	0.18	0.21
O106	0.09	0.16	0.14	0.01	0.28	0.18	0.25	0.28	0.18	0.17
O107	0.15	0.14	0.12	0.01	0.36	0.27	0.19	0.20	0.14	0.18
O108	0.02	0.03	0.04	0.02	0.05	0.19	0.40	0.18	0.10	0.12
O109	0.08	0.11	0.13	0.05	0.05	0.06	0.42	0.29	0.37	0.16
O110	0.14	0.17	0.18	0.28	0.06	0.10	0.32	0.36	0.31	0.20
O111	0.14	0.18	0.17	0.25	0.38	0.32	0.21	0.24	0.27	0.23
O112	0.14	0.16	0.14	0.23	0.31	0.36	0.18	0.11	0.12	0.19
O113	0.19	0.16	0.10	0.21	0.06	0.09	0.32	0.45	0.27	0.20
O114	0.20	0.13	0.12	0.20	0.15	0.20	0.14	0.13	0.10	0.16
O115	0.14	0.16	0.16	0.22	0.06	0.09	0.17	0.02	0.05	0.13
O116	0.15	0.04	0.13	0.17	0.17	0.13	0.08	0.10	0.04	0.11
O117	0.06	0.11	0.13	0.15	0.24	0.10	0.02	0.17	0.05	0.11
O118	0.01	0.02	0.03	0.05	0.28	0.22	0.28	0.28	0.20	0.14
O119	0.12	0.16	0.01	0.01	0.35	0.36	0.57	0.47	0.30	0.25
O120	0.16	0.24	0.04	0.09	0.30	0.28	0.57	0.59	0.36	0.28
O121	0.07	0.08	0.06	0.07	0.14	0.07	0.09	0.34	0.21	0.11
O122	0.01	0.21	0.04	0.03	0.07	0.15	0.18	0.48	0.26	0.14
O123	0.09	0.18	0.05	0.02	0.38	0.29	0.12	0.18	0.17	0.16
O124	0.08	0.17	0.03	0.06	0.42	0.32	0.37	0.33	0.30	0.22
O125	0.10	0.03	0.21	0.18	0.07	0.27	0.15	0.16	0.11	0.14
O126	0.05	0.21	0.25	0.22	0.45	0.20	0.13	0.11	0.04	0.19
O127	0.08	0.04	0.13	0.12	0.33	0.30	0.31	0.17	0.03	0.17
O128	0.10	0.05	0.11	0.08	0.29	0.08	0.20	0.25	0.06	0.13
O129	0.04	0.10	0.08	0.03	0.38	0.32	0.11	0.17	0.04	0.14
O130	0.04	0.06	0.05	0.04	0.16	0.04	0.17	0.14	0.03	0.08
O131	0.02	0.13	0.11	0.07	0.25	0.31	0.27	0.19	0.05	0.16
O132	0.06	0.13	0.10	0.04	0.40	0.35	0.21	0.20	0.06	0.17
O133	0.01	0.15	0.13	0.06	0.18	0.10	0.23	0.23	0.10	0.13
O134	0.10	0.15	0.15	0.06	0.28	0.22	0.26	0.20	0.04	0.17
O135	0.01	0.12	0.06	0.03	0.39	0.43	0.41	0.06	0.08	0.18
O136	0.04	0.15	0.07	0.05	0.17	0.25	0.36	0.18	0.11	0.15
O137	0.03	0.19	0.09	0.04	0.13	0.18	0.03	0.33	0.17	0.12
O138	0.06	0.19	0.11	0.13	0.51	0.41	0.45	0.10	0.28	0.24
O139	0.11	0.25	0.14	0.10	0.31	0.09	0.36	0.51	0.27	0.23
O140	0.05	0.11	0.22	0.22	0.45	0.30	0.06	0.19	0.05	0.18
O141	0.12	0.26	0.24	0.23	0.41	0.20	0.17	0.22	0.09	0.22
O142	0.09	0.24	0.21	0.21	0.14	0.02	0.36	0.31	0.28	0.20
O143	0.06	0.14	0.13	0.14	0.37	0.07	0.21	0.25	0.25	0.17

A2 Proposed Scheme VR tables

A2.1 Annual Condition

Table A 11 VR value for the Perimeter Points of Proposed Scheme under Annual Condition

	NNE	NE	ENE	E	ESE	SE	SSE	S	Overall
	7.5%	**10.1%**	**17.4%**	**16.6%**	**8.4%**	**5.9%**	**5.9%**	**4.9%**	**76.6%**
P1	0.57	0.32	0.23	0.11	0.22	0.17	0.07	0.25	0.23
P2	0.40	0.24	0.18	0.08	0.09	0.08	0.04	0.14	0.16
P3	0.31	0.18	0.18	0.08	0.13	0.06	0.03	0.02	0.14
P4	0.11	0.11	0.15	0.07	0.15	0.04	0.03	0.07	0.10
P5	0.18	0.14	0.11	0.09	0.07	0.09	0.03	0.07	0.10
P6	0.28	0.16	0.06	0.10	0.18	0.02	0.05	0.10	0.12
P7	0.12	0.05	0.05	0.06	0.04	0.07	0.05	0.09	0.06
P8	0.21	0.05	0.02	0.02	0.04	0.02	0.07	0.22	0.06
P9	0.10	0.06	0.08	0.10	0.15	0.10	0.03	0.18	0.10
P10	0.14	0.17	0.07	0.06	0.25	0.22	0.06	0.16	0.12
P11	0.20	0.20	0.03	0.05	0.33	0.27	0.05	0.10	0.13
P12	0.17	0.20	0.14	0.19	0.34	0.28	0.09	0.10	0.19
P13	0.09	0.20	0.08	0.14	0.33	0.28	0.08	0.05	0.15
P14	0.09	0.19	0.13	0.13	0.33	0.29	0.08	0.17	0.17
P15	0.12	0.19	0.16	0.07	0.33	0.29	0.14	0.34	0.18
P16	0.10	0.19	0.15	0.03	0.33	0.29	0.10	0.24	0.16
P17	0.13	0.17	0.12	0.03	0.33	0.29	0.11	0.26	0.15
P18	0.17	0.18	0.09	0.06	0.32	0.29	0.13	0.18	0.15
P19	0.22	0.17	0.15	0.14	0.32	0.29	0.11	0.42	0.20
P20	0.23	0.14	0.19	0.17	0.34	0.30	0.03	0.45	0.21
P21	0.22	0.16	0.21	0.18	0.35	0.30	0.09	0.49	0.23
P22	0.19	0.17	0.18	0.18	0.04	0.01	0.13	0.47	0.17
P23	0.23	0.23	0.14	0.18	0.14	0.01	0.13	0.42	0.18
P24	0.25	0.23	0.15	0.20	0.12	0.03	0.07	0.29	0.17
P25	0.19	0.04	0.18	0.16	0.12	0.06	0.04	0.28	0.14
P26	0.08	0.16	0.30	0.24	0.15	0.19	0.16	0.21	0.21
P27	0.16	0.09	0.03	0.07	0.13	0.19	0.30	0.23	0.12
P28	0.28	0.33	0.25	0.05	0.09	0.19	0.36	0.39	0.21
P29	0.28	0.27	0.25	0.16	0.11	0.19	0.37	0.39	0.23
P30	0.05	0.25	0.21	0.14	0.16	0.20	0.37	0.43	0.21
P31	0.47	0.07	0.06	0.14	0.15	0.20	0.37	0.47	0.19
P32	0.17	0.20	0.18	0.17	0.13	0.20	0.38	0.50	0.21
P33	0.59	0.17	0.16	0.20	0.14	0.20	0.38	0.47	0.25
P34	0.44	0.05	0.09	0.15	0.15	0.20	0.36	0.48	0.19
P35	0.14	0.05	0.06	0.13	0.15	0.19	0.32	0.47	0.15
P36	0.20	0.05	0.03	0.02	0.13	0.14	0.29	0.51	0.12
P37	0.16	0.06	0.08	0.05	0.12	0.07	0.23	0.54	0.12
P38	0.14	0.08	0.17	0.15	0.07	0.02	0.06	0.53	0.14

	NNE	NE	ENE	E	ESE	SE	SSE	S	Overall
P39	0.22	0.10	0.18	0.25	0.01	0.11	0.10	0.03	0.15
P40	0.15	0.10	0.19	0.24	0.16	0.20	0.07	0.24	0.17
P41	0.15	0.12	0.23	0.27	0.17	0.26	0.09	0.28	0.20
P42	0.42	0.27	0.25	0.27	0.21	0.27	0.09	0.26	0.26

Table A 12 VR value for the Overall Points of Proposed Scheme under Annual Condition

	NNE	NE	ENE	E	ESE	SE	SSE	S	Overall
	7.5%	**10.1%**	**17.4%**	**16.6%**	**8.4%**	**5.9%**	**5.9%**	**4.9%**	**76.6%**
O1	0.44	0.27	0.25	0.07	0.13	0.16	0.08	0.16	0.19
O2	0.46	0.28	0.23	0.13	0.15	0.23	0.08	0.14	0.21
O3	0.47	0.34	0.25	0.22	0.19	0.28	0.09	0.18	0.26
O4	0.17	0.23	0.25	0.27	0.20	0.33	0.16	0.15	0.23
O5	0.19	0.10	0.19	0.24	0.18	0.26	0.14	0.22	0.19
O6	0.21	0.08	0.07	0.04	0.03	0.07	0.03	0.19	0.08
O7	0.39	0.24	0.18	0.06	0.07	0.09	0.07	0.20	0.16
O8	0.28	0.16	0.10	0.02	0.03	0.01	0.05	0.03	0.09
O9	0.02	0.05	0.06	0.04	0.05	0.10	0.06	0.04	0.05
O10	0.12	0.07	0.13	0.10	0.06	0.15	0.03	0.07	0.10
O11	0.17	0.10	0.12	0.12	0.12	0.17	0.04	0.06	0.12
O12	0.23	0.09	0.04	0.11	0.11	0.06	0.03	0.10	0.09
O13	0.09	0.04	0.04	0.02	0.05	0.01	0.01	0.03	0.04
O14	0.23	0.14	0.09	0.05	0.06	0.11	0.07	0.07	0.10
O15	0.29	0.01	0.04	0.06	0.06	0.06	0.04	0.08	0.07
O16	0.35	0.20	0.08	0.14	0.05	0.18	0.11	0.13	0.15
O17	0.23	0.15	0.11	0.22	0.09	0.26	0.18	0.12	0.17
O18	0.13	0.12	0.09	0.15	0.07	0.14	0.13	0.10	0.12
O19	0.41	0.18	0.09	0.14	0.12	0.20	0.11	0.16	0.16
O20	0.24	0.24	0.10	0.11	0.11	0.13	0.04	0.19	0.14
O21	0.08	0.09	0.16	0.10	0.12	0.14	0.09	0.04	0.11
O22	0.10	0.10	0.17	0.12	0.15	0.18	0.13	0.07	0.13
O23	0.15	0.06	0.14	0.18	0.12	0.14	0.09	0.09	0.13
O24	0.07	0.09	0.15	0.03	0.11	0.17	0.09	0.05	0.09
O25	0.13	0.03	0.15	0.10	0.13	0.19	0.11	0.08	0.11
O26	0.09	0.07	0.18	0.17	0.09	0.18	0.14	0.16	0.14
O27	0.06	0.09	0.14	0.15	0.05	0.19	0.15	0.22	0.13
O28	0.09	0.11	0.12	0.16	0.15	0.23	0.16	0.01	0.13
O29	0.27	0.09	0.10	0.18	0.12	0.19	0.12	0.09	0.14
O30	0.20	0.09	0.06	0.13	0.05	0.15	0.11	0.14	0.11
O31	0.09	0.02	0.03	0.16	0.10	0.06	0.02	0.31	0.09
O32	0.05	0.04	0.11	0.17	0.06	0.07	0.02	0.44	0.11
O33	0.13	0.14	0.07	0.19	0.14	0.12	0.08	0.38	0.14
O34	0.03	0.11	0.13	0.20	0.14	0.15	0.02	0.36	0.14
O35	0.03	0.11	0.20	0.22	0.11	0.06	0.09	0.24	0.15
O36	0.02	0.16	0.20	0.22	0.16	0.18	0.19	0.06	0.17

	NNE	NE	ENE	E	ESE	SE	SSE	S	Overall
O37	0.08	0.06	0.16	0.28	0.13	0.06	0.04	0.03	0.14
O38	0.04	0.05	0.13	0.24	0.12	0.03	0.04	0.29	0.13
O39	0.02	0.12	0.21	0.32	0.17	0.05	0.08	0.04	0.17
O40	0.08	0.12	0.19	0.25	0.14	0.08	0.06	0.17	0.16
O41	0.09	0.15	0.13	0.23	0.17	0.19	0.06	0.19	0.16
O42	0.10	0.09	0.19	0.30	0.01	0.02	0.01	0.28	0.15
O43	0.09	0.15	0.06	0.15	0.11	0.15	0.06	0.23	0.12
O44	0.07	0.11	0.16	0.26	0.01	0.03	0.05	0.19	0.13
O45	0.11	0.09	0.05	0.08	0.06	0.01	0.06	0.14	0.07
O46	0.08	0.16	0.08	0.09	0.03	0.05	0.05	0.06	0.08
O47	0.07	0.10	0.12	0.19	0.01	0.03	0.06	0.16	0.11
O48	0.07	0.04	0.10	0.11	0.01	0.06	0.02	0.19	0.08
O49	0.10	0.16	0.09	0.04	0.05	0.06	0.05	0.15	0.08
O50	0.09	0.14	0.06	0.04	0.05	0.09	0.03	0.14	0.07
O51	0.07	0.16	0.16	0.18	0.16	0.23	0.01	0.15	0.15
O52	0.05	0.14	0.17	0.15	0.14	0.15	0.15	0.31	0.15
O53	0.03	0.19	0.22	0.25	0.13	0.24	0.17	0.38	0.20
O54	0.08	0.20	0.19	0.24	0.08	0.22	0.02	0.39	0.18
O55	0.09	0.19	0.21	0.24	0.13	0.19	0.02	0.38	0.19
O56	0.08	0.18	0.22	0.24	0.13	0.13	0.04	0.46	0.19
O57	0.19	0.18	0.16	0.11	0.31	0.29	0.06	0.42	0.19
O58	0.07	0.07	0.03	0.05	0.11	0.13	0.13	0.27	0.08
O59	0.04	0.05	0.07	0.14	0.15	0.18	0.14	0.28	0.12
O60	0.02	0.06	0.14	0.16	0.15	0.20	0.16	0.15	0.13
O61	0.32	0.25	0.24	0.16	0.13	0.17	0.15	0.12	0.20
O62	0.28	0.16	0.09	0.06	0.22	0.17	0.10	0.08	0.13
O63	0.20	0.14	0.22	0.19	0.31	0.29	0.05	0.24	0.20
O64	0.19	0.03	0.23	0.19	0.27	0.28	0.09	0.31	0.19
O65	0.12	0.10	0.23	0.19	0.25	0.29	0.11	0.33	0.20
O66	0.12	0.16	0.26	0.22	0.28	0.33	0.13	0.19	0.22
O67	0.18	0.18	0.26	0.23	0.27	0.33	0.13	0.17	0.23
O68	0.01	0.05	0.09	0.12	0.09	0.13	0.06	0.13	0.09
O69	0.03	0.02	0.13	0.18	0.15	0.20	0.06	0.13	0.12
O70	0.13	0.09	0.11	0.10	0.03	0.07	0.09	0.04	0.09
O71	0.07	0.06	0.13	0.10	0.10	0.09	0.12	0.08	0.10
O72	0.06	0.09	0.12	0.08	0.07	0.12	0.07	0.23	0.10
O73	0.02	0.07	0.14	0.20	0.19	0.23	0.10	0.28	0.15
O74	0.05	0.06	0.10	0.17	0.15	0.19	0.07	0.10	0.11
O75	0.02	0.02	0.07	0.15	0.15	0.19	0.14	0.29	0.11
O76	0.01	0.06	0.03	0.07	0.09	0.10	0.13	0.28	0.07
O77	0.02	0.08	0.02	0.07	0.12	0.11	0.10	0.23	0.08
O78	0.01	0.03	0.01	0.04	0.13	0.11	0.11	0.21	0.06
O79	0.02	0.08	0.05	0.07	0.11	0.15	0.10	0.26	0.09
O80	0.05	0.14	0.10	0.15	0.10	0.11	0.17	0.21	0.12

	NNE	NE	ENE	E	ESE	SE	SSE	S	Overall
O81	0.03	0.06	0.05	0.07	0.09	0.11	0.15	0.23	0.08
O82	0.01	0.05	0.08	0.06	0.03	0.05	0.02	0.04	0.05
O83	0.35	0.24	0.19	0.08	0.16	0.16	0.19	0.31	0.19
O84	0.24	0.06	0.20	0.22	0.13	0.02	0.12	0.47	0.18
O85	0.31	0.25	0.11	0.19	0.10	0.05	0.05	0.24	0.16
O86	0.13	0.05	0.04	0.04	0.16	0.19	0.33	0.22	0.11
O87	0.19	0.23	0.08	0.12	0.16	0.20	0.33	0.09	0.16
O88	0.26	0.16	0.22	0.07	0.16	0.19	0.33	0.23	0.18
O89	0.13	0.06	0.15	0.06	0.18	0.18	0.32	0.18	0.14
O90	0.17	0.12	0.15	0.02	0.20	0.18	0.34	0.13	0.14
O91	0.17	0.12	0.08	0.07	0.22	0.18	0.34	0.32	0.15
O92	0.28	0.06	0.03	0.10	0.22	0.18	0.35	0.23	0.14
O93	0.15	0.08	0.07	0.16	0.22	0.17	0.35	0.04	0.14
O94	0.07	0.04	0.07	0.14	0.22	0.19	0.35	0.20	0.14
O95	0.13	0.09	0.13	0.17	0.18	0.18	0.30	0.31	0.17
O96	0.13	0.15	0.09	0.14	0.14	0.12	0.19	0.23	0.14
O97	0.14	0.19	0.02	0.02	0.06	0.12	0.08	0.10	0.08
O98	0.20	0.16	0.09	0.13	0.17	0.17	0.03	0.34	0.15
O99	0.27	0.19	0.08	0.13	0.17	0.16	0.03	0.27	0.15
O100	0.04	0.02	0.07	0.06	0.14	0.15	0.01	0.24	0.08
O101	0.03	0.02	0.05	0.04	0.14	0.14	0.01	0.22	0.07
O102	0.06	0.05	0.04	0.03	0.14	0.14	0.01	0.20	0.07
O103	0.14	0.04	0.05	0.07	0.16	0.21	0.31	0.35	0.12
O104	0.04	0.15	0.05	0.09	0.14	0.20	0.30	0.24	0.12
O105	0.26	0.20	0.21	0.11	0.13	0.18	0.31	0.07	0.18
O106	0.09	0.19	0.11	0.08	0.11	0.15	0.11	0.30	0.13
O107	0.12	0.18	0.19	0.13	0.06	0.12	0.09	0.31	0.15
O108	0.12	0.04	0.13	0.03	0.02	0.04	0.03	0.10	0.07
O109	0.19	0.03	0.13	0.11	0.06	0.09	0.04	0.08	0.10
O110	0.20	0.05	0.13	0.12	0.17	0.17	0.36	0.04	0.14
O111	0.17	0.13	0.02	0.14	0.19	0.16	0.33	0.37	0.15
O112	0.25	0.14	0.08	0.16	0.18	0.13	0.32	0.35	0.17
O113	0.26	0.14	0.12	0.21	0.18	0.10	0.33	0.05	0.17
O114	0.05	0.14	0.13	0.20	0.16	0.11	0.26	0.10	0.15
O115	0.02	0.04	0.11	0.11	0.15	0.14	0.18	0.03	0.10
O116	0.08	0.09	0.10	0.11	0.05	0.13	0.16	0.15	0.10
O117	0.15	0.10	0.11	0.01	0.11	0.13	0.13	0.25	0.10
O118	0.07	0.01	0.02	0.01	0.05	0.03	0.05	0.30	0.04
O119	0.33	0.02	0.06	0.13	0.19	0.02	0.04	0.35	0.12
O120	0.32	0.02	0.07	0.15	0.22	0.02	0.11	0.31	0.14
O121	0.08	0.04	0.07	0.06	0.02	0.05	0.08	0.15	0.06
O122	0.13	0.03	0.02	0.01	0.17	0.04	0.04	0.09	0.05
O123	0.02	0.03	0.02	0.11	0.16	0.06	0.02	0.37	0.08
O124	0.10	0.04	0.04	0.08	0.17	0.03	0.03	0.42	0.09

	NNE	NE	ENE	E	ESE	SE	SSE	S	Overall
O125	0.10	0.13	0.12	0.08	0.15	0.20	0.18	0.06	0.12
O126	0.09	0.03	0.02	0.06	0.23	0.25	0.21	0.47	0.12
O127	0.02	0.11	0.03	0.09	0.07	0.13	0.12	0.38	0.09
O128	0.10	0.03	0.01	0.06	0.05	0.07	0.05	0.23	0.06
O129	0.11	0.12	0.07	0.03	0.08	0.07	0.07	0.39	0.09
O130	0.08	0.11	0.05	0.04	0.05	0.06	0.07	0.22	0.07
O131	0.17	0.10	0.04	0.04	0.12	0.12	0.06	0.23	0.09
O132	0.18	0.04	0.05	0.04	0.12	0.09	0.04	0.40	0.09
O133	0.23	0.12	0.01	0.02	0.14	0.13	0.05	0.16	0.08
O134	0.24	0.16	0.10	0.11	0.15	0.15	0.02	0.26	0.14
O135	0.04	0.08	0.19	0.09	0.10	0.02	0.02	0.27	0.11
O136	0.05	0.02	0.11	0.05	0.15	0.07	0.04	0.26	0.09
O137	0.08	0.06	0.02	0.02	0.18	0.10	0.06	0.11	0.06
O138	0.06	0.07	0.03	0.09	0.19	0.07	0.10	0.54	0.11
O139	0.20	0.01	0.02	0.05	0.22	0.05	0.08	0.23	0.09
O140	0.03	0.05	0.02	0.08	0.11	0.18	0.19	0.44	0.10
O141	0.01	0.06	0.04	0.16	0.25	0.23	0.25	0.42	0.14
O142	0.01	0.02	0.05	0.16	0.26	0.24	0.24	0.08	0.12
O143	0.01	0.09	0.06	0.08	0.12	0.12	0.15	0.38	0.10

A2.2 Summer Condition

Table A 13 VR value for the Perimeter Points of Proposed Scheme under Summer Condition

	E	ESE	SE	SSE	S	SSW	SW	WSW	W	Overall
	11.5%	**9.5%**	**9.3%**	**8.3%**	**7.9%**	**8.8%**	**9.9%**	**7.2%**	**4.7%**	**77.1%**
P1	0.11	0.22	0.17	0.07	0.25	0.48	0.50	0.51	0.37	0.28
P2	0.08	0.09	0.08	0.04	0.14	0.08	0.03	0.05	0.07	0.07
P3	0.08	0.13	0.06	0.03	0.02	0.15	0.10	0.10	0.03	0.08
P4	0.07	0.15	0.04	0.03	0.07	0.14	0.14	0.05	0.06	0.09
P5	0.09	0.07	0.09	0.03	0.07	0.18	0.16	0.13	0.09	0.10
P6	0.10	0.18	0.02	0.05	0.10	0.12	0.13	0.15	0.24	0.12
P7	0.06	0.04	0.07	0.05	0.09	0.08	0.10	0.12	0.06	0.07
P8	0.02	0.04	0.02	0.07	0.22	0.20	0.04	0.01	0.16	0.08
P9	0.10	0.15	0.10	0.03	0.18	0.04	0.09	0.07	0.03	0.09
P10	0.06	0.25	0.22	0.06	0.16	0.08	0.08	0.06	0.16	0.12
P11	0.05	0.33	0.27	0.05	0.10	0.08	0.16	0.28	0.30	0.17
P12	0.19	0.34	0.28	0.09	0.10	0.07	0.14	0.07	0.34	0.17
P13	0.14	0.33	0.28	0.08	0.05	0.13	0.18	0.06	0.34	0.17
P14	0.13	0.33	0.29	0.08	0.17	0.07	0.16	0.04	0.31	0.17
P15	0.07	0.33	0.29	0.14	0.34	0.49	0.16	0.05	0.29	0.24
P16	0.03	0.33	0.29	0.10	0.24	0.15	0.22	0.12	0.26	0.19
P17	0.03	0.33	0.29	0.11	0.26	0.14	0.12	0.20	0.16	0.18
P18	0.06	0.32	0.29	0.13	0.18	0.16	0.15	0.13	0.12	0.17

	E	ESE	SE	SSE	S	SSW	SW	WSW	W	Overall
P19	0.14	0.32	0.29	0.11	0.42	0.44	0.34	0.23	0.05	0.27
P20	0.17	0.34	0.30	0.03	0.45	0.49	0.46	0.42	0.33	0.33
P21	0.18	0.35	0.30	0.09	0.49	0.53	0.52	0.27	0.18	0.33
P22	0.18	0.04	0.01	0.13	0.47	0.50	0.50	0.27	0.23	0.26
P23	0.18	0.14	0.01	0.13	0.42	0.47	0.47	0.25	0.20	0.25
P24	0.20	0.12	0.03	0.07	0.29	0.33	0.35	0.31	0.44	0.22
P25	0.16	0.12	0.06	0.04	0.28	0.17	0.25	0.17	0.31	0.17
P26	0.24	0.15	0.19	0.16	0.21	0.09	0.25	0.13	0.33	0.19
P27	0.07	0.13	0.19	0.30	0.23	0.33	0.28	0.34	0.35	0.23
P28	0.05	0.09	0.19	0.36	0.39	0.43	0.34	0.48	0.35	0.28
P29	0.16	0.11	0.19	0.37	0.39	0.41	0.30	0.41	0.36	0.29
P30	0.14	0.16	0.20	0.37	0.43	0.41	0.17	0.31	0.36	0.27
P31	0.14	0.15	0.20	0.37	0.47	0.41	0.14	0.21	0.33	0.26
P32	0.17	0.13	0.20	0.38	0.50	0.42	0.24	0.15	0.30	0.27
P33	0.20	0.14	0.20	0.38	0.47	0.38	0.39	0.34	0.33	0.31
P34	0.15	0.15	0.20	0.36	0.48	0.36	0.18	0.39	0.31	0.27
P35	0.13	0.15	0.19	0.32	0.47	0.29	0.41	0.37	0.29	0.28
P36	0.02	0.13	0.14	0.29	0.51	0.15	0.36	0.33	0.26	0.23
P37	0.05	0.12	0.07	0.23	0.54	0.21	0.22	0.32	0.20	0.21
P38	0.15	0.07	0.02	0.06	0.53	0.43	0.39	0.42	0.20	0.25
P39	0.25	0.01	0.11	0.10	0.03	0.33	0.39	0.40	0.23	0.21
P40	0.24	0.16	0.20	0.07	0.24	0.18	0.28	0.33	0.20	0.21
P41	0.27	0.17	0.26	0.09	0.28	0.29	0.41	0.46	0.28	0.28
P42	0.27	0.21	0.27	0.09	0.26	0.33	0.46	0.53	0.37	0.30

Table A 14 VR value for the Overall Points of Proposed Scheme under Summer Condition

	E	ESE	SE	SSE	S	SSW	SW	WSW	W	Overall
	11.5%	**9.5%**	**9.3%**	**8.3%**	**7.9%**	**8.8%**	**9.9%**	**7.2%**	**4.7%**	**77.1%**
O1	0.07	0.13	0.16	0.08	0.16	0.32	0.31	0.22	0.16	0.18
O2	0.13	0.15	0.23	0.08	0.14	0.39	0.36	0.35	0.20	0.22
O3	0.22	0.19	0.28	0.09	0.18	0.37	0.41	0.44	0.25	0.27
O4	0.27	0.20	0.33	0.16	0.15	0.27	0.44	0.51	0.32	0.29
O5	0.24	0.18	0.26	0.14	0.22	0.21	0.35	0.49	0.36	0.26
O6	0.04	0.03	0.07	0.03	0.19	0.17	0.32	0.19	0.04	0.12
O7	0.06	0.07	0.09	0.07	0.20	0.36	0.31	0.33	0.11	0.18
O8	0.02	0.03	0.01	0.05	0.03	0.15	0.15	0.23	0.13	0.08
O9	0.04	0.05	0.10	0.06	0.04	0.13	0.14	0.10	0.05	0.08
O10	0.10	0.06	0.15	0.03	0.07	0.25	0.14	0.21	0.10	0.12
O11	0.12	0.12	0.17	0.04	0.06	0.33	0.20	0.11	0.20	0.15
O12	0.11	0.11	0.06	0.03	0.10	0.17	0.26	0.16	0.24	0.13
O13	0.02	0.05	0.01	0.01	0.03	0.27	0.32	0.25	0.18	0.12
O14	0.05	0.06	0.11	0.07	0.07	0.08	0.23	0.18	0.13	0.11
O15	0.06	0.06	0.06	0.04	0.08	0.20	0.37	0.32	0.18	0.15

	E	ESE	SE	SSE	S	SSW	SW	WSW	W	Overall
O16	0.14	0.05	0.18	0.11	0.13	0.09	0.14	0.19	0.04	0.12
O17	0.22	0.09	0.26	0.18	0.12	0.14	0.17	0.17	0.05	0.17
O18	0.15	0.07	0.14	0.13	0.10	0.15	0.17	0.17	0.04	0.13
O19	0.14	0.12	0.20	0.11	0.16	0.20	0.24	0.21	0.09	0.17
O20	0.11	0.11	0.13	0.04	0.19	0.13	0.24	0.22	0.03	0.14
O21	0.10	0.12	0.14	0.09	0.04	0.21	0.18	0.15	0.04	0.12
O22	0.12	0.15	0.18	0.13	0.07	0.09	0.12	0.12	0.05	0.12
O23	0.18	0.12	0.14	0.09	0.09	0.22	0.21	0.18	0.04	0.15
O24	0.03	0.11	0.17	0.09	0.05	0.06	0.05	0.02	0.32	0.09
O25	0.10	0.13	0.19	0.11	0.08	0.23	0.21	0.18	0.33	0.16
O26	0.17	0.09	0.18	0.14	0.16	0.02	0.09	0.09	0.38	0.13
O27	0.15	0.05	0.19	0.15	0.22	0.07	0.04	0.10	0.40	0.14
O28	0.16	0.15	0.23	0.16	0.01	0.06	0.06	0.06	0.41	0.13
O29	0.18	0.12	0.19	0.12	0.09	0.14	0.34	0.33	0.20	0.19
O30	0.13	0.05	0.15	0.11	0.14	0.09	0.20	0.18	0.15	0.13
O31	0.16	0.10	0.06	0.02	0.31	0.17	0.04	0.07	0.24	0.12
O32	0.17	0.06	0.07	0.02	0.44	0.05	0.04	0.11	0.03	0.11
O33	0.19	0.14	0.12	0.08	0.38	0.27	0.09	0.13	0.15	0.17
O34	0.20	0.14	0.15	0.02	0.36	0.17	0.08	0.09	0.07	0.15
O35	0.22	0.11	0.06	0.09	0.24	0.19	0.11	0.08	0.05	0.13
O36	0.22	0.16	0.18	0.19	0.06	0.03	0.18	0.11	0.03	0.14
O37	0.28	0.13	0.06	0.04	0.03	0.06	0.01	0.03	0.15	0.09
O38	0.24	0.12	0.03	0.04	0.29	0.15	0.03	0.09	0.11	0.12
O39	0.32	0.17	0.05	0.08	0.04	0.06	0.03	0.06	0.03	0.11
O40	0.25	0.14	0.08	0.06	0.17	0.09	0.07	0.10	0.06	0.12
O41	0.23	0.17	0.19	0.06	0.19	0.07	0.08	0.15	0.04	0.14
O42	0.30	0.01	0.02	0.01	0.28	0.08	0.15	0.10	0.04	0.12
O43	0.15	0.11	0.15	0.06	0.23	0.24	0.15	0.11	0.19	0.15
O44	0.26	0.01	0.03	0.05	0.19	0.29	0.11	0.18	0.06	0.14
O45	0.08	0.06	0.01	0.06	0.14	0.27	0.05	0.16	0.08	0.10
O46	0.09	0.03	0.05	0.05	0.06	0.07	0.08	0.07	0.19	0.07
O47	0.19	0.01	0.03	0.06	0.16	0.12	0.07	0.06	0.12	0.09
O48	0.11	0.01	0.06	0.02	0.19	0.22	0.10	0.09	0.17	0.10
O49	0.04	0.05	0.06	0.05	0.15	0.11	0.14	0.22	0.09	0.10
O50	0.04	0.05	0.09	0.03	0.14	0.05	0.10	0.22	0.06	0.08
O51	0.18	0.16	0.23	0.01	0.15	0.03	0.18	0.08	0.09	0.13
O52	0.15	0.14	0.15	0.15	0.31	0.36	0.46	0.26	0.06	0.23
O53	0.25	0.13	0.24	0.17	0.38	0.40	0.49	0.34	0.17	0.29
O54	0.24	0.08	0.22	0.02	0.39	0.46	0.51	0.36	0.24	0.28
O55	0.24	0.13	0.19	0.02	0.38	0.47	0.53	0.36	0.26	0.29
O56	0.24	0.13	0.13	0.04	0.46	0.53	0.51	0.38	0.26	0.30
O57	0.11	0.31	0.29	0.06	0.42	0.48	0.49	0.30	0.22	0.30
O58	0.05	0.11	0.13	0.13	0.27	0.36	0.11	0.32	0.28	0.18
O59	0.14	0.15	0.18	0.14	0.28	0.42	0.12	0.22	0.20	0.20

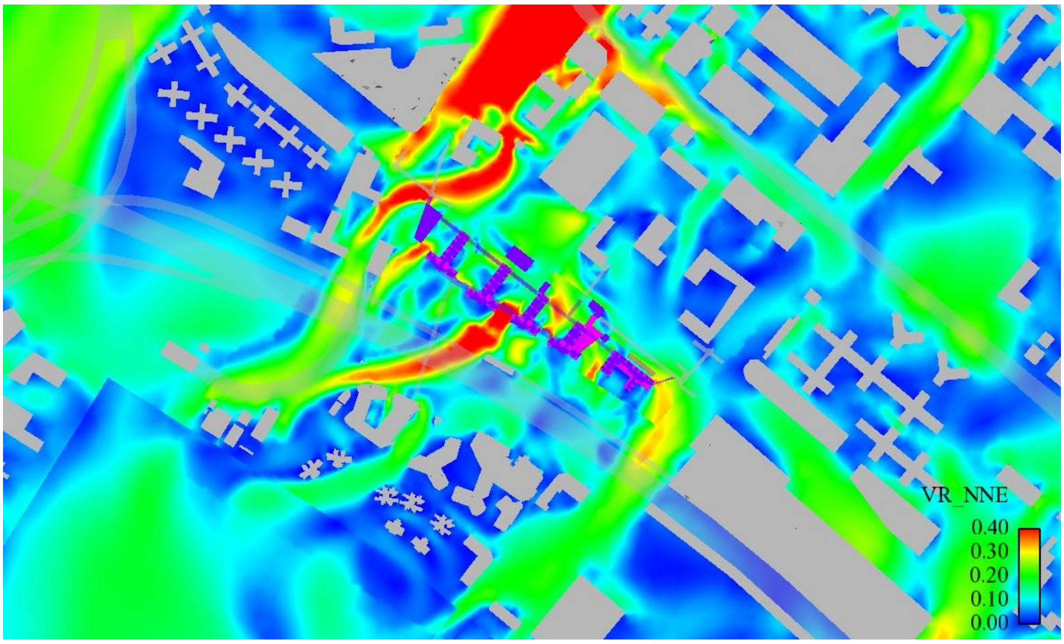
	E	ESE	SE	SSE	S	SSW	SW	WSW	W	Overall
O60	0.16	0.15	0.20	0.16	0.15	0.17	0.19	0.17	0.12	0.17
O61	0.16	0.13	0.17	0.15	0.12	0.27	0.27	0.36	0.22	0.20
O62	0.06	0.22	0.17	0.10	0.08	0.08	0.16	0.10	0.10	0.12
O63	0.19	0.31	0.29	0.05	0.24	0.25	0.40	0.29	0.27	0.25
O64	0.19	0.27	0.28	0.09	0.31	0.27	0.09	0.08	0.05	0.19
O65	0.19	0.25	0.29	0.11	0.33	0.43	0.22	0.25	0.06	0.24
O66	0.22	0.28	0.33	0.13	0.19	0.13	0.23	0.36	0.08	0.22
O67	0.23	0.27	0.33	0.13	0.17	0.24	0.20	0.42	0.09	0.24
O68	0.12	0.09	0.13	0.06	0.13	0.31	0.20	0.19	0.13	0.15
O69	0.18	0.15	0.20	0.06	0.13	0.30	0.22	0.27	0.20	0.19
O70	0.10	0.03	0.07	0.09	0.04	0.21	0.12	0.13	0.15	0.10
O71	0.10	0.10	0.09	0.12	0.08	0.22	0.17	0.19	0.14	0.13
O72	0.08	0.07	0.12	0.07	0.23	0.45	0.32	0.34	0.23	0.21
O73	0.20	0.19	0.23	0.10	0.28	0.46	0.36	0.35	0.23	0.27
O74	0.17	0.15	0.19	0.07	0.10	0.32	0.28	0.39	0.28	0.21
O75	0.15	0.15	0.19	0.14	0.29	0.23	0.25	0.30	0.14	0.20
O76	0.07	0.09	0.10	0.13	0.28	0.20	0.21	0.15	0.09	0.14
O77	0.07	0.12	0.11	0.10	0.23	0.26	0.29	0.30	0.16	0.18
O78	0.04	0.13	0.11	0.11	0.21	0.14	0.23	0.30	0.18	0.15
O79	0.07	0.11	0.15	0.10	0.26	0.23	0.28	0.38	0.22	0.19
O80	0.15	0.10	0.11	0.17	0.21	0.05	0.17	0.20	0.21	0.15
O81	0.07	0.09	0.11	0.15	0.23	0.17	0.22	0.31	0.29	0.17
O82	0.06	0.03	0.05	0.02	0.04	0.21	0.31	0.29	0.29	0.13
O83	0.08	0.16	0.16	0.19	0.31	0.45	0.48	0.45	0.36	0.28
O84	0.22	0.13	0.02	0.12	0.47	0.44	0.37	0.44	0.24	0.27
O85	0.19	0.10	0.05	0.05	0.24	0.25	0.29	0.05	0.27	0.16
O86	0.04	0.16	0.19	0.33	0.22	0.22	0.26	0.35	0.21	0.21
O87	0.12	0.16	0.20	0.33	0.09	0.27	0.28	0.36	0.14	0.22
O88	0.07	0.16	0.19	0.33	0.23	0.37	0.29	0.34	0.17	0.23
O89	0.06	0.18	0.18	0.32	0.18	0.43	0.44	0.26	0.25	0.25
O90	0.02	0.20	0.18	0.34	0.13	0.13	0.30	0.33	0.33	0.20
O91	0.07	0.22	0.18	0.34	0.32	0.07	0.17	0.32	0.33	0.21
O92	0.10	0.22	0.18	0.35	0.23	0.24	0.21	0.23	0.24	0.22
O93	0.16	0.22	0.17	0.35	0.04	0.06	0.32	0.37	0.18	0.21
O94	0.14	0.22	0.19	0.35	0.20	0.22	0.08	0.17	0.17	0.19
O95	0.17	0.18	0.18	0.30	0.31	0.26	0.10	0.02	0.04	0.18
O96	0.14	0.14	0.12	0.19	0.23	0.31	0.05	0.12	0.03	0.15
O97	0.02	0.06	0.12	0.08	0.10	0.29	0.20	0.12	0.03	0.12
O98	0.13	0.17	0.17	0.03	0.34	0.38	0.35	0.26	0.03	0.21
O99	0.13	0.17	0.16	0.03	0.27	0.35	0.35	0.33	0.15	0.22
O100	0.06	0.14	0.15	0.01	0.24	0.26	0.22	0.20	0.11	0.15
O101	0.04	0.14	0.14	0.01	0.22	0.19	0.25	0.07	0.11	0.13
O102	0.03	0.14	0.14	0.01	0.20	0.13	0.21	0.13	0.10	0.12
O103	0.07	0.16	0.21	0.31	0.35	0.25	0.28	0.35	0.15	0.23

	E	ESE	SE	SSE	S	SSW	SW	WSW	W	Overall
O104	0.09	0.14	0.20	0.30	0.24	0.19	0.25	0.34	0.13	0.20
O105	0.11	0.13	0.18	0.31	0.07	0.37	0.28	0.31	0.18	0.21
O106	0.08	0.11	0.15	0.11	0.30	0.19	0.26	0.28	0.19	0.18
O107	0.13	0.06	0.12	0.09	0.31	0.28	0.20	0.18	0.14	0.16
O108	0.03	0.02	0.04	0.03	0.10	0.29	0.40	0.18	0.09	0.13
O109	0.11	0.06	0.09	0.04	0.08	0.04	0.40	0.27	0.16	0.14
O110	0.12	0.17	0.17	0.36	0.04	0.13	0.24	0.29	0.30	0.19
O111	0.14	0.19	0.16	0.33	0.37	0.09	0.26	0.22	0.28	0.22
O112	0.16	0.18	0.13	0.32	0.35	0.26	0.29	0.13	0.07	0.21
O113	0.21	0.18	0.10	0.33	0.05	0.12	0.32	0.41	0.23	0.21
O114	0.20	0.16	0.11	0.26	0.10	0.18	0.14	0.08	0.08	0.15
O115	0.11	0.15	0.14	0.18	0.03	0.12	0.14	0.03	0.01	0.11
O116	0.11	0.05	0.13	0.16	0.15	0.21	0.05	0.09	0.04	0.11
O117	0.01	0.11	0.13	0.13	0.25	0.14	0.02	0.10	0.03	0.10
O118	0.01	0.05	0.03	0.05	0.30	0.23	0.26	0.29	0.20	0.15
O119	0.13	0.19	0.02	0.04	0.35	0.36	0.56	0.44	0.27	0.26
O120	0.15	0.22	0.02	0.11	0.31	0.29	0.56	0.59	0.35	0.28
O121	0.06	0.02	0.05	0.08	0.15	0.08	0.07	0.37	0.26	0.11
O122	0.01	0.17	0.04	0.04	0.09	0.14	0.18	0.44	0.28	0.14
O123	0.11	0.16	0.06	0.02	0.37	0.27	0.13	0.16	0.15	0.16
O124	0.08	0.17	0.03	0.03	0.42	0.32	0.37	0.34	0.30	0.22
O125	0.08	0.15	0.20	0.18	0.06	0.28	0.19	0.19	0.09	0.16
O126	0.06	0.23	0.25	0.21	0.47	0.19	0.15	0.11	0.05	0.19
O127	0.09	0.07	0.13	0.12	0.38	0.30	0.32	0.18	0.06	0.19
O128	0.06	0.05	0.07	0.05	0.23	0.10	0.12	0.21	0.14	0.11
O129	0.03	0.08	0.07	0.07	0.39	0.28	0.10	0.13	0.06	0.13
O130	0.04	0.05	0.06	0.07	0.22	0.06	0.16	0.15	0.05	0.09
O131	0.04	0.12	0.12	0.06	0.23	0.28	0.25	0.19	0.07	0.15
O132	0.04	0.12	0.09	0.04	0.40	0.33	0.20	0.17	0.04	0.16
O133	0.02	0.14	0.13	0.05	0.16	0.09	0.23	0.22	0.10	0.13
O134	0.11	0.15	0.15	0.02	0.26	0.21	0.25	0.19	0.06	0.16
O135	0.09	0.10	0.02	0.02	0.27	0.43	0.41	0.06	0.08	0.17
O136	0.05	0.15	0.07	0.04	0.26	0.28	0.35	0.19	0.11	0.17
O137	0.02	0.18	0.10	0.06	0.11	0.13	0.07	0.32	0.20	0.12
O138	0.09	0.19	0.07	0.10	0.54	0.40	0.47	0.15	0.29	0.25
O139	0.05	0.22	0.05	0.08	0.23	0.07	0.24	0.45	0.27	0.17
O140	0.08	0.11	0.18	0.19	0.44	0.22	0.05	0.08	0.09	0.16
O141	0.16	0.25	0.23	0.25	0.42	0.14	0.15	0.14	0.09	0.21
O142	0.16	0.26	0.24	0.24	0.08	0.11	0.35	0.31	0.28	0.22
O143	0.08	0.12	0.12	0.15	0.38	0.08	0.24	0.21	0.24	0.17

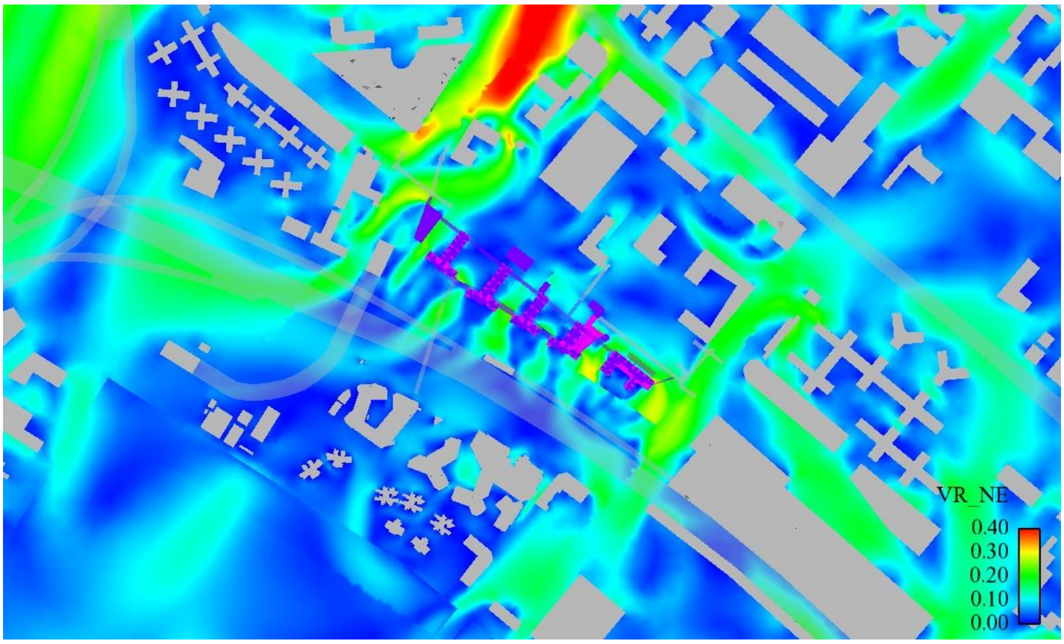
Appendix B

Directional VR Contour Plots

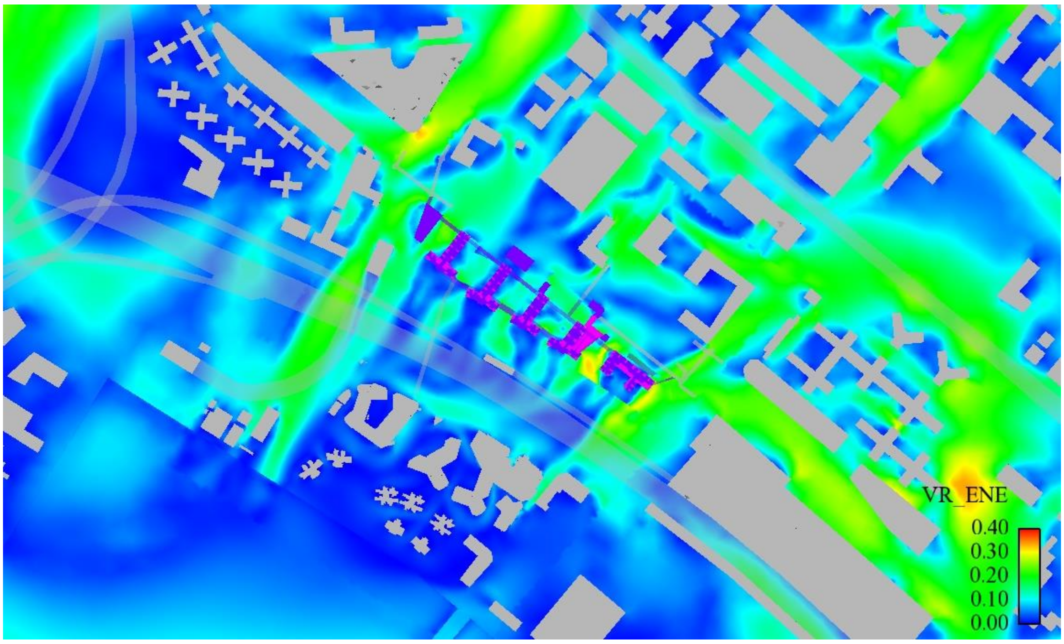
B1 Baseline Scheme Directional VR Contour Plots



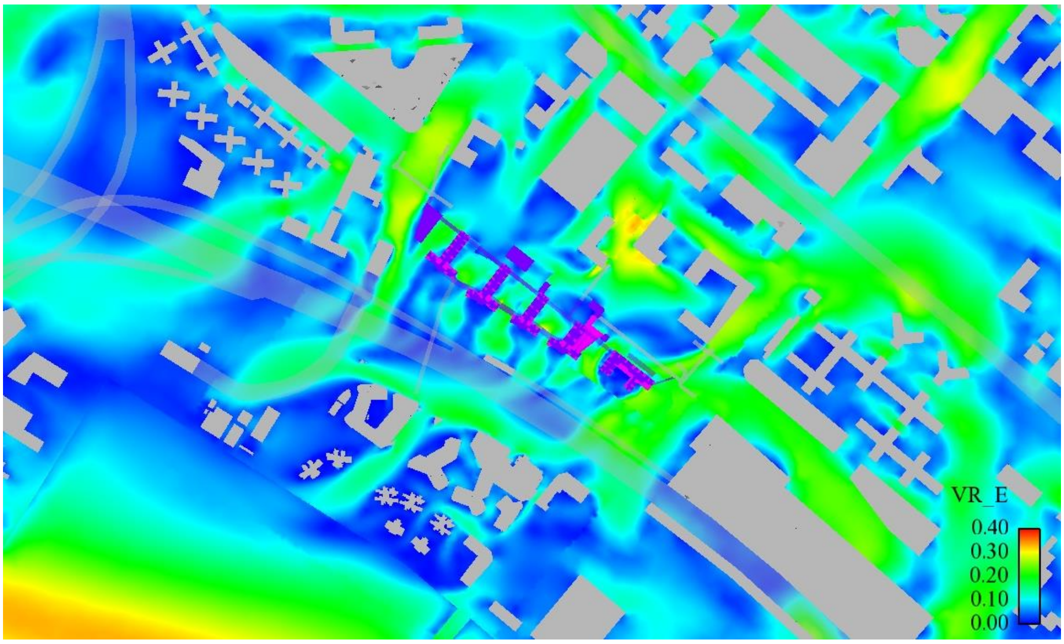
Contour Plot under NNE Wind (Baseline Scheme)



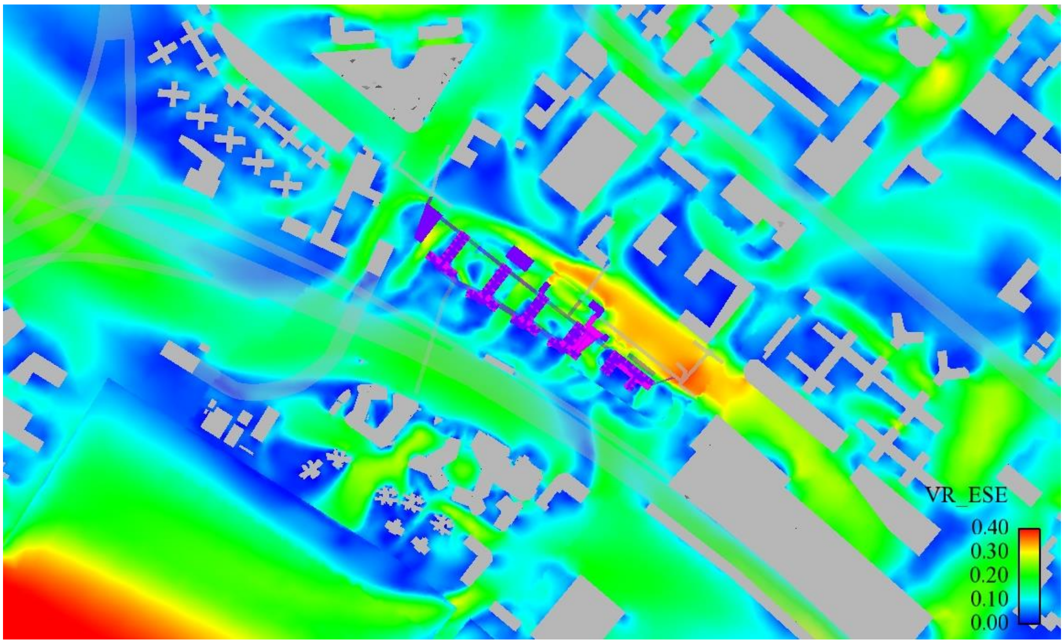
Contour Plot under NE Wind (Baseline Scheme)



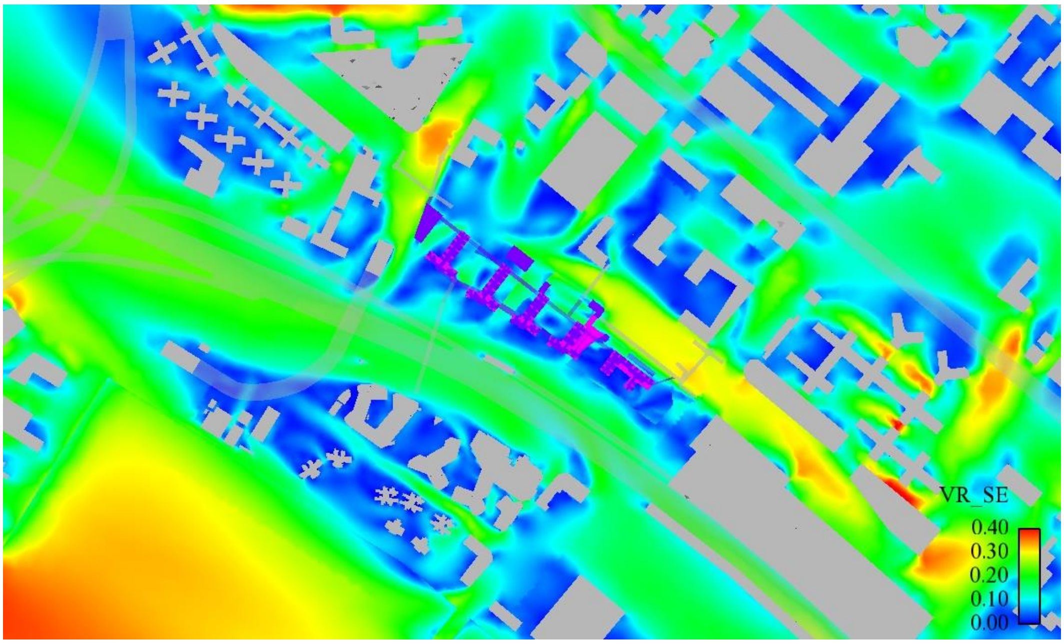
Contour Plot under ENE Wind (Baseline Scheme)



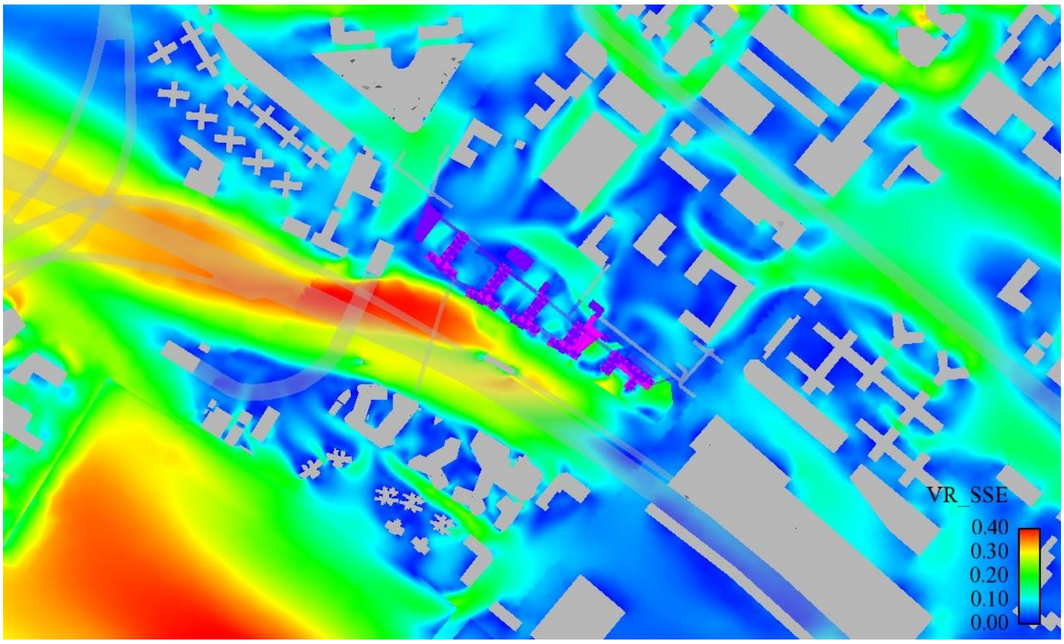
Contour Plot under E Wind (Baseline Scheme)



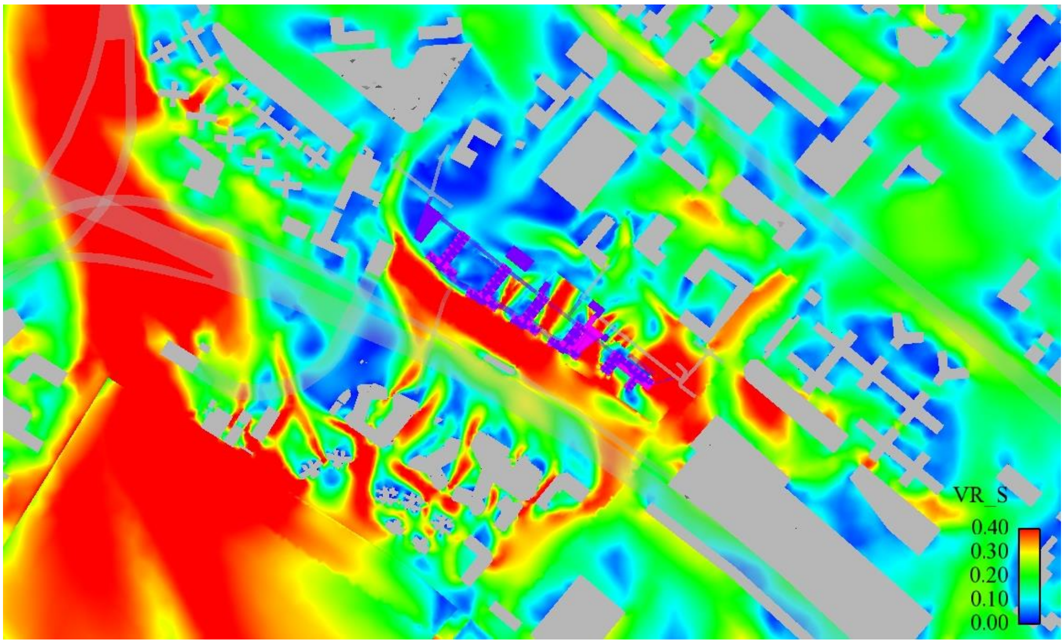
Contour Plot under ESE Wind (Baseline Scheme)



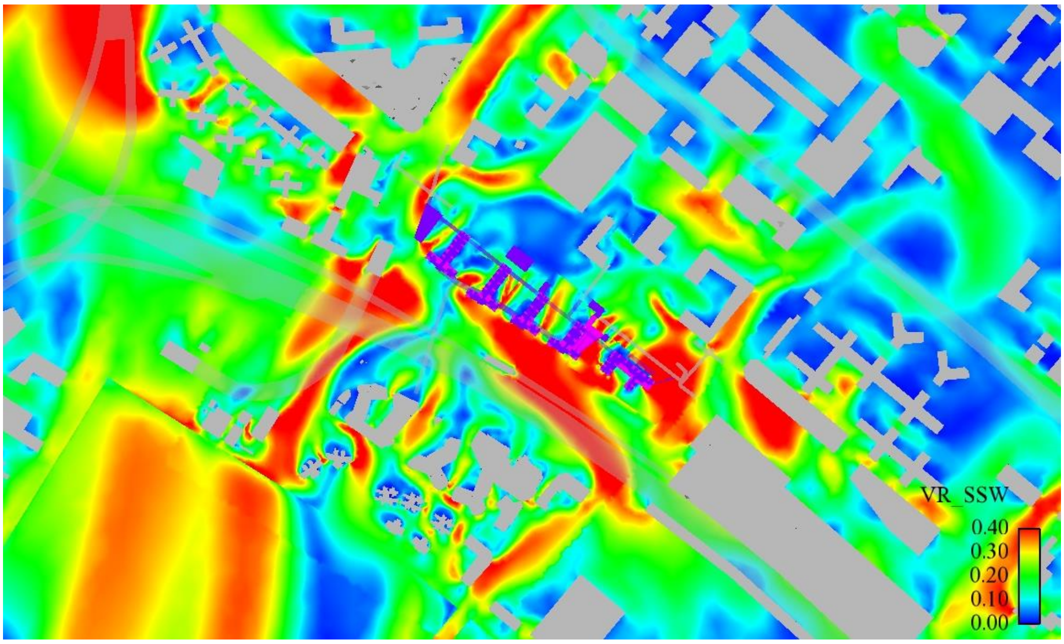
Contour Plot under SE Wind (Baseline Scheme)



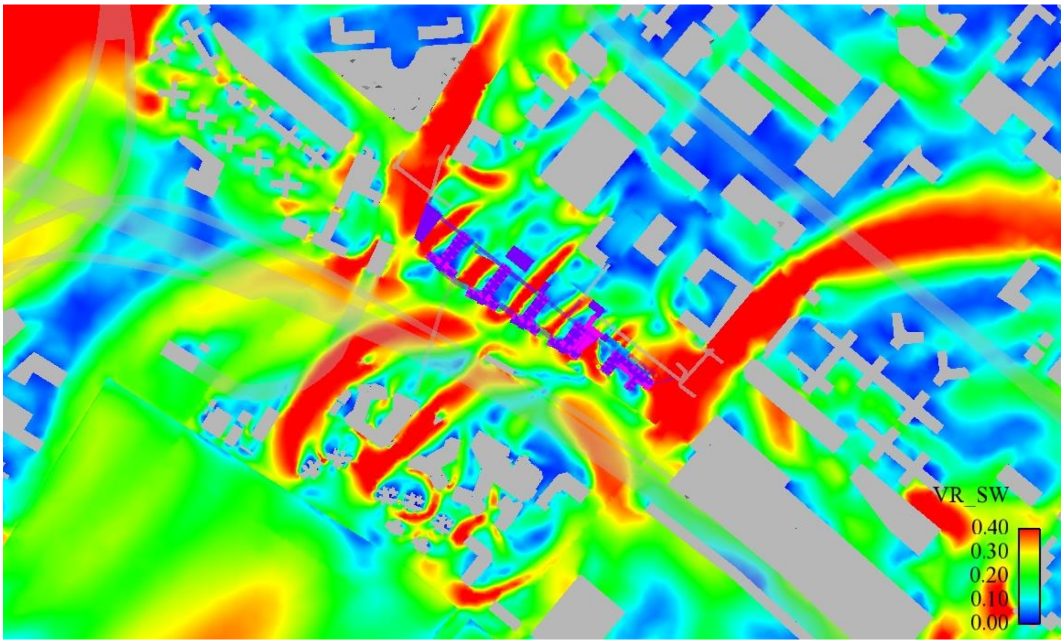
Contour Plot under SSE Wind (Baseline Scheme)



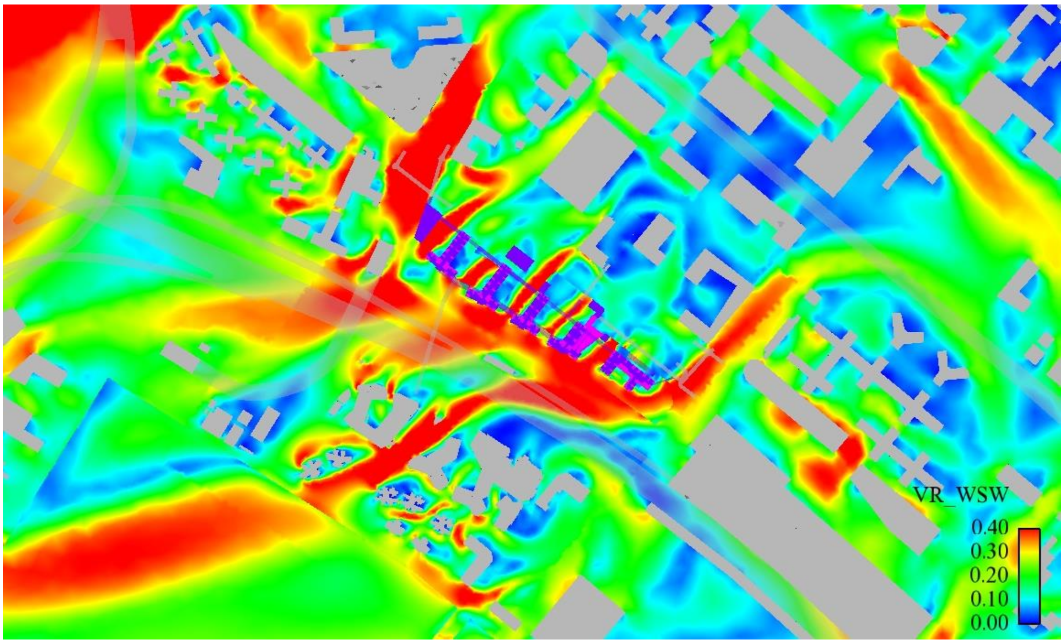
Contour Plot under S Wind (Baseline Scheme)



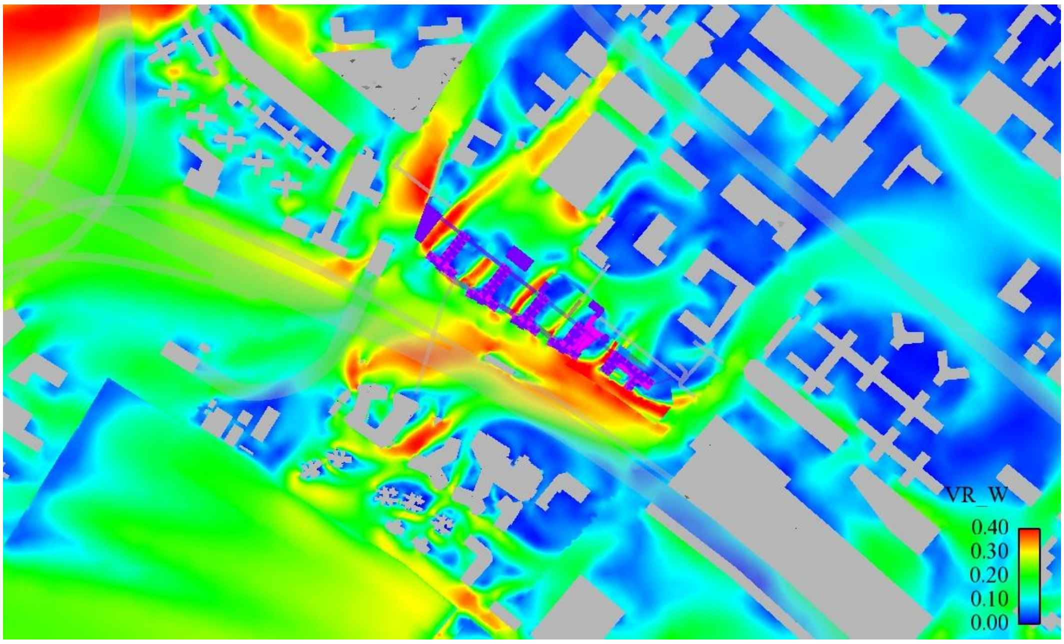
Contour Plot under SSW Wind (Baseline Scheme)



Contour Plot under SW Wind (Baseline Scheme)

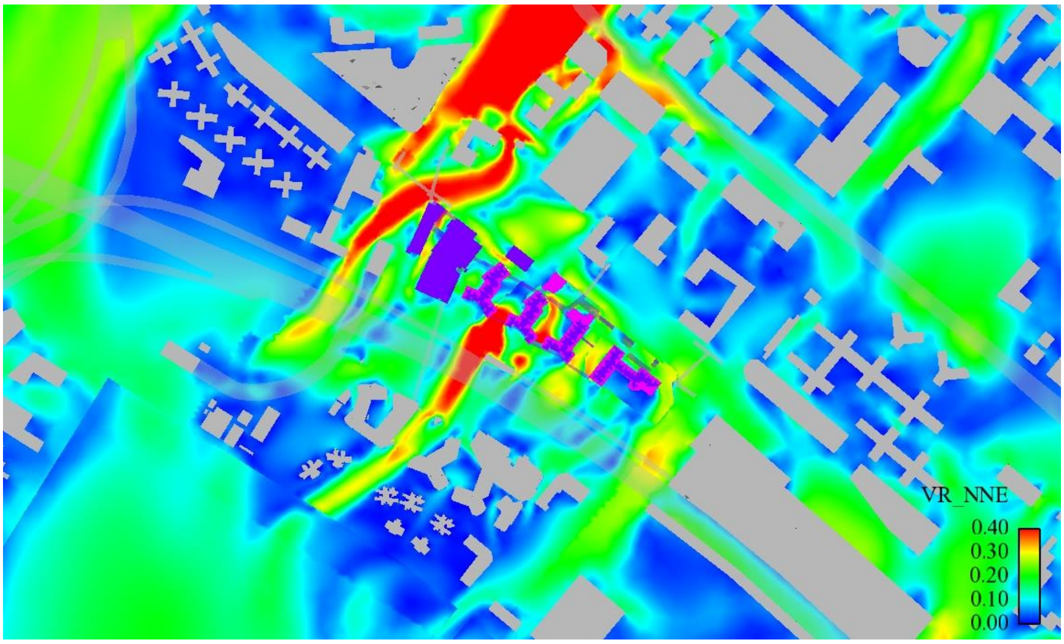


Contour Plot under WSW Wind (Baseline Scheme)

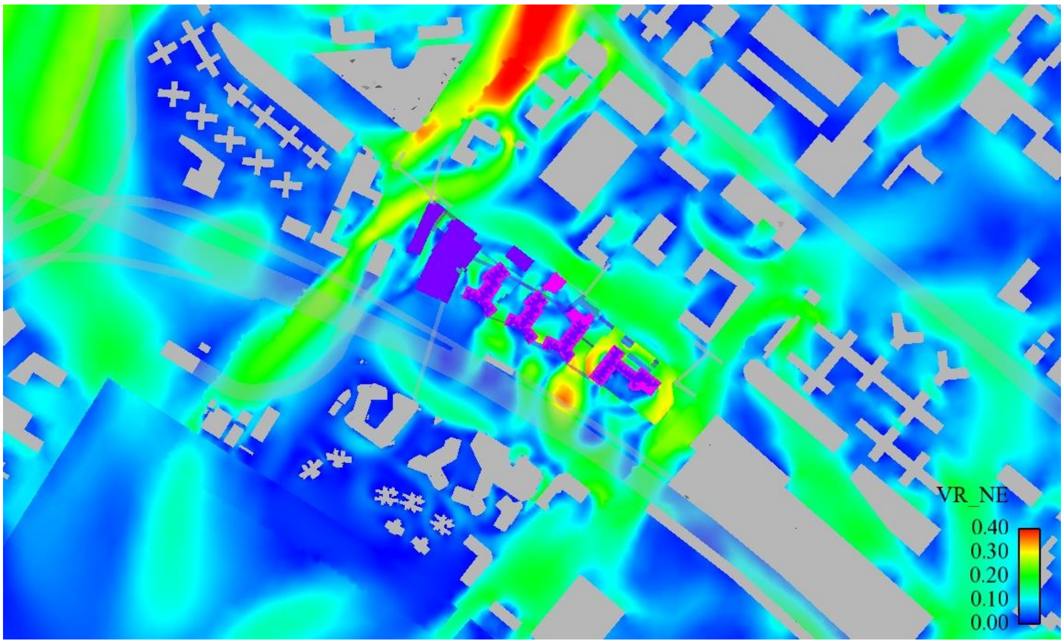


Contour Plot under W Wind (Baseline Scheme)

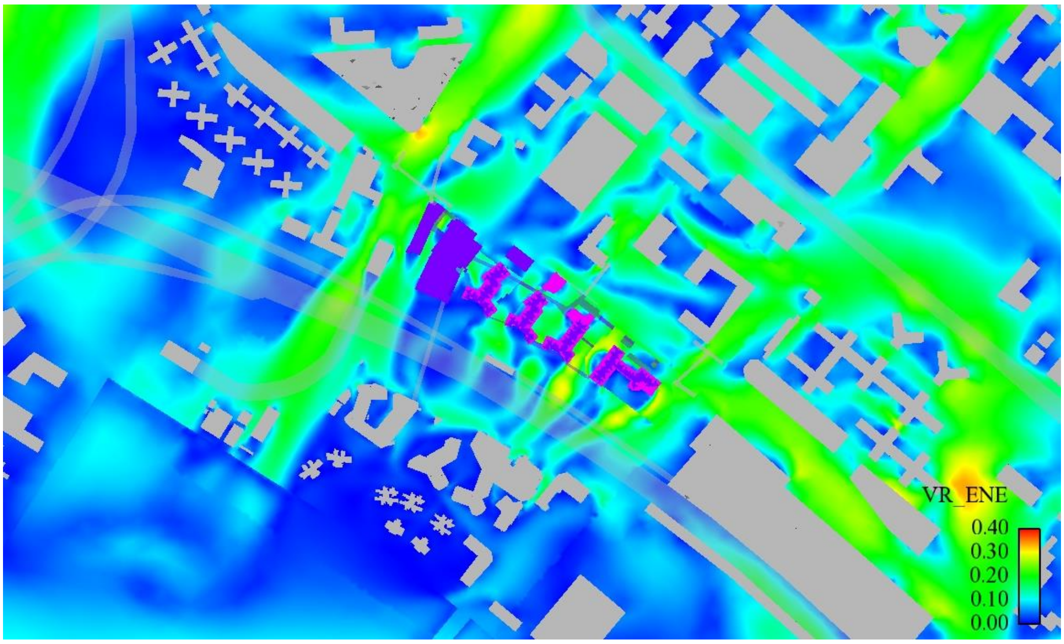
B2 Proposed Scheme Directional VR Contour Plots



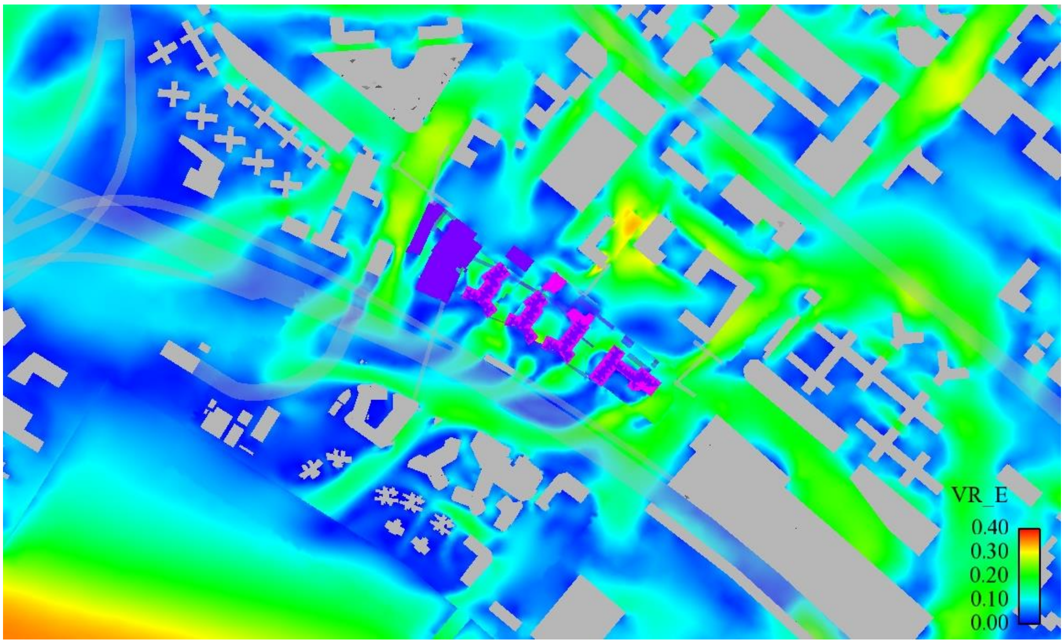
Contour Plot under NNE Wind (Proposed Scheme)



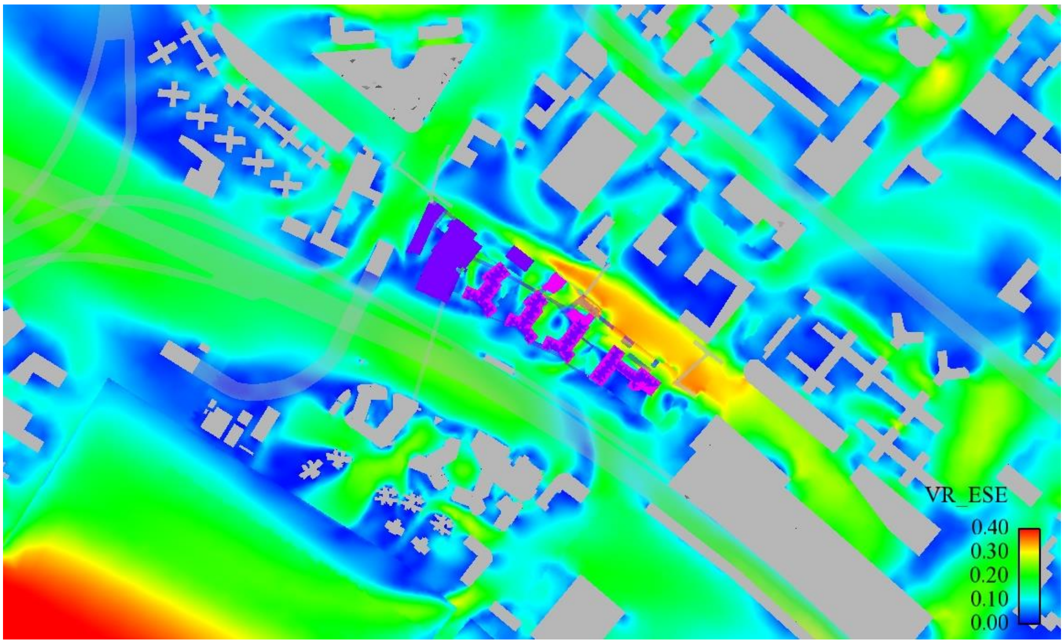
Contour Plot under NE Wind (Proposed Scheme)



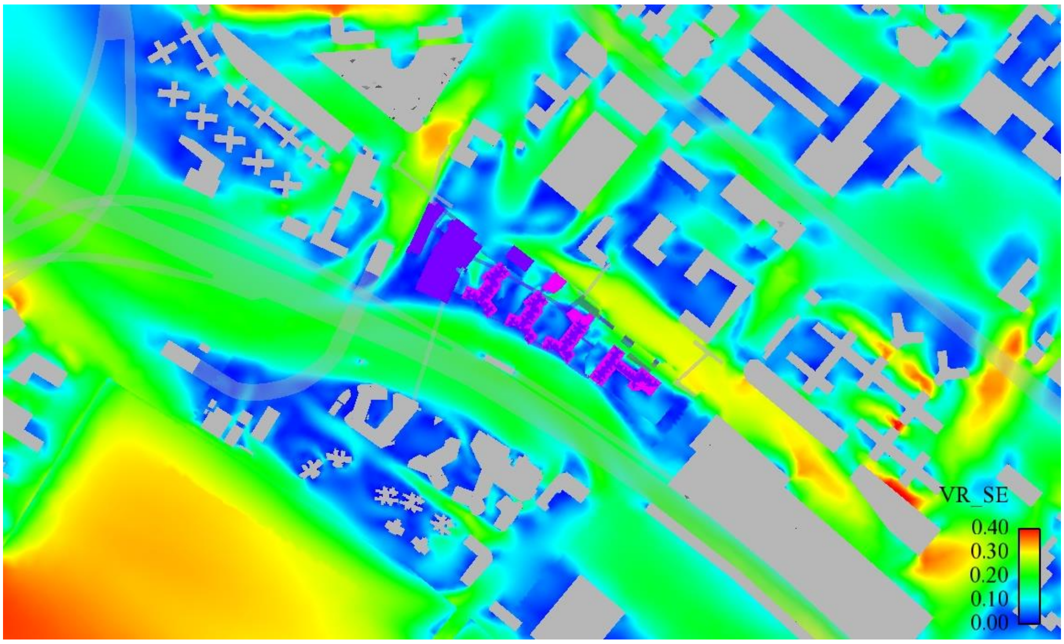
Contour Plot under ENE Wind (Proposed Scheme)



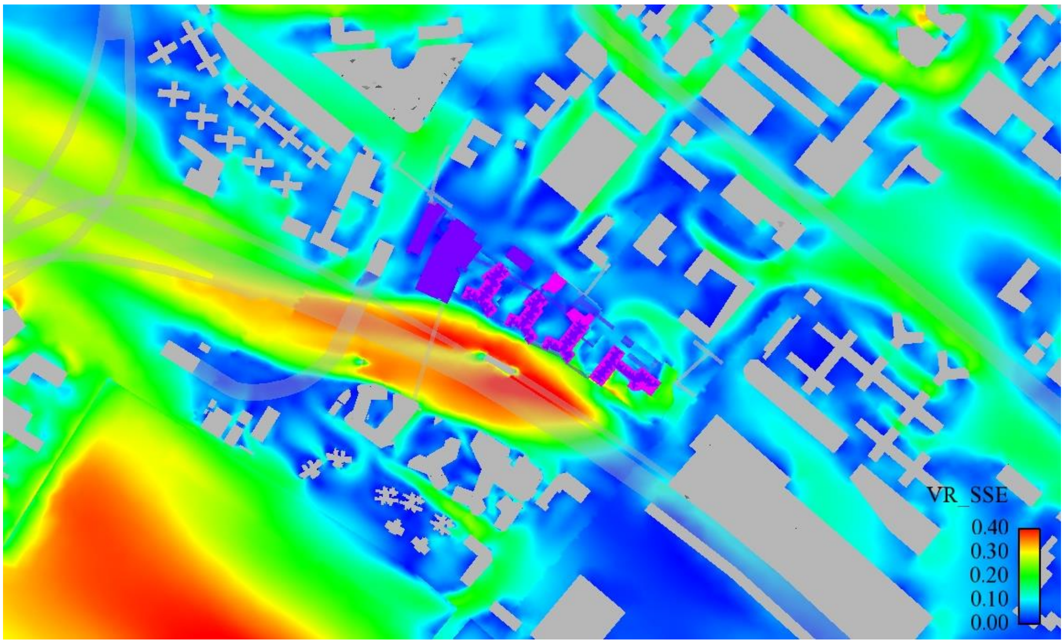
Contour Plot under E Wind (Proposed Scheme)



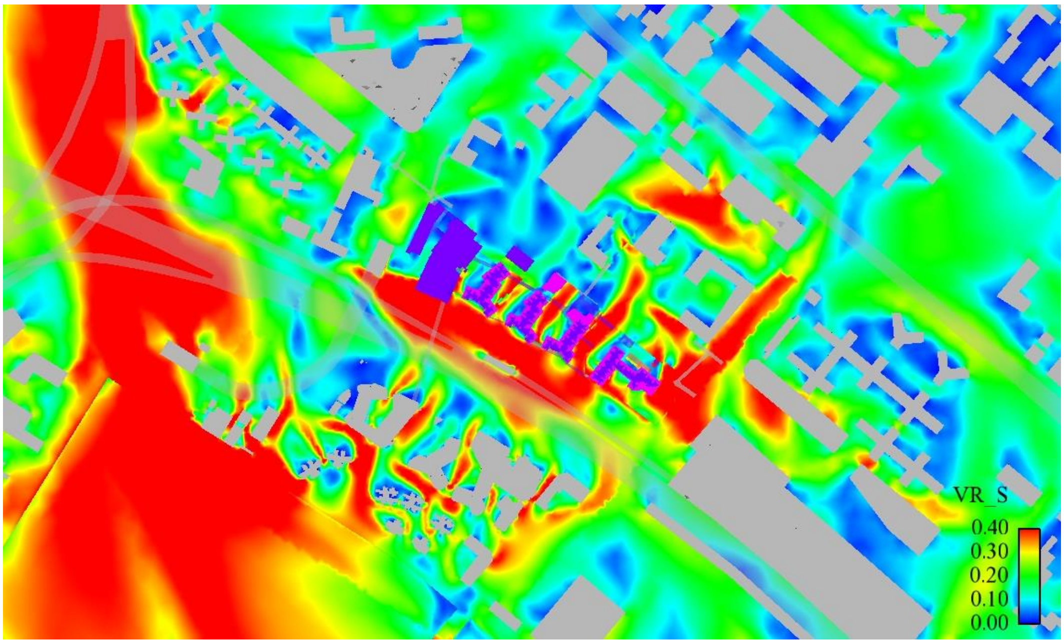
Contour Plot under ESE Wind (Proposed Scheme)



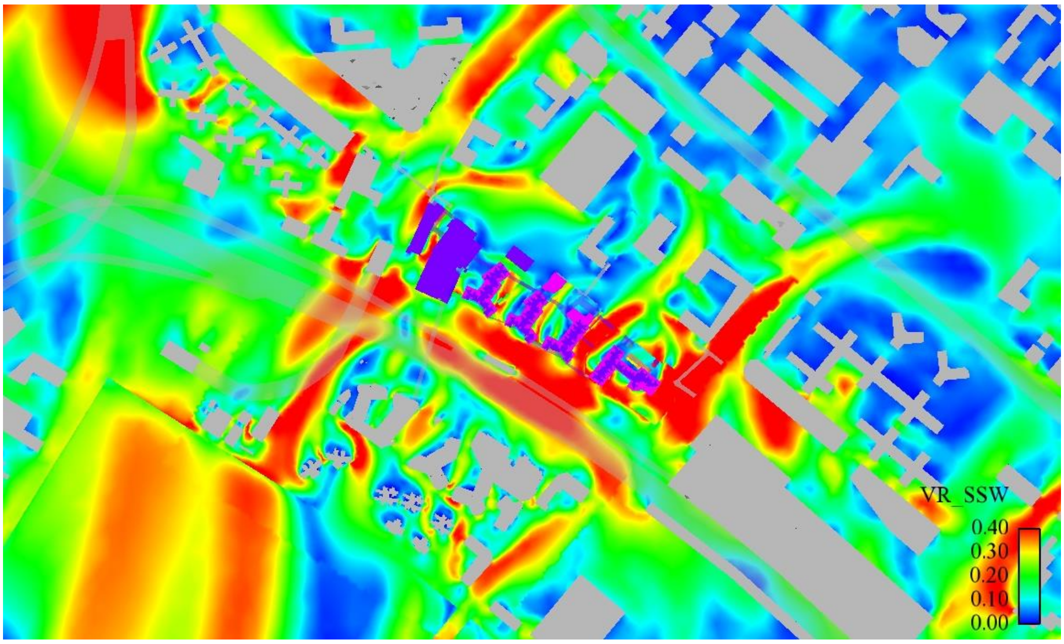
Contour Plot under SE Wind (Proposed Scheme)



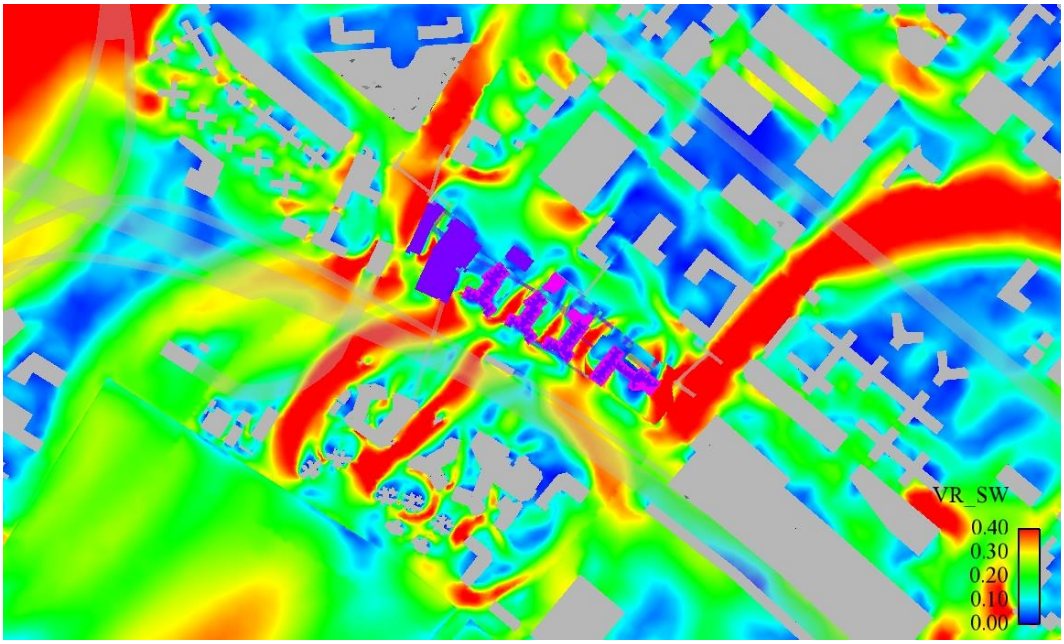
Contour Plot under SSE Wind (Proposed Scheme)



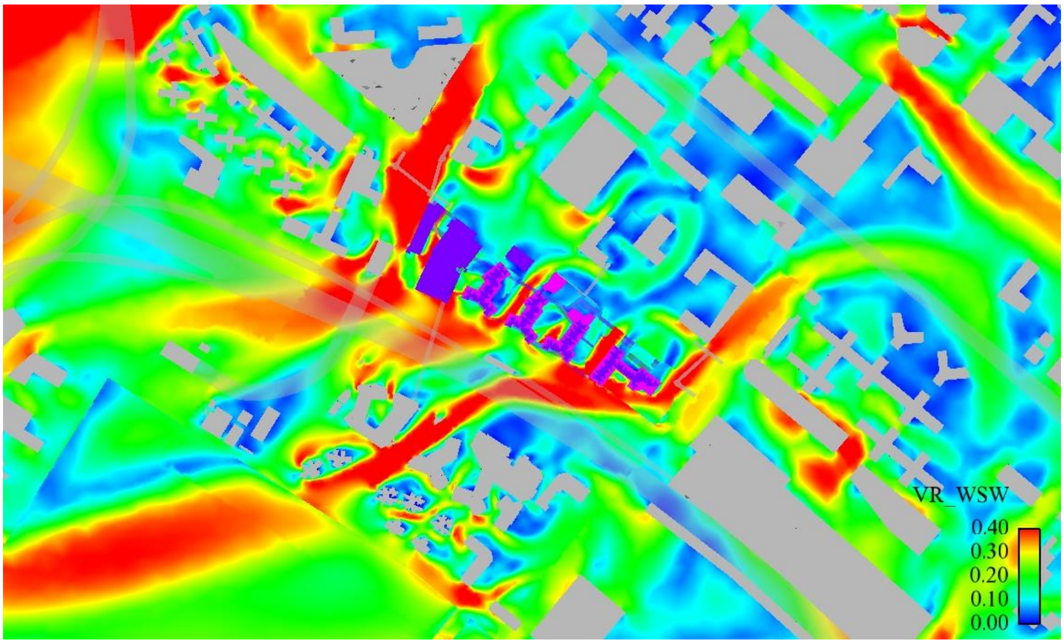
Contour Plot under S Wind (Proposed Scheme)



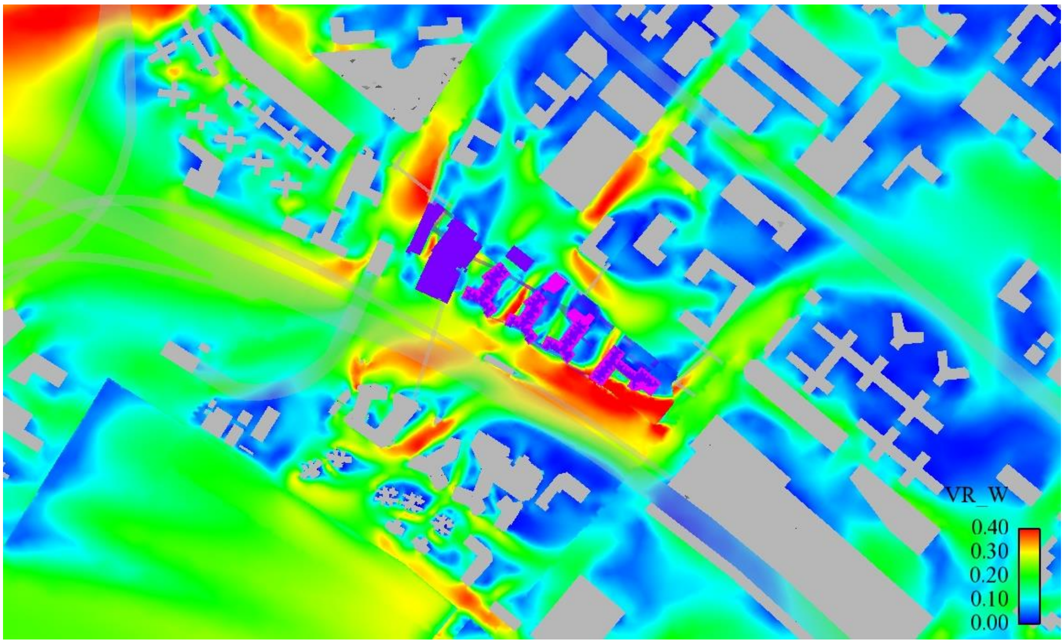
Contour Plot under SSW Wind (Proposed Scheme)



Contour Plot under SW Wind (Proposed Scheme)



Contour Plot under WSW Wind (Proposed Scheme)

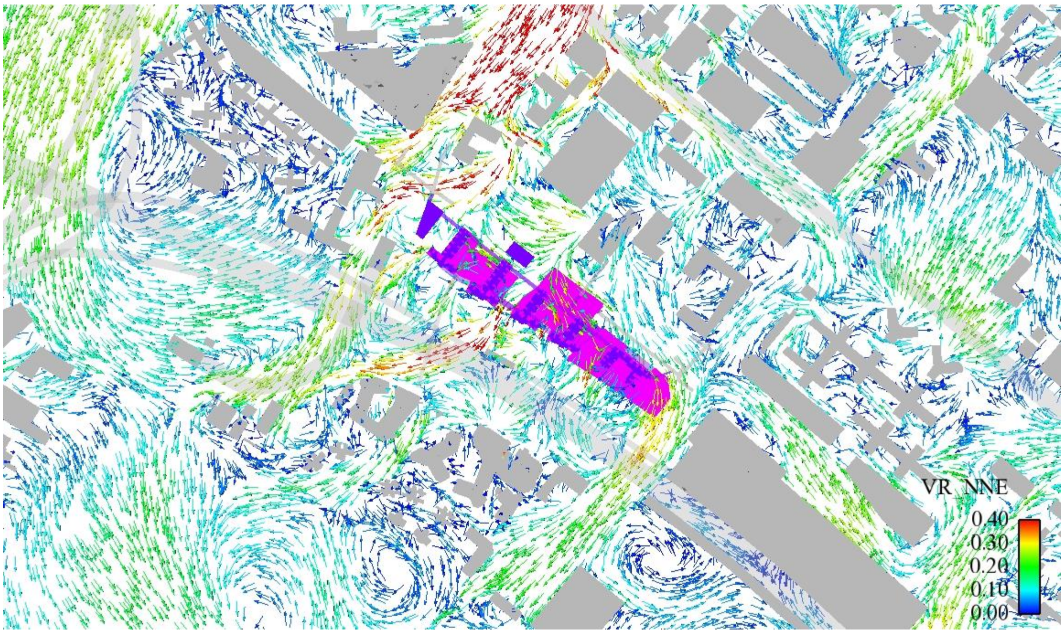


Contour Plot under W Wind (Proposed Scheme)

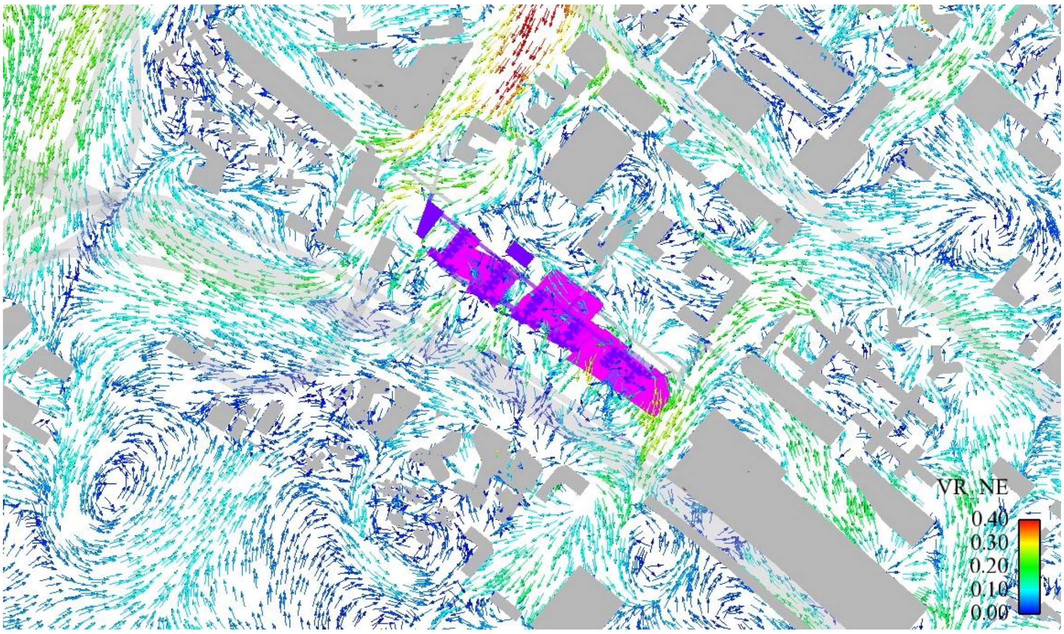
Appendix C

Directional VR Vector Plots

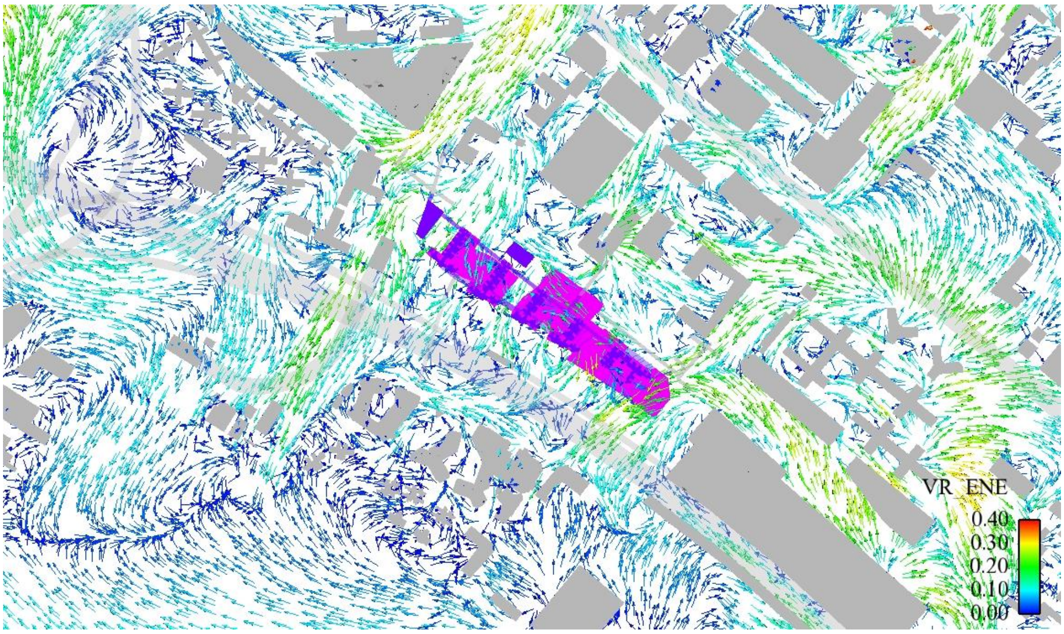
C1 Baseline Scheme Directional VR Vector Plots



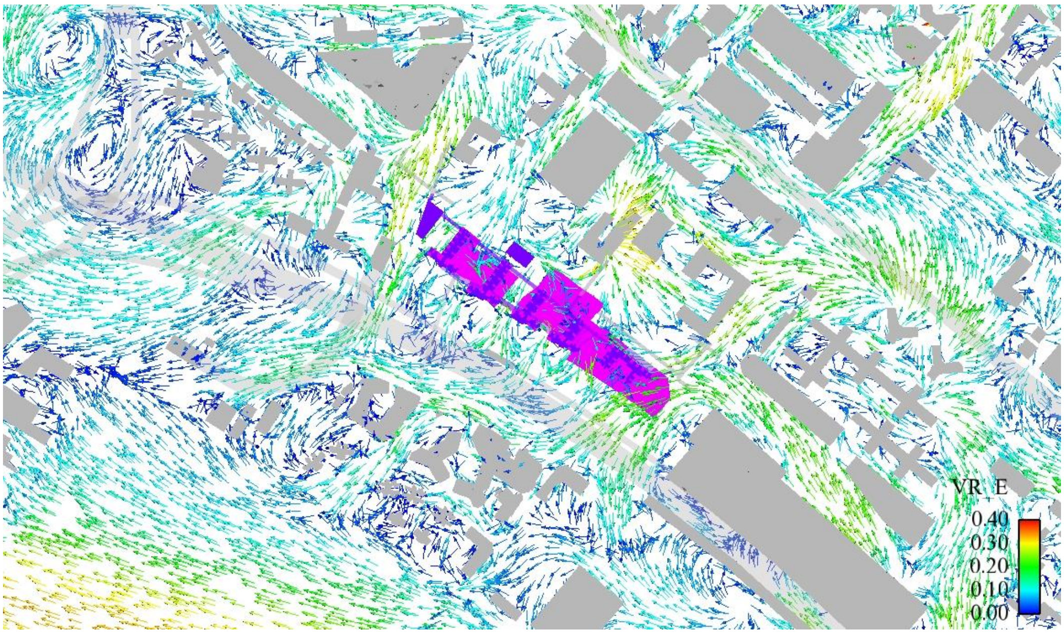
Vector Plot under NNE Wind (Baseline Scheme)



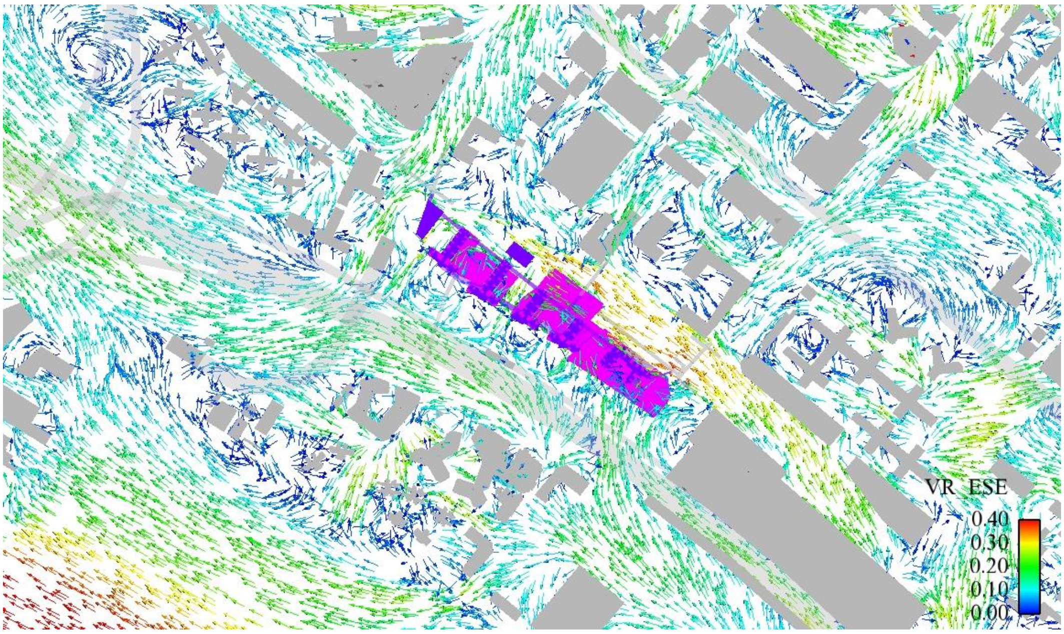
Vector Plot under NE Wind (Baseline Scheme)



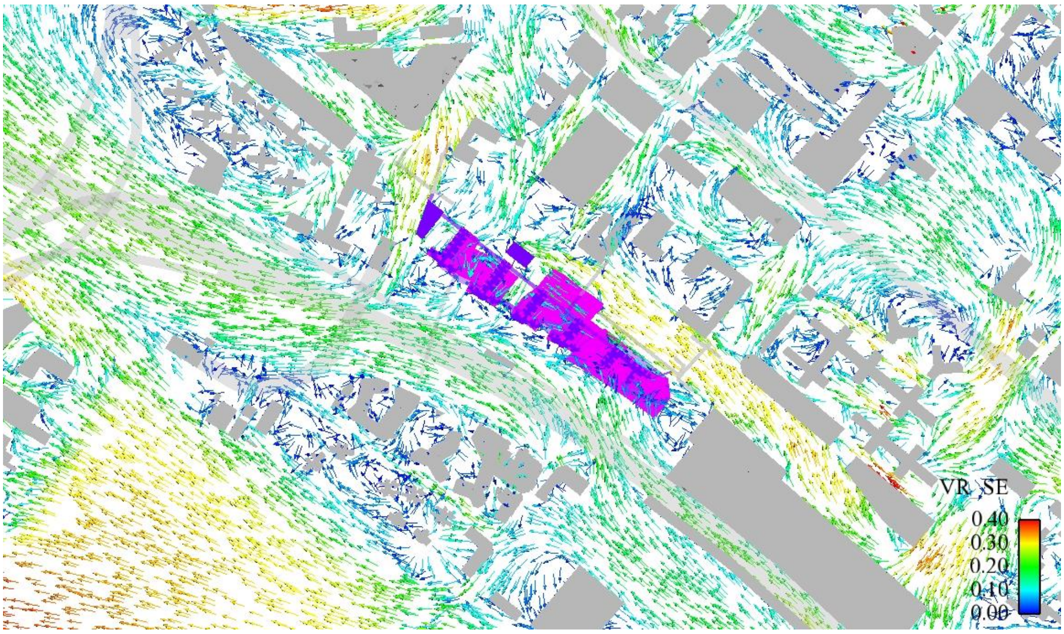
Vector Plot under ENE Wind (Baseline Scheme)



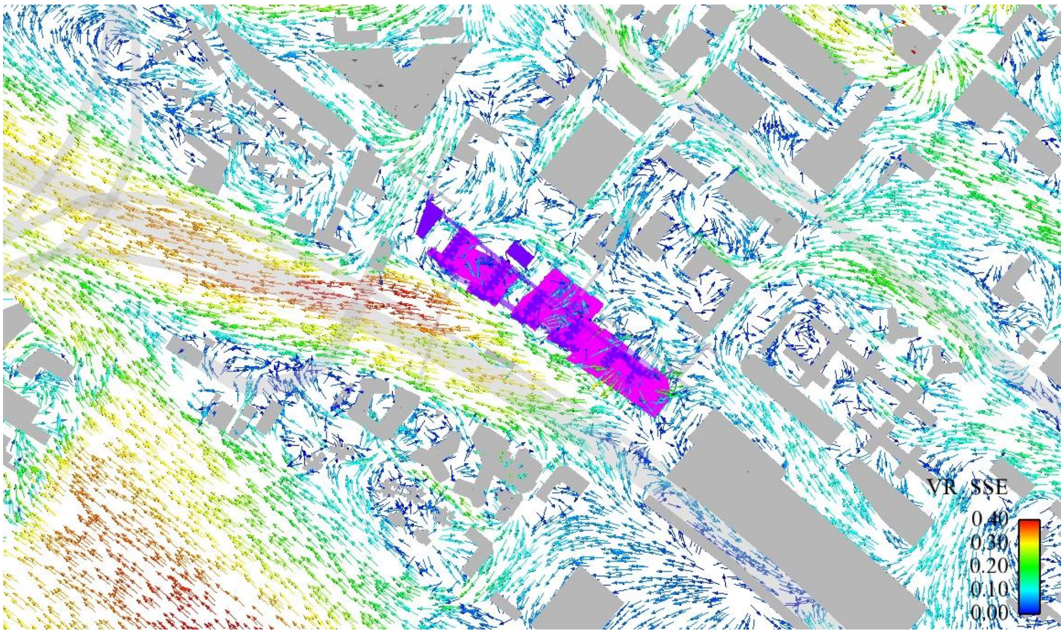
Vector Plot under E Wind (Baseline Scheme)



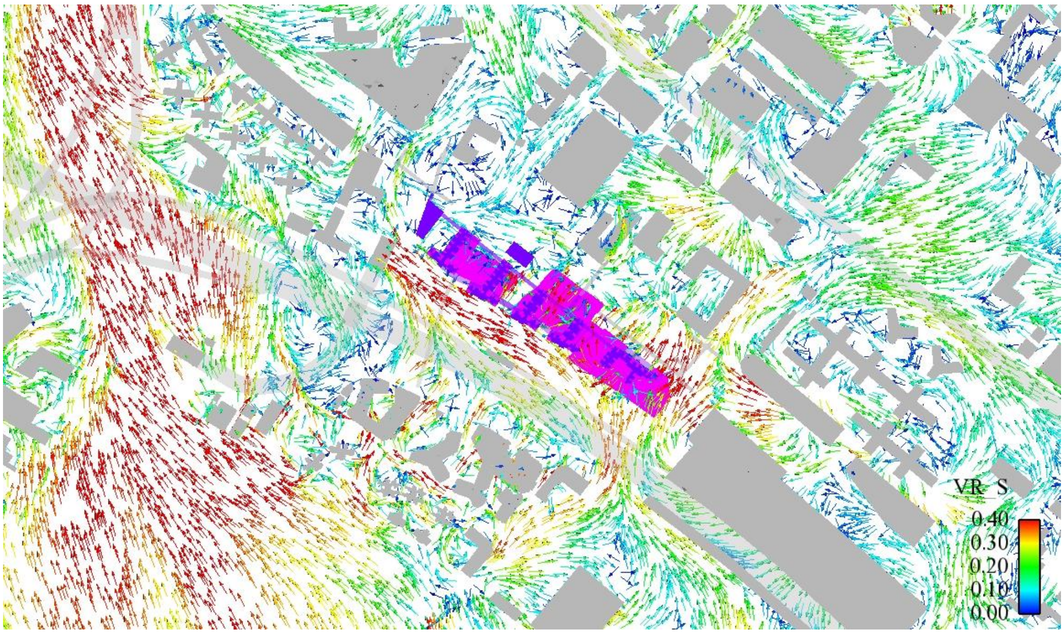
Vector Plot under ESE Wind (Baseline Scheme)



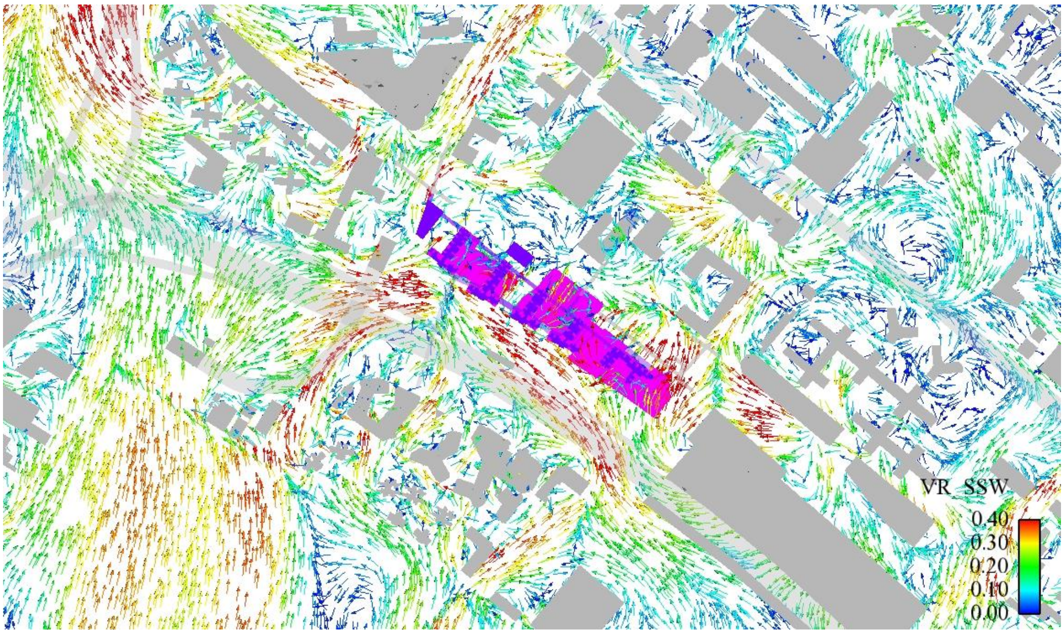
Vector Plot under SE Wind (Baseline Scheme)



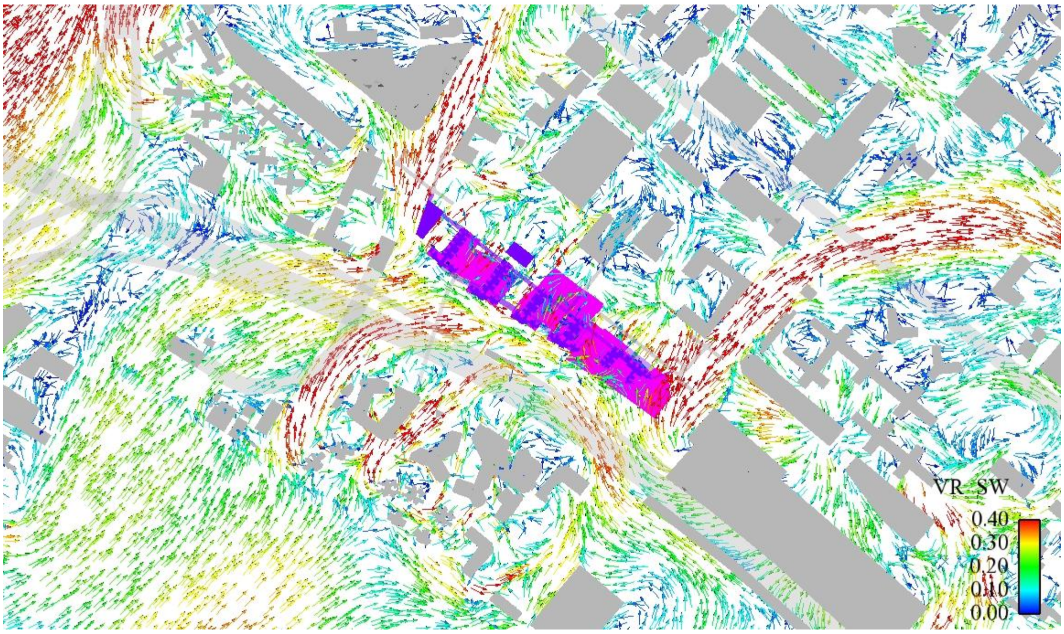
Vector Plot under SSE Wind (Baseline Scheme)



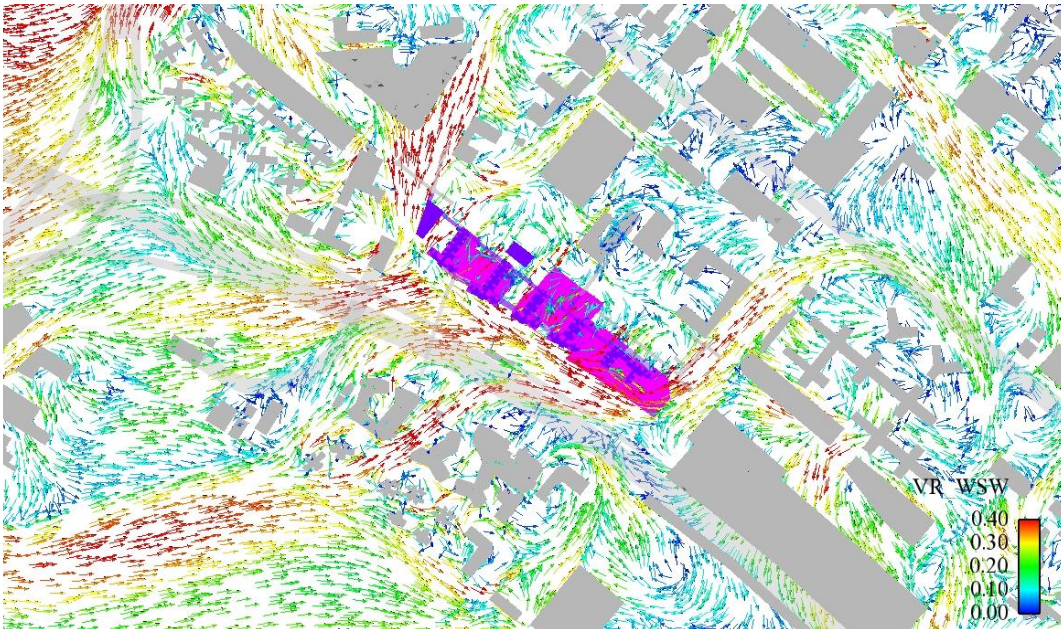
Vector Plot under S Wind (Baseline Scheme)



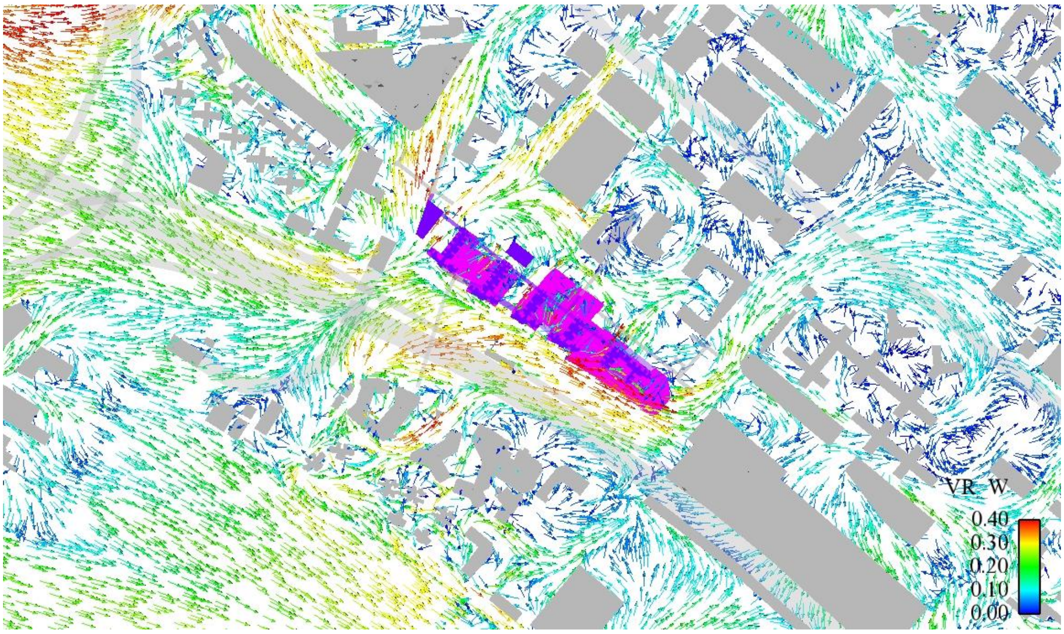
Vector Plot under SSW Wind (Baseline Scheme)



Vector Plot under SW Wind (Baseline Scheme)

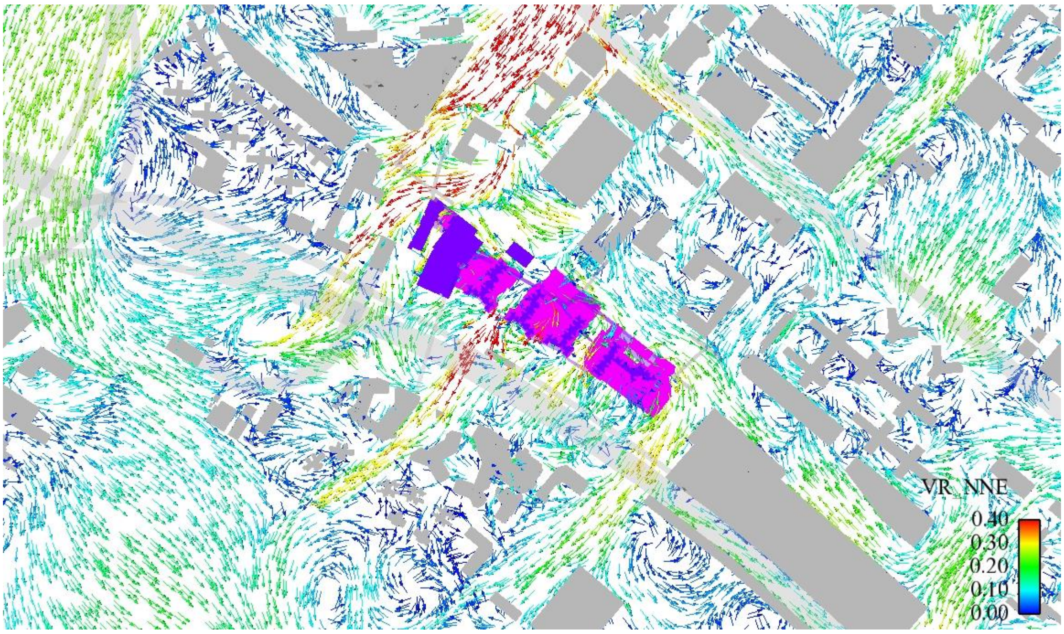


Vector Plot under WSW Wind (Baseline Scheme)

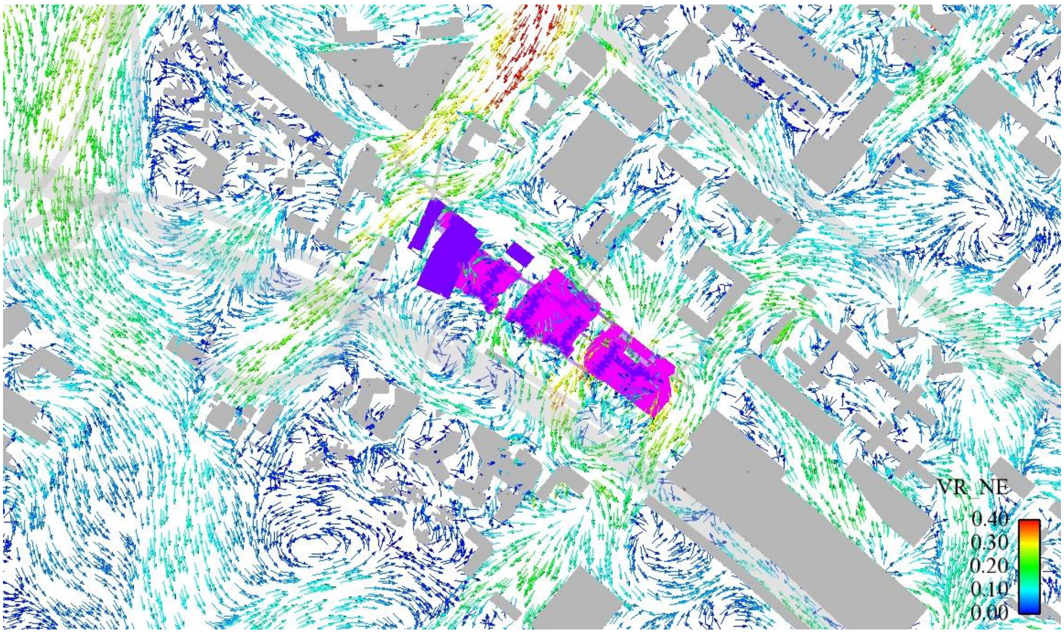


Vector Plot under W Wind (Baseline Scheme)

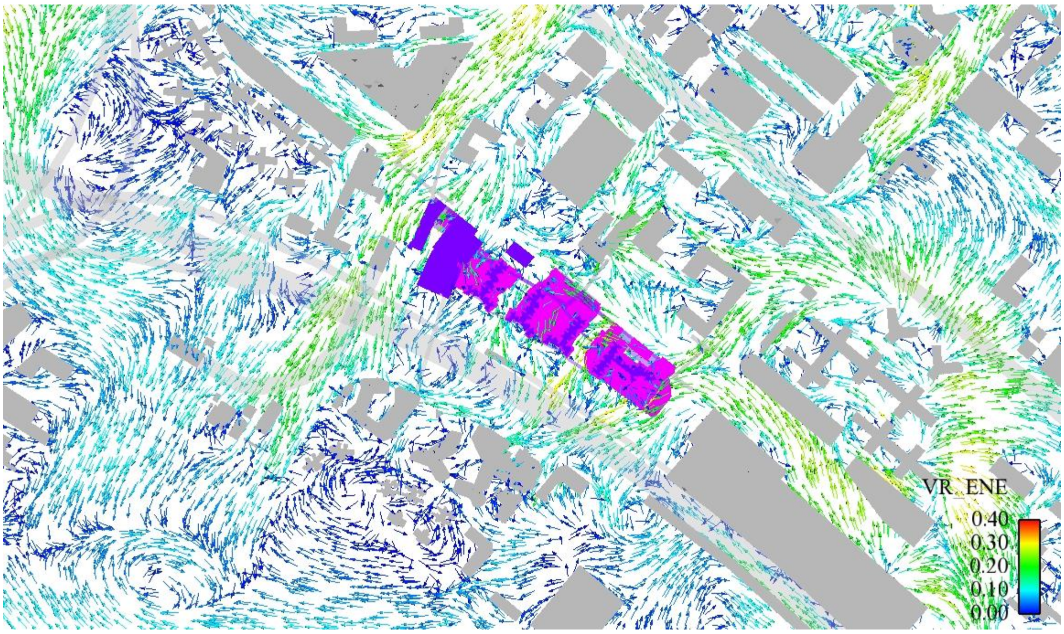
C2 Proposed Scheme Directional VR Vector Plots



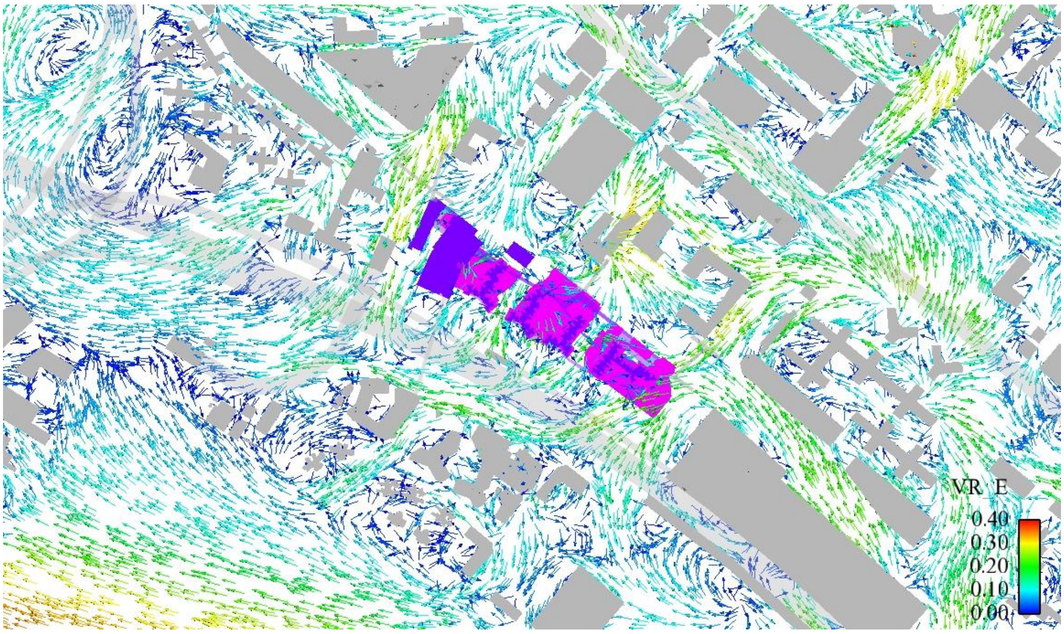
Vector Plot under NNE Wind (Proposed Scheme)



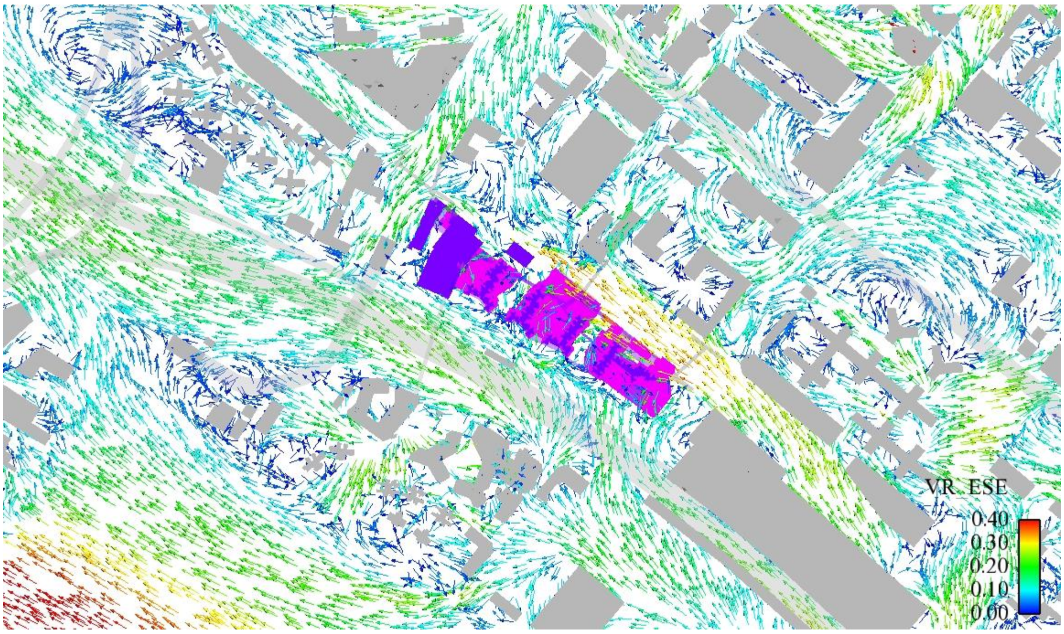
Vector Plot under NE Wind (Proposed Scheme)



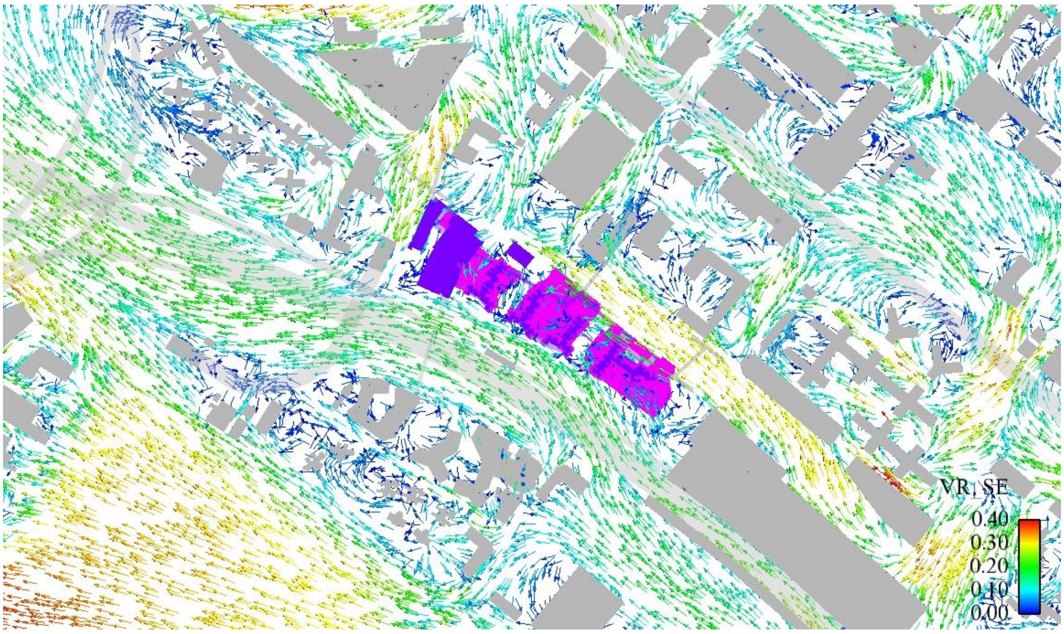
Vector Plot under ENE Wind (Proposed Scheme)



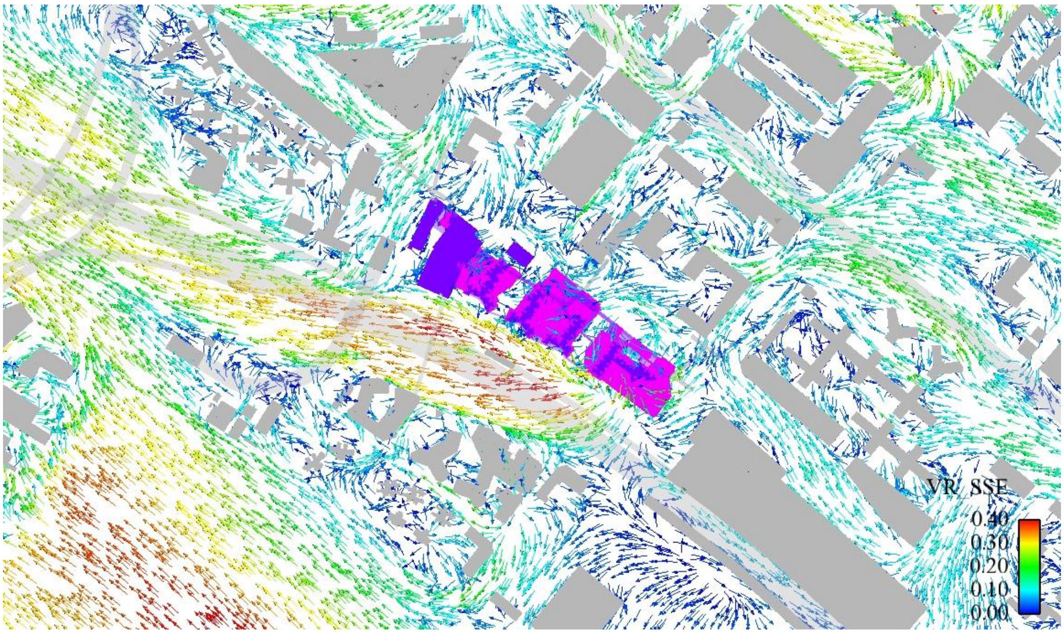
Vector Plot under E Wind (Proposed Scheme)



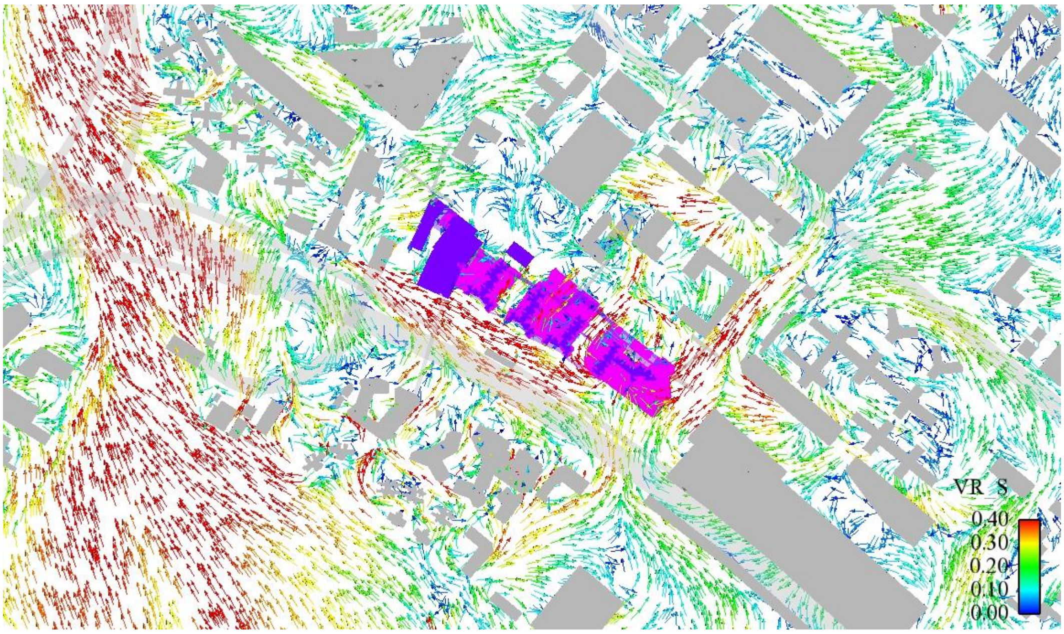
Vector Plot under ESE Wind (Proposed Scheme)



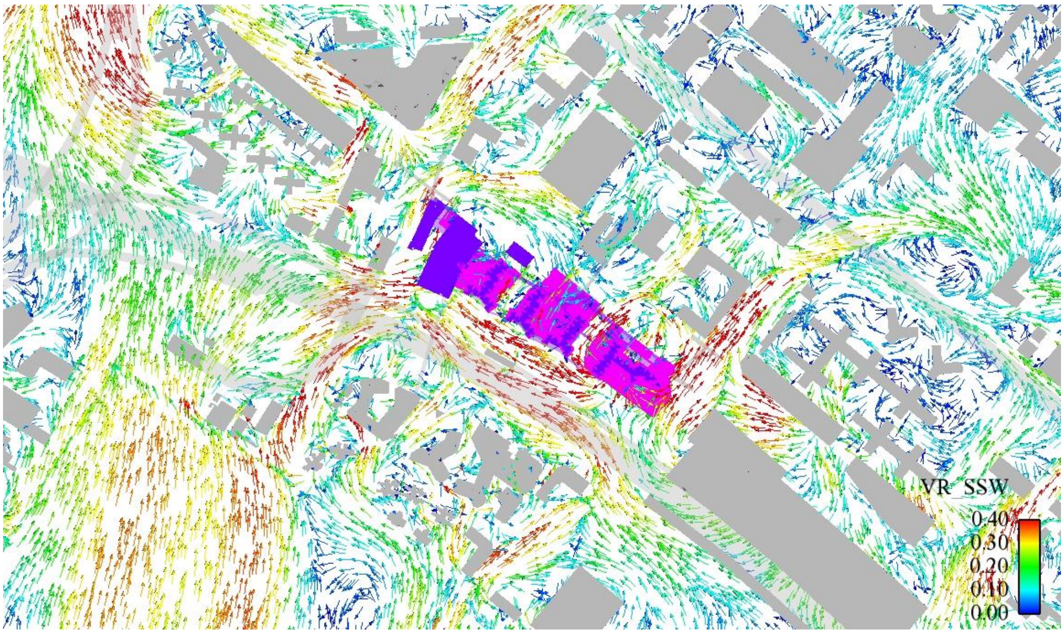
Vector Plot under SE Wind (Proposed Scheme)



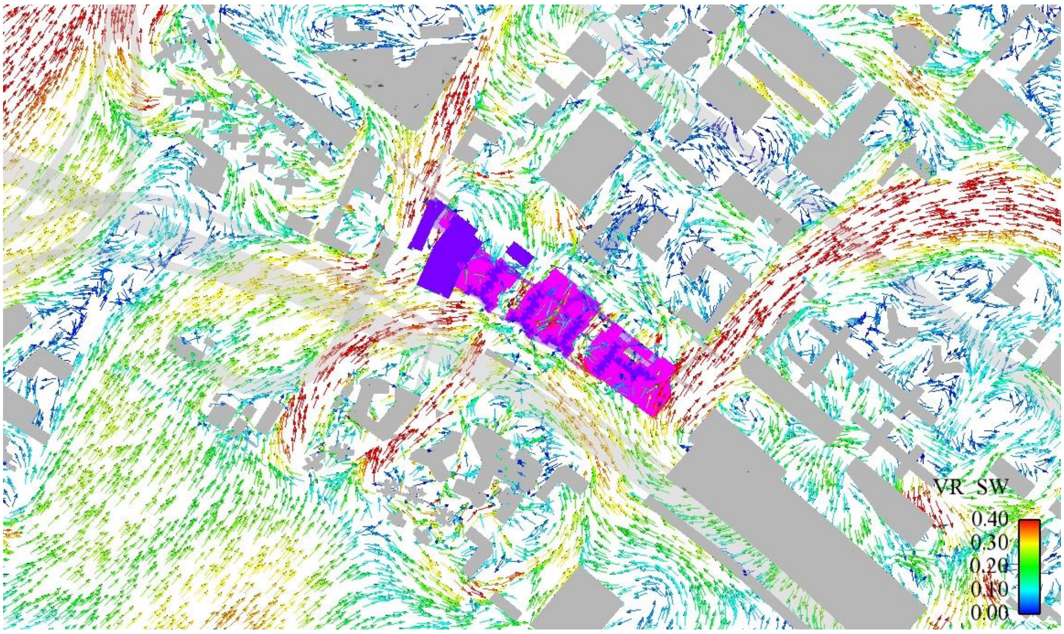
Vector Plot under SSE Wind (Proposed Scheme)



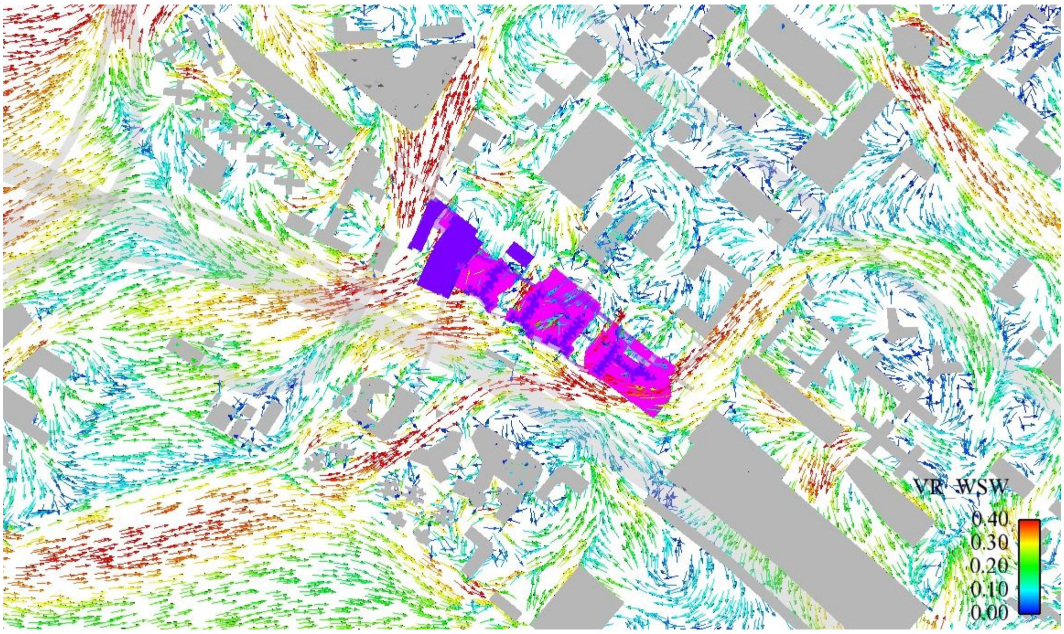
Vector Plot under S Wind (Proposed Scheme)



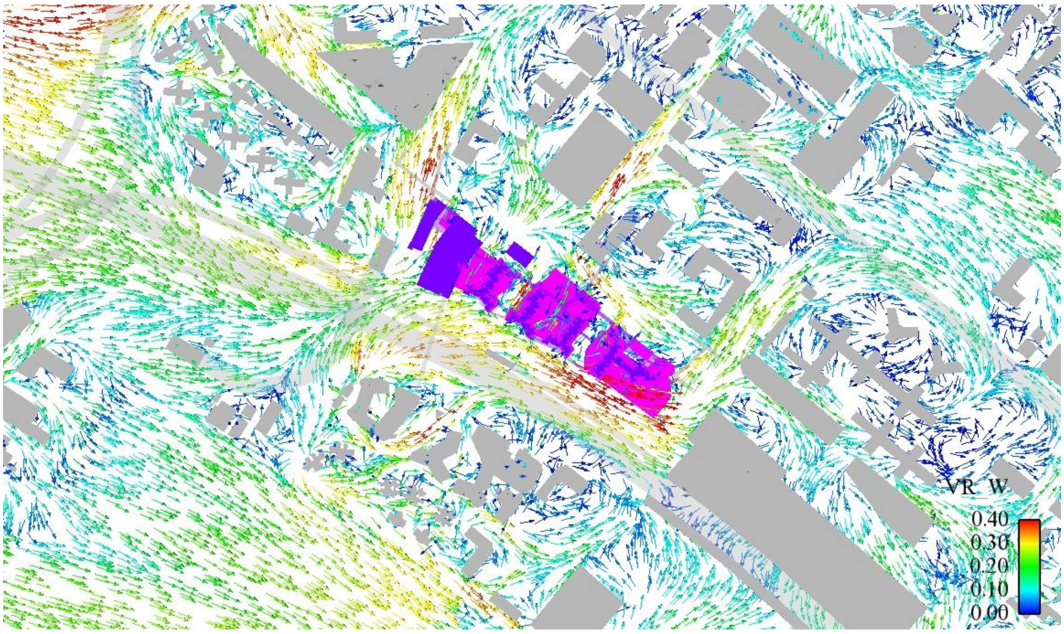
Vector Plot under SSW Wind (Proposed Scheme)



Vector Plot under SW Wind (Proposed Scheme)



Vector Plot under WSW Wind (Proposed Scheme)



Vector Plot under W Wind (Proposed Scheme)