Urban Renewal Authority
Kai Tak Road / Sa Po Road
Development Scheme (KC-015)

Air Ventilation Assessment
(Final)

May 2019

Approved By _____
(Principal Environmental Consultant: Mr. KS Lee)

REMARKS:

The information supplied and contained within this report is, to the best of our knowledge, correct at the time of printing.

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1. INTRODUCTION

1.1 Project Background

1.1.1 The Urban Renewal Authority (URA) has proposed a Development Scheme at Kai Tak Road / Sa Po Road Development Scheme (KC-015) (the Proposed Scheme) under section 25 of the Urban Renewal Authority Ordinance (URAO). This Air Ventilation Assessment (AVA) is to support the submission of a draft Development Scheme Plan (DSP) with its planning proposal to the Town Planning Board (TPB) for consideration.

1.1.2 The site of the Scheme (the Site) is located in Kowloon City. The Site comprises two lines of buildings facing Kai Tak Road and Sa Po Road respectively (except 51 Sa Po Road and 33 Carpenter Road), two pieces of government amenity area and a portion of Sa Po Road. The location of the Site is shown in **Figure 1.1** and the captured OZP is shown in **Figure 1.2**. The existing zoning of the Site is **"**Residential (Group A)**"** (R(A)2) and shown **"**Road**"**, on the Approved Ma Tau Kok OZP No. S/K10/24. The maximum permissible building height of **"**R(A)2**"** is 100PD (for site not less than 400sq.m.) in the current OZP.

1.1.3 As the Proposed Scheme involves several residential towers with a proposed building height of 120mPD, which is higher than the maximum permissible building height of the current OZP, Cinotech Consultants Limited was commissioned by URA to carry out an Air Ventilation Assessment (AVA) to assess and envisage any potential/adverse air ventilation impact on the implementation of the Proposed Scheme as compared to the OZP-compliance notional redevelopment (i.e. 100mPD) and to recommend mitigation measures when necessary.

1.1.4 This AVA study was conducted in accordance with the recommendations of **"***Feasibility Study for Establishment of Air Ventilation Assessment System – Final Report***"** by Planning Department in 2005, and **"***Technical Circular No. 1/06 on Air Ventilation Assessments"*by HPLB & ETWB in 2006 (Technical Circular).

1.2 The Proposed Scheme (120mPD Scheme)

1.2.1 The gross site area of the Scheme is about 6,106m^2 and planned to be completed by **year 2030**. The Proposed Scheme intends to demolish the existing 5 – 12 storeys high buildings on Nos. 24-82 Kai Tak Road (even numbers), 31 – 49 and 55 – 73 Sa Po Road (odd numbers) for redevelopment. Under the current notional design, the proposed development of the Scheme (the Proposed Scheme) will compose of 3 residential towers on a podium with community/retail facilities and private residential clubhouse, a basement carpark, and a split-level sunken plaza on the southern part within the Scheme. The proposed building height of the Scheme is 120mPD. The

existing portion of Sa Po Road will be re-aligned within the Scheme to connect the traffic from Sa Po Road to Kai Tak Road. The notional layout and section plan of the Proposed Scheme is shown in **Figure 1.3** and **Figure 1.4**. The notional design of the Proposed Scheme is subject to change in the detailed design stage upon CE in C's approval of the draft DSP.

1.2.2 According to *Approved OZP No. S/K10/24*, for site with 400m^2 or larger for zone R(A)2, a maximum building height of 100mPD is allowed. The Proposed Scheme involves three residential towers (T1- T3) each with building height of not more than 120 mPD including 29 residential storey, a storey for clubhouse and three commercial storey. An AVA study is required to demonstrate no insurmountable air ventilation impact is induced by the additional height in the Proposed Scheme on the pedestrian wind environment.

1.2.3 **Figure 1.3** shows the general layout of the Proposed Scheme. As shown in the layout, a split-level sunken plaza (the sunken plaza) will be provided at the southern side the Scheme. It will enhance wind flow penetration along the E-S-W direction through the sunken plaza to inner area. The Sa Po Road will be re-aligned within the Scheme to connect Sa Po Road and Kai Tak Road, which would also enhance flow penetration at the pedestrian level along the E-W direction through the Site.

1.2.4 Gaps are provided between the three towers, an approximately 11 m wide gap is created between T1-2 and T3 which allows East /West wind to flow through the Site directly. Wind could also be directed to/from the Carpenter road via the gap (~13 m) between T1 and T2 at the North of the Site. The designs for enhancing ventilation are illustrated in **Figure 1.5**.

1.3 The Baseline Scheme (100mPD Scheme)

1.3.1 A Baseline Scheme fulfilling the maximum building height requirement (100mPD) of *Approved Ma Tau Kok OZP No. S/K10/24*, will be used to represent the intended air ventilation performance.

1.3.2 In the Baseline Scheme, five residential towers are set in two rows with alternate arrangement as to reflect the possible redevelopment by market practice, which is shown in **Appendix 1.1**. Despite there is no sunken plaza provision in the Baseline Scheme, the alternate arrangement of the five towers would allow wind to penetrate through the towers uniformly even though the wind cannot pass through the Site directly because of the arrangement. A small gap (~3 m) between the podium of T1-T2 and T3-T5 would allow ground level wind to penetrate through the buildings in the N-S direction.

1.3.3 A comparison of the two schemes is illustrated in **Figure 1.5a and 1.5b**.

1.4 The Surrounding Environment

1.4.1 The Site is located in a developed urban area, however, there are not many high-rise buildings in the surrounding area. Unlike other fully developed area in Hong Kong, the buildings in Kowloon City that are built prior to the relocation of the former Kai Tak Airport are mostly short tenement buildings due to the height restriction required for the airport, therefore most of the buildings are lower than 30 m. Only the new buildings that are built after the relocation of the airport are high-rise buildings.

1.4.2 The Regal Oriental Hotel and the building east of Site are between 30 m – 50 m in height, a few buildings in the vicinity of the Site are between 50 m – 75m in height and buildings that are tallest within the surrounding are the Le Billionaire and the Billionaire Royale which are 144 m and 166 m in height respectively. The height distribution of the buildings in the surrounding environment of the Site is shown in **Figure 1.6**.

1.4.3 The Kai Tak Development Area (KTDA) is in the South-East of the Site. Although the land slots in KTDA have already been zoned into different zones by Planning Department (please refer to *Approved Kai Tak OZP No. S/K22/6*), most of the area near the Site are not yet developed. The zoned but not yet developed land slots in the KTDA near the Site are illustrated in **Figure 1.7**. As the Proposed Scheme is planned to be completed in **year 2030**, it is assumed that undeveloped land slots will be occupied during the operation phase of the Development. Since no detailed scheme are available for those land slots at the moment, the buildings for those land slots applied in the model has adopted the height and land coverage restriction for assessment purpose.

1.5 Objective

1.5.1 The objective of this AVA study is to demonstrate that the air ventilation impact on the surrounding area at the pedestrian level of the Proposed Scheme is not worse than the Baseline Scheme, which has adopted the requirement as listed in the *Approved Ma Tau Kok OZP No. S/K10/24*, by qualitatively comparing the two schemes. This comparison is conducted using the Velocity Ratio (VR) computed by Computational Fluid Dynamics (CFD) models for the two schemes.

1.5.2 It should be noted that the current Proposed Scheme is only tentative and subject to change. In case there are major changes in building design, the AVA may need to be modified to reflect the changes. In addition, the results and conclusion in this report should only be used for the comparison of the Baseline and Proposed Scheme for this development to assess the air ventilation impact.

2. THE WIND ENVIRONMENT

2.1 Introduction

2.1.1 The selection and evaluation of the wind availability data for the upstream wind conditions are described in this section. The following sources of wind data have been reviewed for this AVA study as follows:

- Measurement from Hong Kong Observatory (HKO) weather station
- Measurement from Wind Tunnel Test in Experimental Site Wind Availability Study[1]
- Simulated results from Meso-Scale Model Regional Atmospheric System (RAMS)[2] in Planning Department website.

2.2 Selection of Wind Data Source

2.2.1 Simulated result of RAMS from Planning Department website is adopted in this AVA study. The reason for the selection of this wind data source is explained in the following paragraphs.

2.2.2 HKO weather stations provided reliable wind data in Hong Kong. The closest HKO weather stations to the Site is Kowloon City Automatic Weather Station which is located approximately 980 m away from the Site. Since the measurement location of HKO weather station is often at low height or a few meters above roof top, the wind at the weather station is inevitably affected by nearby developments or topography. Its data should be applied with caution specifically when the station is not very close to the Site.

2.2.3 The measurement level of the wind data from the Kowloon City Automatic Weather Station is 92m which is 28 m lower than the proposed building and considering that the weather station is located with an urban area, it should only be adopted when no other alternatives are preferred. However, the Waglan Island Automatic Weather Station is located in an undisturbed area and its measured wind data can describe the overall wind condition for Hong Kong well. Therefore, the wind data from Waglan Island Automatic Weather Station is often adopted in AVA study.

2.2.4 A series of experimental site wind availability studies for various regions in Hong Kong using wind tunnel experiment have been conducted and some of the reports are available to public. The closest location can be found in "*Experimental Site Wind*

[1] https://www.pland.gov.hk/pland_en/info_serv/site_wind/index.html
[2] https://www.pland.gov.hk/pland_en/info_serv/site_wind/site_wind/index.html

Availability Study for the Proposed Kai Tak Development, Hong Kong - Investigation Report WWTF013-2009". One of its assessment locations is representing the northern half of KTD area. The wind data in this experiment study is often adopted in AVA studies of KTDA (e.g. AVA studies for government projects: AVR/G/018 & AVR/G/076). As the site of this development is also included in the wind tunnel experiment and in the assessment area of those government AVA studies. It is believed that the wind data from WWTF013-2009 is suitable for this AVA study if no better alternative wind data are available.

2.2.5 In order to provide a comprehensive set of standardized and reasonably representative site wind availability data for both qualitative and quantitative AVA, a consultancy study was commissioned by the Planning Department. The study adopted meso-scale model RAMS to simulated 10-year wind climate at horizontal resolution of 0.5km x 0.5km, covering the whole Hong Kong. Three levels of nested domains with realistic boundary conditions were adopted to provides reasonable approaching wind condition to the finest level of nesting. To refine the model results, the wind data from various wind stations have been used in RAMS.

2.2.6 When comparing the RAMS to the wind tunnel experiments in the experimental site wind availability studies, the RAMS have the following advantage:

- RAMS covers a much larger upwind area, with terrain height and land surface type, compare to those wind tunnel experiments;
- RAMS considers the atmospheric stability where those wind tunnel experiments do not consider thermal effect;
- RAMS provides wind data for every single grid unlike those wind tunnel experiments that can only provide data at predetermined locations.

2.2.7 Considering that the grid from RAMS can cover the Site and the advantages of the RAMS over those wind tunnel experiments, the data of grid [84,45] from RAMS is best suited for this AVA study.

2.3 Adopted Wind Conditions

2.3.1 The wind speed and the vertical wind profiles of grid [84,45] from RAMS[3] have been adopted in order to provide a realistic flow condition.

2.3.2 The wind velocity and wind direction at 500m elevation have been adopted in the analysis of general wind condition of the site, while the vertical wind profiles are adopted as the inlet conditions of the numerical analysis.

[3] https://www.pland.gov.hk/pland_en/info_serv/site_wind/site_wind/index.html

2.3.3 It should be noted that the wind profiles from RAMS are grouped into four range of wind directions, therefore, all wind directions within the same 90-degree segment share the same profiles (with different free stream flow velocities). The boundary layer height is assumed to be 500m, thus the flow velocity at 500m is the free stream flow velocity and the flow above 500m is uniform.

2.3.4 The wind rose at 500m elevation of grid [84,45] and the wind profile from RAMS are illustrated in **Figures 2.1a and 2.1b**. The top 9 of wind directions, which will be assessed in this study, are presented in the **Tables 2.1 & 2.2**. Detailed occurrence probability for each wind directions and wind speed at 500m elevation are listed in **Appendix 2.1**. The adopted wind profile from 10-500m were extracted from the wind profile curve provided by PlanD (**Figure 2.1b**). The wind profiles for different wind direction, in term of ratio to the free stream flow velocity at different heights, are summarised in **Table 2.3**.

2.3.5 Under annual condition, the major wind direction is East. For around 59% of the time, the wind comes from NE, ENE, E, ESE, or SE. Around 23% of the wind comes from S, SSW, SW, WSW, or W. The occurrence chance for the rest of wind directions are all below 5% each.

2.3.6 Under summer condition, the major wind direction shifted to South-Western. For around 53% of the time, the wind comes from S, SSW, SW, WSW, or W. Around 36% of the wind comes from ENE, E, ESE, SE, or SSE. The occurrence chance for the rest of wind directions are all below 4% each.

2.3.7 Generally, the major wind direction of concern is the east direction for the whole year and the south-western direction for summer. A good designer should have considered those two major wind directions to reduce the impact of air ventilation to the surrounding area.

Table 2.1 Occurrence Probability for Each Wind Directions and The Average Wind Speed at 500m Elevation (Annual)

Wind Direction	Wind Direction (degree)	Occurrence Probability at 500m elevation	Speed (m/s) rounded to integer
E	90	20.2%	7
ESE	112.5	11.8%	7
ENE	67.5	11.4%	6
NE	45	9.0%	6
SE	135	7.0%	6
SW	225	6.6%	6
NNE	22.5	6.5%	7
SSW	202.5	5.9%	6
S	180	4.3%	5
Sum	--	82.7%	--

Table 2.2 Occurrence Probability for Each Wind Directions and The Average Wind Speed at 500m Elevation (Summer)

Wind Direction	Wind Direction (degree)	Occurrence Probability at 500m elevation	Speed (m/s) rounded to integer
SW	225	15.9%	6
SSW	202.5	13.3%	6
WSW	247.5	10.1%	6
ESE	112.5	10.0%	7
S	180	8.9%	6
E	90	8.4%	8
SE	135	8.1%	6
SSE	157.5	7.7%	6
W	270	5.2%	4
Sum	--	87.6%	--

Table 2.3 Vertical Wind Profiles for different Wind Directions

Heights (m)	Wind speed (Ratio to the freestream flow velocity) for different Wind directions (degree from North)			
	22.5- 112.5^{o}	112.5-202.4^{o}	202.5-292.4^{o}	292.5-22.4^{o}
10	0.47	0.42	0.51	0.37
50	0.49	0.44	0.54	0.41
100	0.52	0.46	0.56	0.43
150	0.53	0.48	0.56	0.46
200	0.59	0.52	0.59	0.52
250	0.67	0.60	0.67	0.63
300	0.74	0.68	0.72	0.74
350	0.82	0.76	0.82	0.81
400	0.89	0.84	0.87	0.91
450	0.96	0.92	0.92	1.00
500 and above	1.00	1.00	1.00	1.00

3. ASSESSMENT METHODOLOGY

3.1 Assessment Tool

3.1.1 The microclimate around the Site for the two Schemes have been assessed by Computational Fluid Dynamics (CFD). Open source CFD code, OpenFOAM 2.4.0, has been utilized for calculating the local wind speed. GroovyBC has been used for applying the inlet boundary condition. The model solves the algebraic equations by applying the conservation laws of physics to finite volumes of space and time. Renormalization Group (RNG) k-epsilon with wall model is adopted to handle the flow turbulence.

3.2 Assessment Area and Surround Area

3.2.1 According to the Technical Circular, the Assessment Area of the DSP should include the Scheme's surrounding up to a perpendicular distance H from the DSP boundary, H being the height of the tallest building on site, that is the . Surrounding Area of up to a perpendicular distance of 2H from the DSP boundary must be included. Since the highest building near the Site, that is the Billionaire Royale, is around 170mPD, area of 170m and 340m from the DSP boundary are adopted as the Assessment Area and Surrounding Area, respectively. The Assessment Area and Surrounding Area are illustrated in **Figure 3.1**.

3.3 Test Points

3.3.1 42 perimeter test points (P01-P42) have been used to examine the air ventilation around the Site. The perimeter test points are evenly spread, with around 10m separation, on the nearby streets which covering the four sides of the Site and the two adjacent buildings. The exceptions are the Test Points P31 & P45, which located in narrow back lanes. The locations of the perimeter test points are illustrated in **Figure 3.2**.

3.3.2 124 overall test points (O01-O124) have been used to examine the air ventilation of the local area. Overall test points are evenly spread, with around 30m separation, on all roads within the Assessment Area, where there is frequent pedestrian access. The overall test points are also placed in the planned roads within the TKDA. Besides the roads, overall test points are also placed in playgrounds (O78-O88, O89-O96 and O98-O100). The locations of the perimeter test points are illustrated in **Figure 3.3**.

3.3.3 The locations of the test points within the proposed development of the Scheme are illustrated in **Figure 3.4**. As the Sunken Plaza and its landscape deck on the 1/F in the southern part of the Site will be opened for public access, the air ventilation in the public area within the Site are also be assessed (D12 ,D16-D22). Test points D13-D15 are

added to assess the area for the proposed public access between Sa Po Road and Kai Tak Road within the Site, D08 and D09 are added for the new private road within the Scheme. No test points are placed in the lower ground of the sunken plaza (e.g. entrance of the Government subway) as those areas are expected to be served by mechanical ventilation which is not the subject of this study.

3.3.4 The vertical locations of all test points within the Site (D07-D12) are 2mAG except the two test points at 1/F of the proposed development (D21 & D22). Test points D21 & D22 are located at 2m above the slab level of the Deck of the Sunken Plaza (8mAG). Test points D24 & D25 are open area within the gaps between the Baseline and Proposed residential towers, and they are both located at ~24 mAG. D07-D25 are not applicable to the Baseline Scheme and the test points are included for the assessment of the mitigation measure adopted in the Proposed Scheme.

3.3.5 A total of six Special test points are also assigned outside of the Site to assess the air ventilation impact to the immediate surrounding of the site. Two of the six test points are given to the podiums of the buildings that are located immediately outside the Site, which are High Place (D05) and Carlson Court (D06). The vertical distances for the test points are 12.4 m and 15 m respectively. Four special test points were assigned to the podiums of Le Billionaire and Billionaire Royale (D01-D04).

3.4 Assessed Parameters

3.4.1 According to the Technical Circular, Wind Velocity Ratio (VR) should be used as an indicator of wind performance for the AVA. It is defined as

$$\boldsymbol{VR = V_P / V_g}$$

Where V_g is the wind velocity at the top of boundary layer (at 500m in this AVA) and V_P is the wind velocity at pedestrian level (2m above ground or slab).

3.4.2 To quantitatively assess the air ventilation for the Site and in the surrounding area, two spatial averaged values, namely Site Air Ventilation Assessment (SVR) and Local Air Ventilation Assessment (LVR) will be used.

3.4.3 SVR is the weight average (weighted by the occurrence probability of the wind directions) of the VRs for the Site (i.e. P01-P42), to quantify the air ventilation of the Site. LVR is the weight average of the VRs for the whole assessment area, for quantify the air ventilation of the local region.

3.4.4 It should be noted that the VRs (also SVRs and LVRs) should only be compared between the Baseline Scheme and the Proposed Scheme of the study which have applied

identical setting for each parameter, and should not be directly compared with on-site measurement and/or wind tunnel experiment.

3.4.5 Averaged VRs for smaller areas (e.g. a street section) will also be presented to examine the effect of the building design to air ventilation of individual regions within the Assessment Area.

3.5 Studied Scenarios

3.5.1 Two scenarios were considered in this study. The first scenario is based on the design of the Baseline Scheme. The other scenario is based on the Proposed Scheme. The results of the scenarios will be compared to draw the conclusion.

3.5.2 In both scenarios, all buildings in the surrounding area are included. As the North-West of the Site has a rather open upstream within the Study Area, which would allow the adopted wind profiles, as stated in Section 2.3, to enter the pedestrian level of assessment area directly, resulting in an unexpectedly high VR at the NW boundary wind condition during the simulation. Therefore, some buildings in the North-West outsides of the surrounding area are also included. As stated in **Section 1.4**, the buildings in KTDA are made-up buildings based on the OZP's requirement. The buildings (and flyovers) included in the CFD are illustrated in **Figure 3.5**.

3.5.3 The main difference between the two scenarios is the design of the block layout of the development as shown in **Figures 1.3** & **1.4**. The Baseline Scheme have a range of shorter and wider buildings; while the Proposed Scheme have a range of taller and narrower buildings. The simplified 3D model of the development adopted in both scenarios are illustrated in **Figures 3.6 & 3.7** for Baseline Scheme and Proposed Scheme, respectively.

3.5.4 Both scenarios share the identical boundary conditions and other modelling parameters to have a fair comparison focused on the design between the Proposed Scheme and Baseline Scheme only. The details models' setting will be explained later.

3.6 Computational Domain and Boundary Condition

3.6.1 The global domain size is 3000m (length) x 3000m (width) x 1500m (height) centered at 837870.2641 m (E), 821200.4520 m (N). All the buildings within the surrounding area have been included in the model. The distance between the sides boundaries of the domain and the buildings are more than 5 times the highest building adopted. The Blockage ratio is less than 3% for all wind directions. The domain boxes were built in

the way that the prevailing wind is perpendicular to the flow inlet and outlet, while parallel to the side boundaries.

3.6.2 Velocity inlet has been applied on the flow inlet using data provided as stated in **Section 2.3**. Outflow condition (fixed value for pressure, zero gradient for other variables) has been applied on the flow outlet. Free slip condition has been applied on the top boundary and two side boundaries. **Figure 3.8** shows the boundary conditions using the southerly wind direction (180^{o}) as an example.

3.6.3 The computation domain has been discretized by triangle and tetrahedral meshes for 2D surfaces and 3D volumes, respectively. The triangle meshes on the surface of buildings and flyovers are mostly in the range of 1m – 10m. The tetrahedral meshes with size of 1m - 80m were used in the discretization of the computation domain. In order to resolve the near ground flow velocity, as the data sampling point is 2m above ground, 4 viscous layers with a total thickness of 1.6m were applied on the Ground. The different in size of neighborhood grids, also called grid expansion ratio, are in the range of 10%-20% for the whole domain. Generally, smaller grids were placed near the building surfaces and ground in order to resolve the near surface flow properly. The meshes adopted in the model are illustrated in **Figure 3.9 & 3.10**.

3.7 Model Setting

3.7.1 The RNG k-epsilon model has been used in this study as it can provide better results than the standard k-epsilon model. Wall functions are applied on the solid boundaries, i.e. ground and building facades, to account for the turbulence, generated by flow over surfaces.

3.7.2 SIMPLE algorithm is adopted to handle the velocity-pressure coupling.

3.7.3 Convergence criterion is used to control when the iteration will stop. When the residual value reaches the target tolerance value, the iteration will stop and progress to the next step. For iterations of individual variable, a tolerance of 1e-7 was applied to the pressure equation; a tolerance of 1e-8 was applied to the momentum equation; and a tolerance of 1e-6 was applied to the turbulence related equations. For the velocity-pressure couple (SIMPLE algorithm), a tolerance of 1e-4 was used for the pressure and turbulence parameters, and a tolerance of 1e-5 was used for the flow velocities. By nature, the RNG k-epsilon model is harder to converge compared to the Standard k-epsilon model. When the variables cannot achieve the target residual due to the nature of turbulence model, the model is assumed to be converged when the residual remains below < 5e-4 for a

sufficiently long time (> 50% of the total running time). A summary of the model setting can be found in **Table 3.1**.

Table 3.1 Summary of Modeling Settings

Software	Pre-processing	Salome 8.5.0
	Processing	OpenFOAM 2.4.0 with GroovyBC
	Post-processing	ParaView
Domain Size	3000m x 3000m x 1500m (Width x Length x Height)	
Boundary Conditions	Inlet	Flow inlet
	Outlet	Outflow Condition
	Top	Free Slip Condition
	Sides	Free Slip Condition
	Ground and Building Surfaces	No Slip Condition with Wall Function
Grid Expansion Ratio	<= 20%	
Blockage Ratio	< 3%	
Primary Variables	U	Flow Speed
	P	Pressure
		Turbulence Kinetic Energy
	Epsilon	Dissipation Rate of Turbulence Energy
Residual (Individual Variable)	U	1e-8
	P	1e-7
	K	1e-6
	Epsilon	1e-6
Residual (SIMPLE Algorithm)	U	1e-5 (or stay below 5e-4 for half of the iteration steps)
	P	1e-4 (or stay below 5e-4 for half of the iteration steps)
	K	1e-4 (or stay below 5e-4 for half of the iteration steps)
	Epsilon	1e-4 (or stay below 5e-4 for half of the iteration steps)

3.8 List of Models

3.8.1 The wind environment of the site has been discussed in **Section 2**. The top 80% wind directions for both annual and summer condition will be adopted in this study (**Table 2.1 & 2.2**). The averaged wind speed at 500m will be adopted at the free stream flow velocity. As some wind directions and their corresponding wind speed in annual and summer are overlapped, only 14 wind conditions thus 28 models are required (**Table 3.2**).

Table 3.2 List of Wind Conditions Included in the AVA Study

Wind Direction		Averaged Wind Speed at 500m (m/s)	Occurrence Probability (Annual)	Occurrence Probability (Summer)
22.5	NNE	7	6.5%	
45	NE	6	9.0%	
67.5	ENE	6	11.4%	
90	E	7	20.2%	
90	E	8		8.4%
112.5	ESE	7	11.8%	10.0%
135	SE	6	7.0%	8.1%
157.5	SSE	6		7.7%
180	S	5	4.3%	
180	S	6		8.9%
202.5	SSW	6	5.9%	13.3%
225	SW	6	6.6%	15.9%
247.5	WSW	6		10.1%
270	W	4		5.2%

4. ASSESSMENT RESULTS

4.1 Previous Study

4.1.1 Although the result of this report should not directly compare with other AVA study due to the difference in model settings, size of computational domain, the geometry of the buildings in KTD area, wind environment, and etc. as stated in previous sections, the results in previous studies can still be served as validation purpose to ensure the results in the models of this study are not out of order.

4.1.2 Although there are a few AVA studies near the subject Site, not many have considered the increase in development density in KTDA. One suitable AVA study, "*Kai Tak Development Engineering Study Cum Design and Construction of Advance Works - Investigation, Design and Construction - Additional Services for Technical Study on Increasing the Development Density in Kai Tak*" (AVR/G/76). is available in Planning Department (PlanD) website.

4.1.3 AVR/G/76 covers the Subject Site of this study in its "group 20". Its ultimate scenario has considered the increases in development density in TKDA which is closer to the current OZP. Although AVR/G/76 covers a much larger area thus resulted in less grid resolution (minimum grid size of 0.5m in TKD area, 2m in other areas), and its testing point are not spread in the same way as the current AVA, its spatial averaged VRs should still be comparable to LVRs of the current models. The spatial averaged VRs of Group 20 in the Ultimate Scenario of AVR/G/76 are presented in **Table 4.1**.

Table 4.1 Spatial Averaged VRs of Group 20 in AVR/G/76 (Ultimate Scenario)

Annual Wind	Summer Wind
0.145	0.154

4.2 Model Results

4.2.1 2 Scenarios each with 14 wind configurations, as stated in **Table 3.2** have been conducted based on the methodology mentioned in **Section 3**. As the difference between two Schemes has occurred only on superstructures above the podium with minor difference on street level (Baseline Scheme with amenity areas and Proposed Scheme with split-level sunken plaza), whereas the test points are near ground level, it is expected the difference between the two Schemes should be small.

4.2.2 The SVR for both the Baseline and Proposed Scheme are 0.18 for Annual wind conditions. During summer, the SVRs are 0.18 in both Schemes. The LVRs in the Baseline Scheme and Proposed Scheme are both 0.17 for Annual and Summer. During Summer, the LVR become 0.14 for both Schemes. A summary of the predicted spatial averaged VRs of the test points are presented in **Table 4.2**. The detailed simulated VRs at individual test points are listed in **Appendix 4.1**. The bar charts for the comparison between the Baseline Scheme and the Proposed Scheme are also illustrated in **Appendix 4.1**. The contours of VRs at 2m above ground are illustrated in **Figures 4.1a** to **4.1n**.

4.2.3 The values of LVRs in this study is similar to the averaged VRs of Group 20 in AVR/G/76, even though the summer VR in AVR/G/76 is higher whereas the annual LVR in the current study is higher. The discrepancy could have many reasons, however, having comparable LVRs means the setting of the current CFD models can at least produce reasonable results, which is sufficient to serve the purpose for the comparison of two schemes.

4.2.4 From the small difference in SVRs and LVRs in two schemes, it is safe to assume that both designs have similar effect to the local wind environment in average. In order to examined the localised ventilation, the spatial averaged VRs have been broken into 12 zones for road sections and 4 zones for open areas. Similar to the SVRs and LVRs, the averaged VRs for each sub-zone also show little variations between the Baseline Scheme and the Proposed Scheme. It further proven that the design in the Proposed Scheme have little AVA impact to local area in comparison with the Baseline Scheme.

Table 4.2 Summary of Spatial Averaged Velocity Ratios for the Subject Site

Test Points for the Subject Site and Assessment Area	Base		Proposed	
	Annual	Summer	Annual	Summer
Overall				
Site Air Ventilation Assessment (SVR) (All P Points)	0.18	0.18	0.18	0.18
Local Air Ventilation Assessment (LVR) (All P & O Points)	0.18	0.17	0.18	0.17
Road Sections				
Kai Tak Road (P01-P18, O90-O95)	0.15	0.18	0.15	0.17
Prince Edward Road East Section (P19-P26, O21-O46)	0.24	0.21	0.26	0.21
Sa Po Road (P27-P37, O101-104)	0.15	0.15	0.18	0.18
Carpenter Road Section (near Carpenter Road Park) (O01-O04)	0.14	0.13	0.11	0.12
Carpenter Road Section (near Project Site) (P40-P42, O05-O07,O96-O97)	0.24	0.18	0.23	0.17

Shek Ku Lung Road (O08)	0.15	0.11	0.13	0.11
Lok Sin Road Section (O09-O15)	0.20	0.16	0.19	0.16
Nga Tsin Wai Road Section (O16-O20)	0.16	0.16	0.14	0.15
South Wall Road (O17, O47-O54)	0.15	0.19	0.14	0.18
Tak Ku Ling Road (O19, O55-O62)	0.14	0.15	0.14	0.14
Tung Tsing Road (O63-O68)	0.18	0.15	0.17	0.14
Roads in TKD Area (O69-O77)	0.16	0.16	0.15	0.16
Area within Site				
Public Area within the Site (G/F) (D07-D12)	[1]	[1]	0.17	0.13
Public Area within the Site (Landscape Deck on 1/F) (D21-D22)	[1]	[1]	0.17	0.14
New Private Road for the Proposed Development (D13-D15)	[1]	[1]	0.18	0.12
Podium within the Site (D23:D25)	[1]	[1]	0.10	0.09
Sunken Plaza at G/F (D12,D16-D21)	[1]	[1]	0.21	0.17
Public Area outside the carriageway at G/F for the Proposed Development (D08-D09)	[1]	[1]	0.18	0.15
Other Concerned Area				
Podium on Carlson Court (D06)	0.07	0.09	0.07	0.09
Podium on High Place (D05)	0.06	0.06	0.13	0.10
Carpenter Road Park (O78-O88)	0.18	0.12	0.16	0.13
Shek Ku Lung Road Playground (O105-O119)	0.28	0.18	0.27	0.19
Tak Ku Ling Playground (O98-O100)	0.19	0.15	0.19	0.15
Po Yan Oblate Primary School (0107-O111)	0.13	0.14	0.13	0.13
Le Billionaire & Billionaire Royale (D01-D04)	0.23	0.18	0.21	0.17
[1] Those locations are not applicable to Baseline Scenario				

4.3 Flow Penetration

4.3.1 The spatial averaged VRs have been examined in previous section and no significant overall difference between the two Schemes have been observed. The major difference between the two Schemes are the arrangement of the buildings and the gaps created between the towers above the podium with minor difference on street level (Baseline Scheme with amenity areas and Proposed Scheme with split-level sunken plaza), therefore it is expected that results at certain test points for both Schemes shall not be consistent and the results produced are aligned with the expected. However, this give little, if any, information to the flow penetration of the Site.

4.3.2 Two major wind directions for the site are the east direction for annual and South-West direction for summer. For the South-Western wind, the upstream wind flow can go along the Prince Edward Road East and then reaches the downstream area.

4.3.3 The design of the current Schemes offers three potential wind paths for the eastern wind penetrating the Site. The first is the open area in the southern part of the Site, as no large superstructure in that region and its upstream location is roads, it is expected that will become a major wind path in future. The second is the vehicle running-in/out located on ground floor. As the size of the opening is limited, and its direct upstream area is blocked by the Regal Oriental Hotel, its effect is very little. Since the above two opening are presented in both Schemes, no comparison for them can be made by the current methodology. The third potential wind path is the gap between the residential towers which is only available above the podium floor. Generally, opening for wind path should be located on ground to maximised its effect. However, when there are several long and narrow street canyons in the downstream area perpendicular to the wind direction, the flow at roof level of the downstream street canyon become important.

4.3.4 When there are several long and narrow street canyons in the downstream area that lies perpendicular to the wind direction, the wind pattern will behave like skimming flow regime (Oke, 1988)[4] as illustrated in **Figure 4.2**. In skimming flow regime, the upstream flow in the pedestrian level cannot enter the downstream street canyons. The mean flow within the street canyon cannot escape the roof level of the canyon, instead, the air exchange of the canyons is mainly relied on turbulence exchanges occurring at the roof level. Therefore, the mean wind speed and the VRs have little meaning in this case. The rate of turbulence exchange is expected to be a function of urban roughness (Ho YK, Liu CH & Wong MS, 2015)[5]. This kind of flow regime should be avoided in urban planning especially for the major wind direction as it will give the worst ventilation.

4.3.5 The design of the building in the subject site has little effect to the overall flow turbulence in the surrounding as the site area is not significant. The turbulence exchange would only be affected by the change in the subject site unless the site area has amounted to entire district e.g KTD. In addition, the study of flow turbulence is not the objective of this study. However, the design of the superstructure in the subject Site can allow more fresh air reaching the roof level of the downstream street canyon thus more fresh air, rather than re-entrained aged air, can reach the pedestrians level of the street canyon.

4.3.6 In the Proposed Scheme, the open area provided at the Sunken Plaza at the south of the Site would allow plenty of airflow from the SW direction, the upstream wind flow can go along the Prince Edward Road East and then reaches the downstream area. However, in the Baseline Scheme, most of the SW wind approaching the residential

[4] Oke (1988), Street design and urban canopy layer climate, Energy and Buildings
[5] Ho YK, Liu CH & Wong MS (2015), Ho Building and Environment, v. 89, p. 345-355

towers (T4) is forced to go upward or on the Kai Tak Road or Prince Edward Road East before leaving the Site, resulting in lesser wind reaching the roof level of downstream area, hence the results at Sa Po Road (P27-P37) shows that the wind penetration along the SW direction in the Proposed Scheme has shown advantage over the Baseline Scheme. The streamline of the flow passing through the Site is illustrated in **Figure 4.3**.

4.3.7 Under the easterly winds, the Baseline Scheme may offer a better flow penetration due to the uniform gaps with larger cross sectional area, as indicated by the results at Kai Tak Road's test points. However, since the streets are long and narrow, the wind is forced to go upward by the buildings across the street after leaving the Site.

4.3.8 Apart from the easterly and south-westerly winds as discussed above, on the whole, the ventilation performance in both Schemes are similar when considering all simulated wind directions as shown by the SVR and LVR, however given that the designs in both schemes are quite different, the results in both schemes are would not be consistent at all test points.

5. CONCLUSIONS

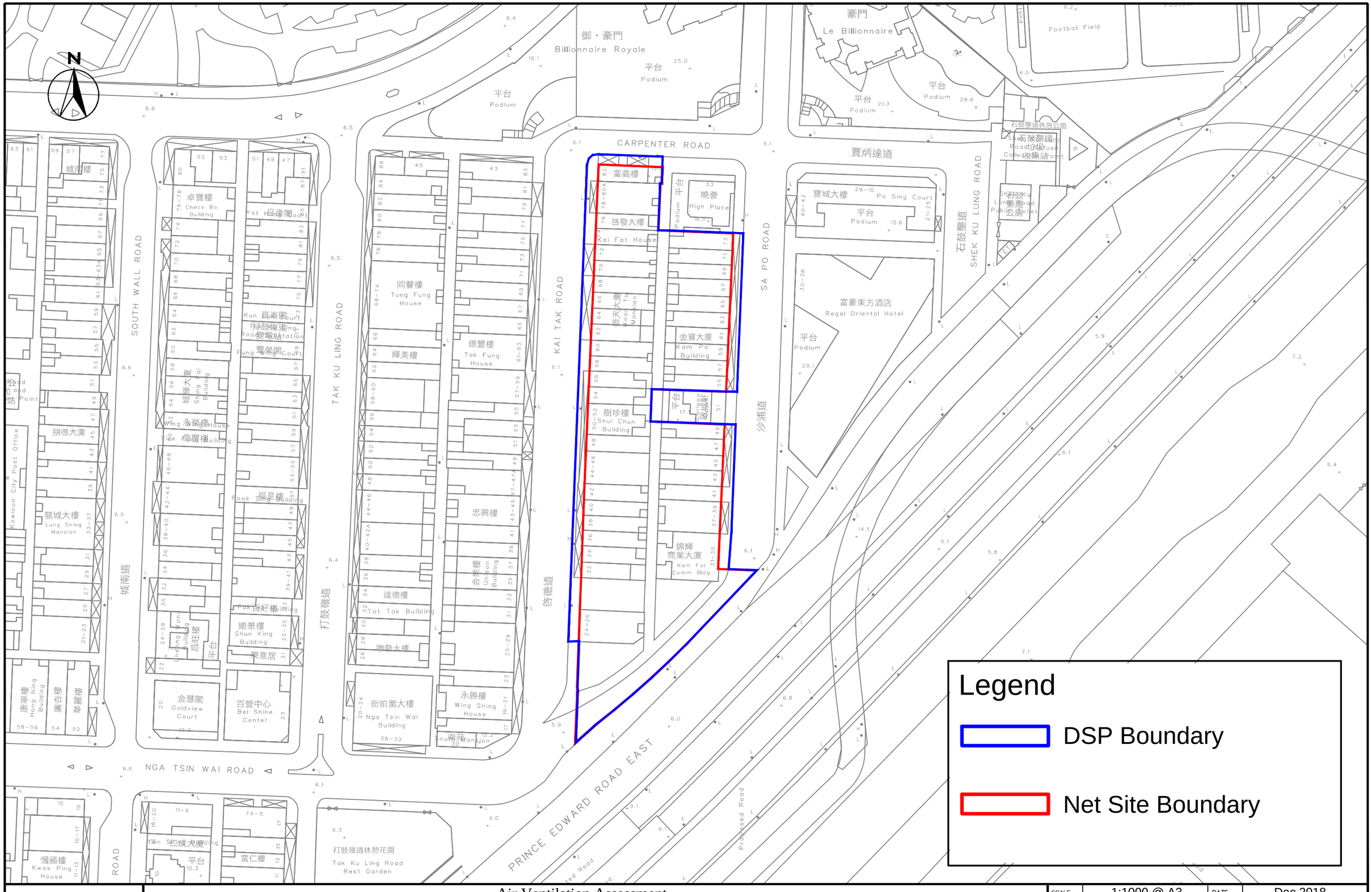
5.1.1 The Urban Renewal Authority (URA) has proposed a Development Scheme at Kai Tak Road / Sa Po Road Development Scheme (KC-015) (the Proposed Scheme) under section 25 of the Urban Renewal Authority Ordinance (URAO). An Air Ventilation Assessment (AVA) has been conducted in accordance with the recommendations of "*Feasibility Study for Establishment of Air Ventilation Assessment System – Final Report*" by Planning Department, and "*Technical Circular No. 1/06 on Air Ventilation Assessments"* by HPLB & ETWB to support the submission of a draft Development Scheme Plan (DSP) with its planning proposal to the Town Planning Board (TPB) for consideration.

5.1.2 The microclimate around the Site for the two Schemes have been assessed by Computational Fluid Dynamics (CFD). The results in this study have been compared to previous study to ensure the trustworthiness of the model settings and reliability of the model results.

5.1.3 The models result suggest that the air ventilation performance of the Proposed Scheme is similar to that of the Baseline Scheme thus no further air ventilation mitigation measures would be required for the Proposed Scheme. Further analysis for the south-westerly wind, which is one of the major wind direction, implies that the Proposed Scheme has the advantage in terms of ventilation performance of the downstream street canyons.

5.1.4 In conclusion, no adverse AVA impact is anticipated for the Proposed Scheme in compare with the Baseline Scheme, which follows the requirement in the latest OZP.

FIGURES



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Air Ventilation Assessment
Kai Tak Road / Sa Po Road Project (KC015)

Location of the Development Scheme Plan

SCALE	1:1000 @ A3	DATE	Dec 2018
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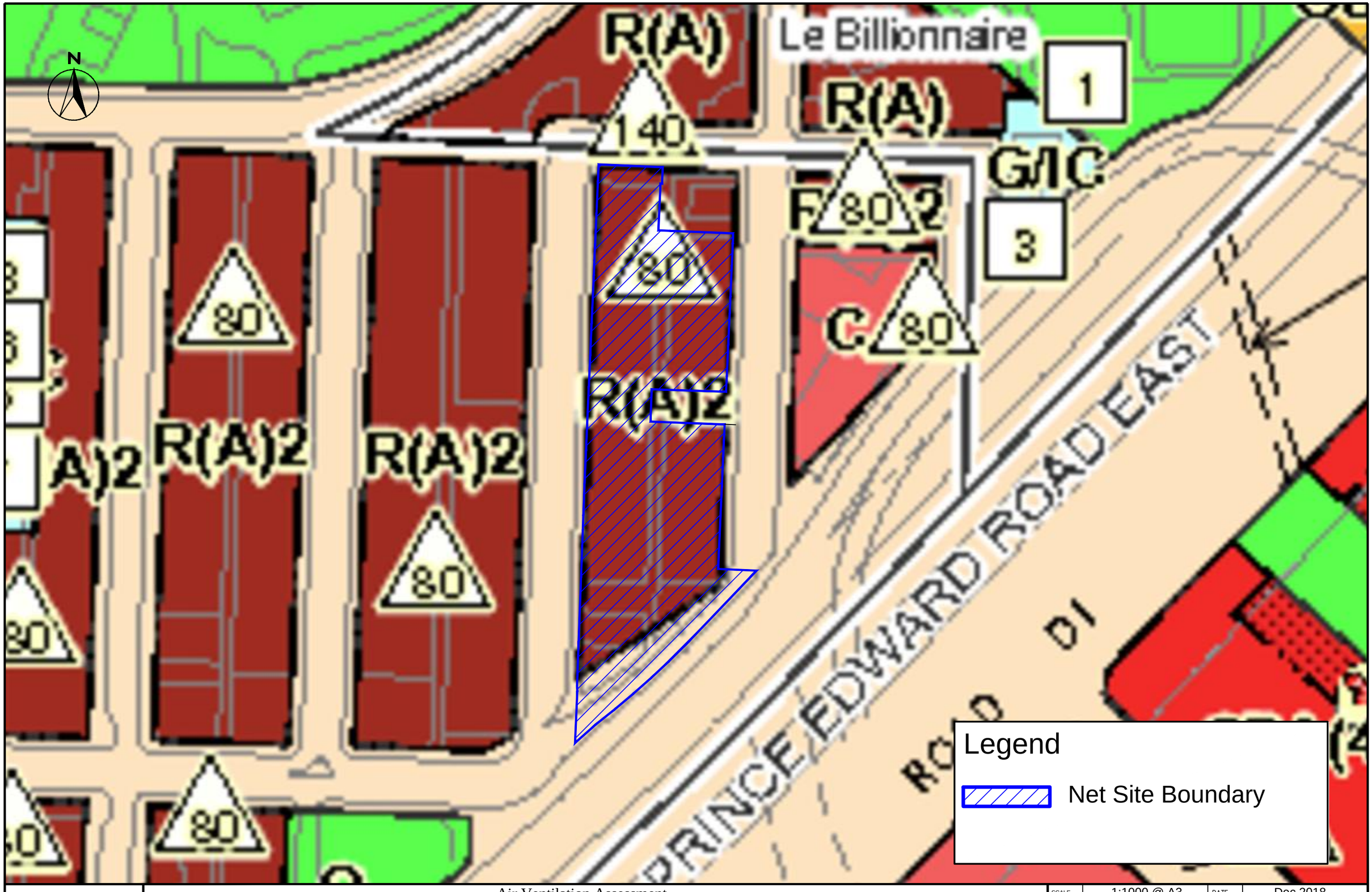
JOB No.	IA17019/KC015	DRAWING No.	1.1
		REV	-



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Air Ventilation Assessment
Kai Tak Road / Sa Po Road Project (KC015)

OZP Capture from Draft Ma Tau Kok OZP No. S/K10/23

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JOB No.	IA17019/KC015	DRAWING No.	1.2
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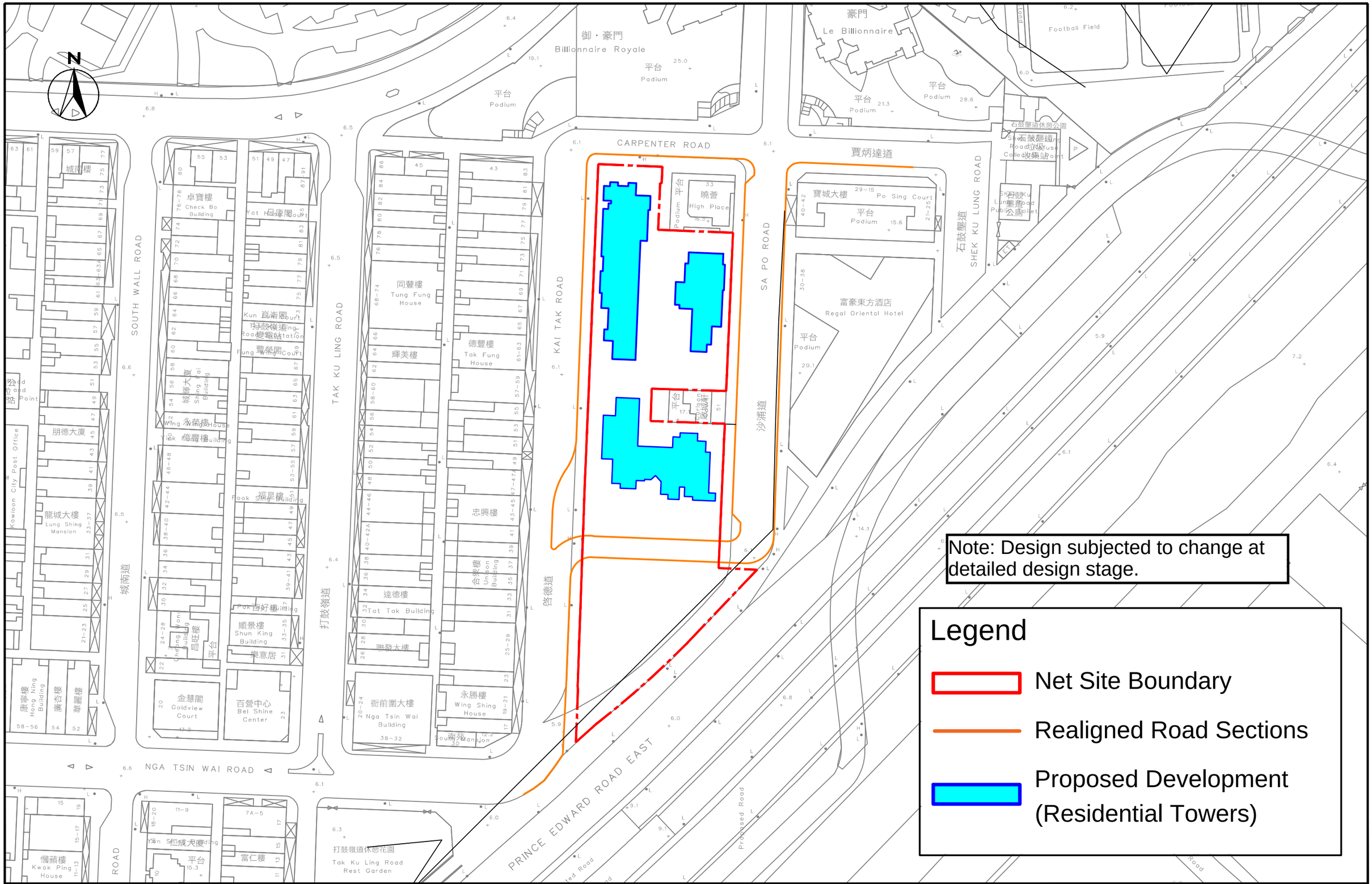

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Air Ventilation Assessment
Kai Tak Road / Sa Po Road Project (KC015)

General Layout of the Proposed Development

SCALE	1:1000 @ A3	DATE	Feb 2019
CHECK	KW	DRAWN	CC
JOB No.	IA17019/KC015	DRAWING No.	1.3
		REV	-

Note: Design subjected to change at detailed design stage.

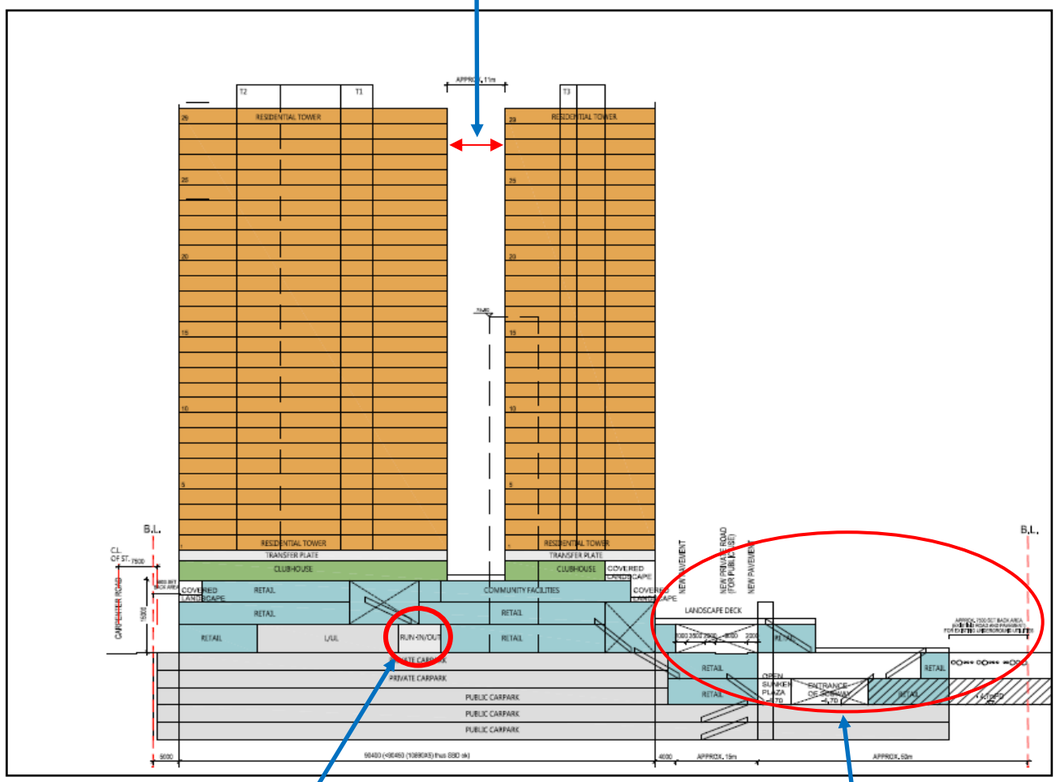
Key Plan

(Notional layout subject to detailed design upon DSP approval.)

Figure 1.4 Scheme Section of the Proposed Development

1:750 (A3)
26 NOV 2018

Gap Width:
~11m



Ingress/Egress

Split-level Sunken Plaza with landscaping and open area

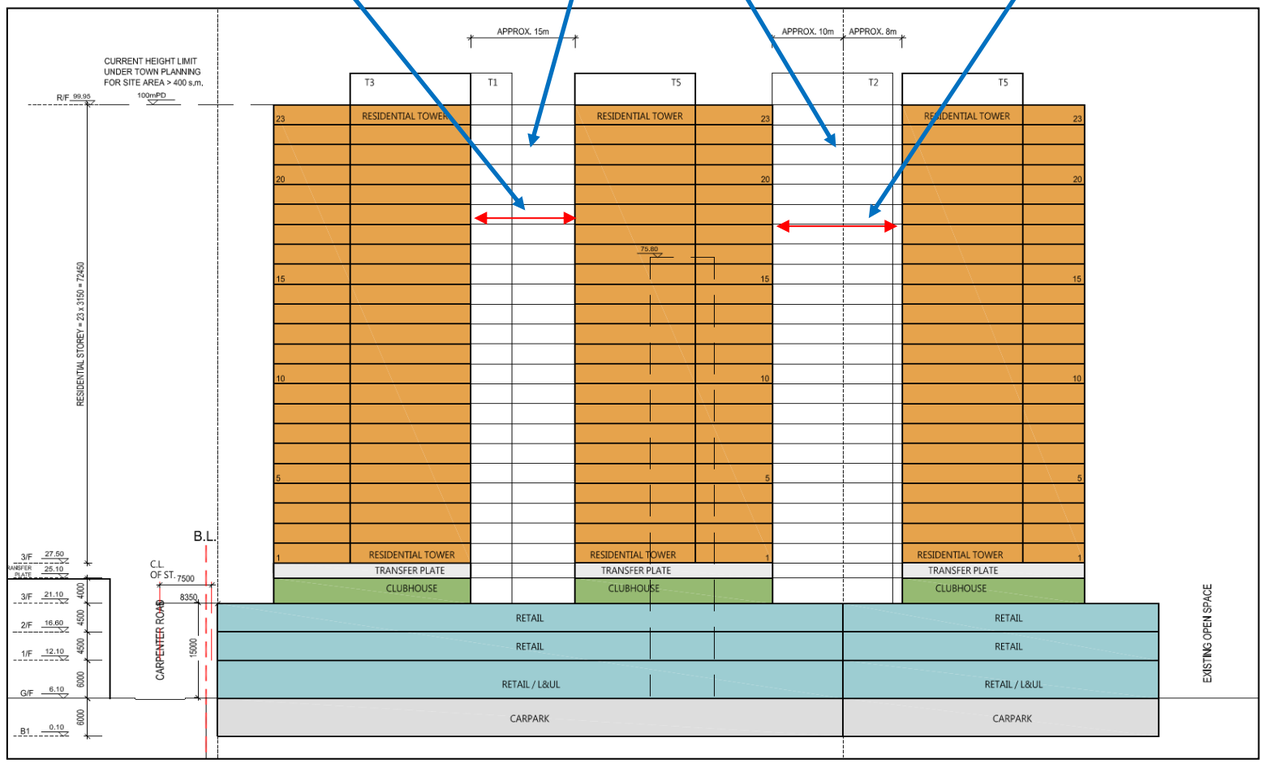
Proposed Scheme (120 mPD)

Note: Design subjected to change at detailed design stage.

Two Building with the same Building Height behind the Gap (Please refer to Figure 1.5b)

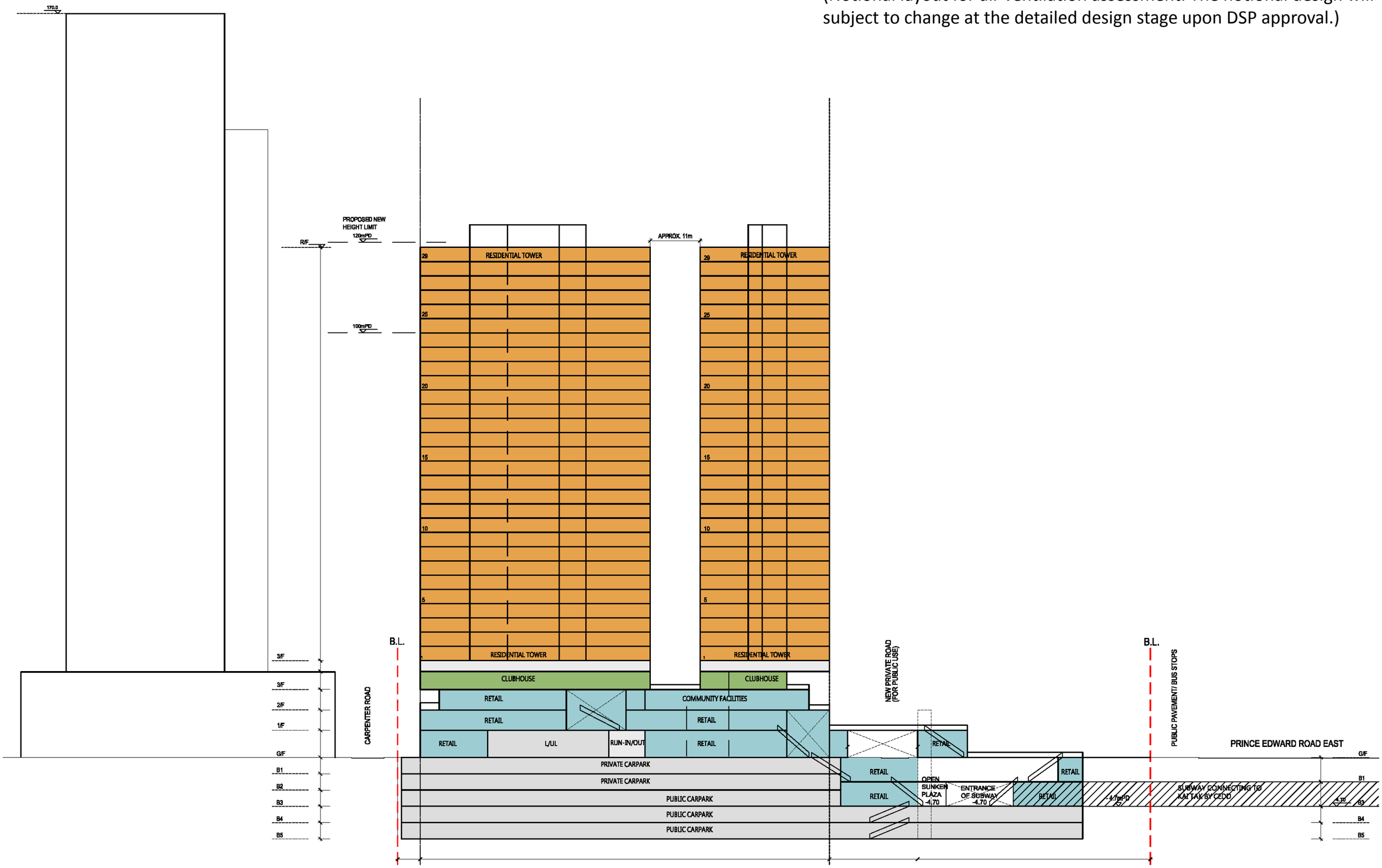
Gap Width:
~ 15 m

Gap Width:
~18 m



Baseline Scheme (100 mPD)

(Notional layout for air ventilation assessment. The notional design will subject to change at the detailed design stage upon DSP approval.)



URBAN RENEWAL AUTHORITY 市區重建局

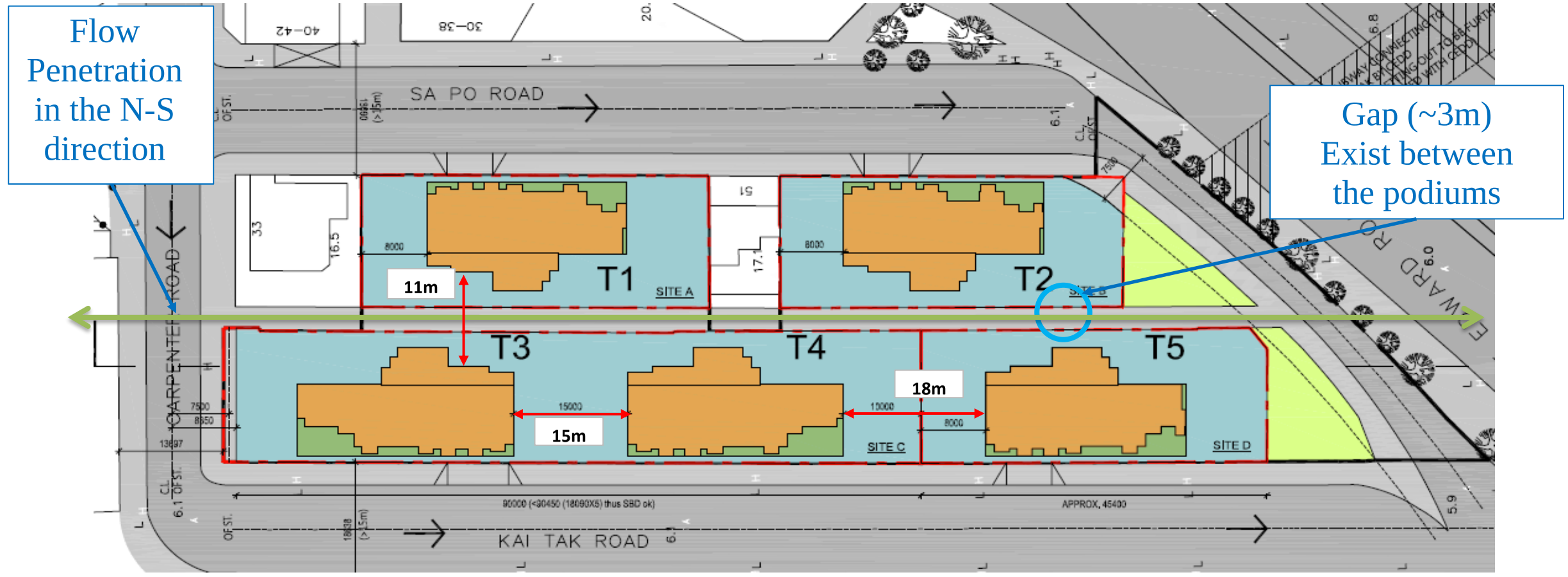
URA Kai Tak Road / Sa Po Road Development Scheme (KC-015)

Blown-up Plan of the 120mPD Proposed Scheme from AVA Report Fig 1.5a

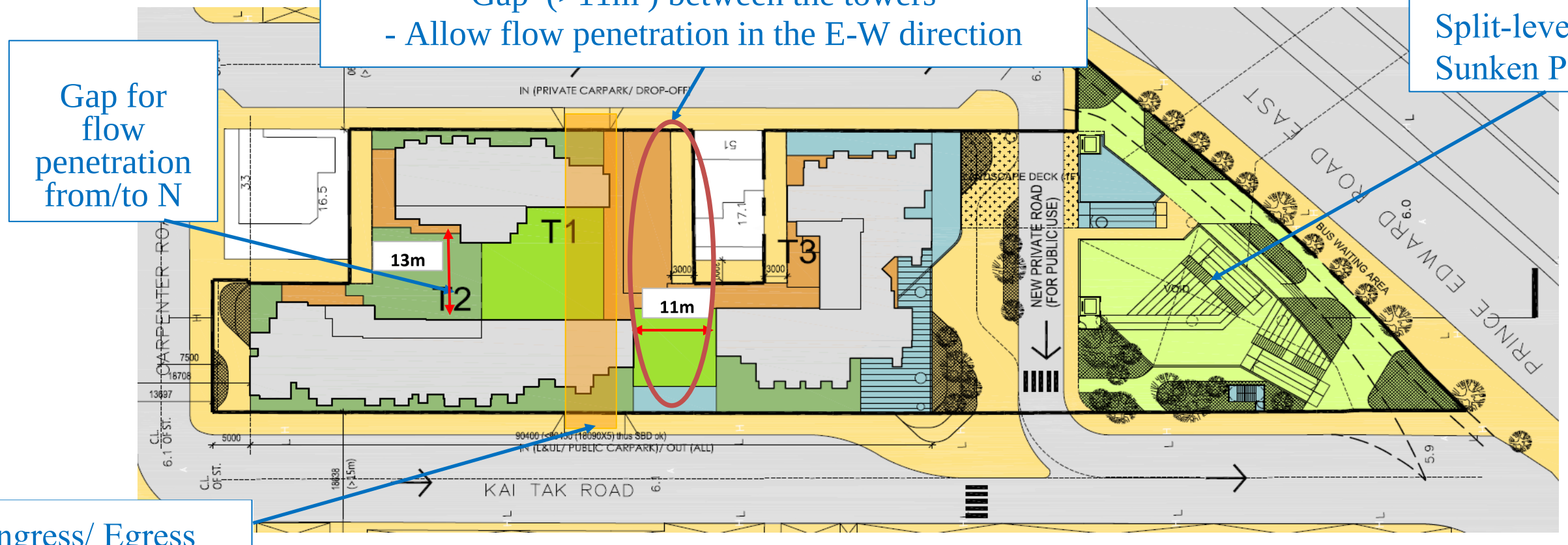
Comparison between Designs of the Baseline and Proposed Schemes

SCALE	N.T.S.	DATE	Feb-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO.	1.5b	REV. 1

Baseline Scheme (100 mPD)



Proposed Scheme (120 mPD)



Note: Notional Design subjected to change

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Air Ventilation Assessment
Kai Tak Road / Sa Po Road Project (KC015)

Building Heights in the Surrounding Area

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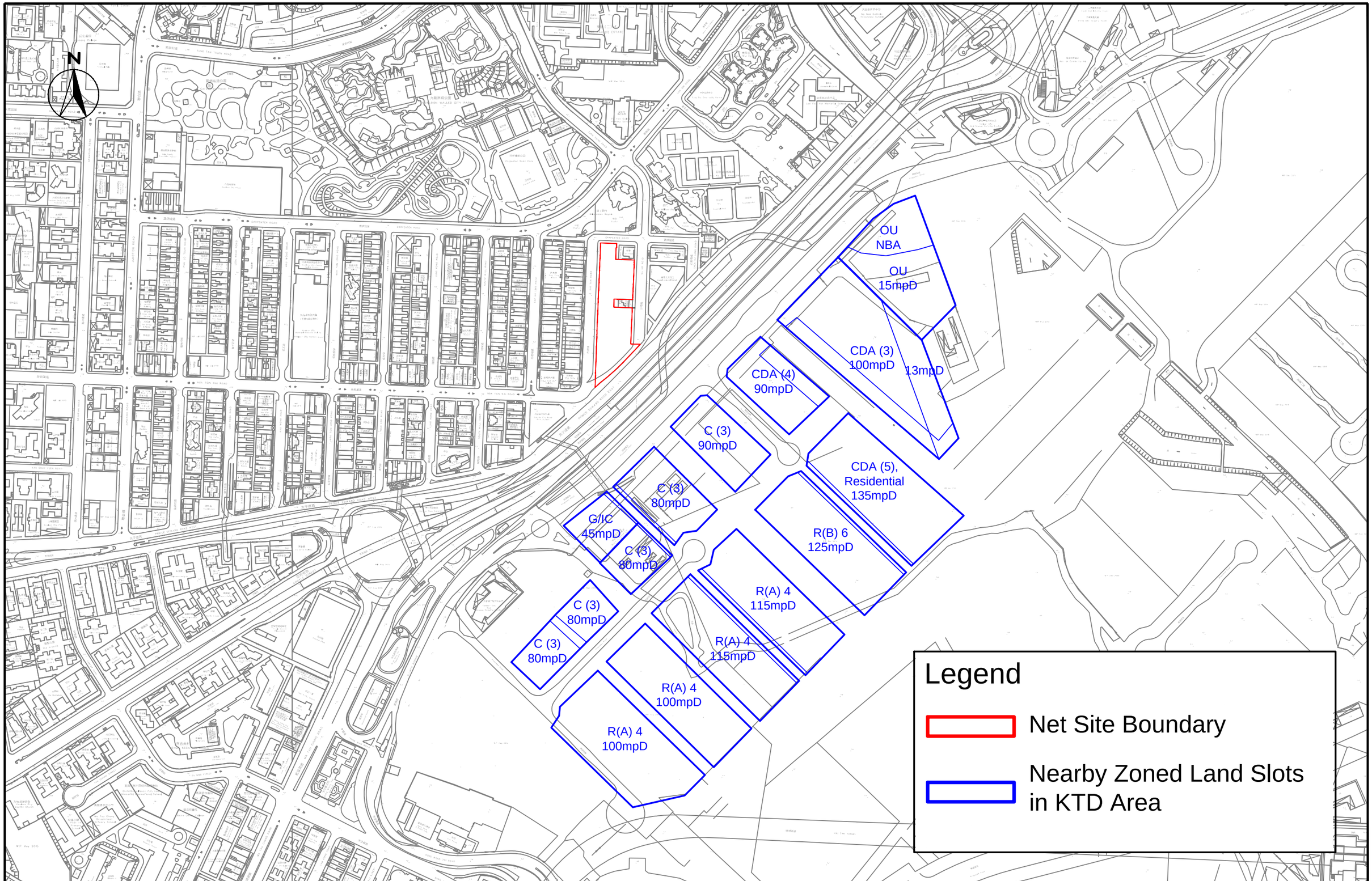
CHECK	KW	DRAWN	CC
JOB No.	IA17019/KC015	DRAWING No.	1.6
		REV	-



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Air Ventilation Assessment
Kai Tak Road / Sa Po Road Project (KC015)

Zoned Land Slots Capture from Approved Kai Tak OZP No. S/K22/6

SCALE	1:4000 @ A3	DATE	Feb 2019
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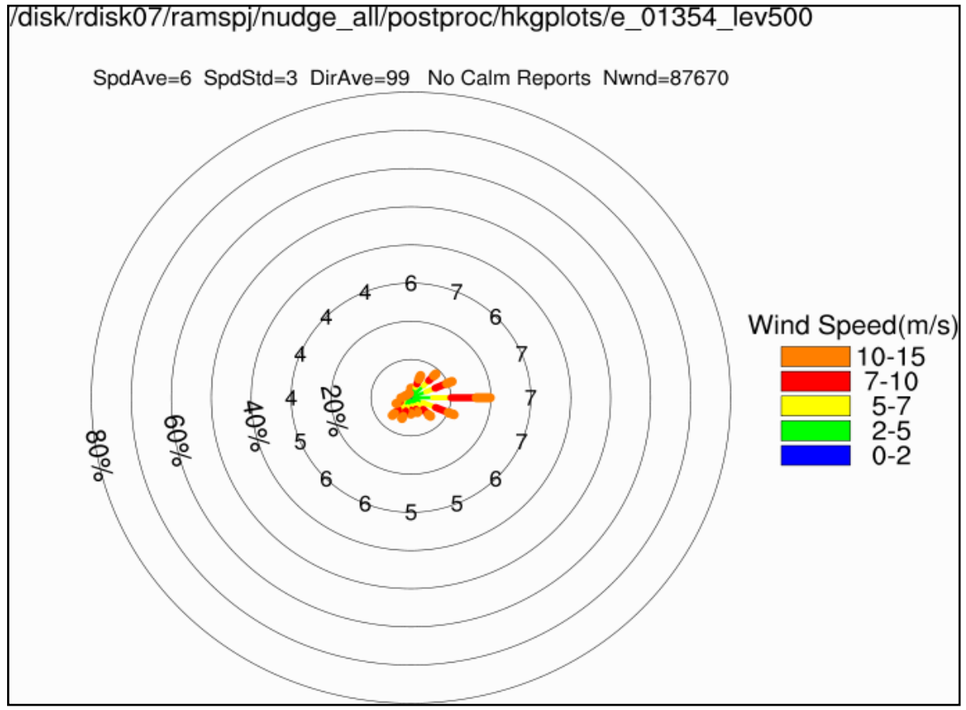
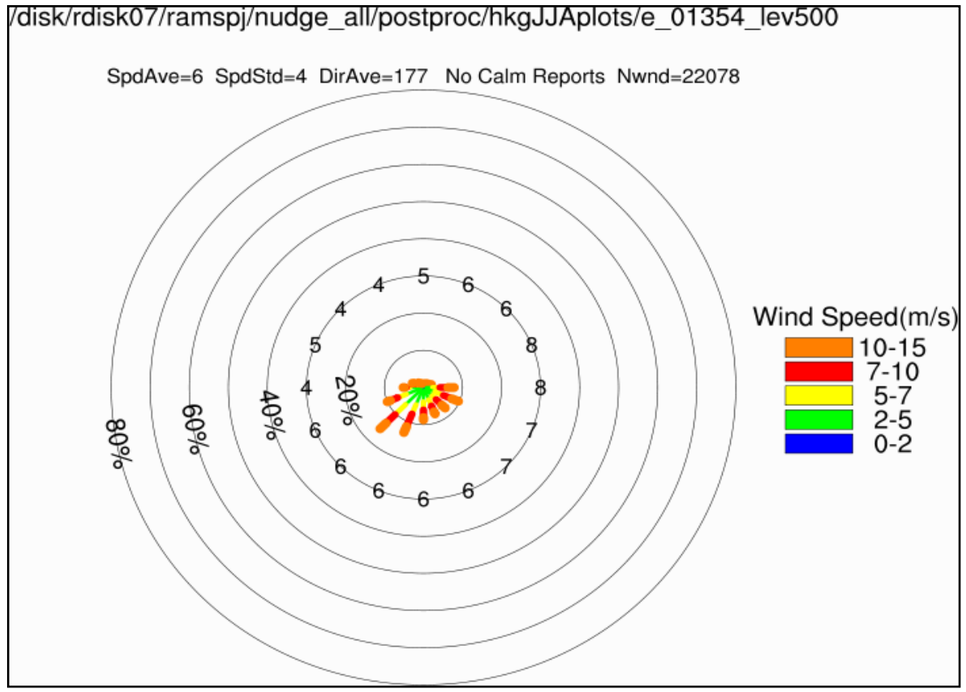
JOB No.	IA17019/KC015	DRAWING No.	1.7
		REV	-

Annual



Summer



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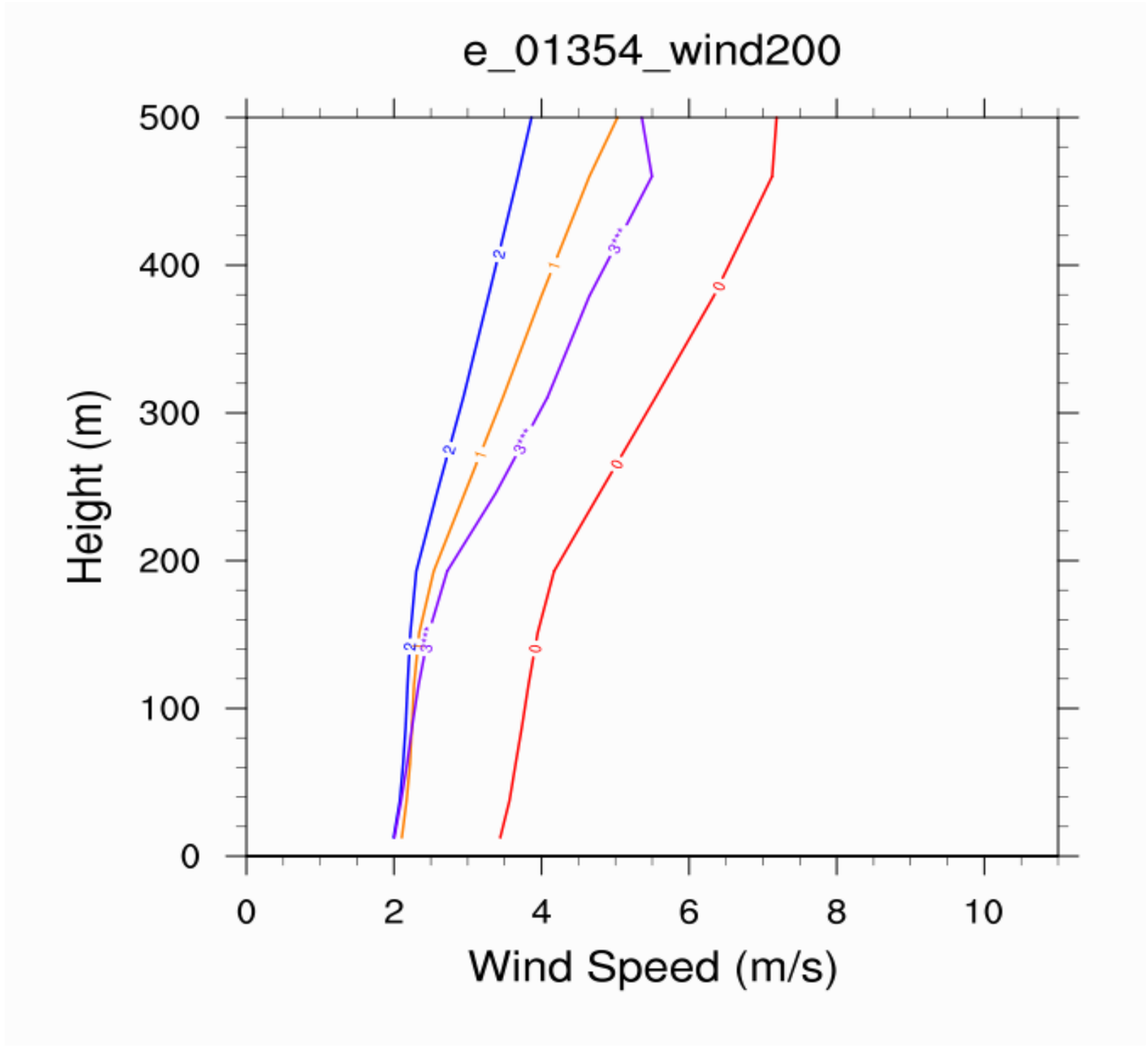
Kai Tak Road / Sa Po Road Project (KC015)

The Wind Roses at grid [084,045] from RAMS

SCALE	N.T.S.	DATE	Oct-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO.	2.1a	REV. 1



Legend

0: 22.5°-112.4°

1: 112.5°-202.4°

2: 202.5°-292.4°

3: 292.5°-22.4°

https://www.pland.gov.hk/pland_en/info_serv/site_wind/site_wind/084045.html

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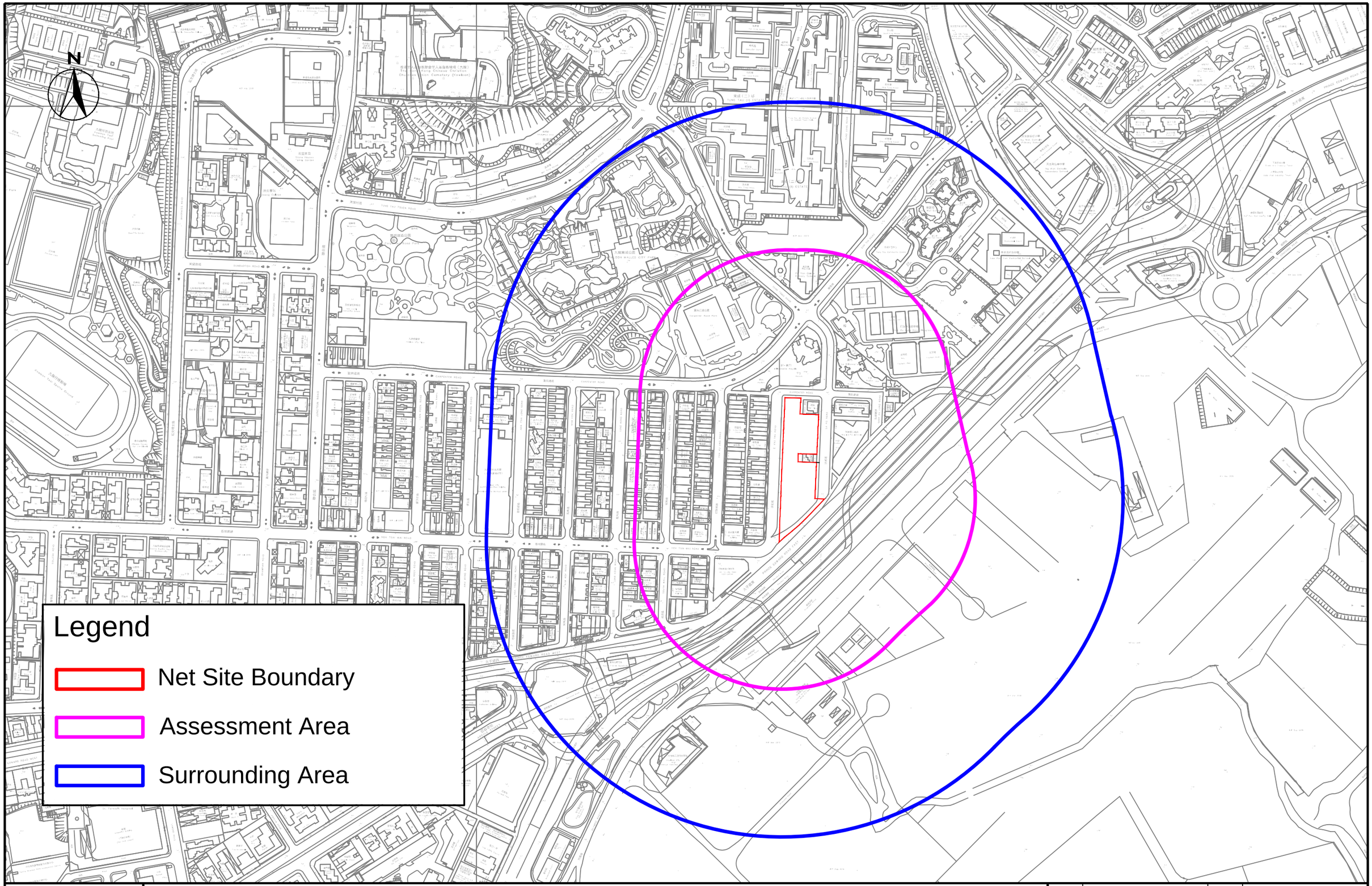
Air Ventilation Assessment

Kai Tak Road / Sa Po Road Project (KC015)

The Wind Profile from RAMS

SCALE	N.T.S.	DATE	Feb-19	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO.	2.1b	REV. 1



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Air Ventilation Assessment
Kai Tak Road / Sa Po Road Project (KC015)

Assessment Area and Surrounding Area

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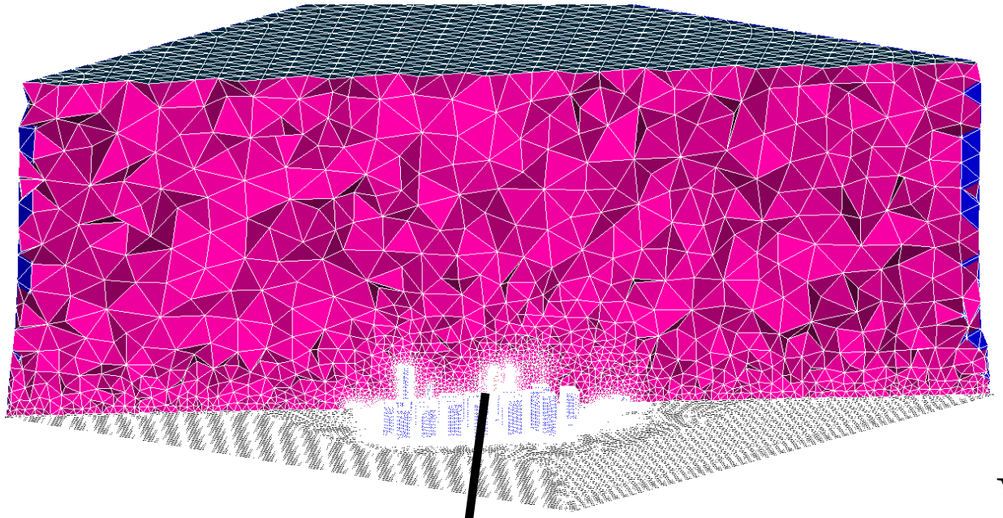
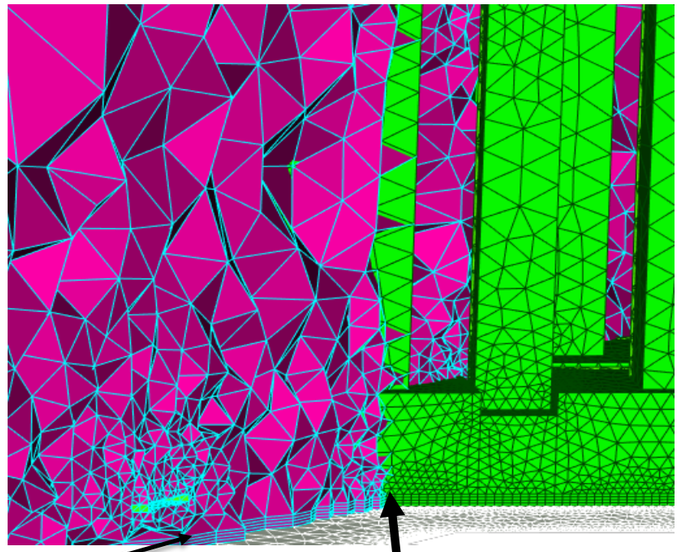
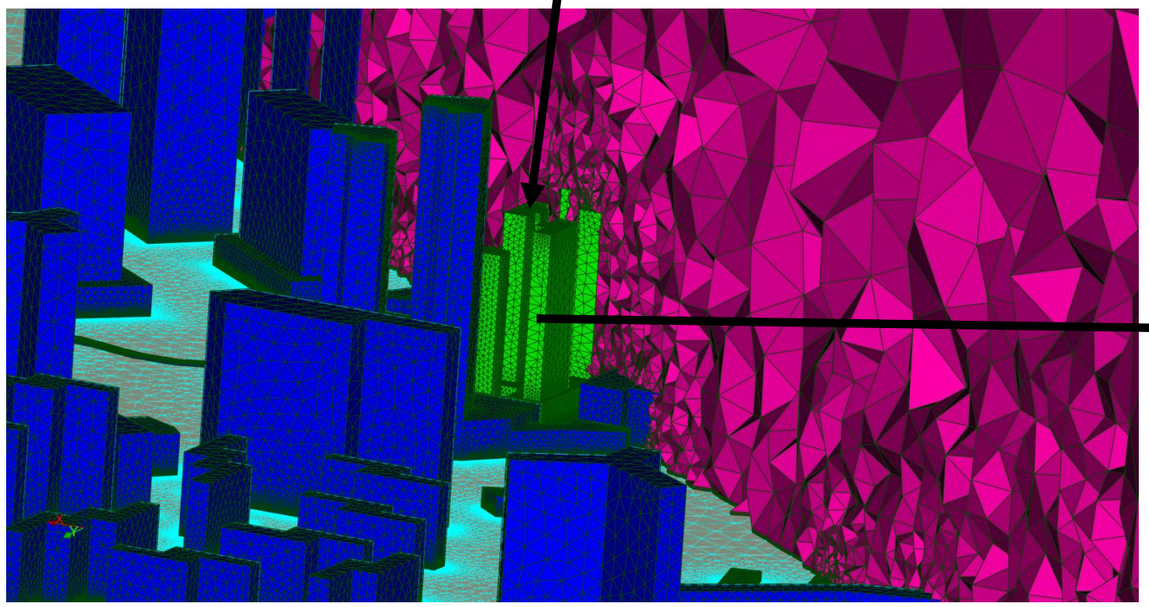
CHECK	KW	DRAWN	CC
JOB No.	IA17019/KC015	DRAWING No.	3.1
		REV	-

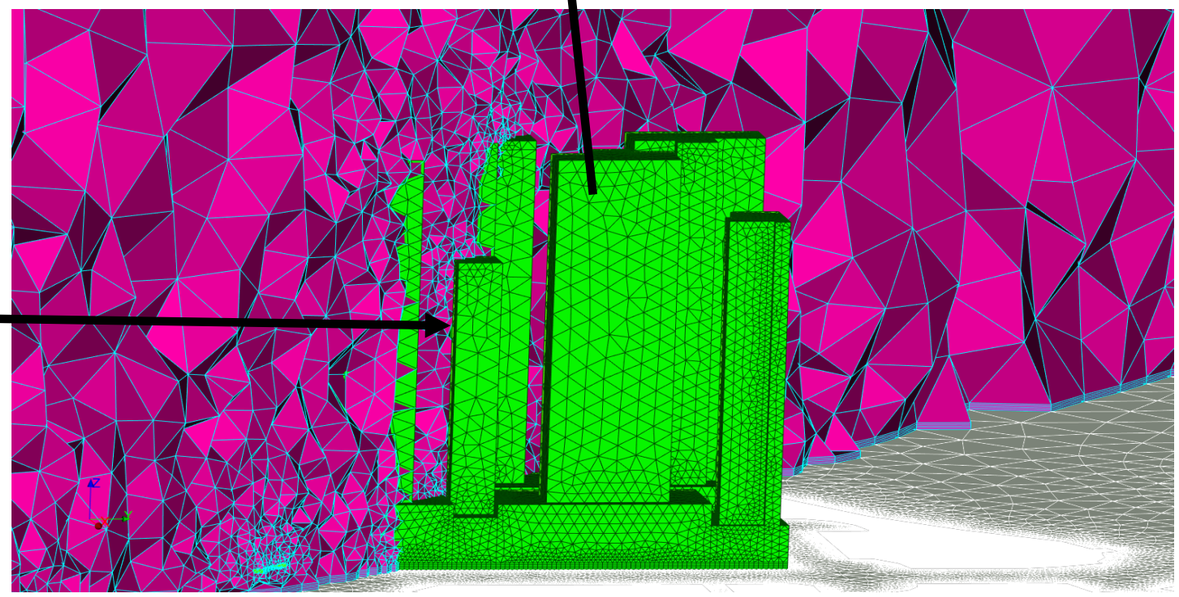




Viscous Layers at Ground

Near the Site





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Air Ventilation Assessment

Kai Tak Road / Sa Po Road Project (KC015)

Meshes in 3D Space

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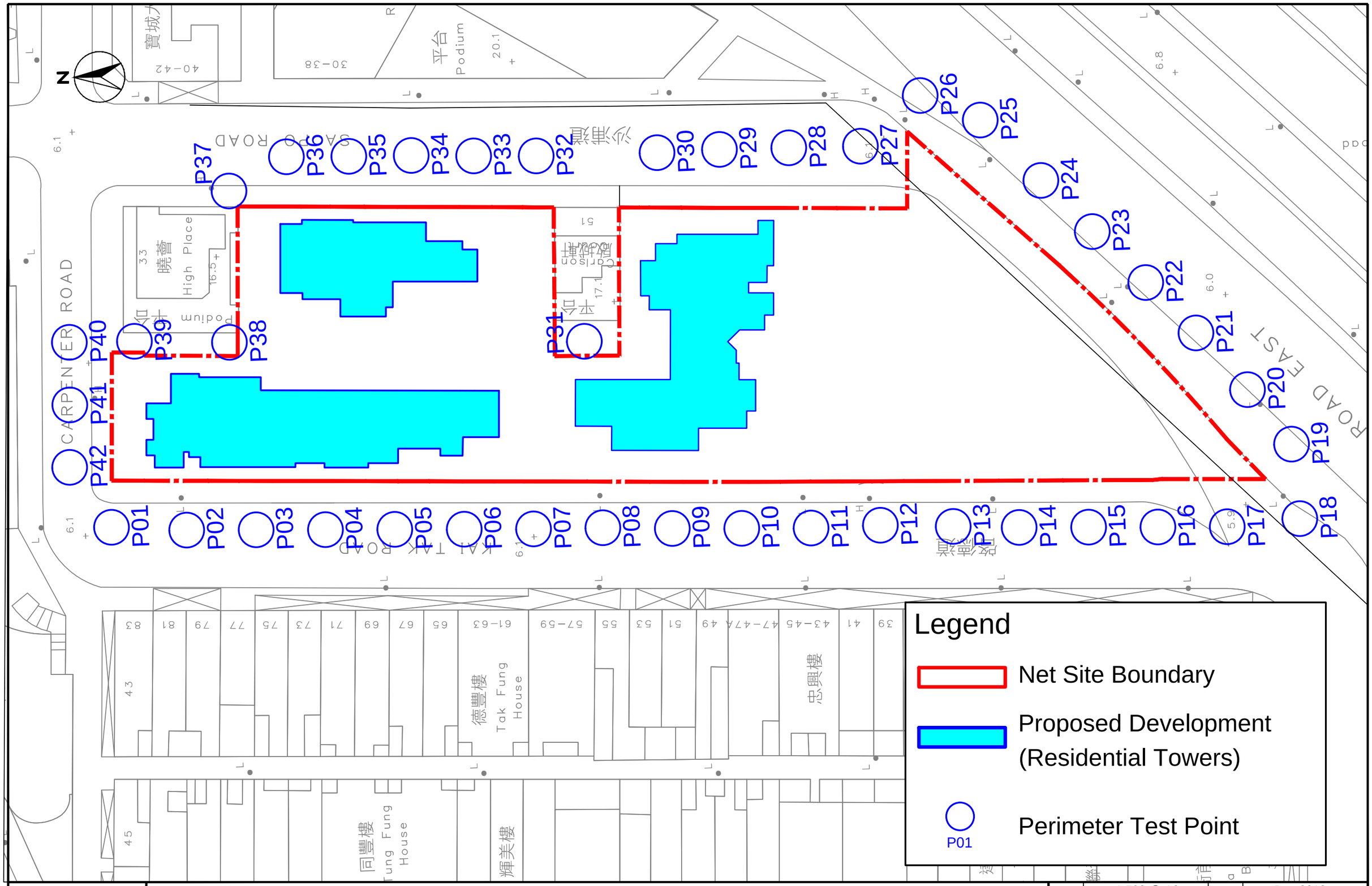
CHECK	KW	DRAWN	CC	
JOB NO.	17019/KC0	FIGURE NO.	3.10	REV. 1



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Air Ventilation Assessment
Kai Tak Road / Sa Po Road Project (KC015)

Perimeter Test Points

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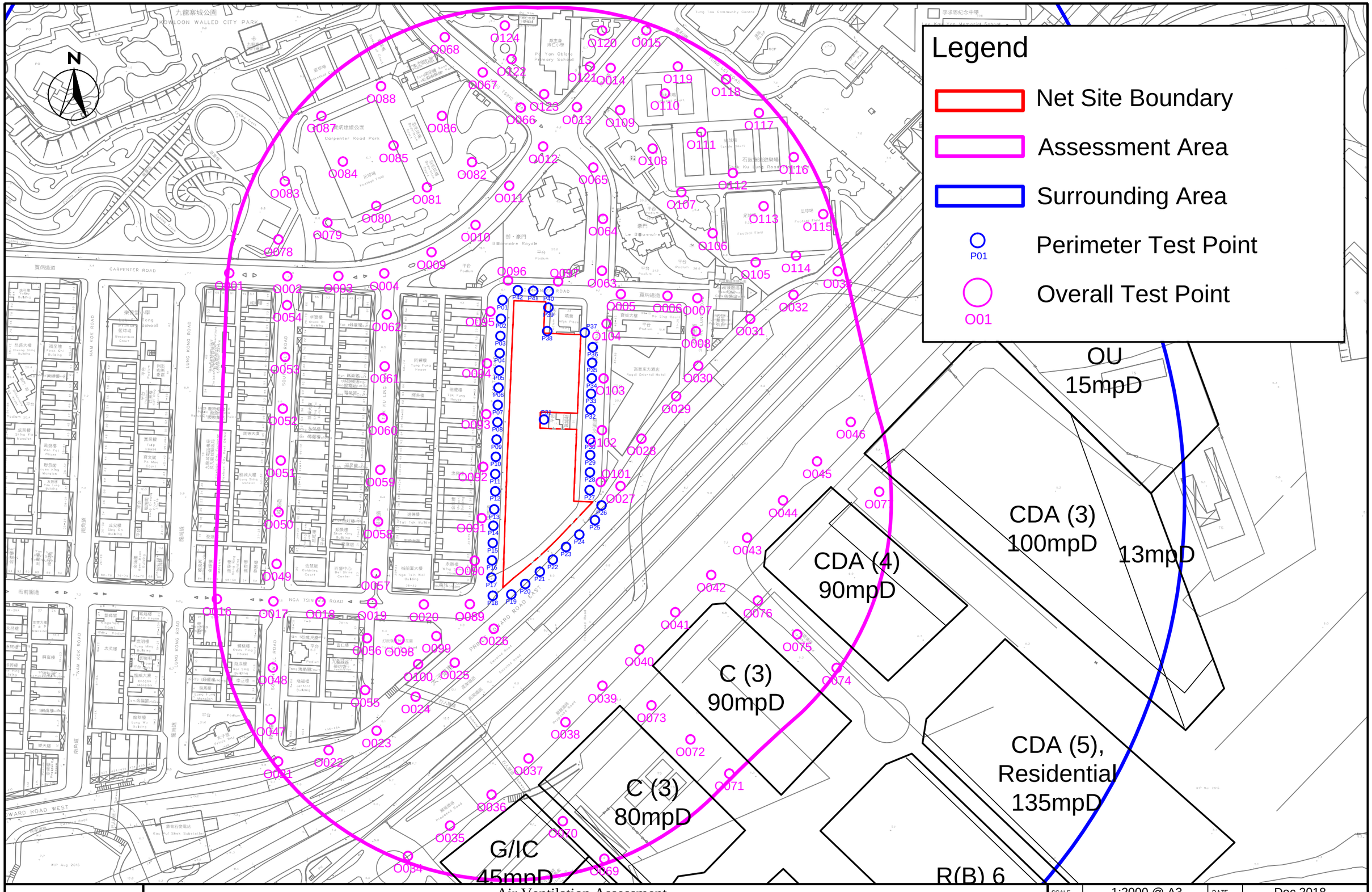
JOB No.	IA17019/KC015	DRAWING No.	3.2
		REV	-



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Air Ventilation Assessment
Kai Tak Road / Sa Po Road Project (KC015)

Overall Test Points

SCALE	1:2000 @ A3	DATE	Dec 2018
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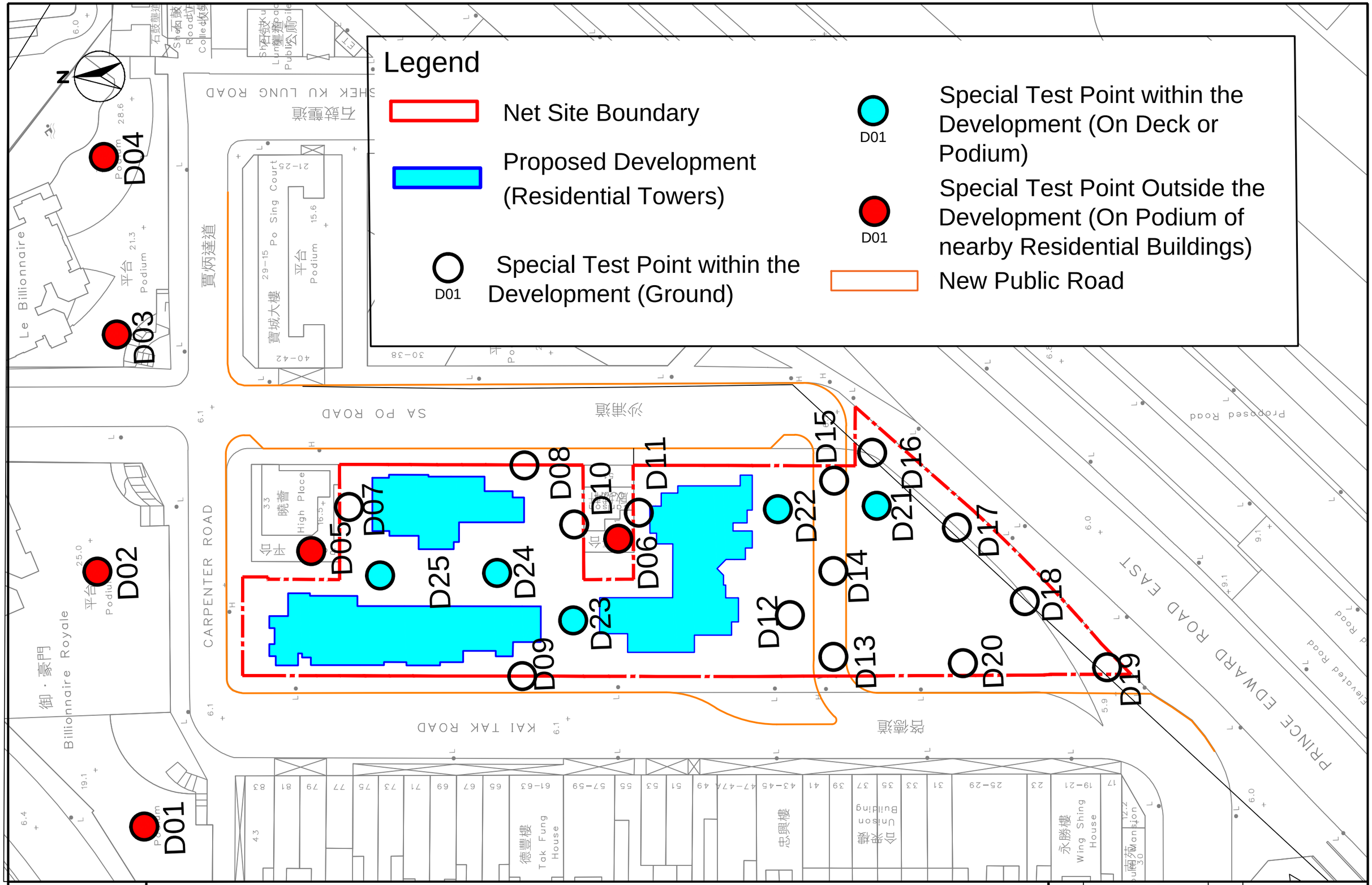
JOB No.	IA17019/KC015	DRAWING No.	3.3
		REV	-



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Air Ventilation Assessment
Kai Tak Road / Sa Po Road Project (KC015)

Special Test Points

SCALE	1:1000 @ A3	DATE	Feb 2019
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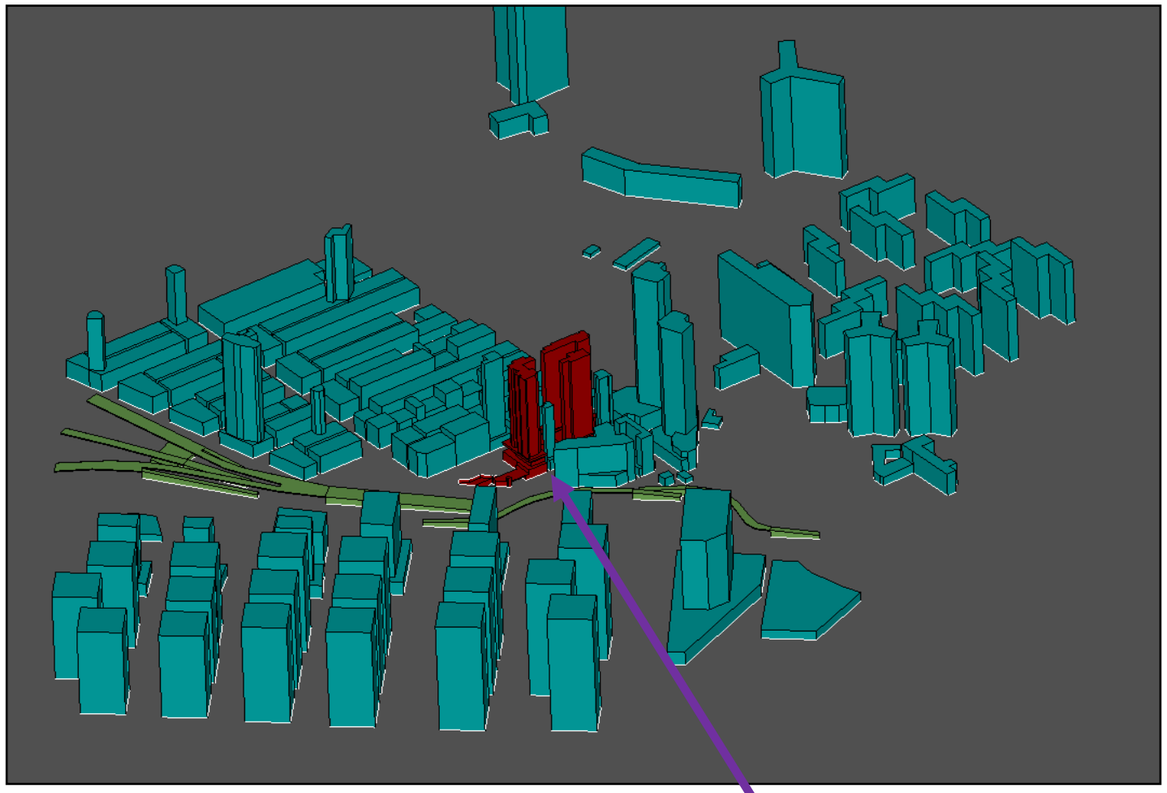
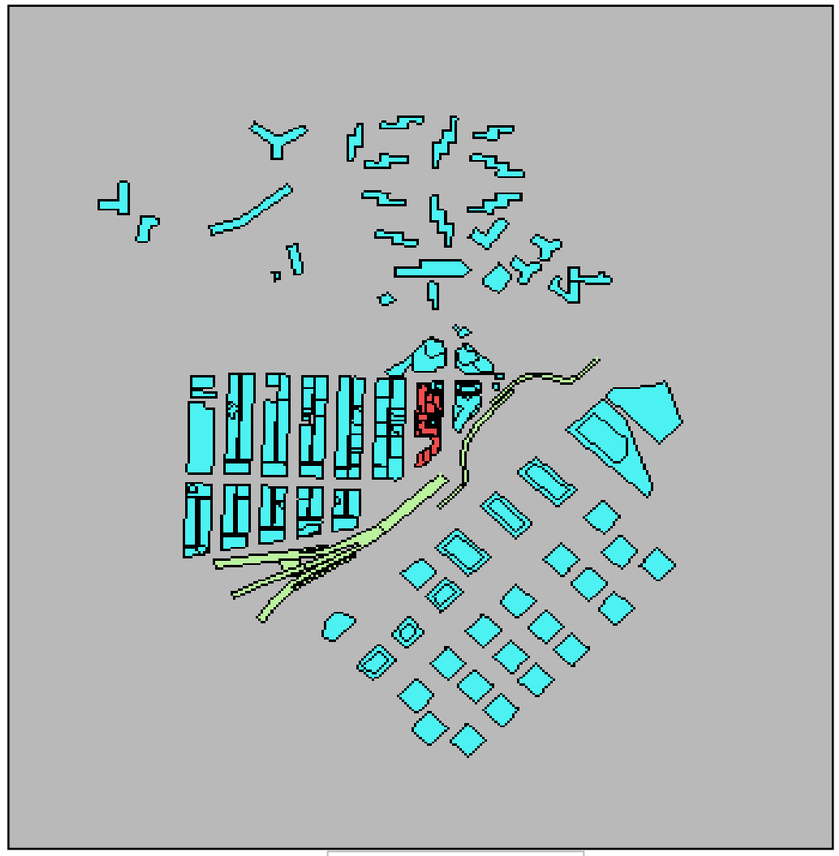
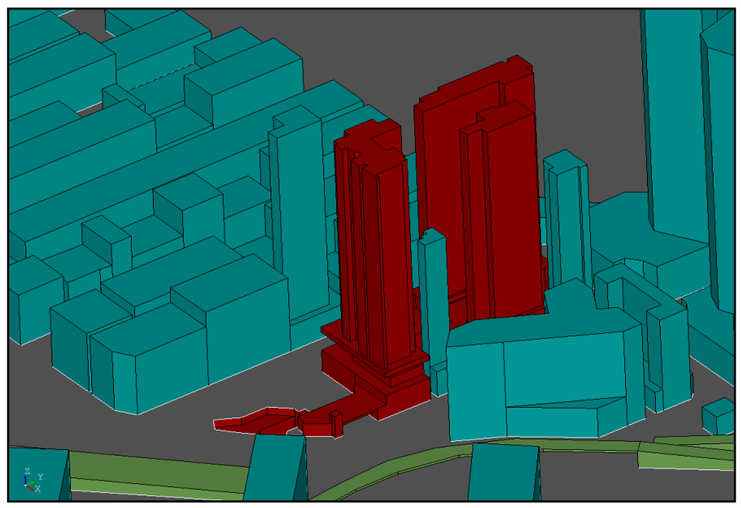
JOB No.	IA17019/KC015	DRAWING No.	3.4
		REV	-





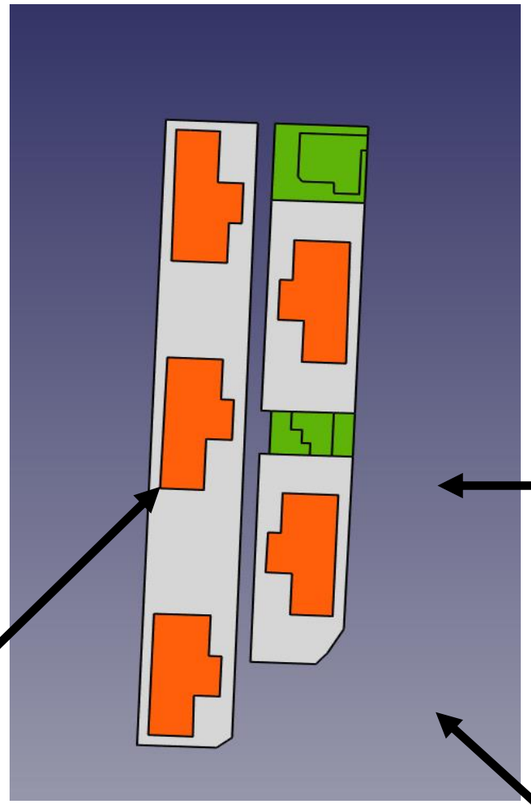
Top

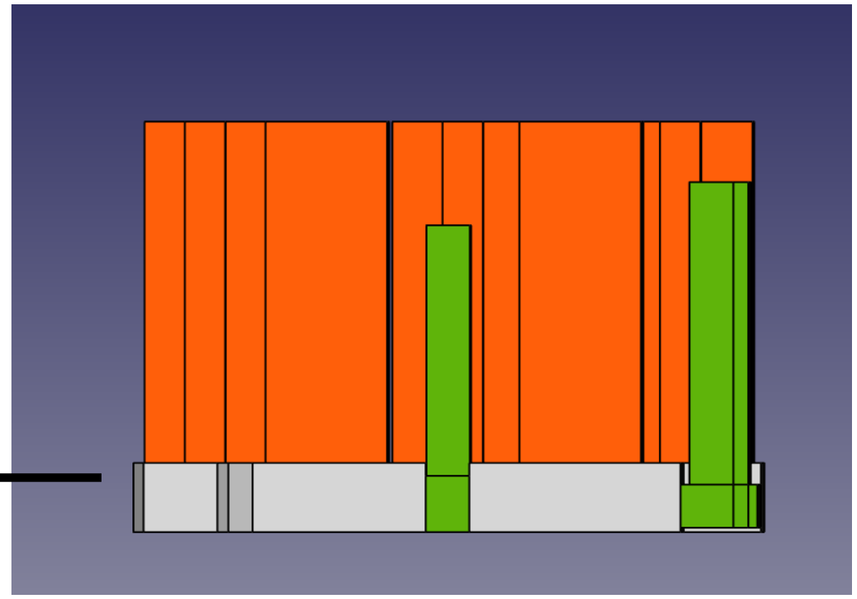


Site

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) Buildings Included in the CFD Models	SCALE	N.T.S.	DATE Feb-19
		CHECK	KW	DRAWN CC
		JOB NO.	IA17019/K	FIGURE NO. 3.5 REV. 1

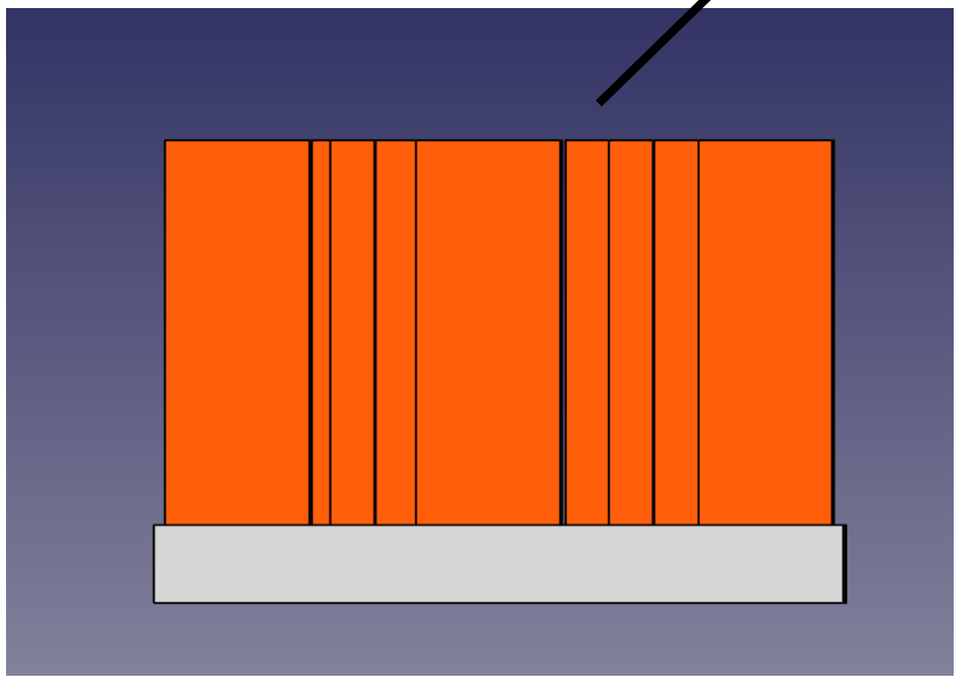
Top





Back

Front



Note: The green buildings are the existing buildings

*** The buildings in green are other buildings in the immediate surrounding of the site**

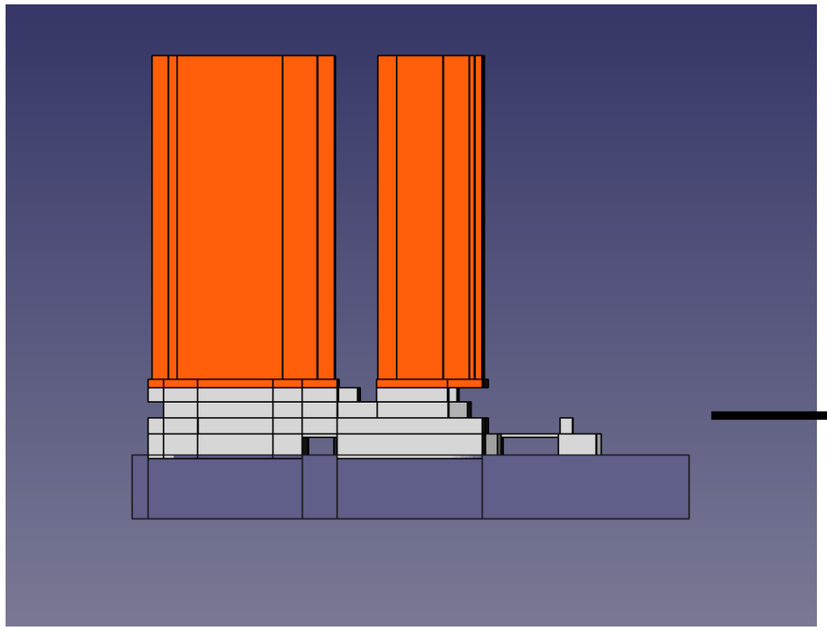
CINOTECH 漢臻 consultants limited

Air Ventilation Assessment

Kai Tak Road / Sa Po Road Project (KC015)

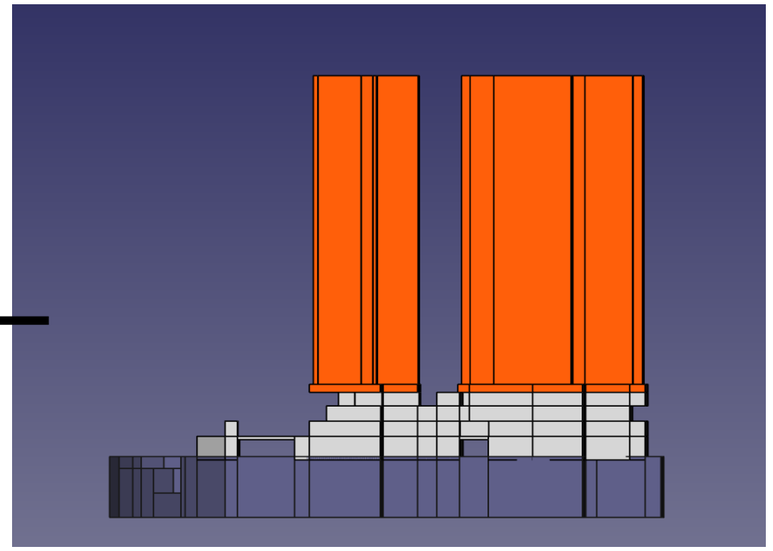
3D Model of the Baseline Building (Superstructure) adopted in CFD

SCALE	N.T.S.	DATE	Feb-19	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO. 3.6a		REV.
				1



Front

Top



Back

*** The purple shaded structure underneath the grey region is the underground, which includes the part of the entrance area of the underpass**

CINOTECH 漢臻 consultants limited

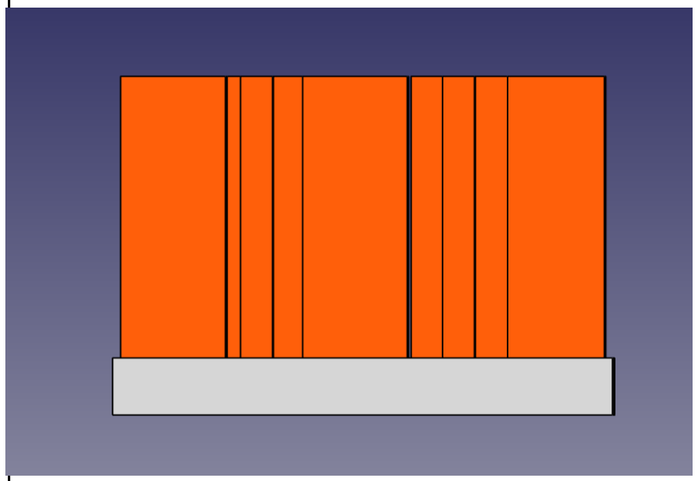
Air Ventilation Assessment

Kai Tak Road / Sa Po Road Project (KC015)

3D Model of the Proposed Building (Superstructure) adopted in CFD

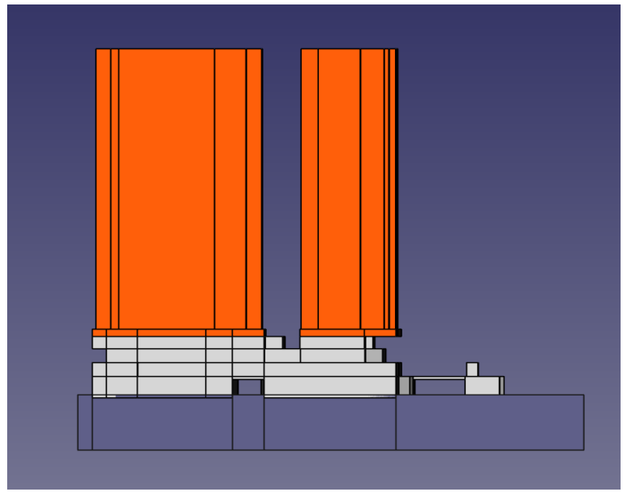
SCALE	N.T.S.	DATE	Oct-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO.	3.6b	REV.
				1

Baseline

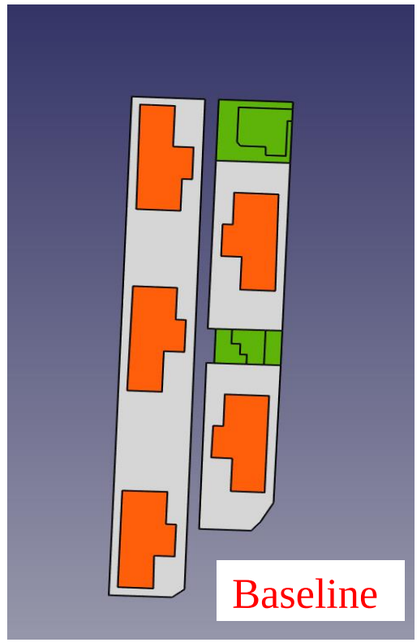


Front

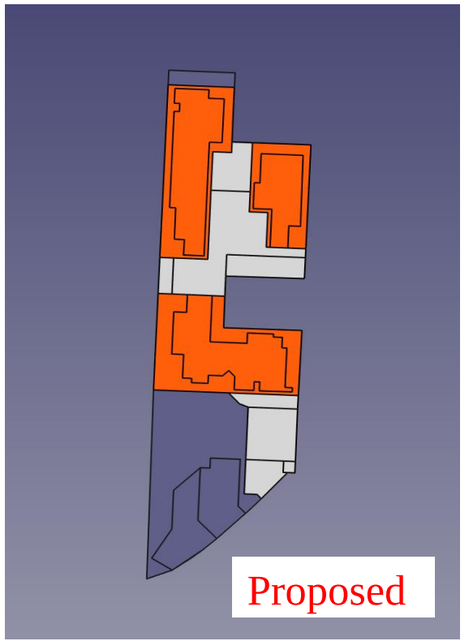
Proposed



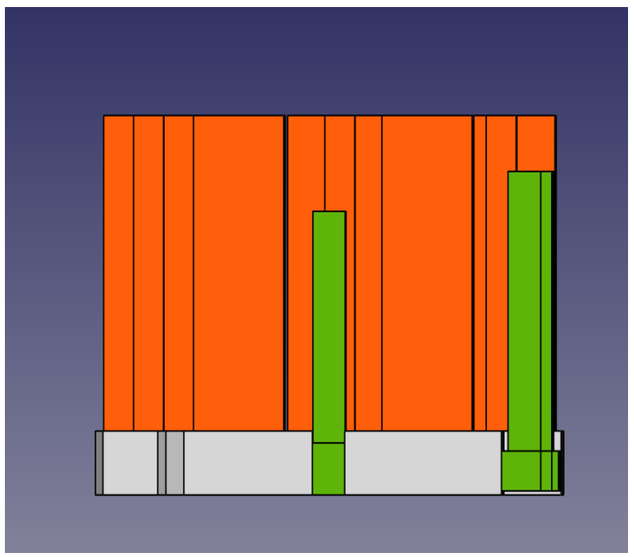
Note: The green buildings are the existing buildings.



Top

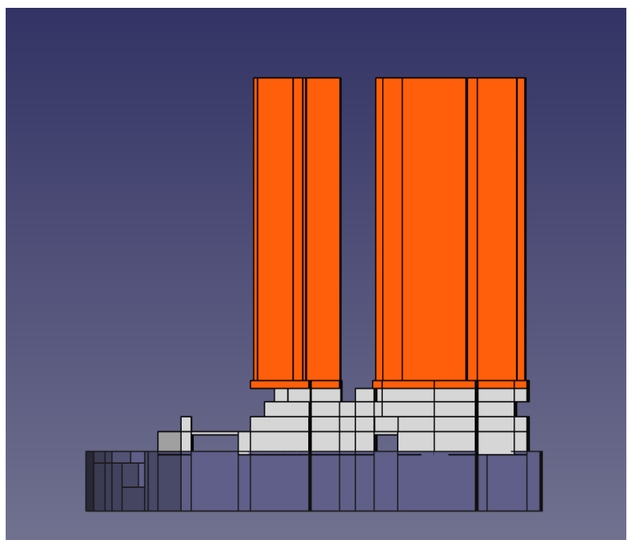


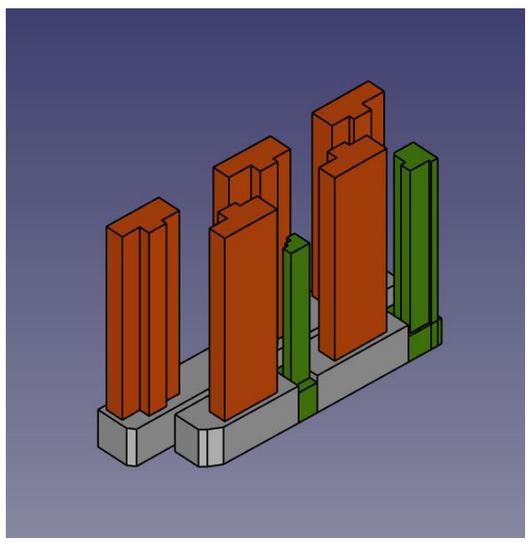
Baseline



Back

Proposed





Baseline

Orthogonal

Proposed

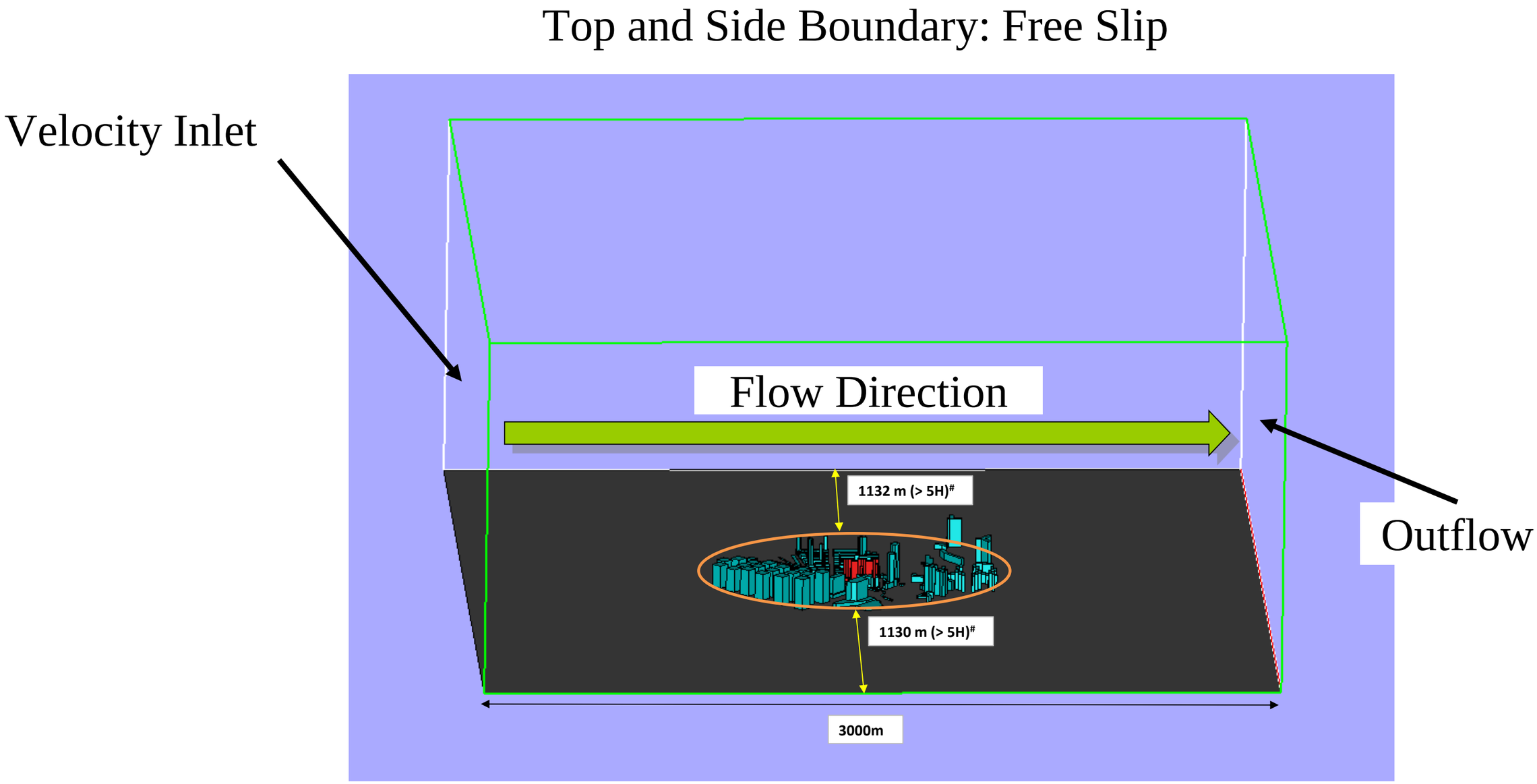
CINOTECH 漢臻 consultants limited

Air Ventilation Assessment

Kai Tak Road / Sa Po Road Project (KC015)

Comparison between the Baseline and Proposed Model

SCALE	N.T.S.	DATE	Feb-19	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO. 3.6b		REV.
				1

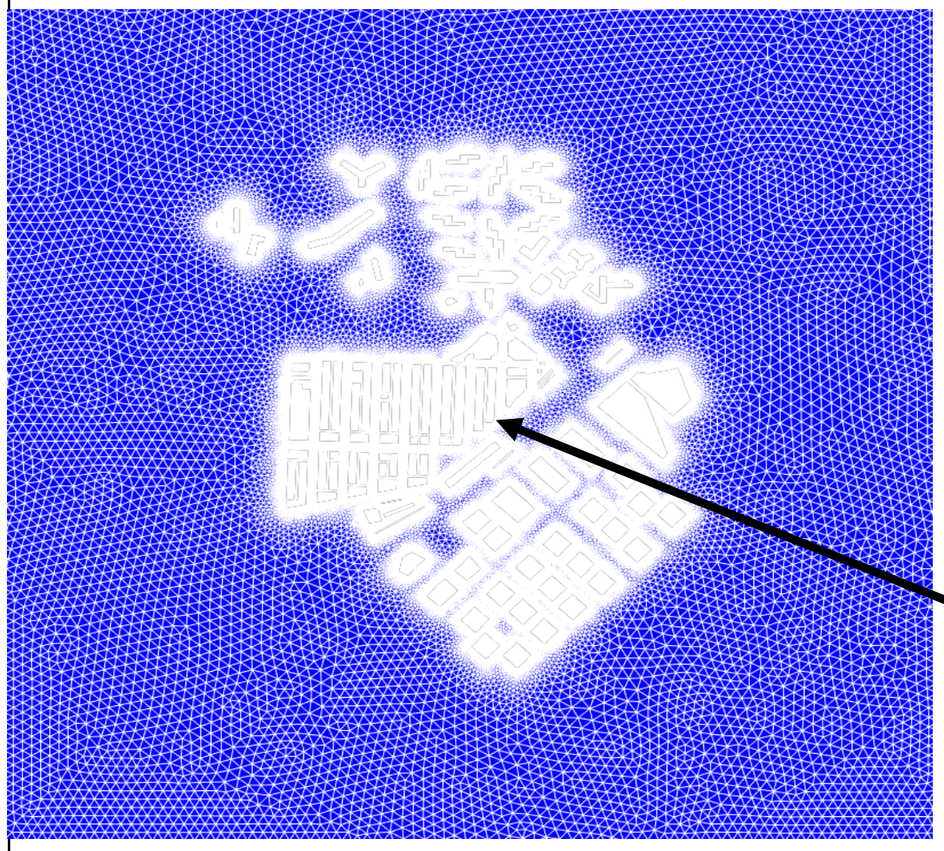


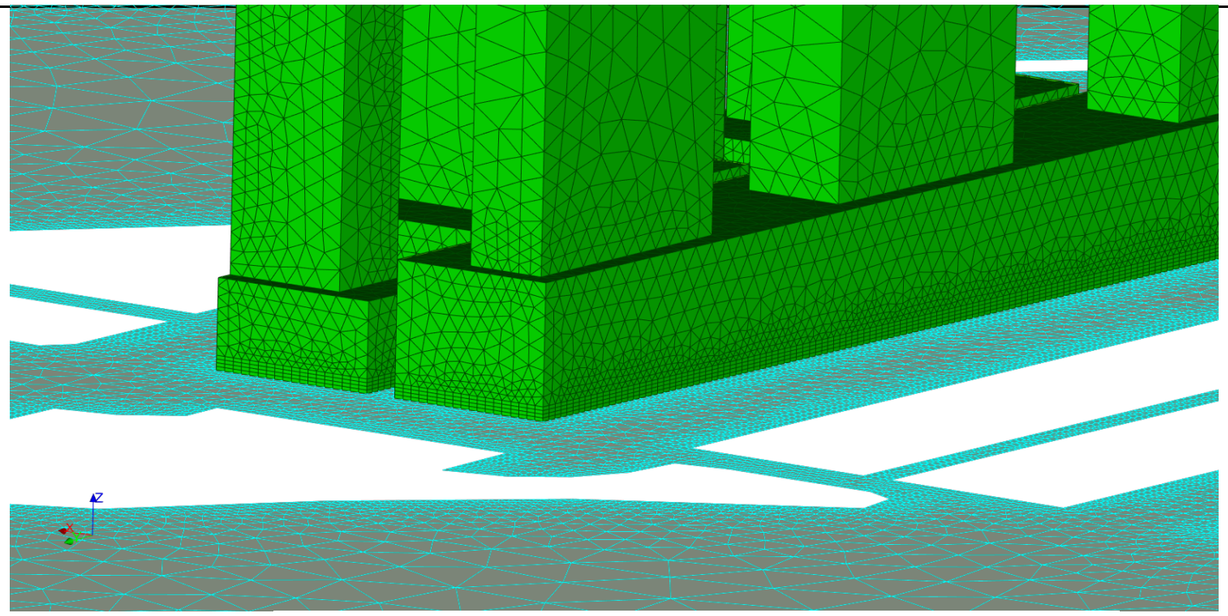
Ground & Building Walls: No Slip

* Setting for 180 deg Wind is adopted in this example

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Computational Domain**	SCALE	N.T.S.	DATE	Feb-19
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 3.8	REV. 1

Top





Viscous Layers at Ground

Near the Site

CINOTECH 漢臻 consultants limited

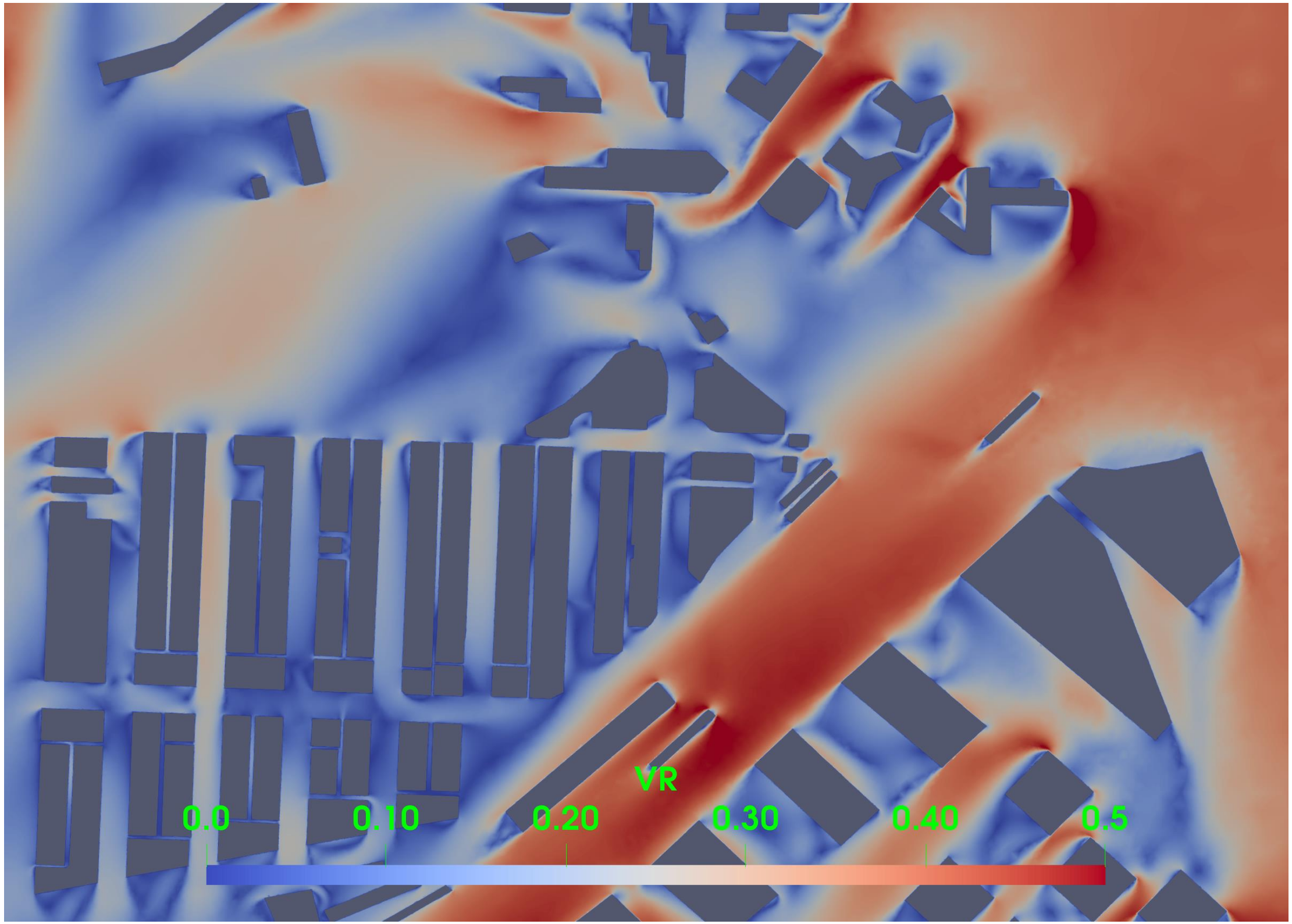
Air Ventilation Assessment

Kai Tak Road / Sa Po Road Project (KC015)

Meshes on 2D Surfaces

SCALE	N.T.S.	DATE	Oct-18
CHECK	KW	DRAWN	CC
JOB NO.	17019/KC0	FIGURE NO. 3.9	REV. 1

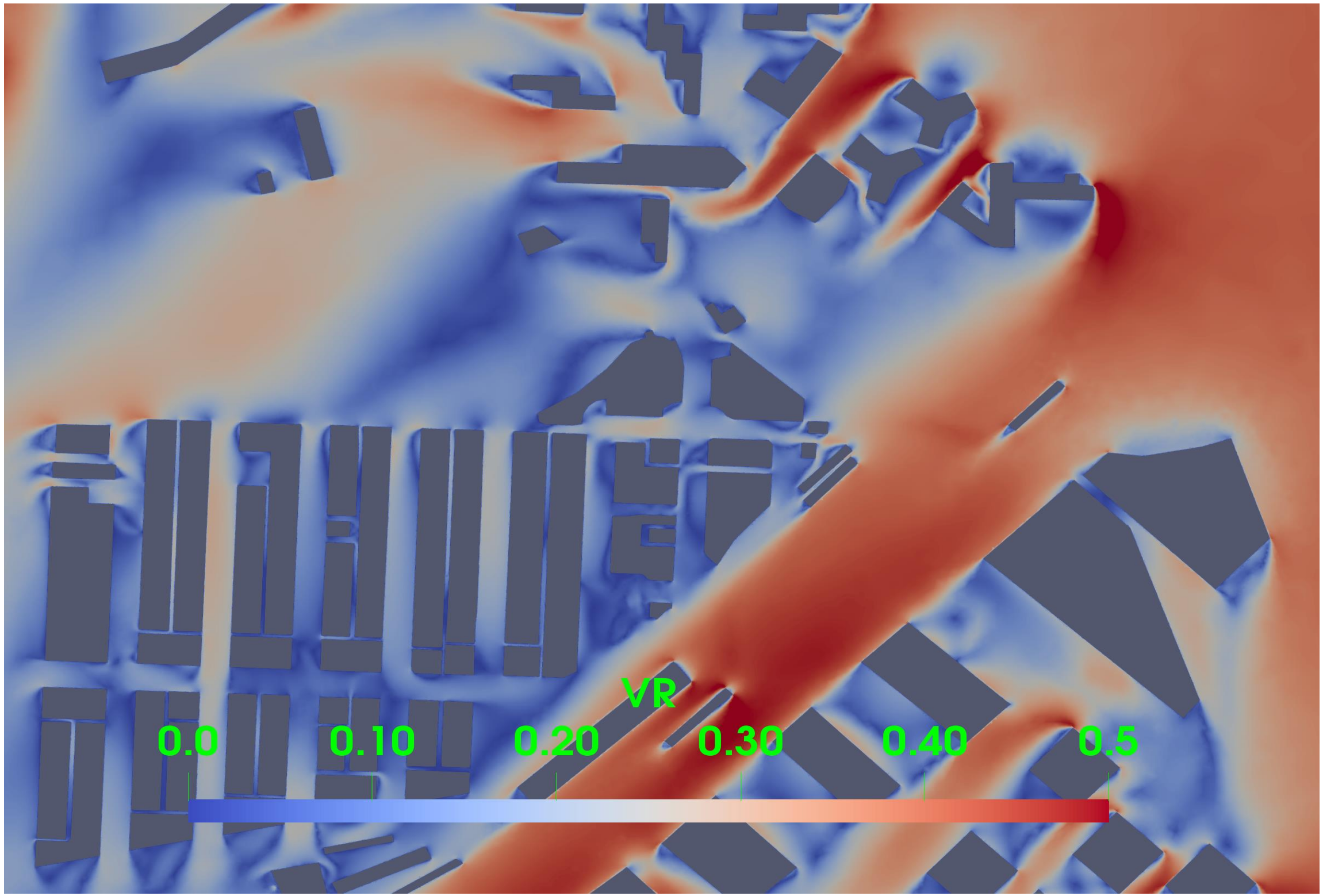
022.5 deg Wind Direction (7m/s at 500m)



Baseline Scheme

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-18
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1a	REV. 1

022.5 deg Wind Direction (7m/s at 500m)



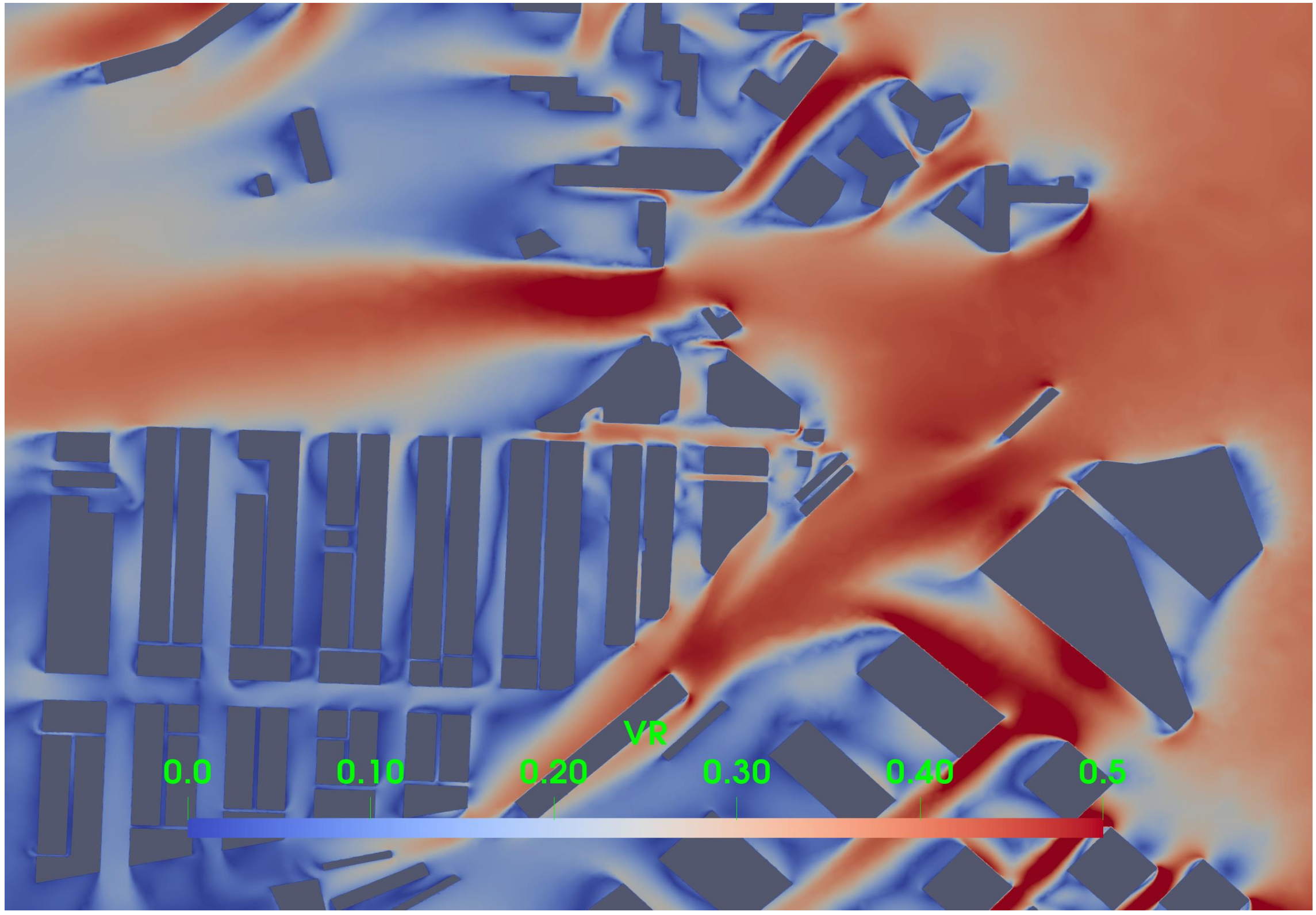
Proposed Scheme

CINOTECH 漢臻 consultants limited

Air Ventilation Assessment
Kai Tak Road / Sa Po Road Project (KC015)
Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO. 4.1a		REV.
				1

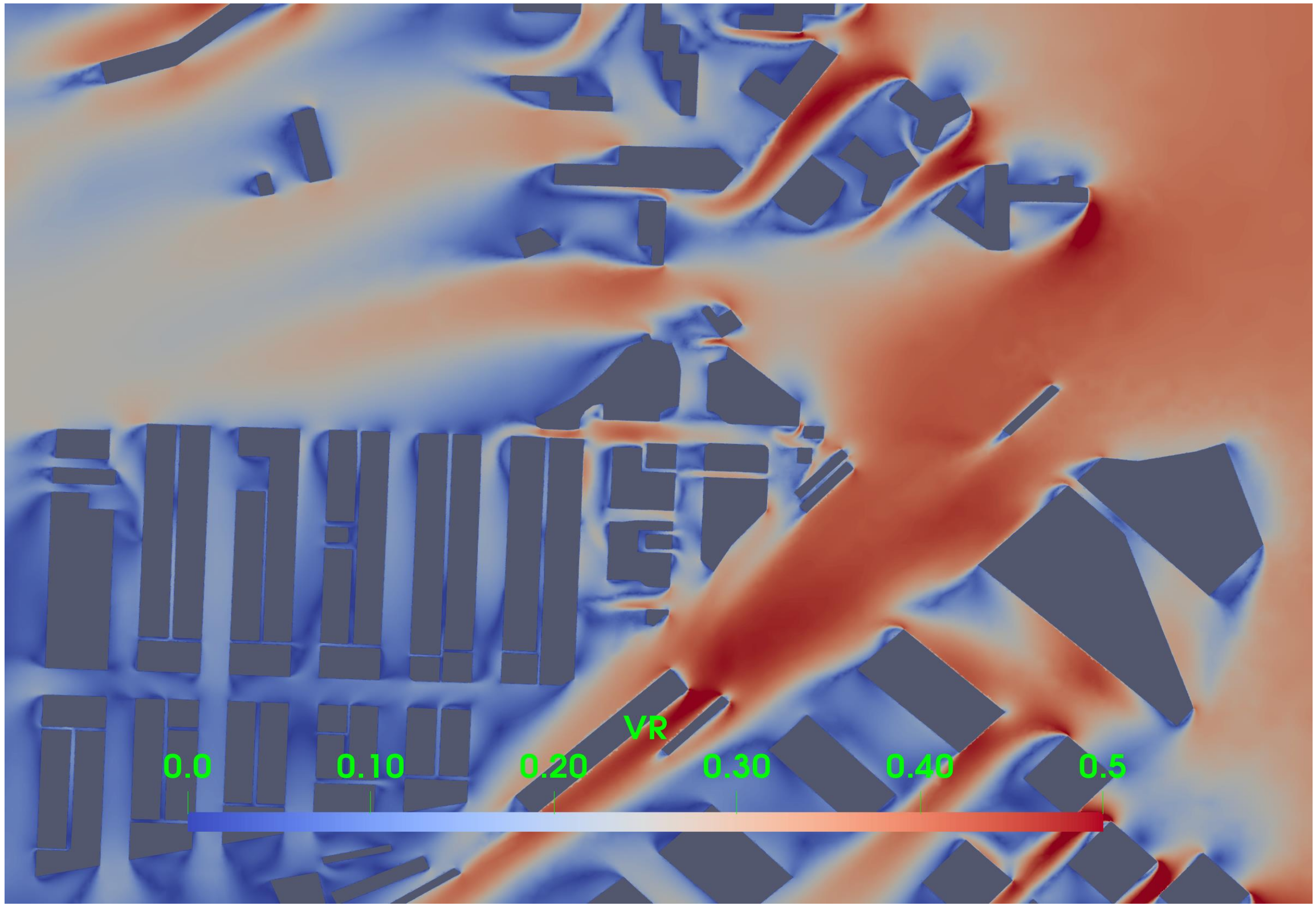
045 deg Wind Direction (6m/s at 500m)



Baseline Scheme

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-1
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1b	REv. 1

045 deg Wind Direction (6m/s at 500m)



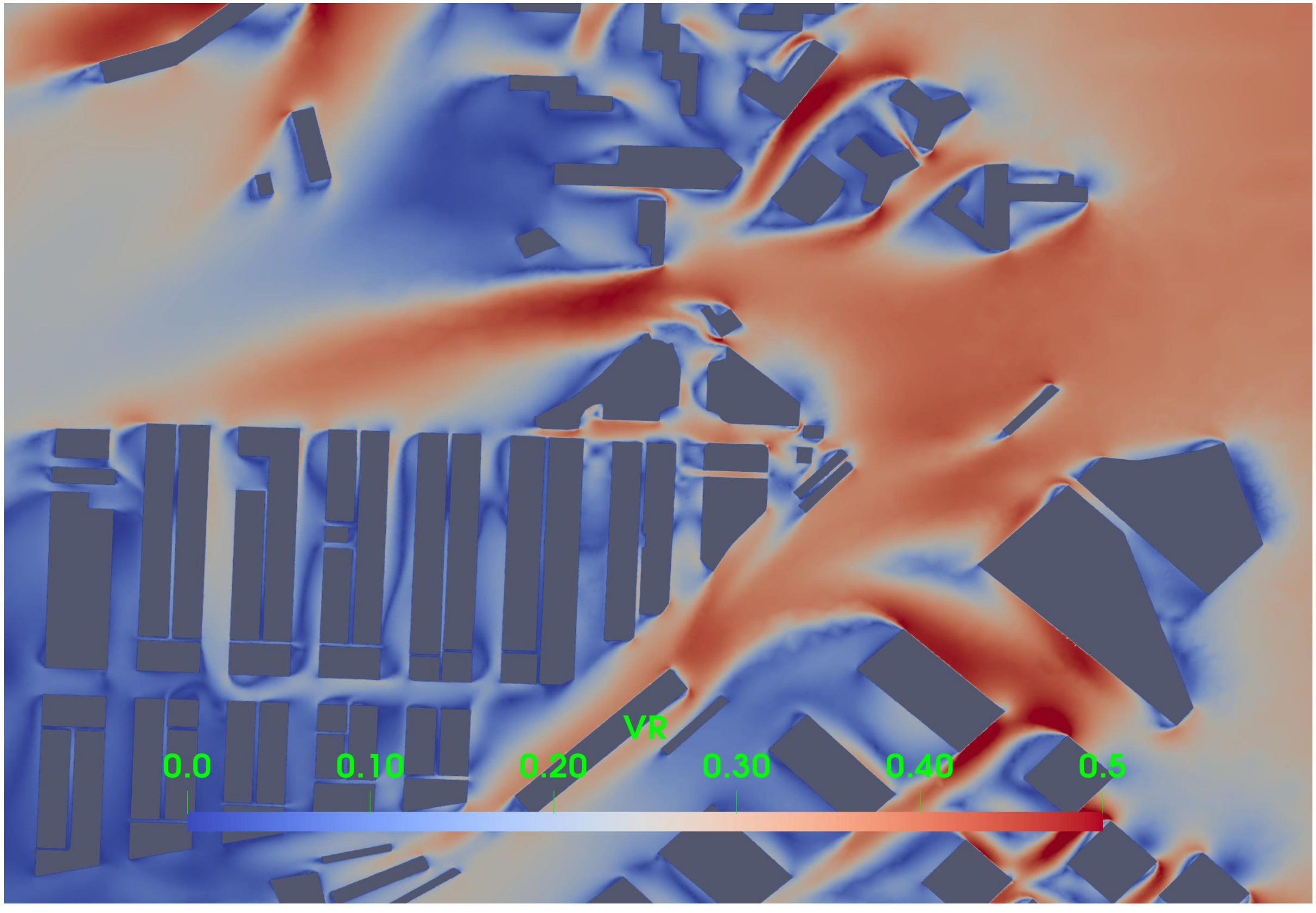
Proposed Scheme

CINOTECH 漢臻 consultants limited

Air Ventilation Assessment
Kai Tak Road / Sa Po Road Project (KC015)
Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO. 4.1b		REV. 1

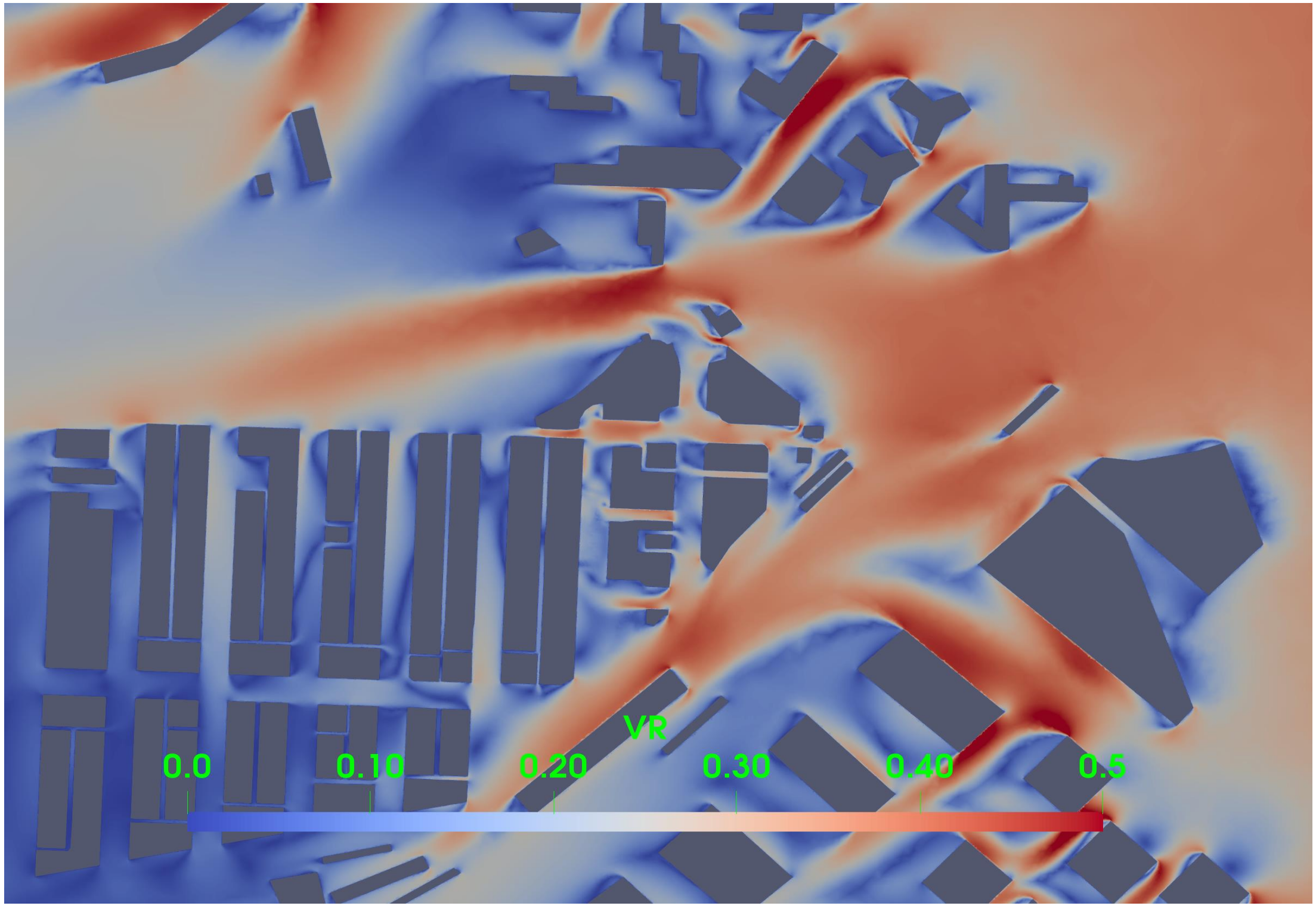
067.5 deg Wind Direction (6m/s at 500m)



Baseline Scheme

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-18
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1c	REV. 1

067.5 deg Wind Direction (6m/s at 500m)



Proposed Scheme

CINOTECH 漢臻 consultants limited

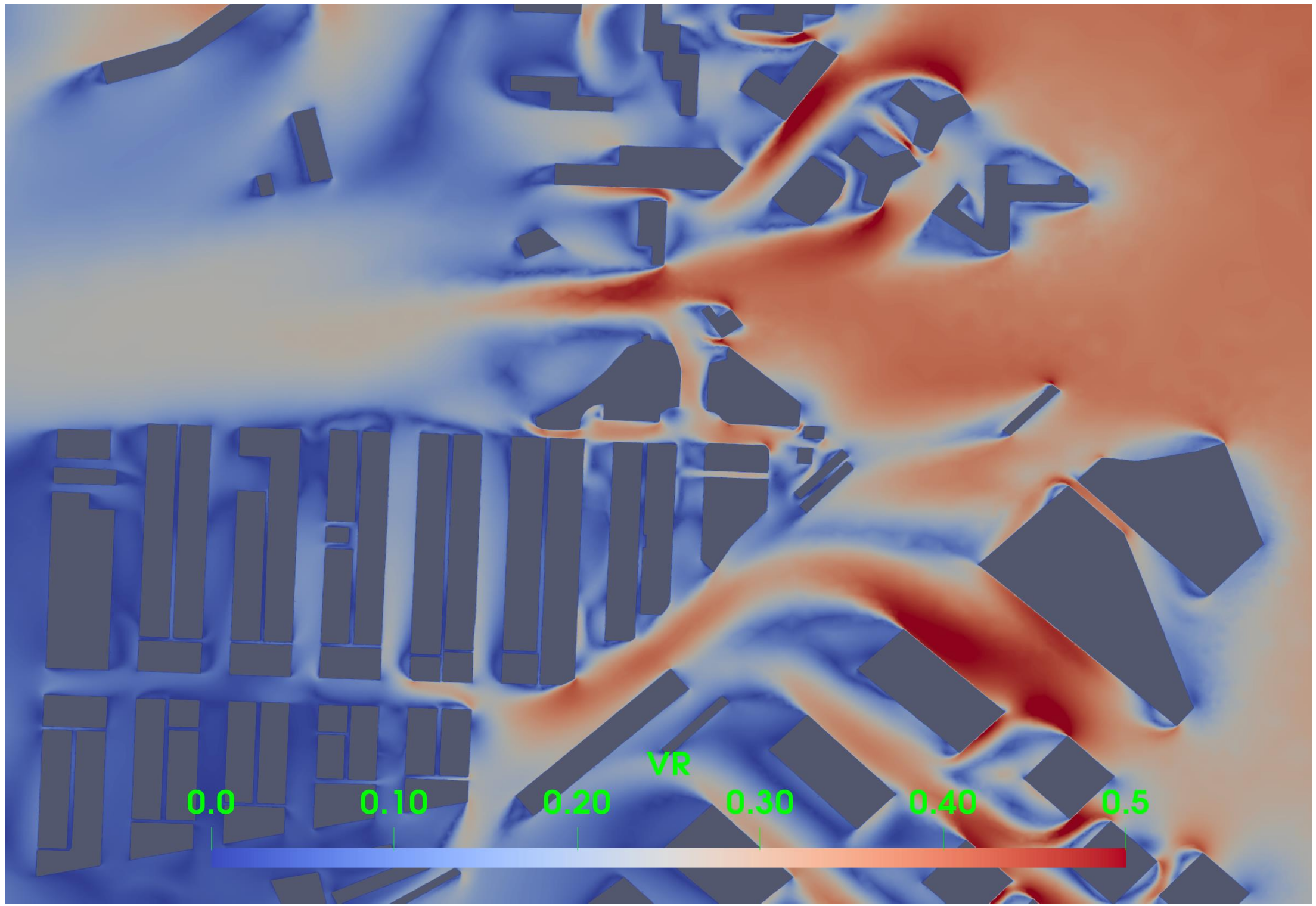
Air Ventilation Assessment

Kai Tak Road / Sa Po Road Project (KC015)

Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO. 4.1c		REV.
				1

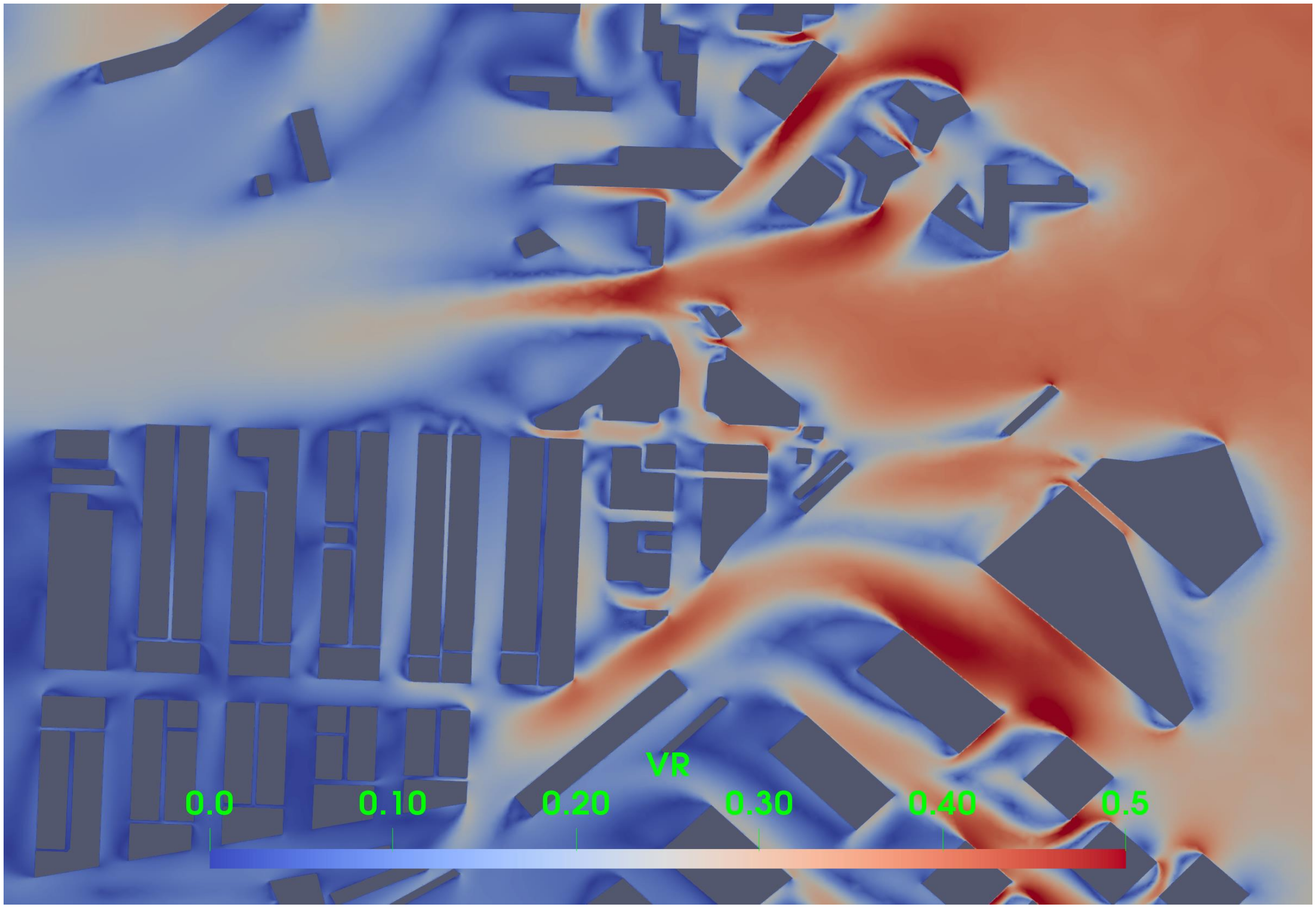
090 deg Wind Direction (7m/s at 500m)



Baseline Scheme

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-18
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1d	REV. 1

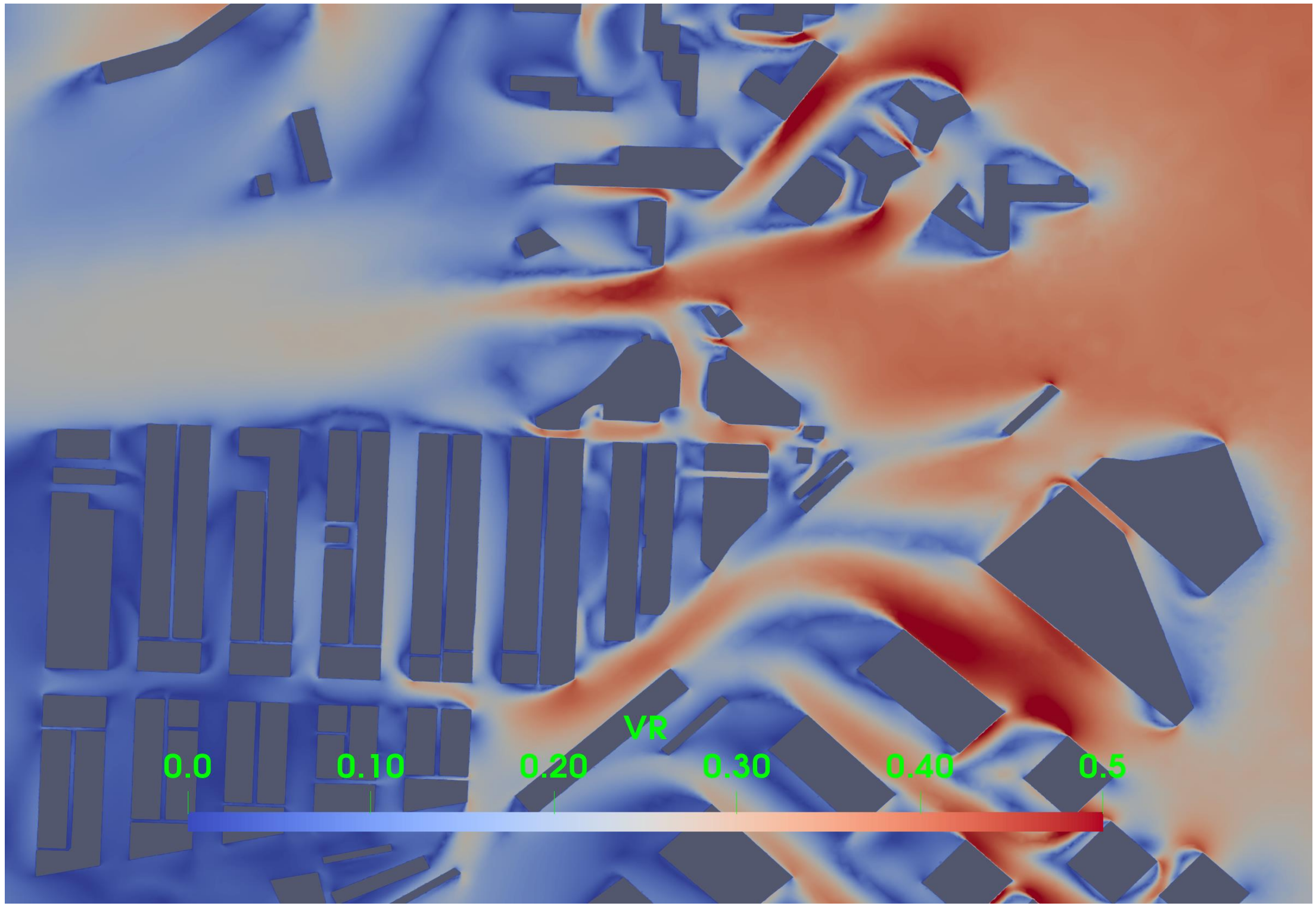
090 deg Wind Direction (7m/s at 500m)



Proposed Scheme

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-18
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1d	REV. 1

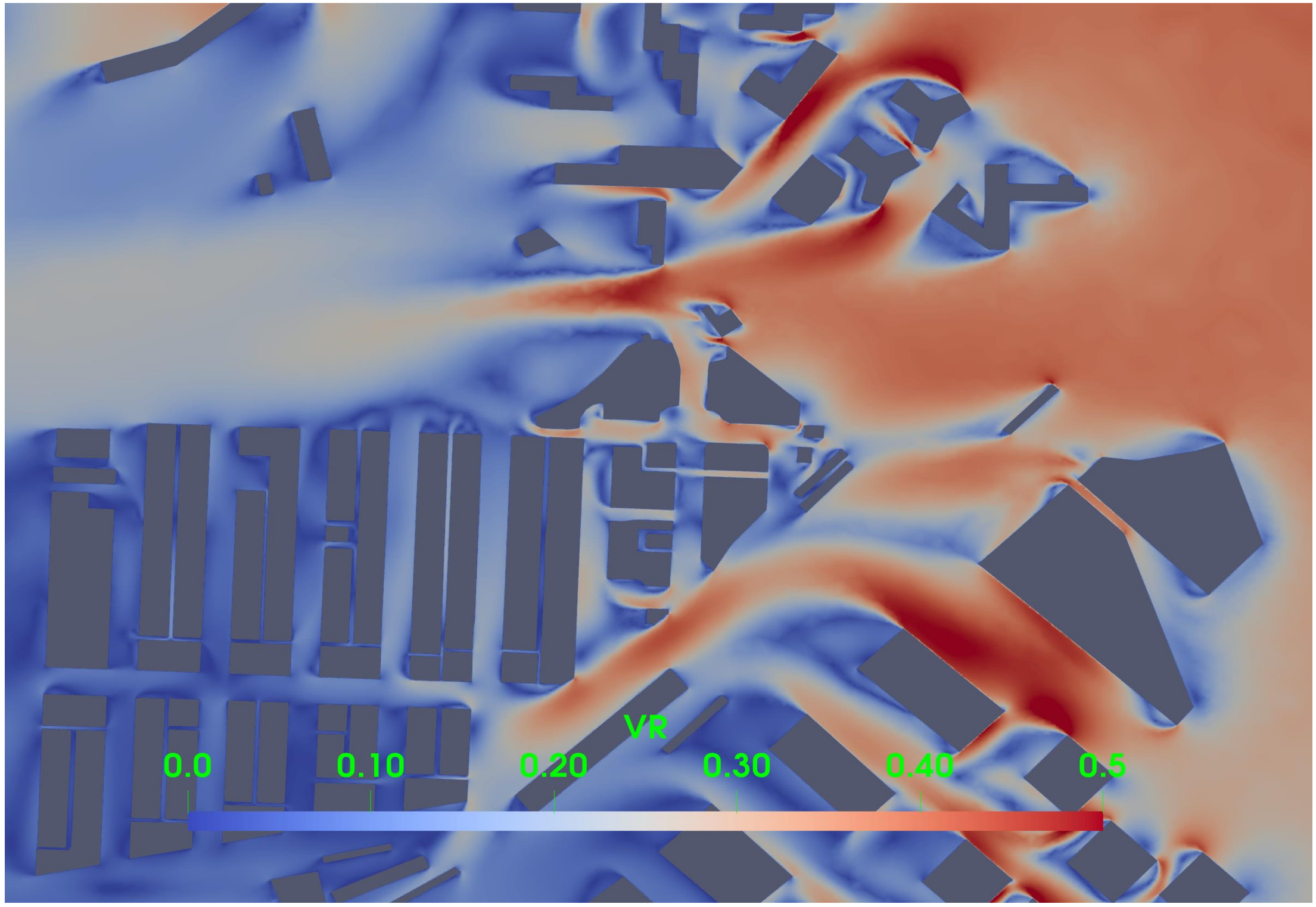
090 deg Wind Direction (8m/s at 500m)



Baseline Scheme

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-18
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1e	REV. 1

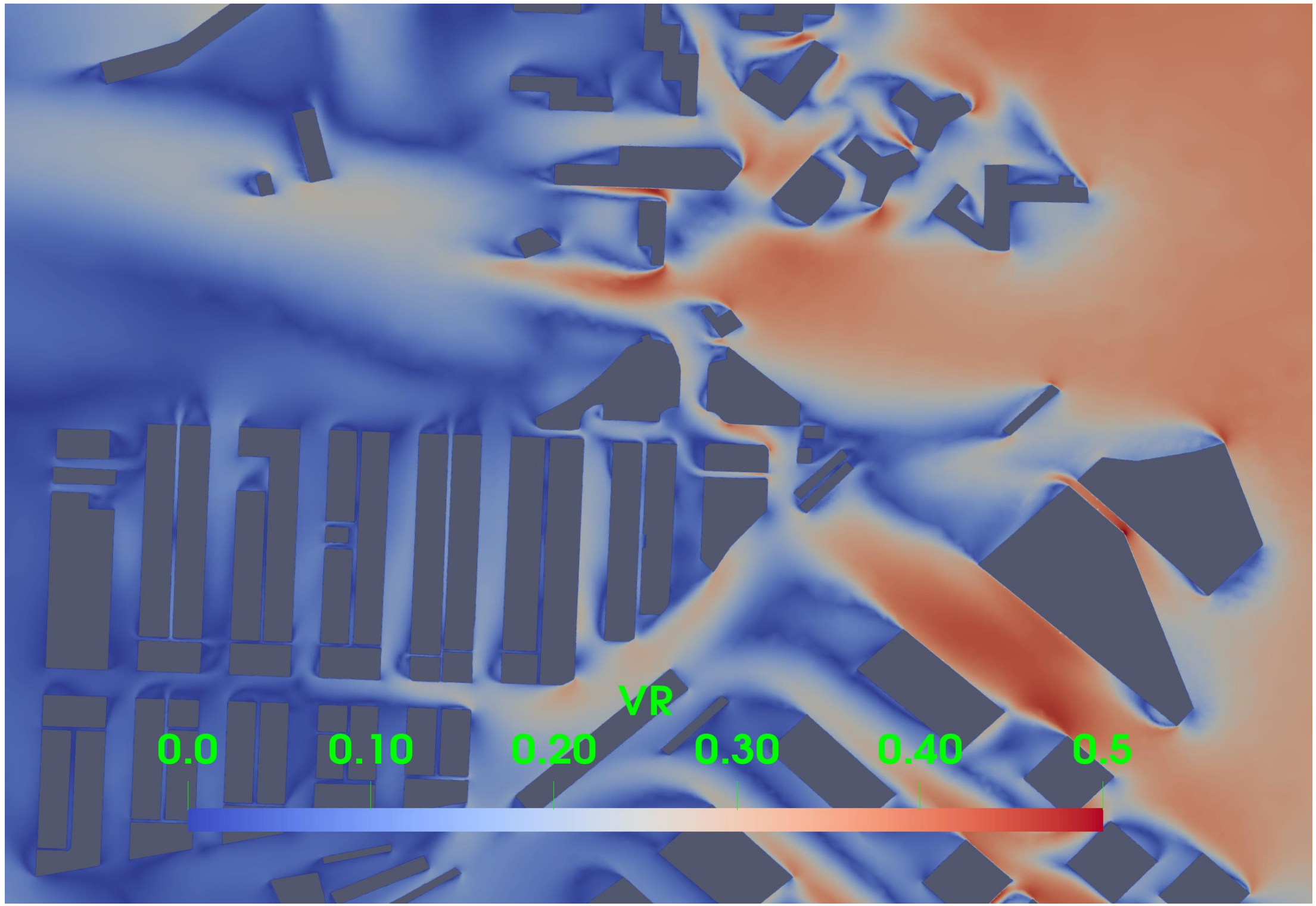
090 deg Wind Direction (8m/s at 500m)



Proposed Scheme

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-18
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1e	REV. 1

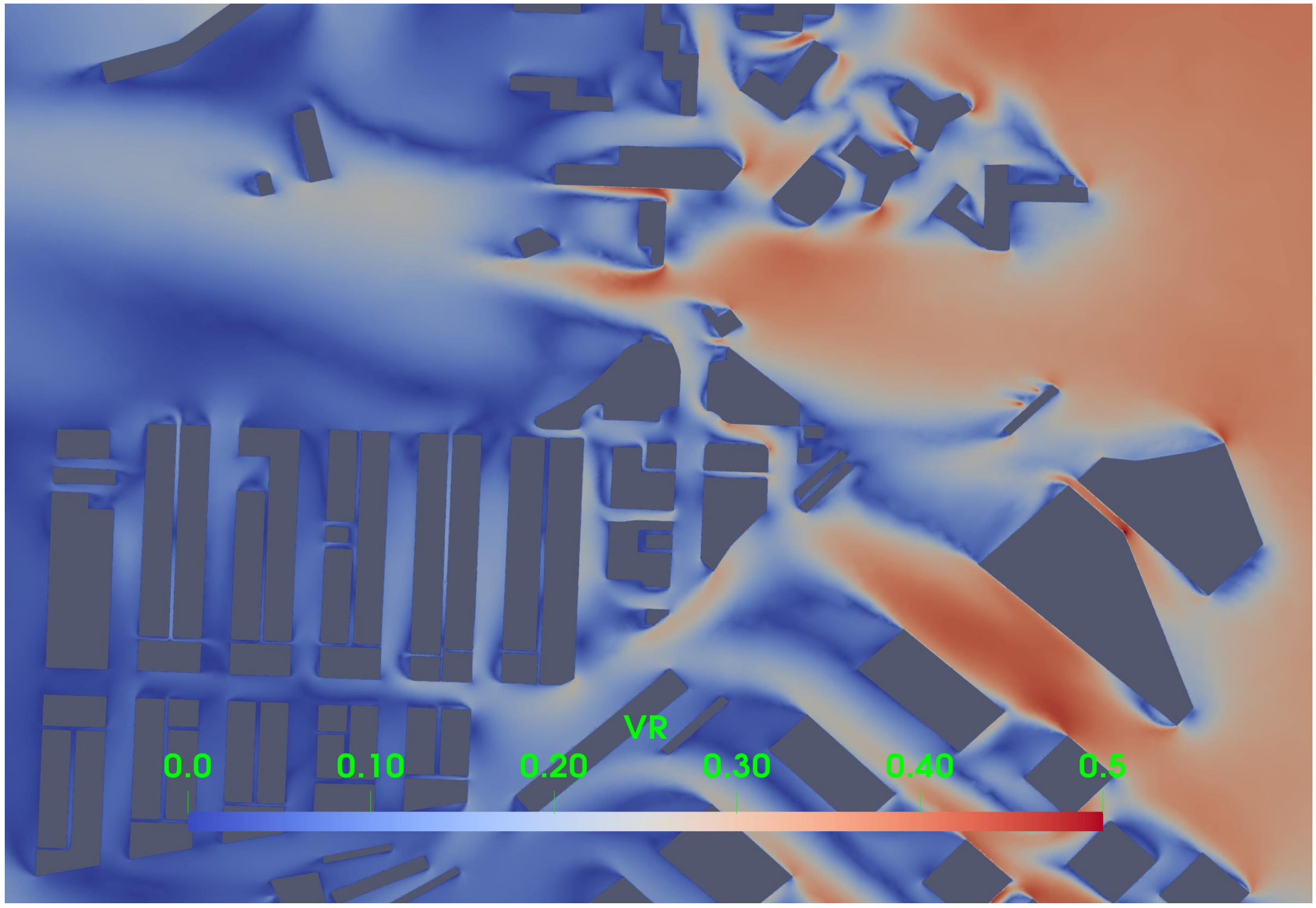
112.5 deg Wind Direction (7m/s at 500m)



Baseline Scheme

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-18
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1f	REV. 1

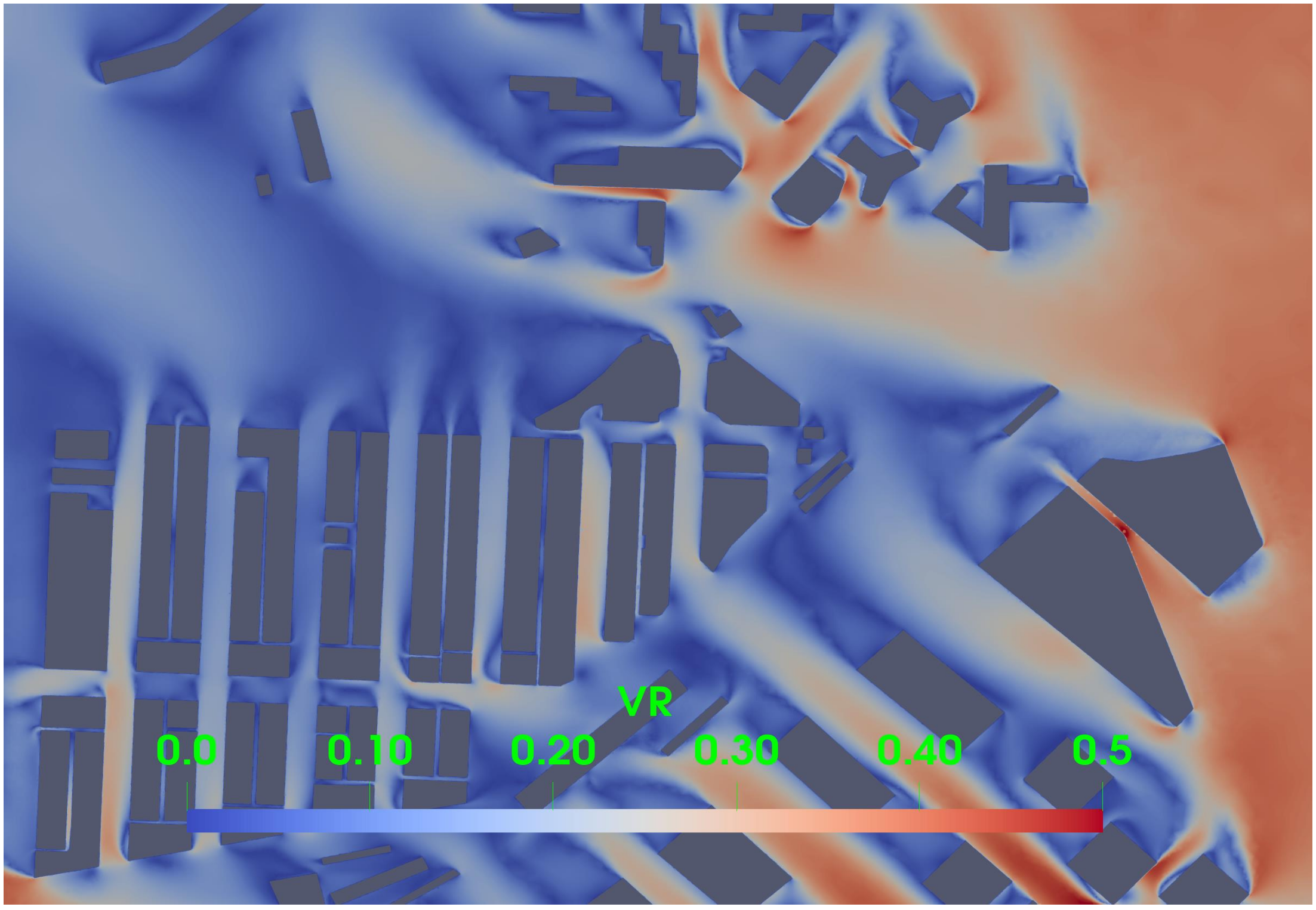
112.5 deg Wind Direction (7m/s at 500m)



Proposed Scheme

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-18
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1f	REV. 1

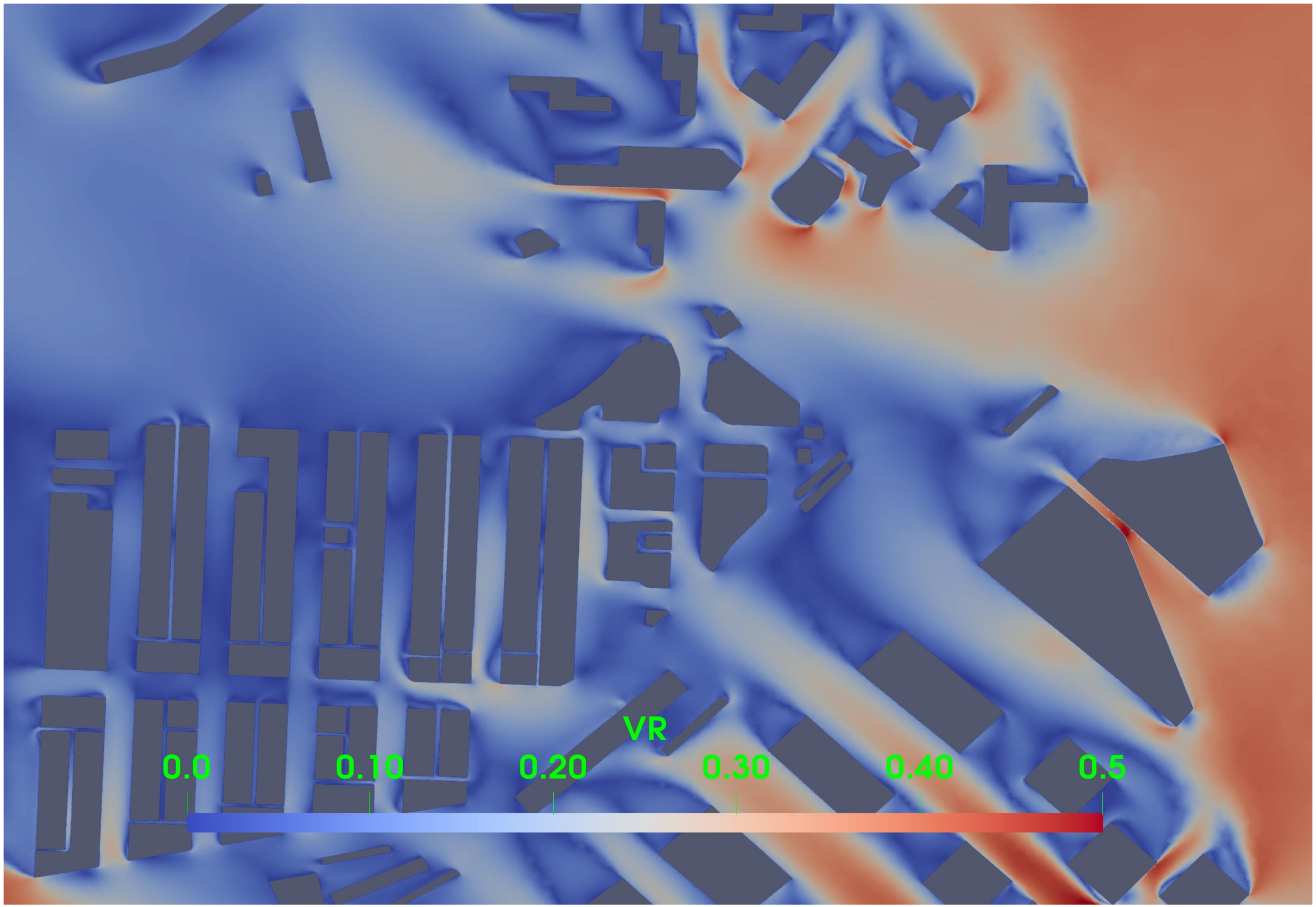
135 deg Wind Direction (6m/s at 500m)



Baseline Scheme

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-18
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1g	REV. 1

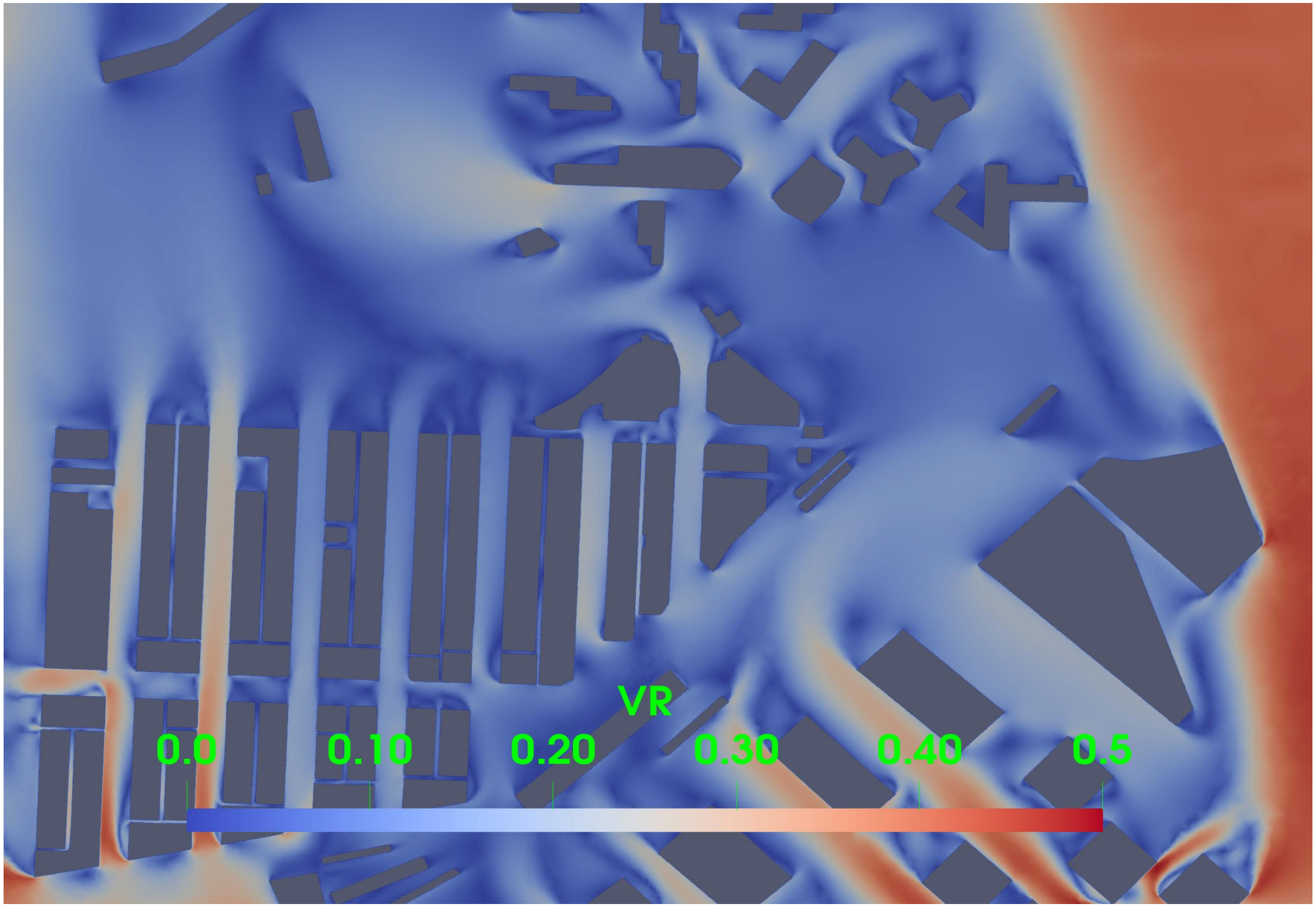
135 deg Wind Direction (6m/s at 500m)



Proposed Scheme

CINOTECH consultants limited 漢臻	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-18
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1g	REV. 1

157.5 deg Wind Direction (6m/s at 500m)



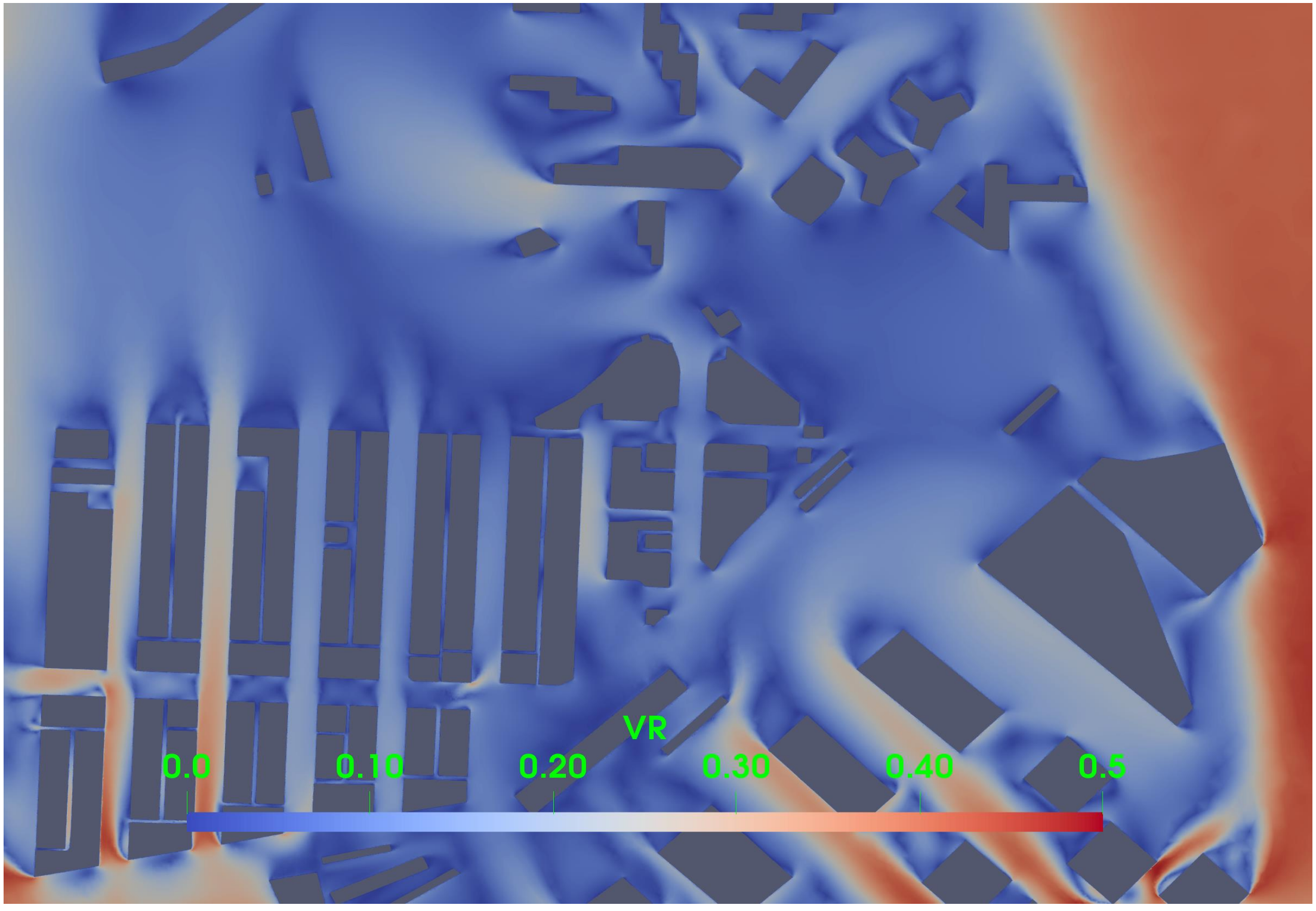
Baseline Scheme

CINOTECH 漢臻 consultants limited

Air Ventilation Assessment
Kai Tak Road / Sa Po Road Project (KC015)
Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO. 4.1h		REV.
				1

157.5 deg Wind Direction (6m/s at 500m)



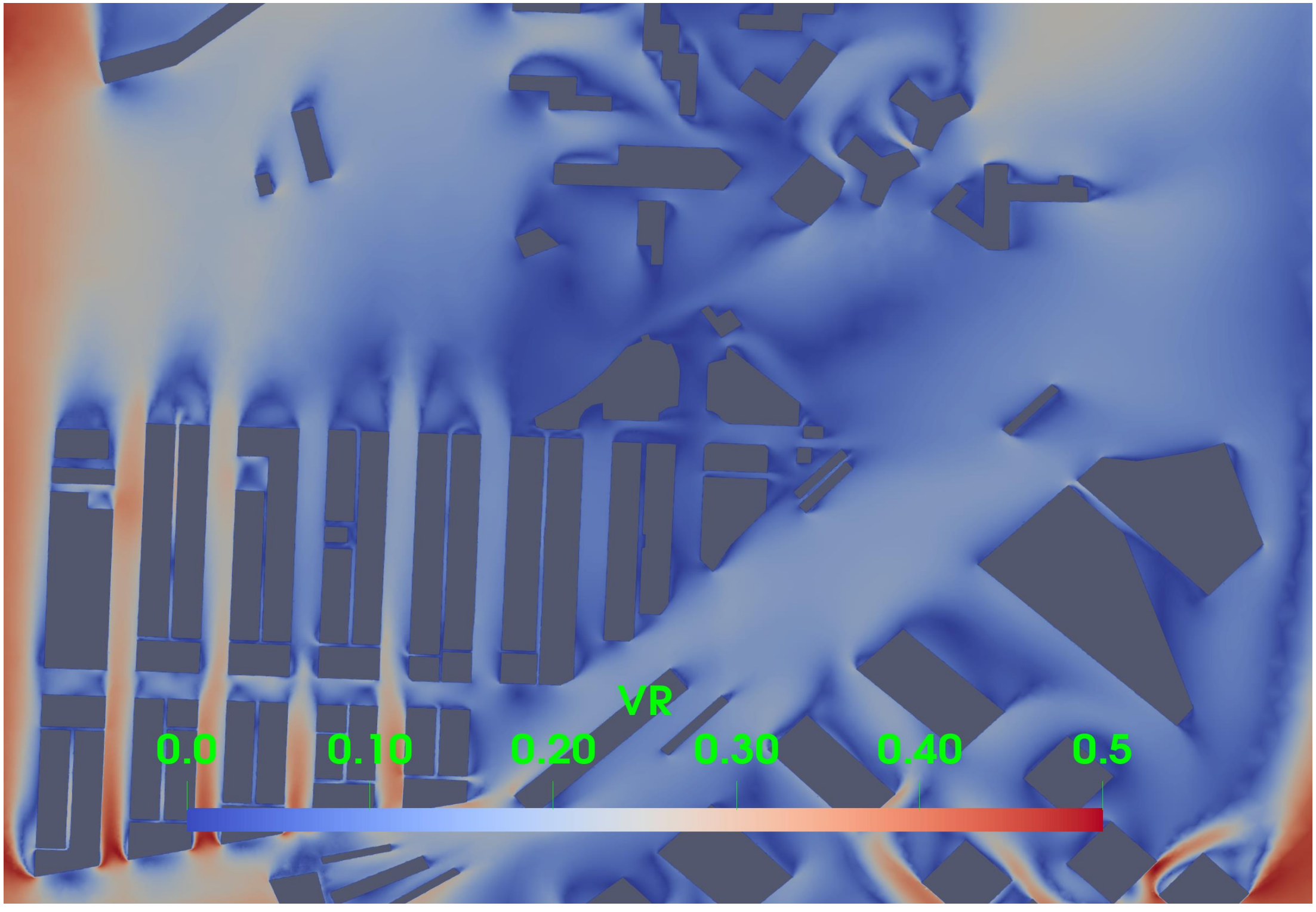
Proposed Scheme

CINOTECH 漢臻 consultants limited

Air Ventilation Assessment
Kai Tak Road / Sa Po Road Project (KC015)
Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K(	FIGURE NO. 4.1h		REV. 1

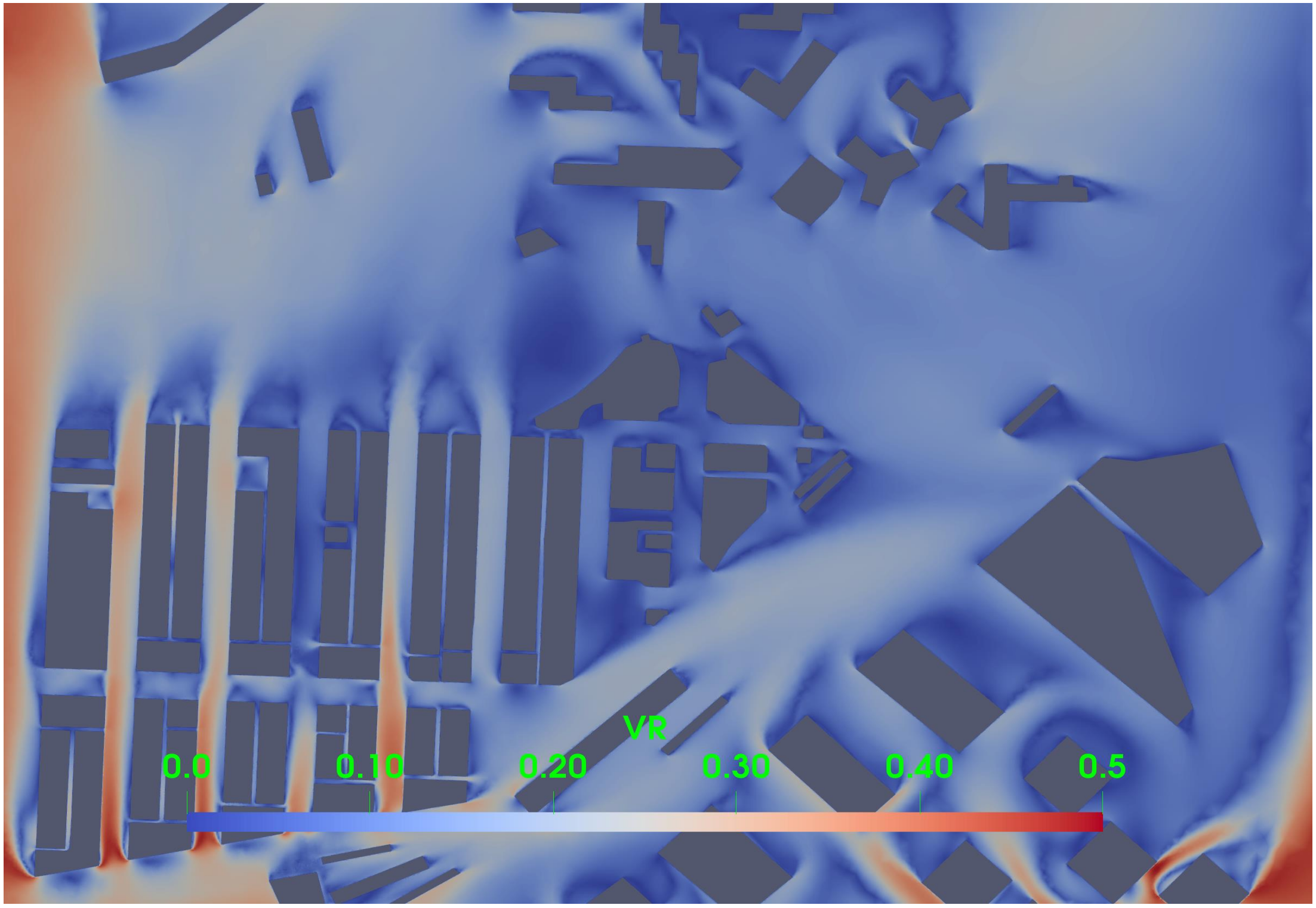
180 deg Wind Direction (5m/s at 500m)



Baseline Scheme

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-18
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1i	REV. 1

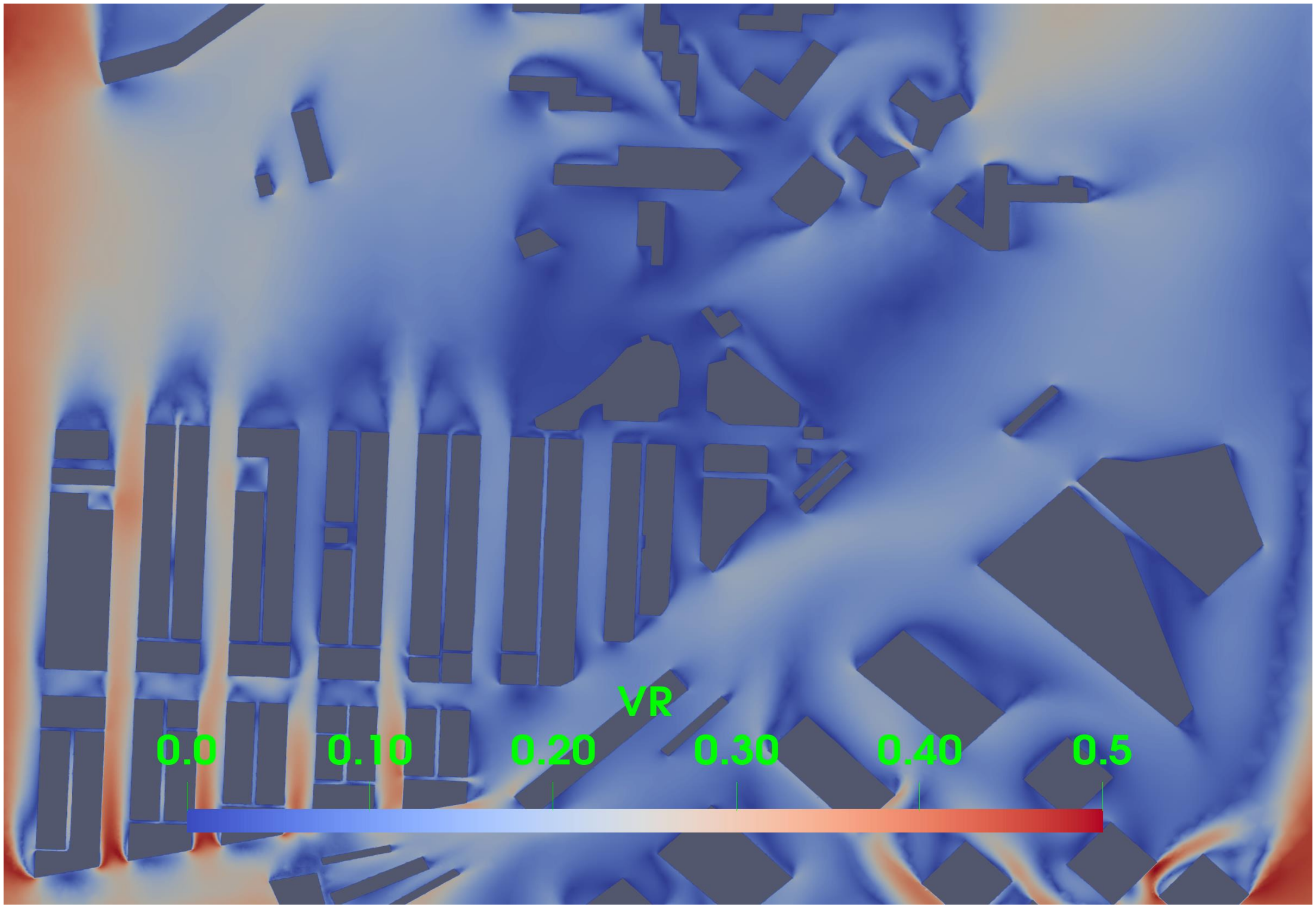
180 deg Wind Direction (5m/s at 500m)



Baseline Scheme

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-18
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1i	REV. 1

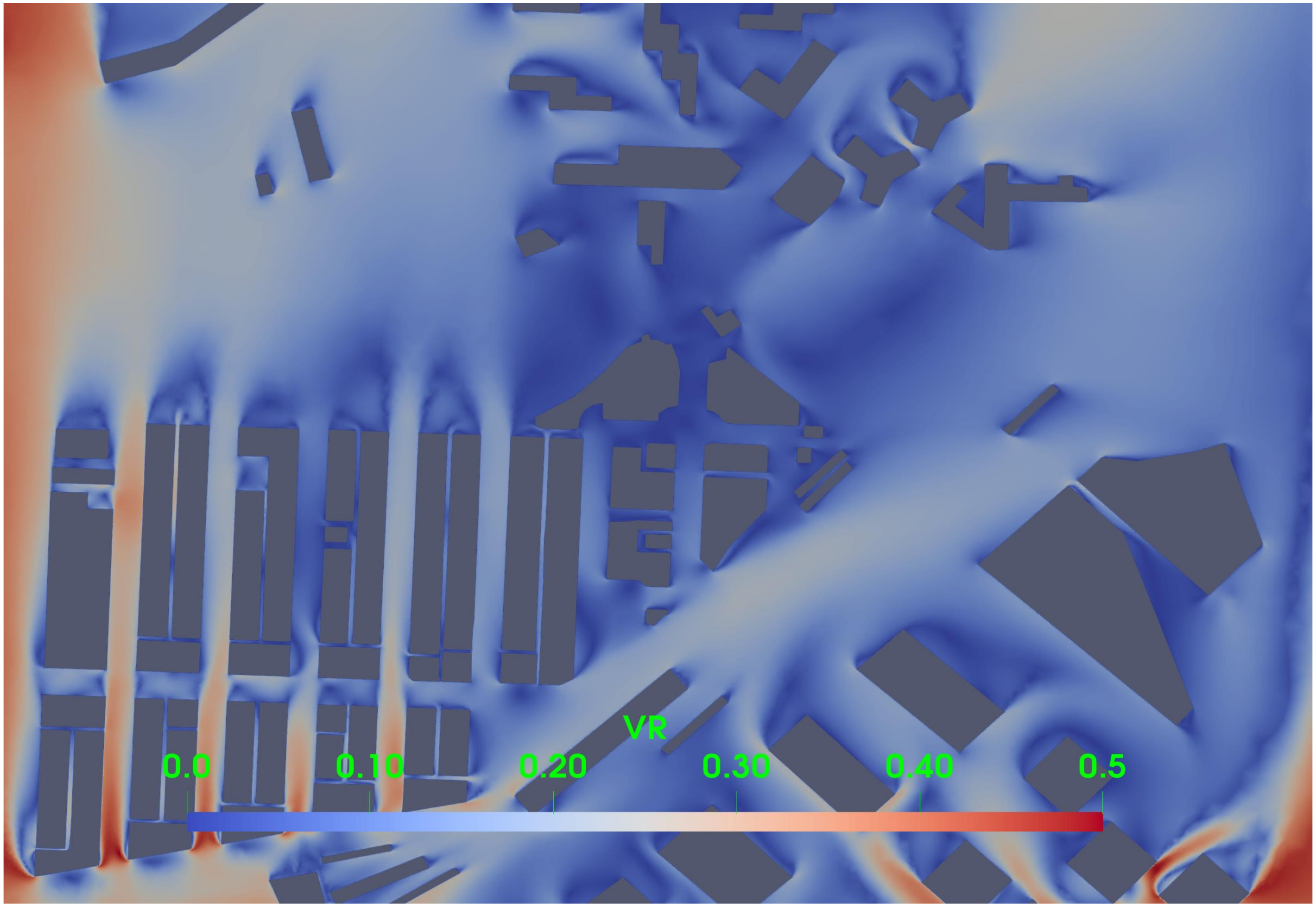
180 deg Wind Direction (6m/s at 500m)



Baseline Scheme

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-18
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1j	REV. 1

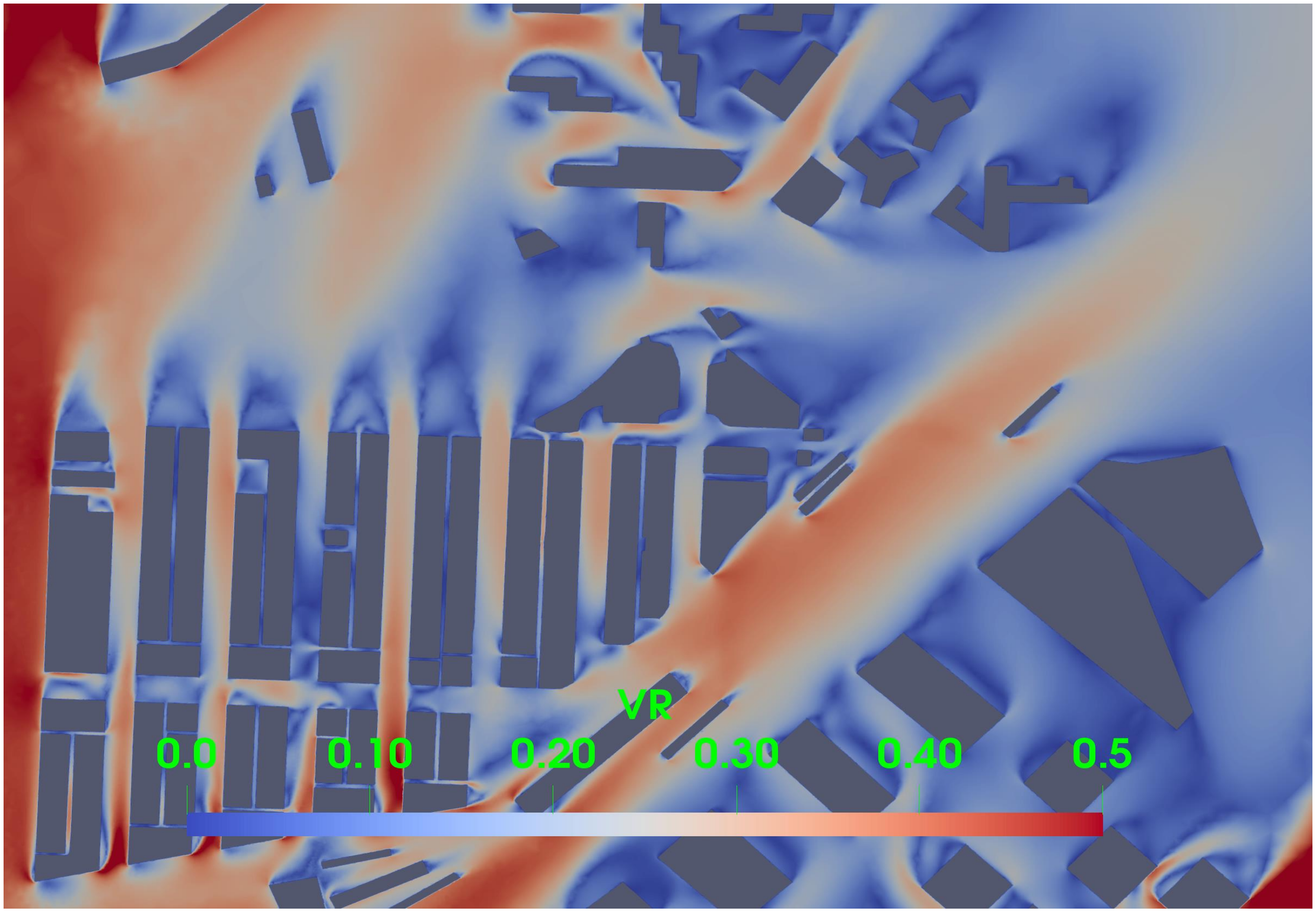
180 deg Wind Direction (6m/s at 500m)



Proposed Scheme

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-18
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1j	REV. 1

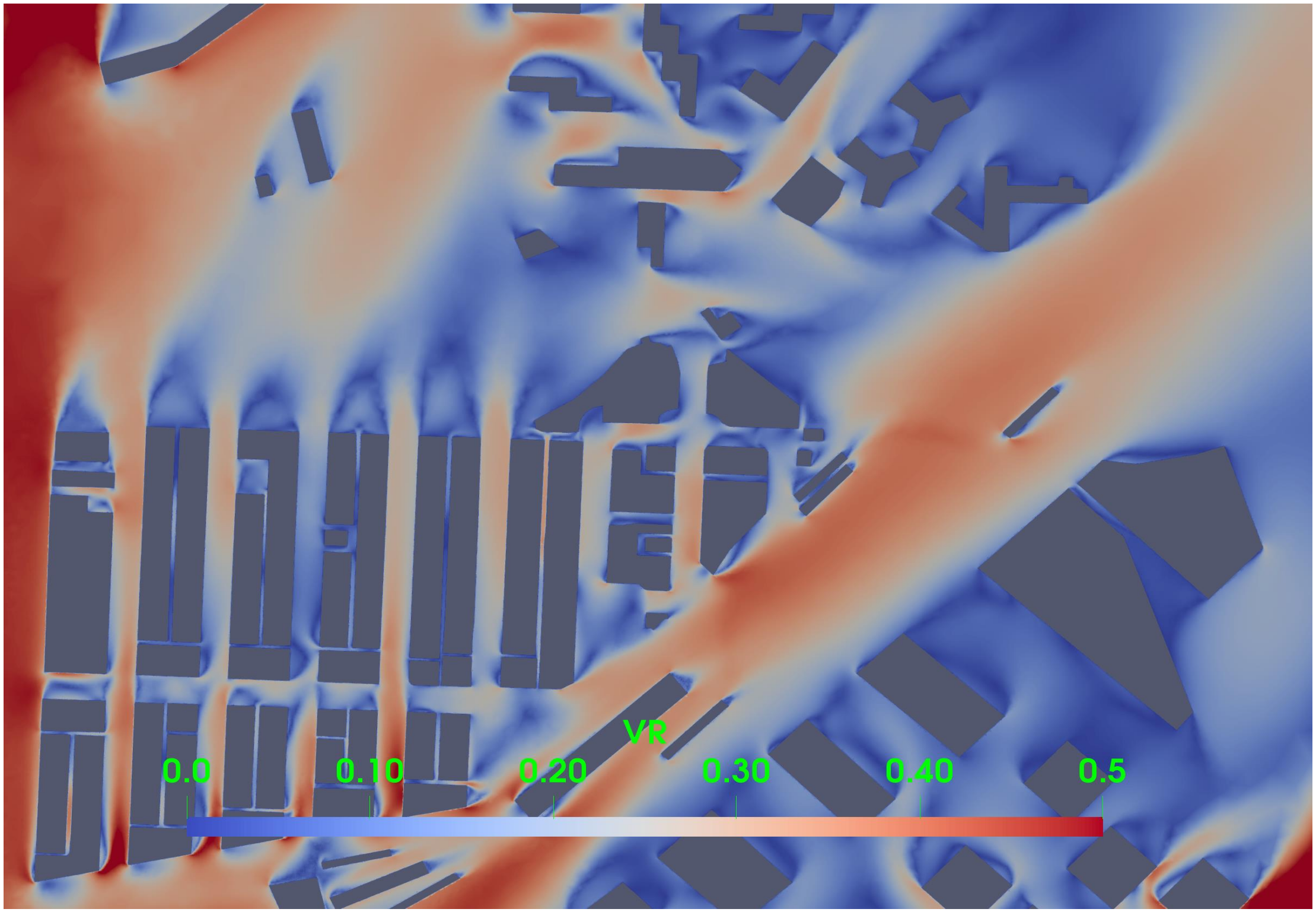
202.5 deg Wind Direction (6m/s at 500m)



Baseline Scheme

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-18
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1k	REV. 1

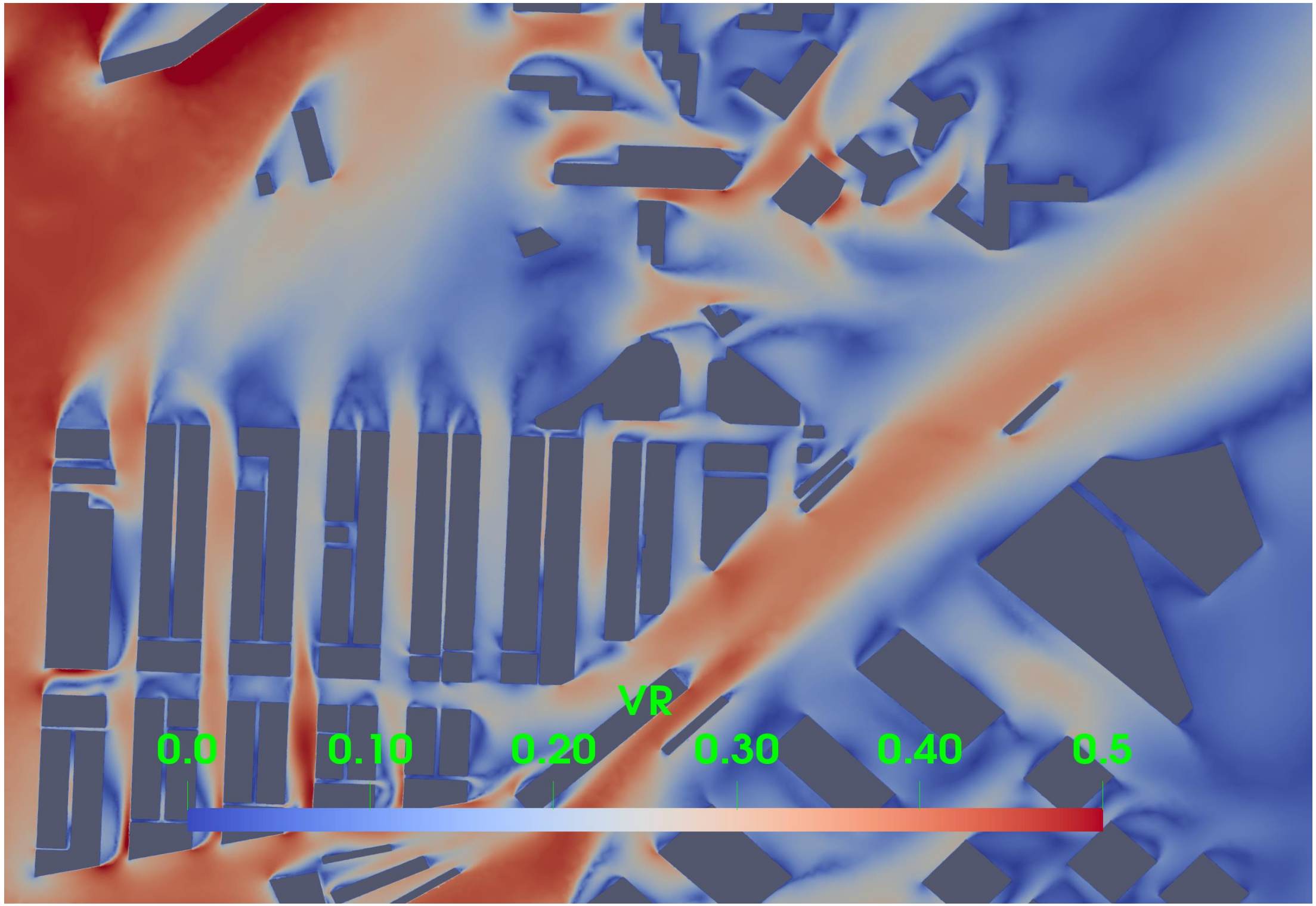
202.5 deg Wind Direction (6m/s at 500m)



Proposed Scheme

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-18
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1k	REV. 1

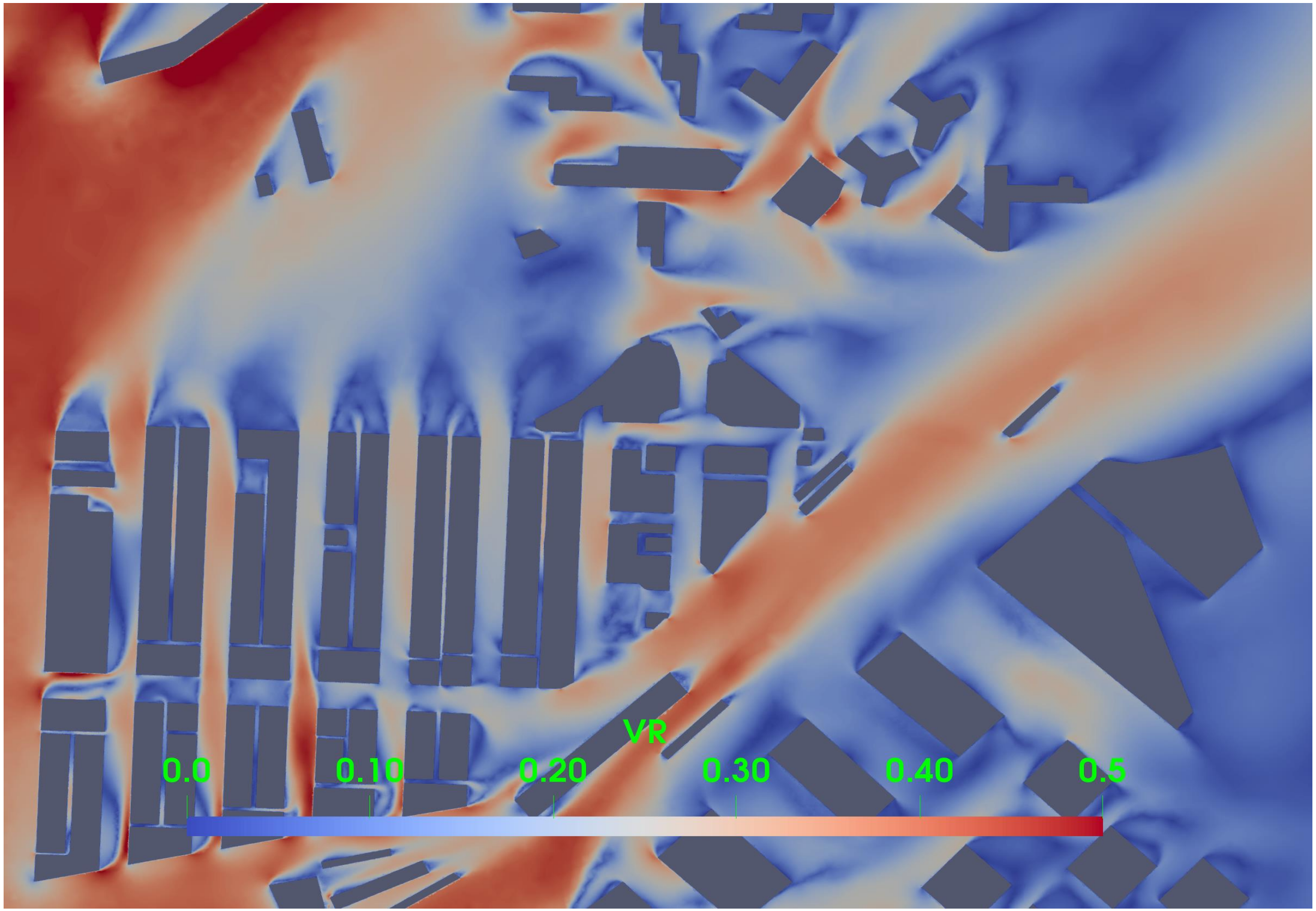
225 deg Wind Direction (6m/s at 500m)



Baseline Scheme

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-18
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1I	REV. 1

225 deg Wind Direction (6m/s at 500m)



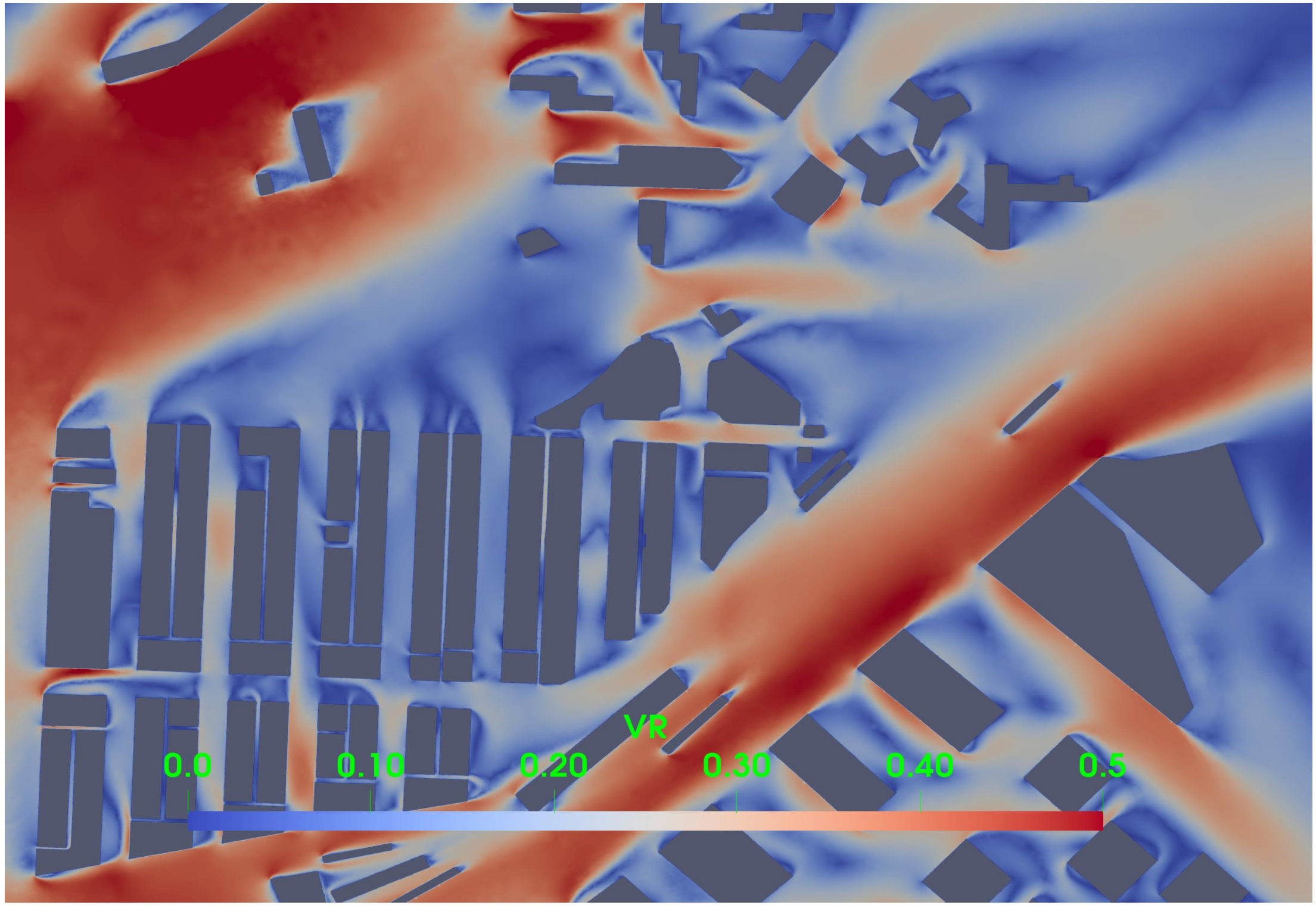
Proposed Scheme

CINOTECH 漢臻 consultants limited

Air Ventilation Assessment
Kai Tak Road / Sa Po Road Project (KC015)
Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO. 4.1I		REV. 1

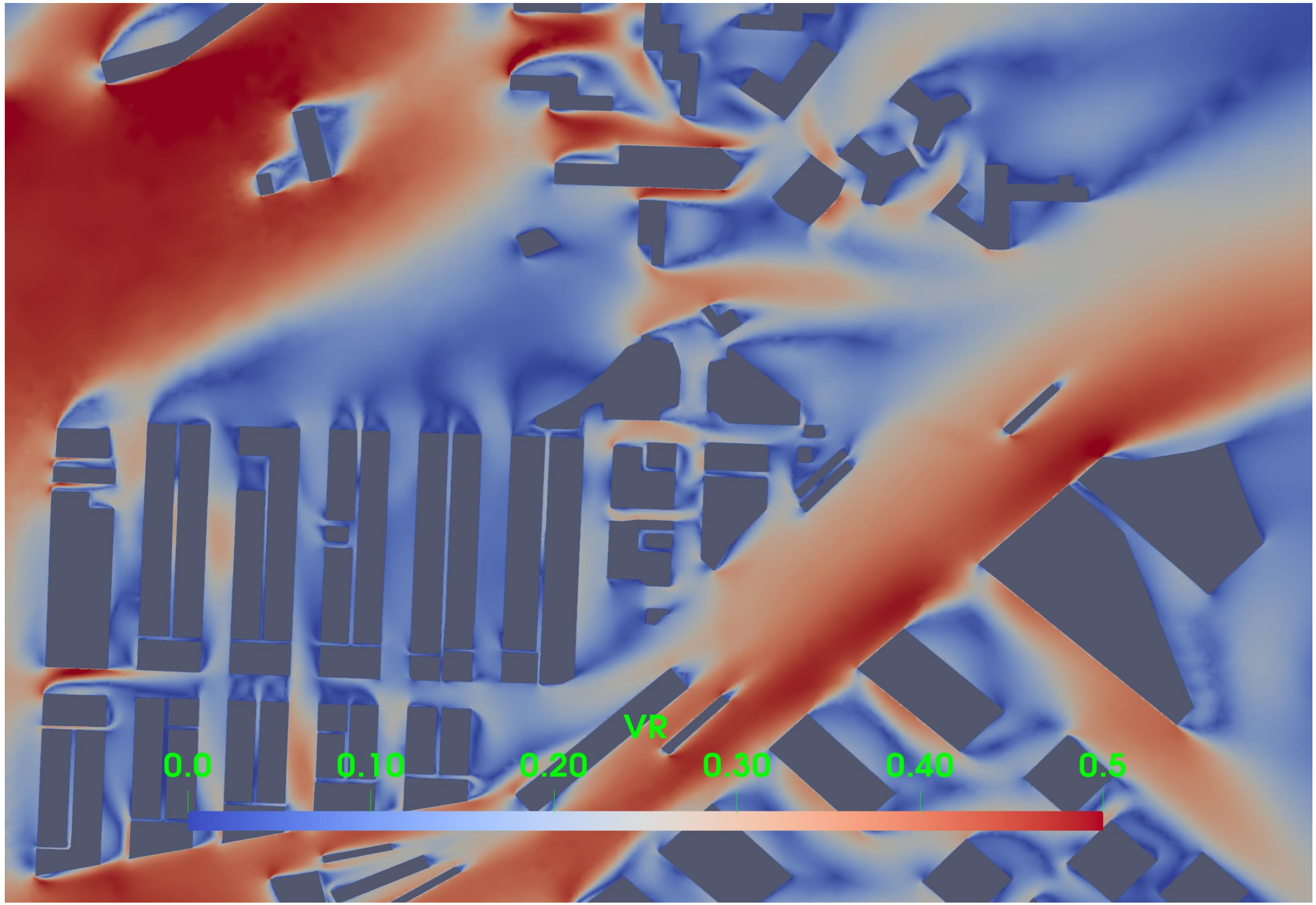
247.5 deg Wind Direction (6m/s at 500m)



Baseline Scheme

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-18
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1m	REV. 1

247.5 deg Wind Direction (6m/s at 500m)



Proposed Scheme

CINOTECH 漢臻 consultants limited

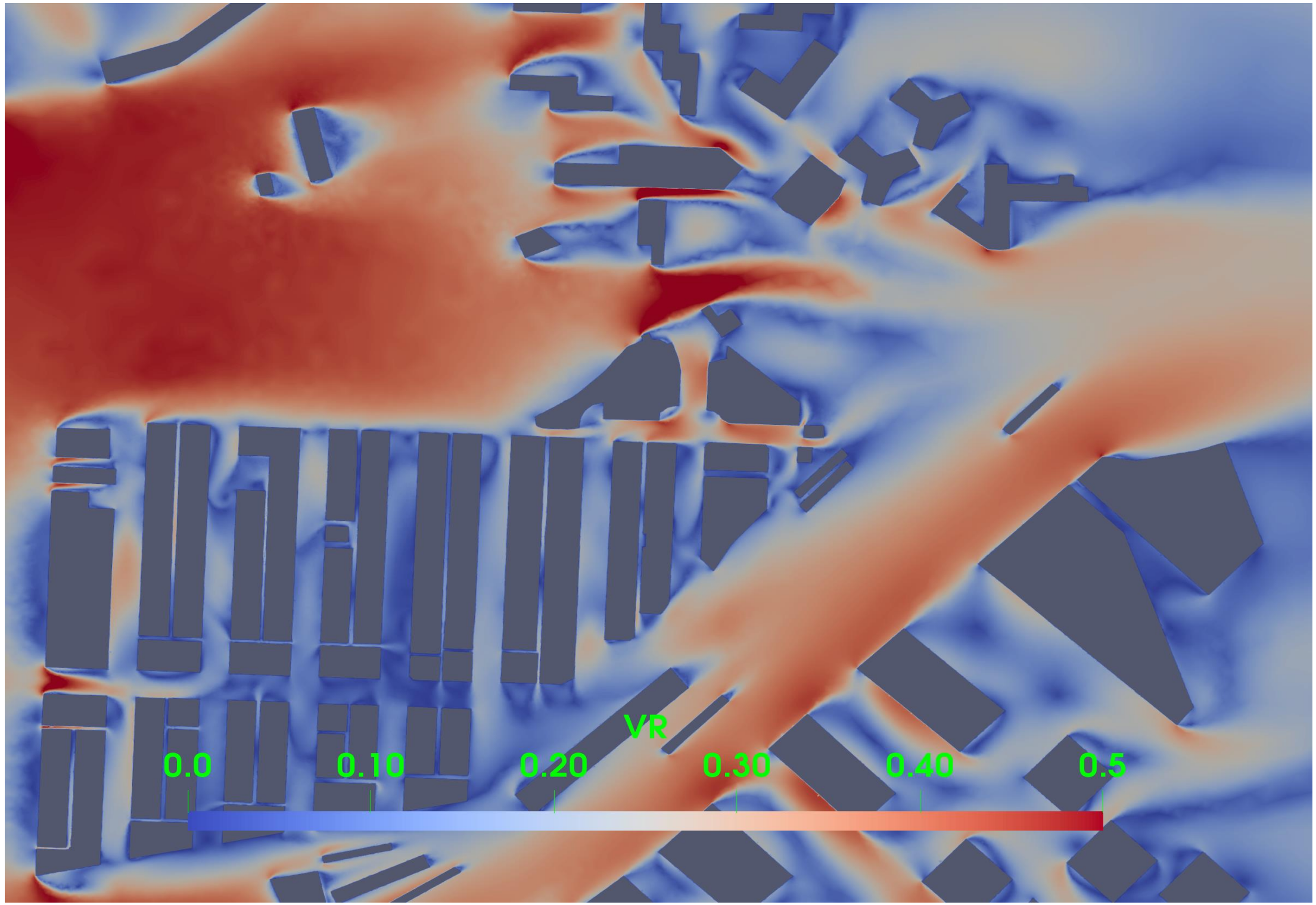
Air Ventilation Assessment

Kai Tak Road / Sa Po Road Project (KC015)

Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO. 4.1m		REV. 1

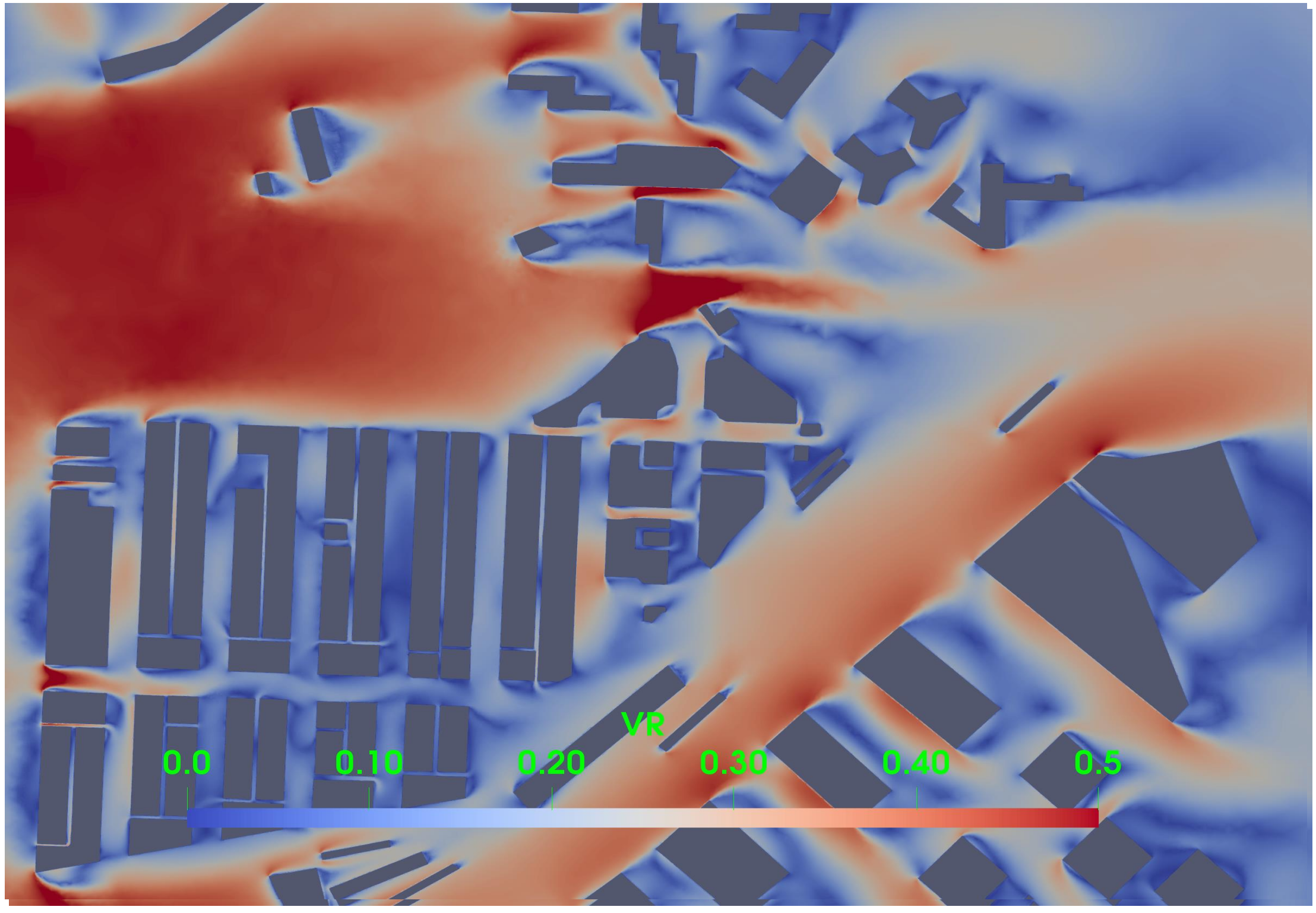
270 deg Wind Direction (4m/s at 500m)



Baseline Scheme

CINOTECH 漢臻 consultants limited	Air Ventilation Assessment Kai Tak Road / Sa Po Road Project (KC015) **Contours of Wind Velocity Ratio at 2mAG**	SCALE	N.T.S.	DATE	Nov-18
		CHECK	KW	DRAWN	CC
		JOB NO.	IA17019/K	FIGURE NO. 4.1n	REV. 1

270 deg Wind Direction (4m/s at 500m)

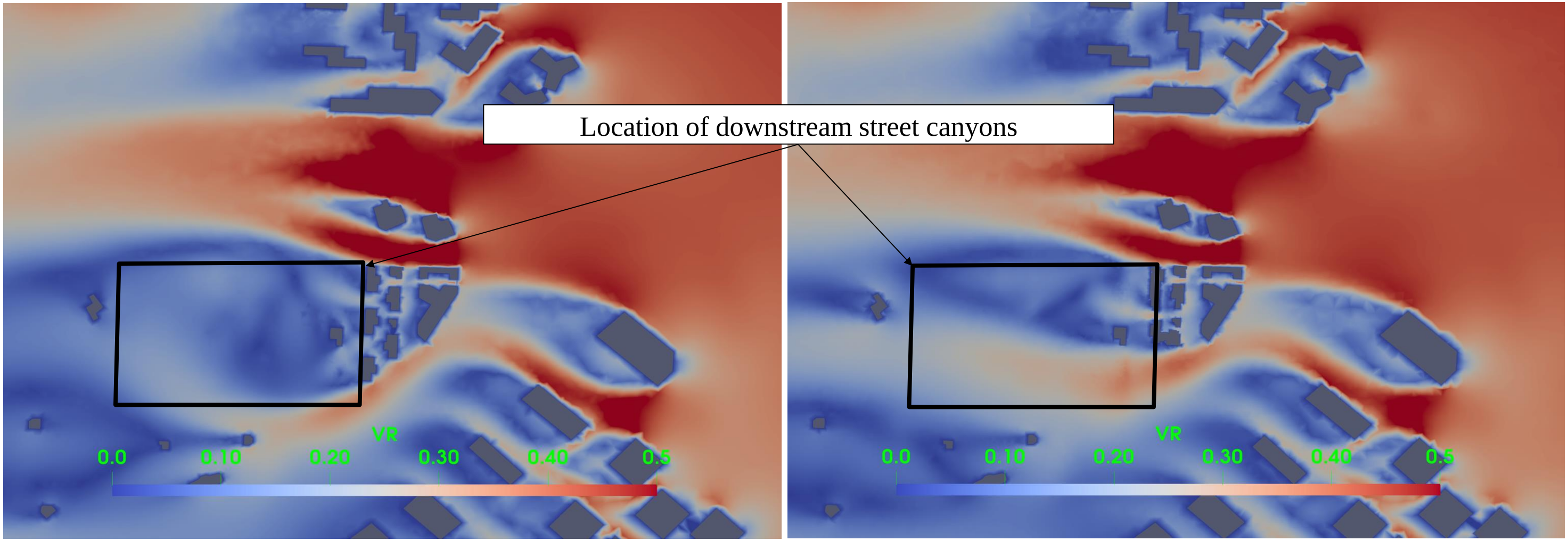


Proposed Scheme

CINOTECH 漢臻 consultants limited

Air Ventilation Assessment
Kai Tak Road / Sa Po Road Project (KC015)
Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO. 4.1n		REV.
				1



Baseline Scheme

Proposed Scheme

Easterly Wind with 7m/s at 500m

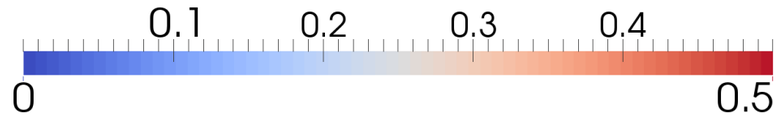
CINOTECH 漢臻 consultants limited

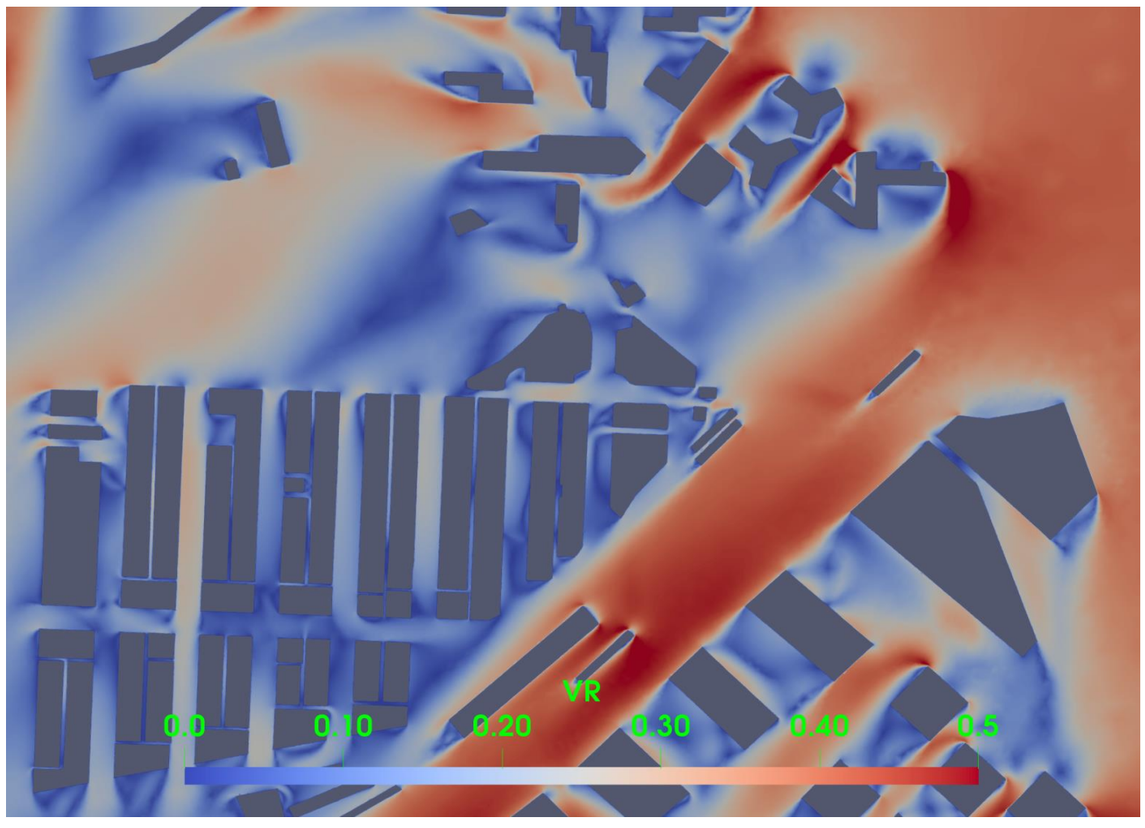
Air Ventilation Assessment

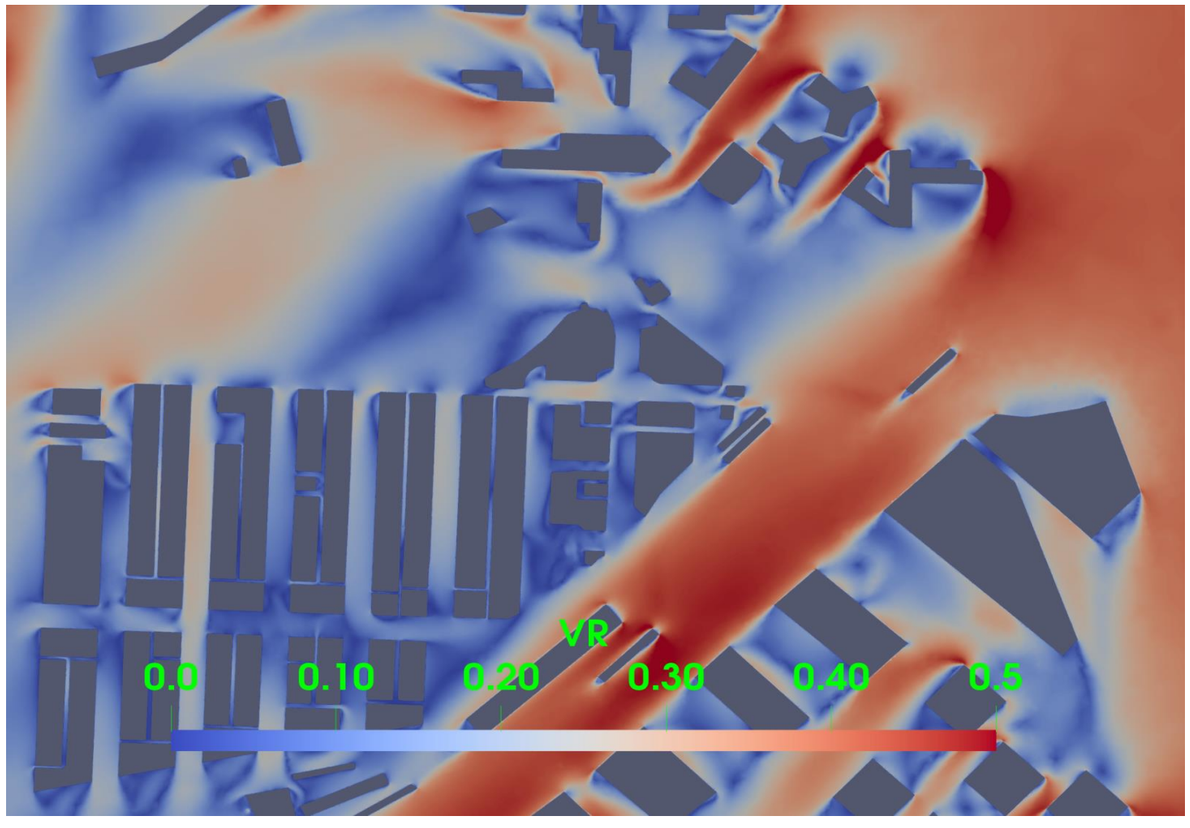
Kai Tak Road / Sa Po Road Project (KC015)

Wind Contours of Wind Velocity Ratio at 40mAG under Easterly Wind

SCALE	N.T.S.	DATE	Apr-19	
CHECK	KW	DRAWN	CC	
JOB NO.	17019/KC0	FIGURE NO.	4.3	REV. 1







Baseline Scheme

Proposed Scheme

022.5 deg Wind Direction (7m/s at 500m)

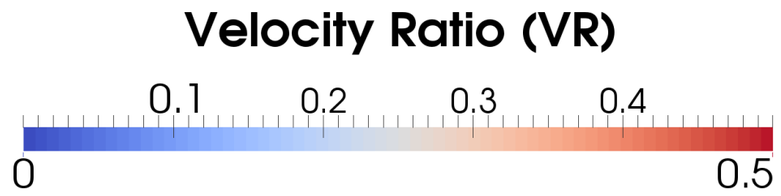
CINOTECH 漢臻 consultants limited

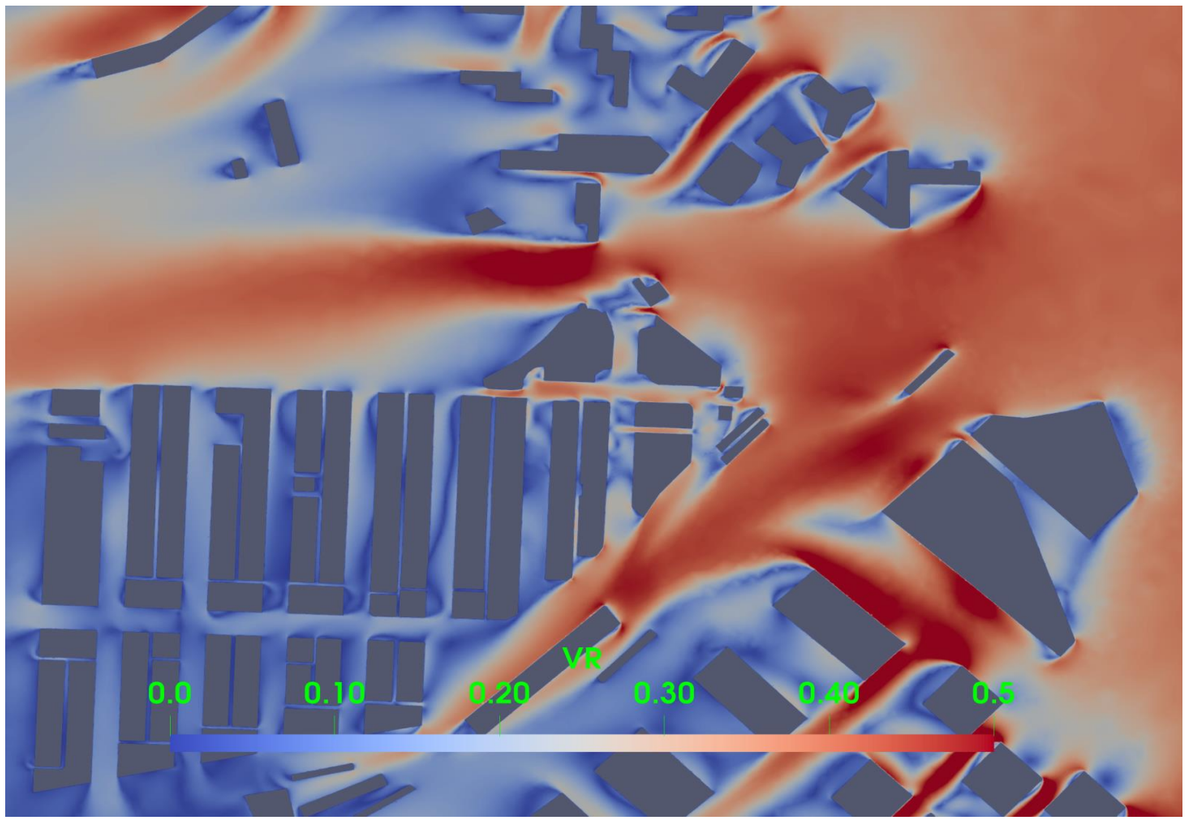
Air Ventilation Assessment

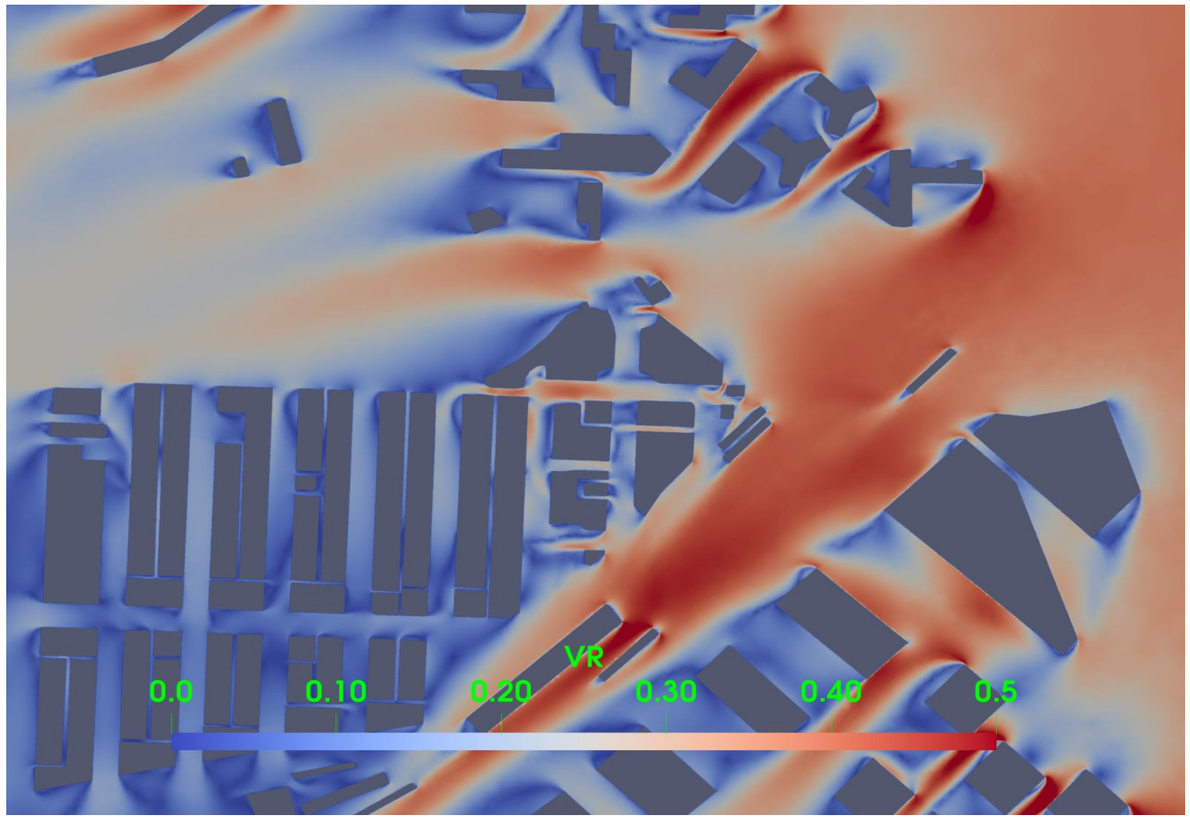
Kai Tak Road / Sa Po Road Project (KC015)

Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO.	4.1a	REV. 1







Baseline Scheme

Proposed Scheme

045 deg Wind Direction (6m/s at 500m)

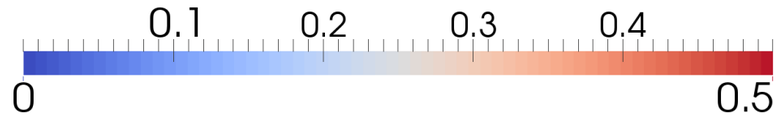
CINOTECH 漢臻 consultants limited

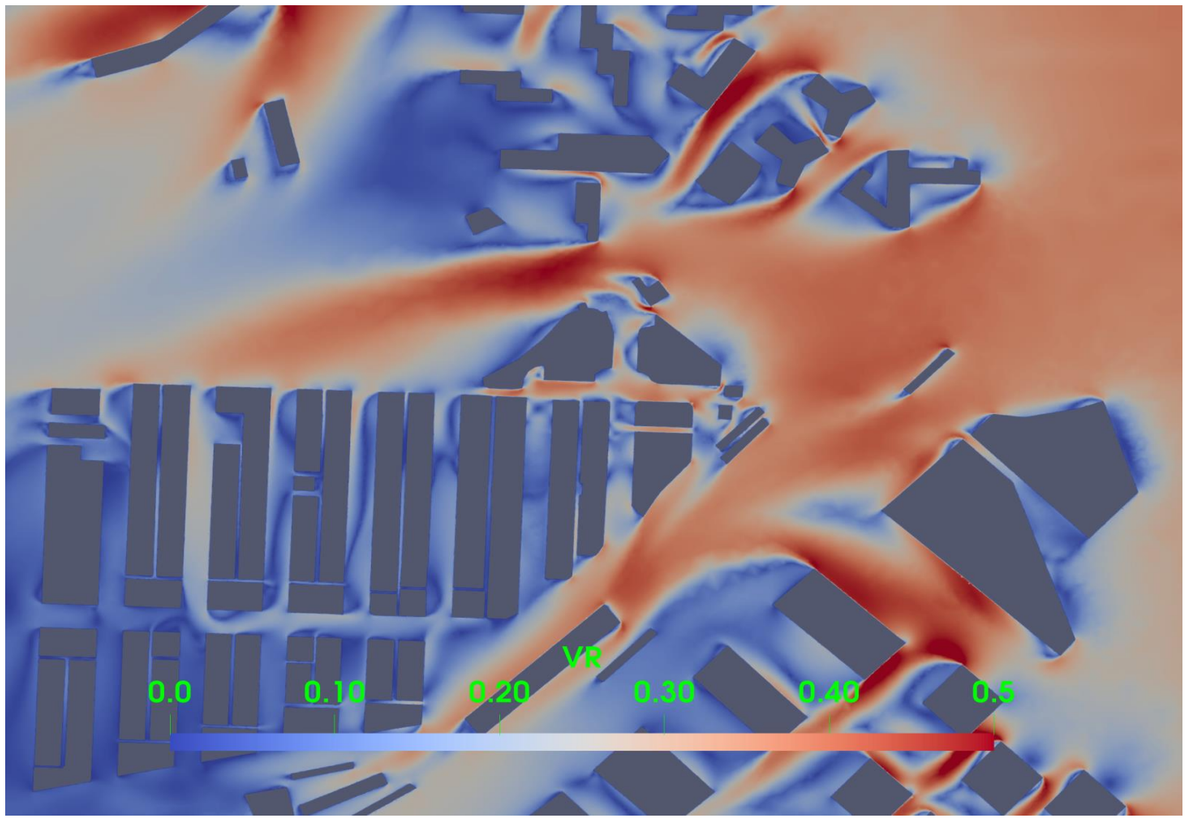
Air Ventilation Assessment

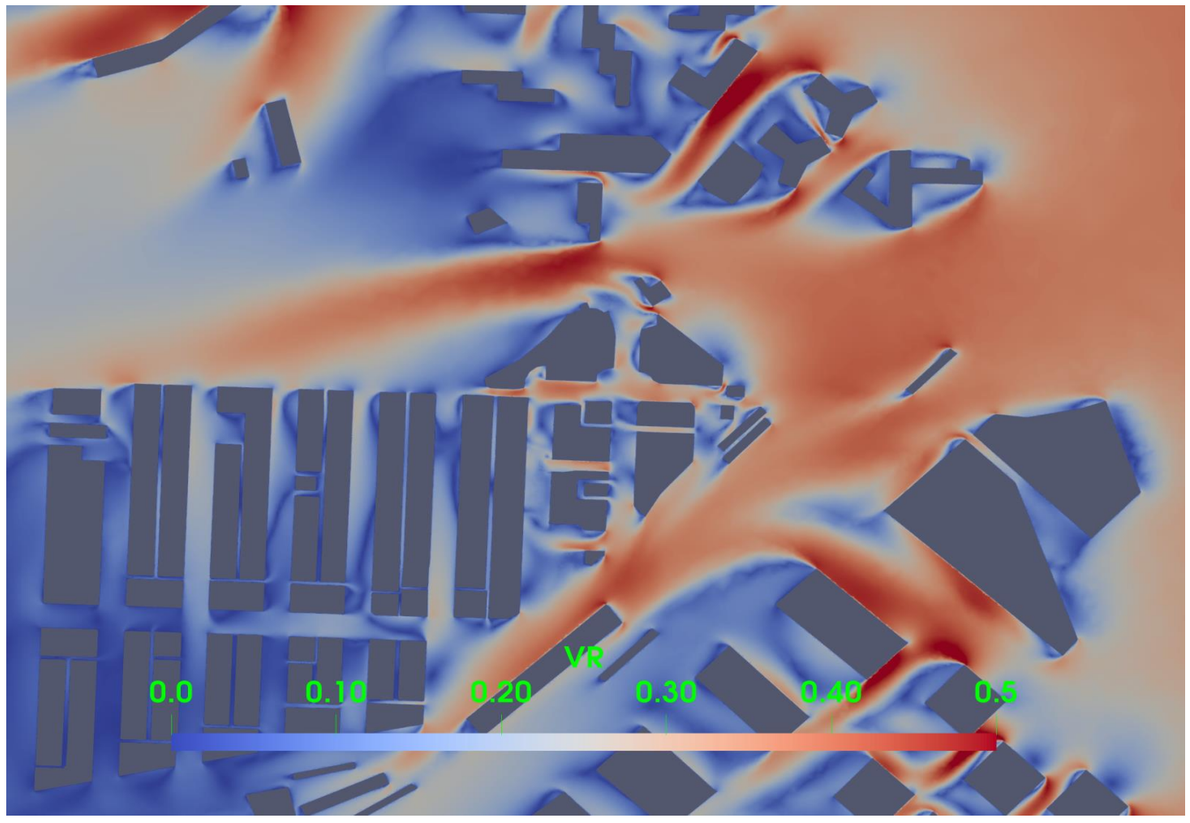
Kai Tak Road / Sa Po Road Project (KC015)

Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO.	4.1b	REV.
				1







Baseline Scheme

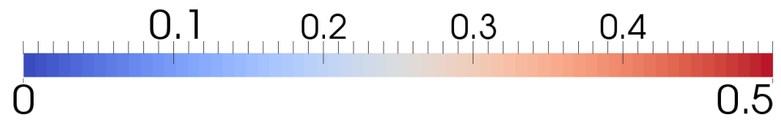
Proposed Scheme

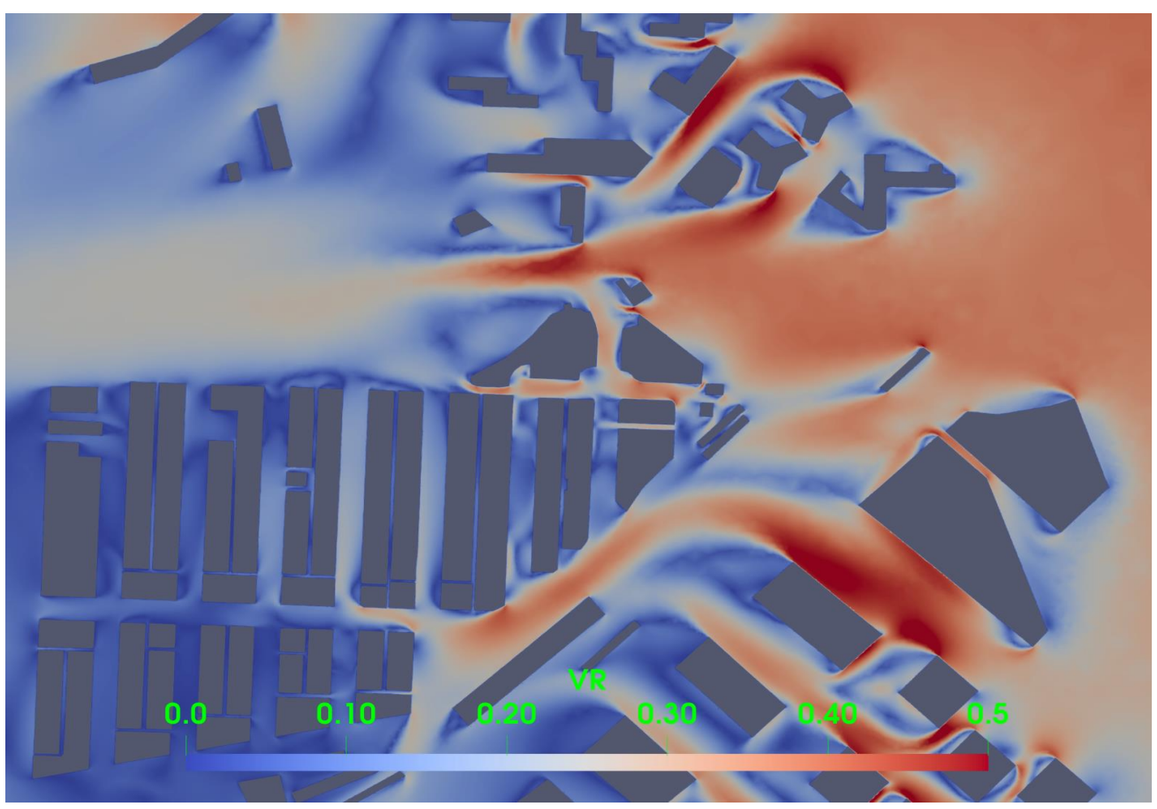
067.5 deg Wind Direction (6m/s at 500m)

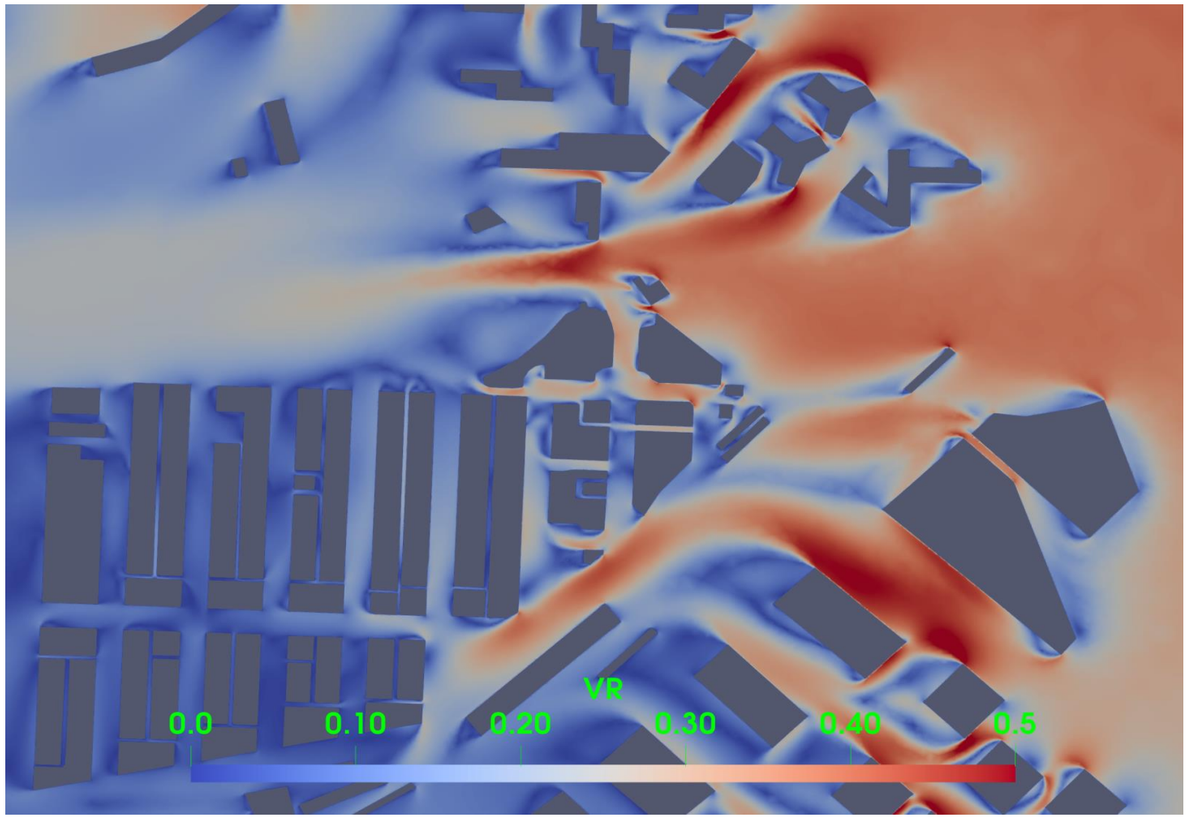
CINOTECH 漢臻 consultants limited

Air Ventilation Assessment
Kai Tak Road / Sa Po Road Project (KC015)
Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO.	4.1c	REV. 1







Baseline Scheme

Proposed Scheme

090 deg Wind Direction (7m/s at 500m)

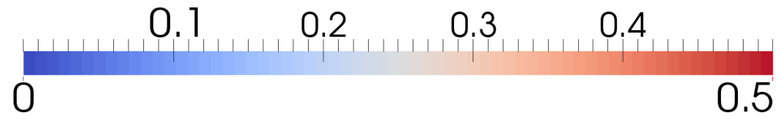
CINOTECH 漢蘇 consultants limited

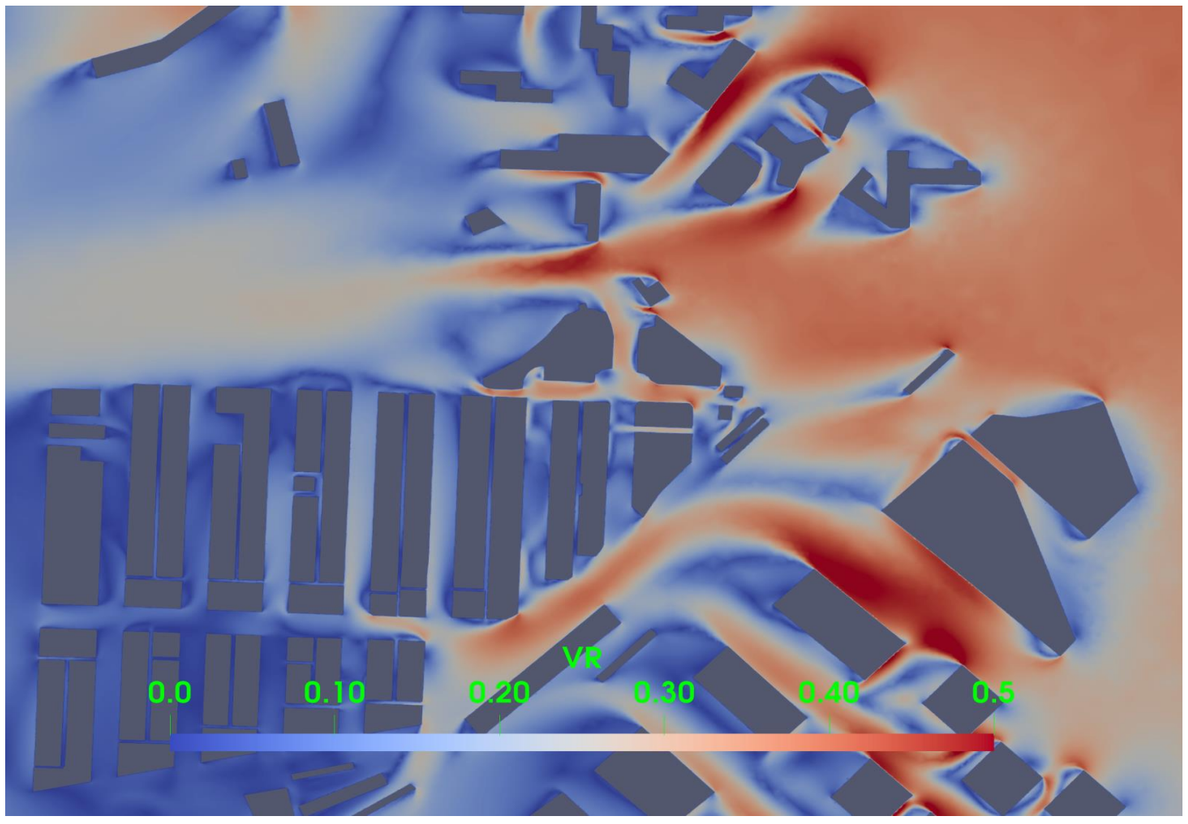
Air Ventilation Assessment

Kai Tak Road / Sa Po Road Project (KC015)

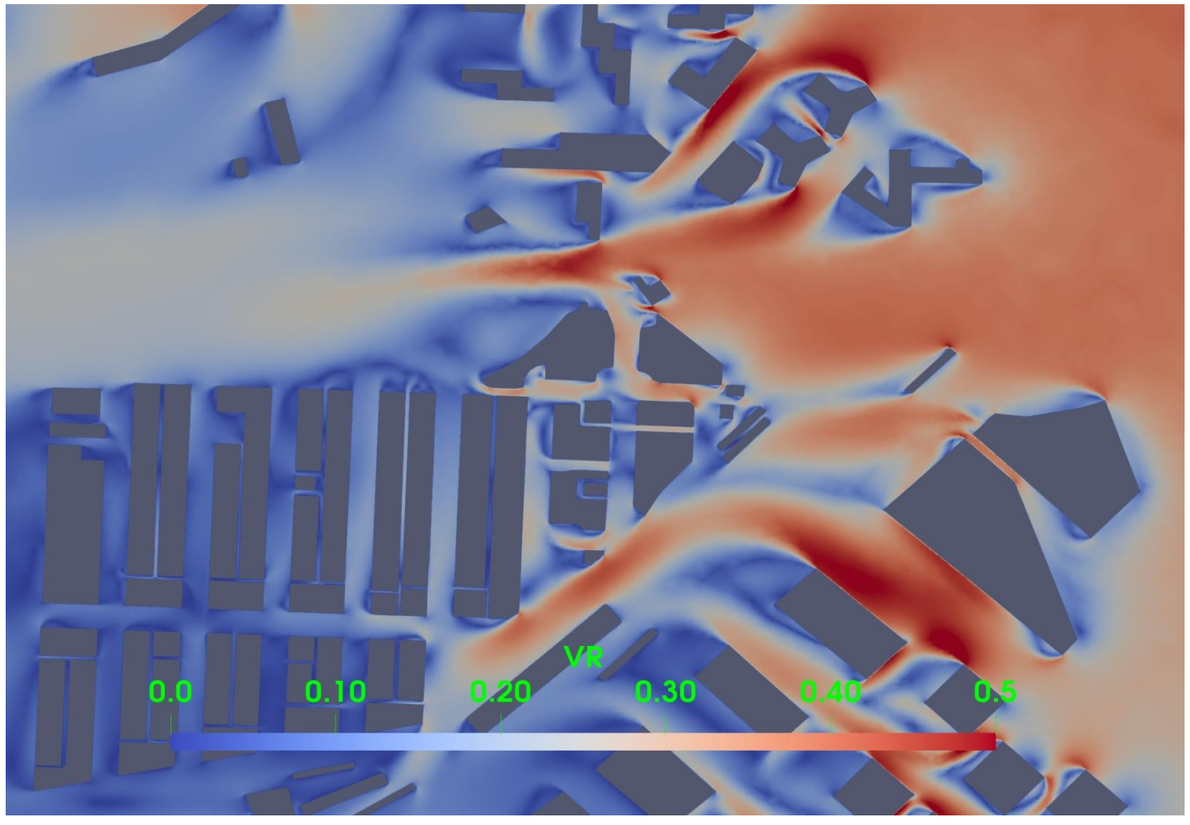
Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO.	4.1d	REV.
				1





Baseline Scheme



Proposed Scheme

090 deg Wind Direction (8m/s at 500m)

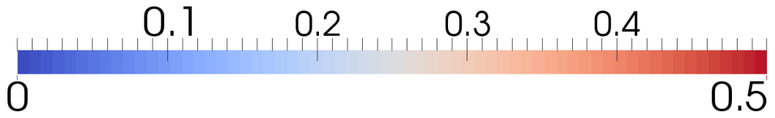
CINOTECH 漢臻 consultants limited

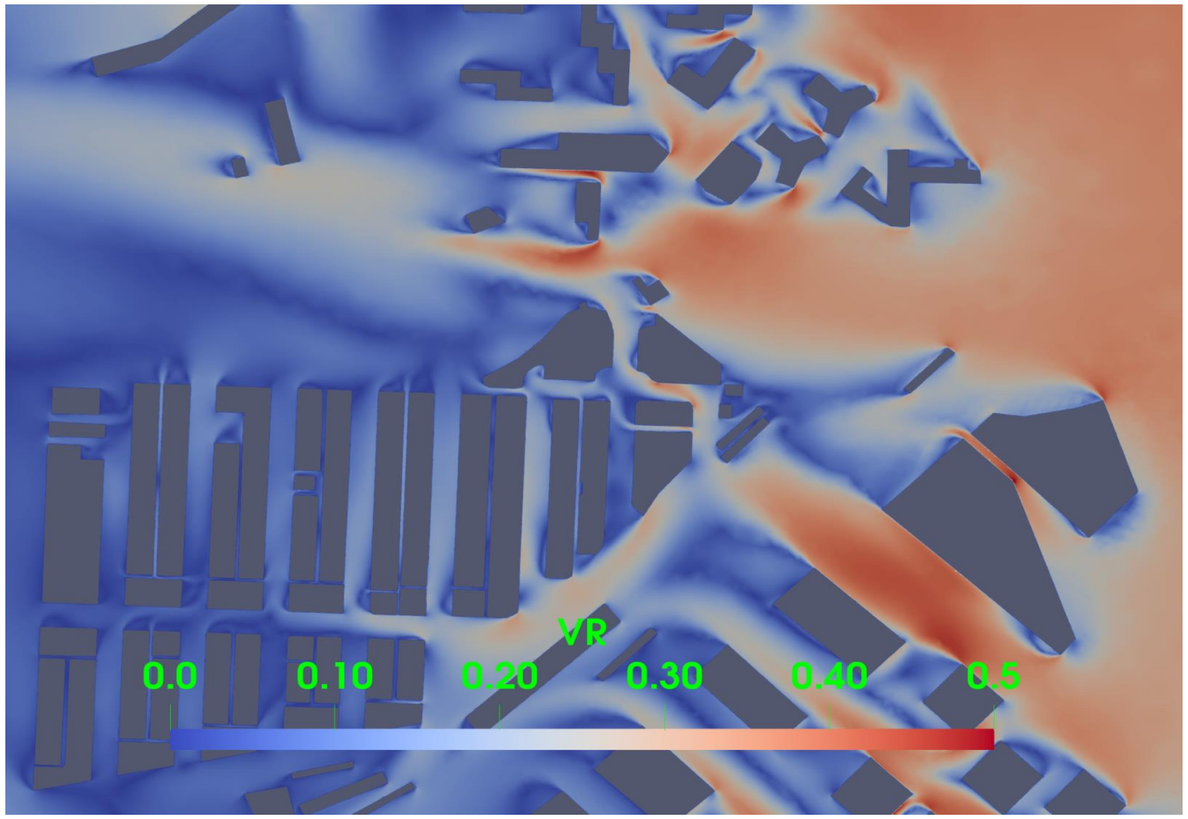
Air Ventilation Assessment

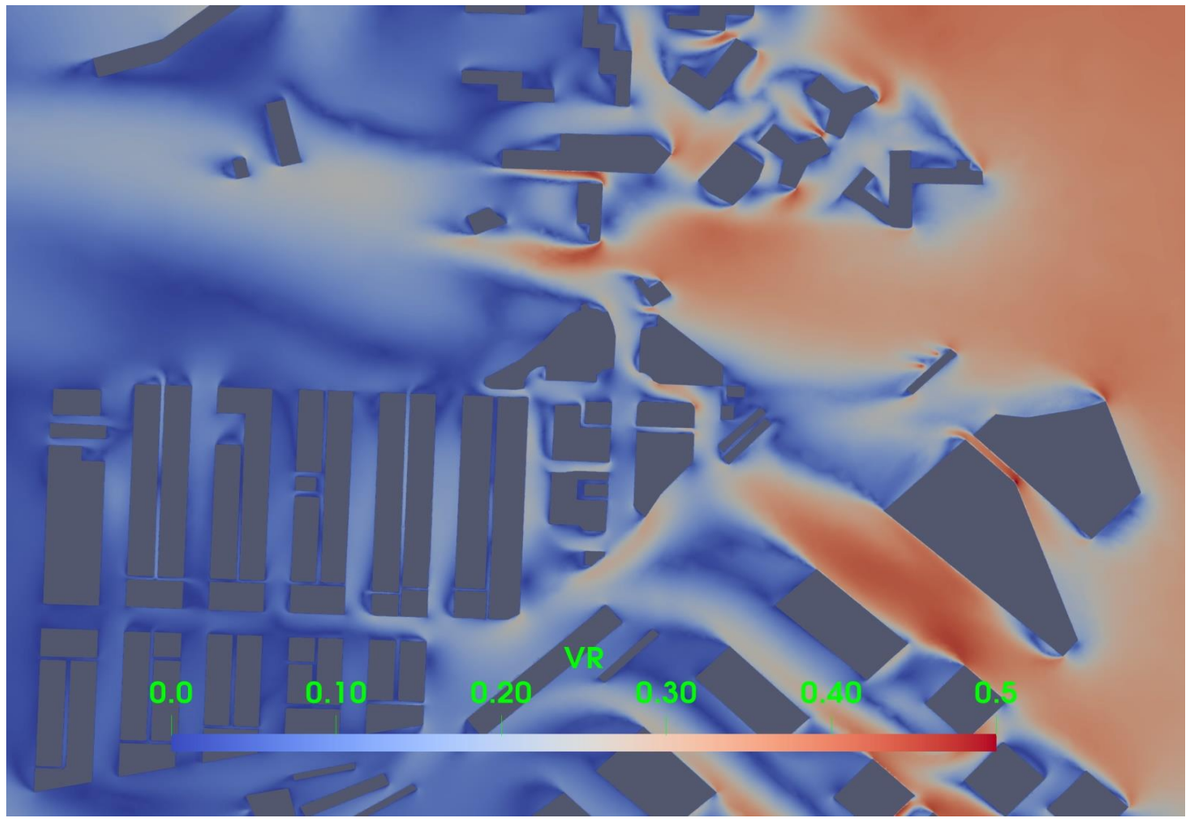
Kai Tak Road / Sa Po Road Project (KC015)

Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO.	4.1e	REV.
				1







Baseline Scheme

Proposed Scheme

112.5 deg Wind Direction (7m/s at 500m)

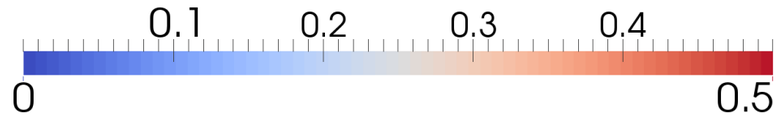
CINOTECH 漢槎 consultants limited

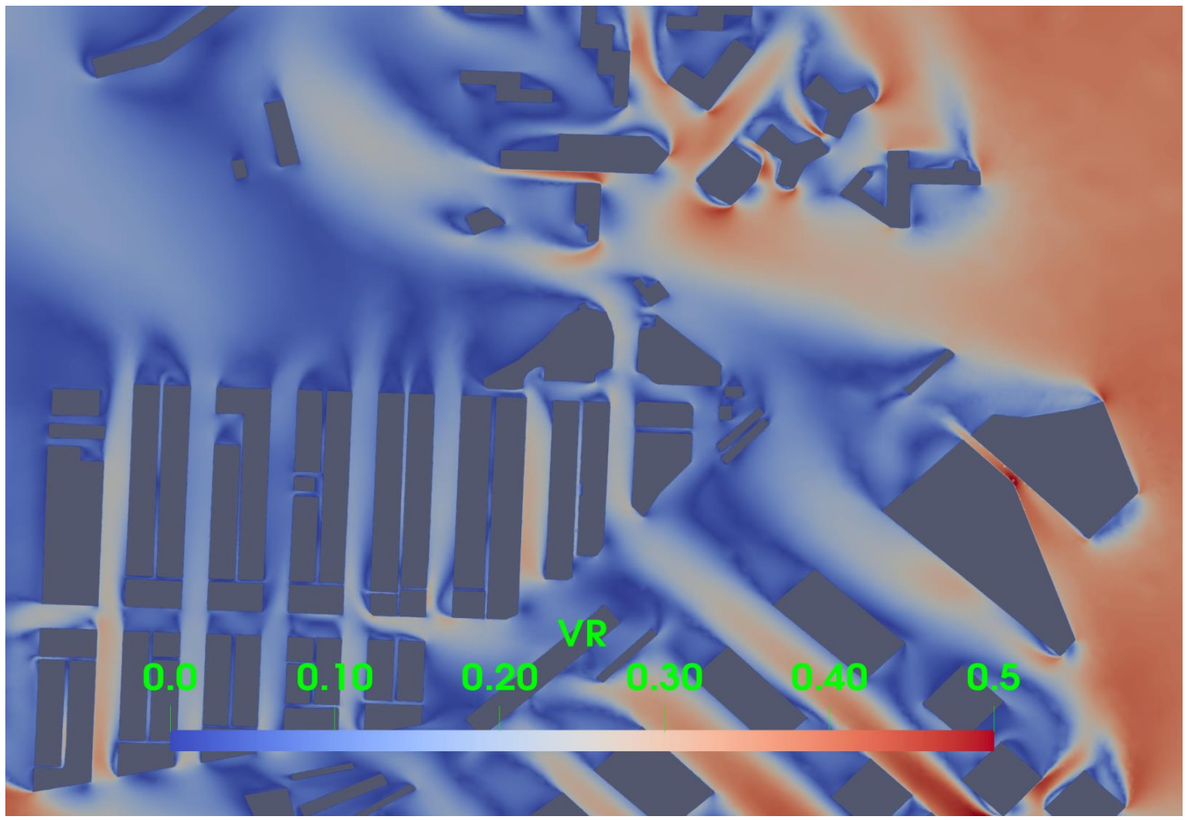
Air Ventilation Assessment

Kai Tak Road / Sa Po Road Project (KC015)

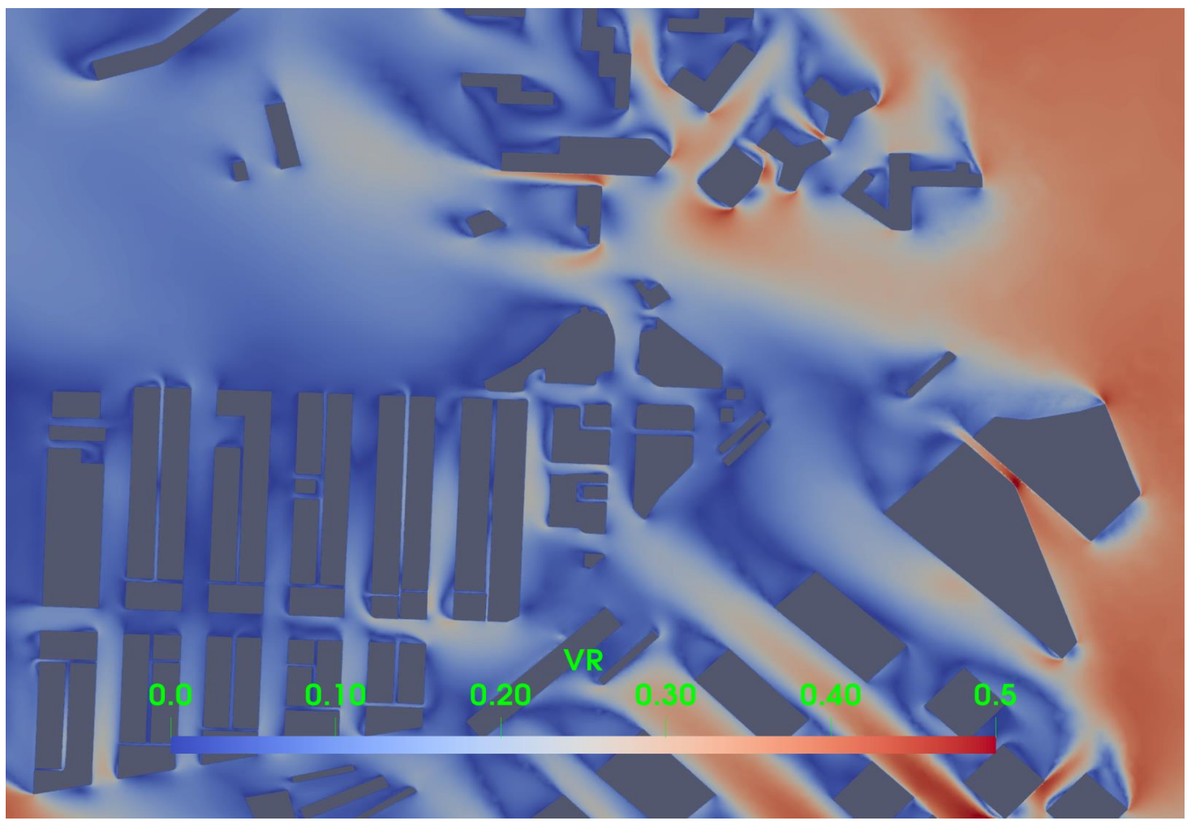
Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO.	4.1f	REV.
				1





Baseline Scheme



Proposed Scheme

135 deg Wind Direction (6m/s at 500m)

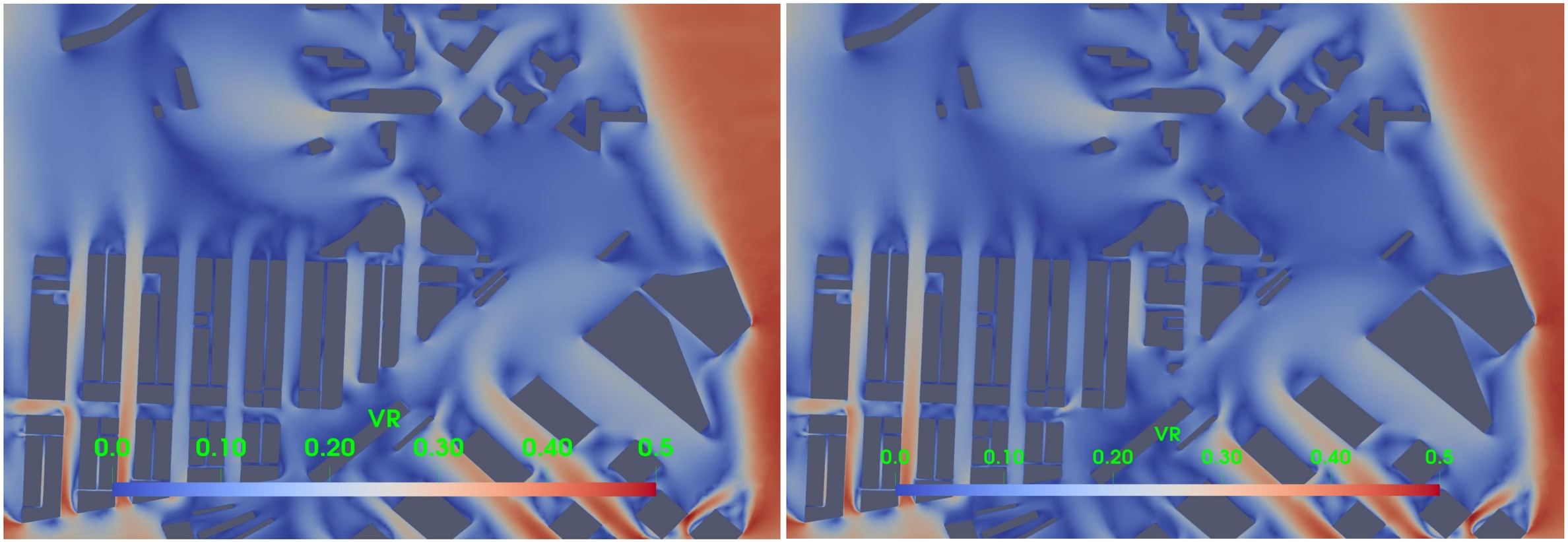
CINOTECH 漢蘇 consultants limited

Air Ventilation Assessment

Kai Tak Road / Sa Po Road Project (KC015)

Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO.	4.1g	REV.
				1



Baseline Scheme

Proposed Scheme

157.5 deg Wind Direction (6m/s at 500m)

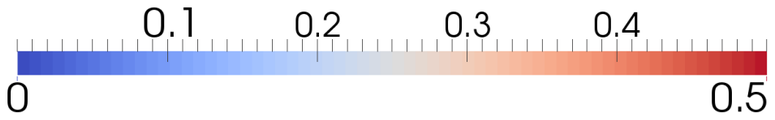
CINOTECH 漢臻 consultants limited

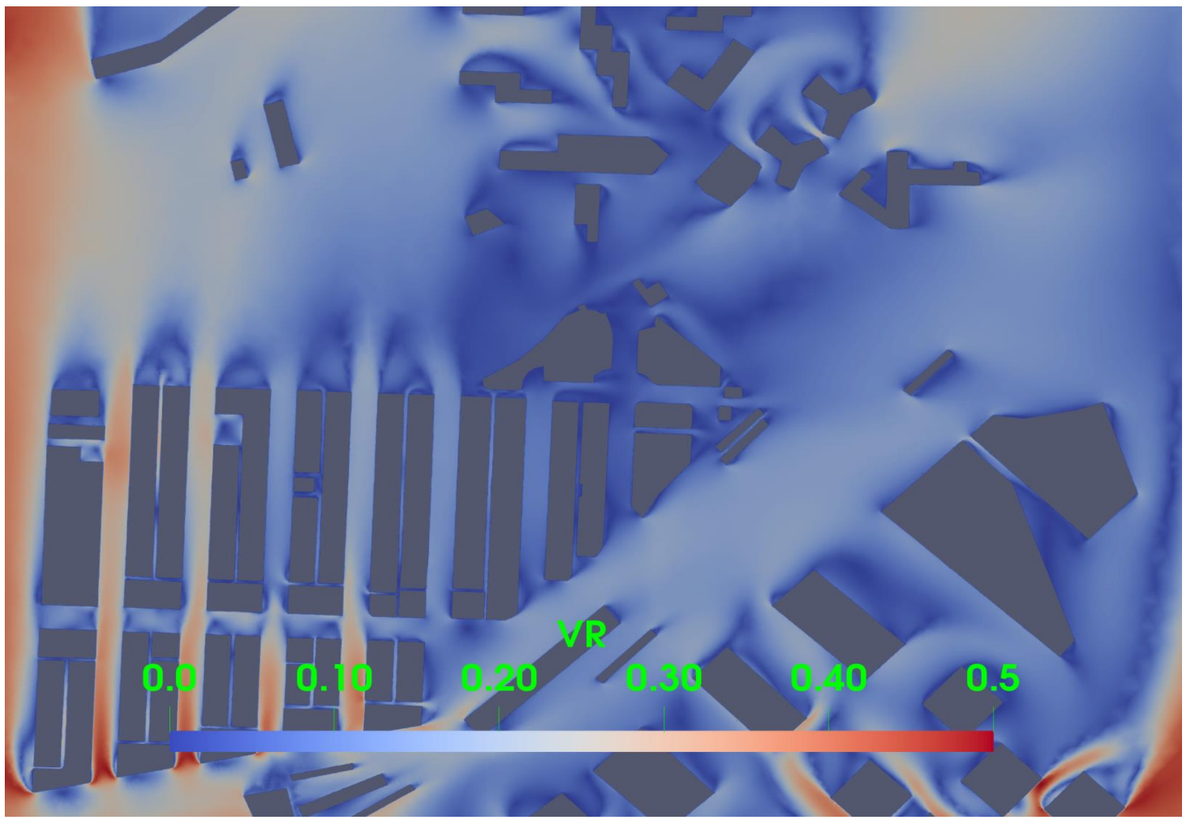
Air Ventilation Assessment

Kai Tak Road / Sa Po Road Project (KC015)

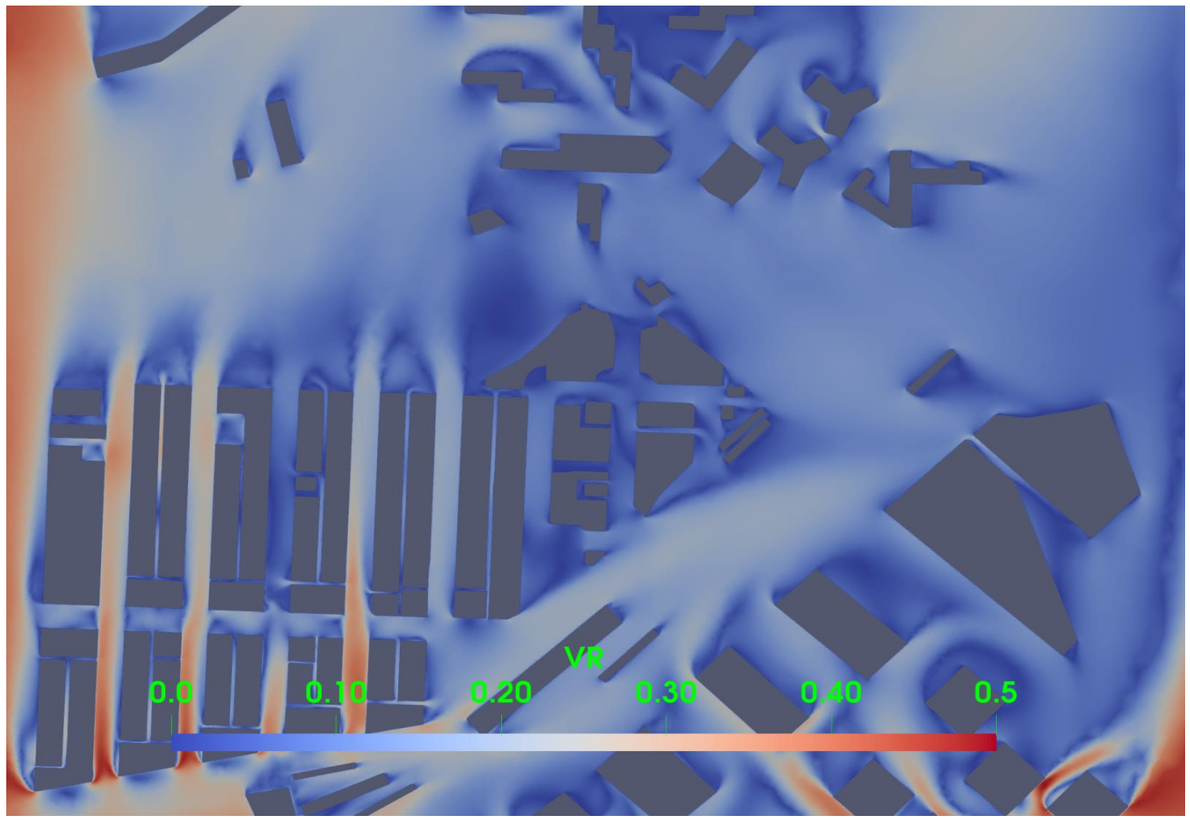
Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO.	4.1h	REV. 1





Baseline Scheme



Proposed Scheme

180 deg Wind Direction (5m/s at 500m)

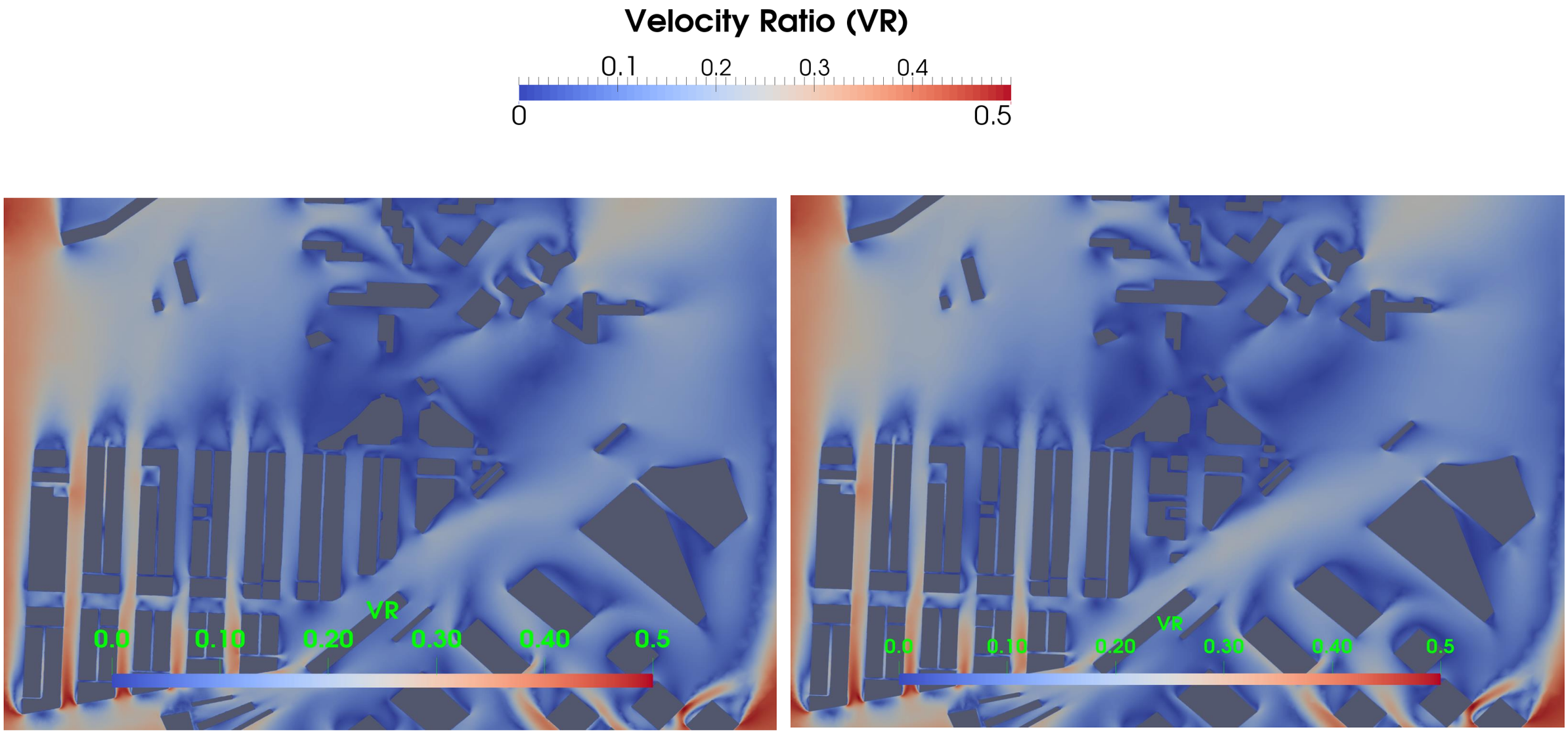
CINOTECH 漢蘇 consultants limited

Air Ventilation Assessment

Kai Tak Road / Sa Po Road Project (KC015)

Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO.	4.1i	REV.
				1



Baseline Scheme

Proposed Scheme

180 deg Wind Direction (6m/s at 500m)

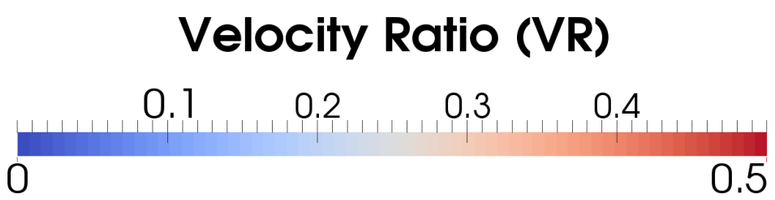
CINOTECH 漢臻 consultants limited

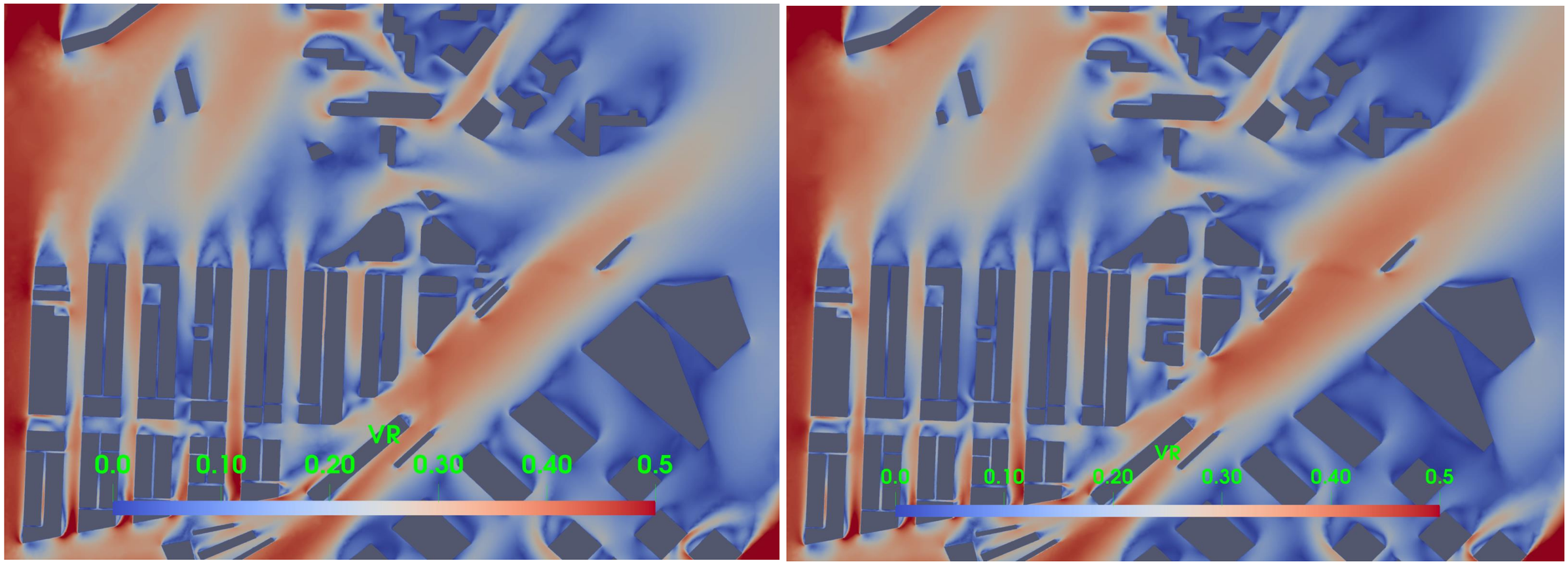
Air Ventilation Assessment

Kai Tak Road / Sa Po Road Project (KC015)

Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO.	4.1j	REV.
				1





Baseline Scheme

Proposed Scheme

202.5 deg Wind Direction (6m/s at 500m)

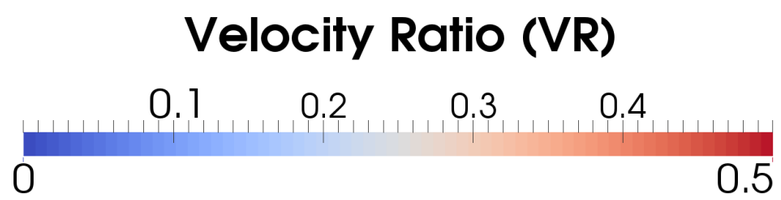
CINOTECH 漢臻 consultants limited

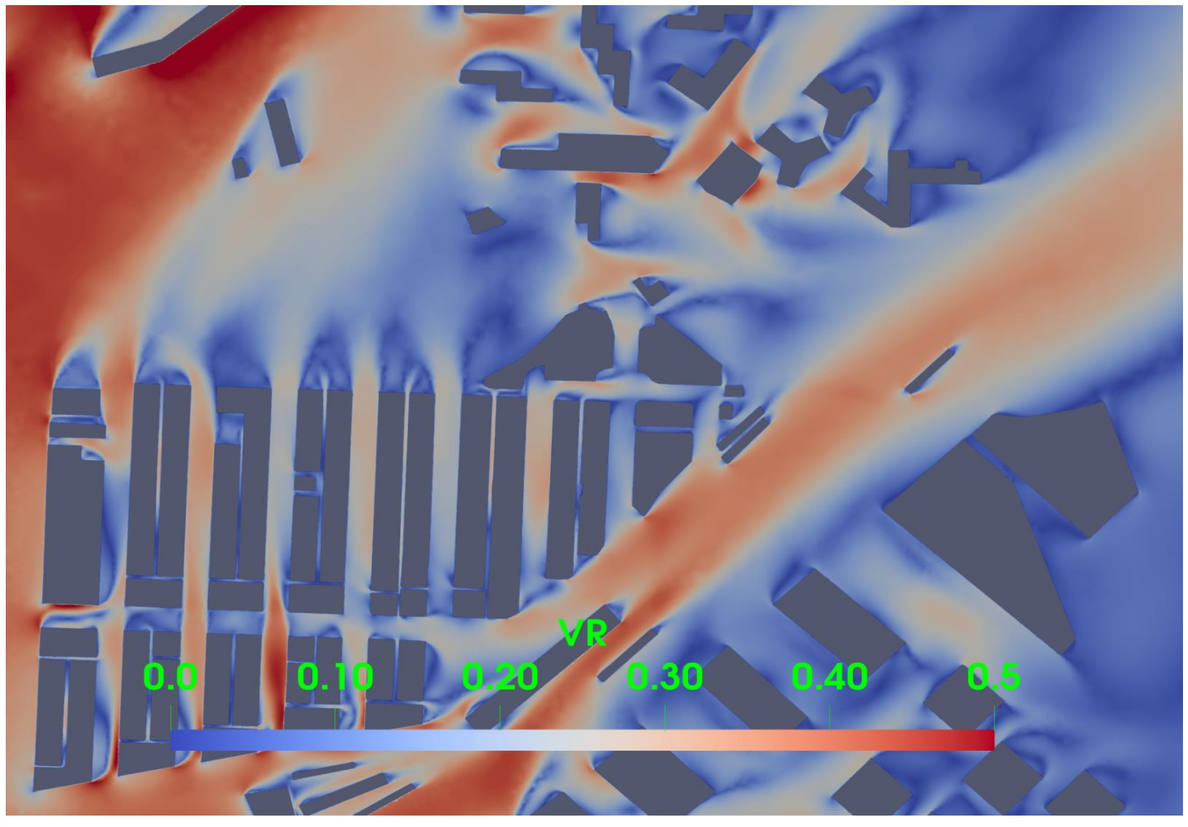
Air Ventilation Assessment

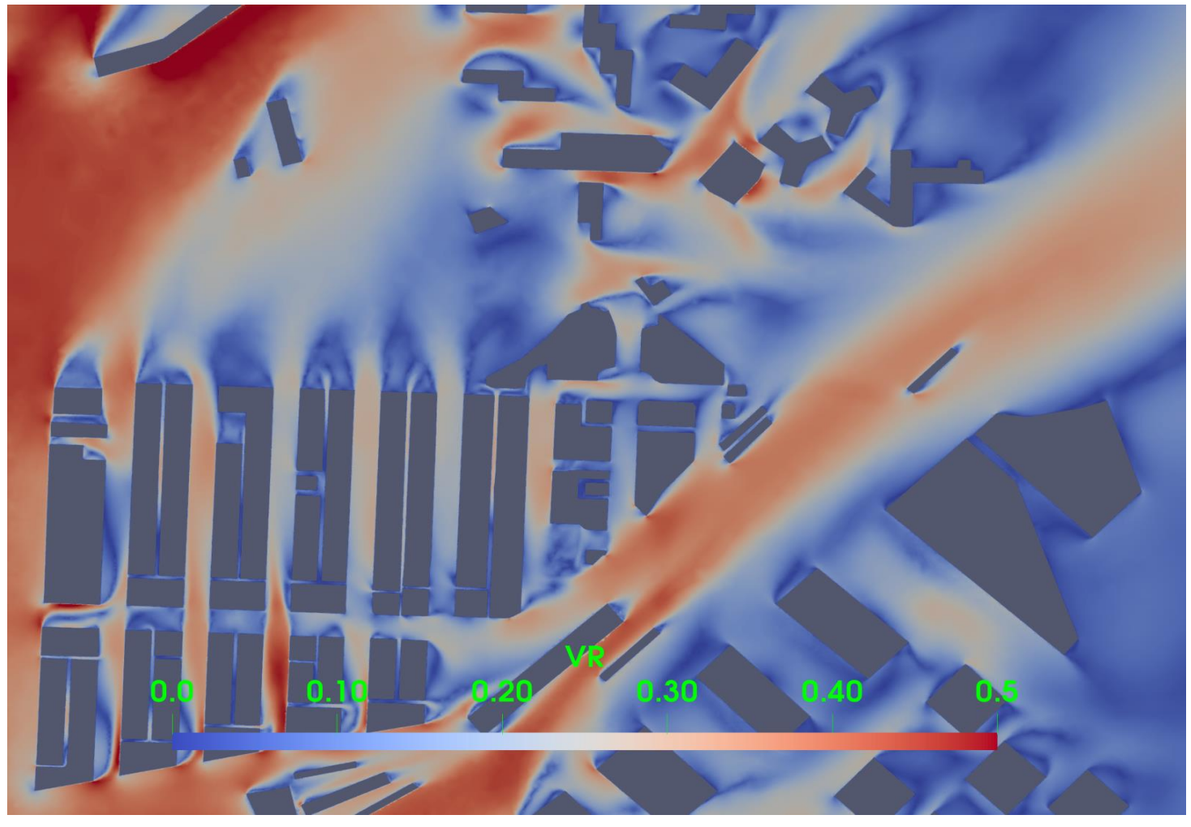
Kai Tak Road / Sa Po Road Project (KC015)

Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO.	4.1k	REV.
				1







Baseline Scheme

Proposed Scheme

225 deg Wind Direction (6m/s at 500m)

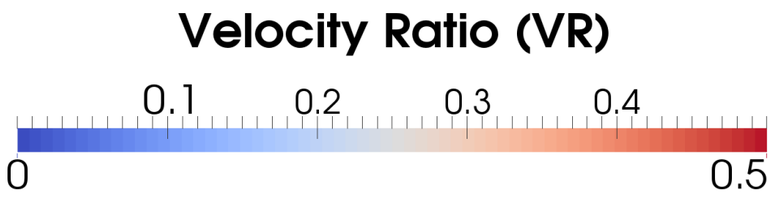
CINOTECH 漢臻 consultants limited

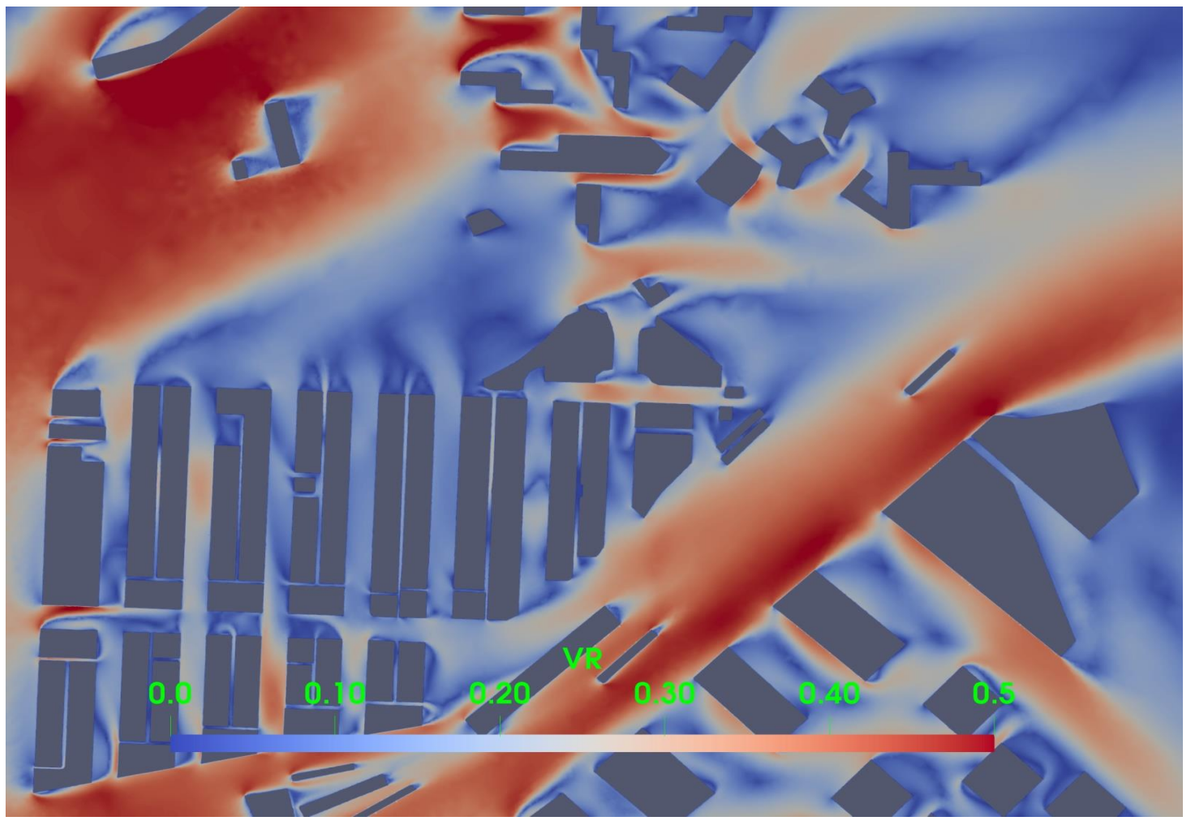
Air Ventilation Assessment

Kai Tak Road / Sa Po Road Project (KC015)

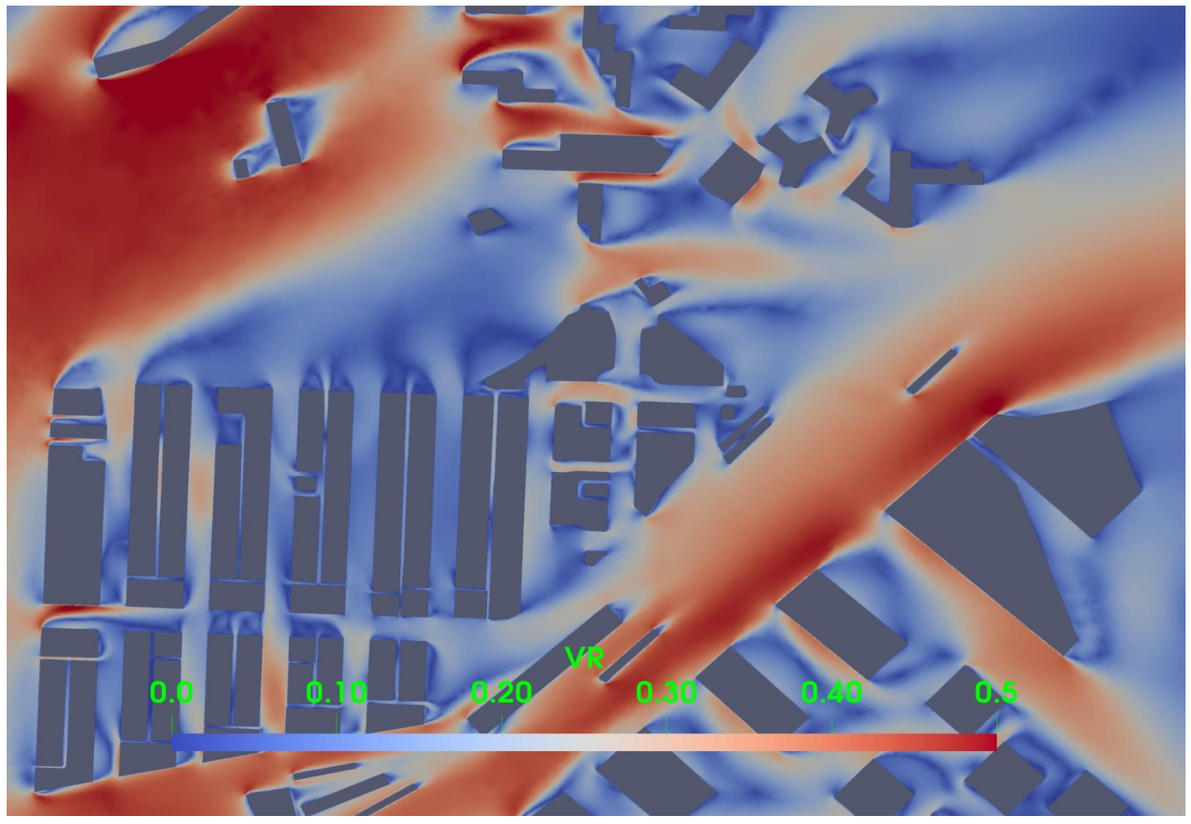
Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO.	4.1I	REV.
				1





Baseline Scheme



Proposed Scheme

247.5 deg Wind Direction (6m/s at 500m)

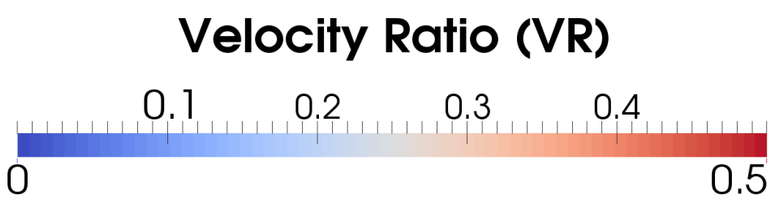
CINOTECH 漢臻 consultants limited

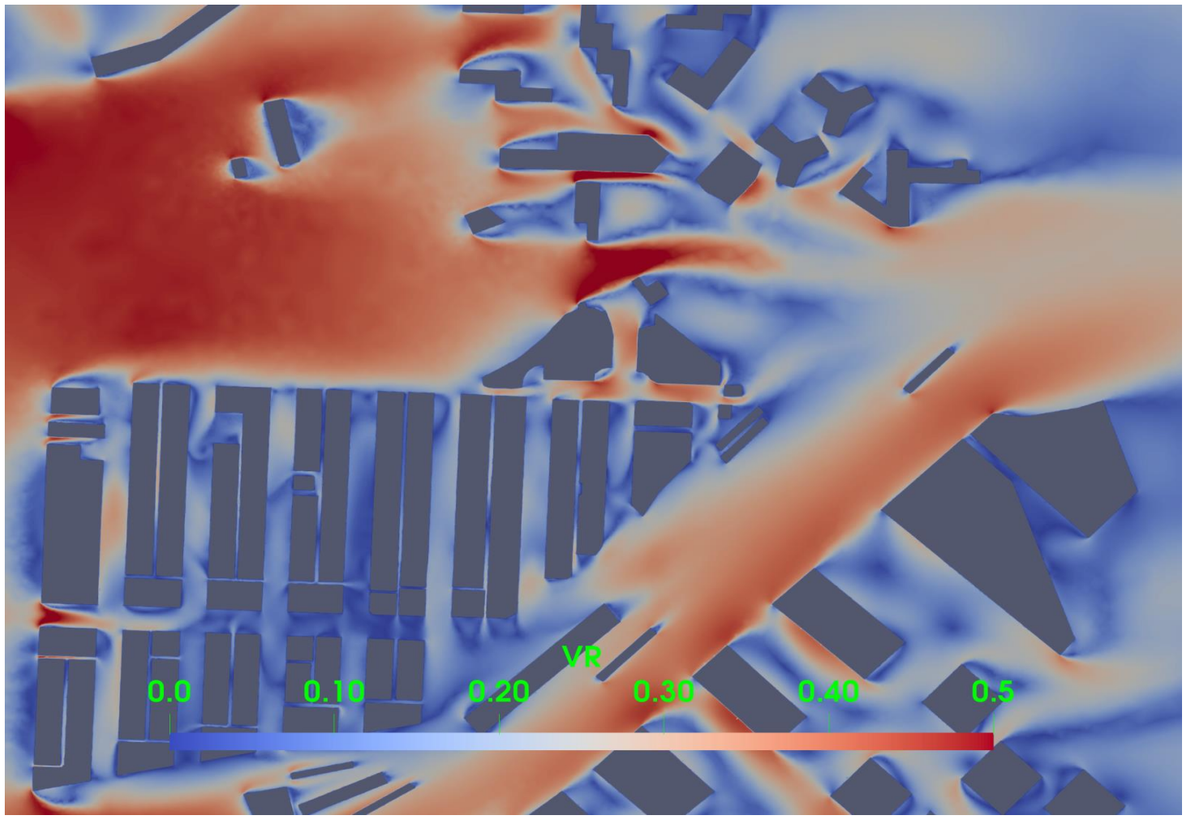
Air Ventilation Assessment

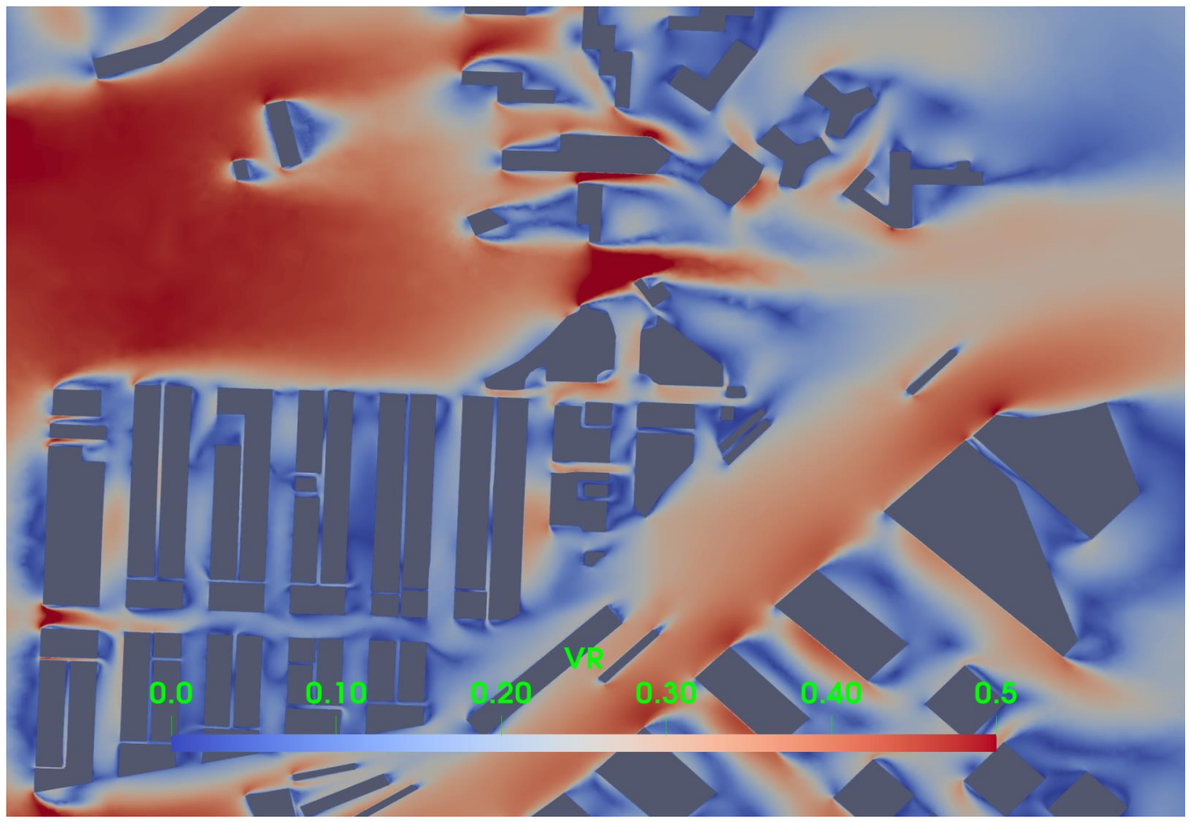
Kai Tak Road / Sa Po Road Project (KC015)

Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO.	4.1m	REV.
				1







Baseline Scheme

Proposed Scheme

270 deg Wind Direction (4m/s at 500m)

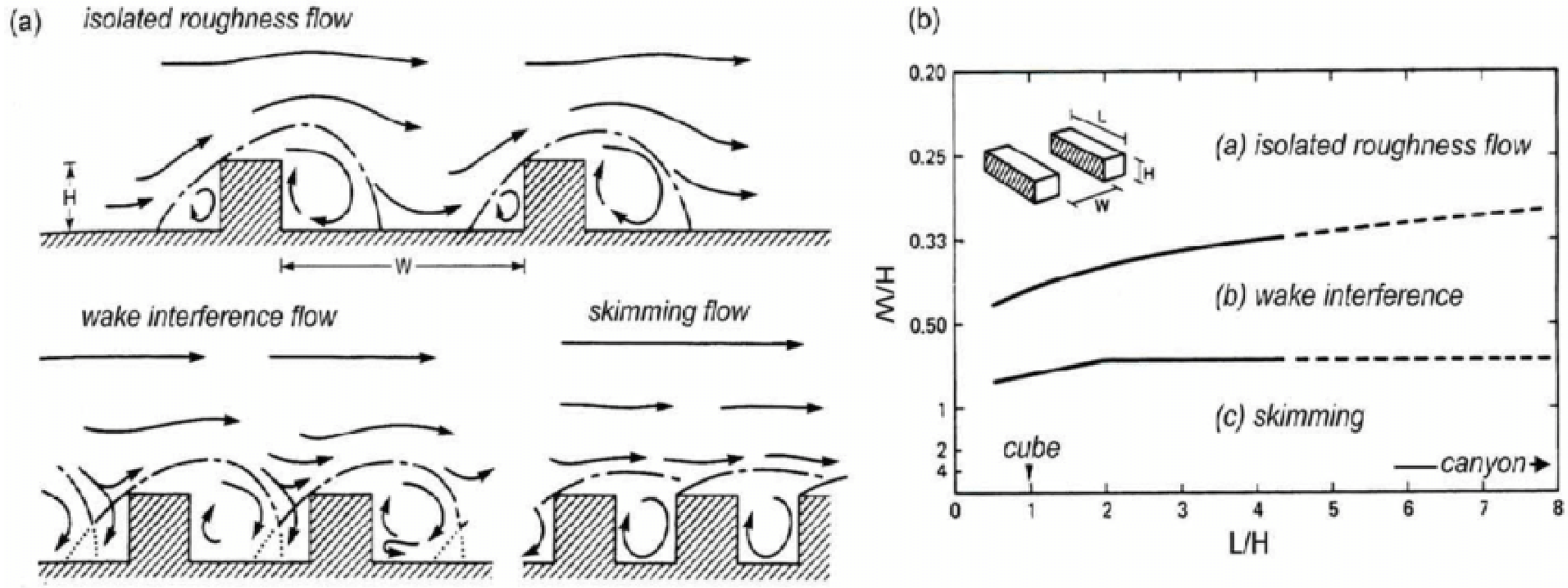
CINOTECH 漢臻 consultants limited

Air Ventilation Assessment

Kai Tak Road / Sa Po Road Project (KC015)

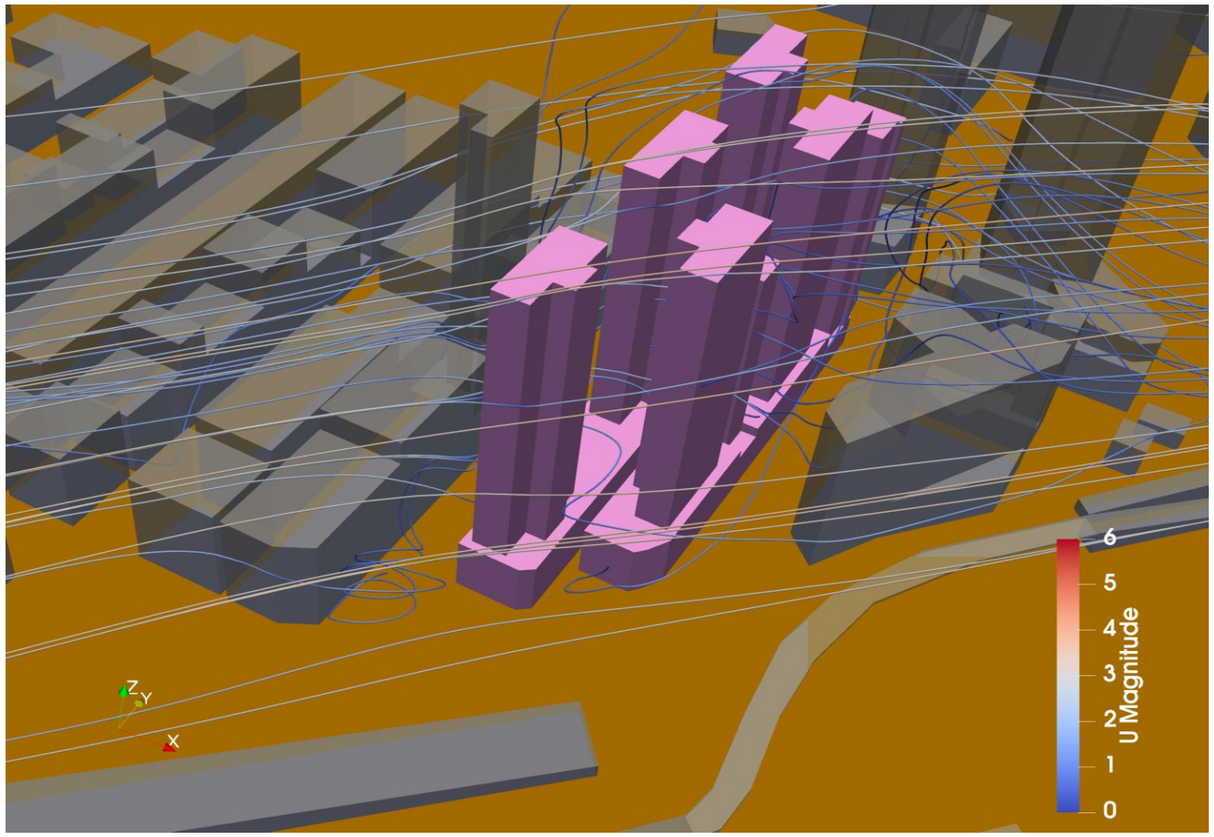
Contours of Wind Velocity Ratio at 2mAG

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	IA17019/K	FIGURE NO.	4.1n	REV.
				1

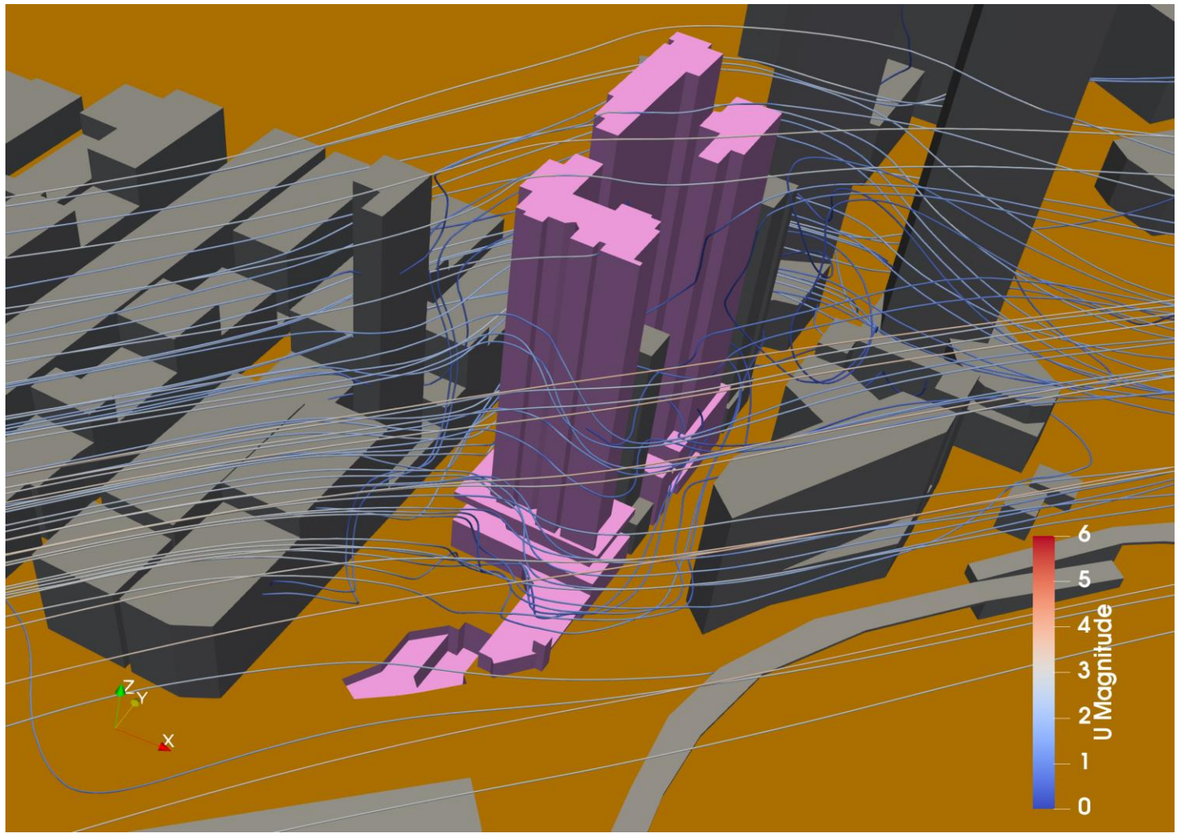


Source: Oke (1988), Street design and urban canopy layer climate, Energy and Buildings

CINOTECH 漢蘇 consultants limited	**Air Ventilation Assessment** **Kai Tak Road / Sa Po Road Project (KC015)** **Flow Regime for Urban Street Canyon**	SCALE	N.T.S.	DATE Nov-18
		CHECK	KW	DRAWN CC
		JOB NO.	17019/KC0	FIGURE NO. 4.2 REV. 1



Baseline Scheme



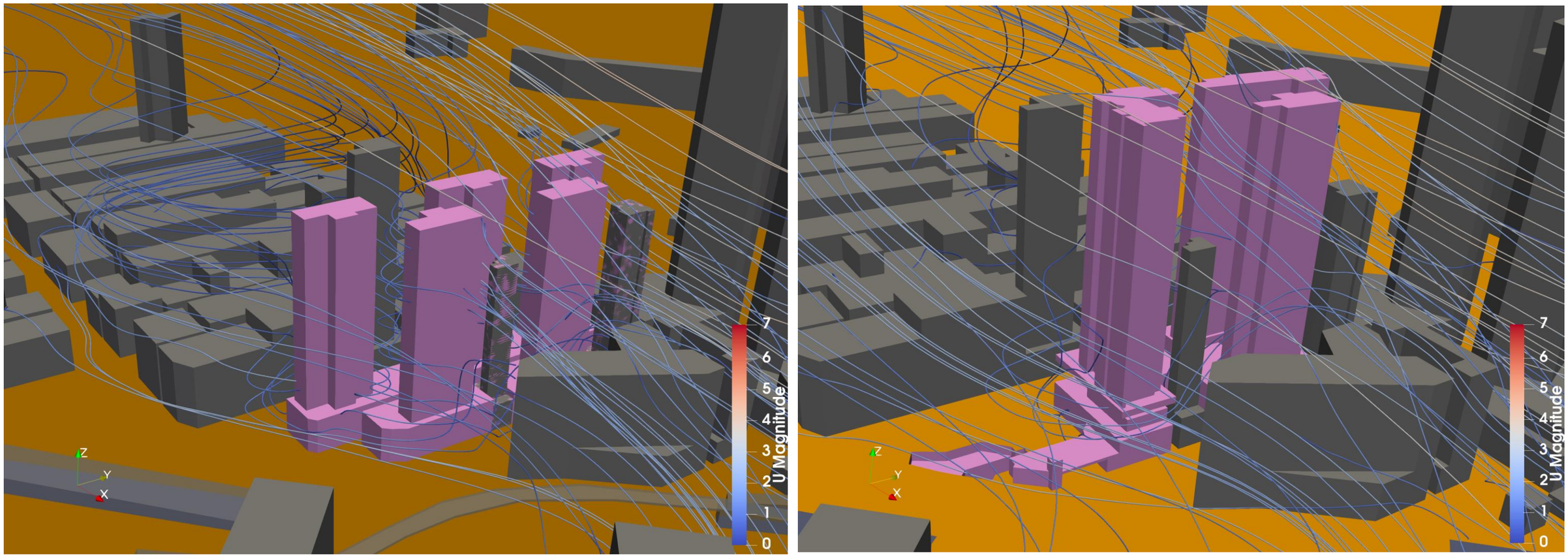
Proposed Scheme

Both with South-Westerly Wind with 6m/s at 500m

CINOTECH 漢臻 consultants limited

Air Ventilation Assessment
Kai Tak Road / Sa Po Road Project (KC015)
Flow Penetration of the Site under South Westerly Wind

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	17019/KC0	FIGURE NO.	4.3a	REV. 1



Baseline Scheme

Proposed Scheme

Both with Easterly Wind with 7m/s at 500m

CINOTECH 漢臻 consultants limited

Air Ventilation Assessment

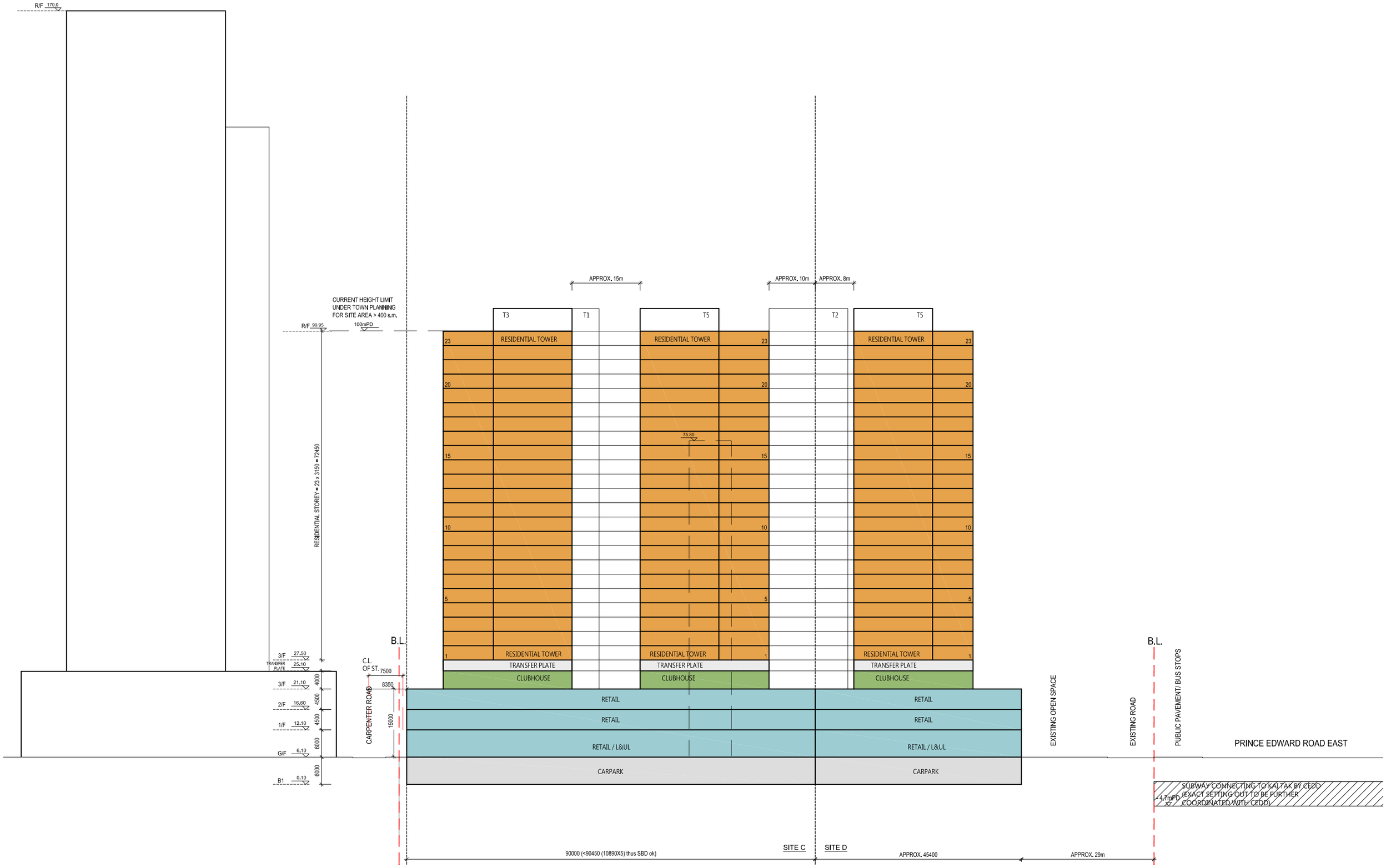
Kai Tak Road / Sa Po Road Project (KC015)

Flow Penetration of the Site under Easterly Wind

SCALE	N.T.S.	DATE	Nov-18	
CHECK	KW	DRAWN	CC	
JOB NO.	17019/KC0	FIGURE NO.	4.3b	REV. 1

APPENDIX 1.1

Notional Layout of the Baseline Scheme



Note: Proposed Height 100mPD

SCHEMATIC SECTION

KC-015 - OZP-COMPLIANCE SCHEME

1:750 (A3)

24 JAN 2019

N

SA PO ROAD

KAI TAK ROAD

CARPENTER ROAD

PRINCE EDWARD ROAD

SUBWAY CONNECTING TO KAI TAK BY CEDD (EXACT SETTING OUT TO BE FURTHER COORDINATED WITH CEDD)

-4.70

T1 SITE A

T2 SITE B

T3 T4 T5 SITE C SITE D

8000 8000 7500 15000 10000 8000 7500 8350 13697

51 17.1 33 16.5

C.L. OF ST. 18090 (>15m)

C.L. OF ST. 18638 (>15m)

90000 (<90450 (18090X5) thus SBD ok)

APPROX. 45400

6.1 6.1 6.1 6.1 6.8 6.0 5.9 12.2 14.1 20.1

30–38 40–42 43 83 81 79 77 75 73 71 69 67 65 61–63 57–59 55 53 51 49 47–47A 45–43 41 39 37 35 33 31 29–25 23 21–19 17

Note: Proposed Height 100mPD
SCHEMATIC BLOCK PLAN

KC-015 - OZP-COMPLIANCE SCHEME

1:500 (A3)
24 JAN 2019

APPENDIX 2.1

Wind Data at grid [84,45] form RAMS

Occurrence Probability at 500m elevation (Annual)

e_01354	Wind_direction	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
V_infinity(m/s)	Sum	0.026	0.065	0.09	0.114	0.202	0.118	0.07	0.042	0.043	0.059	0.066	0.04	0.025	0.015	0.011	0.012
00_to_01	0.02	0.001	0.001	0.001	0.001	0.004	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.001
01_to_02	0.06	0.003	0.005	0.007	0.007	0.007	0.003	0.003	0.003	0.003	0.004	0.003	0.003	0.004	0.002	0.001	0.002
02_to_03	0.095	0.004	0.008	0.012	0.01	0.013	0.006	0.005	0.005	0.005	0.006	0.007	0.005	0.004	0.002	0.002	0.003
03_to_04	0.11	0.004	0.007	0.012	0.011	0.014	0.009	0.007	0.006	0.007	0.007	0.008	0.006	0.004	0.003	0.002	0.002
04_to_05	0.116	0.003	0.006	0.012	0.012	0.017	0.014	0.008	0.006	0.006	0.007	0.009	0.006	0.004	0.003	0.002	0.002
05_to_06	0.117	0.002	0.005	0.011	0.013	0.022	0.017	0.01	0.005	0.005	0.006	0.009	0.005	0.003	0.002	0.001	0.001
06_to_07	0.112	0.002	0.006	0.008	0.013	0.024	0.017	0.01	0.005	0.005	0.006	0.008	0.004	0.001	0.001	0.001	0.001
07_to_08	0.1	0.002	0.005	0.008	0.012	0.024	0.014	0.008	0.004	0.005	0.006	0.006	0.003	0.001	0.001	0.001	0
08_to_09	0.08	0.002	0.004	0.006	0.011	0.022	0.011	0.006	0.002	0.003	0.005	0.004	0.003	0.001	0	0	0
09_to_10	0.061	0.001	0.004	0.004	0.008	0.018	0.009	0.004	0.001	0.001	0.004	0.003	0.002	0	0	0	0
10_to_11	0.044	0.001	0.003	0.003	0.006	0.014	0.006	0.003	0.001	0.001	0.003	0.003	0.001	0	0	0	0
11_to_12	0.029	0.001	0.003	0.002	0.003	0.009	0.004	0.002	0	0	0.002	0.002	0.001	0	0	0	0
12_to_13	0.018	0	0.002	0.001	0.002	0.006	0.002	0.001	0	0	0.001	0.001	0	0	0	0	0
13_to_14	0.012	0	0.002	0.001	0.002	0.003	0.002	0.001	0	0	0	0.001	0	0	0	0	0
14_to_15	0.008	0	0.001	0.001	0.001	0.002	0.001	0	0	0	0	0	0	0	0	0	0
15_to_16	0.005	0	0.001	0	0.001	0.002	0.001	0	0	0	0	0	0	0	0	0	0
16_to_17	0.004	0	0.001	0	0.001	0.001	0	0	0	0	0	0	0	0	0	0	0
17_to_18	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18_to_19	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19_to_20	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20_to_21	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21_to_22	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22_to_23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23_to_24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Occurrence Probability at 500m elevation (Summer)

e_01354	Wind_direction	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW
V_infinity(m/s)	Sum	0.009	0.012	0.015	0.024	0.084	0.1	0.081	0.077	0.089	0.133	0.159	0.101	0.052	0.031	0.018	0.012
00_to_01	0.019	0.001	0.001	0.001	0.001	0.002	0.001	0.001	0.002	0.001	0.001	0.002	0.001	0.002	0.001	0	0.001
01_to_02	0.058	0.001	0.002	0.003	0.003	0.003	0.003	0.005	0.004	0.006	0.007	0.007	0.004	0.006	0.002	0.002	0.002
02_to_03	0.098	0.002	0.002	0.003	0.003	0.005	0.005	0.006	0.009	0.008	0.012	0.015	0.011	0.008	0.003	0.003	0.002
03_to_04	0.122	0.001	0.001	0.002	0.001	0.005	0.01	0.009	0.01	0.012	0.015	0.021	0.015	0.009	0.005	0.003	0.002
04_to_05	0.125	0.001	0.001	0.001	0.001	0.007	0.012	0.009	0.01	0.011	0.014	0.02	0.016	0.009	0.006	0.004	0.001
05_to_06	0.115	0	0	0.001	0.001	0.01	0.013	0.008	0.009	0.011	0.014	0.02	0.014	0.006	0.005	0.002	0.001
06_to_07	0.105	0.001	0	0.001	0.001	0.009	0.012	0.007	0.01	0.011	0.014	0.018	0.011	0.003	0.003	0.002	0.001
07_to_08	0.095	0	0	0.001	0.002	0.008	0.01	0.009	0.008	0.01	0.016	0.014	0.009	0.002	0.003	0.002	0.001
08_to_09	0.07	0.001	0.001	0.001	0.002	0.007	0.007	0.007	0.005	0.007	0.011	0.011	0.006	0.002	0.001	0	0
09_to_10	0.051	0	0.001	0	0.002	0.006	0.006	0.005	0.004	0.004	0.009	0.008	0.005	0.001	0.001	0	0
10_to_11	0.042	0	0	0	0.001	0.005	0.005	0.004	0.003	0.002	0.008	0.007	0.003	0.001	0	0	0
11_to_12	0.031	0	0.001	0.001	0.001	0.004	0.004	0.003	0.002	0.001	0.004	0.007	0.002	0.001	0	0	0
12_to_13	0.021	0	0	0.001	0.001	0.003	0.004	0.002	0.001	0.001	0.003	0.004	0.001	0	0	0	0
13_to_14	0.015	0	0	0	0.001	0.002	0.003	0.002	0	0.001	0.001	0.002	0.001	0	0	0	0
14_to_15	0.01	0	0	0	0	0.002	0.002	0	0	0.001	0.001	0.001	0	0	0	0	0
15_to_16	0.008	0	0	0	0.001	0.003	0.001	0.001	0	0	0	0.001	0	0	0	0	0
16_to_17	0.005	0	0	0	0	0.001	0	0	0	0.001	0	0.001	0	0	0	0	0
17_to_18	0.003	0	0	0	0	0.001	0	0	0	0	0	0	0	0	0	0	0
18_to_19	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19_to_20	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20_to_21	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21_to_22	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22_to_23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23_to_24	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX 3.1

Detailed Simulated Velocity Ratio

Wind Velocity Ratio, Base Case

Tes Point			Wind direction (Degree)	22.5	45	67.5	90	90	112.5	135	157.5	180	180	202.5	225	247.5	270	Sum	Average (Annual)	Average (Summer)
			Wind direction	NNE	NE	ENE	E	E	ESE	SE	SSE	S	S	SSW	SW	WSW	W			
			Average Wind Speed at 500m elevation	7	6	6	7	8	7	6	6	5	6	6	6	6	4			
ID	Easting (m)	Northing (m)	Probability (Annual)	6.5%	9.0%	11.4%	20.2%		11.8%	7.0%		4.3%		5.9%	6.6%			82.7%		
			Probability (Summer)					8.4%	10.0%	8.1%	7.7%		8.9%	13.3%	15.9%	10.1%	5.2%	87.6%		
P01	837848.1486	821265.2969		0.23	0.30	0.28	0.29	0.29	0.03	0.05	0.12	0.07	0.07	0.29	0.26	0.17	0.17		0.21	0.17
P02	837847.3208	821254.4717		0.04	0.08	0.10	0.07	0.07	0.13	0.18	0.15	0.09	0.08	0.33	0.27	0.13	0.13		0.12	0.18
P03	837846.9514	821244.4786		0.04	0.08	0.17	0.05	0.05	0.16	0.21	0.16	0.09	0.09	0.33	0.27	0.12	0.10		0.14	0.19
P04	837846.582	821234.4854		0.03	0.15	0.14	0.11	0.12	0.17	0.24	0.17	0.09	0.09	0.33	0.28	0.15	0.14		0.16	0.20
P05	837846.2126	821224.4922		0.08	0.10	0.11	0.07	0.08	0.18	0.24	0.20	0.10	0.09	0.33	0.29	0.17	0.16		0.15	0.21
P06	837845.8432	821214.499		0.11	0.07	0.09	0.05	0.05	0.17	0.25	0.19	0.10	0.10	0.33	0.30	0.14	0.17		0.14	0.21
P07	837845.4738	821204.5059		0.11	0.06	0.06	0.04	0.04	0.18	0.25	0.19	0.10	0.10	0.32	0.31	0.07	0.15		0.13	0.20
P08	837845.2487	821194.5217		0.10	0.08	0.05	0.06	0.05	0.18	0.25	0.20	0.10	0.10	0.31	0.31	0.13	0.15		0.14	0.20
P09	837844.735	821184.5195		0.09	0.11	0.08	0.07	0.06	0.16	0.25	0.20	0.09	0.09	0.29	0.30	0.19	0.17		0.14	0.21
P10	837844.3656	821174.5263		0.05	0.13	0.10	0.11	0.09	0.13	0.25	0.21	0.09	0.09	0.27	0.28	0.23	0.16		0.15	0.20
P11	837843.9962	821164.5332		0.04	0.14	0.11	0.14	0.14	0.11	0.25	0.15	0.08	0.08	0.24	0.25	0.20	0.13		0.15	0.18
P12	837843.9962	821154.54		0.03	0.12	0.11	0.09	0.10	0.09	0.25	0.10	0.07	0.07	0.19	0.22	0.14	0.11		0.12	0.15
P13	837843.4049	821144.0414		0.02	0.10	0.09	0.11	0.10	0.10	0.26	0.07	0.07	0.06	0.11	0.18	0.10	0.14		0.11	0.13
P14	837842.8881	821134.5536		0.03	0.09	0.09	0.10	0.11	0.14	0.28	0.05	0.07	0.06	0.08	0.13	0.12	0.22		0.11	0.13
P15	837842.5187	821124.5605		0.02	0.07	0.09	0.06	0.06	0.17	0.21	0.03	0.05	0.05	0.17	0.16	0.14	0.27		0.11	0.14
P16	837842.1493	821114.5673		0.06	0.05	0.07	0.21	0.20	0.16	0.11	0.02	0.06	0.05	0.15	0.09	0.09	0.25		0.12	0.12
P17	837841.7799	821104.5741		0.14	0.23	0.18	0.31	0.30	0.21	0.07	0.03	0.15	0.16	0.29	0.30	0.16	0.19		0.22	0.21
P18	837842.5296	821094.0798		0.21	0.30	0.23	0.38	0.38	0.26	0.09	0.03	0.16	0.17	0.26	0.31	0.26	0.11		0.27	0.23
P19	837853.2848	821094.8537		0.28	0.36	0.30	0.37	0.37	0.26	0.10	0.03	0.16	0.17	0.25	0.29	0.27	0.11		0.29	0.22
P20	837861.3935	821100.868		0.30	0.38	0.32	0.38	0.38	0.26	0.11	0.04	0.16	0.16	0.27	0.29	0.28	0.13		0.30	0.23
P21	837869.8475	821107.9724		0.31	0.39	0.33	0.40	0.40	0.28	0.09	0.07	0.16	0.16	0.29	0.30	0.28	0.17		0.31	0.24
P22	837877.3922	821114.9105		0.32	0.40	0.34	0.40	0.40	0.28	0.06	0.08	0.16	0.17	0.32	0.33	0.29	0.22		0.32	0.25
P23	837885.0522	821122.3098		0.31	0.39	0.34	0.39	0.39	0.27	0.03	0.10	0.16	0.17	0.34	0.34	0.30	0.26		0.31	0.26
P24	837892.7069	821129.4184		0.31	0.40	0.35	0.39	0.38	0.27	0.03	0.10	0.16	0.17	0.36	0.36	0.31	0.29		0.31	0.27
P25	837901.7463	821137.8129		0.32	0.44	0.39	0.38	0.38	0.27	0.06	0.10	0.16	0.16	0.37	0.37	0.34	0.31		0.33	0.28
P26	837905.6312	821146.3139		0.28	0.42	0.37	0.36	0.36	0.28	0.12	0.11	0.15	0.15	0.36	0.37	0.34	0.29		0.32	0.28
P27	837898.6802	821155.2203		0.12	0.27	0.24	0.19	0.19	0.11	0.09	0.12	0.10	0.09	0.29	0.30	0.29	0.27		0.19	0.21
P28	837898.8586	821165.5444		0.05	0.21	0.20	0.10	0.11	0.03	0.14	0.13	0.06	0.03	0.27	0.23	0.24	0.08		0.14	0.16
P29	837899.0314	821175.5407		0.05	0.22	0.21	0.09	0.10	0.04	0.19	0.12	0.02	0.02	0.24	0.18	0.17	0.05		0.13	0.14
P30	837898.9295	821184.5401		0.05	0.25	0.23	0.11	0.11	0.03	0.23	0.13	0.02	0.02	0.24	0.15	0.12	0.12		0.14	0.14
P31	837872.1948	821196.0993		0.02	0.08	0.08	0.05	0.05	0.10	0.16	0.03	0.03	0.03	0.05	0.08	0.01	0.10		0.07	0.07
P32	837899.1554	821201.9848		0.02	0.15	0.18	0.10	0.10	0.05	0.24	0.13	0.04	0.01	0.25	0.16	0.11	0.10		0.13	0.13
P33	837899.5166	821210.9775		0.02	0.10	0.10	0.05	0.05	0.06	0.23	0.13	0.04	0.02	0.25	0.17	0.12	0.12		0.10	0.14
P34	837899.9453	821219.9673		0.03	0.10	0.14	0.09	0.09	0.06	0.22	0.12	0.05	0.02	0.25	0.17	0.09	0.13		0.12	0.14
P35	837900.177	821228.9643		0.03	0.09	0.09	0.09	0.10	0.06	0.22	0.12	0.05	0.03	0.25	0.16	0.07	0.13		0.11	0.13
P36	837900.4744	821237.9594		0.10	0.14	0.10	0.07	0.07	0.06	0.21	0.13	0.05	0.03	0.24	0.15	0.03	0.11		0.11	0.12
P37	837895.8873	821246.4201		0.07	0.16	0.17	0.12	0.12	0.08	0.22	0.11	0.04	0.01	0.21	0.12	0.09	0.03		0.13	0.12
P38	837874.0999	821247.235		0.01	0.12	0.09	0.01	0.01	0.10	0.14	0.02	0.01	0.02	0.14	0.22	0.20	0.17		0.08	0.12
P39	837874.7958	821260.9193		0.03	0.22	0.16	0.05	0.05	0.12	0.09	0.03	0.01	0.01	0.12	0.18	0.12	0.15		0.11	0.10
P40	837875.0099	821270.2824		0.27	0.35	0.32	0.35	0.35	0.16	0.15	0.04	0.01	0.01	0.17	0.21	0.30	0.31		0.25	0.19
P41	837866.015	821270.5863		0.27	0.39	0.36	0.35	0.35	0.19	0.14	0.04	0.01	0.01	0.18	0.18	0.23	0.28		0.26	0.18
P42	837857.0229	821270.9641		0.26	0.40	0.36	0.35	0.35	0.18	0.12	0.06	0.06	0.06	0.29	0.26	0.19	0.30		0.28	0.20
O001	837689.8385	821280.8902		0.09	0.22	0.27	0.03	0.05	0.07	0.01	0.02	0.04	0.04	0.14	0.07	0.06	0.30		0.10	0.08
O002	837723.5232	821278.9883		0.17	0.22	0.26	0.06	0.05	0.04	0.13	0.12	0.19	0.19	0.29	0.27	0.14	0.28		0.16	0.18
O003	837753.0211	821279.1785		0.13	0.16	0.21	0.14	0.16	0.06	0.10	0.03	0.04	0.04	0.07	0.13	0.11	0.28		0.12	0.10
O004	837779.6644	821280.7		0.13	0.11	0.18	0.18	0.18	0.06	0.13	0.05	0.13	0.14	0.29	0.24	0.16	0.28		0.16	0.18
O005	837916.7856	821268.6982		0.17	0.32	0.36	0.33	0.34	0.13	0.04	0.07	0.06	0.06	0.14	0.18	0.30	0.26		0.23	0.17
O006	837943.7994	821267.7037		0.14	0.28	0.31	0.37	0.37	0.32	0.14	0.07	0.08	0.09	0.07	0.15	0.30	0.40		0.25	0.20
O007	837961.1744	821266.3647		0.13	0.33	0.36	0.30	0.30	0.18	0.07	0.07	0.08	0.08	0.09	0.08	0.27	0.35		0.22	0.15
O008	837960.3213	821247.1836		0.10	0.22	0.23	0.12	0.12	0.22	0.10	0.01	0.02	0.02	0.10	0.18	0.10	0.05		0.15	0.11
O009	837807.0428	821292.9648		0.08	0.10	0.15	0.11	0.11	0.07	0.01	0.02	0.03	0.03	0.07	0.08	0.06	0.24		0.09	0.07
O010	837832.5731	821308.7192		0.06	0.06	0.08	0.13	0.13	0.09	0.05	0.03	0.04	0.04	0.15	0.06	0.04	0.20		0.09	0.08

Wind Velocity Ratio, Base Case

Tes Point			Wind direction (Degree)	22.5	45	67.5	90	90	112.5	135	157.5	180	180	202.5	225	247.5	270	Sum	Average (Annual)	Average (Summer)
			Wind direction	NNE	NE	ENE	E	E	ESE	SE	SSE	S	S	SSW	SW	WSW	W			
			Average Wind Speed at 500m elevation	7	6	6	7	8	7	6	6	5	6	6	6	6	4			
ID	Easting (m)	Northing (m)	Probability (Annual)	6.5%	9.0%	11.4%	20.2%		11.8%	7.0%		4.3%		5.9%	6.6%			82.7%		
			Probability (Summer)					8.4%	10.0%	8.1%	7.7%		8.9%	13.3%	15.9%	10.1%	5.2%	87.6%		
O011	837852.0991	821331.4949		0.05	0.23	0.28	0.08	0.08	0.09	0.06	0.03	0.04	0.05	0.25	0.19	0.16	0.32		0.14	0.14
O012	837871.7222	821354.1872		0.25	0.49	0.45	0.37	0.36	0.26	0.21	0.13	0.03	0.04	0.28	0.27	0.27	0.47		0.32	0.25
O013	837891.3072	821376.9121		0.17	0.41	0.39	0.41	0.41	0.33	0.25	0.12	0.03	0.02	0.23	0.19	0.33	0.50		0.31	0.25
O014	837910.8923	821399.6371		0.10	0.27	0.27	0.18	0.18	0.19	0.20	0.07	0.07	0.08	0.16	0.20	0.12	0.22		0.19	0.16
O015	837931.5592	821421.383		0.40	0.28	0.32	0.25	0.25	0.13	0.22	0.02	0.08	0.09	0.27	0.31	0.03	0.09		0.25	0.18
O016	837682.6729	821092.1394		0.07	0.11	0.16	0.07	0.07	0.07	0.04	0.05	0.11	0.11	0.15	0.18	0.02	0.04		0.10	0.10
O017	837715.443	821090.806		0.07	0.11	0.12	0.12	0.12	0.12	0.16	0.14	0.28	0.29	0.39	0.24	0.19	0.05		0.15	0.21
O018	837742.6524	821090.5699		0.11	0.16	0.13	0.25	0.24	0.21	0.19	0.04	0.14	0.14	0.13	0.18	0.14	0.03		0.18	0.15
O019	837772.6421	821089.7852		0.11	0.13	0.17	0.24	0.24	0.20	0.23	0.08	0.11	0.11	0.21	0.23	0.20	0.18		0.19	0.19
O020	837802.6319	821089.0005		0.10	0.05	0.05	0.28	0.26	0.23	0.21	0.06	0.04	0.04	0.15	0.21	0.16	0.02		0.17	0.16
O021	837718.1576	820998.087		0.11	0.22	0.16	0.07	0.08	0.03	0.11	0.07	0.23	0.23	0.34	0.36	0.41	0.09		0.15	0.22
O022	837747.4363	821004.626		0.07	0.21	0.11	0.08	0.08	0.03	0.08	0.02	0.23	0.23	0.33	0.33	0.38	0.10		0.13	0.20
O023	837775.2203	821015.9417		0.20	0.32	0.31	0.22	0.22	0.15	0.06	0.10	0.27	0.27	0.39	0.36	0.37	0.12		0.25	0.26
O024	837797.8719	821035.6116		0.25	0.36	0.34	0.22	0.21	0.14	0.02	0.04	0.24	0.23	0.37	0.31	0.29	0.16		0.24	0.22
O025	837820.5235	821055.2815		0.29	0.37	0.34	0.27	0.26	0.18	0.09	0.01	0.18	0.18	0.26	0.12	0.11	0.12		0.25	0.15
O026	837843.1751	821074.9514		0.32	0.38	0.34	0.31	0.31	0.23	0.13	0.01	0.16	0.17	0.22	0.20	0.19	0.13		0.27	0.18
O027	837916.6007	821157.5422		0.27	0.44	0.40	0.34	0.34	0.28	0.19	0.11	0.15	0.15	0.36	0.38	0.33	0.27		0.33	0.29
O028	837928.7116	821185.0314		0.18	0.37	0.33	0.19	0.20	0.26	0.09	0.10	0.07	0.03	0.27	0.29	0.24	0.19		0.24	0.20
O029	837948.8537	821209.5287		0.18	0.32	0.30	0.12	0.12	0.10	0.11	0.11	0.07	0.04	0.28	0.26	0.21	0.10		0.19	0.17
O030	837961.6155	821227.2203		0.09	0.18	0.12	0.08	0.07	0.20	0.10	0.07	0.02	0.02	0.20	0.25	0.18	0.13		0.13	0.15
O031	837991.7848	821254.3929		0.12	0.13	0.14	0.07	0.07	0.10	0.07	0.06	0.04	0.03	0.15	0.19	0.03	0.06		0.11	0.10
O032	838016.8545	821268.2334		0.34	0.41	0.37	0.26	0.26	0.04	0.12	0.06	0.08	0.08	0.21	0.25	0.11	0.07		0.24	0.15
O033	838042.4668	821281.9154		0.37	0.46	0.42	0.33	0.34	0.18	0.03	0.06	0.09	0.10	0.31	0.31	0.19	0.13		0.30	0.20
O034	837793.4425	820943.4247		0.47	0.14	0.22	0.11	0.11	0.09	0.17	0.10	0.05	0.05	0.36	0.41	0.38	0.34		0.20	0.24
O035	837817.7762	820960.9708		0.46	0.10	0.21	0.09	0.09	0.07	0.05	0.03	0.11	0.11	0.29	0.44	0.43	0.35		0.17	0.23
O036	837841.8493	820978.873		0.45	0.17	0.20	0.06	0.06	0.09	0.06	0.07	0.08	0.08	0.11	0.25	0.44	0.38		0.14	0.17
O037	837863.2658	820999.8809		0.46	0.09	0.18	0.03	0.03	0.02	0.13	0.12	0.10	0.11	0.14	0.25	0.44	0.37		0.13	0.18
O038	837884.6823	821020.8889		0.47	0.11	0.15	0.03	0.03	0.03	0.07	0.06	0.12	0.12	0.18	0.22	0.46	0.39		0.12	0.17
O039	837906.0988	821041.8968		0.49	0.11	0.12	0.20	0.20	0.15	0.29	0.11	0.13	0.13	0.20	0.14	0.48	0.40		0.19	0.22
O040	837927.5153	821062.9047		0.51	0.12	0.10	0.04	0.04	0.05	0.19	0.26	0.15	0.15	0.21	0.13	0.47	0.38		0.13	0.20
O041	837948.3411	821084.4984		0.49	0.13	0.08	0.06	0.07	0.02	0.06	0.03	0.17	0.17	0.24	0.07	0.48	0.39		0.12	0.16
O042	837969.1669	821106.0921		0.48	0.20	0.11	0.25	0.25	0.19	0.26	0.10	0.14	0.15	0.24	0.13	0.49	0.40		0.22	0.23
O043	837989.9927	821127.6858		0.48	0.11	0.10	0.09	0.09	0.07	0.06	0.22	0.14	0.15	0.24	0.16	0.47	0.40		0.14	0.20
O044	838010.8184	821149.2795		0.47	0.44	0.36	0.22	0.22	0.06	0.02	0.08	0.17	0.17	0.26	0.15	0.47	0.40		0.24	0.20
O045	838030.54	821171.8861		0.46	0.23	0.23	0.38	0.38	0.38	0.16	0.13	0.17	0.18	0.26	0.17	0.46	0.39		0.29	0.27
O046	838050.0655	821194.6623		0.45	0.41	0.27	0.11	0.11	0.26	0.18	0.14	0.16	0.16	0.26	0.20	0.44	0.38		0.24	0.24
O047	837713.9362	821022.5054		0.14	0.06	0.15	0.07	0.07	0.07	0.16	0.15	0.34	0.34	0.42	0.15	0.13	0.12		0.14	0.19
O048	837715.0554	821052.4845		0.04	0.08	0.07	0.03	0.03	0.07	0.19	0.17	0.36	0.36	0.48	0.20	0.21	0.13		0.13	0.22
O049	837717.2937	821112.4427		0.14	0.05	0.04	0.17	0.16	0.08	0.21	0.13	0.21	0.21	0.37	0.15	0.11	0.02		0.14	0.17
O050	837718.4129	821142.4219		0.16	0.06	0.12	0.20	0.20	0.14	0.14	0.13	0.17	0.17	0.36	0.23	0.13	0.04		0.17	0.19
O051	837719.6519	821172.3963		0.16	0.13	0.04	0.20	0.20	0.15	0.14	0.12	0.16	0.17	0.32	0.26	0.12	0.03		0.17	0.19
O052	837720.8909	821202.3707		0.16	0.14	0.05	0.18	0.18	0.12	0.15	0.12	0.17	0.18	0.30	0.26	0.12	0.06		0.16	0.18
O053	837722.1298	821232.3451		0.15	0.12	0.03	0.17	0.16	0.10	0.14	0.12	0.18	0.18	0.29	0.28	0.15	0.12		0.15	0.19
O054	837723.3688	821262.3195		0.19	0.21	0.15	0.13	0.13	0.05	0.13	0.12	0.18	0.19	0.28	0.28	0.14	0.07		0.16	0.17
O055	837768.5787	821039.4704		0.02	0.06	0.08	0.22	0.22	0.13	0.05	0.10	0.02	0.02	0.11	0.11	0.07	0.09		0.11	0.10
O056	837769.6459	821069.4515		0.05	0.13	0.16	0.08	0.08	0.07	0.06	0.11	0.05	0.05	0.17	0.06	0.04	0.17		0.09	0.09
O057	837774.705	821107.0123		0.04	0.04	0.05	0.14	0.14	0.10	0.06	0.18	0.13	0.13	0.18	0.10	0.11	0.18		0.10	0.13
O058	837776.0538	821136.982		0.16	0.11	0.09	0.15	0.15	0.15	0.17	0.11	0.12	0.13	0.20	0.15	0.13	0.18		0.14	0.15
O059	837777.4026	821166.9517		0.20	0.03	0.13	0.17	0.16	0.16	0.19	0.12	0.13	0.13	0.25	0.20	0.12	0.16		0.16	0.17
O060	837778.7514	821196.9213		0.22	0.06	0.12	0.16	0.15	0.14	0.19	0.12	0.14	0.14	0.28	0.22	0.11	0.17		0.16	0.18
O061	837779.9153	821226.8987		0.23	0.11	0.08	0.13	0.12	0.13	0.17	0.11	0.14	0.14	0.30	0.23	0.12	0.14		0.15	0.18
O062	837781.0793	821256.8761		0.23	0.15	0.09	0.08	0.07	0.09	0.15	0.07	0.13	0.14	0.30	0.24	0.15	0.04		0.14	0.16

Wind Velocity Ratio, Base Case

Tes Point			Wind direction (Degree)	22.5	45	67.5	90	90	112.5	135	157.5	180	180	202.5	225	247.5	270	Sum	Average (Annual)	Average (Summer)
			Wind direction	NNE	NE	ENE	E	E	ESE	SE	SSE	S	S	SSW	SW	WSW	W			
			Average Wind Speed at 500m elevation	7	6	6	7	8	7	6	6	5	6	6	6	6	4			
ID	Easting (m)	Northing (m)	Probability (Annual)	6.5%	9.0%	11.4%	20.2%		11.8%	7.0%		4.3%		5.9%	6.6%			82.7%		
			Probability (Summer)					8.4%	10.0%	8.1%	7.7%		8.9%	13.3%	15.9%	10.1%	5.2%	87.6%		
O063	837905.8574	821282.2419		0.09	0.15	0.27	0.27	0.27	0.21	0.16	0.09	0.02	0.05	0.21	0.13	0.09	0.26		0.20	0.16
O064	837906.4098	821312.2369		0.09	0.22	0.24	0.30	0.30	0.21	0.22	0.14	0.02	0.02	0.19	0.26	0.25	0.37		0.22	0.21
O065	837900.799	821341.9543		0.14	0.06	0.16	0.23	0.23	0.19	0.18	0.09	0.01	0.02	0.09	0.10	0.07	0.13		0.15	0.12
O066	837858.751	821376.7075		0.09	0.51	0.36	0.28	0.27	0.36	0.24	0.03	0.07	0.08	0.13	0.14	0.15	0.34		0.28	0.18
O067	837836.7413	821397.093		0.10	0.17	0.19	0.22	0.22	0.09	0.09	0.08	0.05	0.06	0.03	0.06	0.09	0.10		0.14	0.09
O068	837814.7315	821417.4786		0.07	0.12	0.09	0.11	0.11	0.08	0.14	0.18	0.03	0.03	0.16	0.17	0.12	0.34		0.11	0.14
O069	837907.2166	820941.7594		0.35	0.18	0.10	0.10	0.10	0.11	0.32	0.06	0.05	0.05	0.14	0.25	0.17	0.22		0.16	0.16
O070	837883.1779	820963.5399		0.27	0.16	0.10	0.06	0.06	0.09	0.28	0.05	0.03	0.03	0.01	0.24	0.13	0.09		0.13	0.12
O071	837979.6531	820991.0857		0.13	0.07	0.06	0.14	0.14	0.10	0.36	0.25	0.10	0.10	0.13	0.17	0.11	0.19		0.13	0.17
O072	837957.0857	821010.8521		0.02	0.09	0.10	0.16	0.16	0.10	0.35	0.22	0.06	0.06	0.08	0.14	0.06	0.10		0.13	0.13
O073	837934.5183	821030.6186		0.23	0.04	0.09	0.16	0.16	0.10	0.33	0.20	0.05	0.06	0.04	0.07	0.21	0.38		0.13	0.15
O074	838041.8332	821052.2632		0.10	0.14	0.13	0.30	0.30	0.20	0.32	0.28	0.17	0.17	0.19	0.08	0.13	0.21		0.20	0.19
O075	838019.0114	821071.7354		0.09	0.12	0.13	0.26	0.27	0.19	0.30	0.25	0.16	0.16	0.14	0.09	0.06	0.17		0.18	0.17
O076	837996.1896	821091.2076		0.14	0.14	0.07	0.23	0.23	0.17	0.28	0.21	0.08	0.07	0.05	0.11	0.26	0.28		0.16	0.17
O077	838066.5434	821154.2853		0.16	0.27	0.30	0.38	0.38	0.40	0.22	0.16	0.08	0.08	0.04	0.13	0.20	0.17		0.27	0.19
O078	837718.3121	821300.3583		0.07	0.28	0.33	0.17	0.17	0.07	0.08	0.08	0.13	0.13	0.23	0.19	0.08	0.41		0.18	0.16
O079	837746.6913	821310.0857		0.08	0.26	0.33	0.17	0.17	0.03	0.02	0.02	0.03	0.03	0.08	0.06	0.05	0.40		0.14	0.08
O080	837775.0821	821319.7791		0.09	0.25	0.32	0.10	0.11	0.07	0.06	0.05	0.06	0.07	0.16	0.15	0.09	0.38		0.15	0.12
O081	837804.3843	821330.5353		0.10	0.28	0.35	0.10	0.10	0.07	0.04	0.06	0.03	0.02	0.12	0.06	0.04	0.35		0.14	0.08
O082	837830.4738	821345.0837		0.16	0.44	0.46	0.19	0.19	0.05	0.02	0.09	0.03	0.03	0.13	0.08	0.08	0.35		0.20	0.10
O083	837721.9945	821334.0651		0.08	0.40	0.39	0.25	0.25	0.08	0.06	0.05	0.09	0.09	0.16	0.14	0.11	0.42		0.21	0.14
O084	837755.6946	821345.4837		0.03	0.42	0.40	0.25	0.25	0.14	0.02	0.07	0.08	0.09	0.05	0.11	0.09	0.40		0.20	0.12
O085	837785.0556	821354.7342		0.03	0.47	0.43	0.30	0.30	0.10	0.05	0.08	0.06	0.06	0.14	0.12	0.06	0.39		0.23	0.13
O086	837813.1149	821371.9343		0.13	0.51	0.31	0.25	0.24	0.28	0.16	0.09	0.03	0.02	0.06	0.06	0.08	0.39		0.24	0.13
O087	837743.2586	821371.8284		0.10	0.44	0.16	0.17	0.17	0.18	0.06	0.07	0.11	0.11	0.14	0.13	0.15	0.41		0.18	0.15
O088	837777.8265	821389.0285		0.04	0.17	0.07	0.11	0.11	0.21	0.18	0.06	0.10	0.10	0.11	0.11	0.12	0.34		0.13	0.14
O089	837829.2576	821089.1858		0.12	0.23	0.19	0.42	0.41	0.29	0.13	0.12	0.15	0.15	0.23	0.31	0.24	0.05		0.26	0.23
O090	837835.36	821114.3329		0.06	0.06	0.09	0.11	0.11	0.08	0.11	0.02	0.02	0.03	0.06	0.12	0.13	0.26		0.08	0.09
O091	837836.1729	821138.9981		0.04	0.13	0.13	0.16	0.16	0.25	0.30	0.04	0.05	0.05	0.08	0.13	0.12	0.19		0.15	0.14
O092	837837.0365	821168.6993		0.08	0.15	0.13	0.10	0.09	0.20	0.29	0.07	0.08	0.08	0.21	0.23	0.21	0.17		0.16	0.18
O093	837838.7661	821199.1156		0.15	0.03	0.05	0.07	0.06	0.21	0.28	0.08	0.10	0.10	0.28	0.29	0.06	0.18		0.14	0.19
O094	837839.1981	821228.6156		0.14	0.09	0.13	0.09	0.09	0.20	0.26	0.08	0.10	0.09	0.30	0.29	0.16	0.15		0.16	0.20
O095	837841.2164	821258.5987		0.14	0.14	0.09	0.08	0.08	0.14	0.21	0.07	0.08	0.08	0.31	0.27	0.15	0.13		0.14	0.18
O096	837851.4423	821276.619		0.18	0.37	0.38	0.30	0.31	0.16	0.09	0.03	0.03	0.03	0.10	0.13	0.09	0.22		0.23	0.12
O097	837880.3894	821276.0434		0.21	0.26	0.35	0.22	0.23	0.10	0.15	0.06	0.07	0.07	0.34	0.32	0.33	0.42		0.23	0.23
O098	837788.4206	821068.6249		0.03	0.08	0.11	0.27	0.27	0.19	0.13	0.07	0.09	0.09	0.15	0.22	0.19	0.10		0.16	0.17
O099	837809.8903	821070.6683		0.07	0.20	0.20	0.34	0.34	0.23	0.15	0.10	0.12	0.12	0.08	0.20	0.17	0.08		0.21	0.17
O100	837799.2832	821054.4488		0.11	0.25	0.25	0.27	0.27	0.18	0.08	0.12	0.14	0.14	0.08	0.11	0.11	0.07		0.19	0.13
O101	837905.118	821159.9335		0.12	0.23	0.22	0.21	0.20	0.16	0.16	0.09	0.11	0.10	0.30	0.32	0.29	0.26		0.20	0.22
O102	837905.8471	821189.9247		0.01	0.23	0.23	0.11	0.12	0.05	0.23	0.04	0.05	0.01	0.31	0.22	0.14	0.09		0.15	0.15
O103	837906.7709	821219.9104		0.09	0.17	0.17	0.09	0.09	0.06	0.18	0.04	0.05	0.02	0.25	0.17	0.05	0.15		0.13	0.12
O104	837908.4733	821251.5377		0.06	0.09	0.11	0.07	0.08	0.03	0.17	0.03	0.04	0.01	0.21	0.11	0.13	0.18		0.09	0.11
O105	837994.9121	821287.1066		0.24	0.30	0.26	0.29	0.29	0.18	0.07	0.04	0.04	0.07	0.03	0.14	0.16	0.12		0.21	0.12
O106	837970.0451	821303.8885		0.11	0.17	0.13	0.24	0.24	0.21	0.13	0.05	0.05	0.07	0.05	0.15	0.07	0.09		0.16	0.12
O107	837951.8239	821327.721		0.13	0.32	0.28	0.34	0.34	0.29	0.16	0.05	0.06	0.07	0.06	0.13	0.12	0.18		0.24	0.15
O108	837935.2263	821352.9729		0.21	0.42	0.37	0.39	0.39	0.34	0.17	0.04	0.04	0.06	0.15	0.12	0.11	0.06		0.29	0.16
O109	837916.3123	821375.214		0.15	0.42	0.40	0.40	0.40	0.34	0.22	0.05	0.06	0.06	0.21	0.18	0.34	0.52		0.31	0.24
O110	837942.3071	821384.9073		0.17	0.36	0.36	0.40	0.40	0.37	0.29	0.07	0.09	0.07	0.16	0.17	0.24	0.34		0.31	0.22
O111	837963.364	821362.4345		0.17	0.39	0.36	0.39	0.39	0.37	0.25	0.08	0.09	0.10	0.21	0.24	0.30	0.27		0.31	0.25
O112	837981.6875	821338.8127		0.09	0.37	0.33	0.37	0.37	0.34	0.17	0.03	0.04	0.05	0.12	0.10	0.12	0.12		0.27	0.15
O113	837999.5347	821319.5748		0.16	0.37	0.33	0.36	0.36	0.30	0.11	0.03	0.04	0.04	0.07	0.07	0.13	0.17		0.25	0.13
O114	838018.3418	821290.9256		0.30	0.41	0.37	0.36	0.36	0.22	0.07	0.06	0.07	0.08	0.13	0.17	0.10	0.22		0.27	0.16

Wind Velocity Ratio, Base Case

Tes Point			Wind direction (Degree)	22.5	45	67.5	90	90	112.5	135	157.5	180	180	202.5	225	247.5	270	Sum	Average (Annual)	Average (Summer)
			Wind direction	NNE	NE	ENE	E	E	ESE	SE	SSE	S	S	SSW	SW	WSW	W			
			Average Wind Speed at 500m elevation	7	6	6	7	8	7	6	6	5	6	6	6	6	4			
ID	Easting (m)	Northing (m)	Probability (Annual)	6.5%	9.0%	11.4%	20.2%		11.8%	7.0%		4.3%		5.9%	6.6%			82.7%		
			Probability (Summer)					8.4%	10.0%	8.1%	7.7%		8.9%	13.3%	15.9%	10.1%	5.2%	87.6%		
O115	838034.102	821315.0249		0.27	0.43	0.40	0.40	0.40	0.31	0.12	0.06	0.07	0.08	0.11	0.15	0.11	0.14		0.30	0.16
O116	838016.9993	821348.0503		0.14	0.42	0.39	0.39	0.39	0.35	0.25	0.03	0.03	0.04	0.14	0.13	0.15	0.18		0.30	0.18
O117	837996.8242	821373.6404		0.13	0.39	0.37	0.39	0.39	0.37	0.31	0.07	0.09	0.10	0.19	0.24	0.28	0.35		0.32	0.25
O118	837977.762	821393.0576		0.13	0.36	0.38	0.44	0.44	0.39	0.36	0.12	0.14	0.14	0.20	0.30	0.18	0.19		0.34	0.26
O119	837949.8296	821400.5297		0.14	0.32	0.30	0.31	0.31	0.35	0.35	0.04	0.05	0.05	0.17	0.23	0.08	0.06		0.28	0.19
O120	837905.945	821421.329		0.31	0.28	0.23	0.22	0.22	0.07	0.20	0.07	0.08	0.09	0.24	0.26	0.11	0.21		0.21	0.17
O121	837898.8866	821400.4287		0.07	0.19	0.20	0.07	0.07	0.08	0.11	0.05	0.06	0.06	0.17	0.20	0.15	0.22		0.12	0.13
O122	837853.475	821404.74		0.09	0.18	0.15	0.12	0.12	0.16	0.11	0.07	0.08	0.09	0.07	0.12	0.12	0.08		0.13	0.11
O123	837872.317	821384.4606		0.06	0.08	0.09	0.13	0.13	0.08	0.06	0.04	0.05	0.06	0.17	0.23	0.25	0.25		0.11	0.15
O124	837849.5725	821424.2231		0.04	0.14	0.07	0.09	0.09	0.18	0.11	0.05	0.06	0.06	0.09	0.14	0.17	0.32		0.11	0.13
D01	837827.3723	821284.5045		0.03	0.18	0.15	0.21	0.21	0.08	0.05	0.01	0.02	0.01	0.17	0.07	0.07	0.23		0.13	0.10
D02	837875.3914	821291.3735		0.24	0.19	0.20	0.32	0.32	0.22	0.11	0.05	0.06	0.07	0.14	0.20	0.25	0.44		0.21	0.19
D03	837919.5661	821285.9497		0.07	0.34	0.35	0.42	0.42	0.29	0.19	0.04	0.05	0.06	0.05	0.25	0.35	0.43		0.27	0.22
D04	837952.8274	821287.0337		0.17	0.46	0.46	0.39	0.39	0.12	0.09	0.07	0.08	0.08	0.22	0.24	0.37	0.36		0.29	0.22
D05	837877.6186	821251.2285		0.05	0.09	0.07	0.03	0.03	0.08	0.11	0.02	0.02	0.02	0.06	0.06	0.08	0.05		0.06	0.06
D06	837878.2297	821193.2792		0.04	0.11	0.10	0.04	0.04	0.03	0.02	0.02	0.03	0.03	0.12	0.22	0.08	0.09		0.07	0.09

Wind Velocity Ratio, Proposed Case

Tes Point			Wind direction (Degree)	22.5	45	67.5	90	90	112.5	135	157.5	180	180	202.5	225	247.5	270	Sum	Average (Annual)	Average (Summer)
			Wind direction	NNE	NE	ENE	E	E	ESE	SE	SSE	S	S	SSW	SW	WSW	W			
			Average Wind Speed at 500m elevation	7	6	6	7	8	7	6	6	5	6	6	6	6	4			
ID	Easting (m)	Northing (m)	Probability (Annual)	6.5%	9.0%	11.4%	20.2%		11.8%	7.0%		4.3%		5.9%	6.6%			82.7%		
			Probability (Summer)					8.4%	10.0%	8.1%	7.7%		8.9%	13.3%	15.9%	10.1%	5.2%	87.6%		
P01	837848.1486	821265.2969		0.22	0.33	0.32	0.25	0.23	0.10	0.04	0.12	0.08	0.05	0.29	0.25	0.25	0.21		0.22	0.19
P02	837847.3208	821254.4717		0.03	0.09	0.05	0.05	0.11	0.05	0.05	0.15	0.10	0.06	0.33	0.29	0.22	0.18		0.09	0.18
P03	837846.9514	821244.4786		0.03	0.10	0.04	0.13	0.05	0.03	0.05	0.16	0.10	0.07	0.33	0.28	0.14	0.11		0.11	0.16
P04	837846.582	821234.4854		0.02	0.11	0.17	0.04	0.03	0.03	0.06	0.17	0.10	0.08	0.33	0.28	0.11	0.08		0.11	0.15
P05	837846.2126	821224.4922		0.07	0.09	0.20	0.06	0.06	0.06	0.13	0.20	0.11	0.09	0.33	0.29	0.13	0.13		0.13	0.18
P06	837845.8432	821214.499		0.10	0.11	0.14	0.13	0.14	0.14	0.17	0.19	0.10	0.10	0.33	0.30	0.16	0.17		0.16	0.21
P07	837845.4738	821204.5059		0.11	0.21	0.11	0.16	0.17	0.15	0.19	0.19	0.10	0.10	0.32	0.32	0.18	0.20		0.18	0.22
P08	837845.2487	821194.5217		0.11	0.25	0.13	0.18	0.18	0.16	0.21	0.20	0.10	0.11	0.31	0.32	0.20	0.26		0.19	0.23
P09	837844.735	821184.5195		0.09	0.18	0.12	0.20	0.21	0.17	0.22	0.20	0.09	0.11	0.29	0.31	0.20	0.31		0.19	0.23
P10	837844.3656	821174.5263		0.06	0.18	0.12	0.22	0.23	0.19	0.23	0.21	0.09	0.11	0.27	0.29	0.20	0.35		0.19	0.23
P11	837843.9962	821164.5332		0.05	0.15	0.11	0.22	0.22	0.15	0.15	0.15	0.07	0.09	0.24	0.24	0.20	0.34		0.16	0.20
P12	837843.9962	821154.54		0.03	0.08	0.17	0.20	0.21	0.11	0.09	0.10	0.04	0.05	0.19	0.20	0.18	0.30		0.14	0.16
P13	837843.4049	821144.0414		0.01	0.04	0.07	0.18	0.19	0.09	0.08	0.07	0.03	0.03	0.11	0.16	0.17	0.26		0.10	0.13
P14	837842.8881	821134.5536		0.02	0.07	0.08	0.13	0.14	0.07	0.07	0.05	0.05	0.01	0.08	0.15	0.15	0.24		0.09	0.10
P15	837842.5187	821124.5605		0.02	0.12	0.08	0.08	0.08	0.07	0.06	0.03	0.05	0.01	0.17	0.17	0.12	0.20		0.09	0.11
P16	837842.1493	821114.5673		0.06	0.14	0.13	0.15	0.15	0.10	0.04	0.02	0.03	0.06	0.15	0.09	0.07	0.15		0.11	0.09
P17	837841.7799	821104.5741		0.14	0.21	0.22	0.30	0.30	0.16	0.04	0.03	0.18	0.17	0.29	0.29	0.14	0.09		0.22	0.19
P18	837842.5296	821094.0798		0.21	0.29	0.32	0.37	0.37	0.18	0.10	0.03	0.20	0.18	0.26	0.31	0.23	0.14		0.27	0.22
P19	837853.2848	821094.8537		0.28	0.33	0.35	0.34	0.34	0.15	0.08	0.03	0.20	0.18	0.25	0.29	0.24	0.19		0.27	0.21
P20	837861.3935	821100.868		0.30	0.34	0.35	0.35	0.35	0.15	0.07	0.04	0.20	0.18	0.27	0.28	0.25	0.18		0.27	0.21
P21	837869.8475	821107.9724		0.32	0.35	0.37	0.37	0.38	0.18	0.06	0.07	0.20	0.18	0.29	0.29	0.25	0.15		0.29	0.22
P22	837877.3922	821114.9105		0.32	0.36	0.38	0.40	0.40	0.21	0.06	0.08	0.20	0.18	0.32	0.32	0.24	0.14		0.31	0.24
P23	837885.0522	821122.3098		0.31	0.36	0.40	0.42	0.42	0.22	0.07	0.10	0.19	0.18	0.34	0.35	0.22	0.15		0.32	0.25
P24	837892.7069	821129.4184		0.32	0.38	0.41	0.43	0.43	0.24	0.06	0.10	0.19	0.18	0.36	0.36	0.22	0.17		0.33	0.26
P25	837901.7463	821137.8129		0.32	0.38	0.42	0.42	0.42	0.25	0.10	0.10	0.18	0.19	0.37	0.38	0.22	0.20		0.34	0.27
P26	837905.6312	821146.3139		0.28	0.36	0.40	0.41	0.41	0.27	0.15	0.11	0.15	0.18	0.36	0.38	0.22	0.20		0.33	0.27
P27	837898.6802	821155.2203		0.12	0.28	0.32	0.29	0.28	0.19	0.14	0.12	0.09	0.09	0.29	0.31	0.16	0.13		0.24	0.21
P28	837898.8586	821165.5444		0.07	0.24	0.29	0.22	0.22	0.13	0.14	0.13	0.10	0.11	0.27	0.25	0.22	0.15		0.20	0.19
P29	837899.0314	821175.5407		0.07	0.21	0.26	0.20	0.20	0.13	0.16	0.12	0.06	0.08	0.24	0.20	0.18	0.04		0.18	0.16
P30	837898.9295	821184.5401		0.07	0.21	0.25	0.19	0.19	0.13	0.18	0.13	0.07	0.10	0.24	0.17	0.17	0.04		0.18	0.16
P31	837872.1948	821196.0993		0.01	0.06	0.07	0.08	0.08	0.01	0.04	0.03	0.02	0.02	0.05	0.02	0.11	0.07		0.05	0.05
P32	837899.1554	821201.9848		0.03	0.15	0.10	0.10	0.10	0.10	0.15	0.13	0.06	0.10	0.25	0.16	0.13	0.02		0.12	0.14
P33	837899.5166	821210.9775		0.03	0.13	0.11	0.07	0.07	0.09	0.11	0.13	0.05	0.09	0.25	0.16	0.25	0.28		0.10	0.16
P34	837899.9453	821219.9673		0.03	0.11	0.13	0.07	0.08	0.07	0.07	0.12	0.04	0.08	0.25	0.17	0.07	0.08		0.10	0.12
P35	837900.177	821228.9643		0.04	0.09	0.11	0.08	0.09	0.07	0.06	0.12	0.02	0.08	0.25	0.16	0.08	0.12		0.09	0.12
P36	837900.4744	821237.9594		0.09	0.11	0.08	0.07	0.07	0.10	0.06	0.13	0.02	0.07	0.24	0.15	0.16	0.11		0.10	0.13
P37	837895.8873	821246.4201		0.08	0.07	0.14	0.09	0.08	0.13	0.05	0.11	0.03	0.05	0.21	0.10	0.14	0.05		0.10	0.11
P38	837874.0999	821247.235		0.07	0.13	0.14	0.14	0.13	0.10	0.07	0.02	0.01	0.02	0.14	0.14	0.15	0.13		0.11	0.11
P39	837874.7958	821260.9193		0.06	0.17	0.21	0.13	0.13	0.16	0.07	0.03	0.02	0.02	0.12	0.14	0.14	0.14		0.13	0.11
P40	837875.0099	821270.2824		0.28	0.39	0.36	0.29	0.29	0.13	0.15	0.04	0.06	0.01	0.17	0.21	0.31	0.32		0.25	0.18
P41	837866.015	821270.5863		0.27	0.41	0.39	0.30	0.30	0.16	0.14	0.04	0.07	0.02	0.18	0.20	0.31	0.34		0.26	0.19
P42	837857.0229	821270.9641		0.25	0.40	0.39	0.29	0.29	0.17	0.13	0.06	0.08	0.02	0.29	0.26	0.28	0.34		0.27	0.21
O001	837689.8385	821280.8902		0.10	0.16	0.23	0.06	0.04	0.07	0.04	0.02	0.04	0.03	0.14	0.06	0.05	0.32		0.10	0.08
O002	837723.5232	821278.9883		0.17	0.14	0.21	0.08	0.09	0.08	0.04	0.12	0.20	0.18	0.29	0.27	0.12	0.30		0.15	0.18
O003	837753.0211	821279.1785		0.14	0.09	0.15	0.04	0.05	0.06	0.04	0.03	0.07	0.05	0.07	0.14	0.08	0.29		0.08	0.09
O004	837779.6644	821280.7		0.14	0.06	0.12	0.13	0.11	0.01	0.03	0.05	0.18	0.16	0.29	0.24	0.16	0.28		0.12	0.16
O005	837916.7856	821268.6982		0.17	0.27	0.35	0.30	0.30	0.04	0.10	0.07	0.05	0.04	0.14	0.18	0.18	0.22		0.20	0.14
O006	837943.7994	821267.7037		0.15	0.19	0.30	0.36	0.36	0.29	0.14	0.07	0.10	0.06	0.07	0.14	0.15	0.31		0.24	0.17
O007	837961.1744	821266.3647		0.13	0.32	0.34	0.30	0.30	0.16	0.05	0.07	0.09	0.05	0.09	0.08	0.16	0.28		0.21	0.13
O008	837960.3213	821247.1836		0.09	0.15	0.18	0.10	0.10	0.21	0.06	0.01	0.04	0.04	0.10	0.18	0.12	0.09		0.13	0.11
O009	837807.0428	821292.9648		0.08	0.07	0.11	0.11	0.10	0.06	0.03	0.02	0.03	0.02	0.07	0.08	0.07	0.25		0.08	0.07
O010	837832.5731	821308.7192		0.06	0.04	0.06	0.11	0.11	0.05	0.04	0.03	0.03	0.02	0.15	0.06	0.03	0.21		0.07	0.07

Wind Velocity Ratio, Proposed Case

Tes Point			Wind direction (Degree)	22.5	45	67.5	90	90	112.5	135	157.5	180	180	202.5	225	247.5	270	Sum	Average (Annual)	Average (Summer)
			Wind direction	NNE	NE	ENE	E	E	ESE	SE	SSE	S	S	SSW	SW	WSW	W			
			Average Wind Speed at 500m elevation	7	6	6	7	8	7	6	6	5	6	6	6	6	4			
ID	Easting (m)	Northing (m)	Probability (Annual)	6.5%	9.0%	11.4%	20.2%		11.8%	7.0%		4.3%		5.9%	6.6%			82.7%		
			Probability (Summer)					8.4%	10.0%	8.1%	7.7%		8.9%	13.3%	15.9%	10.1%	5.2%	87.6%		
O011	837852.0991	821331.4949		0.04	0.13	0.22	0.08	0.07	0.08	0.03	0.03	0.05	0.02	0.25	0.18	0.18	0.32		0.11	0.13
O012	837871.7222	821354.1872		0.25	0.33	0.43	0.40	0.40	0.25	0.20	0.13	0.10	0.05	0.28	0.27	0.29	0.48		0.31	0.26
O013	837891.3072	821376.9121		0.17	0.33	0.39	0.42	0.42	0.33	0.25	0.12	0.10	0.01	0.23	0.19	0.34	0.50		0.31	0.25
O014	837910.8923	821399.6371		0.10	0.13	0.25	0.16	0.16	0.22	0.18	0.07	0.11	0.04	0.16	0.21	0.12	0.23		0.18	0.16
O015	837931.5592	821421.383		0.38	0.31	0.35	0.24	0.24	0.14	0.22	0.02	0.10	0.07	0.27	0.31	0.04	0.16		0.26	0.18
O016	837682.6729	821092.1394		0.06	0.08	0.16	0.09	0.10	0.05	0.02	0.05	0.15	0.04	0.15	0.18	0.01	0.13		0.10	0.09
O017	837715.443	821090.806		0.07	0.10	0.15	0.12	0.12	0.06	0.12	0.14	0.34	0.27	0.39	0.24	0.19	0.13		0.15	0.20
O018	837742.6524	821090.5699		0.11	0.10	0.04	0.17	0.17	0.13	0.15	0.04	0.17	0.14	0.13	0.18	0.14	0.09		0.13	0.14
O019	837772.6421	821089.7852		0.11	0.11	0.24	0.17	0.17	0.16	0.22	0.08	0.14	0.12	0.21	0.23	0.19	0.14		0.18	0.18
O020	837802.6319	821089.0005		0.10	0.08	0.06	0.10	0.08	0.17	0.21	0.06	0.07	0.03	0.15	0.21	0.15	0.05		0.12	0.14
O021	837718.1576	820998.087		0.10	0.03	0.11	0.03	0.01	0.04	0.12	0.07	0.24	0.23	0.34	0.36	0.40	0.24		0.11	0.22
O022	837747.4363	821004.626		0.07	0.04	0.05	0.02	0.03	0.02	0.12	0.02	0.25	0.22	0.33	0.33	0.37	0.20		0.10	0.21
O023	837775.2203	821015.9417		0.20	0.24	0.31	0.18	0.19	0.12	0.07	0.10	0.28	0.27	0.39	0.36	0.37	0.21		0.22	0.26
O024	837797.8719	821035.6116		0.25	0.30	0.33	0.19	0.20	0.12	0.02	0.04	0.24	0.25	0.37	0.30	0.30	0.17		0.22	0.22
O025	837820.5235	821055.2815		0.29	0.32	0.37	0.24	0.25	0.14	0.09	0.01	0.19	0.19	0.26	0.12	0.15	0.19		0.23	0.16
O026	837843.1751	821074.9514		0.31	0.33	0.39	0.28	0.28	0.15	0.10	0.01	0.19	0.18	0.22	0.20	0.17	0.21		0.26	0.17
O027	837916.6007	821157.5422		0.28	0.35	0.39	0.39	0.38	0.28	0.19	0.11	0.14	0.18	0.36	0.39	0.25	0.24		0.33	0.28
O028	837928.7116	821185.0314		0.18	0.28	0.31	0.19	0.19	0.25	0.07	0.10	0.06	0.02	0.27	0.29	0.15	0.15		0.22	0.18
O029	837948.8537	821209.5287		0.18	0.30	0.28	0.13	0.13	0.09	0.09	0.11	0.07	0.01	0.28	0.27	0.19	0.17		0.18	0.16
O030	837961.6155	821227.2203		0.09	0.17	0.09	0.07	0.07	0.19	0.07	0.07	0.07	0.04	0.20	0.25	0.23	0.22		0.13	0.16
O031	837991.7848	821254.3929		0.11	0.22	0.08	0.07	0.07	0.06	0.05	0.06	0.03	0.01	0.15	0.19	0.10	0.01		0.10	0.09
O032	838016.8545	821268.2334		0.34	0.39	0.37	0.24	0.24	0.11	0.09	0.06	0.12	0.06	0.21	0.24	0.22	0.14		0.24	0.17
O033	838042.4668	821281.9154		0.37	0.43	0.41	0.33	0.33	0.21	0.04	0.06	0.14	0.08	0.31	0.31	0.26	0.18		0.30	0.22
O034	837793.4425	820943.4247		0.47	0.07	0.19	0.10	0.09	0.07	0.20	0.10	0.08	0.05	0.36	0.41	0.38	0.35		0.18	0.24
O035	837817.7762	820960.9708		0.47	0.04	0.18	0.08	0.07	0.05	0.04	0.03	0.13	0.10	0.29	0.43	0.43	0.37		0.16	0.22
O036	837841.8493	820978.873		0.45	0.13	0.17	0.07	0.06	0.08	0.05	0.07	0.09	0.06	0.11	0.24	0.44	0.39		0.14	0.16
O037	837863.2658	820999.8809		0.47	0.09	0.16	0.02	0.02	0.03	0.10	0.12	0.15	0.05	0.14	0.25	0.43	0.39		0.12	0.17
O038	837884.6823	821020.8889		0.48	0.10	0.15	0.05	0.04	0.03	0.07	0.06	0.17	0.07	0.18	0.22	0.45	0.39		0.13	0.17
O039	837906.0988	821041.8968		0.49	0.12	0.11	0.10	0.10	0.16	0.28	0.11	0.16	0.04	0.20	0.14	0.47	0.41		0.17	0.20
O040	837927.5153	821062.9047		0.51	0.25	0.11	0.04	0.04	0.03	0.23	0.26	0.13	0.10	0.21	0.12	0.46	0.38		0.15	0.19
O041	837948.3411	821084.4984		0.49	0.30	0.11	0.01	0.02	0.03	0.05	0.03	0.20	0.11	0.24	0.07	0.47	0.39		0.13	0.15
O042	837969.1669	821106.0921		0.49	0.35	0.10	0.20	0.22	0.19	0.24	0.10	0.15	0.03	0.24	0.13	0.47	0.38		0.22	0.21
O043	837989.9927	821127.6858		0.48	0.41	0.09	0.09	0.10	0.04	0.05	0.22	0.13	0.10	0.24	0.16	0.46	0.37		0.16	0.19
O044	838010.8184	821149.2795		0.47	0.41	0.33	0.21	0.21	0.05	0.02	0.08	0.17	0.13	0.26	0.15	0.46	0.38		0.23	0.19
O045	838030.54	821171.8861		0.46	0.41	0.22	0.38	0.38	0.38	0.13	0.13	0.18	0.15	0.26	0.17	0.44	0.38		0.31	0.26
O046	838050.0655	821194.6623		0.45	0.45	0.26	0.13	0.13	0.24	0.16	0.14	0.18	0.17	0.26	0.20	0.42	0.36		0.24	0.23
O047	837713.9362	821022.5054		0.14	0.05	0.13	0.03	0.03	0.05	0.13	0.15	0.37	0.33	0.42	0.13	0.13	0.09		0.12	0.18
O048	837715.0554	821052.4845		0.04	0.05	0.08	0.02	0.04	0.07	0.16	0.17	0.40	0.34	0.48	0.20	0.18	0.13		0.12	0.21
O049	837717.2937	821112.4427		0.14	0.06	0.06	0.13	0.13	0.09	0.16	0.13	0.31	0.25	0.37	0.15	0.11	0.05		0.14	0.17
O050	837718.4129	821142.4219		0.16	0.10	0.03	0.16	0.16	0.12	0.11	0.13	0.24	0.22	0.36	0.23	0.11	0.06		0.15	0.19
O051	837719.6519	821172.3963		0.16	0.13	0.12	0.15	0.16	0.14	0.08	0.12	0.21	0.20	0.32	0.26	0.10	0.03		0.16	0.18
O052	837720.8909	821202.3707		0.16	0.14	0.17	0.12	0.12	0.12	0.03	0.12	0.20	0.20	0.30	0.26	0.08	0.06		0.15	0.17
O053	837722.1298	821232.3451		0.15	0.13	0.16	0.12	0.12	0.09	0.03	0.12	0.20	0.19	0.29	0.28	0.13	0.10		0.15	0.17
O054	837723.3688	821262.3195		0.19	0.15	0.20	0.11	0.11	0.03	0.03	0.12	0.20	0.19	0.28	0.28	0.13	0.06		0.14	0.16
O055	837768.5787	821039.4704		0.02	0.02	0.13	0.20	0.20	0.10	0.05	0.10	0.05	0.02	0.11	0.11	0.06	0.08		0.11	0.10
O056	837769.6459	821069.4515		0.05	0.11	0.12	0.06	0.06	0.04	0.05	0.11	0.08	0.04	0.17	0.05	0.02	0.07		0.08	0.07
O057	837774.705	821107.0123		0.04	0.02	0.26	0.15	0.16	0.12	0.11	0.18	0.17	0.14	0.18	0.10	0.09	0.14		0.14	0.13
O058	837776.0538	821136.982		0.16	0.05	0.22	0.18	0.19	0.14	0.17	0.11	0.17	0.13	0.20	0.15	0.10	0.17		0.16	0.15
O059	837777.4026	821166.9517		0.20	0.15	0.19	0.18	0.18	0.16	0.19	0.12	0.18	0.15	0.25	0.20	0.08	0.15		0.18	0.17
O060	837778.7514	821196.9213		0.22	0.18	0.12	0.15	0.15	0.15	0.17	0.12	0.18	0.16	0.28	0.22	0.08	0.16		0.17	0.17
O061	837779.9153	821226.8987		0.23	0.16	0.05	0.12	0.13	0.12	0.08	0.11	0.19	0.17	0.30	0.23	0.09	0.14		0.15	0.17
O062	837781.0793	821256.8761		0.23	0.17	0.18	0.08	0.09	0.04	0.03	0.07	0.18	0.16	0.30	0.24	0.14	0.05		0.14	0.15

Wind Velocity Ratio, Proposed Case

Tes Point			Wind direction (Degree)	22.5	45	67.5	90	90	112.5	135	157.5	180	180	202.5	225	247.5	270	Sum	Average (Annual)	Average (Summer)
			Wind direction	NNE	NE	ENE	E	E	ESE	SE	SSE	S	S	SSW	SW	WSW	W			
			Average Wind Speed at 500m elevation	7	6	6	7	8	7	6	6	5	6	6	6	6	4			
ID	Easting (m)	Northing (m)	Probability (Annual)	6.5%	9.0%	11.4%	20.2%		11.8%	7.0%		4.3%		5.9%	6.6%			82.7%		
			Probability (Summer)					8.4%	10.0%	8.1%	7.7%		8.9%	13.3%	15.9%	10.1%	5.2%	87.6%		
O063	837905.8574	821282.2419		0.09	0.08	0.28	0.26	0.26	0.17	0.13	0.09	0.04	0.02	0.21	0.12	0.16	0.23		0.18	0.15
O064	837906.4098	821312.2369		0.09	0.18	0.23	0.31	0.31	0.21	0.18	0.14	0.02	0.02	0.19	0.26	0.22	0.26		0.21	0.20
O065	837900.799	821341.9543		0.14	0.09	0.18	0.23	0.23	0.20	0.16	0.09	0.08	0.01	0.09	0.11	0.07	0.11		0.16	0.12
O066	837858.751	821376.7075		0.10	0.40	0.37	0.23	0.22	0.38	0.22	0.03	0.11	0.05	0.13	0.12	0.15	0.36		0.26	0.17
O067	837836.7413	821397.093		0.09	0.06	0.17	0.20	0.20	0.09	0.07	0.08	0.07	0.04	0.03	0.06	0.09	0.07		0.12	0.08
O068	837814.7315	821417.4786		0.07	0.07	0.07	0.10	0.11	0.09	0.12	0.18	0.04	0.02	0.16	0.16	0.15	0.33		0.10	0.14
O069	837907.2166	820941.7594		0.34	0.24	0.15	0.09	0.09	0.12	0.20	0.06	0.07	0.03	0.14	0.27	0.19	0.20		0.17	0.15
O070	837883.1779	820963.5399		0.26	0.21	0.13	0.07	0.07	0.10	0.21	0.05	0.04	0.02	0.01	0.24	0.13	0.08		0.13	0.11
O071	837979.6531	820991.0857		0.13	0.04	0.05	0.08	0.07	0.13	0.36	0.25	0.11	0.12	0.13	0.17	0.16	0.23		0.12	0.17
O072	837957.0857	821010.8521		0.03	0.08	0.04	0.08	0.07	0.14	0.34	0.22	0.12	0.10	0.08	0.14	0.06	0.16		0.11	0.14
O073	837934.5183	821030.6186		0.21	0.11	0.05	0.08	0.07	0.13	0.33	0.20	0.04	0.05	0.04	0.07	0.25	0.39		0.11	0.14
O074	838041.8332	821052.2632		0.10	0.11	0.10	0.31	0.30	0.17	0.32	0.28	0.14	0.15	0.19	0.08	0.14	0.25		0.19	0.19
O075	838019.0114	821071.7354		0.09	0.11	0.08	0.26	0.27	0.17	0.29	0.25	0.14	0.15	0.14	0.09	0.08	0.22		0.17	0.17
O076	837996.1896	821091.2076		0.14	0.09	0.09	0.19	0.21	0.18	0.27	0.21	0.11	0.12	0.05	0.11	0.25	0.33		0.15	0.17
O077	838066.5434	821154.2853		0.15	0.12	0.25	0.38	0.38	0.40	0.18	0.16	0.07	0.10	0.04	0.13	0.26	0.24		0.24	0.20
O078	837718.3121	821300.3583		0.07	0.21	0.28	0.14	0.14	0.02	0.07	0.08	0.12	0.10	0.23	0.19	0.06	0.41		0.15	0.14
O079	837746.6913	821310.0857		0.08	0.21	0.27	0.13	0.13	0.06	0.08	0.02	0.04	0.04	0.08	0.05	0.05	0.41		0.13	0.08
O080	837775.0821	821319.7791		0.10	0.20	0.28	0.09	0.09	0.09	0.09	0.05	0.11	0.11	0.16	0.16	0.08	0.39		0.14	0.13
O081	837804.3843	821330.5353		0.10	0.21	0.30	0.08	0.09	0.06	0.06	0.06	0.01	0.03	0.12	0.06	0.06	0.37		0.12	0.09
O082	837830.4738	821345.0837		0.17	0.31	0.42	0.19	0.18	0.04	0.06	0.09	0.02	0.02	0.13	0.09	0.11	0.36		0.18	0.11
O083	837721.9945	821334.0651		0.09	0.29	0.38	0.25	0.25	0.10	0.10	0.05	0.08	0.08	0.16	0.14	0.10	0.44		0.20	0.15
O084	837755.6946	821345.4837		0.03	0.31	0.39	0.26	0.25	0.13	0.12	0.07	0.10	0.10	0.05	0.11	0.09	0.42		0.20	0.13
O085	837785.0556	821354.7342		0.03	0.33	0.41	0.31	0.30	0.09	0.11	0.08	0.09	0.09	0.14	0.12	0.08	0.40		0.22	0.14
O086	837813.1149	821371.9343		0.13	0.35	0.31	0.24	0.24	0.24	0.18	0.09	0.05	0.04	0.06	0.06	0.10	0.41		0.21	0.13
O087	837743.2586	821371.8284		0.10	0.27	0.17	0.15	0.14	0.16	0.13	0.07	0.13	0.12	0.14	0.13	0.16	0.43		0.16	0.15
O088	837777.8265	821389.0285		0.04	0.10	0.07	0.10	0.11	0.18	0.17	0.06	0.11	0.12	0.11	0.11	0.13	0.36		0.11	0.14
O089	837829.2576	821089.1858		0.12	0.23	0.31	0.40	0.40	0.23	0.16	0.06	0.18	0.15	0.27	0.30	0.22	0.14		0.27	0.23
O090	837835.36	821114.3329		0.06	0.05	0.07	0.07	0.06	0.08	0.05	0.02	0.05	0.05	0.09	0.13	0.09	0.17		0.07	0.09
O091	837836.1729	821138.9981		0.04	0.08	0.12	0.19	0.20	0.08	0.10	0.04	0.05	0.01	0.11	0.13	0.20	0.28		0.12	0.12
O092	837837.0365	821168.6993		0.08	0.18	0.15	0.26	0.26	0.20	0.18	0.16	0.06	0.08	0.16	0.23	0.22	0.35		0.19	0.20
O093	837838.7661	821199.1156		0.15	0.20	0.16	0.20	0.20	0.20	0.24	0.23	0.10	0.12	0.25	0.30	0.20	0.24		0.20	0.23
O094	837839.1981	821228.6156		0.14	0.25	0.20	0.22	0.22	0.21	0.23	0.23	0.11	0.11	0.25	0.29	0.12	0.10		0.22	0.21
O095	837841.2164	821258.5987		0.14	0.22	0.19	0.09	0.04	0.08	0.12	0.18	0.09	0.08	0.26	0.28	0.22	0.16		0.15	0.17
O096	837851.4423	821276.619		0.18	0.33	0.36	0.27	0.27	0.16	0.12	0.07	0.04	0.02	0.14	0.12	0.13	0.23		0.22	0.13
O097	837880.3894	821276.0434		0.22	0.29	0.30	0.18	0.18	0.10	0.12	0.04	0.07	0.02	0.31	0.32	0.33	0.40		0.21	0.21
O098	837788.4206	821068.6249		0.03	0.03	0.16	0.25	0.25	0.14	0.14	0.07	0.14	0.10	0.11	0.23	0.17	0.07		0.15	0.15
O099	837809.8903	821070.6683		0.07	0.19	0.29	0.33	0.33	0.17	0.15	0.05	0.15	0.13	0.13	0.21	0.15	0.14		0.22	0.16
O100	837799.2832	821054.4488		0.11	0.22	0.29	0.26	0.27	0.14	0.09	0.05	0.17	0.15	0.20	0.11	0.07	0.15		0.19	0.14
O101	837905.118	821159.9335		0.14	0.25	0.30	0.28	0.28	0.21	0.17	0.13	0.10	0.12	0.24	0.33	0.20	0.18		0.24	0.22
O102	837905.8471	821189.9247		0.02	0.17	0.24	0.17	0.17	0.14	0.10	0.14	0.09	0.12	0.36	0.23	0.21	0.08		0.17	0.19
O103	837906.7709	821219.9104		0.09	0.17	0.17	0.09	0.10	0.07	0.04	0.12	0.01	0.09	0.33	0.17	0.12	0.06		0.12	0.14
O104	837908.4733	821251.5377		0.05	0.06	0.07	0.06	0.06	0.16	0.06	0.13	0.07	0.05	0.28	0.10	0.28	0.18		0.09	0.15
O105	837994.9121	821287.1066		0.24	0.31	0.28	0.28	0.28	0.18	0.08	0.03	0.11	0.04	0.21	0.14	0.15	0.19		0.22	0.15
O106	837970.0451	821303.8885		0.11	0.18	0.13	0.24	0.24	0.20	0.12	0.03	0.06	0.05	0.03	0.15	0.11	0.08		0.16	0.11
O107	837951.8239	821327.721		0.13	0.29	0.28	0.34	0.34	0.29	0.15	0.03	0.06	0.05	0.07	0.13	0.11	0.14		0.23	0.14
O108	837935.2263	821352.9729		0.20	0.35	0.37	0.39	0.39	0.34	0.18	0.04	0.09	0.07	0.09	0.12	0.12	0.14		0.28	0.16
O109	837916.3123	821375.214		0.15	0.31	0.39	0.40	0.40	0.34	0.21	0.03	0.10	0.03	0.15	0.17	0.35	0.49		0.29	0.22
O110	837942.3071	821384.9073		0.17	0.23	0.34	0.41	0.41	0.37	0.28	0.04	0.11	0.06	0.14	0.18	0.25	0.14		0.29	0.21
O111	837963.364	821362.4345		0.17	0.28	0.36	0.38	0.38	0.37	0.24	0.05	0.11	0.09	0.18	0.24	0.31	0.44		0.30	0.25
O112	837981.6875	821338.8127		0.09	0.29	0.33	0.38	0.37	0.33	0.17	0.05	0.10	0.04	0.07	0.09	0.12	0.07		0.26	0.14
O113	837999.5347	821319.5748		0.16	0.34	0.34	0.37	0.37	0.30	0.13	0.05	0.11	0.02	0.19	0.08	0.11	0.15		0.26	0.15
O114	838018.3418	821290.9256		0.29	0.39	0.38	0.35	0.35	0.24	0.07	0.05	0.13	0.06	0.30	0.17	0.14	0.15		0.28	0.18

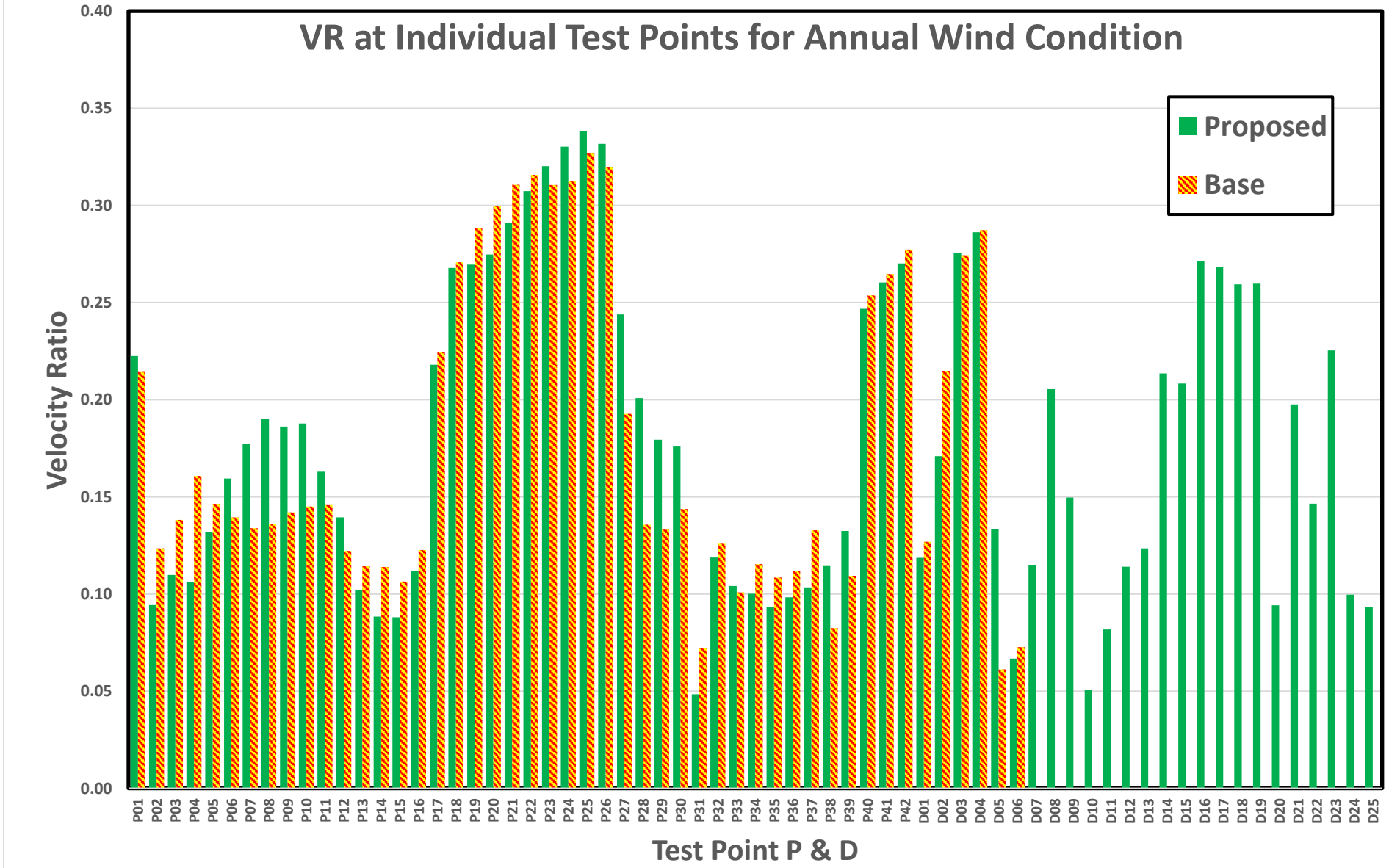
Wind Velocity Ratio, Proposed Case

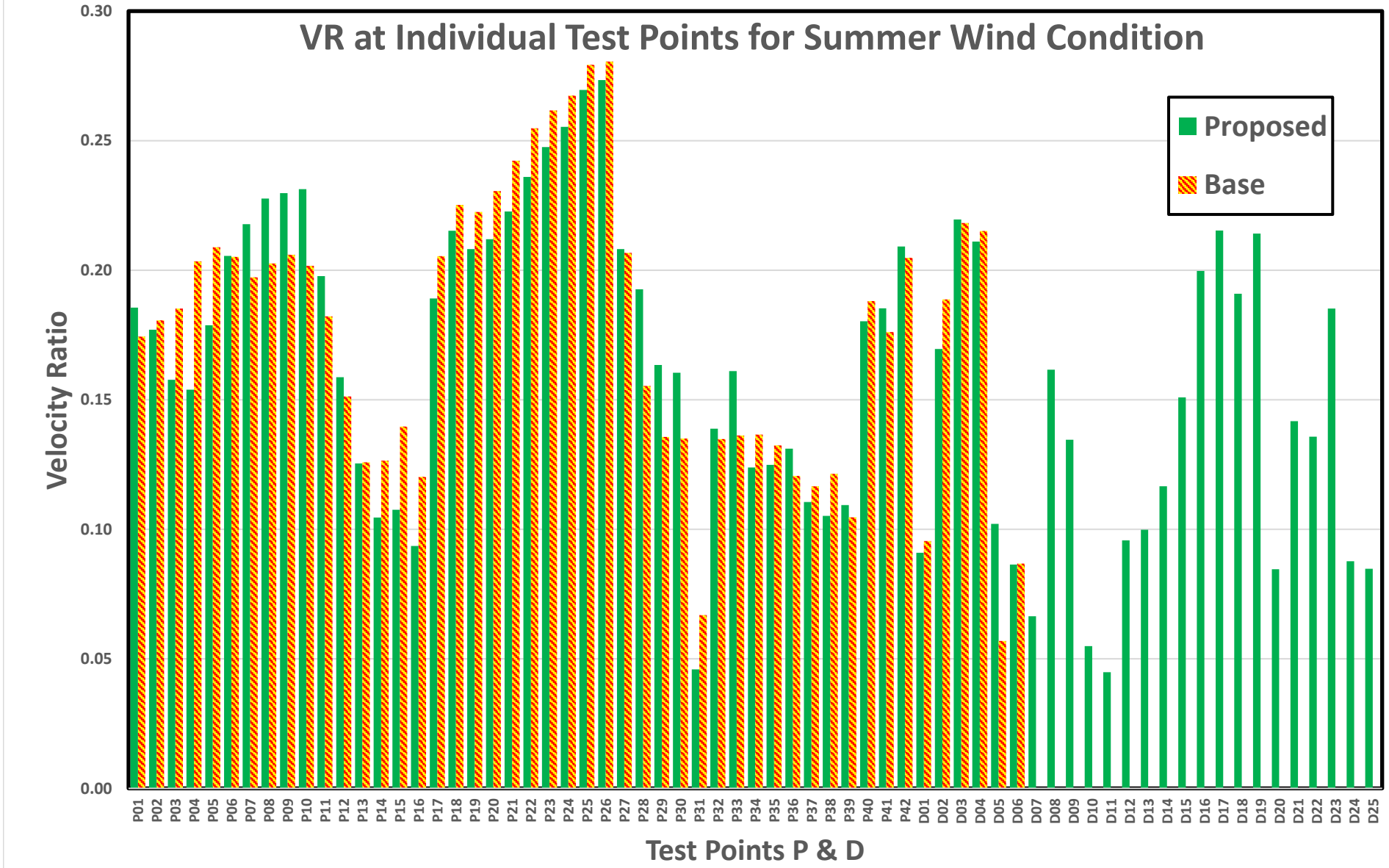
Tes Point			Wind direction (Degree)	22.5	45	67.5	90	90	112.5	135	157.5	180	180	202.5	225	247.5	270	Sum	Average (Annual)	Average (Summer)
			Wind direction	NNE	NE	ENE	E	E	ESE	SE	SSE	S	S	SSW	SW	WSW	W			
			Average Wind Speed at 500m elevation	7	6	6	7	8	7	6	6	5	6	6	6	6	4			
ID	Easting (m)	Northing (m)	Probability (Annual)	6.5%	9.0%	11.4%	20.2%		11.8%	7.0%		4.3%		5.9%	6.6%			82.7%		
			Probability (Summer)					8.4%	10.0%	8.1%	7.7%		8.9%	13.3%	15.9%	10.1%	5.2%	87.6%		
O115	838034.102	821315.0249		0.26	0.41	0.40	0.40	0.40	0.31	0.15	0.06	0.13	0.05	0.30	0.15	0.14	0.11		0.31	0.19
O116	838016.9993	821348.0503		0.14	0.34	0.39	0.39	0.39	0.34	0.25	0.06	0.11	0.03	0.15	0.13	0.17	0.24		0.29	0.19
O117	837996.8242	821373.6404		0.12	0.27	0.36	0.37	0.37	0.37	0.30	0.05	0.11	0.08	0.17	0.25	0.29	0.28		0.30	0.24
O118	837977.762	821393.0576		0.13	0.26	0.38	0.44	0.44	0.39	0.35	0.04	0.11	0.12	0.21	0.30	0.18	0.22		0.33	0.25
O119	837949.8296	821400.5297		0.13	0.18	0.30	0.31	0.31	0.35	0.33	0.06	0.11	0.03	0.18	0.23	0.10	0.14		0.26	0.20
O120	837905.945	821421.329		0.31	0.28	0.24	0.23	0.23	0.08	0.17	0.06	0.10	0.06	0.22	0.26	0.14	0.06		0.21	0.16
O121	837898.8866	821400.4287		0.06	0.07	0.17	0.07	0.07	0.13	0.10	0.10	0.12	0.03	0.16	0.20	0.15	0.19		0.11	0.13
O122	837853.475	821404.74		0.09	0.11	0.15	0.11	0.10	0.16	0.10	0.06	0.10	0.04	0.07	0.12	0.13	0.09		0.12	0.10
O123	837872.317	821384.4606		0.06	0.14	0.08	0.12	0.12	0.06	0.05	0.03	0.09	0.06	0.18	0.23	0.26	0.26		0.11	0.15
O124	837849.5725	821424.2231		0.04	0.11	0.05	0.06	0.06	0.16	0.09	0.14	0.06	0.04	0.08	0.13	0.19	0.31		0.09	0.13
D01	837827.3723	821284.5045		0.02	0.10	0.14	0.22	0.22	0.11	0.08	0.04	0.02	0.04	0.05	0.08	0.04	0.28		0.12	0.09
D02	837875.3914	821291.3735		0.11	0.18	0.29	0.22	0.23	0.09	0.14	0.12	0.04	0.02	0.09	0.19	0.40	0.28		0.17	0.17
D03	837919.5661	821285.9497		0.08	0.27	0.34	0.44	0.44	0.28	0.20	0.06	0.05	0.02	0.10	0.25	0.35	0.32		0.28	0.22
D04	837952.8274	821287.0337		0.17	0.43	0.44	0.44	0.44	0.13	0.09	0.12	0.08	0.05	0.09	0.27	0.39	0.37		0.29	0.21
D05	837877.6186	821251.2285		0.06	0.19	0.22	0.15	0.15	0.15	0.10	0.02	0.06	0.03	0.05	0.05	0.25	0.20		0.13	0.10
D06	837878.2297	821193.2792		0.03	0.09	0.10	0.04	0.04	0.02	0.16	0.02	0.02	0.01	0.07	0.10	0.17	0.22		0.07	0.09
D07	837885.5851	821243.8358		0.07	0.15	0.14	0.18	0.18	0.07	0.09	0.04	0.02	0.01	0.06	0.06	0.02	0.08		0.11	0.07
D08	837892.0227	821210.6803		0.09	0.27	0.36	0.24	0.24	0.18	0.23	0.12	0.03	0.06	0.11	0.07	0.28	0.32		0.21	0.16
D09	837855.147	821212.5698		0.05	0.19	0.25	0.17	0.17	0.16	0.12	0.04	0.01	0.01	0.05	0.13	0.27	0.33		0.15	0.13
D10	837880.622	821201.8274		0.06	0.07	0.08	0.03	0.03	0.04	0.06	0.07	0.05	0.05	0.10	0.01	0.12	0.03		0.05	0.05
D11	837882.3172	821189.6578		0.05	0.15	0.17	0.07	0.07	0.04	0.10	0.06	0.01	0.01	0.06	0.03	0.01	0.03		0.08	0.04
D12	837862.0567	821162.1529		0.03	0.12	0.15	0.14	0.15	0.10	0.13	0.05	0.01	0.02	0.11	0.10	0.06	0.14		0.11	0.10
D13	837853.9254	821154.3421		0.04	0.20	0.26	0.11	0.11	0.10	0.07	0.09	0.02	0.05	0.14	0.07	0.11	0.22		0.12	0.10
D14	837869.967	821153.6992		0.07	0.32	0.35	0.32	0.32	0.19	0.07	0.05	0.04	0.06	0.06	0.09	0.11	0.16		0.21	0.12
D15	837886.8448	821152.8671		0.08	0.27	0.31	0.27	0.27	0.17	0.13	0.05	0.10	0.08	0.23	0.11	0.18	0.12		0.21	0.15
D16	837891.2369	821145.486		0.22	0.36	0.39	0.32	0.32	0.21	0.06	0.11	0.09	0.12	0.21	0.35	0.12	0.13		0.27	0.20
D17	837876.9782	821130.1137		0.20	0.25	0.25	0.39	0.39	0.27	0.07	0.09	0.13	0.15	0.24	0.33	0.13	0.12		0.27	0.22
D18	837862.8999	821118.1371		0.21	0.29	0.27	0.38	0.38	0.21	0.06	0.08	0.18	0.16	0.29	0.22	0.12	0.08		0.26	0.19
D19	837849.9257	821103.2182		0.21	0.29	0.28	0.35	0.36	0.17	0.06	0.04	0.20	0.18	0.33	0.29	0.20	0.12		0.26	0.21
D20	837854.2657	821130.1703		0.03	0.15	0.12	0.10	0.10	0.13	0.04	0.07	0.01	0.08	0.08	0.06	0.08	0.15		0.09	0.08
D21	837881.8283	821145.1043		0.15	0.37	0.36	0.17	0.18	0.12	0.10	0.13	0.09	0.11	0.22	0.11	0.14	0.17		0.20	0.14
D22	837881.9412	821163.6206		0.04	0.21	0.19	0.15	0.16	0.11	0.14	0.06	0.09	0.09	0.22	0.11	0.18	0.12		0.15	0.14
D23	837862.6939	821202.7516		0.11	0.36	0.38	0.26	0.26	0.18	0.11	0.14	0.05	0.08	0.17	0.16	0.31	0.29		0.23	0.19
D24	837872.1197	821216.6204		0.07	0.19	0.15	0.06	0.07	0.10	0.09	0.04	0.04	0.02	0.07	0.12	0.16	0.06		0.10	0.09
D25	837872.532	821238.5118		0.10	0.05	0.09	0.16	0.16	0.03	0.06	0.04	0.06	0.04	0.05	0.18	0.05	0.11		0.09	0.08

Spatial Averaged Velocity Ratio

	Base		Proposed	
	Annual	Summer	Annual	Summer
Overall				
Site Air Ventilation Assessment (SVR) (All P Points)	0.18	0.18	0.18	0.18
Local Air Ventilation Assessment (LVR) (All P & O Points)	0.18	0.17	0.18	0.17
Road Sections				
Kai Tak Road (P01-P18, O90-O95)	0.15	0.18	0.15	0.17
Prince Edward Road East Section (P19-P26, O21-O46)	0.24	0.21	0.26	0.21
Sa Po Road (P27-P37, O101-104)	0.15	0.15	0.18	0.18
Carpenter Road Section (near Carpenter Road Park) (O01-O04)	0.14	0.13	0.11	0.12
Carpenter Road Section (near Project Site) (P40-P42, O05-O07,O96-O97)	0.24	0.18	0.23	0.17
Shek Ku Lung Road (O08)	0.15	0.11	0.13	0.11
Lok Sin Road Section (O09-O15)	0.20	0.16	0.19	0.16
Nga Tsin Wai Road Section (O16-O20)	0.16	0.16	0.14	0.15
South Wall Road (O17, O47-O54)	0.15	0.19	0.14	0.18
Tak Ku Ling Road (O19, O55-O62)	0.14	0.15	0.14	0.14
Tung Tsing Road (O63-O68)	0.18	0.15	0.17	0.14
Roads in TKD Area (O69-O77)	0.16	0.16	0.15	0.16
Area within Site				
Public Area within the Site (G/F) (D07-D12)	[1]	[1]	0.17	0.13
Public Area within the Site (Landscape Deck on 1/F) (D21-D22)	[1]	[1]	0.17	0.14
New Private Road for the Proposed Development (D13-D15)	[1]	[1]	0.18	0.12
Podium within the Site (D23:D25)	[1]	[1]	0.10	0.09
Sunken Plaza at G/F (D12,D16-D21)	[1]	[1]	0.21	0.17
Public Area outside the carriageway at G/F for the Proposed Development (D08-D09)	[1]	[1]	0.18	0.15
Other Concerned Area				
Podium on Carlson Court (D06)	0.07	0.09	0.07	0.09
Podium on High Place (D05)	0.06	0.06	0.13	0.10
Carpenter Road Park (O78-O88)	0.18	0.12	0.16	0.13
Shek Ku Lung Road Playground (O105-O119)	0.28	0.18	0.27	0.19
Tak Ku Ling Playground (O98-O100)	0.19	0.15	0.19	0.15
Po Yan Oblate Primary School (0107-O111)	0.13	0.14	0.13	0.13
Le Billionaire & Billionaire Royale (D01-D04)	0.23	0.18	0.21	0.17

[1] Those locations are not applicable to Baseline Scenario


VR at Individual Test Points for Annual Wind Condition
Proposed
Base
Velocity Ratio
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
P01 P02 P03 P04 P05 P06 P07 P08 P09 P10 P11 P12 P13 P14 P15 P16 P17 P18 P19 P20 P21 P22 P23 P24 P25 P26 P27 P28 P29 P30 P31 P32 P33 P34 P35 P36 P37 P38 P39 P40 P41 P42 D01 D02 D03 D04 D05 D06 D07 D08 D09 D10 D11 D12 D13 D14 D15 D16 D17 D18 D19 D20 D21 D22 D23 D24 D25
Test Point P & D


VR at Individual Test Points for Summer Wind Condition
Proposed
Base
Velocity Ratio
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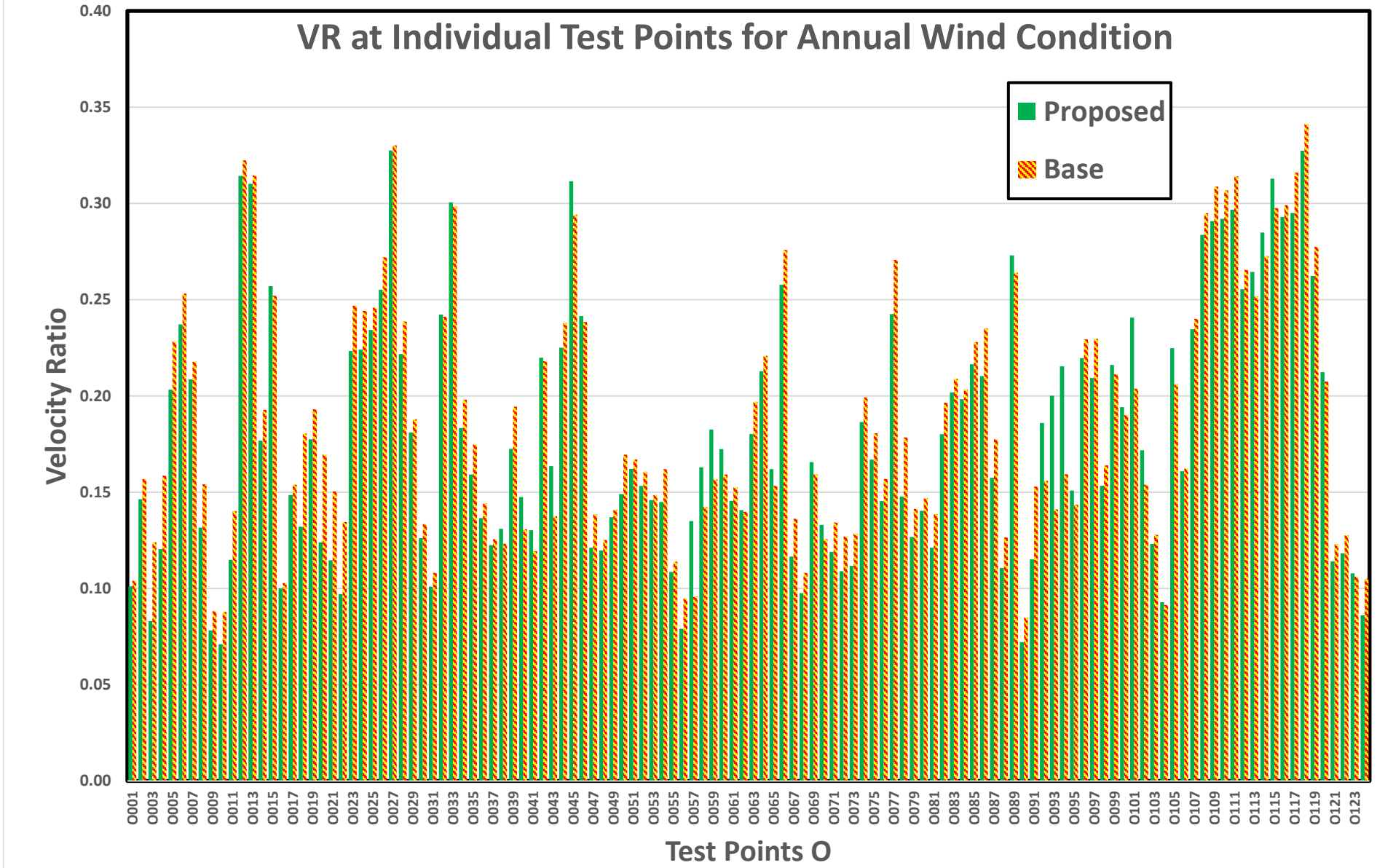
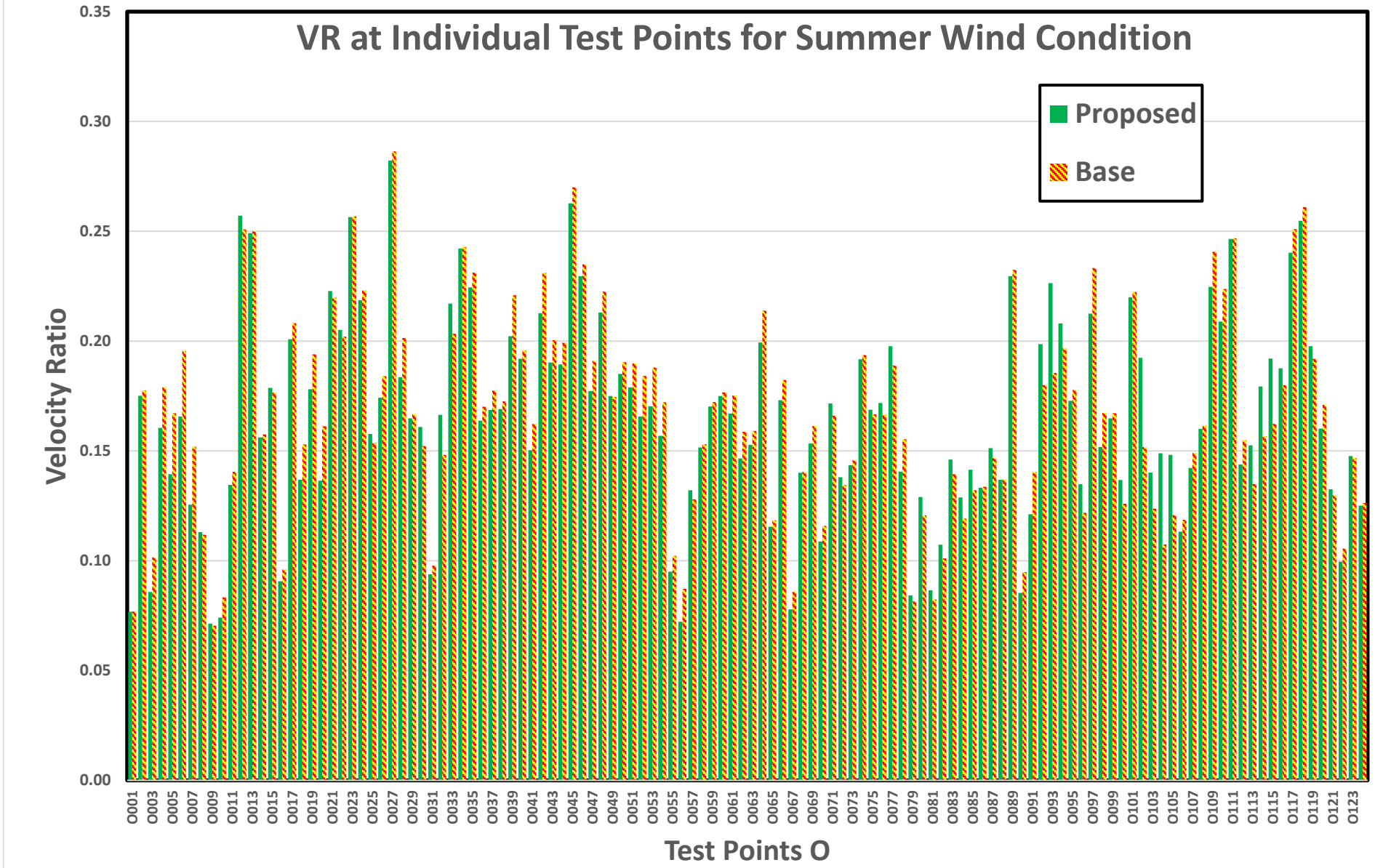
0.25
0.20
0.15
0.10
0.05
0.00
P01 P02 P03 P04 P05 P06 P07 P08 P09 P10 P11 P12 P13 P14 P15 P16 P17 P18 P19 P20 P21 P22 P23 P24 P25 P26 P27 P28 P29 P30 P31 P32 P33 P34 P35 P36 P37 P38 P39 P40 P41 P42 D01 D02 D03 D04 D05 D06 D07 D08 D09 D10 D11 D12 D13 D14 D15 D16 D17 D18 D19 D20 D21 D22 D23 D24 D25
Test Points P & D


VR at Individual Test Points for Annual Wind Condition
Proposed
Base
Velocity Ratio
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
O001 O003 O005 O007 O009 O011 O013 O015 O017 O019 O021 O023 O025 O027 O029 O031 O033 O035 O037 O039 O041 O043 O045 O047 O049 O051 O053 O055 O057 O059 O061 O063 O065 O067 O069 O071 O073 O075 O077 O079 O081 O083 O085 O087 O089 O091 O093 O095 O097 O099 O101 O103 O105 O107 O109 O111 O113 O115 O117 O119 O121 O123
Test Points O


VR at Individual Test Points for Summer Wind Condition
Proposed
Base
Velocity Ratio
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
O001 O003 O005 O007 O009 O011 O013 O015 O017 O019 O021 O023 O025 O027 O029 O031 O033 O035 O037 O039 O041 O043 O045 O047 O049 O051 O053 O055 O057 O059 O061 O063 O065 O067 O069 O071 O073 O075 O077 O079 O081 O083 O085 O087 O089 O091 O093 O095 O097 O099 O101 O103 O105 O107 O109 O111 O113 O115 O117 O119 O121 O123
Test Points O