Quantitative Air Ventilation Assessment for Subsidised Sale Flats Development at Tung Chung Area 54, Tung Chung

Prepared by:
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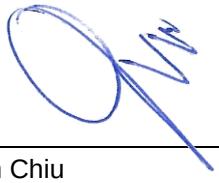
Approved by: 

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Contents

Figures

Appendix

1. Introduction

1.1 Background and Objectives

1.1.1 The Subject Site at Tung Chung Area 54 is to be developed as Subsidised Sale Flats Development. The Subject Site is located in Tung Chung North Area and is bounded by high-rise residential developments such as Century Link, Caribbean Coast and Coastal Skyline. The zoning of the Subject Site is "Residential (Group A)" (R(A)) under the approved Tung Chung Extension Area Outline Zoning Plan No. S/I-TCE/2 gazetted on 17 February 2017.

1.1.2 Ramboll Hong Kong Limited (the Consultant) has been commissioned to conduct this air ventilation assessment for the proposed development. This air ventilation assessment report has been prepared to evaluate the potential air ventilation impact of the proposed development scheme. Architectural drawings and technical information on the Proposed Development are provided by Hong Kong Housing Authority.

1.2 Site Environs

1.2.1 The Subject Site is located in Tung Chung North Area. It is zoned R(A) under the approved Tung Chung Extension Area Outline Zoning Plan No. S/I-TCE/2 (OZP). The building height restriction for the Subject Site is +95mPD and the maximum permitted domestic (PR) is 5.0. The Site is currently a piece of government land with foundation works of the captioned development in progress with a gross site area of about 3.24 ha.

1.2.2 The Subject Site is located at around +5.7mPD. The Site is located near a coastal area immediate next to the waterfront. It is located at Tung Chung Area 54; where it is bounded by Ying Hei Street to the south and the proposed Road L3 to the west and north. To the west is the Hotel Development at Tung Chung Area 53a, Century Link to the east, Caribbean Coast to the southeast and Coastal Skyline to the southwest of the Subject Site.

1.2.3 **Figure 1** shows the location of the Subject Site and its environs.

1.3 Baseline Scheme

1.3.1 **Appendix A** shows the baseline building design for assessment purpose. This Baseline Scheme is an OZP-Compliant scenario which complies with the building height restriction of +95mPD and maximum domestic plot ratio of 5.0. The Baseline Scheme comprises eight residential blocks with 30-story, one 2-storey carpark with an elevation of +11.5mPD and the Retail is proposed at the eastern side of the Subject Site.

1.3.2 Under Baseline Scheme, two building separation are proposed at towers, i.e. two ~15m building separation between Block 6 and Block 7 and building separation between Block 2 and Block 3 along SE direction. There is another ~15m building separation between Block 5 and Block 3 and a building separation between Block 8

and Block 2 along ENE direction. The building separations of the Subject Site are shown in **Appendix A.**

1.4 Proposed Scheme

1.4.1 The Proposed Scheme consists of six residential blocks with 30-storeys with maximum building height limit of +95mPD. The proposed residential buildings are Y-shaped public housing blocks. The Proposed Scheme includes single-storey retail block (+12.3mPD), kindergarten with 6-classrooms (+10.1mPD), basement carpark for private car and motorcycle and open parking spaces for loading/unloading parking.

1.4.2 When compared with the Baseline Scheme, the Proposed Scheme incorporates change on building orientation, retail & RCP and carpark design. In order to minimise potential air ventilation impact, the carpark is relocated to basement. It is envisaged that the proposed change would have more influence to wind flow within the Subject Site and also benefit to adjust site for wind penetration. **Appendix B** shows the Master Layout Plan and section plan of the Proposed Scheme.

2. Site Wind Availability

2.1 Site Wind Availability Data

2.1.1 This expert evaluation is supposingly not a detailed study of the air ventilation performance. It is therefore considered acceptable to use the Regional Atmospheric Modeling System (RAMS) data for Site Wind Availability initially as a starting point. Based on the RAMS data of the grid (033,037) of the RAMS data extracted from the Site Wind Availability Data of Planning Department's web site where the subject site is located.

2.1.2 **Figure 2** shows the relevant windrose diagram representing the frequency and wind speed distribution at a height of 500m of the district concerned under the annual condition and summer condition (Jun – Aug). According to the wind data from RAMS, the annual prevailing wind directions for the sites are from ENE, E and ESE; where summer prevailing wind directions are from S, SSW and SW. The wind frequency data under the annual and summer condition is shown in **Table 1** below.

Table 1 Summary of RAMS Data and Wind Direction under Annual and Summer Condition

Wind Direction	Probability for Annual Condition	Probability for Summer Condition	Designated Wind Profile Curve
N	4.0%	1.3%	3
NNE	**7.3%**	1.6%	0
NE	**7.5%**	1.4%	0
ENE	**10.3%**	2.8%	0
E	**16.6%**	**7.3%**	0
ESE	**9.4%**	**9.1%**	1
SE	**6.4%**	**7.0%**	1
SSE	**6.4%**	**8.4%**	1
S	**6.8%**	**12.3%**	1
SSW	**7.7%**	**15.5%**	2
SW	**6.3%**	**14.4%**	2
WSW	3.0%	**6.3%**	2
W	2.8%	5.0%	2
WNW	1.7%	2.7%	3
NW	1.8%	2.8%	3
NNW	2.1%	1.6%	3
Total	**84.7%**	**80.3%**	

Note: **Bold** characters with the highlight in grey represent the selected prevailing wind directions for Evaluation

2.2 Topography and Building Morphology

2.2.1 The Subject Site is located near a coastal area immediate next to the waterfront. The terrain in the immediate vicinity of the Subject Site is rather flat with hilly terrain from approximately 1 km to the southeast (Por Kai Shan). The influence of local topography to the wind flow pattern around the Subject Site is minimal, the Subject

Site is surrounded by a number of existing residential developments in east to southwest directions. Therefore, the wind flow pattern at the Subject Site would be influenced by this surrounding built environment.

2.2.2 Under annual prevailing winds, wind comes from the E, ENE and ESE directions whereas summer dominant wind comes from S to SW directions. Ying Hei Road, Tung Chung Waterfront Road and Man Tung Road acts as east to west wind corridors while Yi Tung Road acts as north to south wind corridor. These major important wind corridors are not blocked by the Proposed Development and hence the wind environment after its completion is not expected to be affected.

2.2.3 Since the Subject Site is located at a coastal area immediate next to the waterfront, the annual ENE wind towards the Subject Site is unobstructed. Under the ENE wind condition, the sea breeze would be the dominate wind of the area. Therefore, annual ENE prevailing winds towards the Subject Site are considered to be optimal.

2.2.4 For E, ESE, S, SSW and SW wind, surrounding residential developments are generally considered to be unfavourable for wind penetration. As there are high-rise residential developments, it is expected that there are low wind zone near the Subject Site.

3. Quantitative Assessment Methodology

3.1 Assessment Area

3.1.1 The assessment area is determined by the height (H) of the highest building within the assessment area (i.e. Caribbean Coast, with a building height of approximately 180m). Therefore, the assessment area shall be at least 1H (with H = 180m) from the Subject Site boundary.

3.1.2 Important pedestrian areas are identified as places that are publicly accessible and pedestrians would frequently access. The important pedestrian areas within the assessment area (i.e. 1H = 180m) from the Subject Site boundary include Tung Chung Waterfront Road, Ying Hei Road, Yi Tung Road, Open areas near Hotel Development at Tung Chung Area 53a, Century Link, The Visionary, Coastal Skyline, Caribbean Coast and open spaces near Ho Yu Primary School and Ho Yu College.

3.2 Atmospheric Conditions

3.2.1 Simulated wind profile curves are extracted from the Planning Department's website using RAMS site wind availability data and directly adopted for this quantitative AVA (see **Figure 2**). Wind profile curves 0, 1 and 2 would be utilized for quantitative AVA according to the selected wind directions in **Figure 3.**

3.3 CFD Code and Major Parameters

3.3.1 A quantitative assessment based on requirement for Initial Study stipulated in the technical guide was conducted for the purpose to verify the air ventilation performance for the Proposed Scheme over the Baseline Scheme.

3.3.2 The quantitative assessment was conducted using a commercial CFD code, FLUENT. FLUENT model had been widely applied for various AVA research and studies worldwide. The accuracy level of the FLUENT model was very much accepted by the industry for AVA application.

3.3.3 Realizable K-epsilon turbulence which gives better prediction of separation and vortexes are adopted for air ventilation assessment as recommended in COST action C14.

3.3.4 The domain covers the model area of not less than 360m (>2H where H is the maximum height of the highest building height within the assessment area) from the Subject Site boundary. The domain dimension is about 2000m x 2000m and with an elevation of 1000m. More than 10 million grid cells are defined to simulate the air flow. Given the large domain adopted in this assessment and the physical limitation on the computational resources of the CFD model, the horizontal and vertical grid size employed in the CFD model in the vicinity of the Subject Site is taken with maximum size of 2 m and minimum size of 0.25 m. For the grid size of the grid cells further away from the Subject Site is increased at a growth ratio of 1.2. Under this growth ratio, the global maximum size of cells is up to 32 m and global minimum size of cell down to 0.25 m. Besides, the first four layers of grid cells above the terrain and

podium within the Subject Site are maintained at 0.5 m thick for each layer. The blockage ratio is less than 3%. Topography will cover entire domain.

3.3.5 The windward boundary is defined as inflow with the wind profile defined. The leeward boundary is defined as outflow. The sky and lateral boundaries are defined as symmetric boundary condition. **Appendix C** shows the captured CFD models views.

3.3.6 The advection terms of the momentum and viscous terms are resolved with the second order numerical schemes. The scaled residuals are converged to an order of magnitude of at least 1 x 10^{-4} as recommended in COST action C14.

3.4 Test Point Location

3.4.1 Test points include 32 numbers of perimeter test points defined along the boundary of the Subject Site, and 73 numbers of overall test points around the Subject Site. Overall test points generally represent important pedestrian areas.

3.4.2 Additionally, 11 numbers of special test points are defined within open spaces within the Subject Site. All these test points are located at 2m above ground level. **Figure 4** shows the tests points selected for quantitative air ventilation assessment.

4. Quantitative Assessment Result

4.1 Spatial Average Wind Velocity Ratio

4.1.1 The wind velocity ratio (VR) under a specific wind direction at a test point is calculated by dividing the simulated wind speed at the test point under this wind direction with the velocity at gradient height under the same wind direction.

4.1.2 **Table 2** and **Table 3** showed the site spatial average velocity ratio (SVR), local spatial average velocity ratio (LVR) and average VR of other focused areas respectively for annual and summer prevailing wind situations.

4.1.3 The wind velocity ratios of individual test points are shown in **Figure 5** to **Figure 8** respectively for the Baseline Scheme and the Proposed Scheme for annual situation and summer situations

4.1.4 **Appendix C** shows VR contour plot at pedestrian level. For area covered with landscaped deck within the Subject Site, the VR contour plot shows the level of 2m above the landscaped deck. **Appendix D** shows detailed VR result for tested wind directions.

Table 2 Summary of Spatial Average Wind Velocity Ratios (VR) (Annual)

Focused Group	Spatial Average Wind Velocity Ratio (VR)	Baseline Scheme	Proposed Scheme
	SVR (P1 –P32)	0.11	**0.12**
	LVR (P1-P32, T01 – T73)	0.11	**0.12**
1	Hotel Development at Tung Chung Area 53a (T01 –T10)	0.08	**0.09**
2	Tung Chung Waterfront Road (T11 –T14)	**0.11**	0.10
3	Ying Hei Road (T15 –T25)	0.15	**0.16**
4	Open space between the Subject Site and Century Link (T26 –T28, T70 –T73)	0.15	**0.17**
5	Century Link (T29 –T40)	0.11	**0.12**
6	The Visionary (T41 –T45)	0.09	0.09
7	Green Areas at Costal Skyline (T46 – T49)	0.06	**0.07**
8	Green Areas at Caribbean coast (T50 – T54)	0.05	0.05
9	Ho Yu Primary School and Ho Yu College (T55 – T57)	0.11	0.11
10	Yi Tung Road ((T14, T16 and T48 – T51))	0.06	0.06
11	Proposed Road L3 (T4 –T6, T63 – T69, P5 –P22)	0.09	**0.10**
12	Open areas of the northeast of Subject Site (T58– T62)	0.17	**0.19**
13	Open spaces within Subject Site (S1 – S11)	0.11	**0.12**

Note: bolded values represent higher VR in the comparison

Table 3 Summary of Spatial Average Wind Velocity Ratios (VR) (Summer)

Focused Group	Spatial Average Wind Velocity Ratio (VR)	Baseline Scheme	Proposed Scheme
	SVR (P1 –P32)	0.08	0.08
	LVR (P1-P32, T01 - T73)	0.09	**0.10**
1	Hotel Development at Tung Chung Area 53a (T01 –T10)	0.05	**0.06**
2	Tung Chung Waterfront Road (T11 –T14)	0.10	**0.12**
3	Ying Hei Road (T15 –T25)	0.15	**0.18**
4	Open space between the Subject Site and Century Link (T26 –T28, T70 –T73)	0.11	**0.12**
5	Century Link (T29 –T40)	0.11	0.11
6	The Visionary (T41 –T45)	0.04	0.04
7	Green Areas at Costal Skyline (T46 – T49)	0.04	0.04
8	Green Areas at Caribbean coast (T50 – T54)	0.03	0.03
9	Ho Yu Primary School and Ho Yu College (T55 – T57)	0.11	0.11
10	Yi Tung Road ((T14, T16 and T48 – T51))	0.04	**0.05**
11	Proposed Road L3 (T4 –T6, T63 – T69, P5 –P22)	0.07	**0.09**
12	Open areas of the northeast of Subject Site (T58– T62)	0.21	**0.23**
13	Open spaces within Subject Site (S1 – S11)	0.06	0.06

Note: bolded values represent higher VR in the comparison

4.2 Discussion

4.2.1 The SVR indicates how the lower portion of the buildings on the Subject Site may affect the wind environment of its immediate vicinity. According to **Table 2** and **Table 3**, the annual predicted SVR for the Baseline Scheme and the Proposed Scheme are 0.11 and 0.12 respectively whereas summer predicted SVR for the Baseline Scheme and the Proposed Scheme are both 0.08. This shows that the Proposed Scheme have slightly higher VR under annual wind conditions when compared to the Baseline Scheme and comparable ventilation performance under summer wind conditions.

4.2.2 The predicted LVR for the Baseline Scheme and the Proposed Scheme under annual winds which are 0.11 and 0.12 respectively whereas the summer LVR for the Baseline Scheme and the Proposed Scheme are 0.09 and 0.10 respectively. There are better predicted LVR for both Schemes under annual and summer wind situations. Therefore, the results indicate a slightly better ventilation performance under Proposed Scheme at the immediate areas and its surrounding of the development under annual and summer condition.

4.2.3 According to the **Table 2,** under annual situation, spatial average VR of focused groups of the Proposed Scheme is higher than the Baseline Scheme for Hotel Development at Tung Chung Area 53a, Ying Hei Road, Open space between Subject

Site and Century Link, Century Link, Green Areas at Costal Skyline, Proposed Road L3, open areas of the northeast f Subject Site and Open spaces within Subject Site.

4.2.4 Under summer situation (**Table 3**), the Proposed Scheme performs better than the Baseline Scheme in Focused Group 1 to 4, 10 to 12. These focused areas would have better air ventilation performance under summer situation.

4.2.5 Under NNE wind condition, wind availability of the Subject Site relies on sea breeze. There are higher wind availability of the open spaces between the Subject Site and Hotel Development at Tung Chung 53a and the open spaces between Subject Site and Century Link is observed under both Schemes. From the contour plot of the NNE wind direction under Proposed Scheme, slightly higher VRs is found at the open areas within the Subject Site and Coastal Skyline. This improvement is due to less blockage of the building towers, relocation of the RCP & Retail and carpark together with the slightly large building separation between E and D under the Proposed Scheme, which would facilitate NNE prevailing wind penetrating into the open areas within the Subject Site and further reach to its downstream areas such as Coastal Skyline. Therefore, it can be concluded that the ventilation is improved.

4.2.6 Under the NE wind, Proposed development for both Schemes are obstructing some of the NE prevailing wind flow to the Hotel Development at Tung Chung Area 53a. Similar to the NNE wind conditions, higher predicted VR is observed along open spaces between Subject Site and Century Link. The large open space under both Schemes would still allow NE wind penetrate to the Coastal Skyline. Since relocation of carpark to basement and RCP & Retail under the Proposed Scheme, it would divert the majority of the incoming NE wind towards the Subject Site. Also building separation between Block E and Block D provided under Proposed Scheme would also facilitate wind towards Subject Site. Therefore, it can be concluded that the Proposed Scheme would not induce significant adverse impact to surroundings.

4.2.7 Under ENE wind condition, potential building blockage effect due to the surrounding developments is considered medium. ENE wind mainly enters the Subject Site via the coastal. As the change of building disposition and relocation of the RCP & Retail and carpark under the Proposed Scheme is desirable to capture more wind flow penetrating into the Subject Site, it is observed that a slightly higher VR at the open areas within the Subject Site and open areas between the Hotel Development at Tung Chung 53a and Subject Site. Furthermore, the large building separation between Block E and Block D under the Proposed Scheme would enhance the wind permeability and allow wind penetrate into the Subject Site and further reach to the Coastal Skyline. Thus, slightly higher VR is found at Coastal Skyline.

4.2.8 Under E wind, there is higher wind availability at the existing Tung Chung Waterfront Road and Ying Hei Road. In both scheme, the prevailing E wind would be obstructed by existing buildings such as The Century Link, The Visionary. Thus, wind availability of the Subject Site would be slightly lower under E wind direction. By comparing two schemes, a higher VR is found at Tung Chung Waterfront Road, green areas at Caribbean Coast, Ho Yu Primary School & Ho Yu College and Yi Tung Road under the Proposed Scheme. The building disposition and orientation of the Proposed Scheme. It allows more portion of E wind along Tung Chung Waterfront Road

penetration Caribbean Coast. Thus, a slightly higher VR is observed the aforementioned areas.

4.2.9 Under ESE wind, it is apparent that ESE wind would be significantly blocked by existing buildings (Coastal Skyline, Caribbean Coast), lowering wind availability of the Subject Site under both schemes. Therefore, the ESE prevailing wind mainly enters the Subject Site from Ying Hei Road and Tung Chung Waterfront Road. As observed, under the ESE predicted results, there are slightly higher predicted VR at Tung Chung Waterfront Road, Ying Hei Road, Man Tung Road and Yi Tung Road under Proposed Scheme than the Baseline Scheme.

4.2.10 Under SE and SSE wind condition, wind is able to penetrate the Subject Site via Yi Tung Road. Under both Schemes, it is observed that higher VR is found at Yi Tung Road, Tung Chung Waterfront Road and Hotel Development at Tung Chung Area 53a. Under the Proposed Scheme, the change of the building blocks and sufficient building separation is provided, more wind flow is able to pass through the Subject Site and further reach to the surrounding areas. Thus, it is observed that there is slightly higher VR at open areas between Subject Site and Hotel Development at Tung Chung Area 53a.

4.2.11 Under SSW wind condition, it is found that there are higher wind availability observed near Yi Tung Road, Man Tung Road and open areas between Hotel Development at Tung Chung Area 53a and Subject Site and Tung Chung Waterfront Road under both Schemes. Taking into account the SSW results, there are slightly higher SVR and LVR under the Proposed Scheme than the Baseline Scheme. It indicates that the ventilation performance of the Proposed Scheme is slightly better than the Baseline Scheme. Under the Proposed Scheme, a slightly higher VR is found at open areas between the Subject Site and Century Link. As there is large building separation provided under the Proposed Scheme, more SSW wind flows to the separation and towards the east side of the Subject Site.

4.2.12 Under SW wind condition, there are higher wind availability observed near Yi Tung Road, Tung Chung Waterfront Road and open areas between Hotel Development at Tung Chung Area 53a and Subject Site under both schemes. For the Baseline Scheme, a slightly higher VR is found at open areas between the Subject Site and Century Link. As the building disposition and orientation of the Baseline Scheme, more wind divert to the open areas between the Subject Site and Century Link. On the Contrary, more SW wind towards Subject Site and proposed Road L3 under the Proposed Scheme. It is due to the Proposed Scheme has large building separation, which is favorable to capture wind towards the Subject Site and it surrounding areas. Taking into account the SW results, there is comparable SVR and slightly lower LVR under the Proposed Scheme than the Baseline Scheme. It indicates that the ventilation performance at immediate areas of the Proposed Scheme is comparable whereas slightly lower ventilation performance at its surroundings in SW wind condition.

4.2.13 For the WSW wind, the air paths along Ying Hei Road, Tung Chung Waterfront Road and open spaces next to the Subject Site are effective for wind penetration. For the Proposed Scheme, it is observed that a slightly higher VR is found at the Subject Site, Century Link and Proposed Road L3 when compared to the Baseline Scheme.

Possibly due to the building disposition under the Proposed Scheme, higher VR is found at the open areas of the Subject Site and further reach to the Proposed Road L3. Thus, a slightly higher VR is observed at that area.

5. Conclusions

5.1.1 The Baseline and Proposed Schemes at the Subject Site at Tung Chung Area 54 have been evaluated from an air ventilation standpoint. The Proposed Scheme mainly differs from the Baseline Scheme by relocating the carpark to basement, relocating the RCP & Retail and reduce number of residential blocks. It would result in less building blockage effect and facilitate wind penetration. The maximum building heights of the Proposed Scheme is the same as similar than the Baseline Scheme. Other minor changes include revising the building disposition and orientation.

5.1.2 The Subject Site is surrounded by a number of existing high-rise residential developments and the site wind flow pattern would be significantly influenced by this surrounding environment. For instance, the prevailing winds from E to S towards the Subject Site would be partially blocked by the existing high-rise residential developments. Since there are various building separations proposed in the design of the development to facilitate wind penetration, it would be able to capture more wind flow to the Subject Site and enhance the wind performance.

5.1.3 According to the Quantitative Assessment results, the predicted SVR for Baseline Scheme and Proposed Scheme under annual are 0.11 and 0.12 respectively whereas the summer SVR for the Baseline Scheme and the Proposed Scheme are both 0.08. The predicted LVR for the Baseline Scheme and the Proposed Scheme under annual winds which are 0.11 and 0.12 respectively whereas the summer LVR for the Baseline Scheme and the Proposed Scheme are 0.09 and 0.10 respectively. Therefore, the results indicate a better ventilation performance under Proposed Scheme at the surrounding of the development under annual and summer condition.

5.1.4 To conclude, the Proposed Scheme has incorporated a number of ventilation improvement measures during the scheme design such as wider building separation, reduction of building blockage, relocation of Carpark and RCP & Retail. The modelling results show that it maintains comparable wind performance generally at the pedestrian level of the area around the Subject Site when compared with Baseline Scheme. Therefore, this study demonstrates that the Proposed Scheme will perform better than the Baseline Scheme from an air ventilation standpoint in general.

FIGURES

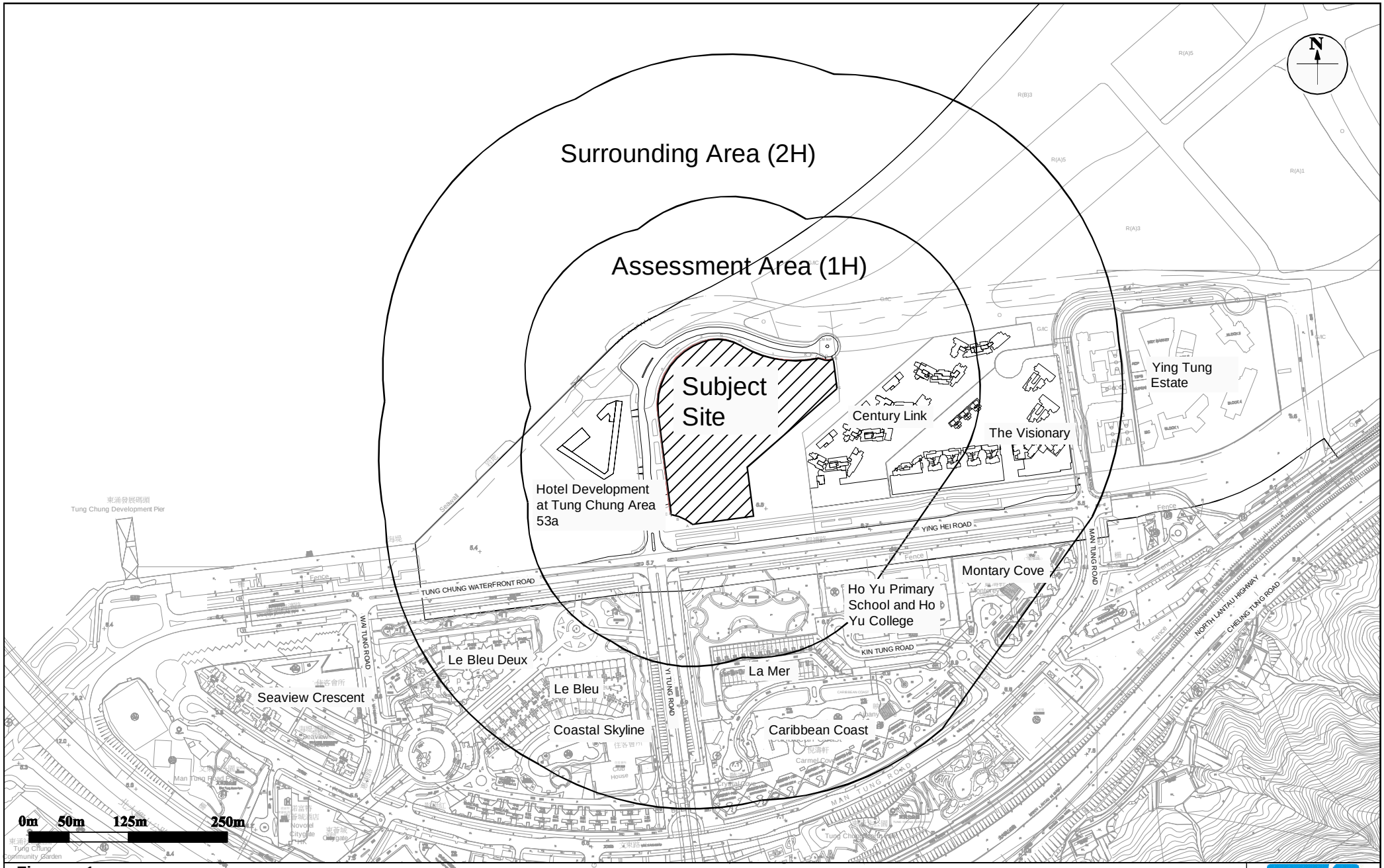

Figure: 1

Title: Location of Subject Site and Its Environs

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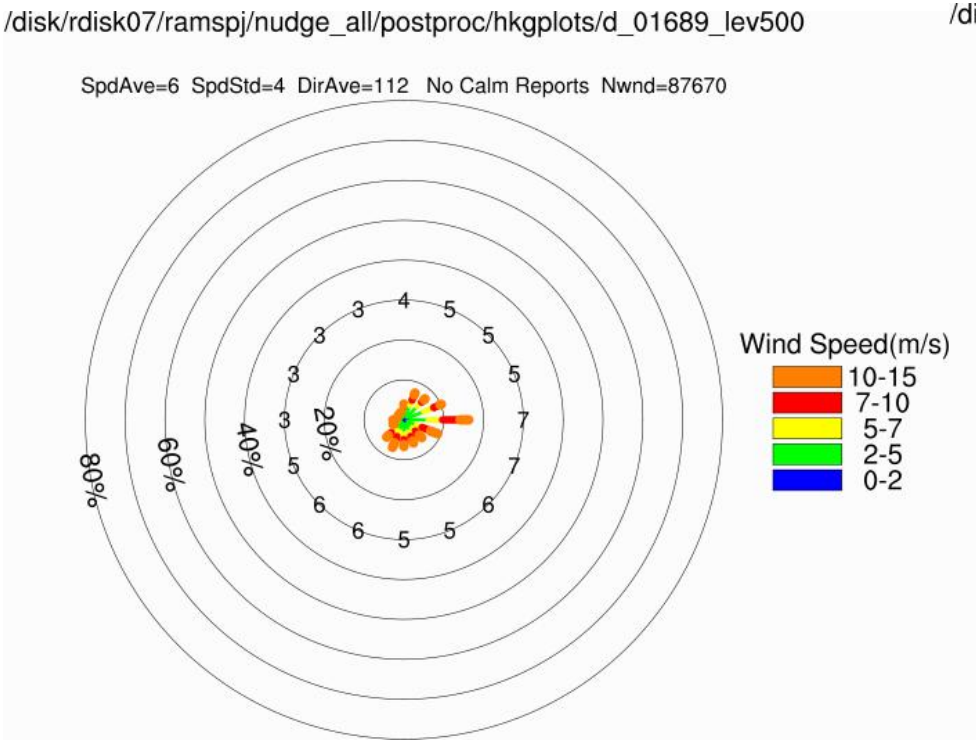
Date:	Jan 2018



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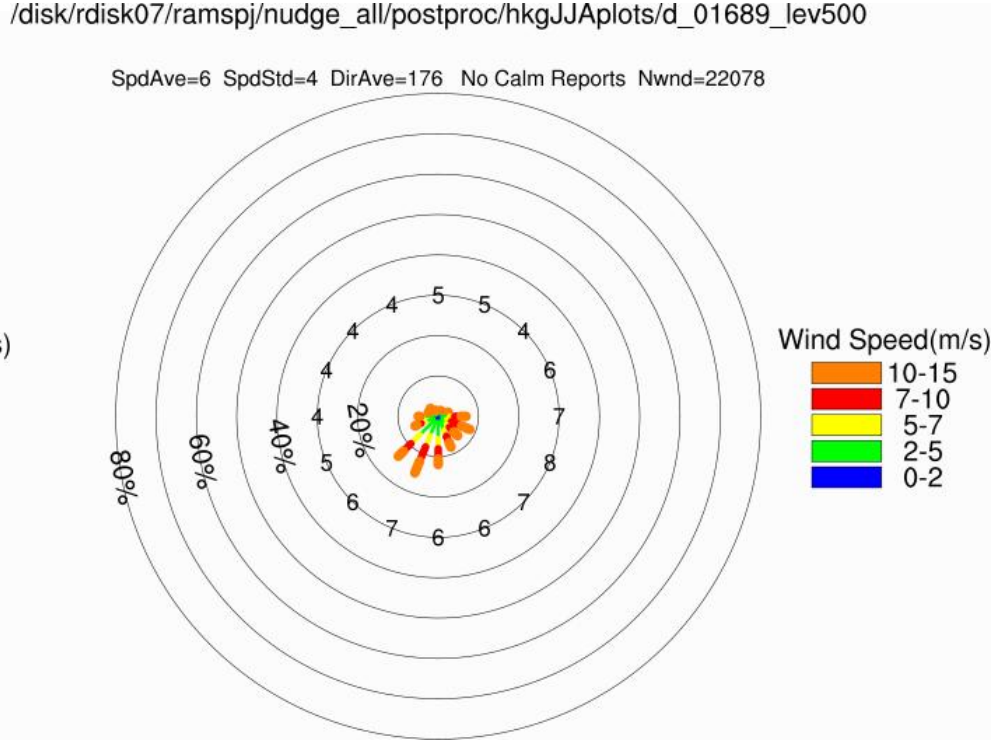

Summer

Figure:	**2**	RAMBOLL
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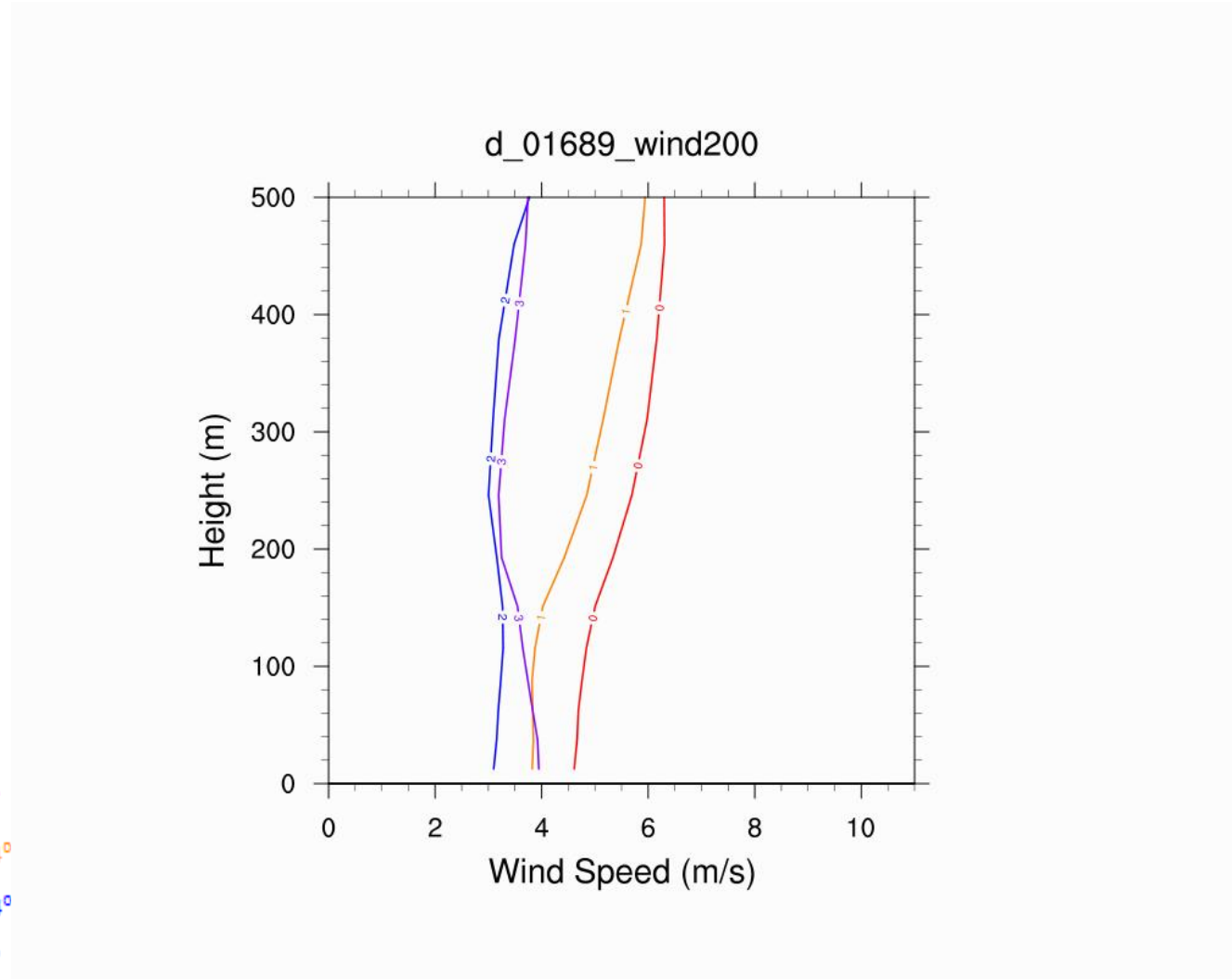
Project:	**Quantitative Air Ventilation Assessment for Subsidised Sale Flats Development At Tung Chung Area 54, Tung Chung**	Rev.: 1.0
		Date: Jan 2018



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Title:	**Wind Profile Curve for Grid X:033, Y:037**	Drawn by: KC
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		Date: Jan 2018

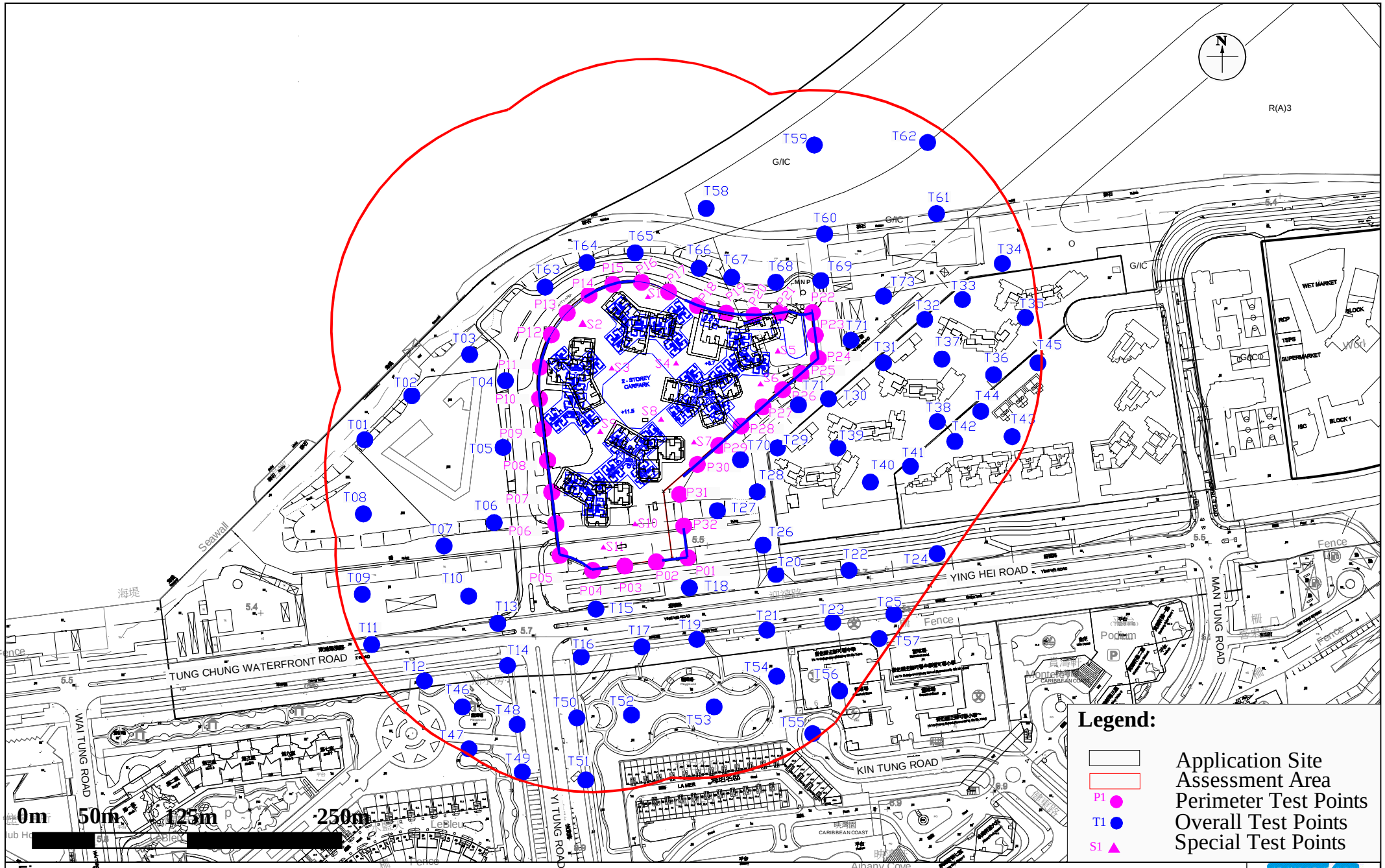

Figure: 4

Title: Test Points Selected For Quantitative Air Ventilation Assessment

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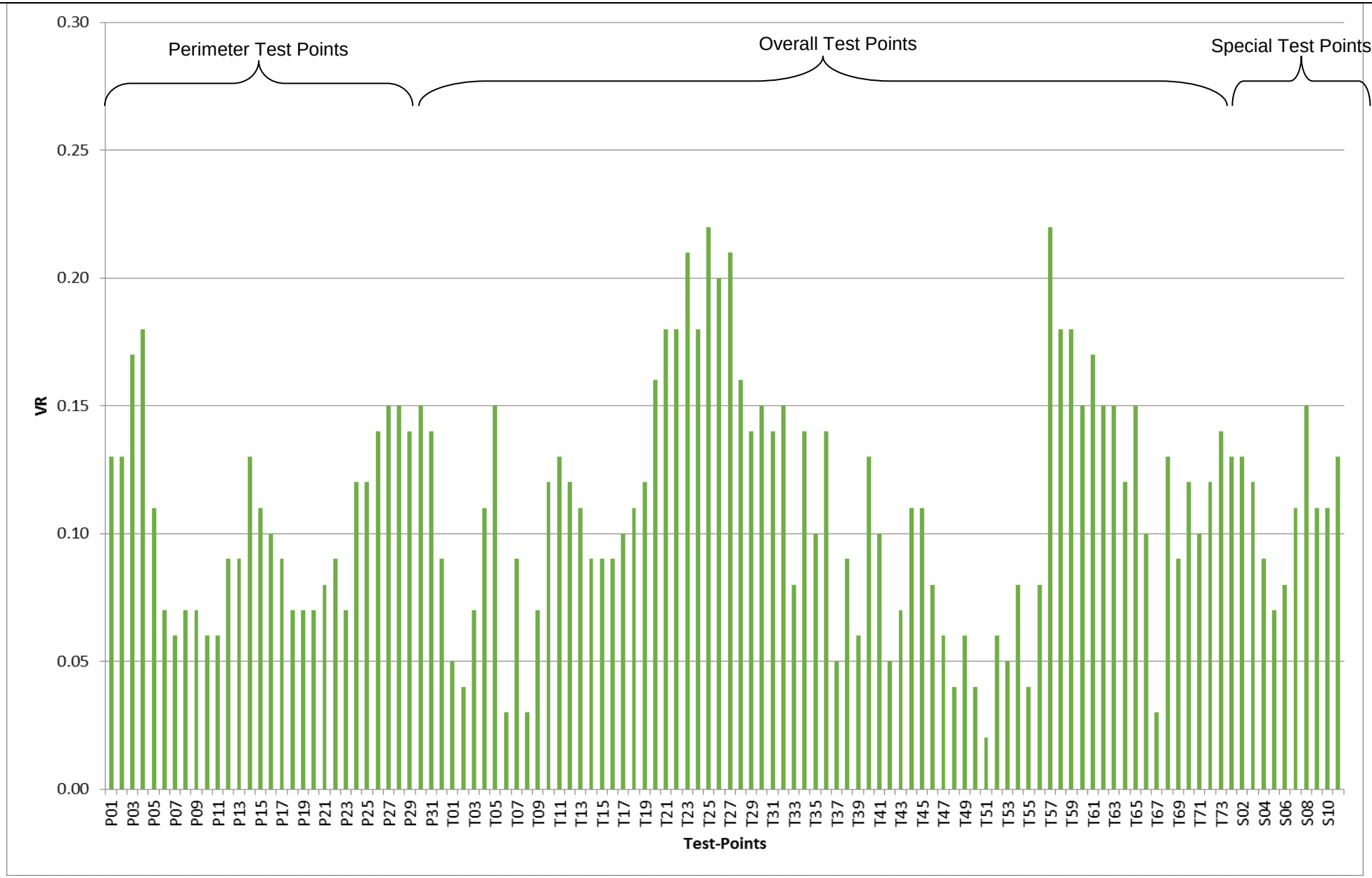

Figure: 5	RAMBOLL
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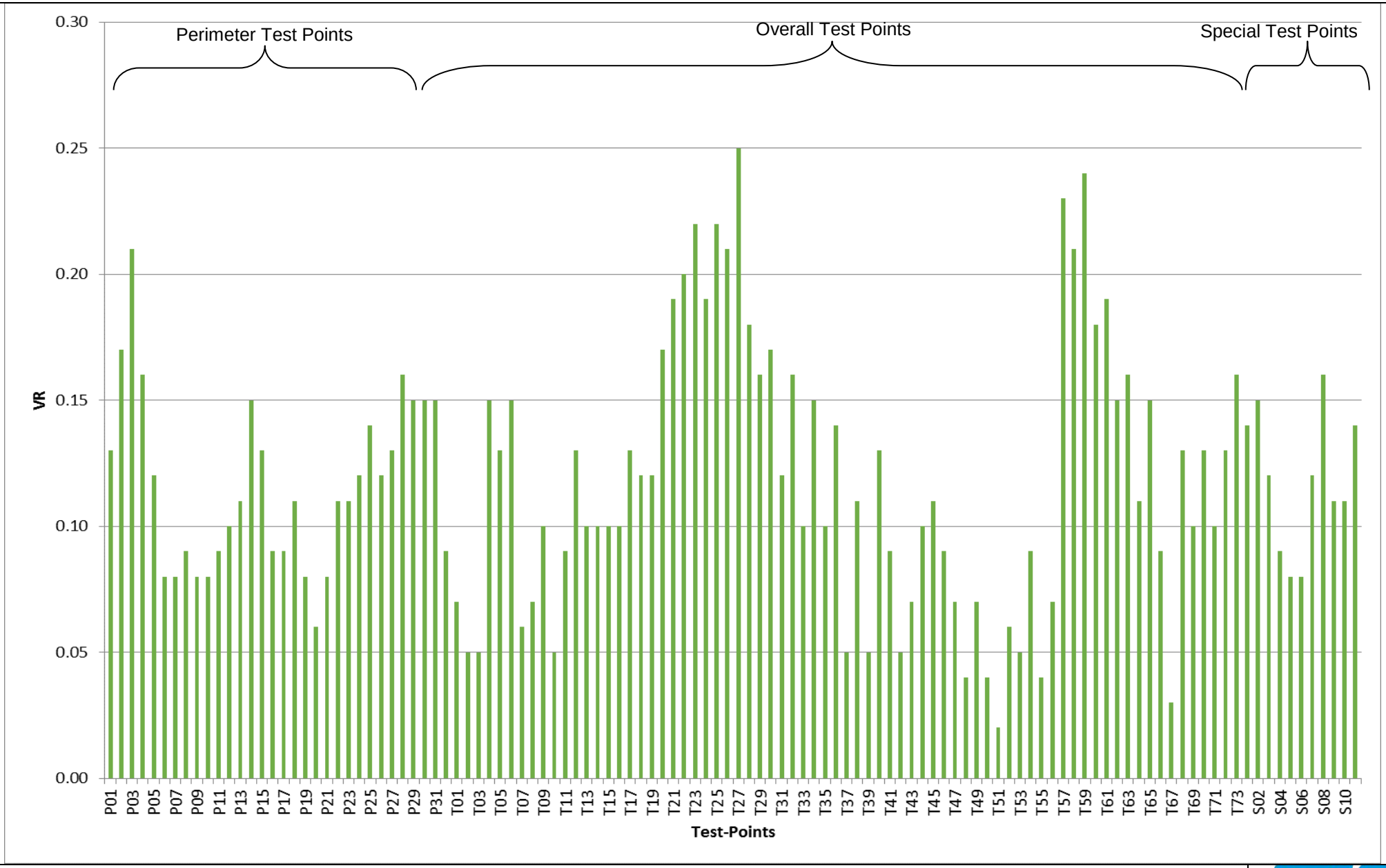
	Date: Apr 2019



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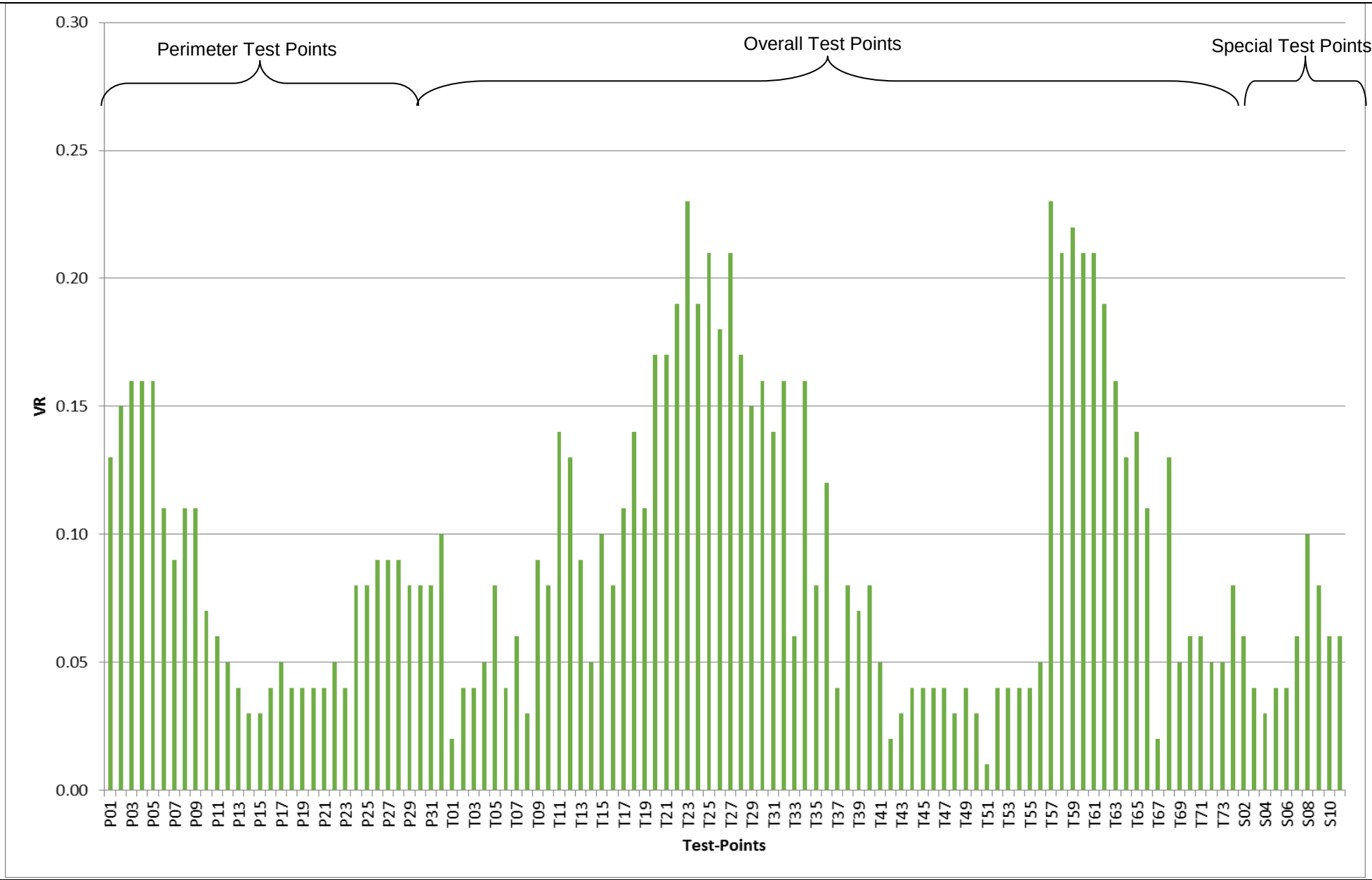
	Date: Apr 2019



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Project: **Quantitative Air Ventilation Assessment for Subsidised Sale Flats Development At Tung Chung Area 54, Tung Chung**	Rev.: 1.2
	Date: Apr 2019

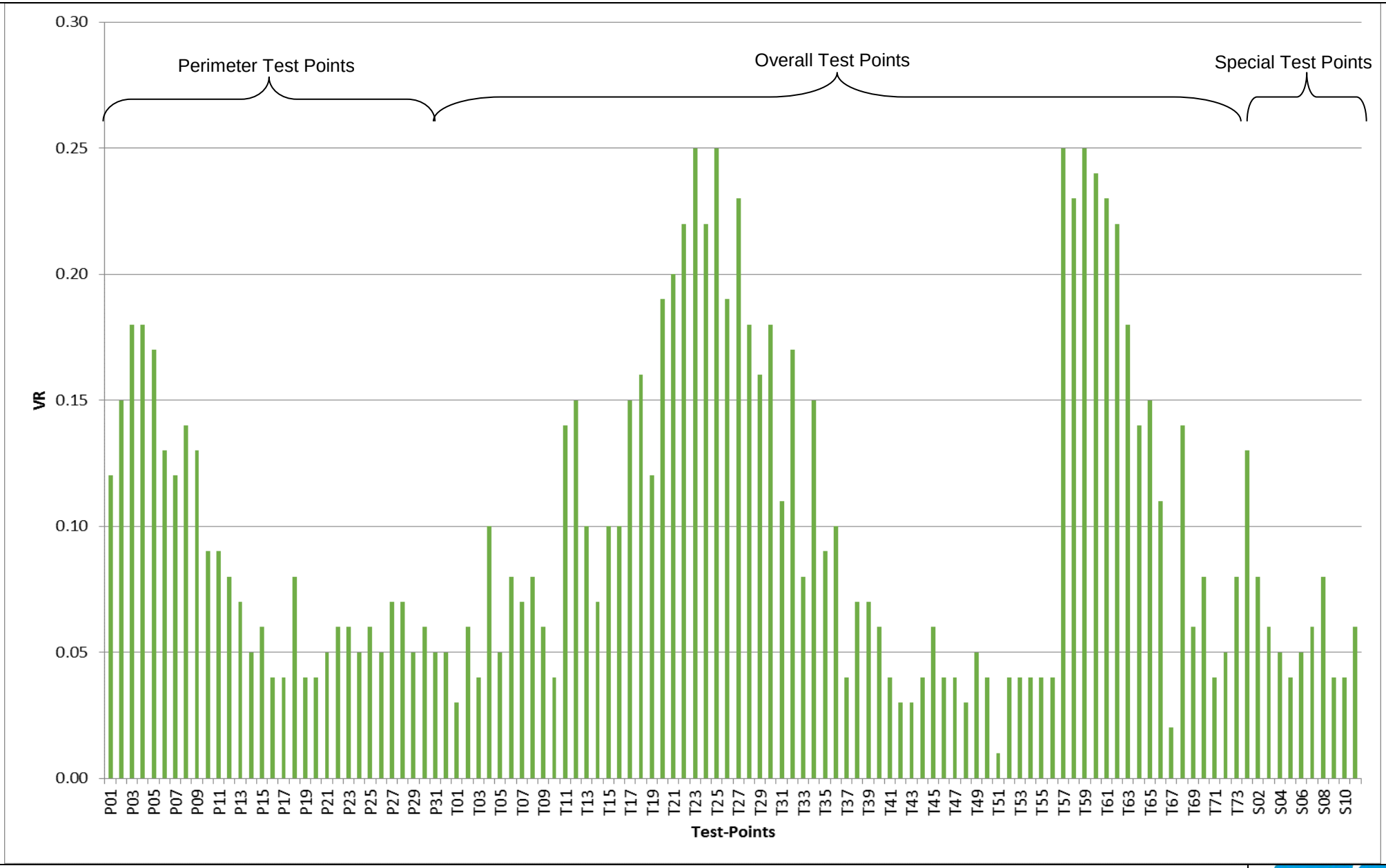
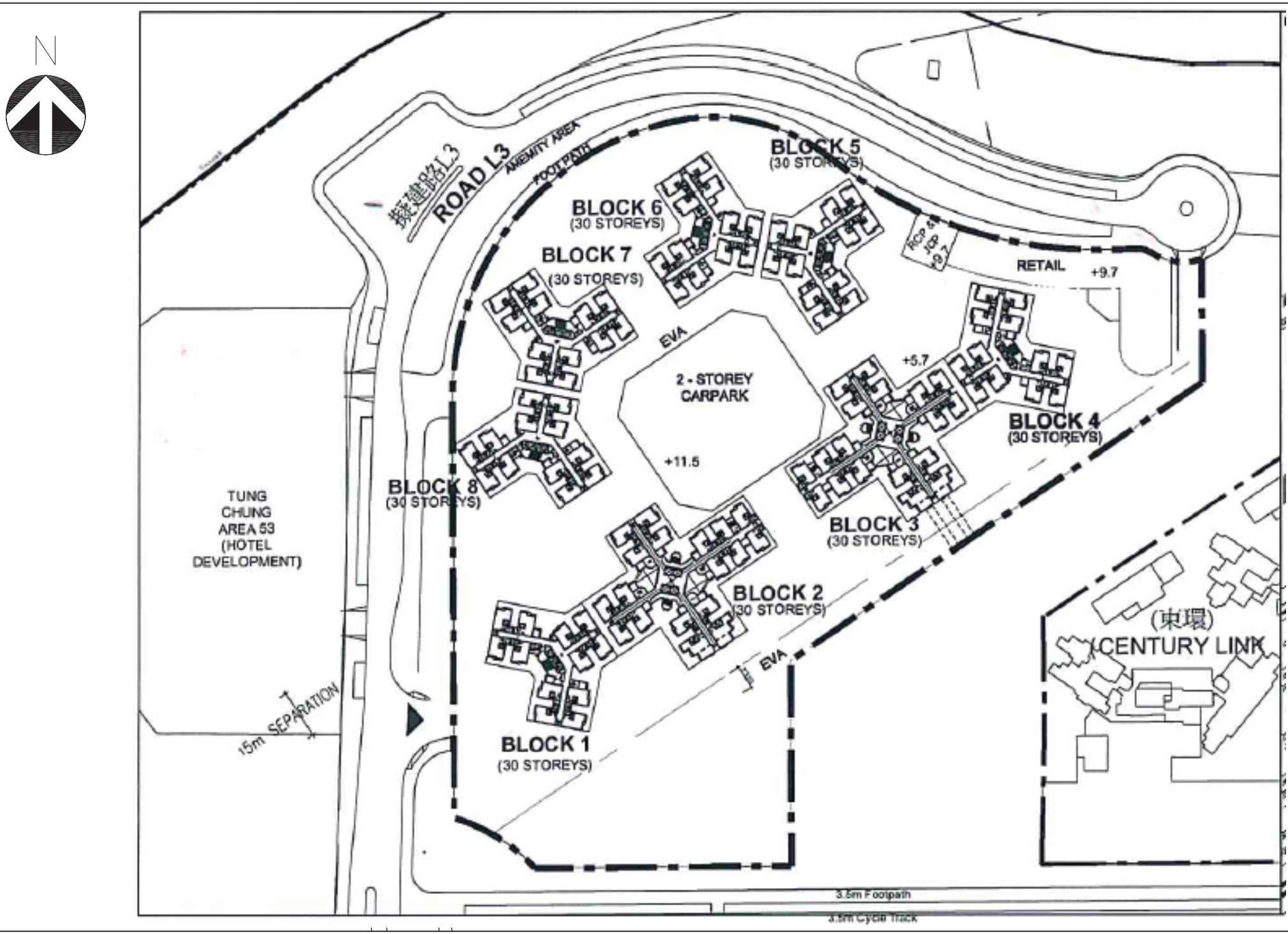


Figure: 8	RAMBOLL
Title: Average VR Results of the Proposed Scheme (Summer)	Drawn by: CC
	Checked by: CC
Project: Quantitative Air Ventilation Assessment for Subsidised Sale Flats Development At Tung Chung Area 54, Tung Chung	Rev.: 1.2
	Date: Apr 2019

APPENDIX A:
BASELINE SCHEME


N
擬建路L3
ROAD L3
AMENITY AREA
FOOT PATH
BLOCK 5
(30 STOREYS)
BLOCK 6
(30 STOREYS)
BLOCK 7
(30 STOREYS)
RCP 4
+9.7
RETAIL
+9.7
EVA
2 - STOREY
CARPARK
+11.5
+5.7
BLOCK 4
(30 STOREYS)
BLOCK 8
(30 STOREYS)
TUNG
CHUNG
AREA 53
(HOTEL
DEVELOPMENT)
BLOCK 3
(30 STOREYS)
BLOCK 2
(30 STOREYS)
(東環)
CENTURY LINK
EVA
15m SEPARATION
BLOCK 1
(30 STOREYS)
3.5m Footpath
3.5m Cycle Track

APPENDIX B:
PROPOSED SCHEME

N

COAST LINE

REGIONAL OPEN SPACE (PLANNED)

seawall

ROAD L3 (APP. 21M. W.)

撥建路 ROAD L3 (APP. 21M. W.)

EVA / DRIVEWAY

FOOT PATH

BLOCK E

BLOCK F

BLOCK D

BLOCK C

BLOCK B

BLOCK A

RETAIL & RCP

CPA

LAWN

LAWN

EVA / DRIVEWAY

EVA / DRIVEWAY

MAJOR BREEZEWAY / VIEW CORRIDOR

KINDERGARTEN ENTRANCE

SECONDARY PEDESTRIAN ENTRANCE

VEHICULAR ENTRANCE

SECONDARY PEDESTRIAN ENTRANCE

MAIN PEDESTRIAN ENTRANCE

VEHICULAR ENTRANCE

BASEMENT CARPARK PEDESTRIAN ENTRANCE

SECONDARY PEDESTRIAN ENTRANCE

RAMP UP

MASTER WATER METER ROOM

GAS KIOSK

ESS

TS

TS

TS

TS

迎禧路 5 號

5 YING HEI RO

(東環)

(CENTURY LINK)

WIP Nov 2013

TUNG CHUNG AREA 53a

(HOTEL DEVELOPMENT)

3.5m Footpath

3.5m Cycle Track

STAIRCASE CP–ST7, DETAIL REFER TO DWG. NO. IS13/BC/A/LO–24

STAIRCASE CP–ST11, DETAIL REFER TO DWG. NO. IS13/BC/A/LO–26

COVER WALKWAY CW4, DETAIL REFER TO DWG. NO. IS13/EX/A/LO–07 TO LO–08

STAIRCASE CP–ST8, DETAIL REFER TO DWG. NO. IS13/BC/A/LO–25

COVER WALKWAY CW5, DETAIL REFER TO DWG. NO. IS13/EX/A/LO–09 TO LO–10

WIND CATCHER 6, DETAIL REFER TO DWG. NO. IS13/EX/A/AS–01 TO AS–04

STAIRCASE CP–ST6, DETAIL REFER TO DWG. NO. IS13/BC/A/LO–24

COVER WALKWAY CW10, DETAIL REFER TO DWG. NO. IS13/EX/A/LO–17 TO LO–18

STAIRCASE CP–ST13, DETAIL REFER TO DWG. NO. IS13/BC/A/LO–27

WIND CATCHER 3, DETAIL REFER TO DWG. NO. IS13/EX/A/AS–01 TO AS–04

STAIRCASE CP–ST5, DETAIL REFER TO DWG. NO. IS13/BC/A/LO–23

STAIRCASE CP–ST3, DETAIL REFER TO DWG. NO. IS13/BC/A/LO–22

COVER WALKWAY CW8, DETAIL REFER TO DWG. NO. IS13/EX/A/LO–14 TO LO–15

STAIRCASE CP–ST1, DETAIL REFER TO DWG. NO. IS13/BC/A/LO–21

COVER WALKWAY CW3, DETAIL REFER TO DWG. NO. IS13/EX/A/LO–05 TO LO–06

WIND CATCHER 5, DETAIL REFER TO DWG. NO. IS13/EX/A/AS–01 TO AS–04

STAIRCASE CP–ST9, DETAIL REFER TO DWG. NO. IS13/BC/A/LO–25

STAIRCASE CP–ST12, DETAIL REFER TO DWG. NO. IS13/BC/A/LO–26

WIND CATCHER 4, DETAIL REFER TO DWG. NO. IS13/EX/A/AS–01 TO AS–04

COVER WALKWAY CW2, DETAIL REFER TO DWG. NO. IS13/EX/A/LO–03 TO LO–04

STAIRCASE CP–ST10, DETAIL REFER TO DWG. NO. IS13/BC/A/LO–23

STAIRCASE CP–ST4, DETAIL REFER TO DWG. NO. IS13/BC/A/LO–22

WIND CATCHER 2, DETAIL REFER TO DWG. NO. IS13/EX/A/AS–01 TO AS–04

COVER WALKWAY CW1, DETAIL REFER TO DWG. NO. IS13/EX/A/LO–01 TO LO–02

STAIRCASE CP–ST2, DETAIL REFER TO DWG. NO. IS13/BC/A/LO–21

WIND CATCHER 1, DETAIL REFER TO DWG. NO. IS13/EX/A/AS–01 TO AS–04

INDEX PLAN OF GROUND FLOOR

1:1500

REFER TO DWG. NO. IS13/BLE/A/LO–01

REFER TO DWG. NO. IS13/BLF/A/LO–01

PEDESTRIAN ENTRANCE, REFER TO DWG. NO. IS13/EX/A/LO–51 TO LO–52

REFER TO DWG. NO. IS13/RR/A/LO–01

REFER TO DWG. NO. IS13/BC/A/LO–08

MAIN ENTRANCE PORTAL REFER TO DWG. NO. IS13/EX/A/LO–30 TO LO–31

CARPARK ENTRANCE CANOPY, REFER TO DWG. NO. IS13/EX/A/AS–11 TO LO–12

VEHICULAR ACCESS GATE, REFER TO DWG. NO. IS13/EX/A/LO–40 TO LO–41

REFER TO DWG. NO. IS13/KDN/A/LO–01

REFER TO DWG. NO. IS13/BLD/A/LO–01

REFER TO DWG. NO. IS13/BLC/A/LO–01

REFER TO DWG. NO. IS13/BLB/A/LO–01

REFER TO DWG. NO. IS13/BLA/A/LO–01

PEDESTRIAN ENTRANCE, REFER TO DWG. NO. IS13/EX/A/LO–53 TO LO–54

NOTES:

LEGEND

- SITE BOUNDARY
- STRUCTURAL FLOOR LEVEL
- FINISHED FLOOR LEVEL
- P PLANTER
- B BENCH
- TP TREE PIT
- STREET FIRE HYDRANT
- NON–BUILDING AREA
- MAIN PEDESTRIAN ENTRANCE
- SECONDARY PEDESTRIAN ENTRANCE
- VEHICULAR ENTRANCE
- ENTRANCE TO CARPARK
- SV–XX SMOKE VENT, DETAIL REFER TO DWG. NO. IS13/EX/A/AS–21 TO AS–25
- DG–X DOG HOUSE, DETAIL REFER TO DWG. NO. IS13/EX/A/AS–26 TO AS–29

TENDER ADDENDUM NO.2

REVISIONS

NO	DESCRIPTION AND DATE	INITIAL AND DESIGNATION DWN	CKD	AUTH
A	ADDENDUM NO.2 (11/2018) 1. REV. LAYOUT.	S.W. MA	E.H.	C.C.

ORIGINAL SIGNED

	NAME AND DESIGNATION	INITIAL	DATE
AUTHORISED FOR ISSUE BY HD	Ms. CHIM Sau Yi (CA / 5)	ORIGINAL SIGNED	10/2018
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AUTHORISED	Mr. Chris Che (Design Director)	ORIGINAL SIGNED	10/2018
ENDORSED	Mr. Joel Chan (Senior Design Professional)	ORIGINAL SIGNED	10/2018
CHECKED	Mr. Edward Ho (Design Professional)	ORIGINAL SIGNED	10/2018
DRAWN	Mr. Ma Siu Wah (Drawing Office Team Leader)	ORIGINAL SIGNED	10/2018

PROJECT: CONSTRUCTION OF SUBSIDISED SALE FLATS DEVELOPMENT AT TUNG CHUNG AREA 54

DRAWING TITLE: SITE LAYOUT PLAN GROUND FLOOR LEVEL

SCALE: 1 : 500 (A1)

DRAWING NO.: IS13/SITE/A/LO–03/A

SOURCE:

ICU NO.:

AutoCAD 2000 A1 594 x 841

HOUSING DEPARTMENT

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COUNTERCHECKED ☑

N

REGIONAL OPEN SPACE (PLANNED)

COAST LINE

Seawall

擬建路 ROAD L3 (APP. 21M. W.)

擬建路 ROAD L3 (APP. 21M. W.)

擬建路 ROAD L3 (APP. 21M. W.)

擬建路 ROAD L3[10] (APP. 21M. W.)

FP

FP

EVA / DRIVEWAY

FOOT PATH

BLOCK D

BLOCK E

BLOCK F

BLOCK C

BLOCK B

BLOCK A

RETAIL & RCP

CPA

CPA

LAWN

LAWN

8.750(T.O.S.)

RAMP UP

EVA / DRIVEWAY

EVA / DRIVEWAY

TS

ESS

MAJOR BREEZEWAY /VIEW CORRIDOR

(東環)
(CENTURY LINK)

WIP Nov 2013

TUNG CHUNG AREA 53a
(HOTEL DEVELOPMENT)

PLANNED LOCAL OPEN SPACE

CARPARK ENTRANCE CANOPY, DETAIL REFER TO DWG. NO. IS13/EX/A/AS-11 TO AS-12

3.5m Footpath

3.5m Cycle Track

TS

TS

NOTES:

LEGEND

SITE BOUNDARY

STRUCTURAL FLOOR LEVEL

FINISHED FLOOR LEVEL

REVISIONS

NO	DESCRIPTION AND DATE	INITIAL AND DESIGNATION DWN	CKD	AUTH

	NAME AND DESIGNATION	INITIAL	DATE
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DRAWN	Mr. Ma Siu Wah (Drawing Office Team Leader)	ORIGINAL SIGNED	10/2018

PROJECT: CONSTRUCTION OF SUBSIDISED SALE FLATS DEVELOPMENT AT TUNG CHUNG AREA 54

DRAWING TITLE: SITE LAYOUT PLAN- FIRST FLOOR LEVEL

SCALE: 1 : 500 (A1)

DRAWING NO.: IS13/SITE/A/LO-04

SOURCE:

ICU NO.:

AutoCAD 2000 A1 594 x 841

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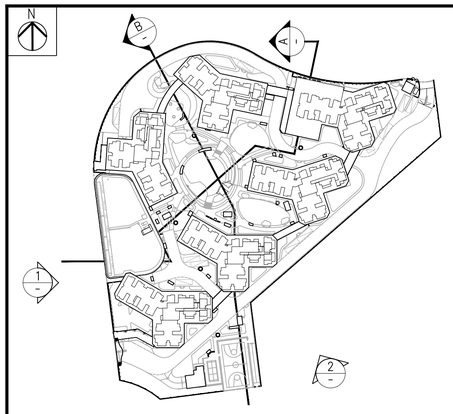

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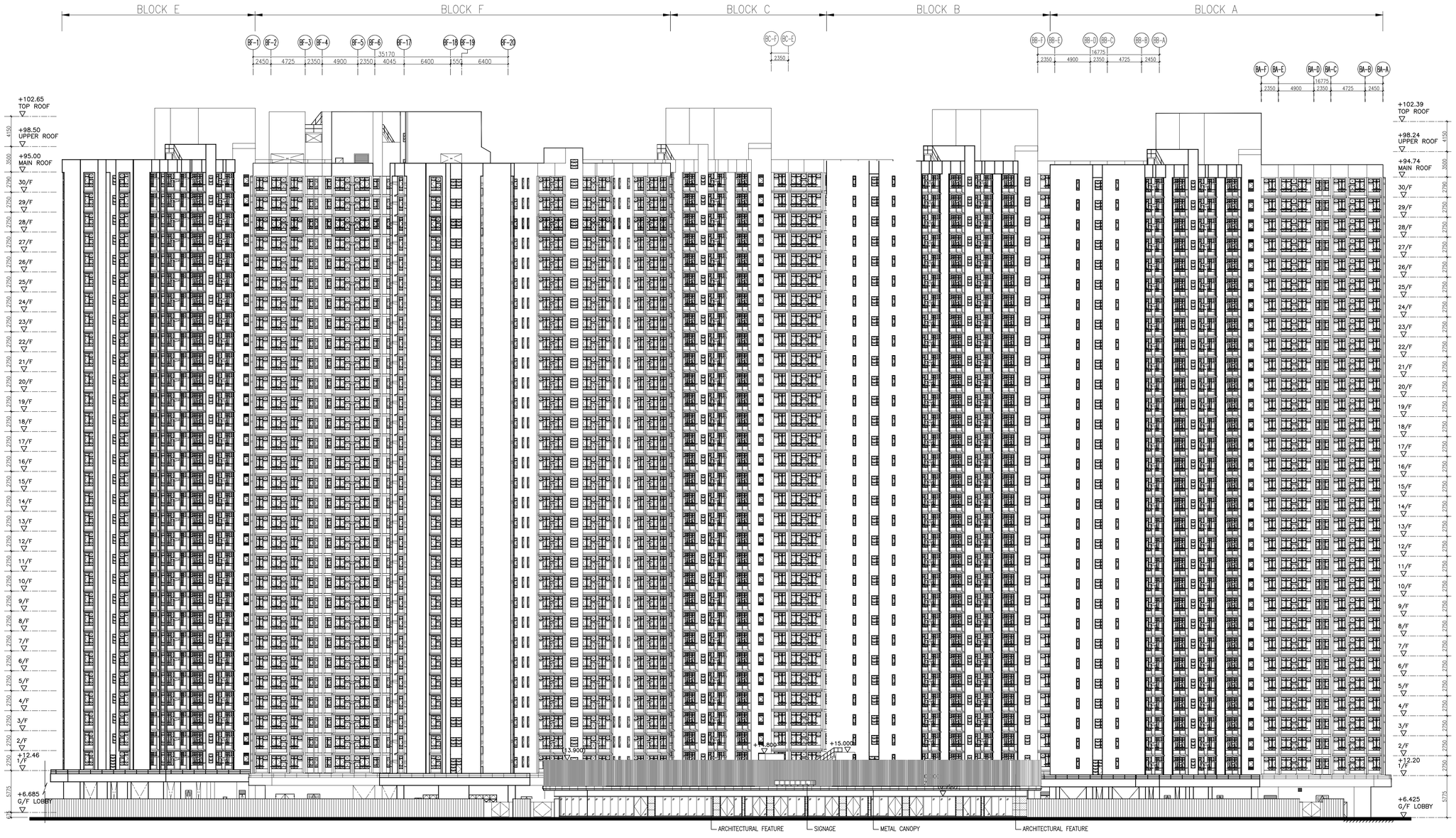

SITE ELEVATION 1

NOTES:

REVISIONS

NO	DESCRIPTION AND DATE	INITIAL AND DESIGNATION DWN	CKD	AUTH

	NAME AND DESIGNATION	INITIAL	DATE
AUTHORISED FOR ISSUE BY HD	Ms. CHIM Sau Yi (CA / 5)	ORIGINAL SIGNED	10/2018
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DRAWN	Mr. Ma Siu Wah (Drawing Office Team Leader)	ORIGINAL SIGNED	10/2018

PROJECT
CONSTRUCTION OF SUBSIDISED SALE FLATS DEVELOPMENT AT TUNG CHUNG AREA 54

DRAWING TITLE
SITE ELEVATION 1

SCALE 1 : 300 (A1)

DRAWING NO.
IS13/SITE/A/LO-07

SOURCE

ICU NO.

AutoCAD 2000 A1 594 x 841

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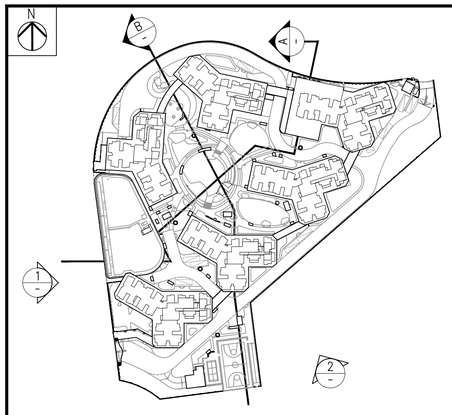

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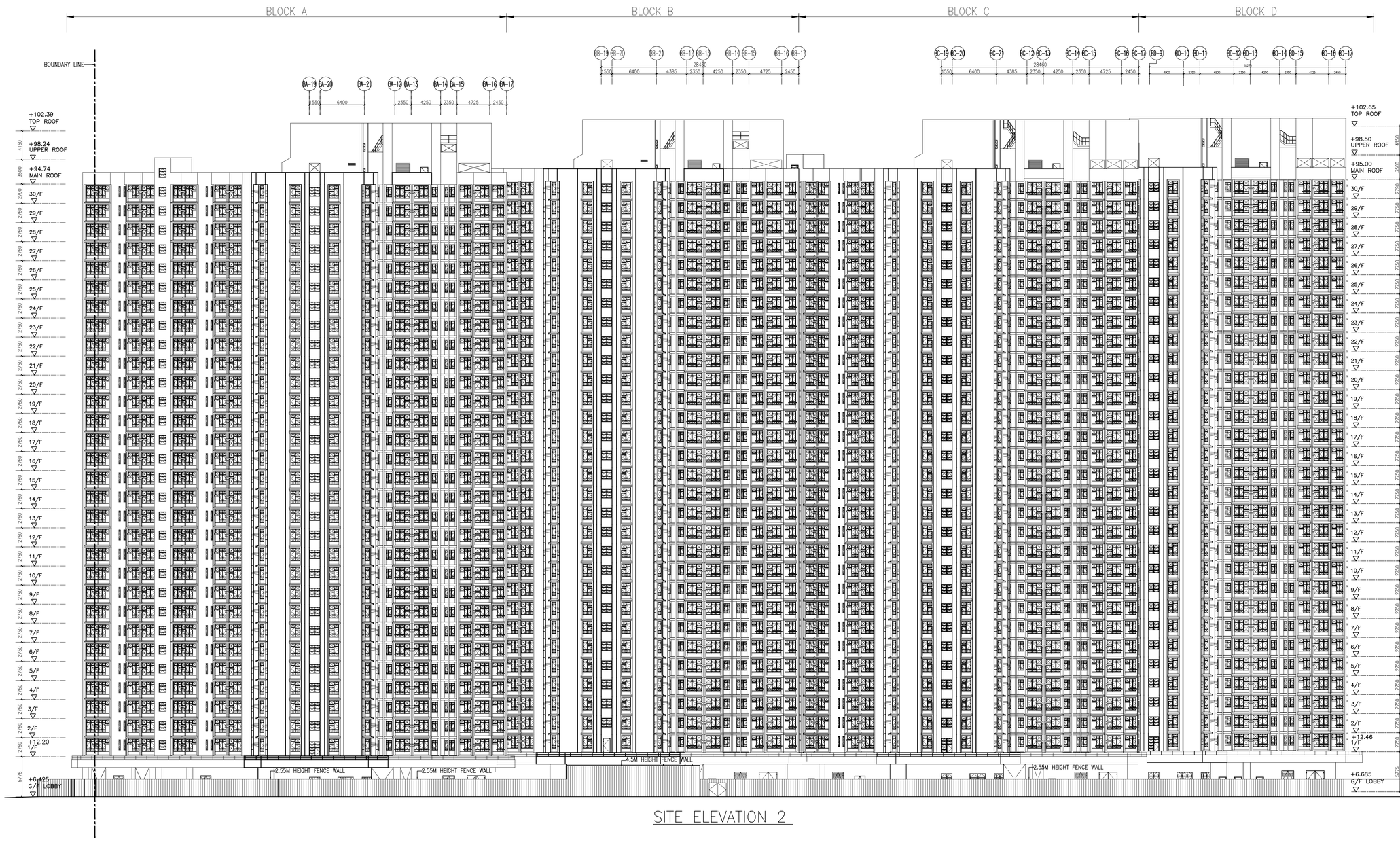

SITE ELEVATION 2

NOTES:

REVISIONS

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AUTHORISED FOR ISSUE BY HD	Ms. CHIM Sau Yi (CA / 5)	ORIGINAL SIGNED	10/2018

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DRAWN	Mr. Ma Siu Wah (Drawing Office Team Leader)	ORIGINAL SIGNED	10/2018

PROJECT
CONSTRUCTION OF SUBSIDISED SALE FLATS DEVELOPMENT AT TUNG CHUNG AREA 54

DRAWING TITLE
SITE ELEVATION 2

SCALE 1 : 300 (A1)

DRAWING NO.
IS13/SITE/A/LO-08

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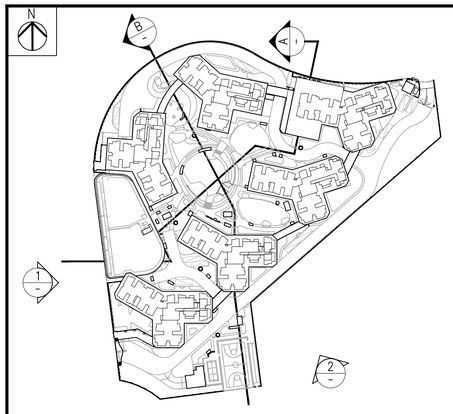

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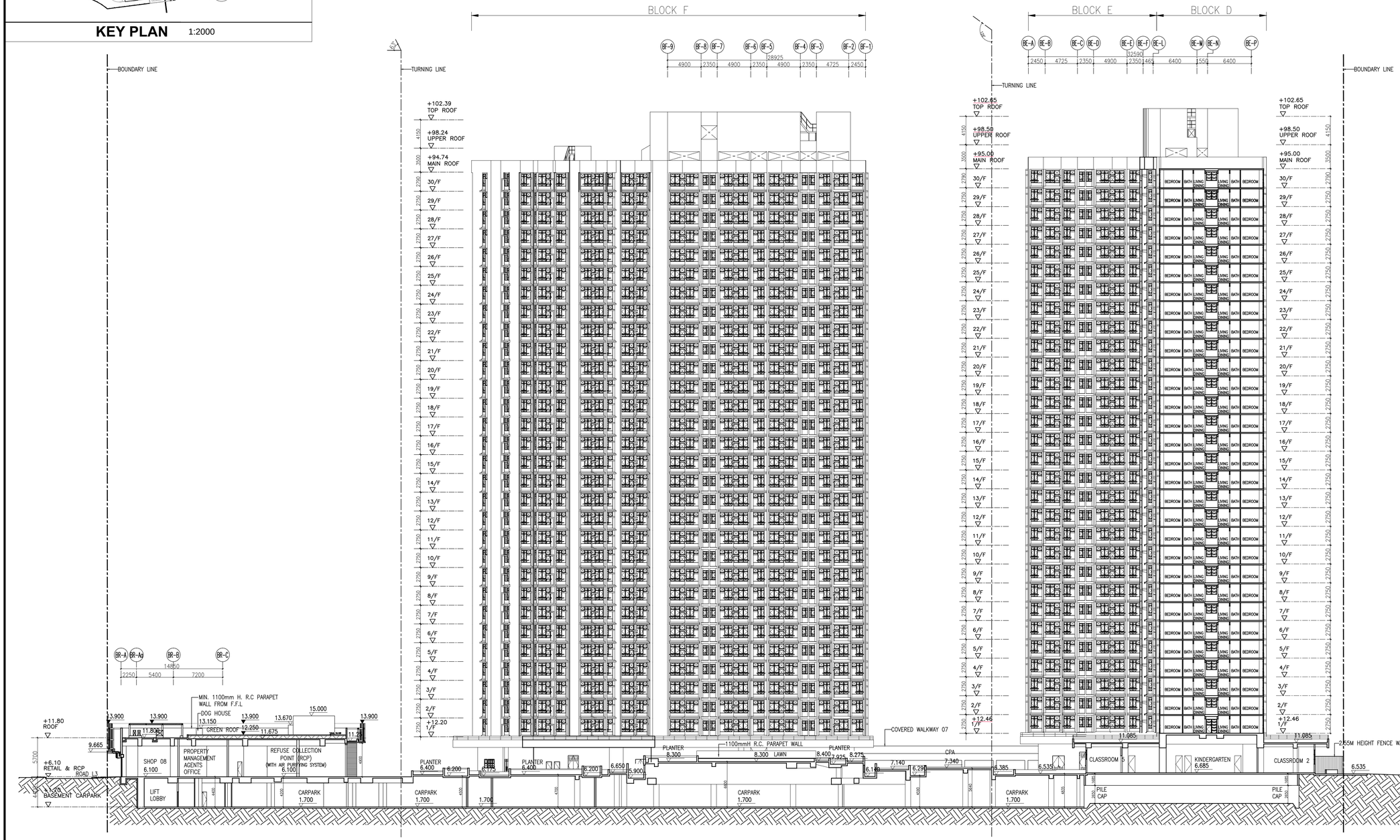

SITE SECTION A–A

NOTES:

REVISIONS		INITIAL AND DESIGNATION		
NO	DESCRIPTION AND DATE	DWN	CKD	AUTH

	NAME AND DESIGNATION	INITIAL	DATE
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PROJECT
CONSTRUCTION OF SUBSIDISED SALE FLATS DEVELOPMENT AT TUNG CHUNG AREA 54

DRAWING TITLE
SITE SECTION A-A

SCALE 1 : 300 (A1)

DRAWING NO.
IS13/SITE/A/LO-09

SOURCE

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AutoCAD 2000 A1 594 x 841

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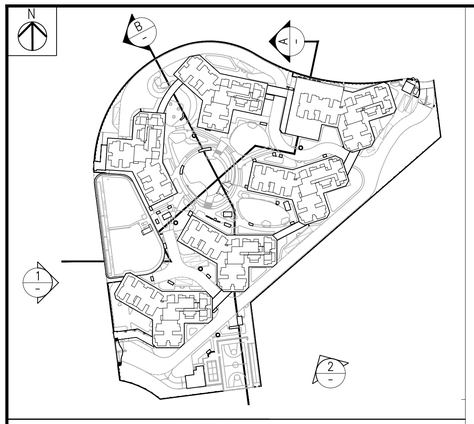

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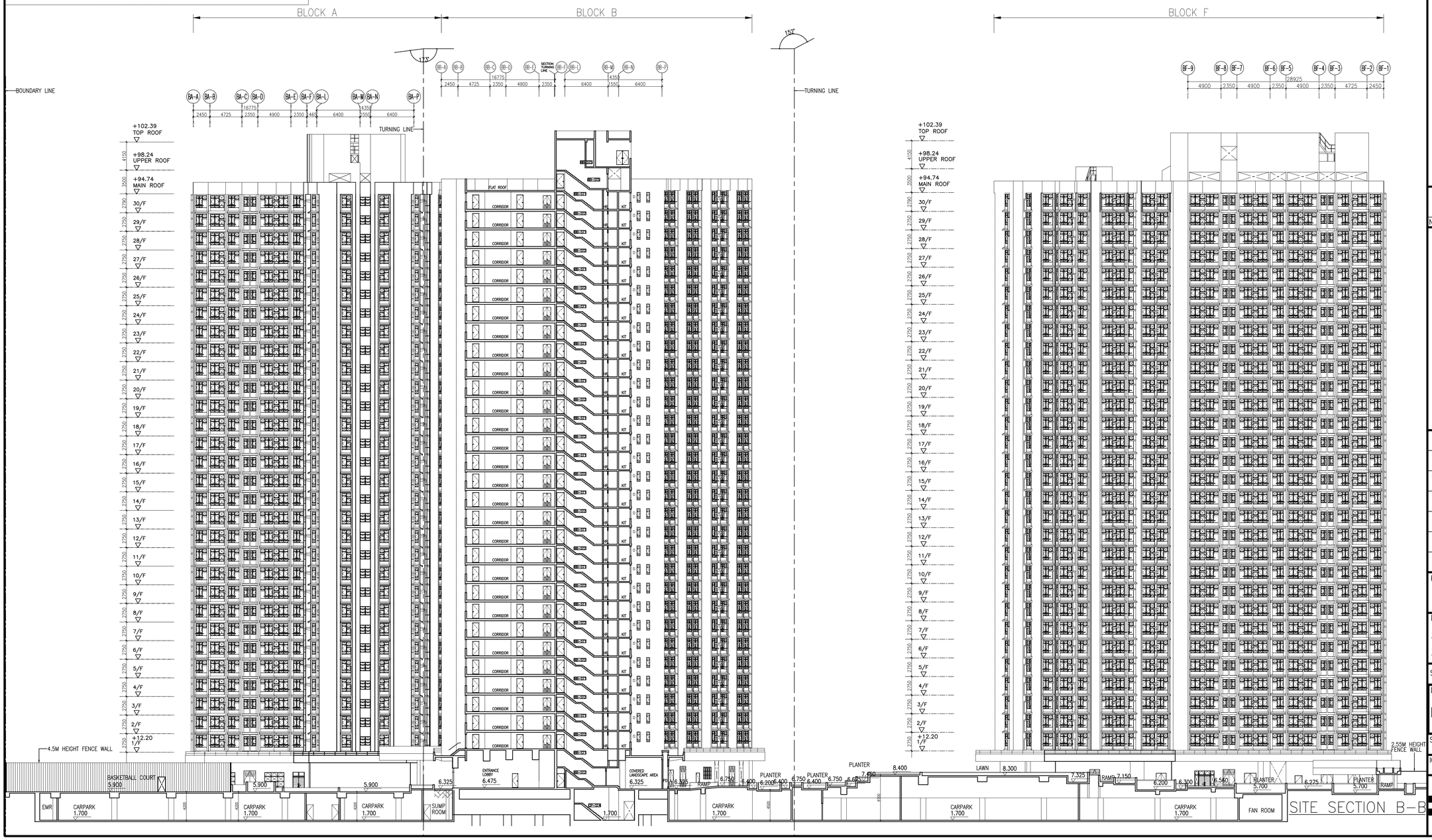

NOTES:

REVISIONS

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PROJECT
CONSTRUCTION OF SUBSIDISED SALE FLATS DEVELOPMENT AT TUNG CHUNG AREA 54

DRAWING TITLE
SITE SECTION B-B

SCALE 1 : 300 (A1)

DRAWING NO.
IS13/SITE/A/LO-10

SOURCE

ICU NO.

AutoCAD 2000 AT 594 x 841

HOUSING DEPARTMENT

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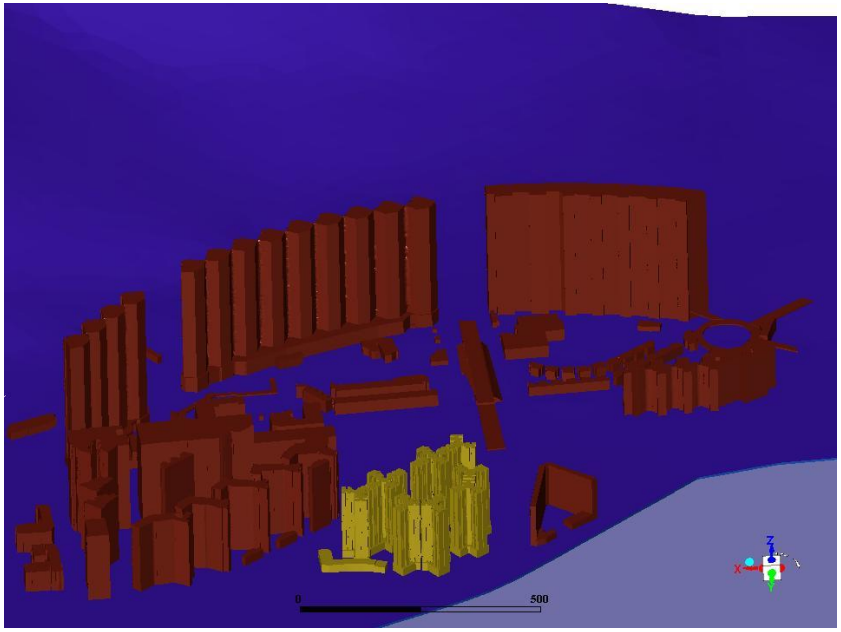
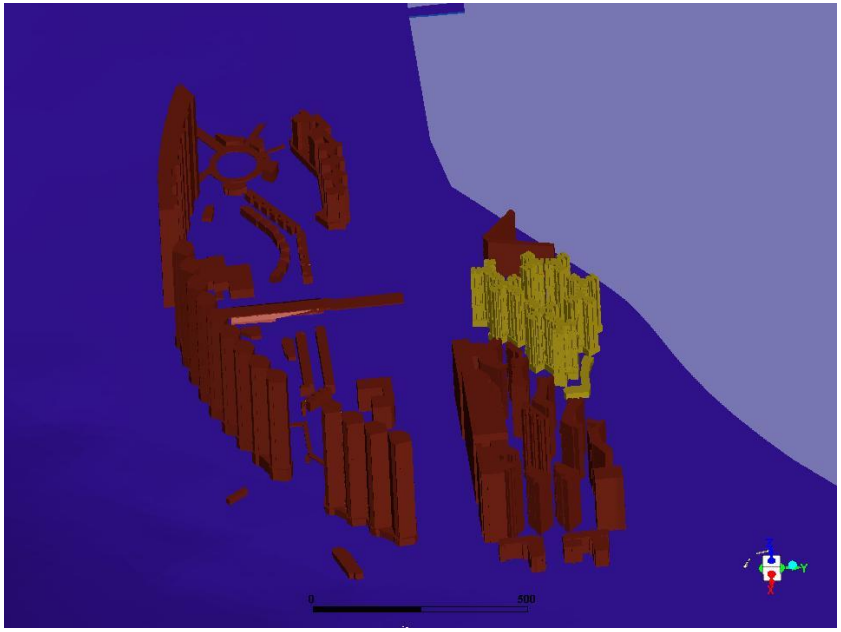
COUNTERCHECKED ☑

APPENDIX C:
DOMAIN SIZE, CFD MODEL IN DIFFERENT VIEWS, CONTOUR PLOTS OF SIMULATION RESULTS

Appendix C Captured CFD Model in Different Views



Baseline Scheme - N



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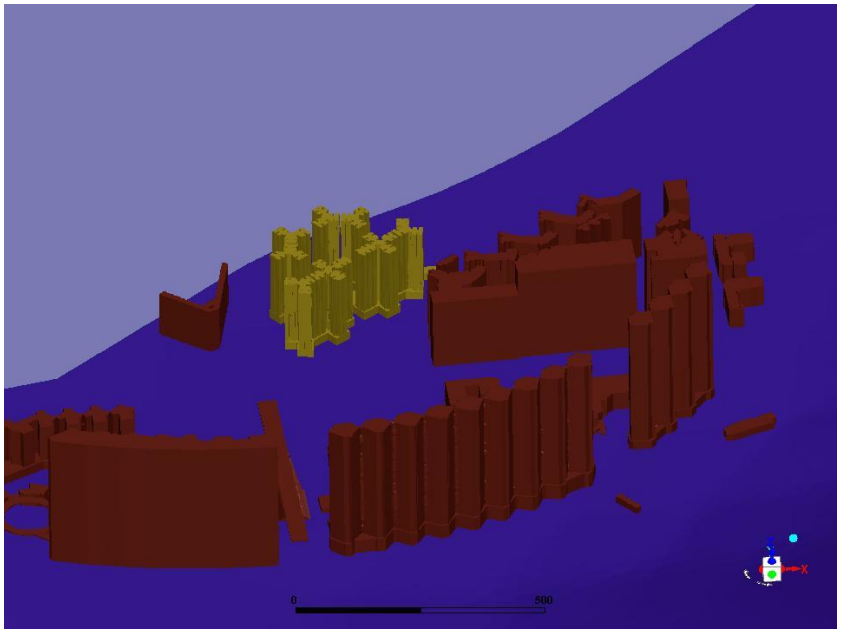
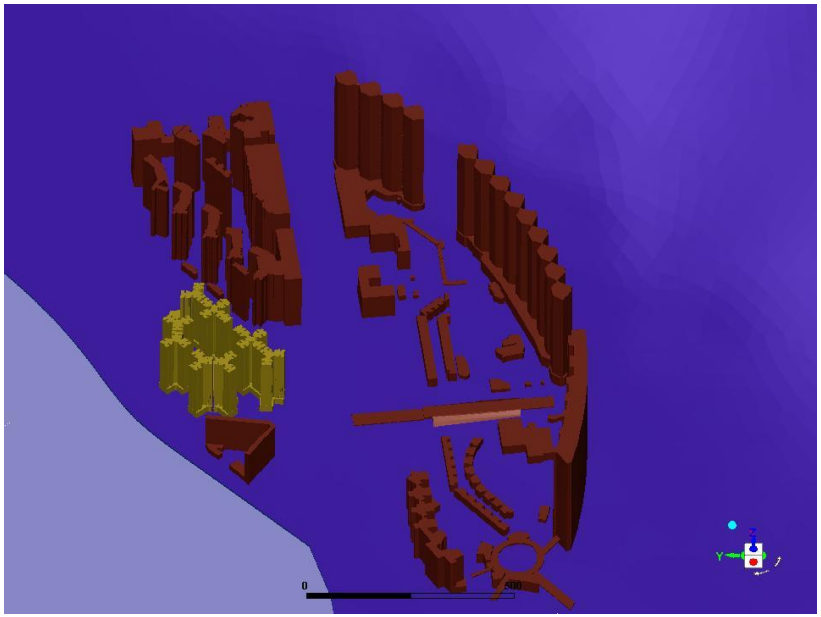
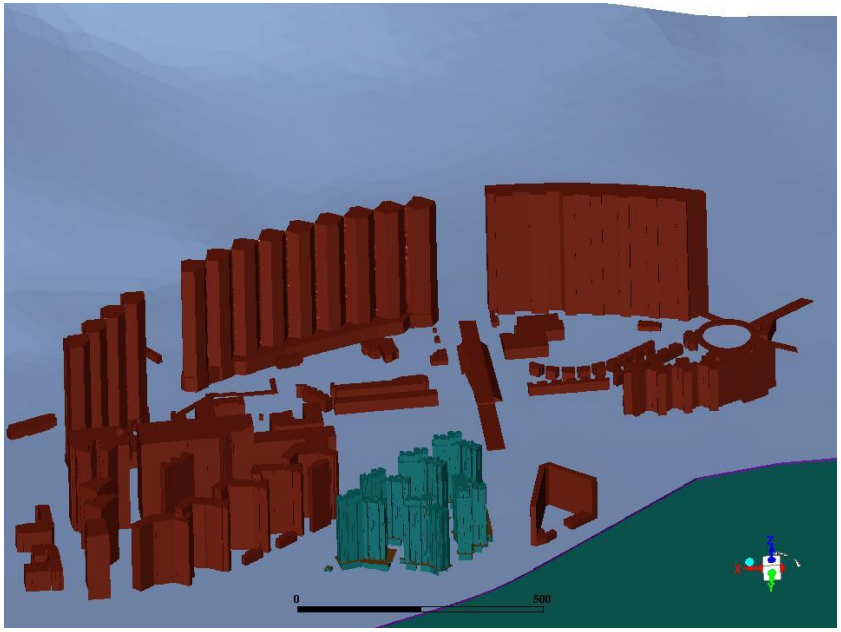


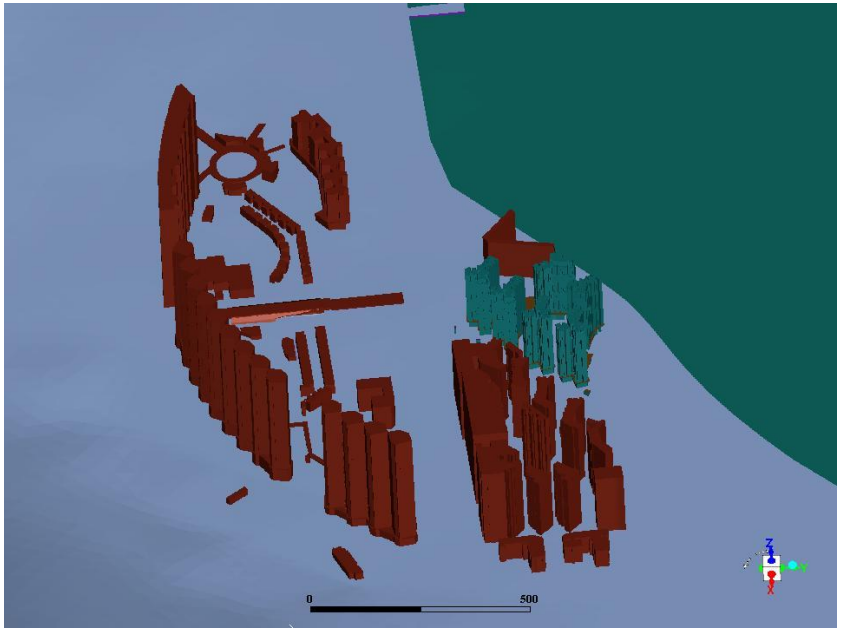
Baseline Scheme - S



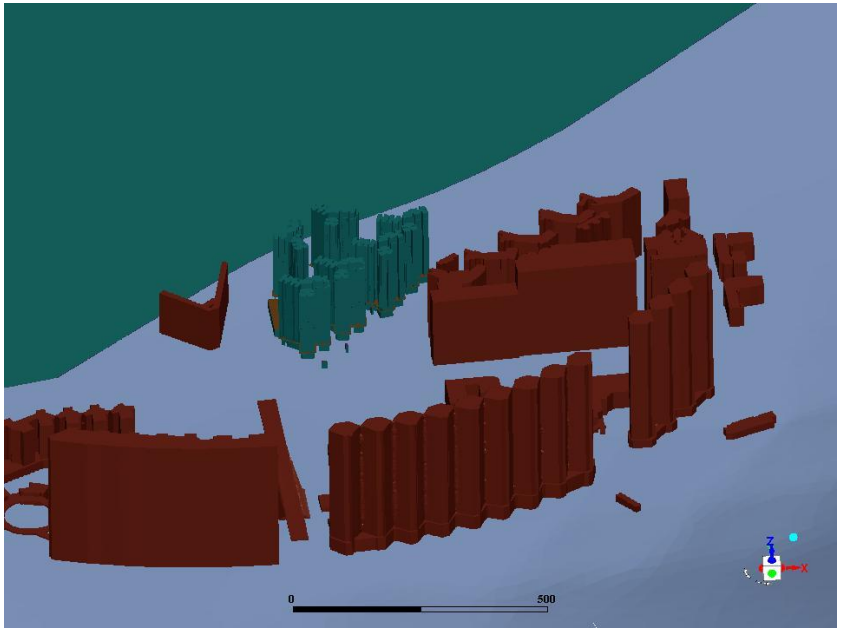
Baseline Scheme - W



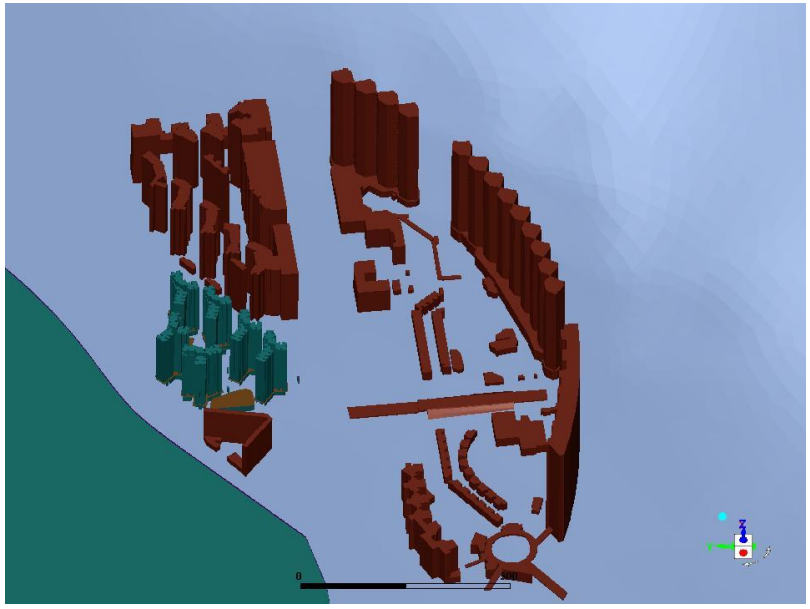
Proposed Scheme - N



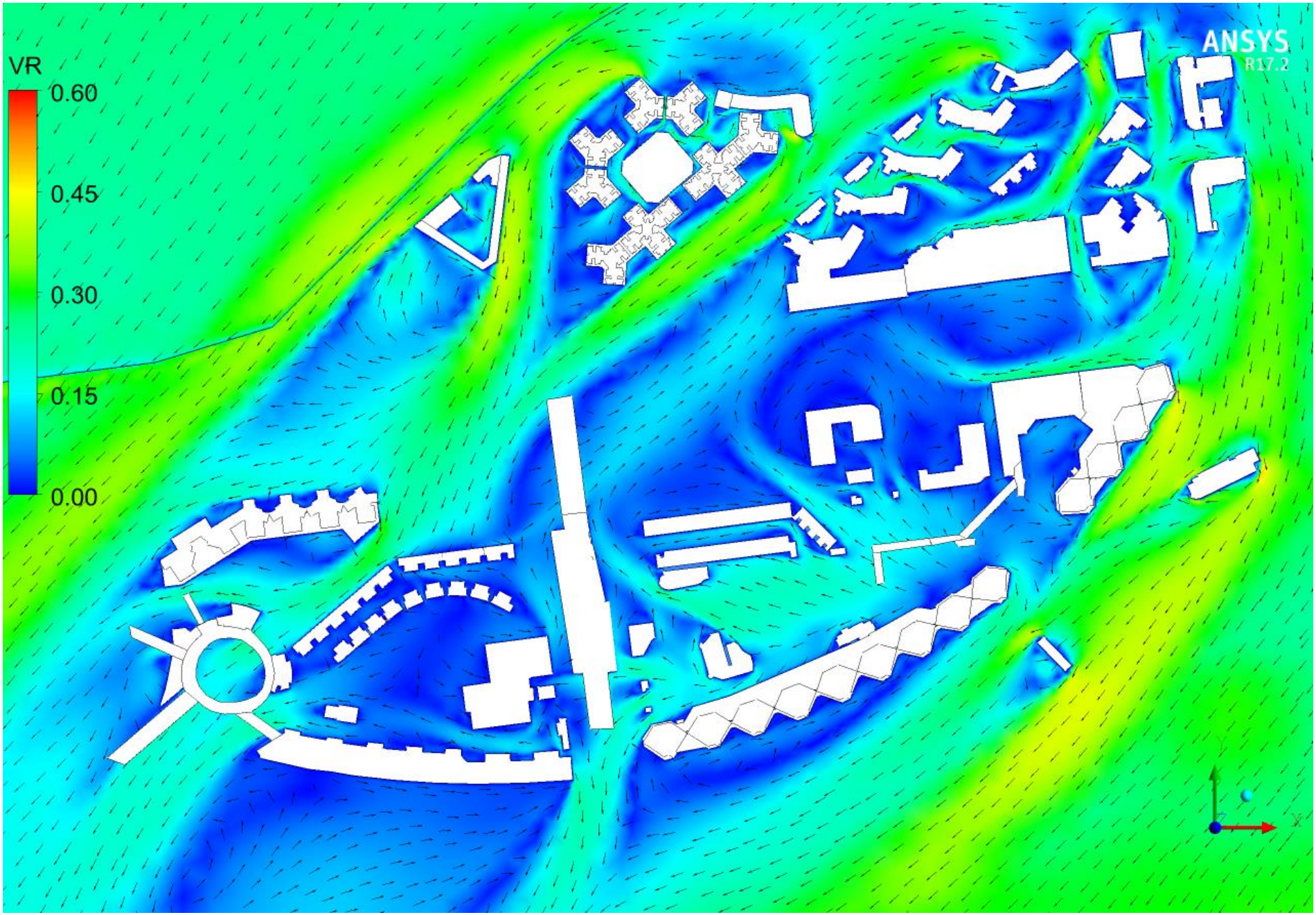
Propose Scheme - E



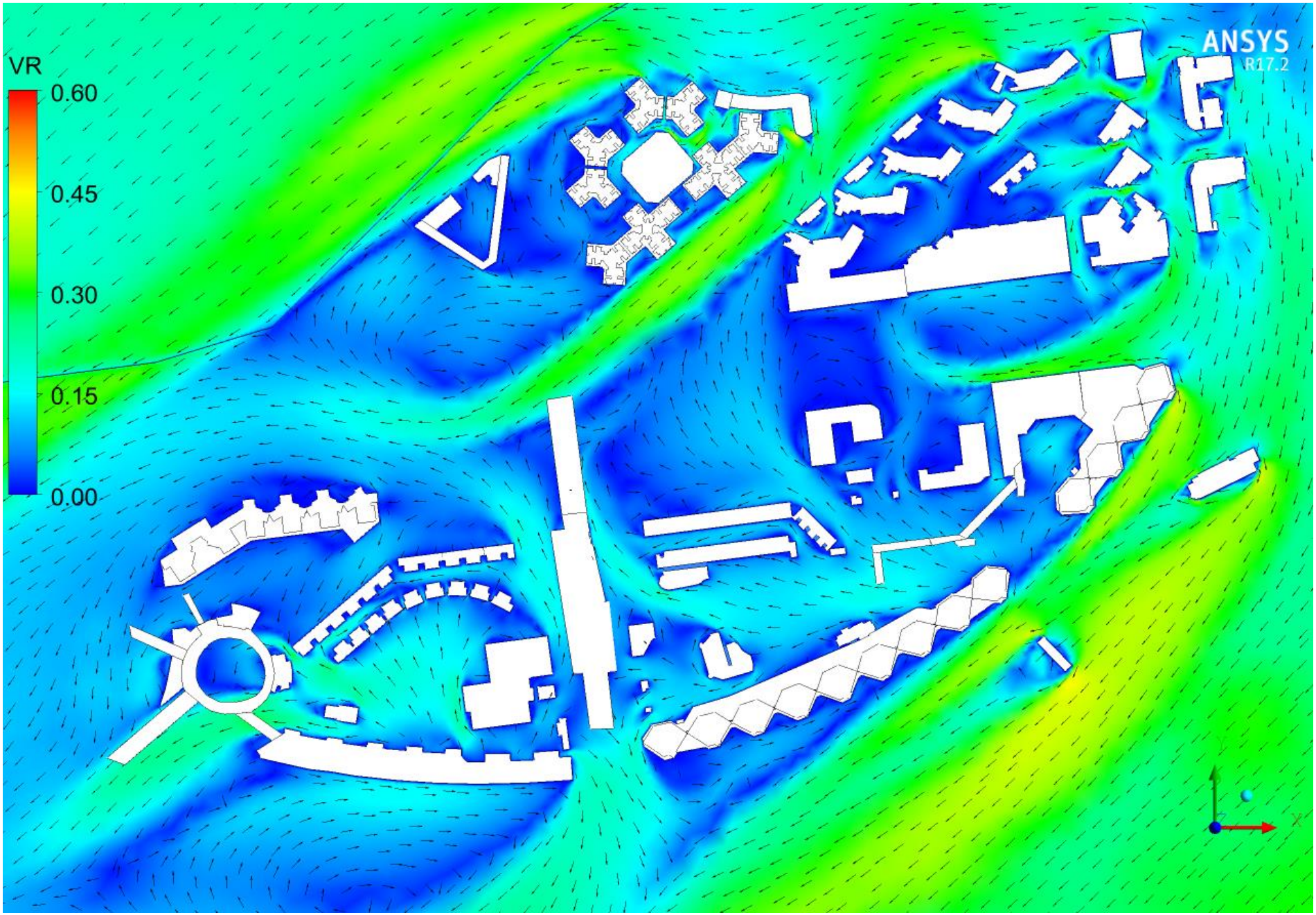
Proposed Scheme - S



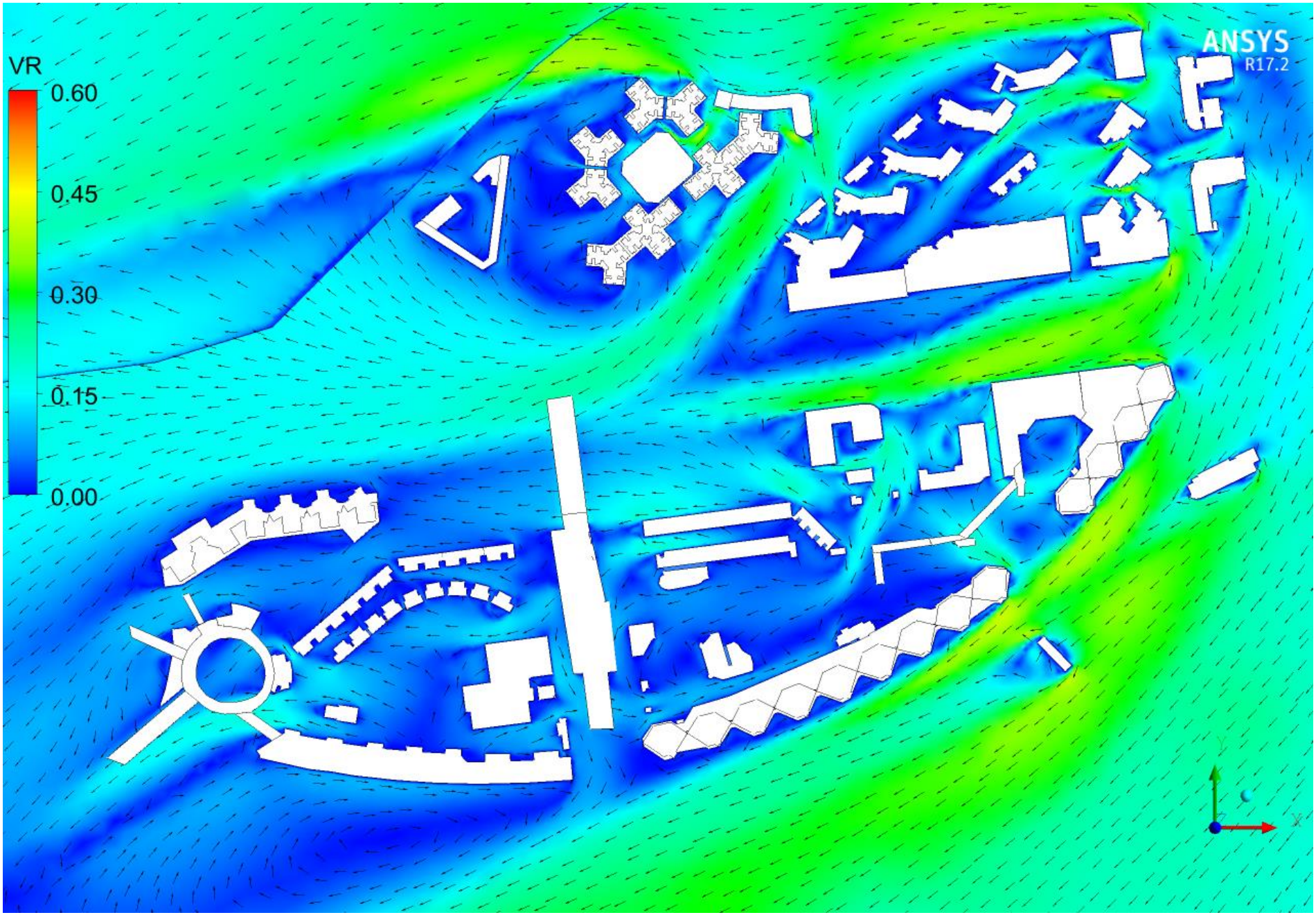
Proposed Scheme - W



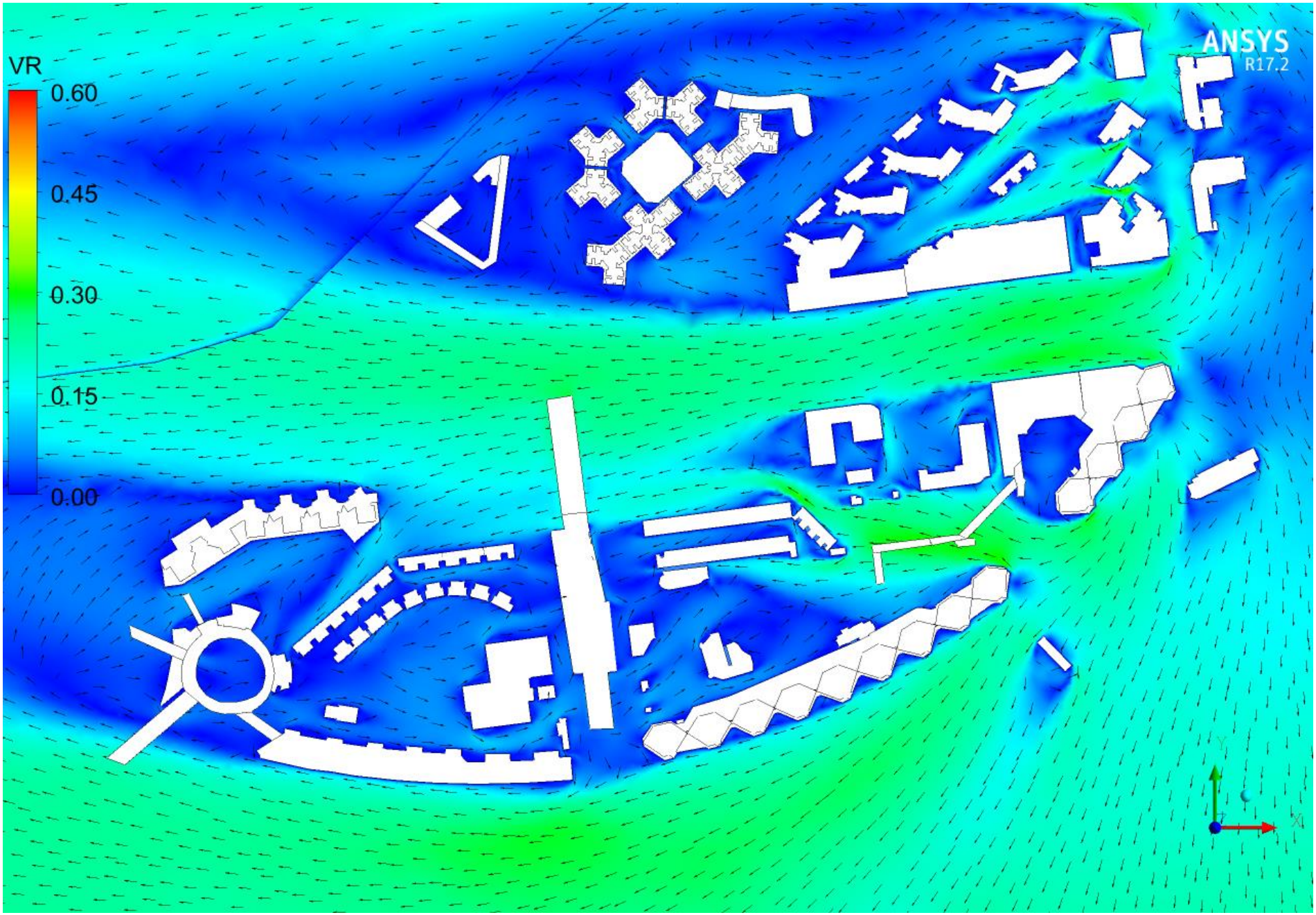
Baseline Scheme - Wind VR contour and vector plot at pedestrian level under NNE Wind



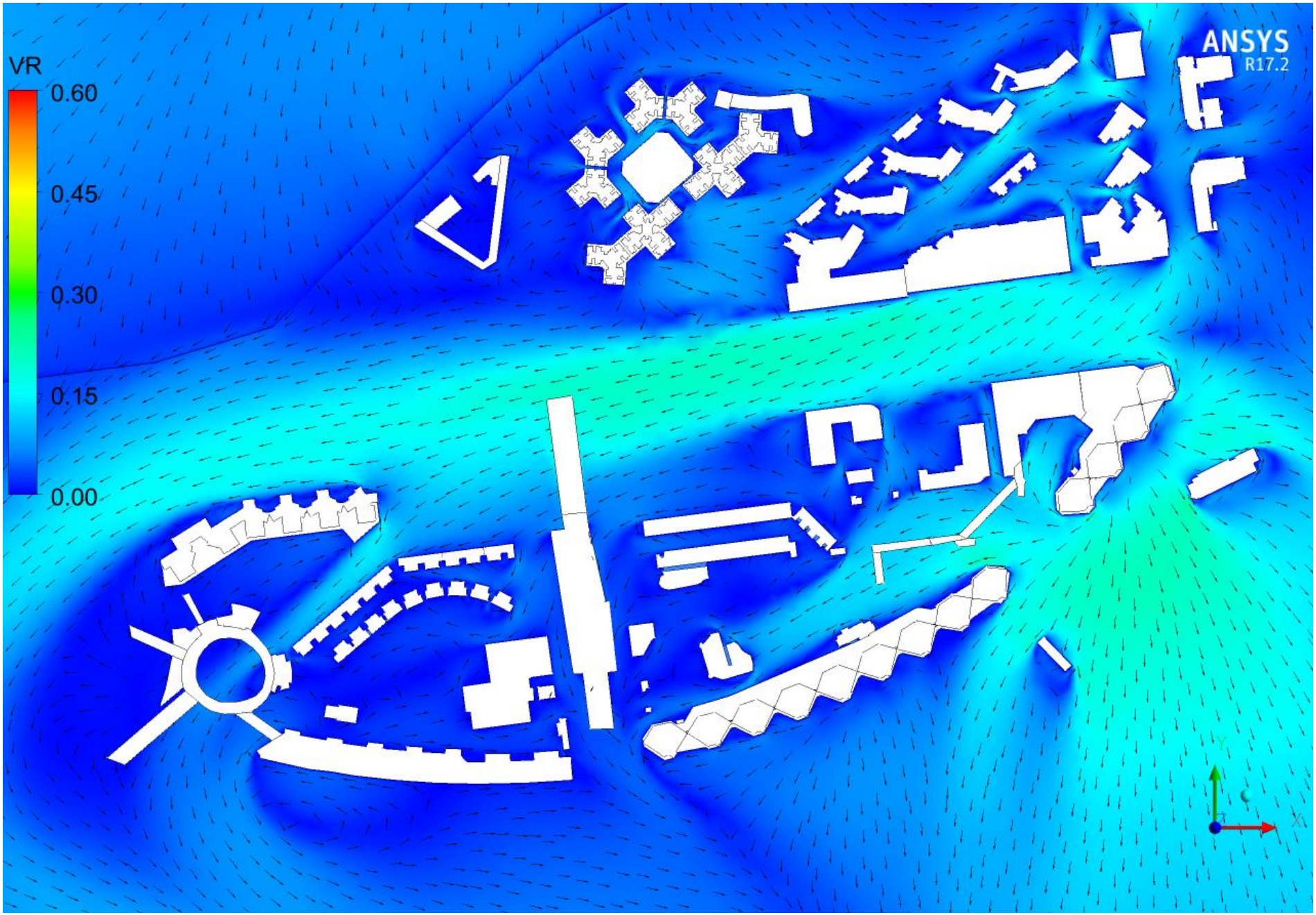
Baseline Scheme - Wind VR contour and vector plot at pedestrian level under NE Wind



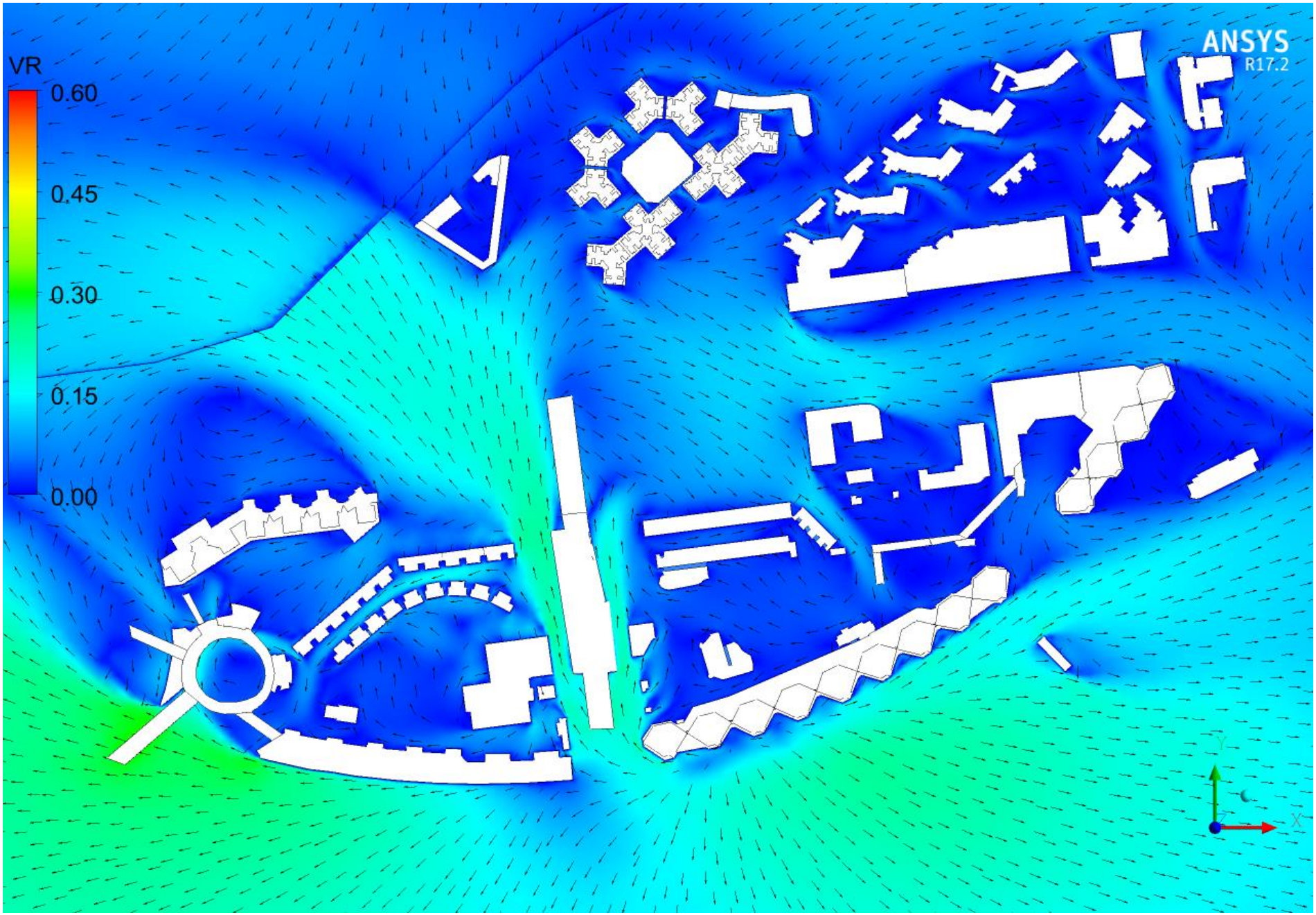
Baseline Scheme - Wind VR contour and vector plot at pedestrian level under ENE Wind



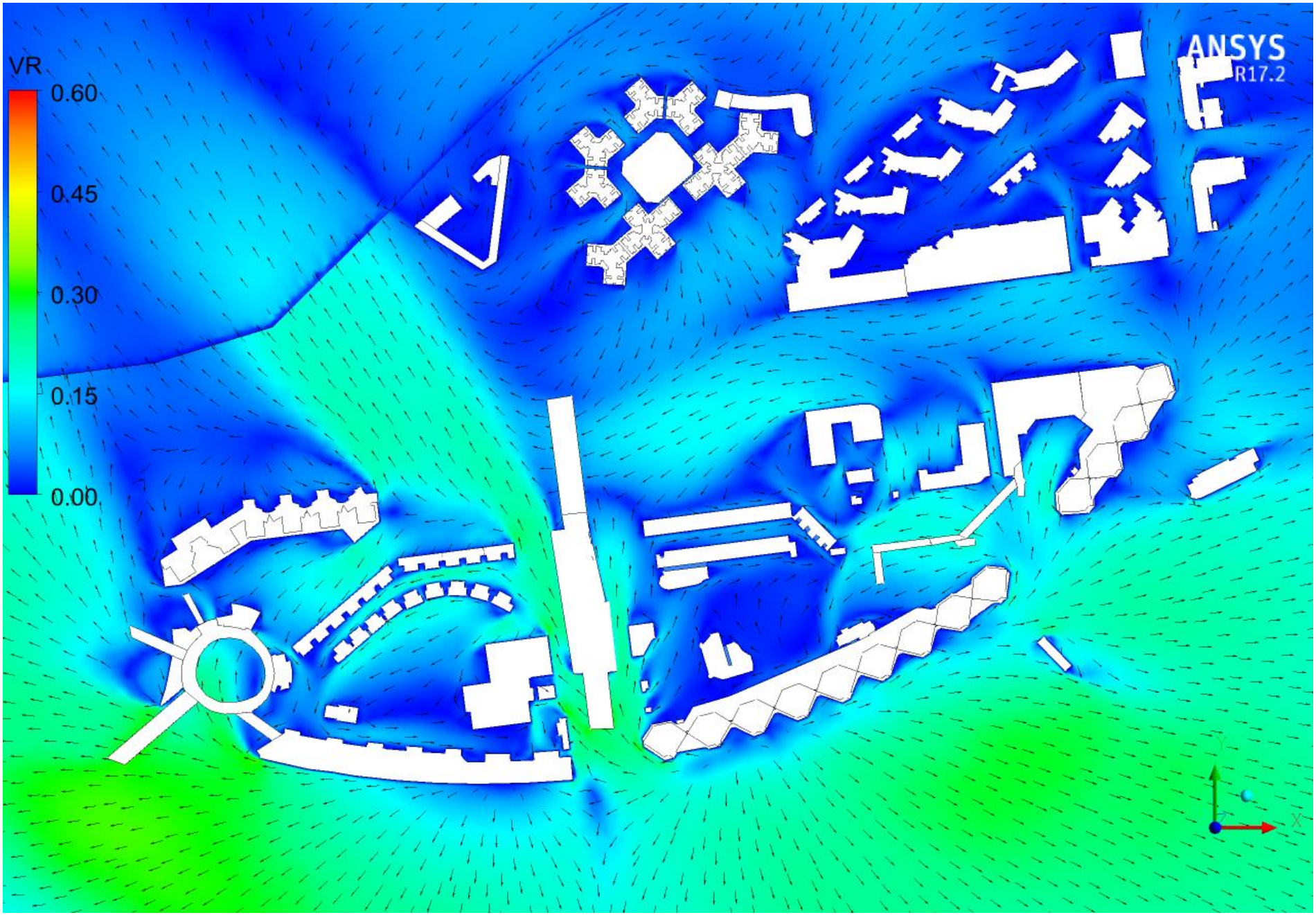
Baseline Scheme - Wind VR contour and vector plot at pedestrian level under E Wind



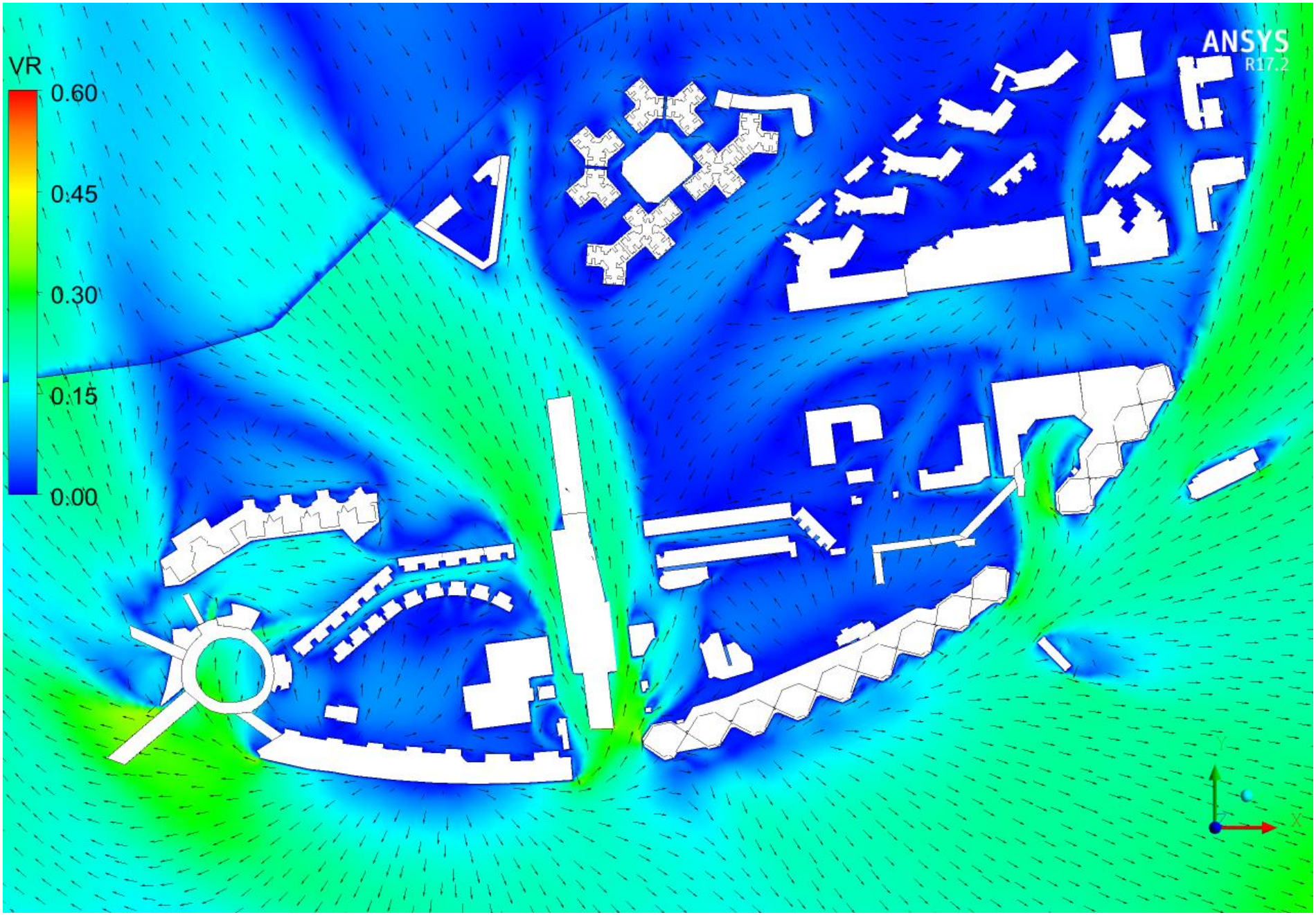
Baseline Scheme - Wind VR contour and vector plot at pedestrian level under ESE Wind



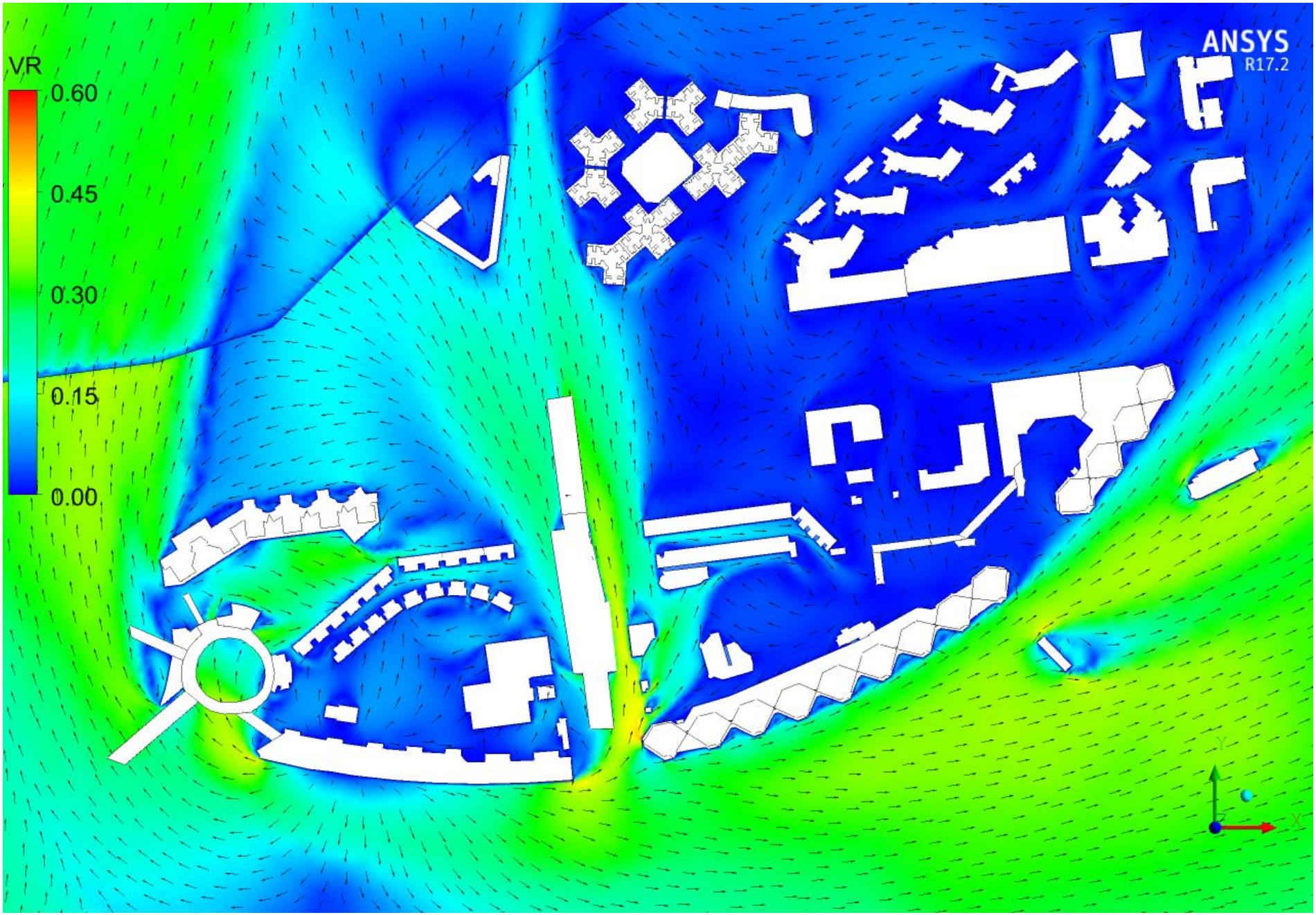
Baseline Scheme - Wind VR contour and vector plot at pedestrian level under SE Wind



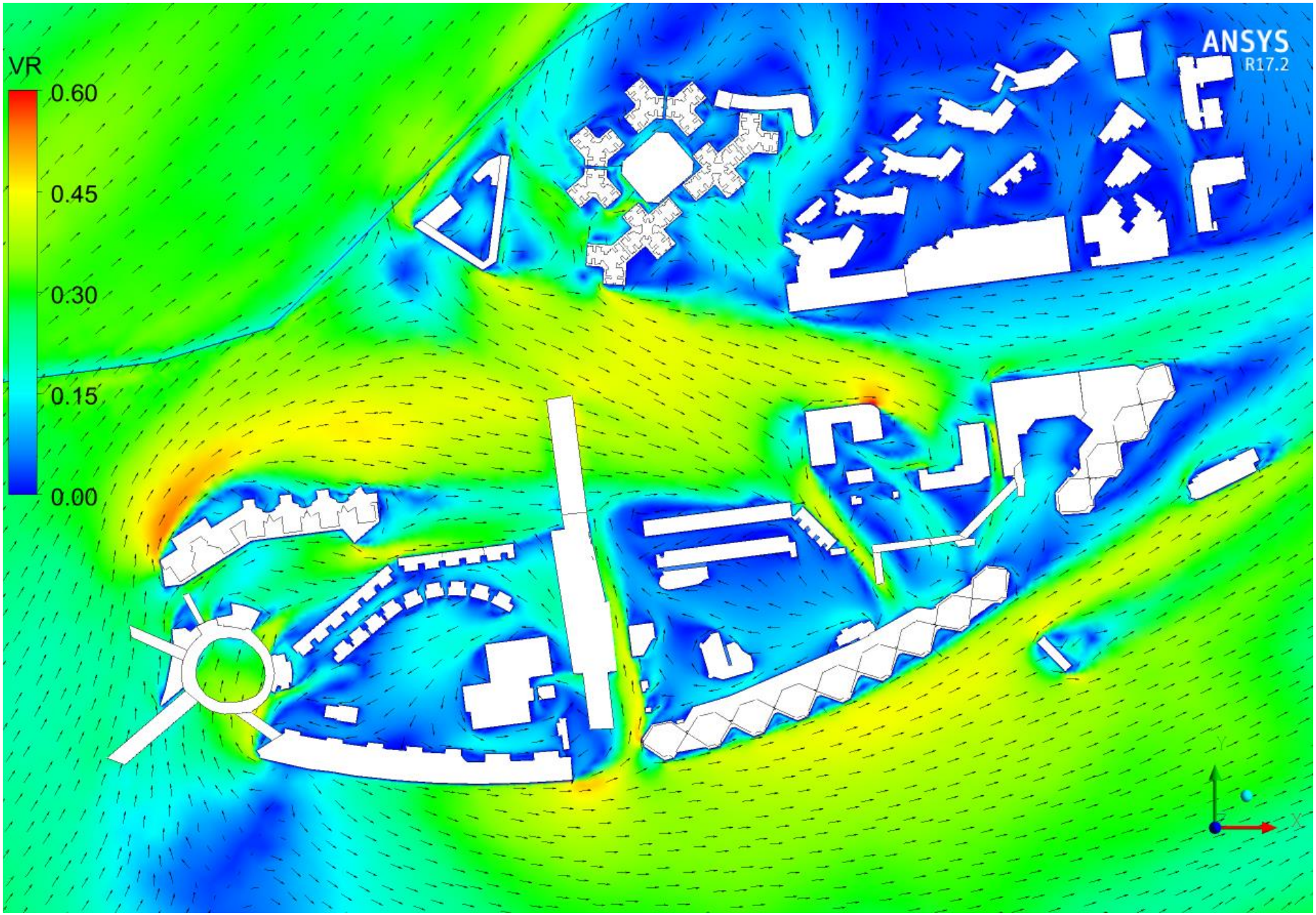
Baseline Scheme - Wind VR contour and vector plot at pedestrian level under SSE Wind



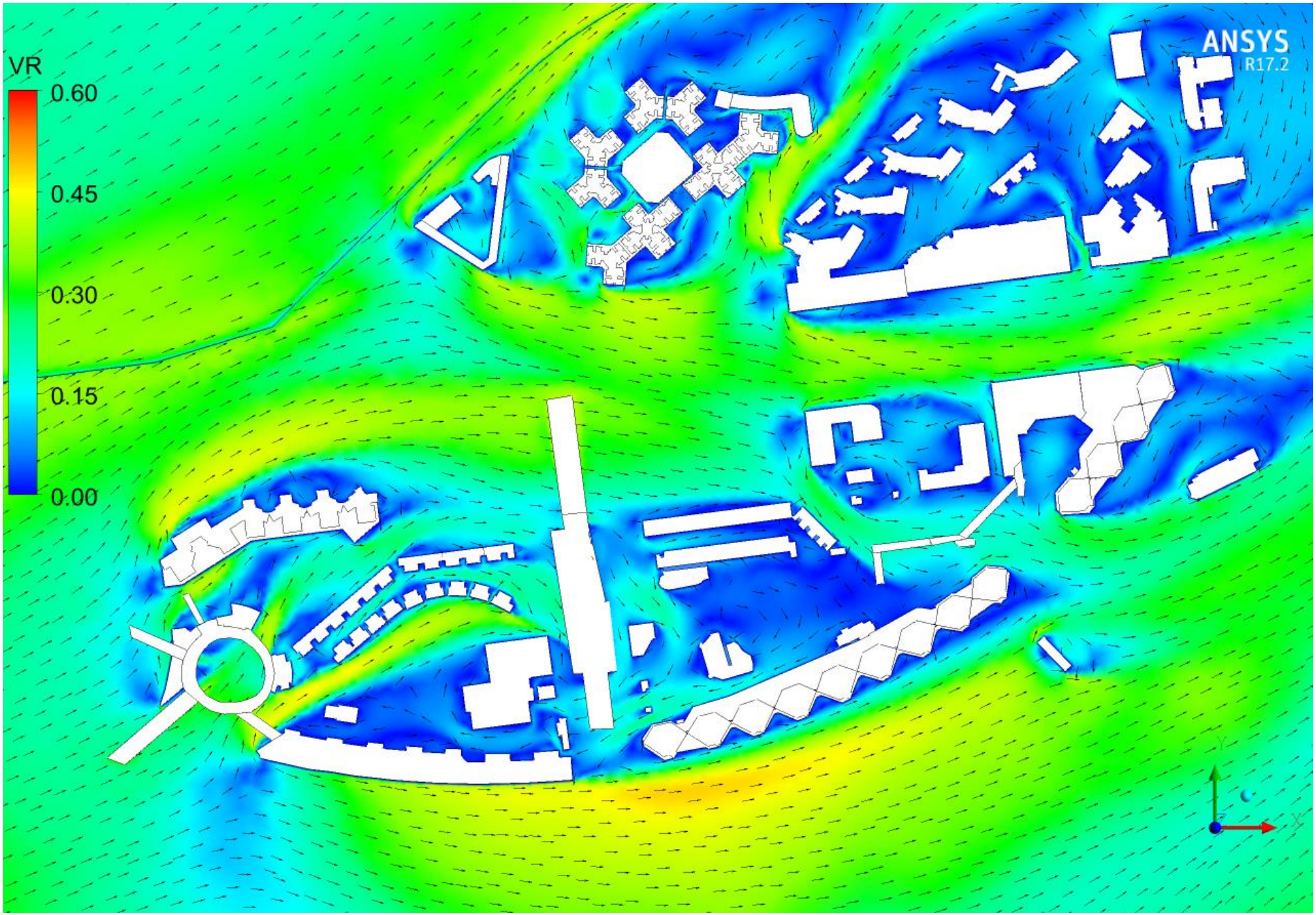
Baseline Scheme - Wind VR contour and vector plot at pedestrian level under S Wind



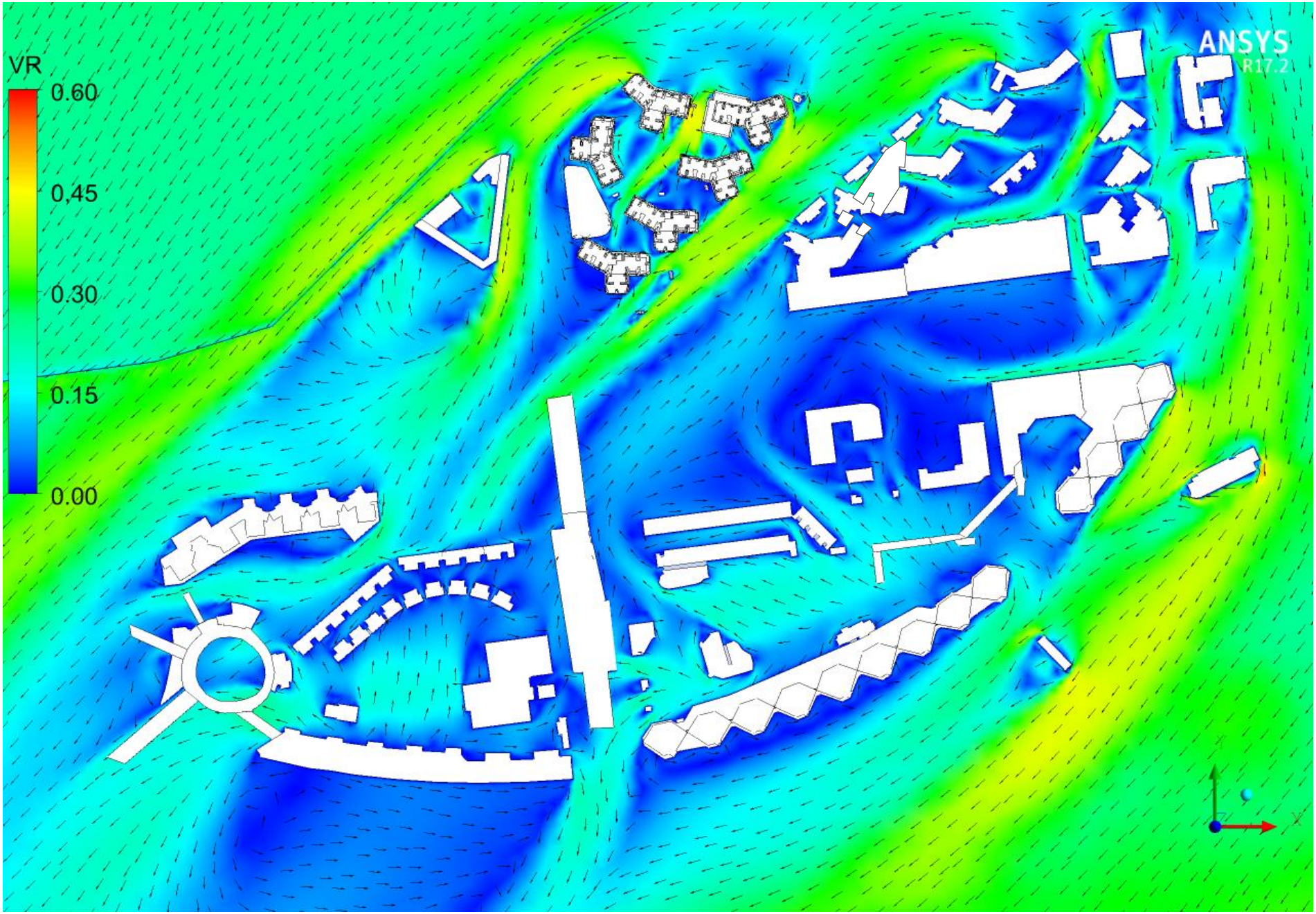
Baseline Scheme - Wind VR contour and vector plot at pedestrian level under SSW Wind



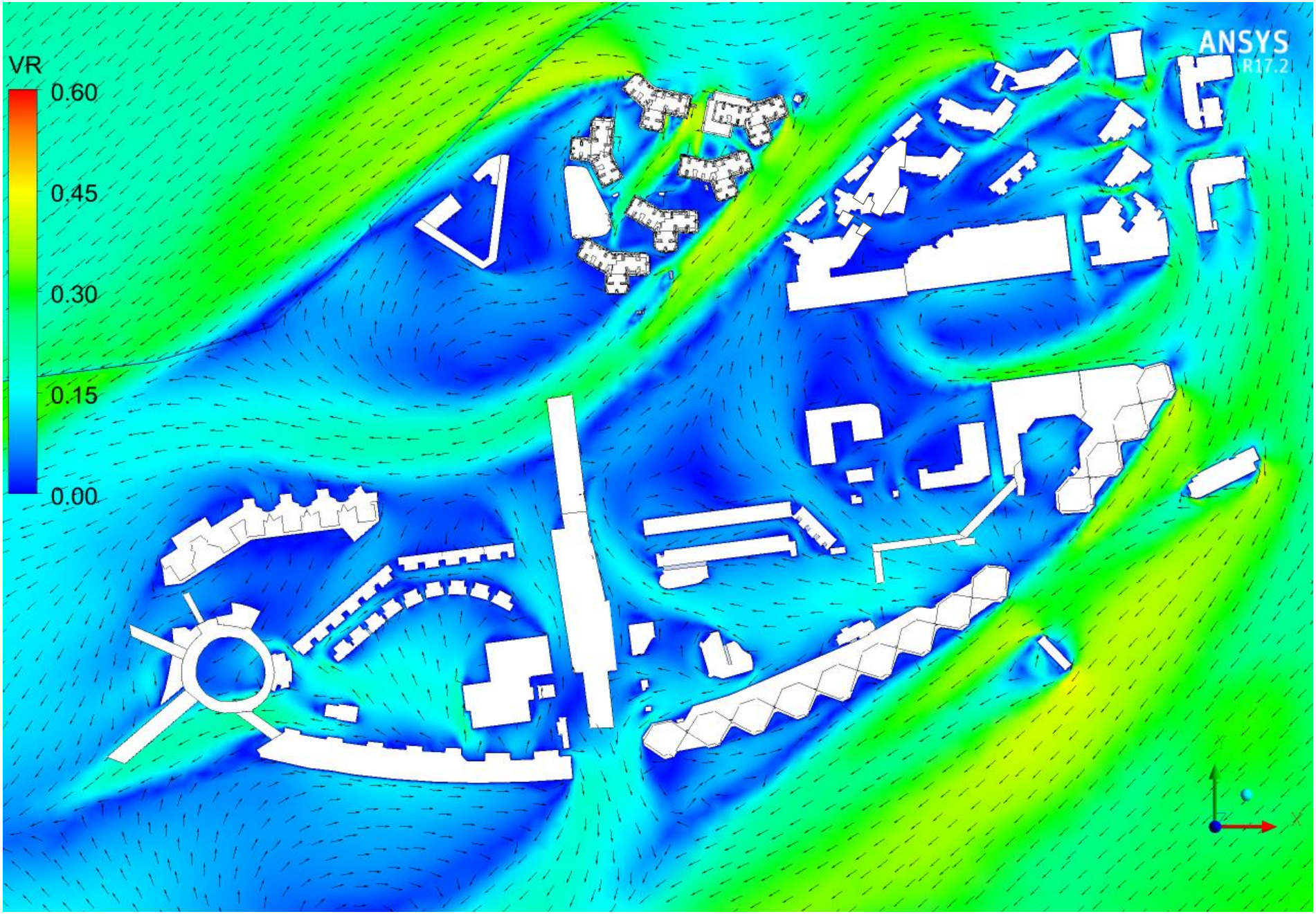
Baseline Scheme - Wind VR contour and vector plot at pedestrian level under SW Wind



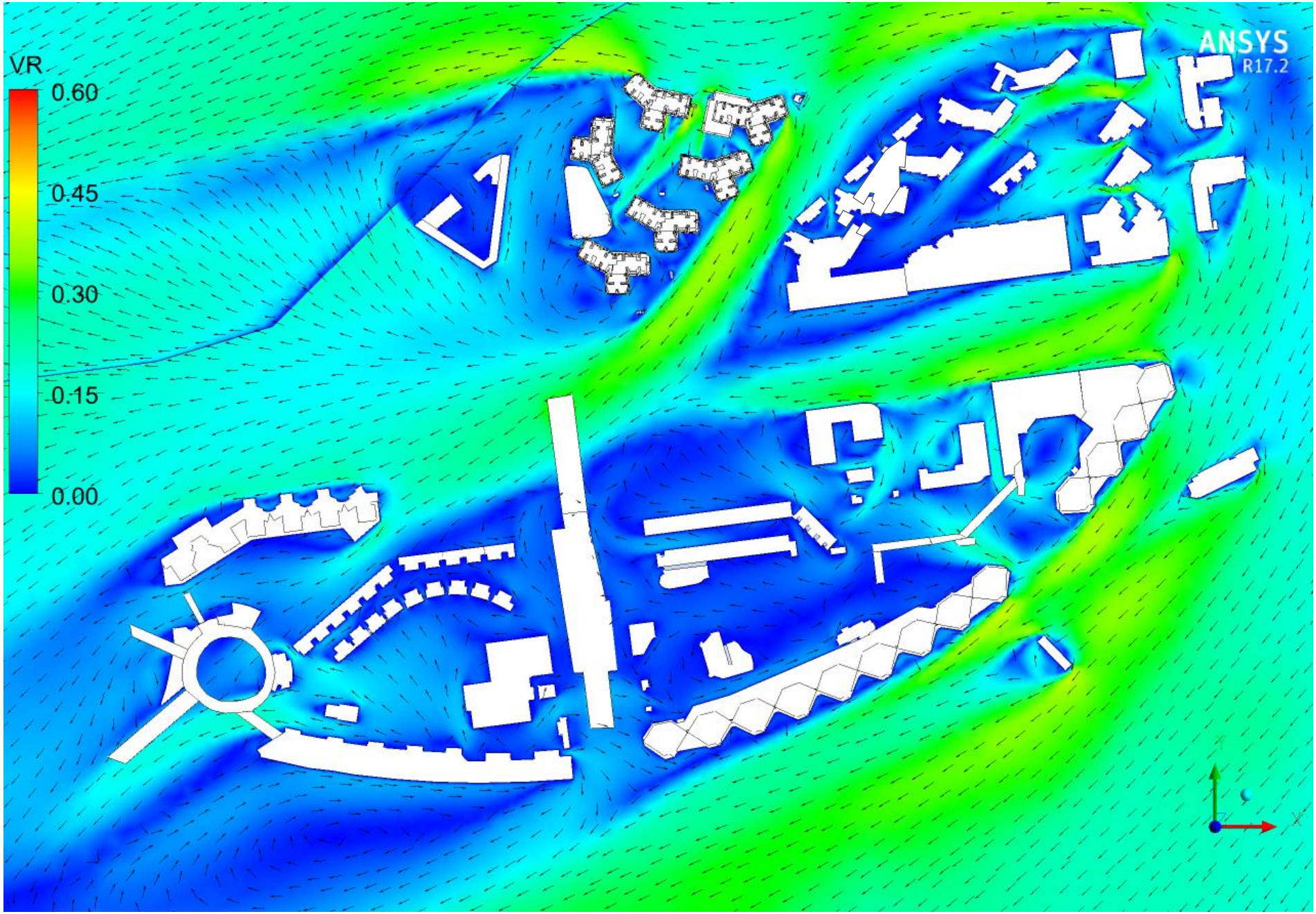
Baseline Scheme - Wind VR contour and vector plot at pedestrian level under WSW Wind



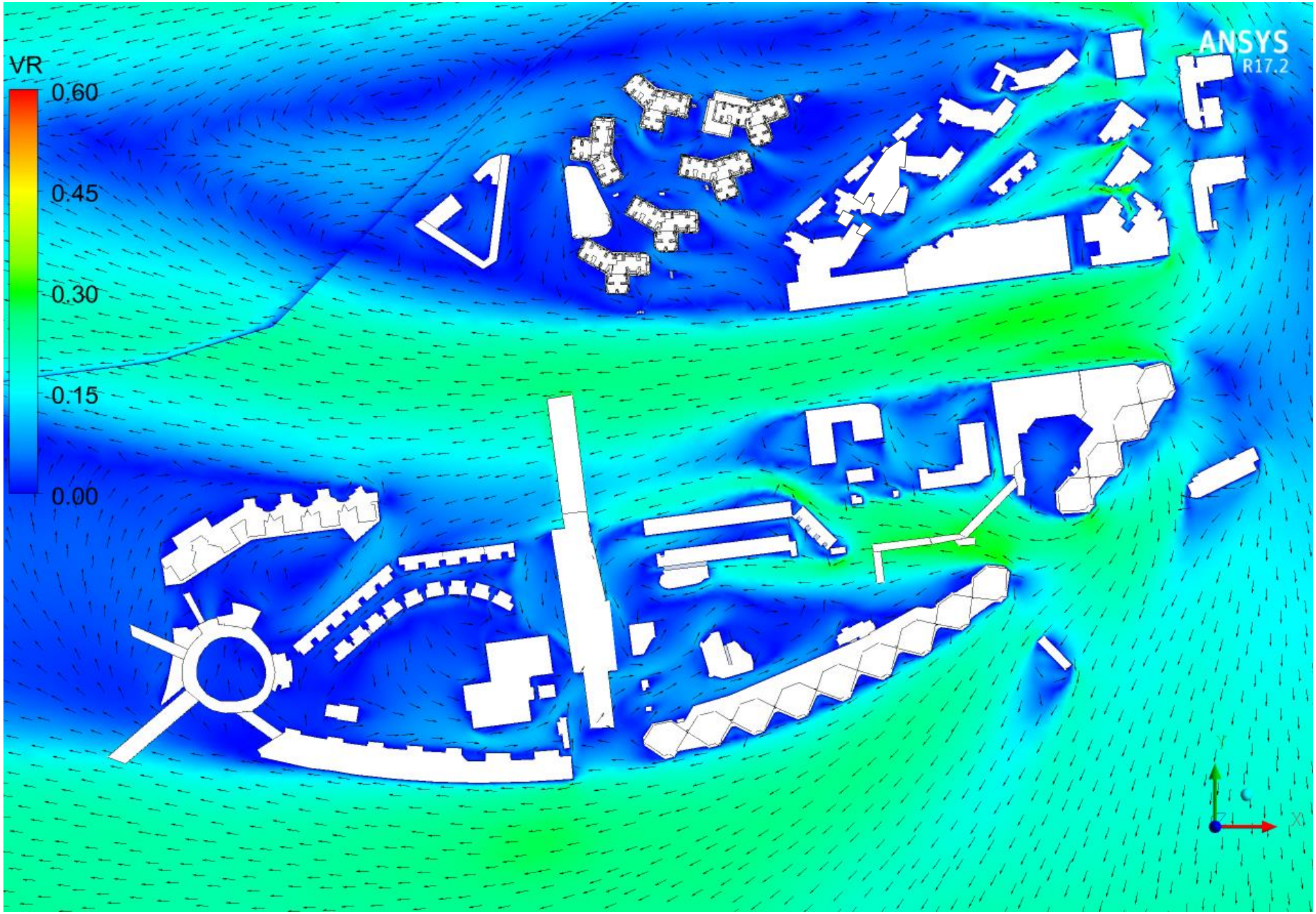
Proposed Scheme - Wind VR contour and vector plot at pedestrian level under NNE Wind



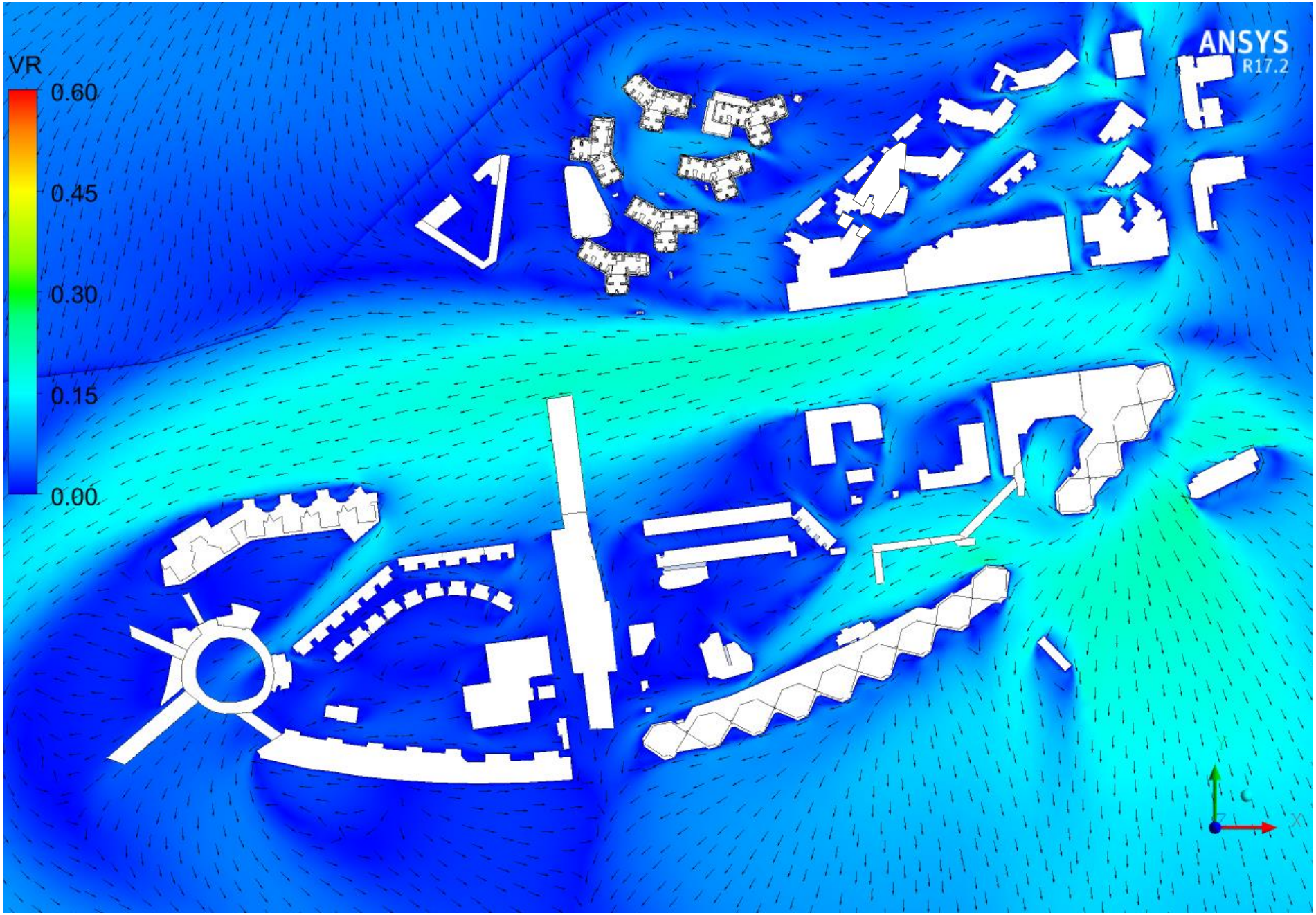
Proposed Scheme - Wind VR contour and vector plot at pedestrian level under NE Wind



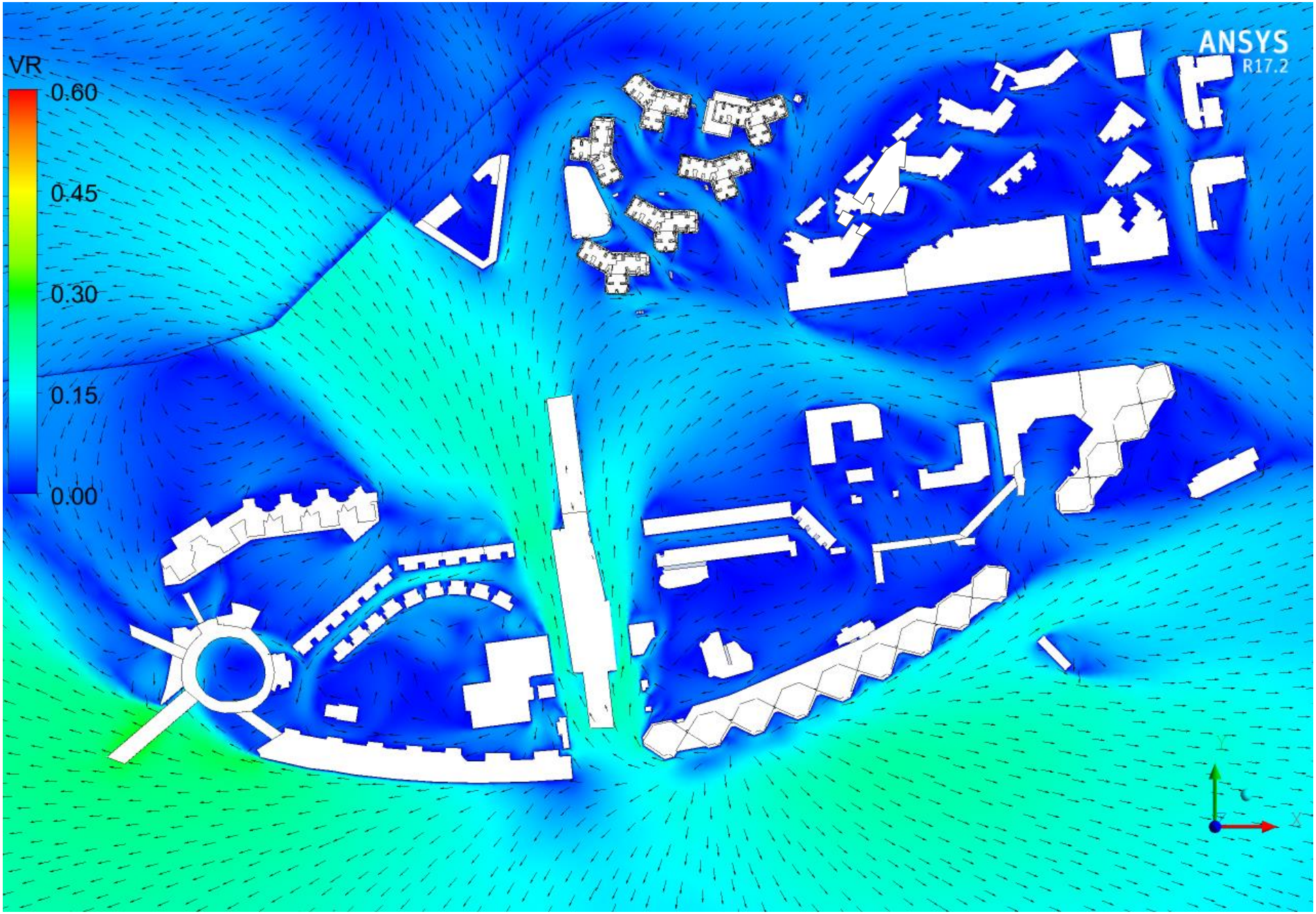
Proposed Scheme - Wind VR contour and vector plot at pedestrian level under ENE Wind



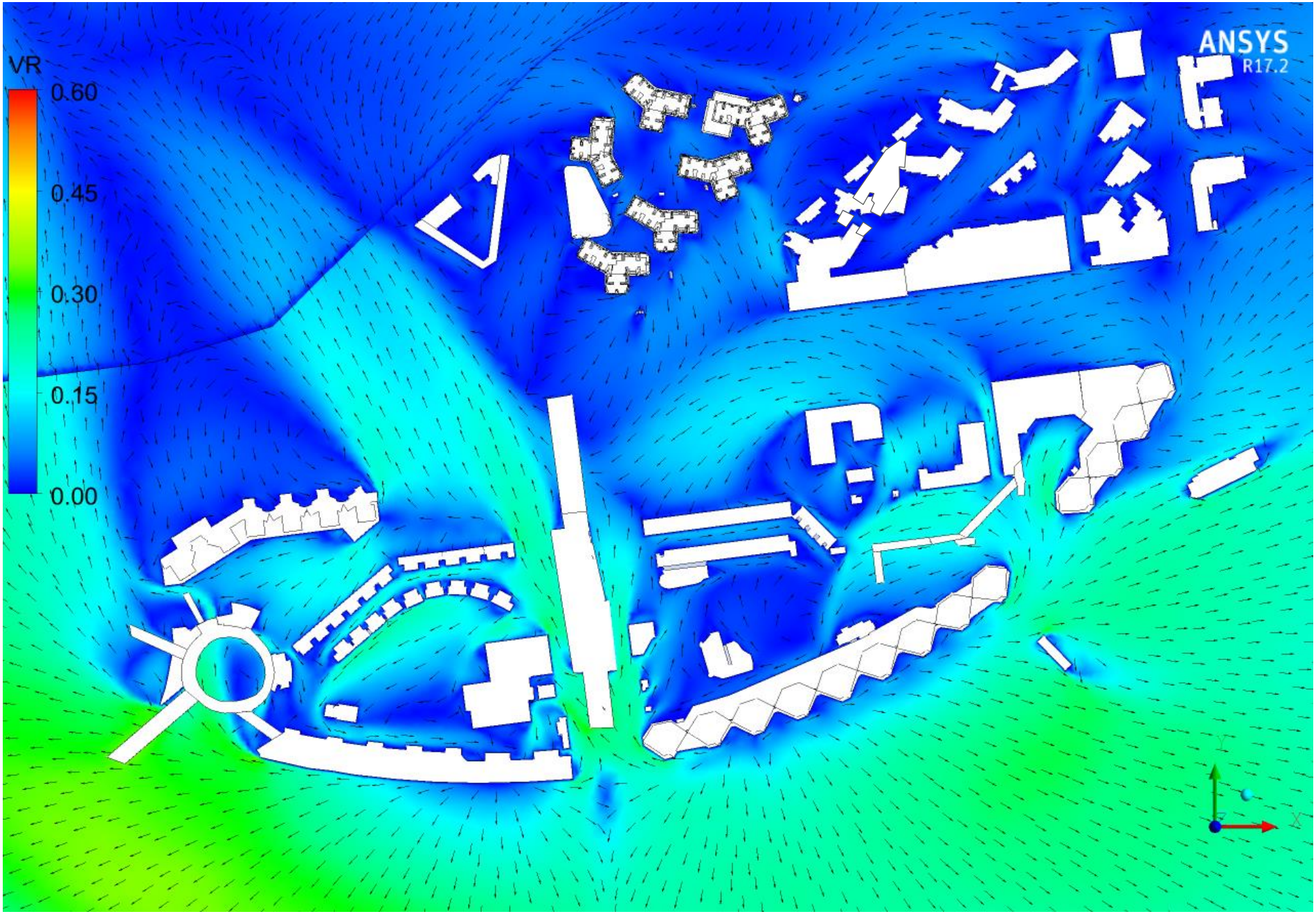
Proposed Scheme - Wind VR contour and vector plot at pedestrian level under E Wind



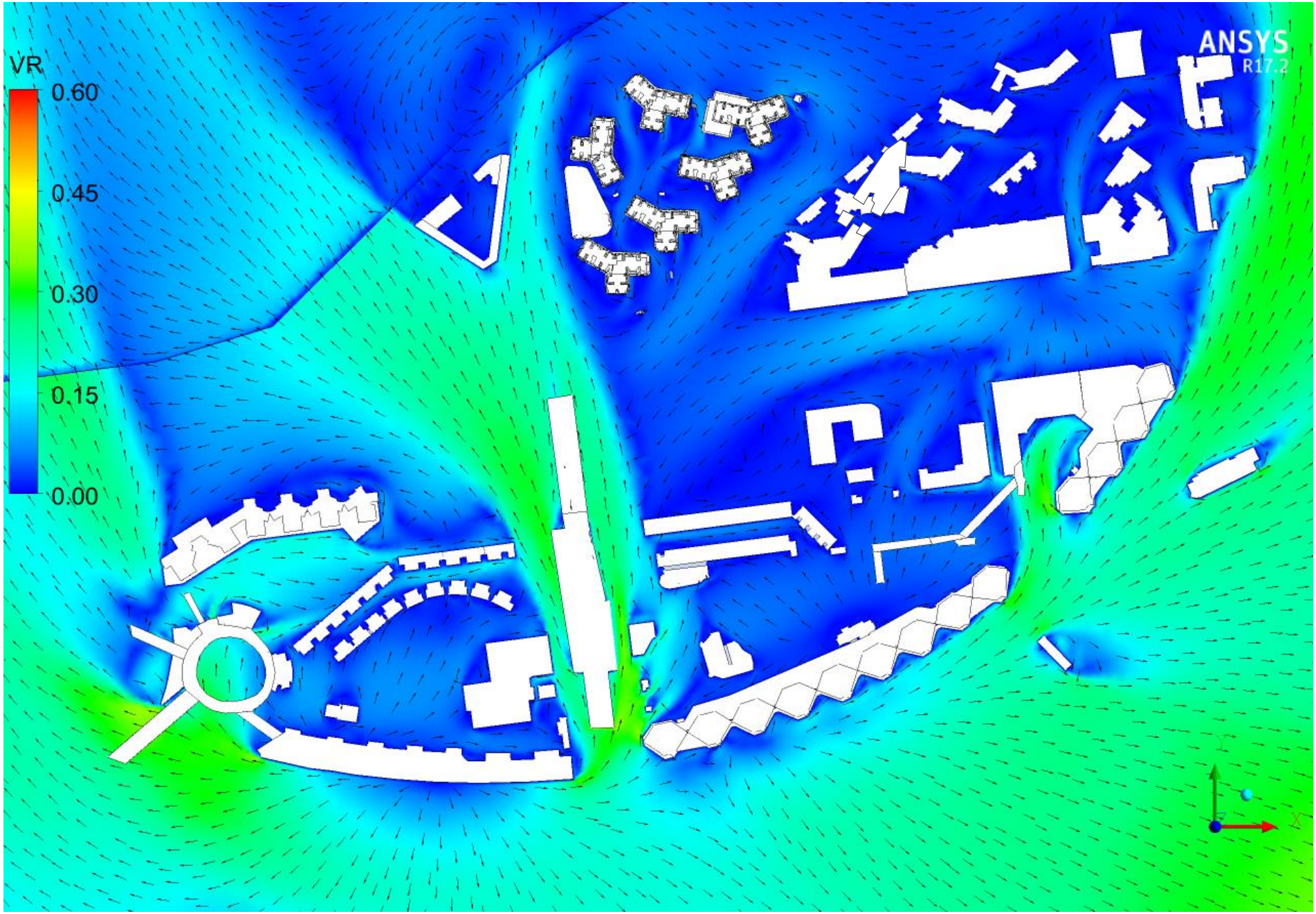
Proposed Scheme - Wind VR contour and vector plot at pedestrian level under ESE Wind



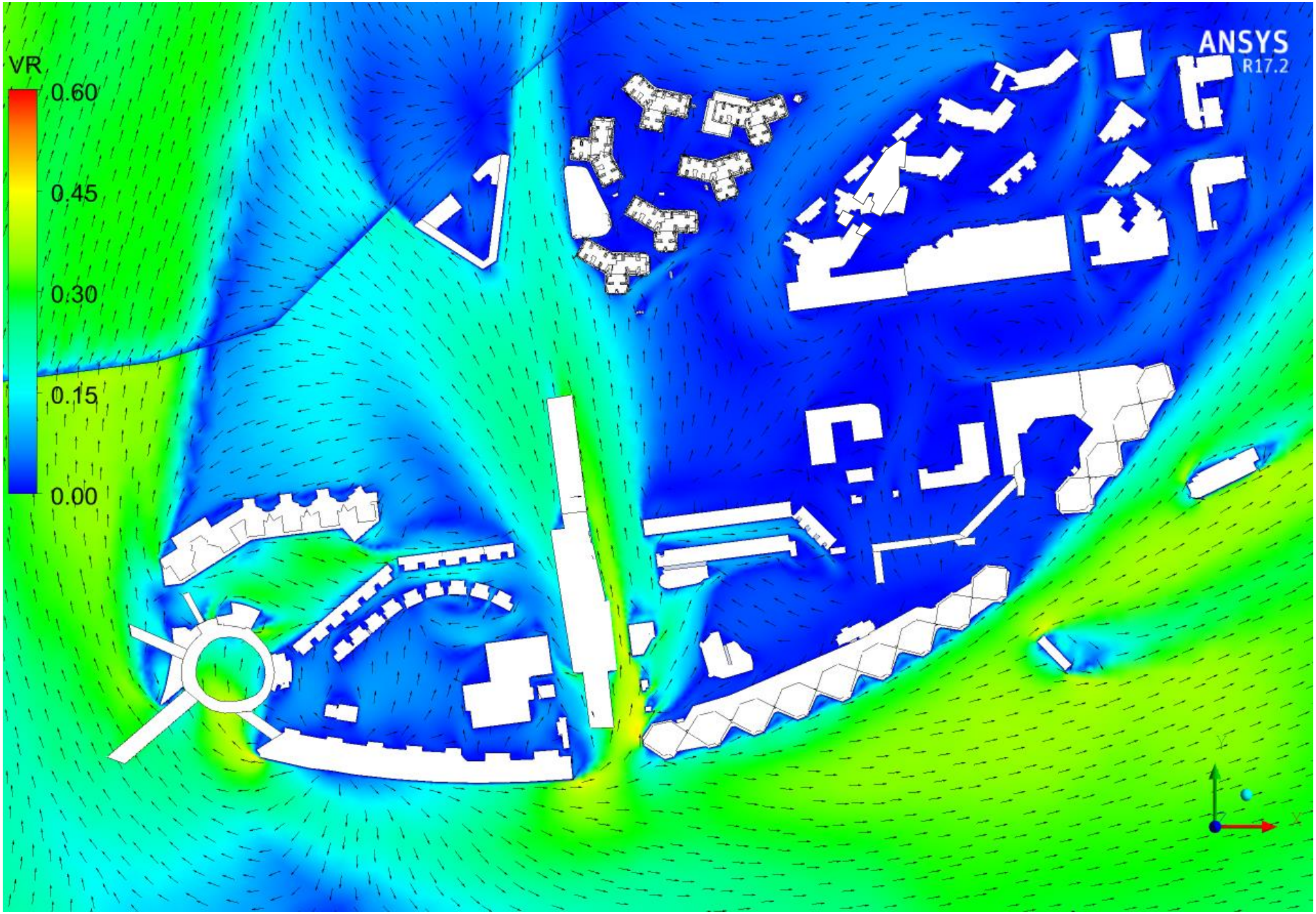
Proposed Scheme - Wind VR contour and vector plot at pedestrian level under SE Wind



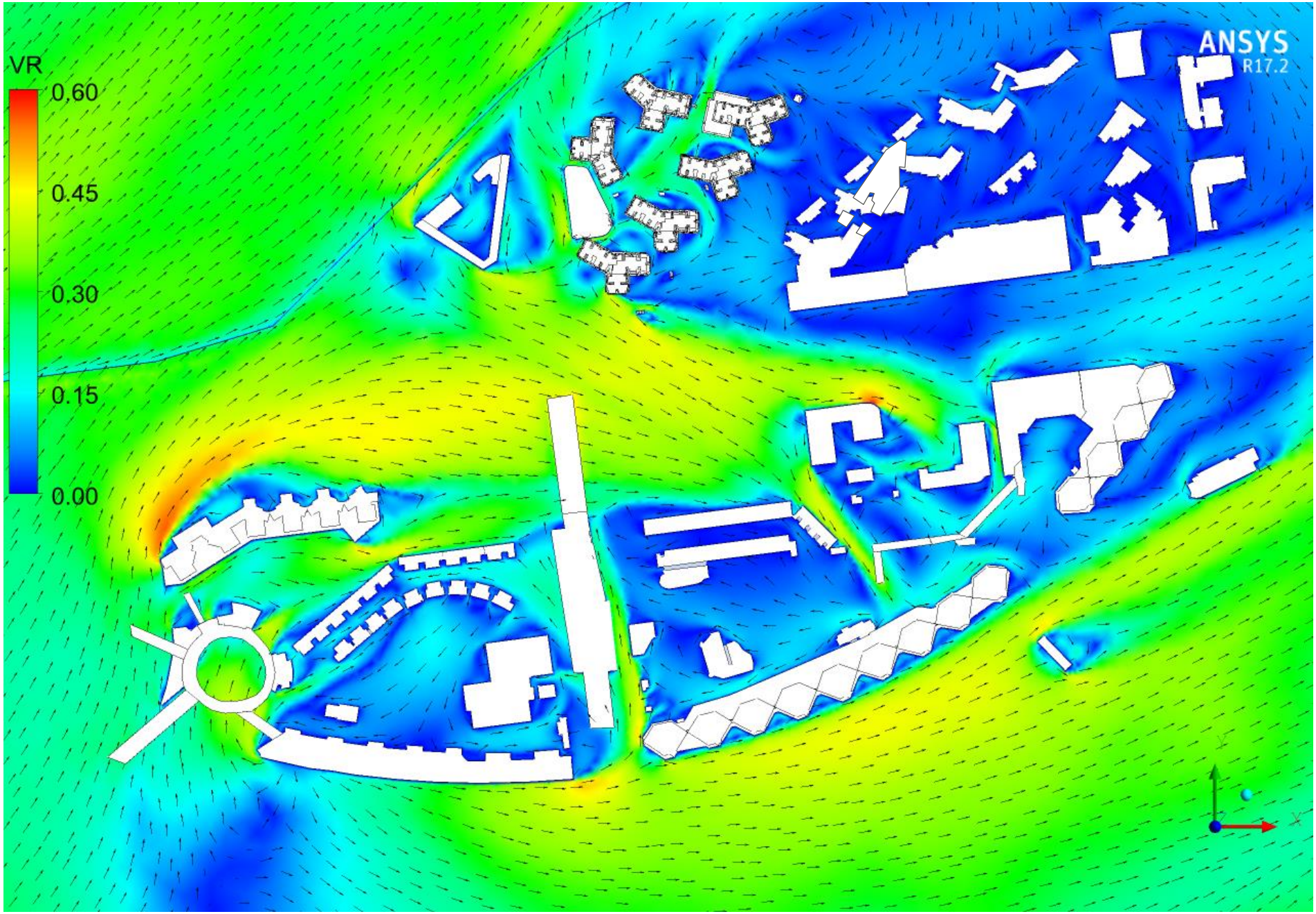
Proposed Scheme - Wind VR contour and vector plot at pedestrian level under SSE Wind



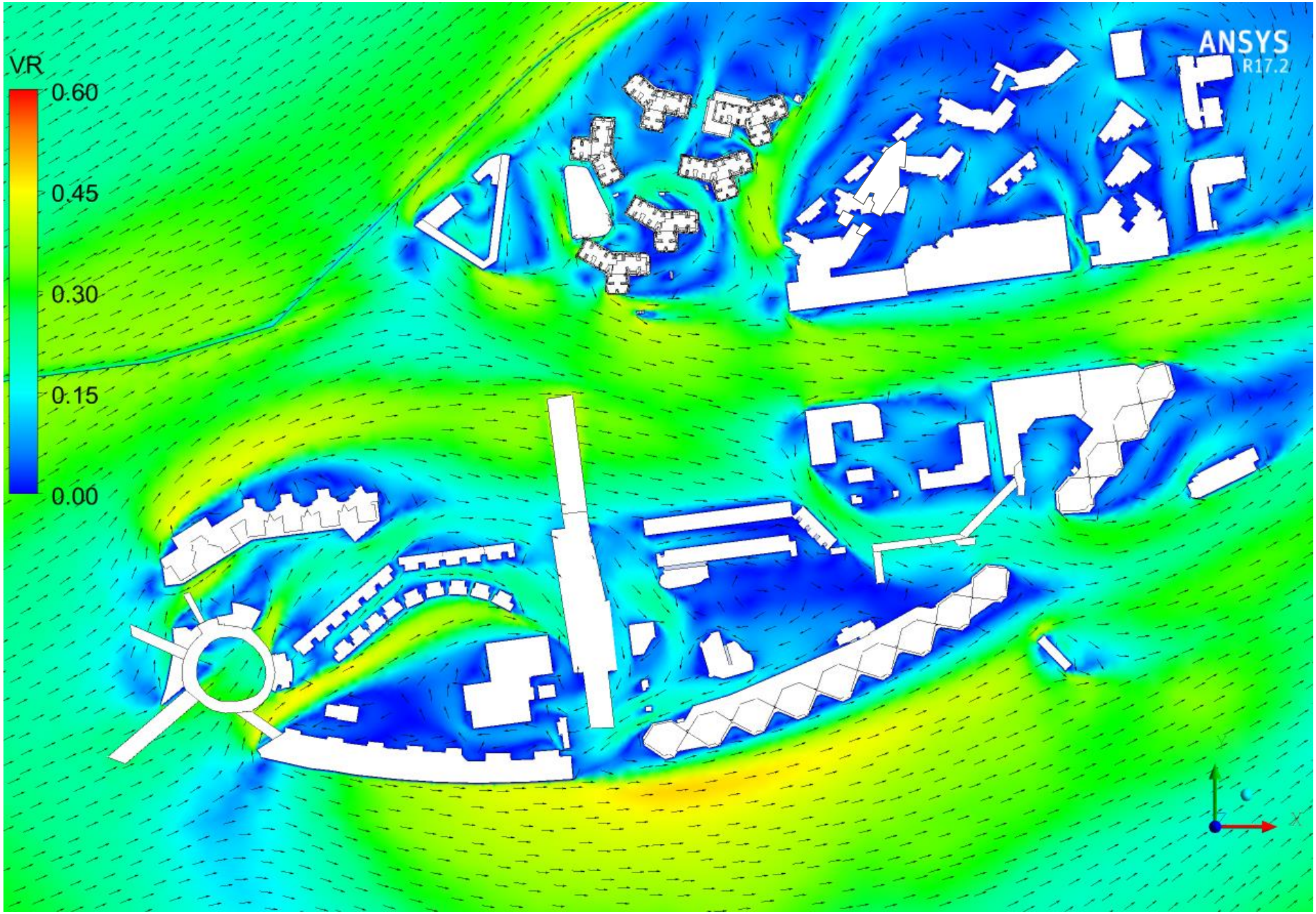
Proposed Scheme - Wind VR contour and vector plot at pedestrian level under S Wind



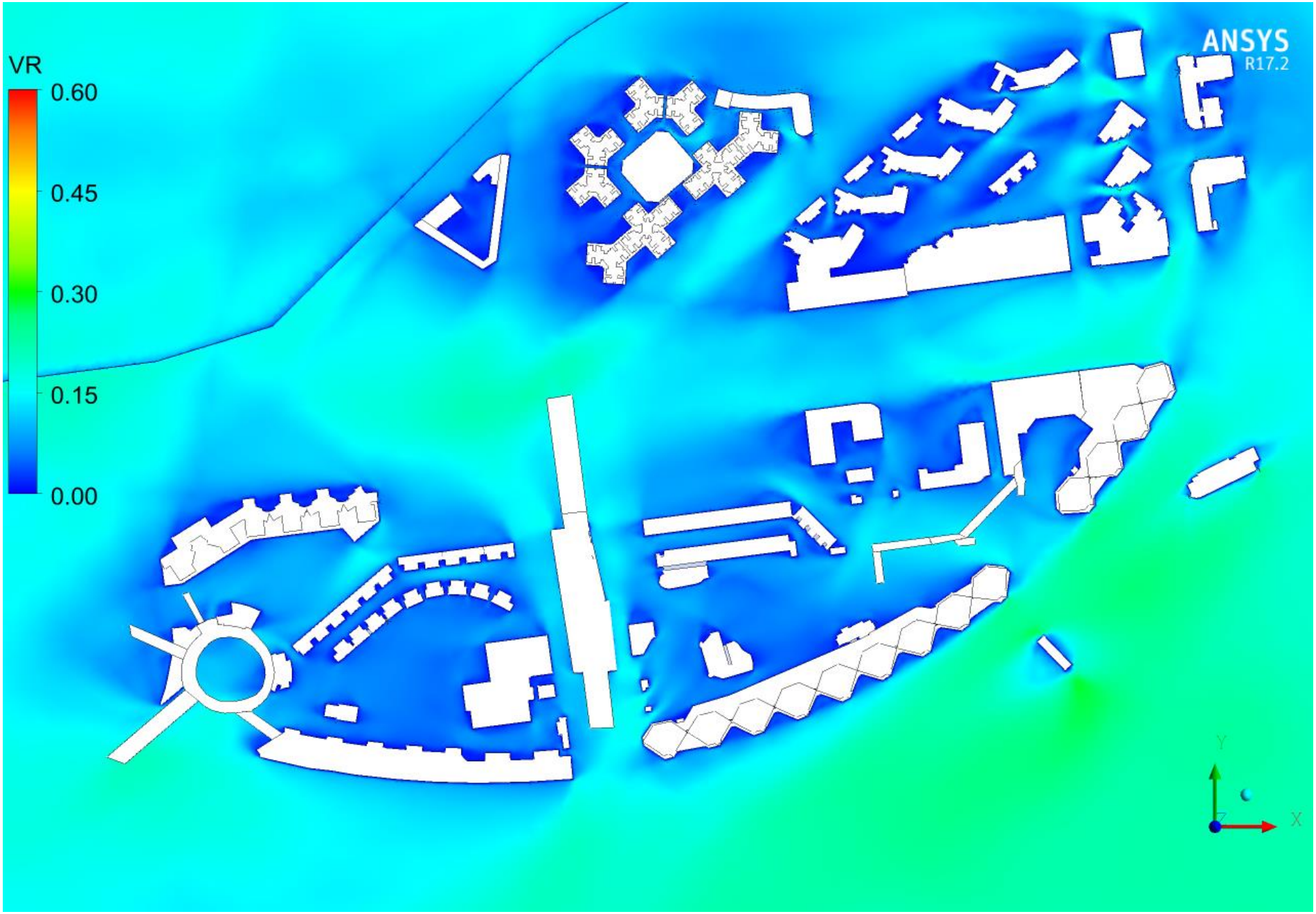
Proposed Scheme - Wind VR contour and vector plot at pedestrian level under SSW Wind



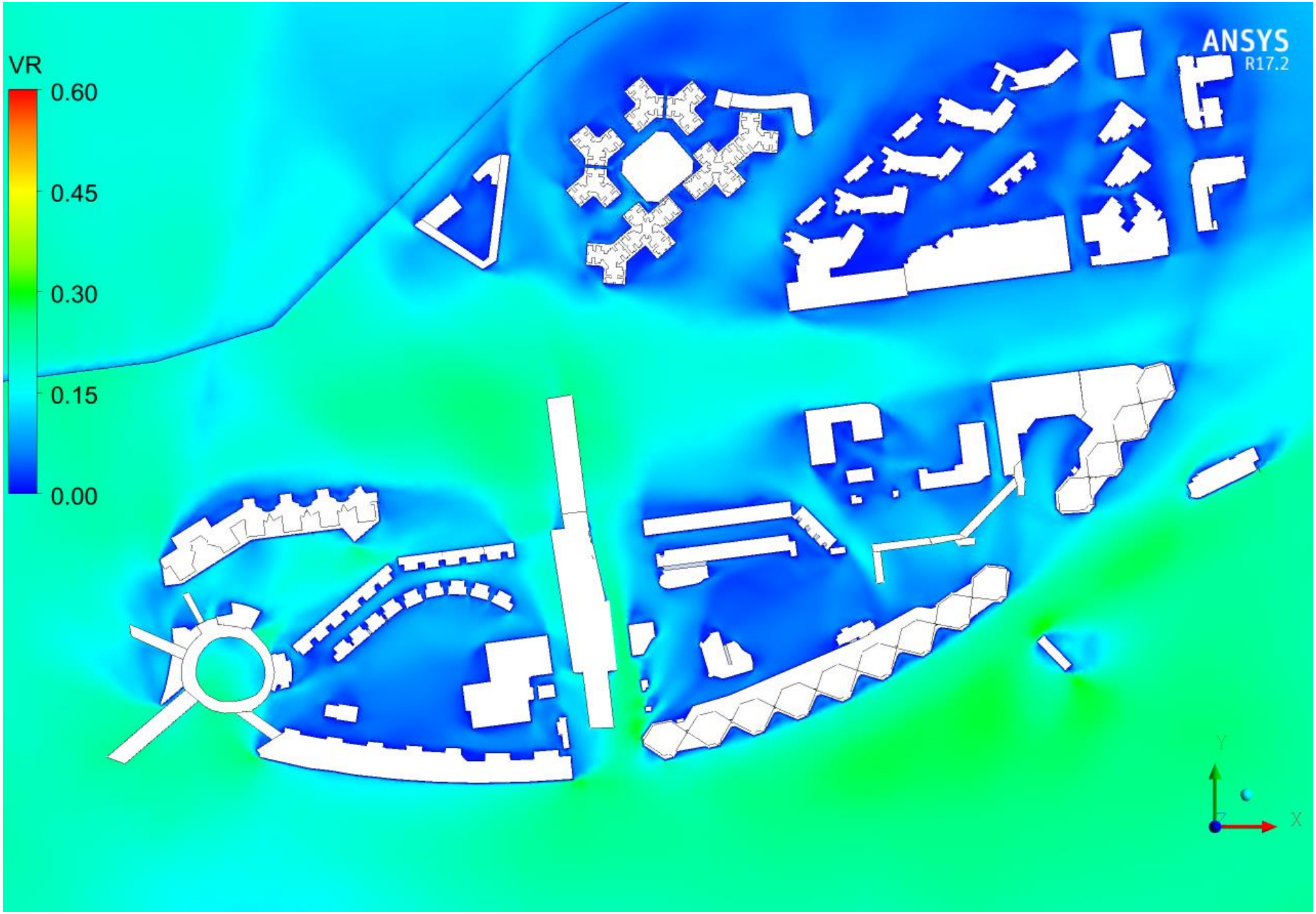
Proposed Scheme - Wind VR contour and vector plot at pedestrian level under SW Wind



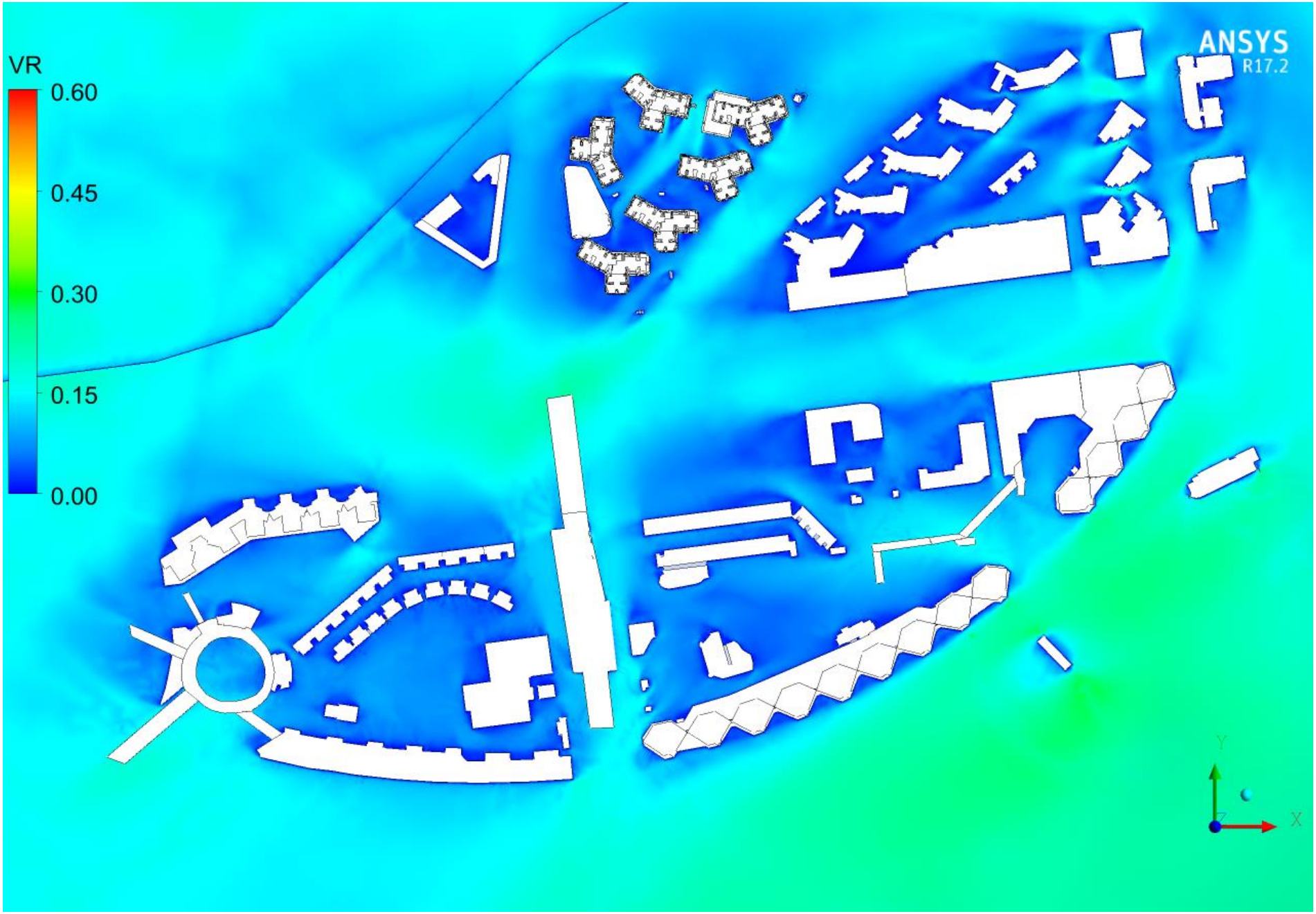
Proposed Scheme - Wind VR contour and vector plot at pedestrian level under WSW Wind



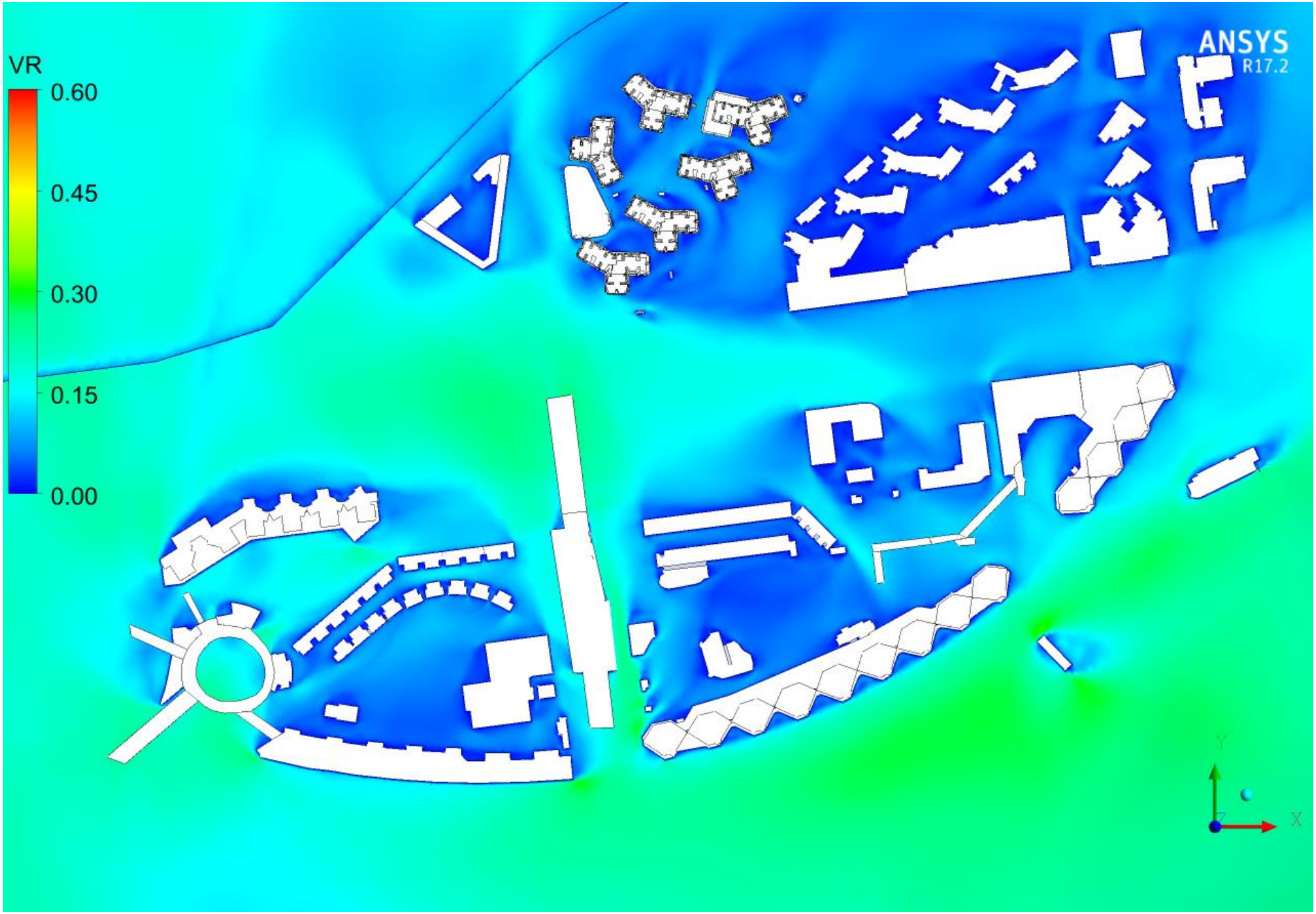
Baseline Scheme – Annual weighted average VR contour plot at pedestrian level



Baseline Scheme –Summer weighted average VR contour plot at pedestrian level



Proposed Scheme – Annual weighted average VR contour plot at pedestrian level



Proposed Scheme – Summer weighted average VR contour plot at pedestrian level

APPENDIX D:
DETAILED WIND VELOCITY RATIOS

Appendix D - Detailed Wind Velocity Ratio under different Wind Directions

Test Point	Baseline Scheme												
	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	Annual	Summer
P1	0.09	0.06	0.14	0.17	0.10	0.09	0.06	0.03	0.02	0.34	0.29	0.13	0.13
P2	0.01	0.06	0.22	0.18	0.09	0.09	0.08	0.05	0.01	0.38	0.32	0.13	0.15
P3	0.19	0.26	0.18	0.19	0.07	0.08	0.07	0.05	0.06	0.39	0.33	0.17	0.16
P4	0.29	0.30	0.12	0.20	0.06	0.06	0.06	0.04	0.16	0.37	0.32	0.18	0.16
P5	0.02	0.04	0.07	0.14	0.04	0.06	0.02	0.07	0.19	0.34	0.31	0.11	0.16
P6	0.03	0.09	0.03	0.02	0.02	0.05	0.01	0.01	0.18	0.26	0.26	0.07	0.11
P7	0.04	0.02	0.04	0.03	0.01	0.05	0.05	0.03	0.17	0.19	0.14	0.06	0.09
P8	0.04	0.07	0.05	0.03	0.02	0.05	0.03	0.02	0.15	0.27	0.21	0.07	0.11
P9	0.08	0.06	0.01	0.03	0.02	0.02	0.02	0.04	0.14	0.29	0.23	0.07	0.11
P10	0.10	0.08	0.02	0.03	0.04	0.02	0.03	0.02	0.09	0.16	0.17	0.06	0.07
P11	0.25	0.06	0.03	0.03	0.01	0.02	0.04	0.04	0.05	0.15	0.16	0.06	0.06
P12	0.37	0.17	0.05	0.04	0.02	0.03	0.05	0.03	0.02	0.13	0.14	0.09	0.05
P13	0.38	0.30	0.05	0.02	0.02	0.03	0.05	0.04	0.02	0.08	0.11	0.09	0.04
P14	0.37	0.34	0.31	0.01	0.02	0.02	0.07	0.04	0.01	0.04	0.11	0.13	0.03
P15	0.26	0.24	0.31	0.02	0.04	0.04	0.06	0.02	0.03	0.04	0.04	0.11	0.03
P16	0.14	0.24	0.29	0.03	0.05	0.05	0.06	0.01	0.05	0.05	0.06	0.10	0.04
P17	0.08	0.17	0.22	0.05	0.05	0.05	0.05	0.04	0.04	0.07	0.08	0.09	0.05
P18	0.03	0.13	0.14	0.06	0.03	0.05	0.04	0.04	0.03	0.05	0.09	0.07	0.04
P19	0.07	0.13	0.16	0.06	0.03	0.05	0.04	0.03	0.04	0.02	0.09	0.07	0.04
P20	0.08	0.12	0.16	0.06	0.04	0.04	0.04	0.04	0.04	0.04	0.07	0.07	0.04
P21	0.10	0.11	0.17	0.07	0.05	0.02	0.04	0.04	0.04	0.04	0.05	0.08	0.04
P22	0.13	0.13	0.19	0.07	0.06	0.03	0.04	0.05	0.04	0.10	0.02	0.09	0.05
P23	0.17	0.15	0.17	0.03	0.02	0.04	0.03	0.02	0.02	0.06	0.12	0.07	0.04
P24	0.28	0.27	0.24	0.05	0.01	0.02	0.05	0.05	0.05	0.16	0.35	0.12	0.08
P25	0.27	0.27	0.21	0.05	0.03	0.03	0.02	0.05	0.04	0.15	0.34	0.12	0.08
P26	0.33	0.32	0.24	0.05	0.04	0.02	0.05	0.07	0.05	0.15	0.32	0.14	0.09
P27	0.35	0.35	0.23	0.05	0.04	0.04	0.06	0.07	0.05	0.17	0.31	0.15	0.09
P28	0.34	0.35	0.22	0.05	0.08	0.05	0.08	0.07	0.03	0.18	0.24	0.15	0.09
P29	0.34	0.35	0.19	0.05	0.08	0.05	0.09	0.07	0.01	0.18	0.14	0.14	0.08
P30	0.33	0.35	0.21	0.06	0.07	0.05	0.09	0.07	0.03	0.14	0.13	0.15	0.08
P31	0.24	0.29	0.24	0.08	0.08	0.06	0.09	0.07	0.02	0.06	0.25	0.14	0.08
P32	0.03	0.08	0.23	0.02	0.05	0.08	0.08	0.05	0.03	0.23	0.31	0.09	0.10
Average SVR	**0.18**	**0.19**	**0.16**	**0.06**	**0.04**	**0.04**	**0.05**	**0.04**	**0.06**	**0.16**	**0.19**	**0.11**	**0.08**

Appendix D - Detailed Wind Velocity Ratio under different Wind Directions

Test Point	Baseline Scheme												
	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	Annual	Summer
T1	0.09	0.07	0.16	0.04	0.02	0.02	0.02	0.01	0.01	0.05	0.05	0.05	0.02
T2	0.07	0.06	0.05	0.04	0.02	0.03	0.05	0.04	0.01	0.02	0.17	0.04	0.04
T3	0.12	0.15	0.12	0.04	0.06	0.02	0.05	0.04	0.01	0.05	0.13	0.07	0.04
T4	0.17	0.29	0.27	0.04	0.06	0.04	0.03	0.05	0.03	0.06	0.06	0.11	0.05
T5	0.38	0.37	0.30	0.03	0.02	0.05	0.03	0.05	0.05	0.18	0.23	0.15	0.08
T6	0.04	0.04	0.05	0.02	0.04	0.02	0.04	0.01	0.00	0.07	0.16	0.03	0.04
T7	0.17	0.14	0.12	0.05	0.08	0.04	0.05	0.04	0.00	0.15	0.05	0.09	0.06
T8	0.06	0.02	0.03	0.04	0.01	0.05	0.01	0.02	0.01	0.08	0.05	0.03	0.03
T9	0.11	0.04	0.06	0.04	0.03	0.06	0.06	0.03	0.01	0.29	0.20	0.07	0.09
T10	0.33	0.34	0.05	0.05	0.05	0.06	0.05	0.06	0.03	0.11	0.27	0.12	0.08
T11	0.29	0.25	0.06	0.07	0.03	0.08	0.05	0.05	0.10	0.38	0.34	0.13	0.14
T12	0.37	0.15	0.09	0.02	0.02	0.05	0.03	0.11	0.14	0.32	0.25	0.12	0.13
T13	0.35	0.24	0.09	0.05	0.03	0.04	0.03	0.03	0.06	0.19	0.32	0.11	0.09
T14	0.30	0.29	0.05	0.05	0.02	0.03	0.03	0.02	0.03	0.06	0.29	0.09	0.05
T15	0.29	0.07	0.03	0.02	0.02	0.02	0.03	0.11	0.14	0.24	0.06	0.09	0.10
T16	0.37	0.02	0.04	0.01	0.03	0.01	0.02	0.12	0.14	0.15	0.06	0.09	0.08
T17	0.38	0.05	0.03	0.01	0.02	0.10	0.04	0.12	0.14	0.23	0.11	0.10	0.11
T18	0.02	0.09	0.11	0.10	0.01	0.12	0.05	0.16	0.14	0.23	0.25	0.11	0.14
T19	0.20	0.12	0.12	0.06	0.02	0.14	0.13	0.18	0.14	0.05	0.18	0.12	0.11
T20	0.10	0.07	0.14	0.20	0.05	0.15	0.16	0.21	0.14	0.23	0.17	0.16	0.17
T21	0.36	0.08	0.14	0.20	0.05	0.14	0.04	0.17	0.17	0.31	0.25	0.18	0.17
T22	0.12	0.05	0.14	0.22	0.09	0.15	0.17	0.21	0.12	0.33	0.23	0.18	0.19
T23	0.27	0.12	0.15	0.22	0.14	0.16	0.18	0.23	0.14	0.39	0.32	0.21	0.23
T24	0.23	0.04	0.14	0.23	0.11	0.14	0.03	0.17	0.18	0.33	0.24	0.18	0.19
T25	0.18	0.25	0.18	0.23	0.16	0.15	0.05	0.19	0.20	0.36	0.29	0.22	0.21
T26	0.23	0.30	0.17	0.23	0.13	0.05	0.06	0.05	0.18	0.37	0.30	0.20	0.18
T27	0.12	0.21	0.20	0.24	0.17	0.04	0.05	0.17	0.23	0.40	0.28	0.21	0.21
T28	0.09	0.05	0.14	0.23	0.18	0.07	0.09	0.03	0.08	0.39	0.28	0.16	0.17
T29	0.05	0.03	0.19	0.21	0.13	0.09	0.07	0.05	0.01	0.38	0.32	0.14	0.15
T30	0.13	0.08	0.06	0.23	0.18	0.10	0.12	0.03	0.01	0.38	0.28	0.15	0.16
T31	0.13	0.08	0.06	0.20	0.17	0.10	0.08	0.04	0.04	0.32	0.22	0.14	0.14
T32	0.07	0.09	0.06	0.23	0.18	0.11	0.12	0.05	0.02	0.37	0.26	0.15	0.16
T33	0.05	0.02	0.04	0.15	0.14	0.04	0.08	0.06	0.01	0.04	0.03	0.08	0.06
T34	0.04	0.03	0.05	0.22	0.17	0.13	0.09	0.07	0.03	0.36	0.32	0.14	0.16
T35	0.03	0.08	0.06	0.18	0.15	0.01	0.06	0.11	0.01	0.07	0.05	0.10	0.08
T36	0.09	0.11	0.12	0.23	0.16	0.08	0.07	0.05	0.02	0.20	0.31	0.14	0.12
T37	0.11	0.05	0.05	0.03	0.04	0.07	0.04	0.02	0.05	0.04	0.06	0.05	0.04
T38	0.03	0.04	0.23	0.06	0.07	0.07	0.08	0.05	0.04	0.07	0.24	0.09	0.08
T39	0.10	0.06	0.05	0.04	0.05	0.04	0.08	0.02	0.04	0.13	0.18	0.06	0.07
T40	0.31	0.27	0.21	0.05	0.06	0.05	0.06	0.07	0.05	0.09	0.23	0.13	0.08
T41	0.16	0.27	0.21	0.05	0.06	0.03	0.05	0.04	0.04	0.05	0.08	0.10	0.05
T42	0.10	0.15	0.04	0.05	0.05	0.01	0.00	0.01	0.02	0.02	0.04	0.05	0.02
T43	0.22	0.18	0.05	0.05	0.04	0.03	0.03	0.02	0.03	0.05	0.06	0.07	0.03
T44	0.33	0.30	0.11	0.05	0.05	0.04	0.05	0.02	0.05	0.04	0.04	0.11	0.04
T45	0.23	0.26	0.16	0.08	0.05	0.06	0.05	0.03	0.04	0.03	0.03	0.11	0.04
T46	0.01	0.19	0.16	0.12	0.09	0.00	0.02	0.01	0.01	0.05	0.03	0.08	0.04
T47	0.04	0.12	0.10	0.07	0.07	0.01	0.04	0.02	0.01	0.06	0.09	0.06	0.04
T48	0.23	0.01	0.02	0.02	0.00	0.04	0.00	0.02	0.01	0.07	0.07	0.04	0.03
T49	0.06	0.05	0.06	0.11	0.08	0.03	0.03	0.02	0.00	0.05	0.08	0.06	0.04
T50	0.05	0.04	0.03	0.05	0.03	0.02	0.02	0.02	0.01	0.05	0.09	0.04	0.03
T51	0.03	0.02	0.02	0.04	0.03	0.01	0.00	0.00	0.00	0.01	0.03	0.02	0.01
T52	0.08	0.06	0.07	0.09	0.05	0.03	0.02	0.02	0.02	0.05	0.07	0.06	0.04
T53	0.07	0.06	0.05	0.08	0.05	0.02	0.03	0.02	0.02	0.04	0.09	0.05	0.04
T54	0.23	0.03	0.07	0.15	0.04	0.03	0.02	0.01	0.03	0.03	0.04	0.08	0.04
T55	0.01	0.01	0.03	0.07	0.05	0.02	0.04	0.02	0.01	0.06	0.12	0.04	0.04
T56	0.16	0.04	0.06	0.11	0.09	0.04	0.06	0.02	0.01	0.05	0.07	0.08	0.05
T57	0.24	0.21	0.16	0.19	0.14	0.16	0.18	0.24	0.19	0.37	0.32	0.22	0.23
T58	0.20	0.08	0.07	0.16	0.13	0.16	0.19	0.24	0.16	0.33	0.26	0.18	0.21
T59	0.15	0.02	0.13	0.18	0.14	0.18	0.10	0.23	0.23	0.35	0.31	0.18	0.22
T60	0.02	0.07	0.06	0.14	0.10	0.19	0.13	0.24	0.24	0.28	0.24	0.15	0.21
T61	0.06	0.08	0.10	0.21	0.15	0.05	0.10	0.19	0.26	0.34	0.28	0.17	0.21
T62	0.11	0.07	0.09	0.14	0.09	0.05	0.07	0.20	0.29	0.27	0.24	0.15	0.19
T63	0.13	0.04	0.11	0.22	0.15	0.06	0.13	0.01	0.12	0.34	0.29	0.15	0.16
T64	0.03	0.10	0.09	0.16	0.08	0.10	0.14	0.03	0.01	0.34	0.25	0.12	0.13
T65	0.01	0.10	0.22	0.21	0.14	0.10	0.14	0.05	0.01	0.31	0.21	0.15	0.14
T66	0.09	0.11	0.13	0.09	0.04	0.08	0.04	0.03	0.03	0.31	0.24	0.10	0.11
T67	0.03	0.01	0.02	0.05	0.02	0.01	0.04	0.00	0.00	0.05	0.04	0.03	0.02
T68	0.06	0.01	0.23	0.12	0.09	0.11	0.08	0.03	0.00	0.44	0.12	0.13	0.13
T69	0.17	0.18	0.20	0.04	0.04	0.04	0.05	0.03	0.05	0.06	0.06	0.09	0.05
T70	0.22	0.18	0.22	0.12	0.03	0.07	0.07	0.04	0.05	0.05	0.05	0.12	0.06
T71	0.17	0.22	0.23	0.01	0.05	0.06	0.06	0.04	0.05	0.11	0.06	0.10	0.06
T72	0.23	0.29	0.30	0.01	0.03	0.08	0.09	0.02	0.05	0.01	0.23	0.12	0.05
T73	0.23	0.23	0.24	0.19	0.02	0.09	0.09	0.02	0.05	0.01	0.06	0.14	0.05
Average LVR	**0.16**	**0.14**	**0.13**	**0.09**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.18**	**0.18**	**0.11**	**0.09**
S1	0.35	0.36	0.20	0.02	0.04	0.03	0.06	0.01	0.06	0.14	0.33	0.13	0.08
S2	0.32	0.32	0.33	0.03	0.04	0.02	0.06	0.03	0.01	0.11	0.28	0.13	0.06
S3	0.25	0.29	0.28	0.04	0.04	0.02	0.06	0.04	0.04	0.05	0.10	0.12	0.04
S4	0.13	0.21	0.24	0.03	0.04	0.02	0.05	0.02	0.05	0.02	0.03	0.09	0.03
S5	0.07	0.14	0.17	0.05	0.05	0.02	0.04	0.04	0.04	0.06	0.07	0.07	0.04
S6	0.08	0.16	0.20	0.05	0.05	0.04	0.04	0.04	0.04	0.02	0.11	0.08	0.04
S7	0.18	0.21	0.25	0.05	0.05	0.05	0.06	0.04	0.05	0.12	0.04	0.11	0.06
S8	0.31	0.32	0.27	0.05	0.07	0.05	0.10	0.07	0.04	0.20	0.29	0.15	0.10
S9	0.27	0.24	0.18	0.05	0.05	0.03	0.04	0.06	0.05	0.11	0.28	0.11	0.08
S10	0.27	0.30	0.15	0.05	0.03	0.04	0.07	0.03	0.05	0.06	0.27	0.11	0.06
S11	0.27	0.31	0.25	0.05	0.05	0.06	0.08	0.02	0.05	0.02	0.24	0.13	0.06
Average VR for Special Test Point (S1 - S11)	**0.23**	**0.26**	**0.23**	**0.04**	**0.05**	**0.03**	**0.06**	**0.03**	**0.04**	**0.08**	**0.18**	**0.11**	**0.06**

Appendix D - Detailed Wind Velocity Ratio under different Wind Directions

Test Point	Proposed Scheme												
	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	Annual	Summer
P1	0.04	0.00	0.26	0.16	0.15	0.10	0.05	0.04	0.01	0.24	0.34	0.13	0.12
P2	0.09	0.17	0.33	0.18	0.16	0.11	0.07	0.06	0.03	0.31	0.36	0.17	0.15
P3	0.34	0.27	0.30	0.19	0.16	0.10	0.03	0.04	0.08	0.43	0.38	0.21	0.18
P4	0.21	0.13	0.11	0.18	0.16	0.08	0.04	0.03	0.16	0.39	0.32	0.16	0.18
P5	0.04	0.05	0.07	0.09	0.10	0.10	0.02	0.13	0.21	0.33	0.29	0.12	0.17
P6	0.07	0.06	0.06	0.01	0.01	0.09	0.00	0.10	0.19	0.26	0.26	0.08	0.13
P7	0.08	0.04	0.05	0.02	0.03	0.09	0.02	0.04	0.18	0.28	0.23	0.08	0.12
P8	0.07	0.07	0.04	0.03	0.02	0.08	0.03	0.04	0.16	0.37	0.33	0.09	0.14
P9	0.04	0.08	0.07	0.04	0.01	0.08	0.02	0.05	0.13	0.34	0.29	0.08	0.13
P10	0.05	0.09	0.09	0.05	0.01	0.09	0.01	0.05	0.12	0.20	0.13	0.08	0.09
P11	0.22	0.09	0.09	0.05	0.03	0.09	0.00	0.05	0.10	0.22	0.12	0.09	0.09
P12	0.39	0.04	0.08	0.06	0.01	0.08	0.04	0.02	0.02	0.23	0.14	0.10	0.08
P13	0.41	0.26	0.03	0.05	0.04	0.05	0.06	0.02	0.02	0.18	0.12	0.11	0.07
P14	0.38	0.38	0.37	0.03	0.06	0.03	0.03	0.04	0.02	0.13	0.08	0.15	0.05
P15	0.26	0.29	0.30	0.03	0.06	0.03	0.03	0.04	0.03	0.13	0.06	0.13	0.06
P16	0.13	0.18	0.21	0.05	0.03	0.03	0.03	0.04	0.03	0.07	0.05	0.09	0.04
P17	0.12	0.17	0.20	0.05	0.02	0.03	0.04	0.05	0.04	0.08	0.02	0.09	0.04
P18	0.17	0.20	0.24	0.06	0.03	0.03	0.04	0.04	0.04	0.21	0.12	0.11	0.08
P19	0.11	0.16	0.20	0.07	0.02	0.01	0.04	0.03	0.04	0.06	0.05	0.08	0.04
P20	0.02	0.09	0.15	0.07	0.02	0.01	0.05	0.04	0.04	0.04	0.04	0.06	0.04
P21	0.11	0.08	0.17	0.08	0.04	0.03	0.05	0.07	0.04	0.05	0.07	0.08	0.05
P22	0.16	0.19	0.24	0.07	0.04	0.06	0.05	0.07	0.04	0.07	0.15	0.11	0.06
P23	0.29	0.26	0.25	0.00	0.03	0.06	0.05	0.05	0.05	0.05	0.26	0.11	0.06
P24	0.35	0.32	0.26	0.01	0.04	0.06	0.02	0.05	0.05	0.04	0.15	0.12	0.05
P25	0.37	0.33	0.29	0.03	0.05	0.06	0.03	0.04	0.05	0.04	0.21	0.14	0.06
P26	0.34	0.31	0.31	0.02	0.00	0.03	0.05	0.04	0.05	0.02	0.32	0.12	0.05
P27	0.32	0.32	0.34	0.02	0.03	0.01	0.08	0.05	0.04	0.07	0.36	0.13	0.07
P28	0.36	0.38	0.36	0.05	0.07	0.02	0.05	0.05	0.03	0.08	0.30	0.16	0.07
P29	0.36	0.40	0.34	0.04	0.06	0.06	0.05	0.05	0.02	0.05	0.08	0.15	0.05
P30	0.37	0.37	0.35	0.03	0.06	0.02	0.06	0.06	0.03	0.10	0.14	0.15	0.06
P31	0.37	0.34	0.36	0.05	0.06	0.02	0.08	0.06	0.01	0.10	0.02	0.15	0.05
P32	0.12	0.17	0.33	0.01	0.02	0.08	0.07	0.06	0.01	0.00	0.27	0.09	0.05
Average SVR	**0.21**	**0.20**	**0.21**	**0.06**	**0.05**	**0.06**	**0.04**	**0.05**	**0.06**	**0.16**	**0.19**	**0.12**	**0.08**

Appendix D - Detailed Wind Velocity Ratio under different Wind Directions

Test Point	Proposed Scheme												
	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	Annual	Summer
T1	0.10	0.14	0.18	0.06	0.01	0.05	0.02	0.03	0.02	0.03	0.05	0.07	0.03
T2	0.07	0.02	0.01	0.07	0.05	0.09	0.06	0.03	0.01	0.10	0.12	0.05	0.06
T3	0.10	0.12	0.08	0.01	0.05	0.00	0.02	0.04	0.01	0.09	0.11	0.05	0.04
T4	0.39	0.30	0.22	0.04	0.10	0.01	0.06	0.05	0.02	0.29	0.12	0.15	0.10
T5	0.39	0.37	0.33	0.01	0.04	0.06	0.04	0.01	0.04	0.00	0.32	0.13	0.05
T6	0.35	0.34	0.32	0.06	0.04	0.05	0.05	0.02	0.04	0.11	0.33	0.15	0.08
T7	0.08	0.03	0.07	0.06	0.01	0.07	0.03	0.04	0.01	0.17	0.23	0.06	0.07
T8	0.06	0.07	0.09	0.05	0.08	0.07	0.03	0.01	0.01	0.21	0.25	0.07	0.08
T9	0.23	0.23	0.18	0.02	0.03	0.09	0.04	0.04	0.02	0.14	0.12	0.10	0.06
T10	0.05	0.11	0.04	0.05	0.02	0.05	0.05	0.04	0.04	0.05	0.04	0.05	0.04
T11	0.10	0.05	0.06	0.02	0.05	0.10	0.05	0.01	0.09	0.41	0.38	0.09	0.14
T12	0.38	0.01	0.16	0.03	0.02	0.09	0.02	0.12	0.15	0.35	0.29	0.13	0.15
T13	0.37	0.11	0.04	0.07	0.02	0.04	0.03	0.01	0.06	0.25	0.37	0.10	0.10
T14	0.30	0.15	0.09	0.09	0.03	0.04	0.03	0.04	0.02	0.10	0.32	0.10	0.07
T15	0.30	0.02	0.10	0.03	0.02	0.05	0.02	0.17	0.18	0.16	0.05	0.10	0.10
T16	0.35	0.01	0.11	0.01	0.01	0.11	0.00	0.18	0.18	0.11	0.08	0.10	0.10
T17	0.36	0.05	0.12	0.01	0.02	0.12	0.03	0.17	0.17	0.32	0.17	0.13	0.15
T18	0.08	0.06	0.14	0.07	0.05	0.14	0.02	0.20	0.18	0.27	0.27	0.12	0.16
T19	0.18	0.08	0.18	0.04	0.00	0.16	0.12	0.20	0.17	0.06	0.18	0.12	0.12
T20	0.11	0.06	0.13	0.20	0.12	0.18	0.14	0.23	0.16	0.28	0.19	0.17	0.19
T21	0.34	0.06	0.13	0.18	0.13	0.15	0.01	0.23	0.21	0.32	0.27	0.19	0.20
T22	0.13	0.05	0.14	0.24	0.16	0.19	0.14	0.22	0.14	0.38	0.24	0.20	0.22
T23	0.24	0.09	0.18	0.23	0.18	0.19	0.15	0.25	0.15	0.44	0.33	0.22	0.25
T24	0.15	0.03	0.14	0.23	0.17	0.16	0.02	0.23	0.23	0.36	0.25	0.19	0.22
T25	0.07	0.12	0.22	0.25	0.19	0.17	0.02	0.24	0.24	0.43	0.31	0.22	0.25
T26	0.26	0.19	0.21	0.23	0.18	0.09	0.04	0.05	0.19	0.39	0.31	0.21	0.19
T27	0.28	0.27	0.29	0.26	0.19	0.09	0.04	0.21	0.25	0.40	0.29	0.25	0.23
T28	0.04	0.04	0.27	0.26	0.19	0.11	0.05	0.03	0.10	0.42	0.32	0.18	0.18
T29	0.02	0.05	0.29	0.21	0.18	0.11	0.06	0.05	0.03	0.36	0.37	0.16	0.16
T30	0.12	0.07	0.11	0.26	0.19	0.11	0.09	0.04	0.02	0.42	0.33	0.17	0.18
T31	0.11	0.08	0.06	0.20	0.19	0.10	0.08	0.04	0.02	0.14	0.28	0.12	0.11
T32	0.08	0.09	0.12	0.26	0.19	0.10	0.11	0.06	0.01	0.39	0.30	0.16	0.17
T33	0.06	0.04	0.07	0.18	0.17	0.04	0.09	0.07	0.01	0.02	0.19	0.10	0.08
T34	0.03	0.02	0.15	0.26	0.18	0.12	0.10	0.08	0.02	0.25	0.35	0.15	0.15
T35	0.05	0.09	0.01	0.21	0.17	0.03	0.07	0.11	0.01	0.03	0.18	0.10	0.09
T36	0.06	0.14	0.21	0.27	0.17	0.01	0.08	0.07	0.01	0.05	0.33	0.14	0.10
T37	0.10	0.08	0.04	0.02	0.04	0.05	0.03	0.01	0.04	0.09	0.03	0.05	0.04
T38	0.13	0.14	0.31	0.05	0.07	0.02	0.07	0.06	0.03	0.10	0.16	0.11	0.07
T39	0.10	0.08	0.02	0.02	0.05	0.04	0.10	0.01	0.05	0.09	0.25	0.05	0.07
T40	0.33	0.29	0.27	0.05	0.06	0.04	0.05	0.06	0.05	0.06	0.16	0.13	0.06
T41	0.19	0.24	0.13	0.05	0.05	0.03	0.02	0.05	0.03	0.04	0.09	0.09	0.04
T42	0.16	0.11	0.03	0.05	0.03	0.00	0.01	0.02	0.01	0.05	0.03	0.05	0.03
T43	0.28	0.15	0.04	0.03	0.02	0.01	0.02	0.03	0.03	0.05	0.07	0.07	0.03
T44	0.31	0.27	0.09	0.05	0.04	0.02	0.03	0.03	0.05	0.07	0.04	0.10	0.04
T45	0.23	0.25	0.11	0.09	0.05	0.08	0.06	0.04	0.05	0.06	0.02	0.11	0.06
T46	0.03	0.13	0.21	0.13	0.10	0.03	0.02	0.01	0.01	0.03	0.04	0.09	0.04
T47	0.02	0.15	0.11	0.08	0.09	0.03	0.04	0.02	0.01	0.04	0.09	0.07	0.04
T48	0.22	0.02	0.02	0.03	0.00	0.03	0.01	0.02	0.01	0.08	0.08	0.04	0.03
T49	0.05	0.06	0.06	0.13	0.09	0.01	0.04	0.02	0.01	0.03	0.10	0.07	0.05
T50	0.06	0.05	0.03	0.06	0.04	0.01	0.03	0.03	0.01	0.06	0.08	0.04	0.04
T51	0.03	0.01	0.02	0.03	0.03	0.01	0.01	0.00	0.00	0.01	0.02	0.02	0.01
T52	0.10	0.04	0.06	0.09	0.06	0.02	0.04	0.02	0.02	0.02	0.09	0.06	0.04
T53	0.07	0.05	0.03	0.08	0.06	0.02	0.04	0.02	0.02	0.02	0.08	0.05	0.04
T54	0.23	0.04	0.10	0.16	0.04	0.02	0.02	0.01	0.02	0.04	0.03	0.09	0.04
T55	0.07	0.02	0.02	0.07	0.05	0.02	0.05	0.02	0.00	0.03	0.12	0.04	0.04
T56	0.13	0.04	0.04	0.11	0.10	0.04	0.05	0.02	0.01	0.03	0.04	0.07	0.04
T57	0.13	0.20	0.22	0.20	0.17	0.19	0.17	0.27	0.19	0.43	0.34	0.23	0.25
T58	0.13	0.17	0.24	0.15	0.15	0.19	0.17	0.25	0.16	0.38	0.30	0.21	0.23
T59	0.25	0.22	0.25	0.18	0.16	0.19	0.13	0.27	0.25	0.40	0.35	0.24	0.25
T60	0.10	0.03	0.16	0.12	0.13	0.21	0.18	0.29	0.24	0.33	0.29	0.18	0.24
T61	0.01	0.04	0.22	0.21	0.16	0.10	0.02	0.24	0.29	0.38	0.32	0.19	0.23
T62	0.07	0.05	0.01	0.13	0.11	0.14	0.07	0.25	0.32	0.32	0.27	0.15	0.22
T63	0.11	0.08	0.10	0.22	0.16	0.13	0.07	0.02	0.13	0.38	0.33	0.16	0.18
T64	0.04	0.05	0.03	0.14	0.10	0.08	0.13	0.03	0.02	0.38	0.27	0.11	0.14
T65	0.05	0.09	0.20	0.21	0.16	0.07	0.14	0.02	0.02	0.36	0.27	0.15	0.15
T66	0.08	0.08	0.09	0.09	0.02	0.03	0.05	0.02	0.01	0.35	0.29	0.09	0.11
T67	0.01	0.01	0.05	0.04	0.03	0.01	0.04	0.01	0.00	0.04	0.05	0.03	0.02
T68	0.03	0.04	0.25	0.11	0.10	0.09	0.08	0.04	0.00	0.48	0.16	0.13	0.14
T69	0.16	0.17	0.21	0.05	0.04	0.07	0.02	0.04	0.05	0.14	0.08	0.10	0.06
T70	0.22	0.17	0.24	0.16	0.02	0.09	0.03	0.03	0.05	0.16	0.07	0.13	0.08
T71	0.17	0.22	0.26	0.02	0.05	0.07	0.03	0.04	0.05	0.03	0.05	0.10	0.04
T72	0.24	0.29	0.33	0.03	0.03	0.08	0.06	0.03	0.06	0.05	0.09	0.13	0.05
T73	0.23	0.22	0.27	0.25	0.02	0.09	0.06	0.03	0.06	0.11	0.10	0.16	0.08
Average LVR	**0.17**	**0.14**	**0.16**	**0.10**	**0.08**	**0.07**	**0.05**	**0.07**	**0.07**	**0.18**	**0.19**	**0.12**	**0.10**
S1	0.35	0.38	0.06	0.05	0.03	0.02	0.06	0.13	0.11	0.25	0.38	0.14	0.13
S2	0.34	0.36	0.38	0.01	0.02	0.02	0.04	0.04	0.02	0.20	0.35	0.15	0.08
S3	0.26	0.28	0.29	0.02	0.05	0.02	0.03	0.05	0.03	0.13	0.13	0.12	0.06
S4	0.14	0.19	0.21	0.02	0.06	0.04	0.02	0.05	0.05	0.09	0.01	0.09	0.05
S5	0.10	0.15	0.20	0.04	0.05	0.04	0.02	0.04	0.05	0.05	0.04	0.08	0.04
S6	0.07	0.14	0.20	0.04	0.06	0.05	0.02	0.05	0.05	0.06	0.09	0.08	0.05
S7	0.19	0.23	0.28	0.05	0.06	0.07	0.04	0.05	0.05	0.05	0.21	0.12	0.06
S8	0.36	0.36	0.35	0.06	0.07	0.05	0.08	0.07	0.03	0.10	0.31	0.16	0.08
S9	0.26	0.33	0.25	0.02	0.03	0.05	0.03	0.06	0.05	0.02	0.11	0.11	0.04
S10	0.29	0.32	0.18	0.02	0.02	0.05	0.03	0.05	0.06	0.04	0.02	0.11	0.04
S11	0.29	0.30	0.28	0.06	0.05	0.07	0.06	0.03	0.07	0.08	0.02	0.14	0.06
Average VR for Special Test Point (S1 - S11)	**0.24**	**0.28**	**0.24**	**0.04**	**0.05**	**0.04**	**0.04**	**0.06**	**0.05**	**0.10**	**0.15**	**0.12**	**0.06**