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Hong Kong Housing Authority

Prepared by

Ramboll Hong Kong Limited

PUBLIC HOUSING DEVELOPMENT AT WANG CHIU ROAD PHASE 1

AIR VENTILATION ASSESSMENT

Date	**10 April 2025**
Prepared by	**Echo Cao** **Environmental Consultant**
Signed	
Approved by	**Tony Cheng** **Senior Manager**
Signed	
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Ramboll Hong Kong Limited

21/F, BEA Harbour View Centre
56 Gloucester Road, Wan Chai, Hong Kong

Tel: (852) 3465 2888
Fax: (852) 3465 2899
mail: hkinfo@ramboll.com

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1. INTRODUCTION

1.1 Project Background

1.1.1 The Green Form Subsidised Home Ownership Scheme (GSH) at Wang Chiu Road Phase 1 (the proposed development) has been proposed by Hong Kong Housing Authority (HA). According to the draft Ngau Tau Kok and Kowloon Bay Outline Zoning Plan (OZP) No. S/K13/33, the Site is zoned as "Residential (Group A)" with maximum plot ratio of 7.5 for a domestic building or 9.0 for a building that is partly domestic and partly non-domestic, and a building height restriction of 120mPD.

1.1.2 Ramboll Hong Kong Limited is commissioned by Hong Kong Housing Authority (HKHA) to conduct the Air Ventilation Assessment ("AVA") based on the indicative scheme of the Proposed Development provided by project architect, Hsin Yieh Architects & Associates Ltd.

1.2 Objectives

1.2.1 This AVA contains a quantitative Computational Fluid Dynamics (CFD) assessment of the potential ventilation impact of the proposed building design on the future pedestrian wind environment.

1.3 Subject Sites and its Environs

1.3.1 The Subject Site covers an area of about 1.71 ha, is relatively flat with a level of about 4 mPD. A 25m wide Drainage Reserve Area (DRA) and Waterworks Reserve Area (WWR) run through the site from north to south, dividing it into two buildable areas.

1.3.2 The site is bordered to the southwest by Wang Chiu Road, with Richland Gardens located directly across the road. To the north, there is a strip of government land occupied by the Drainage Services Department (DSD), which houses a pumping chamber. To the northeast, the Social Welfare Department occupies a Grade 1 Historic Building that serves as the Caritas Family Crisis Support Centre (FCSC). Beyond the FCSC is the Kwun Tong Road and further beyond is Ping Shek Estate. Kai Yip Estate abuts the site to the southeast. To the northwest, it is Wang Chiu Road Phase 2 public housing development, along with a future secondary school situated between the two phases.

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

1.4 Future/ Committed Development

1.4.1 The following future/ committed developments have been considered in this study. **Figure 3** illustrates the location and building blocks of these developments which have been included in the CFD simulation.

1. Housing Development Wang Chiu Road Phase 2 and the future school was referred to Metro Planning Committee (MPC) Paper No. 1/17.
2. UptownEast was referred to the sales brochure.

1.5 Baseline Scheme

1.5.1 The notional scheme is referred to the Master Layout Plan prepared in 2017.

1.5.2 In the Baseline Scheme, the proposed development consists of three building blocks. The building height of the three blocks are 119.90 mPD (Block 1) and 119.85 mPD (Block 2 and 3) respectively. Blocks 2 and 3 are sitting on 3-storeys podium while Block 1 is sitting on ground. For mitigating the severe traffic noise, single aspect design is adopted at Block 1 and 3.

1.5.3 Stepping building height is applied at Block 1 and 3. The single aspect wing of Block 1 is truncated to have 34 storey with the localized building height at 103.4 mPD. Similarly, the single aspect wing of Block 3 is truncated to have 34 storey with the localized building height at 111.60 mPD.

1.5.4 Empty bays are adopted at the upper ground level of the Block 1 and 3.

1.5.5 **Appendix 1** show the Master Layout Plan (MLP) of the Baseline Scheme.

1.6 Proposed Scheme

1.6.1 The master layout of the Proposed Scheme is basically same as the Baseline Scheme. The building shape and disposition of the three blocks almost same as that in the Baseline Scheme. Some localized changes are found in the extent of the truncated floors at single aspect wing of Block A and C and the shape of the empty bay at upper ground floor.

1.6.2 The major difference between the Proposed Scheme and Baseline Scheme are summarized at below.

1. The localized building height of the single aspect wing of Block A (referred to as Block 1 in the Baseline Scheme) is increased to be 119.94 mPD which is about 16.54m taller than that of the Baseline Scheme (103.4mPD);
2. The localized building height of the three wings of Block B (referred to as Block 2 in the Baseline Scheme) is decreased slightly from 119.85 mPD to 118.14 mPD.
3. The localized building height of the single aspect wing of Block C (referred to as Block 3 in the Baseline Scheme) is increased to be 119.89 mPD from 111.6mPD in the Baseline Scheme.
4. The shape of the empty bay at the ground and first floor of Block A (referred to as Block 1 in the Baseline Scheme) is adjusted for accommodating the revised layout design while that at Block C (referred to as Block 3 in the Baseline Scheme) is filled with staircase.

1.6.3 **Appendix 2** show the Master Layout Plan (MLP) of the Proposed Scheme.

2. SITE WIND AVAILABILITY

2.1 Site Wind Availability Data

2.1.1 According to the Planning Department's website, a meso-scale Regional Atmospheric Modeling System (RAMS) was used to simulate a 10-year wind climate at the horizontal resolution of 0.5 km x 0.5 km covering the whole territory of Hong Kong. The simulated wind data represents the annual, winter and summer wind conditions at various levels, i.e. 200 m, 300 m, and 500 m above terrain.

2.1.2 It is considered an acceptable starting point to use the simulated RAMS data for Site wind availability. The use of RAMS data (grid: X;087, Y:045) is preferred over measurement data at Waglan Island as it can reflect the effect of topography to wind availability.

2.1.3 The relevant annual windrose for the district under concern has been extracted from the Planning Department's website for the Subject Sites wind availability data. **Figure 4** shows the relevant windrose diagram (at 500 m) representing the frequency and wind speed distribution of the district concerned for both summer and annual conditions. The simulated windroses show that the annual prevailing wind is coming from E direction (19.8%) with contributions from ENE (11.9%) and ESE (10.8%); while the summer prevailing wind is coming from SW direction (15.3%) with contributions from SSW (13.0%). In this quantitative AVA, a CFD model has been used. According to the *Technical Guide*, simplification of wind data for the initial study has been adopted. The wind directions with highest probability of occurrence are selected for AVA purposes. 11 most frequently occurred prevailing wind directions were selected for both annual and summer conditions with overall frequency of occurrence equivalent to 77.0% and 81.9% respectively of the time in a year.

2.1.4 **Table 2.1** summarizes the simulated wind availability data including probability of occurrence.

Table 2.1 Summary of RAMS Data and Wind Direction

Wind Direction	Probability for Annual Condition (%)	Probability for Summer Condition (%)
N	2.8%	0.9%
NNE	5.7%	1.0%
NE	8.0%	1.4%
ENE	11.9%	2.6%
E	19.8%	8.5%
ESE	10.8%	9.3%
SE	8.5%	8.2%
SSE	4.9%	8.3%
S	4.4%	8.9%
SSW	5.8%	13.0%
SW	6.5%	15.3%
WSW	4.1%	10.4%
W	2.6%	5.5%
WNW	1.5%	3.0%
NW	1.2%	1.9%
NNW	1.5%	1.3%
Total Selected	77.0%	81.9%

Note: Bolded characters highlighted in grey represent the selected prevailing wind directions for evaluation.

2.2 Topography and Building Morphology

Topography

2.2.1 The topography is generally flat in the immediate surrounding area. The ground elevation increases gradually from the Kwun Tong Road towards north, i.e. Kowloon Peak, which is located around 1.5 km to the north of the Subject Site with the hill top around 600 mPD.

Building Morphology

2.2.2 Based on onsite survey of existing developments, the published information in Statutory Planning Portal under the Town Planning Board regarding planned/committed developments in the model area, there are existing mid to high-rise developments near the Subject Site, i.e. Wang Chiu Road Phase 2, Richland Gardens, Kai Yip Estate, Ping Shek Estate as well as UptownEast. Therefore, the wind flow pattern at the Subject Site would be influenced by this surrounding built environment.

3. QUANTITATIVE ASSESSMENT METHODOLOGY

3.1 Atmospheric Conditions

3.1.1 Simulated wind profile curves are extracted from the Planning Department's website using RAMS site wind availability data and is directly adopted for this quantitative AVA. **Figure 5** shows the wind profile curves for grid X:087, Y:045.

3.1.2 Wind profile curves (i.e. approach condition from the detail study) 0, 1, and 2 would be utilized for quantitative AVA according to the selected wind directions in **Table 2.1**.

3.1.3 For elevation from 0 to 10 m where wind profile information is not available, the wind speed is assumed based on fitted Log Law and measured wind speed value at 10 m from the RAMS Site wind availability data for each wind profile curve.

3.1.4 The wind profile of 0 m to 10 m is interpolated and then combined with the wind profile curves on RAMS site wind availability data.

3.1.5 The roughness length in the CFD model is set as 2m.

3.2 CFD Code and Major Parameters

3.2.1 A quantitative assessment based on the requirement for Initial Study stipulated in the relevant Technical Guide has been conducted for the purpose of comparing the air ventilation performance between the Proposed and the Baseline Schemes.

3.2.2 The quantitative assessment is conducted by using a commercial CFD code, FLUENT. FLUENT model has been widely applied for various AVA research and studies worldwide. The accuracy level of the FLUENT model is well-accepted by the industry for AVA application.

3.2.3 Realizable K-epsilon turbulence providing better prediction of separation and vortexes has been adopted for air ventilation assessment as recommended in COST action C14.

3.2.4 The assessment area is determined by the height (H) of the highest building within the surrounding area. Therefore, the assessment area shall be at least 1H (with H=140m of UptownEast).

3.2.5 The surrounding area is determined by 2 times the height of the highest building within the model area which is equivalent to at least 2H of the highest building (i.e. >2H where H=140 m) from the project Site boundary. It is confirmed that all major noise barriers, elevated structures, and planned / committed / existing developments in the model area have been modelled in the simulation. **Figure 1** indicates the assessment area and the surrounding area of the CFD model.

3.2.6 The domain dimension is about 5100m x 5000m and with an elevation of 1500m. More than 27,300,000 grid cells have been 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 Project Area is taken as a global minimum size of 2m, and the size of the grid cells further away from the Project Area is increased by a growth ratio of 1.3. The global maximum size of cells is 24m while smaller cells size of 0.25m were used. Besides, four layers of prism cells (each layer of 0.5m thickness) are employed above the terrain of Subject Sites. The blockage ratio is less than 3%.

3.2.7 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 a symmetric boundary condition.

3.2.8 **Appendix 3** shows the domain size and the CFD model in different views.

3.2.9 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.

3.3 Important Areas

3.3.1 For the proposed development, important surrounding areas that the public would often access have been identified as follows:

(1) Kwun Tong Road

(2) Ping Shek Estate

(3) Urban Oasis

(4) Wang Chiu Road

(5) Kai Yip Estate

(6) Richland Gardens

(7) Kwun Tong Road Children's Playground

(8) Sam Shan Kwok Wong Temple

(9) Future School Site

(10) Public Housing Development at Wang Chiu Road Phase 2

3.4 Test Point Location

3.4.1 A total of 163 test points (including 31 numbers of perimeter test points defined along the boundary of the Subject Site, 132 numbers of overall test points within the assessment area) have been selected. The overall test point generally represents important pedestrian areas which are listed in **Section 3.3** above. All test points are located at 2 m above ground level.

3.4.2 **Figure 6** shows the perimeter and overall test points selected for quantitative air ventilation assessment.

4. KEY FINDINGS

4.1 Spatial Average Wind Velocity Ratios

4.1.1 The velocity ratio under a specific wind direction at a test point is calculated by dividing the simulated wind speed at the test point under a certain wind direction by the velocity at gradient height under the same wind direction. All test points are located at 2 m above ground level.

4.1.2 **Table 4.1** shows the Subject Site spatial average velocity ratio (SVR), local spatial average velocity ratio (LVR), and average wind velocity ratio in the surrounding sensitive area during annual condition and summer condition (for the Proposed Scheme (PS) and Baseline Scheme (BS)).

4.1.3 The wind velocity ratios of individual test points are shown in **Figure 7a** and **Figure 8a** for the annual condition of the Baseline Scheme and Proposed Scheme respectively, while **Figure 7b** and **Figure 8b** shows the wind velocity ratios for summer condition of the Baseline Scheme and Proposed Scheme, respectively. **Appendix 5** shows the detailed simulation results of the Proposed Scheme and the Baseline Scheme.

Table 4.1 Summary of Spatial Average Wind Velocity Ratios (VR) – Annual and Summer Condition

Location	Test Point	Annual Condition		Summer Condition	
		BS	PS	BS	PS
SVR	P01-P31	**0.18**	0.17	**0.12**	0.11
LVR	P01-P31, T001-T132	0.19	0.19	0.14	0.14
1. Kwun Tong Road	T001-T029	0.21	0.21	0.15	0.15
2. Ping Shek Estate	T030 – T037	**0.17**	0.16	**0.11**	0.10
3. Urban Oasis	T038-T042	0.23	**0.26**	0.14	0.14
4. Wang Chiu Road	P17-P24,T043-T066	0.20	**0.21**	**0.14**	0.13
5. Kai Yip Estate	T067-T092	0.24	**0.25**	0.17	**0.18**
6. Richland Gardens	T093-T119	0.15	**0.16**	0.14	**0.15**
7. Kwun Tong Road Children's Playground	T120-T121	0.20	**0.21**	0.19	0.19
8. Sam Shan Kwok Wong Temple	T122-T123	**0.22**	0.19	**0.12**	0.11
9. Future School Site	T124-T127	**0.13**	0.12	**0.08**	0.07
10. Public Housing Development at Wang Chiu Road Phase 2	T128-T132	0.15	**0.17**	0.07	**0.08**

Note: Highlighted in **red** where VR is higher in the Proposed Scheme

Highlighted in **blue** where VR is higher in the Baseline Scheme

4.2 Discussion on Air Ventilation Performance

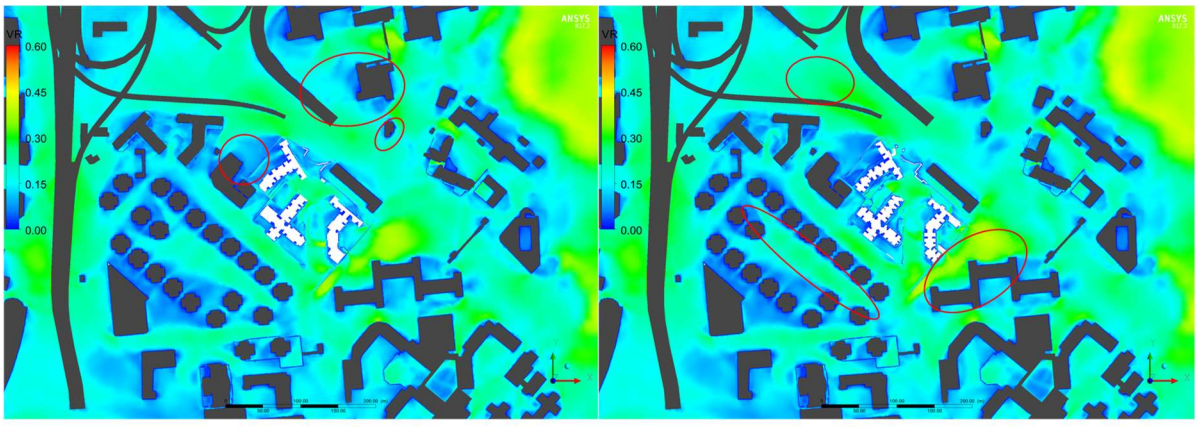
Discussion for VR Table

4.2.1 According to Table 4.1 above, it is noted that the LVR is comparable in the Proposed Scheme and Baseline Scheme under both annual and summer condition; however, the SVR is slightly reduced in the Proposed Scheme under both annual and summer conditions.

4.2.2 In some localized area within the Study Area, there are some variations between the Baseline Scheme and Proposed Scheme. The VR is higher under the Proposed Scheme at Urban Oasis (annual ccondition), Wang Chiu Road (annual condition), Kai Yip Estate (annual and summer condition), Richland Gardens (annual and summer condition), Kwun Tong Road Children's Playground (annual condition) and Public Housing Development at Wang Chiu Road Phase 2 (annual and summer condition).

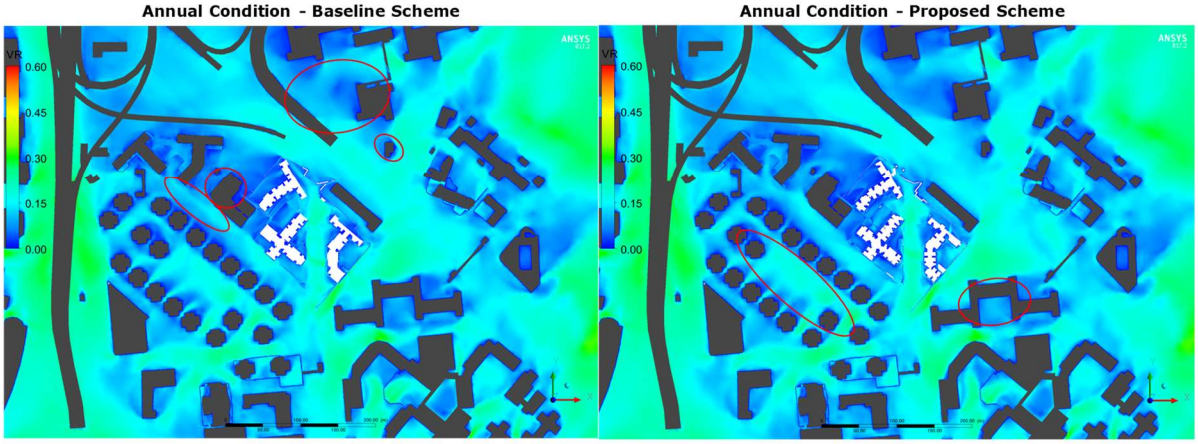
4.2.3 On the other hand, the VR is higher under the Baseline Scheme at Ping Shek Estate (annual and summer Condition), Wang Chiu Road (summer condition), Sam Shan Kok Wong Temple (annual and summer condition) and Future School Site (annual and summer condition).

Discussion for Weighted Average contour Plot.



Annual Condition - Baseline Scheme

Annual Condition - Proposed Scheme



Summer Condition - Baseline Scheme

Summer Condition - Proposed Scheme

4.2.4 According to the weighted average contour plots, the wind pattern and ventilation performance is similar between two design options in both annual and summer conditions with some localized variations.

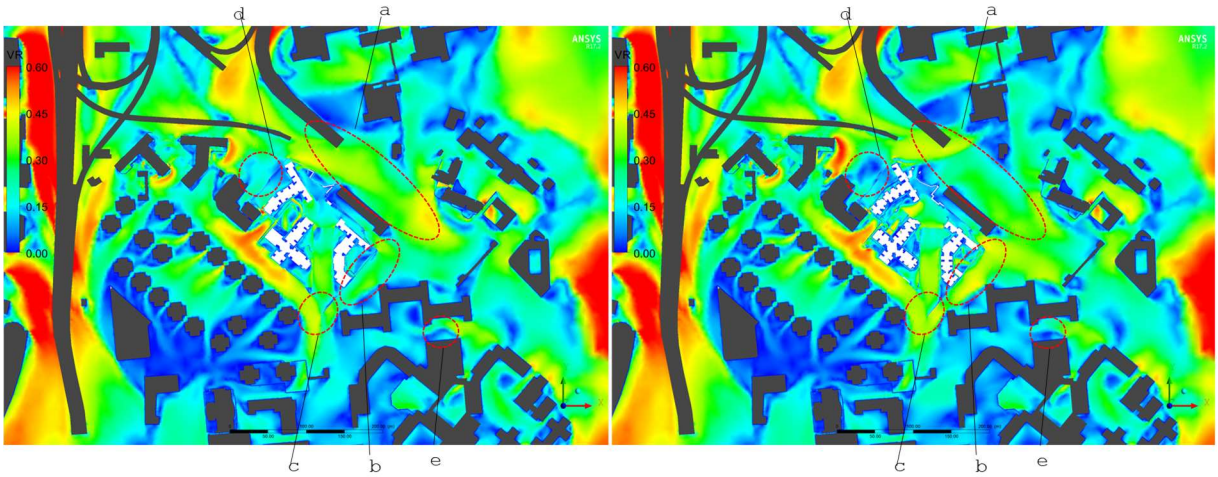
4.2.5 As observed, a slightly improvement is found in the Proposed Scheme at Urban Oasis under annual condition.

4.2.6 The VR performances at Kai Yip Estate and Richland Garden at the south of the site are slightly better in the Proposed Scheme under both Annual and Summer Conditions as shown in the contour plots.

4.2.7 However, under the Proposed Scheme, there is a slightly reduction in the VR performance at Ping Shek Estate under both annual and summer condition. The VR performance of the Sam Shan Kwok Wong Temple, which is also north of the Site is slightly reduced under the Proposed Scheme. The VR performance at adjacent future school site is also reduced under both conditions. These slightly reduction of VR performance may be due to the increase of the single aspect wing of the Block A and C.

4.3 Directional Analysis

Wind performance under wind direction of NNE



Contour plot for Baseline Scheme **Contour plot for Proposed Scheme**

4.3.1 According to the contour plots under NNE wind,

a. The building height of the Single Aspect Wing of the Block C and Block A is increased, and more NNE wind at high level is captured in the Proposed Scheme. The increase of the captured NNE winds diverted to the ground level and flow towards along the Kwun Tong Road. As such, the wind performance at the Kwun Tong Road and its western portion is better under the proposed scheme.

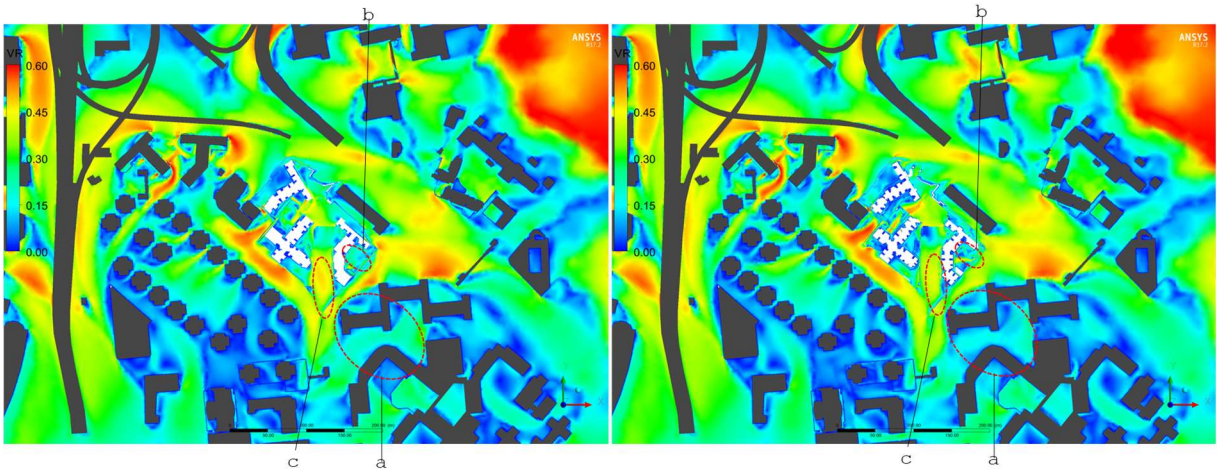
b. The wind performance along the area between the Site and the Kai Yip Estate is better under the Proposed Scheme. This may be due to the increased downwash wind captured by the higher building façade of the single aspect wing of Block A. More wind at high level is captured and diverted to the pedestrian level, resulting an increase of wind performance at this area.

c. This increased wind continuously flow towards south and slightly benefit the wind performance at area near the junction of Kai Yip Road and Wang Chiu Road.

d. However, the wind performance at the future school is reduced under the Proposed Scheme. This may be due to the increase of the building height of the single aspect wind of Block C. The increase of this façade captures more high-level wind, and driver it towards pedestrian level. Part of these winds were diverted towards the future school, but the upcoming NNE from the north of the school may counter with this downwash wind, resulting a turbulence created and a lower wind performance is observed at this area.

e. From the contour, the wind performance at the eastern portion of Kai Yip Road is slightly reduced under the Proposed Scheme. It may be the increase of the single aspect wing of Block A reduce the wind flow of further downwind area in comparing with the Baseline Scheme.

Wind performance under wind direction of NE



Contour plot for Baseline Scheme **Contour plot for Proposed Scheme**

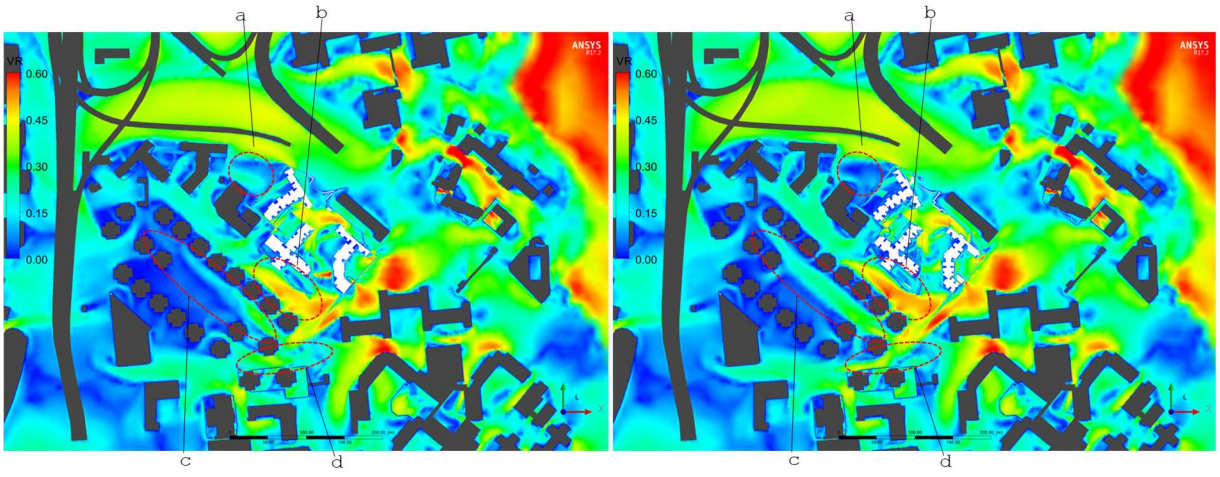
4.3.2 According to the contour plots under NE wind,

a. The increased building height of single aspect wing of Block A reduce the high-level wind passing through the site. The ventilation performance of further downwind area is therefore reduced under the Proposed Scheme.

b. Although there is a shape change of the empty bay, the wind still can pass through it and reach the downwind area, as shown in the contour.

c. With a reduction of the high-level wind due to the increased building height of the single aspect wing, there may be a reduction of NE winds passing through the site. Therefore, the wind performance of this area is slightly reduced under the Proposed Scheme.

Wind performance under wind direction of ENE



Contour plot for Baseline Scheme **Contour plot for Proposed Scheme**

4.3.3 According to the contour plots under ENE wind,

a. The minor change in the building façade of the Block C streamline the wind flow to downwind area, as such more wind is diverted towards the Wang Chiu Road Phase 2 building. These winds hit on the Phase 2 building and rebound towards

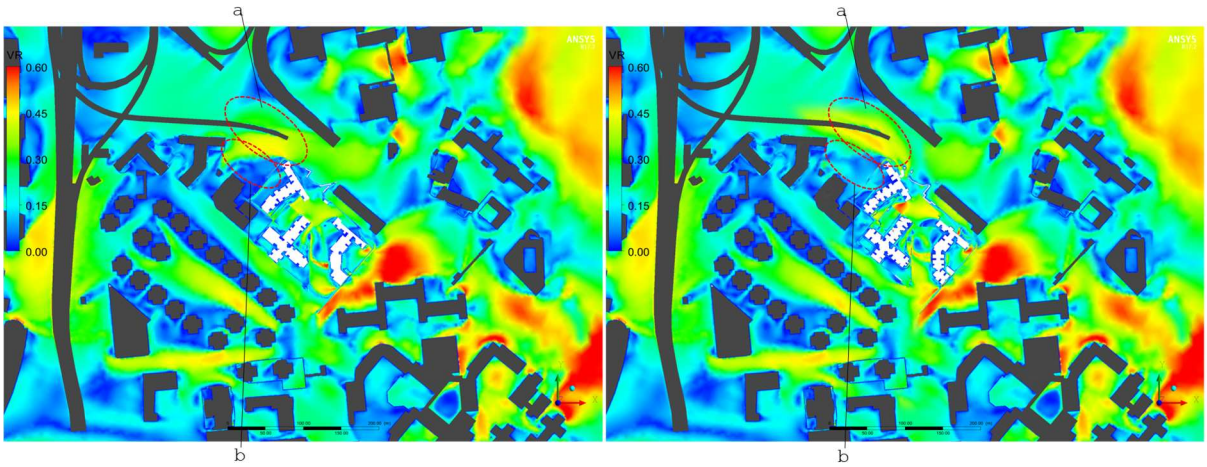
back to the Site, and a stronger turbulence is recreated at this area. The wind performance of this area is therefore reduced.

b. The size of the empty bay at Block A under the Proposed Scheme is changed and there is less wind passing through it. With less wind passing through the empty bay, there will be less wind hitting on the Block B and rebound back towards east. This reduction of the rebound wind flow may help to reduce the counter wind flow for the ENE wind flowing along the area between the site and the western end of the Kai Yip Estate. Therefore, it is observed in the contour that the wind performance along the Wang Chiu Road is slightly better under the Proposed Scheme.

c. Similarly, there may be an increase of the wind flow passing into the Richland Garden under the Proposed Scheme, as shown in the contour.

d. This also benefit the wind performance at Kai Yan Street under the Proposed Scheme, as shown in the contour that more ENE wind can pass and reach this road.

Wind performance under wind direction of E



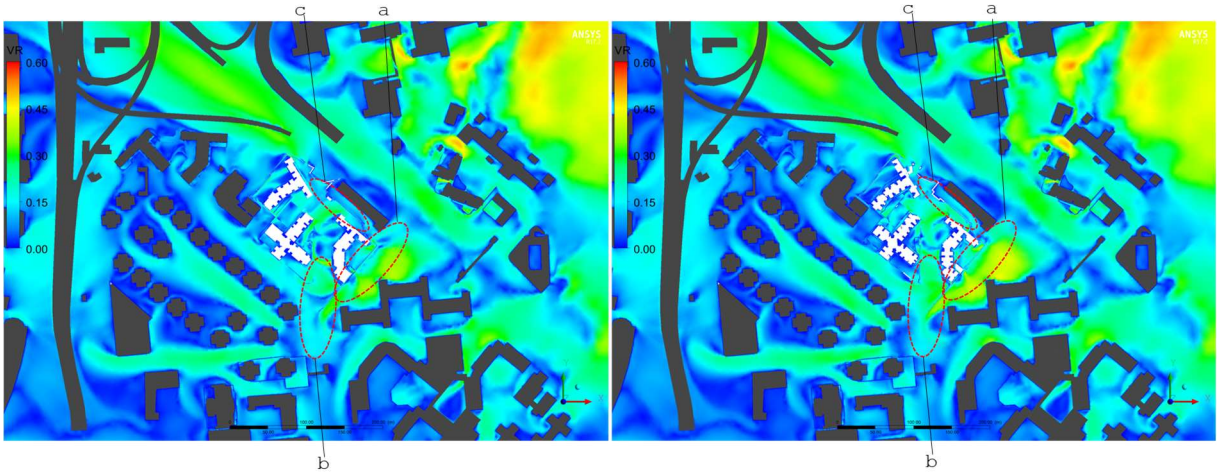
Contour plot for Baseline Scheme **Contour plot for Proposed Scheme**

4.3.4 According to the contour plots under E wind,

a. Comparing the layout between the Baseline and Proposed Scheme, the design of the single aspect wing of Block C in the Proposed Scheme is in a more streamline facade, and this would facilitate the wind passing across. From the contour, more E winds is diverted towards west and the wind performance along the Prince Edward Road East is better under the Proposed Scheme.

b. As more E wind is diverted to Prince Edward Road East by the streamlined single aspect wing of Block C under the Proposed Scheme, there is less wind diverted towards the Wang Chiu Road Phase 2. Thus, the wind performance at the area between Phase 1 and Phase 2 is reduced under the Proposed Scheme. However, with less wind hit on the Phase 2 building, there is less wind bound back to the Phase 1 and the potential turbulence effect at the area in front of the future school site is reduced. A better wind performance at the future school site is observed under the Proposed Scheme.

Wind performance under wind direction of ESE



Contour plot for Baseline Scheme **Contour plot for Proposed Scheme**

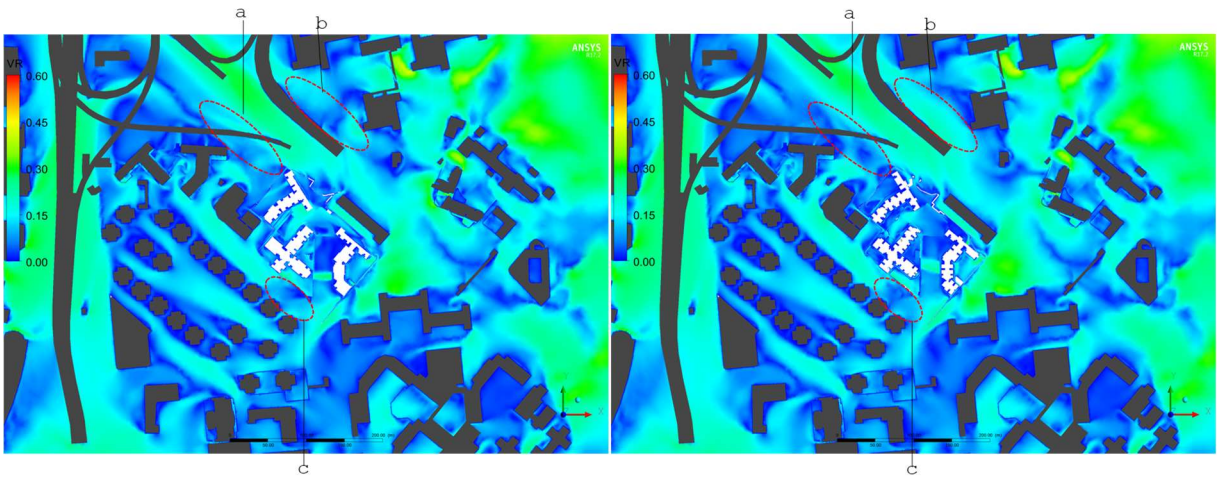
4.3.5 According to the contour plots under ESE wind,

a. The increased of the building height of Block A captured more high-level wind and divert them towards pedestrian. With this increased downwash wind, the wind performance at the area in front of the Phase 1 is better under the Proposed Scheme.

b. Similarly, the downwash wind from the higher single aspect wing of Block A under the Proposed Scheme may also improve the ventilation performance of the immediate area. This downwash wind may continuously flow across the site and benefit the further downwind area to the south of the Site.

c. With a wider shape of the empty bay at Block A under the Proposed Scheme, there may be more ESE wind passing through it. Then, the wind hits on the Block B of the Proposed Scheme and may divert towards north and south. For south, as mentioned in b above, the ventilation performance is improved to the south of the site. For north, in comparing with the Baseline Scheme, the ventilation performance at the area between the site and the Caritas Family Crisis Support Centre is slightly improved under the Proposed Scheme.

Wind performance under wind direction of SE



Contour plot for Baseline Scheme **Contour plot for Proposed Scheme**

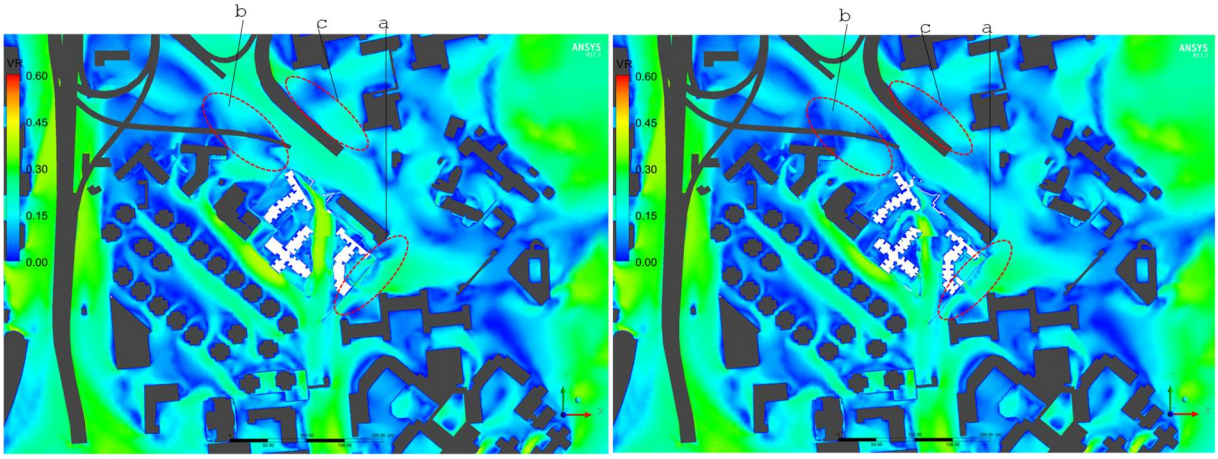
4.3.6 According to the contour plots under SE wind,

a. A more streamlined façade layout is adopted at single aspect wing of Block C under the Proposed Scheme, more SE wind is likely to be diverted towards the Kwun Tong Road as observed in the contour. As a result, less SE wind is flowing towards the Urban Oasis, and the wind performance of this area is reduced under the Proposed Scheme. Similarly, as observed in the contour, the wind performance at the northern area of the future school is also reduced as more wind is diverted towards north.

b. With more SE wind being diverted towards the Kwun Tong Road, the air ventilation performance at area south of the Ping Shek Estate is better under the Proposed Scheme. However, this increased wind flow may counter the upcoming wind flowing from north of the Wong Shek House of Ping Shek Estate, and so the VR at the area between Wong Shek House and Tsui Shek House is reduced in comparing with that under the Baseline Scheme.

c. From the contour, with a wider opening of the empty bay at Block A under the Proposed Scheme, more SE wind could pass through this empty bay than that under the Baseline Scheme. This additional wind would benefit the surrounding area, and the wind performance at the Wang Chiu Road south of the Site is better under the Proposed Scheme.

Wind performance under wind direction of SSE



Contour plot for Baseline Scheme **Contour plot for Proposed Scheme**

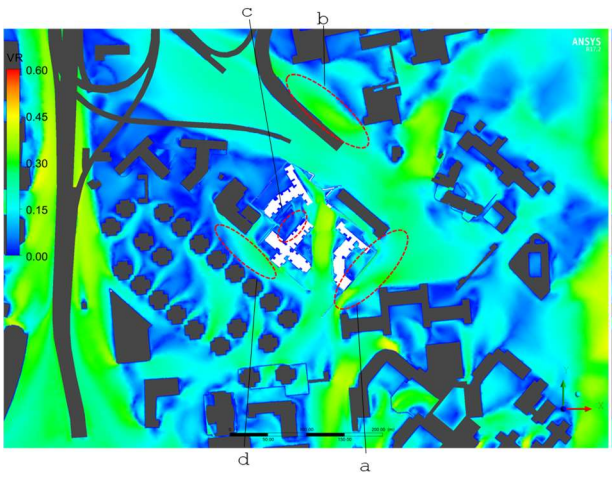
4.3.7 According to the contour plots under SSE wind,

a. The increased of the building height of Block A in the Proposed Scheme captured more high-level wind and divert them towards pedestrian. With this increased downwash wind, the wind performance at the area in front of the Phase 1 is better under the Proposed Scheme.

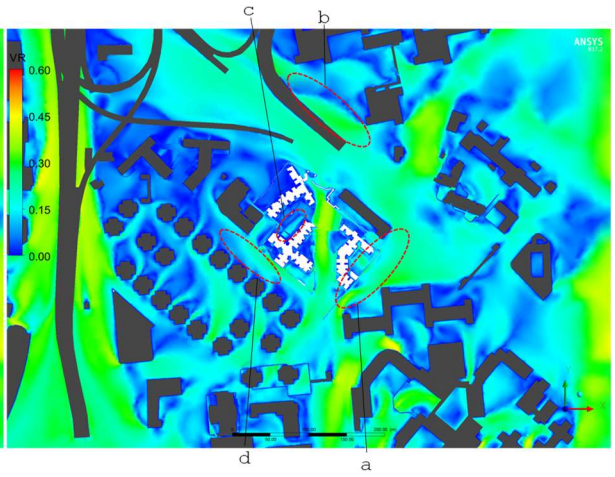
b. Similar to the SE wind, the more streamlined façade adopted at single aspect wind of Block C in the Proposed Scheme is likely to divert more SSE wind towards the Kwun Tong Road. As a result, less SSE wind flows towards the Urban Oasis, thus the wind performance of this area is slightly reduced under the Proposed Scheme.

c. The increased building height of Block A in the Proposed Scheme may slightly reduce the wind performance at its downwind area, i.e. Ping Shek Estate.

Wind performance under wind direction of S



Contour plot for Baseline Scheme



Contour plot for Proposed Scheme

4.3.8 According to the contour plots under S wind,

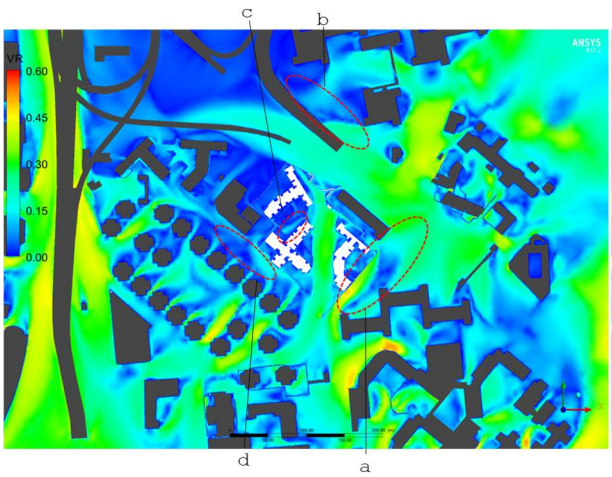
a. The increased building height of Block A captured more high-level wind and divert them towards pedestrian. However, this stronger downwash wind may counter the upcoming S wind and slightly reduced the area in front of Phase 1.

b. The increased building height of Block A in the Proposed Scheme may slightly reduce the wind performance at its downwind area, i.e. Ping Shek Estate.

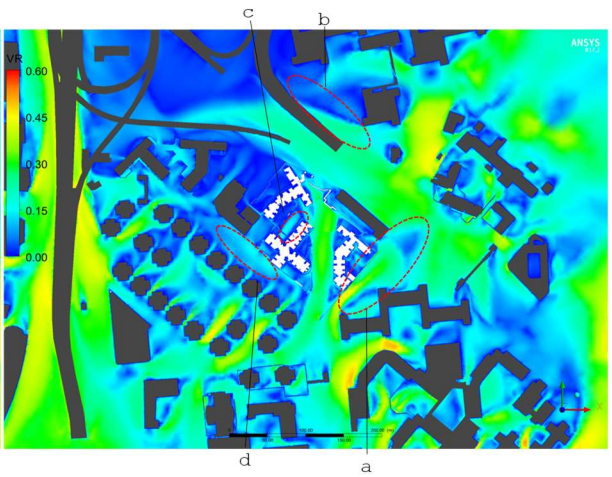
c. The EVA/driveway has been slightly expanded near the vehicular entrance and exit on Wong Chiu Road in the Proposed Scheme. This modification may redirect more S wind from Wang Chiu Road towards the Site, resulting in improved wind performance at the EVA/driveway in the Proposed Scheme.

d. As a result, less would flow continuously along Wong Chiu Road towards further northwest.

Wind performance under wind direction of SSW



Contour plot for Baseline Scheme



Contour plot for Proposed Scheme

4.3.9 According to the contour plots under SSW wind,

a. The increased building height of Block A captured more high-level wind and diverts them towards pedestrian. This downwash effect counteracts the

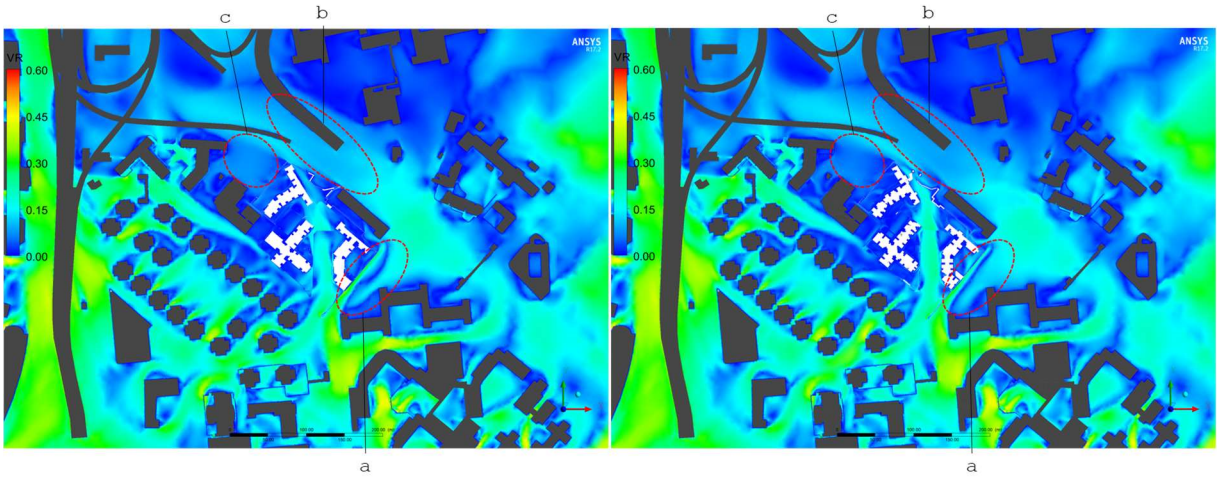
downwash winds generated by the high-rise residential building at UptownEast. As the downwash from Block A in the Proposed Scheme is stronger, the wake zone of this counter flow is further north compared to the Baseline Scheme.

b. The increased building height of Block C in the Proposed Scheme may slightly reduce the wind performance at its downwind area, i.e. Ping Shek Estate.

c. The EVA/driveway has been slightly expanded near the vehicular entrance and exit on Wong Chiu Road in the Proposed Scheme. This modification may redirect more SSW wind from Wang Chiu Road towards the Site, resulting in improved wind performance at the EVA/driveway in the Proposed Scheme.

d. Compared to the Baseline Scheme, improved wind performance is observed at the Wang Chiu Road. This enhancement may be attributed to the slightly increased height of Block C in the Proposed Scheme, which results in a stronger downwash effect.

Wind performance under wind direction of SW



Contour plot for Baseline Scheme **Contour plot for Proposed Scheme**

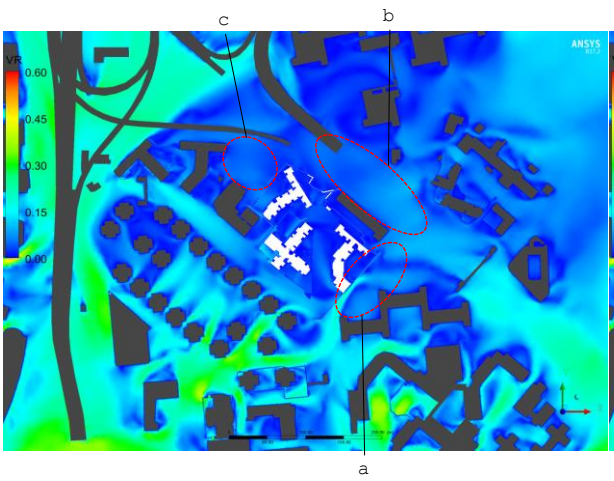
4.3.10 According to the contour plots under SW wind,

a. The increased building height of Block A captured more high-level wind and diverts them towards pedestrian. This downwash effect counteracts the downwash winds generated by the high-rise residential building at UptownEast. As the downwash from Block A in the Proposed Scheme is stronger, the wake zone of this counter flow is slightly different from that of the Baseline Scheme.

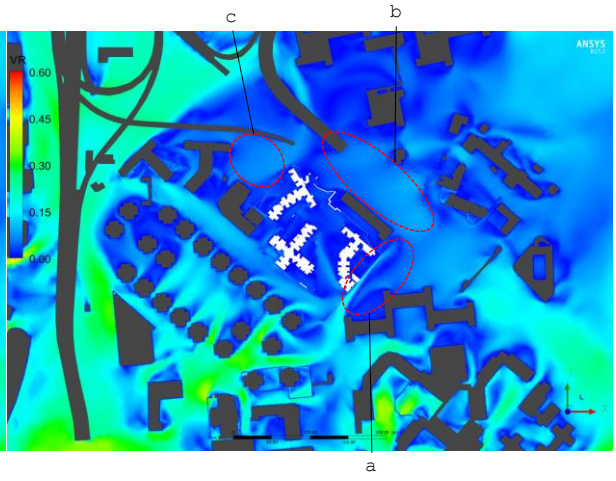
b. The increased building height of Block C in the Proposed Scheme may slightly reduce the wind performance at its downwind area, i.e. Ping Shek Estate.

c. The increased building height of Block C of the Proposed Scheme may capture more high-level wind and diverts it towards the northern area of the school site. However, this downwash is likely to counter the upcoming wind from Kwu Tong Road. From the contour plot, the wind performance at this area is slightly lower in the Proposed Scheme.

Wind performance under wind direction of WSW



Contour plot for Baseline Scheme



Contour plot for Proposed Scheme

4.3.11 According to the contour plots under WSW wind,

a. The increased building height of Block A captured more high-level wind and diverts them towards pedestrian. This downwash effect counteracts the downwash winds generated by the high-rise residential building at UptownEast. As the downwash from Block A in the Proposed Scheme is stronger, the wake zone of this counter flow is slightly different from that of the Baseline Scheme.

b. The Kwun Tong Road section to the north of the Subject Site exhibits slightly different contour patterns in the two schemes. The predominant wind flow in this area is downwash from UptownEast. The minor layout changes are expected to have minor impact on the wind pattern.

c. The increased building height of Block C of the Proposed Scheme may capture more high-level wind and diverts it towards the northern area of the school site. Thus, higher VR is observed at this area under the Proposed Scheme.

5. CONCLUSION

5.1.1 The proposed development, which is located in Kownloon Bay, has been evaluated from an air ventilation perspective.

5.1.2 A public housing development is proposed at the Subject Site. It consists of three residential towers sitting on top of a podium.

5.1.3 According to section 4.2 above, it is noted the SVR is slightly lower in the Proposed Scheme in both annual and summer condition as compared with the Baseline Scheme. However, the LVR is comparable in the two schemes under both annual and summer conditions.

5.1.4 It is found that the average VR of the overall test points are comparable between the Proposed Scheme and Baseline Scheme. Based on the results, the change in building form would not have adverse impact in air ventilation terms.

5.1.5 In some localized area within the Study Area, there are some variations between the Baseline Scheme and Proposed Scheme. The VR is higher under the Proposed Scheme at Urban Oasis (annual ccondition), Wang Chiu Road (annual condition), Kai Yip Estate (annual and summer condition), Richland Gardens (annual and summer condition), Kwun Tong Road Children's Playground (annual condition) and Public Housing Development at Wang Chiu Road Phase 2 (annual and summer condition).

5.1.6 On the other hand, the VR is higher under the Baseline Scheme at Ping Shek Estate (annual and summer Condition), Wang Chiu Road (summer condition), Sam Shan Kok Wong Temple (annual and summer condition) and Future School Site (annual and summer condition).

5.1.7 In short, the air ventilation performance of the Baseline Scheme and Proposed Scheme would be comparable. It is concluded that the proposed building design would not induce significant impact on air ventilation to the nearby environment.

Figures

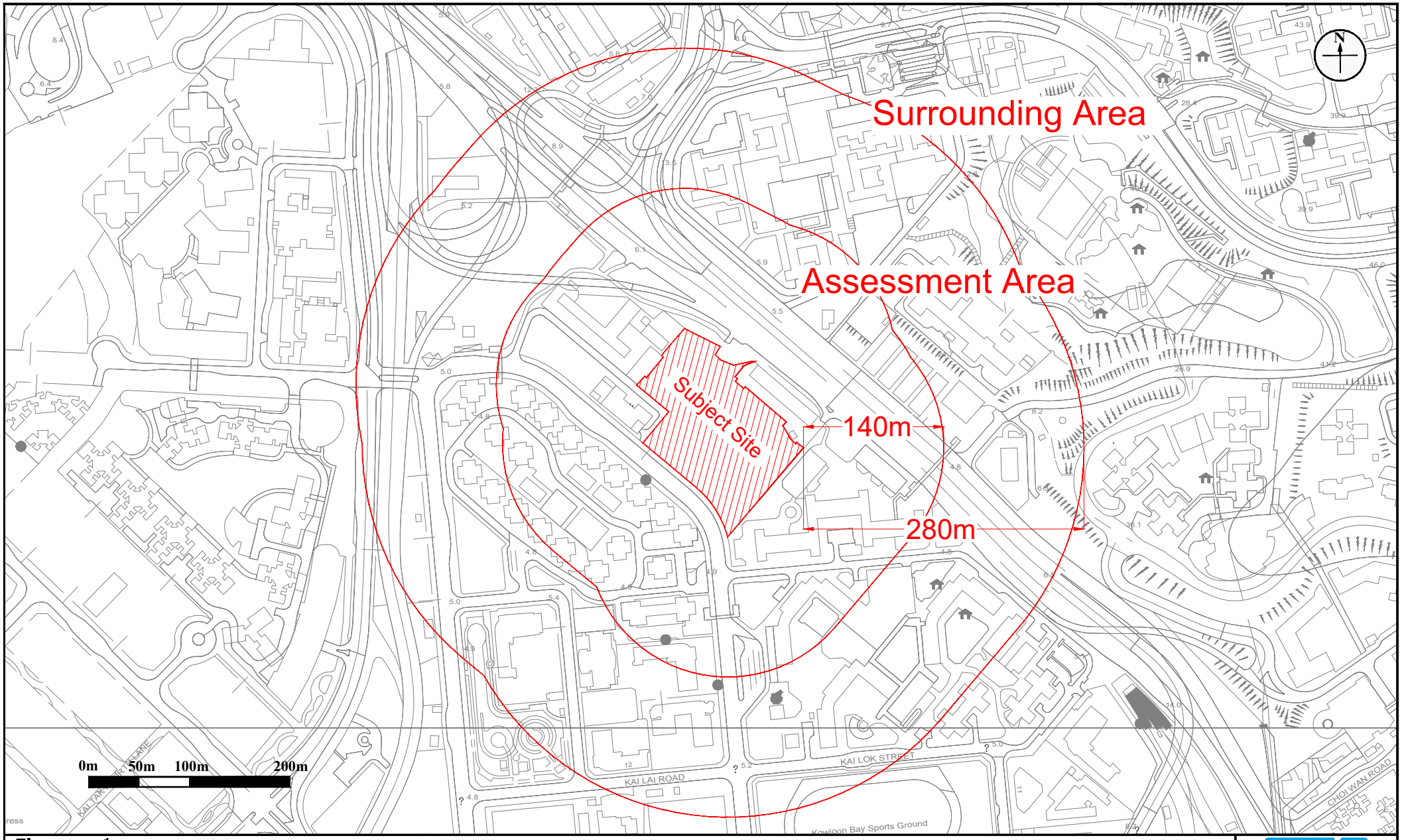


Figure: 1	RAMBOLL
Title: Location of the Subject Site and Environs	Drawn by: WT
	Checked by: EC
Project: Public Rental Housing Development at Wang Chiu Road Phase 1	Rev.: 1.0
	Date: Aug 2024

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Figure: 2a	RAMBOLL
Title: Building Height of Existing Development within the Surrounding Area (Northwestern Part)	Drawn by: WT Checked by: EC
Project: Public Rental Housing Development at Wang Chiu Road Phase 1	Rev.: 1.0 Date: Aug 2024

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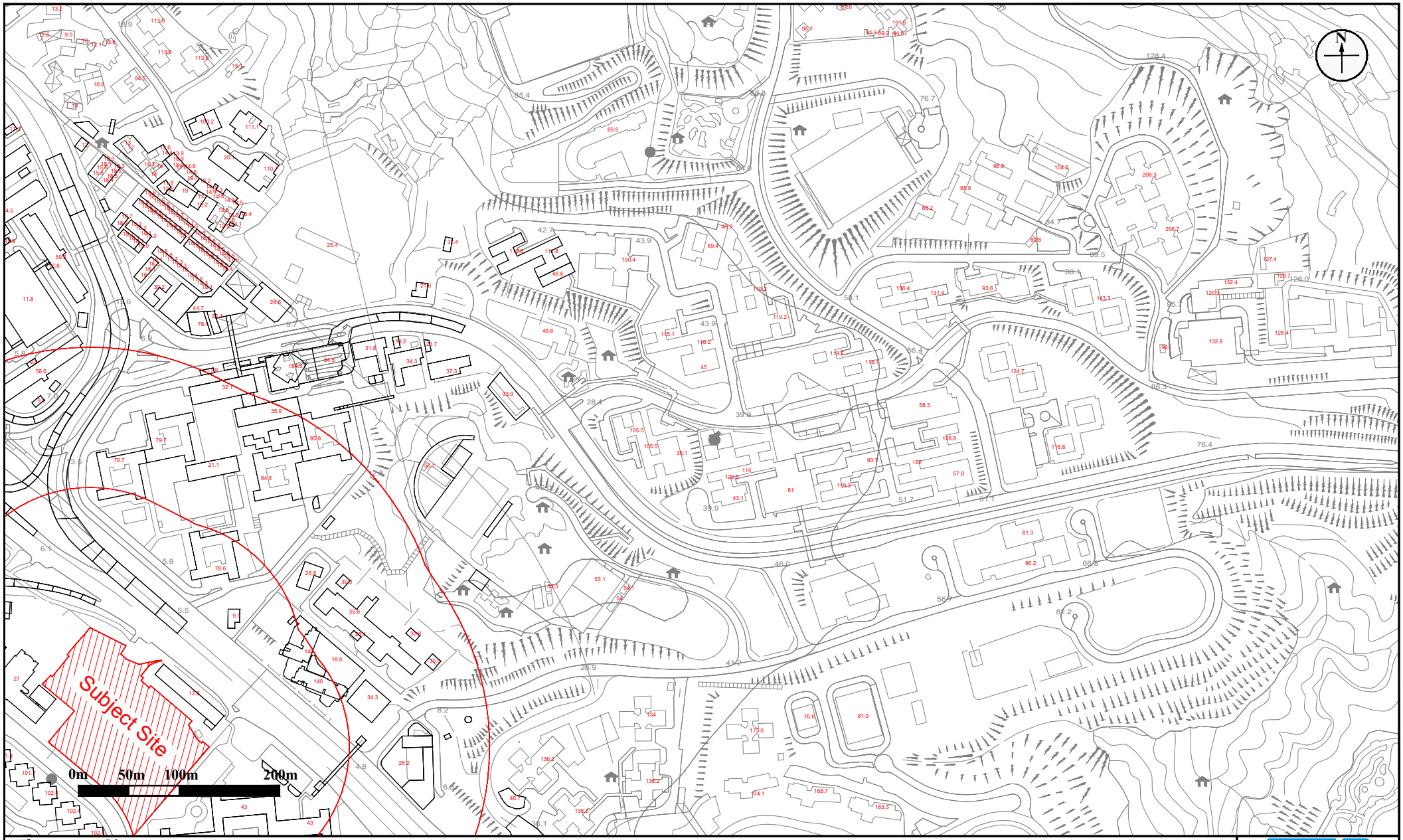

Figure: 2b	RAMBOLL
Title: Building Height of Existing Development within the Surrounding Area (Northeastern Part)	Drawn by: WT Checked by: EC
Project: Public Rental Housing Development at Wang Chiu Road Phase 1	Rev.: 1.0 Date: Aug 2024

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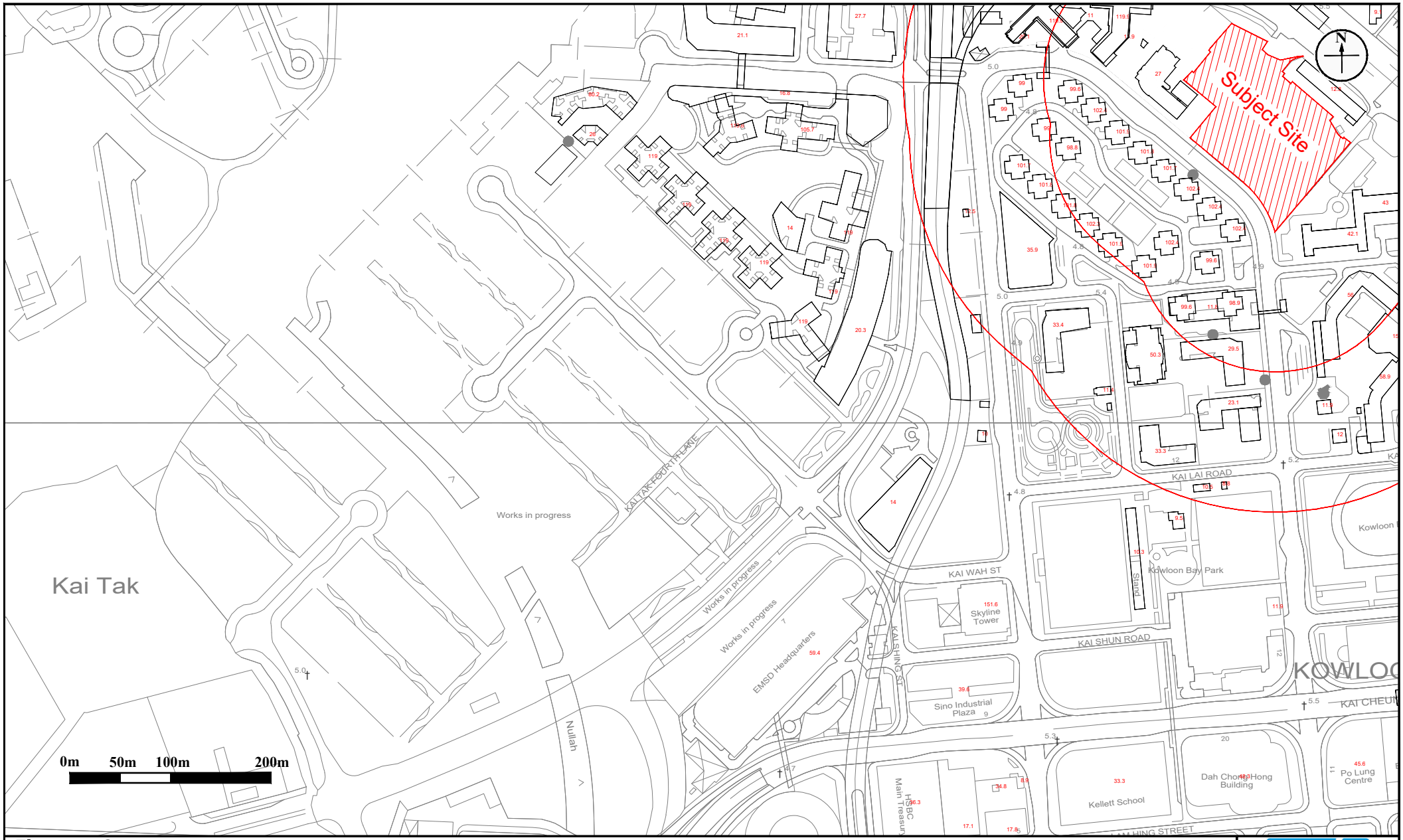

Figure: 2c	RAMBOLL
Title: Building Height of Existing Development within the Surrounding Area (Southwestern Part)	Drawn by: WT Checked by: EC
Project: Public Rental Housing Development at Wang Chiu Road Phase 1	Rev.: 1.0 Date: Aug 2024

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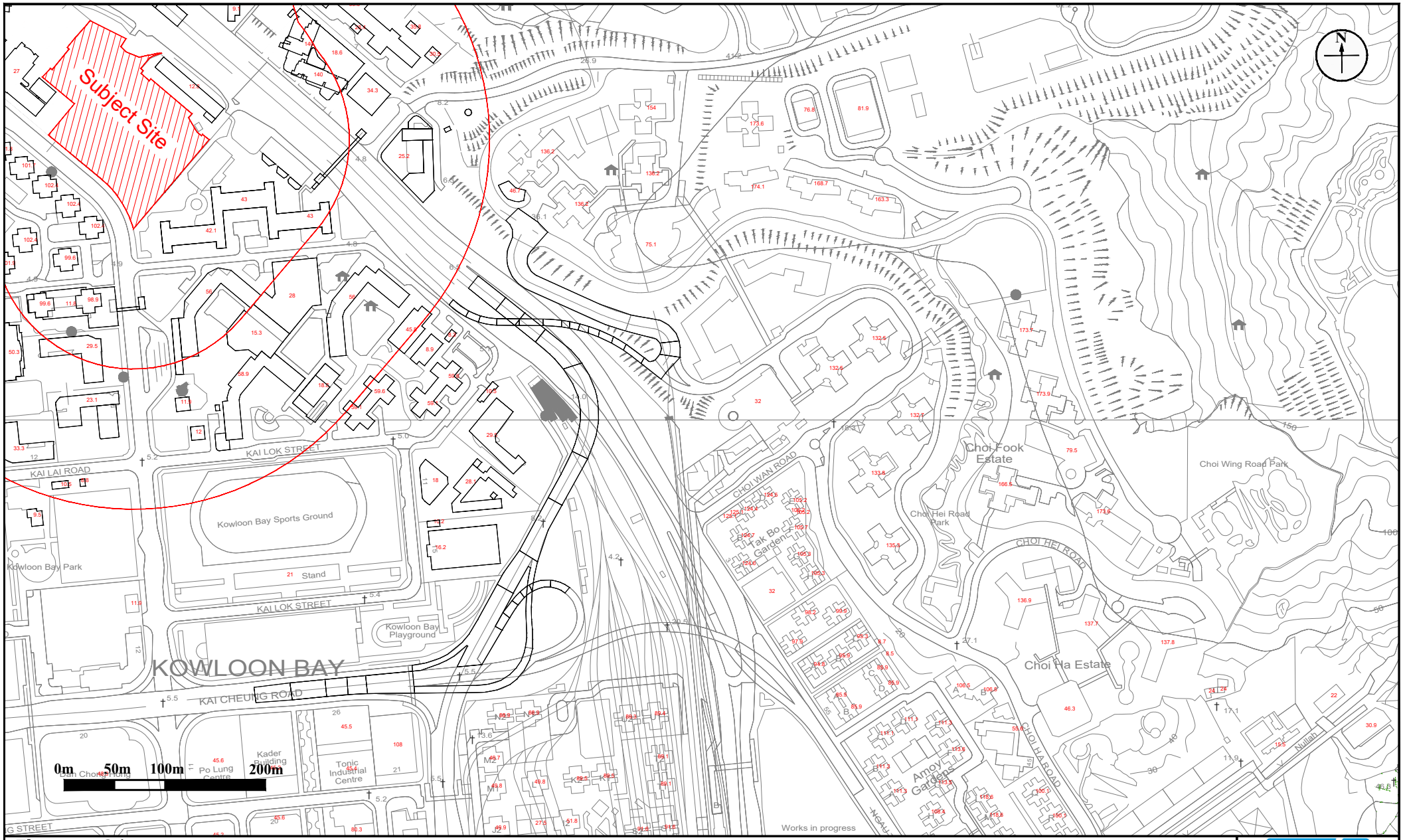

Figure: 2d	RAMBOLL
Title: Building Height of Existing Development within the Surrounding Area (Southeastern Part)	Drawn by: WT Checked by: EC
Project: Public Rental Housing Development at Wang Chiu Road Phase 1	Rev.: 1.0 Date: Aug 2024

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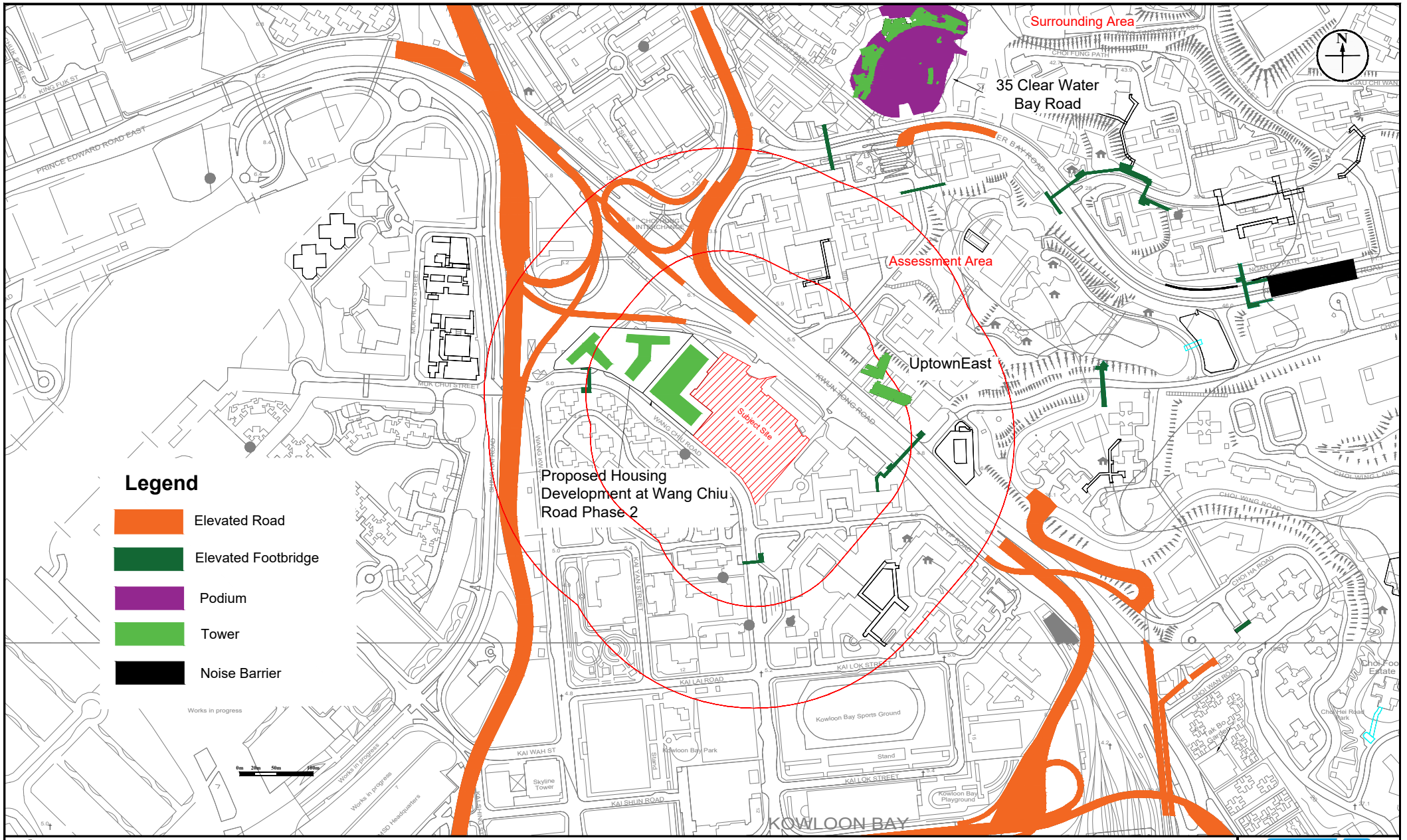

Figure: 3

Title: Building Blocks of Surrounding Future/ Committed Development Assumed in CFD model

Project: Public Housing Development at Wang Chiu Road Phase 2

RAMBOLL

Drawn by:	KN
Checked by:	EC
Rev.:	1.1
Date:	Oct 2024

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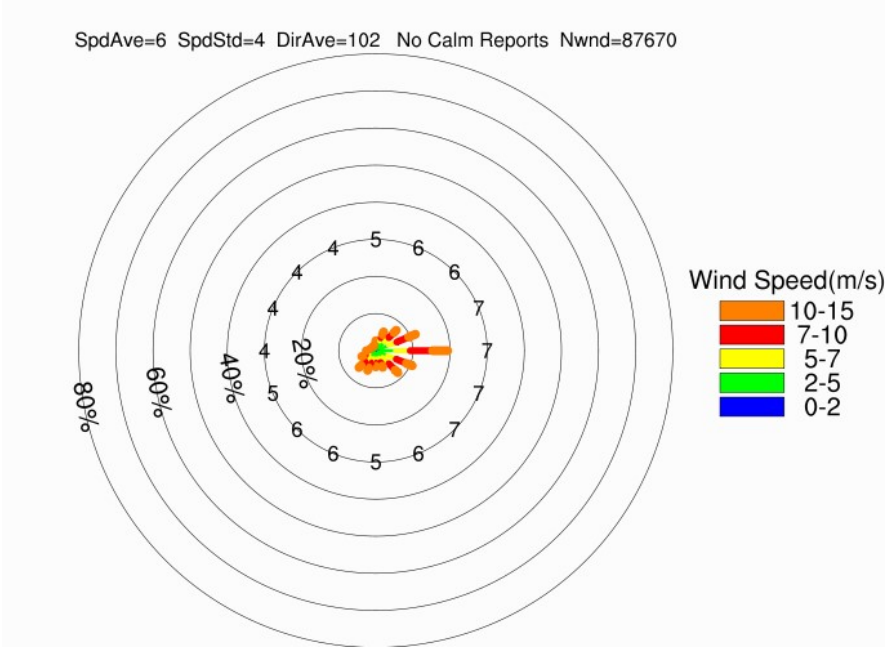
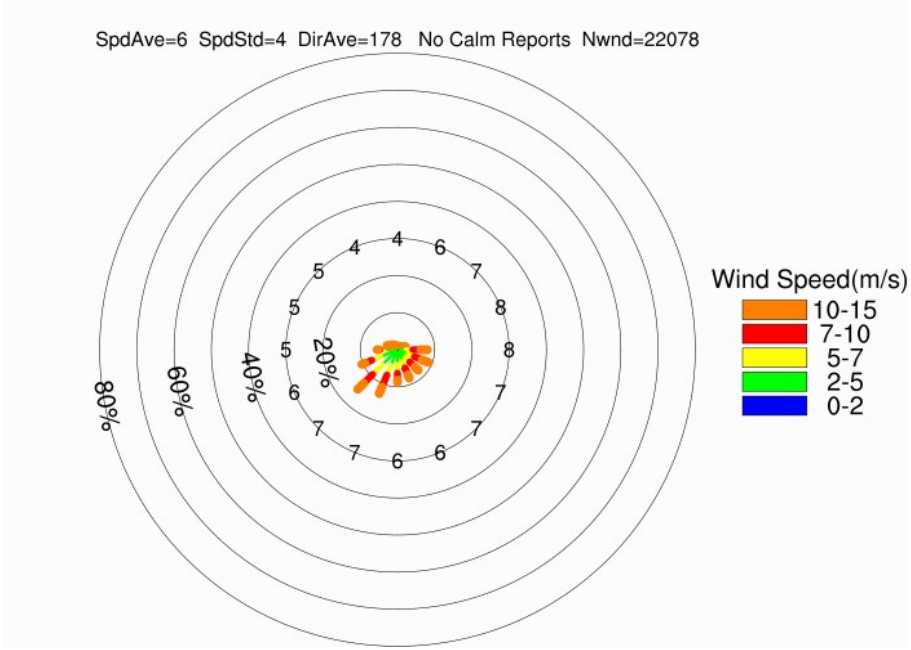


Annual Condition



Summer Condition

Figure: 4	RAMBOLL
Title: Windrose Diagram representing V∞ of the Area under Concern	Drawn by: EC Checked by: SL
Project: Public Rental Housing Development at Wang Chiu Road Phase 1	Rev.: 1.0 Date: Mar 2019

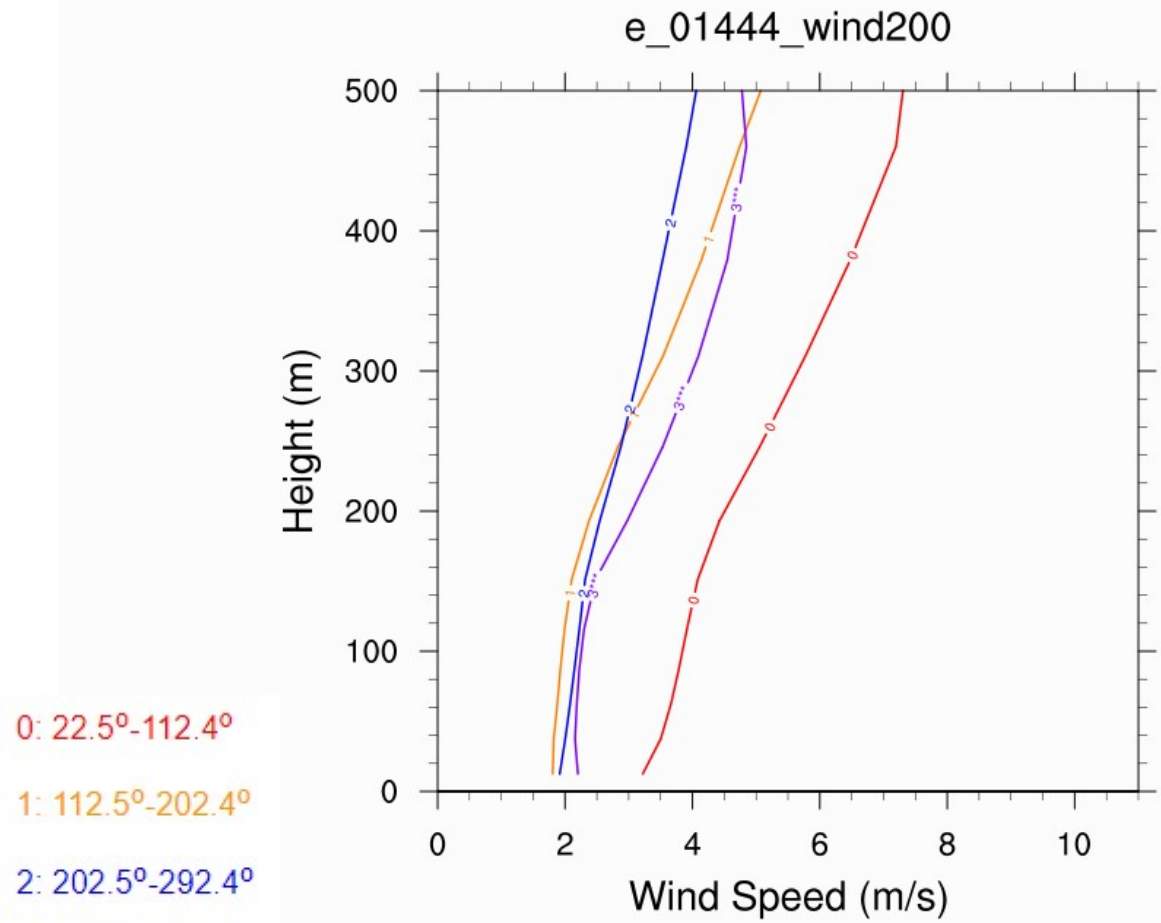


Figure: 5	RAMBOLL
Title: Wind Profile Curve for Grid X:087, Y:045	Drawn by: WT Checked by: EC
Project: Public Rental Housing Development at Wang Chiu Road Phase 1	Rev.: 1.0 Date: Aug 2024

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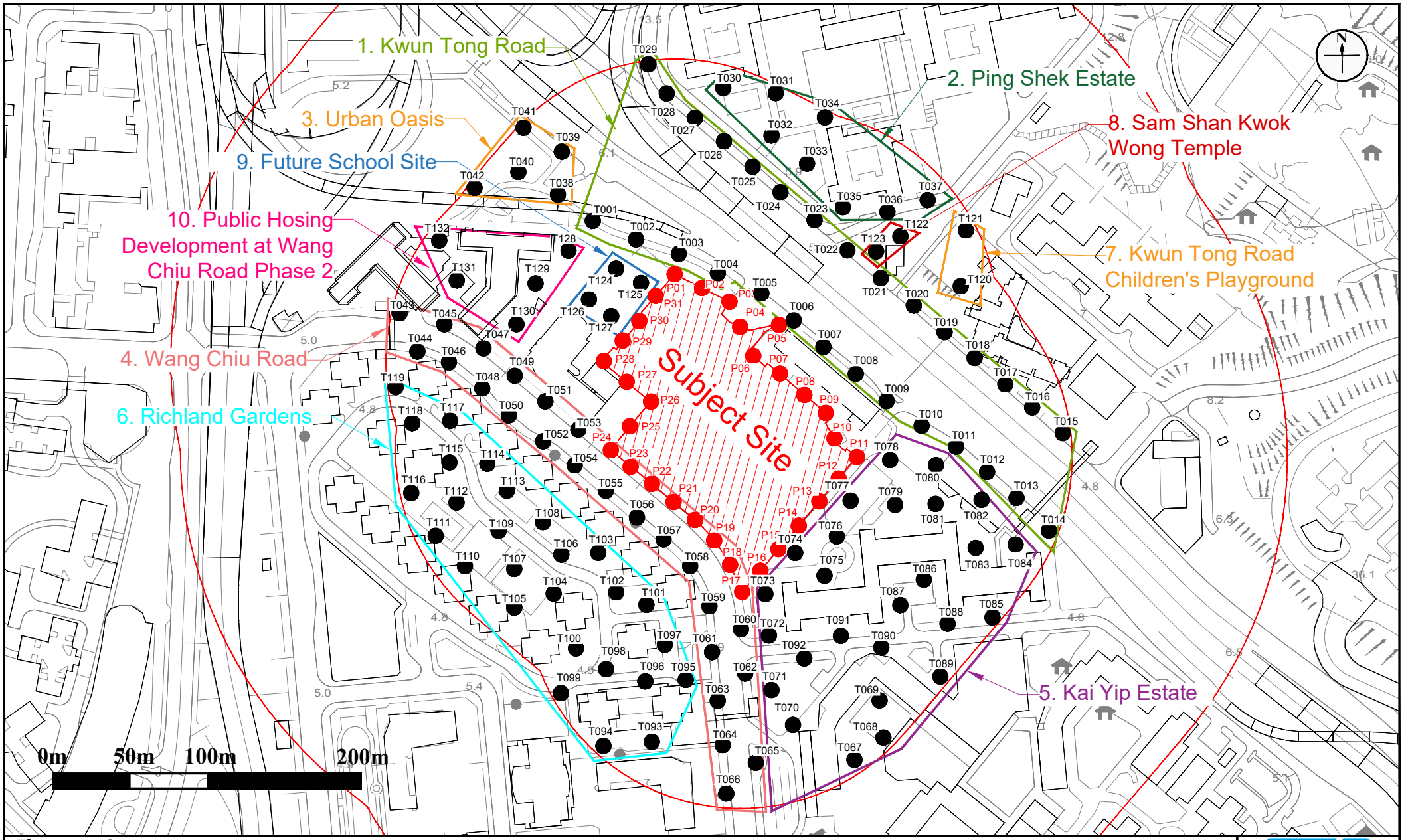

Figure: 6	RAMBOLL
Title: Test Points Selected for Quantitative Air Ventilation Assessment	Drawn by: WT Checked by: EC
Project: Public Rental Housing Development at Wang Chiu Road Phase 1	Rev.: 1.0 Date: Aug 2024

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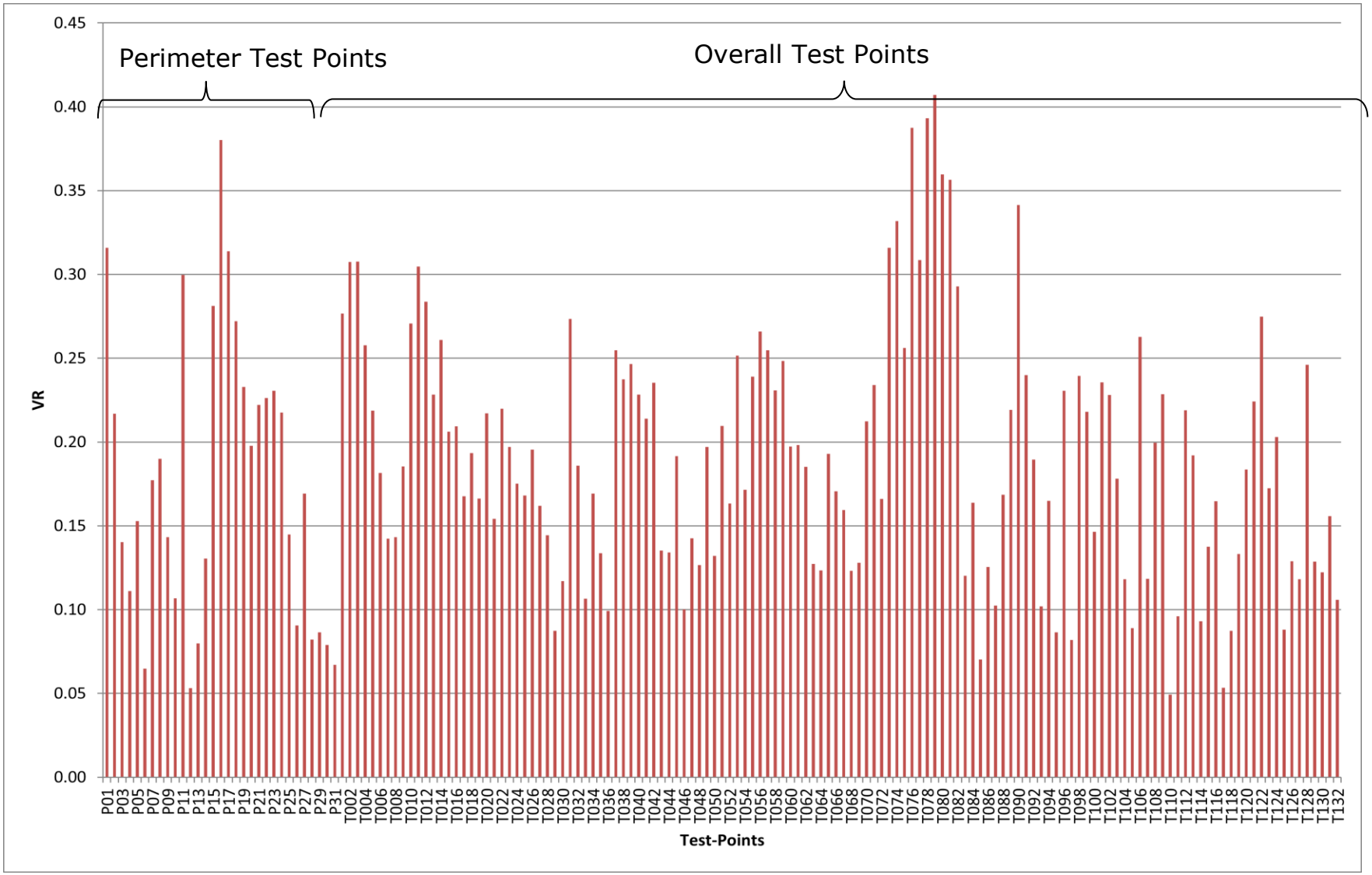

Figure: 7**a**	RAMBOLL
Title: **Wind Velocity Ratios of Individual Test Points for Baseline Scheme (Annual)**	Drawn by: KN Checked by: EC
Project: **Public Rental Housing Development at Wang Chiu Road Phase 1**	Rev.: 1.0 Date: Oct 2024

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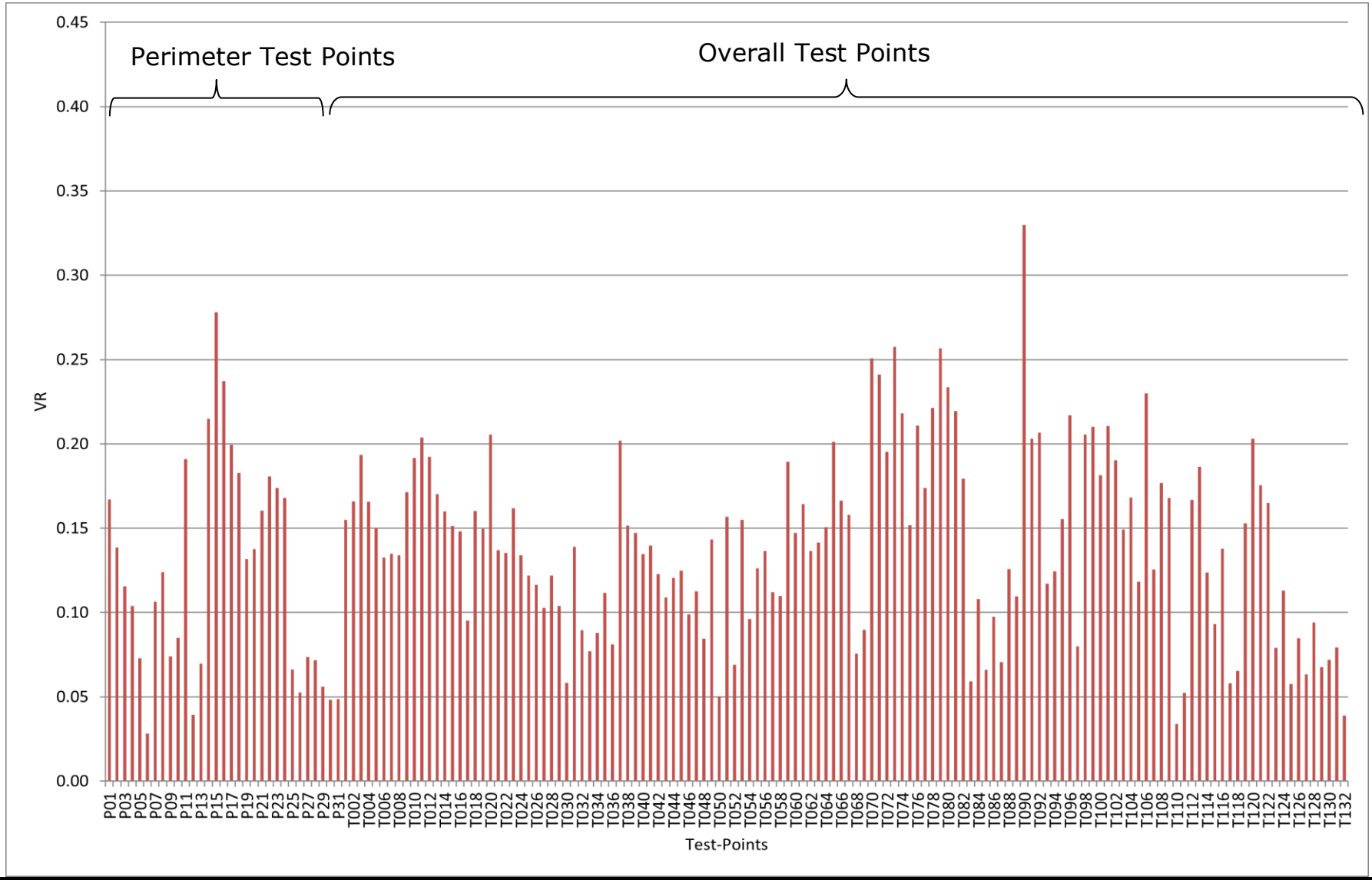


Figure: 7**b**	RAMBOLL
Title: **Wind Velocity Ratios of Individual Test Points for Baseline Scheme (Summer)**	Drawn by: KN Checked by: EC
Project: Public Rental Housing Development at Wang Chiu Road Phase 1	Rev.: 1.0 Date: Oct 2024

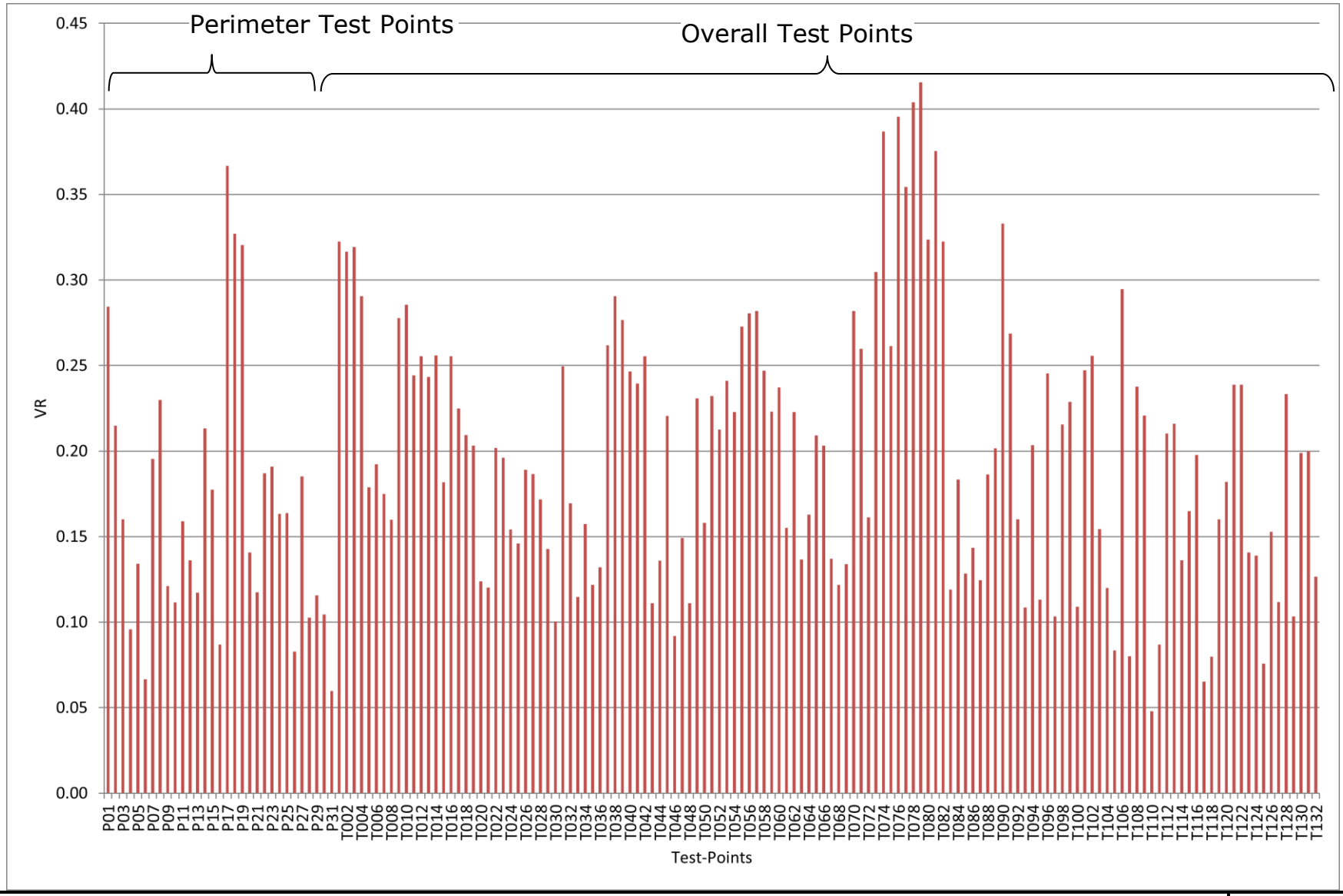


Figure: 8**a**	RAMBOLL
Title: **Wind Velocity Ratios of Individual Test Points for Proposed Scheme (Annual)**	Drawn by: KT Checked by: EC
Project: **Public Rental Housing Development at Wang Chiu Road Phase 1**	Rev.: 1.0 Date: Oct 2024

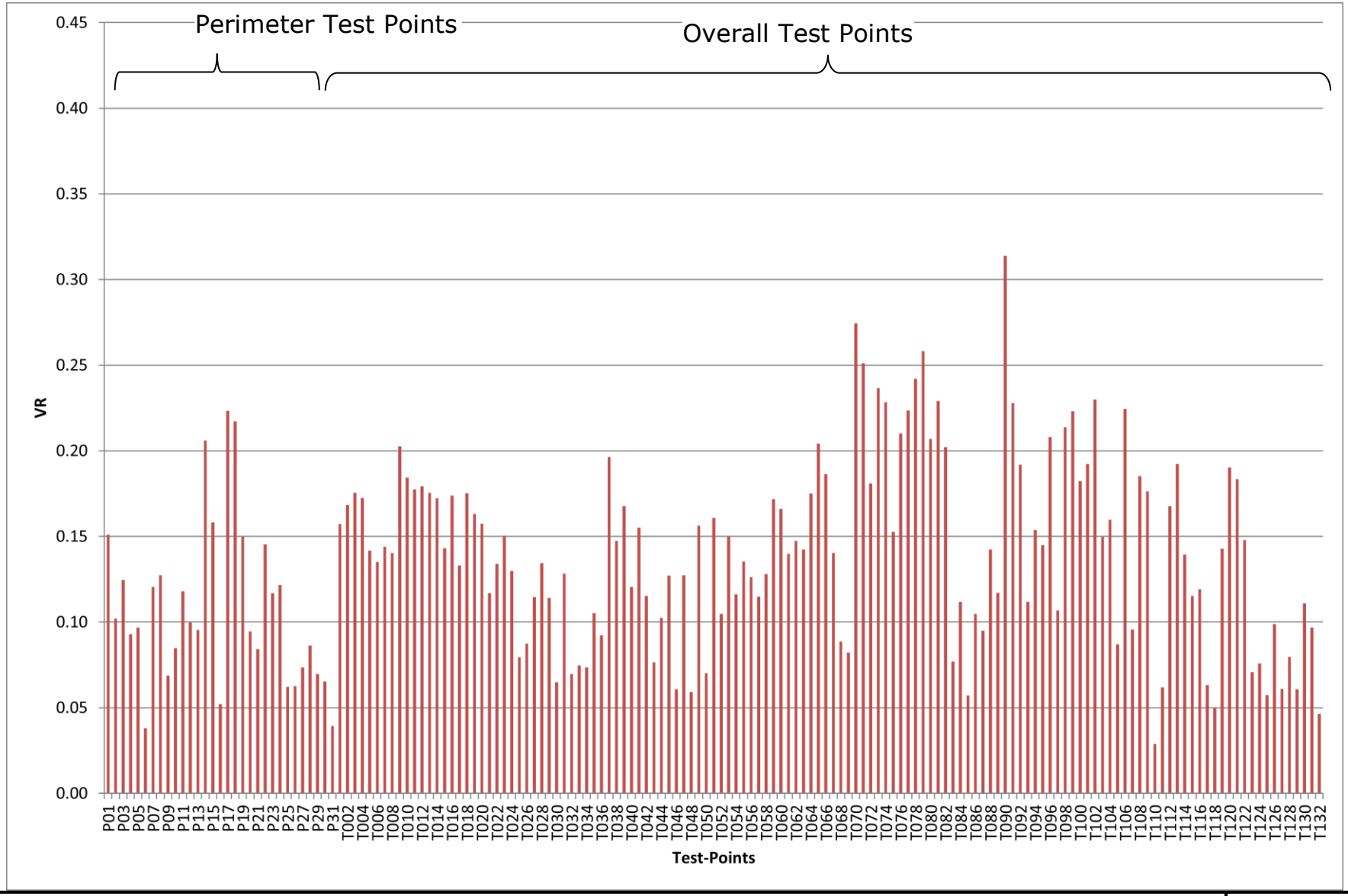


Figure: 8**b**	RAMBOLL
Title: **Wind Velocity Ratios of Individual Test Points for Proposed Scheme (Summer)**	Drawn by: KT Checked by: EC
Project: **Public Rental Housing Development at Wang Chiu Road Phase 1**	Rev.: 1.0 Date: Oct 2024

Appendix 1

Master Layout Plan for Baseline Scheme

KWUN TONG ROAD

PROPOSED PEDESTRIAN ACCESS

GOVERNMENT LAND

+4.85

SUMP PUMP

DRY WEATHER FLOW INTERCEPTION PUMPING CHAMBER

GOVERNMENT LAND

CARITAS FAMILY CRISIS SUPPORT CENTRE

20m SETBACK LINE

BLOCK 3
36 STOREYS
+119.85

BLOCK 1
39 STOREYS
+119.90

BLOCK 2
36 STOREYS
+119.85

+5.15

PODIUM WITH WELFARE FACILITIES AND STREET SHOPS

NEW HORIZONS BUILDING

FSD's STAFF CLUB

5m SETBACK LINE

VEHICULAR ENTRANCE

+5.00

PEDESTRIAN ACCESS

WANG CHIU ROAD

WANG CHIU ROAD

RICHLAND GARDEN

KAI YIP ESTATE

LEGEND:

- PHASE 1 BOUNDARY
- SETBACK TO MEET AIR QUALITY STANDARD
- DRAINAGE AND WATER WORKS RESERVE
- DOMESTIC BLOCKS
- PODIUM WITH WELFARE FACILITIES AND STREET SHOPS

PROJECT

PUBLIC RENTAL HOUSING DEVELOPMENT AT WANG CHIU ROAD PHASE 1

DRAWING TITLE

MASTER LAYOUT PLAN

SCALE 1 : 1000 (A3)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO.
KT27/1/BC/SITE/A/PL0-03

04

Appendix 2

Master Layout Plan for Proposed Scheme

GOVERNMENT LAND

DRY WEATHER FLOW INTERCEPTION PUMPING CAMBER

CARITAS FAMILY CRISIS SUPPORT CENTRE

GOVERNMENT LAND

COMMUNITY SPACE

CPA

PROPOSED SCHOOL SITE

EVA

BLOCK C
36 STOREYS
119.89

BLOCK A
39 STOREYS
119.94

EVA

KAI YIP ESTATE

5.32

4.943

PROPOSED SCHOOL SITE

BLOCK B
35 STOREYS
118.14

PODIUM WITH WELFARE FACILITIES AND STREET SHOPS

ESTATE ENTRANCE

VEHICULAR INGRESS/ EGRESS

WANG CHIU ROAD

EXISTING PLA

LEGEND:

- PHASE 1 BOUNDARY
- DRAINAGE AND WATER WORKS RESERVE
- DOMESTIC BLOCKS
- PODIUM WITH WELFARE FACILITIES AND STREET SHOPS

PROJECT

PUBLIC HOUSING DEVELOPMENT AT WANG CHIU ROAD PHASE 1

DRAWING TITLE

MASTER SITE LAYOUT PLAN ROOF LEVEL

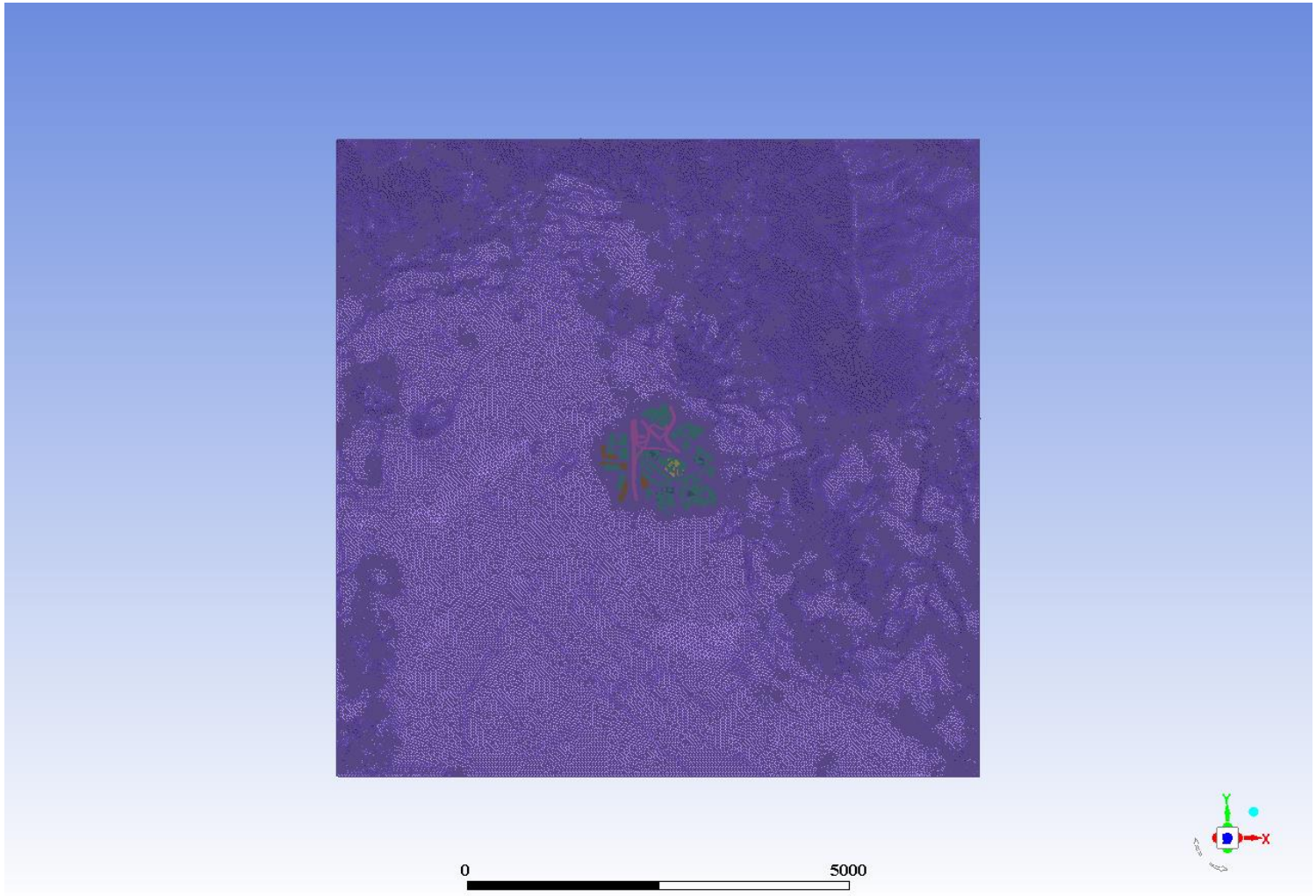
SCALE 1 : 600 (A3)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO.
KT27/1/ICU/A/GBP-14/J

Appendix 3

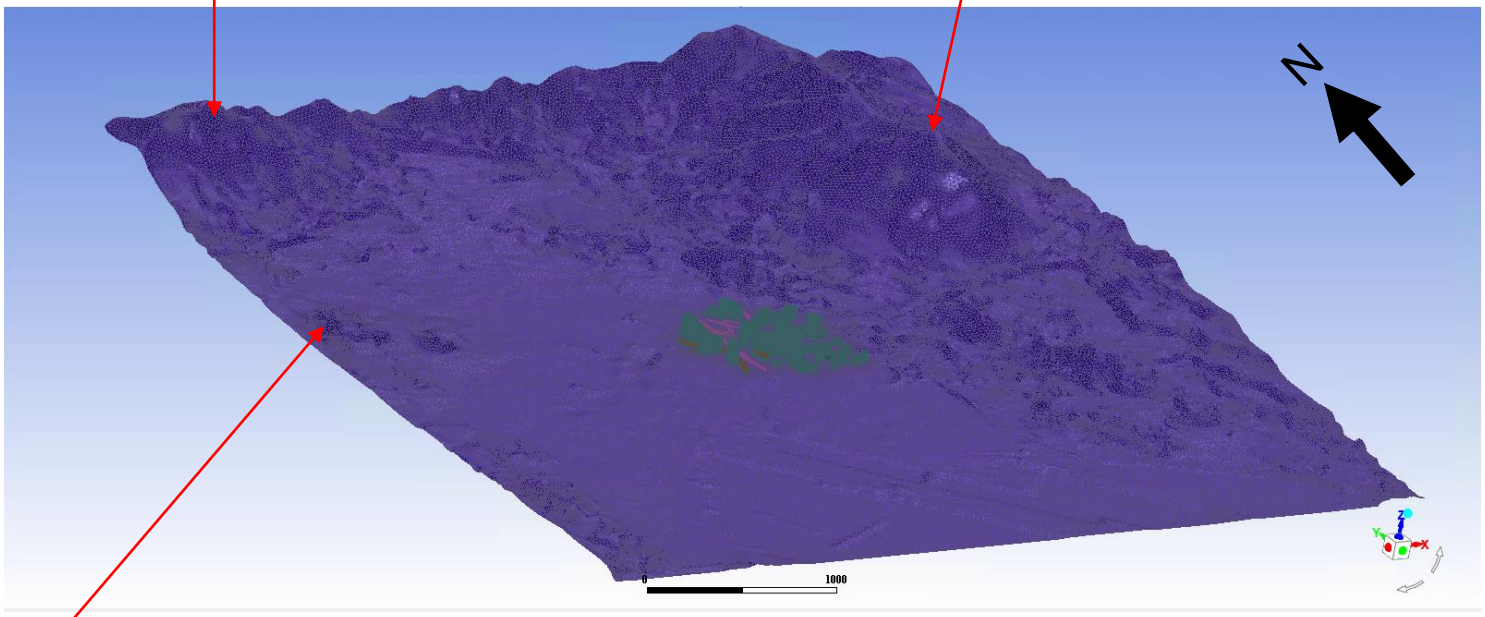
Captured Pictures of the CFD Model



Topography of Whole Domain

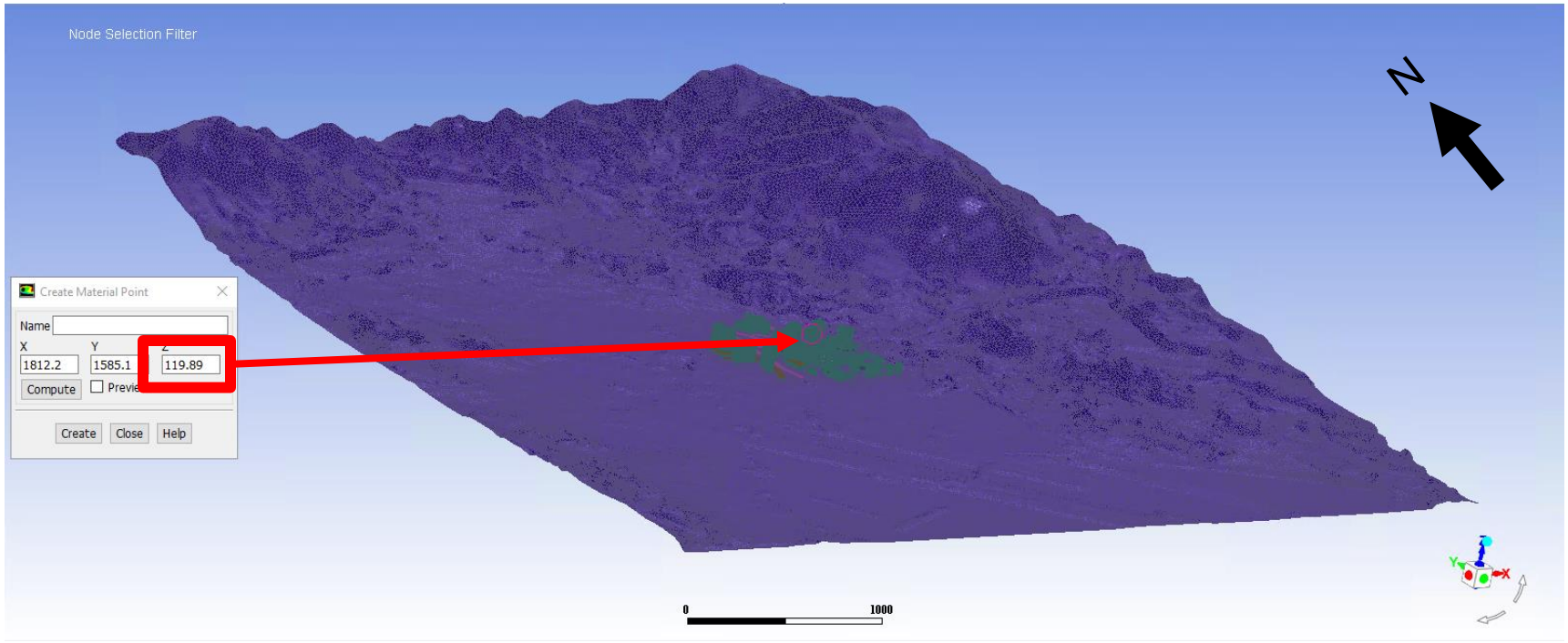
Lion Rock
(~490mPD)

Kowloon Peak
(~600mPD)

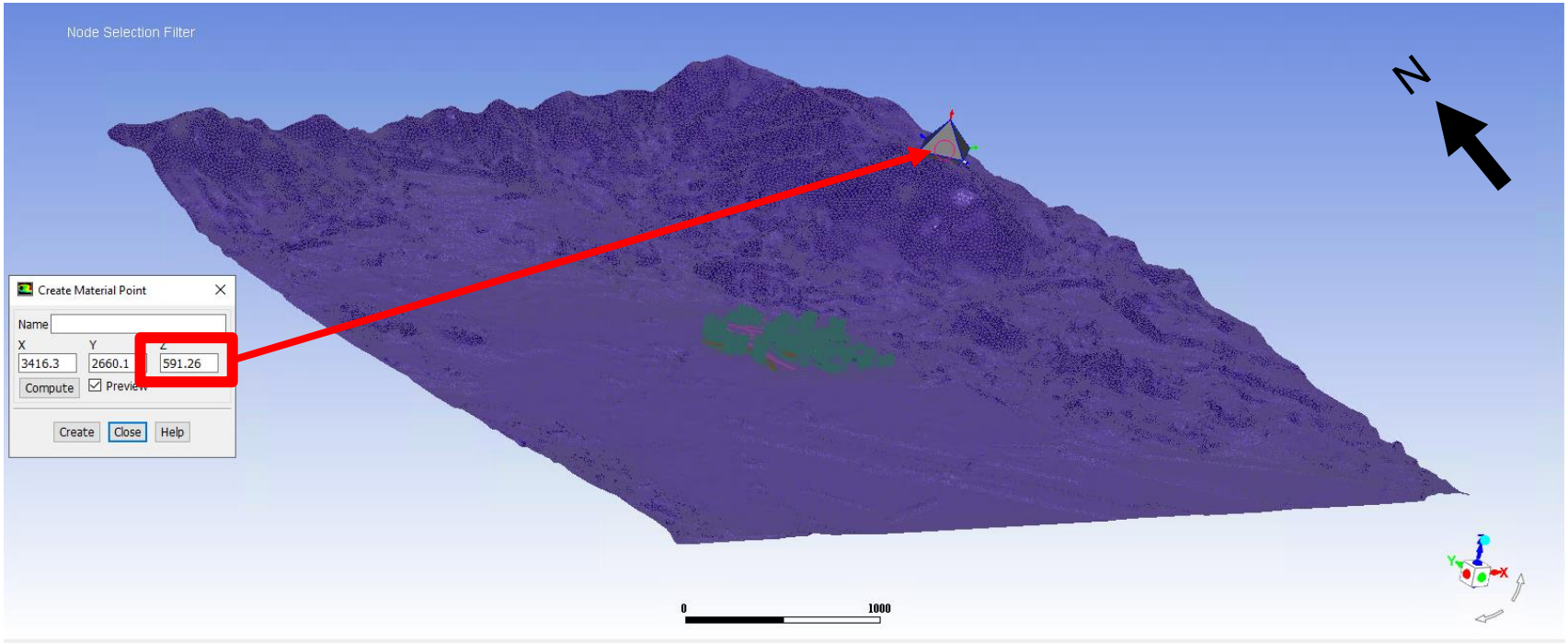


Lok Fu Service Reservoir Rest Garden
(~90mPD)

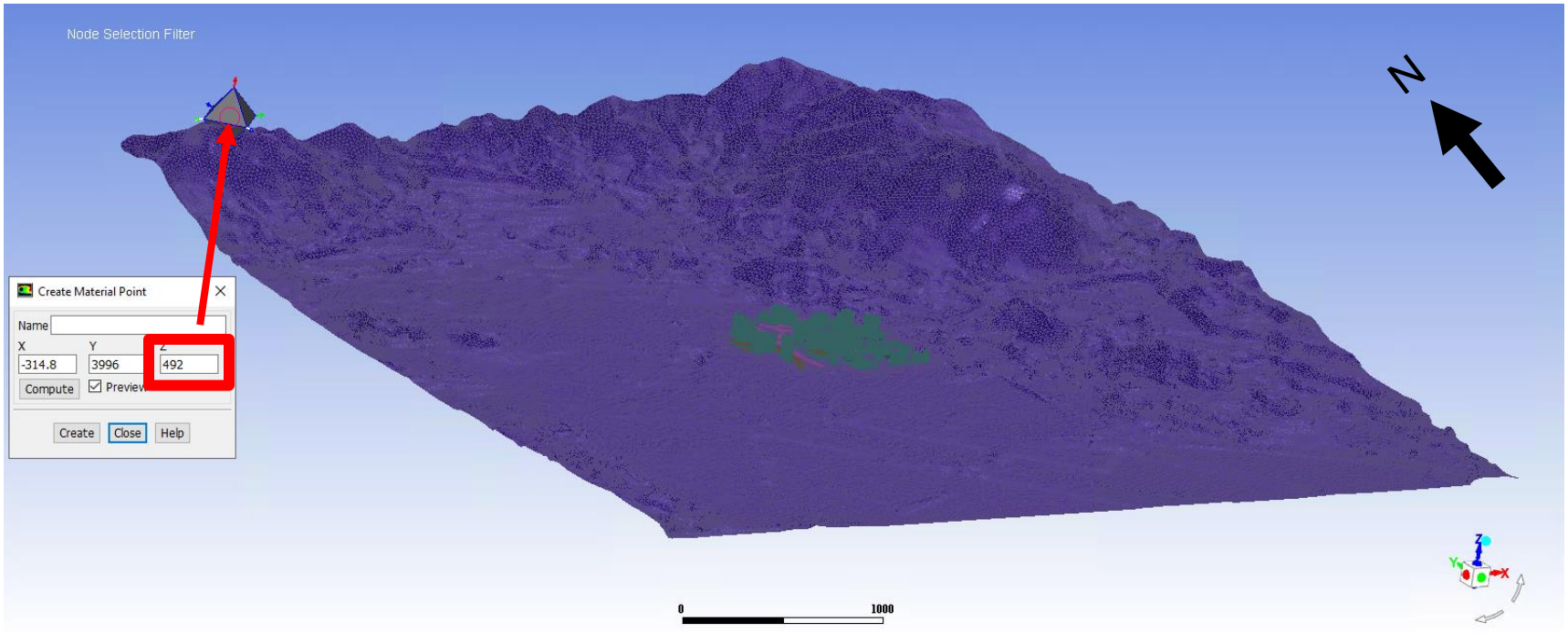
Mountains within domain topography
(Viewed from direction SW)



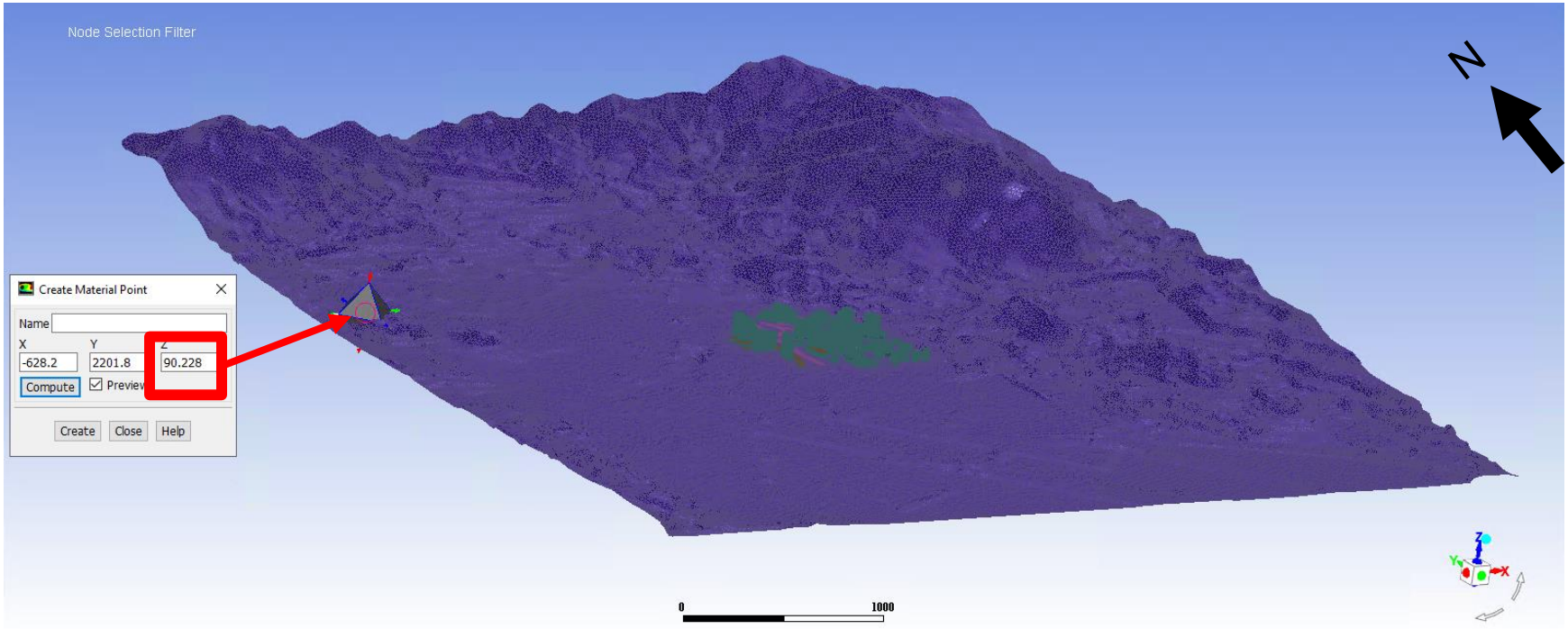
Height of PS tower (Block 3)



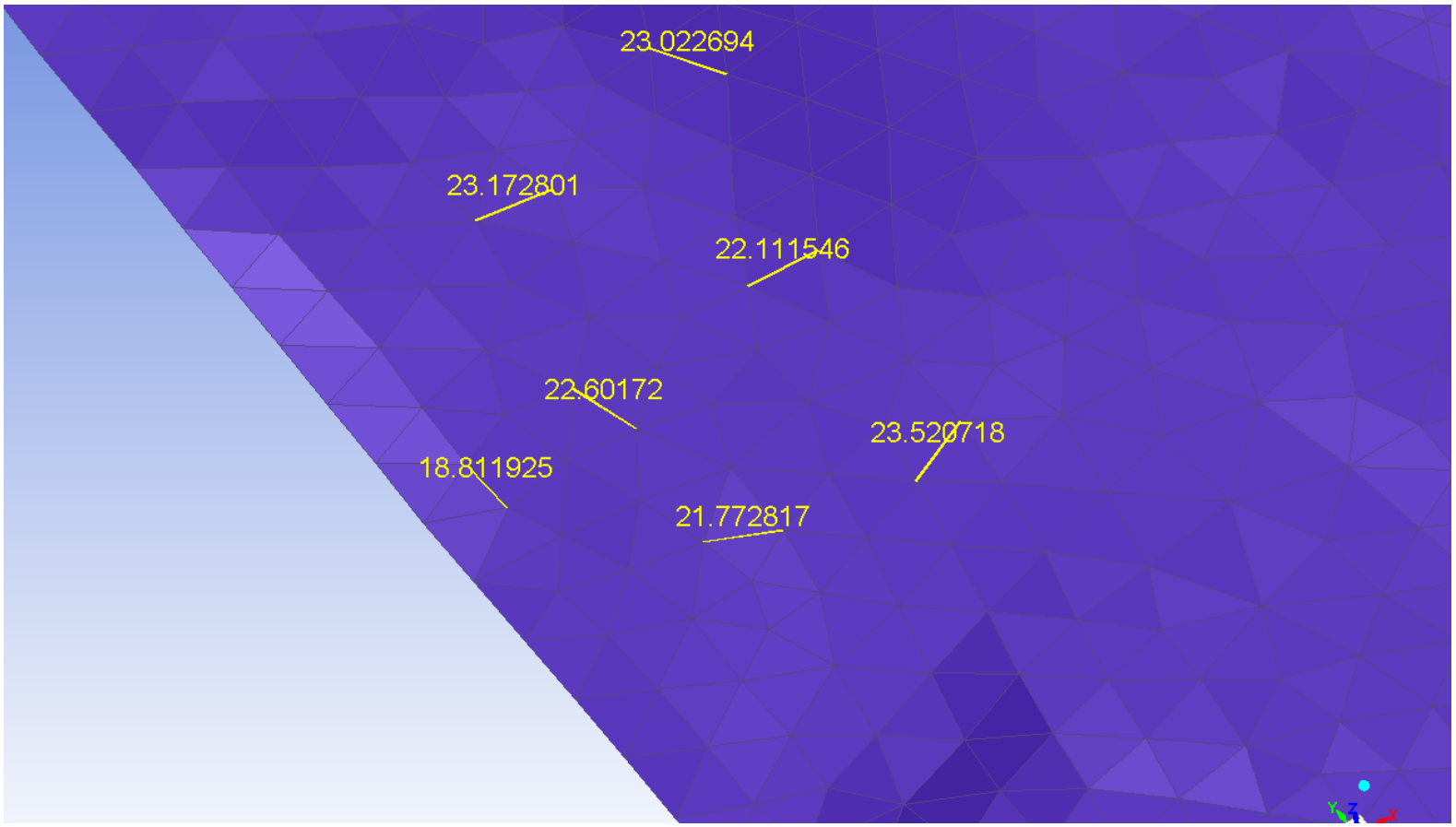
Height of Kowloon Peak (~600mPD)



Height of Lion Rock (~490mPD)



Height of Lok Fu Service Reservoir Rest Garden (~90mPD)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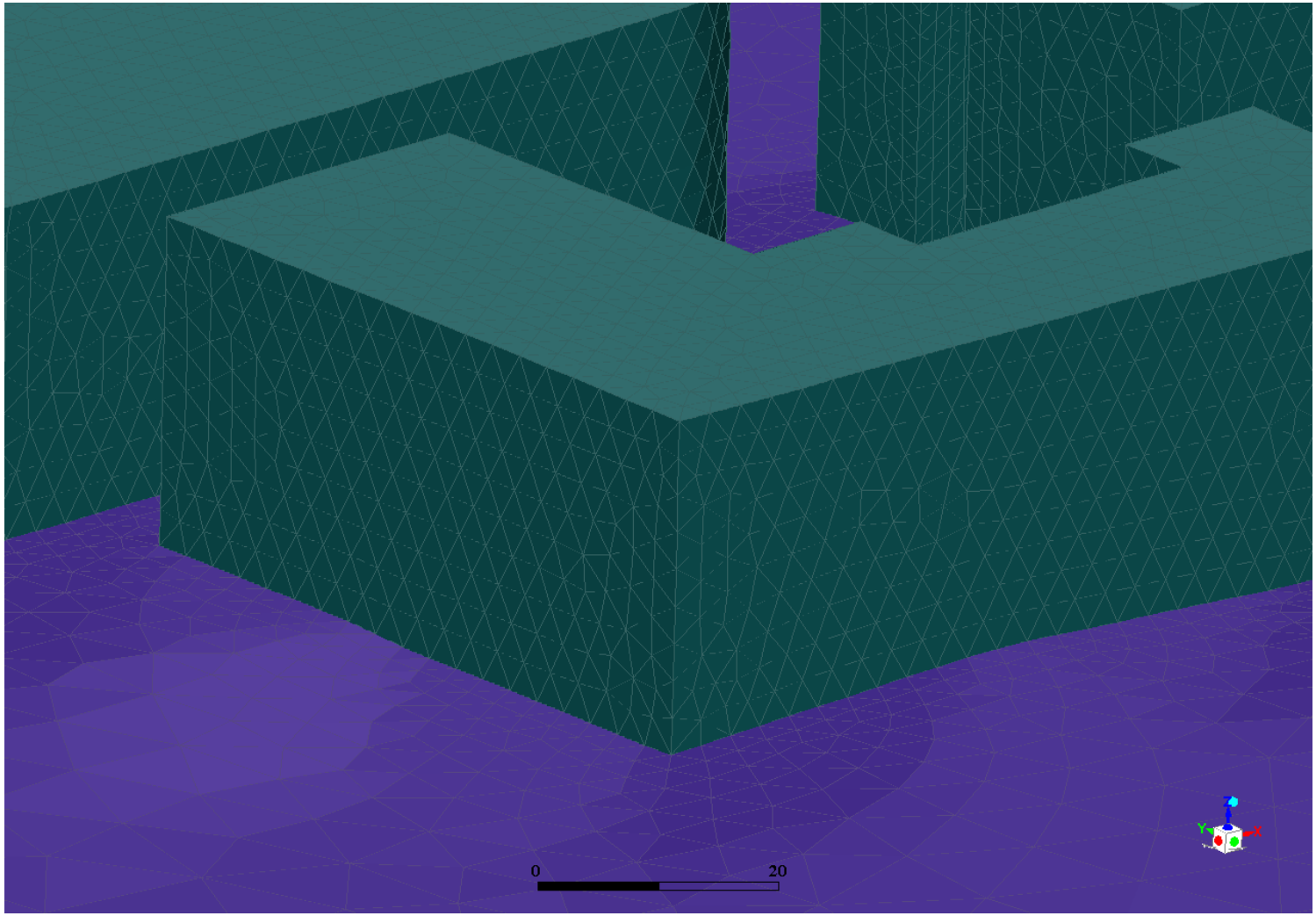
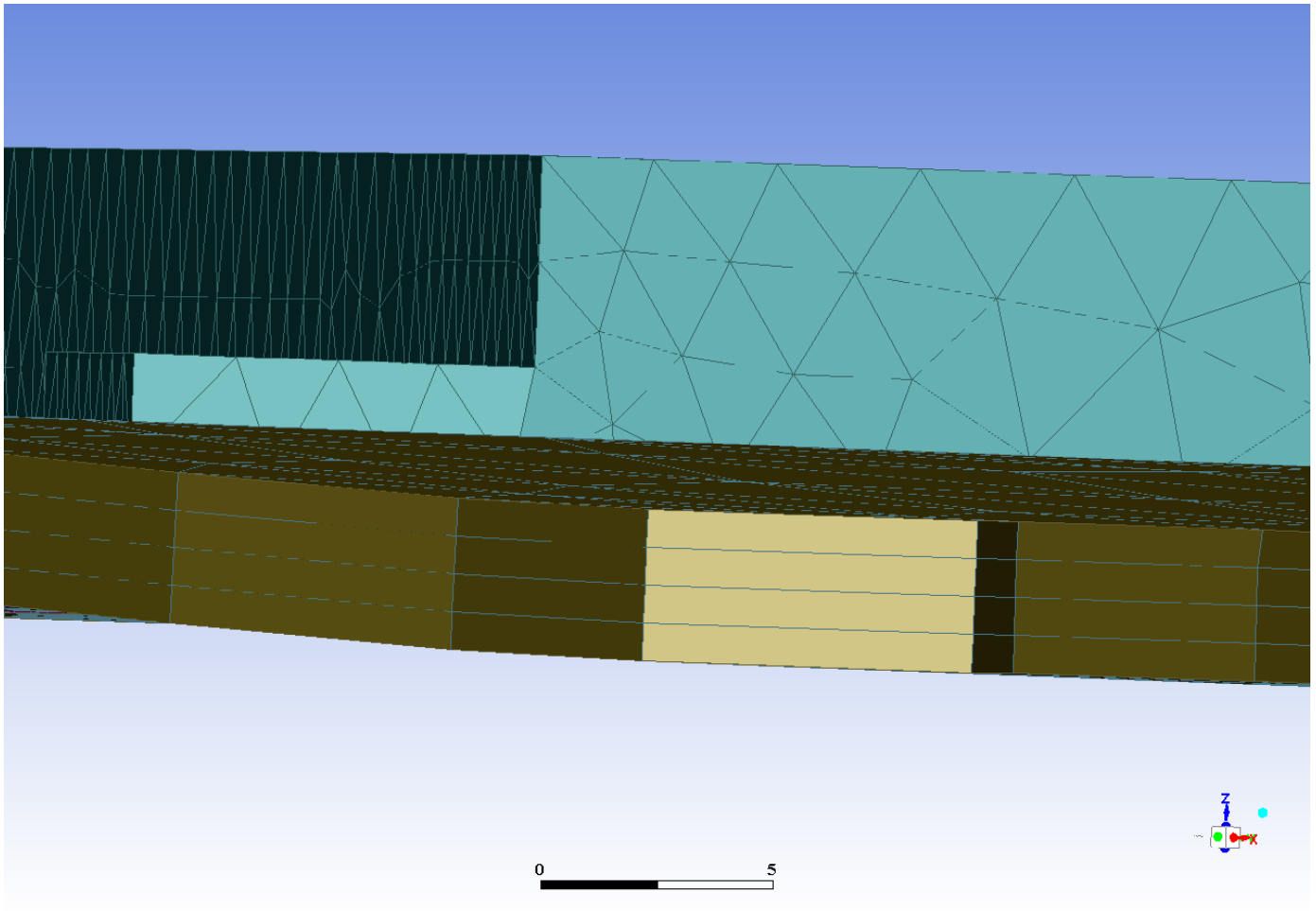
21.772817

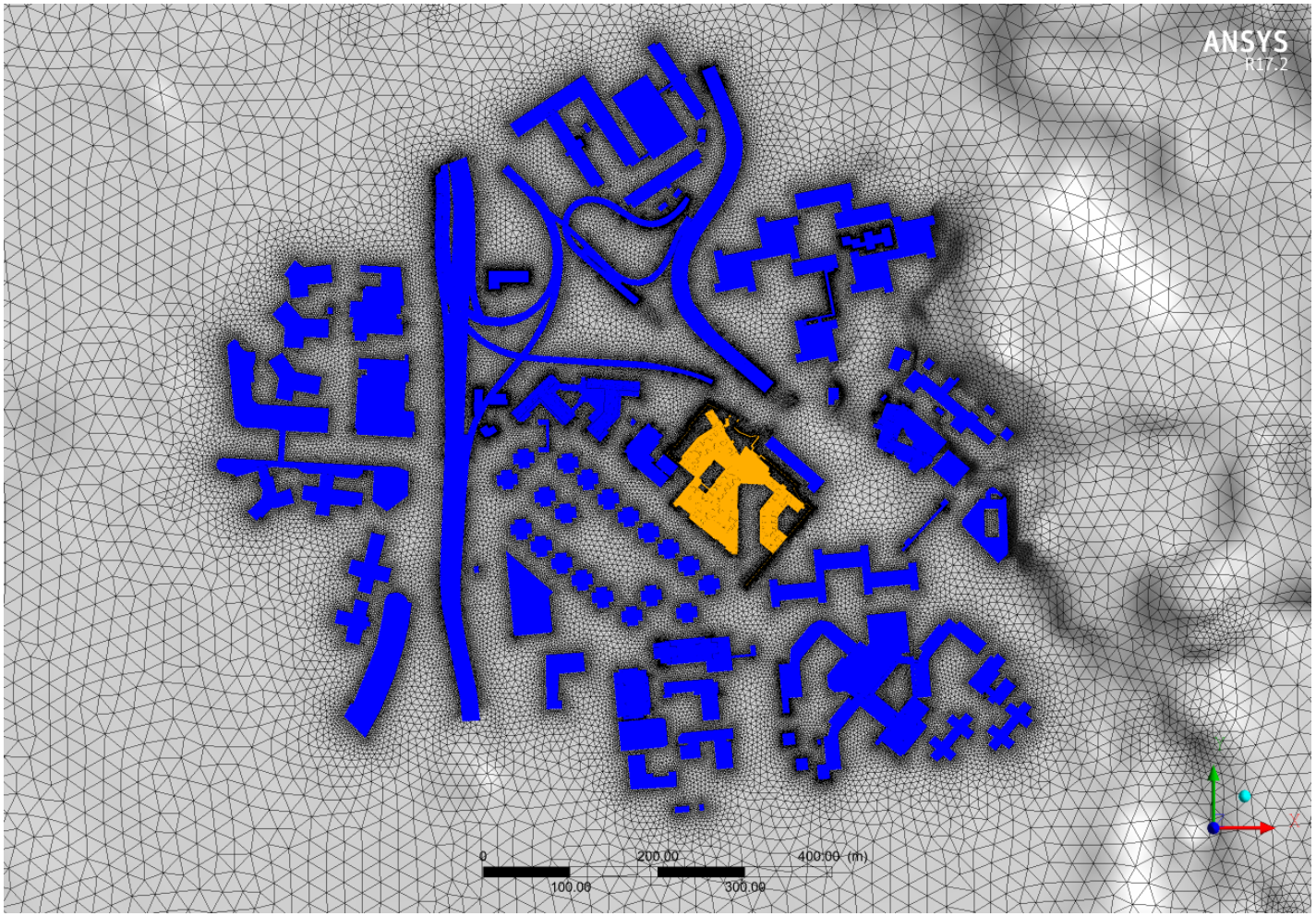
Mesh Size



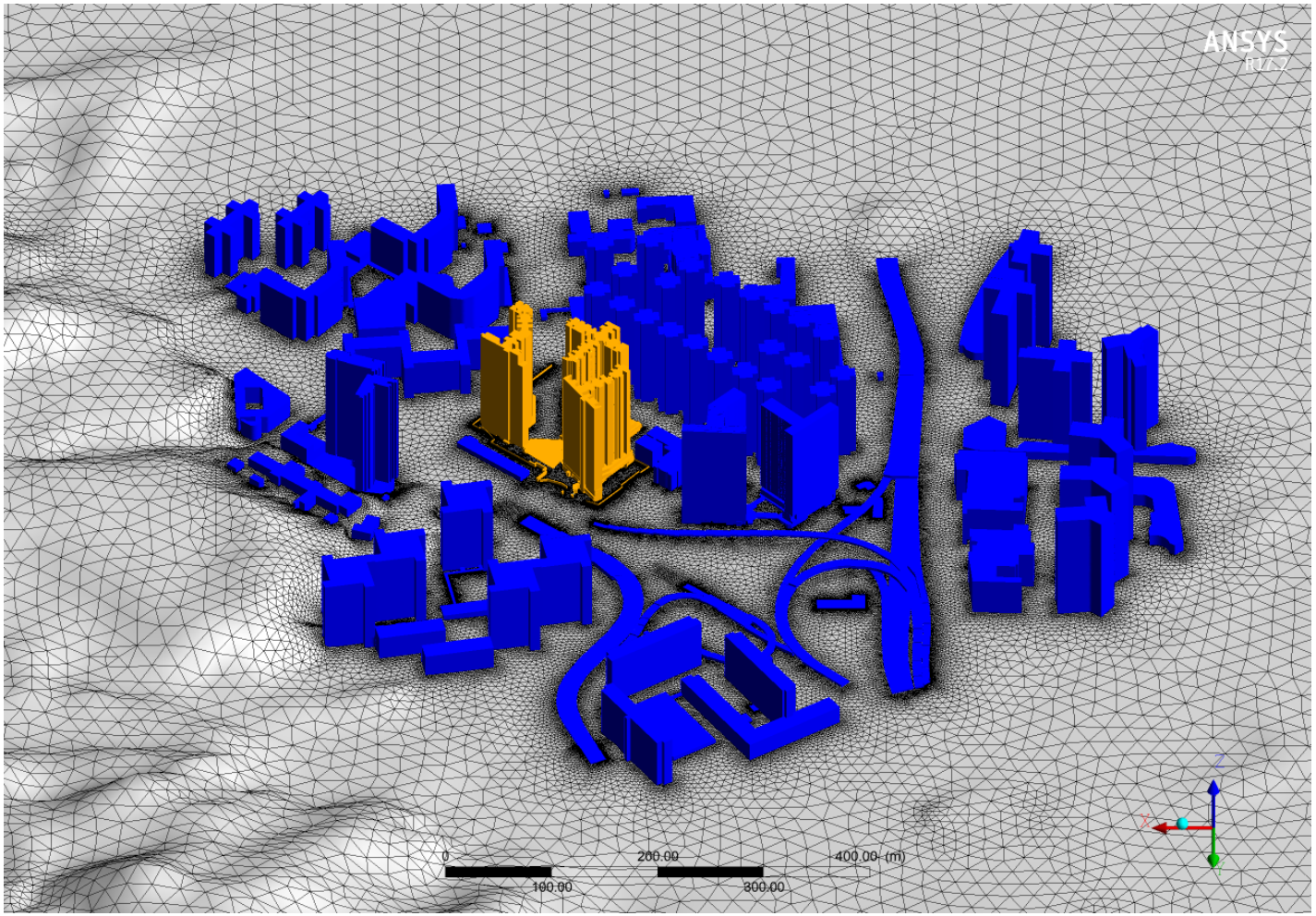
Surface Mesh



4 layers of prismatic meshes at 0.5m thick

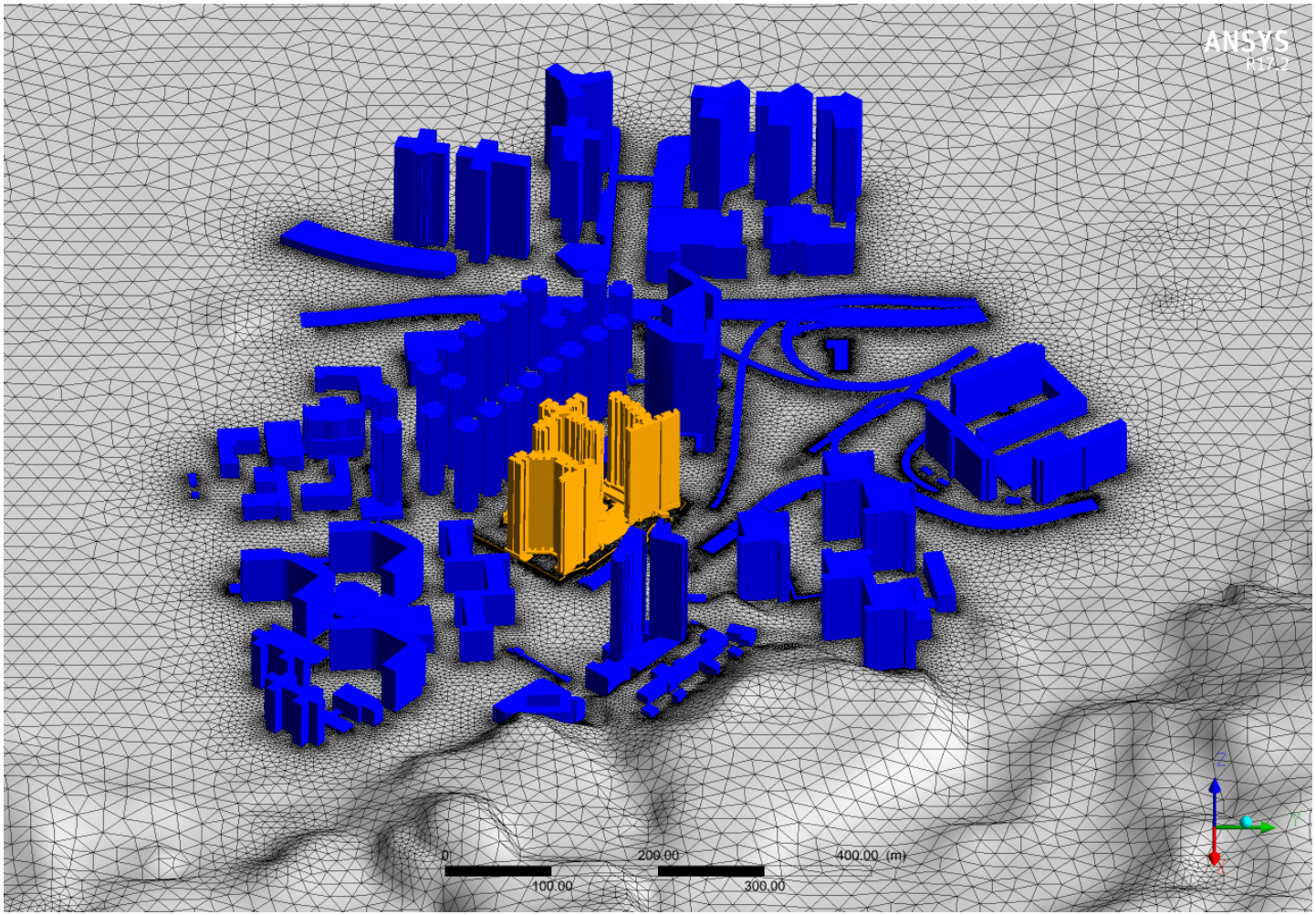


Surrounding Area – Top View

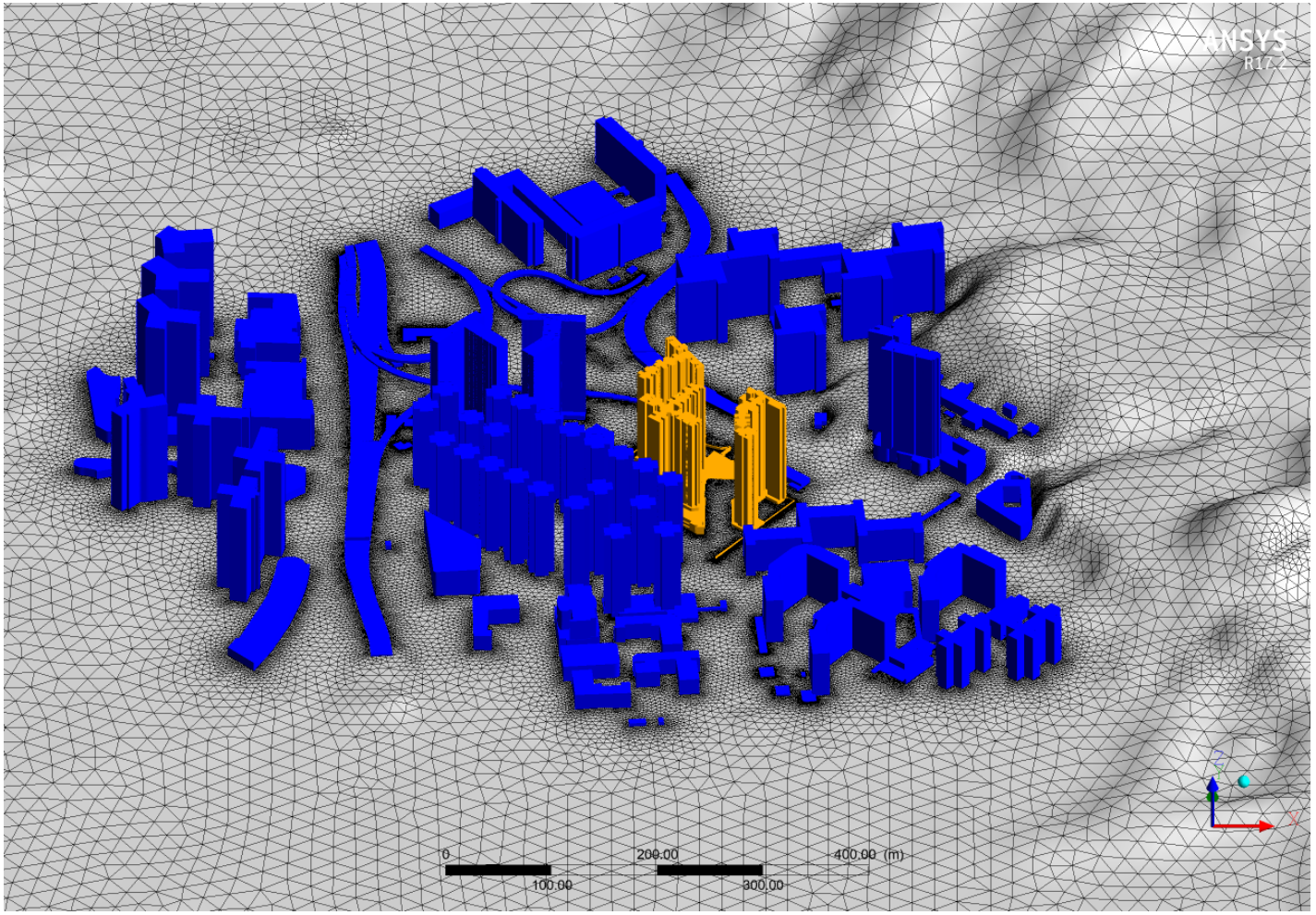


N

Surrounding Area – N

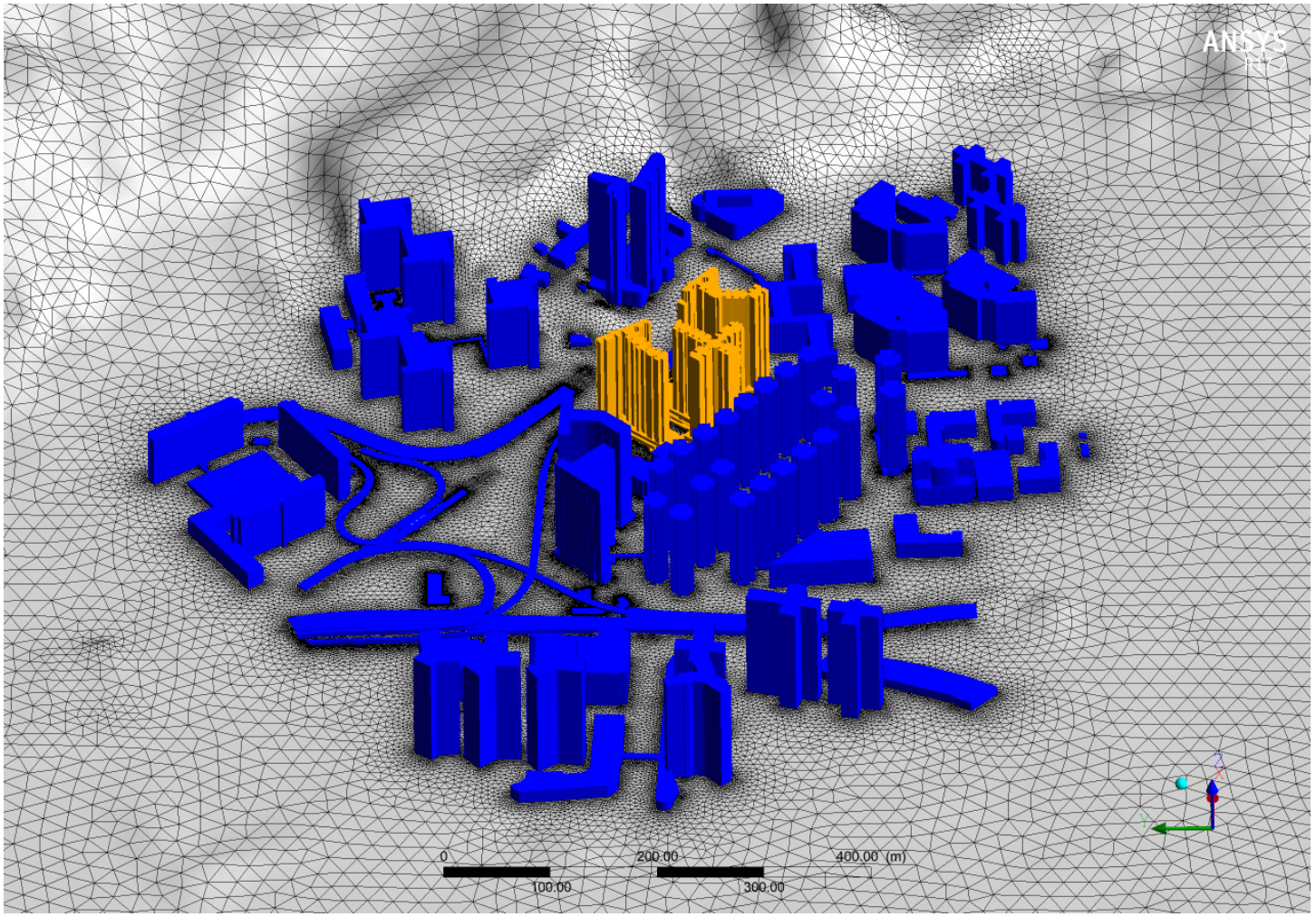


Surrounding Area – E



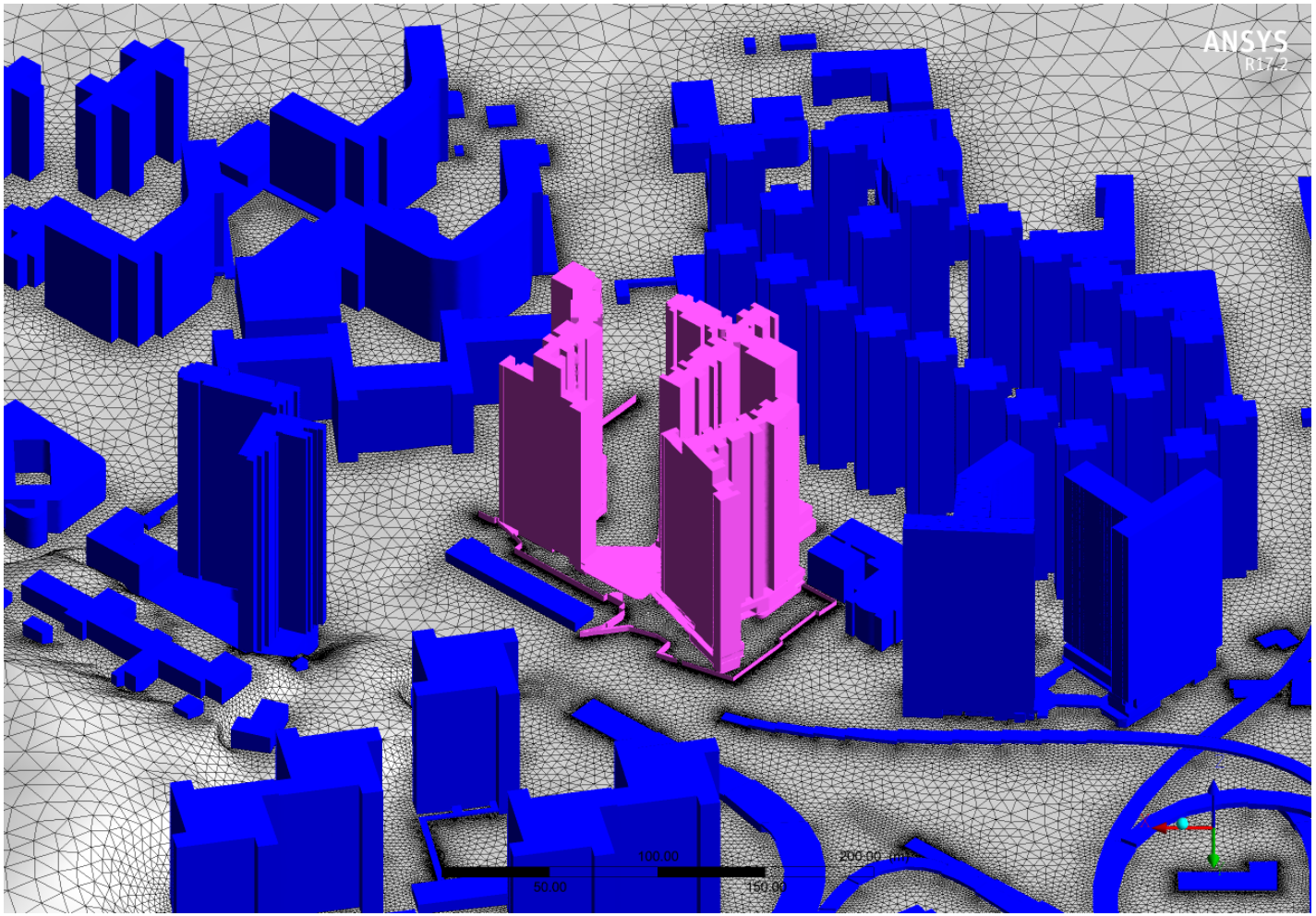
N

Surrounding Area – S

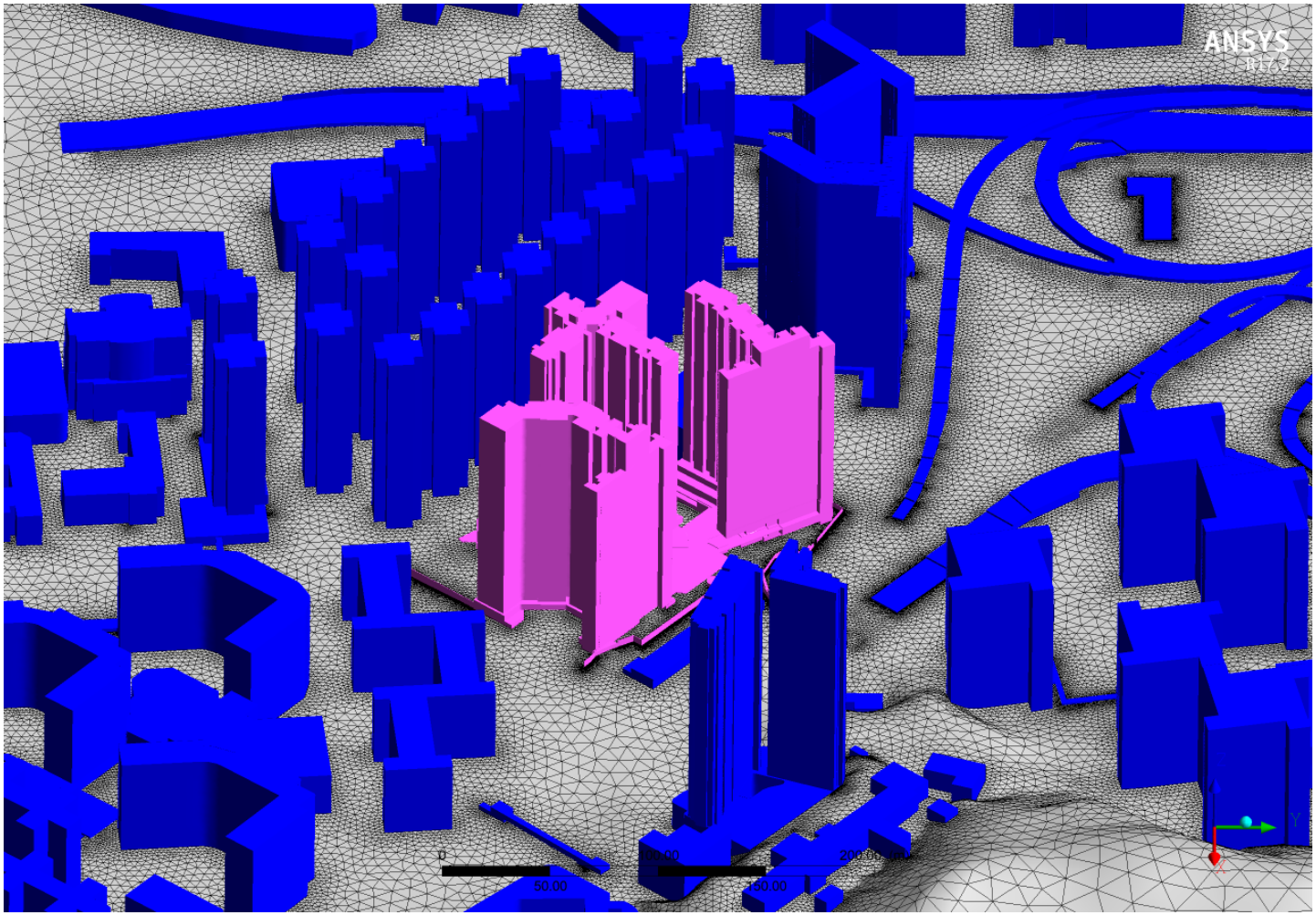


N

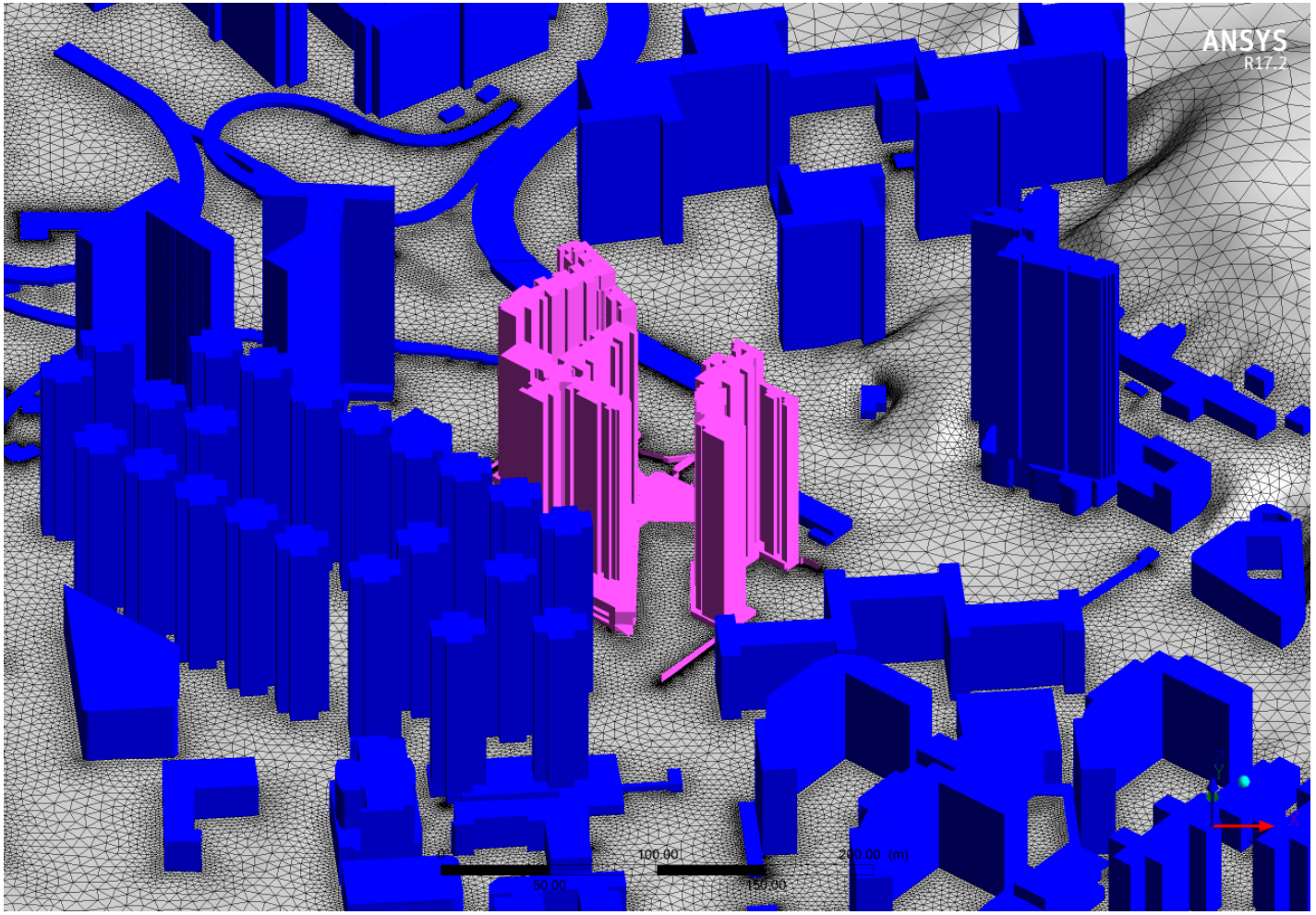
Surrounding Area – W



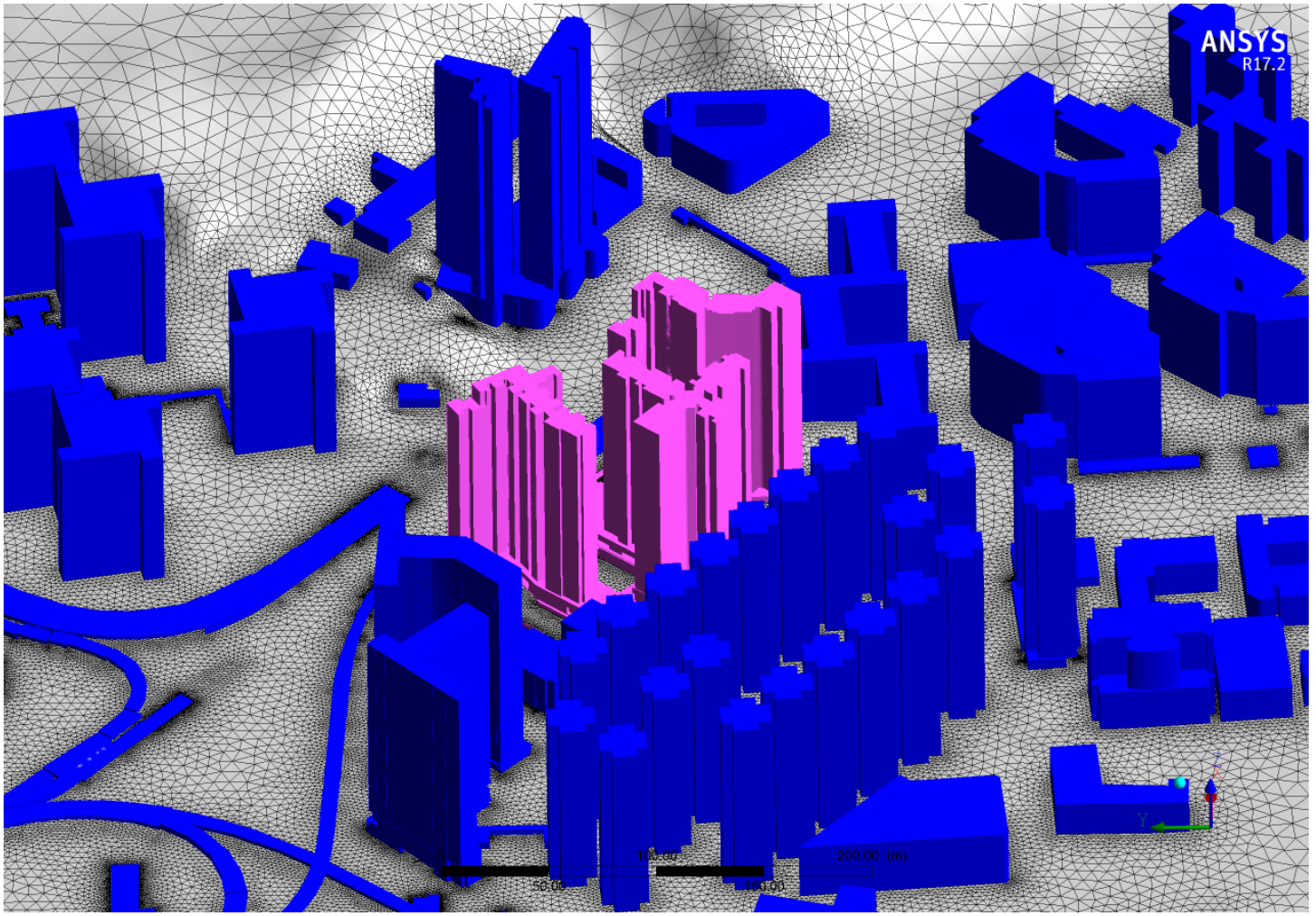
Baseline Scheme – N



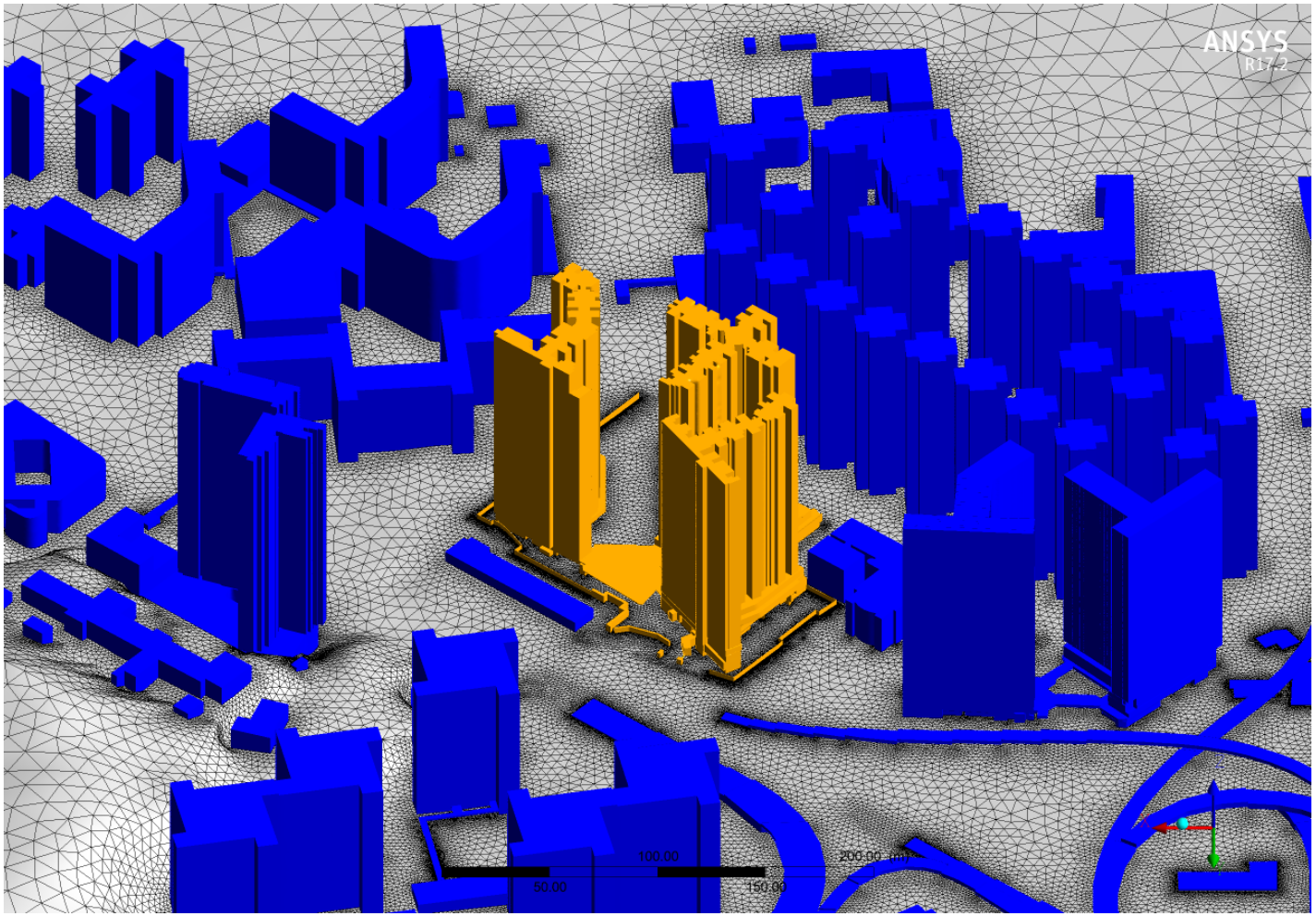
Baseline Scheme – E



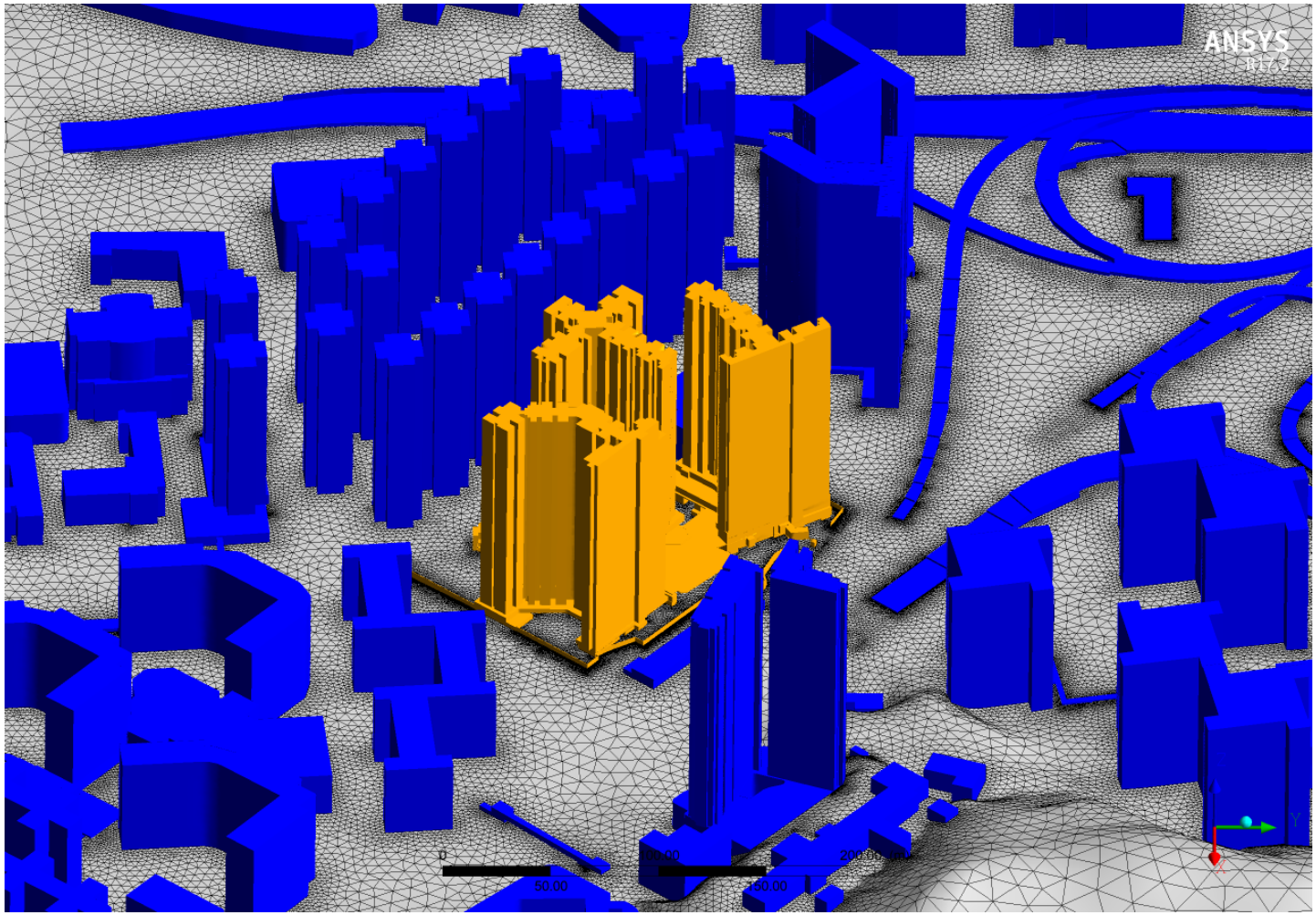
Baseline Scheme – S



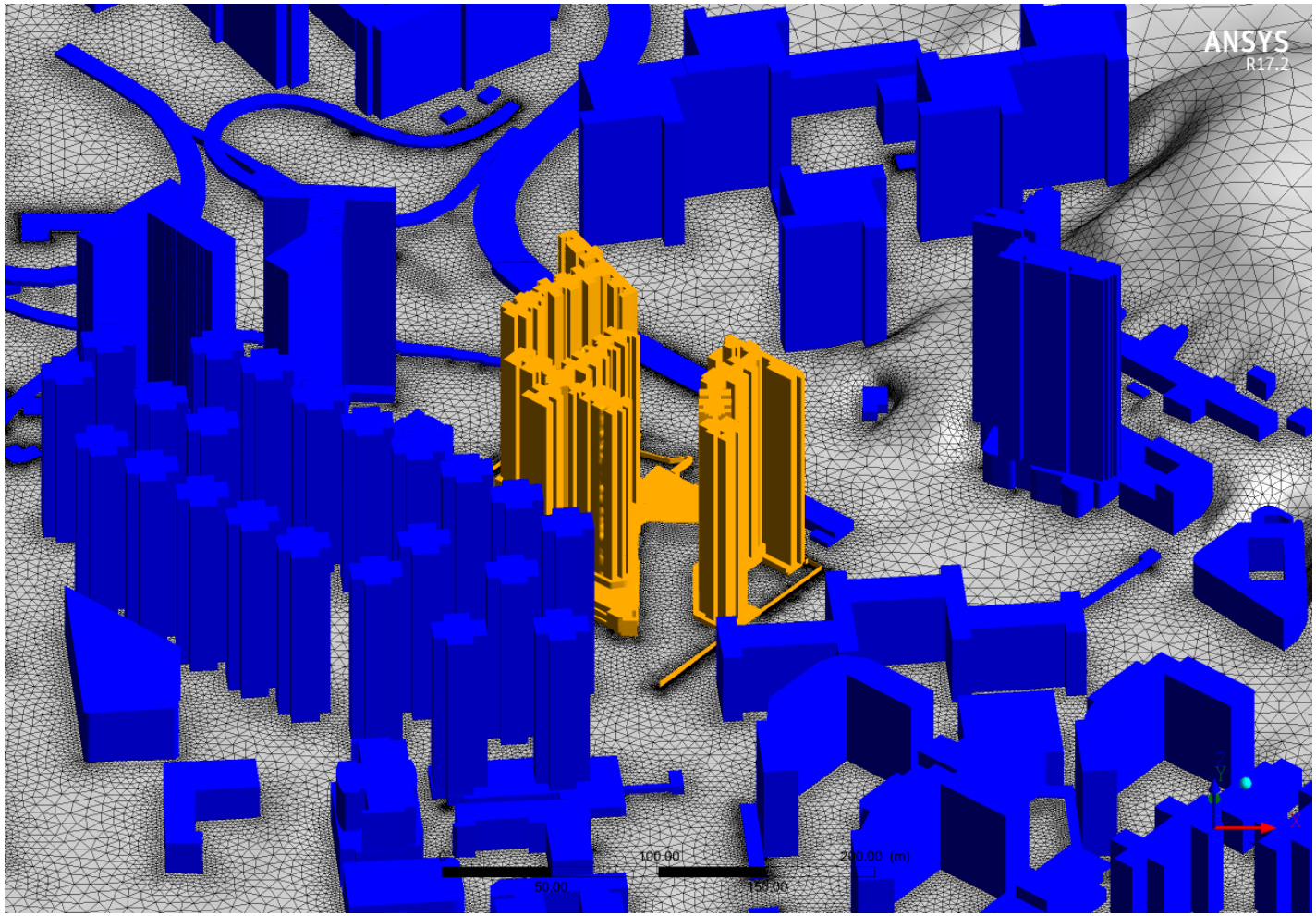
Baseline Scheme – W



Proposed Scheme – N

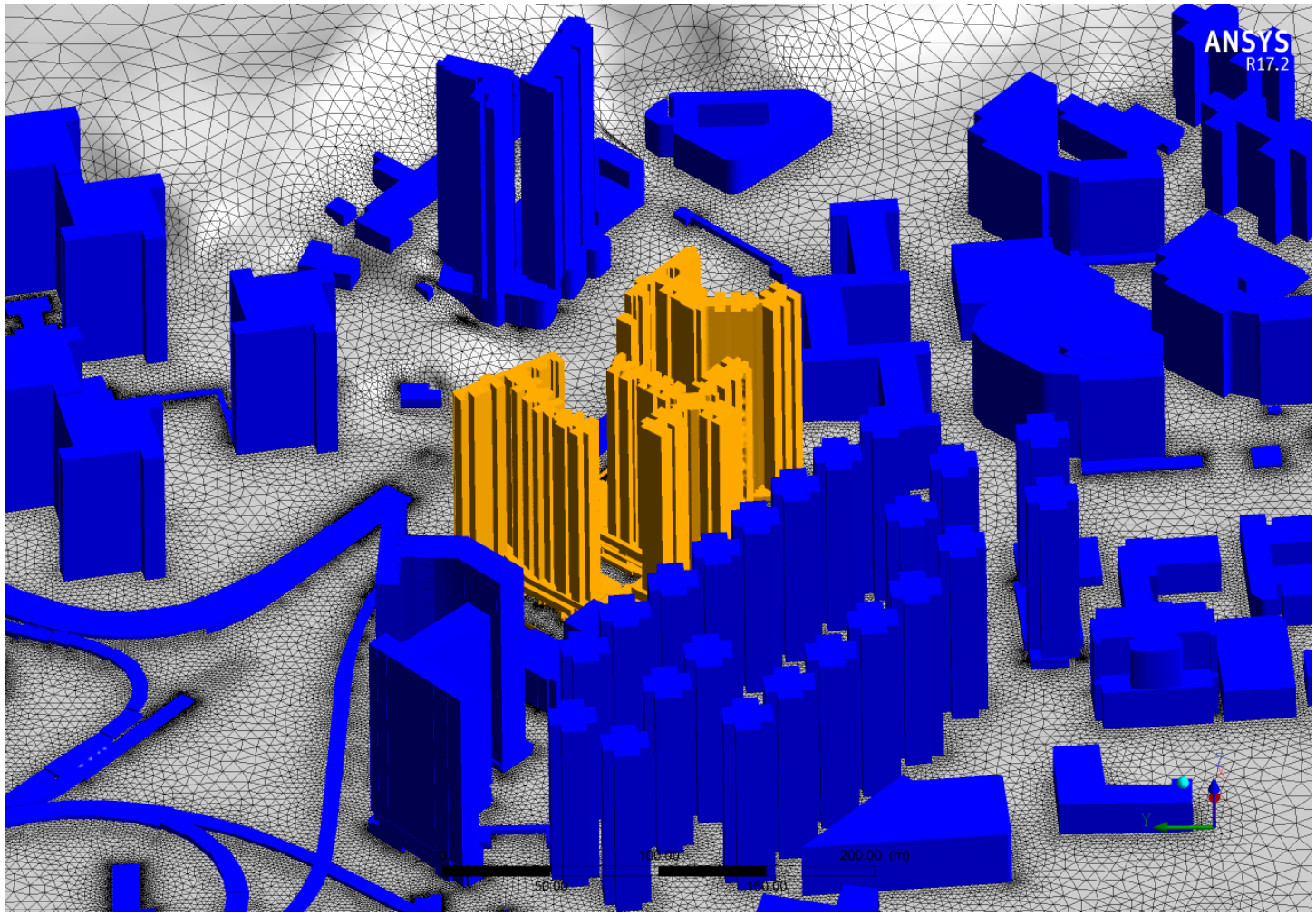


Proposed Scheme – E



N

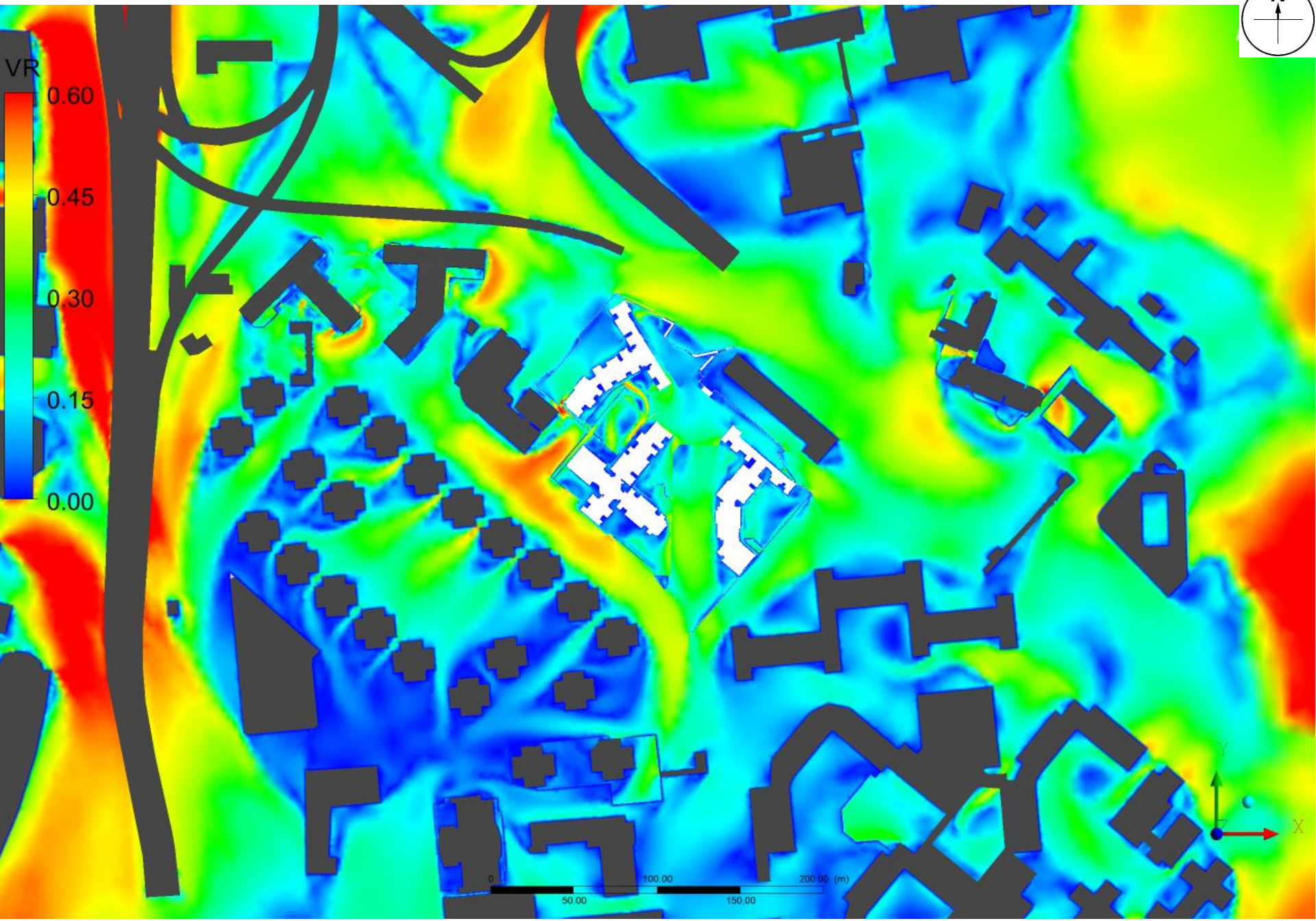
Proposed Scheme – S



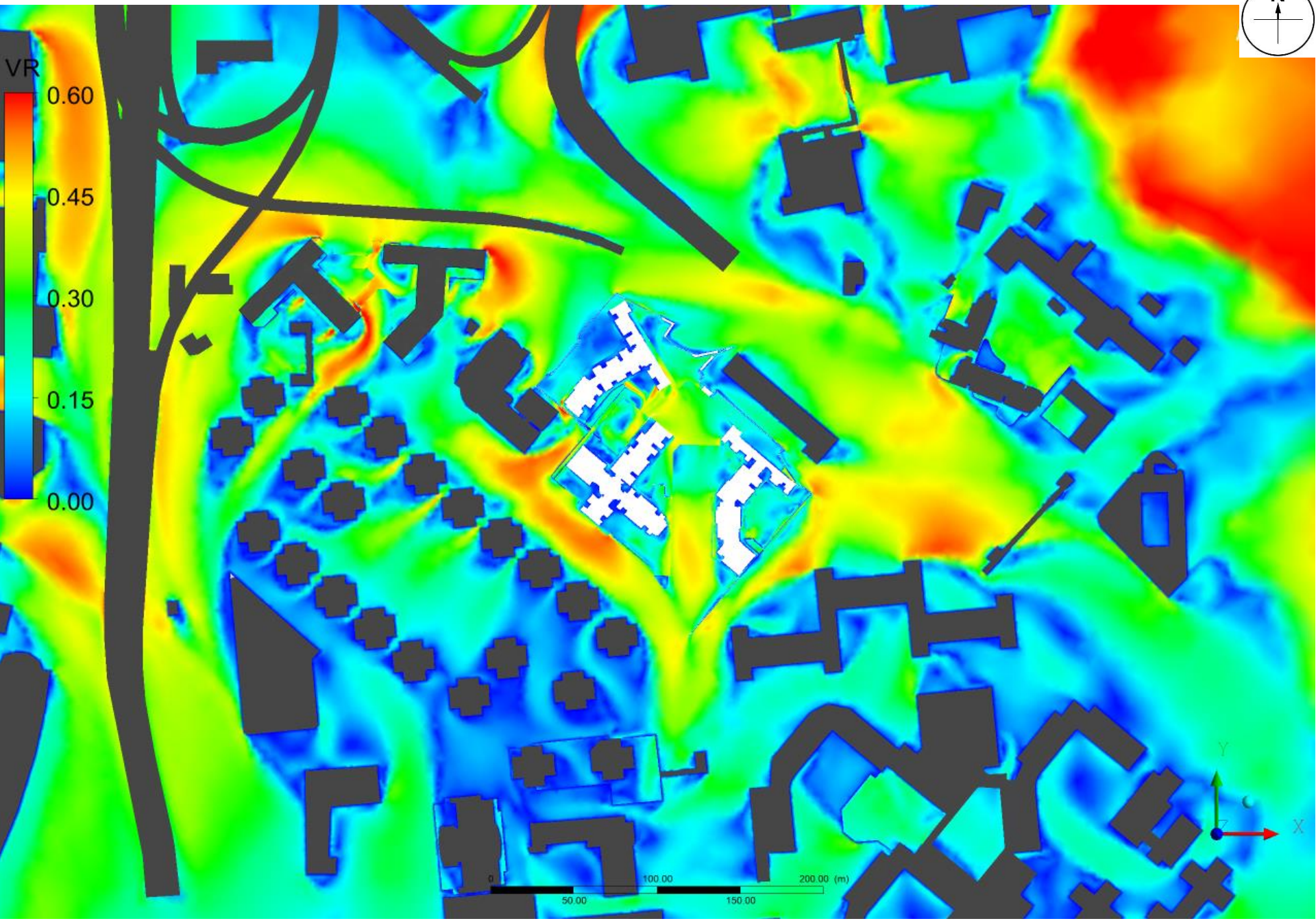
Proposed Scheme – W

Appendix 4

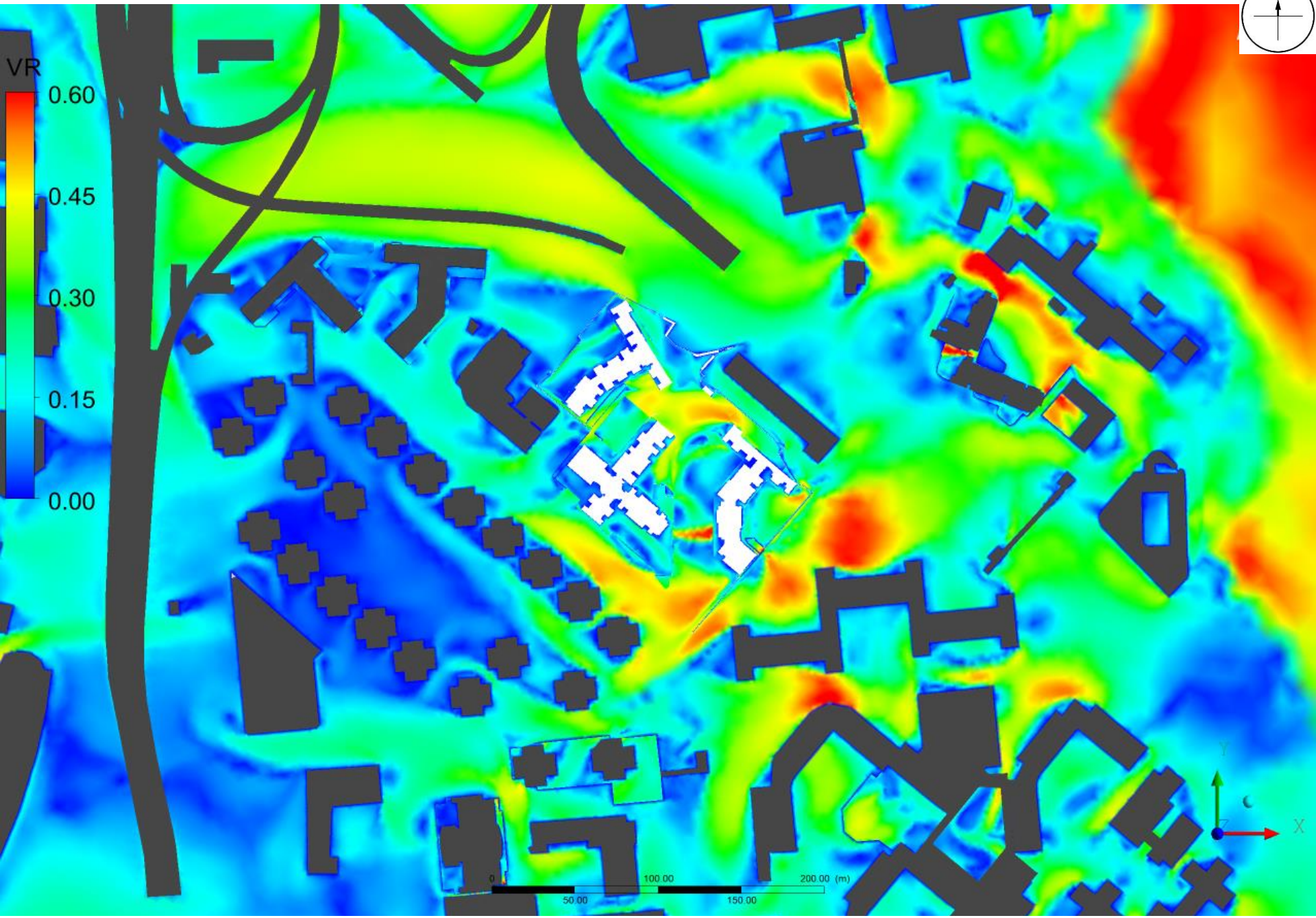
Contour Result of the CFD Simulation



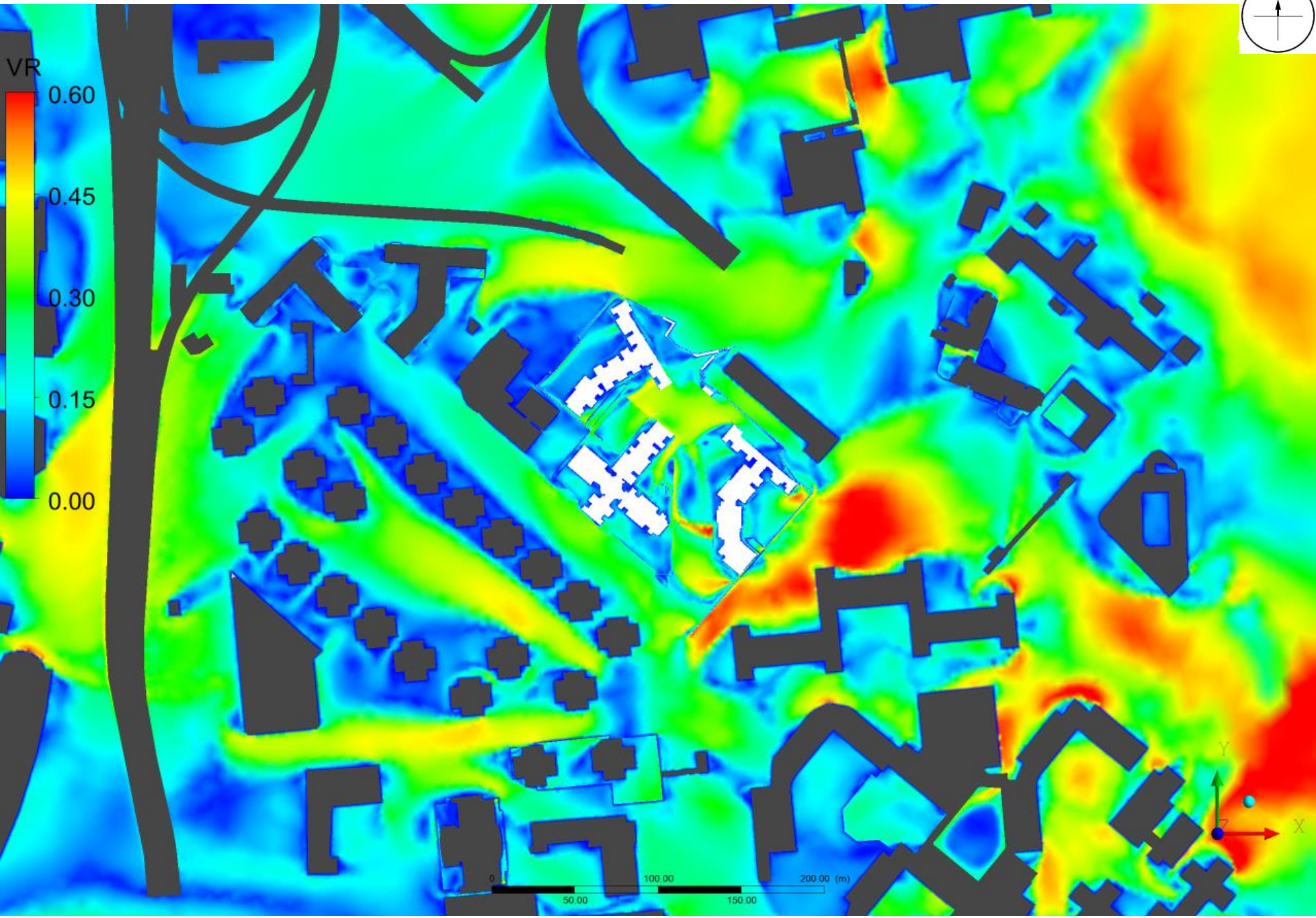
Baseline Scheme - Contour plot at pedestrian level under NNE Wind



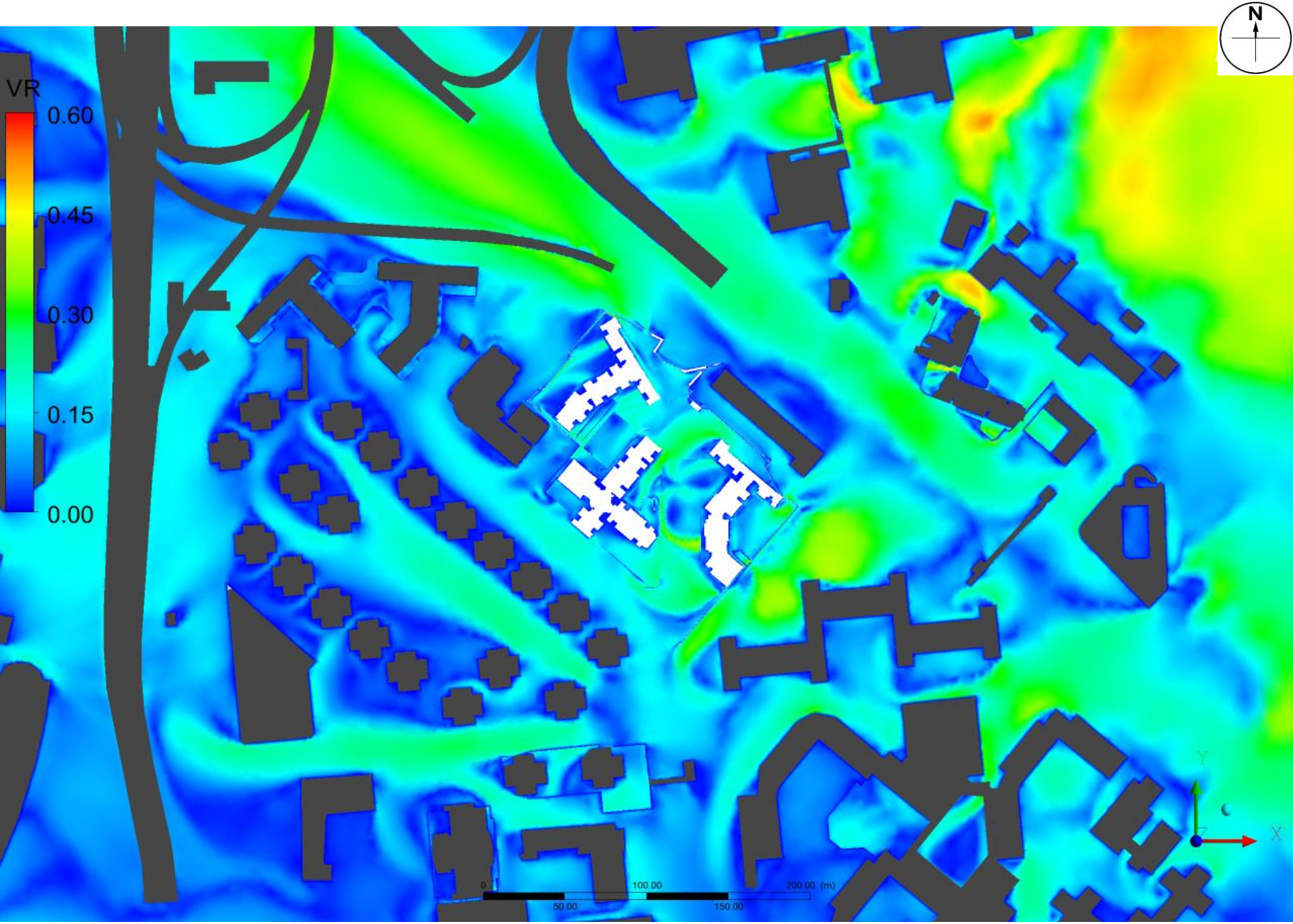
Baseline Scheme - Contour plot at pedestrian level under NE Wind



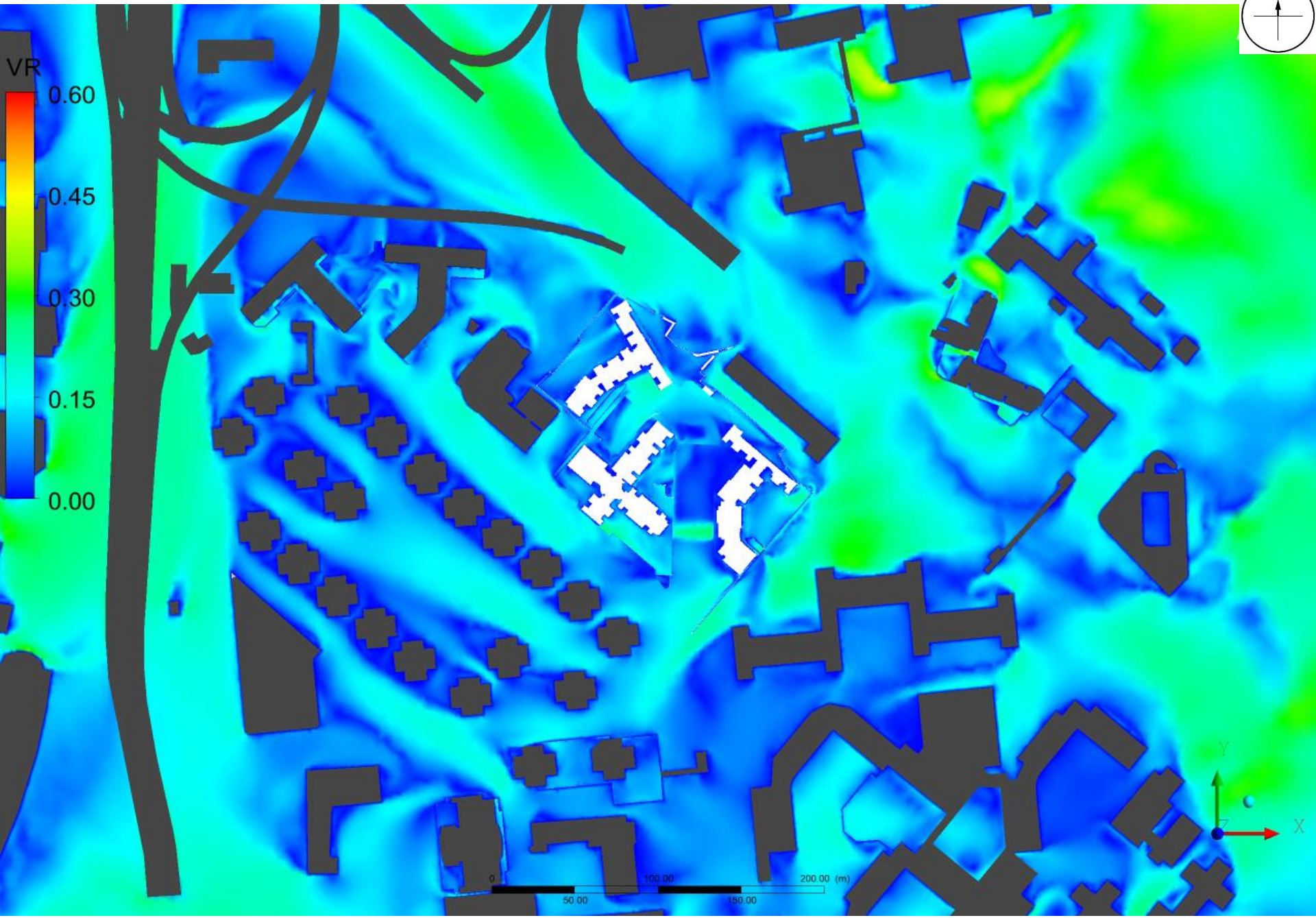
Baseline Scheme - Contour plot at pedestrian level under ENE Wind



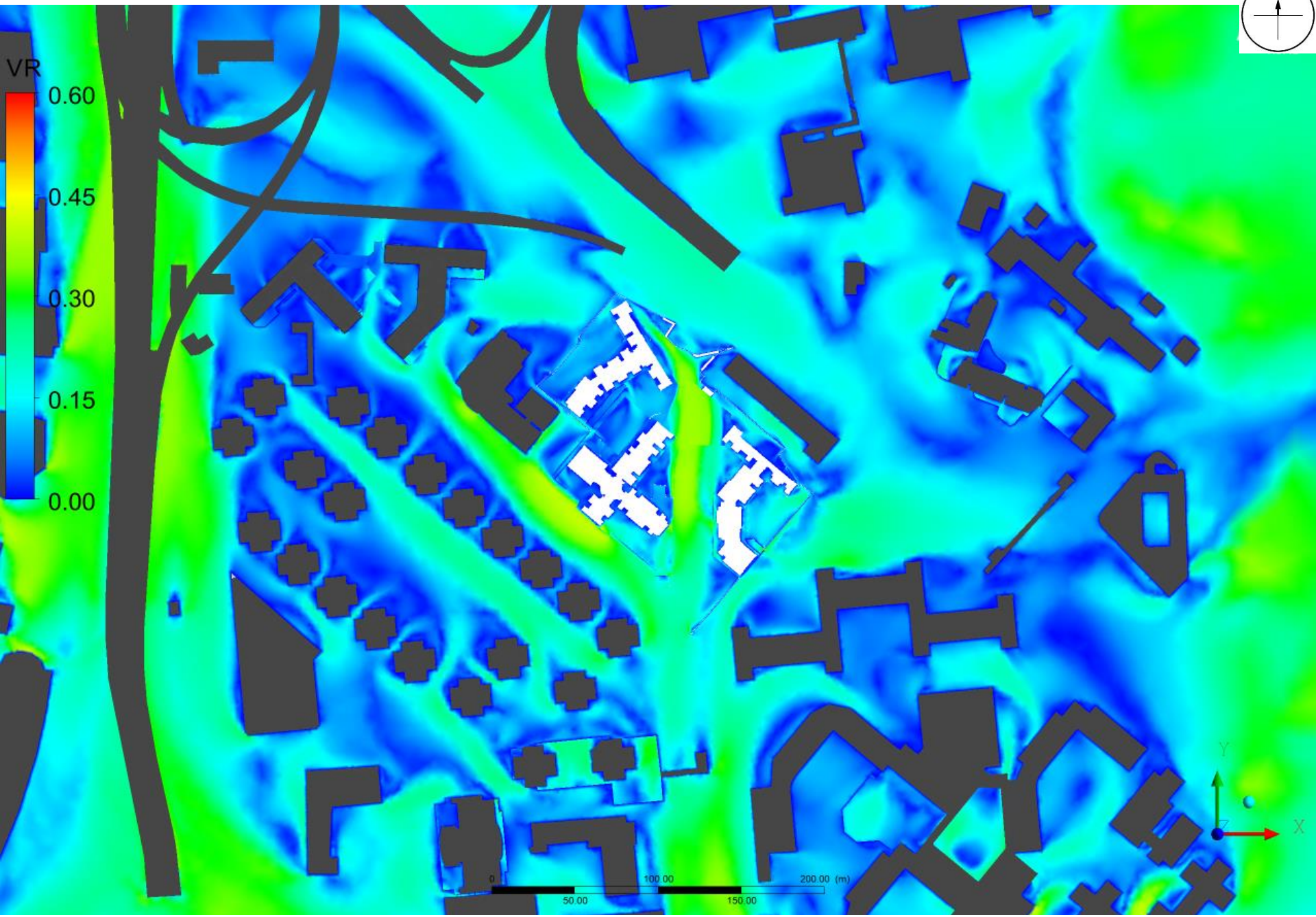
Baseline Scheme - Contour plot at pedestrian level under E Wind



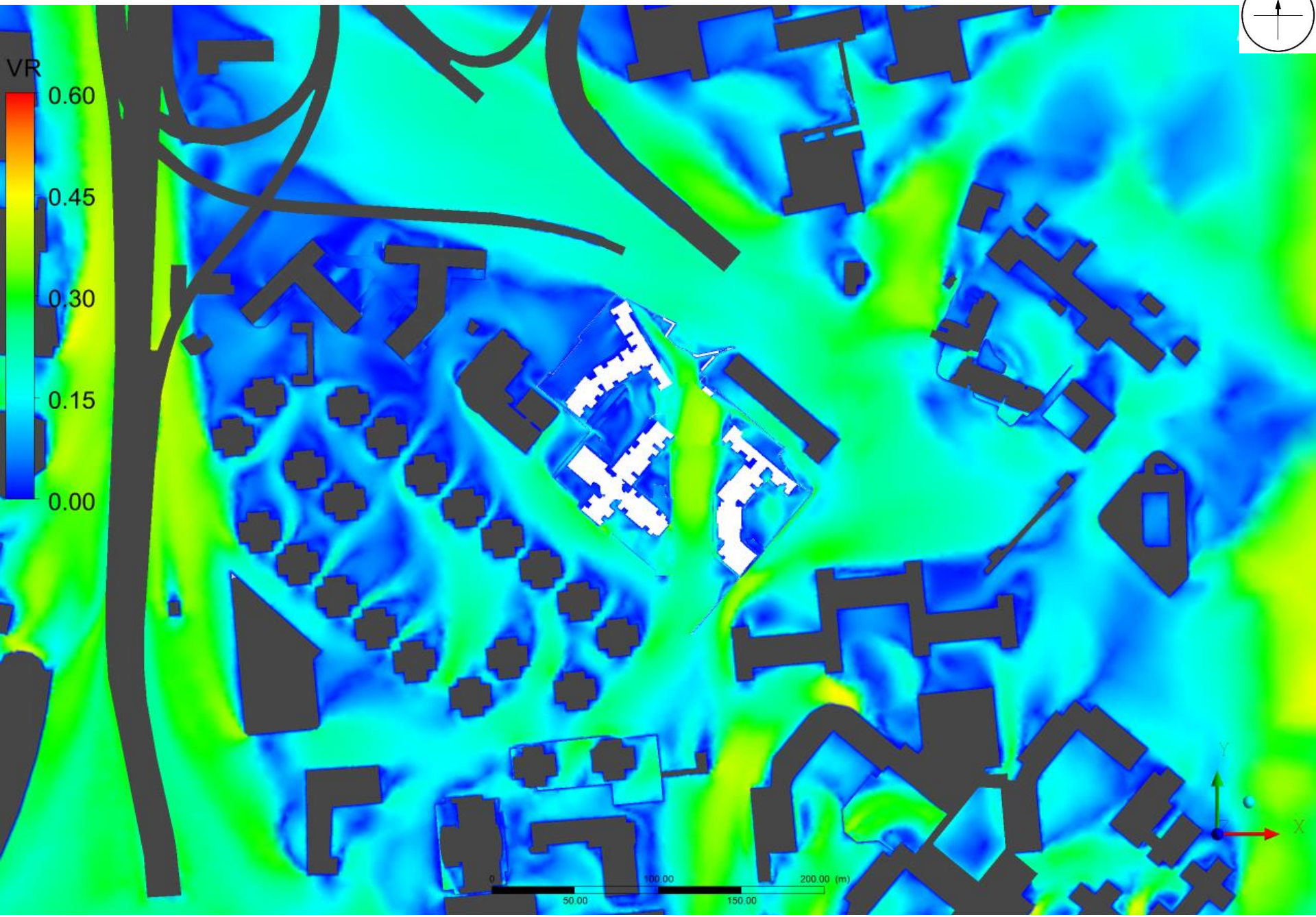
Baseline Scheme - Contour plot at pedestrian level under ESE Wind



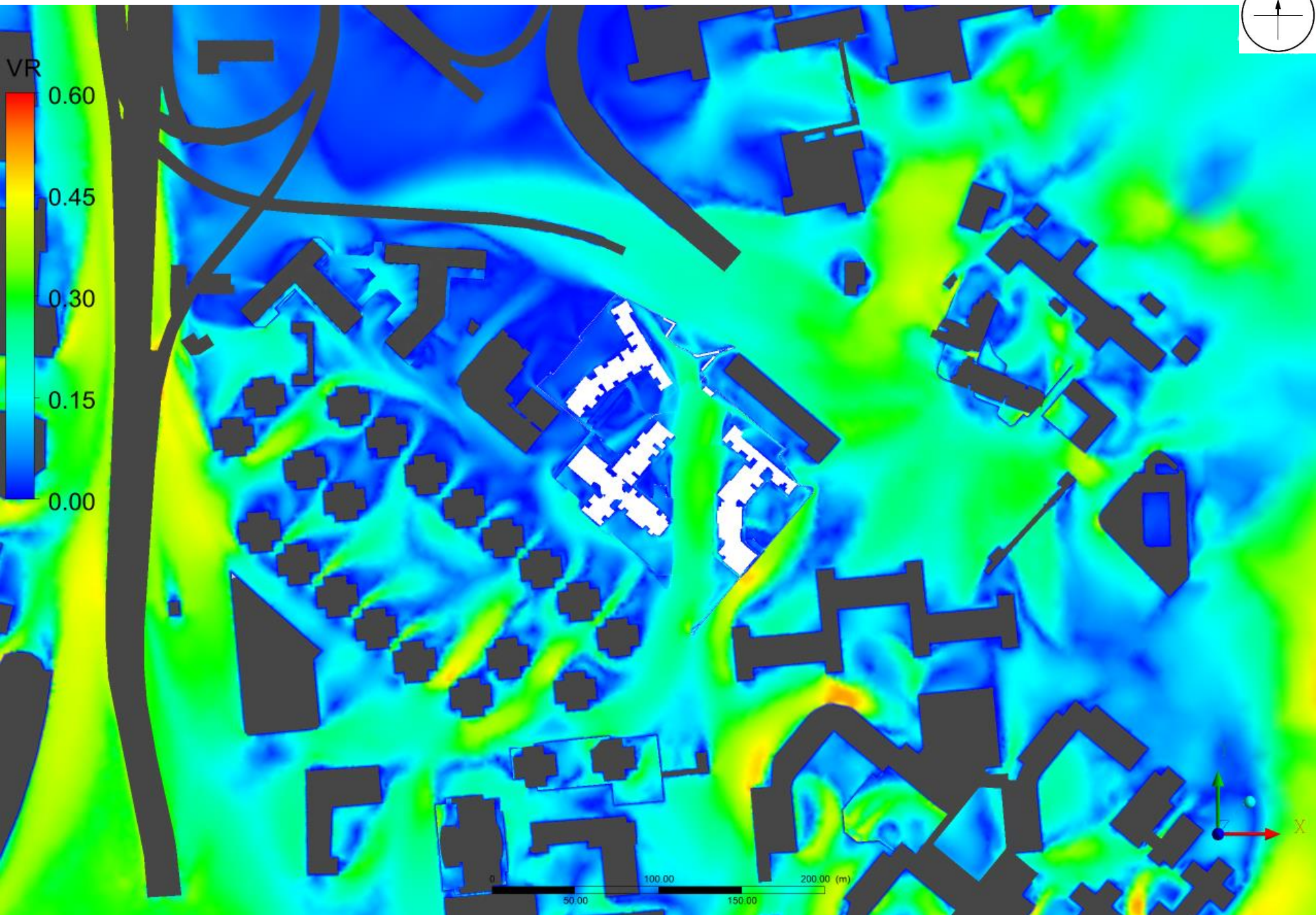
Baseline Scheme - Contour plot at pedestrian level under SE Wind



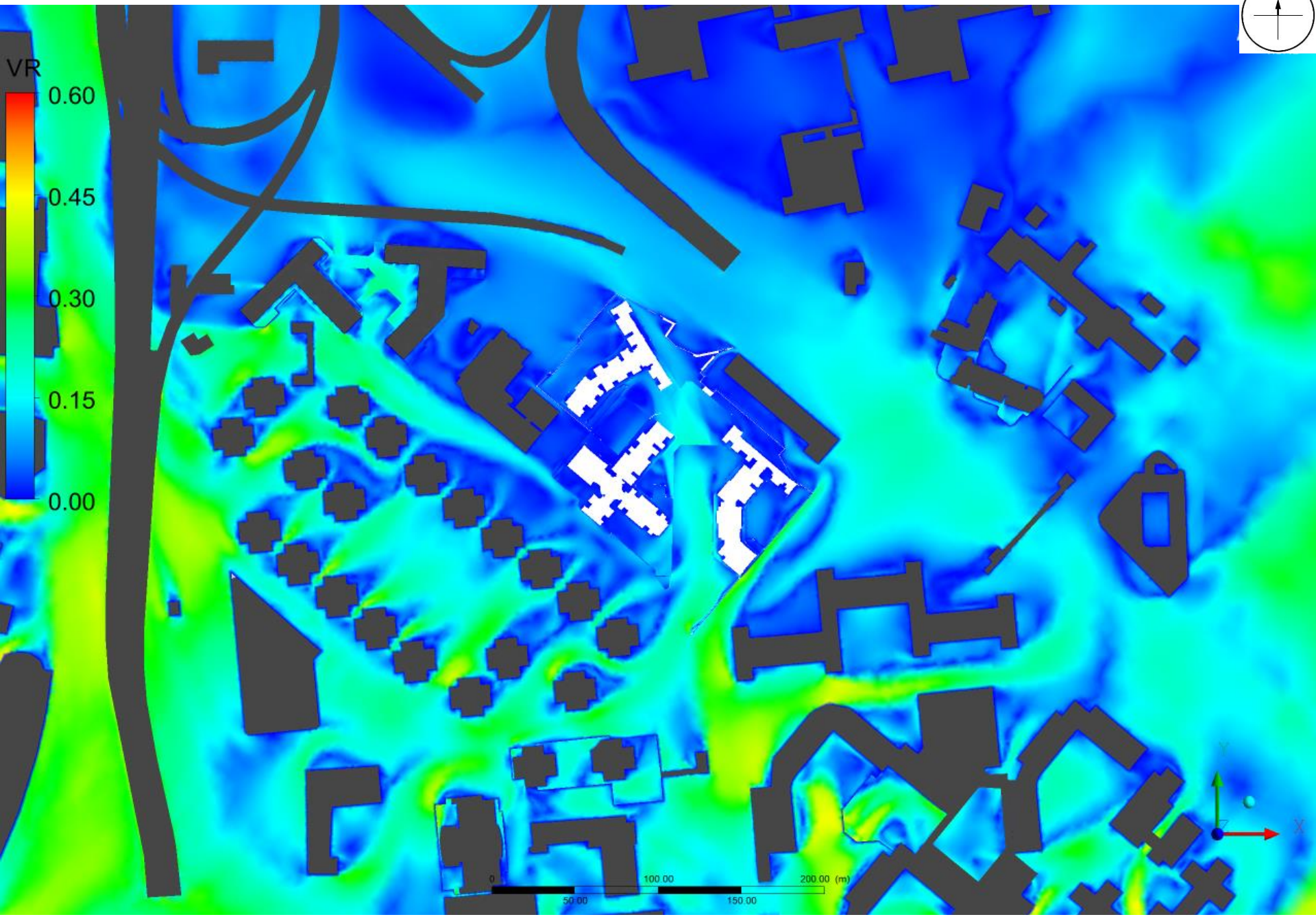
Baseline Scheme - Contour plot at pedestrian level under SSE Wind



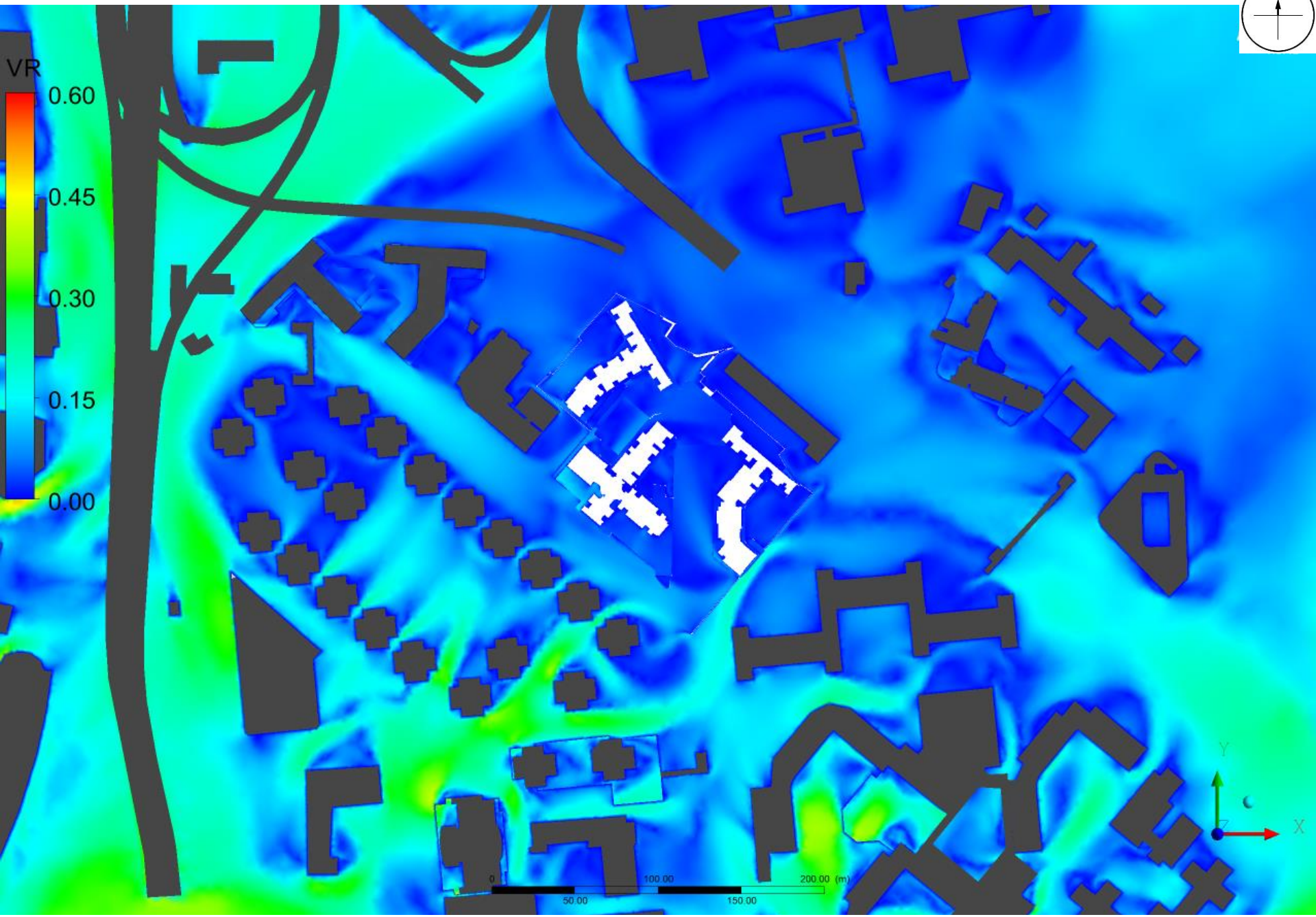
Baseline Scheme - Contour plot at pedestrian level under S Wind



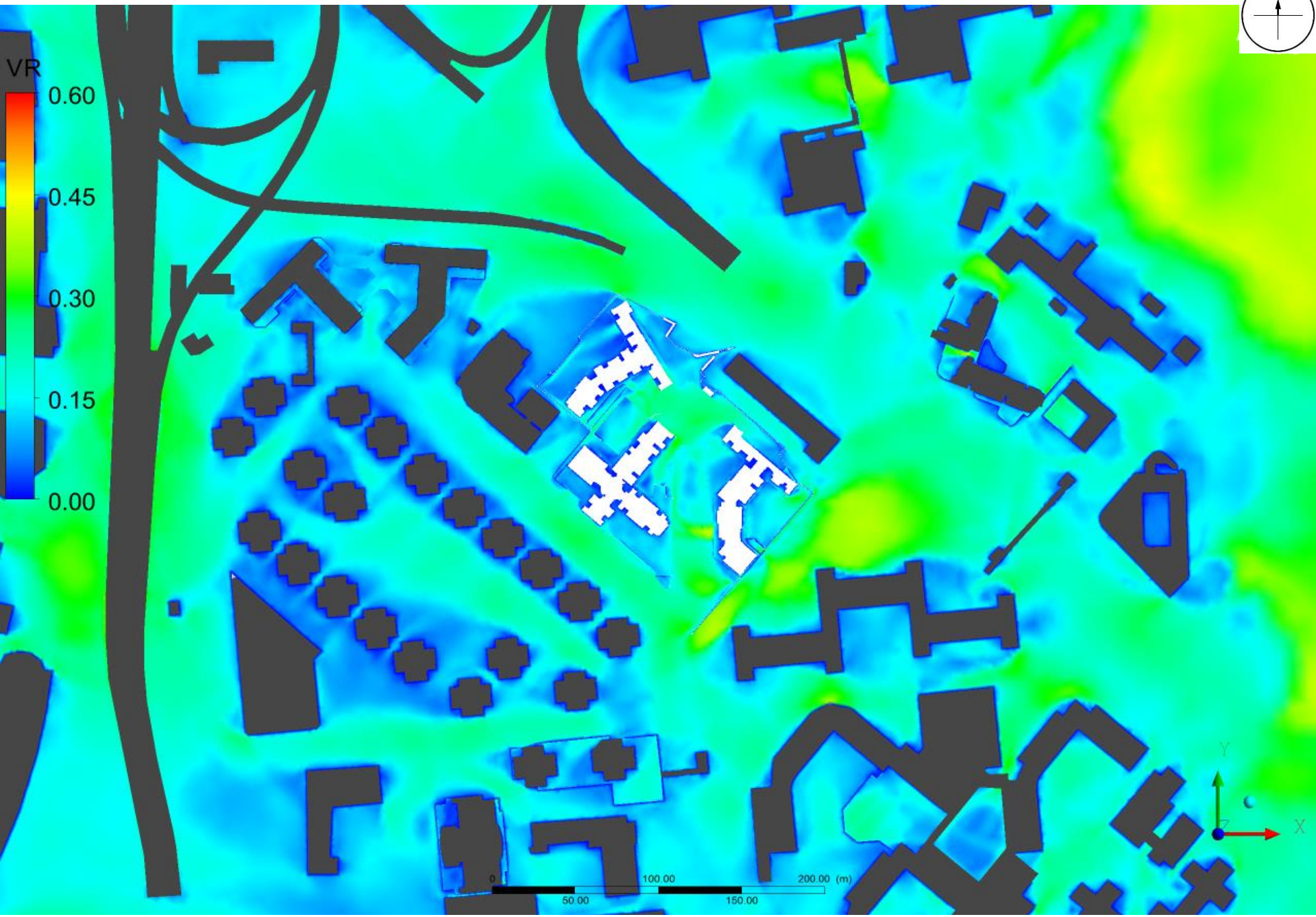
Baseline Scheme - Contour plot at pedestrian level under SSW Wind



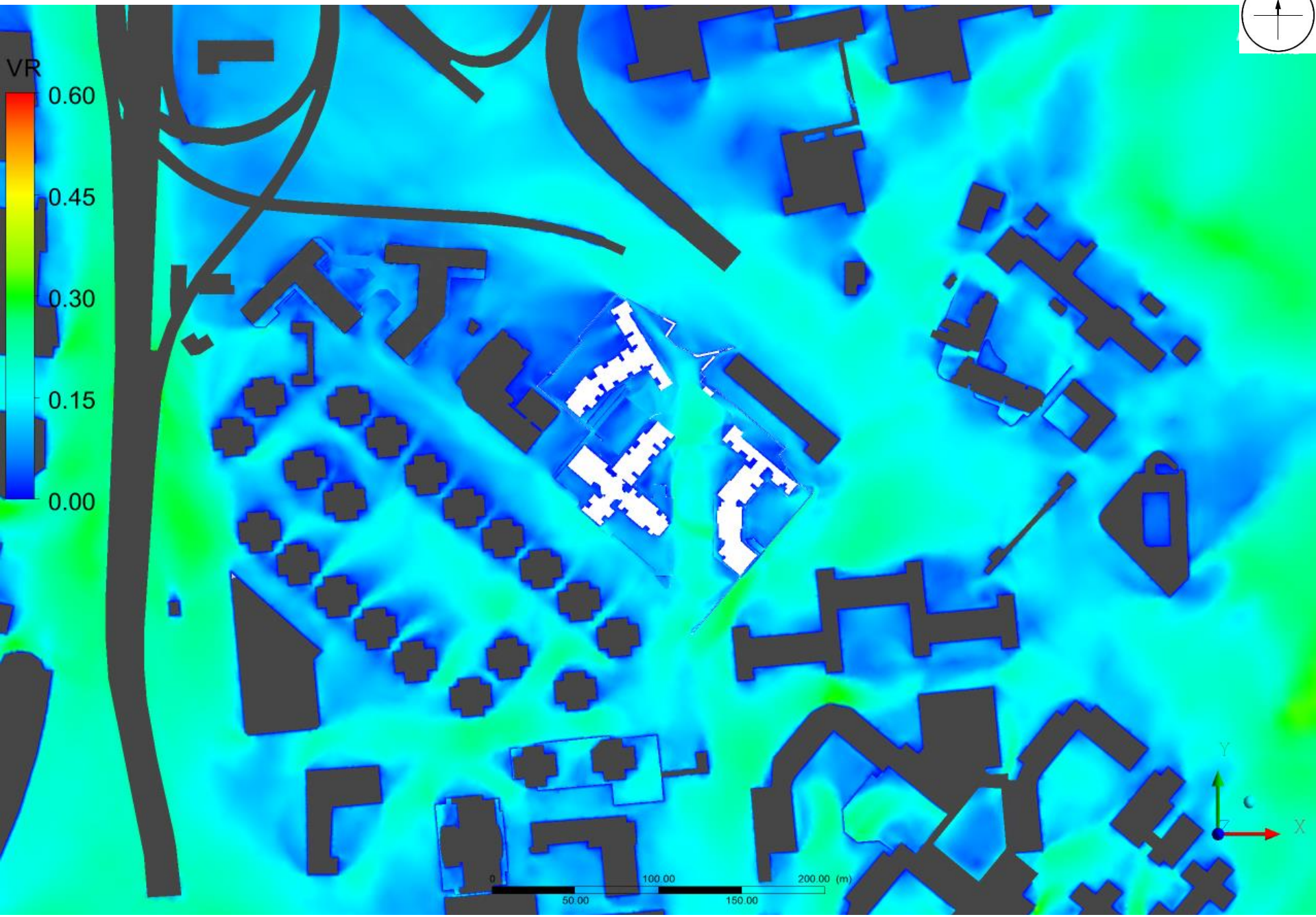
Baseline Scheme - Contour plot at pedestrian level under SW Wind



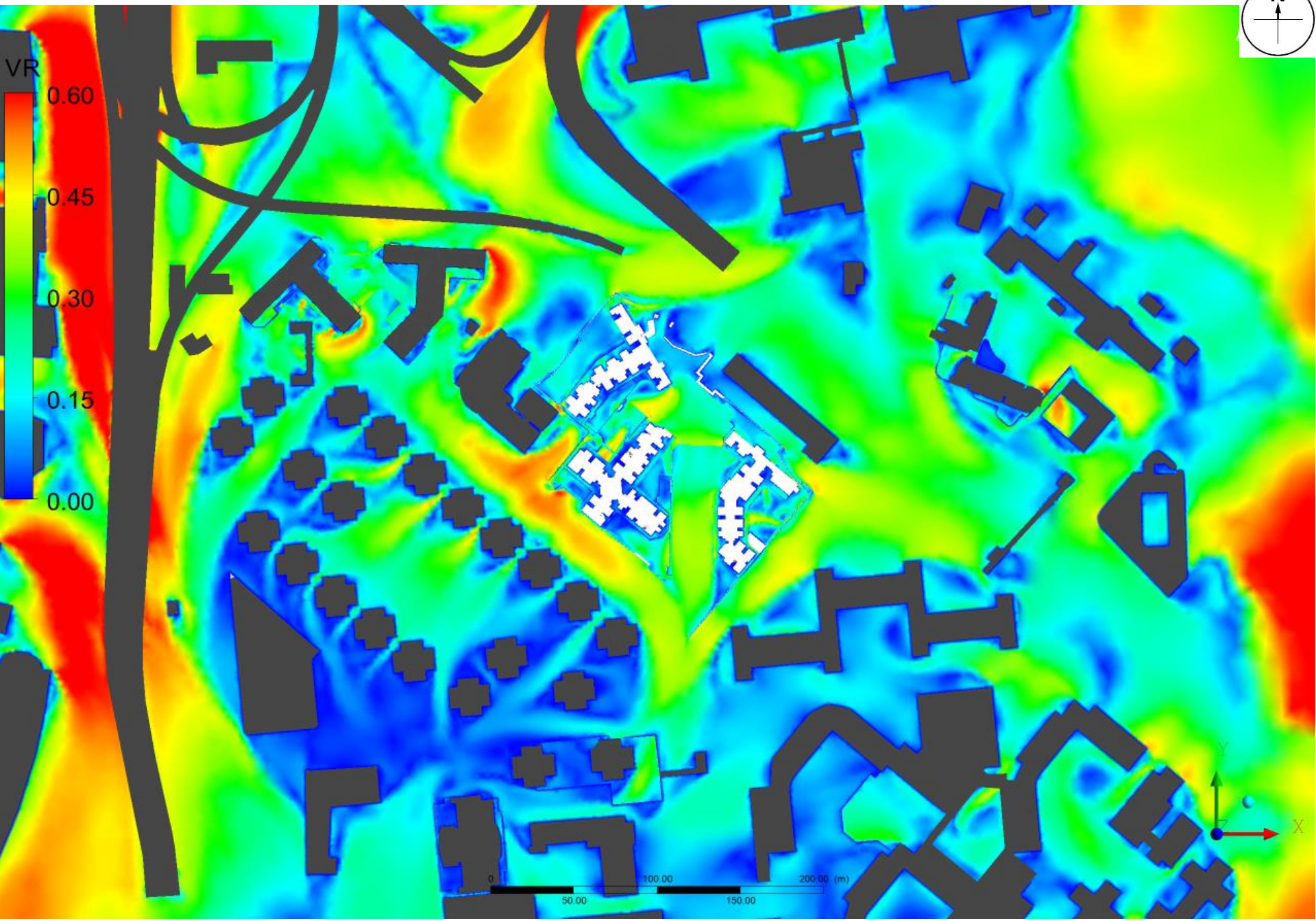
Baseline Scheme - Contour plot at pedestrian level under WSW Wind



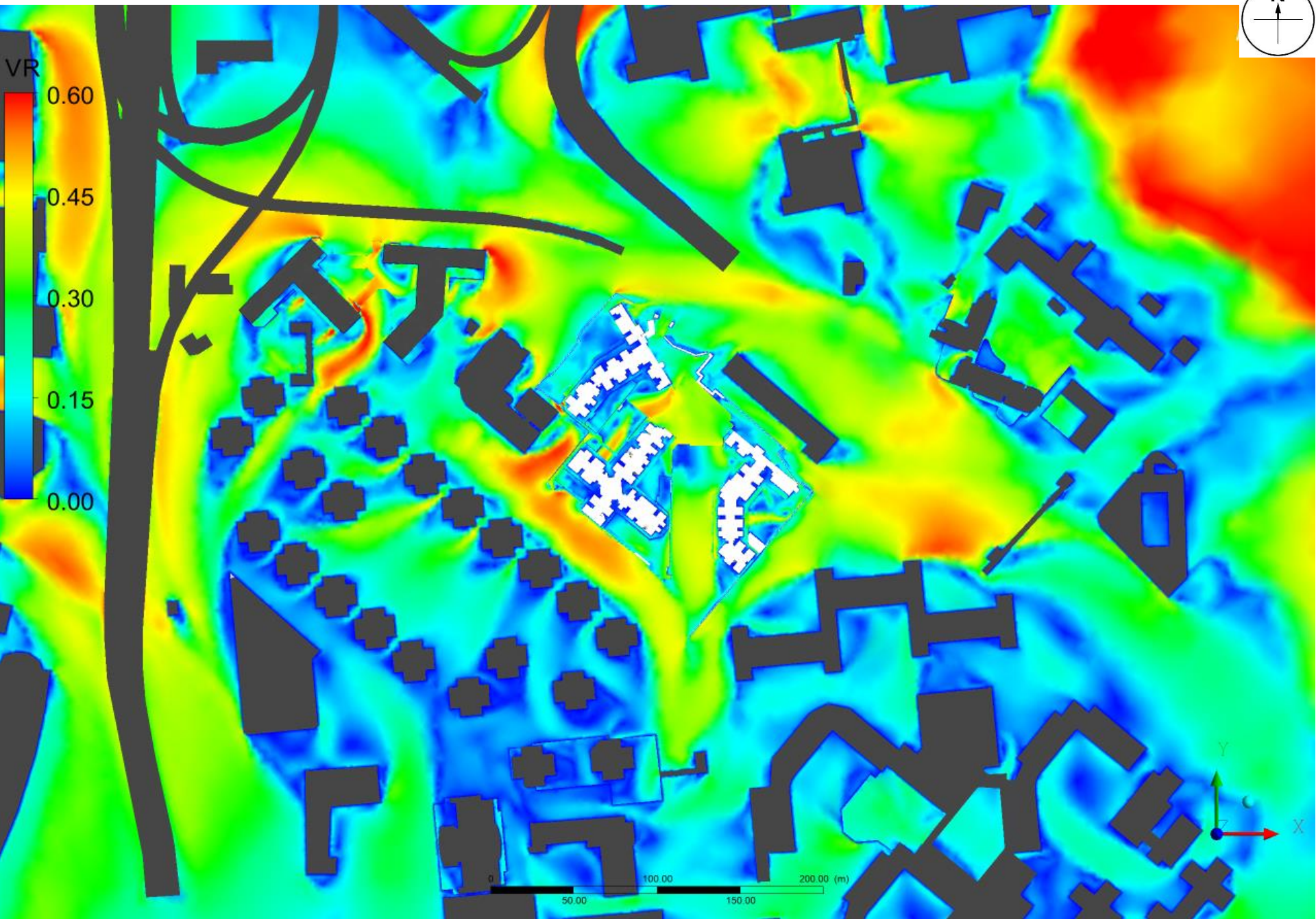
Baseline Scheme - Annual weighted wind speed colour at pedestrian level



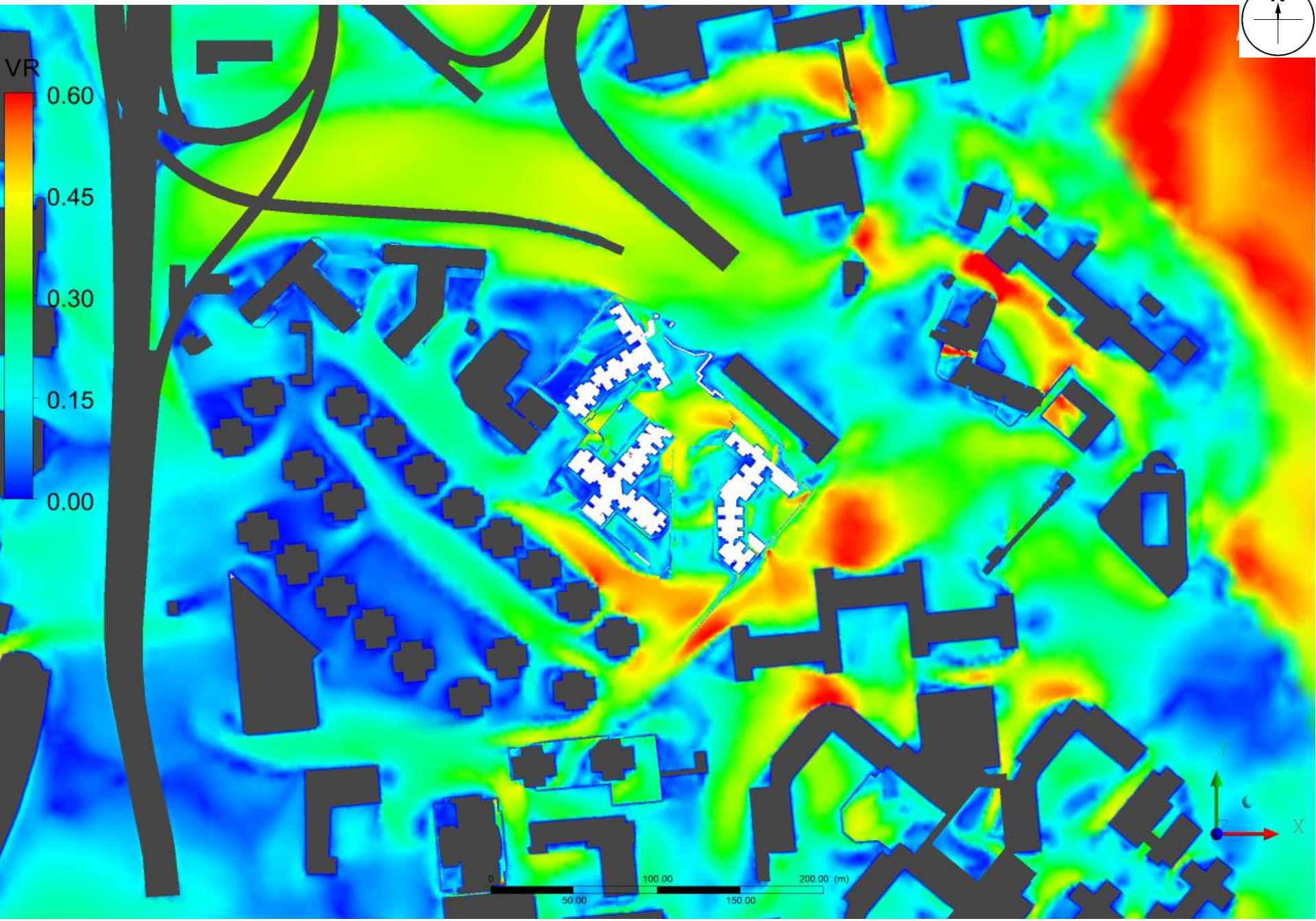
Baseline Scheme - Summer weighted wind speed colour at pedestrian level



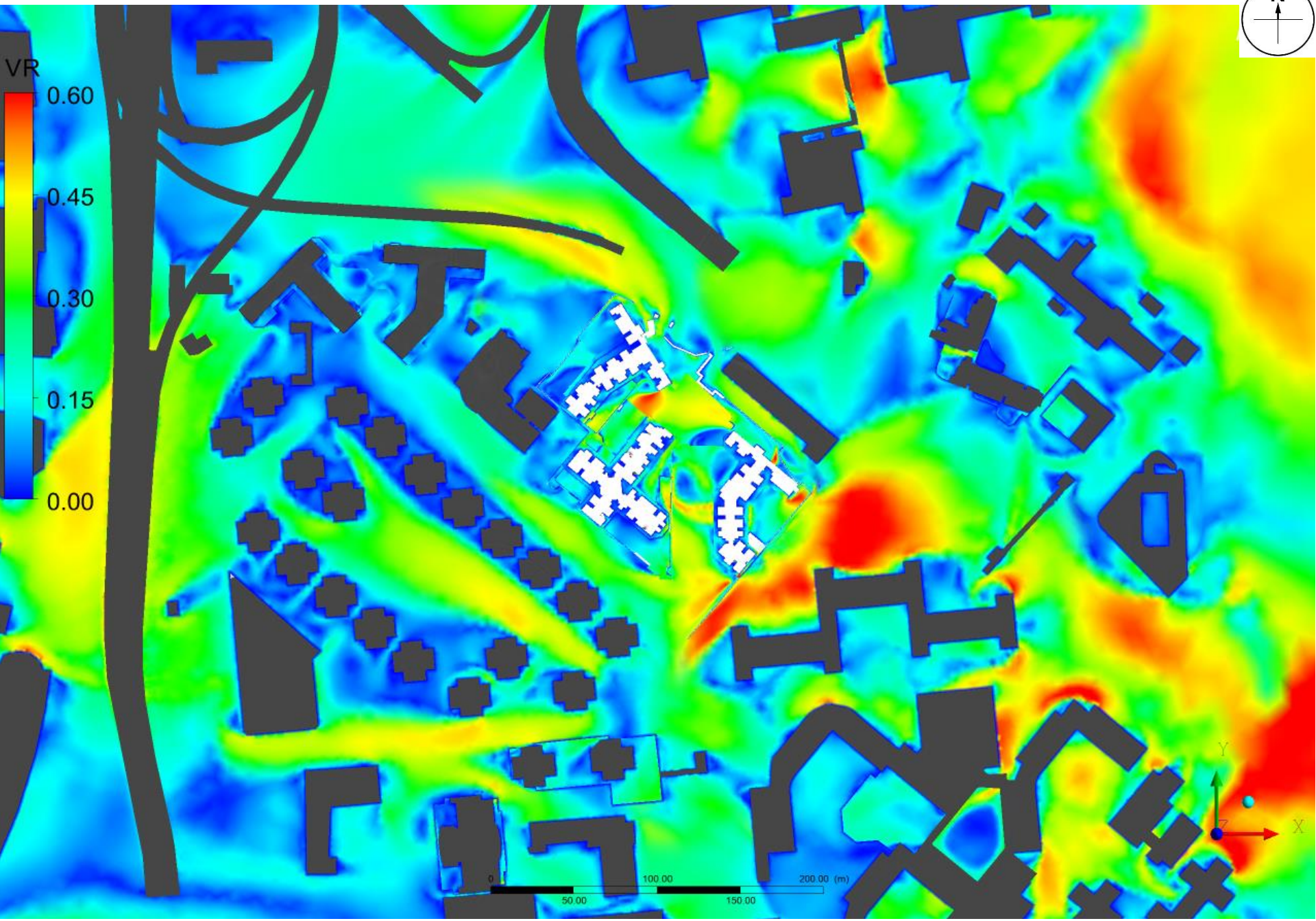
Proposed Scheme - Contour plot at pedestrian level under NNE Wind



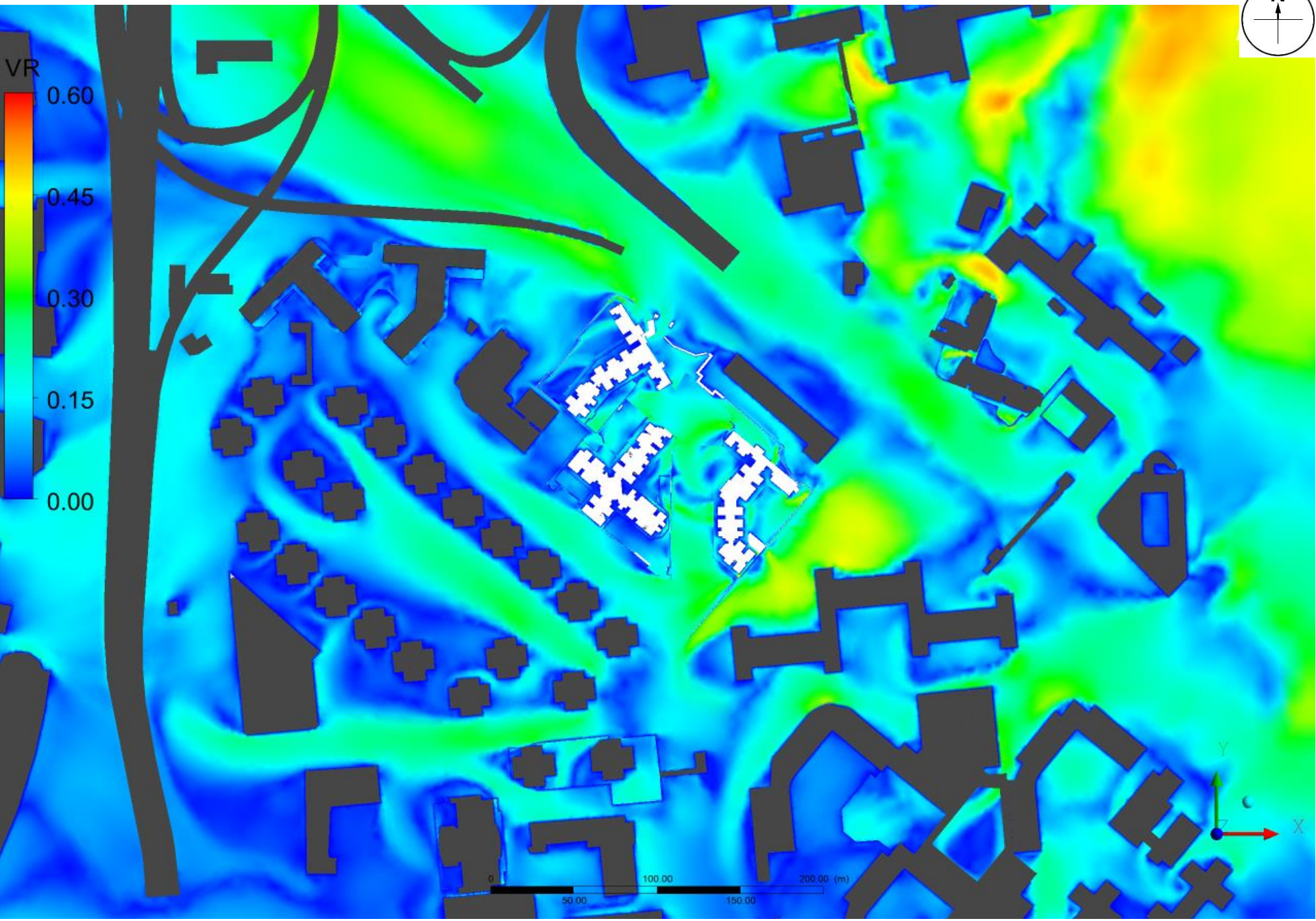
Proposed Scheme - Contour plot at pedestrian level under NE Wind



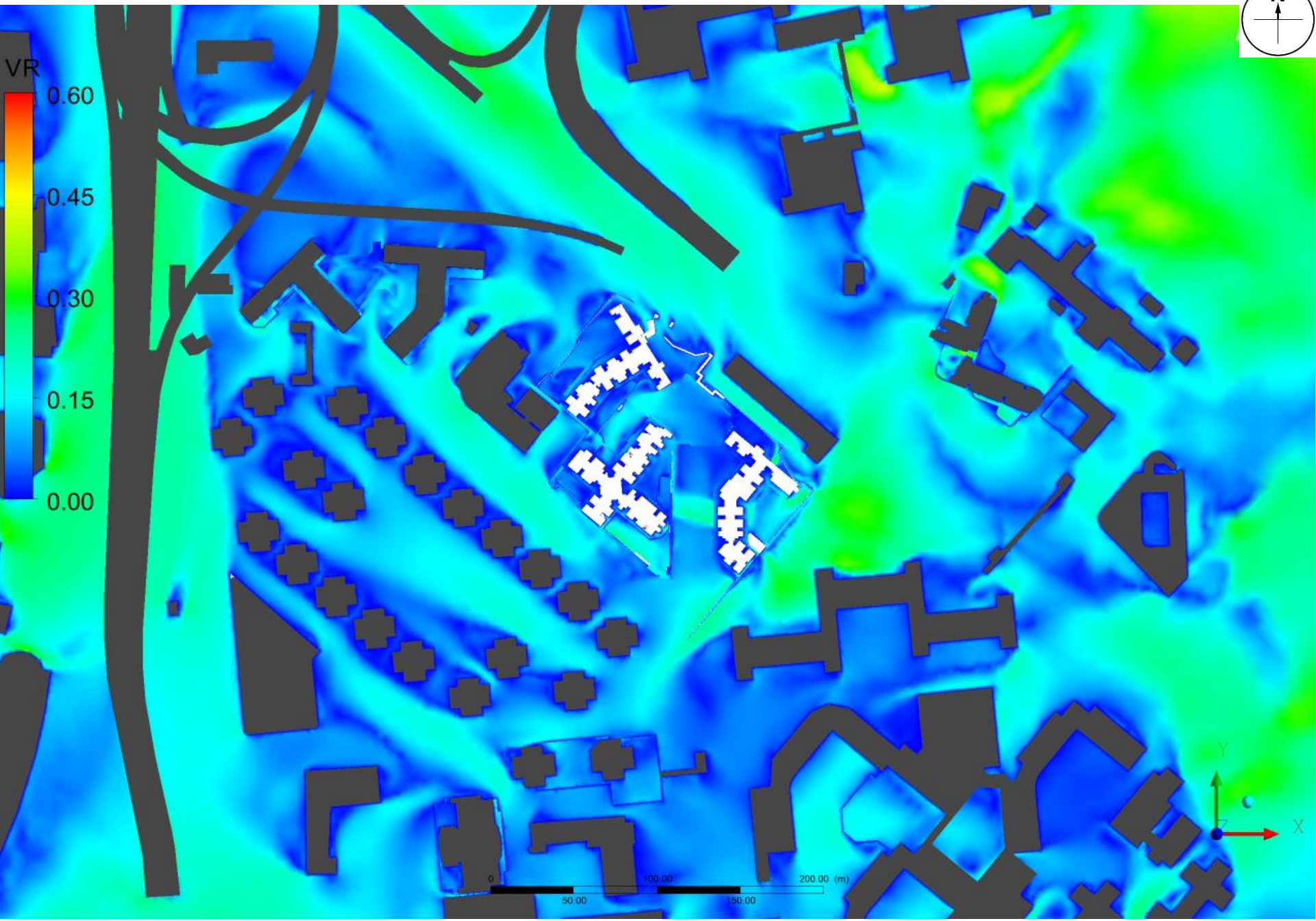
Proposed Scheme - Contour plot at pedestrian level under ENE Wind



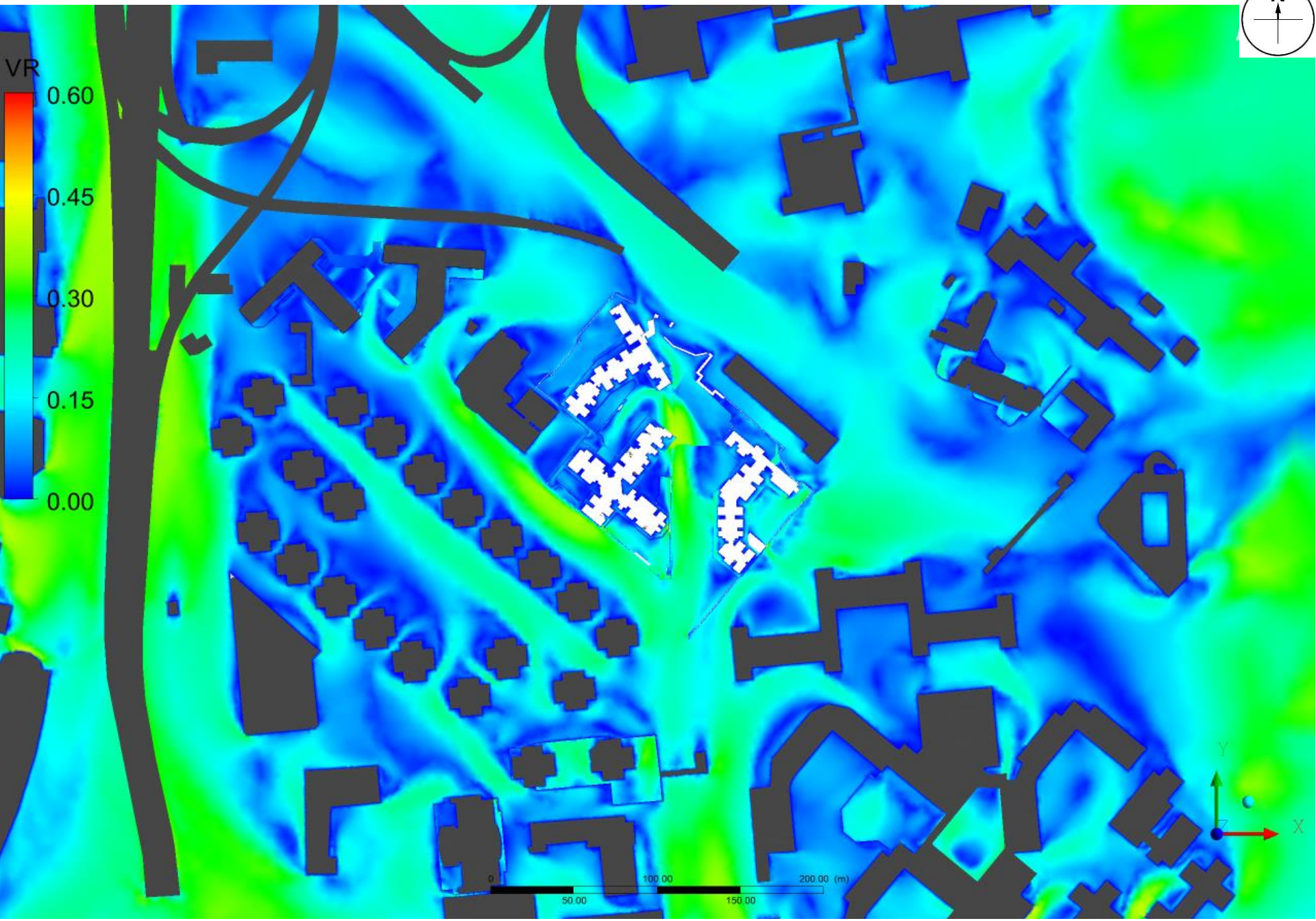
Proposed Scheme - Contour plot at pedestrian level under E Wind



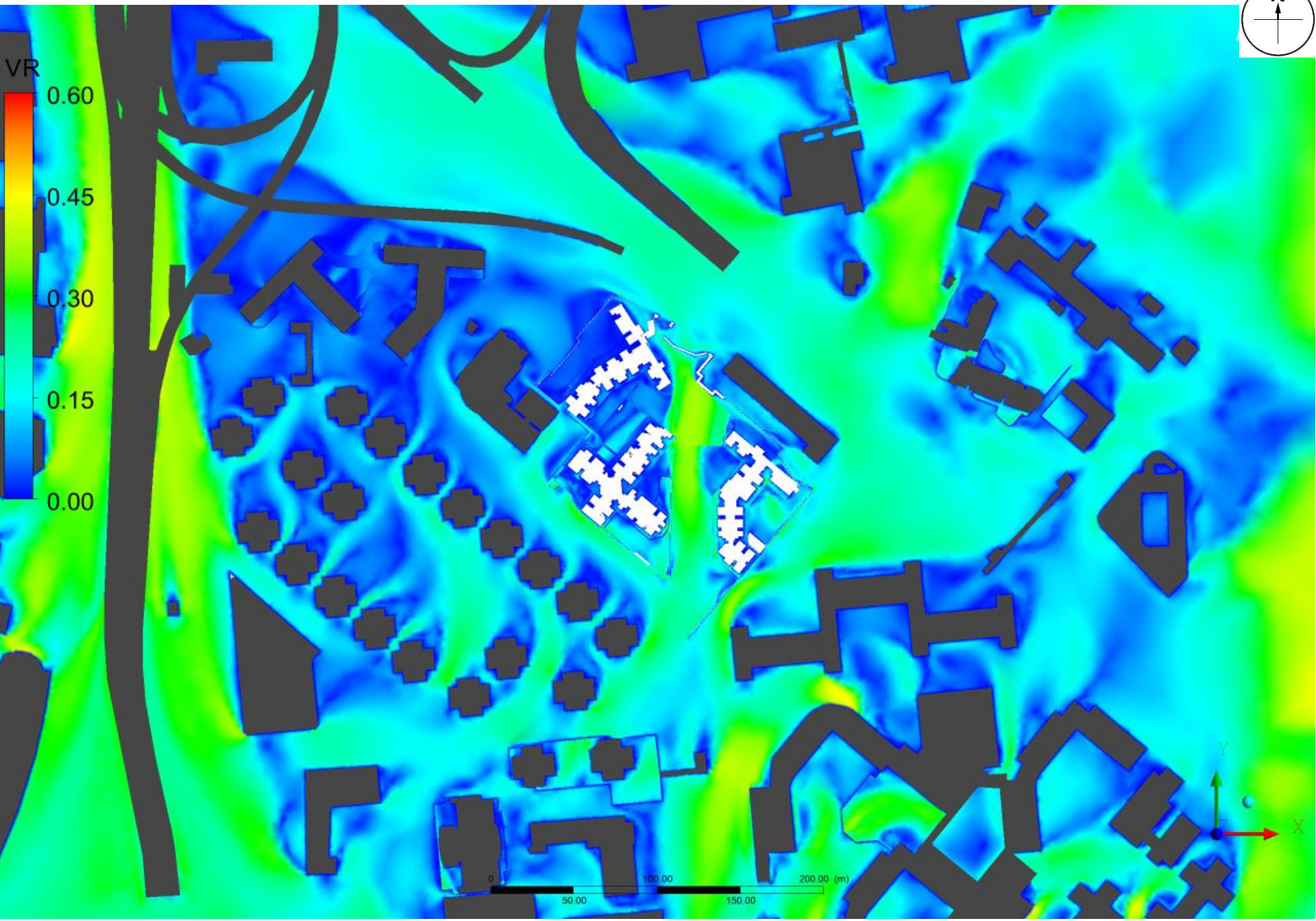
Proposed Scheme - Contour plot at pedestrian level under ESE Wind



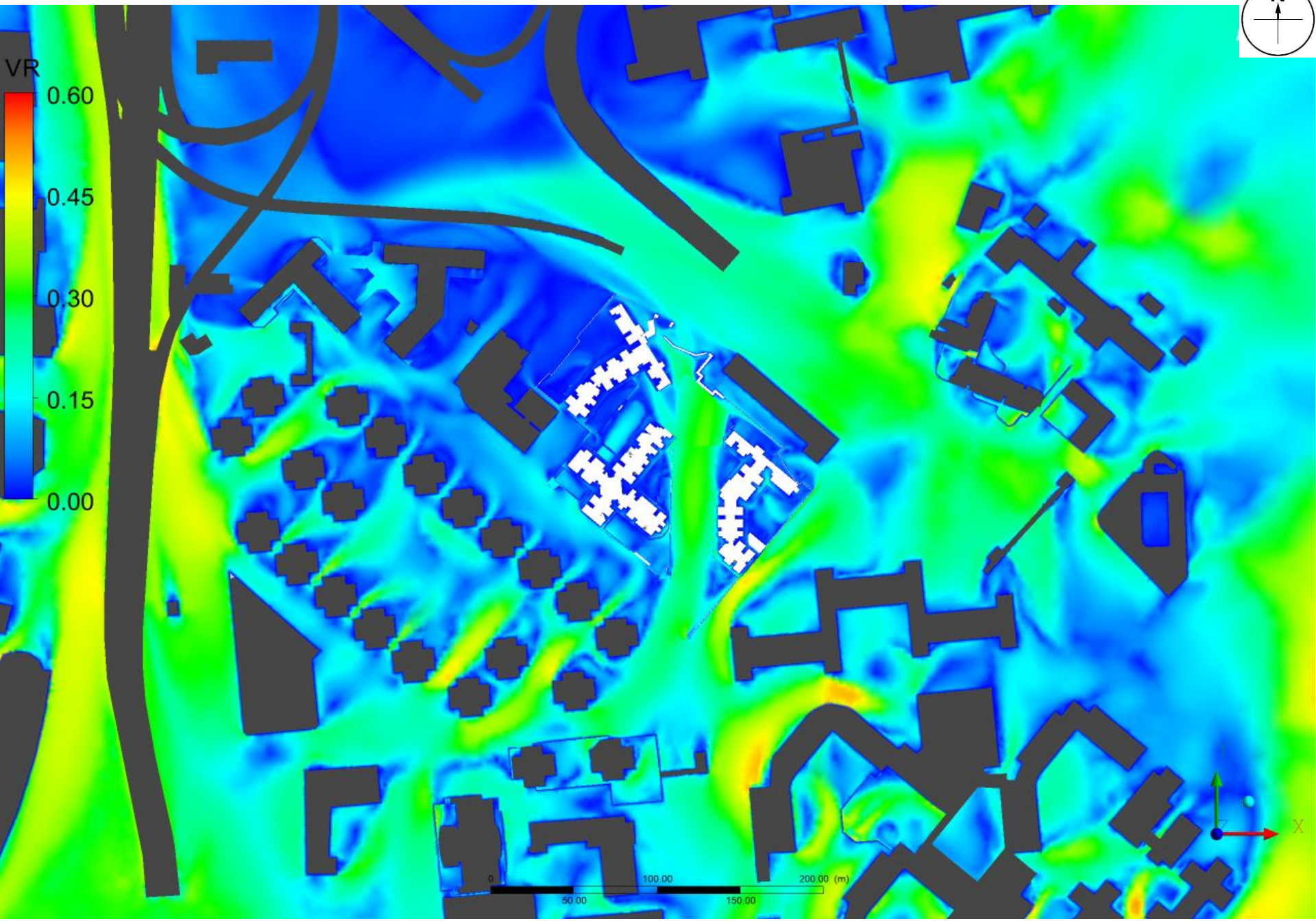
Proposed Scheme - Contour plot at pedestrian level under SE Wind



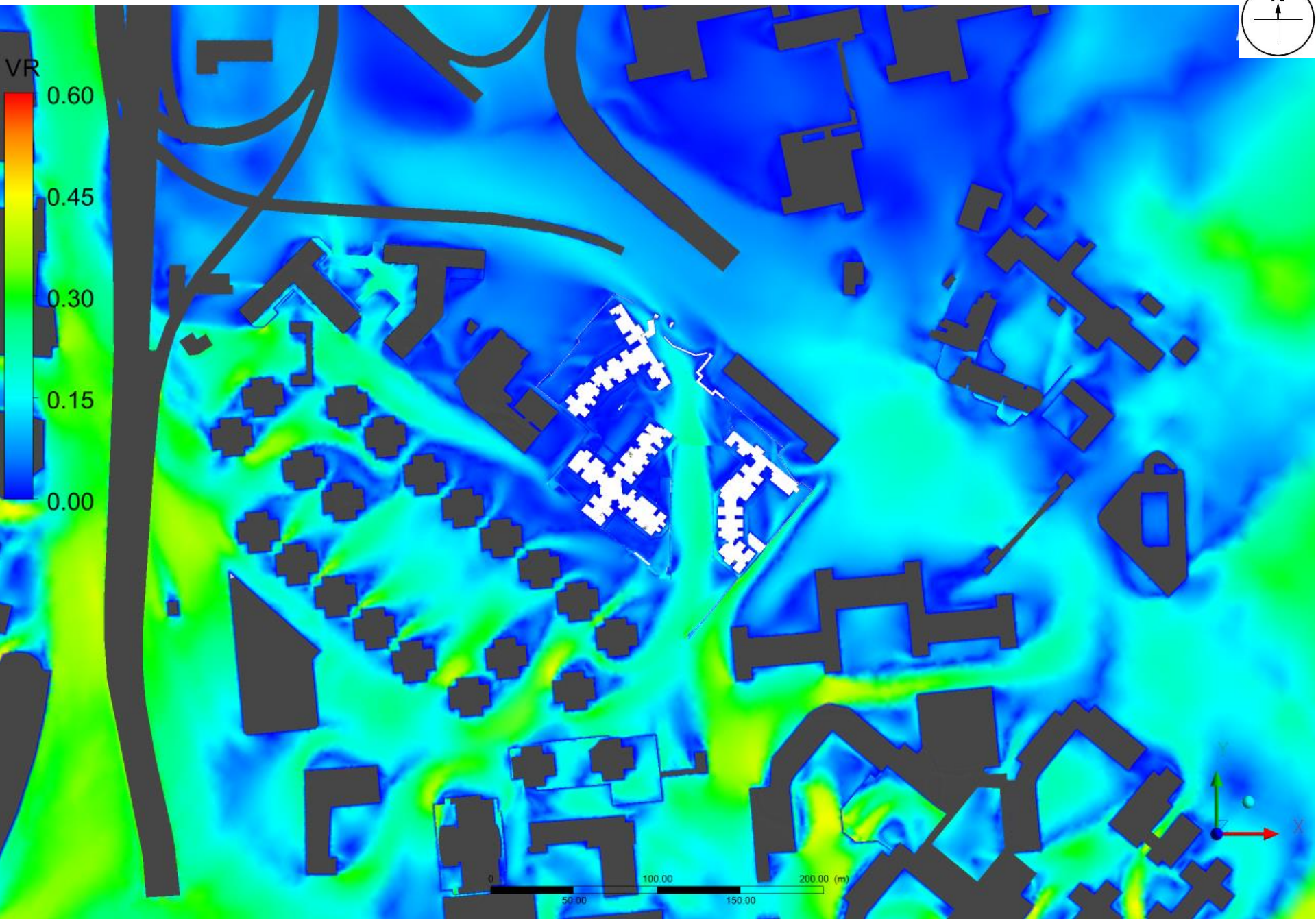
Proposed Scheme - Contour plot at pedestrian level under SSE Wind



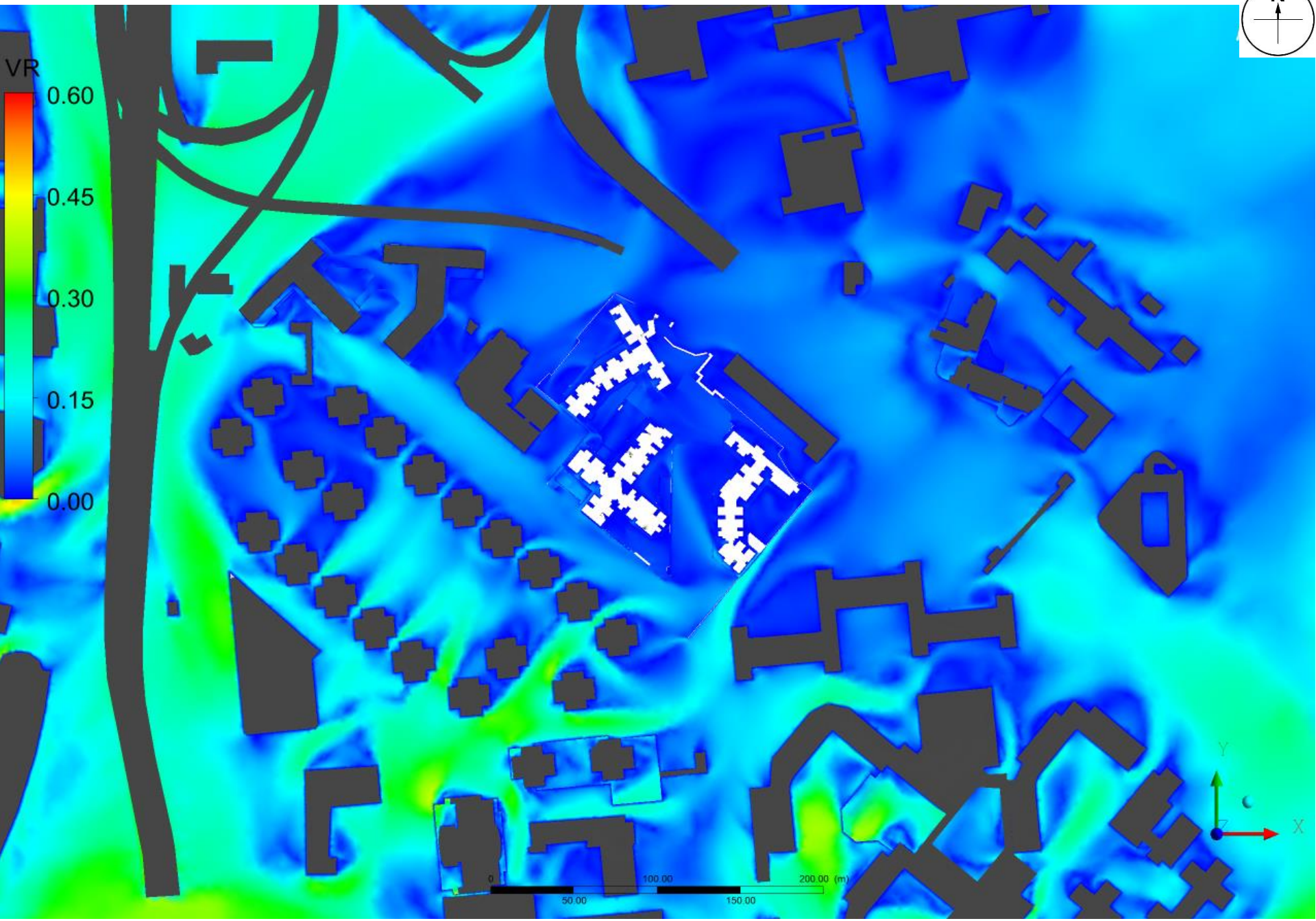
Proposed Scheme - Contour plot at pedestrian level under S Wind



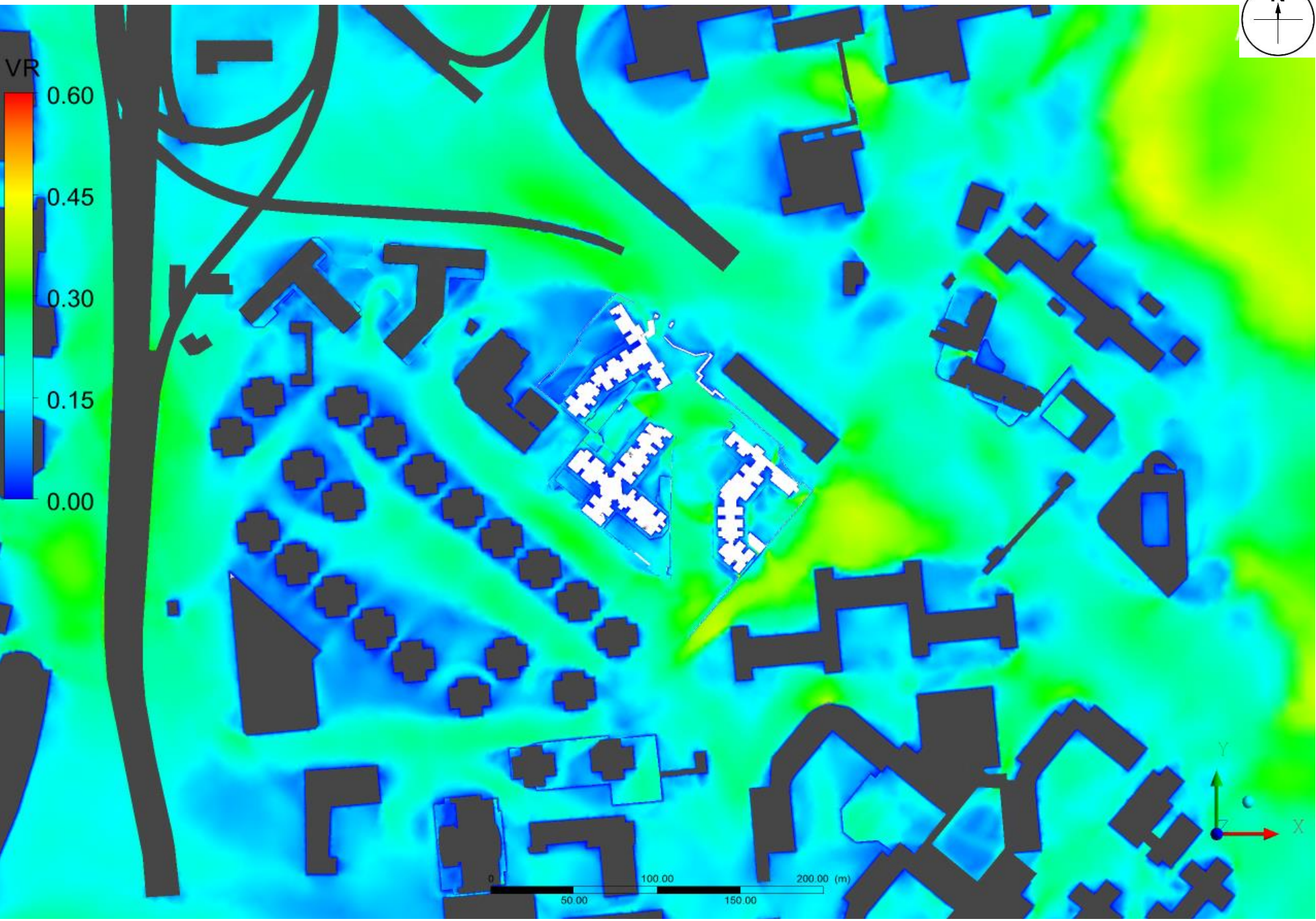
Proposed Scheme - Contour plot at pedestrian level under SSW Wind



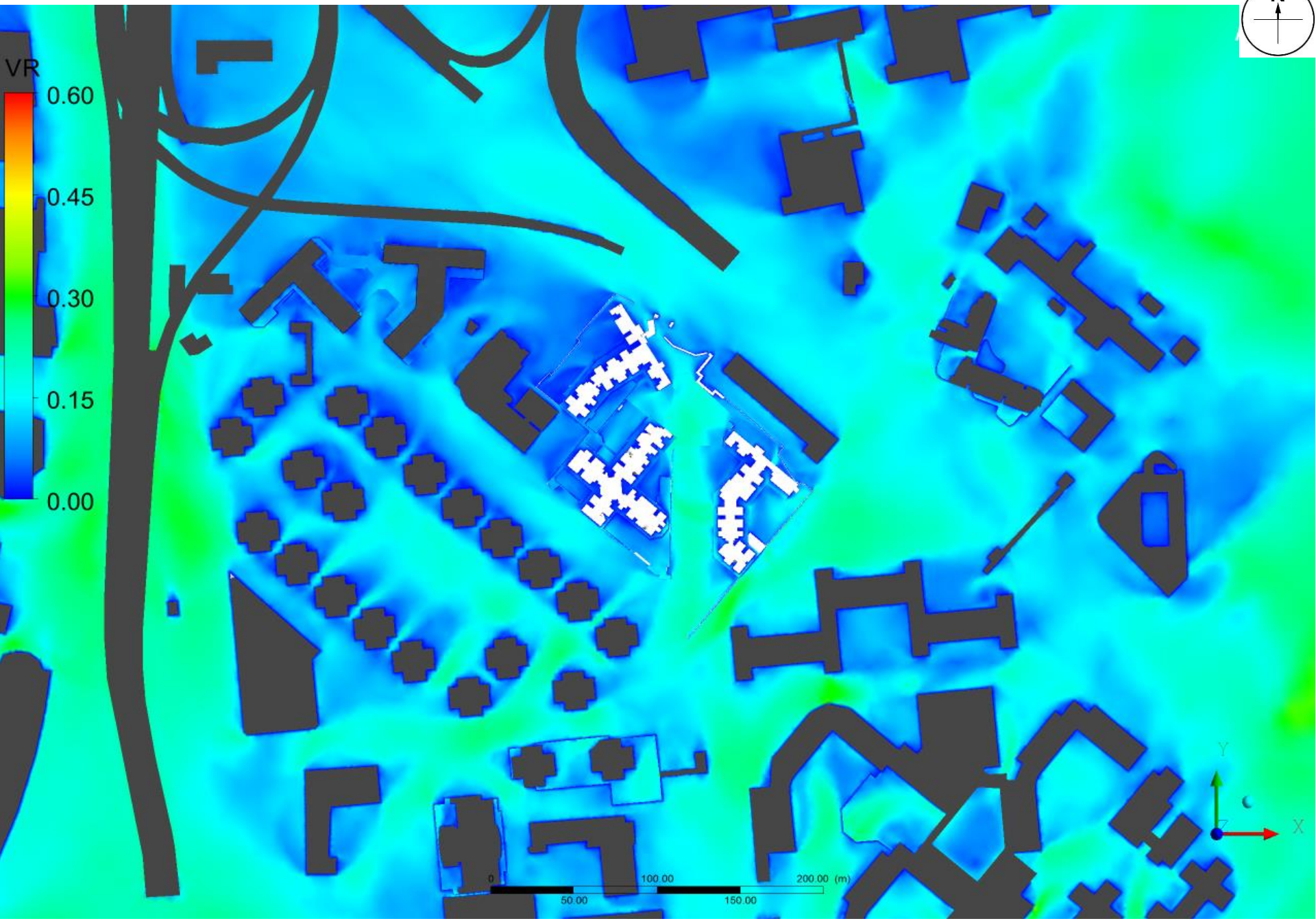
Proposed Scheme - Contour plot at pedestrian level under SW Wind



Proposed Scheme - Contour plot at pedestrian level under WSW Wind



Proposed Scheme – Annual weighted wind speed colour at pedestrian level



Proposed Scheme – Summer weighted wind speed colour at pedestrian level

Appendix 5

Detailed CFD Simulation Result for Selected Test Points

Baseline Scheme(VR)													
Test Point	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	Annual	Summer
P01	0.36	0.39	0.39	0.44	0.26	0.16	0.07	0.18	0.16	0.10	0.03	0.32	0.17
P02	0.40	0.35	0.20	0.27	0.12	0.11	0.15	0.21	0.19	0.08	0.02	0.22	0.14
P03	0.31	0.13	0.13	0.18	0.07	0.08	0.16	0.20	0.18	0.06	0.02	0.14	0.12
P04	0.14	0.05	0.09	0.18	0.07	0.10	0.15	0.18	0.15	0.03	0.02	0.11	0.10
P05	0.20	0.27	0.07	0.28	0.08	0.09	0.04	0.08	0.04	0.04	0.01	0.15	0.07
P06	0.03	0.14	0.08	0.09	0.03	0.06	0.04	0.02	0.01	0.01	0.00	0.06	0.03
P07	0.09	0.15	0.21	0.31	0.09	0.19	0.10	0.15	0.08	0.02	0.01	0.18	0.11
P08	0.17	0.21	0.22	0.31	0.11	0.17	0.17	0.23	0.07	0.03	0.02	0.19	0.12
P09	0.26	0.33	0.07	0.22	0.02	0.12	0.05	0.16	0.04	0.02	0.02	0.14	0.07
P10	0.18	0.17	0.06	0.14	0.03	0.10	0.08	0.12	0.15	0.04	0.03	0.11	0.08
P11	0.38	0.49	0.25	0.41	0.17	0.21	0.10	0.27	0.26	0.13	0.04	0.30	0.19
P12	0.04	0.06	0.07	0.07	0.04	0.03	0.03	0.05	0.05	0.04	0.01	0.05	0.04
P13	0.06	0.08	0.10	0.10	0.06	0.04	0.07	0.08	0.09	0.08	0.03	0.08	0.07
P14	0.16	0.14	0.10	0.07	0.04	0.06	0.13	0.29	0.43	0.32	0.20	0.13	0.22
P15	0.16	0.20	0.21	0.45	0.21	0.14	0.20	0.29	0.38	0.32	0.18	0.28	0.28
P16	0.33	0.45	0.43	0.56	0.28	0.22	0.17	0.18	0.22	0.22	0.10	0.38	0.24
P17	0.39	0.35	0.51	0.34	0.18	0.21	0.21	0.20	0.22	0.19	0.07	0.31	0.20
P18	0.35	0.34	0.52	0.28	0.07	0.16	0.23	0.25	0.24	0.16	0.09	0.27	0.18
P19	0.35	0.35	0.42	0.18	0.23	0.11	0.15	0.13	0.08	0.12	0.09	0.23	0.13
P20	0.34	0.38	0.19	0.23	0.17	0.02	0.23	0.19	0.12	0.11	0.07	0.20	0.14
P21	0.45	0.49	0.07	0.28	0.14	0.13	0.29	0.22	0.18	0.08	0.05	0.22	0.16
P22	0.34	0.38	0.11	0.33	0.17	0.14	0.34	0.26	0.16	0.10	0.05	0.23	0.18
P23	0.40	0.40	0.22	0.30	0.11	0.13	0.38	0.28	0.19	0.05	0.07	0.23	0.17
P24	0.44	0.42	0.15	0.30	0.03	0.16	0.39	0.26	0.15	0.11	0.06	0.22	0.17
P25	0.48	0.50	0.04	0.14	0.06	0.01	0.11	0.09	0.06	0.02	0.07	0.14	0.07
P26	0.27	0.26	0.07	0.05	0.06	0.06	0.09	0.10	0.04	0.01	0.05	0.09	0.05
P27	0.59	0.56	0.15	0.05	0.10	0.10	0.15	0.13	0.02	0.04	0.05	0.17	0.07
P28	0.11	0.06	0.13	0.08	0.06	0.07	0.10	0.09	0.06	0.07	0.06	0.08	0.07
P29	0.18	0.21	0.12	0.02	0.09	0.07	0.09	0.05	0.01	0.06	0.07	0.09	0.06
P30	0.16	0.20	0.09	0.03	0.09	0.07	0.08	0.04	0.00	0.05	0.04	0.08	0.05
P31	0.07	0.12	0.08	0.07	0.02	0.09	0.10	0.03	0.02	0.05	0.03	0.07	0.05
Average SVR	0.26	0.28	0.18	0.22	0.10	0.11	0.15	0.16	0.13	0.09	0.05	0.18	0.12
T001	0.39	0.41	0.41	0.27	0.29	0.10	0.13	0.17	0.14	0.12	0.06	0.28	0.15
T002	0.24	0.31	0.43	0.44	0.30	0.13	0.02	0.18	0.15	0.12	0.04	0.31	0.17
T003	0.33	0.32	0.35	0.42	0.30	0.22	0.17	0.20	0.17	0.13	0.03	0.31	0.19
T004	0.43	0.38	0.25	0.33	0.16	0.16	0.18	0.22	0.20	0.11	0.03	0.26	0.17
T005	0.40	0.26	0.23	0.31	0.06	0.15	0.19	0.21	0.19	0.10	0.05	0.22	0.15
T006	0.33	0.33	0.09	0.27	0.03	0.10	0.16	0.17	0.18	0.11	0.04	0.18	0.13
T007	0.25	0.22	0.08	0.17	0.05	0.10	0.14	0.19	0.24	0.12	0.05	0.14	0.13
T008	0.28	0.30	0.08	0.13	0.02	0.11	0.09	0.23	0.25	0.14	0.05	0.14	0.13
T009	0.32	0.35	0.23	0.08	0.04	0.22	0.16	0.27	0.32	0.18	0.06	0.19	0.17
T010	0.34	0.38	0.26	0.37	0.11	0.19	0.14	0.23	0.21	0.20	0.09	0.27	0.19
T011	0.34	0.44	0.33	0.43	0.14	0.15	0.15	0.21	0.26	0.19	0.10	0.30	0.20
T012	0.28	0.49	0.31	0.36	0.16	0.14	0.17	0.21	0.23	0.18	0.10	0.28	0.19
T013	0.20	0.47	0.18	0.31	0.07	0.12	0.15	0.18	0.27	0.17	0.08	0.23	0.17
T014	0.13	0.24	0.32	0.43	0.16	0.15	0.04	0.04	0.21	0.12	0.14	0.26	0.16
T015	0.18	0.25	0.29	0.21	0.19	0.11	0.09	0.18	0.29	0.07	0.08	0.21	0.15
T016	0.13	0.29	0.37	0.12	0.24	0.21	0.06	0.19	0.21	0.10	0.06	0.21	0.15
T017	0.28	0.36	0.16	0.09	0.24	0.16	0.04	0.09	0.10	0.03	0.05	0.17	0.10
T018	0.18	0.47	0.07	0.10	0.26	0.28	0.15	0.11	0.23	0.12	0.04	0.19	0.16
T019	0.33	0.29	0.07	0.07	0.23	0.18	0.14	0.14	0.27	0.12	0.03	0.17	0.15
T020	0.16	0.37	0.14	0.21	0.25	0.16	0.13	0.30	0.35	0.14	0.08	0.22	0.21
T021	0.17	0.29	0.10	0.16	0.17	0.01	0.14	0.13	0.26	0.13	0.05	0.15	0.14
T022	0.27	0.13	0.33	0.30	0.19	0.07	0.02	0.16	0.21	0.10	0.04	0.22	0.14
T023	0.13	0.06	0.30	0.26	0.20	0.15	0.15	0.27	0.22	0.09	0.01	0.20	0.16
T024	0.04	0.28	0.29	0.18	0.22	0.08	0.18	0.33	0.08	0.08	0.01	0.18	0.13
T025	0.06	0.33	0.25	0.20	0.16	0.06	0.15	0.31	0.08	0.05	0.04	0.17	0.12
T026	0.18	0.33	0.22	0.27	0.16	0.13	0.06	0.28	0.10	0.02	0.01	0.20	0.12
T027	0.20	0.26	0.26	0.13	0.20	0.14	0.13	0.25	0.01	0.01	0.07	0.16	0.10
T028	0.15	0.15	0.29	0.13	0.12	0.17	0.24	0.26	0.01	0.05	0.11	0.14	0.12
T029	0.26	0.02	0.09	0.07	0.06	0.17	0.24	0.20	0.02	0.06	0.10	0.09	0.10
T030	0.28	0.25	0.10	0.10	0.08	0.12	0.09	0.05	0.05	0.01	0.02	0.12	0.06
T031	0.33	0.34	0.37	0.39	0.24	0.08	0.16	0.17	0.14	0.03	0.01	0.27	0.14
T032	0.21	0.41	0.11	0.30	0.11	0.10	0.09	0.06	0.09	0.01	0.03	0.19	0.09
T033	0.11	0.14	0.11	0.13	0.10	0.13	0.19	0.06	0.05	0.01	0.01	0.11	0.08
T034	0.31	0.45	0.22	0.09	0.15	0.09	0.11	0.12	0.12	0.03	0.03	0.17	0.09

Baseline Scheme(VR)													
Test Point	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	Annual	Summer
T035	0.05	0.19	0.20	0.14	0.10	0.09	0.13	0.19	0.18	0.05	0.03	0.13	0.11
T036	0.13	0.23	0.09	0.10	0.04	0.03	0.15	0.09	0.16	0.06	0.02	0.10	0.08
T037	0.25	0.23	0.32	0.28	0.30	0.19	0.16	0.34	0.36	0.03	0.05	0.25	0.20
T038	0.09	0.36	0.37	0.23	0.29	0.13	0.08	0.18	0.15	0.12	0.06	0.24	0.15
T039	0.46	0.16	0.41	0.20	0.34	0.18	0.16	0.20	0.06	0.10	0.02	0.25	0.15
T040	0.19	0.22	0.40	0.22	0.28	0.13	0.00	0.18	0.13	0.13	0.01	0.23	0.13
T041	0.36	0.03	0.39	0.20	0.34	0.16	0.11	0.21	0.03	0.05	0.13	0.21	0.14
T042	0.41	0.36	0.36	0.24	0.21	0.03	0.11	0.15	0.13	0.10	0.04	0.24	0.12
T043	0.39	0.21	0.15	0.05	0.06	0.11	0.08	0.07	0.13	0.21	0.09	0.14	0.11
T044	0.30	0.48	0.02	0.02	0.05	0.07	0.01	0.05	0.25	0.24	0.11	0.13	0.12
T045	0.33	0.57	0.19	0.13	0.10	0.08	0.18	0.05	0.10	0.21	0.13	0.19	0.12
T046	0.14	0.22	0.13	0.06	0.01	0.01	0.05	0.05	0.08	0.28	0.12	0.10	0.10
T047	0.21	0.14	0.17	0.17	0.09	0.14	0.18	0.03	0.09	0.10	0.13	0.14	0.11
T048	0.22	0.18	0.19	0.10	0.06	0.08	0.01	0.02	0.03	0.20	0.11	0.13	0.08
T049	0.32	0.27	0.22	0.21	0.15	0.18	0.26	0.08	0.09	0.12	0.13	0.20	0.14
T050	0.30	0.32	0.21	0.09	0.07	0.09	0.03	0.04	0.03	0.00	0.10	0.13	0.05
T051	0.39	0.39	0.14	0.25	0.11	0.18	0.31	0.12	0.08	0.15	0.11	0.21	0.16
T052	0.33	0.32	0.26	0.11	0.12	0.14	0.05	0.02	0.03	0.03	0.09	0.16	0.07
T053	0.49	0.51	0.27	0.26	0.15	0.14	0.31	0.18	0.07	0.12	0.09	0.25	0.15
T054	0.37	0.26	0.18	0.17	0.13	0.17	0.11	0.08	0.07	0.04	0.07	0.17	0.10
T055	0.36	0.42	0.40	0.22	0.15	0.17	0.24	0.14	0.08	0.07	0.03	0.24	0.13
T056	0.44	0.46	0.45	0.26	0.15	0.10	0.21	0.13	0.15	0.06	0.10	0.27	0.14
T057	0.40	0.41	0.49	0.25	0.15	0.08	0.18	0.03	0.06	0.08	0.11	0.25	0.11
T058	0.29	0.31	0.48	0.25	0.12	0.14	0.18	0.04	0.07	0.02	0.15	0.23	0.11
T059	0.22	0.25	0.40	0.30	0.15	0.12	0.20	0.27	0.21	0.20	0.07	0.25	0.19
T060	0.31	0.35	0.15	0.26	0.14	0.03	0.19	0.14	0.16	0.17	0.09	0.20	0.15
T061	0.25	0.23	0.21	0.24	0.13	0.14	0.15	0.15	0.20	0.16	0.14	0.20	0.16
T062	0.20	0.28	0.11	0.32	0.14	0.05	0.15	0.17	0.13	0.10	0.09	0.19	0.14
T063	0.19	0.15	0.07	0.14	0.05	0.08	0.15	0.15	0.19	0.24	0.05	0.13	0.14
T064	0.13	0.18	0.11	0.13	0.06	0.06	0.19	0.17	0.18	0.19	0.17	0.12	0.15
T065	0.16	0.15	0.25	0.26	0.09	0.08	0.29	0.33	0.24	0.24	0.06	0.19	0.20
T066	0.13	0.15	0.18	0.26	0.11	0.07	0.30	0.20	0.16	0.20	0.05	0.17	0.17
T067	0.08	0.25	0.29	0.12	0.07	0.17	0.06	0.12	0.04	0.27	0.36	0.16	0.16
T068	0.08	0.08	0.31	0.11	0.06	0.12	0.10	0.06	0.06	0.07	0.06	0.12	0.08
T069	0.09	0.08	0.29	0.13	0.06	0.13	0.07	0.12	0.08	0.06	0.10	0.13	0.09
T070	0.16	0.28	0.38	0.06	0.18	0.05	0.21	0.38	0.45	0.37	0.12	0.21	0.25
T071	0.15	0.19	0.30	0.33	0.09	0.06	0.27	0.26	0.32	0.36	0.13	0.23	0.24
T072	0.12	0.30	0.27	0.04	0.15	0.04	0.20	0.22	0.29	0.33	0.15	0.17	0.20
T073	0.32	0.41	0.23	0.49	0.18	0.08	0.17	0.26	0.33	0.32	0.15	0.32	0.26
T074	0.26	0.43	0.35	0.53	0.25	0.10	0.18	0.31	0.34	0.08	0.03	0.33	0.22
T075	0.09	0.15	0.37	0.41	0.25	0.13	0.05	0.07	0.23	0.04	0.08	0.26	0.15
T076	0.30	0.40	0.53	0.57	0.36	0.25	0.17	0.22	0.08	0.14	0.06	0.39	0.21
T077	0.29	0.45	0.38	0.43	0.26	0.19	0.15	0.24	0.16	0.03	0.08	0.31	0.17
T078	0.30	0.45	0.52	0.60	0.28	0.27	0.21	0.21	0.12	0.14	0.08	0.39	0.22
T079	0.18	0.31	0.58	0.63	0.37	0.30	0.25	0.28	0.17	0.14	0.08	0.41	0.26
T080	0.24	0.47	0.41	0.53	0.25	0.20	0.21	0.24	0.26	0.18	0.06	0.36	0.23
T081	0.20	0.42	0.45	0.55	0.25	0.24	0.21	0.24	0.22	0.10	0.07	0.36	0.22
T082	0.27	0.55	0.28	0.43	0.11	0.18	0.18	0.21	0.21	0.14	0.03	0.29	0.18
T083	0.14	0.19	0.20	0.11	0.12	0.04	0.05	0.02	0.12	0.01	0.01	0.12	0.06
T084	0.06	0.11	0.13	0.30	0.16	0.10	0.03	0.08	0.06	0.13	0.03	0.16	0.11
T085	0.17	0.05	0.11	0.03	0.07	0.04	0.16	0.03	0.04	0.12	0.01	0.07	0.07
T086	0.04	0.16	0.13	0.19	0.08	0.06	0.06	0.07	0.13	0.10	0.08	0.13	0.10
T087	0.12	0.15	0.12	0.09	0.09	0.08	0.06	0.03	0.07	0.08	0.05	0.10	0.07
T088	0.22	0.32	0.31	0.12	0.03	0.04	0.07	0.17	0.26	0.15	0.09	0.17	0.13
T089	0.14	0.19	0.39	0.34	0.19	0.01	0.04	0.07	0.11	0.09	0.06	0.22	0.11
T090	0.18	0.16	0.58	0.41	0.25	0.08	0.17	0.45	0.52	0.39	0.24	0.34	0.33
T091	0.15	0.21	0.46	0.26	0.17	0.03	0.18	0.27	0.27	0.26	0.12	0.24	0.20
T092	0.11	0.20	0.36	0.13	0.11	0.07	0.21	0.26	0.31	0.33	0.13	0.19	0.21
T093	0.04	0.06	0.17	0.09	0.11	0.08	0.12	0.12	0.02	0.21	0.15	0.10	0.12
T094	0.11	0.06	0.25	0.24	0.18	0.07	0.08	0.13	0.16	0.05	0.11	0.16	0.12
T095	0.17	0.05	0.08	0.03	0.04	0.07	0.10	0.22	0.22	0.21	0.24	0.09	0.16
T096	0.15	0.08	0.32	0.33	0.19	0.12	0.10	0.24	0.23	0.24	0.26	0.23	0.22
T097	0.04	0.03	0.25	0.05	0.03	0.08	0.06	0.22	0.07	0.07	0.07	0.08	0.08
T098	0.11	0.09	0.30	0.39	0.23	0.14	0.10	0.17	0.17	0.20	0.27	0.24	0.21
T099	0.02	0.09	0.21	0.38	0.22	0.08	0.08	0.16	0.23	0.24	0.25	0.22	0.21
T100	0.09	0.02	0.21	0.18	0.08	0.06	0.11	0.14	0.28	0.22	0.27	0.15	0.18

Baseline Scheme(VR)													
Test Point	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	Annual	Summer
T101	0.06	0.15	0.23	0.40	0.23	0.12	0.26	0.16	0.17	0.23	0.13	0.24	0.21
T102	0.02	0.09	0.30	0.40	0.22	0.15	0.19	0.21	0.25	0.03	0.17	0.23	0.19
T103	0.11	0.04	0.24	0.28	0.16	0.11	0.15	0.12	0.06	0.21	0.11	0.18	0.15
T104	0.10	0.16	0.05	0.08	0.05	0.04	0.02	0.21	0.39	0.29	0.07	0.12	0.17
T105	0.17	0.08	0.07	0.09	0.03	0.04	0.05	0.13	0.13	0.18	0.22	0.09	0.12
T106	0.21	0.24	0.10	0.45	0.24	0.17	0.23	0.19	0.26	0.22	0.09	0.26	0.23
T107	0.21	0.17	0.05	0.16	0.01	0.05	0.07	0.13	0.14	0.21	0.16	0.12	0.13
T108	0.10	0.10	0.12	0.38	0.22	0.13	0.24	0.19	0.13	0.12	0.09	0.20	0.18
T109	0.33	0.29	0.04	0.38	0.18	0.15	0.11	0.07	0.14	0.19	0.12	0.23	0.17
T110	0.14	0.12	0.02	0.04	0.03	0.03	0.02	0.04	0.01	0.06	0.04	0.05	0.03
T111	0.14	0.18	0.02	0.19	0.04	0.03	0.03	0.05	0.04	0.02	0.04	0.10	0.05
T112	0.32	0.34	0.05	0.32	0.15	0.12	0.07	0.05	0.22	0.21	0.14	0.22	0.17
T113	0.16	0.14	0.13	0.30	0.19	0.11	0.24	0.20	0.22	0.14	0.12	0.19	0.19
T114	0.07	0.05	0.11	0.08	0.12	0.06	0.17	0.18	0.13	0.15	0.08	0.09	0.12
T115	0.10	0.12	0.04	0.29	0.15	0.10	0.14	0.06	0.03	0.04	0.02	0.14	0.09
T116	0.10	0.06	0.02	0.34	0.17	0.14	0.08	0.07	0.15	0.14	0.03	0.16	0.14
T117	0.04	0.05	0.04	0.05	0.08	0.06	0.09	0.06	0.01	0.11	0.01	0.05	0.06
T118	0.10	0.21	0.06	0.10	0.04	0.06	0.10	0.05	0.08	0.07	0.03	0.09	0.07
T119	0.16	0.04	0.07	0.15	0.12	0.12	0.19	0.09	0.26	0.21	0.02	0.13	0.15
T120	0.25	0.17	0.09	0.20	0.18	0.18	0.19	0.34	0.39	0.11	0.05	0.18	0.20
T121	0.17	0.25	0.41	0.19	0.13	0.18	0.12	0.32	0.38	0.06	0.05	0.22	0.18
T122	0.05	0.21	0.49	0.44	0.21	0.08	0.16	0.15	0.22	0.06	0.05	0.27	0.17
T123	0.17	0.09	0.33	0.30	0.07	0.06	0.14	0.06	0.02	0.04	0.01	0.17	0.08
T124	0.24	0.36	0.07	0.36	0.16	0.13	0.17	0.04	0.02	0.07	0.04	0.20	0.11
T125	0.18	0.23	0.06	0.07	0.07	0.07	0.16	0.04	0.01	0.05	0.03	0.09	0.06
T126	0.17	0.33	0.22	0.01	0.14	0.17	0.17	0.10	0.01	0.08	0.06	0.13	0.08
T127	0.17	0.33	0.17	0.04	0.11	0.10	0.04	0.09	0.02	0.07	0.05	0.12	0.06
T128	0.51	0.58	0.25	0.30	0.14	0.06	0.14	0.08	0.02	0.05	0.04	0.25	0.09
T129	0.35	0.37	0.08	0.07	0.12	0.08	0.09	0.07	0.04	0.07	0.02	0.13	0.07
T130	0.25	0.18	0.22	0.05	0.11	0.14	0.13	0.09	0.03	0.06	0.01	0.12	0.07
T131	0.19	0.34	0.18	0.16	0.11	0.10	0.06	0.04	0.04	0.09	0.05	0.16	0.08
T132	0.32	0.41	0.08	0.06	0.03	0.05	0.07	0.06	0.01	0.03	0.03	0.11	0.04
Average LVR	0.22	0.26	0.22	0.23	0.14	0.11	0.14	0.16	0.15	0.12	0.08	0.19	0.14

Proposed Scheme(VR)													
Test Point	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	Annual	Summer
P01	0.31	0.36	0.44	0.34	0.26	0.12	0.06	0.18	0.14	0.10	0.06	0.28	0.15
P02	0.37	0.30	0.30	0.24	0.19	0.09	0.03	0.15	0.10	0.06	0.00	0.21	0.10
P03	0.03	0.16	0.18	0.26	0.10	0.11	0.10	0.19	0.16	0.10	0.01	0.16	0.12
P04	0.09	0.06	0.11	0.13	0.07	0.04	0.02	0.21	0.18	0.06	0.01	0.10	0.09
P05	0.21	0.22	0.20	0.08	0.17	0.04	0.06	0.13	0.17	0.06	0.05	0.13	0.10
P06	0.04	0.17	0.05	0.08	0.03	0.06	0.03	0.04	0.05	0.02	0.01	0.07	0.04
P07	0.11	0.22	0.18	0.34	0.10	0.20	0.09	0.12	0.13	0.04	0.02	0.20	0.12
P08	0.16	0.27	0.24	0.39	0.14	0.20	0.13	0.12	0.11	0.02	0.03	0.23	0.13
P09	0.19	0.25	0.12	0.14	0.09	0.08	0.08	0.10	0.06	0.03	0.01	0.12	0.07
P10	0.23	0.22	0.07	0.14	0.02	0.10	0.08	0.19	0.08	0.08	0.01	0.11	0.08
P11	0.07	0.06	0.18	0.28	0.10	0.13	0.06	0.11	0.14	0.10	0.04	0.16	0.12
P12	0.14	0.13	0.18	0.16	0.11	0.07	0.07	0.09	0.13	0.10	0.06	0.14	0.10
P13	0.11	0.10	0.18	0.12	0.11	0.06	0.09	0.10	0.11	0.10	0.06	0.12	0.10
P14	0.26	0.24	0.21	0.25	0.11	0.06	0.10	0.16	0.37	0.28	0.17	0.21	0.21
P15	0.12	0.11	0.19	0.27	0.13	0.08	0.10	0.16	0.22	0.18	0.09	0.18	0.16
P16	0.09	0.09	0.10	0.12	0.07	0.05	0.04	0.04	0.05	0.05	0.02	0.09	0.05
P17	0.32	0.26	0.58	0.50	0.31	0.22	0.20	0.16	0.21	0.17	0.09	0.37	0.22
P18	0.35	0.39	0.54	0.37	0.23	0.14	0.22	0.24	0.26	0.19	0.11	0.33	0.22
P19	0.36	0.40	0.52	0.44	0.29	0.11	0.16	0.15	0.01	0.08	0.09	0.32	0.15
P20	0.35	0.41	0.22	0.05	0.03	0.07	0.22	0.20	0.14	0.04	0.05	0.14	0.09
P21	0.28	0.31	0.05	0.11	0.07	0.07	0.17	0.15	0.09	0.02	0.04	0.12	0.08
P22	0.37	0.42	0.05	0.24	0.15	0.14	0.29	0.25	0.12	0.03	0.07	0.19	0.15
P23	0.45	0.45	0.24	0.13	0.07	0.13	0.12	0.26	0.14	0.06	0.07	0.19	0.12
P24	0.34	0.30	0.18	0.12	0.05	0.18	0.08	0.21	0.17	0.10	0.07	0.16	0.12
P25	0.49	0.55	0.09	0.12	0.08	0.02	0.02	0.06	0.07	0.06	0.06	0.16	0.06
P26	0.11	0.09	0.07	0.13	0.05	0.08	0.07	0.10	0.05	0.03	0.03	0.08	0.06
P27	0.50	0.54	0.18	0.13	0.07	0.10	0.06	0.10	0.08	0.04	0.05	0.19	0.07
P28	0.08	0.03	0.17	0.10	0.12	0.14	0.06	0.12	0.08	0.06	0.05	0.10	0.09
P29	0.19	0.23	0.06	0.14	0.12	0.10	0.10	0.06	0.02	0.04	0.03	0.12	0.07
P30	0.09	0.24	0.06	0.14	0.09	0.11	0.09	0.04	0.02	0.04	0.04	0.10	0.07
P31	0.10	0.15	0.05	0.07	0.01	0.05	0.09	0.02	0.02	0.04	0.02	0.06	0.04
Average SVR	0.22	0.25	0.19	0.20	0.11	0.10	0.10	0.14	0.12	0.08	0.05	0.17	0.11
T001	0.41	0.49	0.36	0.46	0.30	0.08	0.13	0.08	0.10	0.13	0.05	0.32	0.16
T002	0.30	0.39	0.41	0.46	0.30	0.10	0.12	0.13	0.11	0.13	0.06	0.32	0.17
T003	0.36	0.40	0.38	0.43	0.28	0.17	0.06	0.17	0.15	0.13	0.07	0.32	0.18
T004	0.37	0.47	0.32	0.36	0.19	0.18	0.17	0.21	0.20	0.10	0.02	0.29	0.17
T005	0.14	0.23	0.28	0.13	0.17	0.18	0.19	0.16	0.19	0.10	0.04	0.18	0.14
T006	0.26	0.36	0.20	0.16	0.18	0.13	0.15	0.13	0.17	0.11	0.05	0.19	0.14
T007	0.20	0.25	0.13	0.22	0.11	0.14	0.12	0.16	0.25	0.11	0.05	0.18	0.14
T008	0.27	0.31	0.05	0.21	0.03	0.11	0.10	0.20	0.29	0.11	0.05	0.16	0.14
T009	0.32	0.35	0.25	0.42	0.10	0.21	0.17	0.26	0.28	0.16	0.06	0.28	0.20
T010	0.33	0.35	0.34	0.36	0.22	0.23	0.17	0.21	0.09	0.19	0.07	0.29	0.18
T011	0.30	0.34	0.34	0.21	0.21	0.18	0.16	0.20	0.21	0.18	0.07	0.24	0.18
T012	0.31	0.38	0.38	0.22	0.19	0.15	0.18	0.19	0.26	0.15	0.09	0.26	0.18
T013	0.30	0.37	0.22	0.34	0.10	0.16	0.14	0.18	0.24	0.15	0.10	0.24	0.18
T014	0.03	0.10	0.30	0.50	0.16	0.15	0.00	0.05	0.18	0.21	0.12	0.26	0.17
T015	0.13	0.06	0.26	0.24	0.21	0.07	0.03	0.16	0.31	0.06	0.06	0.18	0.14
T016	0.12	0.04	0.34	0.42	0.25	0.19	0.03	0.17	0.23	0.09	0.06	0.26	0.17
T017	0.17	0.10	0.17	0.42	0.26	0.16	0.02	0.07	0.11	0.05	0.06	0.22	0.13
T018	0.31	0.28	0.05	0.24	0.26	0.21	0.16	0.15	0.24	0.13	0.04	0.21	0.18
T019	0.27	0.19	0.12	0.27	0.21	0.17	0.15	0.16	0.27	0.09	0.03	0.20	0.16
T020	0.16	0.22	0.06	0.09	0.08	0.08	0.15	0.27	0.33	0.12	0.09	0.12	0.16
T021	0.06	0.20	0.18	0.08	0.08	0.09	0.13	0.13	0.24	0.10	0.05	0.12	0.12
T022	0.11	0.12	0.38	0.26	0.14	0.12	0.10	0.13	0.20	0.08	0.06	0.20	0.13
T023	0.18	0.11	0.31	0.27	0.12	0.16	0.16	0.25	0.21	0.07	0.03	0.20	0.15
T024	0.07	0.30	0.29	0.06	0.15	0.18	0.14	0.28	0.18	0.06	0.04	0.15	0.13
T025	0.02	0.29	0.27	0.15	0.07	0.19	0.02	0.23	0.01	0.04	0.01	0.15	0.08
T026	0.28	0.29	0.20	0.23	0.16	0.18	0.05	0.08	0.04	0.03	0.02	0.19	0.09
T027	0.29	0.24	0.27	0.17	0.19	0.17	0.14	0.08	0.10	0.03	0.12	0.19	0.11
T028	0.26	0.19	0.24	0.12	0.20	0.20	0.23	0.12	0.13	0.06	0.09	0.17	0.13
T029	0.17	0.37	0.06	0.12	0.16	0.20	0.23	0.11	0.01	0.07	0.10	0.14	0.11
T030	0.36	0.26	0.04	0.08	0.06	0.03	0.10	0.10	0.12	0.02	0.02	0.10	0.06
T031	0.41	0.37	0.34	0.25	0.27	0.12	0.15	0.11	0.14	0.03	0.04	0.25	0.13
T032	0.29	0.41	0.16	0.21	0.09	0.09	0.10	0.08	0.04	0.02	0.00	0.17	0.07
T033	0.10	0.29	0.12	0.09	0.16	0.07	0.12	0.11	0.06	0.02	0.03	0.11	0.07
T034	0.30	0.42	0.23	0.11	0.03	0.18	0.13	0.16	0.03	0.03	0.01	0.16	0.07

Proposed Scheme(VR)													
Test Point	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	Annual	Summer
T035	0.04	0.18	0.17	0.13	0.10	0.08	0.15	0.18	0.18	0.04	0.02	0.12	0.11
T036	0.09	0.10	0.17	0.23	0.08	0.02	0.13	0.05	0.17	0.06	0.01	0.13	0.09
T037	0.27	0.31	0.32	0.24	0.35	0.20	0.13	0.31	0.36	0.01	0.04	0.26	0.20
T038	0.21	0.40	0.39	0.42	0.27	0.10	0.03	0.14	0.12	0.11	0.04	0.29	0.15
T039	0.37	0.15	0.37	0.38	0.29	0.16	0.12	0.18	0.20	0.08	0.02	0.28	0.17
T040	0.13	0.18	0.37	0.43	0.26	0.04	0.03	0.13	0.02	0.10	0.02	0.25	0.12
T041	0.41	0.04	0.35	0.30	0.29	0.14	0.05	0.18	0.18	0.04	0.12	0.24	0.16
T042	0.41	0.37	0.36	0.36	0.15	0.06	0.11	0.13	0.04	0.10	0.02	0.26	0.12
T043	0.41	0.16	0.14	0.03	0.05	0.12	0.08	0.06	0.07	0.10	0.09	0.11	0.08
T044	0.31	0.51	0.04	0.05	0.02	0.05	0.01	0.08	0.23	0.19	0.08	0.14	0.10
T045	0.33	0.59	0.22	0.19	0.13	0.14	0.16	0.05	0.07	0.16	0.13	0.22	0.13
T046	0.24	0.26	0.11	0.03	0.02	0.09	0.05	0.04	0.03	0.11	0.10	0.09	0.06
T047	0.21	0.07	0.20	0.17	0.10	0.15	0.17	0.03	0.13	0.15	0.12	0.15	0.13
T048	0.24	0.18	0.20	0.06	0.06	0.11	0.04	0.04	0.05	0.04	0.08	0.11	0.06
T049	0.32	0.24	0.26	0.30	0.19	0.20	0.26	0.07	0.04	0.15	0.11	0.23	0.16
T050	0.29	0.32	0.21	0.16	0.06	0.12	0.04	0.04	0.03	0.06	0.08	0.16	0.07
T051	0.42	0.41	0.19	0.26	0.16	0.20	0.30	0.12	0.09	0.13	0.11	0.23	0.16
T052	0.36	0.31	0.24	0.27	0.15	0.15	0.06	0.07	0.07	0.05	0.08	0.21	0.10
T053	0.49	0.50	0.28	0.22	0.13	0.16	0.31	0.14	0.12	0.10	0.10	0.24	0.15
T054	0.35	0.29	0.27	0.29	0.17	0.18	0.14	0.09	0.07	0.04	0.06	0.22	0.12
T055	0.37	0.38	0.42	0.32	0.20	0.18	0.22	0.10	0.10	0.03	0.04	0.27	0.14
T056	0.43	0.45	0.49	0.30	0.19	0.15	0.19	0.15	0.03	0.05	0.08	0.28	0.13
T057	0.39	0.42	0.55	0.30	0.19	0.06	0.16	0.02	0.09	0.06	0.09	0.28	0.11
T058	0.27	0.30	0.50	0.26	0.18	0.12	0.18	0.07	0.07	0.08	0.12	0.25	0.13
T059	0.32	0.29	0.43	0.17	0.08	0.11	0.20	0.27	0.25	0.21	0.05	0.22	0.17
T060	0.36	0.32	0.15	0.38	0.18	0.03	0.18	0.12	0.18	0.17	0.10	0.24	0.17
T061	0.32	0.25	0.05	0.19	0.09	0.09	0.18	0.11	0.18	0.14	0.12	0.16	0.14
T062	0.21	0.36	0.15	0.37	0.17	0.08	0.16	0.16	0.14	0.09	0.08	0.22	0.15
T063	0.12	0.24	0.05	0.16	0.09	0.05	0.14	0.14	0.21	0.22	0.04	0.14	0.14
T064	0.15	0.20	0.14	0.22	0.09	0.04	0.22	0.16	0.20	0.24	0.17	0.16	0.17
T065	0.21	0.22	0.19	0.29	0.15	0.05	0.29	0.32	0.25	0.24	0.02	0.21	0.20
T066	0.19	0.19	0.17	0.35	0.16	0.03	0.31	0.20	0.15	0.20	0.12	0.20	0.19
T067	0.05	0.15	0.27	0.12	0.08	0.17	0.04	0.17	0.13	0.08	0.34	0.14	0.14
T068	0.09	0.11	0.26	0.09	0.06	0.14	0.07	0.07	0.09	0.10	0.08	0.12	0.09
T069	0.09	0.12	0.28	0.15	0.08	0.13	0.04	0.11	0.03	0.04	0.12	0.13	0.08
T070	0.20	0.25	0.35	0.38	0.16	0.04	0.21	0.37	0.46	0.35	0.10	0.28	0.27
T071	0.12	0.18	0.23	0.41	0.20	0.08	0.27	0.16	0.33	0.35	0.11	0.26	0.25
T072	0.08	0.37	0.23	0.06	0.09	0.05	0.18	0.19	0.27	0.33	0.13	0.16	0.18
T073	0.42	0.38	0.33	0.44	0.10	0.04	0.16	0.25	0.34	0.32	0.14	0.30	0.24
T074	0.35	0.36	0.48	0.60	0.34	0.17	0.16	0.30	0.32	0.05	0.02	0.39	0.23
T075	0.09	0.13	0.34	0.44	0.27	0.16	0.07	0.09	0.21	0.04	0.02	0.26	0.15
T076	0.43	0.35	0.51	0.57	0.40	0.28	0.21	0.24	0.04	0.12	0.01	0.40	0.21
T077	0.39	0.38	0.44	0.44	0.33	0.24	0.20	0.22	0.31	0.11	0.03	0.35	0.22
T078	0.41	0.39	0.52	0.54	0.37	0.30	0.23	0.22	0.23	0.15	0.02	0.40	0.24
T079	0.27	0.27	0.60	0.62	0.41	0.28	0.26	0.28	0.20	0.13	0.05	0.42	0.26
T080	0.36	0.39	0.43	0.36	0.31	0.25	0.22	0.22	0.14	0.17	0.07	0.32	0.21
T081	0.31	0.35	0.51	0.54	0.34	0.25	0.21	0.25	0.17	0.13	0.08	0.38	0.23
T082	0.38	0.44	0.39	0.43	0.19	0.19	0.13	0.22	0.26	0.15	0.09	0.32	0.20
T083	0.13	0.11	0.23	0.12	0.06	0.05	0.02	0.04	0.18	0.05	0.07	0.12	0.08
T084	0.23	0.06	0.18	0.31	0.23	0.08	0.05	0.07	0.01	0.13	0.07	0.18	0.11
T085	0.19	0.07	0.35	0.11	0.07	0.07	0.14	0.04	0.02	0.04	0.01	0.13	0.06
T086	0.08	0.07	0.15	0.26	0.10	0.06	0.07	0.05	0.16	0.07	0.06	0.14	0.10
T087	0.11	0.06	0.22	0.14	0.09	0.07	0.08	0.04	0.17	0.08	0.06	0.12	0.09
T088	0.13	0.21	0.26	0.26	0.10	0.02	0.08	0.15	0.23	0.16	0.08	0.19	0.14
T089	0.11	0.16	0.33	0.29	0.20	0.04	0.05	0.08	0.12	0.10	0.07	0.20	0.12
T090	0.14	0.14	0.54	0.43	0.30	0.07	0.18	0.43	0.48	0.32	0.21	0.33	0.31
T091	0.13	0.16	0.43	0.37	0.23	0.04	0.18	0.26	0.30	0.26	0.13	0.27	0.23
T092	0.12	0.15	0.33	0.03	0.11	0.09	0.21	0.20	0.32	0.31	0.13	0.16	0.19
T093	0.08	0.05	0.20	0.10	0.10	0.08	0.09	0.12	0.03	0.17	0.17	0.11	0.11
T094	0.14	0.06	0.30	0.32	0.19	0.06	0.09	0.12	0.17	0.14	0.13	0.20	0.15
T095	0.22	0.05	0.13	0.10	0.05	0.05	0.07	0.16	0.21	0.20	0.23	0.11	0.14
T096	0.16	0.07	0.39	0.34	0.23	0.12	0.06	0.21	0.22	0.21	0.25	0.25	0.21
T097	0.02	0.03	0.28	0.09	0.03	0.08	0.07	0.25	0.15	0.11	0.06	0.10	0.11
T098	0.02	0.14	0.08	0.38	0.26	0.13	0.07	0.10	0.22	0.24	0.27	0.22	0.21
T099	0.08	0.06	0.24	0.37	0.25	0.09	0.19	0.11	0.21	0.28	0.24	0.23	0.22
T100	0.01	0.01	0.02	0.17	0.11	0.04	0.10	0.16	0.29	0.24	0.25	0.11	0.18

Proposed Scheme(VR)													
Test Point	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	Annual	Summer
T101	0.16	0.15	0.25	0.41	0.25	0.13	0.25	0.04	0.13	0.21	0.15	0.25	0.19
T102	0.02	0.11	0.29	0.42	0.25	0.15	0.18	0.24	0.27	0.21	0.13	0.26	0.23
T103	0.02	0.02	0.10	0.31	0.18	0.12	0.14	0.16	0.05	0.18	0.11	0.15	0.15
T104	0.16	0.17	0.03	0.08	0.05	0.03	0.03	0.19	0.40	0.29	0.02	0.12	0.16
T105	0.19	0.11	0.06	0.07	0.09	0.03	0.12	0.18	0.06	0.11	0.04	0.08	0.09
T106	0.19	0.21	0.28	0.48	0.28	0.18	0.23	0.11	0.23	0.20	0.12	0.29	0.22
T107	0.22	0.18	0.06	0.06	0.02	0.04	0.14	0.21	0.11	0.06	0.14	0.08	0.10
T108	0.19	0.09	0.23	0.42	0.23	0.15	0.22	0.18	0.16	0.11	0.10	0.24	0.19
T109	0.29	0.28	0.06	0.36	0.21	0.15	0.15	0.18	0.10	0.18	0.12	0.22	0.18
T110	0.12	0.13	0.04	0.04	0.03	0.01	0.03	0.03	0.05	0.03	0.02	0.05	0.03
T111	0.19	0.12	0.03	0.11	0.08	0.06	0.04	0.04	0.05	0.07	0.06	0.09	0.06
T112	0.35	0.31	0.02	0.30	0.17	0.12	0.09	0.03	0.22	0.21	0.14	0.21	0.17
T113	0.12	0.13	0.21	0.36	0.21	0.13	0.22	0.24	0.22	0.12	0.11	0.22	0.19
T114	0.21	0.18	0.09	0.16	0.11	0.09	0.16	0.22	0.13	0.15	0.10	0.14	0.14
T115	0.11	0.12	0.14	0.30	0.18	0.11	0.15	0.10	0.05	0.05	0.07	0.16	0.12
T116	0.28	0.31	0.06	0.32	0.19	0.14	0.07	0.07	0.07	0.06	0.09	0.20	0.12
T117	0.06	0.01	0.07	0.10	0.07	0.05	0.07	0.08	0.01	0.09	0.04	0.07	0.06
T118	0.07	0.23	0.02	0.12	0.03	0.02	0.09	0.01	0.07	0.04	0.01	0.08	0.05
T119	0.27	0.24	0.10	0.17	0.09	0.09	0.18	0.09	0.25	0.16	0.06	0.16	0.14
T120	0.24	0.19	0.22	0.11	0.24	0.08	0.22	0.32	0.44	0.08	0.03	0.18	0.19
T121	0.16	0.23	0.46	0.19	0.17	0.21	0.07	0.27	0.42	0.05	0.08	0.24	0.18
T122	0.07	0.12	0.50	0.28	0.31	0.07	0.13	0.11	0.21	0.06	0.06	0.24	0.15
T123	0.03	0.10	0.36	0.21	0.05	0.05	0.15	0.05	0.06	0.04	0.02	0.14	0.07
T124	0.18	0.41	0.13	0.14	0.12	0.06	0.17	0.05	0.01	0.05	0.07	0.14	0.08
T125	0.05	0.29	0.03	0.07	0.05	0.05	0.16	0.02	0.03	0.04	0.07	0.08	0.06
T126	0.20	0.37	0.09	0.16	0.20	0.10	0.15	0.11	0.02	0.07	0.06	0.15	0.10
T127	0.09	0.35	0.08	0.11	0.16	0.01	0.01	0.10	0.03	0.05	0.04	0.11	0.06
T128	0.60	0.58	0.30	0.18	0.15	0.08	0.11	0.06	0.03	0.05	0.04	0.23	0.08
T129	0.28	0.25	0.04	0.07	0.12	0.07	0.09	0.05	0.03	0.06	0.02	0.10	0.06
T130	0.23	0.20	0.25	0.29	0.18	0.16	0.16	0.11	0.02	0.06	0.02	0.20	0.11
T131	0.18	0.37	0.21	0.26	0.17	0.12	0.04	0.05	0.06	0.08	0.04	0.20	0.10
T132	0.32	0.39	0.11	0.12	0.04	0.07	0.03	0.06	0.01	0.02	0.06	0.13	0.05
Average LVR	0.22	0.24	0.23	0.24	0.15	0.11	0.13	0.14	0.15	0.11	0.07	0.19	0.14

Appendix 6

Supplementary Document for Future/ Committed Developments

KWUN TONG ROAD

N

Conveyor

??? Conveyor

WIP Sep 2002

Sump pump

Caritas Family Crisis Support Centre

8m W. DR

8m W. DR

noise setback line

20000

Phase 2

Phase 1

Assembly Hall

Special Room

Classrooms

10000

22260

6000

SITE ENTRANCE

SITE ENTRANCE (SUBJECT TO ASD)

SITE ENTRANCE

WANG CHIU ROAD

Block 11

Block 12

Block 13

Block 14

Block 15

Block 16

Block 17

Block 18

Block 8

Playground

Playground

RICHLAND GARDENS

Basketball Court

Basketball Court

LPG Store

NOTES

LEGENDS :

- PHASE 1 BOUNDARY
- PHASE 2 BOUNDARY
- SCHOOL SITE BOUNDARY (Indicative layout for reference only)
- NOISE SETBACK
- Drainage and Water Works reserve

REVISIONS

NO	DESCRIPTION AND DATE	INITIAL AND DESIGNATION DWN	CKD	AUTH

	NAME AND DESIGNATION	INITIAL	DATE
AUTHORISED	PK CHIU CA/6		
CHECKED	Stephen LEUNG SA/5		
	Cindy CHAN A/122		
	Regina Lam STO(A)/66		
DRAWN	Edward Ho CTA/(A)609		

PROJECT

Proposed Development at Wang Chiu Road

DRAWING TITLE

SITE LAYOUT PLAN
SCHOOL SITE
(Indicative layout)

SCALE 1:500 (A1) 1:1000 (A3)

DRAWING NO.

SOURCE

ICU NO.

AutoCAD 2000 A1 594 x 841

2015-05-28

HOUSING DEPARTMENT

UptownEast

Layout plan of the development
發展項目的布局圖

The estimated date of completion of the buildings and facilities, as provided by the Authorized Person for the Development, is 30 September 2024.
由發展項目的認可人士提供的建築物及設施的預計落成日期為2024年9月30日。