Highways Department

Agreement No. CE 32/2014 (HY) Elevated Pedestrian Corridor in Yuen Long Town connecting with Long Ping Station - Investigation, Design and Construction

Air Ventilation Assessment Report

REP-015-02

Issue 2 | August 2016

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 240246

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1 Introduction

1.1 General

Ove Arup and Partners Hong Kong Limited (Arup) was commissioned by Highways Department (HyD) of the Hong Kong Special Administrative Region (HKSAR) Government on 30 December 2014 to provide consultancy services for the investigation, design and construction of the elevated pedestrian corridor in Yuen Long Town connecting with Long Ping Station (the Project).

1.2 Project Background

It is the Government's policy objective to provide a safe, efficient, reliable and environmentally friendly transport system that meets the economic, social and recreational needs of the community, and is capable of supporting sustainability and the future development of Hong Kong. Improvement to the pedestrian environment in business districts, shopping areas and leisure zones with heavy pedestrian flows (including Yuen Long District) is one of the initiatives set out in the 2008/09 and 2009/10 Policy Addresses.

The existing Yuen Long town center is overcrowded with heavy pedestrian activities with potential safety problem due to the possible overspilling of pedestrians from the narrow footpaths onto the carriageway. There is an imminent need to resolve the congestion problem and provide a better and safer walking environment for the community.

In September 2011, HyD commissioned a Feasibility Study (FS) (CE 4/2011 (HY)) on the major improvement schemes including the proposed footbridge along Yuen Long Town Nullah (YLTN) connecting with West Rail Long Ping Station (WRLPS). Another public engagement was conducted in March and April 2013 to consult the public on the preliminary proposals for the major improvement schemes formulated in the FS. The public and Yuen Long District Council expressed strong support for the proposed footbridge and urged its early implementation.

The Technical Feasibility Statement (TFS) prepared by HyD for the proposed footbridge along Yuen Long Town Nullah between WRLPS and Kau Yuk Road (KYR) with provision for future extension was approved by the Development Bureau in July 2013. The findings of the above FS and the TFS set out the basis for the current proposal for the proposed footbridge under the Project.

1.3 Project Scope

The scope of works under this Project comprises:

i. construction of a covered footbridge (hereinafter refer to ‘the footbridge’) of about 540 m in length and 6 m clear width with staircases/lifts/escalators along Yuen Long Town Nullah (YLTN) from West Rail Long Ping Station (WRLPS) to the south of Kau Yuk Road (KYR);

ii. connection of the footbridge with WRLPS;

iii. connection of the footbridge with at-grade footways along YLTN and in Yuen Long On Ning Road (YLONR), Castle Peak Road – Yuen Long Section CPR(YLS) and KYR;

iv. provision at the southern end of the footbridge to allow for future extension;

v. measures for mitigating impacts arising from the works;

vi. making allowance for providing connection with the adjoining developments along YLTN;

vii. landscaping and streetscape works of the footpaths along both side of YLTN between WRLPS and KYR; and

viii. associated civil, road, drainage, geotechnical, environmental, traffic aids, utility diversion, street lighting, landscaping and E&M works.

The Project Layout Plan is included in **Appendix A.**

1.4 Objective of this Report

In accordance with Annex C-B20, a technical paper shall be prepared to summarize the finding of the air ventilation assessment as well as a self-contained full report of the Site Wind Availability Study, the Expert Evaluation and Detailed Study by using Computational Fluid Dynamics (CFD) techniques for 16 wind directions of the air ventilation assessment.

A method Statement for the Air Ventilation Assessment was submitted to HyD and Planning Department (PlanD) for comments on 27 January 2015 and 27 February 2015 respectively. PlanD advised that the project proponent (HyD) would be responsible for overseeing the assessment. This report on Air Ventilation Assessment Study is hence prepared and cover the experimental results of the Site Wind Availability Study and the qualitative analysis of wind environment in form of Expert Evaluation (EE) as well as the quantitative analysis of wind environment in form of Detailed Study by CFD techniques.

2 Site Wind Availability Study

2.1 Background

The wind availability of the Project is an essential item for investigating the wind performance of the Site. A Site Wind Availability Study was conducted for the Yuen Long Town. This chapter summarises some results that measured in the wind tunnel in accordance with the Clause 4(a) of Annex C-B20 of "Brief for Agreement No.CE32/2014 (HY) Elevated Pedestrian Corridor in Yuen Long Town connecting with Long Ping Station – Investigation, Design and Construction" (termed as "Study Brief" hereafter). The following sections present the details of the Site Wind Availability Study.

2.2 Physical Model for Wind Tunnel Test

BMT Fluid Mechanics Ltd was engaged to conduct the wind tunnel test. A model scale of 1:2000 has been adopted and it covers area with radius of about 4.2km as indicated in Figure 1.

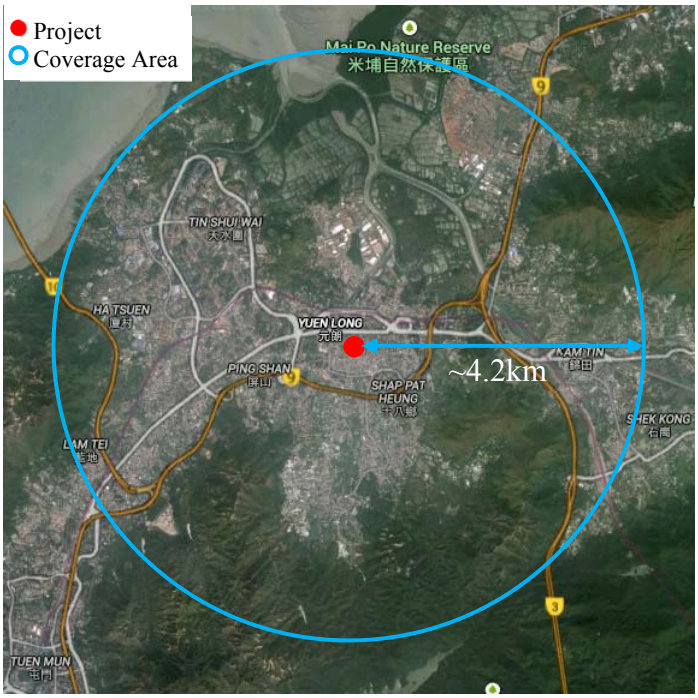


Figure 1 Coverage areas for Site Wind Availability Study (Source: Google Map)

The model encapsulated all the features that are likely to affect the local wind flow at the site. The surrounding area has been represented to a sufficient level of detail to produce the reasonable overall and local wind flows at the location of the proposed development site. The model is mounted on the 4.4m-diameter large turntable of boundary layer wind tunnel. Figure 2 to Figure 5 show some views of the topography model from different angles.

Figure 2 Topographical Model, Viewed From North

Figure 3 Topographical Model, Viewed From East

Figure 4 Topographical Model, Viewed From South

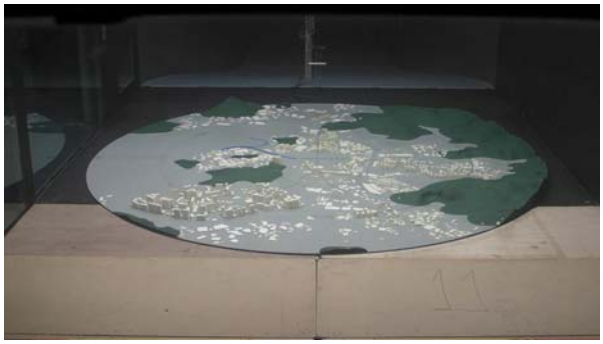


Figure 5 Topographical Model, Viewed From West

2.3 Methodology

2.3.1 Measurements

The vertical variation of the site wind climate has been determined from the topographic studies making use of hot-wire anemometry. The approach is based on measuring temperature changes in a small probe that is fitted with a wire through which an electrical current is passed. The wire is calibrated prior to tests to convert a change in temperature (which induces a change in electrical current) into a change in recorded wind speed. Detailed description could be referred to **Appendix B**.

Hot-wire anemometer measurements have been made for the range of full scale heights (measured in metres above local ground: 20-, 50-, 75-, 100-, 150-, 200-, 300-, 400-, 500-, 600-, 800-, 1000-, 1200-, 1400- and 1600-) for 16 wind directions (22.5º increments). All measurements have been taken at a location in the approximate centre of the measurement zone such that the acquired wind properties are relevant and transferable to the small scale measurement site.

Upon the requirement stated in Clause 4(a) of Annex C-B20 of Study Brief, the following parameters are reported:

- Longitudinal mean wind speed (V_{Mean})
- Longitudinal turbulence intensity (I_u)
- Longitudinal gust wind speed (V_{Gust})
- Yaw angle, ψ [deg]
- Annual and summer wind roses

A single approaching or inflow wind speed profile has been assumed for all directions examined during the tests, as per that stipulated in the Hong Kong Wind Loading Code[1].

2.3.2 Data Presentation

The full set of longitudinal mean velocity profiles (V_{Mean}), longitudinal turbulence intensity profiles (I_u), longitudinal gust velocity profiles (V_{Gust}) and Yaw angle (ϕ) were measured in the study.

All wind speeds are defined with respect to a reference mean wind speed at a reference height of 500m and the reference height mean wind speed is denoted as V_{ref}. The wind speed profiles have been normalised by the mean wind speed at a reference height of 500m. The normalization of the mean wind speed profiles are derived as follows, respectively:

$$V_{mean}/V_{ref}(\theta) = \frac{V_{H,mean}(\theta)}{V_{500m,mean}(\theta)}$$

where

$V_{H,mean}(\theta)$ = Mean wind speed at measurement height H at wind direction θ

$V_{500m,mean}(\theta)$ = Mean wind speed at reference height of 500m at wind direction θ

$V_{ref}(\theta)$ = Reference height mean wind speed at wind direction θ

The probability of wind speed exceedance has been presented in the form of wind rose diagrams at 15 measurement heights from 20m to 500m for the Project.

2.3.3 Definition of Wind Direction

The 0º wind direction has been chosen to coincide with the geographical North (90º East, 180º South, 270º West). The wind angle denotes the direction that the wind is blowing from. The definition of Yaw is provided in Figure 6. The term "oncoming wind" refers to the direction of the free stream wind, whilst the term "site wind" refers to the measured wind direction at the site (inclusive of the influence of local terrain and topographic effects).

[1] Code of Practice on Wind Effects in Hong Kong, 2004

Figure 6 Definition of Yaw Angle

2.4 Results

The full set of longitudinal mean velocity profiles (V_{Mean}), longitudinal turbulence intensity profiles (I_u), longitudinal gust velocity profiles (V_{Gust}) and Yaw angle (ϕ) were measured for the Project. Plots of each parameter shall refer to **Appendix B** of this report.

2.4.1 Wind Rose Diagrams

The probability of wind speed exceedance has been presented in the form of wind rose diagrams for the measurement heights of 20m to 500m. The wind rose diagrams for annual and summer probability distribution at 20m and 500m are shown from Figure 7 to Figure 10. It could be found from the wind roses that the annual and summer prevailing wind directions are ENE and SW, respectively.

With regards to the pedestrian level winds, based on the acquired wind tunnel data, these are best represented by the wind speeds recorded at 20m. Individual wind rose diagrams at each measurement height is presented in **Appendix B**.

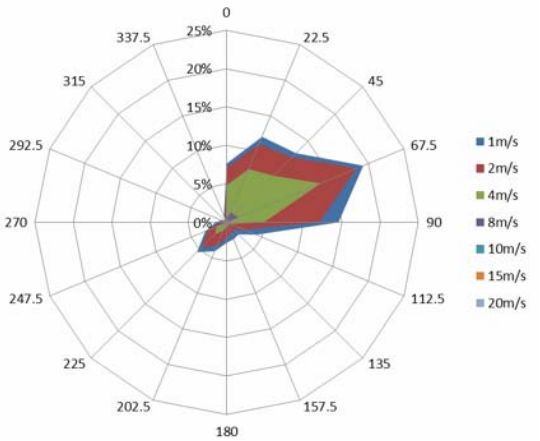


Figure 7 Wind Rose for Annual Probability Distribution, 20m Height

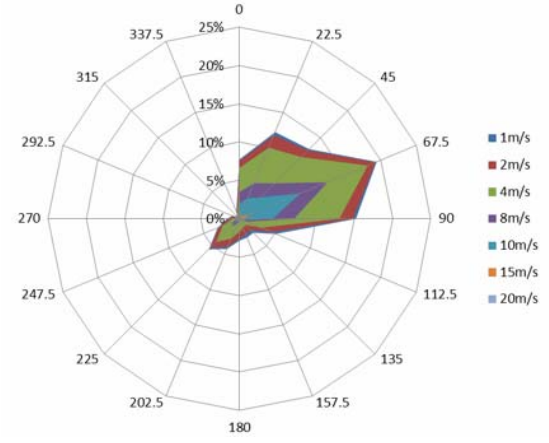


Figure 8 Wind Rose for Annual Probability Distribution, 500m Height

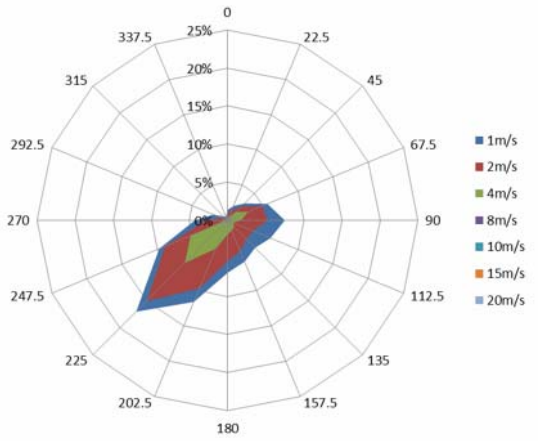


Figure 9 Wind Rose for Summer Probability Distribution, 20m Height

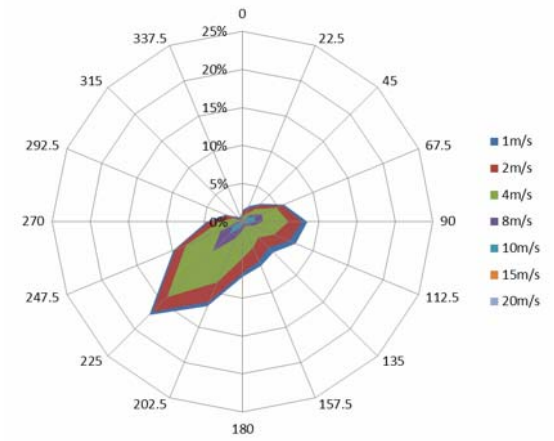


Figure 10 Wind Rose for Summer Probability Distribution, 500m Height

2.5 Discussion

From the wind tunnel results, the highest probabilities of winds exceeding the given speeds occur along the wind directions of ENE annually, and SW for summer condition. This is consistent across all the measurement locations.

From Figure 11, there is a noticeable general trend of the local maxima occurring along the wind direction of NNE for measurement locations within close proximity of ground level with the absence of topography features or building structures of the surrounding region in this direction. At higher elevations, the localised wind speed maxima occur at SE and SSW directions, which is likely due to the acceleration of wind over, and channelling through, the two largest topography features on the model.

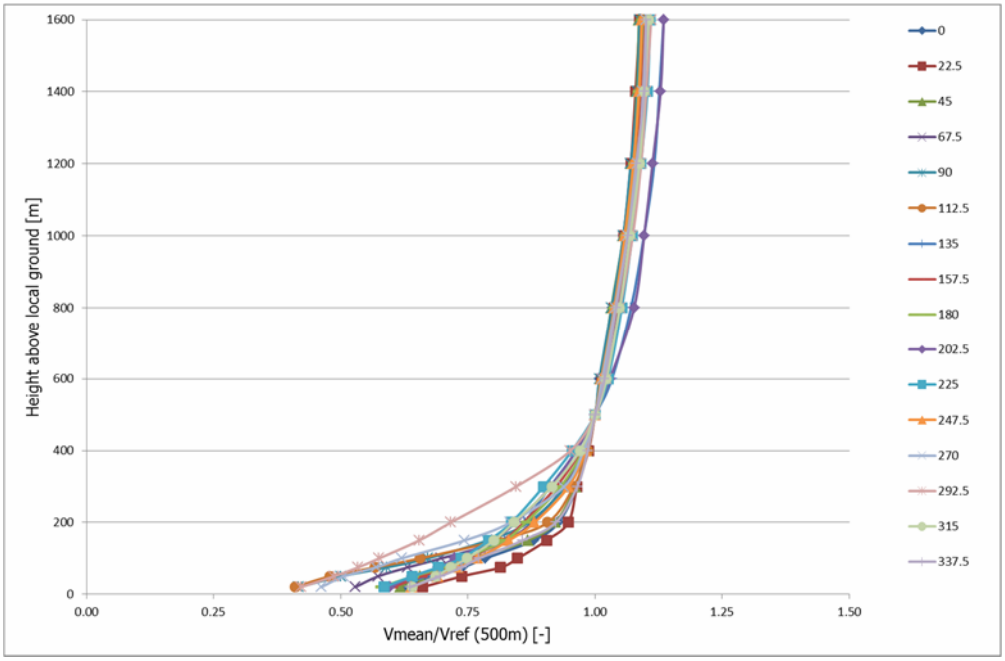


Figure 11 Measured Longitudinal Wind Speeds (V_{mean}) Profiles for the Project

The topographic elements have a substantial impact on the wind turbulence intensity. Based on **Figure 12**, the local minima for turbulence intensities for the majority of measurement locations occurs under NNE wind direction due to relatively free of geographic obstructions or building clusters. In contrast, the highest turbulence levels are observed along wind directions ENE to ESE and W to WSW, where the respective wind paths encounter the largest geographical and structural obstructions present on the topography model.

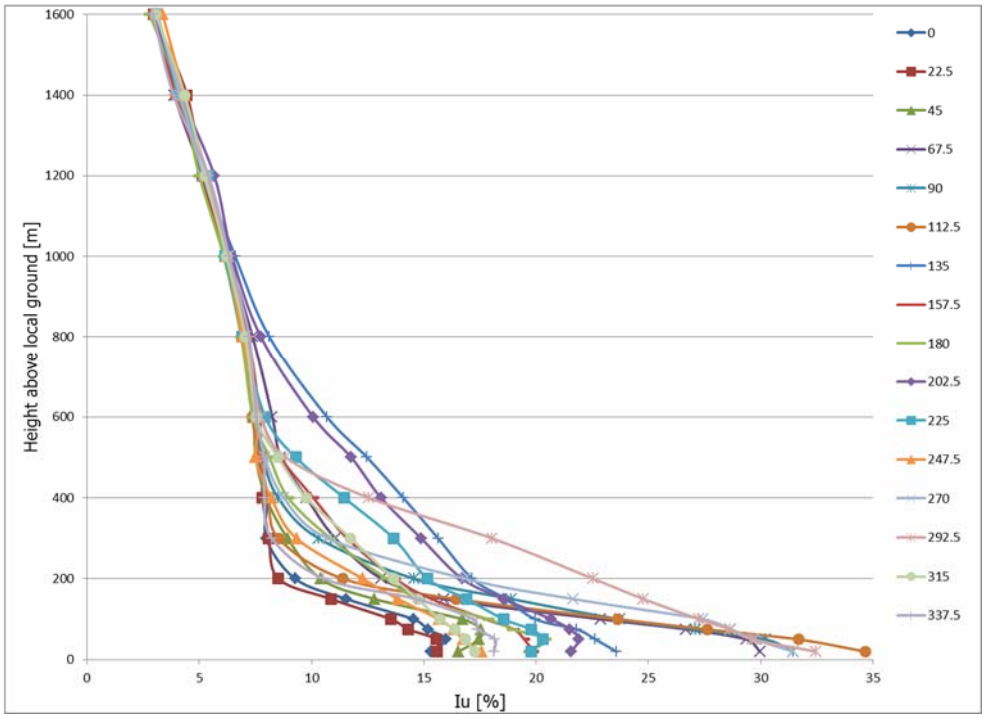


Figure 12 Measured Longitudinal Turbulence Intensities (I_u) Profiles for the Project

2.6 Summary

Upon the completion of Site Wind Availability Study, the annual and summer prevailing wind directions are ENE and SW, respectively, for the Project.

3 Expert Evaluation on Existing Condition

3.1 Background

In accordance with the "*Housing Planning and Lands Bureau – Technical Circular No. 1/06, Environment, Transport and Works Bureau – Technical Circular No. 1/06*" issued on 19th July 2006 (the Technical Circular) and "*Technical Guide for Air Ventilation Assessment for Development in Hong Kong – Annex A*" (the Technical Guide), the objective of this study is to assess the likely air ventilation performance of the Project and its surrounding areas. The Expert Evaluation (EE) would be useful for large sites with specific and unique wind features, issues, concerns and its problems.

A Site Wind Availability Study has been reported in Section 2 in which the annual and summer prevailing wind directions are ENE and SW, respectively. Based on the results of Site Wind Availability Study, a qualitative assessment is performed to evaluate the wind performance from air ventilation viewpoint in order to accomplish the following tasks:

- Identify good design features;
- Identify obvious problem areas and propose mitigation measures; and
- Recommend the scope and details of air ventilation assessment.

3.2 Site Topography and its Surroundings

The Project is located along the Yuen Long Town Nullah in Yuen Long, Hong Kong. The Project is situated on relatively flat topography, however, with existing and planned developments surrounded. The northern end of the Project is connected to the Long Ping Station and large scale Long Ping Estate while West Rail Long Ping Station (North) Site (Application no. A/YL/182), West Rail Long Ping Station (South) Site (Application No. A/YL/188-1), Redevelopment of Ex-Yuen Long Estate and Proposed CDA Development at Tai Kiu (Application No. A/YL/136) (termed as *high-rise planned sites* hereafter) are located near the northern end of the Project.

To the south of the Project, low-rise developments, such as residential buildings of Ma Tin Tsuen, Lung Tin Tsuen and Chun Wah Villas, etc., are positioned. Moreover, medium- to high-rise developments are surrounded to the east and west with several open space and sport fields, such as Kik Yeung Road 5-a-side Football Pitch, Tai Pei Tau open space, Yuen Long's Children Playground, Chung Sing Path Playground, On Hing Playground, Sai Ching Street Children's Playground and Tennis Courts. These sites and building clusters are highlighted in Figure 13.

Figure 13 Development and surroundings (source: Google Map)

3.3 Wind Condition under Existing Condition

Refer to the Site Wind Availability Study, the annual and summer prevailing winds are East-Northeasterly (ENE) and Southwesterly (SW) directions, respectively.

3.3.1 Annual Wind Condition

Under annual wind condition, the *high-rise planned sites* located near the northern end of the Project and dense medium-rise buildings to the east would likely shield the approaching ENE wind and lead to relatively low wind speed at the leeward side.

The incoming ENE wind would likely pass through the East-West running paved roads, including Wang Tat Road & Long Yip Street, Castle Peak Road – Yuen Long and Ma Tin Road & Ma Tong Road, that would serve as the major breezeways to facilitate wind penetration under ENE wind direction as indicated by large blue arrows in **Figure 14**.

However, Yuen Long On Ning Road and Kau Yuk Road would be less effective in wind penetration of annual wind as the building clusters of these paved roads are not in alignment with the annual wind direction. Therefore, these two paved roads would not be as effective as the major breezeways identified above (i.e. Wang Tat Road & Long Yip Street, Castle Peak Road – Yuen Long and Ma Tin Road & Ma Tong Road).

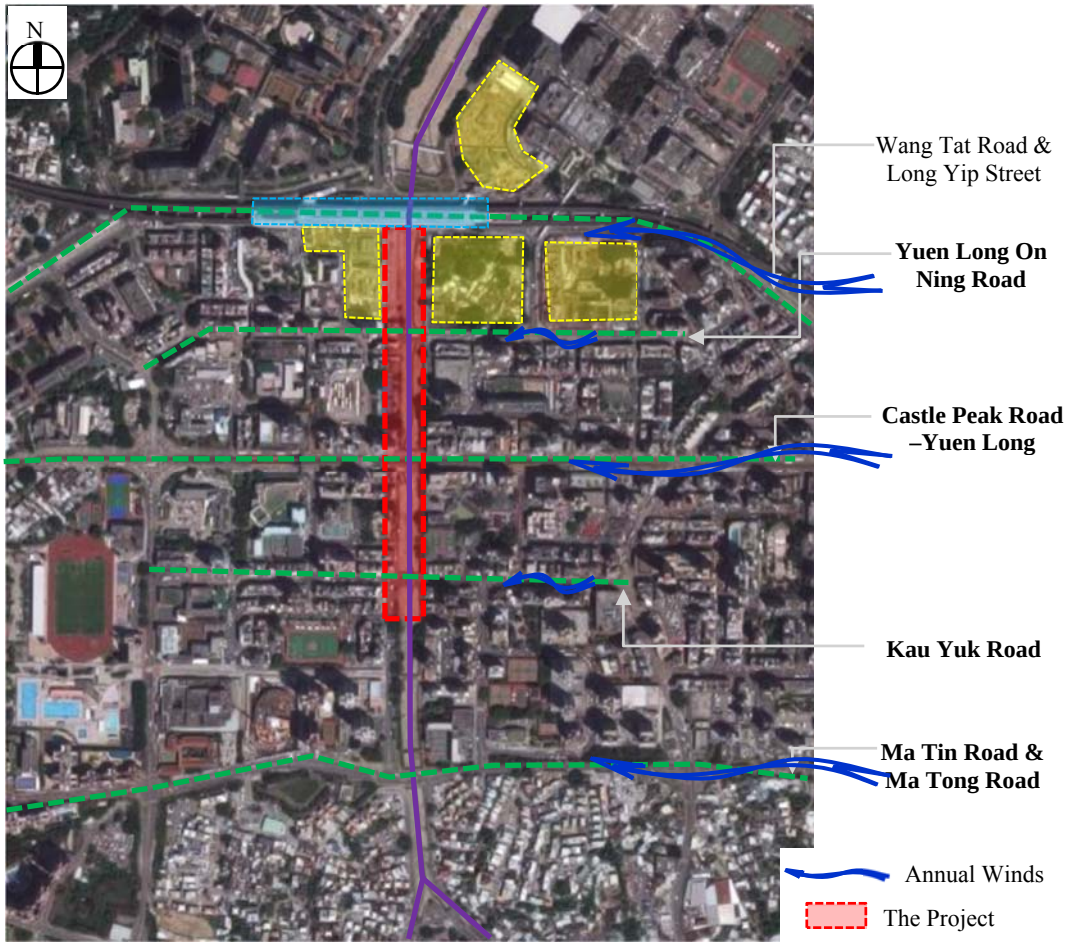


Figure 14 Annual Wind Condition under Existing Condition (ENE Direction)

3.3.2 Summer Wind Condition

Ma Tin Tsuen and Lung Tin Tsuen to the southwest of the Project would located at the windward side under summer prevailing wind condition (i.e. SW wind). However, as the buildings of these villages are low-rise in natural, these villages would not significantly shield the approaching SW winds. In the presence of Yuen Long Stadium, the summer wind would easily reach the Castle Peak Road – Yuen Long via Yuen Long Tai Yuk Road.

The existing Yuen Long Theatre, Hong Chi Morningjoy School, Crystal Park and planned Public Library and Indoor Recreation Centre would likely guide the incoming SW wind to ventilate along Ma Tong Road. Together with presence of the curve-shape podium of Yee Fung Garden, the approaching wind from SW direction would likely divert into the Yuen Long Town Nullah as shown by the dotted arrows in **Figure 15**.

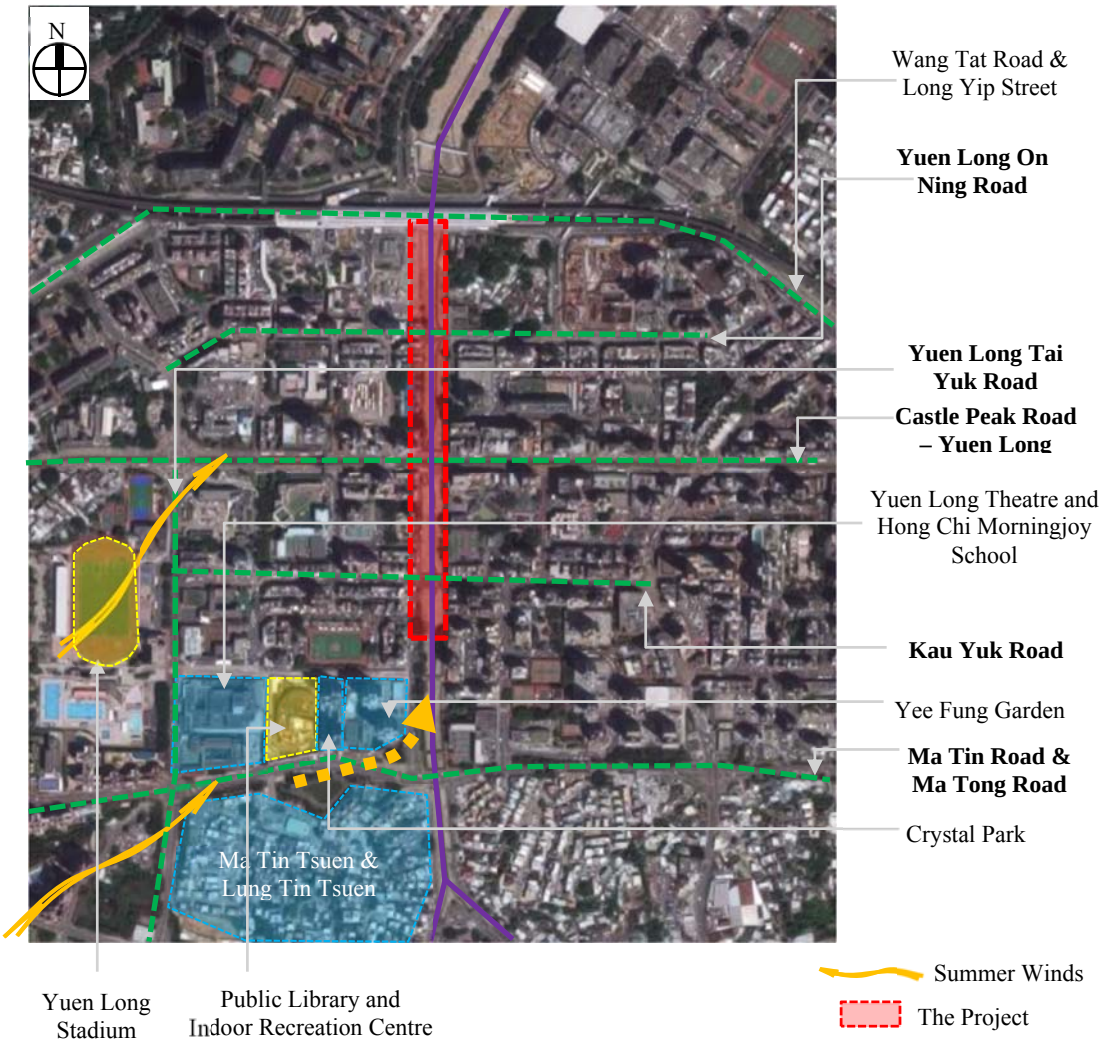


Figure 15 Summer Wind Condition under Existing Condition (SW Direction)

3.3.3 Further Quantitative Study

In general, the Project may not significantly affect the ventilation performance of the existing Yuen Long Town and its surrounding areas, but subject to the detailed footbridge design. An AVA Detailed study could be used to investigate the wind performance quantitatively, which shall follow the guideline given in "*Housing, Planning and Lands Bureau Technical Circular No. 1/06, Technical Guide for Air Ventilation Assessment for Developments in Hong Kong*".

3.3.3.1 Focus Areas for Further Study

Various building clusters, pedestrian walkways, school sites and amenity areas are identified as Focus Areas (FAs) near the Project. Figure 16 shows the identified FAs which includes both existing and committed development clusters. Basically, FAs 1-5 are high-rise residential clusters, FAs 6-16 are pedestrian walkways, FAs 17-21 are school sites and FAs 22-29 are amenity areas.

As these FAs are either existing clusters or committed development clusters, the ventilation performance of these identified FAs shall be assessed in Detailed Study of AVA study.

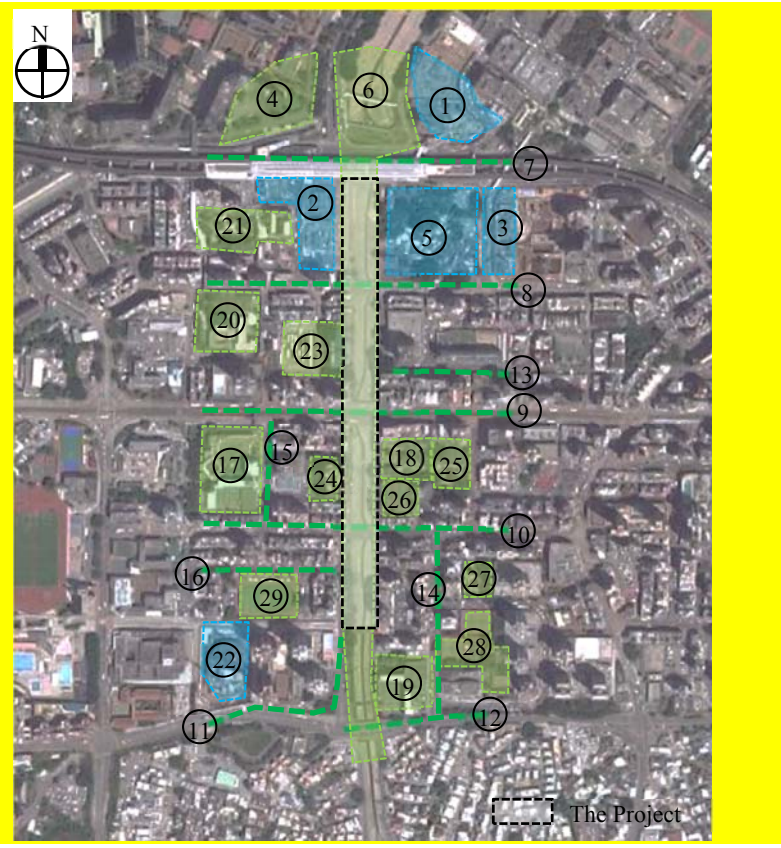


Figure 16 Focus areas proposed for later stage of AVA study

4 AVA Detailed Study

4.1 Study Scenarios

The scope of work of this AVA study also covers the AVA Detailed Study by using CFD techniques which is as required under Clause 5 of Annex C-B20 of the Study Brief. Two schemes have been compared, namely Scheme A and Scheme B, are studied by using CFD techniques under 16 wind directions to investigate the wind environment of the Project.

4.1.1 Scheme A

Scheme A is the proposed footbridge design with about 6m width which is located above Yuen Long Town Nullah (YLTN). It has implemented several platforms in connection with the existing roads at pedestrian level.

Scheme A has non-permeability balustrade design with 1.1m height along the footbridge and on the platforms and with 1.8m height for the section of footbridge above light rail.

4.1.2 Scheme B

The Scheme B has identical footbridge layout as Scheme A, but with different balustrade design – The footbridge adopted a wind enhancement feature of adopting permeable balustrade design under Scheme B. Besides, the section of footbridge above light rail would be kept as non-permeable balustrade with 1.8m height.

4.2 Methodology of AVA Detailed Study

The Air Ventilation Assessment (AVA) methodology for Detailed Study as stipulated in Clause 5 of Annex C-B20 of the Study Brief. The following sections describe the details of the study methodology.

4.2.1 Wind data from Site Wind Availability Study

Site wind availability study had been conducted in the wind tunnel lab and a number of representative approaching wind conditions has been identified in Section 2 for the Project to rationalize and characterize the effects of the various topographical and terrain features for the 16 measured wind directions and the incoming wind profile adopted in this study.

The wind frequency under both annual and summer wind conditions for the Project is tabulated in Table 1.

Table 1 Wind frequency of the Project

Direction	Annual Frequency (%)	Summer Frequency (%)
N	7.8%	1.7%
NNE	12.4%	2.5%
NE	12.9%	3.6%
ENE	19.4%	6.0%
E	15.3%	8.9%

Direction	Annual Frequency (%)	Summer Frequency (%)
ESE	5.5%	8.1%
SE	3.0%	6.2%
SSE	2.9%	6.6%
S	3.0%	7.4%
SSW	4.4%	12.2%
SW	5.7%	17.5%
WSW	3.1%	9.9%
W	1.7%	4.8%
WNW	1.1%	2.5%
NW	0.6%	1.2%
NNW	1.2%	1.0%
Total	100%	100%

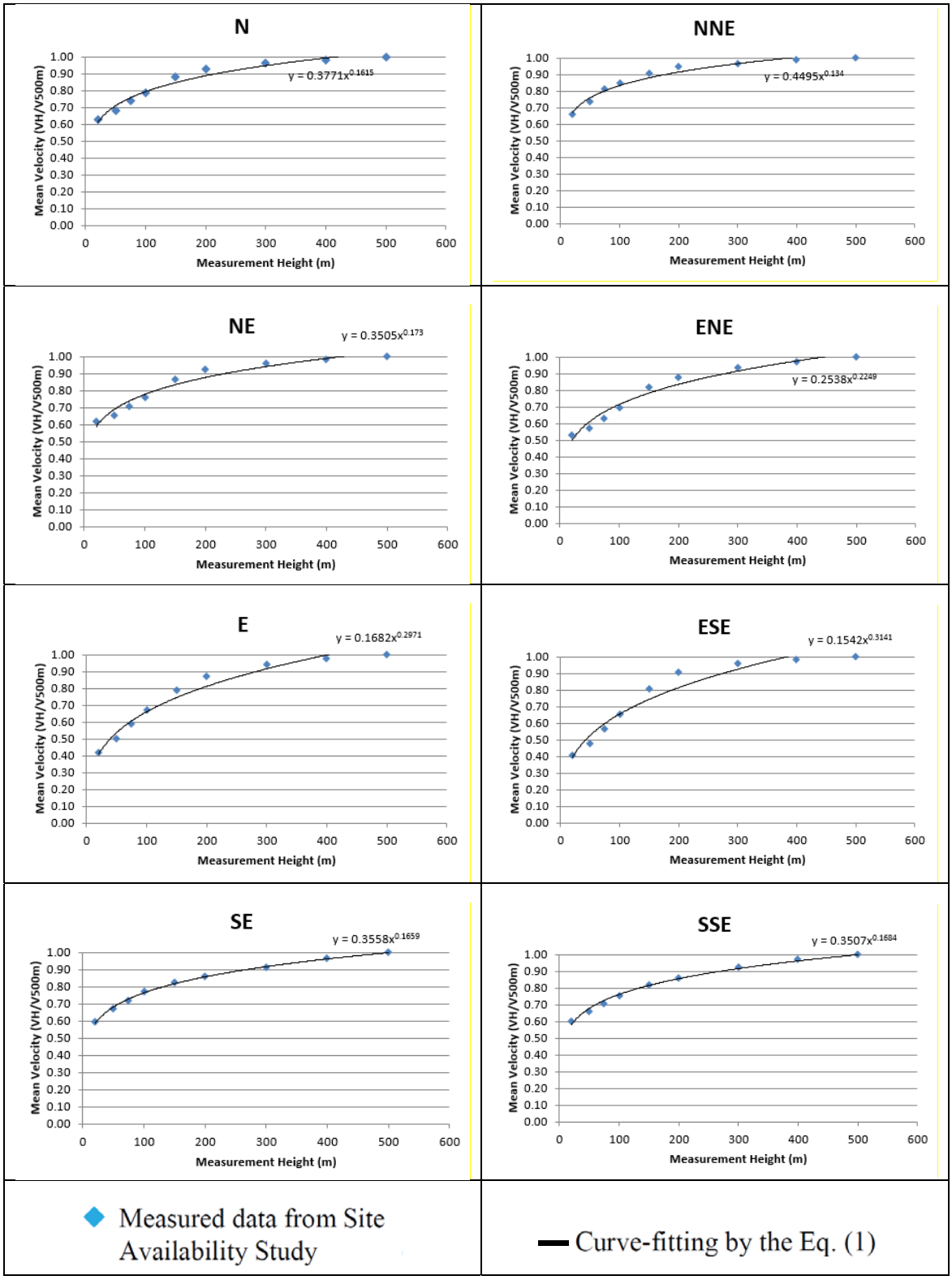
4.2.2 Wind Profile

The wind profiles, including the mean wind speed and the turbulence intensity are taken as input parameters in the CFD models. As required under the Technical Circular, the wind profiles can be assumed by the power law for specific terrains as per the following equation:

$$\frac{U_z}{U_G} = \left(\frac{Z}{Z_G} \right)^n \qquad \text{(Eq.1)}$$

where U_G = reference velocity at height z_G
U_z = velocity at height z
z_G = reference height
z = height above ground
n = power law exponent

The power, n, is related to the ground roughness, which is determined by types of terrain. A larger value of the power n represents higher roughness of the ground i.e. the dense city; alternatively, smaller n represents the lower ground roughness i.e. the sea surface. The n-value will refer to the measured data from Site Wind Availability Study that was approximated by curve-fitting method. **Figure 17** shows the measured data from wind tunnel and the approximated curve by fitting in Eq.1 for all wind directions. The n-value for each wind direction for the Project is tabulated in Table 2.


N
y = 0.3771x^0.1615
NNE
y = 0.4495x^0.134
NE
y = 0.3505x^0.173
ENE
y = 0.2538x^0.2249
E
y = 0.1682x^0.2971
ESE
y = 0.1542x^0.3141
SE
y = 0.3558x^0.1659
SSE
y = 0.3507x^0.1684
Mean Velocity (VH/V500m)
Measurement Height (m)
Measured data from Site Availability Study
Curve-fitting by the Eq. (1)

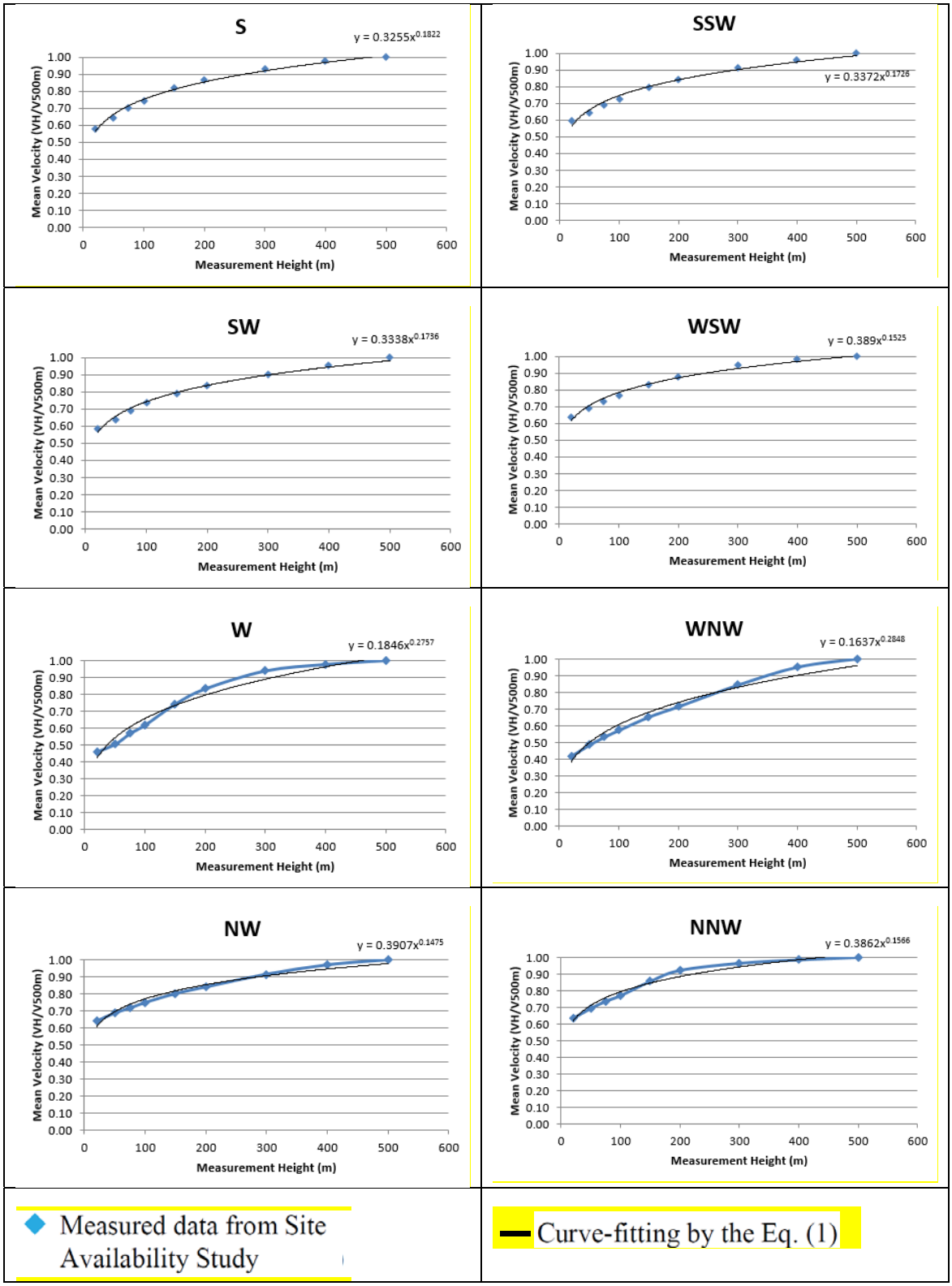


Figure 17 *n*-value for 16 wind directions from the site wind availability study

Table 2 *n*-value approximated from the site wind availability study at each wind direction

Direction	*n*-value	Direction	*n*-value
N	0.16	S	0.18
NNE	0.13	SSW	0.17
NE	0.17	SW	0.17
ENE	0.22	WSW	0.15
E	0.30	W	0.28
ESE	0.31	WNW	0.28
SE	0.17	NW	0.15
SSE	0.17	NNW	0.16

4.3 Study Area

4.3.1 Assessment Area and Surrounding Areas

With reference to the *Technical Circular*, the Assessment Area shall include the Project and a belt up to 1*H* (*H* being the height of the tallest building within the Project). Furthermore, the Surrounding Area is built to include another *H* beyond the Assessment Area to condition the incoming wind towards the Project. All existing, committed, planned and proposed development with the Surrounding and Assessment Areas will be considered in this AVA Detailed Study. However, just few existing clusters could be included within 2*H* area; therefore, larger assessment and surrounding areas were adopted in the study. The assessment and surrounding areas are shown in Figure 18 in which *H* is 200m. Prominent topographical features beyond the Surrounding Area are also included in the computational model to establish the topographic effect.

Following committed/ planned/ proposed developments provided by PlanD have been considered in this AVA study:

- West Rail Long Ping Station (North) Site (Application no. A/YL/182)
- West Rail Long Ping Station (South) Site (Application No. A/YL/188-1)
- Redevelopment of Ex-Yuen Long Estate
- Proposed CDA Development at Tai Kiu (Application No. A/YL/136)
- Public Library and Indoor Recreation Centre Project (ArchSD Project Code 049RG)

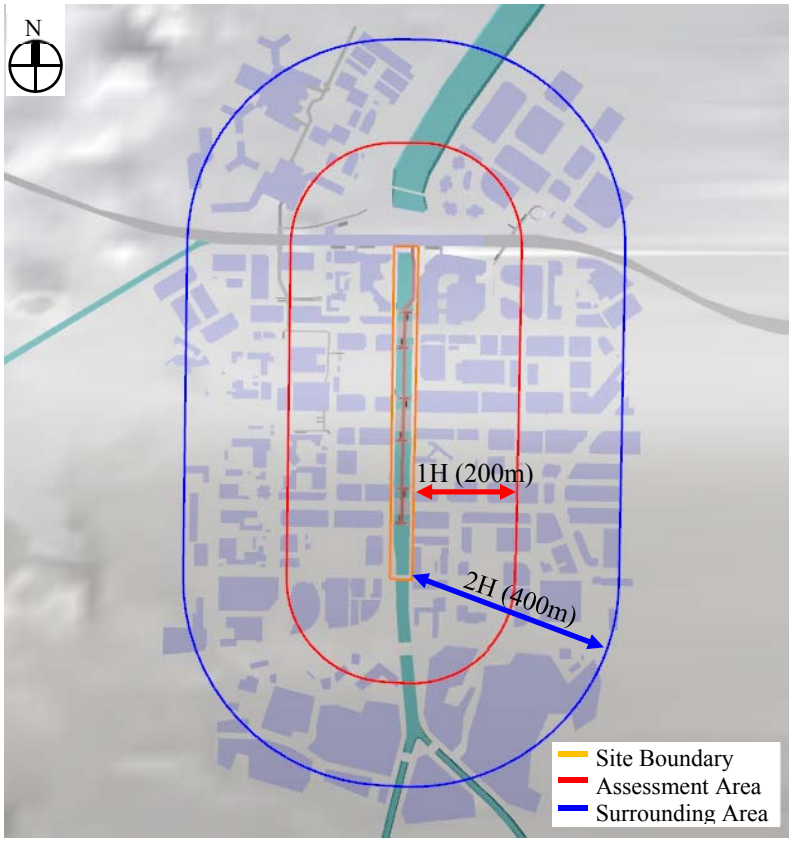


Figure 18 Site boundary (Orange), Assessment Area (Red) and Surrounding Area (Blue)

4.3.2 Assessment Parameter

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

$$VR = \frac{V_p}{V_\infty} \qquad \text{(Eq.2)}$$

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

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).

Higher value of *VR* implies less impact due to buildings on wind performance. The **weighted average *VR*** is defined as the weighted average *VR* with respect to the percentage of occurrence of the considered wind direction. This gives a general idea of the ventilation performance at the considered location on an annual basis.

4.4 Test Point for Ventilation Assessment

Monitoring test points are placed around and in the vicinity of the Project to determine the ventilation performance. There are two types of test points in the study and same location of each test point applies to both Scheme A and Scheme B as shown in **Figure 19**:

4.4.1 Perimeter Test Points (Orange spots)

Perimeter test points are the points positioned along the site boundary of the Project in accordance with the AVA Technical Circular. 46 Perimeter test points are positioned alongside the site boundary for the Project as shown by the Orange spots in **Figure 19**.

4.4.2 Overall Test Points (Green spots)

Overall test points are those points evenly positioned within the Assessment Area in the open space and places where pedestrian frequently access. 160 Overall test points are allocated as shown by Green spots in **Figure 19**.

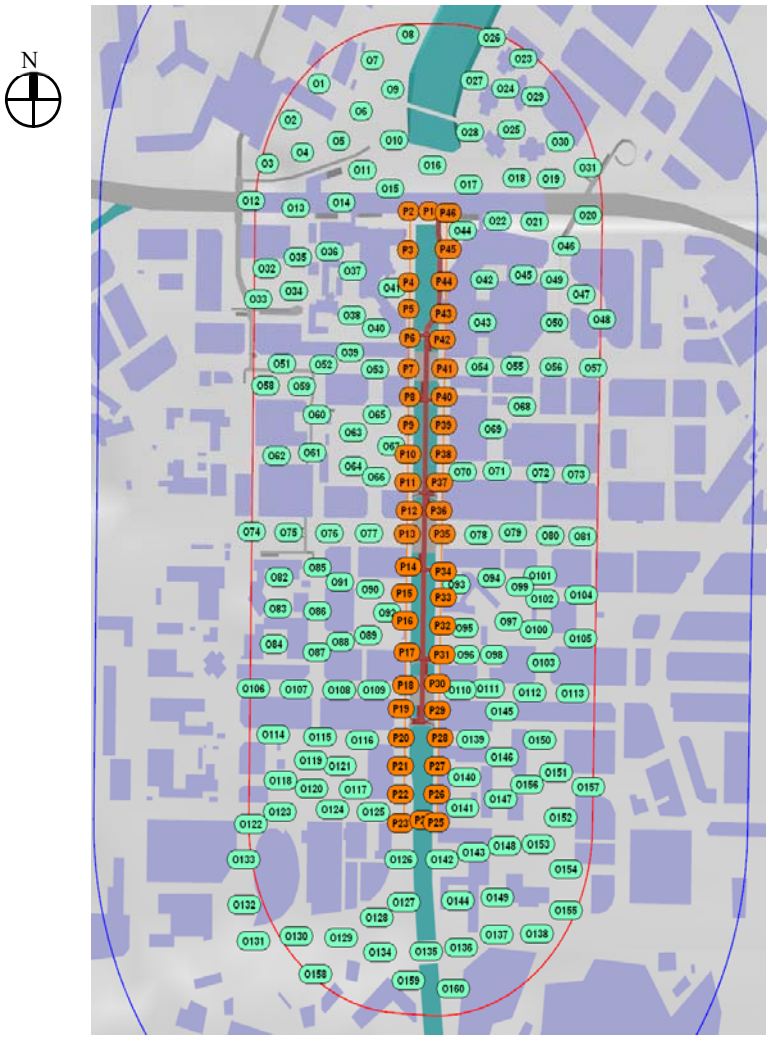


Figure 19 Locations of the Perimeter and Overall test points

4.5 Assessment Tools

Computational Fluid Dynamics (CFD) technique is utilized for this AVA study. With the use of three-dimensional CFD method, the local airflow distribution can be visualized in details. The velocity distribution within the flow domain, being affected by the site-specific design and the nearby topography, will be simulated under 16 wind directions.

4.5.1 CFD Model

Following the Clause 5 of Annex C-B20 of the Study Brief, buildings within Surrounding Area shall be built in the CFD model. In order to simulate the approaching wind turbulence effect in a more accurate manner, the CFD model is built to include the highways, nullahs or bridges as they may affect the approaching wind, even it is falling outside the Surrounding Area. In addition, the computational domain is built far beyond the Surrounding Area as required in the Technical Circular in order to eliminate the boundary effects. Therefore, the studied size of CFD model of the Project is approximately 4,000m (L) x 4,000m (W) x 1,000m (H) which contains more than 5,000,000 cells (Figure 20).

The computational domain covers the site of the Project and provides sufficient consideration on surrounding topography. The model also contains information of the surrounding buildings and site topography via Geographical Information System (GIS) platform. The site topography would be modelled within the whole computational domain. Body-fitted unstructured grid technique is used to fit the geometry and reflect the complexity of the development geometry. A prism layer of 2.5m above ground (totally 5 layers and each layer of 0.5m thick, shown in **Figure 21** is incorporated so as to better capture the approaching wind and wind condition at pedestrian level. A mesh expansion ratio of 1.3 is adopted and the blockage ratio was less than 2%. Different views of the CFD model are shown in **Figure 22** through **Figure 25**.

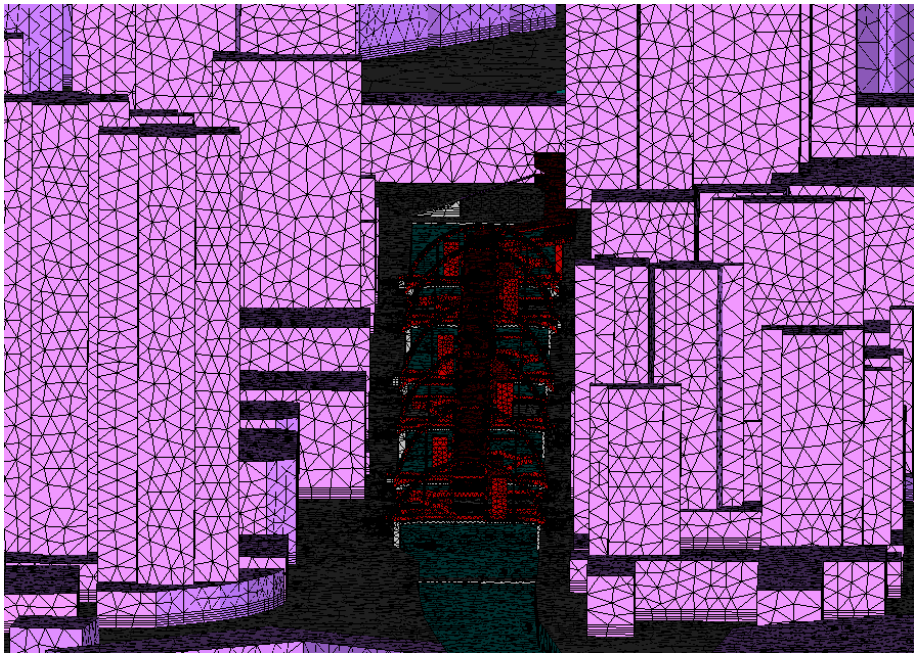


Figure 20 Computational domain of the CFD model

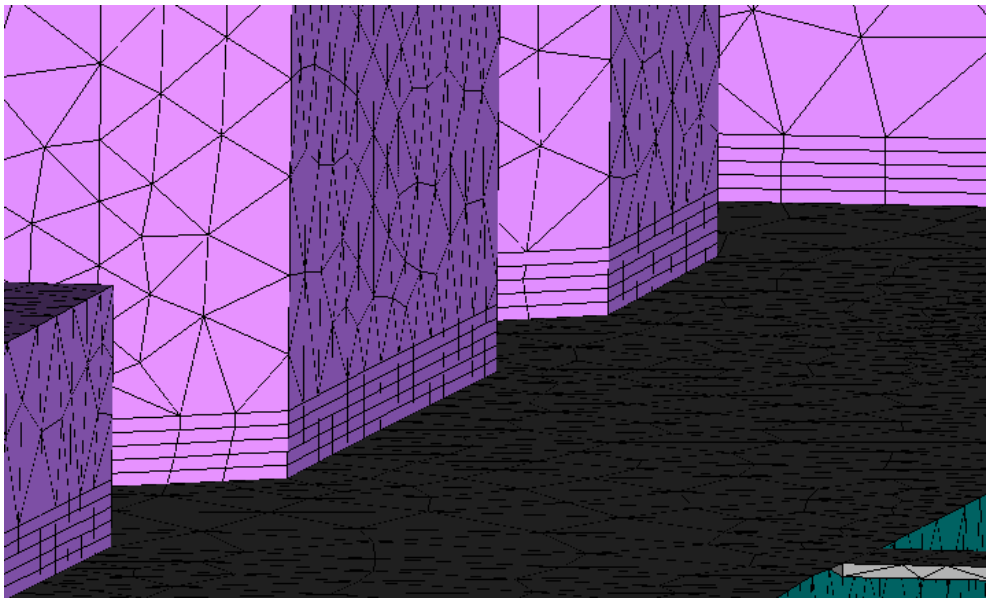


Figure 21 Prism layer created in the CFD model

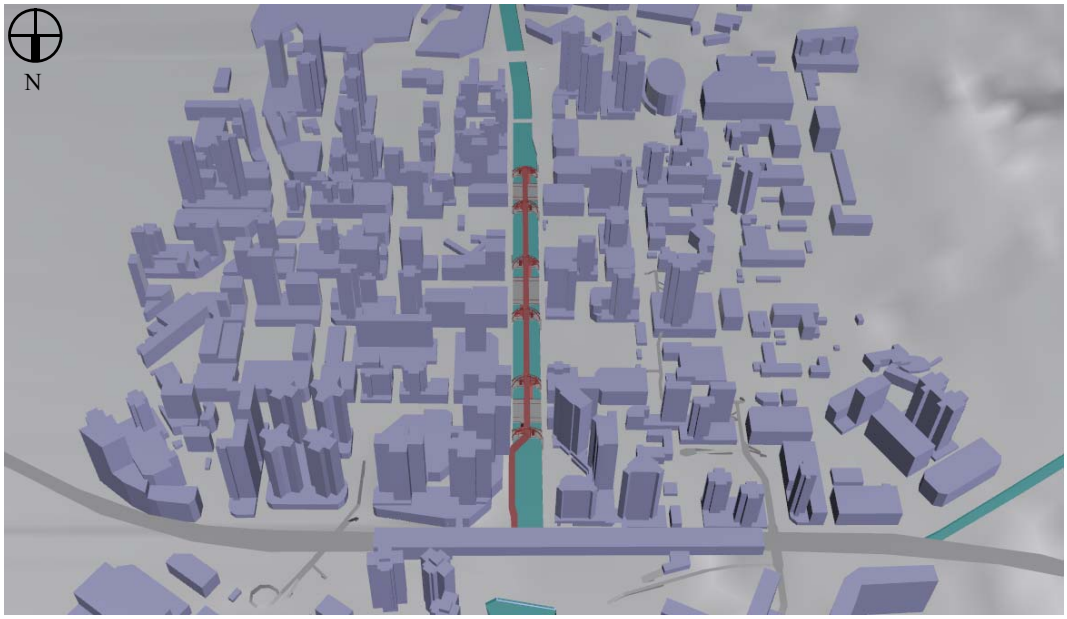


Figure 22 Northern view of the CFD model

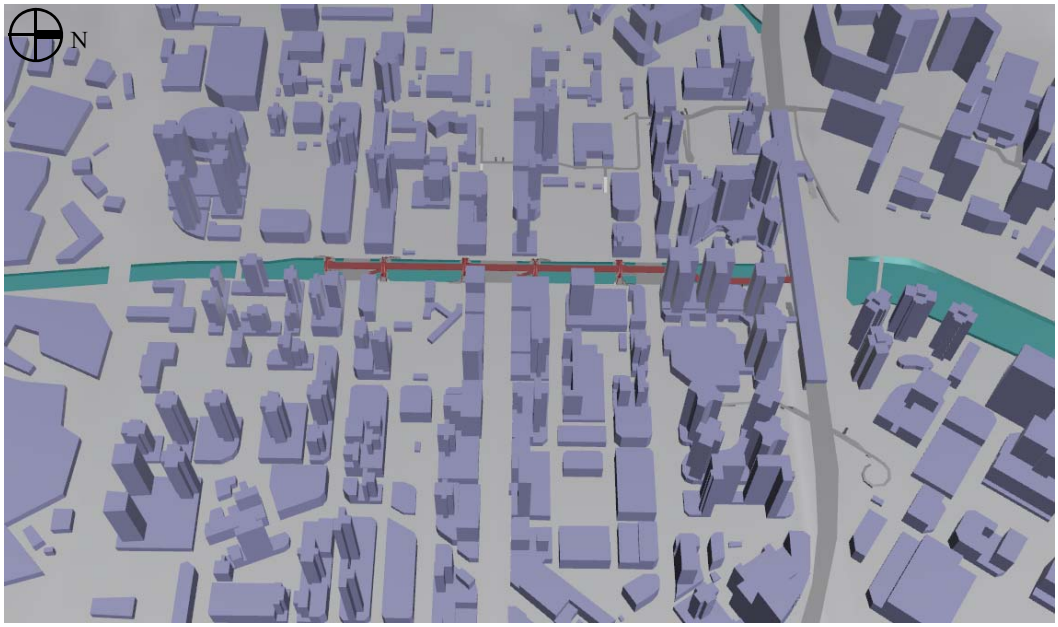


Figure 23 Eastern view of the CFD model

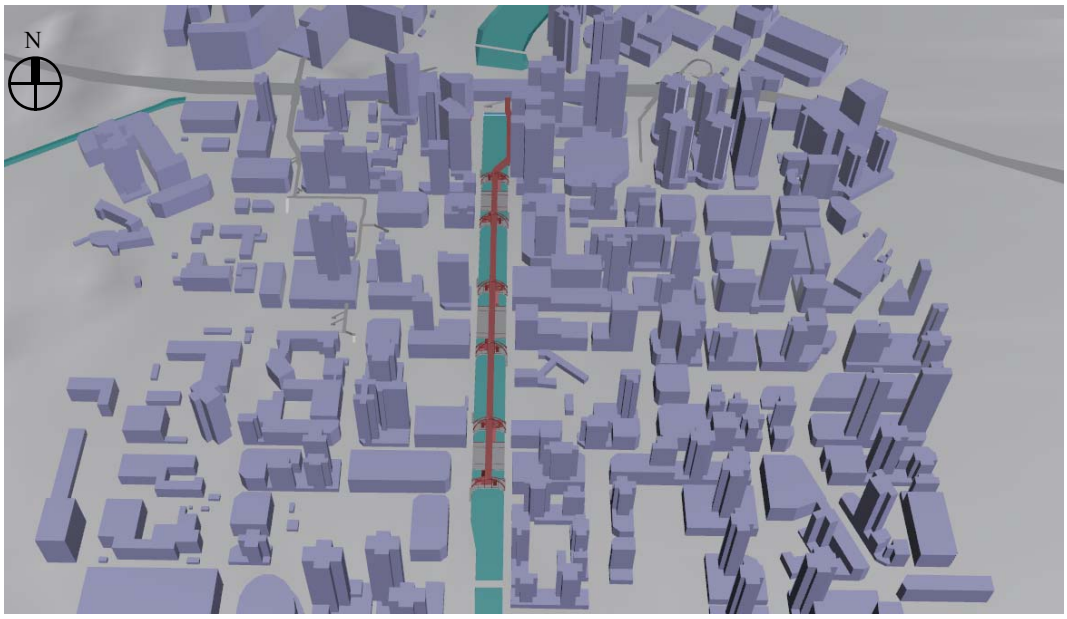


Figure 24 Southern view of the CFD model

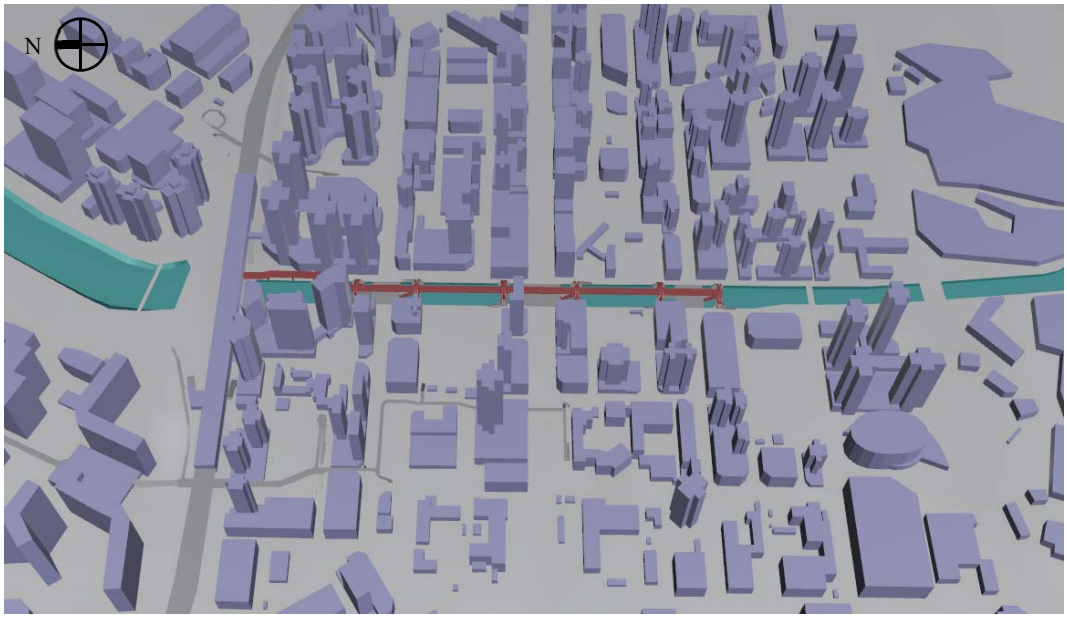


Figure 25 Western view of the CFD model

4.5.2 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.

4.5.3 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 is applied to discretize the governing equations. The convergence criterion is set to 0.0005 on mass conservation. The calculation will repeat until the solution satisfies this convergence criterion.

The prevailing wind direction as mentioned in Section 4.2.1 is set to inlet boundary of the model with wind profile as detailed in Section 4.2.2. The downwind boundary is set to pressure with value of atmospheric pressure. The top and side boundaries are set to symmetry. In addition, to eliminate the boundary effects, the model domain is built beyond the Surrounding Area as required in the Technical Circular.

4.6 Result and Discussion

4.6.1 Overall Pattern of Ventilation Performance

The contour plots at 2m above ground will be presented in the following section in which the contour and vector plots of all studied wind directions may refer to **Appendix C** and **Appendix D** of this Report.

4.6.1.1 Annual Weighted Average

The annual weighted VR contour plot at 2m above ground is shown in Figure 26 and Figure 27 for Scheme A and Scheme B, respectively. Under annual condition, the approaching winds mainly coming from NE quadrant.

It could be observed that relatively higher VR is obtained along the East-West running roads, such as Wang Tat Road & Long Yip Street, Yuen Long On Ning Road, Castle Peak Road – Yuen Long and Ma Tin Road & Ma Tong Road (indicated as black dotted lines). These roads would be considered as the major breezeways to ventilate across Yuen Long Town.

In the presence of these major breezeways, the overall wind performance would be similar between schemes.

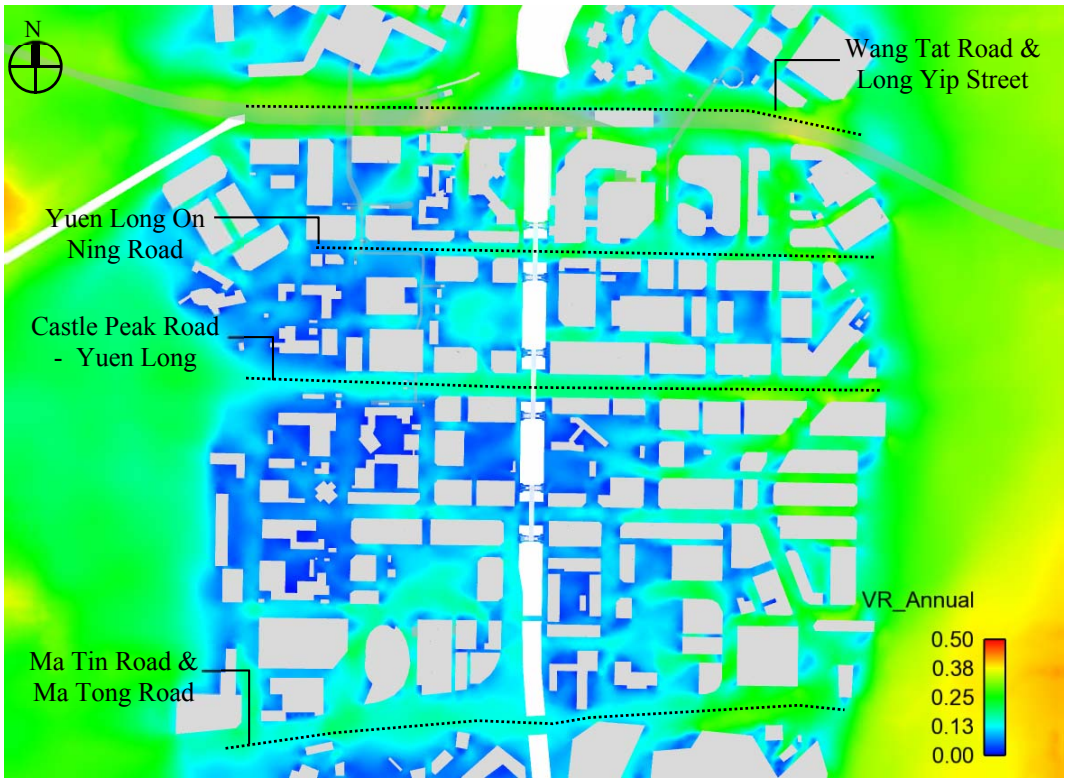


Figure 26 Annual weighted VR Contour plot at pedestrian level for Scheme A

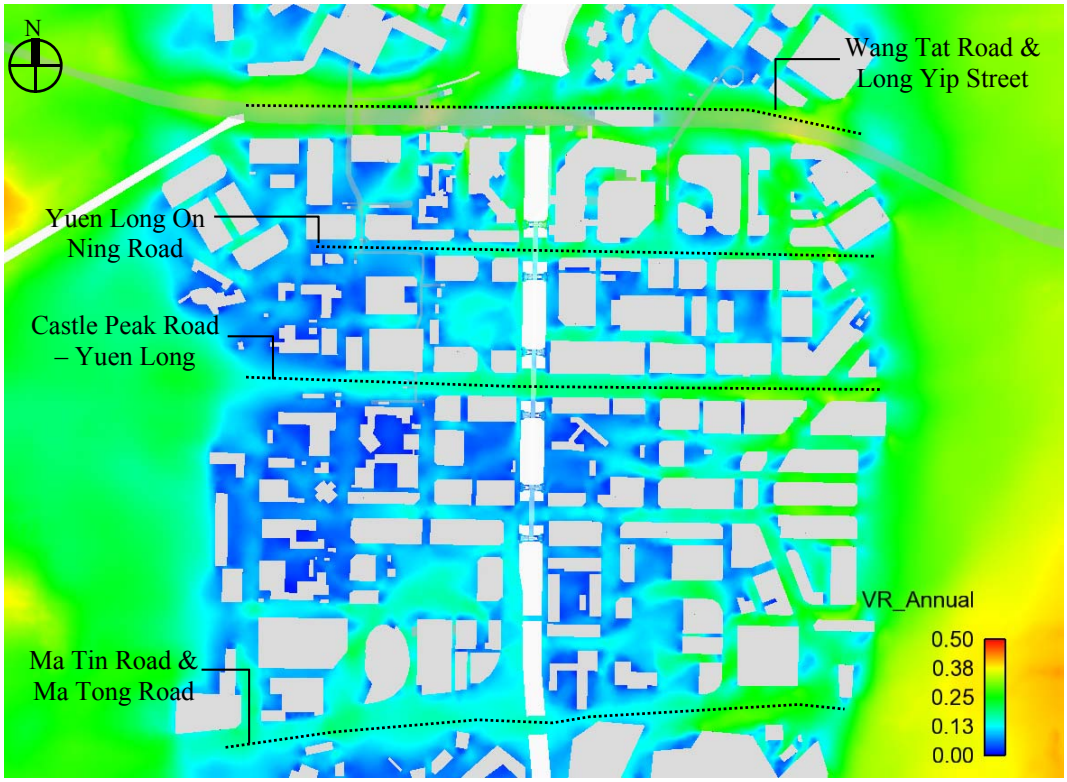


Figure 27 Annual weighted VR Contour plot at pedestrian level for Scheme B

4.6.1.2 Summer Weighted Average

The summer weighted VR contour plot at 2m above the ground is shown in Figure 28 and Figure 29 for Scheme A and Scheme B, respectively. Under summer wind condition, the approaching winds mainly coming from SW quadrant.

There is no significant difference in other surrounding area between Scheme A and Scheme B due to the dominant shielding effect from various building clusters surrounded.

It could be found that the incoming wind from SW quadrant would travel along Ma Tin Road and being diverted into Yuen Long Town Nullah (YLTN) along the curved podium of Yee Fung Garden.

It could be observed that Scheme B would achieve relatively higher VR at the junction of YLTN and Kau Yuk Road. This may because the permeable balustrade under Scheme B would favour the incoming wind to penetrate across the Project and travel along YLTN and consequently lead to higher VR at the immediate leeward side.

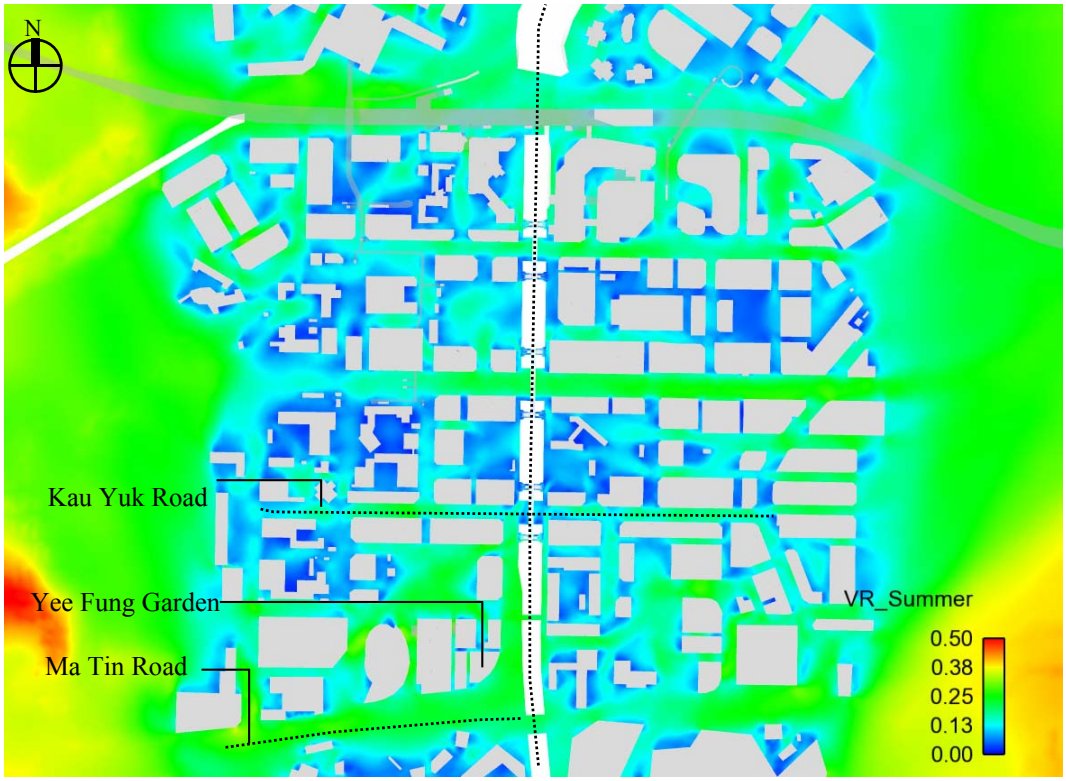


Figure 28 Summer weighted VR Contour plot at pedestrian level for Scheme A

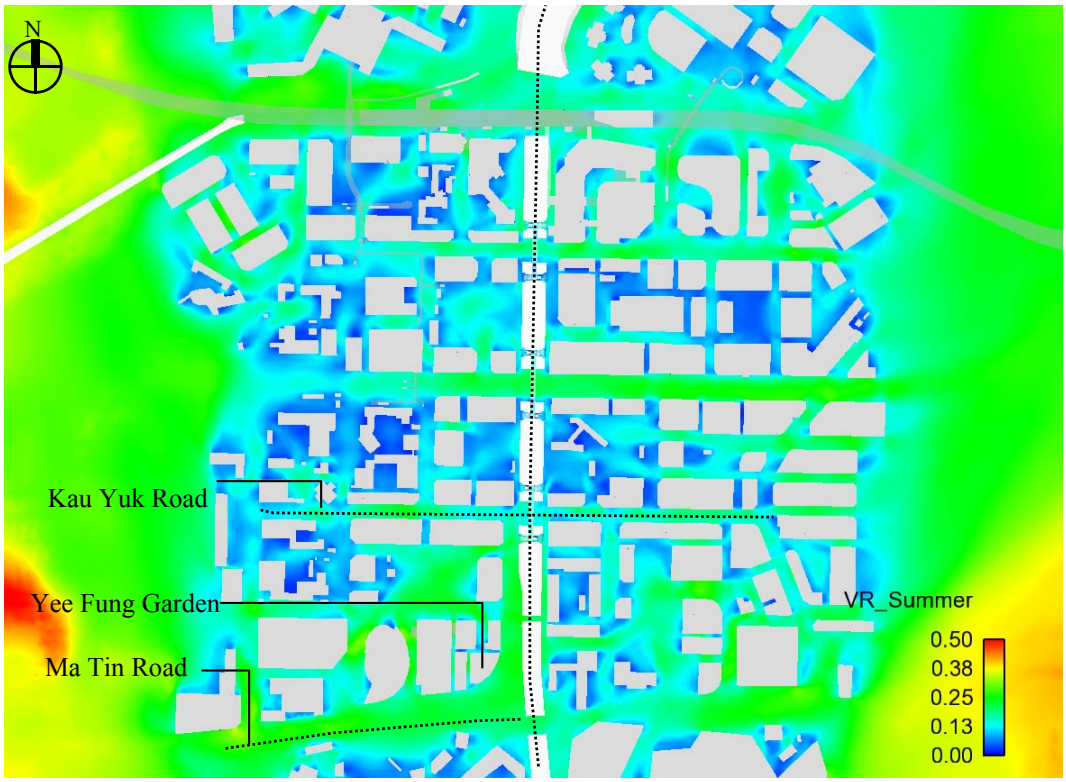


Figure 29 Summer weighted VR Contour plot at pedestrian level for Scheme B

4.6.2 Directional Analysis

4.6.2.1 N/NNE/NNW Wind Directions

The contour plots of VR at 2m above ground under NNE wind direction are presented in Figure 30 and Figure 31 for the Scheme A and Scheme B, respectively.

Under NNE wind direction, the approaching winds ventilate through the YLTN towards the Project. The balustrades implemented on the platform, which are connecting to the existing paved road, are perpendicular to the YLTN. Therefore, the permeable design of balustrades under Scheme B would allow penetration and lead to relatively better wind environment along the YLTN, part of Yuen Long On Ning Road, Castle Peak Road – Yuen Long and Tai Pei Tau Open Space.

However, the non-permeable balustrades under Scheme A would divert the approaching wind to Kik Yeung Road 5-a-side Football pitch such that slightly better wind performance would be found at that area under Scheme A.

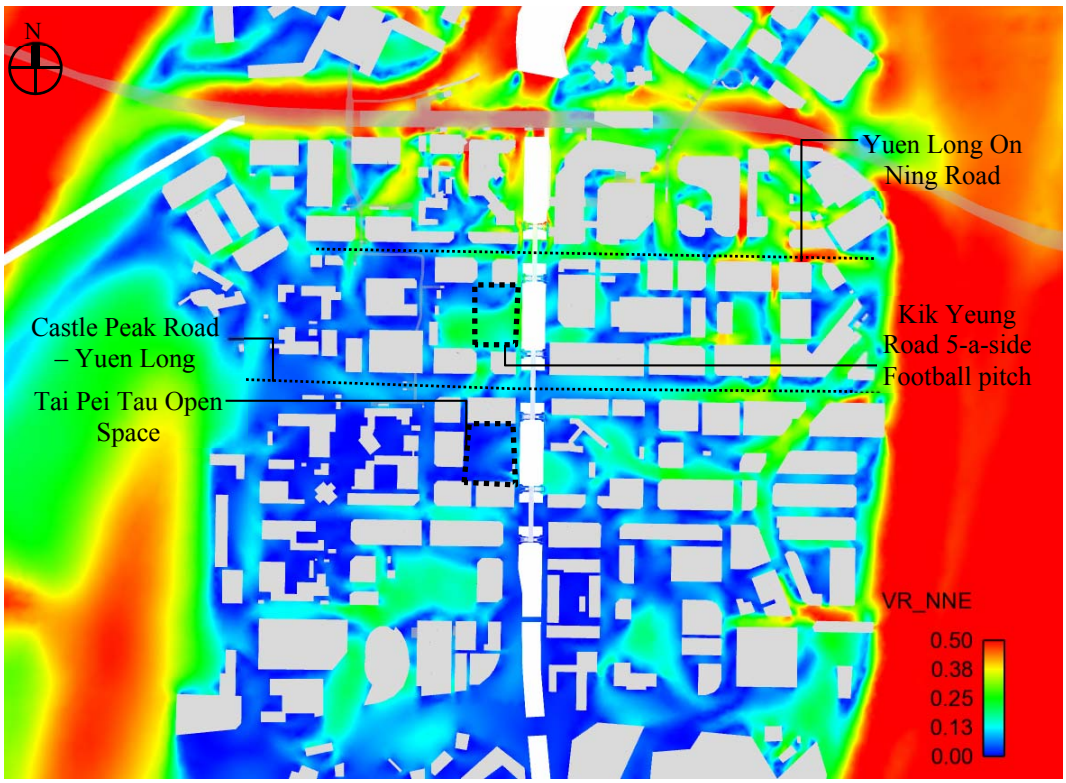


Figure 30 Contour plot at pedestrian level for Scheme A under NNE wind direction

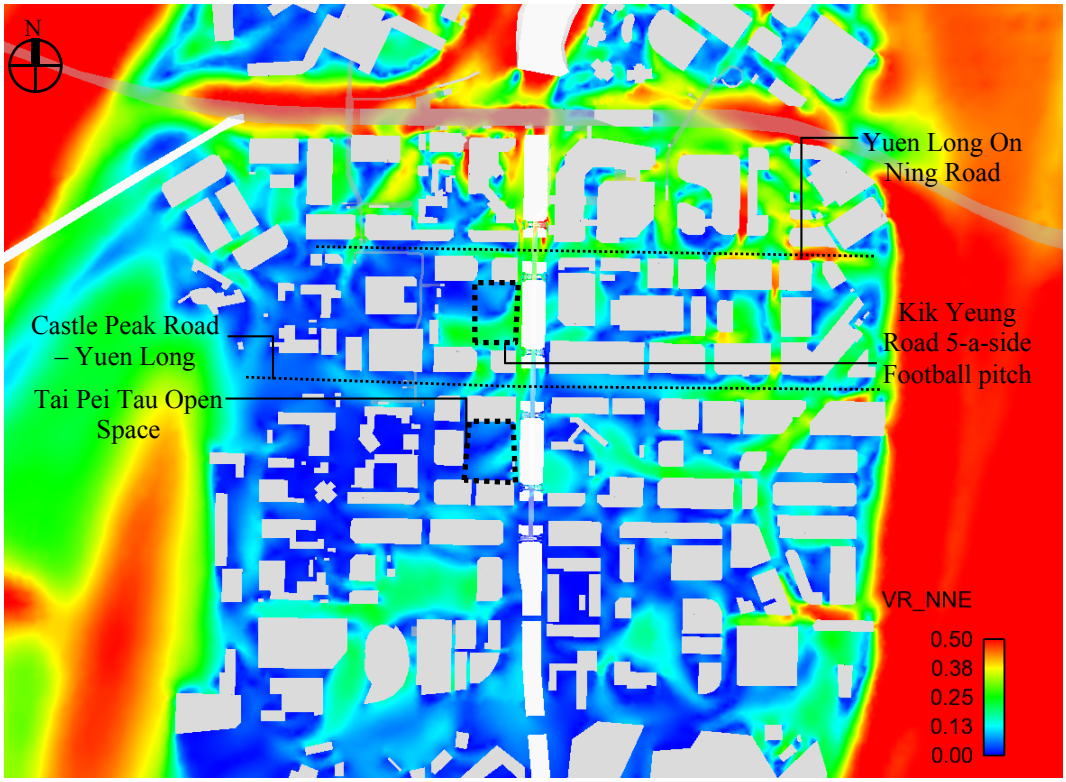


Figure 31 Contour plot at pedestrian level for Scheme B under NNE wind direction

4.6.2.2 NE/ENE Wind Directions

The contour plots of VR at 2m above ground under ENE wind direction are presented in Figure 32 and Figure 33 for the Scheme A and Scheme B, respectively.

The approaching wind would pass through those East-West running roads, such as Wang Tat Road & Long Yip Street, Castle Peak Road – Yuen Long, Sau Fu Street and Kau Tuk Road under ENE wind direction.

It is observed that the high-rise Ho Shun Fuk Building would likely shield the approaching ENE wind towards Kik Yeung Road 5-a-side Football pitch and therefore the wind at higher elevation would be downwashed towards the pedestrian level. With the permeable design of balustrade of the footbridge under Scheme B, the approaching wind could then be easily penetrate across and result in relatively enhanced wind environment at the football pitch than that under Scheme A.

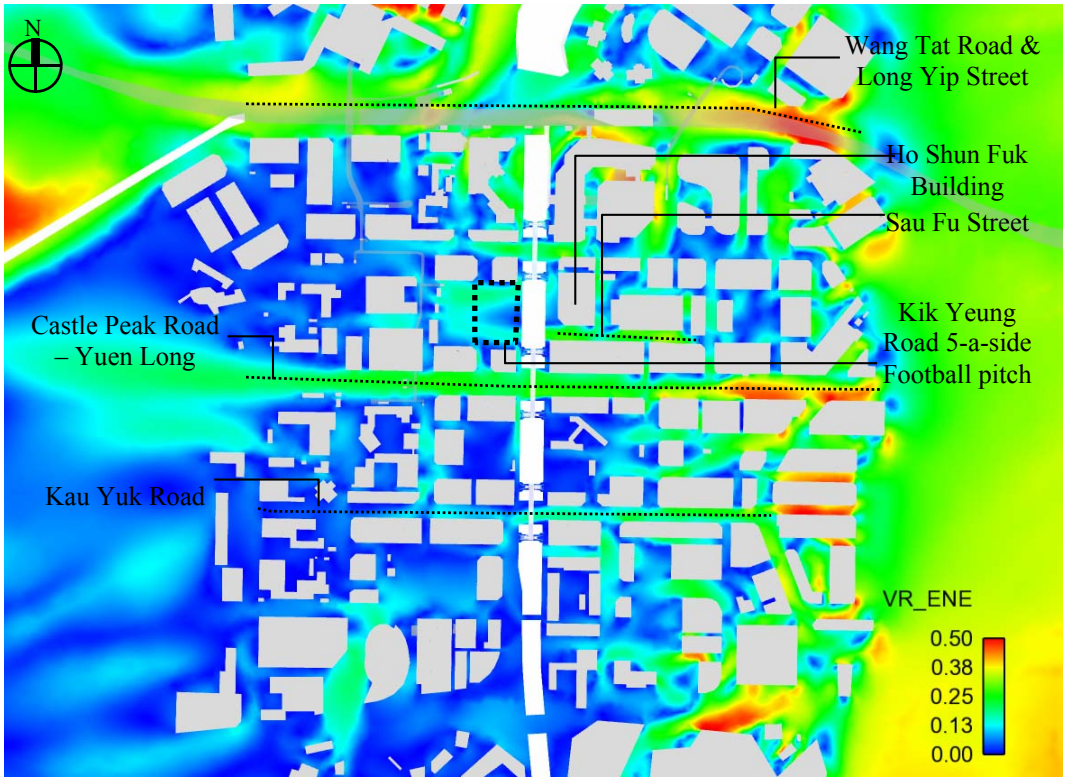


Figure 32 Contour plot at pedestrian level for Scheme A under ENE wind direction

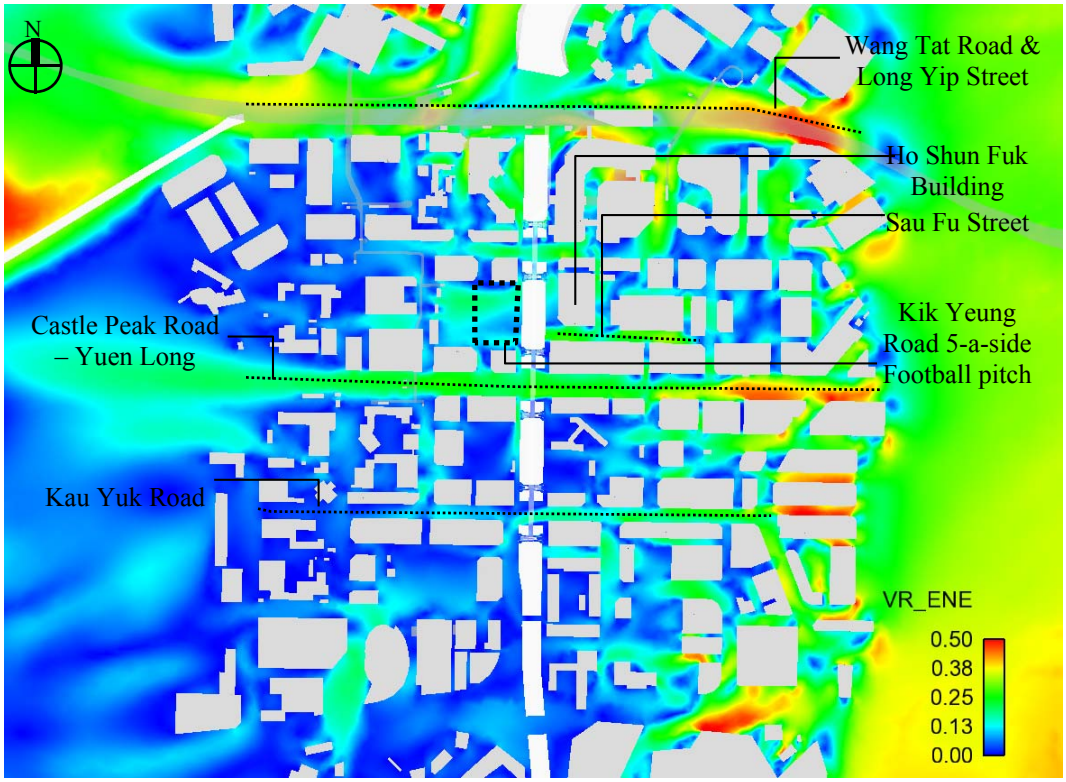


Figure 33 Contour plot at pedestrian level for Scheme B under ENE wind direction

4.6.2.3 E/ESE/SE Wind Directions

The contour plots of VR at 2m above ground under E wind direction are presented in **Figure 34** and **Figure 35** for the Scheme A and Scheme B, respectively.

Under E wind direction, the existing development in Yuen Long Town are compact and generally close to each other. Such compact built environment would shield the approaching wind from east. Other than those portions of the proposed footbridge across the streets, the proposed footbridge would be fallen into the wind shadow of existing developments at windward side. Further impact due to the proposed footbridge on its leeward side would be considered as minimal under E wind condition.

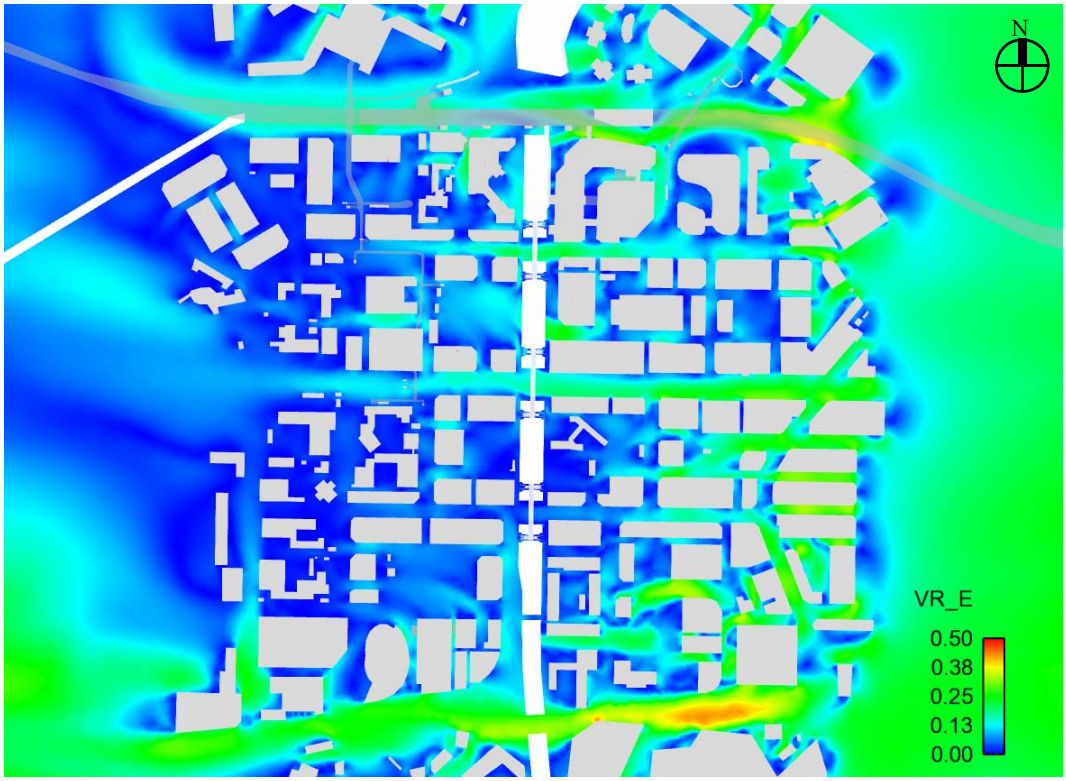


Figure 34 Contour plot at pedestrian level for Scheme A under E wind direction

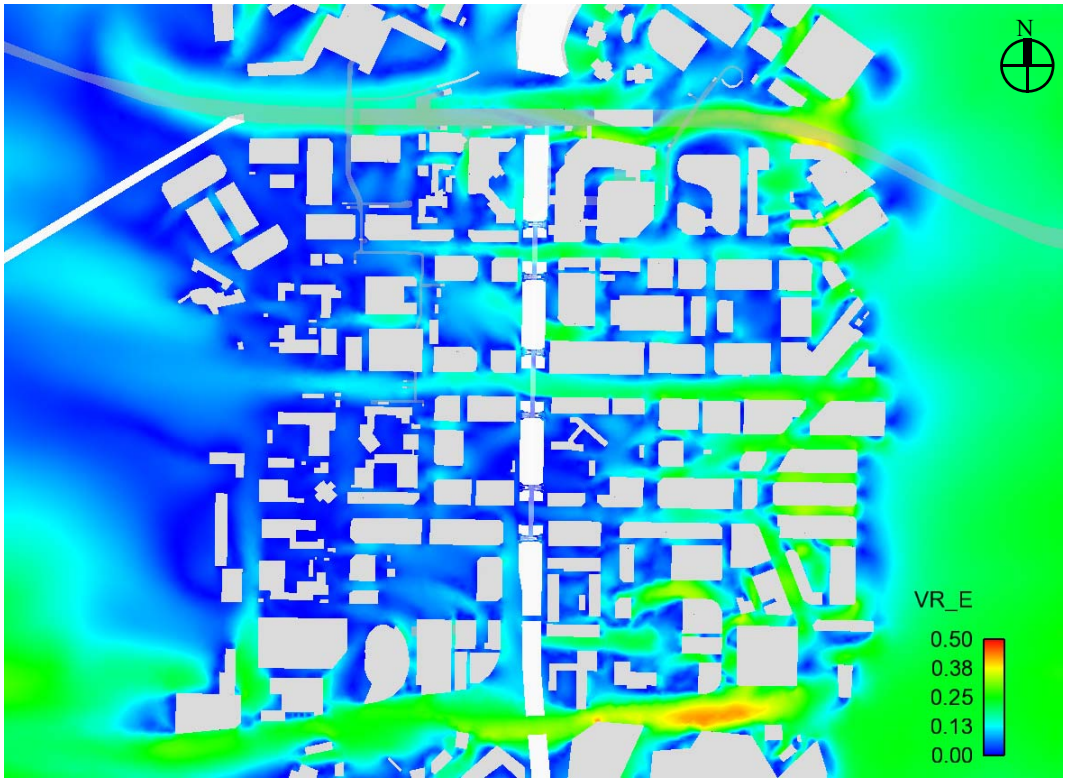


Figure 35 Contour plot at pedestrian level for Scheme B under E wind direction

4.6.2.4 SSE/S/SSW Wind Directions

The contour plots of VR at 2m above ground under S wind direction are presented in Figure 36 and Figure 37 for the Scheme A and Scheme B, respectively.

Under S wind direction, the incoming wind would enter the YLTN freely. With the permeable balustrade design on the connecting platforms to the existing paved road under Scheme B, the immediate leeward side at Kau Yuk Road would obtain better wind environment compared with Scheme A as the permeable balustrade design would favour wind penetration.

A relatively higher VR was found at the junction of YLTN and Castle Peak Road – Yuen Long under Scheme A. It could be due to the non-permeable balustrade design under Scheme A would divert the incoming winds to east and west. Together with the downwash effect due to high-rise Healey Building Shopping Centre near Castle Peak Road – Yuen Long, higher VR was found under Scheme A (as circled in **Figure 36** and **Figure 37**.

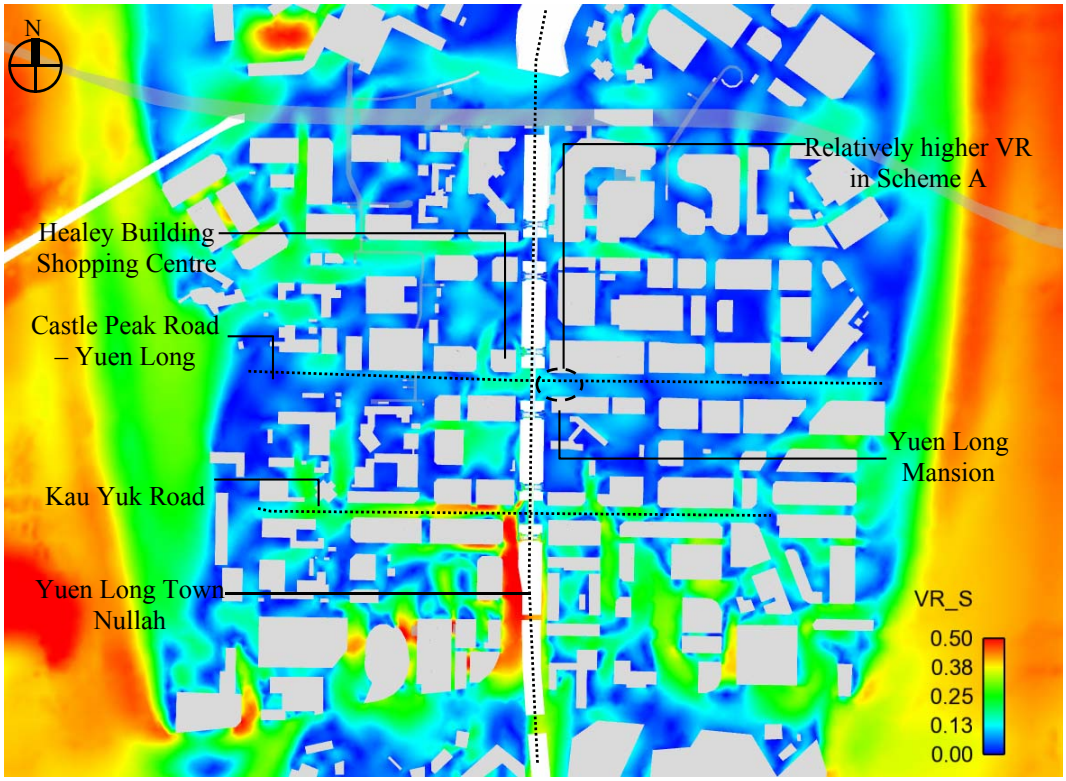


Figure 36 Contour plot at pedestrian level for Scheme A under S wind direction

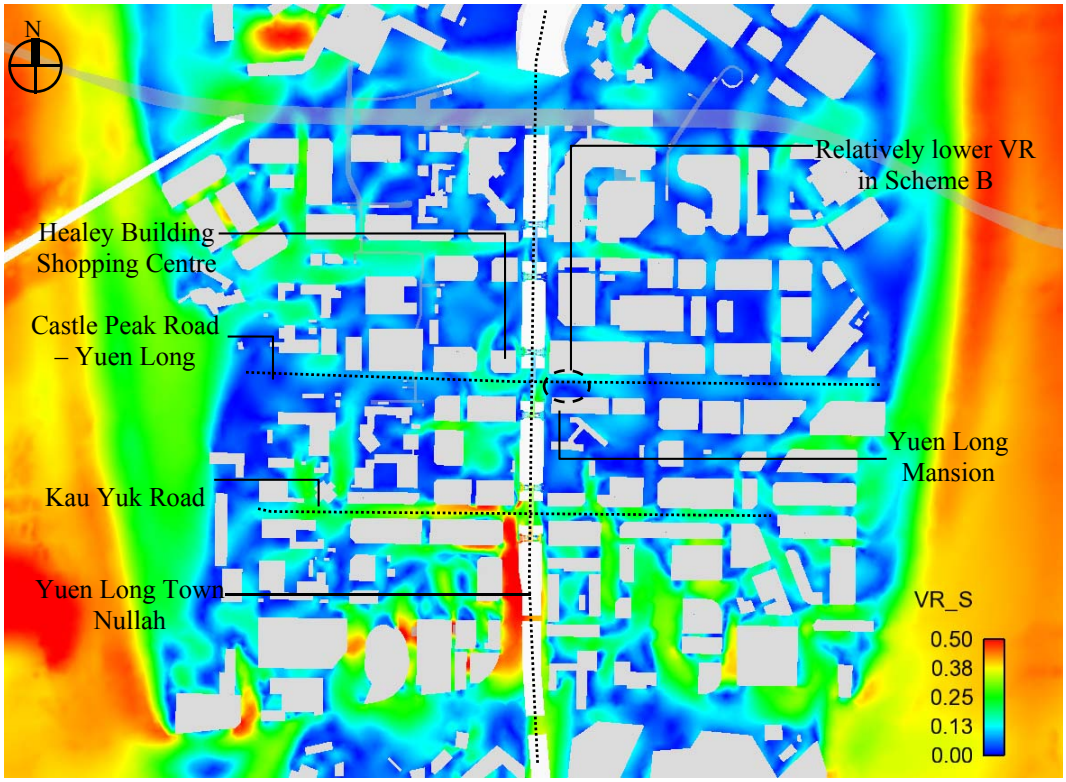


Figure 37 Contour plot at pedestrian level for Scheme B under S wind direction

4.6.2.5 SW/WSW Wind Directions

The contour plots of VR at 2m above ground under SW wind direction are presented in Figure 38 and Figure 39 for the Scheme A and Scheme B, respectively.

With the permeable balustrade design on the platform under Scheme B, the approaching wind flowing along YLTN would easily penetrate continuously that relatively better wind environment is achieved along YLTN compared with Scheme A.

The high-rise Healey Building Shopping Centre would induce catch incoming SW wind at high elevation towards pedestrian level. The downwashed air stream would then follow the air stream flowing along YLTN under Scheme B.

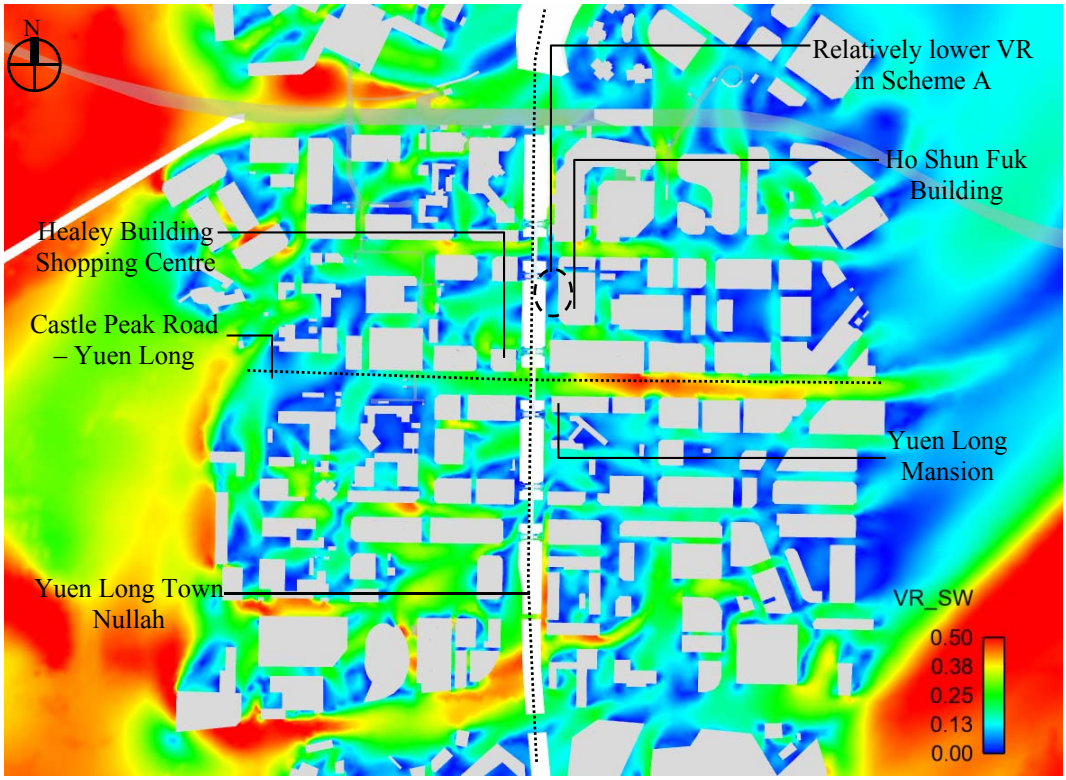


Figure 38 Contour plot at pedestrian level for Scheme A under SW wind direction

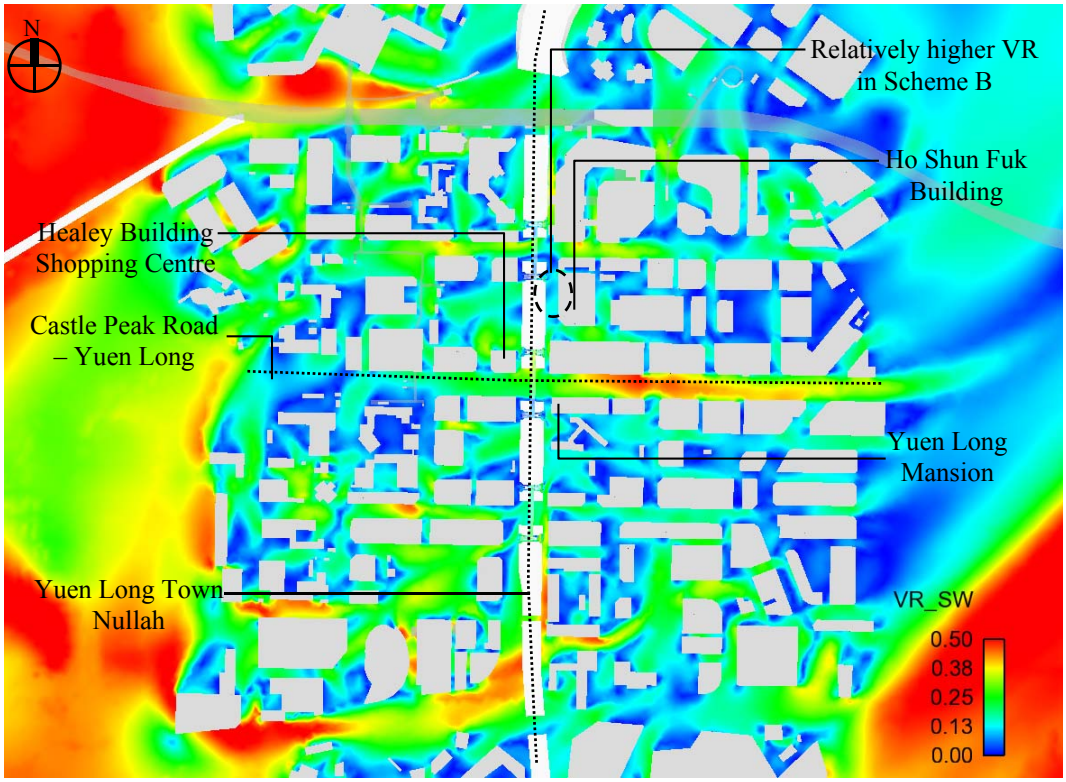


Figure 39 Contour plot at pedestrian level for Scheme B under SW wind direction

4.6.2.6 W/WNW Wind Directions

The contour plots of VR at 2m above ground under W wind direction are presented in Figure 40 and Figure 41 for the Scheme A and Scheme B, respectively.

Similar to its opponent wind direction (i.e. E wind direction), the existing developments in Yuen Long Town to the west of the Project would shield the approaching wind under W wind direction. The impact from proposed footbridge would be considered as insignificant as the existing development to the east of the Project would have dominantly shield from the developments at the windward side.

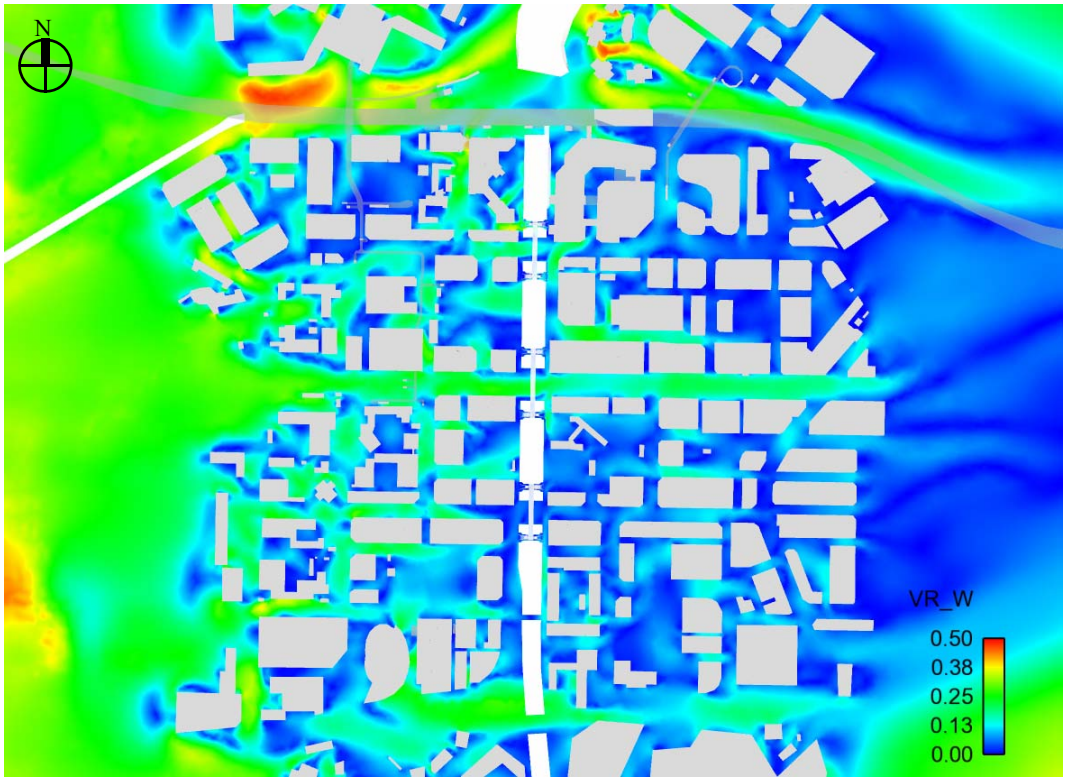


Figure 40 Contour plot at pedestrian level for Scheme A under W wind direction

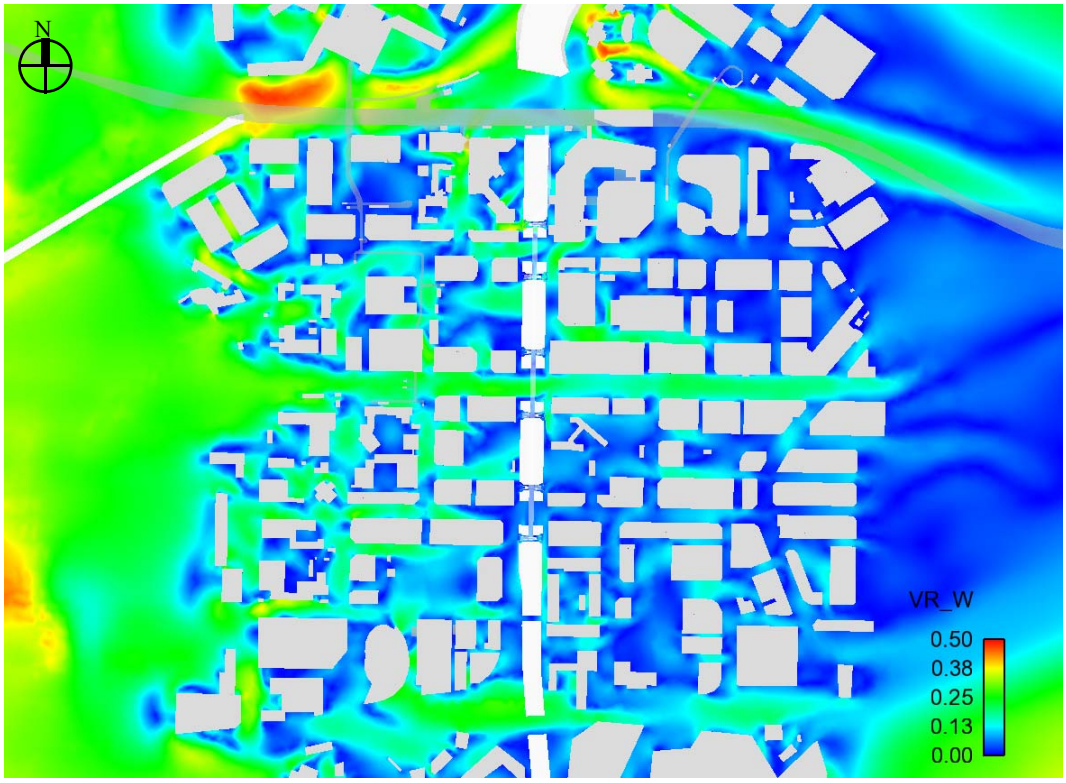


Figure 41 Contour plot at pedestrian level for Scheme B under W wind direction

4.6.2.7 NW Wind Direction

The contour plots of VR at 2m above ground under NW wind direction are presented in Figure 42 and Figure 43 for Scheme A and Scheme B, respectively.

Under NW wind direction, the approaching wind would travel towards the Project via the northern end of YLTN and the western end of East-West running roads, such as Castle Peak Road – Yuen Long and Kau Yuk Road.

Relatively better wind environment along YLTN would be achieved in Scheme B as the permeable balustrade design on the platform would facilitate wind penetration along YLTN than the non-permeable ones.

However, Yuen Long's Children Playground would obtain slightly better wind environment in Scheme A under NW wind direction. The permeable balustrade design under Scheme B would be more favourable to wind penetration; while the Scheme A with non-permeable balustrade design would divert the approaching to sides. In this connection, more approaching wind from Kau Yuk Road would being diverted towards the Yuen Long's Children Playground under Scheme A.

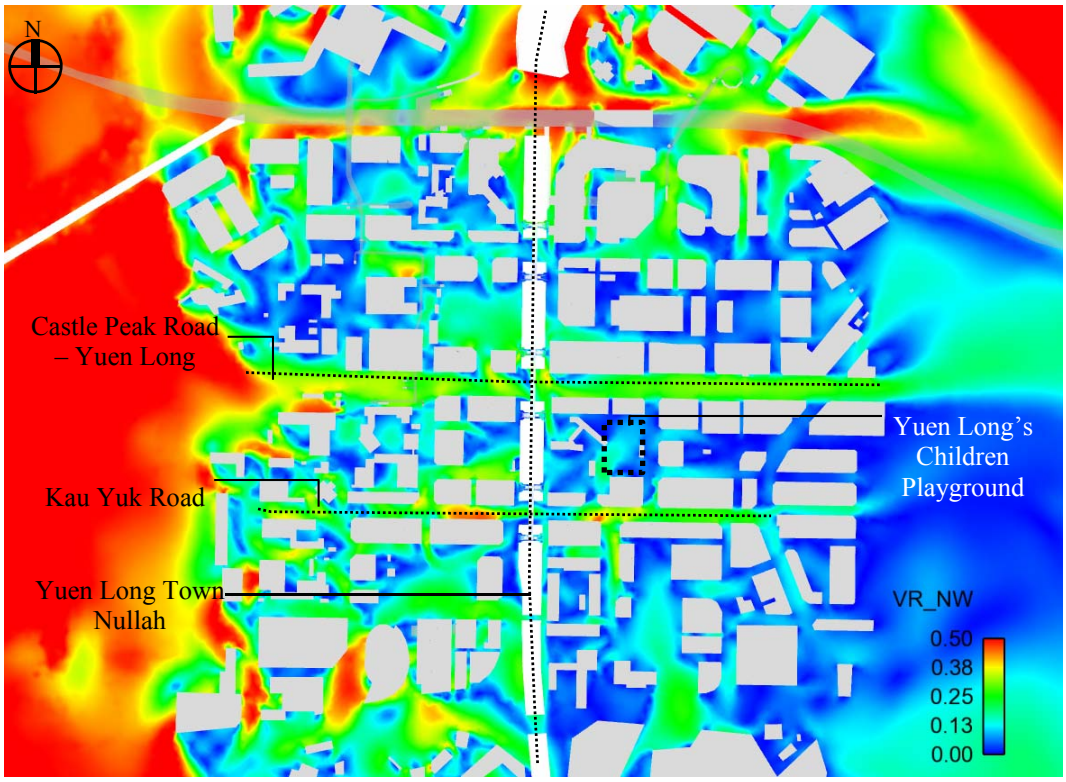


Figure 42 Contour plot at pedestrian level for Scheme A under NW wind direction

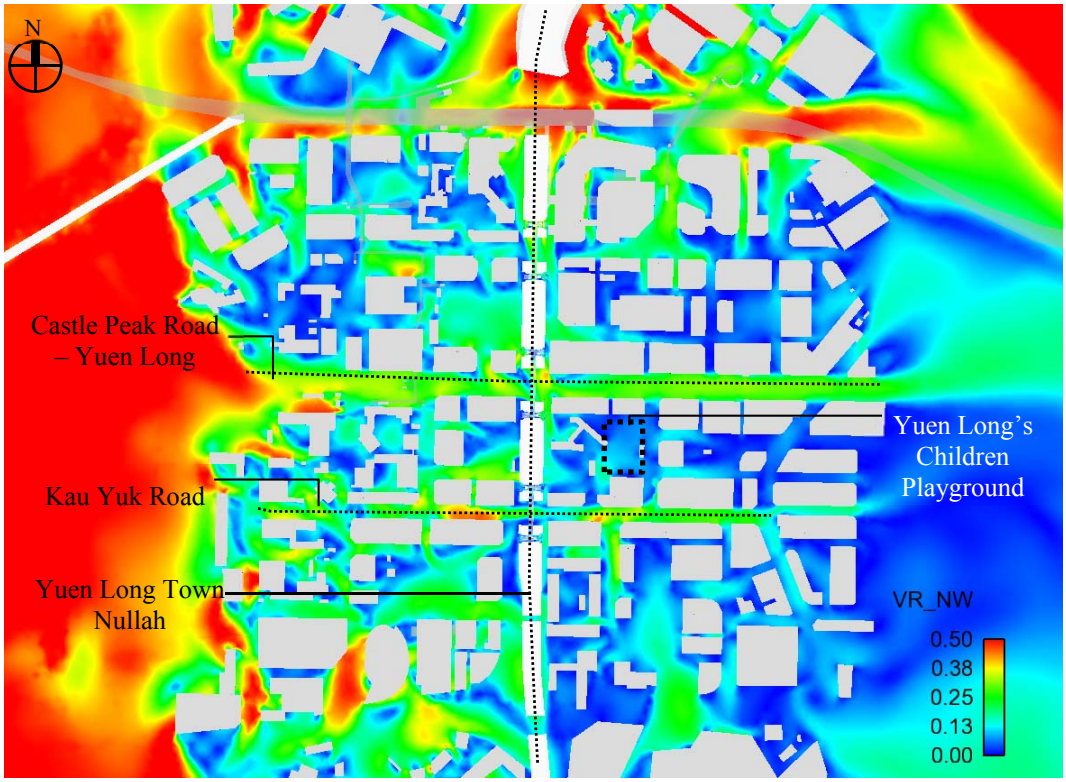


Figure 43 Contour plot at pedestrian level for Scheme B under NW wind direction

4.6.3 VR of Test points

As specified in the Technical Circular, two key ratios are to be determined to give a simple quantity to summarize the ventilation performance:

- **Site spatial average Velocity Ratio (SVR)** – This gives a hint of how the Project impacts the wind environment of its immediate vicinity. This is the average of VR values of all perimeter test points;
- **Local spatial average velocity ratio (LVR)** – This gives a hint of how the Project impacts the wind environment of the local area. This is the average of VR values of all overall and perimeter test points;

Table 3 summarizes the values of SVR and LVR between the two studied schemes for the Project. The VR of individual test point may refer to **Appendix E** of this Report.

Table 3 Comparison of the SVR and LVR between Scheme A and Scheme B

		Scheme A	Scheme B
Annual weighted	SVR	0.13	0.14
	LVR	0.15	0.15
Summer weighted	SVR	0.15	0.15
	LVR	0.16	0.16

The Scheme B obtained a slightly better SVR than the Scheme A under annual wind condition; while same LVR was obtained in two schemes under annual wind condition as well as SVR and LVR under summer wind condition.

With the provision of wind enhancement features adopted in the Scheme B, a slightly better ventilation performance at immediate vicinity under annual condition would be resulted compared with the Scheme A. However, the wind performance of local area under Scheme B was similar to Scheme A, as the built-up area of Yuen Long Town would determine the wind performance of the surrounding environment.

4.6.4 Focus Areas

To further assess the impact of the Project on the wind environment in its vicinity, 29 focus areas are identified as marked in **Figure 44**. These focus areas are considered as places with frequent pedestrian access.

Figure 44 Locations of the focus areas

The area spatial VR of each focus area are tabulated in Table 4, in which the corresponding index of test point for each focus area is also provided. Averaged VR under annual and summer wind conditions are compared between two schemes.

Table 4 Spatial averaged VR for each focus area under annual and summer wind conditions

FA	Name of Development	Test points	Annual wind		Summer Wind	
			Scheme A	Scheme B	Scheme A	Scheme B
Residential Sites						
1	Planned West Rail Long Ping Station (North) Site	O17-O19,O23-O31	0.19	0.19	0.15	0.15
2	Planned West Rail Long Ping Station (South) Site	P2-P6,O14,O36-O38,O40-O41	0.20	0.20	0.15	0.15
3	Redevelopment of Ex-Yuen Long Estate	O46-O50,O56-O57	0.18	0.18	0.17	0.17
4	Long Ping Estate	O1-O7	0.24	0.24	0.19	0.19
5	Proposed CDA Development	P41-P46,O21-O22,O42-O46,O49-O50,O54-O55	0.20	0.20	0.18	0.18
Major Roads						
6	YLTN	P1-P46,O8-O10,O15-O17,O26-O28,O126-127, O135-136, O142, O144, O159-160	0.14	0.15	0.16	0.16
7	Wang Tat Road & Long Yip Street	O12-O19,O31	0.24	0.24	0.19	0.19
8	Yuen Long On Ning Road	P7,P41,O39,O51-O57	0.16	0.16	0.19	0.19
9	Castle Peak Road – Yuen Long	P13,P35,O74-O81	0.19	0.19	0.22	0.22
10	Kau Yuk Road	P18,P30,O106-O113	0.13	0.13	0.18	0.18
11	Ma Tin Road	O135-138, O155	0.14	0.14	0.22	0.22
12	Ma Tong Road	O135-138, O155	0.14	0.14	0.18	0.18
13	Sau Fu Street	P38-P41,O70-O73	0.13	0.13	0.13	0.13
14	Sai Yu Street	O137,O145-O149	0.12	0.12	0.17	0.17
15	Fung Nin Road	O85-O87	0.10	0.10	0.12	0.12
16	Yuen Long On Hing Street	P20,O114-O116	0.12	0.12	0.19	0.19
School Sites						

FA	Name of Development	Test points	Annual wind		Summer Wind	
			Scheme A	Scheme B	Scheme A	Scheme B
17	Yuen Long Merchants Association Primary School and Secondary School	O74-O76,O82-O87	0.10	0.10	0.12	0.12
18	The Church of Christ in China Chun Kwong Primary School	P32-P34,O93-O95	0.06	0.06	0.10	0.10
19	Caritas Chan Chun Ha Prev. School	O136-O137,O142-O144,O149	0.11	0.11	0.17	0.17
20	Yuen Long Lutheran College	O58-O62	0.10	0.10	0.14	0.14
21	The Church of Christ in China Chun Kwong School and adjacent Open Space	O32-O38	0.15	0.15	0.14	0.14
Amenity Areas						
22	Public Library and Indoor Recreation Centre	O122-O123,O130-O133	0.16	0.16	0.22	0.22
23	Kik Yeung Road 5-a-side Football Pitch & Yuen Long West Bus Terminal	P9-P11,O63-O67	0.13	0.13	0.14	0.14
24	Tai Pei Tau open space	P15-P17,O89-O90,O92	0.07	0.08	0.11	0.11
25	Yuen Long's Children Playground	O97,O99-O102	0.12	0.12	0.13	0.13
26	Chung Sing Path Playground	P31-P32,O95-O96	0.07	0.07	0.10	0.10
27	Sai Ching Street Children's Playground	O150-O151,O156	0.10	0.10	0.15	0.15
28	Sai Ching Street Tennis Courts	O148,O152-O155	0.15	0.15	0.18	0.18
29	On Hing Playground	O117-O121	0.14	0.14	0.18	0.18

Among 27 out of 29 focus areas, Scheme B achieve similar ventilation performance as compared with Scheme A due to the predominant effect of the built environment in Yuen Long Town. In particular, Schemes B obtained slightly better wind performance by 0.01 along the Yuen Long Town Nullah (YLTN) and the Tai Pei Tau open space, which located adjacent to the YLTN. This may mainly because the permeable balustrade design of Scheme B would facilitate wind penetration under annual wind condition.

5 Conclusion

An Air Ventilation Assessment (AVA) Detailed Study was conducted to assess the ventilation performance of the proposed development at Yuen Long Town and immediate surroundings of the sites in accordance with the Annex C-B20 of "*Brief for Agreement No.CE32/2014 (HY) Elevated Pedestrian Corridor in Yuen Long Town connecting with Long Ping Station – Investigation, Design and Construction*".

Scheme A and Scheme B were assessed by using Computational Fluid Dynamics (CFD) techniques. A series of CFD simulations using Realizable k–ε turbulence model were performed with reference to the AVA methodology as stipulated in the Annex C-B20 of the Study Brief and relevant sections in the Technical Circular. 16 wind directions were considered to investigate the wind performance under both annual and summer conditions.

The Velocity Ratio (VR) was employed to assess the ventilation performance of the Proposed Development and its impact to the surroundings under two schemes. With reference to the AVA Technical Circular, totally 46 perimeter test points and 160 overall test points were selected to assess the ventilation performance of the Project and its surrounding. Upon CFD simulation, Scheme B achieves slightly better ventilation performance by 0.01 in term of SVR than Scheme A under annual wind condition. The results of the overall ventilation performance could are summarized as followings:

		Scheme A	Scheme B
Annual weighted	SVR	0.13	0.14
	LVR	0.15	0.15
Summer weighted	SVR	0.15	0.15
	LVR	0.16	0.16

In term of wind environment within the assessment area, similar LVR would be obtained in the Scheme A and Scheme B, a slightly higher SVR in Scheme B would be achieved under annual wind condition with the enhanced permeability on balustrade design. It is found that the wind environment of the project site is predominantly affected by the existing building morphology such that the permeable balustrade design of Scheme B would slightly enhance the wind environment at its immediate vicinity.

29 focus areas, where pedestrian frequently accesses such as residential areas, schools and amenity areas (e.g. Parks), are identified within the Assessment Area. The ventilation performance of these identified focus areas are very similar between schemes. In particular, Schemes B leads to slightly better wind performance along Yuen Long Town Nullah and Tai Pei Tau open space due to the permeable balustrade design that encourage wind penetration under annual wind condition.

To conclude, this AVA study demonstrated the ventilation performance of Scheme A and Scheme B with the adoption of non-permeable and permeable balustrade design respectively. The adoption of non-permeable balustrade design in Scheme A would not significantly affect the ventilation performance of its surrounding areas under both annual and summer wind conditions as compared with the adoption of permeable balustrade design in Scheme B. Considered Scheme A of providing glass provides visual transparency to pedestrians on deck level, which allows pedestrians

from the footbridge to enjoy the view of the nullah. Scheme A is preferred and glass balustrade will be provided at both sides along the footbridge.

Appendix A

Project Layout Plan

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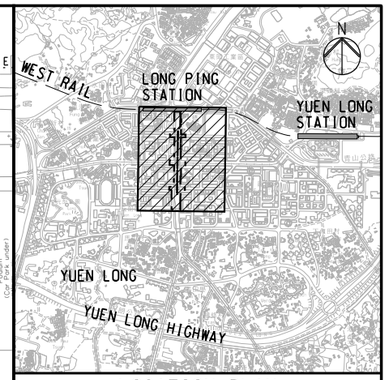

LOCATION PLAN

LEGEND

WORKS LIMIT

I	NINTH ISSUE	EH	06/16
H	EIGHTH ISSUE	EH	04/16
G	SEVENTH ISSUE	EH	04/16
F	SIXTH ISSUE	EH	02/16
Rev	Description	By	Date

Consultant

ARUP

Project title

Agreement No. CE 32/2014 (HY)

Elevated Pedestrian Corridor in Yuen Long Town connecting with Long Ping Station – Investigation, Design and Construction

Drawing title

PROJECT LAYOUT PLAN

Drawing no.		Rev.
240246/1001		I
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Appendix B

Results from Wind Tunnel Testing

Contents

B1 Hotwire Anemometry Details

The wind speeds and local directions of the wind flows at the anemometer location were measured using a DANTEC 2-wire hot-wire probe for a range of wind directions. The measurement of the instantaneous flow velocity is based on the heat transfer between a sensing element within the hotwire (a thin electrically heated wire) and the surrounding wind flow. The rate of heat loss depends on the excess temperature of the sensing element, its physical properties and geometrical configuration, and the properties of the wind flow. A hotwire anemometer provides reliable information on the fluctuating flow component in both the space and time domains.

The constant temperature anemometer that is used is designed so that the frequency limit of the instrument is mainly determined by the electronic circuitry. This is achieved by supplying electrical energy to the wire at exactly the same rate as heat is lost to the surrounding fluid medium, and at the same time. The wire temperature is therefore kept constant irrespective of the flow velocity.

If the flow velocity increases, the wire resistance will tend to decrease and an error voltage will be present. This will cause the probe current to increase. From this we can then determine what the flow velocity is at the measurement location. The wire will then heat and increase in resistance until the balance is restored.

B2 Tabulated Results

B2.1 Measured Longitudinal Wind Speeds (V_{Mean} /V_{Ref})

Table B 1 Normalized Mean Velocity measured at Various Levels of the Wind Tunnel Testing

Height	0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5
20	0.6	0.7	0.6	0.5	0.4	0.4	0.6	0.6	0.6	0.6	0.6	0.6	0.5	0.4	0.6	0.6
50	0.7	0.7	0.7	0.6	0.5	0.5	0.7	0.7	0.6	0.6	0.6	0.7	0.5	0.5	0.7	0.7
75	0.7	0.8	0.7	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.6	0.5	0.7	0.7
100	0.8	0.8	0.8	0.7	0.7	0.7	0.8	0.8	0.7	0.7	0.7	0.8	0.6	0.6	0.7	0.8
150	0.9	0.9	0.9	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.7	0.7	0.8	0.9
200	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.9	0.8	0.7	0.8	0.9
300	1.0	1.0	1.0	0.9	0.9	1.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.9	1.0
400	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
500	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
600	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
800	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.1	1.1	1.0	1.0	1.0	1.0	1.0
1000	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
1200	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
1400	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
1600	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1

B2.2 Measured Longitudinal Turbulence Intensity (Iu) [%]

Table B 2 Turbulence Intensity measured at Various Levels of the Wind Tunnel Testing

Height	0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5
20	15.3	15.6	16.5	30.0	31.4	34.7	23.6	19.9	19.7	21.6	19.8	17.6	31.4	32.5	17.3	18.1
50	16.0	15.6	17.4	29.4	30.2	31.7	22.6	19.5	20.4	21.9	20.3	16.7	29.7	29.6	16.8	18.2
75	15.2	14.3	17.6	26.7	27.1	27.6	21.8	19.0	19.0	21.5	19.8	16.3	28.7	28.6	16.4	17.4
100	14.5	13.5	16.7	22.9	23.7	23.6	20.0	17.8	17.9	20.7	18.6	15.7	27.4	27.3	15.7	17.2
150	11.5	10.9	12.8	15.9	18.9	16.4	18.7	15.3	14.8	18.6	16.9	13.9	21.7	24.8	14.7	14.7
200	9.3	8.5	10.4	13.1	14.6	11.4	17.2	13.7	13.3	16.7	15.2	12.3	16.8	22.5	13.7	10.5
300	8.0	8.1	8.9	11.1	10.3	8.5	15.6	11.6	10.8	14.9	13.7	9.3	10.7	18.0	11.7	8.2
400	8.0	7.8	8.0	9.8	8.5	8.1	14.1	10.1	9.0	13.1	11.5	8.2	8.8	12.6	9.8	7.9
500	7.6	7.7	7.5	8.6	7.8	7.7	12.5	8.6	8.1	11.8	9.3	7.5	7.9	8.9	8.5	7.9
600	7.7	7.6	7.4	8.3	7.5	7.4	10.7	7.8	7.4	10.1	7.9	7.6	7.6	7.7	7.5	7.5
800	7.1	6.9	7.1	7.4	7.0	7.0	8.1	7.2	6.9	7.7	6.9	6.9	7.0	7.1	7.0	7.2
1000	6.4	6.2	6.2	6.3	6.2	6.3	6.6	6.1	6.1	6.5	6.2	6.2	6.3	6.3	6.2	6.3
1200	5.3	5.1	5.3	5.2	5.3	5.2	5.3	5.2	5.0	5.7	5.4	5.3	5.2	5.4	5.3	5.4
1400	3.9	4.4	4.2	3.9	4.0	3.9	4.3	3.9	4.2	4.2	4.1	4.3	4.1	4.3	4.4	3.9
1600	3.1	3.0	3.1	3.1	3.1	2.9	3.0	3.1	2.8	3.0	3.1	3.4	3.1	3.1	3.1	2.9

B2.3 Measured Longitudinal Gust Velocity (V_{gust} / V_{ref})

Table B 3 Normalized Gust Velocity measured at Various Levels of the Wind Tunnel Testing

Height	0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5
20	1.0	1.0	1.0	1.1	0.9	0.9	1.1	1.0	1.0	1.1	1.0	1.1	1.0	0.9	1.0	1.1
50	1.1	1.2	1.1	1.2	1.1	1.0	1.2	1.1	1.1	1.2	1.1	1.1	1.1	1.0	1.1	1.2
75	1.2	1.2	1.2	1.3	1.2	1.1	1.3	1.2	1.2	1.2	1.2	1.2	1.2	1.1	1.1	1.2
100	1.2	1.3	1.2	1.3	1.3	1.2	1.3	1.2	1.2	1.3	1.2	1.2	1.2	1.2	1.2	1.3
150	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.2	1.3
200	1.2	1.2	1.3	1.3	1.3	1.3	1.4	1.3	1.3	1.4	1.3	1.3	1.4	1.3	1.3	1.3
300	1.2	1.3	1.3	1.3	1.3	1.3	1.4	1.3	1.3	1.4	1.4	1.3	1.3	1.4	1.3	1.3
400	1.3	1.3	1.3	1.3	1.3	1.3	1.5	1.3	1.3	1.4	1.4	1.3	1.3	1.4	1.3	1.3
500	1.3	1.3	1.3	1.3	1.3	1.3	1.5	1.3	1.3	1.4	1.3	1.3	1.3	1.3	1.3	1.3
600	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.3	1.3	1.4	1.3	1.3	1.3	1.3	1.3	1.3
800	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.3	1.3	1.4	1.3	1.3	1.3	1.3	1.3	1.3
1000	1.3	1.3	1.3	1.3	1.3	1.3	1.4	1.3	1.3	1.4	1.3	1.3	1.3	1.3	1.3	1.3
1200	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
1400	1.2	1.3	1.2	1.3	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
1600	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.2	1.2	1.3	1.2	1.2	1.2	1.2	1.2	1.2

B2.4 Measured Yaw Angle [Degree]

Table B 4 Measured Yaw Angle at Various Levels of the Wind Tunnel Testing

Height	0	22.5	45	67.5	90	112.5	135	157.5	180	202.5	225	247.5	270	292.5	315	337.5
20	-3.0	0.4	4.2	-5.4	3.5	-2.4	6.6	-1.5	0.0	1.0	-0.8	-2.3	-6.0	5.9	6.9	3.5
50	1.5	-1.2	2.1	-3.8	3.6	0.4	5.2	0.9	-1.5	0.7	-3.2	-2.6	-4.0	3.3	6.1	0.7
75	2.7	-1.0	0.9	-2.7	3.1	1.5	4.1	1.7	-1.7	0.9	-3.5	-2.3	-2.5	2.3	5.7	0.4
100	3.1	-0.6	0.2	-1.8	2.4	2.5	3.3	2.1	-1.4	0.6	-3.6	-2.0	-1.4	1.8	5.2	0.5
150	2.6	-0.2	-0.6	-0.7	1.5	3.2	1.9	1.7	-0.6	-0.2	-2.7	-1.6	-0.2	1.4	3.9	0.9
200	1.8	0.2	-0.8	0.0	0.5	2.7	1.3	1.8	-0.2	-0.5	-1.7	-1.1	-0.2	1.2	2.7	0.9
300	1.2	0.4	-0.5	0.7	-0.5	1.4	0.0	1.8	0.1	-1.1	-0.5	-0.6	-0.4	0.5	1.0	0.7
400	1.0	0.5	-0.3	0.9	-0.7	0.9	-0.3	1.3	0.2	-1.1	0.2	-0.4	-0.4	0.0	0.4	0.5
500	0.5	0.4	-0.1	0.6	-0.6	0.5	-0.2	1.1	0.1	-0.9	0.4	-0.3	-0.5	-0.3	0.0	0.4
600	0.5	0.4	-0.3	0.4	-0.4	0.2	-0.1	0.9	0.0	-0.5	0.5	-0.2	-0.4	-0.4	0.0	0.2
800	0.4	0.3	-0.2	0.1	-0.2	0.1	0.1	0.6	0.1	-0.2	0.4	-0.1	-0.3	-0.5	-0.1	0.2
1000	0.2	0.2	-0.1	0.0	-0.2	0.1	0.1	0.5	0.1	0.0	0.3	-0.2	-0.3	-0.4	-0.1	0.1
1200	0.3	0.3	0.0	0.1	0.0	0.1	0.2	0.4	0.2	0.1	0.3	0.0	-0.2	-0.3	-0.1	0.0
1400	0.3	0.3	0.1	0.1	0.1	0.1	0.2	0.4	0.2	0.1	0.3	0.0	-0.2	-0.3	-0.1	0.1
1600	0.4	0.3	0.2	0.1	0.2	0.2	0.3	0.4	0.2	0.2	0.3	0.1	-0.1	-0.2	0.0	0.1

B3 Plots

B3.1 Measured Longitudinal Wind Speeds (V_{Mean} /V_{Ref})

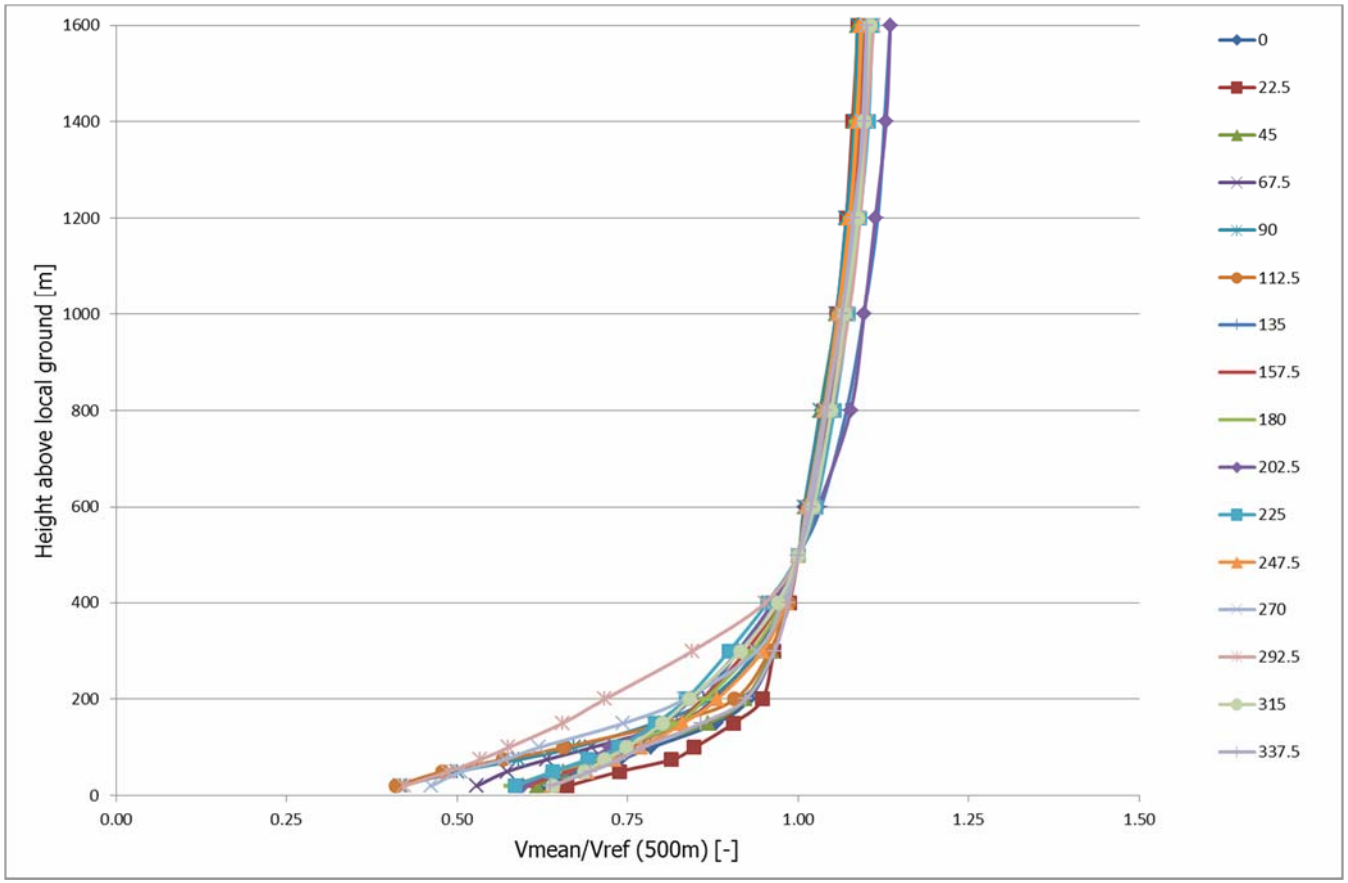

Figure B 1 Normalized Mean Velocity measured at Various Levels of the Wind Tunnel Testing

B3.2 Measured Longitudinal Turbulence Intensity (Iu) [%]

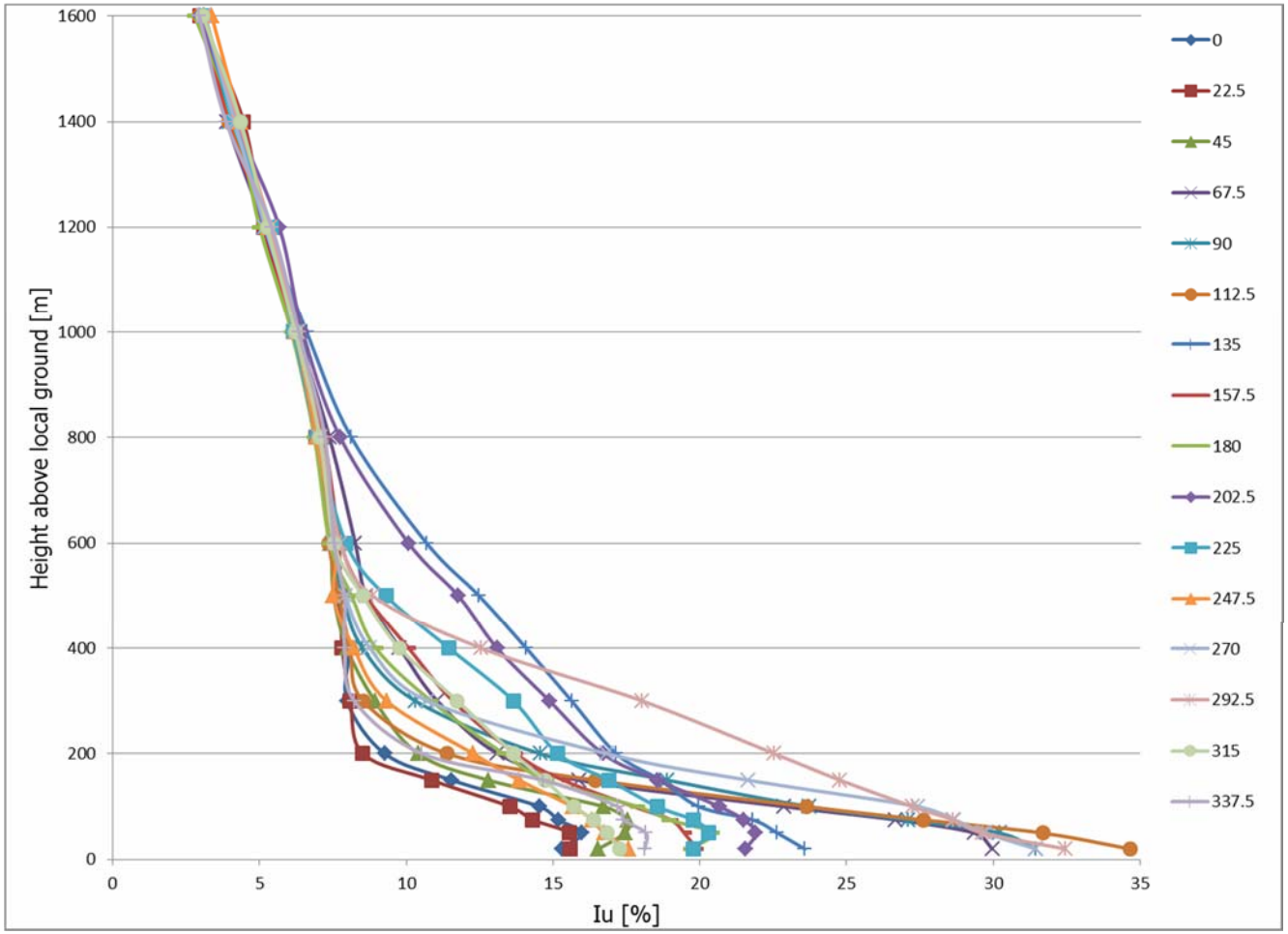

Figure B 2 Turbulence Intensity measured at Various Levels of the Wind Tunnel Testing

B3.3 Measured Longitudinal Gust Velocity (V_{gust} / V_{ref})

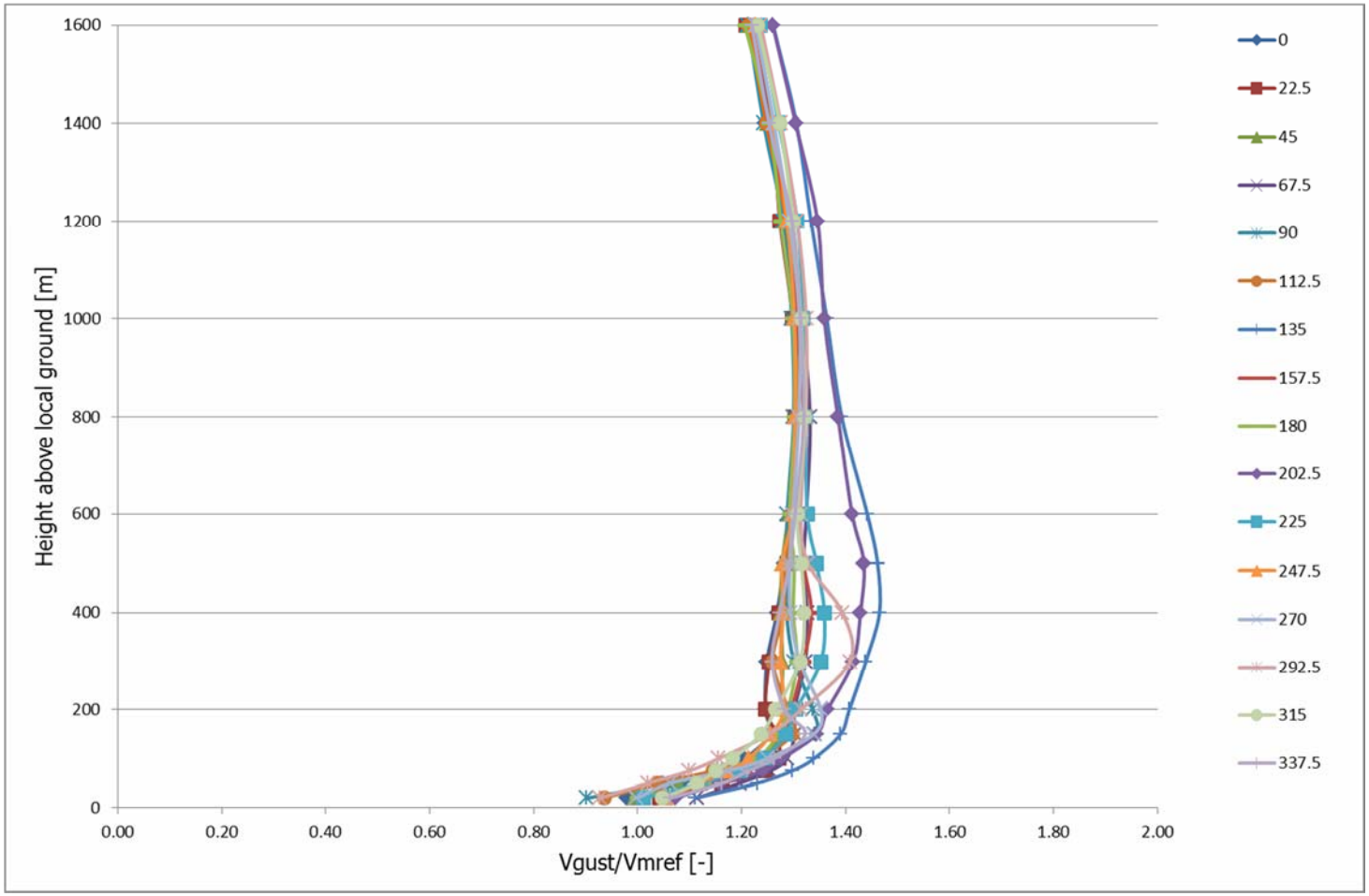

Figure B 3 Normalized Gust Velocity measured at Various Levels of the Wind Tunnel Testing

B3.4 Measured Yaw Angle [Degree]

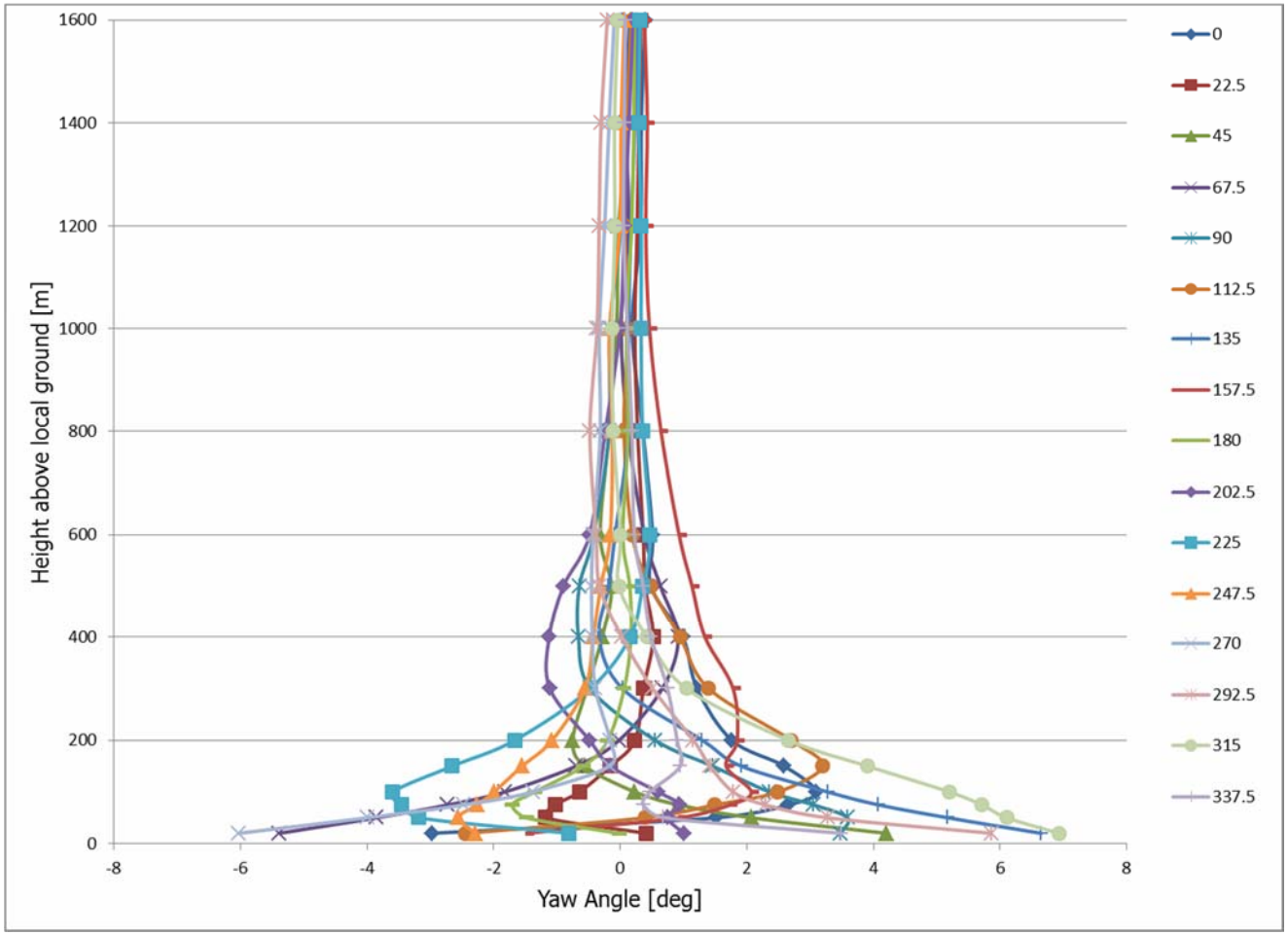

Figure B 4 Measured Yaw Angle at Various Levels of the Wind Tunnel Testing

B4 Wind Rose Diagrams

B4.1 Annual wind condition

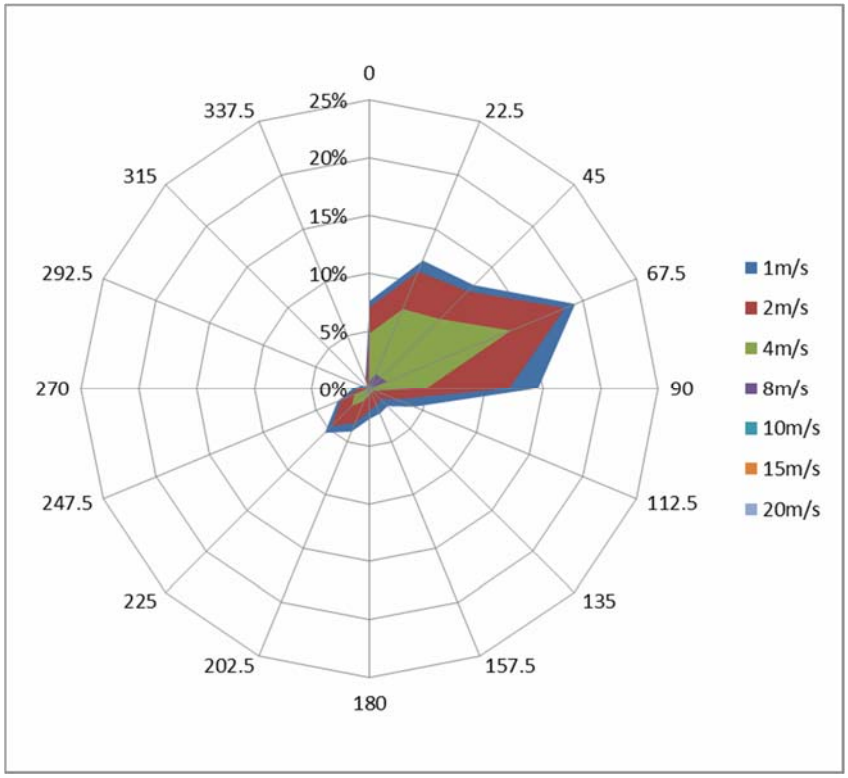

Figure B 5 Wind Rose for Annual Probability Distribution, 20m Height

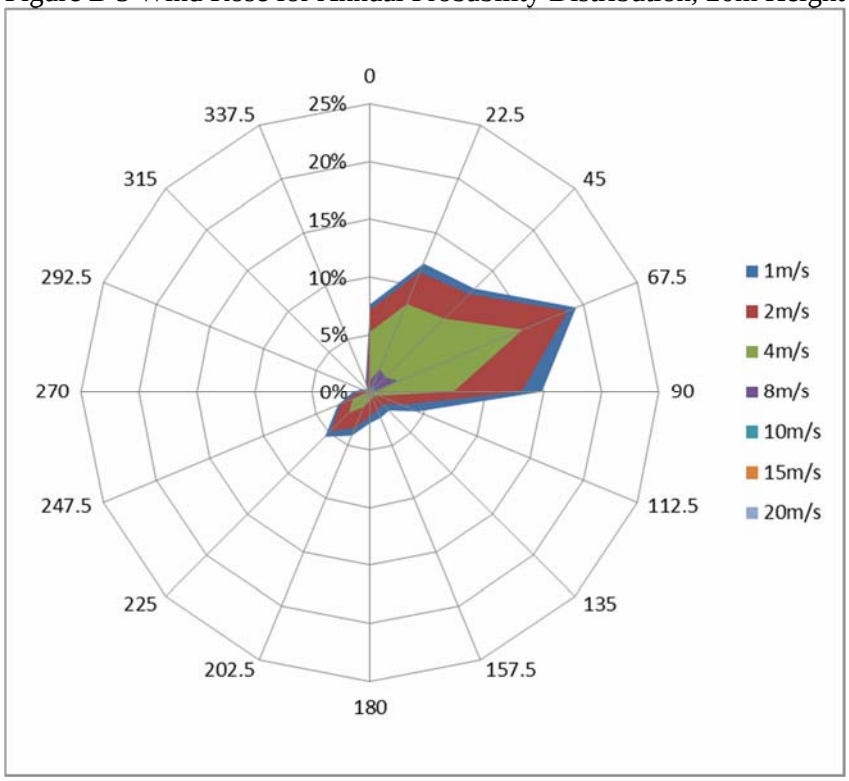

Figure B 6 Wind Rose for Annual Probability Distribution, 50m Height

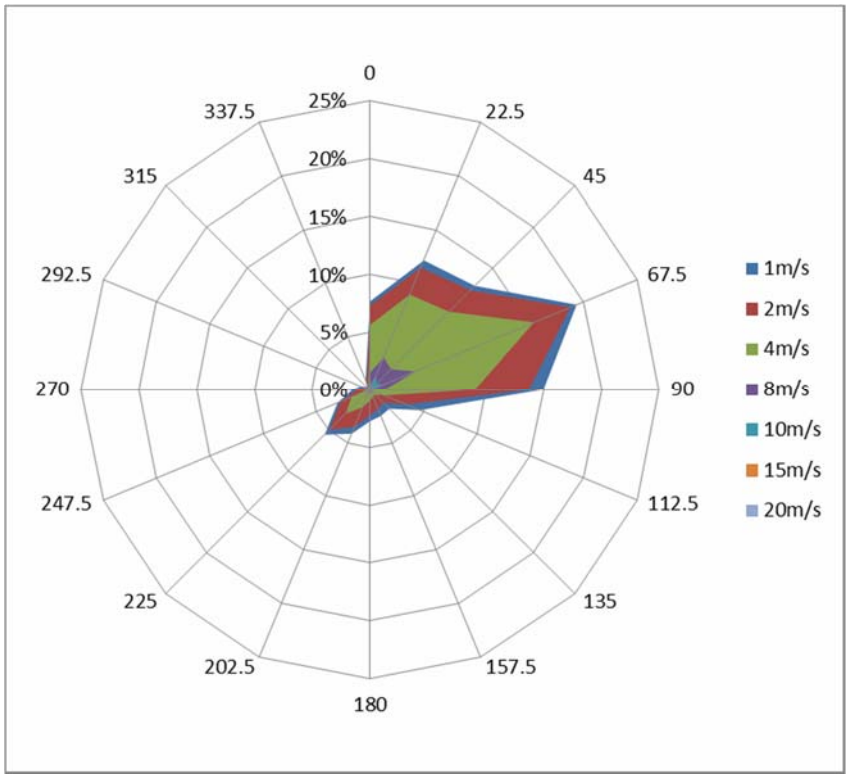

Figure B 7 Wind Rose for Annual Probability Distribution, 75m Height

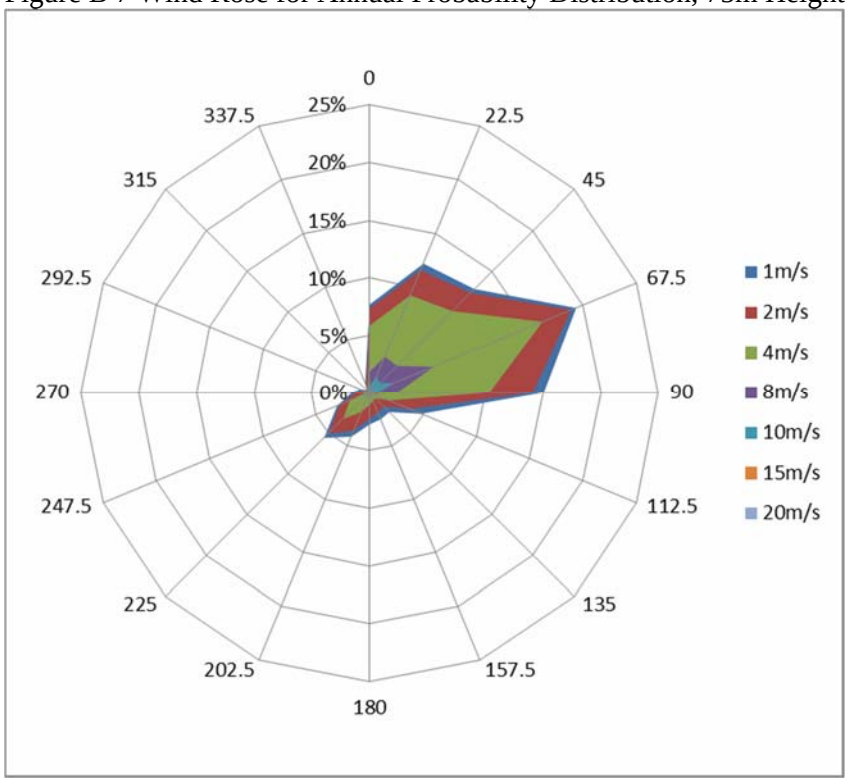

Figure B 8 Wind Rose for Annual Probability Distribution, 100m Height

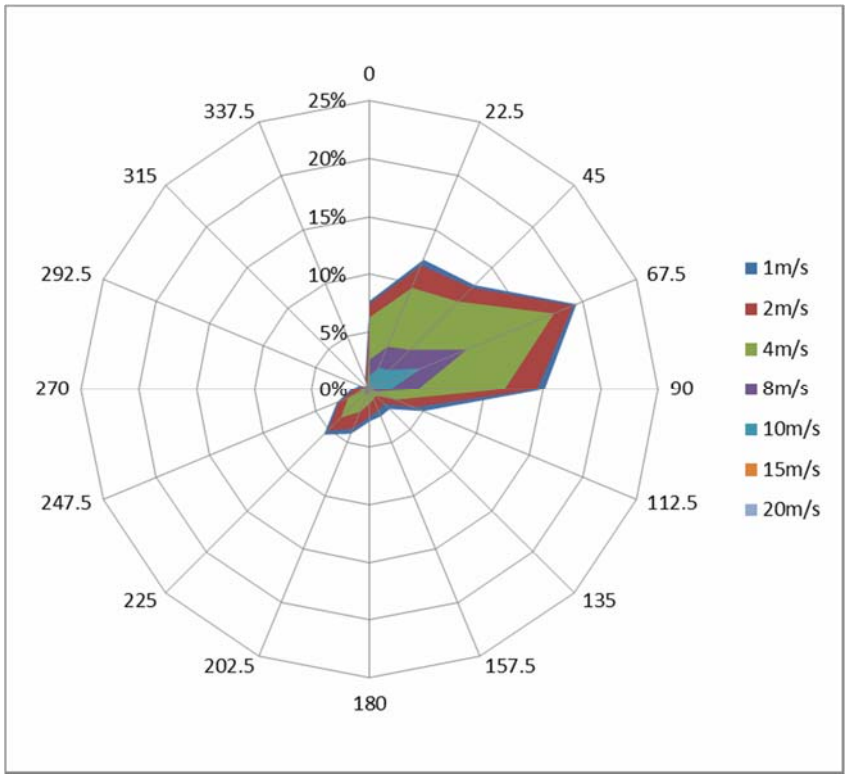

Figure B 9 Wind Rose for Annual Probability Distribution, 150m Height

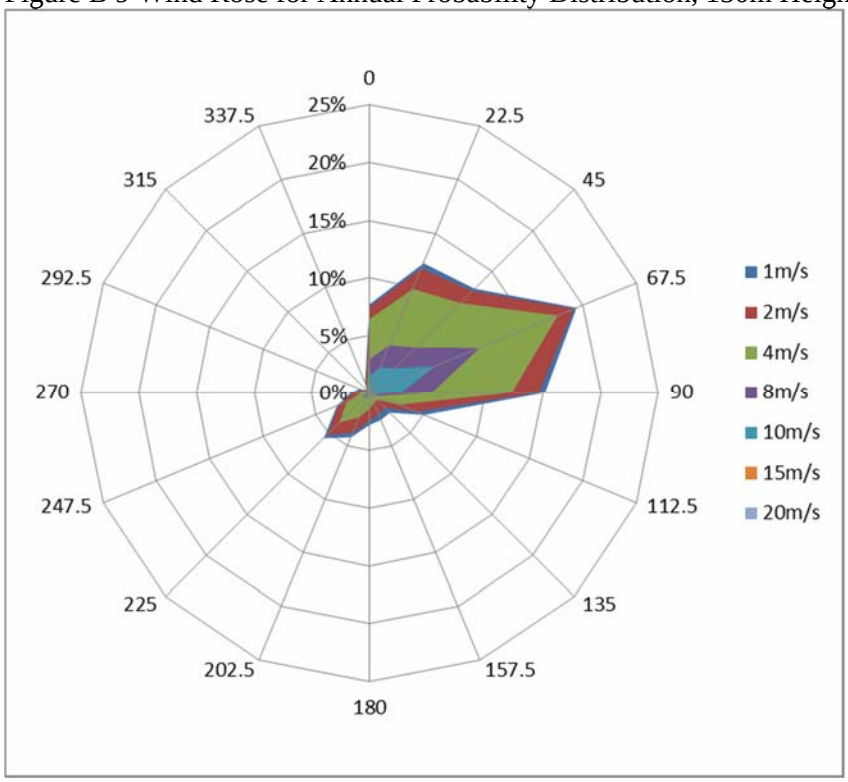

Figure B 10 Wind Rose for Annual Probability Distribution, 200m Height

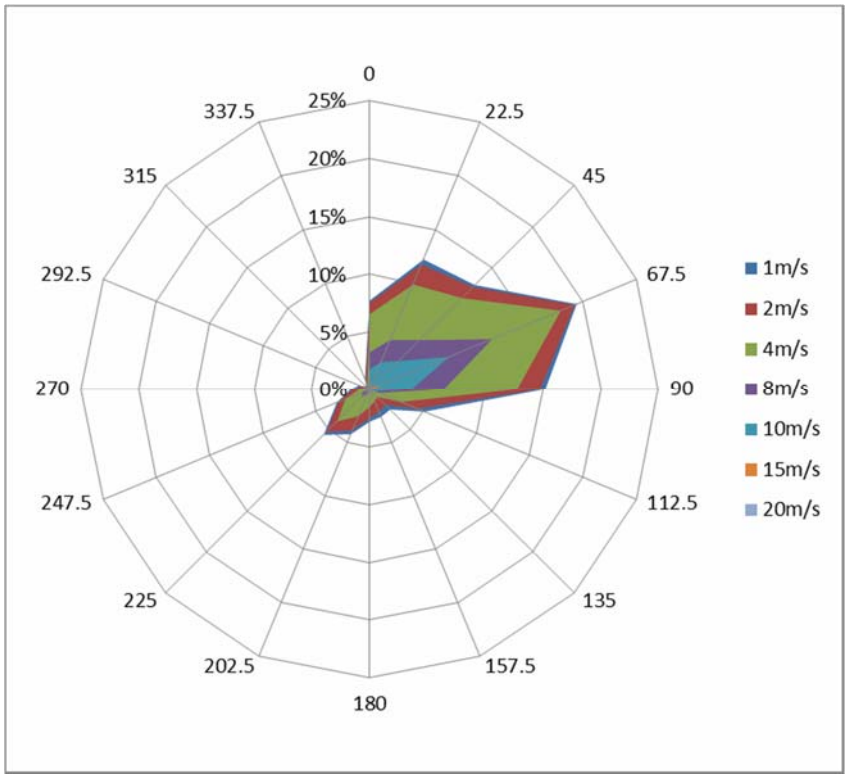

Figure B 11 Wind Rose for Annual Probability Distribution, 300m Height

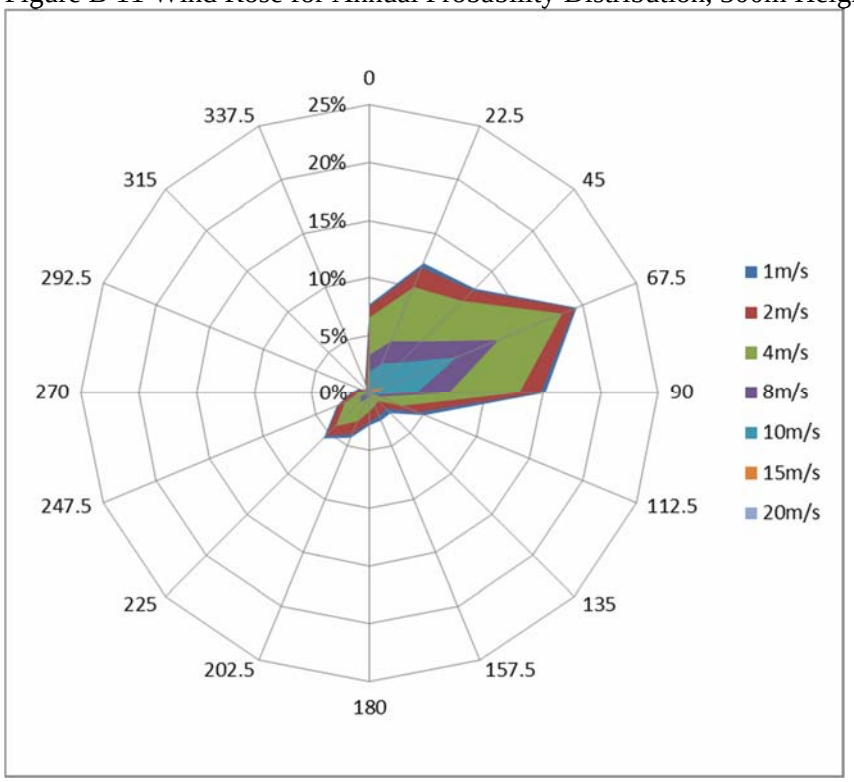

Figure B 12 Wind Rose for Annual Probability Distribution, 400m Height

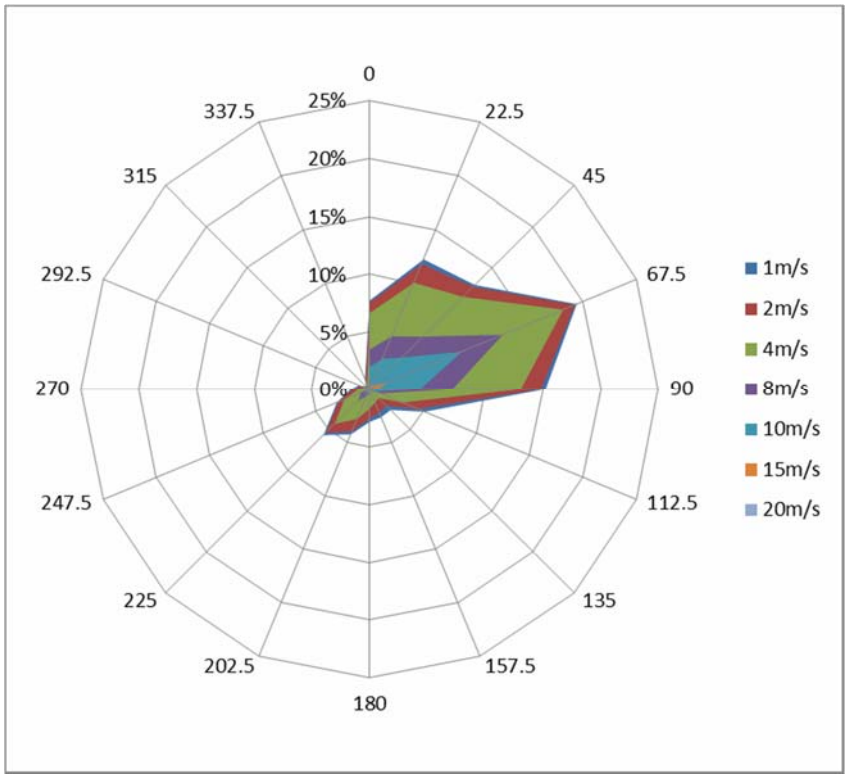

Figure B 13 Wind Rose for Annual Probability Distribution, 500m Height

B4.2 Summer wind condition

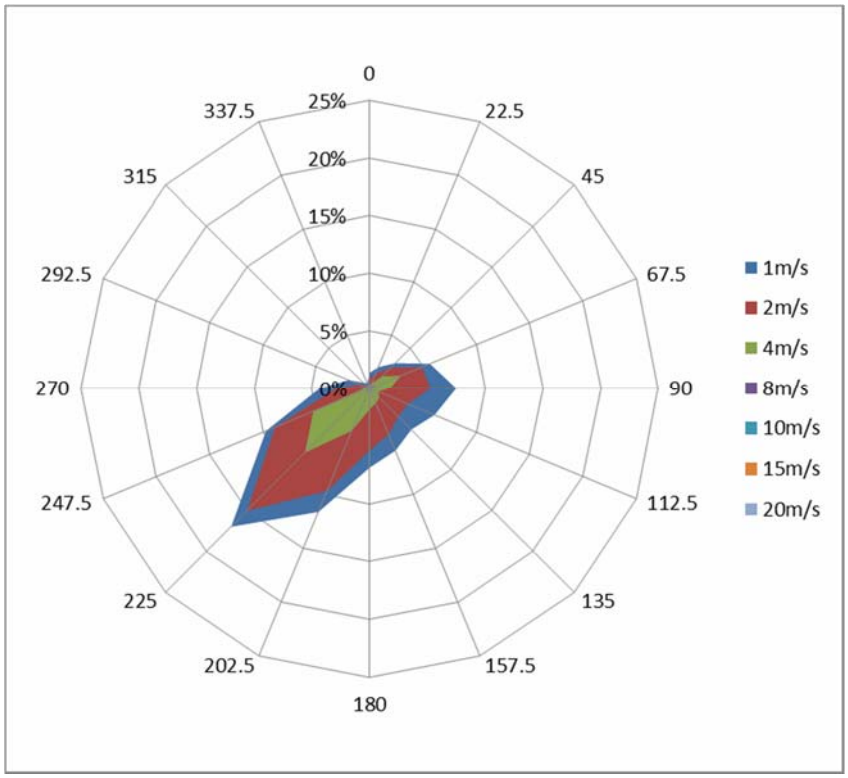

Figure B 14 Wind Rose for Summer Probability Distribution, 20m Height

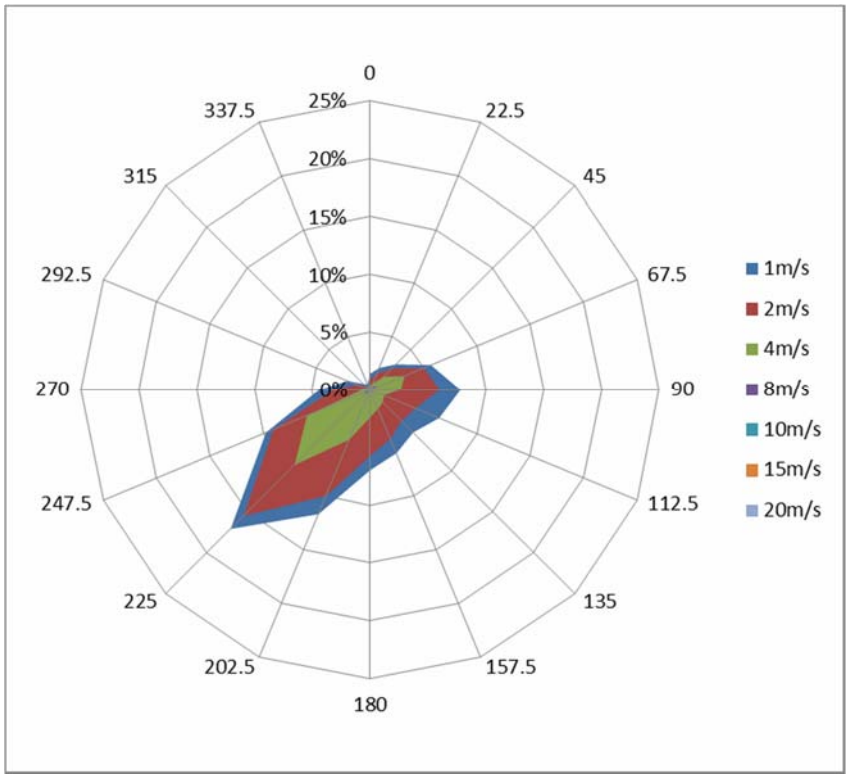

Figure B 15 Wind Rose for Summer Probability Distribution, 50m Height

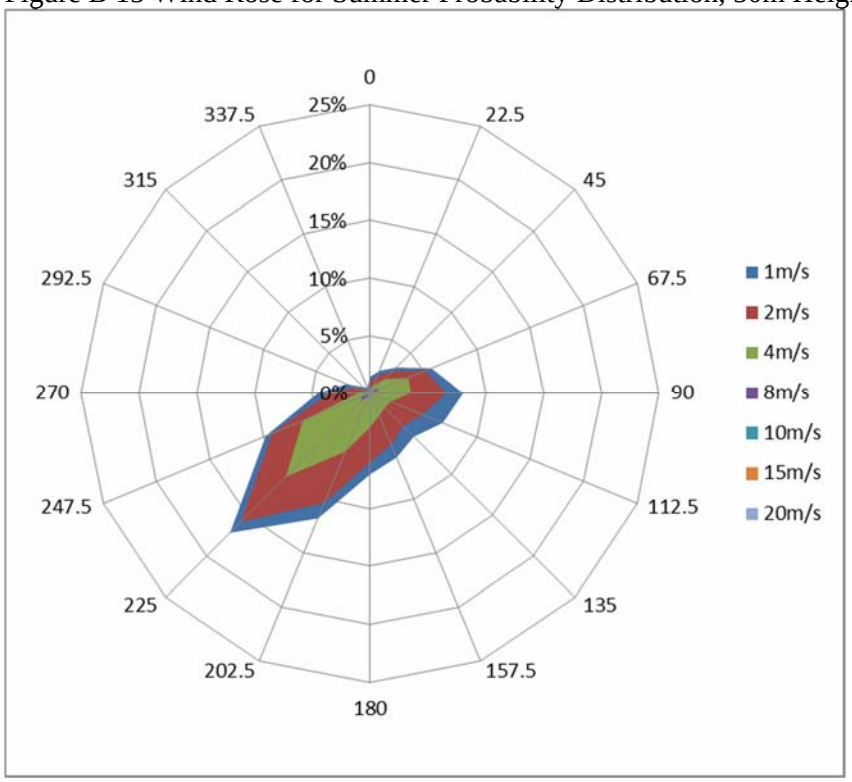

Figure B 16 Wind Rose for Summer Probability Distribution, 75m Height

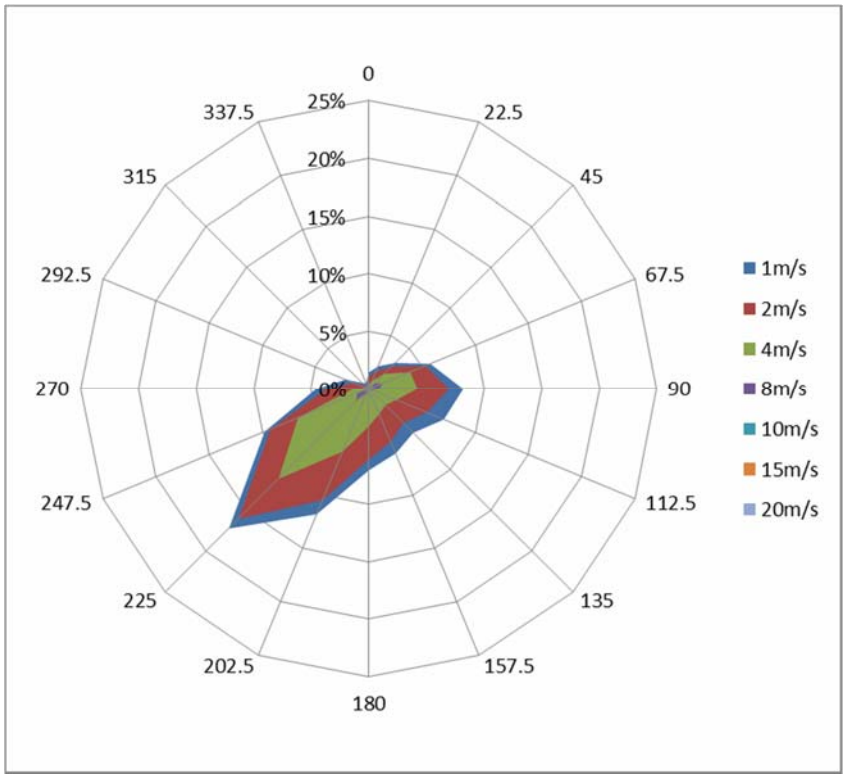

Figure B 17 Wind Rose for Summer Probability Distribution, 100m Height

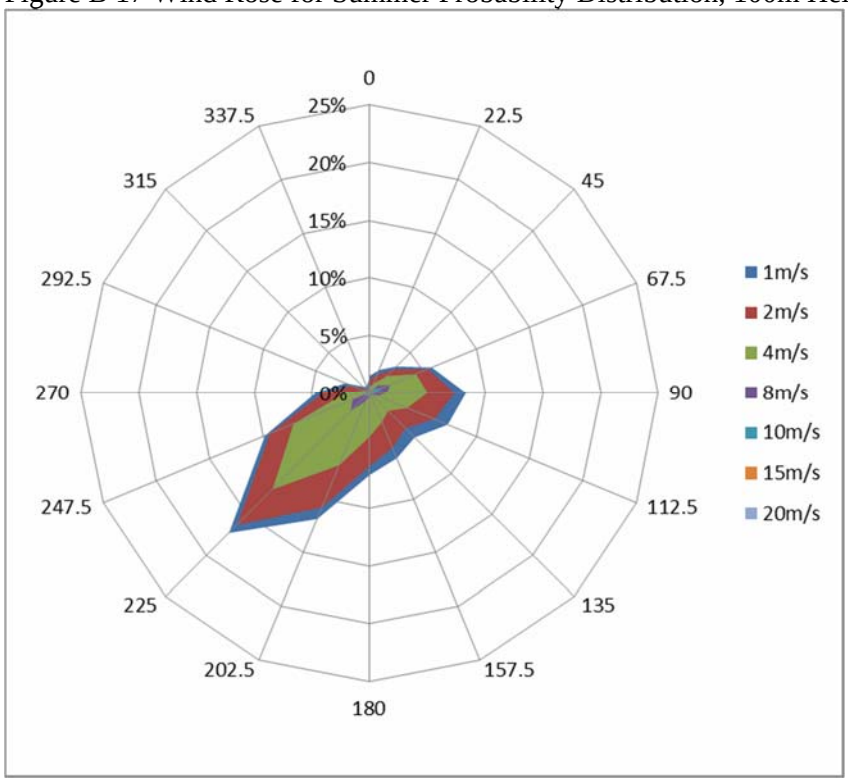

Figure B 18 Wind Rose for Summer Probability Distribution, 150m Height

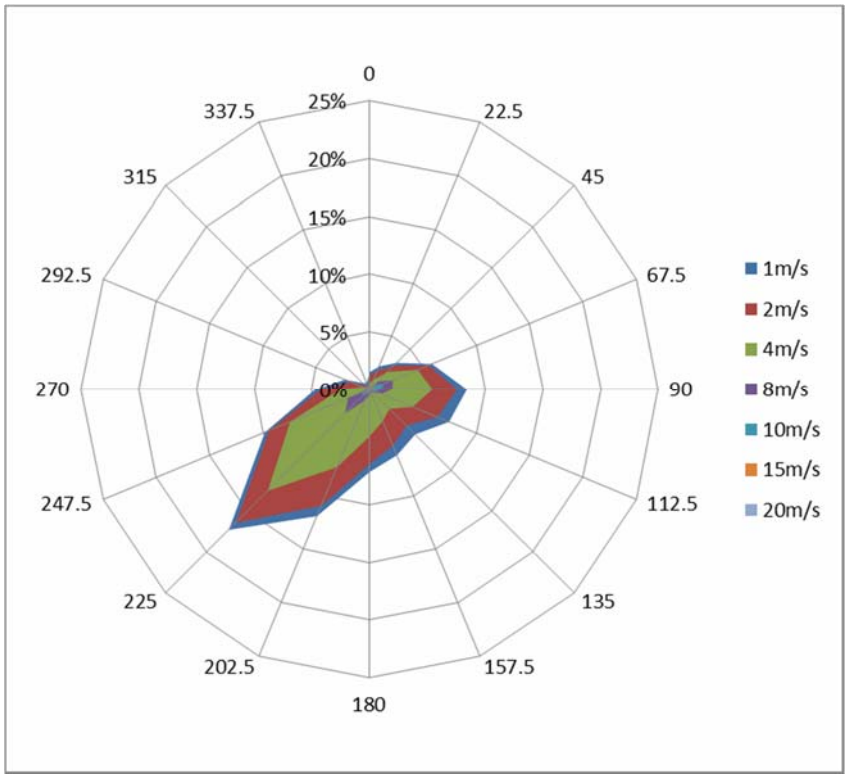

Figure B 19 Wind Rose for Summer Probability Distribution, 200m Height

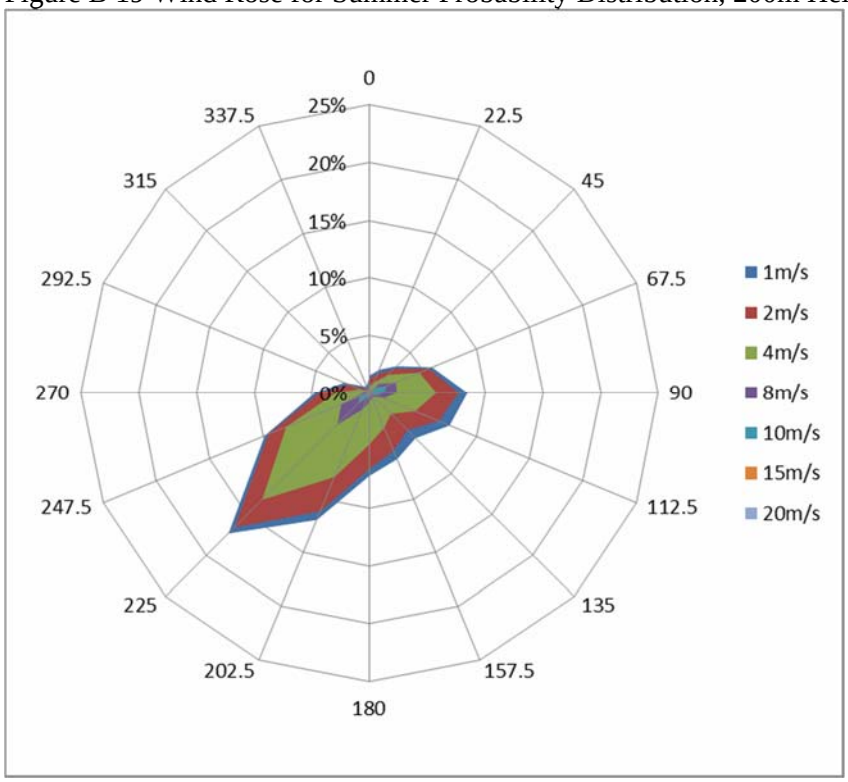

Figure B 20 Wind Rose for Summer Probability Distribution, 300m Height

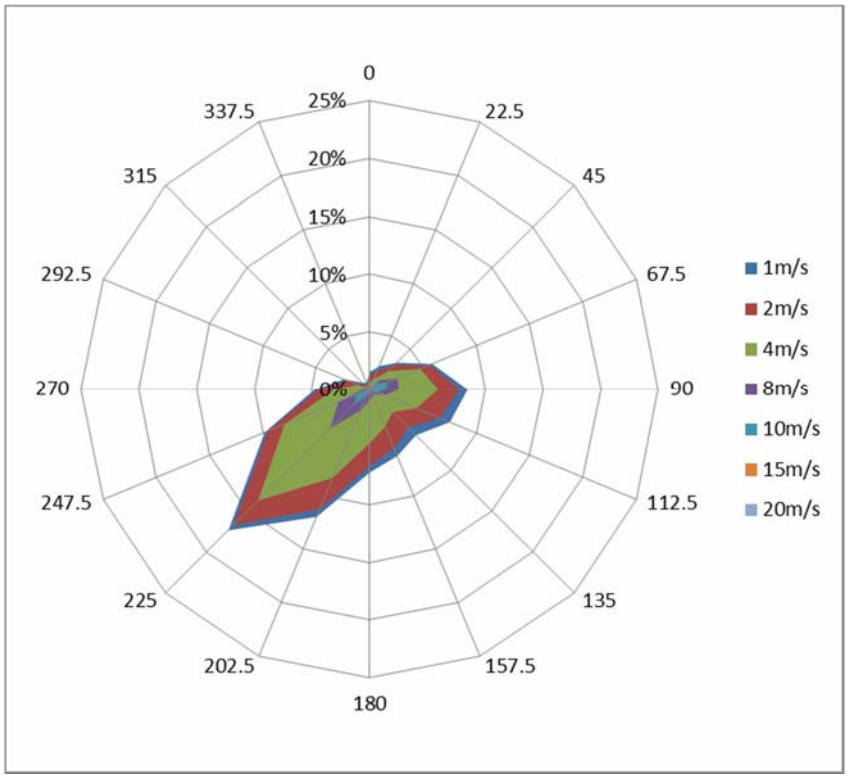

Figure B 21 Wind Rose for Summer Probability Distribution, 400m Height

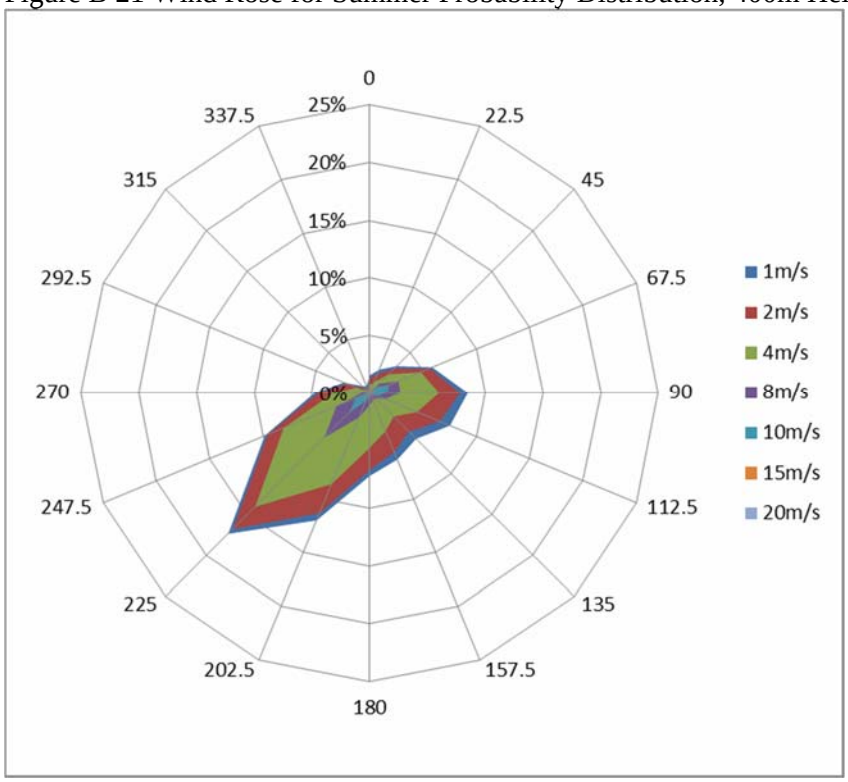

Figure B 22 Wind Rose for Summer Probability Distribution, 500m Height

Appendix C

Contour Plots

Contents

B1 Scheme A

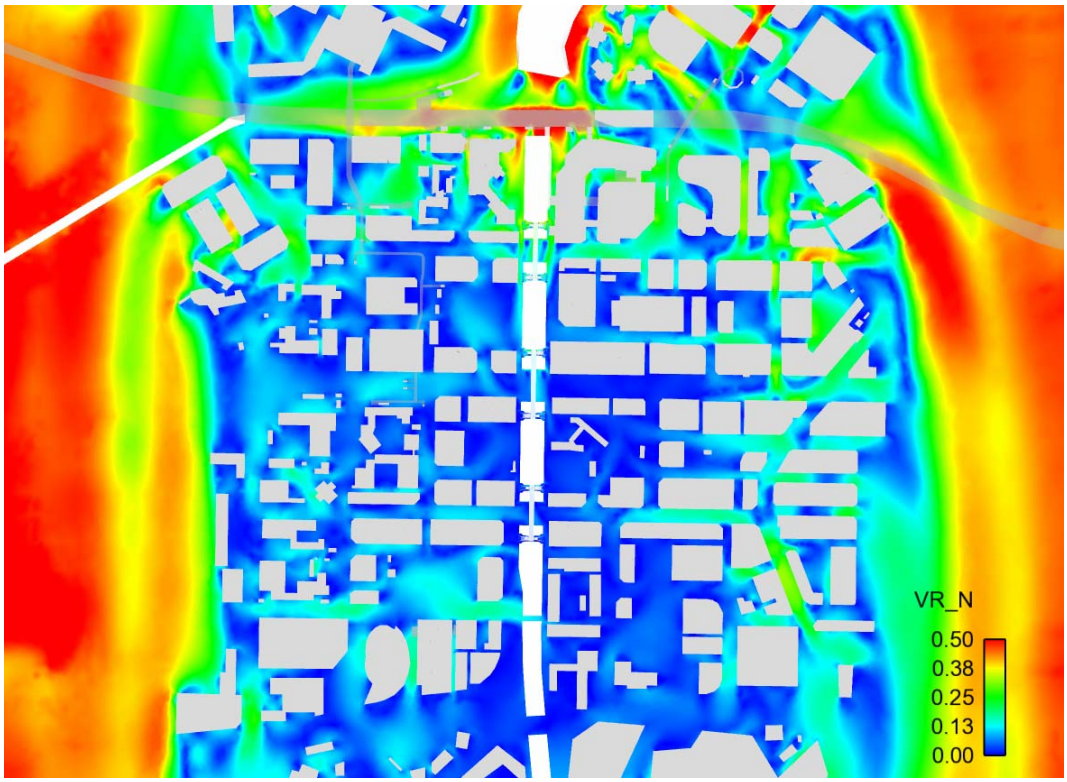

Figure C 1 Contour plot of Scheme A under N Wind Direction

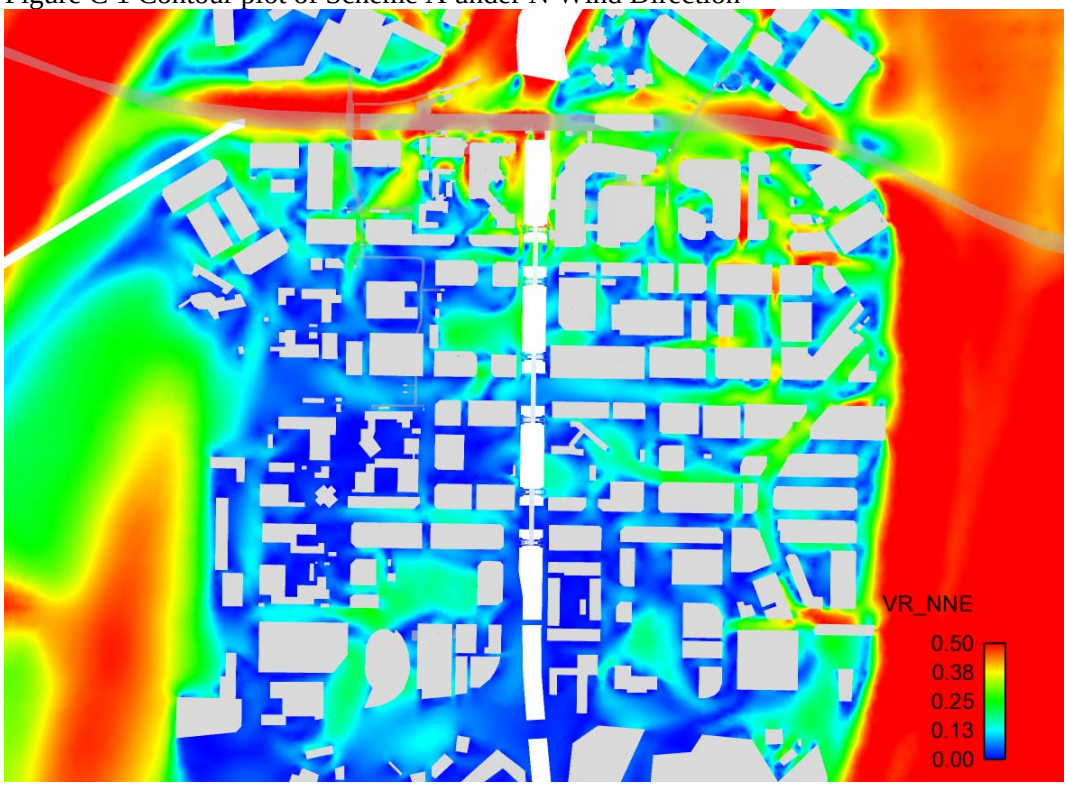

Figure C 2 Contour plot of Scheme A under NNE Wind Direction

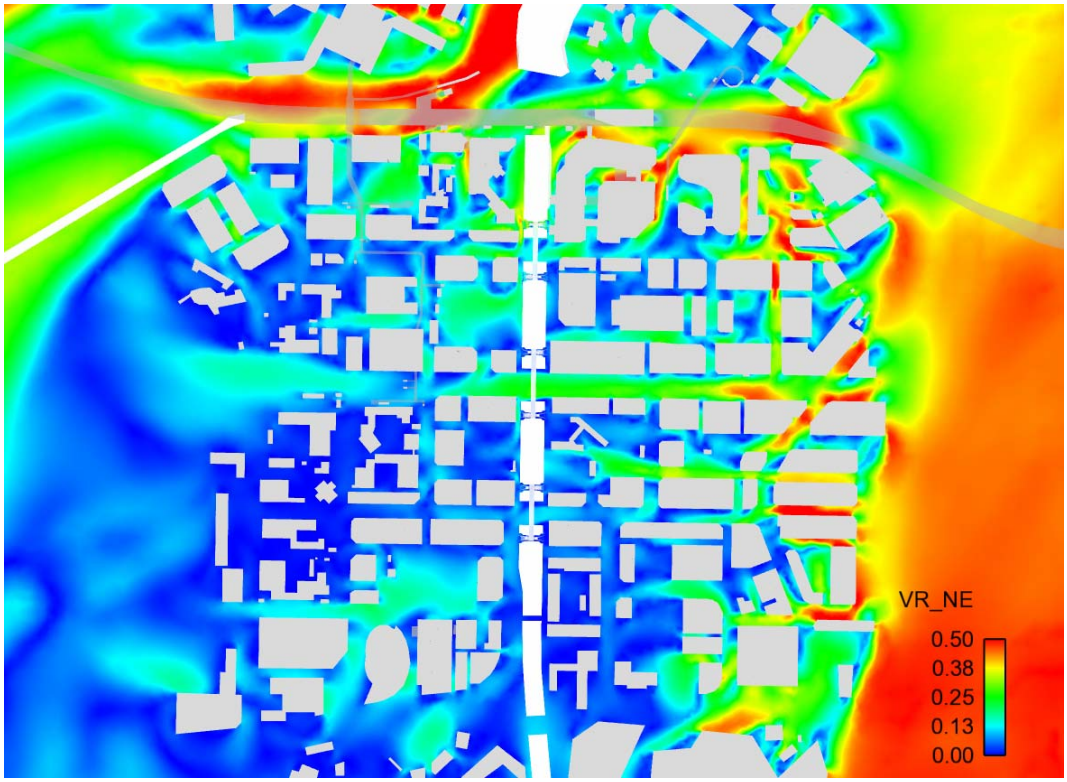

Figure C 3 Contour plot of Scheme A under NE Wind Direction

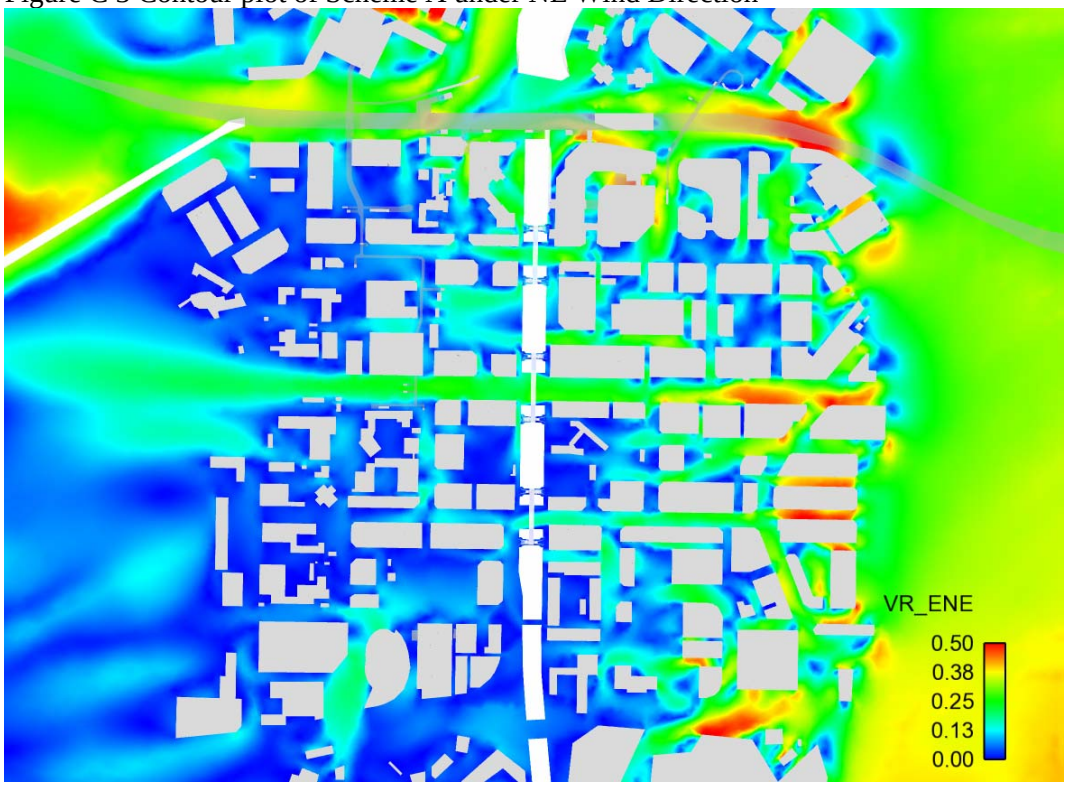

Figure C 4 Contour plot of Scheme A under ENE Wind Direction

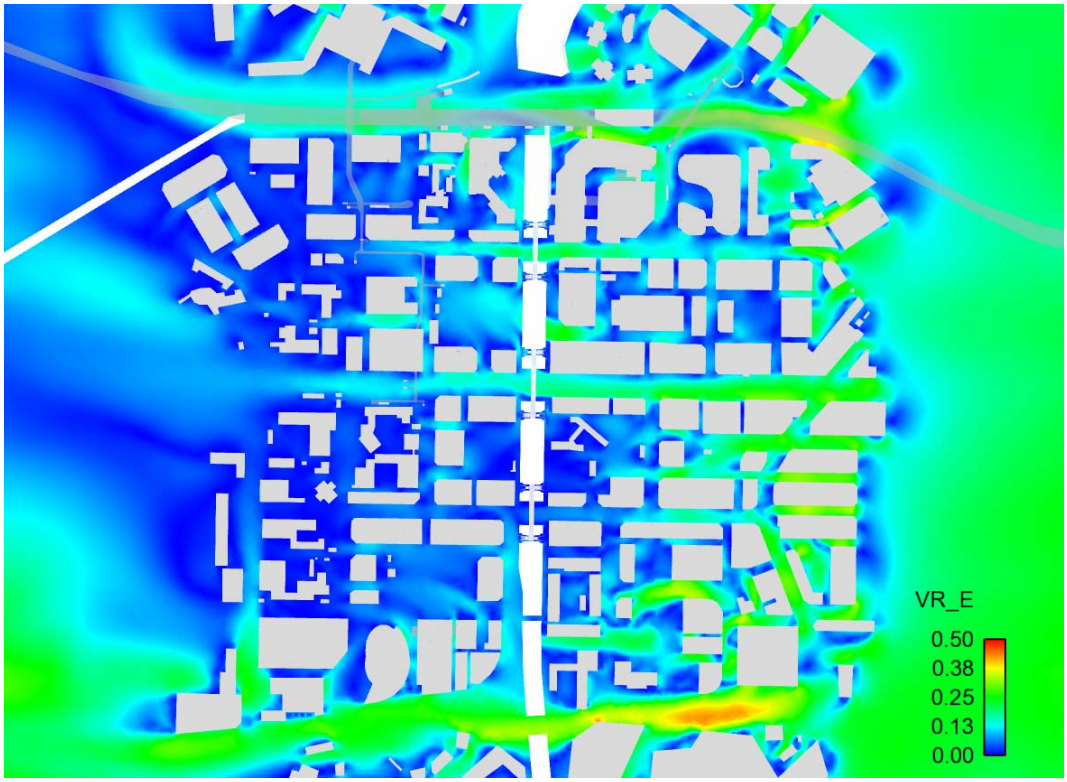

Figure C 5 Contour plot of Scheme A under E Wind Direction

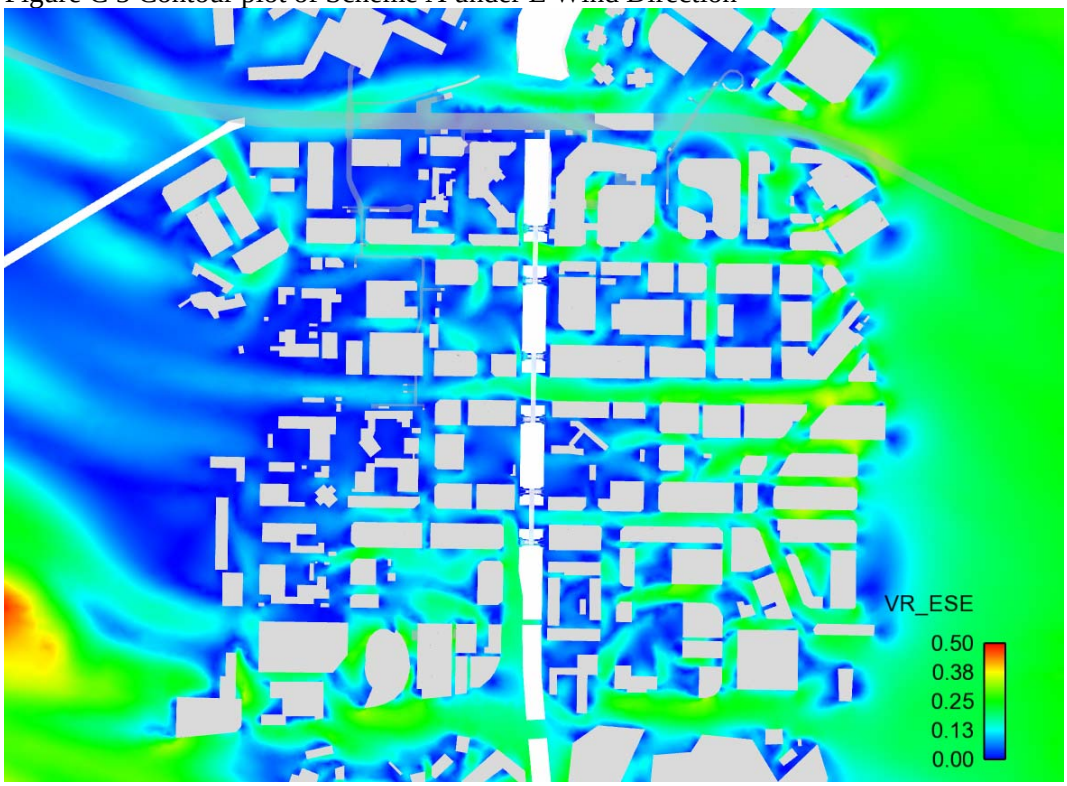

Figure C 6 Contour plot of Scheme A under ESE Wind Direction

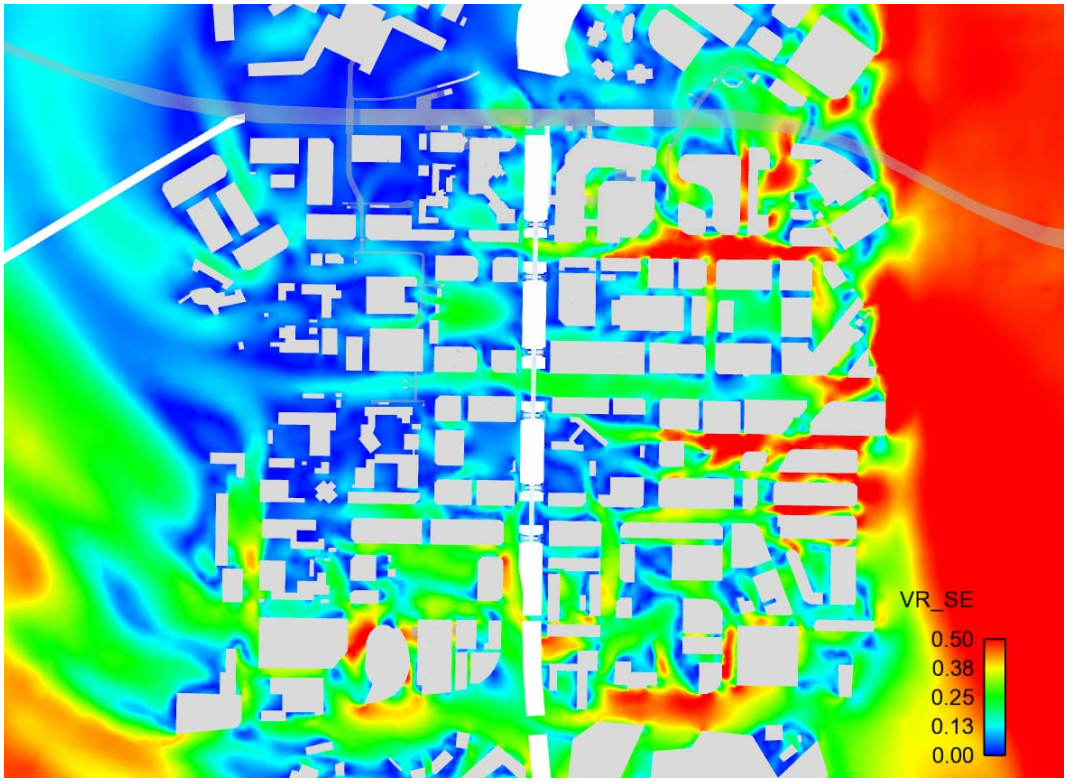

Figure C 7 Contour plot of Scheme A under SE Wind Direction

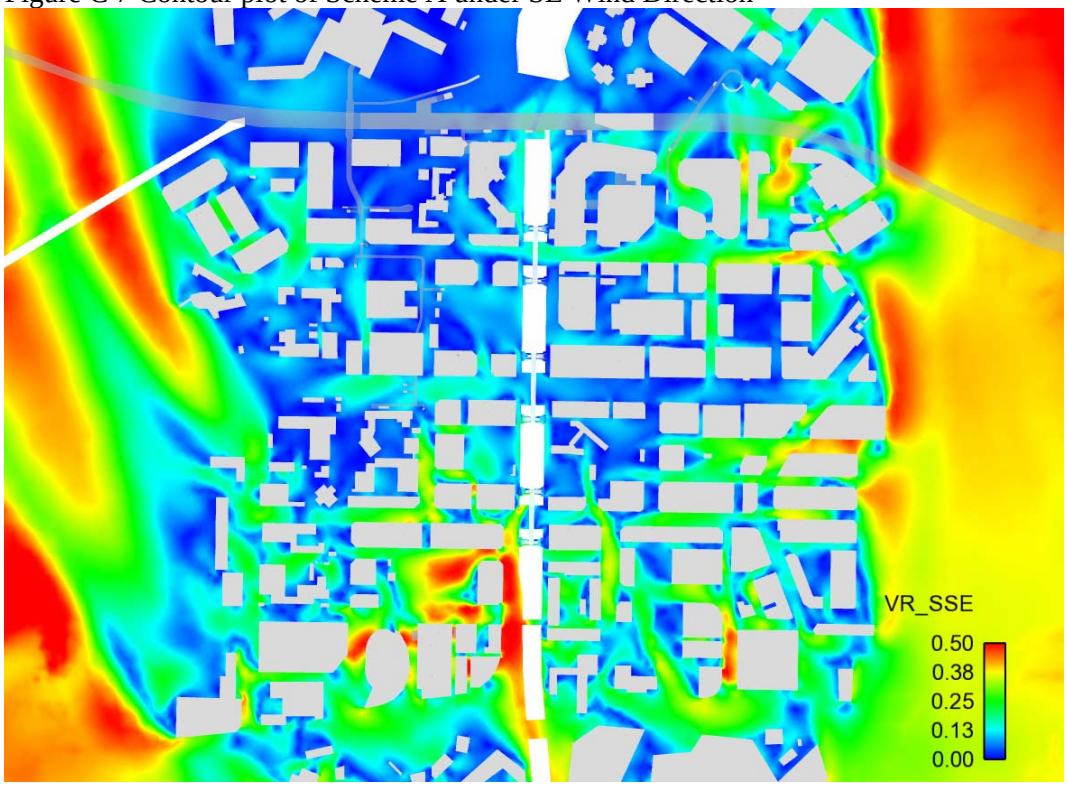

Figure C 8 Contour plot of Scheme A under SSE Wind Direction

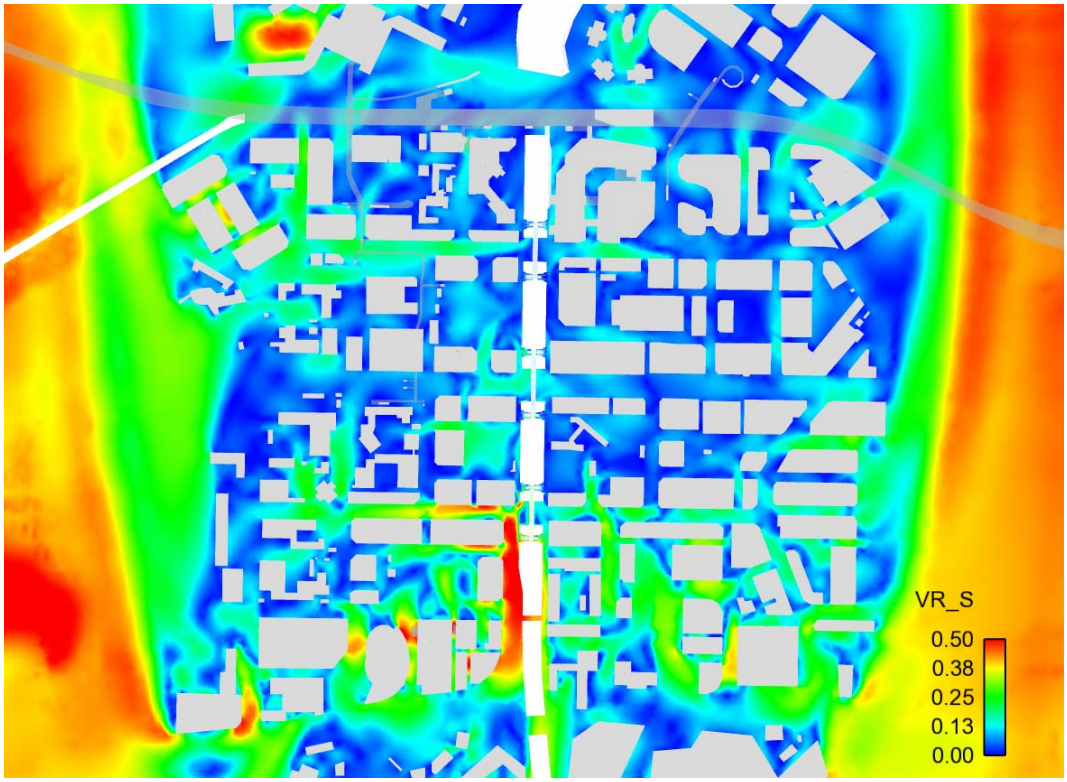

Figure C 9 Contour plot of Scheme A under S Wind Direction

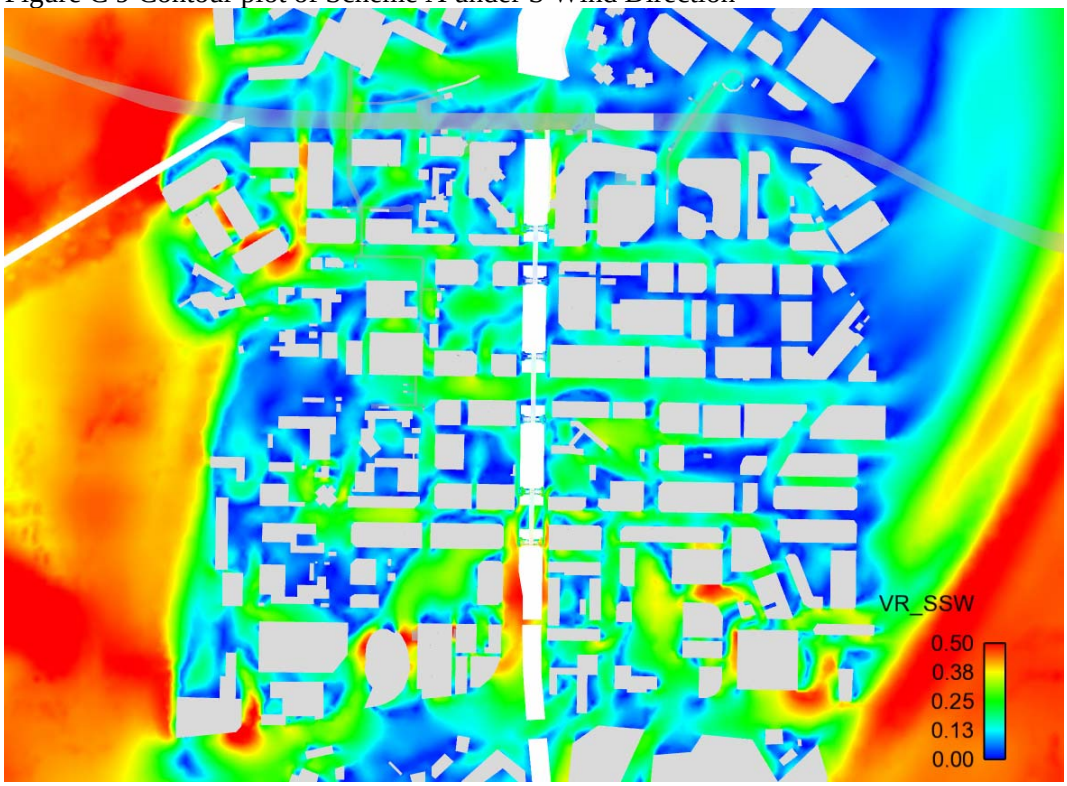

Figure C 10 Contour plot of Scheme A under SSW Wind Direction

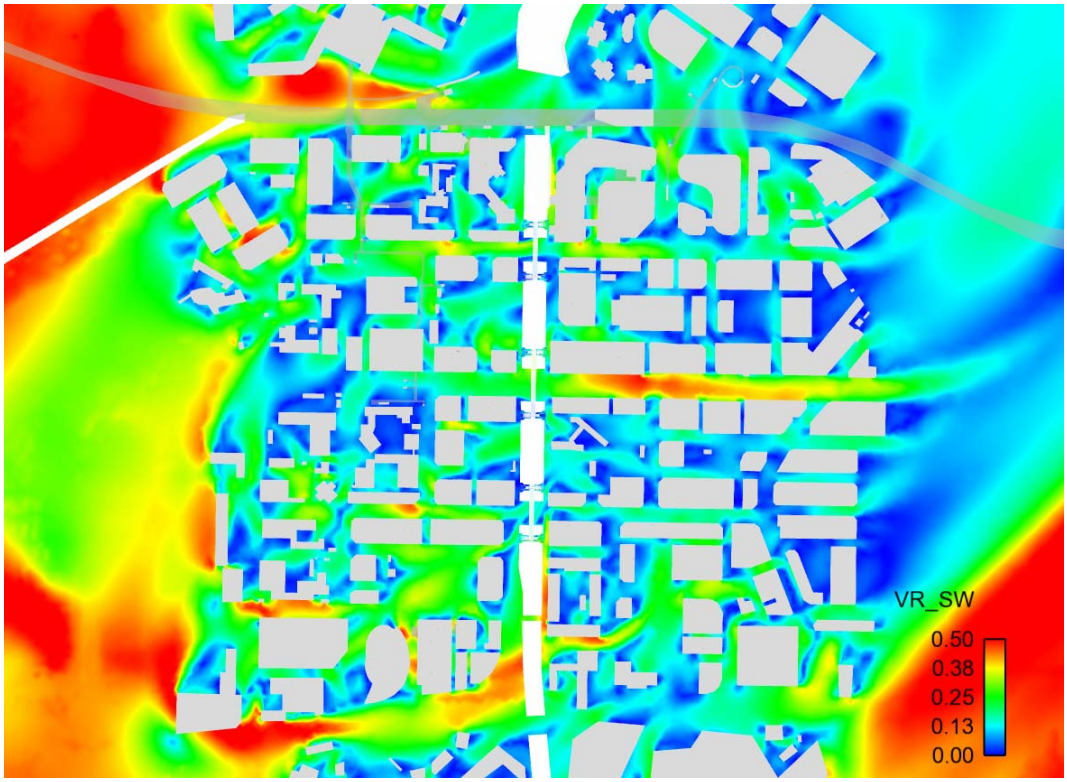

Figure C 11 Contour plot of Scheme A under SW Wind Direction

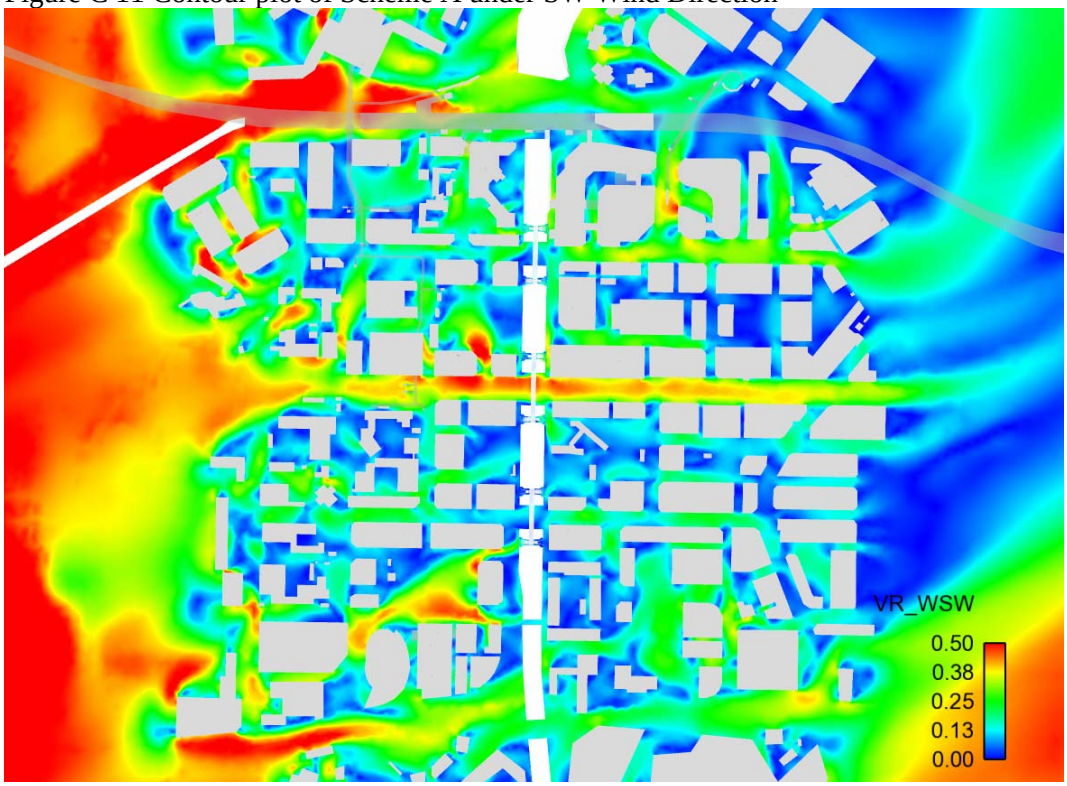

Figure C 12 Contour plot of Scheme A under WSW Wind Direction

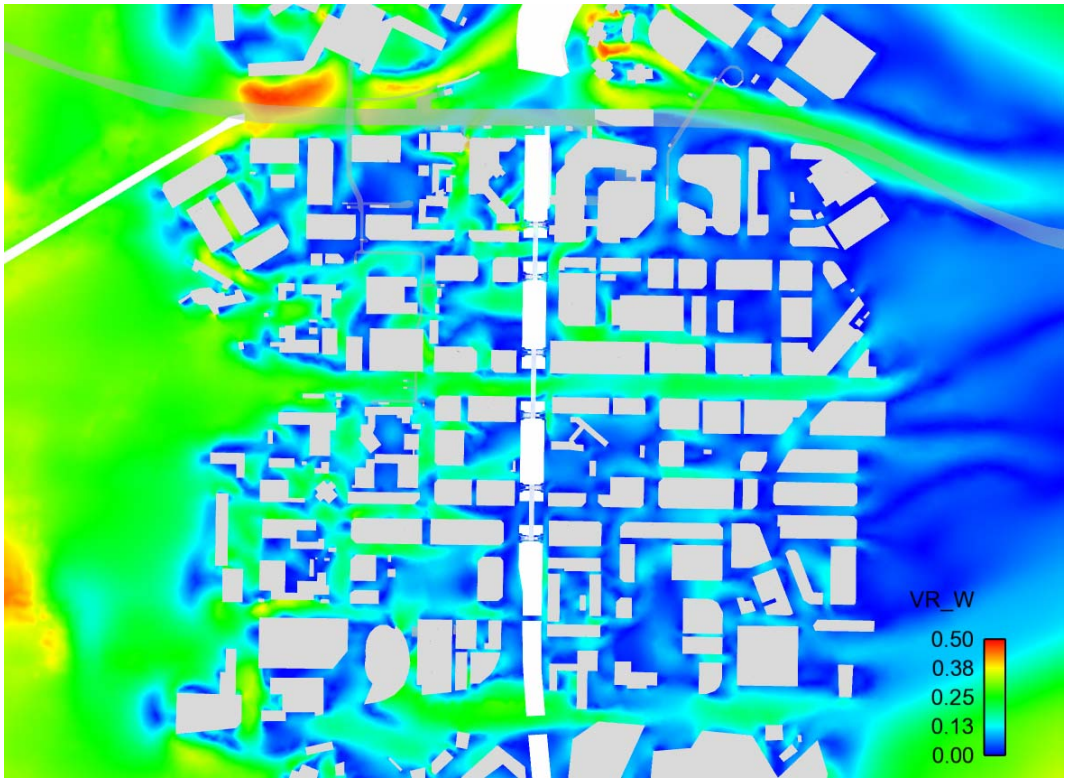

Figure C 13 Contour plot of Scheme A under W Wind Direction

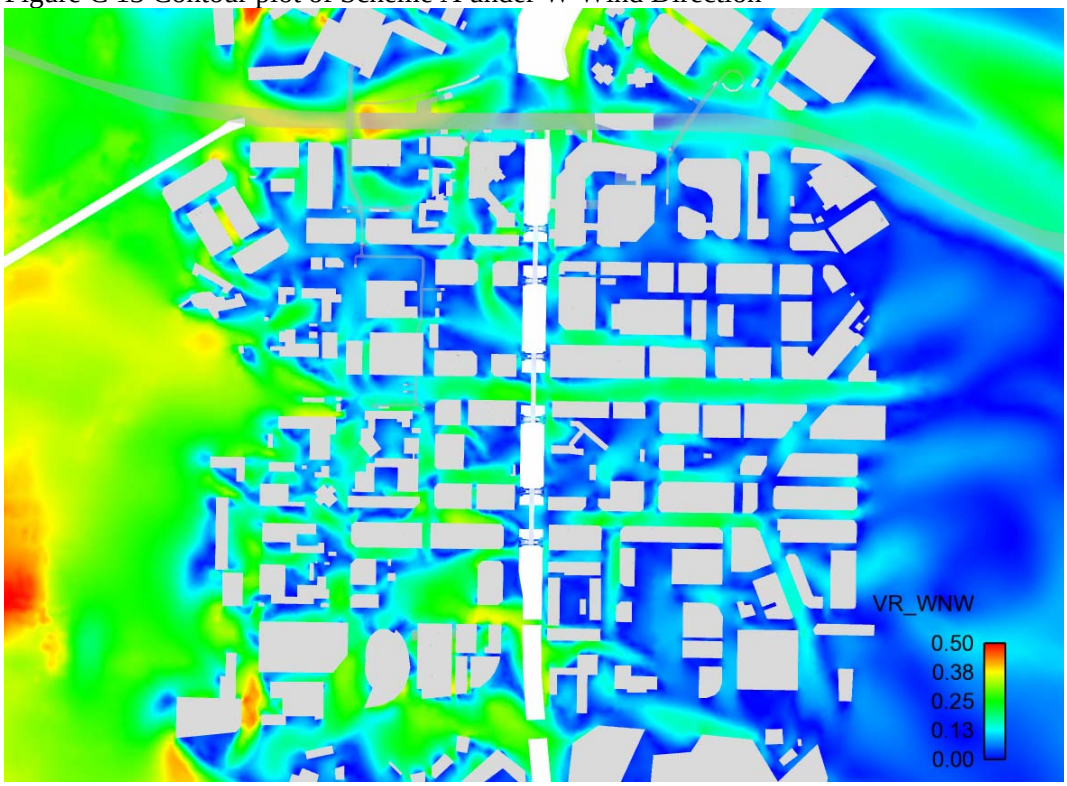

Figure C 14 Contour plot of Scheme A under WNW Wind Direction

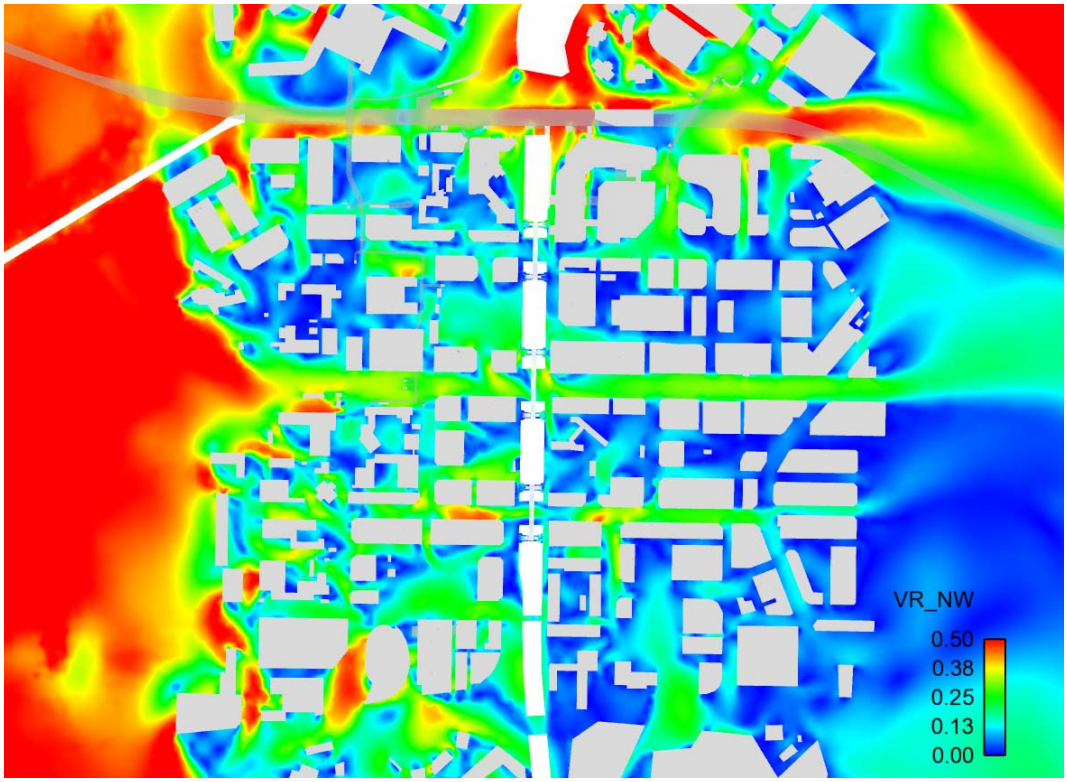

Figure C 15 Contour plot of Scheme A under NW Wind Direction

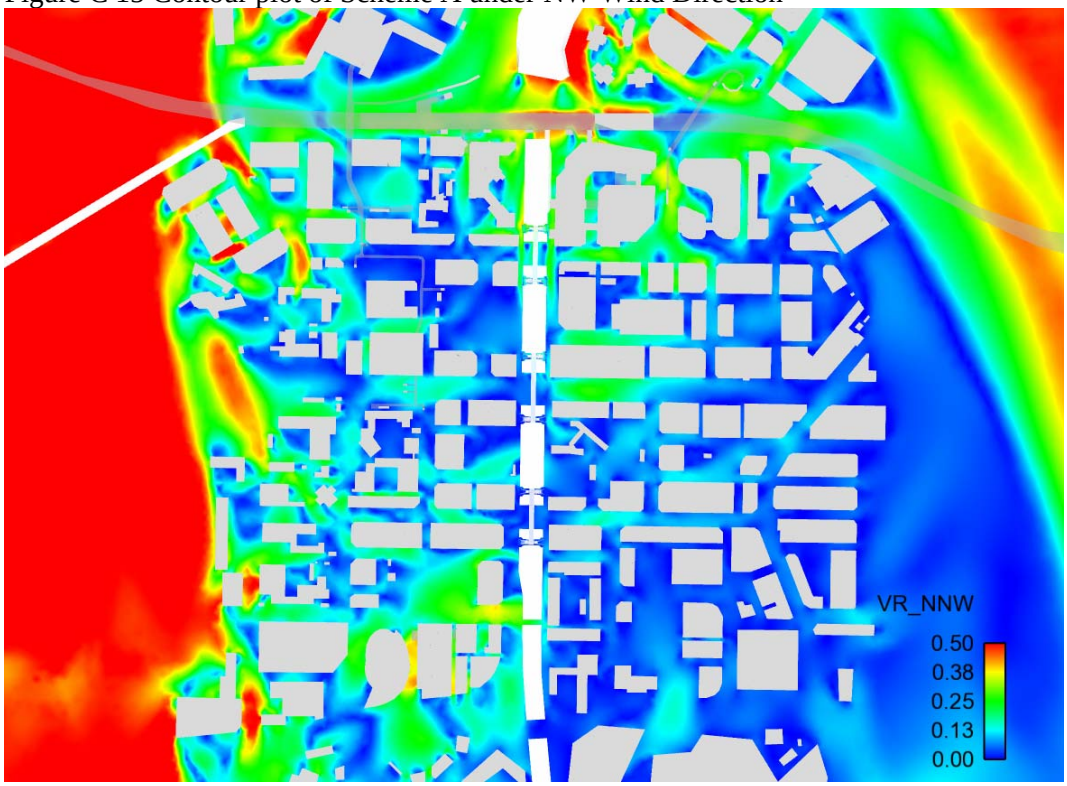

Figure C 16 Contour plot of Scheme A under NNW Wind Direction

B2 Scheme B

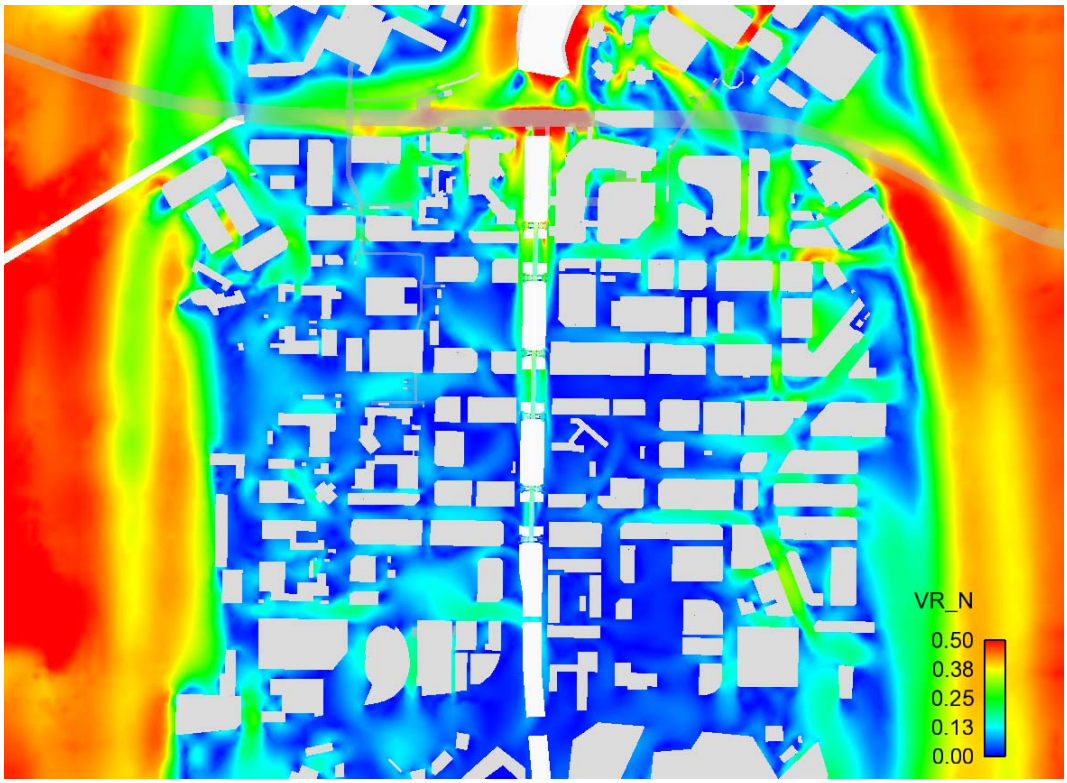

Figure C 17 Contour plot of Scheme B under N Wind Direction

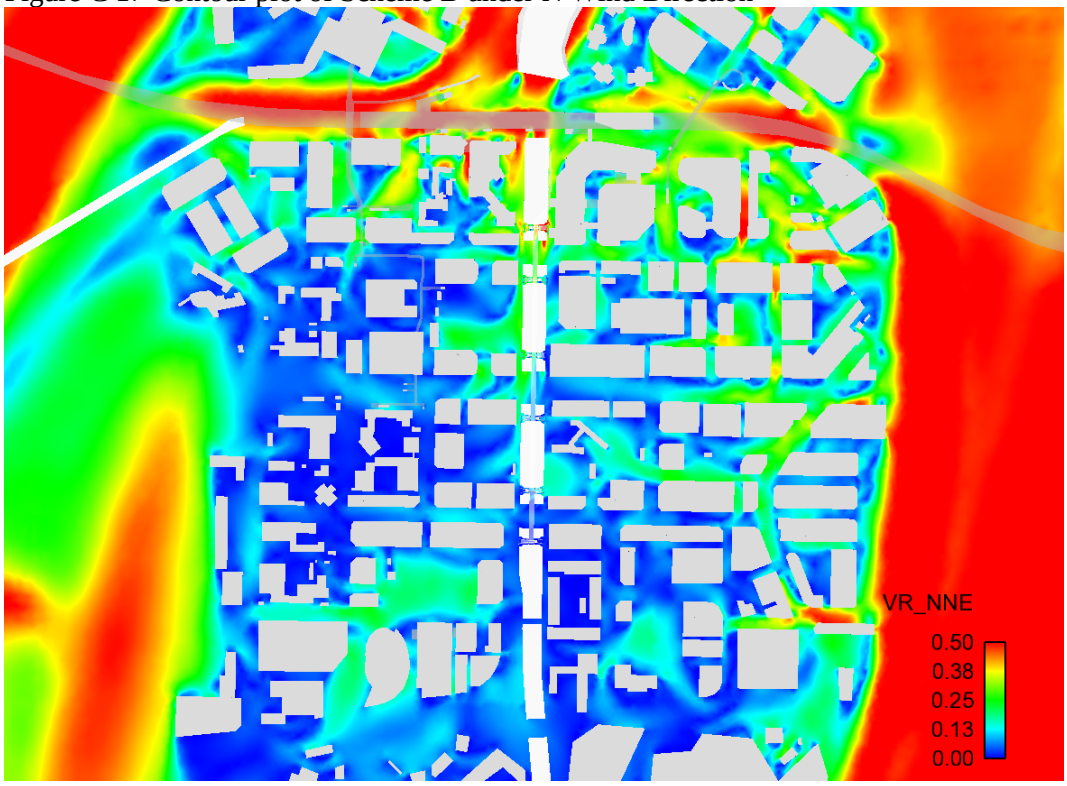

Figure C 18 Contour plot of Scheme B under NNE Wind Direction

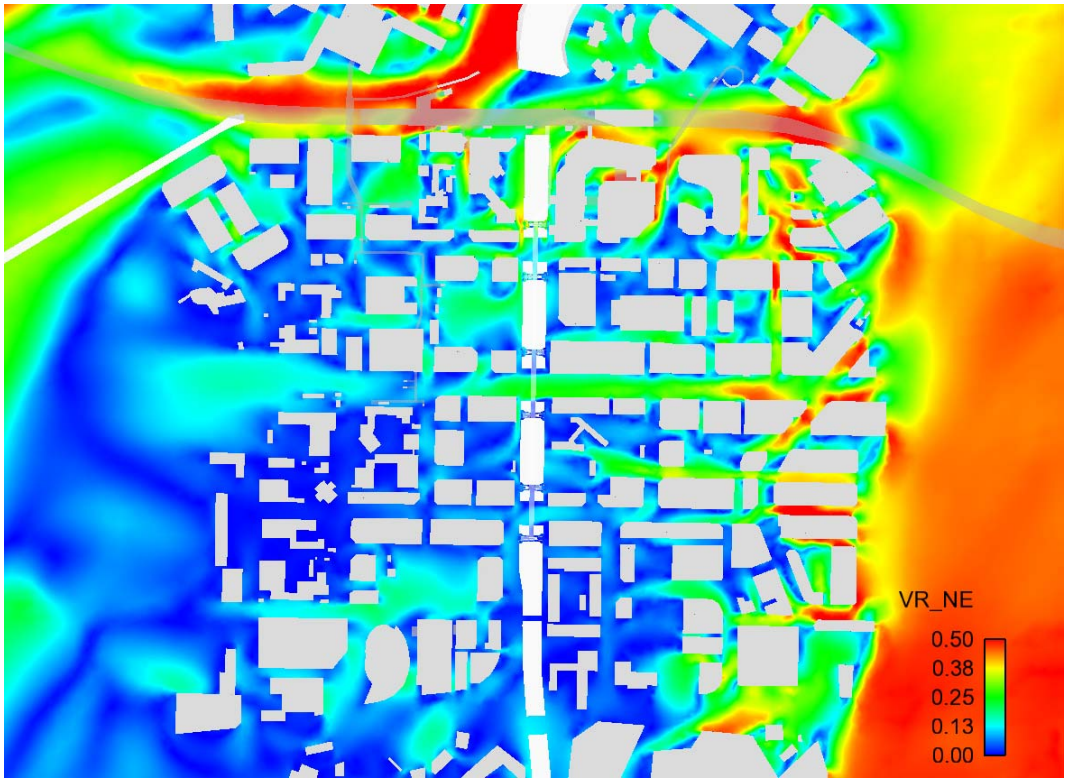

Figure C 19 Contour plot of Scheme B under NE Wind Direction

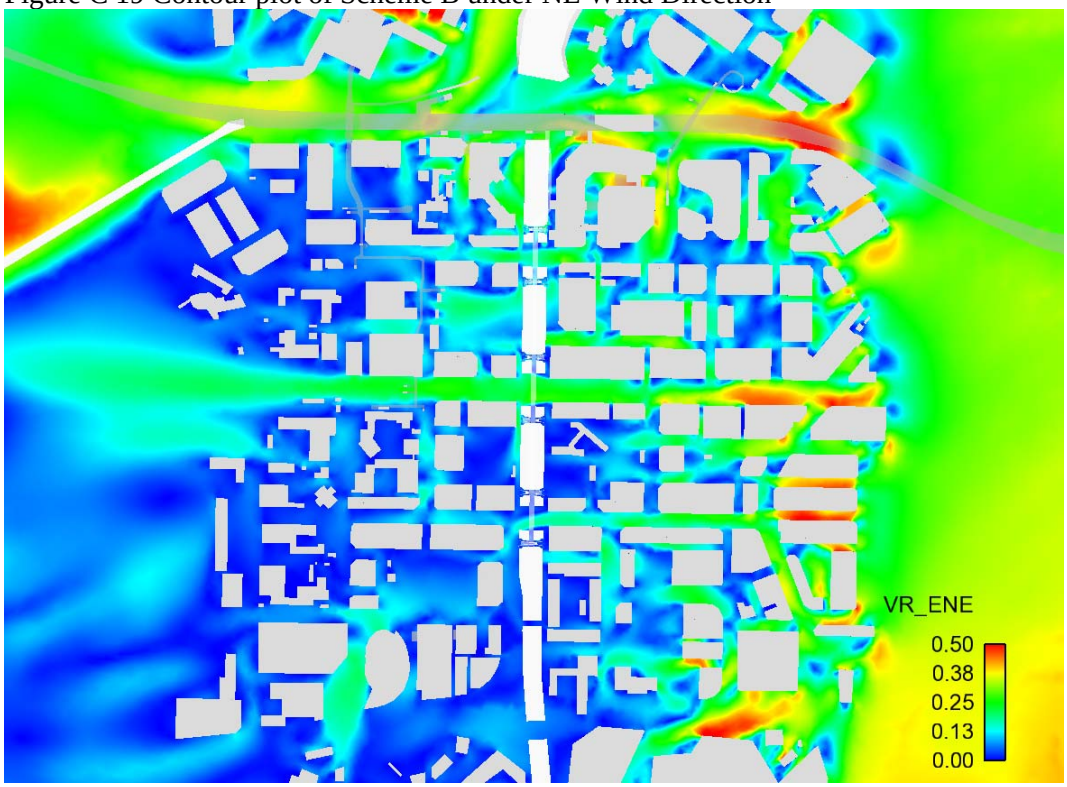

Figure C 20 Contour plot of Scheme B under ENE Wind Direction

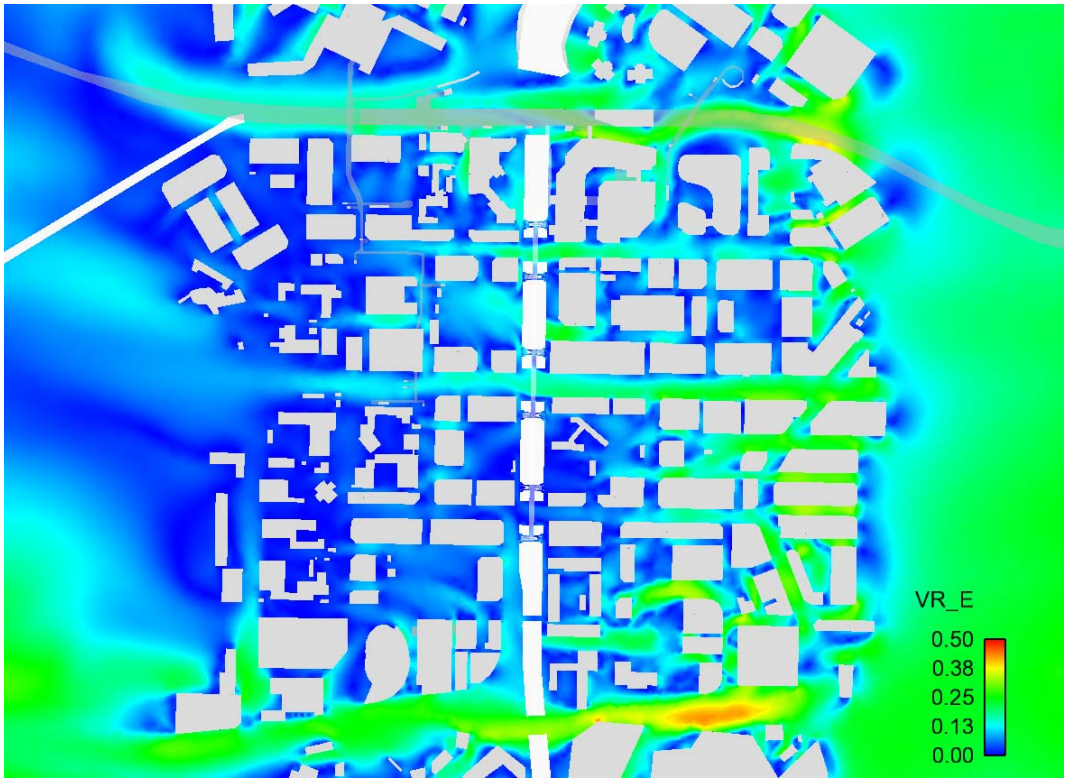

Figure C 21 Contour plot of Scheme B under E Wind Direction

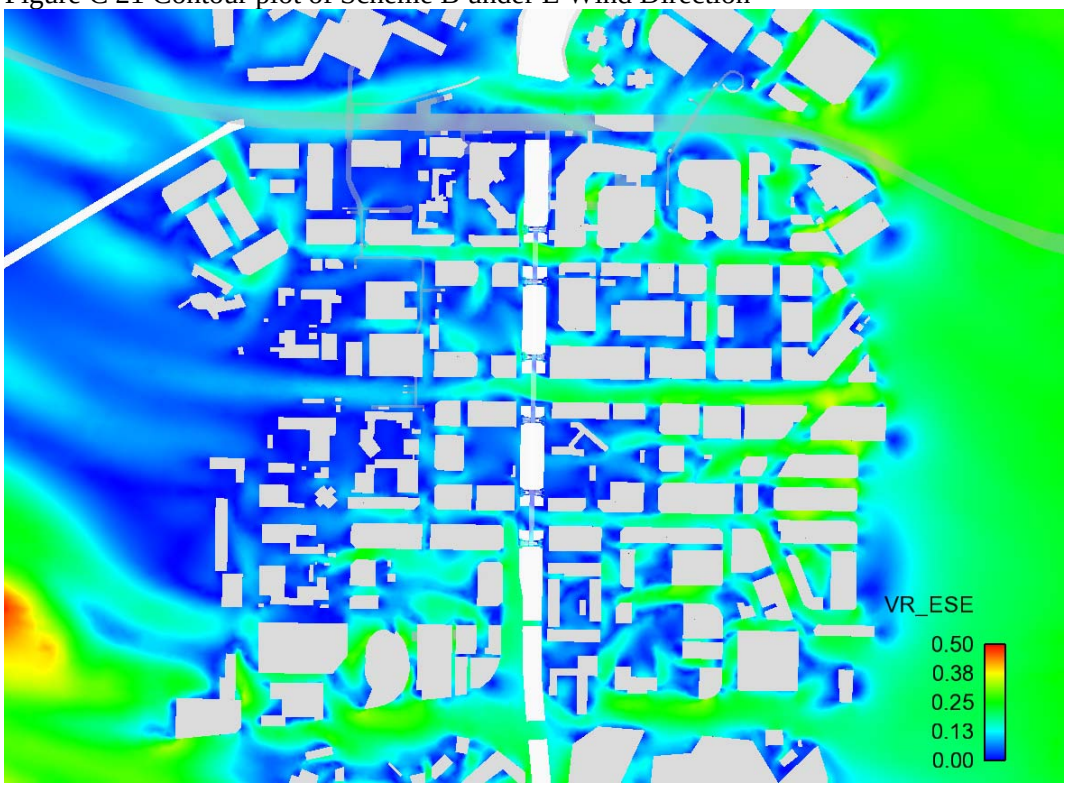

Figure C 22 Contour plot of Scheme B under ESE Wind Direction

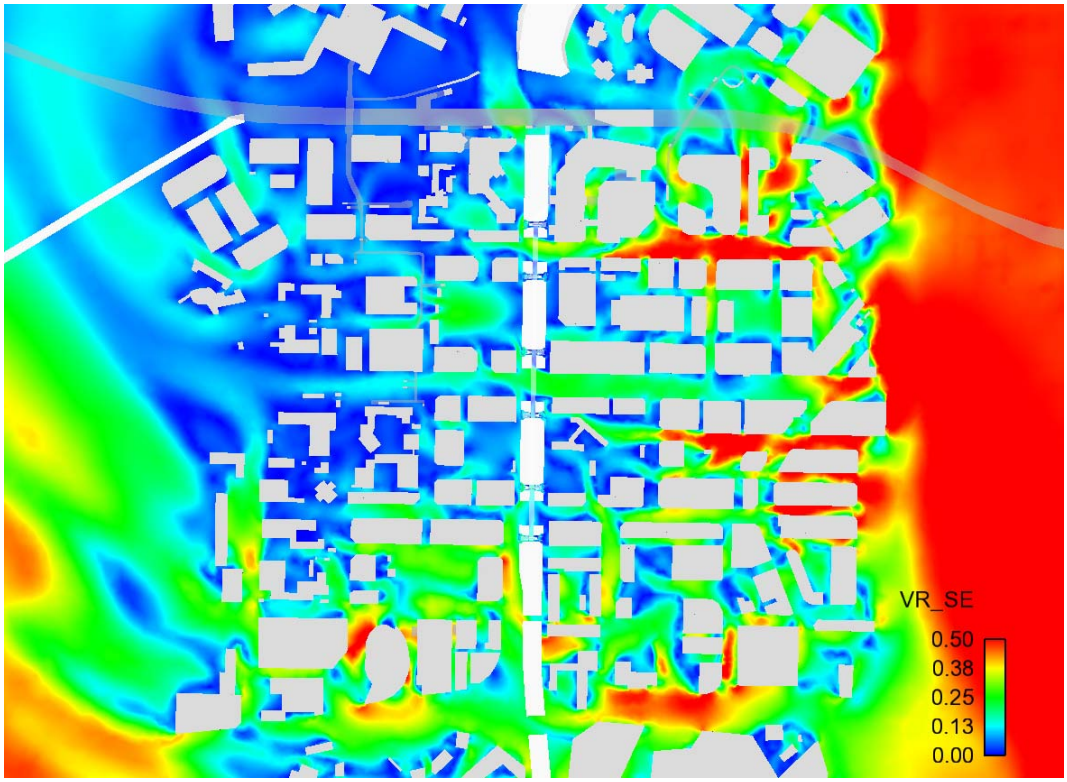

Figure C 23 Contour plot of Scheme B under SE Wind Direction

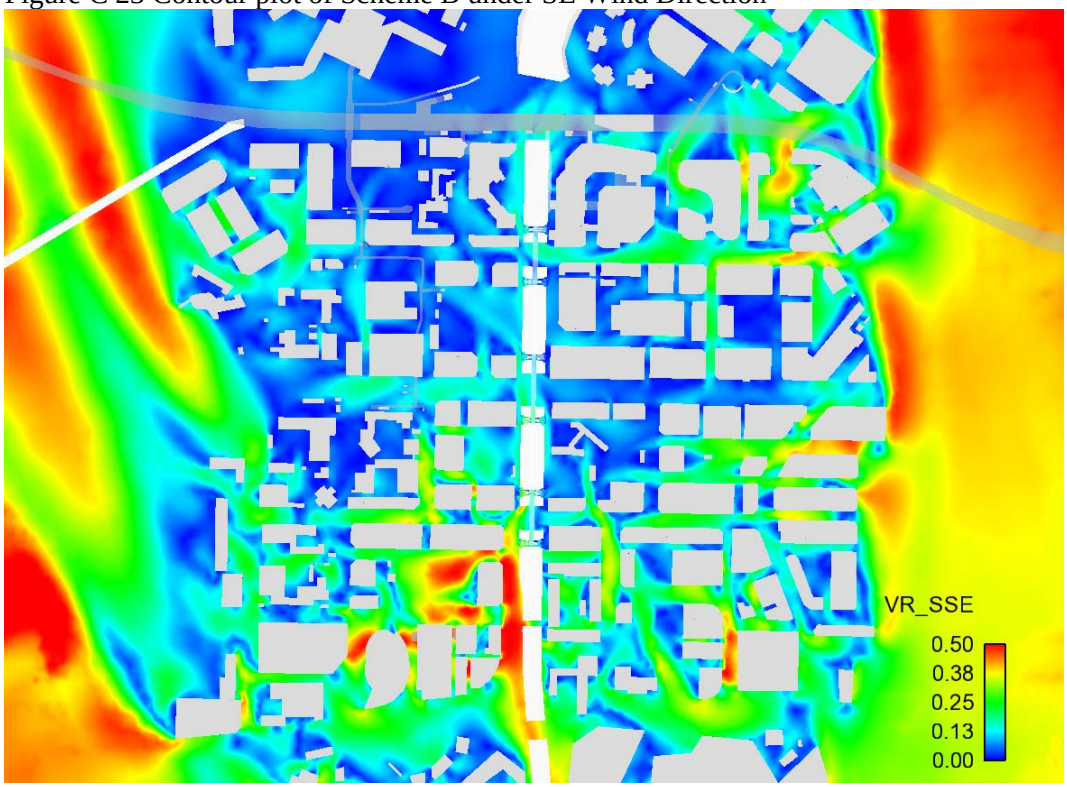

Figure C 24 Contour plot of Scheme B under SSE Wind Direction

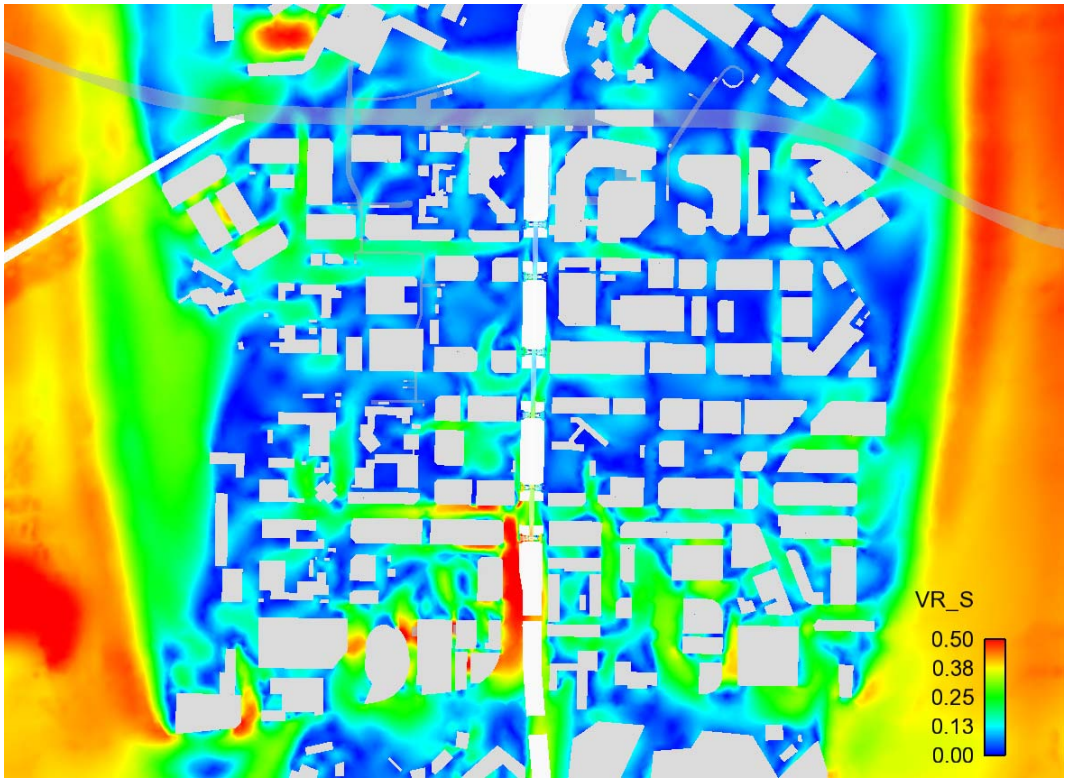

Figure C 25 Contour plot of Scheme B under S Wind Direction

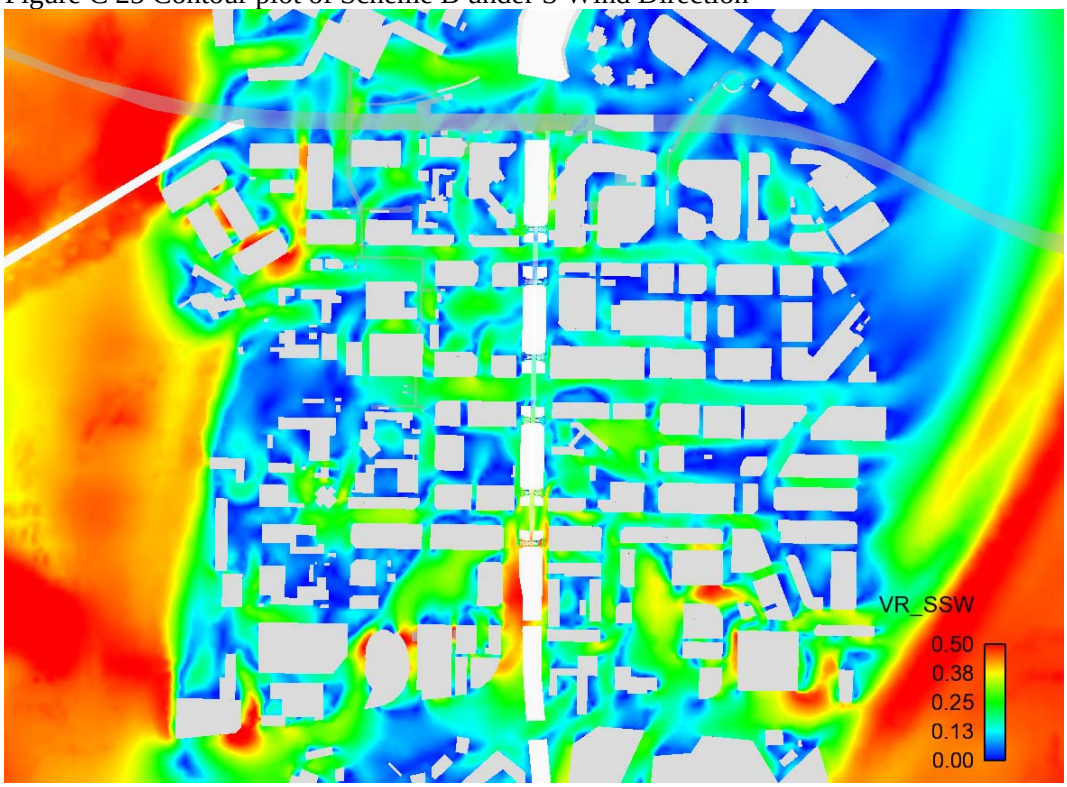

Figure C 26 Contour plot of Scheme B under SSW Wind Direction

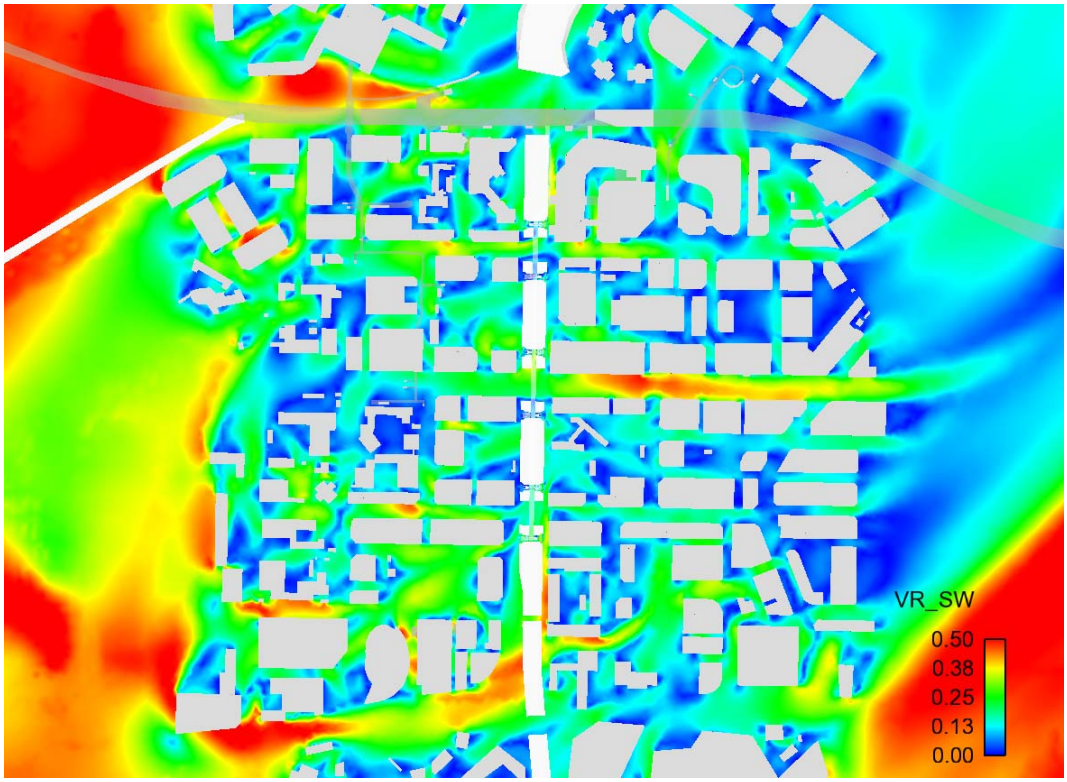

Figure C 27 Contour plot of Scheme B under SW Wind Direction

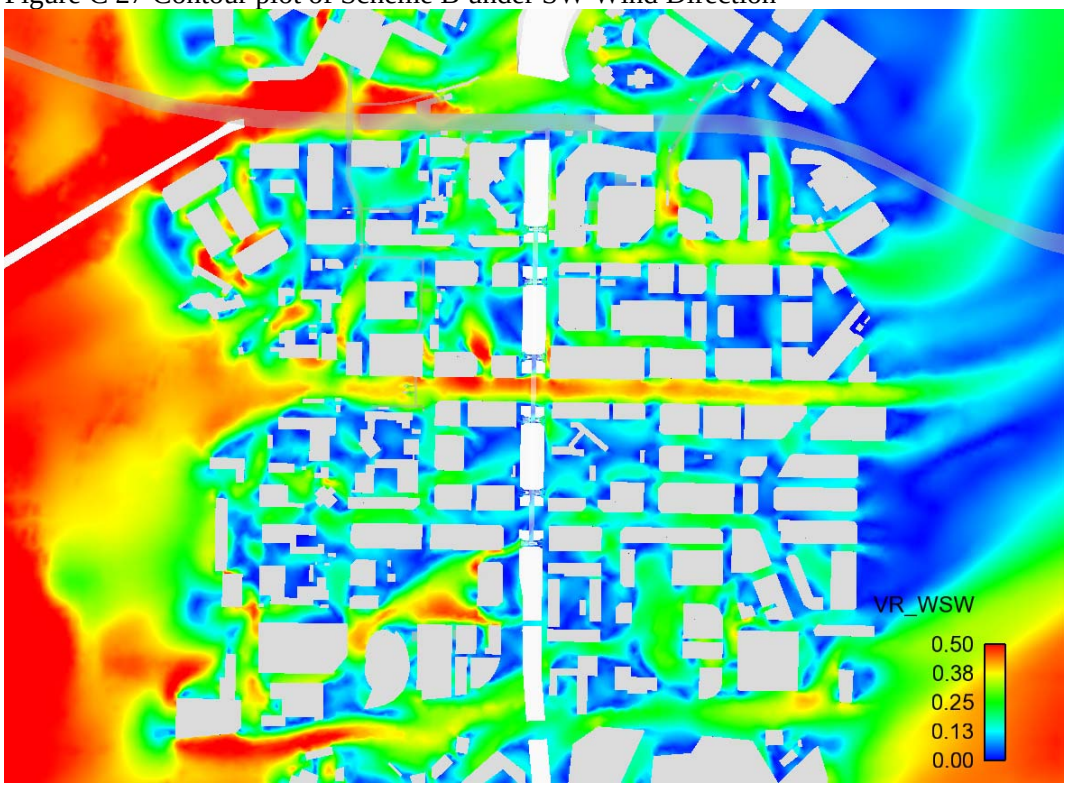

Figure C 28 Contour plot of Scheme B under WSW Wind Direction

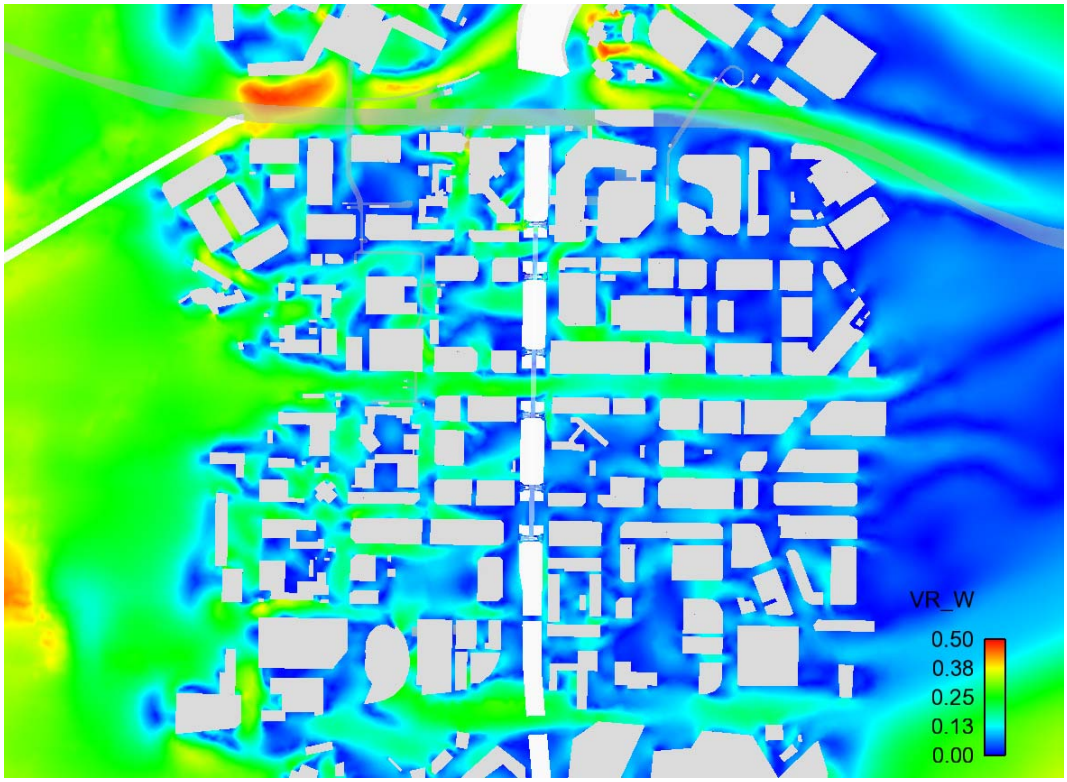

Figure C 29 Contour plot of Scheme B under W Wind Direction

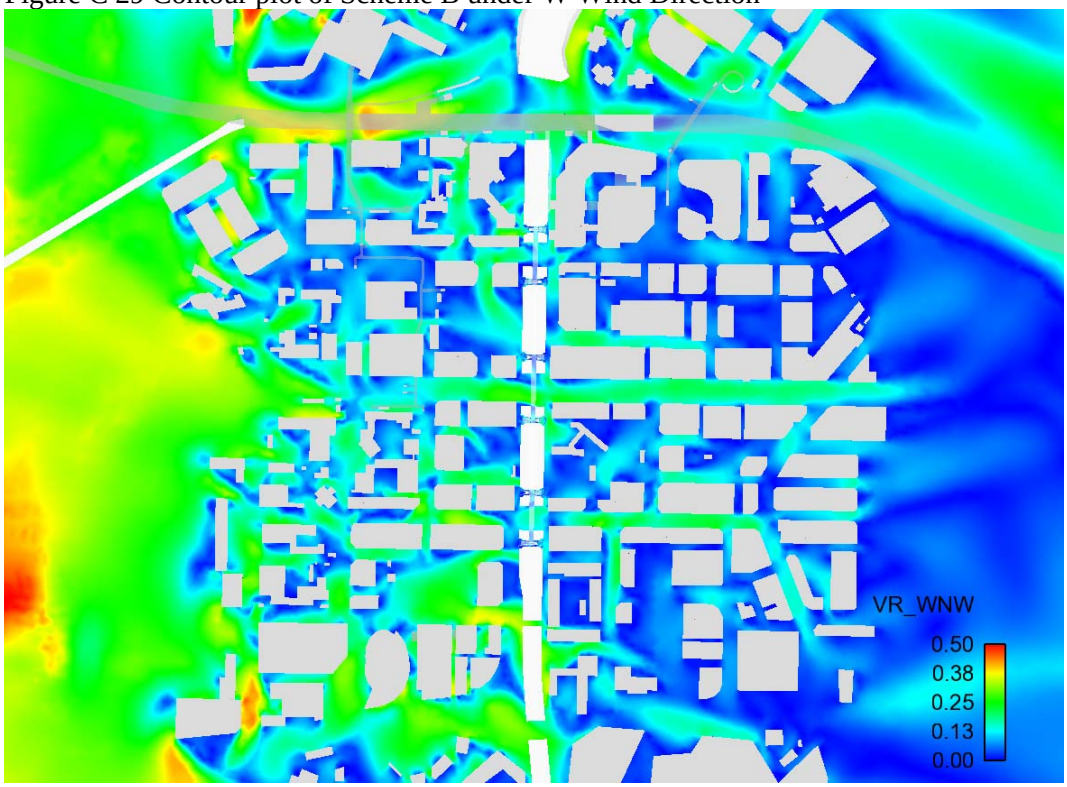

Figure C 30 Contour plot of Scheme B under WNW Wind Direction

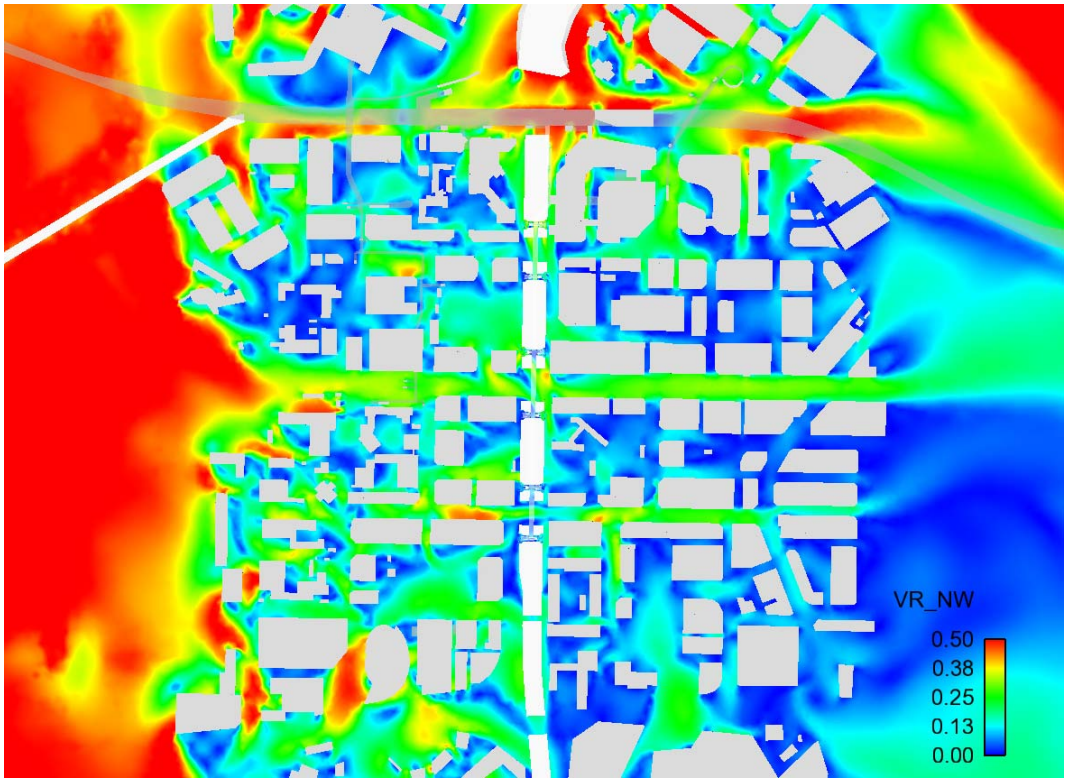

Figure C 31 Contour plot of Scheme B under NW Wind Direction

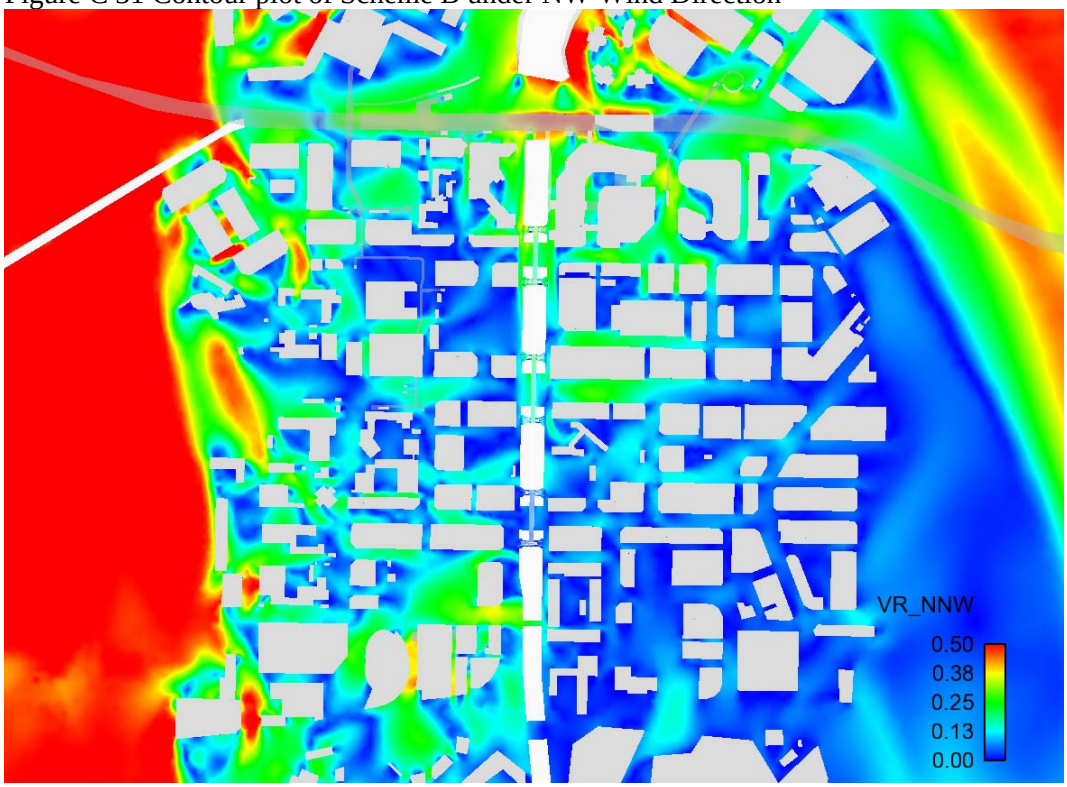

Figure C 32 Contour plot of Scheme B under NNW Wind Direction

Appendix D

Vector Plots

Contents

D1 Scheme A

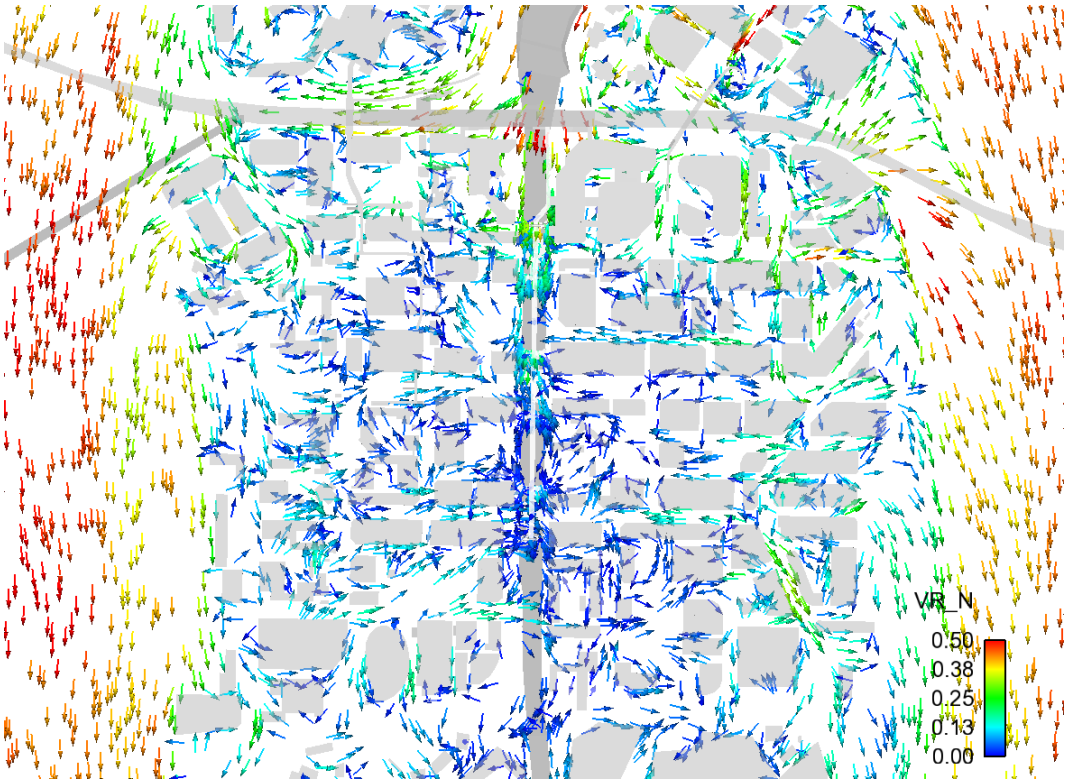

Figure D 1Vector plot of Scheme A under N Wind Direction

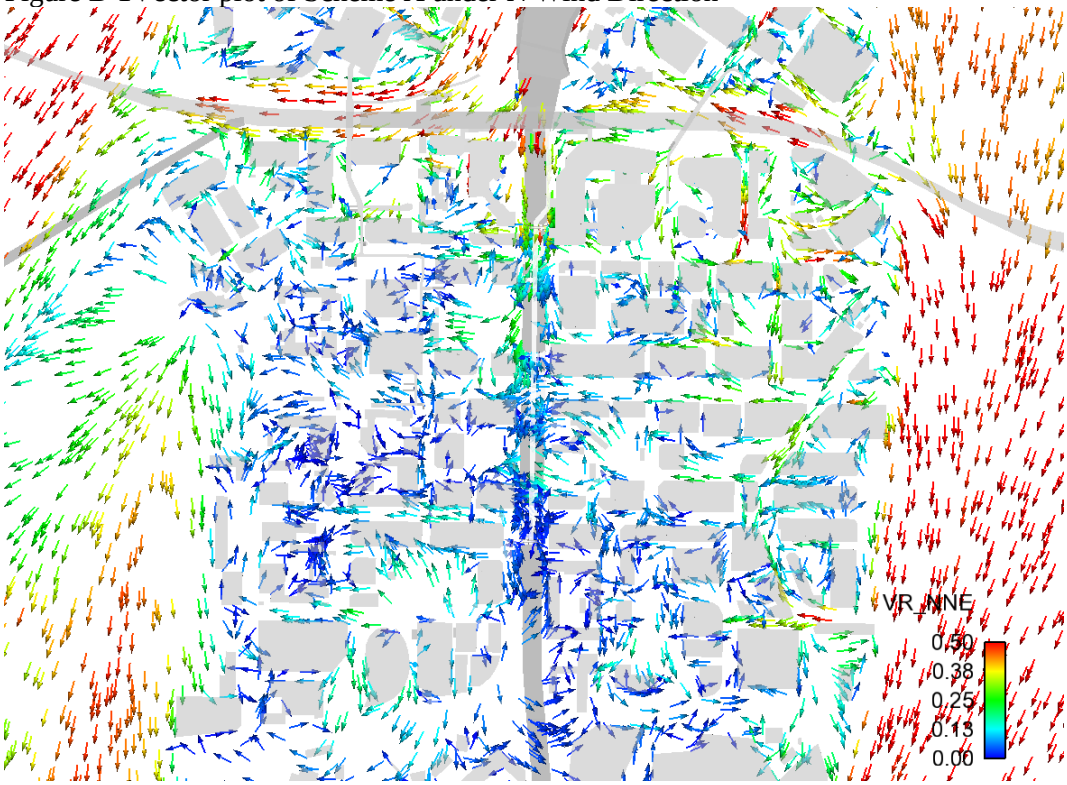

Figure D 2 Vector plot of Scheme A under NNE Wind Direction

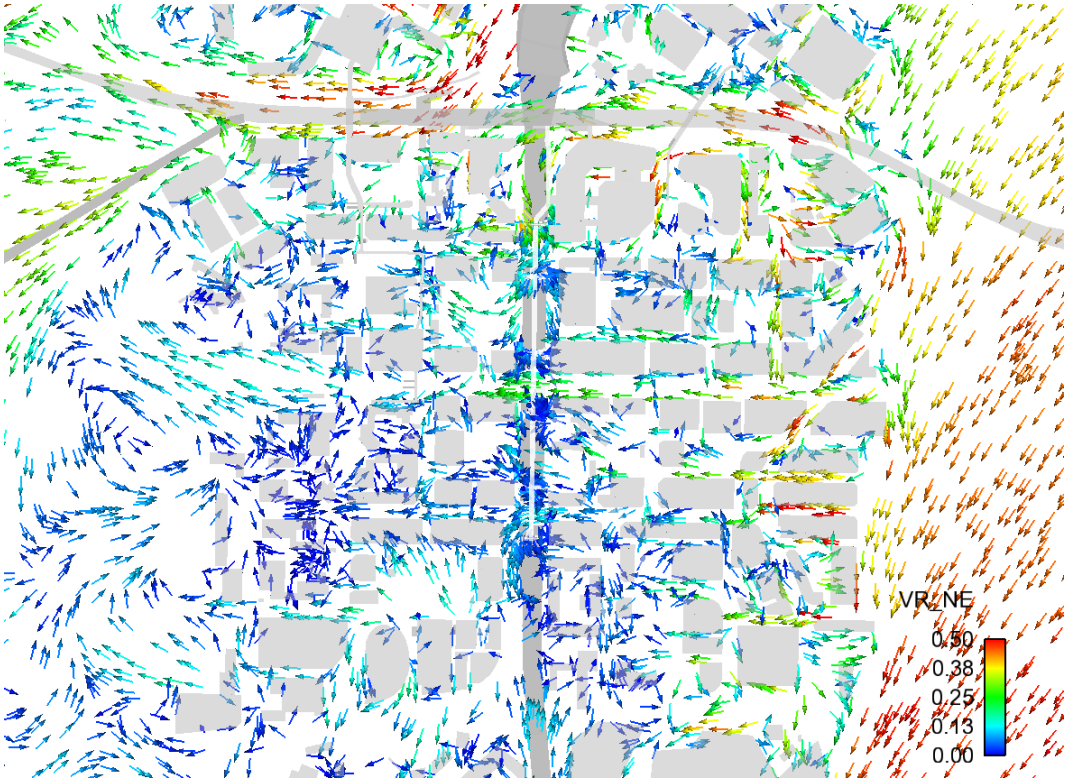

Figure D 3 Vector plot of Scheme A under NE Wind Direction

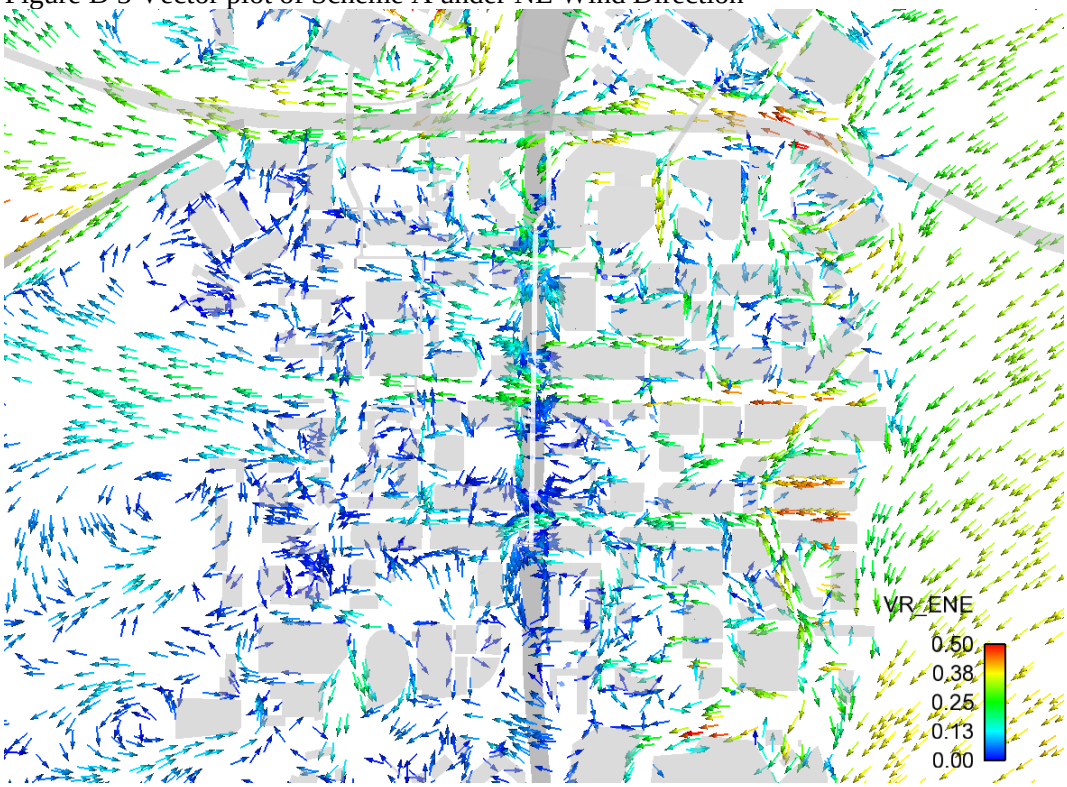

Figure D 4 Vector plot of Scheme A under ENE Wind Direction

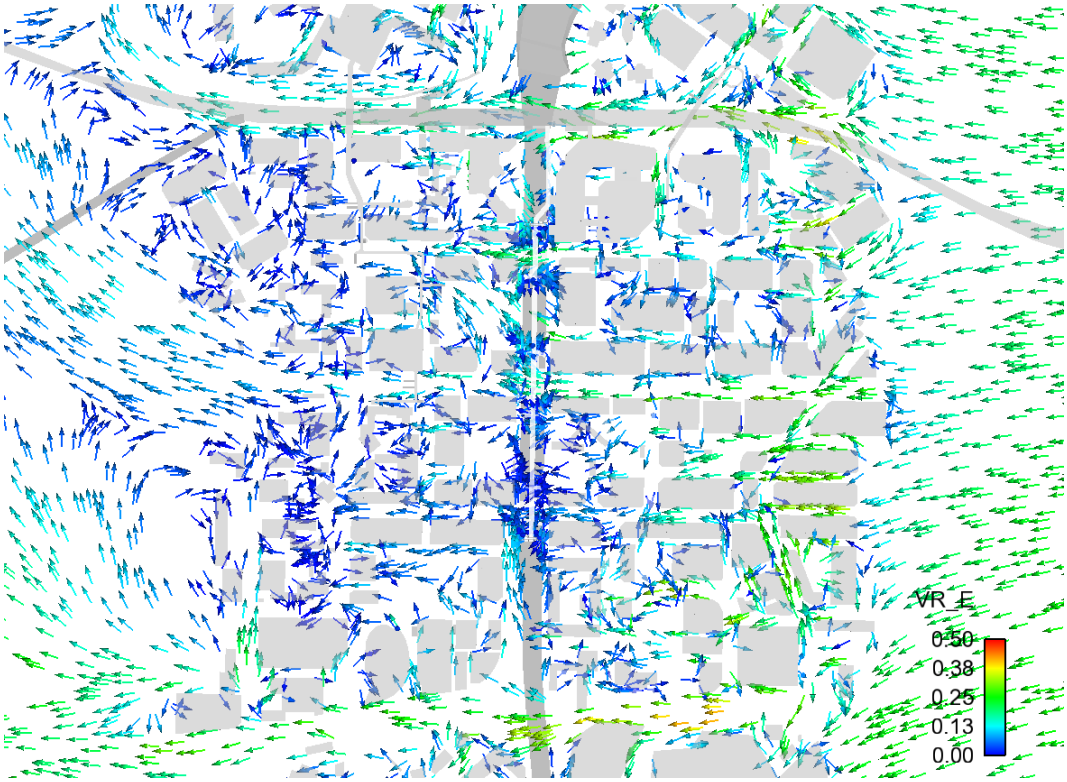

Figure D 5 Vector plot of Scheme A under E Wind Direction

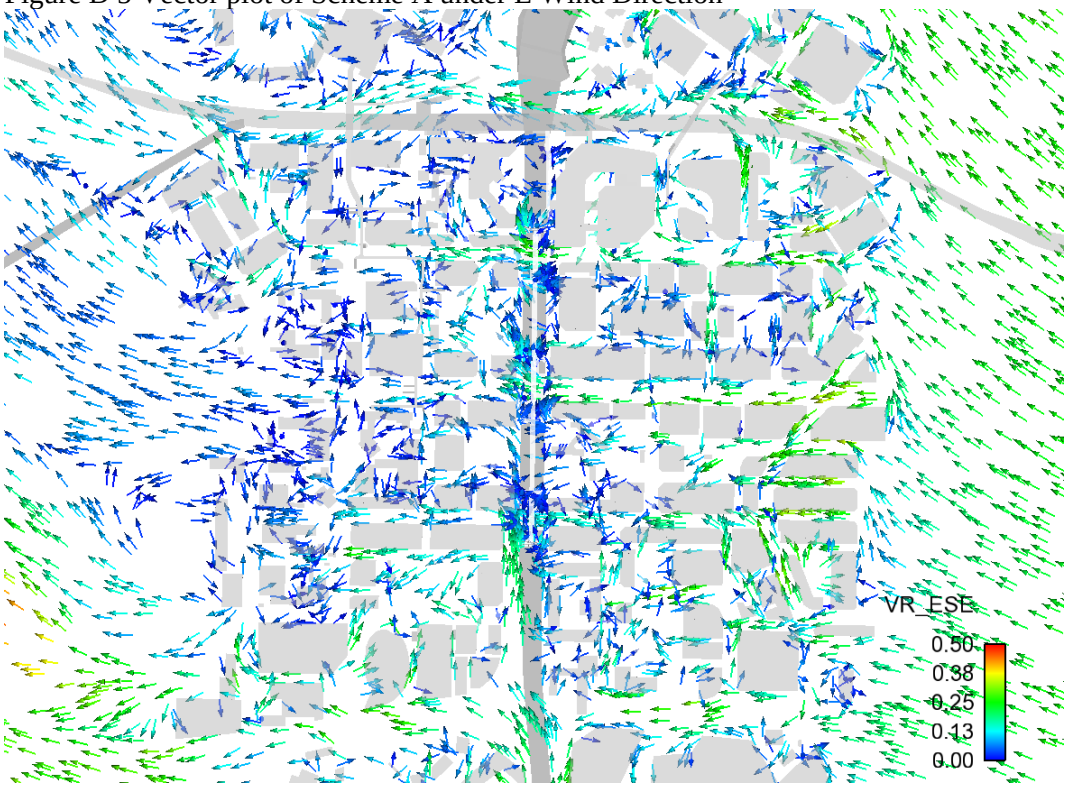

Figure D 6 Vector plot of Scheme A under ESE Wind Direction

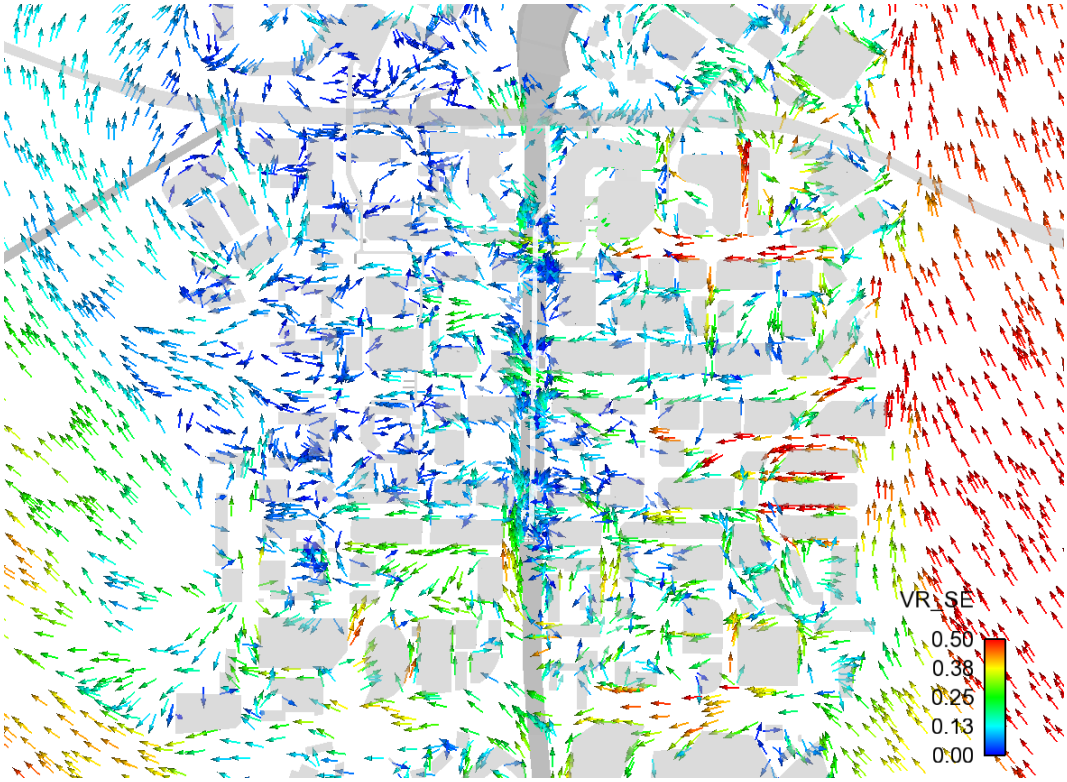

Figure D 7 Vector plot of Scheme A under SE Wind Direction

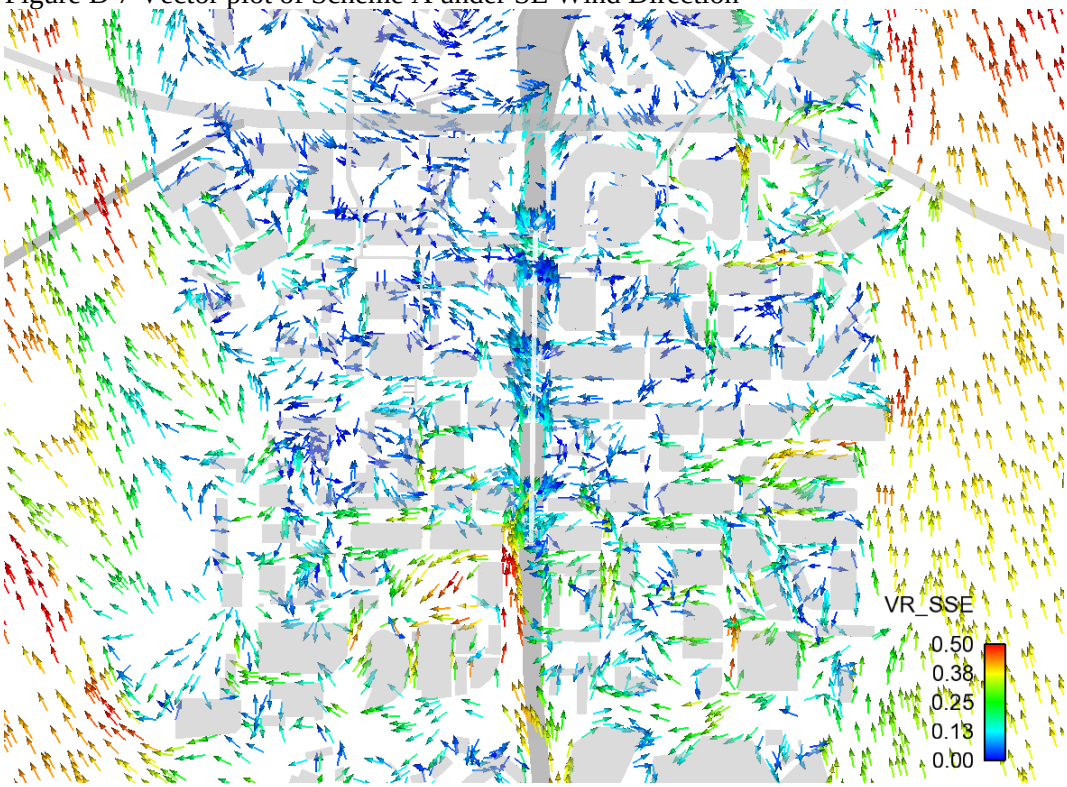

Figure D 8 Vector plot of Scheme A under SSE Wind Direction

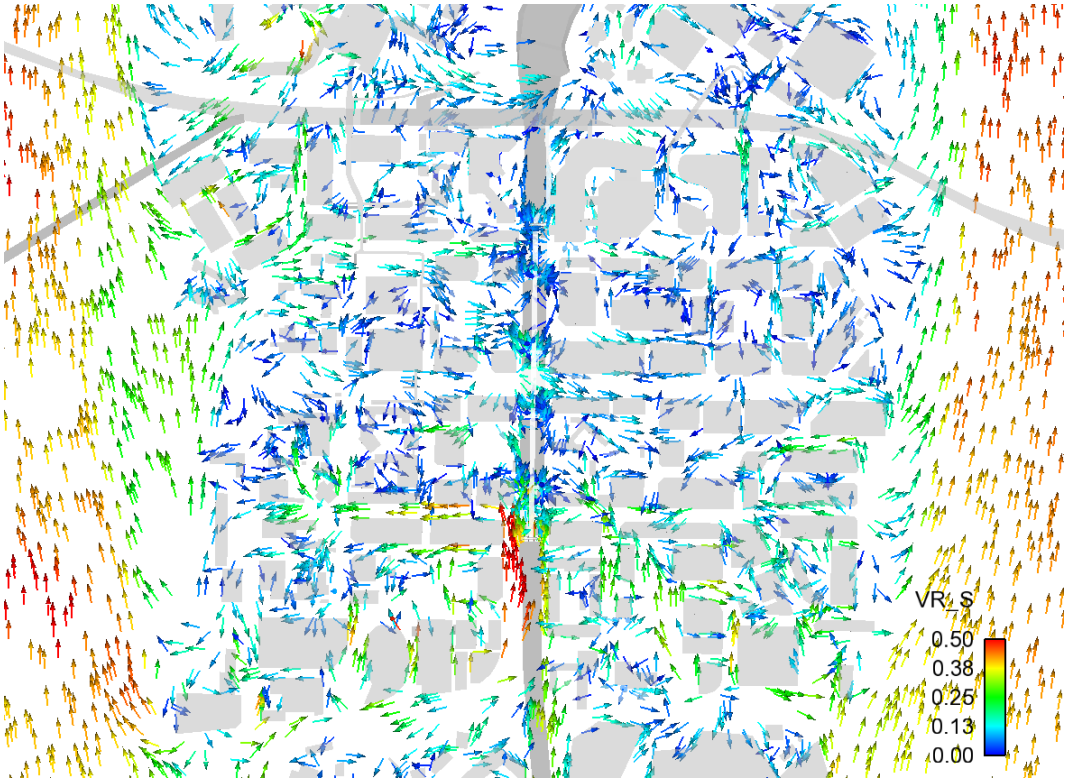

Figure D 9 Vector plot of Scheme A under S Wind Direction

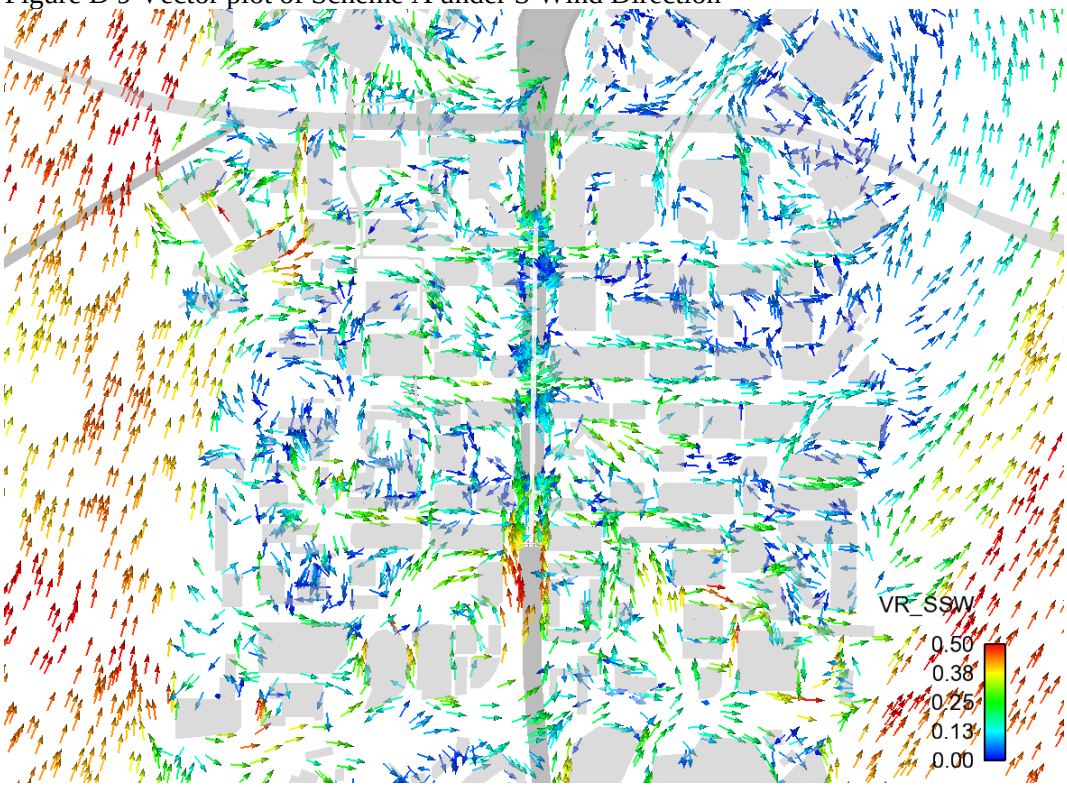

Figure D 10 Vector plot of Scheme A under SSW Wind Direction

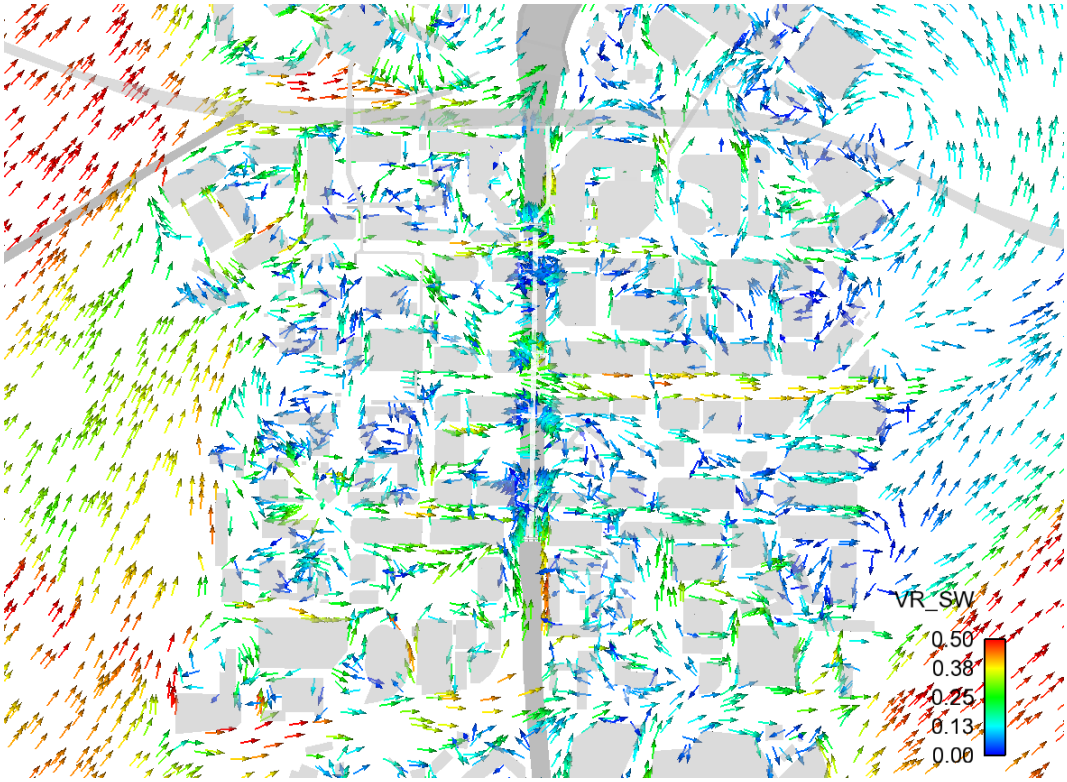

Figure D 11 Vector plot of Scheme A under SW Wind Direction

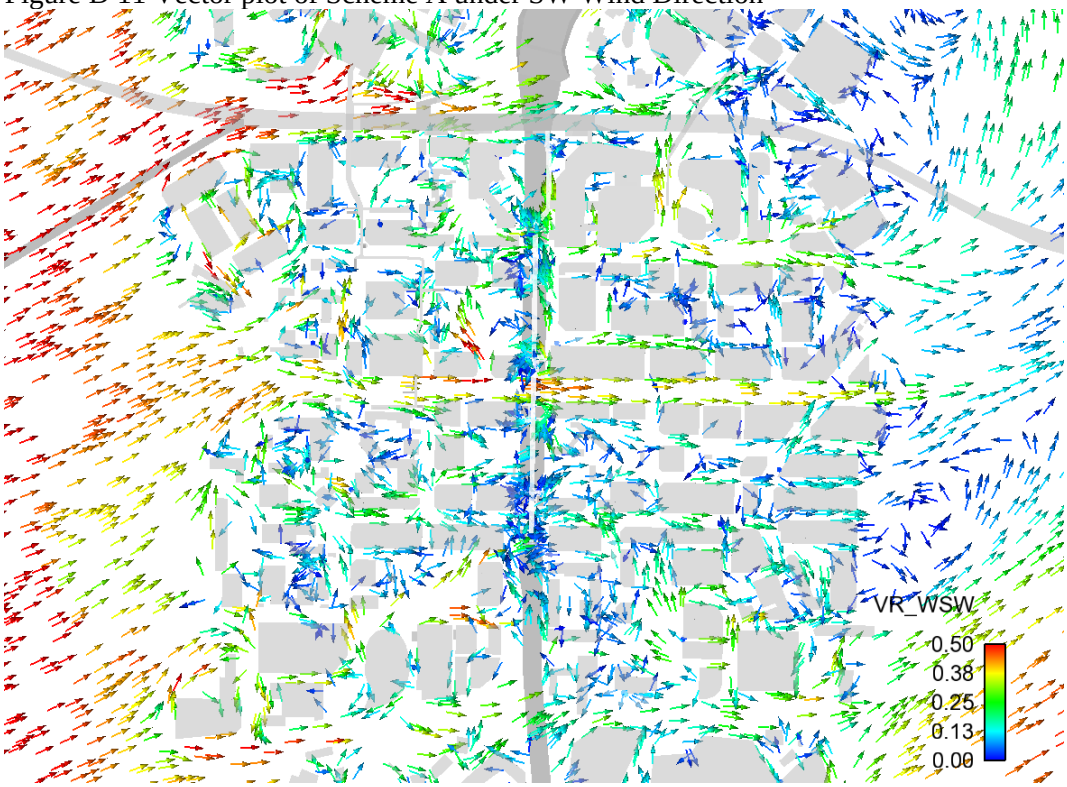

Figure D 12 Vector plot of Scheme A under WSW Wind Direction

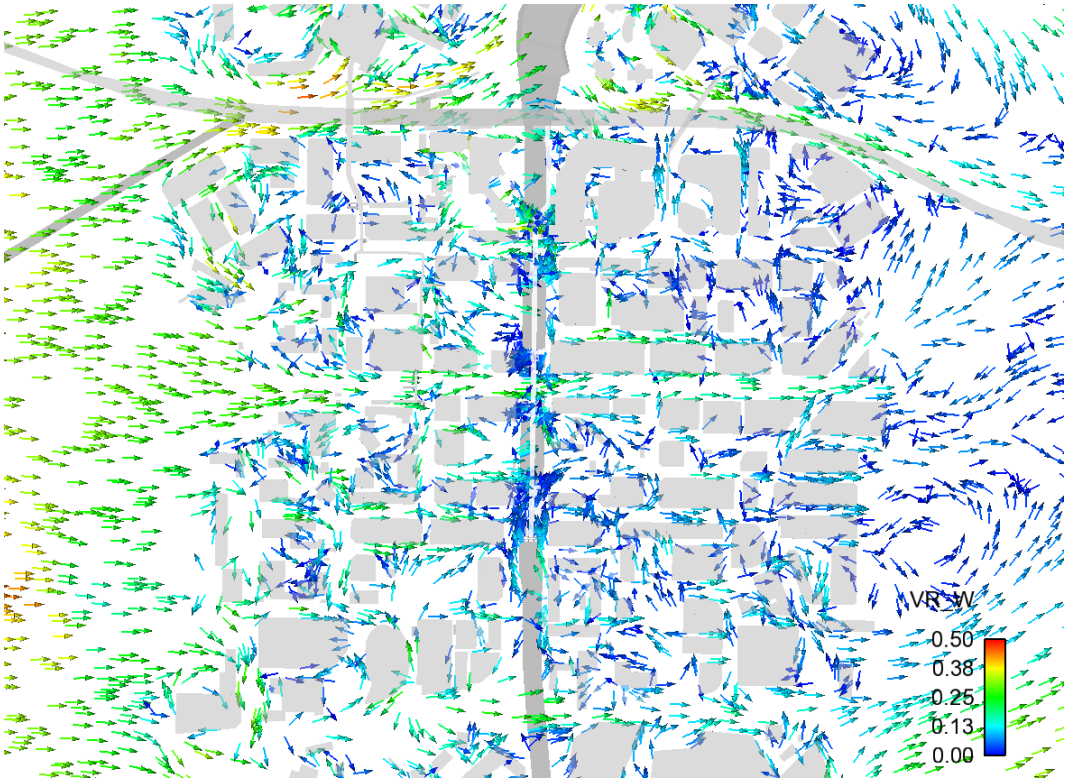

Figure D 13 Vector plot of Scheme A under W Wind Direction

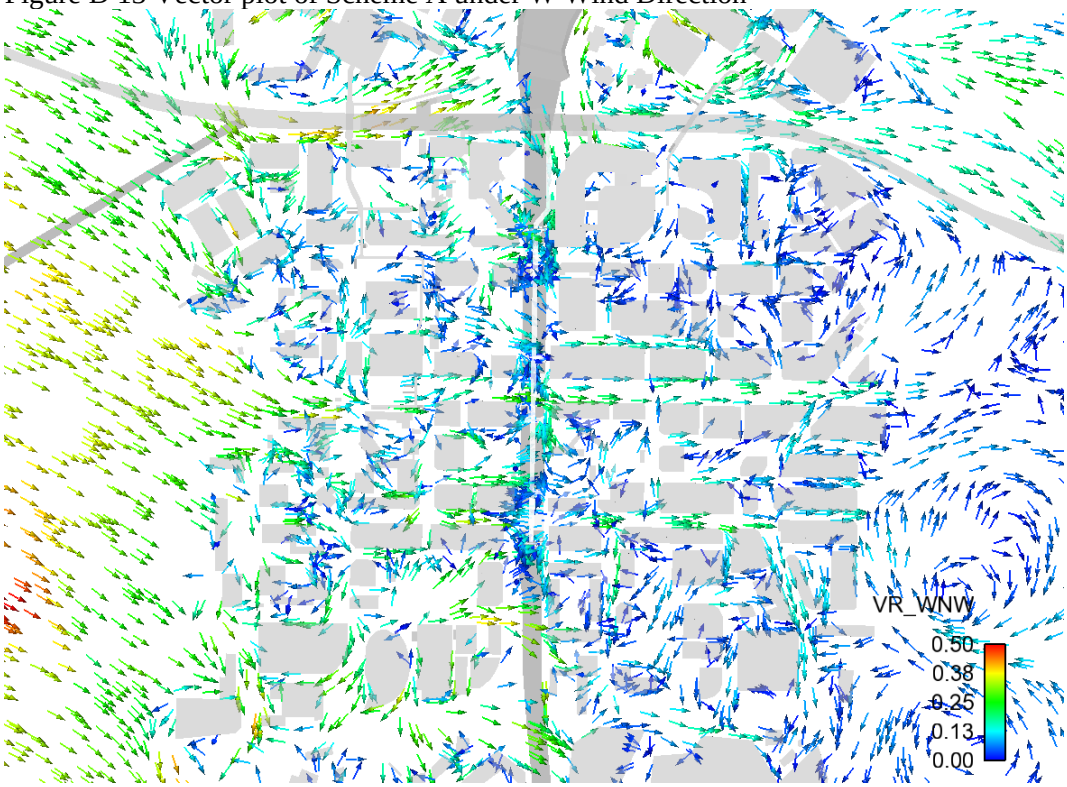

Figure D 14 Vector plot of Scheme A under WNW Wind Direction

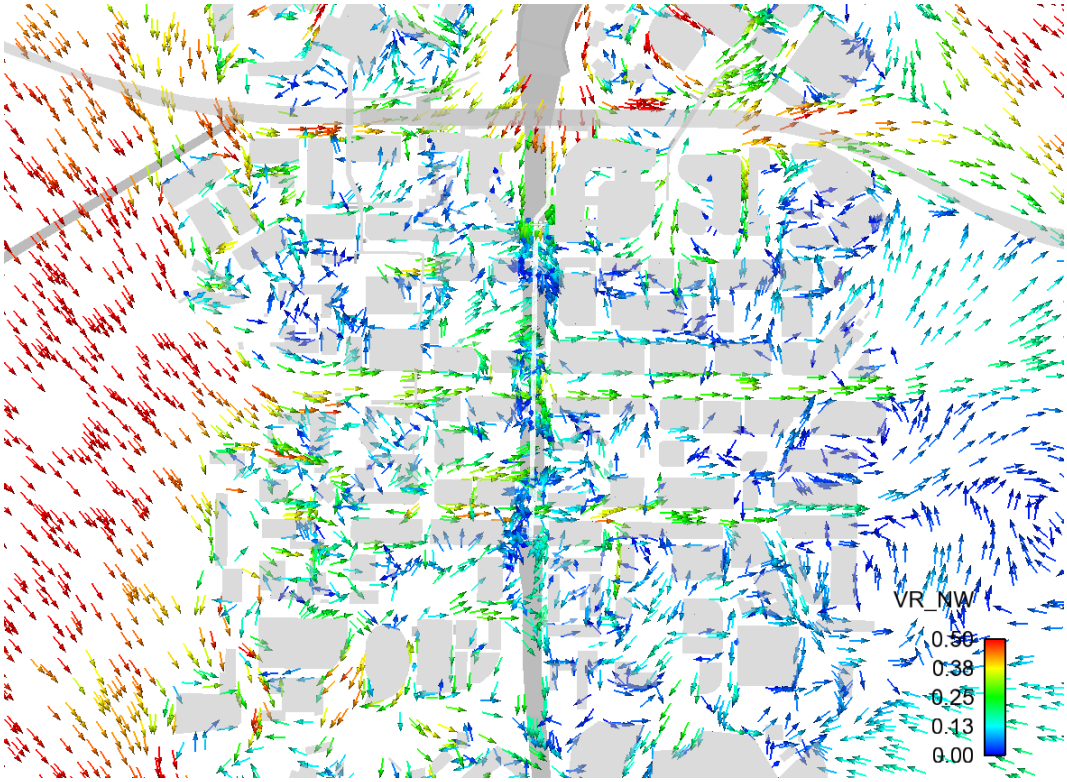

Figure D 15 Vector plot of Scheme A under NW Wind Direction

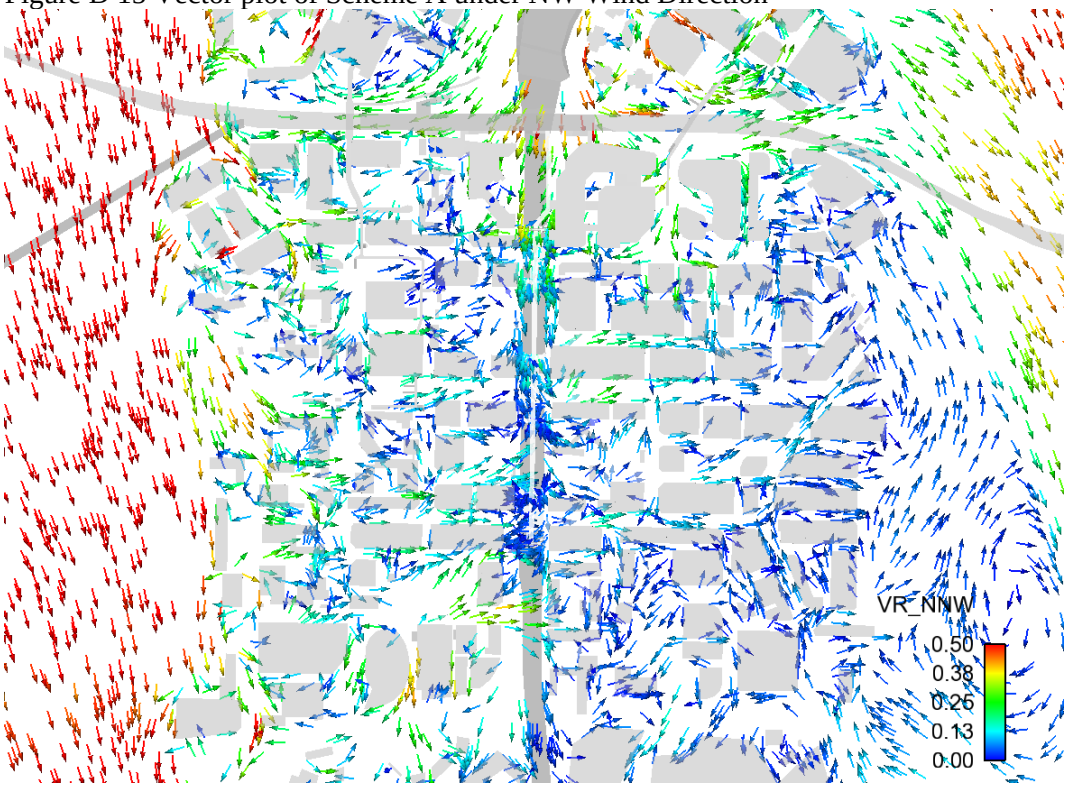

Figure D 16 Vector plot of Scheme A under NNW Wind Direction

D2 Scheme B

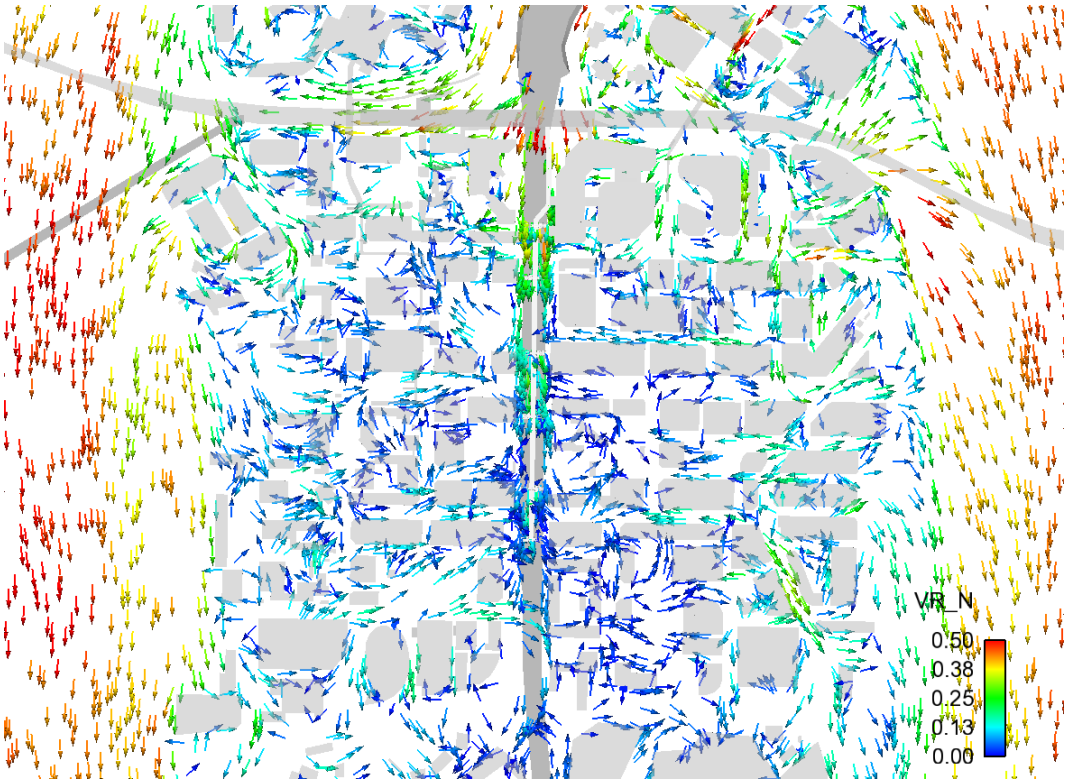

Figure D 17 Vector plot of Scheme B under N Wind Direction

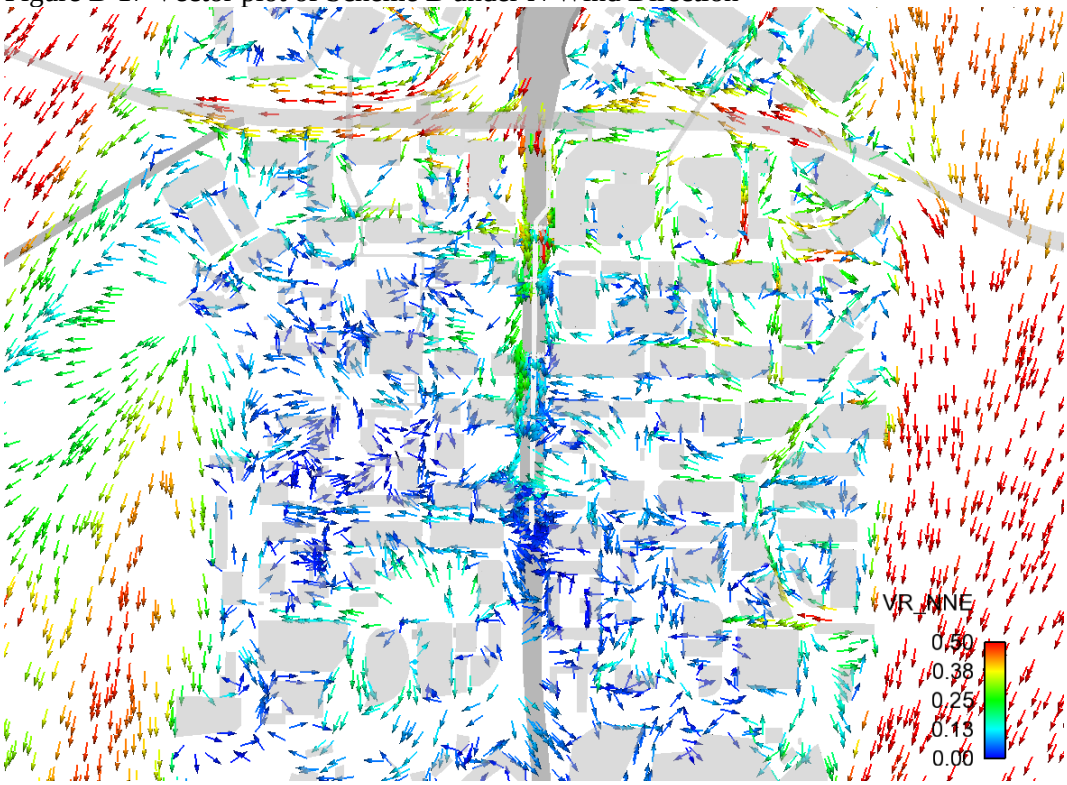

Figure D 18 Vector plot of Scheme B under NNE Wind Direction

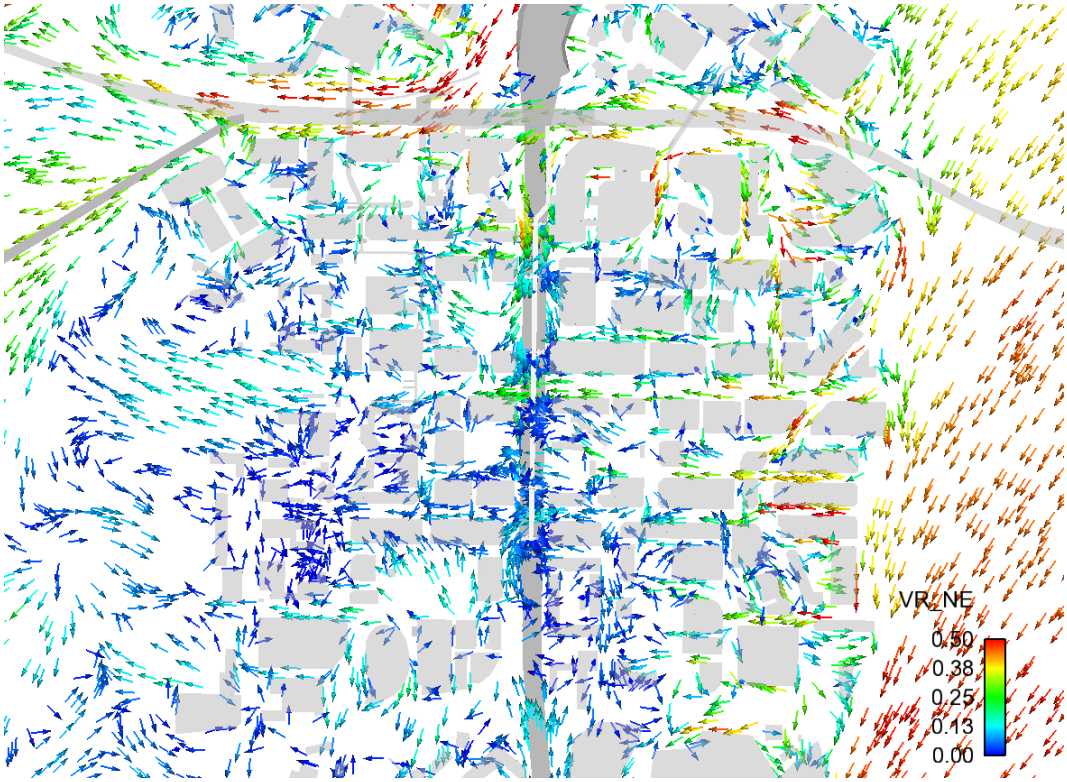

Figure D 19 Vector plot of Scheme B under NE Wind Direction

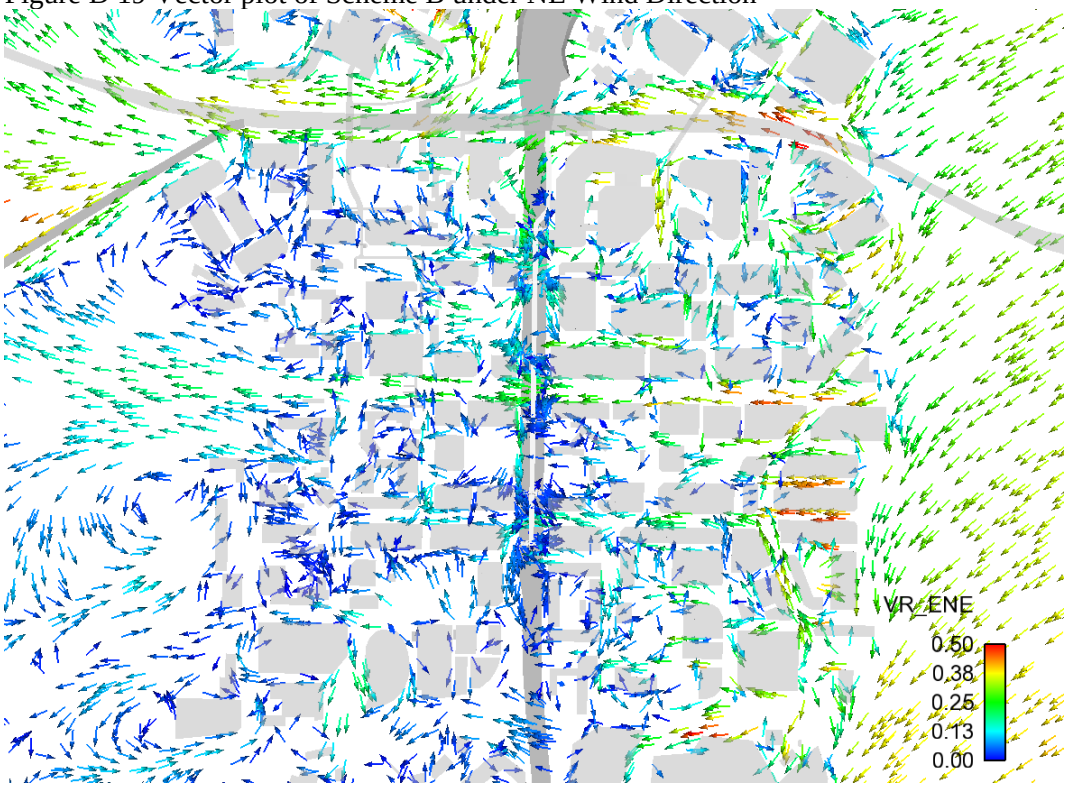

Figure D 20 Vector plot of Scheme B under ENE Wind Direction

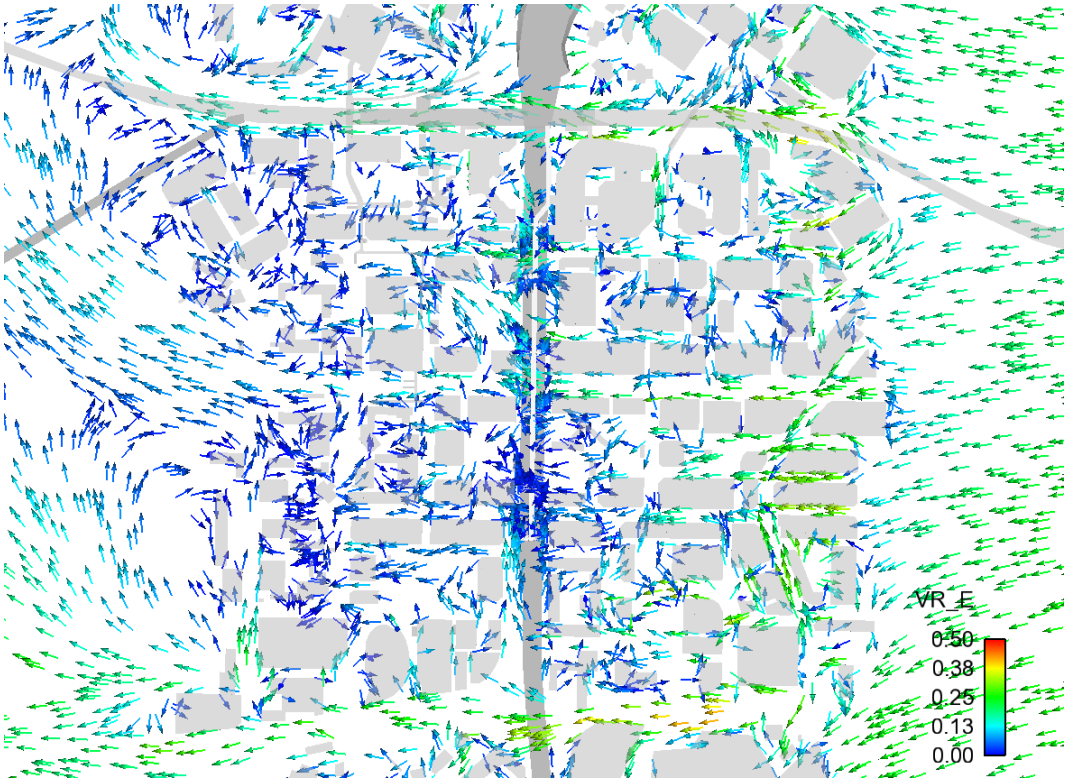

Figure D 21 Vector plot of Scheme B under E Wind Direction

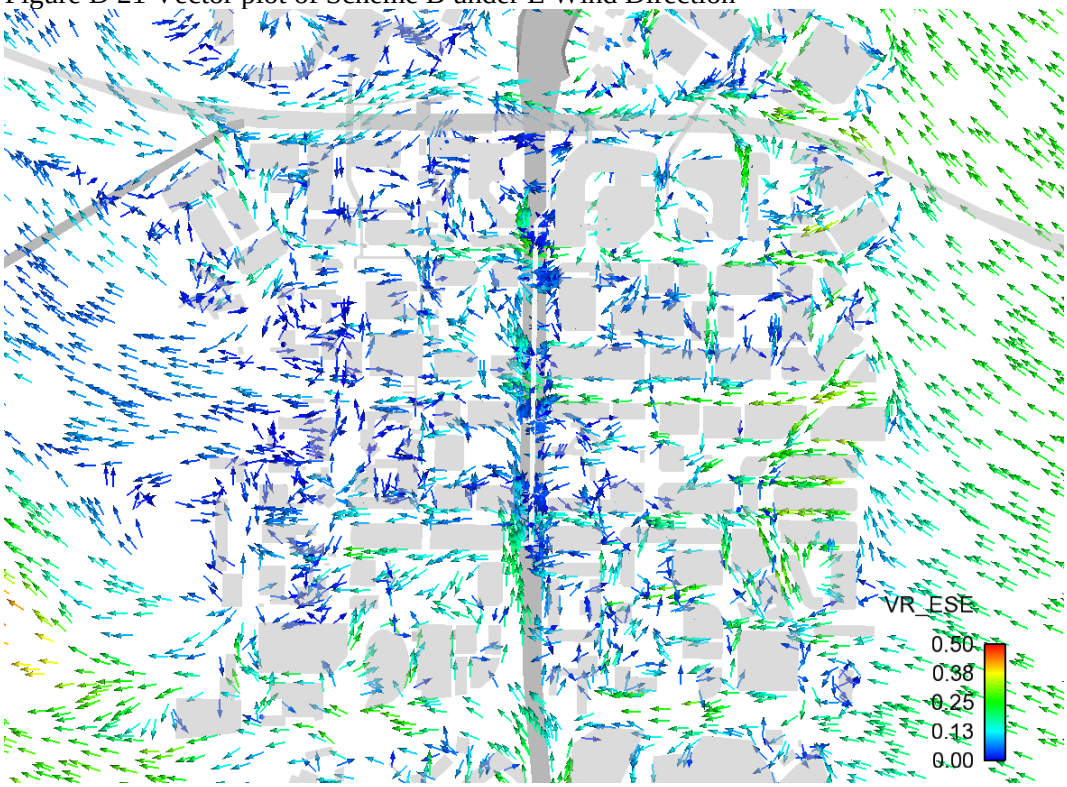

Figure D 22 Vector plot of Scheme B under ESE Wind Direction

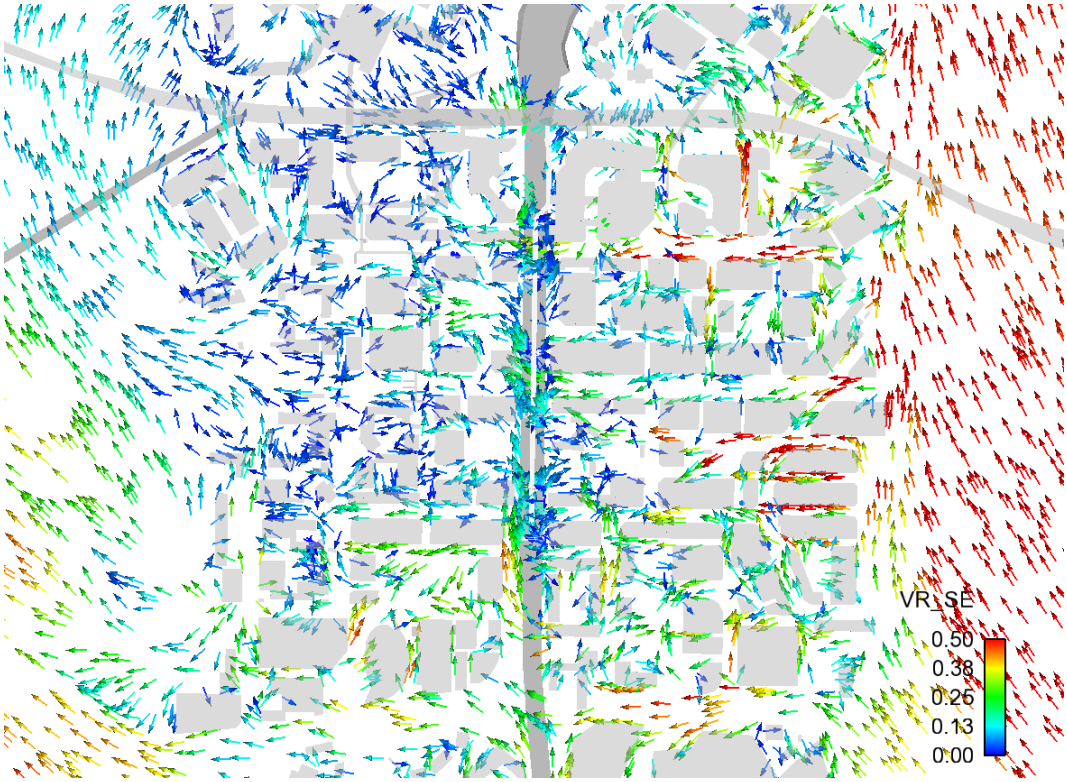

Figure D 23 Vector plot of Scheme B under SE Wind Direction

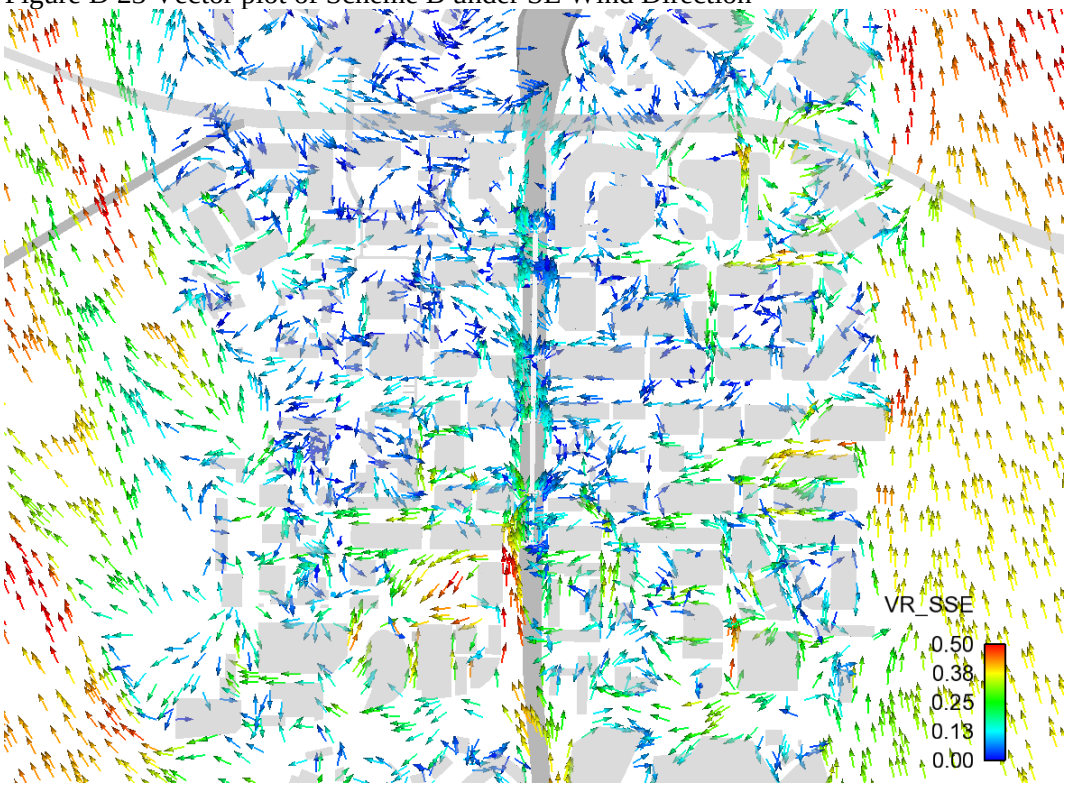

Figure D 24 Vector plot of Scheme B under SSE Wind Direction

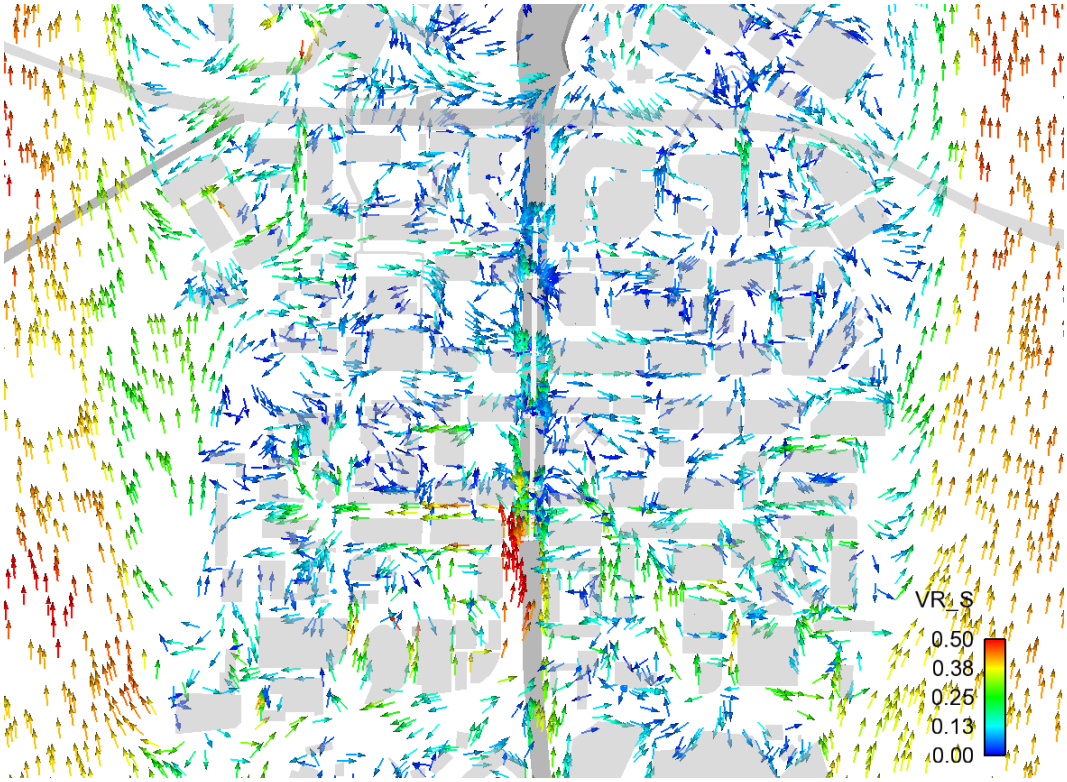

Figure D 25 Vector plot of Scheme B under S Wind Direction

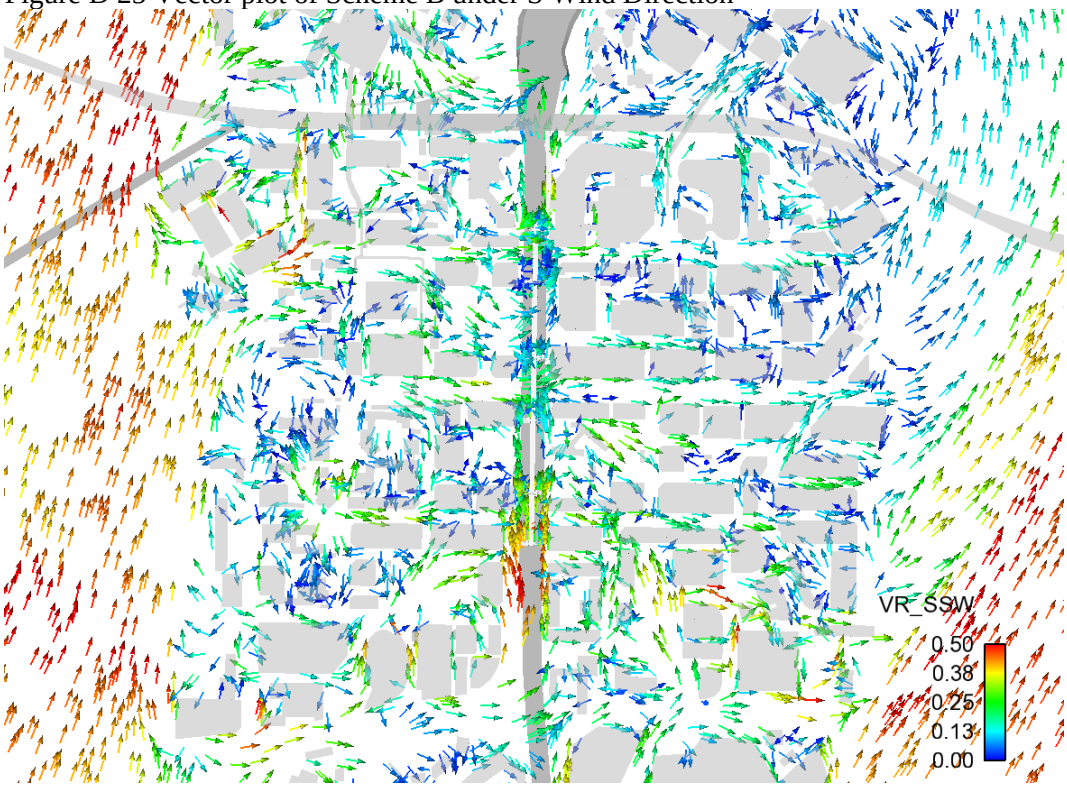

Figure D 26 Vector plot of Scheme B under SSW Wind Direction

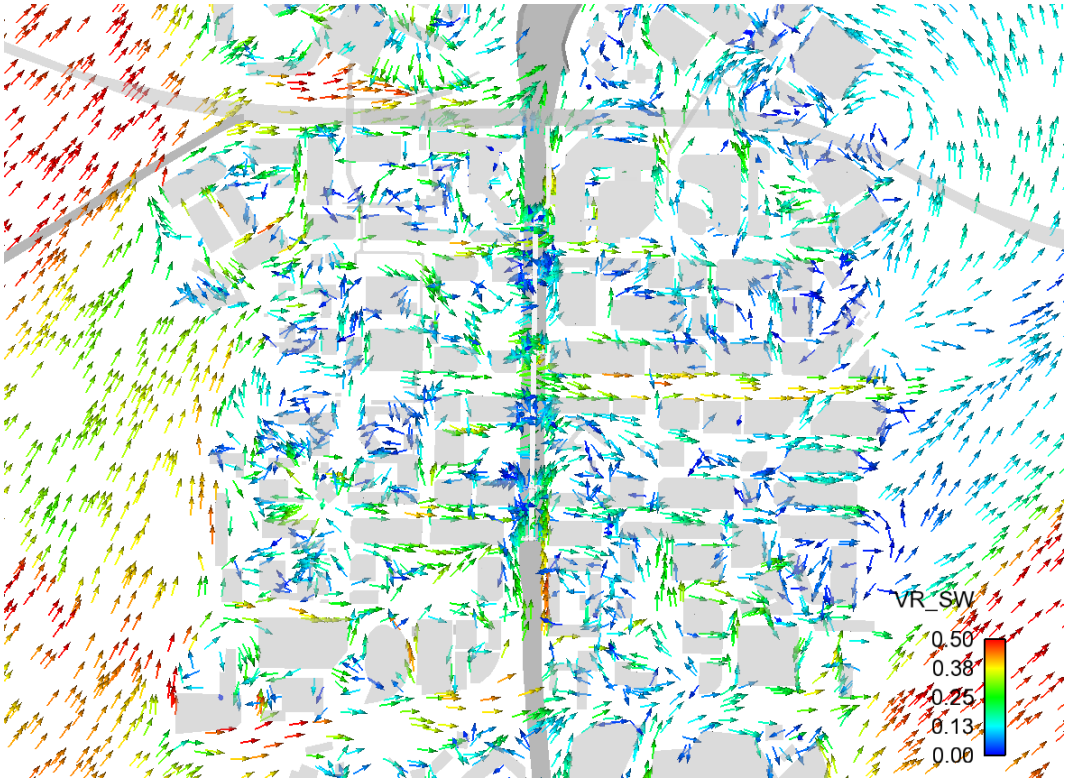

Figure D 27 Vector plot of Scheme B under SW Wind Direction

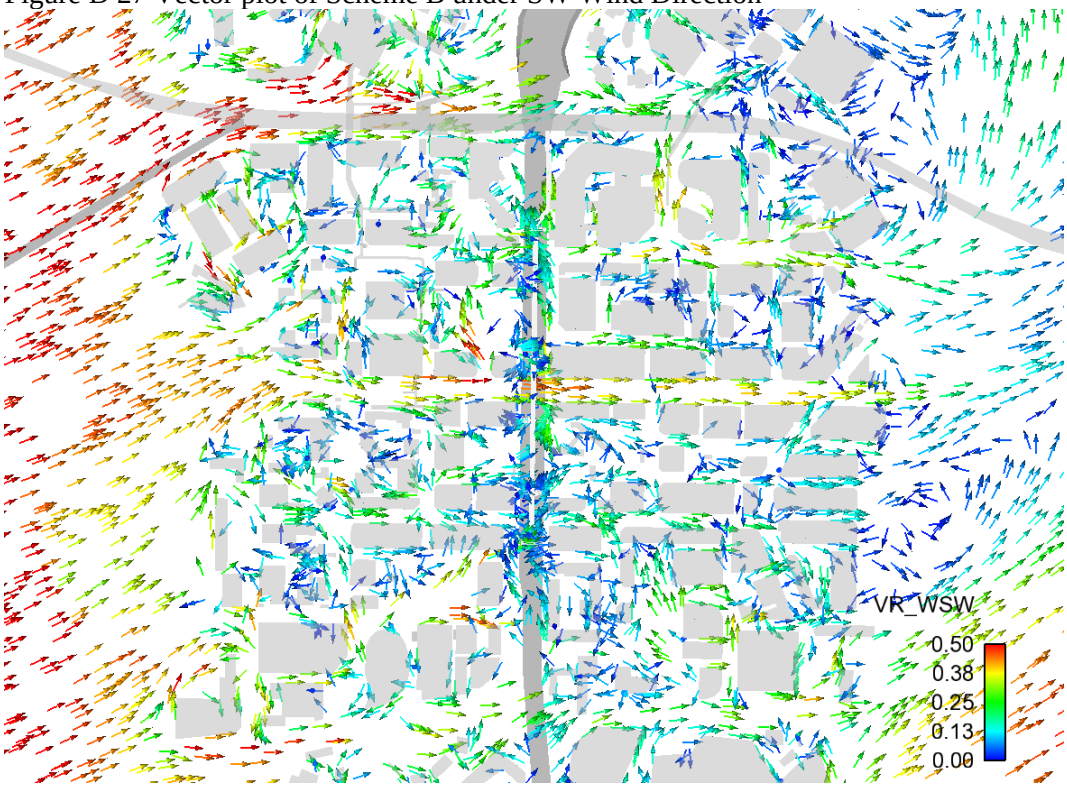

Figure D 28 Vector plot of Scheme B under WSW Wind Direction

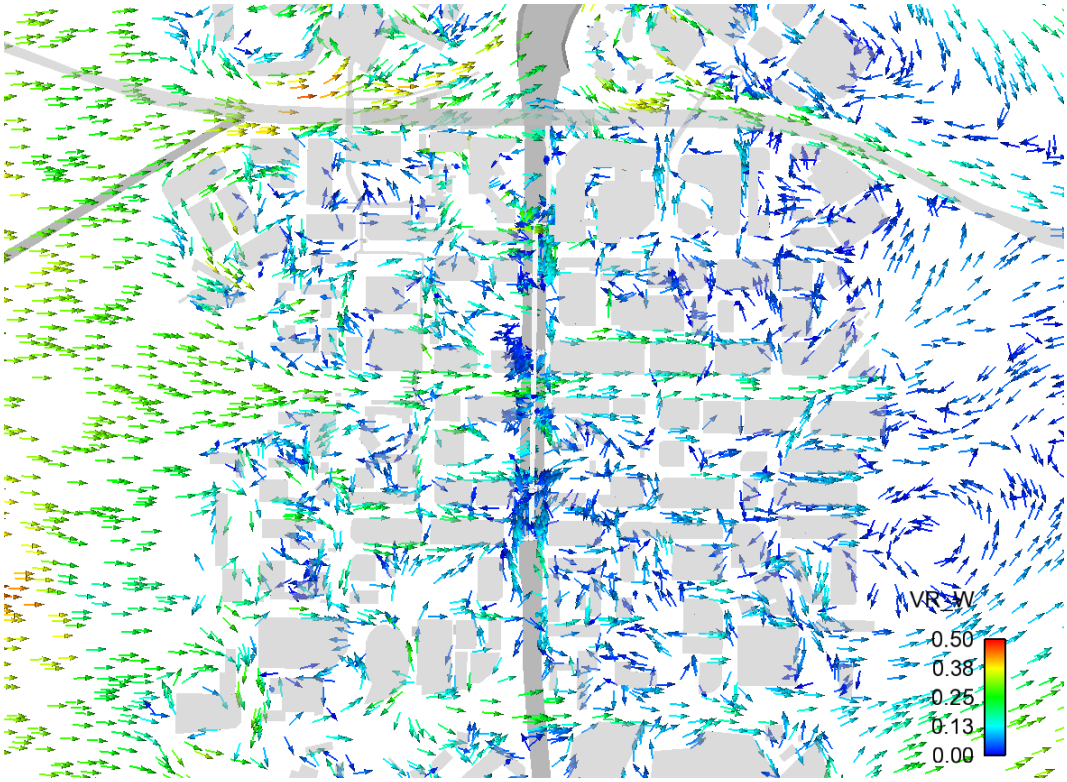

Figure D 29 Vector plot of Scheme B under W Wind Direction

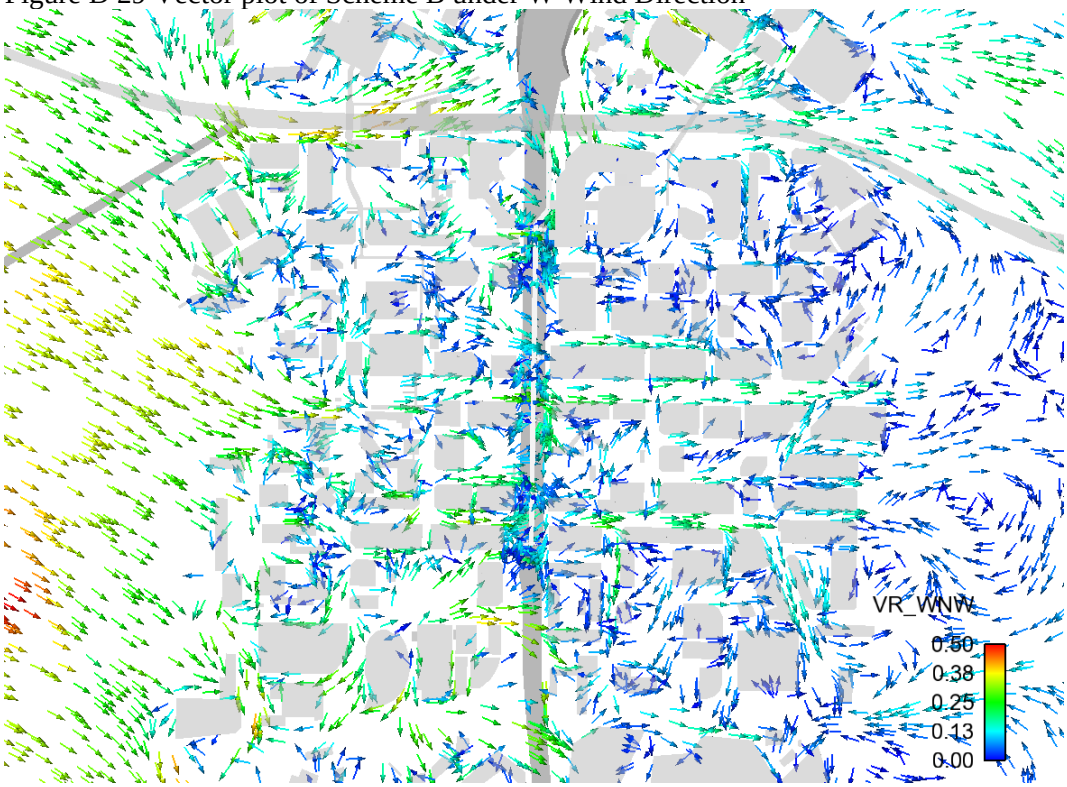

Figure D 30 Vector plot of Scheme B under WNW Wind Direction

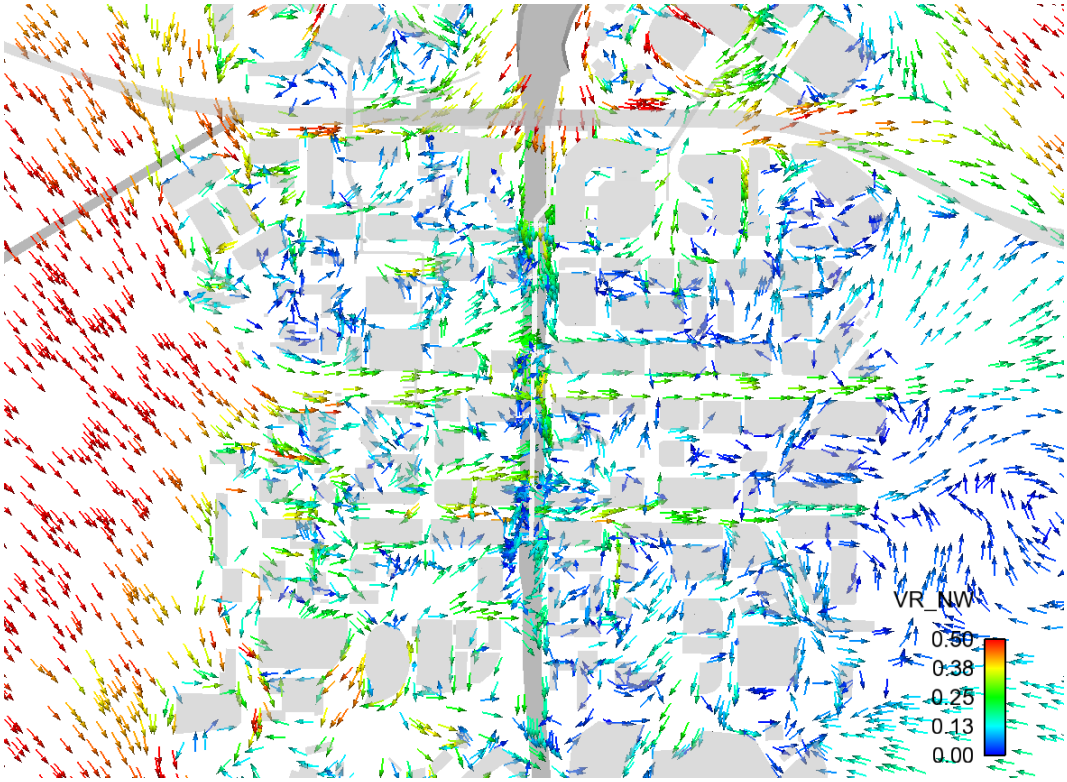

Figure D 31 Vector plot of Scheme B under NW Wind Direction

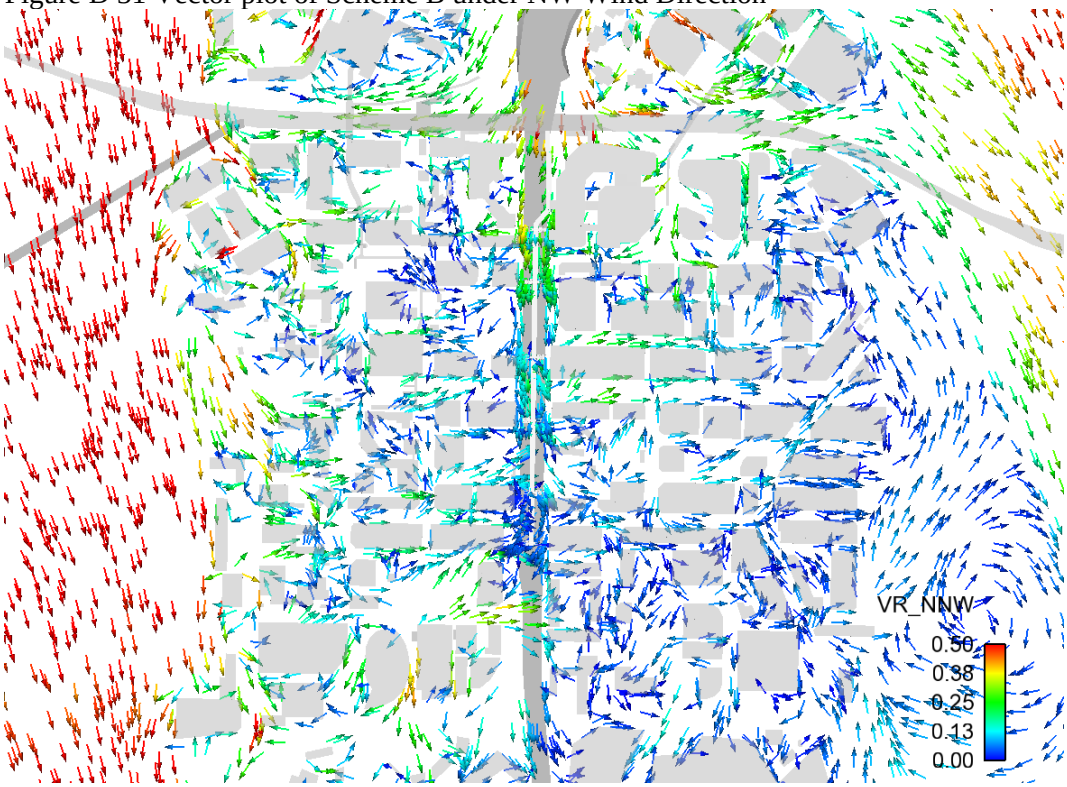

Figure D 32 Vector plot of Scheme B under NNW Wind Direction

Appendix E

Velocity Ratio of Test Points

Contents

E1 Scheme A

E1.1 Perimeter Test Points

Table E 1 VR Value for the Perimeter Test Points of Scheme A

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
P1	0.61	0.55	0.28	0.27	0.08	0.06	0.15	0.18	0.09	0.27	0.23	0.16	0.17	0.22	0.46	0.43	**0.28**	**0.20**
P2	0.53	0.53	0.25	0.24	0.06	0.05	0.35	0.13	0.04	0.04	0.10	0.23	0.20	0.12	0.45	0.39	**0.24**	**0.15**
P3	0.45	0.47	0.25	0.27	0.11	0.03	0.08	0.14	0.03	0.08	0.15	0.14	0.08	0.05	0.31	0.32	**0.23**	**0.14**
P4	0.30	0.35	0.26	0.26	0.13	0.03	0.19	0.14	0.06	0.10	0.17	0.12	0.08	0.13	0.20	0.19	**0.21**	**0.14**
P5	0.22	0.26	0.29	0.24	0.14	0.05	0.09	0.12	0.06	0.20	0.24	0.17	0.08	0.14	0.20	0.20	**0.20**	**0.17**
P6	0.29	0.35	0.35	0.20	0.12	0.21	0.20	0.15	0.07	0.25	0.19	0.20	0.29	0.22	0.16	0.32	**0.23**	**0.20**
P7	0.18	0.25	0.21	0.23	0.19	0.16	0.14	0.12	0.07	0.26	0.28	0.17	0.21	0.19	0.12	0.14	**0.21**	**0.20**
P8	0.19	0.19	0.18	0.09	0.15	0.05	0.08	0.12	0.07	0.04	0.04	0.07	0.03	0.04	0.01	0.21	**0.12**	**0.08**
P9	0.11	0.20	0.21	0.15	0.08	0.08	0.06	0.12	0.07	0.15	0.18	0.09	0.19	0.04	0.15	0.06	**0.14**	**0.12**
P10	0.11	0.23	0.14	0.03	0.13	0.04	0.07	0.09	0.02	0.15	0.08	0.06	0.07	0.14	0.20	0.08	**0.10**	**0.09**
P11	0.05	0.14	0.04	0.09	0.14	0.17	0.18	0.10	0.16	0.12	0.25	0.19	0.03	0.09	0.22	0.06	**0.12**	**0.15**
P12	0.08	0.15	0.03	0.12	0.07	0.09	0.14	0.09	0.12	0.05	0.27	0.13	0.02	0.03	0.11	0.07	**0.10**	**0.12**
P13	0.03	0.12	0.25	0.22	0.17	0.20	0.20	0.12	0.18	0.25	0.24	0.41	0.25	0.26	0.28	0.06	**0.19**	**0.23**
P14	0.01	0.09	0.19	0.21	0.06	0.04	0.10	0.12	0.03	0.16	0.05	0.06	0.02	0.03	0.07	0.02	**0.11**	**0.08**
P15	0.03	0.08	0.09	0.07	0.07	0.09	0.08	0.10	0.11	0.18	0.21	0.06	0.07	0.04	0.08	0.02	**0.09**	**0.11**
P16	0.03	0.08	0.09	0.08	0.01	0.04	0.08	0.10	0.08	0.06	0.13	0.15	0.15	0.14	0.30	0.15	**0.07**	**0.09**
P17	0.03	0.12	0.10	0.04	0.02	0.09	0.15	0.09	0.08	0.23	0.01	0.02	0.01	0.03	0.02	0.01	**0.07**	**0.07**

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
P18	0.07	0.10	0.12	0.04	0.03	0.03	0.17	0.32	0.32	0.28	0.14	0.14	0.05	0.08	0.22	0.02	**0.10**	**0.15**
P19	0.01	0.06	0.06	0.10	0.08	0.19	0.27	0.38	0.54	0.39	0.03	0.09	0.04	0.06	0.10	0.06	**0.12**	**0.18**
P20	0.09	0.06	0.09	0.07	0.11	0.20	0.32	0.43	0.50	0.37	0.04	0.08	0.01	0.19	0.05	0.19	**0.13**	**0.19**
P21	0.02	0.06	0.09	0.07	0.11	0.20	0.40	0.52	0.54	0.44	0.12	0.01	0.05	0.03	0.03	0.04	**0.13**	**0.21**
P22	0.08	0.04	0.06	0.06	0.10	0.21	0.36	0.50	0.53	0.48	0.15	0.06	0.06	0.14	0.08	0.21	**0.14**	**0.23**
P23	0.12	0.04	0.04	0.01	0.11	0.19	0.30	0.51	0.48	0.41	0.21	0.28	0.10	0.38	0.25	0.29	**0.14**	**0.25**
P24	0.12	0.05	0.01	0.03	0.04	0.19	0.14	0.28	0.43	0.39	0.30	0.13	0.02	0.30	0.10	0.24	**0.11**	**0.21**
P25	0.09	0.03	0.01	0.03	0.04	0.03	0.12	0.06	0.38	0.33	0.45	0.14	0.13	0.16	0.16	0.15	**0.09**	**0.20**
P26	0.02	0.03	0.02	0.04	0.04	0.07	0.04	0.19	0.36	0.42	0.47	0.03	0.08	0.15	0.12	0.13	**0.09**	**0.20**
P27	0.03	0.04	0.04	0.05	0.04	0.02	0.03	0.04	0.29	0.38	0.41	0.10	0.18	0.08	0.14	0.14	**0.09**	**0.18**
P28	0.04	0.01	0.06	0.12	0.02	0.05	0.13	0.20	0.06	0.29	0.31	0.06	0.07	0.14	0.12	0.09	**0.09**	**0.15**
P29	0.03	0.03	0.01	0.01	0.01	0.01	0.03	0.03	0.17	0.43	0.33	0.09	0.08	0.10	0.17	0.05	**0.06**	**0.15**
P30	0.03	0.05	0.11	0.11	0.05	0.11	0.16	0.12	0.15	0.22	0.07	0.09	0.03	0.04	0.06	0.09	**0.09**	**0.11**
P31	0.02	0.15	0.05	0.03	0.03	0.04	0.05	0.07	0.05	0.27	0.15	0.17	0.07	0.03	0.10	0.07	**0.07**	**0.11**
P32	0.03	0.16	0.10	0.02	0.01	0.09	0.05	0.10	0.06	0.18	0.13	0.08	0.06	0.10	0.14	0.09	**0.07**	**0.09**
P33	0.02	0.03	0.03	0.01	0.03	0.03	0.04	0.06	0.05	0.14	0.20	0.19	0.11	0.14	0.15	0.08	**0.05**	**0.10**
P34	0.02	0.10	0.05	0.04	0.06	0.05	0.11	0.03	0.07	0.13	0.20	0.21	0.14	0.19	0.08	0.09	**0.08**	**0.12**
P35	0.01	0.08	0.25	0.25	0.18	0.20	0.25	0.08	0.12	0.24	0.25	0.42	0.24	0.18	0.34	0.08	**0.19**	**0.22**
P36	0.04	0.01	0.02	0.07	0.04	0.05	0.04	0.04	0.03	0.13	0.08	0.21	0.10	0.13	0.24	0.13	**0.06**	**0.08**
P37	0.02	0.04	0.04	0.02	0.02	0.01	0.01	0.01	0.11	0.19	0.31	0.39	0.05	0.06	0.19	0.07	**0.06**	**0.14**
P38	0.05	0.05	0.05	0.07	0.18	0.02	0.02	0.08	0.04	0.03	0.11	0.22	0.11	0.03	0.16	0.09	**0.08**	**0.09**
P39	0.03	0.13	0.10	0.11	0.07	0.02	0.05	0.09	0.02	0.10	0.06	0.18	0.05	0.10	0.08	0.15	**0.09**	**0.08**
P40	0.05	0.02	0.05	0.13	0.02	0.03	0.06	0.07	0.01	0.12	0.07	0.21	0.18	0.17	0.07	0.19	**0.07**	**0.09**
P41	0.13	0.12	0.19	0.26	0.21	0.25	0.32	0.17	0.09	0.17	0.18	0.11	0.14	0.08	0.19	0.17	**0.19**	**0.18**

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
P42	0.29	0.38	0.17	0.05	0.05	0.05	0.08	0.05	0.14	0.15	0.22	0.23	0.05	0.16	0.25	0.30	**0.15**	**0.14**
P43	0.23	0.24	0.13	0.04	0.04	0.05	0.03	0.06	0.12	0.29	0.32	0.28	0.15	0.19	0.23	0.29	**0.14**	**0.18**
P44	0.26	0.34	0.27	0.04	0.01	0.03	0.16	0.08	0.14	0.39	0.39	0.31	0.15	0.18	0.30	0.22	**0.18**	**0.22**
P45	0.33	0.33	0.39	0.27	0.04	0.04	0.08	0.10	0.11	0.34	0.23	0.21	0.09	0.17	0.39	0.23	**0.23**	**0.19**
P46	0.56	0.31	0.31	0.21	0.09	0.08	0.13	0.12	0.09	0.21	0.17	0.11	0.14	0.23	0.49	0.42	**0.23**	**0.17**

E1.2 Overall Test Points

Table E 2 VR Value for the Overall Test Points of Scheme A

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
O1	0.06	0.35	0.41	0.39	0.14	0.06	0.03	0.01	0.06	0.22	0.29	0.28	0.21	0.18	0.27	0.06	**0.25**	**0.19**
O2	0.01	0.19	0.22	0.18	0.07	0.03	0.03	0.03	0.10	0.26	0.30	0.38	0.24	0.02	0.12	0.02	**0.15**	**0.18**
O3	0.29	0.49	0.47	0.28	0.12	0.15	0.02	0.07	0.16	0.16	0.49	0.59	0.40	0.30	0.12	0.21	**0.30**	**0.29**
O4	0.27	0.48	0.43	0.36	0.12	0.13	0.06	0.02	0.12	0.18	0.13	0.13	0.37	0.30	0.11	0.24	**0.27**	**0.18**
O5	0.23	0.53	0.24	0.22	0.07	0.09	0.06	0.01	0.15	0.30	0.23	0.15	0.26	0.26	0.20	0.25	**0.22**	**0.18**
O6	0.30	0.50	0.45	0.28	0.10	0.03	0.05	0.04	0.01	0.08	0.17	0.24	0.22	0.14	0.27	0.23	**0.25**	**0.15**
O7	0.32	0.56	0.34	0.32	0.14	0.10	0.05	0.06	0.04	0.15	0.20	0.17	0.04	0.11	0.31	0.29	**0.26**	**0.16**
O8	0.38	0.44	0.50	0.37	0.16	0.04	0.10	0.07	0.01	0.18	0.18	0.20	0.19	0.17	0.32	0.28	**0.29**	**0.18**
O9	0.45	0.48	0.56	0.33	0.13	0.06	0.07	0.07	0.01	0.08	0.18	0.31	0.31	0.15	0.43	0.31	**0.29**	**0.19**
O10	0.42	0.47	0.49	0.25	0.07	0.11	0.04	0.06	0.14	0.25	0.10	0.40	0.26	0.11	0.46	0.34	**0.27**	**0.19**

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
O11	0.35	0.38	0.48	0.30	0.09	0.16	0.06	0.06	0.11	0.18	0.23	0.27	0.23	0.25	0.37	0.25	**0.26**	**0.20**
O12	0.32	0.50	0.42	0.28	0.19	0.14	0.06	0.06	0.17	0.25	0.40	0.57	0.41	0.47	0.38	0.27	**0.31**	**0.29**
O13	0.41	0.48	0.51	0.33	0.18	0.05	0.05	0.04	0.06	0.13	0.19	0.28	0.26	0.35	0.11	0.30	**0.29**	**0.19**
O14	0.39	0.48	0.52	0.28	0.13	0.04	0.04	0.05	0.02	0.01	0.20	0.31	0.16	0.21	0.38	0.27	**0.27**	**0.16**
O15	0.25	0.36	0.08	0.12	0.15	0.05	0.22	0.03	0.08	0.08	0.21	0.27	0.17	0.14	0.34	0.27	**0.17**	**0.15**
O16	0.42	0.47	0.05	0.18	0.09	0.16	0.08	0.09	0.11	0.17	0.13	0.29	0.14	0.13	0.45	0.39	**0.20**	**0.16**
O17	0.28	0.34	0.32	0.31	0.24	0.23	0.06	0.10	0.05	0.19	0.14	0.16	0.18	0.21	0.43	0.27	**0.25**	**0.18**
O18	0.11	0.42	0.32	0.36	0.18	0.20	0.14	0.08	0.15	0.10	0.13	0.31	0.38	0.09	0.36	0.07	**0.25**	**0.19**
O19	0.13	0.42	0.33	0.33	0.11	0.08	0.10	0.04	0.12	0.06	0.20	0.24	0.33	0.03	0.42	0.05	**0.23**	**0.17**
O20	0.19	0.30	0.39	0.35	0.25	0.15	0.22	0.20	0.02	0.17	0.11	0.04	0.06	0.14	0.29	0.12	**0.25**	**0.16**
O21	0.08	0.20	0.31	0.26	0.13	0.06	0.20	0.13	0.16	0.15	0.14	0.07	0.03	0.18	0.09	0.25	**0.18**	**0.14**
O22	0.09	0.28	0.42	0.39	0.28	0.07	0.15	0.17	0.15	0.17	0.20	0.13	0.04	0.04	0.06	0.07	**0.26**	**0.18**
O23	0.42	0.22	0.09	0.19	0.14	0.13	0.09	0.05	0.05	0.04	0.05	0.08	0.16	0.14	0.36	0.39	**0.16**	**0.10**
O24	0.27	0.16	0.13	0.11	0.11	0.09	0.14	0.06	0.17	0.04	0.09	0.08	0.15	0.12	0.40	0.34	**0.13**	**0.11**
O25	0.32	0.08	0.22	0.02	0.10	0.09	0.14	0.09	0.19	0.02	0.10	0.04	0.12	0.13	0.20	0.34	**0.12**	**0.10**
O26	0.42	0.55	0.12	0.16	0.06	0.08	0.04	0.01	0.02	0.15	0.24	0.39	0.41	0.30	0.33	0.31	**0.21**	**0.18**
O27	0.46	0.49	0.13	0.20	0.08	0.23	0.02	0.03	0.06	0.17	0.22	0.34	0.35	0.31	0.49	0.40	**0.23**	**0.20**
O28	0.45	0.17	0.17	0.23	0.22	0.21	0.15	0.12	0.07	0.09	0.08	0.14	0.09	0.31	0.63	0.56	**0.21**	**0.15**
O29	0.27	0.03	0.21	0.06	0.07	0.17	0.15	0.06	0.18	0.05	0.20	0.14	0.17	0.26	0.46	0.39	**0.13**	**0.14**
O30	0.43	0.30	0.07	0.09	0.12	0.12	0.07	0.07	0.06	0.06	0.16	0.18	0.36	0.25	0.49	0.40	**0.16**	**0.14**
O31	0.38	0.33	0.15	0.32	0.16	0.14	0.14	0.03	0.07	0.09	0.15	0.23	0.30	0.19	0.40	0.33	**0.22**	**0.17**
O32	0.06	0.05	0.13	0.02	0.05	0.03	0.05	0.05	0.04	0.18	0.08	0.12	0.07	0.09	0.10	0.09	**0.07**	**0.08**
O33	0.14	0.19	0.19	0.05	0.07	0.10	0.05	0.10	0.15	0.24	0.27	0.18	0.02	0.20	0.10	0.12	**0.13**	**0.15**
O34	0.25	0.34	0.20	0.13	0.08	0.04	0.02	0.04	0.02	0.08	0.11	0.19	0.08	0.19	0.19	0.17	**0.15**	**0.10**

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
O35	0.23	0.38	0.26	0.13	0.07	0.03	0.02	0.05	0.10	0.25	0.35	0.29	0.05	0.09	0.13	0.09	**0.19**	**0.18**
O36	0.05	0.32	0.28	0.21	0.14	0.05	0.04	0.05	0.11	0.10	0.24	0.20	0.13	0.03	0.08	0.10	**0.18**	**0.14**
O37	0.12	0.37	0.30	0.26	0.18	0.06	0.05	0.10	0.14	0.20	0.10	0.23	0.28	0.26	0.25	0.19	**0.22**	**0.17**
O38	0.15	0.06	0.17	0.11	0.06	0.11	0.14	0.10	0.11	0.20	0.23	0.28	0.16	0.17	0.12	0.15	**0.13**	**0.16**
O39	0.08	0.09	0.05	0.06	0.01	0.10	0.10	0.10	0.12	0.20	0.27	0.12	0.13	0.13	0.09	0.12	**0.09**	**0.13**
O40	0.22	0.28	0.28	0.06	0.04	0.10	0.20	0.12	0.04	0.12	0.12	0.19	0.09	0.07	0.09	0.19	**0.14**	**0.12**
O41	0.10	0.20	0.07	0.19	0.04	0.05	0.12	0.05	0.03	0.11	0.12	0.13	0.10	0.09	0.07	0.04	**0.11**	**0.10**
O42	0.15	0.15	0.28	0.16	0.08	0.18	0.20	0.05	0.10	0.13	0.18	0.18	0.06	0.09	0.12	0.12	**0.16**	**0.14**
O43	0.01	0.11	0.08	0.10	0.02	0.18	0.29	0.03	0.14	0.14	0.19	0.23	0.08	0.07	0.07	0.14	**0.10**	**0.14**
O44	0.21	0.32	0.48	0.36	0.15	0.03	0.12	0.07	0.09	0.18	0.14	0.13	0.12	0.10	0.27	0.12	**0.25**	**0.16**
O45	0.31	0.38	0.55	0.47	0.16	0.06	0.04	0.05	0.08	0.13	0.24	0.04	0.06	0.06	0.21	0.15	**0.29**	**0.16**
O46	0.23	0.30	0.45	0.26	0.13	0.05	0.31	0.26	0.11	0.21	0.29	0.32	0.09	0.10	0.21	0.19	**0.25**	**0.22**
O47	0.11	0.14	0.15	0.15	0.05	0.16	0.37	0.25	0.10	0.03	0.06	0.26	0.05	0.02	0.19	0.20	**0.13**	**0.13**
O48	0.05	0.11	0.04	0.07	0.03	0.04	0.09	0.06	0.04	0.04	0.12	0.23	0.05	0.03	0.11	0.13	**0.07**	**0.08**
O49	0.20	0.25	0.43	0.33	0.16	0.09	0.08	0.03	0.07	0.13	0.17	0.36	0.10	0.11	0.33	0.37	**0.24**	**0.18**
O50	0.25	0.35	0.21	0.36	0.14	0.14	0.15	0.10	0.06	0.10	0.18	0.38	0.11	0.06	0.27	0.25	**0.23**	**0.18**
O51	0.03	0.04	0.02	0.10	0.09	0.17	0.10	0.03	0.19	0.25	0.27	0.17	0.14	0.08	0.14	0.02	**0.10**	**0.16**
O52	0.04	0.10	0.03	0.14	0.14	0.19	0.08	0.09	0.21	0.26	0.34	0.19	0.11	0.11	0.18	0.05	**0.13**	**0.19**
O53	0.14	0.21	0.23	0.16	0.17	0.15	0.10	0.07	0.16	0.10	0.30	0.16	0.19	0.20	0.15	0.09	**0.17**	**0.17**
O54	0.20	0.20	0.12	0.12	0.20	0.14	0.19	0.08	0.14	0.25	0.33	0.29	0.06	0.06	0.12	0.29	**0.17**	**0.20**
O55	0.16	0.25	0.13	0.07	0.18	0.17	0.40	0.20	0.18	0.26	0.36	0.38	0.12	0.08	0.19	0.24	**0.18**	**0.24**
O56	0.11	0.17	0.07	0.23	0.14	0.22	0.55	0.27	0.01	0.20	0.29	0.34	0.03	0.04	0.18	0.06	**0.18**	**0.22**
O57	0.07	0.08	0.22	0.11	0.11	0.16	0.51	0.16	0.09	0.14	0.17	0.36	0.08	0.10	0.07	0.16	**0.14**	**0.18**
O58	0.05	0.05	0.08	0.07	0.06	0.08	0.11	0.01	0.12	0.14	0.19	0.05	0.12	0.07	0.27	0.04	**0.08**	**0.10**

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
O59	0.03	0.02	0.10	0.10	0.08	0.06	0.13	0.06	0.12	0.21	0.28	0.14	0.13	0.07	0.38	0.02	**0.10**	**0.14**
O60	0.04	0.04	0.10	0.09	0.06	0.06	0.05	0.09	0.07	0.28	0.25	0.30	0.22	0.08	0.11	0.02	**0.10**	**0.16**
O61	0.08	0.06	0.13	0.06	0.14	0.12	0.18	0.06	0.06	0.10	0.13	0.22	0.20	0.17	0.16	0.17	**0.10**	**0.13**
O62	0.06	0.01	0.17	0.15	0.17	0.14	0.16	0.03	0.11	0.32	0.23	0.26	0.11	0.10	0.05	0.19	**0.14**	**0.18**
O63	0.09	0.11	0.20	0.17	0.10	0.09	0.24	0.09	0.10	0.24	0.21	0.22	0.13	0.08	0.17	0.08	**0.15**	**0.17**
O64	0.11	0.23	0.16	0.14	0.09	0.13	0.17	0.04	0.13	0.19	0.11	0.37	0.05	0.05	0.17	0.04	**0.15**	**0.15**
O65	0.04	0.09	0.11	0.16	0.12	0.12	0.13	0.12	0.05	0.21	0.14	0.10	0.14	0.22	0.12	0.02	**0.12**	**0.13**
O66	0.11	0.19	0.09	0.12	0.04	0.10	0.09	0.06	0.18	0.28	0.31	0.46	0.13	0.07	0.20	0.08	**0.14**	**0.20**
O67	0.04	0.21	0.14	0.07	0.11	0.08	0.17	0.08	0.11	0.08	0.14	0.05	0.10	0.18	0.20	0.07	**0.11**	**0.11**
O68	0.02	0.06	0.08	0.01	0.08	0.08	0.15	0.08	0.05	0.03	0.12	0.04	0.02	0.03	0.01	0.05	**0.06**	**0.07**
O69	0.04	0.18	0.03	0.15	0.09	0.08	0.04	0.06	0.02	0.14	0.19	0.10	0.10	0.07	0.02	0.02	**0.10**	**0.10**
O70	0.07	0.21	0.18	0.28	0.24	0.16	0.18	0.13	0.09	0.12	0.19	0.18	0.20	0.20	0.20	0.21	**0.20**	**0.17**
O71	0.09	0.02	0.14	0.13	0.09	0.08	0.09	0.08	0.13	0.15	0.25	0.27	0.22	0.18	0.12	0.20	**0.12**	**0.16**
O72	0.09	0.03	0.22	0.30	0.10	0.06	0.11	0.07	0.07	0.17	0.08	0.28	0.18	0.15	0.06	0.16	**0.15**	**0.14**
O73	0.13	0.25	0.15	0.23	0.09	0.06	0.09	0.05	0.07	0.16	0.09	0.25	0.16	0.13	0.07	0.11	**0.15**	**0.13**
O74	0.11	0.11	0.13	0.21	0.12	0.11	0.14	0.17	0.09	0.10	0.18	0.40	0.22	0.10	0.34	0.08	**0.15**	**0.17**
O75	0.12	0.07	0.07	0.25	0.11	0.09	0.15	0.12	0.08	0.18	0.14	0.39	0.22	0.11	0.33	0.17	**0.15**	**0.17**
O76	0.10	0.09	0.05	0.27	0.14	0.14	0.15	0.17	0.10	0.26	0.16	0.37	0.21	0.18	0.31	0.17	**0.16**	**0.19**
O77	0.09	0.19	0.12	0.22	0.14	0.17	0.12	0.15	0.16	0.33	0.23	0.45	0.26	0.21	0.18	0.12	**0.18**	**0.23**
O78	0.02	0.12	0.24	0.24	0.16	0.17	0.21	0.07	0.07	0.15	0.38	0.43	0.17	0.16	0.18	0.27	**0.19**	**0.22**
O79	0.02	0.12	0.25	0.22	0.14	0.15	0.24	0.05	0.08	0.21	0.45	0.41	0.16	0.19	0.27	0.22	**0.19**	**0.24**
O80	0.02	0.13	0.28	0.25	0.20	0.24	0.23	0.03	0.04	0.18	0.45	0.40	0.19	0.21	0.29	0.09	**0.21**	**0.24**
O81	0.02	0.19	0.34	0.35	0.24	0.28	0.25	0.10	0.07	0.19	0.44	0.41	0.22	0.21	0.32	0.06	**0.26**	**0.27**
O82	0.04	0.01	0.03	0.04	0.03	0.02	0.04	0.10	0.01	0.11	0.04	0.07	0.07	0.08	0.10	0.03	**0.04**	**0.05**

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
O83	0.06	0.02	0.03	0.03	0.02	0.02	0.05	0.08	0.05	0.09	0.02	0.04	0.06	0.09	0.13	0.06	**0.04**	**0.05**
O84	0.01	0.01	0.01	0.06	0.01	0.04	0.07	0.10	0.04	0.09	0.17	0.13	0.07	0.08	0.14	0.05	**0.05**	**0.08**
O85	0.01	0.05	0.09	0.11	0.01	0.07	0.06	0.08	0.06	0.16	0.09	0.14	0.16	0.14	0.15	0.07	**0.08**	**0.09**
O86	0.08	0.07	0.12	0.15	0.07	0.12	0.12	0.32	0.03	0.21	0.07	0.16	0.20	0.21	0.15	0.07	**0.11**	**0.13**
O87	0.08	0.05	0.10	0.15	0.09	0.03	0.03	0.36	0.04	0.05	0.27	0.22	0.06	0.08	0.28	0.09	**0.11**	**0.14**
O88	0.07	0.03	0.09	0.08	0.09	0.12	0.07	0.29	0.01	0.07	0.20	0.27	0.17	0.21	0.30	0.14	**0.10**	**0.14**
O89	0.07	0.04	0.02	0.01	0.06	0.07	0.15	0.14	0.08	0.19	0.17	0.19	0.16	0.21	0.31	0.17	**0.07**	**0.13**
O90	0.01	0.02	0.02	0.04	0.03	0.05	0.07	0.13	0.19	0.08	0.31	0.07	0.11	0.05	0.19	0.07	**0.06**	**0.12**
O91	0.01	0.03	0.09	0.11	0.15	0.14	0.19	0.30	0.23	0.03	0.35	0.19	0.20	0.20	0.20	0.10	**0.13**	**0.19**
O92	0.06	0.08	0.09	0.02	0.03	0.05	0.09	0.12	0.15	0.03	0.25	0.11	0.09	0.03	0.14	0.13	**0.07**	**0.11**
O93	0.02	0.03	0.03	0.02	0.01	0.03	0.02	0.03	0.09	0.27	0.18	0.17	0.09	0.15	0.08	0.14	**0.05**	**0.11**
O94	0.02	0.12	0.06	0.01	0.08	0.04	0.13	0.10	0.08	0.32	0.09	0.11	0.09	0.03	0.03	0.01	**0.07**	**0.11**
O95	0.03	0.09	0.01	0.02	0.02	0.07	0.11	0.03	0.08	0.23	0.15	0.09	0.06	0.05	0.08	0.06	**0.06**	**0.10**
O96	0.04	0.11	0.09	0.03	0.04	0.02	0.06	0.07	0.07	0.17	0.16	0.13	0.06	0.07	0.08	0.05	**0.07**	**0.09**
O97	0.04	0.17	0.22	0.11	0.08	0.08	0.11	0.04	0.03	0.23	0.15	0.10	0.07	0.13	0.16	0.08	**0.12**	**0.12**
O98	0.06	0.12	0.03	0.06	0.01	0.05	0.09	0.10	0.04	0.01	0.03	0.06	0.02	0.08	0.17	0.07	**0.05**	**0.05**
O99	0.04	0.11	0.11	0.11	0.09	0.13	0.24	0.10	0.09	0.32	0.14	0.13	0.08	0.07	0.10	0.12	**0.12**	**0.14**
O100	0.04	0.19	0.21	0.06	0.06	0.11	0.12	0.09	0.01	0.11	0.12	0.13	0.10	0.10	0.07	0.08	**0.11**	**0.10**
O101	0.02	0.08	0.10	0.13	0.08	0.05	0.13	0.06	0.08	0.27	0.12	0.13	0.10	0.08	0.07	0.11	**0.10**	**0.12**
O102	0.05	0.11	0.07	0.17	0.14	0.16	0.38	0.11	0.04	0.27	0.12	0.10	0.03	0.10	0.08	0.10	**0.13**	**0.15**
O103	0.03	0.06	0.09	0.05	0.02	0.04	0.04	0.03	0.05	0.14	0.04	0.13	0.08	0.09	0.03	0.08	**0.06**	**0.07**
O104	0.09	0.12	0.14	0.20	0.17	0.20	0.48	0.14	0.07	0.27	0.20	0.23	0.16	0.15	0.11	0.10	**0.17**	**0.20**
O105	0.08	0.22	0.29	0.23	0.19	0.18	0.27	0.20	0.07	0.15	0.16	0.21	0.16	0.17	0.14	0.13	**0.20**	**0.18**
O106	0.08	0.08	0.03	0.04	0.05	0.10	0.15	0.23	0.28	0.31	0.24	0.26	0.27	0.05	0.06	0.14	**0.10**	**0.19**

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
O107	0.08	0.13	0.07	0.11	0.07	0.13	0.25	0.35	0.37	0.34	0.43	0.23	0.20	0.05	0.28	0.11	**0.15**	**0.25**
O108	0.12	0.15	0.10	0.12	0.05	0.11	0.08	0.16	0.42	0.05	0.32	0.14	0.18	0.31	0.41	0.19	**0.13**	**0.18**
O109	0.11	0.13	0.08	0.10	0.03	0.07	0.10	0.18	0.40	0.09	0.28	0.13	0.01	0.29	0.45	0.10	**0.11**	**0.16**
O110	0.05	0.02	0.10	0.18	0.08	0.16	0.18	0.17	0.21	0.24	0.09	0.20	0.08	0.13	0.15	0.08	**0.12**	**0.15**
O111	0.08	0.08	0.08	0.15	0.08	0.16	0.28	0.25	0.25	0.28	0.17	0.24	0.07	0.20	0.33	0.14	**0.13**	**0.19**
O112	0.12	0.11	0.14	0.22	0.11	0.18	0.32	0.18	0.25	0.26	0.19	0.15	0.10	0.22	0.34	0.12	**0.17**	**0.19**
O113	0.16	0.02	0.06	0.24	0.17	0.20	0.37	0.25	0.17	0.23	0.19	0.22	0.10	0.20	0.27	0.07	**0.16**	**0.20**
O114	0.12	0.09	0.03	0.04	0.08	0.20	0.29	0.23	0.11	0.10	0.27	0.10	0.23	0.22	0.18	0.20	**0.11**	**0.16**
O115	0.08	0.12	0.07	0.01	0.07	0.15	0.29	0.37	0.27	0.20	0.31	0.01	0.17	0.17	0.32	0.11	**0.12**	**0.19**
O116	0.09	0.07	0.06	0.07	0.06	0.14	0.23	0.44	0.13	0.30	0.27	0.34	0.11	0.21	0.19	0.19	**0.12**	**0.21**
O117	0.12	0.16	0.13	0.08	0.08	0.11	0.07	0.12	0.07	0.20	0.23	0.28	0.04	0.23	0.20	0.26	**0.13**	**0.16**
O118	0.09	0.19	0.16	0.09	0.07	0.10	0.17	0.05	0.03	0.10	0.07	0.03	0.06	0.13	0.12	0.10	**0.11**	**0.08**
O119	0.12	0.17	0.13	0.05	0.06	0.13	0.27	0.40	0.06	0.29	0.20	0.15	0.10	0.17	0.09	0.13	**0.13**	**0.18**
O120	0.12	0.18	0.17	0.10	0.08	0.16	0.23	0.34	0.11	0.27	0.39	0.39	0.11	0.23	0.26	0.21	**0.17**	**0.24**
O121	0.12	0.17	0.11	0.06	0.05	0.15	0.28	0.48	0.30	0.33	0.29	0.33	0.09	0.23	0.16	0.22	**0.15**	**0.24**
O122	0.11	0.15	0.13	0.11	0.03	0.16	0.42	0.33	0.30	0.03	0.11	0.44	0.10	0.18	0.27	0.16	**0.14**	**0.18**
O123	0.08	0.20	0.18	0.14	0.07	0.09	0.14	0.13	0.12	0.19	0.19	0.42	0.14	0.16	0.20	0.15	**0.15**	**0.17**
O124	0.14	0.11	0.14	0.06	0.08	0.17	0.32	0.41	0.11	0.13	0.24	0.47	0.13	0.27	0.24	0.27	**0.15**	**0.21**
O125	0.17	0.12	0.13	0.08	0.08	0.13	0.18	0.39	0.31	0.29	0.28	0.49	0.21	0.37	0.28	0.34	**0.16**	**0.25**
O126	0.01	0.08	0.14	0.06	0.12	0.17	0.28	0.50	0.46	0.41	0.31	0.04	0.09	0.13	0.24	0.11	**0.15**	**0.24**
O127	0.02	0.08	0.03	0.02	0.12	0.11	0.14	0.37	0.30	0.28	0.43	0.26	0.19	0.11	0.23	0.21	**0.12**	**0.23**
O128	0.02	0.06	0.08	0.05	0.17	0.16	0.18	0.23	0.20	0.21	0.44	0.31	0.22	0.29	0.09	0.07	**0.13**	**0.23**
O129	0.08	0.10	0.12	0.06	0.27	0.21	0.28	0.11	0.06	0.15	0.40	0.36	0.25	0.29	0.33	0.10	**0.16**	**0.23**
O130	0.09	0.08	0.05	0.05	0.27	0.29	0.41	0.22	0.26	0.07	0.32	0.16	0.20	0.28	0.25	0.24	**0.15**	**0.22**

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
O131	0.07	0.10	0.09	0.03	0.26	0.29	0.40	0.30	0.17	0.20	0.39	0.39	0.14	0.13	0.12	0.06	**0.17**	**0.26**
O132	0.10	0.20	0.13	0.20	0.01	0.14	0.24	0.19	0.21	0.28	0.14	0.11	0.09	0.28	0.49	0.17	**0.15**	**0.17**
O133	0.13	0.23	0.18	0.22	0.09	0.30	0.58	0.51	0.46	0.33	0.31	0.33	0.10	0.30	0.47	0.30	**0.24**	**0.31**
O134	0.03	0.06	0.02	0.10	0.32	0.20	0.27	0.10	0.09	0.16	0.23	0.21	0.22	0.25	0.27	0.13	**0.14**	**0.18**
O135	0.02	0.02	0.11	0.06	0.31	0.18	0.18	0.41	0.31	0.22	0.16	0.18	0.20	0.27	0.15	0.01	**0.15**	**0.20**
O136	0.02	0.02	0.05	0.05	0.32	0.13	0.36	0.24	0.15	0.15	0.13	0.20	0.18	0.07	0.04	0.03	**0.12**	**0.17**
O137	0.06	0.08	0.05	0.02	0.34	0.18	0.41	0.09	0.14	0.17	0.20	0.29	0.17	0.06	0.03	0.05	**0.14**	**0.19**
O138	0.06	0.10	0.03	0.11	0.36	0.25	0.46	0.22	0.03	0.07	0.06	0.21	0.11	0.12	0.04	0.06	**0.15**	**0.16**
O139	0.06	0.01	0.07	0.12	0.02	0.02	0.11	0.17	0.14	0.24	0.17	0.10	0.08	0.11	0.19	0.11	**0.08**	**0.12**
O140	0.02	0.01	0.03	0.03	0.03	0.02	0.23	0.24	0.16	0.06	0.12	0.09	0.06	0.02	0.05	0.02	**0.05**	**0.09**
O141	0.03	0.01	0.02	0.02	0.07	0.08	0.27	0.20	0.15	0.07	0.05	0.02	0.10	0.04	0.07	0.03	**0.05**	**0.08**
O142	0.05	0.02	0.01	0.06	0.01	0.05	0.42	0.21	0.17	0.22	0.38	0.28	0.09	0.28	0.06	0.07	**0.09**	**0.20**
O143	0.01	0.05	0.01	0.12	0.19	0.06	0.36	0.24	0.21	0.25	0.36	0.20	0.13	0.26	0.07	0.01	**0.13**	**0.21**
O144	0.01	0.02	0.01	0.04	0.06	0.12	0.23	0.17	0.27	0.08	0.14	0.11	0.09	0.10	0.05	0.03	**0.07**	**0.12**
O145	0.06	0.07	0.07	0.11	0.02	0.02	0.27	0.34	0.34	0.31	0.05	0.24	0.04	0.09	0.28	0.08	**0.10**	**0.16**
O146	0.02	0.02	0.06	0.16	0.09	0.16	0.33	0.36	0.27	0.23	0.08	0.11	0.07	0.19	0.24	0.06	**0.12**	**0.16**
O147	0.03	0.07	0.08	0.15	0.12	0.11	0.39	0.33	0.29	0.32	0.11	0.09	0.11	0.15	0.16	0.05	**0.13**	**0.18**
O148	0.05	0.07	0.06	0.08	0.22	0.15	0.27	0.09	0.16	0.29	0.43	0.21	0.02	0.11	0.10	0.06	**0.14**	**0.21**
O149	0.07	0.09	0.05	0.12	0.08	0.12	0.18	0.21	0.16	0.23	0.16	0.08	0.06	0.14	0.03	0.02	**0.11**	**0.14**
O150	0.03	0.04	0.07	0.08	0.07	0.13	0.04	0.01	0.19	0.30	0.10	0.17	0.10	0.04	0.05	0.04	**0.08**	**0.12**
O151	0.04	0.01	0.02	0.09	0.06	0.06	0.13	0.09	0.26	0.39	0.28	0.20	0.04	0.09	0.12	0.03	**0.09**	**0.17**
O152	0.06	0.14	0.07	0.09	0.04	0.05	0.27	0.05	0.32	0.36	0.21	0.26	0.06	0.09	0.15	0.07	**0.12**	**0.18**
O153	0.06	0.19	0.03	0.03	0.22	0.02	0.22	0.27	0.07	0.24	0.14	0.15	0.06	0.05	0.15	0.07	**0.12**	**0.14**
O154	0.03	0.12	0.21	0.33	0.17	0.14	0.04	0.13	0.35	0.29	0.14	0.26	0.10	0.08	0.12	0.07	**0.19**	**0.19**

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
O155	0.06	0.07	0.18	0.19	0.10	0.23	0.46	0.31	0.17	0.18	0.06	0.09	0.09	0.05	0.26	0.15	**0.15**	**0.16**
O156	0.03	0.08	0.10	0.10	0.13	0.21	0.08	0.24	0.23	0.29	0.12	0.06	0.05	0.01	0.05	0.02	**0.11**	**0.14**
O157	0.03	0.07	0.23	0.24	0.33	0.24	0.29	0.32	0.29	0.46	0.36	0.29	0.13	0.12	0.13	0.05	**0.23**	**0.29**
O158	0.09	0.13	0.18	0.03	0.16	0.13	0.24	0.19	0.13	0.08	0.29	0.37	0.14	0.25	0.35	0.25	**0.14**	**0.19**
O159	0.03	0.04	0.07	0.08	0.20	0.21	0.33	0.23	0.06	0.18	0.08	0.09	0.02	0.26	0.26	0.10	**0.11**	**0.14**
O160	0.06	0.03	0.09	0.02	0.02	0.17	0.22	0.34	0.20	0.28	0.14	0.18	0.09	0.14	0.08	0.02	**0.09**	**0.16**

E2 Scheme B

E2.1 Perimeter Test Points

Table E 3 VR Value for the Perimeter Test Points of Scheme B

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
P1	0.61	0.54	0.27	0.27	0.09	0.05	0.11	0.18	0.12	0.28	0.24	0.13	0.17	0.22	0.46	0.43	**0.27**	**0.20**
P2	0.53	0.53	0.25	0.24	0.13	0.04	0.35	0.13	0.03	0.07	0.10	0.22	0.21	0.12	0.45	0.38	**0.25**	**0.16**
P3	0.45	0.47	0.26	0.29	0.11	0.03	0.07	0.15	0.02	0.10	0.15	0.17	0.08	0.05	0.31	0.32	**0.23**	**0.14**
P4	0.31	0.35	0.27	0.29	0.13	0.04	0.20	0.14	0.05	0.08	0.16	0.09	0.05	0.13	0.20	0.20	**0.21**	**0.14**
P5	0.23	0.27	0.30	0.26	0.14	0.07	0.08	0.12	0.04	0.17	0.23	0.15	0.07	0.10	0.20	0.20	**0.20**	**0.16**
P6	0.30	0.36	0.36	0.20	0.12	0.23	0.24	0.17	0.07	0.25	0.21	0.19	0.31	0.23	0.15	0.32	**0.24**	**0.21**
P7	0.18	0.24	0.30	0.20	0.18	0.16	0.13	0.12	0.04	0.26	0.27	0.16	0.21	0.19	0.12	0.13	**0.21**	**0.19**
P8	0.25	0.28	0.24	0.10	0.16	0.05	0.09	0.15	0.09	0.04	0.05	0.07	0.03	0.04	0.09	0.21	**0.15**	**0.09**
P9	0.16	0.27	0.22	0.17	0.05	0.05	0.07	0.13	0.07	0.15	0.17	0.03	0.20	0.04	0.15	0.10	**0.15**	**0.12**
P10	0.16	0.24	0.15	0.10	0.13	0.09	0.03	0.10	0.04	0.14	0.10	0.07	0.06	0.15	0.20	0.08	**0.13**	**0.10**
P11	0.14	0.18	0.08	0.09	0.14	0.17	0.21	0.21	0.18	0.12	0.27	0.16	0.03	0.10	0.25	0.08	**0.14**	**0.17**
P12	0.16	0.24	0.08	0.12	0.06	0.09	0.14	0.16	0.09	0.04	0.19	0.08	0.04	0.03	0.14	0.13	**0.12**	**0.11**
P13	0.07	0.19	0.24	0.22	0.17	0.18	0.18	0.15	0.17	0.24	0.24	0.41	0.25	0.27	0.28	0.07	**0.20**	**0.22**
P14	0.10	0.20	0.21	0.22	0.06	0.05	0.10	0.10	0.02	0.08	0.07	0.05	0.02	0.04	0.05	0.09	**0.13**	**0.08**
P15	0.02	0.09	0.10	0.08	0.07	0.08	0.09	0.12	0.12	0.19	0.22	0.06	0.07	0.04	0.08	0.05	**0.09**	**0.12**
P16	0.03	0.13	0.09	0.10	0.01	0.05	0.07	0.11	0.14	0.05	0.11	0.15	0.15	0.13	0.28	0.14	**0.08**	**0.10**
P17	0.02	0.08	0.09	0.05	0.04	0.10	0.15	0.11	0.24	0.29	0.02	0.01	0.01	0.05	0.05	0.02	**0.08**	**0.10**
P18	0.02	0.11	0.11	0.06	0.02	0.07	0.17	0.31	0.32	0.27	0.13	0.14	0.05	0.10	0.22	0.04	**0.10**	**0.15**

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
P19	0.01	0.06	0.08	0.11	0.09	0.19	0.26	0.38	0.54	0.39	0.03	0.06	0.04	0.11	0.11	0.02	**0.12**	**0.18**
P20	0.09	0.05	0.10	0.07	0.11	0.20	0.32	0.44	0.50	0.37	0.04	0.07	0.02	0.21	0.05	0.17	**0.13**	**0.19**
P21	0.02	0.07	0.10	0.07	0.11	0.20	0.40	0.52	0.54	0.44	0.12	0.01	0.07	0.04	0.03	0.03	**0.14**	**0.22**
P22	0.06	0.08	0.05	0.06	0.10	0.21	0.37	0.50	0.54	0.48	0.15	0.06	0.06	0.13	0.08	0.20	**0.14**	**0.23**
P23	0.15	0.02	0.03	0.01	0.10	0.19	0.30	0.51	0.48	0.41	0.21	0.29	0.10	0.38	0.25	0.28	**0.14**	**0.25**
P24	0.13	0.04	0.01	0.02	0.04	0.19	0.14	0.28	0.43	0.39	0.30	0.13	0.02	0.30	0.11	0.24	**0.11**	**0.21**
P25	0.08	0.04	0.01	0.04	0.04	0.03	0.12	0.06	0.38	0.33	0.45	0.15	0.13	0.16	0.17	0.16	**0.10**	**0.20**
P26	0.07	0.03	0.03	0.03	0.04	0.07	0.04	0.19	0.36	0.42	0.47	0.05	0.08	0.14	0.13	0.14	**0.10**	**0.21**
P27	0.03	0.05	0.04	0.04	0.04	0.02	0.03	0.04	0.29	0.38	0.41	0.09	0.18	0.08	0.12	0.12	**0.09**	**0.18**
P28	0.04	0.02	0.06	0.12	0.02	0.05	0.14	0.20	0.07	0.29	0.31	0.07	0.08	0.11	0.11	0.09	**0.09**	**0.15**
P29	0.01	0.02	0.01	0.01	0.01	0.03	0.05	0.02	0.04	0.43	0.34	0.08	0.08	0.11	0.17	0.06	**0.06**	**0.14**
P30	0.04	0.06	0.11	0.11	0.05	0.10	0.15	0.13	0.16	0.29	0.22	0.08	0.05	0.20	0.09	0.07	**0.10**	**0.15**
P31	0.04	0.16	0.05	0.03	0.03	0.04	0.06	0.09	0.05	0.13	0.11	0.18	0.09	0.04	0.11	0.09	**0.07**	**0.09**
P32	0.03	0.16	0.09	0.03	0.01	0.09	0.02	0.11	0.06	0.16	0.13	0.10	0.08	0.03	0.15	0.12	**0.07**	**0.09**
P33	0.05	0.05	0.04	0.01	0.02	0.03	0.05	0.06	0.03	0.13	0.19	0.18	0.12	0.15	0.16	0.01	**0.05**	**0.10**
P34	0.02	0.10	0.06	0.04	0.06	0.05	0.12	0.03	0.08	0.14	0.20	0.20	0.14	0.19	0.09	0.08	**0.08**	**0.12**
P35	0.02	0.04	0.24	0.25	0.18	0.20	0.25	0.07	0.08	0.19	0.26	0.42	0.24	0.17	0.36	0.09	**0.18**	**0.21**
P36	0.03	0.03	0.03	0.06	0.04	0.04	0.03	0.04	0.16	0.15	0.08	0.22	0.11	0.14	0.26	0.16	**0.06**	**0.10**
P37	0.01	0.03	0.04	0.03	0.03	0.01	0.04	0.01	0.19	0.21	0.29	0.45	0.05	0.05	0.13	0.09	**0.07**	**0.15**
P38	0.01	0.13	0.07	0.07	0.11	0.01	0.02	0.07	0.01	0.05	0.11	0.22	0.12	0.02	0.16	0.10	**0.08**	**0.08**
P39	0.07	0.13	0.12	0.13	0.07	0.01	0.06	0.09	0.02	0.08	0.12	0.17	0.03	0.10	0.12	0.16	**0.10**	**0.09**
P40	0.10	0.02	0.07	0.15	0.01	0.03	0.06	0.07	0.07	0.14	0.13	0.16	0.18	0.17	0.17	0.19	**0.09**	**0.10**
P41	0.14	0.11	0.15	0.24	0.21	0.25	0.32	0.17	0.10	0.19	0.16	0.09	0.18	0.14	0.20	0.17	**0.18**	**0.18**
P42	0.28	0.37	0.17	0.04	0.03	0.04	0.08	0.06	0.14	0.16	0.22	0.23	0.08	0.16	0.25	0.28	**0.15**	**0.14**

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
P43	0.24	0.25	0.12	0.05	0.04	0.05	0.04	0.06	0.11	0.29	0.32	0.28	0.03	0.20	0.24	0.28	**0.14**	**0.17**
P44	0.28	0.34	0.27	0.01	0.01	0.03	0.17	0.07	0.14	0.38	0.39	0.30	0.13	0.19	0.30	0.23	**0.17**	**0.22**
P45	0.34	0.33	0.40	0.11	0.03	0.05	0.09	0.10	0.12	0.21	0.23	0.19	0.11	0.17	0.39	0.24	**0.20**	**0.16**
P46	0.56	0.31	0.33	0.22	0.10	0.07	0.12	0.13	0.10	0.21	0.18	0.11	0.14	0.22	0.49	0.42	**0.23**	**0.17**

E2.2 Overall Test Points

Table E 4 VR Value for the Overall Test Points of Scheme B

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
O1	0.14	0.38	0.43	0.39	0.12	0.06	0.04	0.01	0.07	0.22	0.29	0.27	0.21	0.18	0.26	0.06	**0.26**	**0.20**
O2	0.01	0.19	0.23	0.18	0.08	0.02	0.04	0.03	0.09	0.26	0.30	0.38	0.24	0.03	0.12	0.06	**0.15**	**0.18**
O3	0.29	0.47	0.48	0.28	0.13	0.14	0.03	0.07	0.16	0.16	0.49	0.58	0.40	0.30	0.12	0.21	**0.30**	**0.29**
O4	0.27	0.47	0.44	0.36	0.11	0.13	0.04	0.01	0.09	0.18	0.13	0.12	0.37	0.31	0.10	0.21	**0.27**	**0.17**
O5	0.23	0.53	0.29	0.23	0.10	0.10	0.03	0.01	0.15	0.30	0.23	0.16	0.26	0.25	0.20	0.21	**0.23**	**0.19**
O6	0.30	0.49	0.48	0.27	0.07	0.04	0.01	0.05	0.01	0.08	0.17	0.23	0.22	0.12	0.28	0.24	**0.24**	**0.14**
O7	0.32	0.56	0.34	0.31	0.11	0.11	0.04	0.06	0.04	0.15	0.20	0.16	0.04	0.10	0.31	0.28	**0.26**	**0.16**
O8	0.38	0.44	0.50	0.37	0.14	0.05	0.04	0.06	0.01	0.18	0.18	0.20	0.19	0.17	0.32	0.29	**0.28**	**0.18**
O9	0.45	0.48	0.56	0.33	0.05	0.05	0.02	0.06	0.02	0.08	0.18	0.31	0.30	0.14	0.43	0.32	**0.28**	**0.17**
O10	0.42	0.48	0.48	0.25	0.09	0.13	0.10	0.06	0.13	0.25	0.10	0.40	0.25	0.11	0.46	0.34	**0.27**	**0.20**
O11	0.35	0.39	0.48	0.30	0.07	0.12	0.03	0.06	0.09	0.17	0.23	0.27	0.22	0.24	0.37	0.25	**0.26**	**0.19**

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
O12	0.31	0.50	0.44	0.28	0.19	0.14	0.05	0.06	0.17	0.25	0.40	0.53	0.41	0.47	0.37	0.33	**0.31**	**0.29**
O13	0.41	0.49	0.51	0.33	0.18	0.04	0.06	0.05	0.07	0.13	0.19	0.28	0.25	0.34	0.11	0.28	**0.29**	**0.19**
O14	0.38	0.49	0.53	0.29	0.16	0.05	0.04	0.05	0.01	0.01	0.19	0.30	0.16	0.20	0.38	0.25	**0.28**	**0.16**
O15	0.26	0.37	0.08	0.12	0.15	0.06	0.22	0.03	0.07	0.07	0.21	0.27	0.17	0.16	0.34	0.26	**0.17**	**0.15**
O16	0.42	0.46	0.05	0.18	0.09	0.17	0.07	0.09	0.10	0.17	0.13	0.30	0.14	0.12	0.45	0.39	**0.20**	**0.16**
O17	0.28	0.34	0.32	0.31	0.24	0.23	0.03	0.10	0.04	0.18	0.15	0.15	0.17	0.21	0.43	0.27	**0.25**	**0.18**
O18	0.11	0.42	0.32	0.36	0.18	0.19	0.14	0.08	0.16	0.11	0.13	0.32	0.38	0.10	0.36	0.07	**0.25**	**0.20**
O19	0.13	0.42	0.34	0.33	0.05	0.08	0.11	0.03	0.11	0.09	0.20	0.24	0.34	0.03	0.42	0.05	**0.22**	**0.17**
O20	0.19	0.30	0.40	0.35	0.26	0.14	0.23	0.21	0.02	0.18	0.12	0.04	0.06	0.14	0.28	0.12	**0.25**	**0.17**
O21	0.08	0.20	0.32	0.26	0.14	0.06	0.19	0.13	0.17	0.15	0.13	0.08	0.03	0.17	0.09	0.24	**0.18**	**0.14**
O22	0.09	0.28	0.42	0.39	0.29	0.06	0.14	0.17	0.15	0.17	0.19	0.10	0.05	0.03	0.06	0.07	**0.26**	**0.18**
O23	0.42	0.22	0.09	0.19	0.13	0.13	0.09	0.05	0.07	0.04	0.05	0.08	0.16	0.13	0.36	0.39	**0.16**	**0.10**
O24	0.27	0.14	0.13	0.11	0.11	0.09	0.15	0.06	0.17	0.04	0.09	0.08	0.15	0.12	0.40	0.34	**0.13**	**0.11**
O25	0.32	0.09	0.22	0.02	0.10	0.10	0.15	0.09	0.19	0.03	0.09	0.04	0.11	0.13	0.20	0.34	**0.12**	**0.10**
O26	0.42	0.55	0.13	0.16	0.05	0.09	0.03	0.01	0.05	0.14	0.24	0.39	0.41	0.30	0.33	0.31	**0.21**	**0.18**
O27	0.46	0.49	0.13	0.20	0.11	0.23	0.02	0.04	0.09	0.17	0.22	0.35	0.35	0.32	0.49	0.40	**0.23**	**0.20**
O28	0.45	0.19	0.17	0.23	0.22	0.21	0.16	0.11	0.08	0.08	0.08	0.14	0.09	0.31	0.63	0.56	**0.21**	**0.15**
O29	0.27	0.03	0.21	0.06	0.06	0.18	0.14	0.05	0.19	0.05	0.19	0.14	0.17	0.26	0.46	0.39	**0.13**	**0.14**
O30	0.43	0.30	0.07	0.10	0.12	0.11	0.07	0.07	0.06	0.05	0.16	0.19	0.36	0.26	0.49	0.40	**0.16**	**0.14**
O31	0.38	0.33	0.15	0.32	0.12	0.14	0.14	0.04	0.06	0.08	0.15	0.22	0.30	0.20	0.40	0.33	**0.22**	**0.16**
O32	0.06	0.05	0.13	0.03	0.06	0.03	0.06	0.07	0.05	0.18	0.08	0.13	0.07	0.09	0.10	0.15	**0.07**	**0.08**
O33	0.14	0.12	0.19	0.06	0.07	0.10	0.05	0.09	0.15	0.24	0.27	0.19	0.02	0.19	0.09	0.19	**0.12**	**0.15**
O34	0.25	0.35	0.21	0.13	0.08	0.05	0.01	0.04	0.03	0.09	0.11	0.18	0.09	0.19	0.19	0.21	**0.15**	**0.11**
O35	0.23	0.38	0.27	0.14	0.08	0.02	0.02	0.05	0.12	0.25	0.35	0.29	0.04	0.09	0.17	0.11	**0.19**	**0.18**

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
O36	0.05	0.33	0.28	0.21	0.13	0.05	0.08	0.04	0.11	0.10	0.24	0.20	0.13	0.03	0.07	0.14	**0.18**	**0.15**
O37	0.09	0.37	0.30	0.26	0.18	0.07	0.05	0.09	0.13	0.20	0.10	0.23	0.28	0.26	0.23	0.05	**0.21**	**0.17**
O38	0.14	0.08	0.16	0.12	0.07	0.11	0.14	0.10	0.11	0.20	0.22	0.27	0.15	0.17	0.11	0.14	**0.13**	**0.16**
O39	0.08	0.07	0.04	0.07	0.02	0.10	0.10	0.08	0.12	0.21	0.27	0.11	0.14	0.13	0.08	0.13	**0.08**	**0.13**
O40	0.22	0.27	0.28	0.06	0.03	0.10	0.21	0.12	0.05	0.10	0.12	0.19	0.09	0.06	0.08	0.18	**0.14**	**0.12**
O41	0.10	0.19	0.07	0.20	0.05	0.06	0.11	0.06	0.02	0.11	0.13	0.13	0.10	0.09	0.08	0.03	**0.11**	**0.10**
O42	0.15	0.15	0.29	0.16	0.09	0.18	0.19	0.06	0.11	0.13	0.19	0.15	0.06	0.09	0.12	0.12	**0.16**	**0.14**
O43	0.01	0.12	0.09	0.10	0.01	0.18	0.28	0.03	0.13	0.14	0.20	0.21	0.07	0.06	0.07	0.13	**0.10**	**0.14**
O44	0.21	0.32	0.49	0.28	0.12	0.03	0.09	0.06	0.10	0.18	0.14	0.13	0.13	0.10	0.27	0.12	**0.23**	**0.15**
O45	0.31	0.38	0.56	0.47	0.17	0.06	0.05	0.05	0.09	0.14	0.24	0.05	0.06	0.05	0.21	0.15	**0.30**	**0.17**
O46	0.24	0.30	0.45	0.26	0.14	0.06	0.31	0.26	0.10	0.21	0.29	0.33	0.09	0.10	0.22	0.19	**0.25**	**0.22**
O47	0.11	0.14	0.15	0.15	0.06	0.16	0.37	0.25	0.09	0.04	0.06	0.27	0.06	0.02	0.18	0.20	**0.13**	**0.13**
O48	0.04	0.11	0.04	0.07	0.03	0.04	0.09	0.06	0.04	0.04	0.10	0.23	0.06	0.03	0.11	0.13	**0.07**	**0.08**
O49	0.20	0.25	0.44	0.33	0.16	0.09	0.05	0.02	0.06	0.14	0.17	0.36	0.10	0.10	0.33	0.36	**0.24**	**0.17**
O50	0.25	0.35	0.24	0.36	0.15	0.14	0.18	0.09	0.06	0.11	0.18	0.38	0.11	0.06	0.27	0.25	**0.24**	**0.18**
O51	0.03	0.04	0.05	0.10	0.09	0.14	0.10	0.05	0.20	0.25	0.27	0.19	0.15	0.08	0.14	0.02	**0.10**	**0.16**
O52	0.02	0.12	0.03	0.15	0.13	0.18	0.07	0.10	0.20	0.26	0.33	0.23	0.11	0.11	0.17	0.02	**0.13**	**0.19**
O53	0.13	0.20	0.22	0.19	0.15	0.15	0.10	0.04	0.16	0.11	0.30	0.15	0.19	0.20	0.14	0.06	**0.17**	**0.17**
O54	0.20	0.20	0.12	0.12	0.20	0.14	0.19	0.08	0.14	0.23	0.33	0.30	0.08	0.06	0.12	0.29	**0.17**	**0.20**
O55	0.17	0.26	0.14	0.07	0.18	0.18	0.40	0.20	0.18	0.23	0.36	0.39	0.14	0.08	0.18	0.24	**0.18**	**0.24**
O56	0.11	0.17	0.06	0.23	0.14	0.22	0.55	0.26	0.01	0.18	0.28	0.34	0.05	0.04	0.18	0.07	**0.18**	**0.22**
O57	0.08	0.08	0.23	0.10	0.11	0.16	0.51	0.16	0.08	0.14	0.17	0.37	0.09	0.10	0.07	0.17	**0.15**	**0.18**
O58	0.05	0.05	0.10	0.07	0.06	0.06	0.11	0.01	0.14	0.14	0.19	0.05	0.12	0.06	0.26	0.01	**0.08**	**0.10**
O59	0.05	0.05	0.11	0.10	0.08	0.06	0.13	0.05	0.15	0.20	0.27	0.14	0.13	0.07	0.38	0.04	**0.10**	**0.15**

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
O60	0.05	0.01	0.11	0.07	0.06	0.07	0.06	0.07	0.09	0.28	0.24	0.32	0.21	0.08	0.11	0.04	**0.09**	**0.16**
O61	0.07	0.07	0.12	0.07	0.13	0.12	0.19	0.04	0.03	0.10	0.13	0.23	0.20	0.16	0.18	0.18	**0.10**	**0.12**
O62	0.05	0.01	0.17	0.16	0.16	0.14	0.17	0.03	0.11	0.31	0.23	0.26	0.10	0.10	0.06	0.20	**0.14**	**0.18**
O63	0.05	0.05	0.20	0.20	0.11	0.07	0.24	0.08	0.07	0.25	0.21	0.25	0.13	0.08	0.18	0.10	**0.14**	**0.17**
O64	0.13	0.25	0.15	0.12	0.09	0.13	0.16	0.03	0.09	0.18	0.10	0.26	0.05	0.04	0.17	0.06	**0.14**	**0.13**
O65	0.04	0.09	0.12	0.08	0.13	0.12	0.13	0.12	0.04	0.22	0.14	0.12	0.14	0.22	0.10	0.06	**0.11**	**0.13**
O66	0.11	0.21	0.09	0.13	0.04	0.11	0.08	0.12	0.19	0.28	0.32	0.45	0.13	0.07	0.20	0.08	**0.14**	**0.20**
O67	0.04	0.15	0.15	0.11	0.11	0.07	0.17	0.10	0.09	0.08	0.15	0.04	0.10	0.17	0.21	0.05	**0.11**	**0.11**
O68	0.01	0.06	0.09	0.01	0.08	0.08	0.15	0.08	0.06	0.03	0.13	0.06	0.03	0.04	0.05	0.05	**0.06**	**0.07**
O69	0.04	0.18	0.03	0.15	0.09	0.08	0.04	0.05	0.03	0.14	0.19	0.11	0.10	0.07	0.04	0.04	**0.10**	**0.11**
O70	0.07	0.19	0.17	0.28	0.24	0.16	0.18	0.12	0.09	0.11	0.19	0.18	0.21	0.21	0.24	0.22	**0.19**	**0.17**
O71	0.08	0.03	0.13	0.13	0.09	0.09	0.09	0.07	0.14	0.16	0.26	0.25	0.22	0.19	0.12	0.23	**0.12**	**0.16**
O72	0.08	0.03	0.22	0.30	0.10	0.06	0.10	0.06	0.07	0.17	0.09	0.27	0.18	0.15	0.05	0.19	**0.15**	**0.14**
O73	0.12	0.25	0.15	0.23	0.09	0.06	0.09	0.05	0.07	0.16	0.09	0.24	0.17	0.14	0.04	0.15	**0.15**	**0.13**
O74	0.12	0.11	0.13	0.21	0.12	0.11	0.13	0.17	0.10	0.10	0.18	0.40	0.22	0.08	0.33	0.07	**0.15**	**0.17**
O75	0.13	0.06	0.08	0.26	0.12	0.09	0.15	0.12	0.08	0.18	0.14	0.40	0.23	0.12	0.33	0.18	**0.15**	**0.17**
O76	0.10	0.09	0.05	0.28	0.14	0.13	0.15	0.17	0.09	0.26	0.17	0.37	0.21	0.18	0.31	0.18	**0.16**	**0.19**
O77	0.08	0.21	0.11	0.23	0.14	0.17	0.10	0.15	0.18	0.33	0.24	0.45	0.26	0.21	0.18	0.11	**0.18**	**0.23**
O78	0.02	0.10	0.24	0.24	0.16	0.17	0.22	0.07	0.09	0.05	0.37	0.44	0.18	0.16	0.20	0.28	**0.18**	**0.21**
O79	0.02	0.11	0.25	0.22	0.14	0.15	0.24	0.05	0.10	0.19	0.45	0.42	0.16	0.19	0.28	0.24	**0.19**	**0.24**
O80	0.02	0.12	0.29	0.25	0.20	0.24	0.23	0.02	0.03	0.19	0.45	0.41	0.20	0.21	0.30	0.11	**0.21**	**0.25**
O81	0.01	0.18	0.34	0.35	0.24	0.28	0.25	0.10	0.07	0.19	0.45	0.42	0.22	0.21	0.32	0.08	**0.26**	**0.27**
O82	0.05	0.01	0.03	0.04	0.03	0.02	0.05	0.09	0.02	0.11	0.05	0.06	0.07	0.07	0.10	0.04	**0.04**	**0.05**
O83	0.06	0.01	0.04	0.03	0.02	0.02	0.05	0.08	0.07	0.09	0.02	0.04	0.06	0.10	0.13	0.08	**0.04**	**0.05**

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
O84	0.01	0.01	0.02	0.06	0.01	0.04	0.07	0.10	0.03	0.08	0.17	0.12	0.08	0.07	0.14	0.05	**0.05**	**0.08**
O85	0.01	0.06	0.07	0.11	0.02	0.07	0.07	0.08	0.05	0.16	0.07	0.14	0.16	0.13	0.16	0.09	**0.07**	**0.09**
O86	0.08	0.04	0.11	0.14	0.07	0.11	0.12	0.32	0.01	0.21	0.07	0.15	0.20	0.20	0.16	0.02	**0.11**	**0.13**
O87	0.08	0.04	0.10	0.15	0.09	0.03	0.04	0.36	0.05	0.05	0.27	0.22	0.06	0.09	0.27	0.10	**0.11**	**0.14**
O88	0.07	0.03	0.08	0.08	0.09	0.12	0.05	0.29	0.01	0.08	0.20	0.27	0.17	0.21	0.30	0.14	**0.10**	**0.14**
O89	0.08	0.08	0.07	0.02	0.05	0.08	0.16	0.14	0.14	0.21	0.17	0.20	0.16	0.21	0.31	0.16	**0.09**	**0.14**
O90	0.01	0.07	0.04	0.04	0.03	0.05	0.07	0.13	0.19	0.07	0.31	0.06	0.11	0.06	0.18	0.06	**0.07**	**0.12**
O91	0.02	0.01	0.08	0.11	0.14	0.15	0.20	0.30	0.28	0.02	0.35	0.19	0.20	0.20	0.19	0.07	**0.12**	**0.19**
O92	0.07	0.07	0.08	0.02	0.03	0.05	0.09	0.14	0.17	0.03	0.24	0.11	0.09	0.05	0.15	0.09	**0.07**	**0.11**
O93	0.03	0.02	0.03	0.02	0.01	0.03	0.02	0.03	0.09	0.26	0.18	0.16	0.09	0.16	0.09	0.04	**0.05**	**0.11**
O94	0.01	0.12	0.06	0.02	0.08	0.04	0.13	0.10	0.09	0.30	0.10	0.11	0.09	0.04	0.04	0.02	**0.07**	**0.11**
O95	0.04	0.09	0.01	0.03	0.02	0.07	0.11	0.02	0.09	0.23	0.15	0.11	0.08	0.04	0.04	0.10	**0.06**	**0.10**
O96	0.06	0.11	0.09	0.04	0.05	0.02	0.06	0.08	0.07	0.24	0.15	0.13	0.05	0.10	0.08	0.03	**0.08**	**0.10**
O97	0.06	0.17	0.23	0.11	0.08	0.08	0.11	0.04	0.01	0.23	0.14	0.11	0.07	0.14	0.11	0.11	**0.13**	**0.12**
O98	0.08	0.12	0.04	0.08	0.01	0.05	0.09	0.10	0.05	0.02	0.01	0.07	0.02	0.08	0.15	0.09	**0.06**	**0.05**
O99	0.02	0.10	0.11	0.11	0.09	0.12	0.24	0.09	0.09	0.31	0.17	0.13	0.08	0.08	0.07	0.12	**0.11**	**0.15**
O100	0.05	0.19	0.23	0.07	0.06	0.11	0.12	0.09	0.04	0.12	0.12	0.15	0.10	0.09	0.09	0.12	**0.11**	**0.11**
O101	0.03	0.07	0.10	0.13	0.07	0.04	0.13	0.06	0.08	0.26	0.14	0.13	0.10	0.09	0.06	0.11	**0.10**	**0.12**
O102	0.05	0.10	0.07	0.18	0.14	0.16	0.38	0.11	0.05	0.26	0.15	0.07	0.03	0.11	0.08	0.11	**0.13**	**0.15**
O103	0.02	0.06	0.09	0.06	0.02	0.04	0.04	0.03	0.06	0.07	0.05	0.14	0.08	0.08	0.04	0.10	**0.05**	**0.06**
O104	0.09	0.12	0.14	0.21	0.17	0.20	0.48	0.15	0.08	0.27	0.21	0.23	0.15	0.15	0.12	0.09	**0.18**	**0.21**
O105	0.08	0.22	0.30	0.19	0.19	0.18	0.27	0.21	0.07	0.15	0.16	0.20	0.16	0.18	0.14	0.14	**0.19**	**0.18**
O106	0.07	0.05	0.03	0.04	0.04	0.10	0.15	0.23	0.27	0.31	0.24	0.27	0.27	0.05	0.07	0.14	**0.10**	**0.18**
O107	0.08	0.08	0.08	0.11	0.07	0.13	0.25	0.35	0.36	0.33	0.43	0.24	0.20	0.05	0.28	0.10	**0.15**	**0.25**

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
O108	0.12	0.12	0.08	0.12	0.05	0.11	0.08	0.16	0.41	0.04	0.31	0.14	0.18	0.31	0.41	0.19	**0.13**	**0.17**
O109	0.11	0.10	0.08	0.09	0.02	0.06	0.10	0.15	0.40	0.03	0.27	0.13	0.01	0.27	0.45	0.11	**0.11**	**0.14**
O110	0.06	0.04	0.11	0.18	0.08	0.17	0.18	0.17	0.22	0.24	0.12	0.20	0.07	0.15	0.17	0.07	**0.13**	**0.16**
O111	0.08	0.08	0.08	0.16	0.08	0.16	0.28	0.25	0.25	0.29	0.19	0.24	0.07	0.22	0.31	0.09	**0.14**	**0.20**
O112	0.12	0.11	0.15	0.23	0.11	0.18	0.32	0.19	0.25	0.26	0.19	0.16	0.09	0.23	0.33	0.05	**0.17**	**0.19**
O113	0.16	0.03	0.08	0.24	0.18	0.20	0.37	0.26	0.17	0.19	0.20	0.22	0.10	0.21	0.27	0.05	**0.17**	**0.20**
O114	0.12	0.09	0.03	0.04	0.08	0.20	0.29	0.23	0.14	0.09	0.26	0.11	0.23	0.22	0.18	0.20	**0.11**	**0.16**
O115	0.09	0.10	0.07	0.01	0.07	0.14	0.30	0.37	0.24	0.20	0.32	0.02	0.17	0.17	0.32	0.12	**0.11**	**0.19**
O116	0.09	0.08	0.06	0.07	0.06	0.14	0.23	0.44	0.11	0.30	0.27	0.34	0.11	0.20	0.19	0.19	**0.13**	**0.21**
O117	0.12	0.20	0.13	0.08	0.08	0.11	0.07	0.13	0.08	0.21	0.23	0.28	0.04	0.23	0.20	0.26	**0.13**	**0.16**
O118	0.09	0.19	0.16	0.09	0.07	0.09	0.16	0.06	0.03	0.11	0.08	0.04	0.06	0.13	0.09	0.10	**0.11**	**0.09**
O119	0.12	0.18	0.13	0.05	0.06	0.14	0.27	0.40	0.11	0.29	0.19	0.15	0.10	0.17	0.10	0.12	**0.13**	**0.18**
O120	0.12	0.20	0.17	0.10	0.08	0.16	0.23	0.34	0.11	0.27	0.39	0.39	0.11	0.23	0.26	0.22	**0.17**	**0.24**
O121	0.11	0.17	0.11	0.06	0.05	0.16	0.28	0.48	0.28	0.33	0.29	0.33	0.09	0.23	0.17	0.21	**0.15**	**0.24**
O122	0.11	0.15	0.13	0.11	0.04	0.16	0.41	0.33	0.29	0.03	0.10	0.44	0.10	0.18	0.27	0.16	**0.14**	**0.18**
O123	0.08	0.19	0.18	0.14	0.07	0.10	0.14	0.13	0.14	0.18	0.18	0.42	0.14	0.16	0.21	0.15	**0.15**	**0.17**
O124	0.15	0.13	0.15	0.06	0.08	0.17	0.33	0.41	0.09	0.13	0.24	0.47	0.13	0.27	0.24	0.26	**0.15**	**0.21**
O125	0.18	0.14	0.13	0.08	0.08	0.13	0.18	0.38	0.31	0.29	0.28	0.49	0.21	0.37	0.28	0.34	**0.17**	**0.25**
O126	0.02	0.10	0.13	0.06	0.12	0.17	0.27	0.50	0.46	0.41	0.31	0.06	0.09	0.14	0.24	0.09	**0.15**	**0.24**
O127	0.02	0.11	0.03	0.02	0.12	0.12	0.14	0.37	0.30	0.28	0.43	0.27	0.19	0.11	0.23	0.21	**0.12**	**0.23**
O128	0.02	0.10	0.08	0.04	0.17	0.15	0.17	0.23	0.20	0.20	0.44	0.31	0.22	0.29	0.09	0.06	**0.14**	**0.23**
O129	0.08	0.09	0.12	0.06	0.26	0.21	0.28	0.11	0.06	0.15	0.41	0.36	0.25	0.29	0.31	0.08	**0.16**	**0.23**
O130	0.08	0.09	0.05	0.05	0.27	0.29	0.41	0.22	0.26	0.07	0.32	0.16	0.20	0.28	0.22	0.25	**0.15**	**0.22**
O131	0.07	0.11	0.09	0.03	0.26	0.29	0.40	0.30	0.16	0.20	0.38	0.38	0.13	0.13	0.11	0.07	**0.16**	**0.25**

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
O132	0.10	0.19	0.13	0.19	0.01	0.14	0.23	0.19	0.21	0.28	0.13	0.12	0.09	0.27	0.49	0.16	**0.15**	**0.16**
O133	0.13	0.24	0.18	0.22	0.09	0.31	0.57	0.51	0.46	0.33	0.31	0.33	0.10	0.29	0.47	0.30	**0.23**	**0.31**
O134	0.01	0.06	0.03	0.10	0.31	0.19	0.27	0.11	0.08	0.16	0.23	0.22	0.22	0.25	0.27	0.13	**0.14**	**0.19**
O135	0.04	0.08	0.12	0.07	0.31	0.18	0.17	0.41	0.31	0.22	0.16	0.15	0.20	0.27	0.15	0.06	**0.16**	**0.20**
O136	0.02	0.02	0.06	0.05	0.32	0.13	0.36	0.24	0.15	0.15	0.13	0.20	0.18	0.07	0.04	0.03	**0.13**	**0.17**
O137	0.04	0.09	0.05	0.02	0.34	0.18	0.41	0.09	0.14	0.17	0.20	0.30	0.17	0.06	0.02	0.05	**0.14**	**0.19**
O138	0.05	0.06	0.02	0.10	0.35	0.24	0.46	0.23	0.03	0.07	0.06	0.24	0.11	0.12	0.04	0.03	**0.14**	**0.16**
O139	0.04	0.02	0.07	0.12	0.02	0.02	0.12	0.17	0.14	0.22	0.17	0.10	0.08	0.10	0.19	0.10	**0.08**	**0.12**
O140	0.01	0.01	0.04	0.03	0.03	0.02	0.21	0.24	0.16	0.07	0.13	0.09	0.06	0.02	0.05	0.02	**0.05**	**0.09**
O141	0.04	0.01	0.02	0.02	0.07	0.08	0.28	0.20	0.15	0.07	0.05	0.03	0.10	0.03	0.06	0.04	**0.05**	**0.08**
O142	0.01	0.03	0.01	0.06	0.01	0.06	0.42	0.21	0.17	0.22	0.38	0.26	0.08	0.28	0.05	0.07	**0.09**	**0.19**
O143	0.02	0.07	0.01	0.12	0.19	0.06	0.36	0.24	0.21	0.25	0.36	0.20	0.14	0.25	0.08	0.01	**0.14**	**0.21**
O144	0.01	0.02	0.02	0.04	0.06	0.12	0.23	0.17	0.25	0.08	0.14	0.11	0.09	0.10	0.06	0.03	**0.07**	**0.12**
O145	0.05	0.06	0.07	0.11	0.02	0.02	0.28	0.34	0.34	0.31	0.06	0.23	0.05	0.15	0.27	0.05	**0.10**	**0.16**
O146	0.04	0.01	0.07	0.16	0.09	0.16	0.34	0.36	0.27	0.24	0.08	0.11	0.07	0.20	0.25	0.05	**0.12**	**0.17**
O147	0.01	0.06	0.08	0.15	0.12	0.11	0.37	0.33	0.29	0.32	0.11	0.09	0.11	0.17	0.17	0.06	**0.13**	**0.18**
O148	0.01	0.09	0.05	0.09	0.22	0.15	0.27	0.10	0.16	0.29	0.43	0.21	0.03	0.11	0.08	0.07	**0.14**	**0.21**
O149	0.05	0.06	0.06	0.12	0.07	0.12	0.18	0.21	0.16	0.23	0.16	0.10	0.06	0.14	0.03	0.01	**0.10**	**0.14**
O150	0.03	0.03	0.06	0.08	0.07	0.13	0.04	0.02	0.19	0.30	0.09	0.18	0.10	0.03	0.05	0.04	**0.08**	**0.12**
O151	0.03	0.02	0.02	0.09	0.06	0.06	0.12	0.09	0.26	0.39	0.28	0.21	0.03	0.09	0.11	0.01	**0.09**	**0.17**
O152	0.03	0.14	0.07	0.09	0.04	0.05	0.27	0.05	0.31	0.36	0.21	0.27	0.05	0.07	0.15	0.05	**0.11**	**0.18**
O153	0.02	0.18	0.03	0.03	0.22	0.03	0.22	0.27	0.07	0.24	0.14	0.19	0.06	0.05	0.15	0.06	**0.11**	**0.15**
O154	0.06	0.11	0.21	0.33	0.17	0.14	0.04	0.13	0.34	0.29	0.14	0.26	0.09	0.07	0.12	0.08	**0.19**	**0.19**
O155	0.04	0.06	0.18	0.18	0.09	0.23	0.47	0.31	0.17	0.18	0.06	0.14	0.10	0.05	0.26	0.15	**0.14**	**0.16**

	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	Annual	Summer
Annual Freq.	**7.8%**	**12.4%**	**12.9%**	**19.4%**	**15.3%**	**5.5%**	**3.0%**	**2.9%**	**3.0%**	**4.4%**	**5.7%**	**3.1%**	**1.7%**	**1.1%**	**0.6%**	**1.2%**	**100%**	
Summer Freq.	**1.7%**	**2.5%**	**3.6%**	**6.0%**	**8.9%**	**8.1%**	**6.2%**	**6.6%**	**7.4%**	**12.2%**	**17.5%**	**9.9%**	**4.8%**	**2.5%**	**1.2%**	**1.0%**		**100%**
O156	0.03	0.07	0.11	0.10	0.13	0.21	0.06	0.24	0.23	0.29	0.12	0.04	0.05	0.02	0.05	0.01	**0.11**	**0.14**
O157	0.03	0.07	0.23	0.24	0.33	0.24	0.29	0.32	0.29	0.46	0.36	0.31	0.13	0.12	0.12	0.06	**0.23**	**0.30**
O158	0.09	0.11	0.17	0.03	0.16	0.14	0.24	0.19	0.13	0.09	0.30	0.37	0.14	0.25	0.40	0.26	**0.14**	**0.19**
O159	0.03	0.07	0.09	0.08	0.20	0.21	0.33	0.21	0.05	0.18	0.08	0.12	0.02	0.26	0.23	0.11	**0.12**	**0.14**
O160	0.04	0.04	0.09	0.02	0.02	0.18	0.21	0.35	0.20	0.28	0.14	0.13	0.09	0.15	0.08	0.03	**0.09**	**0.15**