Section 16 Application for Minor Relaxation of Plot Ratio and Building Height Restrictions in support of Public Housing Development at Lai Cho Road, Kwai Chung
Quantitative Air Ventilation Assessment

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Contents

Figures

Appendices

Appendix A: Layout of Baseline Scheme
Appendix B: Layout of Proposed Scheme
Appendix C: Map photo of Existing Scenario
Appendix D: Domain Size, CFD Model in Different Views, Contour Plots of Simulation Results
Appendix E: Detailed Wind Velocity Ratios

1. Introduction

1.1 Background and Objectives

1.1.1 The Subject Site at Lai Cho Road is to be developed as Public Rental Housing (PRH). In order to increase public housing supply, it is proposed to optimise the development potential at the Subject Site with increased floor areas and relaxed building height. A planning application is submitted to apply for minor relaxation of maximum building height from 160mPD to 165mPD and domestic plot ratio from 5.0 to 6.0. In order to demonstrate the increase in maximum building height and domestic plot ratio would not induce significantly adverse impact to the surroundings in term of air ventilation, an air ventilation assessment is prepared to support the planning application.

1.1.2 It must be noted that the Subject Site is zoned as R(A) and it is always permissible for residential development. The main objective of this quantitative air ventilation assessment is to compare the difference in air ventilation performance between the Baseline Scheme (OZP-compliant scenario with domestic plot ratio 5.0) and Proposed Scheme (minor relaxation of the building height from 160mPD to 165mPD with domestic plot ratio 6.0).

1.1.3 This quantitative air ventilation assessment report has been prepared to evaluate the potential air ventilation impact of the proposed development scheme. Architectural drawings and technical information on the Proposed Development are provided by Hong Kong Housing Authority.

1.2 Site Environs

1.2.1 The Subject Site is located in Kwai Chung (i.e. area between Lai Cho Road and Lai Yiu Street). The Subject Site is zoned R(A) under the Draft Kwai Chung Outline Zoning Plan No. S/KC/28 (OZP). The location and its environs are shown in **Figure 1**.

1.2.2 The Subject Site is located at high level and elevated at around 50mPD. The area on the northeast, north and northwest sides is sloping downward with lower elevation than the Subject Site. The Subject Site is bounded by an elevated section of Lai Cho Road on northwest, north to northeast sides, and Lai Yiu Street on the eastern side. The Subject Site is located to the northwest of Lai Yiu Estate and immediate opposite to Fu Yiu House of Lai Yiu Estate. Tung Wah Group of Hospitals Ko Ho Ning Memorial Primary School and Christian Alliance P.C. Lau Memorial International School are located to the further south-southeast of the Subject Site. Two secondary schools along Lai King Hill Road at much lower elevation are located at the southwest of the Subject Site. Tin Hau Temple is located to the northwest of the Subject Site at lower elevaton as well. There are several residential developments (i.e. Kwai Fong Terrace, New Kwai Fong Gardens) located at the northwest side at lower elevation (5 to 7mPD). Low-rise Ha Kwai Chung Village with building height of around 19.5mPD to 34.9mPD is located to the northeast of the Subject Site.

1.2.3 **Figure 5** shows the building heights of the surrounding developments.

1.2.4 An Expert Evaluation on Air Ventilation Assessment of Kwai Chung Area was conducted before (Reference number: AVR/G/68). Since the development is located on the breezeway, an Existing Scenario is simulated to evaluate the effect after the development.

1.3 Baseline Scheme

1.3.1 **Appendix A** shows the baseline building design for assessment purpose. This Baseline Scheme is an OZP-Compliant scenario which complies with the building height restriction of 160mPD and maximum domestic plot ratio of 5.0. The Baseline Scheme with a domestic plot ratio of 5.0 comprises one high-rise residential tower with an elevation of 142.9mPD (include podium garden, ground floor and 31 domestic storeys). The tower is of T-shape and erected on top of the ground floor. A podium garden is located below the ground floor level which is elevated at about 51.4 to 53.2mPD.

1.3.2 Baseline Scheme consists a podium garden elevated at 50mPD. It comprises of a carpark area with some Children's Play Areas (CPA). The design of the podium garden is streamlined and aligned with Lai Cho Road which can divert wind flow around the deck and will counter off the impact in some extent. The extent of the podium garden is extended to the Site Boundary in order to fulfill different essential development such as plant rooms and shops.

1.4 Proposed Scheme

1.4.1 For the Proposed Scheme with relaxed maximum building height of 165mPD and domestic plot ratio of 6.0 proposed, the design is the same as the Baseline Scheme except the number of storeys of the residential tower is increased from 31 to 39 domestic storeys so that the public housing supply can be increased. The Proposed Scheme is elevated at 164.9mPD, which is higher than the Baseline Scheme (142.9mPD) and exceed the building height restriction under current OZP. The floor plan of the Proposed Scheme is similar to the typical floor of the residential tower. The proposed tower is of T-shape and the same as the Baseline Scheme. **Appendix B** shows the proposed building design for assessment purpose.

1.4.2 Proposed Scheme also consists a podium garden which has the same shape and disposition with the Baseline Scheme.

1.5 Existing Scenario

1.5.1 Under the Existing Scenario, there is no development at the Subject Site. **Appendix C** shows the Existing Scenario.

2. Site Wind Availability

2.1 Site Wind Availability Data

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

2.1.2 This evaluation is not a detailed study of the air ventilation performance. It is therefore considered acceptable to use the simulated RAMS data for Site Wind Availability initially as a starting point. The use of RAMS data is preferred over measurement data at Waglan Island as it can reflect the effect of topography to wind availability.

2.1.3 **Figure 4** shows the grid number that corresponds to the location of the Subject Site and is directly extracted from the Planning Department website for site wind availability data (i.e. X: 071, Y: 050), and **Figure 2** shows relevant windrose diagram at Grid X: 071, Y: 050 representing the frequency and wind speed distribution at infinity height of the district concerned for both annual and summer condition.

2.1.4 According to the site wind availability data shown in **Figure 2**, easterly and northeasterly winds are prevailing annually. Southwesterly and southerly wind are prevailing in summer.

2.1.5 **Table 1** showed the summary of the simulated annual site wind availability data including probability of occurrence and average wind speed. In this quantitative air ventilation assessment, CFD (computational fluid dynamic) tool will be employed. According to the Housing, Planning and Lands Bureau Technical Circular No. 1/06, simplification of wind data for the Initial Study has been adopted. The wind directions with highest probability of occurrence are selected for assessment purpose. 11 wind directions were selected with overall frequency of occurrence equivalent to 91.7% and 87.5% respectively of the time in a year for both annual and summer condition.

Table 1 Summary of Simulated Site Wind Availability Data (V∞) and Wind Direction based for the Subject Site at 500m (Grid Number: X:071, Y:050)

	Percentage Occurrence (%)		
Wind Angle	**Annual**	**Summer**	**Designated Wind Profile Curve**
0	1.9%	1.0%	3
22.5	**5.8%**	**1.6%**	**0***
45	**10.3%**	**2.1%**	**0***
67.5	**12.3%**	**2.8%**	**0***
90	**16.9%**	**7.4%**	**0***
112.5	**11.2%**	**9.0%**	**1***
135	**7.1%**	**7.7%**	**1***
157.5	**5.1%**	**7.8%**	**1***
180	**6.3%**	**11.8%**	**1***
202.5	**8.5%**	**18.0%**	**2***
225	**5.5%**	**13.2%**	**2***
247.5	**2.7%**	**6.1%**	**2***
270	2.4%	5.0%	2
292.5	1.4%	2.9%	3
315	1.3%	2.1%	3
337.5	1.2%	1.3%	3
TOTAL Selected*	**91.7%**	**87.5%**	

* Selected wind direction and wind profile curve for quantitative AVA study

2.1.6 The wind direction and average wind speed selected for this assessment represents the condition at 500m height.

3. Quantitative Assessment Methodology

3.1 Atmospheric Conditions

3.1.1 Simulated wind profile curves are extracted from the Planning Department's website using RAMS site wind availability data and directly adopted for this quantitative AVA. **Figure 3** shows the wind profile curves for grid X: 071, Y: 050.

3.1.2 Wind profile curves 0, 1 and 2 would be utilized for quantitative AVA according to the selected wind directions in **Table 1**.

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

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

3.2 CFD Code and Major Parameters

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

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

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

3.2.4 **Figure 14** shows the extent of assessment area and surrounding area for CFD simulation.

3.2.5 The domain (**Appendix D**) covers the model area of 240m (>2H where H, assumed to be 120m which is higher the building height of the Proposed Building (114.9m) is the maximum height of buildings within the surrounding area) from the subject site boundary. It is confirmed that all major noise barriers, elevated structures, and planned / committed / existing developments in the model area have been modelled in the simulation.

3.2.6 The domain dimension is about 2000m x 2000m and with an elevation of 800m. More than 6,800,000 grid cells has been defined to simulate the air flow. Given the large domain adopted in this assessment and the physical limitation on the computational resources of the CFD model, the horizontal and vertical grid size employed in the

CFD model in the vicinity of the Project Area was taken as a global minimum size of 2m and was increased for the grid cells further away from the Project Area at a growth ratio of 1.3. The global maximum size of cells is 32m and smaller cell size up to 0.5m was used. Besides, four layers of prism cells (each layer of 0.5m thick) were employed above the terrain and podium of Subject Site. The blockage ratio is less than 3%.

3.2.7 The windward boundary is defined as inflow with the wind profile defined. The leeward boundary is defined as outflow. The sky and lateral boundaries are defined as symmetric boundary condition.

3.3 Test Point Locations

3.3.1 Test points include 30 numbers of perimeter test point defined along the boundary of the subject site, 77 numbers of overall test points around the subject site within the assessment area (1H from subject site boundary) and 8 numbers of special test point are evenly distributed at the podium garden within the Subject Site which the future residents would acess and likely stay.

3.3.2 The overall test point generally represents important pedestrian areas – Christian Alliance PC Lau Memorial International School, Wah Yiu Road, Lai Yiu Street, Lai Yiu Commercial Complex and Lai Yiu Estate Market, Lai Cho Road, San Kwai Street, Ha Kwai Chung Village, Tin Hau Temple, Tang Uk Street, Lai King Hill Road, Kwai Chung Road, Kwai Fuk Road, Lai Yui Estate Podium and TWGHs Ko Ho Ning Memorial Primary School. Planned developments are taken into account in the simulation with their latest available scheme incorporated into the model.

3.3.3 Most of the test points are located at 2m aboveground. **Figure 6** shows the location of the test points. Special test points locations for Proposed Scheme and Baseline Scheme are shown in **Figure 6a**.

4. Assessment Result

4.1 Good Design Direction for Site Level

4.1.1 According to the guidelines in Chapter 11 of HKPSG, the key principles to consider in order to improve air ventilation performance in site level include podium structure, building disposition, building permeability, building form, landscaping, projecting obstruction and cool materials.

4.1.2 *Podium Structure*. Compact integrated developments and podium structures with full or large ground coverage on extensive sites typically found in Hong Kong are particularly impeding air movement. The principle to improve air ventilation at ground pedestrian level is to reduce coverage, provide setback, designate open area and improve building permeability.

4.1.3 *Building Disposition*. Adequate wide gaps should be provided between buildings. The axis of buildings should be in parallel to prevailing wind direction where possible. Staggering building to allow blocks behind to receive wind through gap and erecting towers abut the podium edge facing pedestrian area to enable most of the downwash are also preferred in general.

4.1.4 *Building Permeability*. The focus is to create building gap and highly permeable podium garden.

4.1.5 *Building Form*. Building form to amplify wind around it is preferable.

4.1.6 *Landscaping, Projecting Obstruction and Cool Materials.* Landscaping & use of cool materials would be encouraged whereas projecting obstruction would be avoided.

4.1.7 In addition, it is important to identify and preserve all important air corridors.

4.2 Evaluation of Merits/Demerits of Design Features of the Proposed Scheme

Podium Structure

4.2.1 The Subject Site location is not topographically flat. It is necessary to form a flat platform for the future development. A podium garden is therefore proposed for both schemes. Both schemes consist of a podium garden of the same shape. The podium garden is elevated higher than Lai Cho Road but will be of similar elevaton as part of Lai Yiu Street. Due to the fact that the level of Lai Cho Road is lower than Lai Yiu Street, a flat podium garden elevated higher than Lai Cho Road cannot be avoided. The elevation is about 51.4 to 53.2mPD for the podium garden. While the podium garden is higher than Lai Cho Road, streamlined design of the podium garden are applied for both schemes with curved design following the shape of the site boundary on northeast, north and west sides. It can help divert wind flow around the deck and will counter off the impact in some extent.

4.2.2 The ground floor of the tower has similar building footprint as the typical floor and not extended as much as the podium garden .

Building Height

4.2.3 Baseline Scheme is the OZP compliance scenario with height of 142.9mPD. It is elevated lower than the Proposed Scheme which is 164.9mPD.

4.2.4 Higher building height would theoretically affect the wind flow at higher level and wind availability at pedestrian areas further away from the Subject Site.

4.2.5 Yet, the higher building height may probably cause stronger downwash effect on the other hand. Therefore while there are generally higher wind blockage effect, some areas may be benefited due to downwash which counteroff the blockage impact in some extent. The overall increased impact of the Proposed Scheme may not be significant, subject to quantitative assessment result.

Building Disposition and Development Permeability

4.2.6 The building form of both schemes is generally the same. Both Baseline Scheme and Proposed Scheme adopt T-Shape tower form, which can more fit into the limited site configuration. Otherwise, the area at each floor will decrease and result in increase in number of storeys and building height.

4.2.7 The building dispositions are the same in both schemes. Thus it is anticipated that air ventilation performance is similar among both schemes.

Landscaping, Projecting Obstruction and Cool Materials

4.2.8 Greening and use of cool materials can help to reduce heat island effect. In addition to ground floor open space, the proponent will explore to provide greening for area at the roof of building block to improve the situation as well.

4.3 Summary of Appraisal

4.3.1 The air ventilation performance of the Baseline Scheme and Proposed Scheme has been appraised. The podium design, podium garden design, building disposition are the same between both schemes. The only difference for both schemes is the higher building height for the Proposed Scheme. The effect due to such minor change may not affect pedestrian area close to the Subject Site. The effect to the air ventilation performance at the pedestrian level has been assessed by CFD simulation.

4.4 Mitigation Measures

4.4.1 It is noted that the main objective of the subject AVA is to assess the difference in air ventilation performance between the Baseline Scheme and the Proposed Scheme. Although the effect on air ventilation performance due to the proposed minor change in maximum building height and plot ratio is slight, some mitigation measures have

been incorporated into the building design (under Baseline & Proposed Scheme) to ameliorate the air ventilation impact that the proposed development may induce.

4.4.2 In order to ameliorate the air ventilation impact due to the proposed development (under Baseline & Proposed Schemes) in some extent, streamlined podium garden is designed for both Baseline and Proposed Schemes so that wind can flow around the building structure easier. In addition, more tower setback from Lai Yiu Street is also adopted for both Baseline and Proposed Schemes. It should be noted that as the site is not topographically flat, it is easier to construct the tower within flat area which is close to Lai Yiu Street, rather than on the slope area. Therefore, the setback from Lai Yiu Street (on the southern side) is in fact at the expense of construction cost and time, and aim to ameliorate impact on the area immediate to the southern site boundary.

4.4.3 Setbacks from typical floor of Baseline Scheme and Proposed Scheme are provided in **Figure 13**.

4.5 Quantitative Assessment Result - Spatial Average Wind Velocity Ratio

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

4.5.2 **Table 2** showed the site spatial average velocity ratio (SVR), local spatial average velocity ratio (LVR) and average VR of other focused areas.

4.5.3 The wind velocity ratios of individual test points are shown in **Figure 7** to **Figure 9** respectively for Baseline Scheme, Proposed Scheme and Existing Scenario for annual situation.

4.5.4 The wind velocity ratios of individual test points are shown in **Figure 10** to **Figure 12** respectively for the Baseline Scheme, Proposed Scheme and Existing Scenario for summer situation.

4.5.5 **Appendix D** shows VR color plot at pedestrian level. **Appendix E** shows detailed VR result for tested wind directions.

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

Spatial Average Wind Velocity Ratio (VR)	Baseline Scheme	Proposed Scheme	Existing Scenario
Annual Wind Situation			
SVR (P01 – P30)	0.14	0.14	0.22
LVR (P01 – P30, T01 – T77)	0.16	0.16	0.18
Christian Alliance PC Lau Memorial International School and elevated Road nearby (T01-T06)	0.15	0.15	0.15
Wah Yiu Road (T07-T09)	0.21	0.21	0.21
Lai Yiu Street (T10-T20, P20-P30)	0.19	0.19	0.22
Lai Yiu Commercial Complex and Lai Yiu Estate Market (T21-T31)	0.18	0.18	0.18
Lai Cho Road (T32-T40, P04-P19)	0.16	0.16	0.19
San Kwai Street (T41-T42)	0.12	0.12	0.12
Ha Kwai Chung Village (T43-T45, T51-T53)	0.12	0.12	0.12
Tin Hau Temple (T54-T55)	0.23	0.23	0.23
Tang Uk Street (T46-T50)	0.11	0.11	0.12
Lai King Hill Road (T56-T61,T73)	0.19	0.19	0.19
Kwai Chung Road (T62-T70)	0.18	0.18	0.18
Kwai Fuk Road (T71-T73)	0.19	0.19	0.20
Lai Yui Estate Podium (T74-T75)	0.13	0.13	0.13
TWGH Ko Ho Ning Memorial Primary School (T76-T77)	0.13	0.13	0.14
Special Testpoint within the Subject Site (S01-S08)	0.14	0.14	NA
Spatial Average Wind Velocity Ratio (VR)	Baseline Scheme	Proposed Scheme	Existing Scenario
Summer Wind Situation			
SVR (P01 – P30)	0.17	0.17	0.24
LVR (P01 – P30, T01 – T77)	0.17	0.17	0.18
Christian Alliance PC Lau Memorial International School and elevated Road nearby (T01-T06)	0.14	0.14	0.14
Wah Yiu Road (T07-T09)	0.25	0.25	0.25
Lai Yiu Street (T10-T20, P20-P30)	0.21	0.21	0.21
Lai Yiu Commercial Complex and Lai Yiu Estate Market (T21-T31)	0.18	0.18	0.17
Lai Cho Road (T32-T40, P04-P19)	0.19	0.19	0.21
San Kwai Street (T41-T42)	0.09	0.09	0.09
Ha Kwai Chung Village (T43-T45, T51-T53)	0.10	0.10	0.09
Tin Hau Temple (T54-T55)	0.22	0.22	0.22
Tang Uk Street (T46-T50)	0.09	0. 09	0.10
Lai King Hill Road (T56-T61,T73)	0.19	0.19	0.19
Kwai Chung Road (T62-T70)	0.17	0.17	0.17
Kwai Fuk Road (T71-T73)	0.16	0.16	0.17
Lai Yui Estate Podium (T74-T75)	0.13	0.13	0.13
TWGH Ko Ho Ning Memorial Primary School (T76-T77)	0.15	0.15	0.15
Special Testpoint within the Subject Site (S01-S08)	0.18	0.18	NA

4.6 Discussion

4.6.1 The Subject Site is a R(A) and residential development is always permissible. Thus the discussion below is considered the VR difference for Baseline Scheme and Proposed Scheme. After that, the comparsion between Existing Scenario and both schemes are also discussed.

4.6.2 According to the spatial average VR presented in **Table 2**, the SVR and LVR and all spatial average VR for focused areas are the same for both Proposed Scheme and Baseline Scheme under both annual and summer situation. It suggests that the proposed increase in building height limit and plot ratio would not result in any significantly adverse air ventilation impact.

4.6.3 The area of the Subject Site, building orientation and podium design of both schemes are generally the same. Therefore, it is reasonable that the difference in air ventilation performance is insignificant. While the Proposed Scheme is elevated higher than the Baseline Scheme, there is no observation of change of VR among area further apart. It may be due to the fact that the proposed development is a single-tower development and the additional blockage impact at higher level is therefore less significant.

4.6.4 When compared with the Existing Scenario under annual and summer wind situation, it is found that SVR and LVR under Existing Scenario are higher than Baseline Scheme and Proposed Scheme where the difference in SVR is most significant. For area further apart, the influence of development at the Subject Site diminishes. The spatial average VR at Lai Yiu Street, Lai Cho Road, Tang Uk Street, Kwai Fuk Road and TWGH Ko Ho Ning Memorial Primary School are slightly lower under Baseline and Proposed Schemes when compared to the Existing Scenario under annual condition. On the other hand, slightly lower spatial VR is found along Lai Cho Road, Tang Uk Street and Kwai Fuk Road under Baseline and Proposed Schemes when compared to the Existing Scenario under summer condition.

4.6.5 However, the spatial average VR of the Baseline Scheme and Proposed Scheme for some focused areas such as Lai Yiu Commercial Complex and Lai Yiu Estate Market & Ha Kwai Chung Village under summer wind situation are even slightly higher than the Existing Scenario. It means that the proposed development would redistribute and divert more wind to these locations to improve the wind availability.

4.6.6 When compared both schemes with the Existing Scenario, lower VR is observed for some focused areas as mentioned before. The building blockage may cause such deterioration VR. However, some good designs such as streamlined podium garden are already incorpated in the development in order to mininize the adverse air ventilation impact.

4.7 Directional Analysis

4.7.1 Under NNE wind directions, high wind flow is observed along Lai Cho Road and Lai Yiu Street. The Baseline/Proposed Schemes may divert more wind to flow along

such focused areas. The proposed development can divert wind to flow along the pedestrian level of Lai Yiu Street. For the Existing Scenario, it is observed that wind availability for Lai Cho Road downwind of the subject site is higher than Baseline/Proposed Schemes. High-rise proposed residential block would block the NNE wind and affect the mentioned areas. On the other hand, obstruction of the proposed development would also reduce the wind availability in the further downwind areas (e.g. Lingnam Dr. Chung Wing Kwong Memorial Secondary School, Tin Hau Temple, Kwai Chung Road and Lai King Hill Road). For other focused areas, the result is comparable for these 3 scenarios.

4.7.2 Under NE wind directions, strong wind flow is observed near the Subject Site in both schemes. Owing to the high building height for the development (i.e.142.9mPD in Baseline Scheme and 164.9mPD in Proposed Scheme), wind from NE can be blocked by the building blocks. Funnelling effect also results in high wind flow at the southern side of the proposed development. Besides, some winds are diverted along Kwai Chung Road as shown in the contour plot. For Lai Yiu Street, the VR is slighter higher for Existing Scenario when compared with Baseline Scheme and Proposed Shceme. The proposed building tower would likely to block the NE wind to Lai Yiu Street and slightly reduce the wind availability. Besides, it is also found that the slightly higher VR is observed at the upwind location along Lai Cho Raod under Existing Scenario when compared with both schemes. Possibly, wind tends to flow around the proposed development, without reaching these upwind locations. However, slightly higher VR is observed along the Lai Cho Road under both schemes when compared with Existing Scenario, it may be due to the wind diversion from the building block to Lai Cho Road.

4.7.3 Under ENE wind directions, wind can flow along Lai Cho Road and Kwai Chung Road to the downwind areas. When compared with the Existing Scenario, higher wind availability is observed along Lai Yiu Street under the Existing Scenario when compared to Baseline/Proposed Schemes. On the other hand, podium garden and the proposed development can cause slightly higher wind flow at the northern part of the Subject Site. The proposed development may divert wind to the mentioned area. The spatial VR at Ha Kwai Chung Village has deteriorated from the Existing Scenario, Baseline Scheme and then to the Proposed Scheme. The proposed high-rise development may generate downwash and turbulence, and disturb wind flow at Ha Kwai Chung Village to cause lower wind availiability when compared with the Existing Scenario.

4.7.4 For both Baseline Scheme and Proposed Scheme, slightly higher VR between TWGH Ko Ho Ning Memorial Primary School and Lok Yiu House under the Proposed Scheme when compared to the Baseline Scheme is observed. Slightly higher building height of the Proposed Scheme results in lower VR at downwind areas, and in turn affect the pressure and induce such minor change of VR. For further downwind areas, the VR of the Baseline Scheme and Proposed Scheme is similar.

4.7.5 Under E and ESE wind direction, it is observed that more wind can flow along the southern boundary of the Subject Site and reach Lai Yiu Street. High wind flow is observed along Lai Cho Road and Lai Yiu Street. The Baseline/Proposed Schemes

may divert more wind to flow along such focused areas. The proposed development can divert wind to flow along the pedestrian level of Lai Yiu Street. For the Existing Scenario, it is observed that wind availability for Lai Cho Road is higher than Baseline/Proposed Schemes. The podium garden and the proposed development can cause slightly higher wind flow at the northern part of the Subject Site. When comparing the Existing Scenario with both Baseline and Proposed Schemes, higher VR is observed along Kwai Chung Road and Lai King Hill Road at both schemes. Proposed development may divert more wind to the high-rise Kwai Fong Terrace, then downwash to Kwai Chung Road and Lai King Hill Road. For the immediate downwind area, VR of the Existing Scenario is higher. For other areas, wind availabililty is comparable among 3 scenarios. Under ESE wind direction, slightly lower VR in Proposed Scheme is observed at San Kwai Street and Ha Kwai Chung Road when comparing with Baseline Scheme. Higher building height of Proposed Scheme may cause stronger downwash and turbulence, and disturb wind flow at the mentioned areas.

4.7.6 Under SE wind direction, the wind availability is generally low. High-rise residential buildings (i.e. Lok Yiu House and Fu Yiu House) can block the wind flow. When compared Baseline/Proposed Schemes with Existing Scenario, obvious downwash effect is observed at the southern part of the tower block whereas it is absent in Existing Scenario. Proposed development can cause downwash to Lai Yiu Street. On the other hand, lower VR is observed at the immediate westen side of the Subject Site under both schemes when compared with Existing Scenario due to building blockage. When compared Baseline and Proposed Scheme, higher VR is observed along Lai Yiu Street near the Subject Site under Proposed Scheme. Since the building height of Propsoed Scheme is higher than the Baseline Scheme, it is anticipated that stronger downwash effect would occur and cause slightly higher VR at the pedestrian level along Lai Yiu Street.

4.7.7 Under the SSE, the wind velocity is generally higher than under SE wind. It is observed that wind can flow along Kwai Chung Road to the Subject Site. Besides, some winds are diverted by the podium garden at the ground floor and cause the wind velocity higher near the proposed development and even to the Ha Kwai Chung Village. When comparing Existing Scenario with Baseline/Proposed Schemes, it is found that the proposed tower can divert wind to Lai Yiu Street leading to higher wind availiability. For other focus areas, the wind availability is generally similar. When compared Baseline and Proposed Schemes, wind availability along Lai Yiu Street is higher for Proposed Scheme. Higher building height of Proposed Scheme can cause stronger downwash effect than Baseline Scheme.

4.7.8 Under S wind, similar wind flow is observed when compared with SSE wind direction except Ha Kwai Chung Village, San Kwai Street and Lai Yiu Street. Lower VR at Ha Kwai Chung Village and San Kwai Street is observed for both schemes when compared to the Existing Scenario. Wind can flow along Kwai Chung Road and Lai King Hill Road to the downwind areas such as Ha Kwai Chung Village and San Kwai Street under Existing Scenario. When compared Baseline Scheme and Proposed Scheme, slightly higher VR is found at the Ha Kwai Chung Village. Slgihtly higher

building height of Proposed Scheme may result in higher downwash effect, diverting more flow to Ha Kwai Chung Village.

4.7.9 Under SSW, SW, WSW wind, wind velocity is also generally high because of absence of high-rise buildings on the upwind area. The building setback for the proposed development can facilitate the air flow along Lai Yiu Street. Besides, since Ha Kwai Chung Village and nearby areas are located at lower level (about 20mPD), thus higher level of the Fu Yiu House and the proposed development will obstruct some wind flows to the leeward areas.

4.7.10 It is observed that strong downwash effect is observed at Lai Yiu Street for both schemes but it is absent under Existing Scenario. It is noted that VR along San Kwai Street between Ha Kwai Chung Village and Wing Yiu House is lower under both schemes than Exisitng Scenario. The proposed high-rise residential building may block the wind to the downwind areas. Moreover, it is observed that VR for Lai Cho Road is higher in Exisitng Scenario than both Baseline and Proposed Scheme. The obstruction of the building block under both schemes would cause deterioration of VR in the mentioned area. However, it is also noted that the downwash effect at Lai Yiu Street can also increase the wind availability at the junction between Lai Yiu Street and Lai Cho Road under both Baseline and Proposed Schemes. When compared Baseline and Proposed Scheme, higher building height of the Proposed Scheme would obstruct more wind and cause slightly lower VR at Lai Cho Road.

4.7.11 Generally, the proposed development under Baseline/Proposed Schemes can divert wind flow and cause downwash to benefit particular area under specific wind directions. Under the Existing Scenario, there is no blockage and can benefit wind flow at all directions.

4.8 Overall Performance – Annual Wind

4.8.1 The dominant wind directions under annual condition are from NE to SE.

4.8.2 According to the weighted contour plot under annual situation, it is observed that there is generally high wind availability at Kwai Chung Road, Lai King Hill Road, Tin Hau Temple, Lai Yiu Street and Lai Cho Road.

4.8.3 Besides, lower wind availability is observed at Ha Kwai Chung Village. It suggests that high topography to the east would block winds to the mentioned area.

4.8.4 It is found that VR at the immdediate western side of the Subejct Site is deteriorated from the Existing Scenario to the Baseline Scheme, then to the Proposed Scheme. The proposed development will obstruct the wind flow from the annual prevailing wind to the downwind areas. Thus it may reduce the wind availability at the pedestrian level.

4.8.5 When comparing Baseline Scheme and Proposed Scheme, it is observed that the wind availability is similar for both schemes. There is only slight difference near Lai Yiu Street.

4.8.6 Weighted contour for the Existing Scenario shows that higher wind availability is observed within and near the periphery of the Subject Site. Besides, slightly higher wind flow is found at Lai King Hill Road, Kwai Chung Road.

4.9 Overall Performance – Summer Wind

4.9.1 The dominant wind directions under summer condition are from ESE to SW.

4.9.2 According to the weighted contour plot under summer situation, it is observed that there is generally high wind availability at Lai King Hill Road and Kwai Chung Road. Wind will flow along these two roads to the downwind areas. For the downwind areas such as Ha Kwai Chung Village, low wind flow is observed due to the topographical location.

4.9.3 When comparing Baseline Scheme and Proposed Scheme, it is observed that the wind availability for both schemes are generally similar. There is only slight differences near Lai Yiu Street.

4.9.4 For the Existing Scenario, lower wind availiabilty is observed at the Subject Site when compared with both Baseline/Proposed Schemes. The proposed building can cause downwash effect to the southern boundary of the Subject Site and it is absent under the Existing Scenario. Besides, slightly higher wind availability is found at San Kwai Street due to the absence of proposed building at the Subject Site.

5. Conclusion

5.1.1 The Baseline Scheme, Proposed Scheme and Existing Scenario of the Subject Site at Lai Cho Road have been evaluated from air ventilation standpoint.

5.1.2 Both Baseline and Proposed Schemes have the same design except the difference of building height in order to allow more storeys of flat units to increase public housing supply under the Proposed Scheme.

5.1.3 According to the quantitative assessment by CFD simulation, SVR, LVR and spatial average VR for selected focused areas for both Baseline Schemes and Proposed Scheme are comparable under annual and summer wind.

5.1.4 Higher SVR and LVR under Existing Scenario is observed when compared with Baseline/Proposod Schemes under both annual and summer wind. In particular, the difference in SVR is more significant. For most focused areas (i.e. Lai Yiu Street, Lai Cho Road, Tang Uk Street, Kwai Fuk Road & TWGH Ko Ho Ning Memorial Primary School under annual wind; Lai Cho Road, Tang Uk Street, Kwai Fuk Road under summer wind), higher VR is found under Existing Scenario when compared with both Schemes. For some focused areas (i.e. Lai Yiu Commercial Complex and Lai Yiu Estate Market, Ha Kwai Chung Village under summer scenario), slightly higher VR is observed for Baseline/Proposed Schemes.

5.1.5 For other focused areas, VR is comparable in these three schemes/scenarios.

5.1.6 As discussed in the directional analysis, VR of some focused areas such as Lai Cho Road, Lai Yiu Street, Ha Kwai Chung Village and San Kwai Street would be deteriorated after the construction of the proposed development. It is noted that the proposed high-rise building may block some winds to such downwind areas. However, the Subject Site is R(A) with building height restriction at 160mPD. The result showed that minor relaxation of the building height would not result in worse-off air ventilation impact when compared with the Baseline Scheme which is OZP compliance.

FIGURES

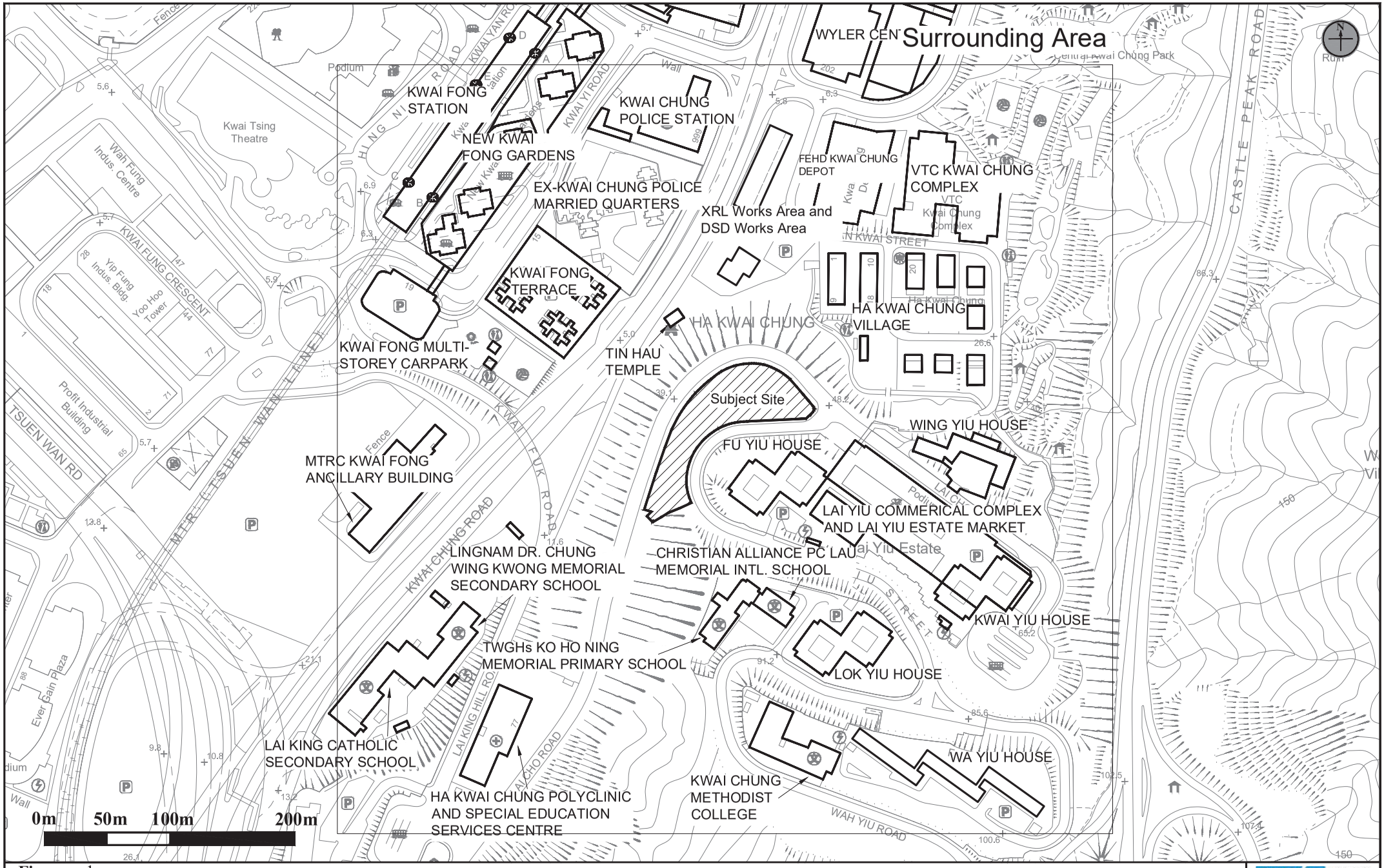

Figure: 1	RAMBOLL ENVIRON
Title: Location of the Subject Site and its Environs	Drawn by: DL
	Checked by: Slo
Project: Section 16 Application for Minor Relaxation of Plot Ratio and Building Height Restrictions in support of Public Housing Development at Lai Cho Road Quantitative Air Ventilation Assessment	Rev.: 1.2
	Date: Feb 2017

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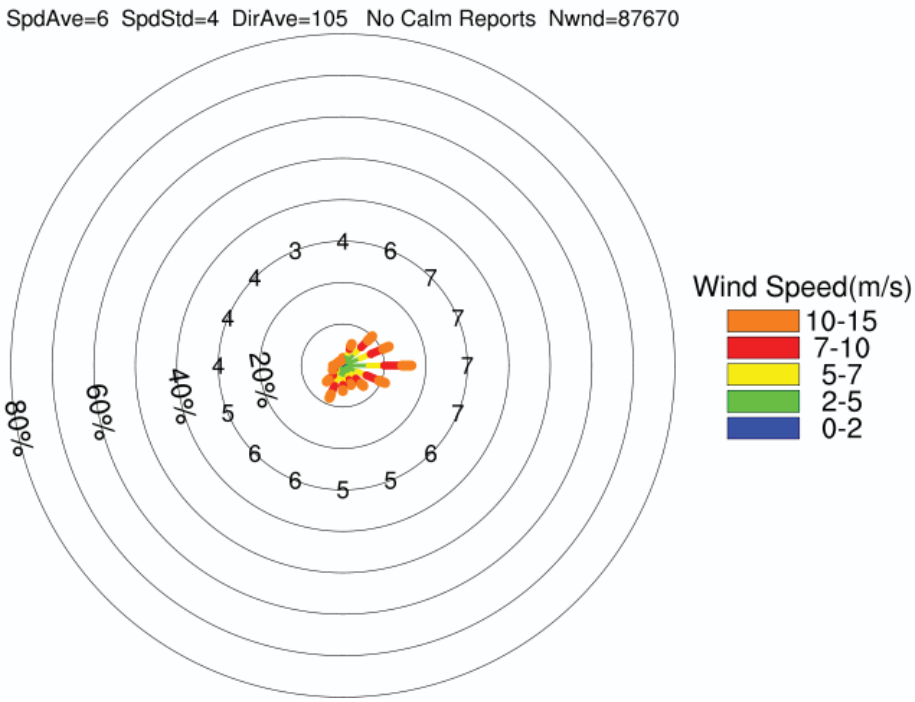

SUMMER
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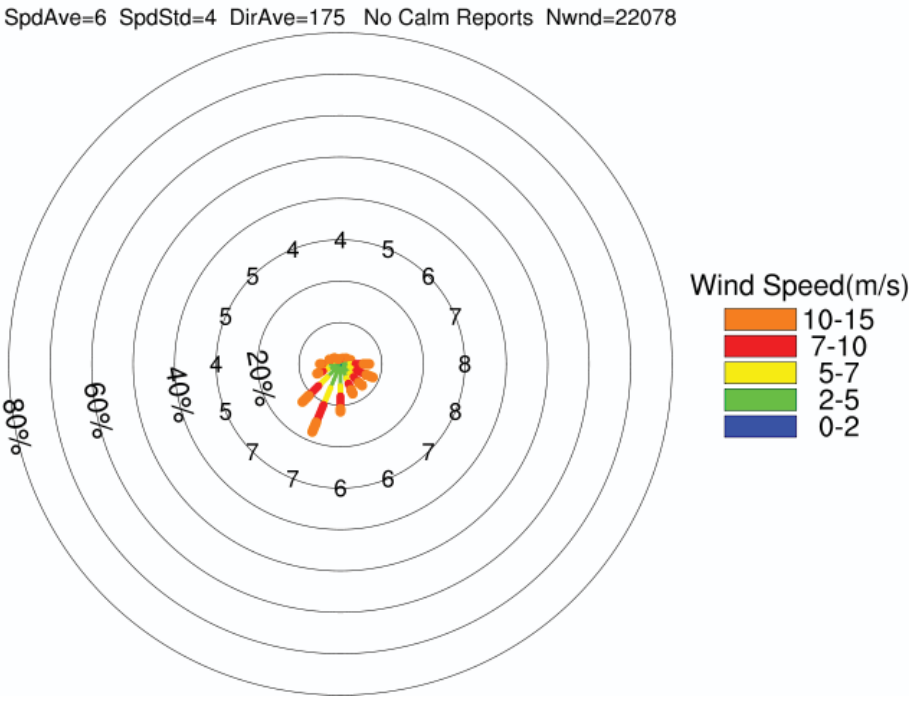

Figure:	2	RAMBOLL ENVIRON
Title:	Wind Rose Diagram representing V ∞ of the Area under Concern	Drawn by: DL
		Checked by: CC
Project:	Section 16 Application for Minor Relaxation of Plot Ratio and Building Height Restrictions in support of Public Housing Development at Lai Cho Road Quantitative Air Ventilation Assessment	Rev.: 1.0
		Date: Apr 2017

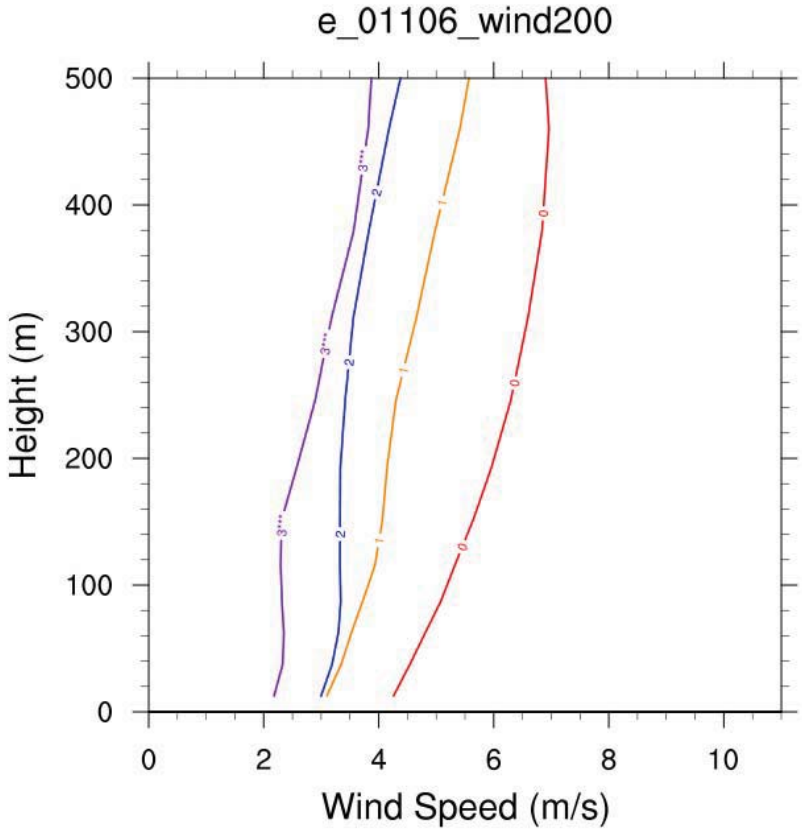

Figure:	3	RAMBOLL ENVIRON
Title:	Wind Profile Curve for Grid X: 071, Y: 050	Drawn by: DL
		Checked by: CC
Project:	Section 16 Application for Minor Relaxation of Plot Ratio and Building Height Restrictions in support of Public Housing Development at Lai Cho Road Quantitative Air Ventilation Assessment	Rev.: 1.0
		Date: Apr 2017

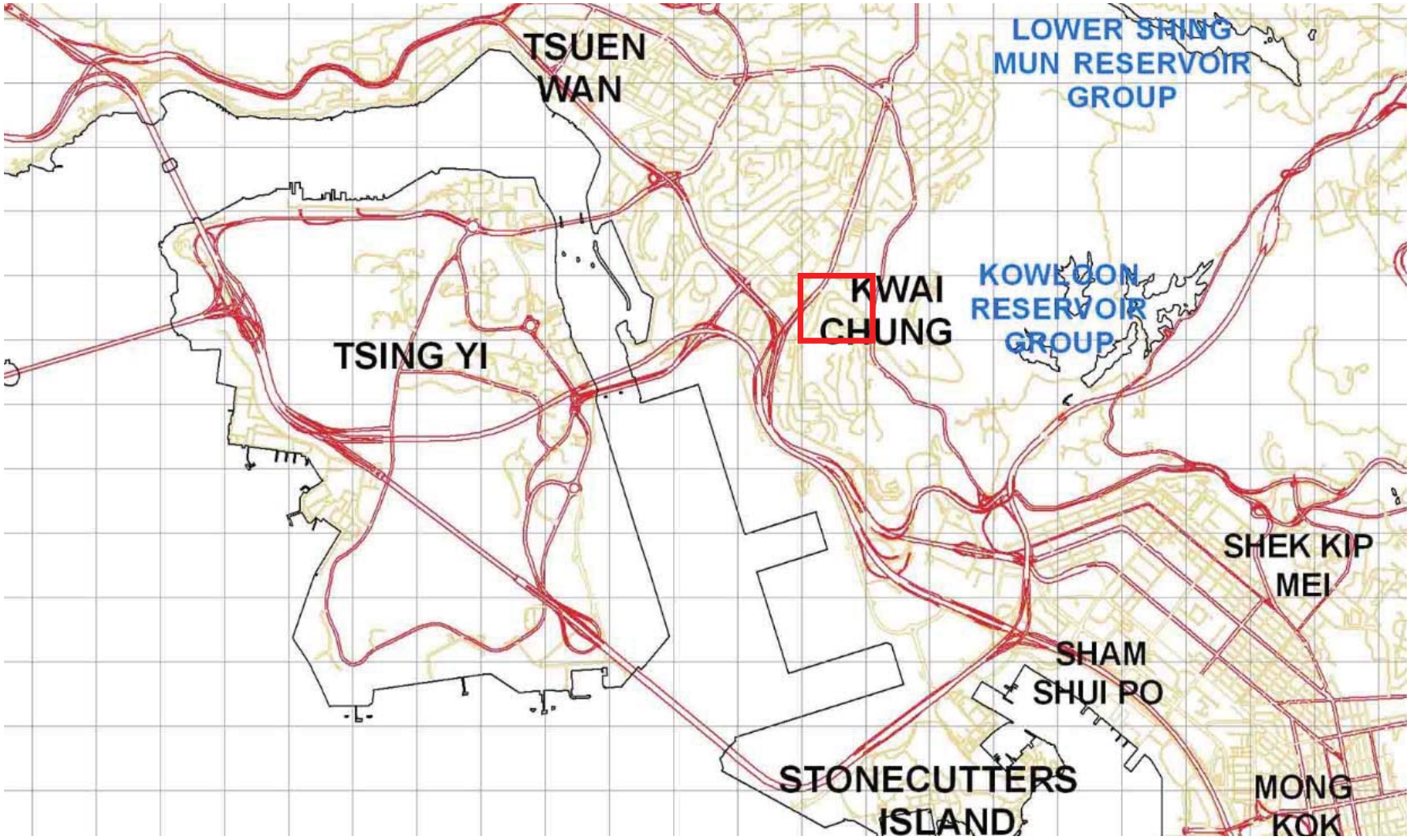

Figure:	4	RAMBOLL ENVIRON
Title:	Location of Grid X:071, Y:050 on RAMS	Drawn by: DL
		Checked by: CC
Project:	Section 16 Application for Minor Relaxation of Plot Ratio and Building Height Restrictions in support of Public Housing Development at Lai Cho Road Quantitative Air Ventilation Assessment	Rev.: 1.0
		Date: Apr 2017

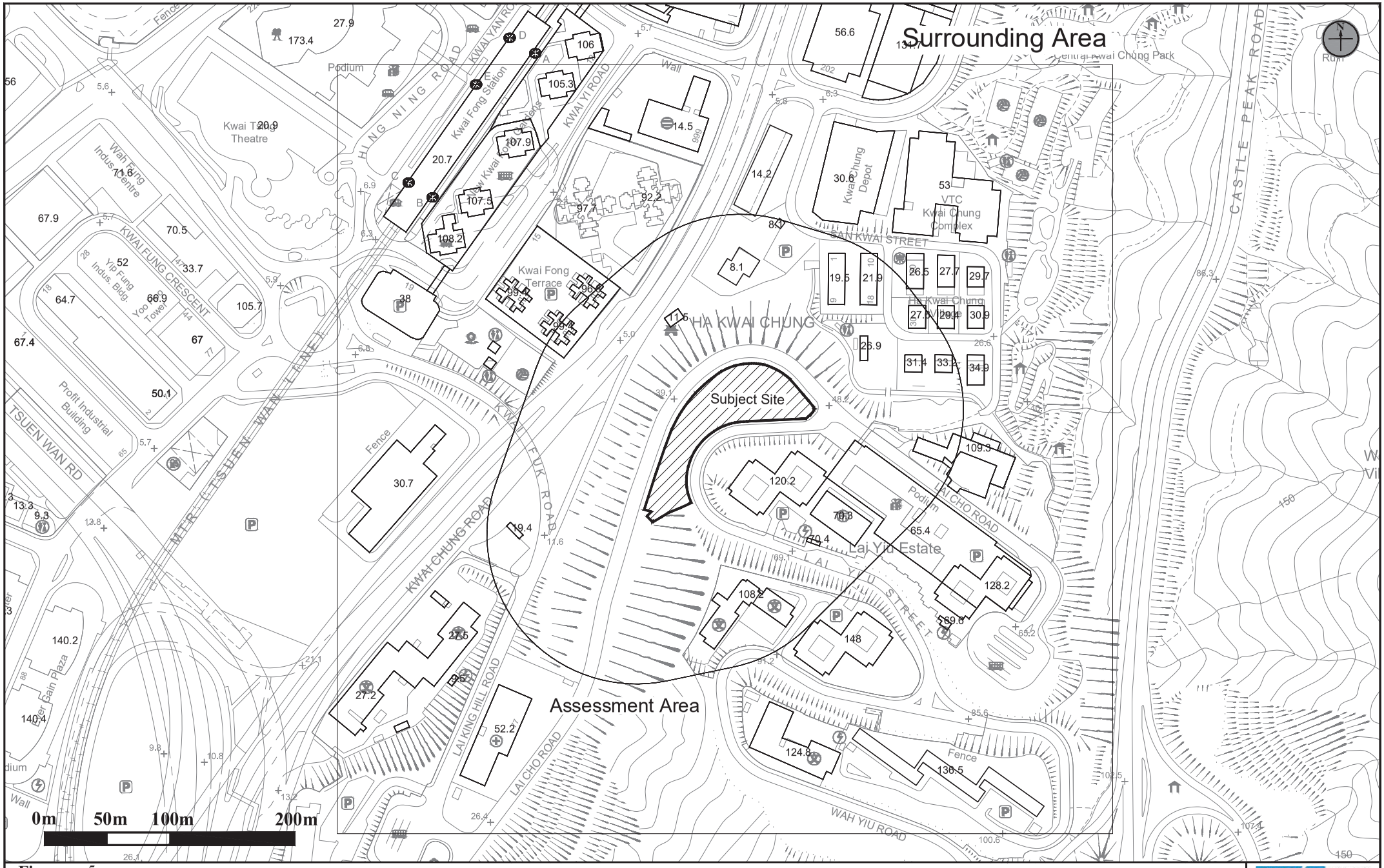

Figure: 5

Title: Building Height of the Surrounding Developments

Project: Section 16 Application for Minor Relaxation of Plot Ratio and Building Height Restrictions in support of Public Housing Development at Lai Cho Road
Quantitative Air Ventilation Assessment

RAMBOLL ENVIRON

Drawn by:	DL
Checked by:	Slo
Rev.:	1.2
Date:	Feb 2017

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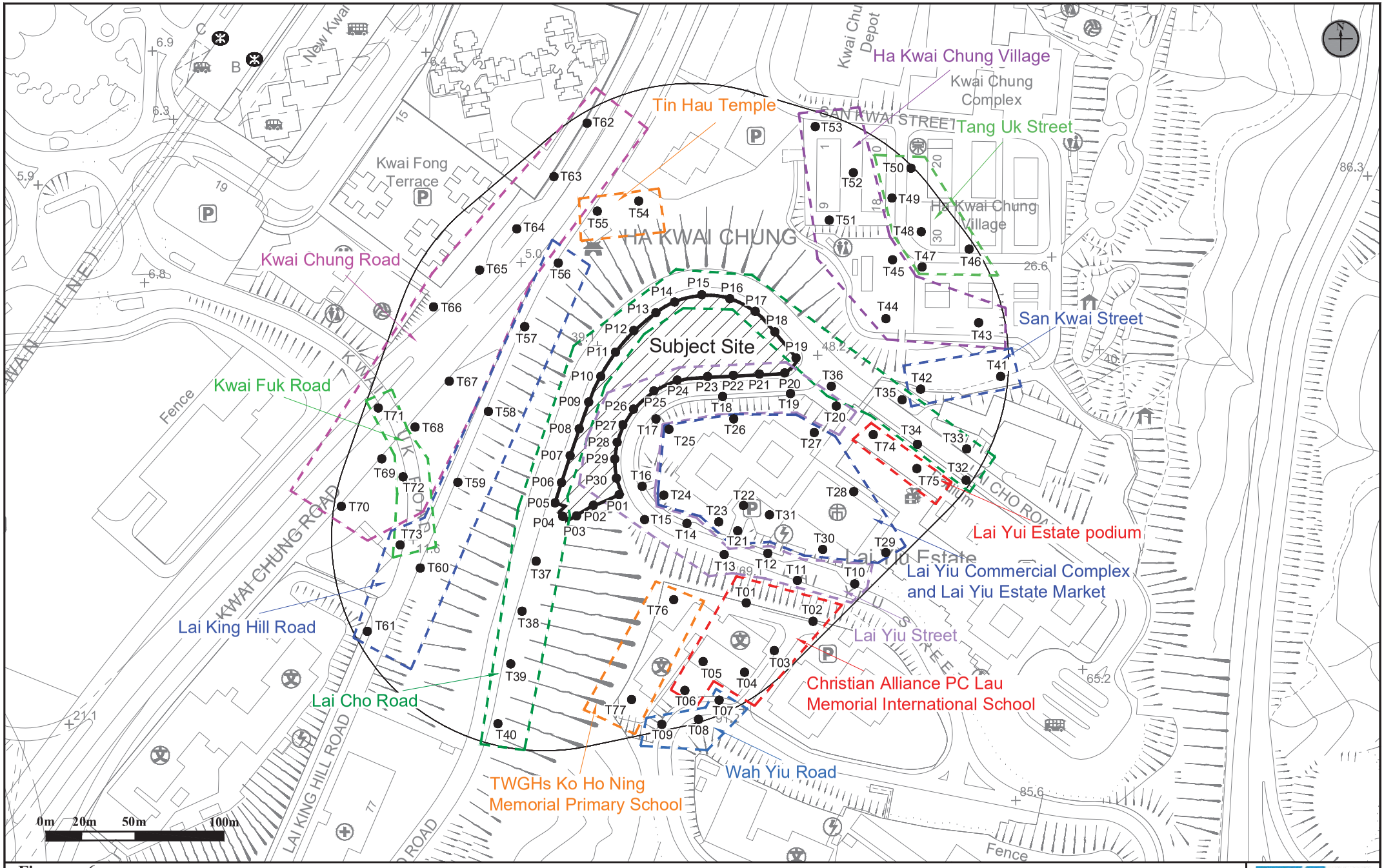

Figure: 6	RAMBOLL ENVIRON
Title: Proposed Test Point Locations	Drawn by: DL
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Project: Section 16 Application for Minor Relaxation of Plot Ratio and Building Height Restrictions in support of Public Housing Development at Lai Cho Road Quantitative Air Ventilation Assessment	Rev.: 1.2
	Date: Feb 2017

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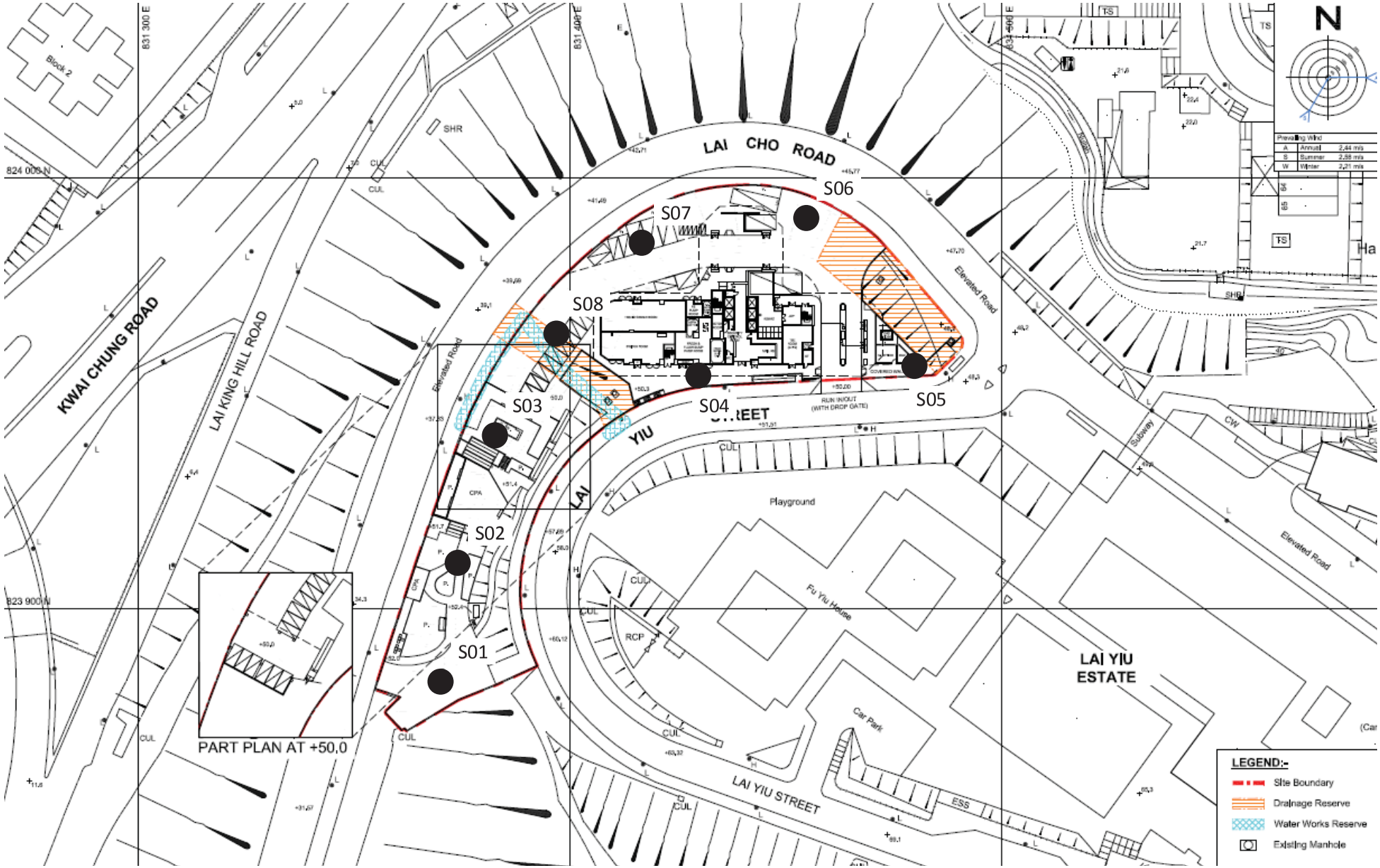

Figure: 6a	RAMBOLL ENVIRON
Title: Proposed Special Test Point Locations for Baseline and Proposed Scheme	Drawn by: DL
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Project: Section 16 Application for Minor Relaxation of Plot Ratio and Building Height Restrictions in support of Public Housing Development at Lai Cho Road Quantitative Air Ventilation Assessment	Rev.: 1.0
	Date: Dec 2016

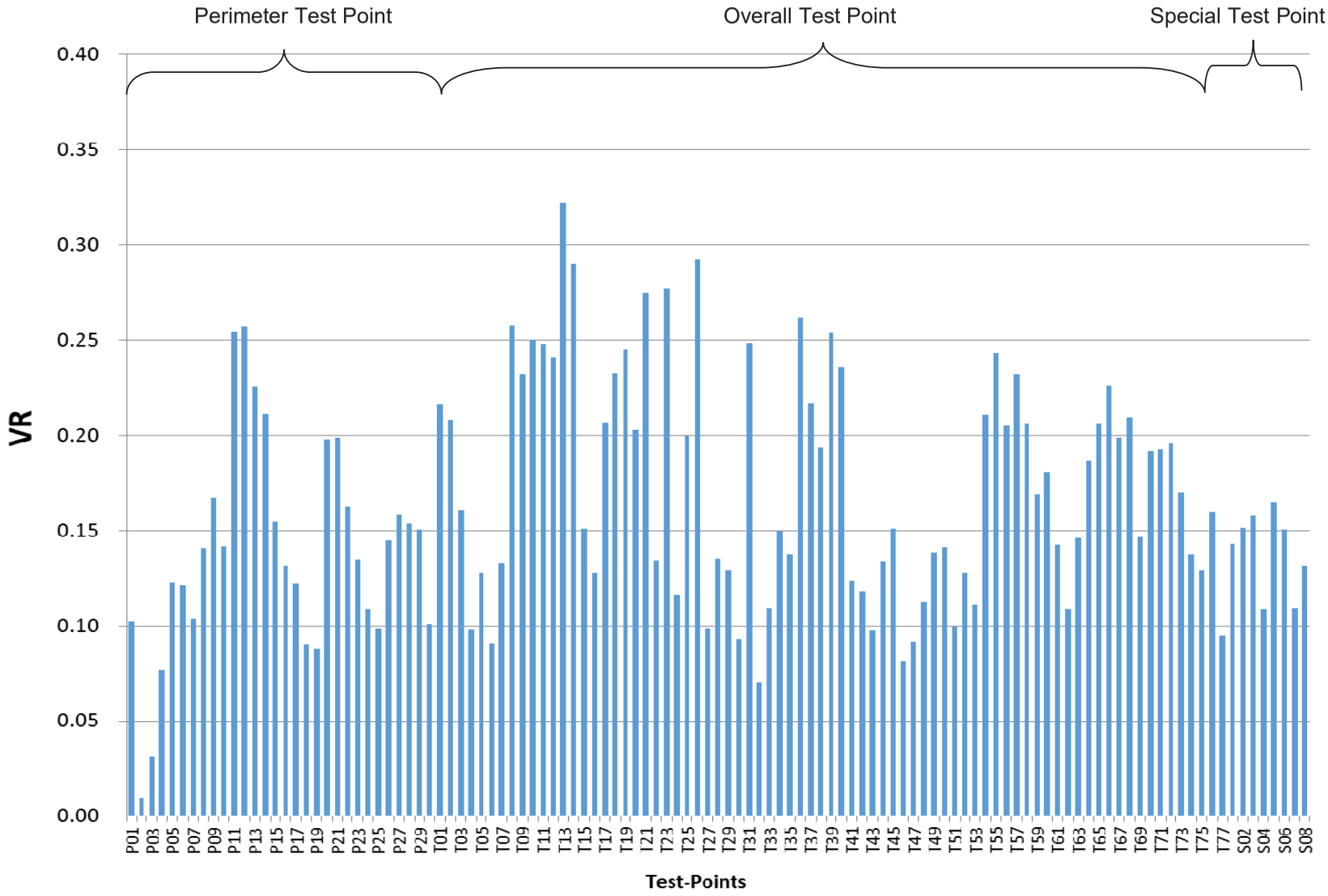

Figure:	7	RAMBOLL ENVIRON
Title:	Wind Velocity Ratio of the Baseline Scheme (Annual)	Drawn by: DL Checked by: CC
Project:	Section 16 Application for Minor Relaxation of Plot Ratio and Building Height Restrictions in support of Public Housing Development at Lai Cho Road Quantitative Air Ventilation Assessment	Rev.: 1.3 Date: March 2017

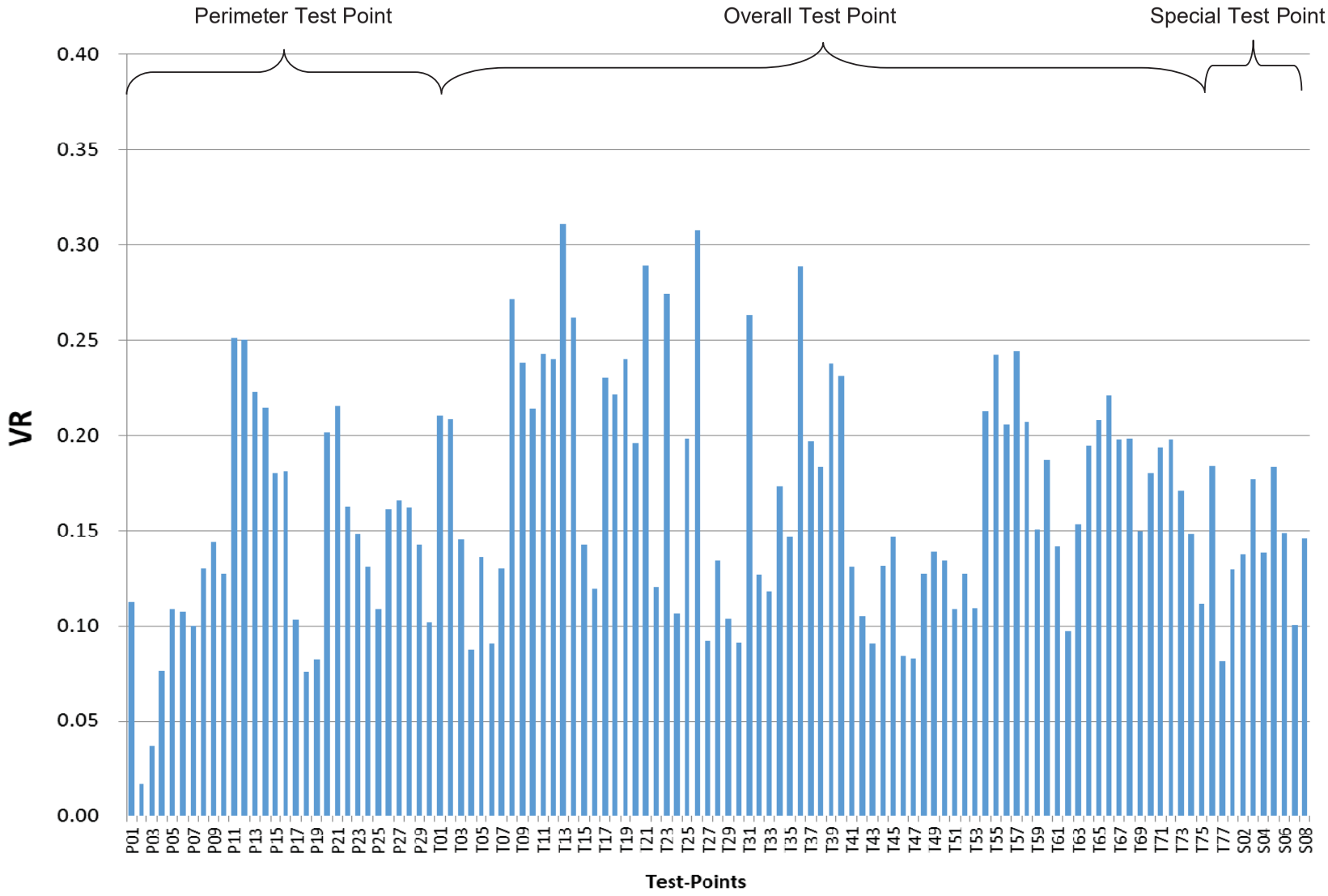

Figure:	8	RAMBOLL ENVIRON
Title:	Wind Velocity Ratio of the Proposed Scheme (Annual)	Drawn by: DL Checked by: CC
Project:	Section 16 Application for Minor Relaxation of Plot Ratio and Building Height Restrictions in support of Public Housing Development at Lai Cho Road Quantitative Air Ventilation Assessment	Rev.: 1.3 Date: March 2017

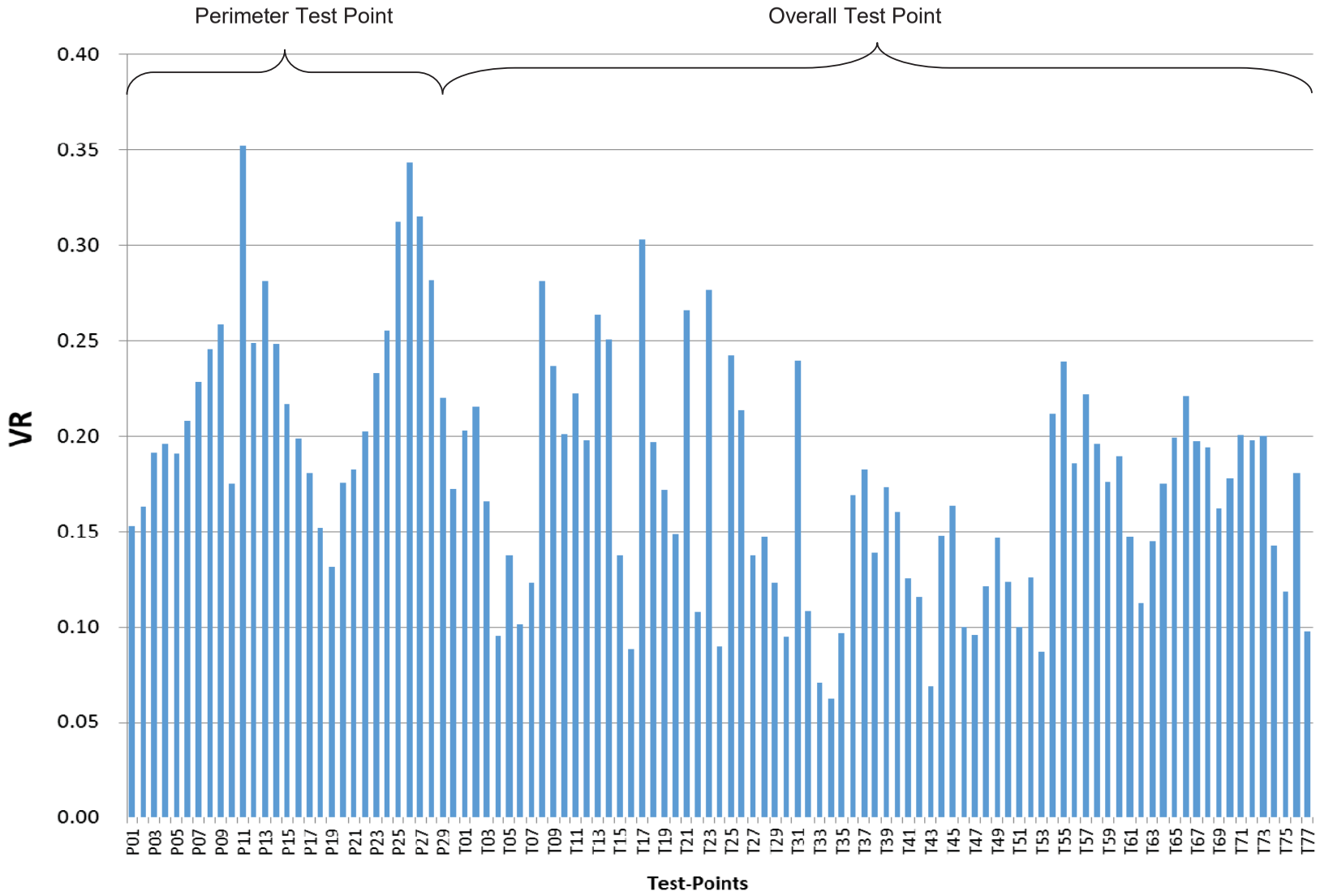

Figure:	9	RAMBOLL ENVIRON
Title:	Wind Velocity Ratio of the Existing Scenario (Annual)	Drawn by: DL Checked by: CC
Project:	Section 16 Application for Minor Relaxation of Plot Ratio and Building Height Restrictions in support of Public Housing Development at Lai Cho Road Quantitative Air Ventilation Assessment	Rev.: 1.3 Date: March 2017

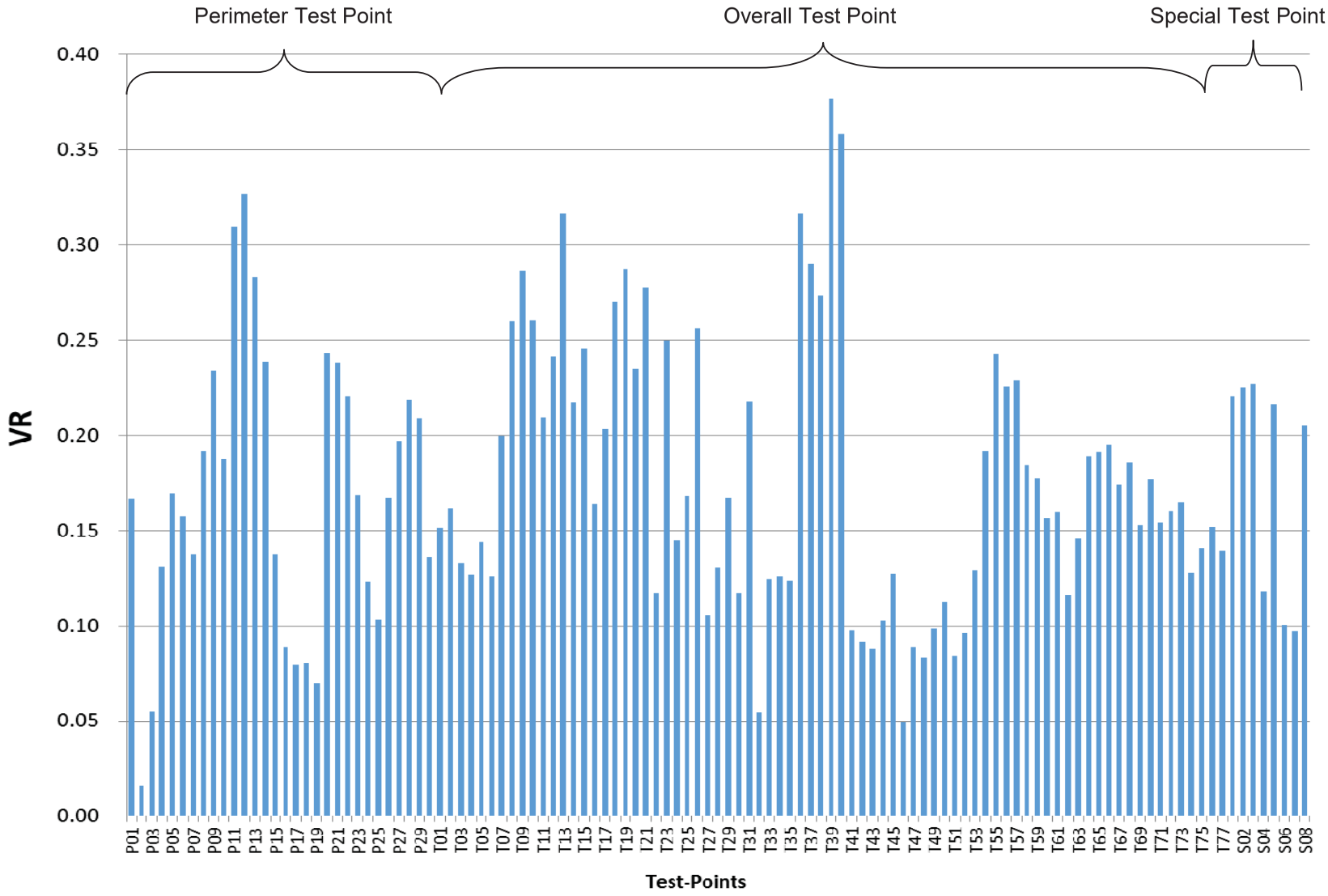

Figure:	10	RAMBOLL ENVIRON
Title:	Wind Velocity Ratio of the Baseline Scheme (Summer)	Drawn by: DL Checked by: CC
Project:	Section 16 Application for Minor Relaxation of Plot Ratio and Building Height Restrictions in support of Public Housing Development at Lai Cho Road Quantitative Air Ventilation Assessment	Rev.: 1.3 Date: March 2017

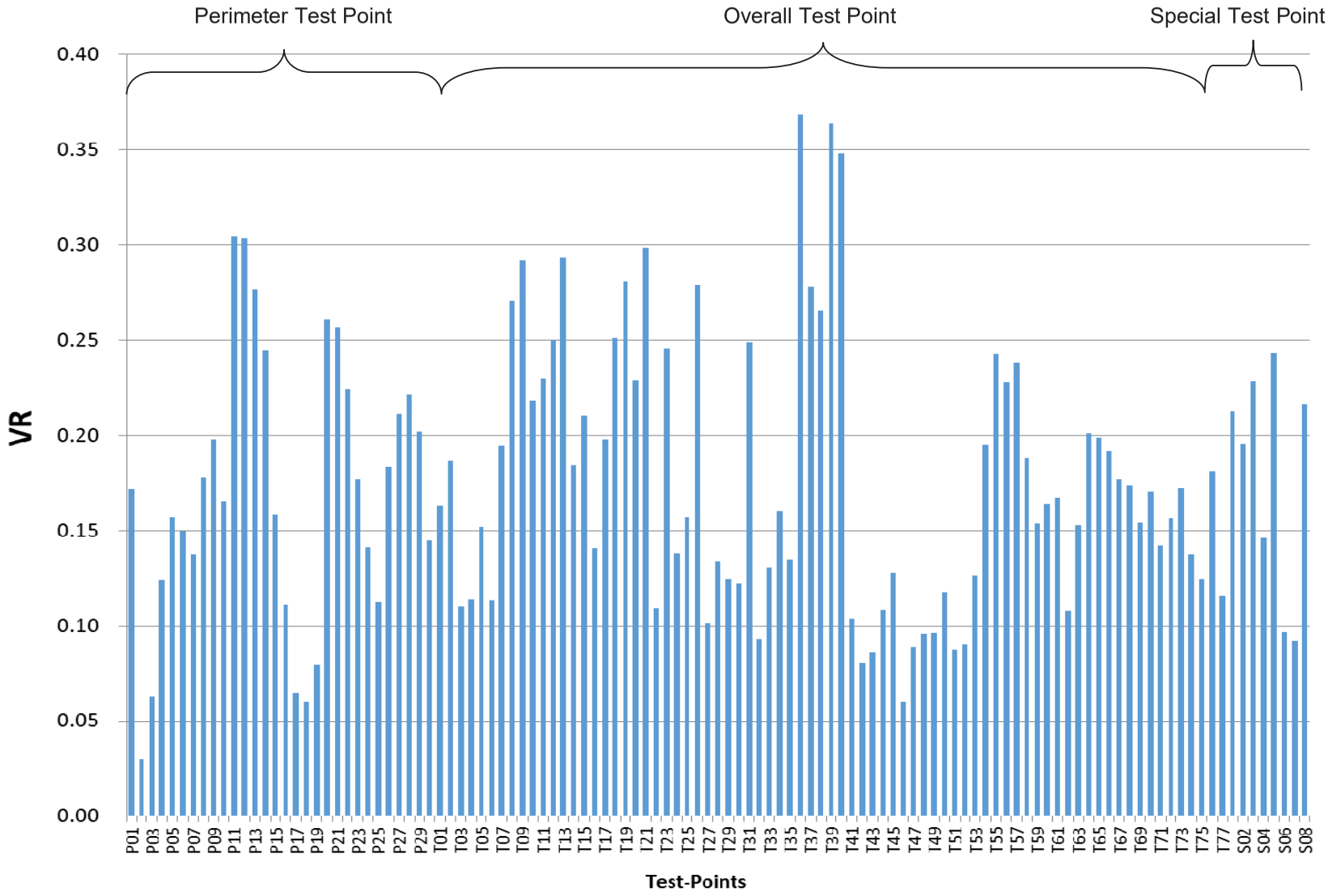

Figure:	11	RAMBOLL ENVIRON
Title:	Wind Velocity Ratio of the Proposed Scheme (Summer)	Drawn by: DL Checked by: CC
Project:	Section 16 Application for Minor Relaxation of Plot Ratio and Building Height Restrictions in support of Public Housing Development at Lai Cho Road Quantitative Air Ventilation Assessment	Rev.: 1.3 Date: March 2017

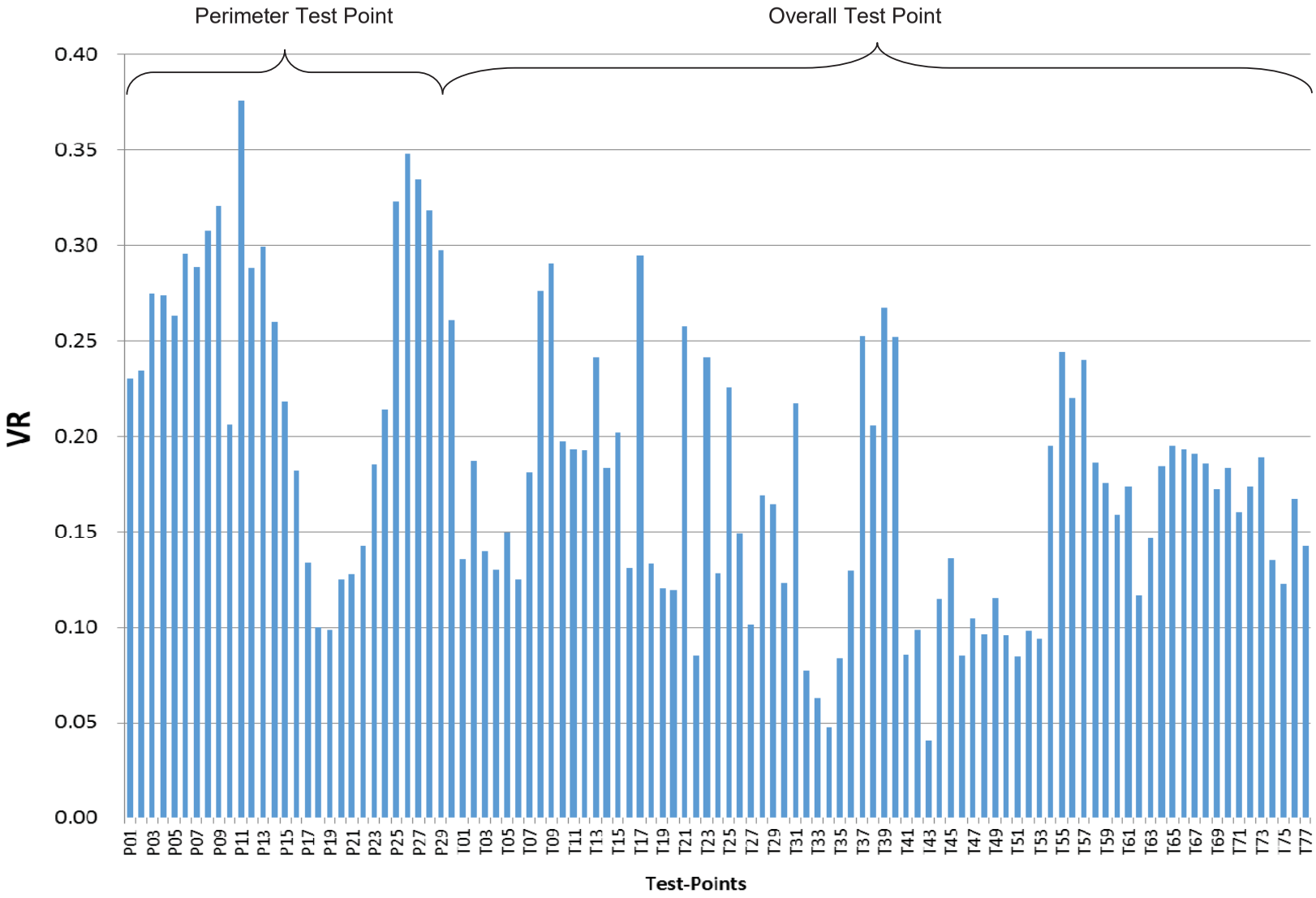

Figure:	12	RAMBOLL ENVIRON
Title:	Wind Velocity Ratio of the Existing Scenario (Summer)	Drawn by: DL
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Project:	Section 16 Application for Minor Relaxation of Plot Ratio and Building Height Restrictions in support of Public Housing Development at Lai Cho Road Quantitative Air Ventilation Assessment	Rev.: 1.3
		Date: March 2017

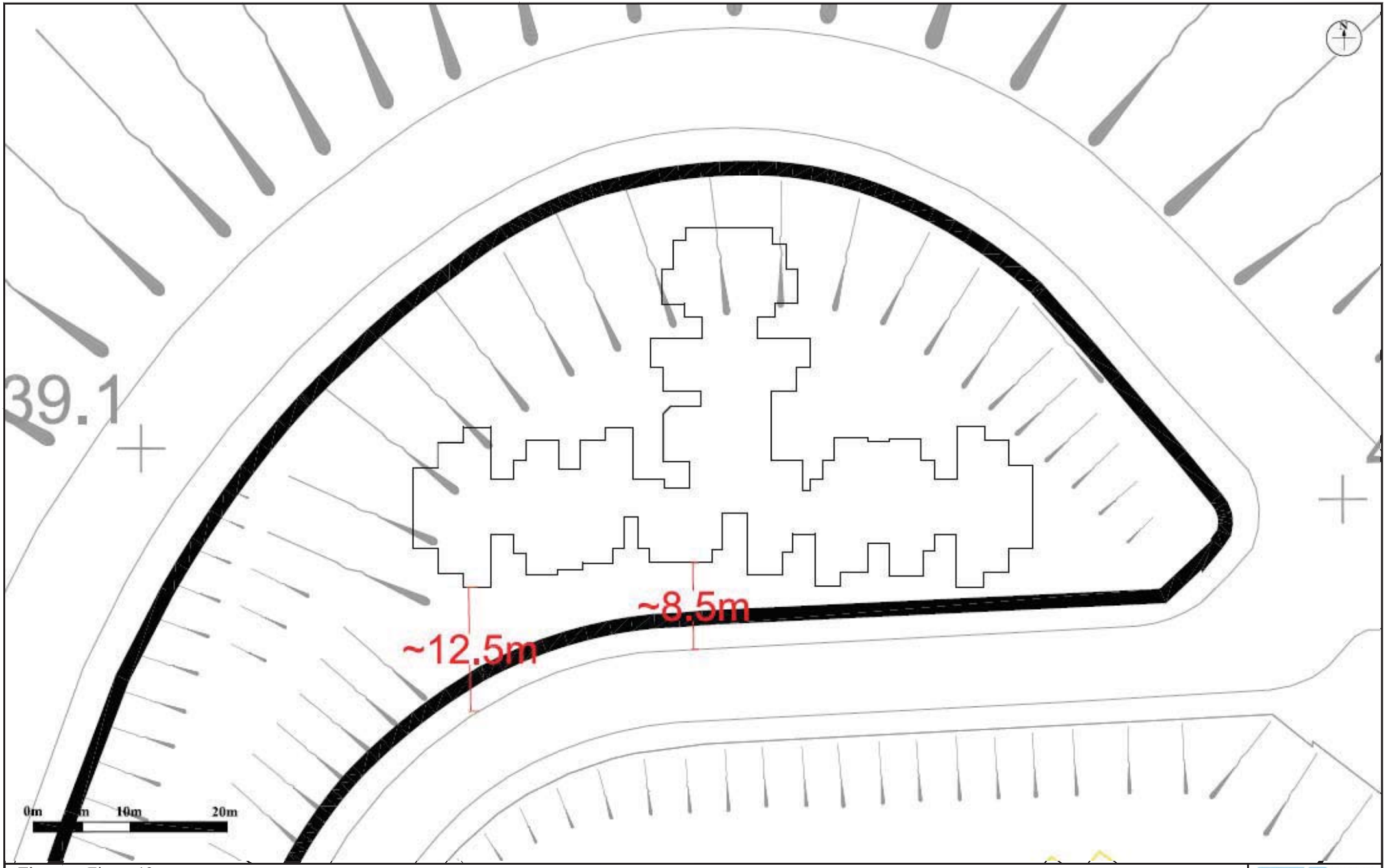

Figure: Figure 13	RAMBOLL ENVIRON
Title: Setback Line from typical floor of the Baseline and Proposed Schemes	Drawn by: DL Checked by: CC
Project: Section 16 Application for Minor Relaxation of Plot Ratio and Building Height Restrictions in support of Public Housing Development at Lai Cho Road Quantitative Air Ventilation Assessment	Rev.: 1.0 Date: Dec 2016

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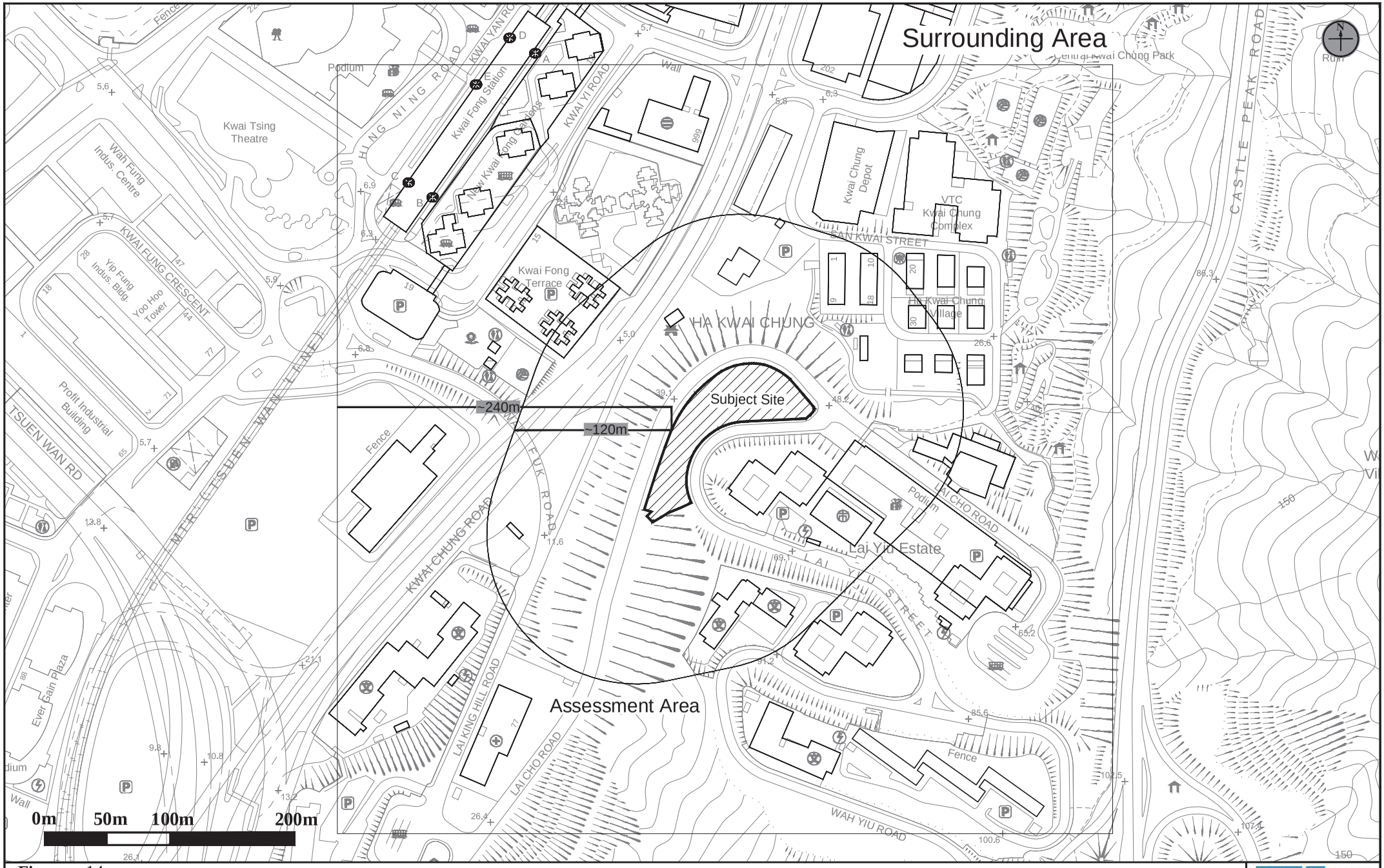

Figure: 14	RAMBOLL ENVIRON
Title: Extent of Assessment Area and Surrounding Area for CFD Simulation	Drawn by: DL
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Project: Section 16 Application for Minor Relaxation of Plot Ratio and Building Height Restrictions in support of Public Housing Development at Lai Cho Road Quantitative Air Ventilation Assessment	Rev.: 1.2
	Date: Feb 2017

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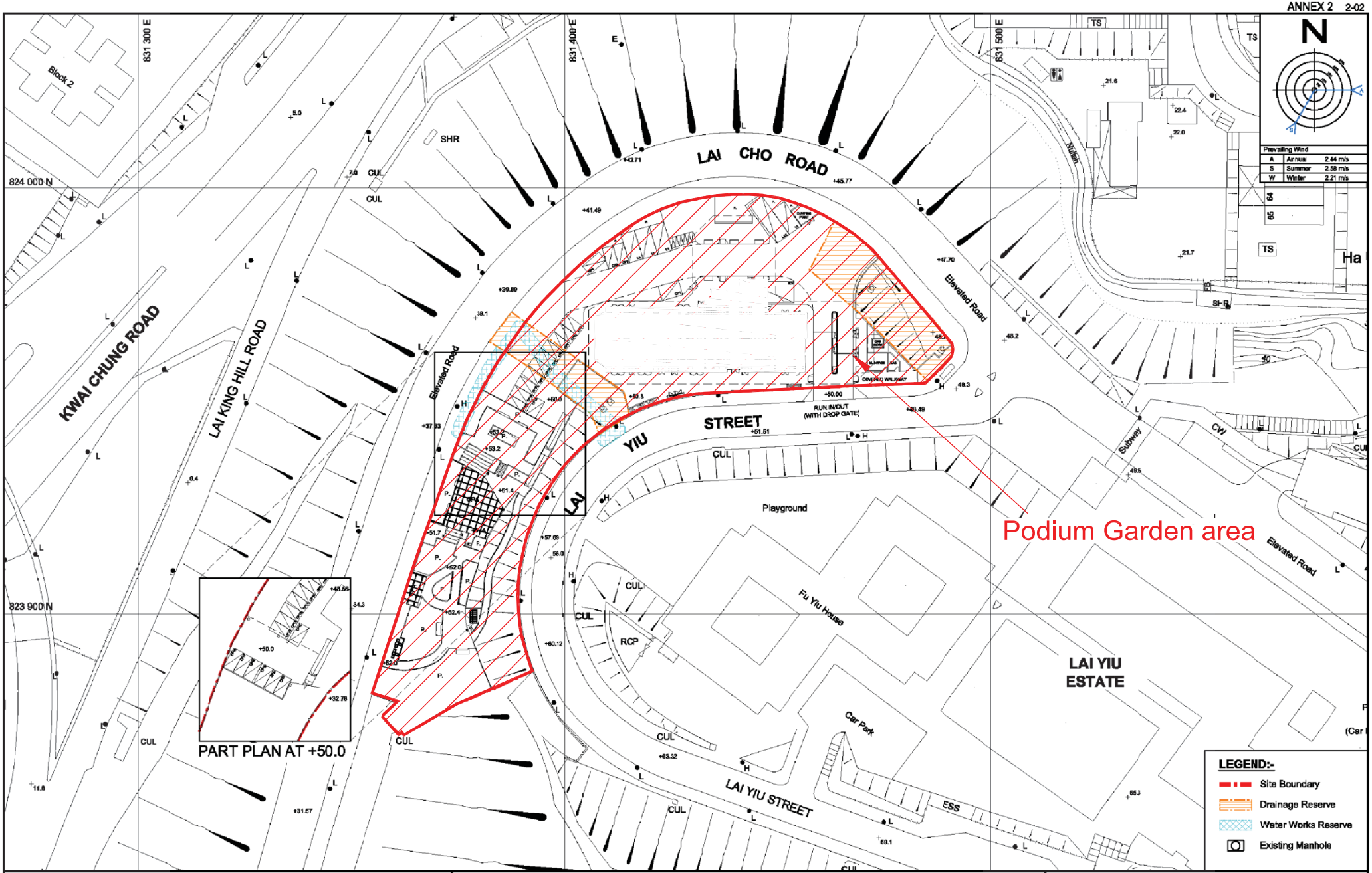
APPENDIX A:
LAYOUT OF BASELINE SCHEME



PROPOSED PUBLIC RENTAL HOUSING AT LAI CHO ROAD, KWAI CHUNG

DRAWING TITLE

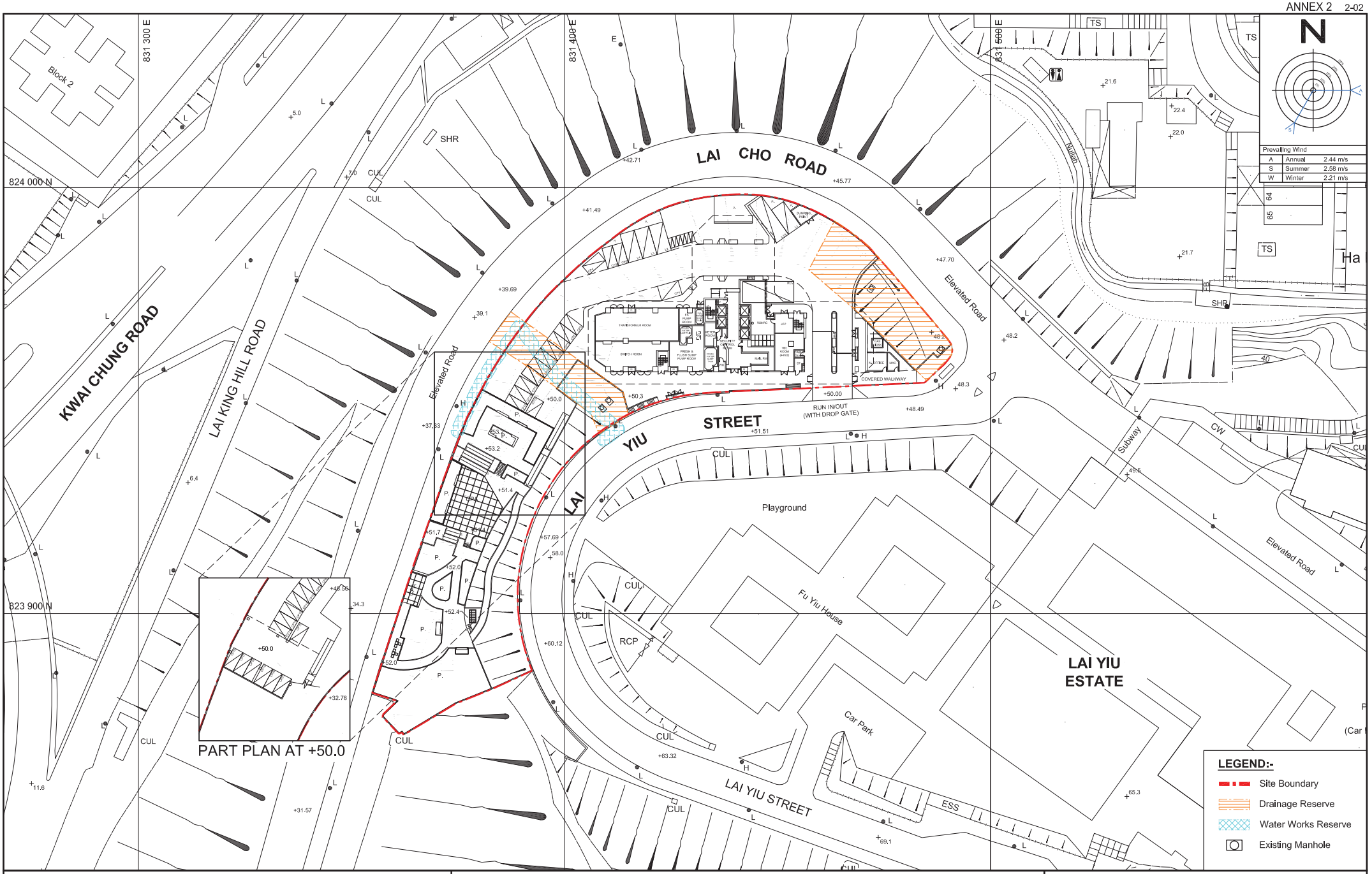
SITE LAYOUT PLAN

1:400 (A1) 1:800 (A3)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO. KS20/A/BC/LO-03

日期 DATE: 17. 11. 2016



PROPOSED PUBLIC RENTAL HOUSING AT LAI CHO ROAD, KWAI CHUNG

DRAWING TITLE

SITE LAYOUT PLAN

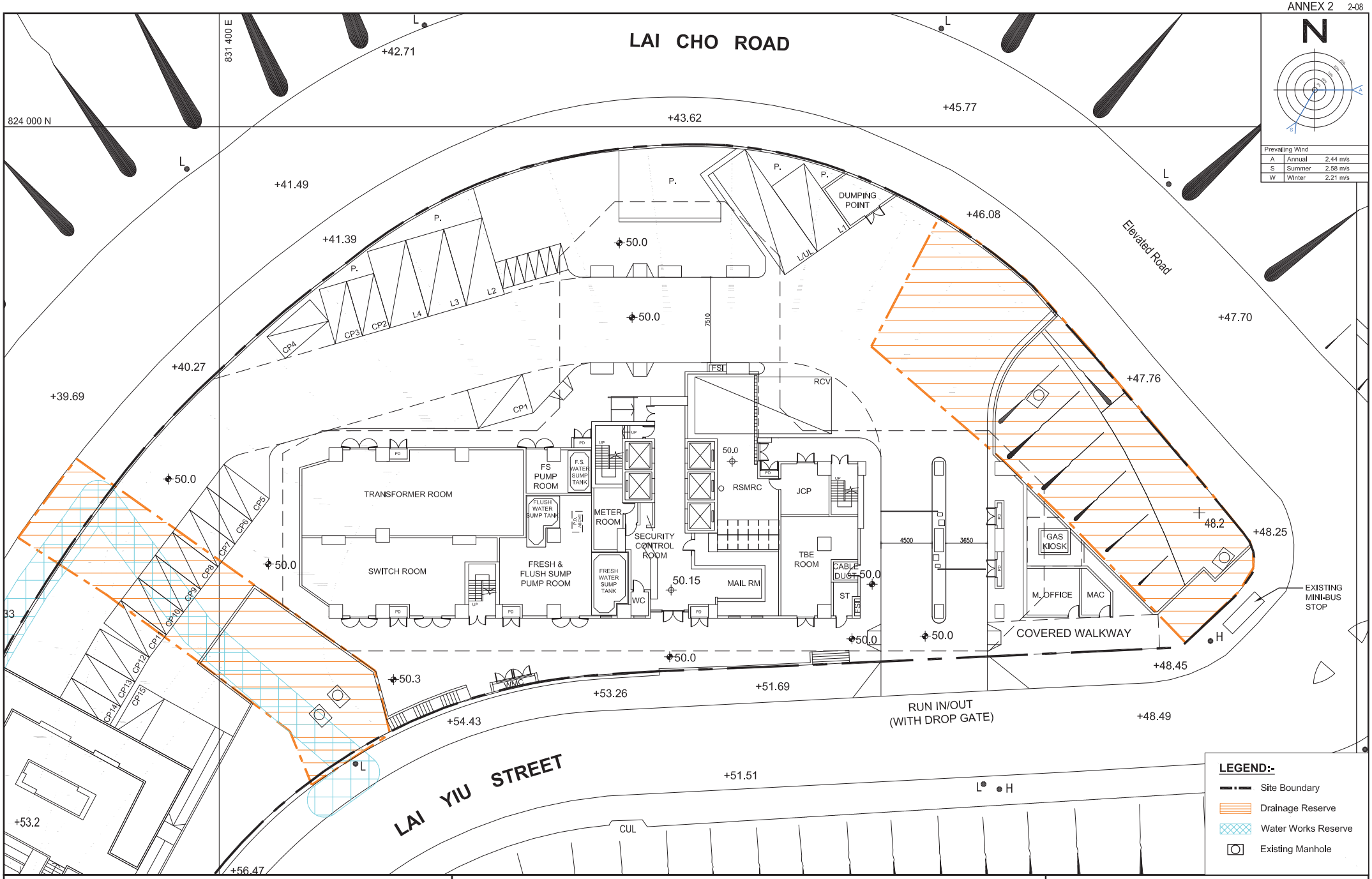
1:400 (A1) 1:800 (A3)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO. KS20/A/BC/LO-03

日期 DATE: 17. 11. 2016

ANNEX 2 2-08



PROPOSED PUBLIC RENTAL HOUSING AT LAI CHO ROAD, KWAI CHUNG

DRAWING TITLE

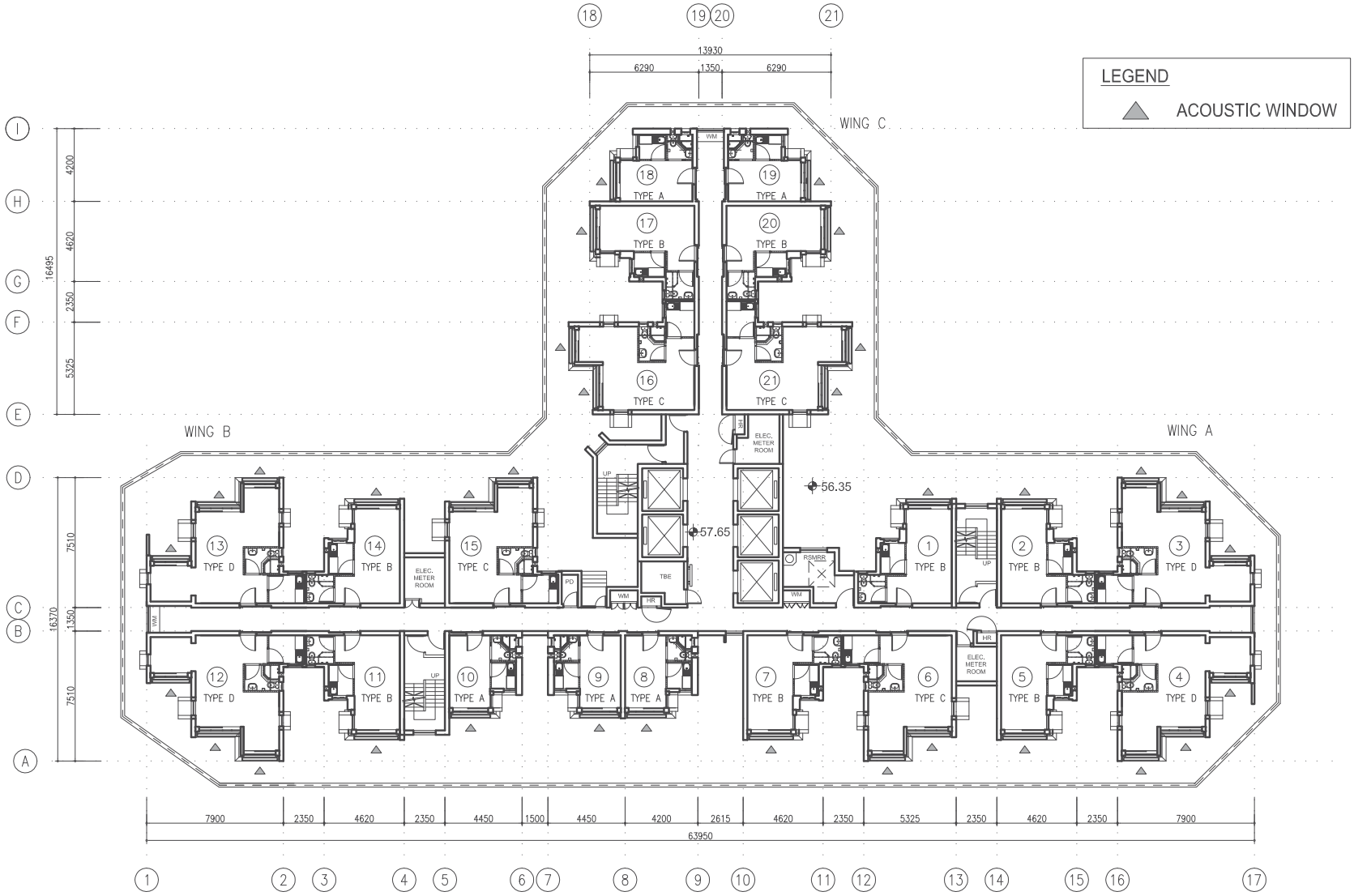
GROUND FLOOR PLAN

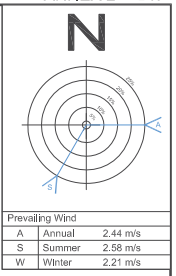
SCALE 1:150 (A1) 1:300 (A3)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO. KS20/A/BC/LO-09

日期 DATE: 17.11. 2016





PROPOSED PUBLIC RENTAL HOUSING AT LAI CHO ROAD, KWAI CHUNG

DRAWING TITLE

FIRST FLOOR PLAN

SCALE 1:125 (A1) 1:250 (A3)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO. KS20/A/BC/LO-10

日期 DATE: 17. 11. 2016

FLAT TYPE	A	B	C	D
NOS. OF FLAT	5	8	4	4
FLAT MIX (%)	23.8	38.1	19.0	19.0
STD. FLAT MIX (%)	22.8	38.2	18.9	20.1

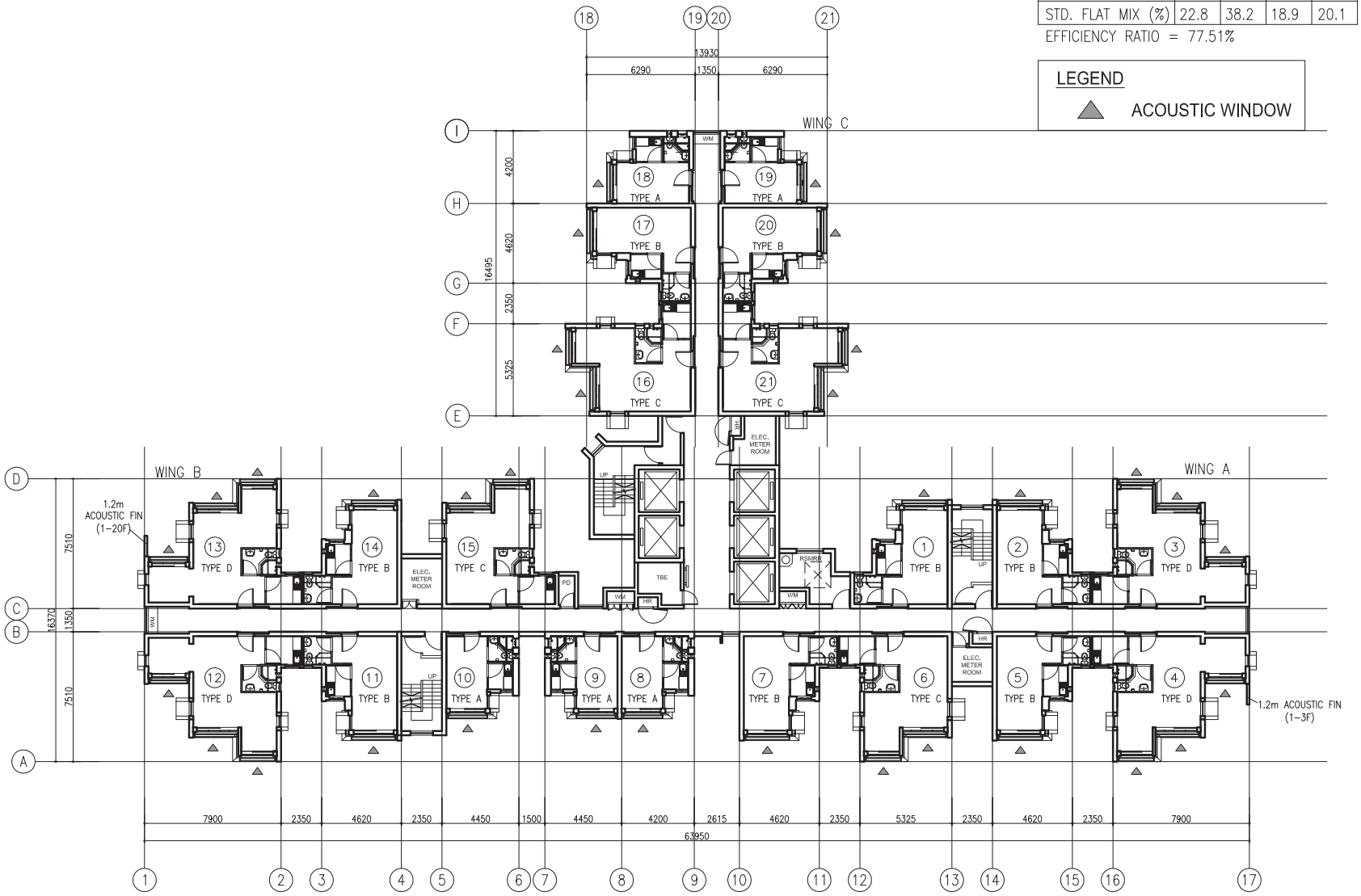
EFFICIENCY RATIO = 77.51%

LEGEND

▲ ACOUSTIC WINDOW

N

Prevailing Wind		
A	Annual	2.44 m/s
S	Summer	2.58 m/s
W	Winter	2.21 m/s



PROPOSED PUBLIC RENTAL HOUSING AT LAI CHO ROAD, KWAI CHUNG

DRAWING TITLE

TYPICAL FLOOR PLAN(F2-F31)

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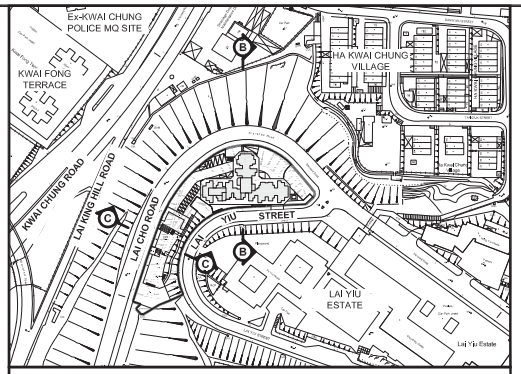
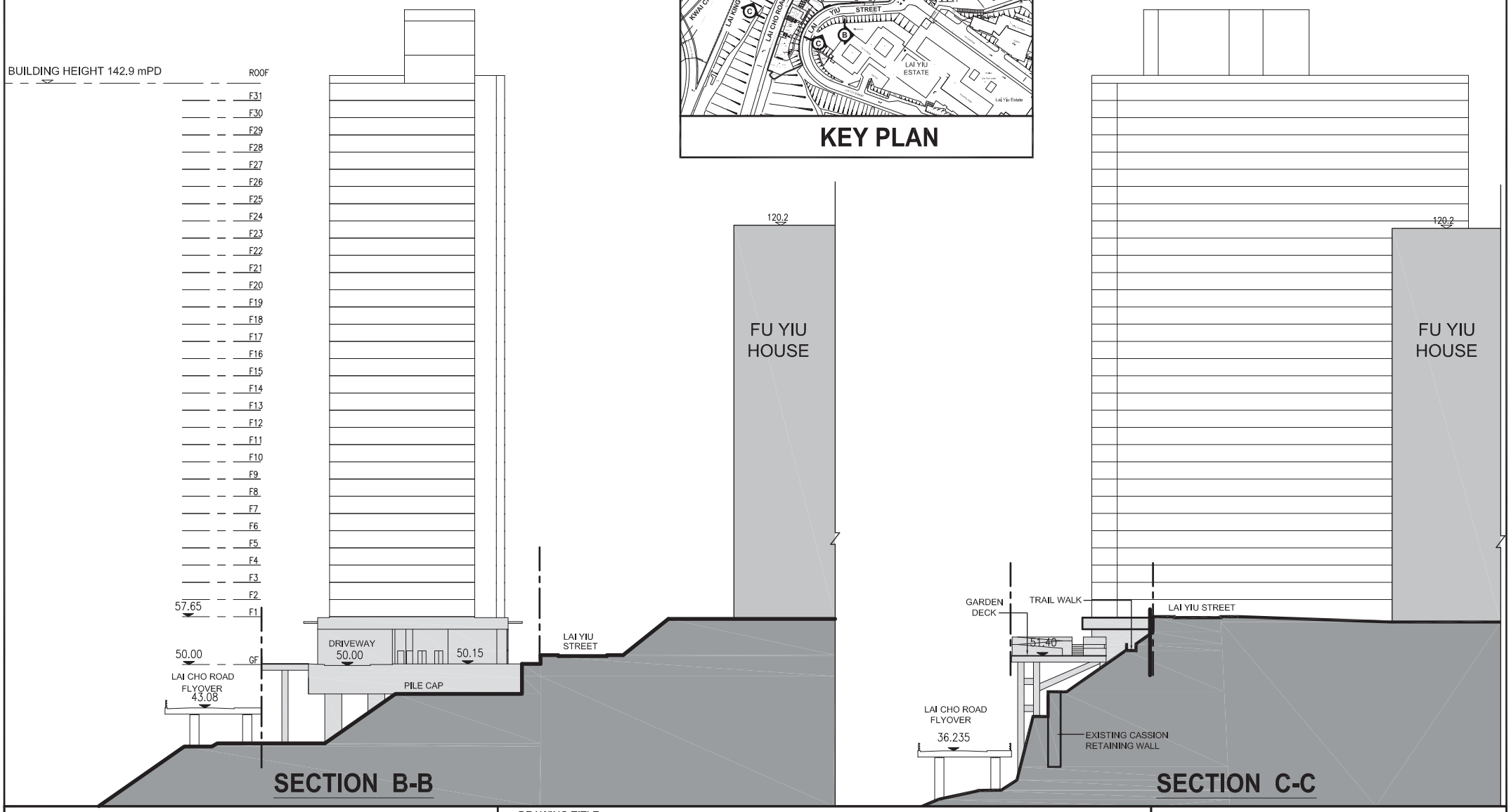
房 屋 署
HOUSING DEPARTMENT

DRAWING NO. KS20/A/BC/LO-111

日期 DATE: 6. 2. 2017





PROPOSED PUBLIC RENTAL HOUSING DEVELOPMENT AT LAI CHO ROAD, KWAI CHUNG

DRAWING TITLE

SITE SECTION (1)

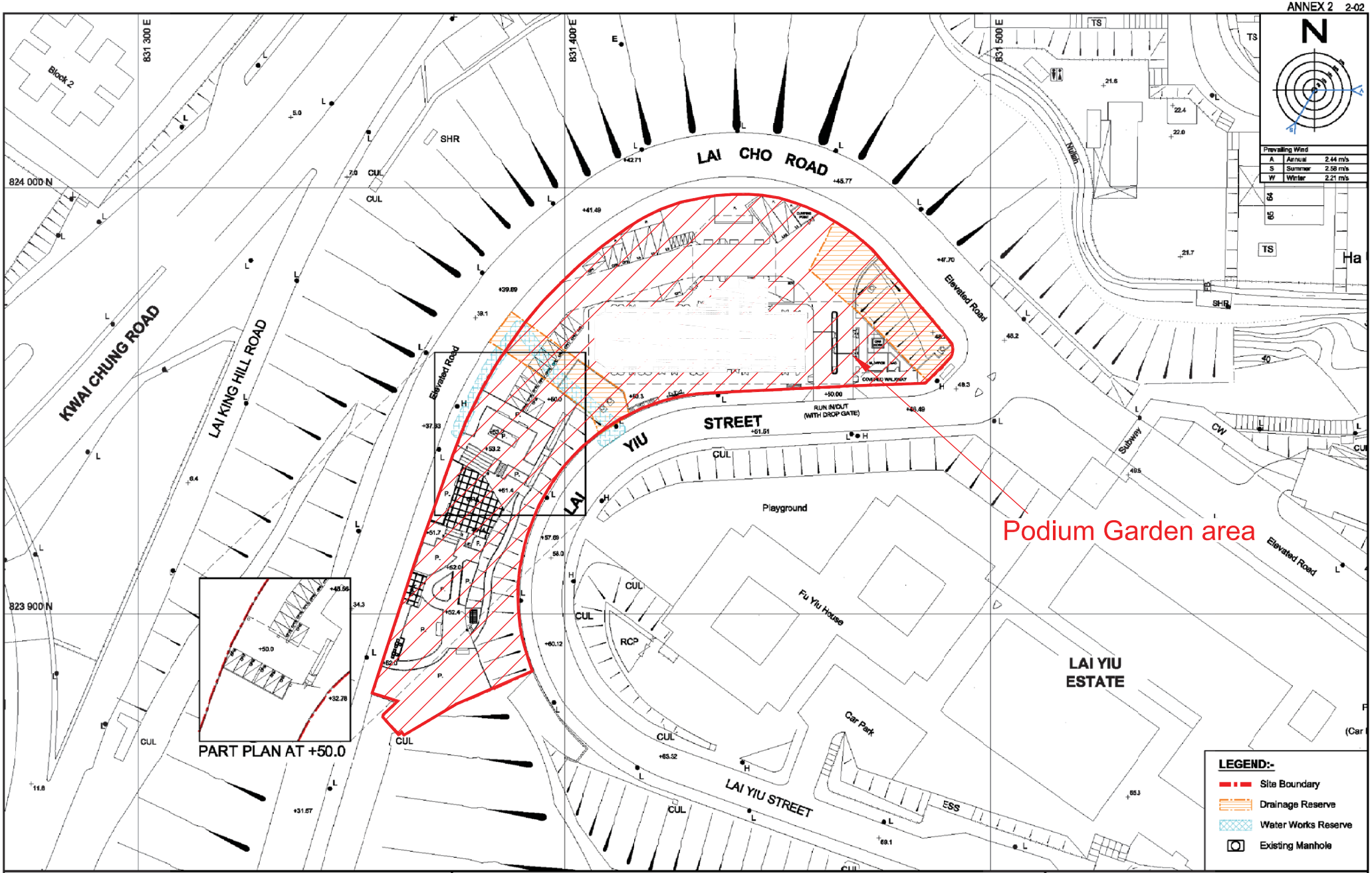
SCALE 1:300 (A1) 1:600 (A3)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO. KS20/A/SPC/LO-071

日期 DATE: 6.2.2017

APPENDIX B:
LAYOUT OF PROPOSED SCHEME



PROPOSED PUBLIC RENTAL HOUSING AT LAI CHO ROAD, KWAI CHUNG

DRAWING TITLE

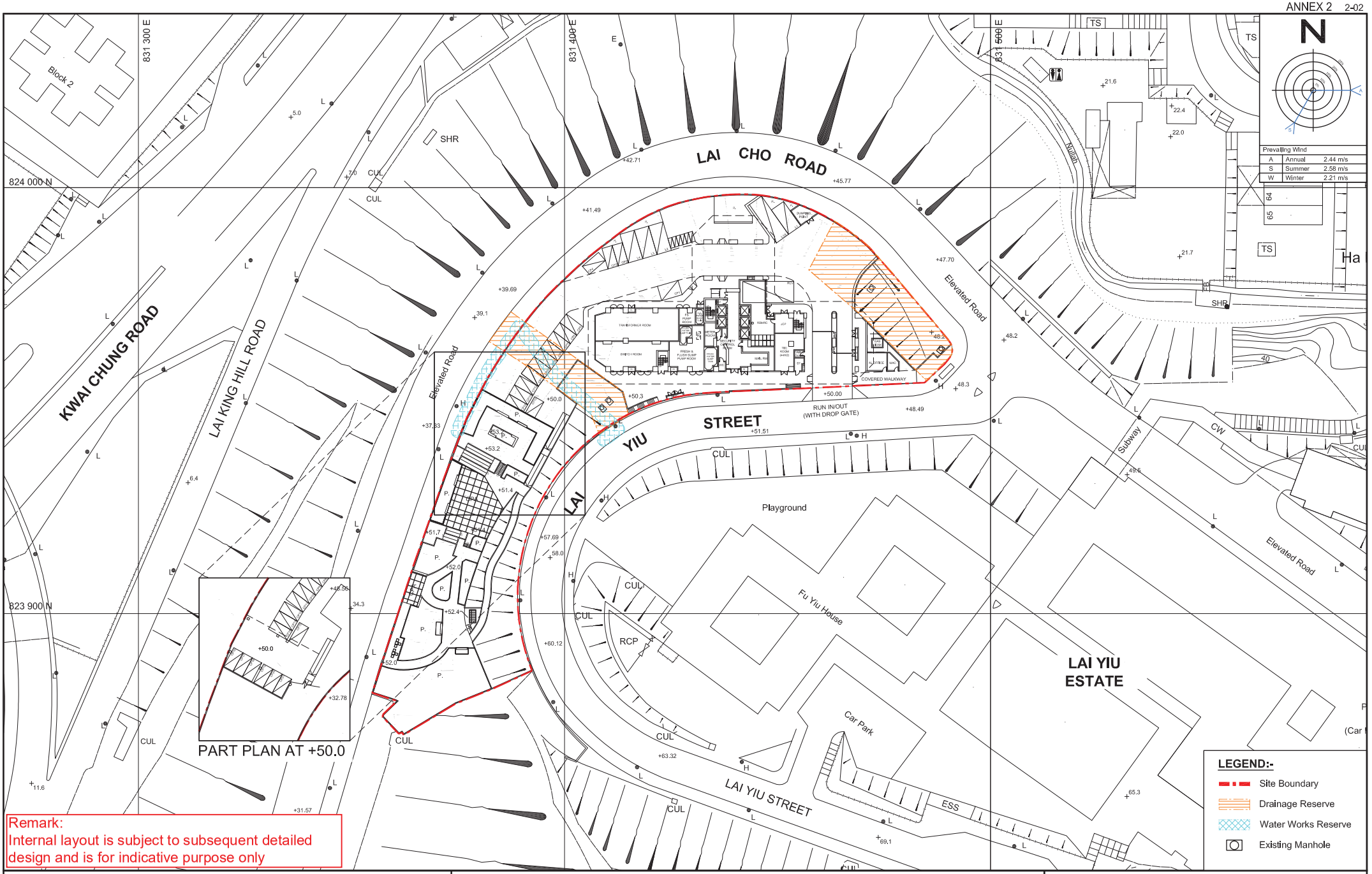
SITE LAYOUT PLAN

1:400 (A1) 1:800 (A3)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO. KS20/A/BC/LO-03

日期 DATE: 17. 11. 2016



Remark:
Internal layout is subject to subsequent detailed design and is for indicative purpose only

PROPOSED PUBLIC RENTAL HOUSING AT LAI CHO ROAD, KWAI CHUNG

DRAWING TITLE

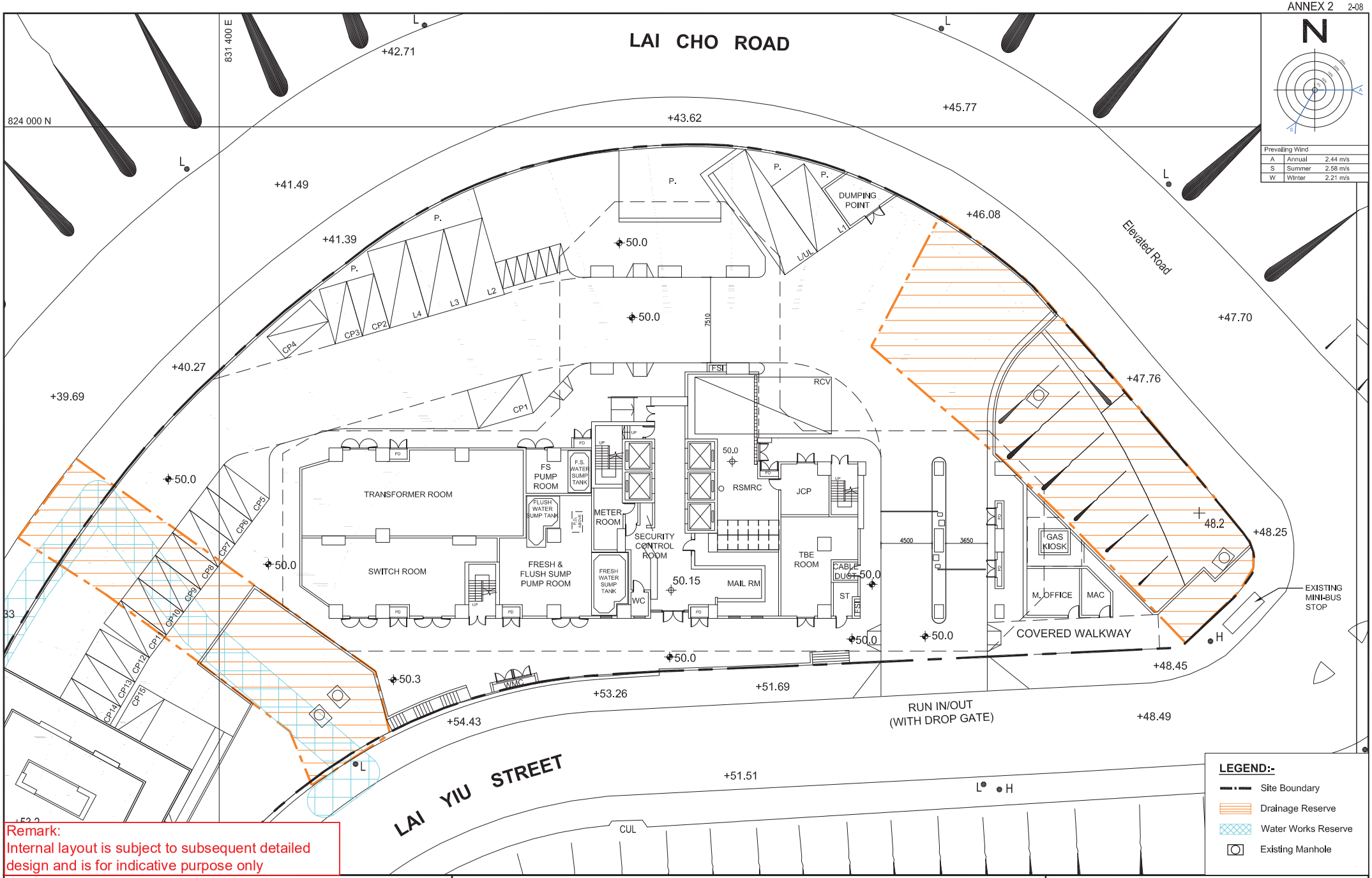
SITE LAYOUT PLAN

1:400 (A1) 1:800 (A3)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO. KS20/A/BC/LO-03

日期 DATE: 17. 11. 2016



N

Prevailing Wind

A	Annual	2.44 m/s
S	Summer	2.58 m/s
W	Winter	2.21 m/s

LEGEND:-

- Site Boundary
- Drainage Reserve
- Water Works Reserve
- Existing Manhole

Remark:
Internal layout is subject to subsequent detailed design and is for indicative purpose only

PROPOSED PUBLIC RENTAL HOUSING AT LAI CHO ROAD, KWAI CHUNG

DRAWING TITLE

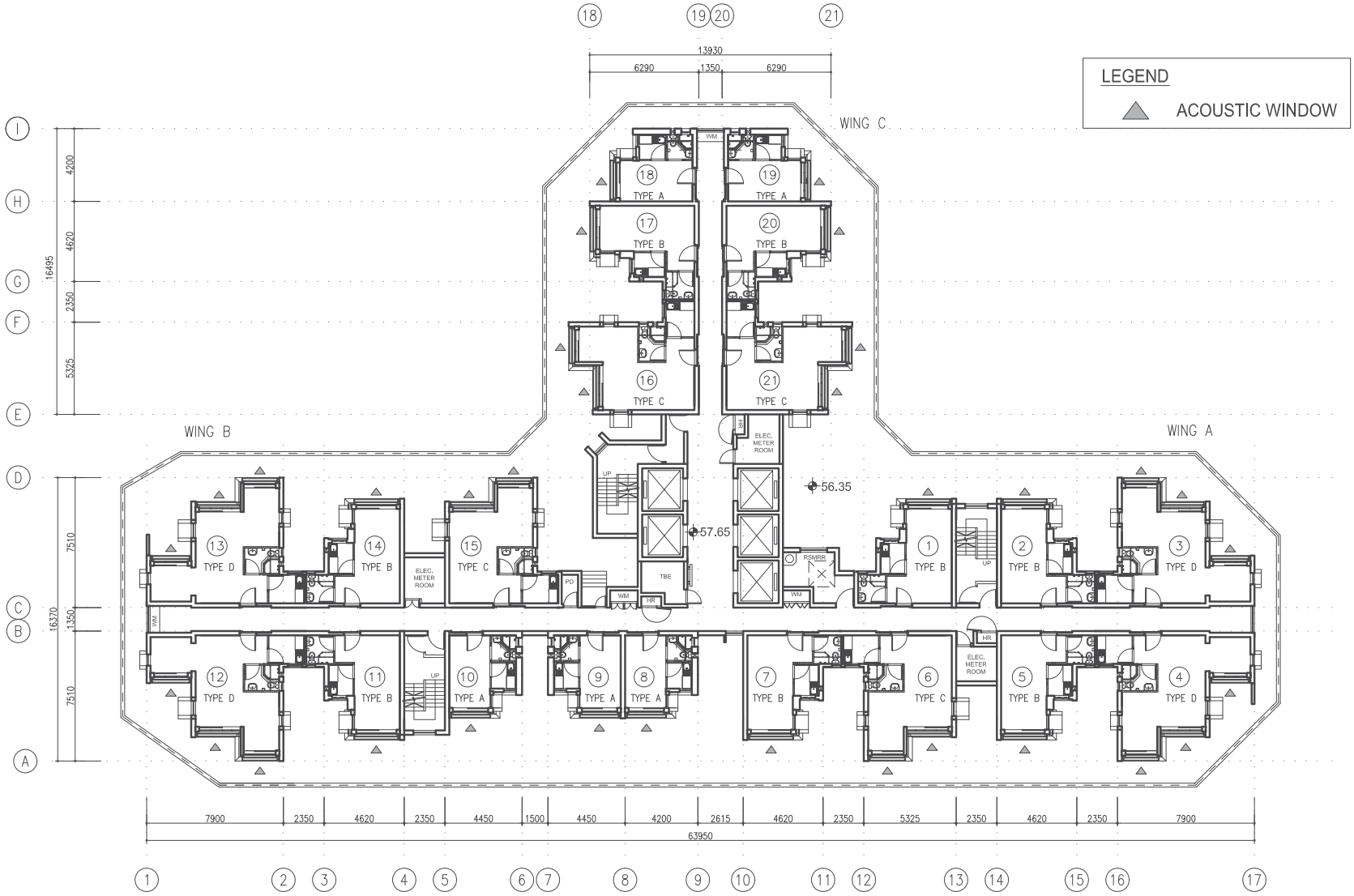
GROUND FLOOR PLAN

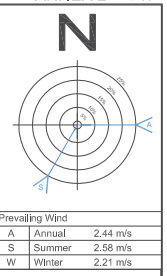
SCALE 1:150 (A1) 1:300 (A3)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO. KS20/A/BC/LO-09

日期 DATE: 17.11. 2016





Remark:
Internal layout is subject to subsequent detailed design and is for indicative purpose only

PROPOSED PUBLIC RENTAL HOUSING AT LAI CHO ROAD, KWAI CHUNG

DRAWING TITLE

FIRST FLOOR PLAN

SCALE 1:125 (A1) 1:250 (A3)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO. KS20/A/BC/LO-10

日期 DATE: 17. 11. 2016

FLAT TYPE	A	B	C	D
NOS. OF FLAT	5	8	4	4
FLAT MIX (%)	23.8	38.1	19.0	19.0
STD. FLAT MIX (%)	22.8	38.2	18.9	20.1

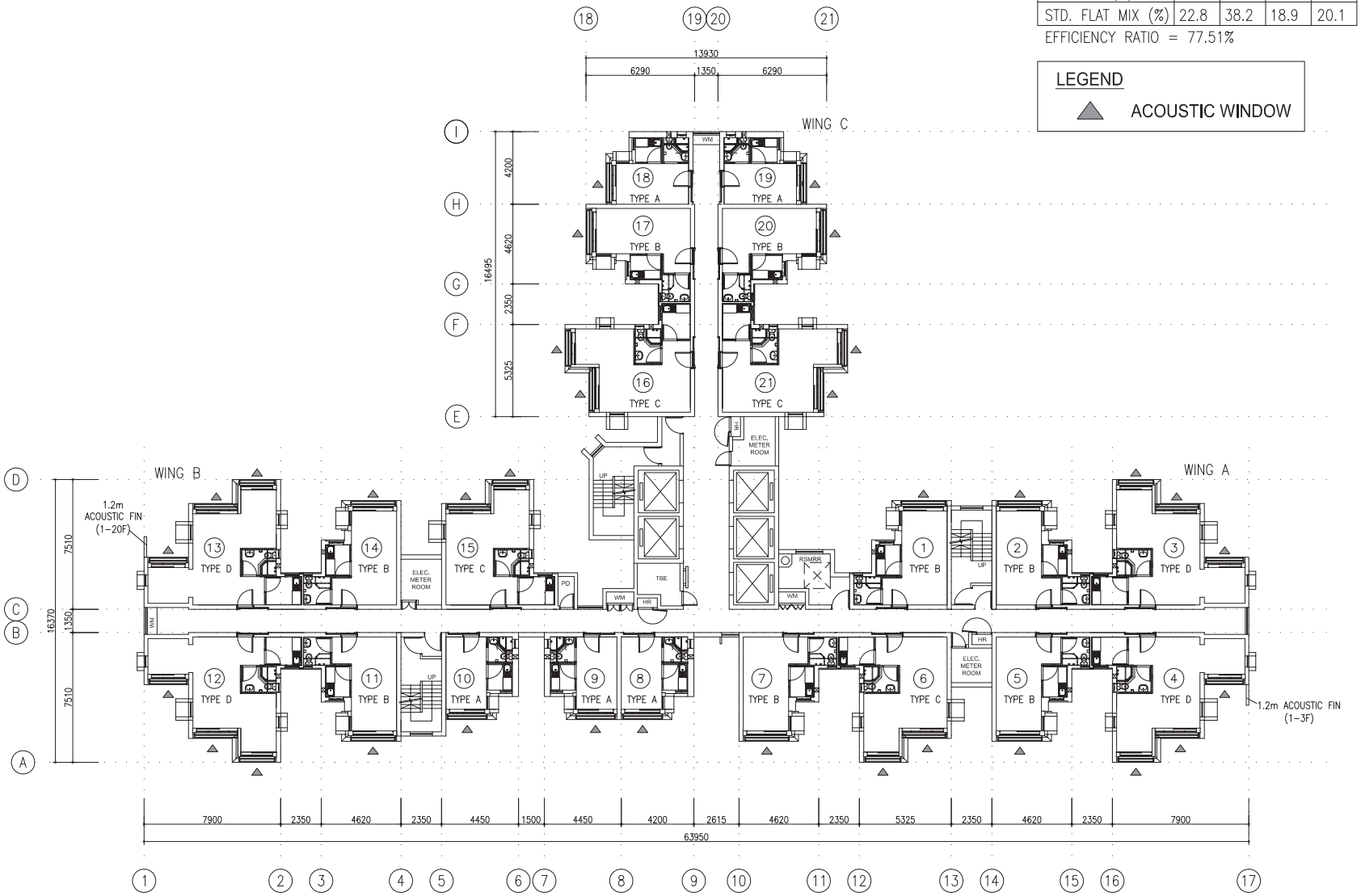
EFFICIENCY RATIO = 77.51%

LEGEND

▲ ACOUSTIC WINDOW

N

Prevailing Wind		
A	Annual	2.44 m/s
S	Summer	2.58 m/s
W	Winter	2.21 m/s



Remark:
Internal layout is subject to subsequent detailed design and is for indicative purpose only

PROPOSED PUBLIC RENTAL HOUSING AT LAI CHO ROAD, KWAI CHUNG

DRAWING TITLE

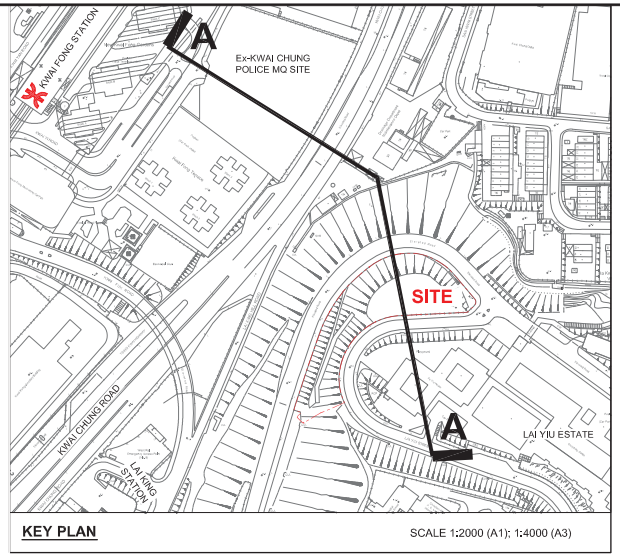
TYPICAL FLOOR PLAN(F2-F39)

SCALE 1:125 (A1) 1:250 (A3)

房 屋 署
HOUSING DEPARTMENT

DRAWING NO. KS20/A/BC/LO-11

日期 DATE: 17. 11. 2016



PROPOSED PUBLIC RENTAL HOUSING DEVELOPMENT AT LAI CHO ROAD, KWAI CHUNG

DRAWING TITLE

SITE SECTION A-A

SCALE 1:400 (A1) 1:800 (A3)

房 屋 署
HOUSING DEPARTMENT

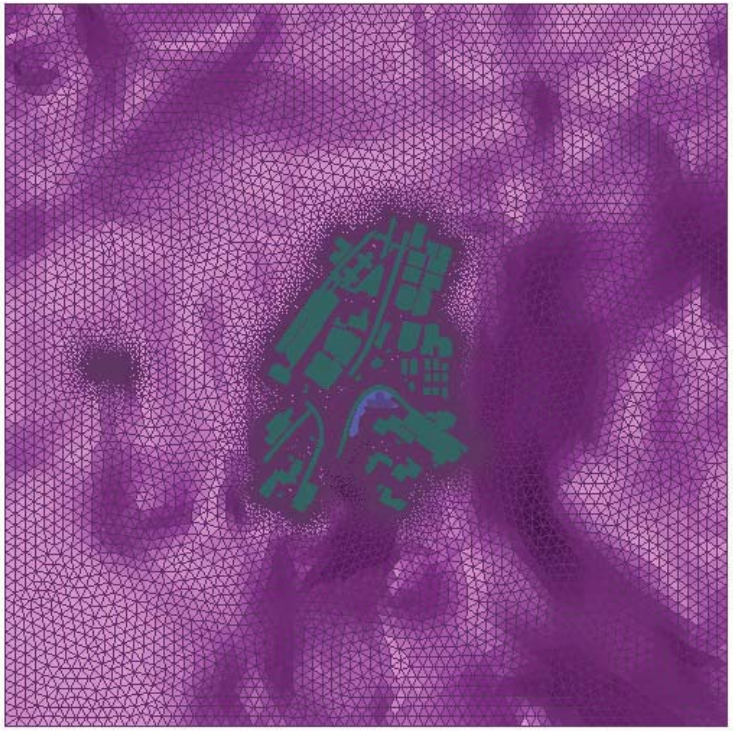
DRAWING NO. KS20/A/SPC/LO-03

日期 DATE: 13. 09. 2016

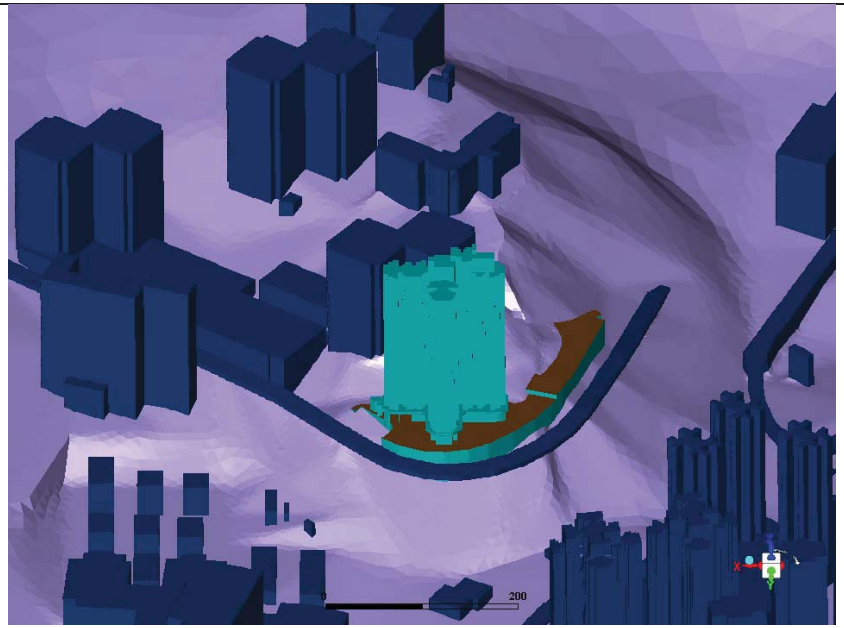
APPENDIX C:
MAP PHOTO OF EXISTING SCENARIO

Existing Scenario of the Subject Site

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

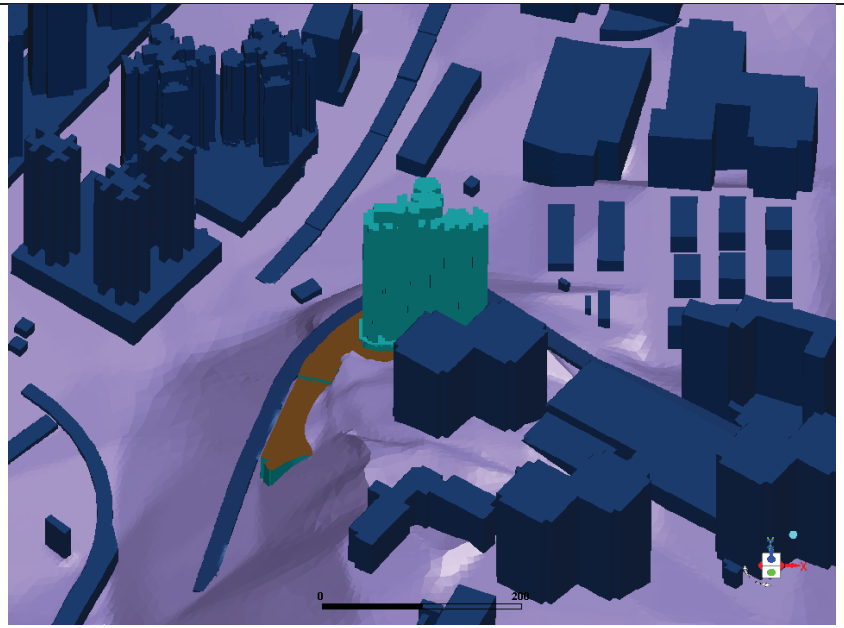


Domain

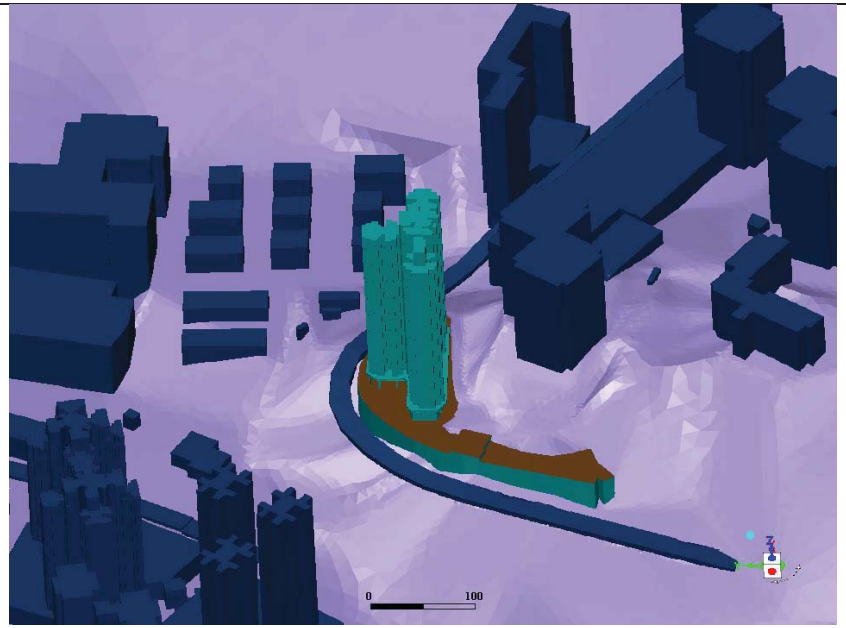


Baseline Scheme - N

Baseline Scheme - E

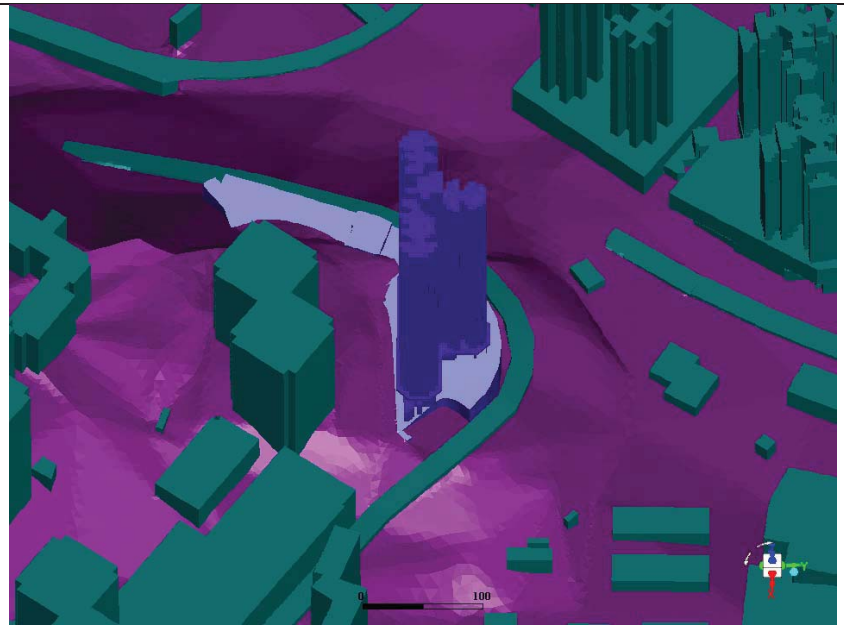


Baseline Scheme - S



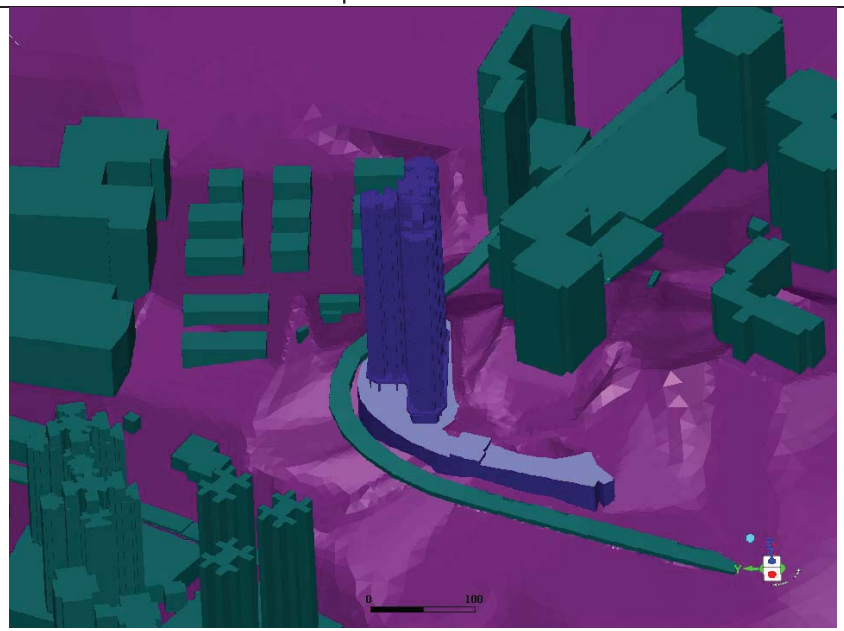
Baseline Scheme - W

Proposed Scheme - N



Proposed Scheme - E

Proposed Scheme - S



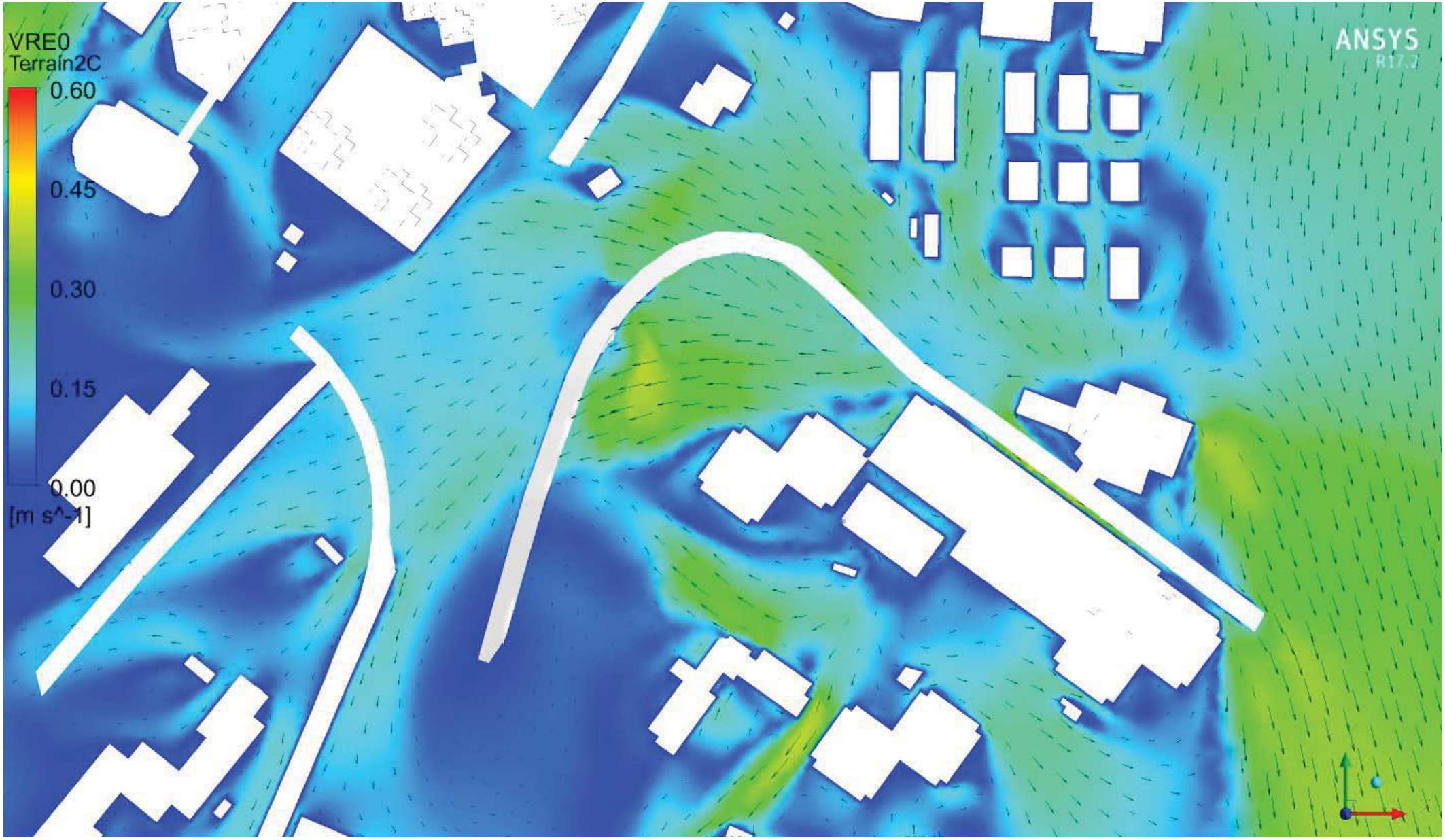
Proposed Scheme - W

Existing Scenario - N

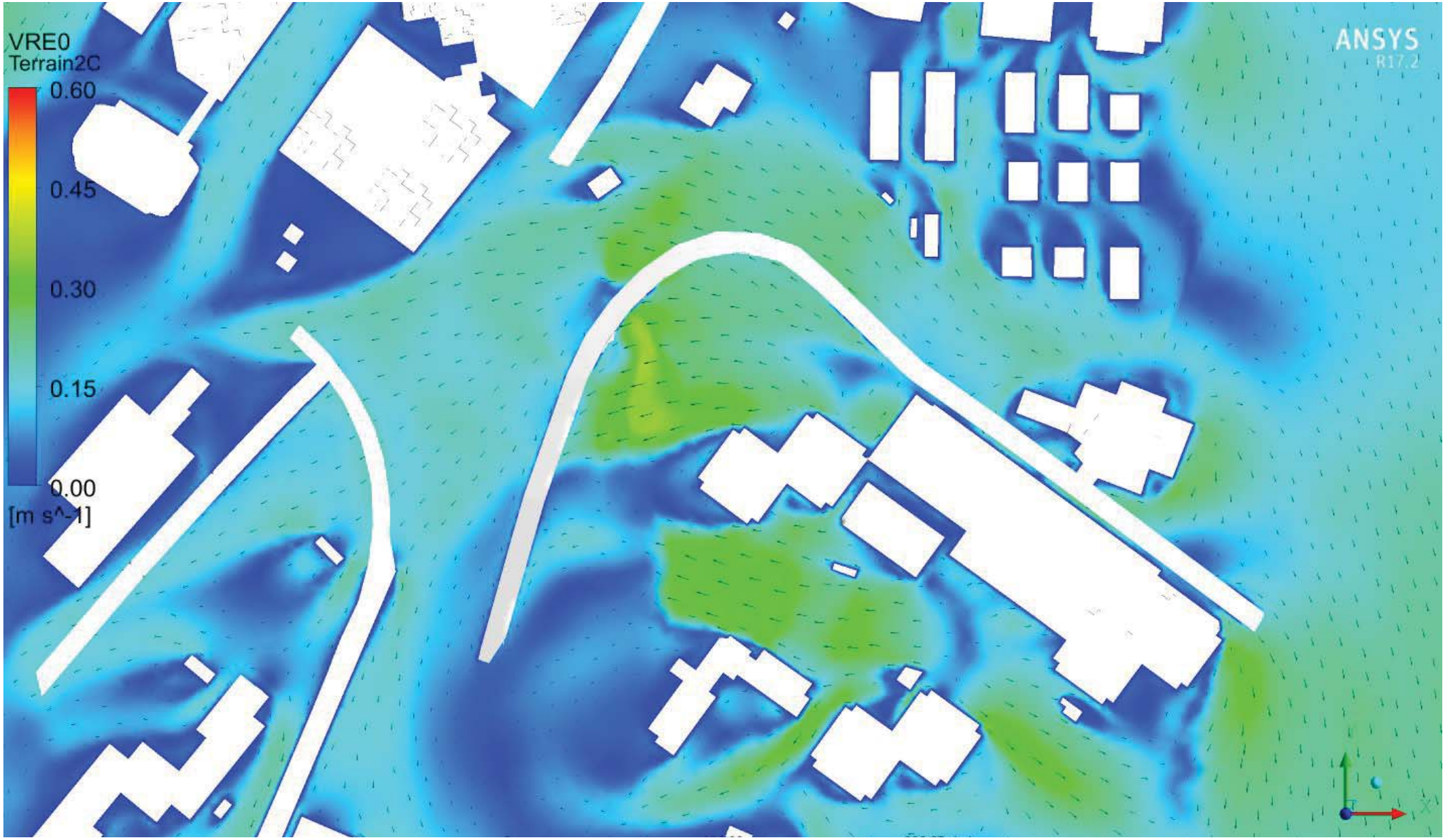
Existing Scenario - E

Existing Scenario - S

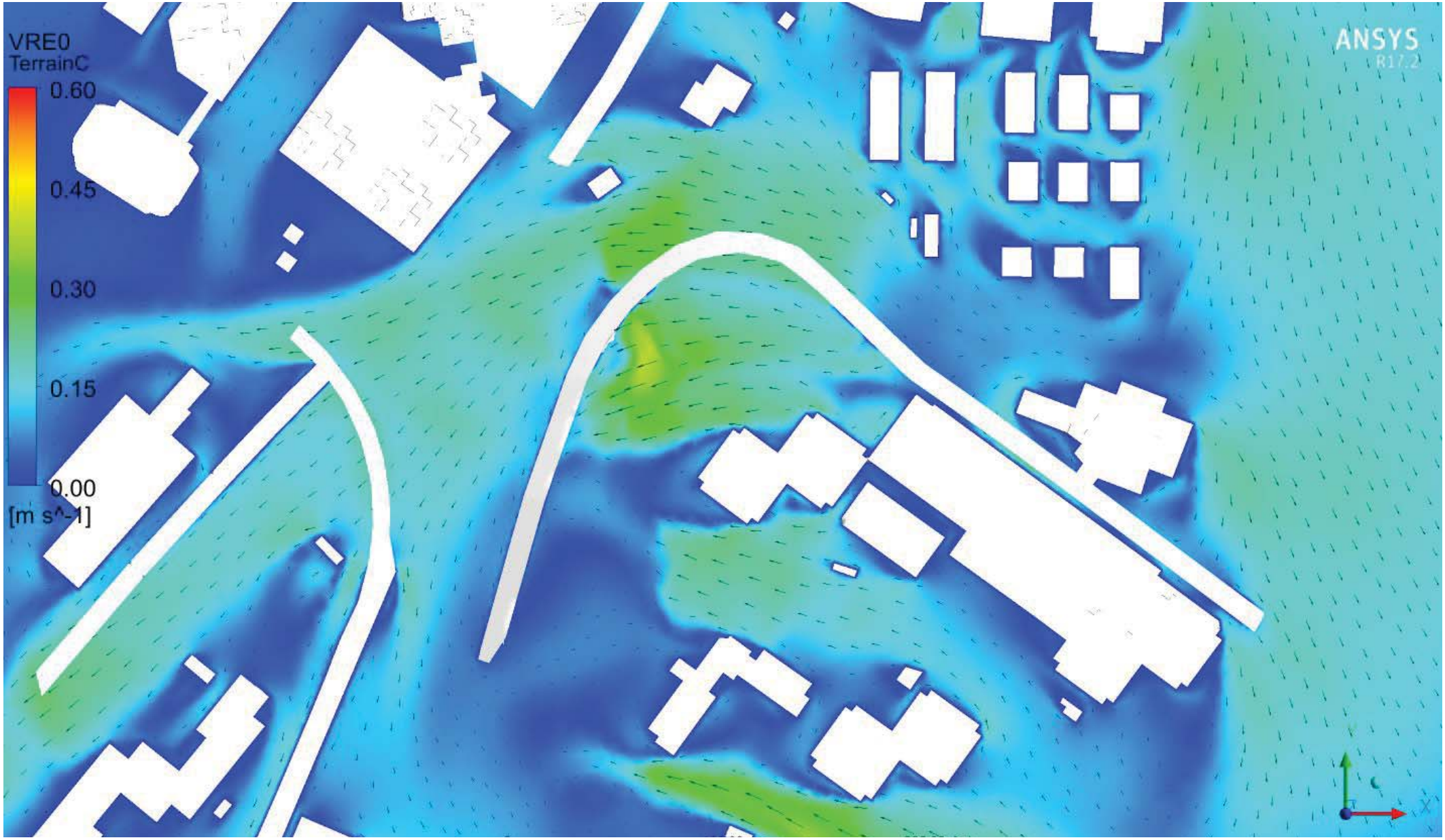
Existing Scenario - W



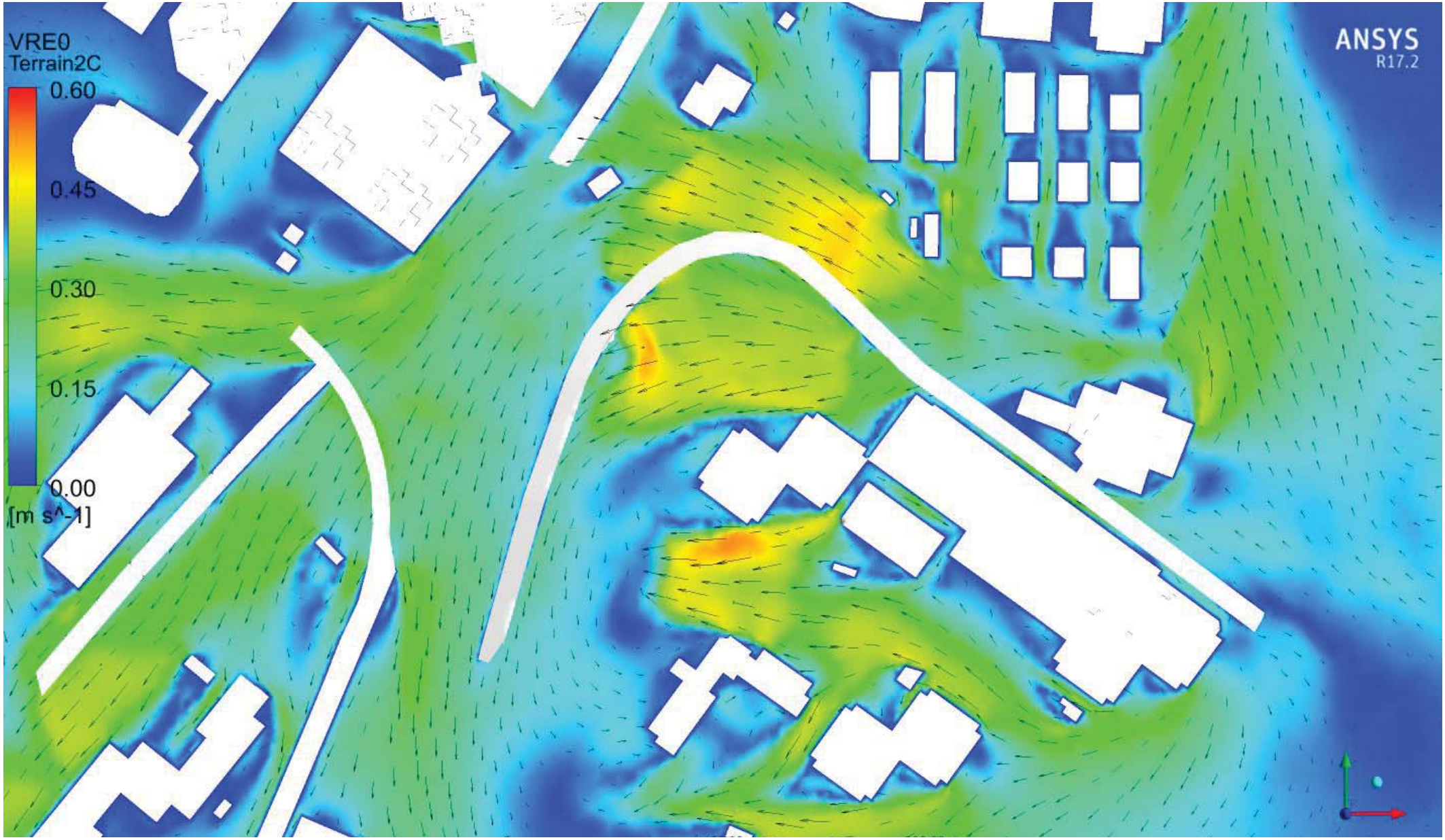
Existing Scenario – Wind VR colour and vector plot at pedestrian level under NNE Wind (1H)



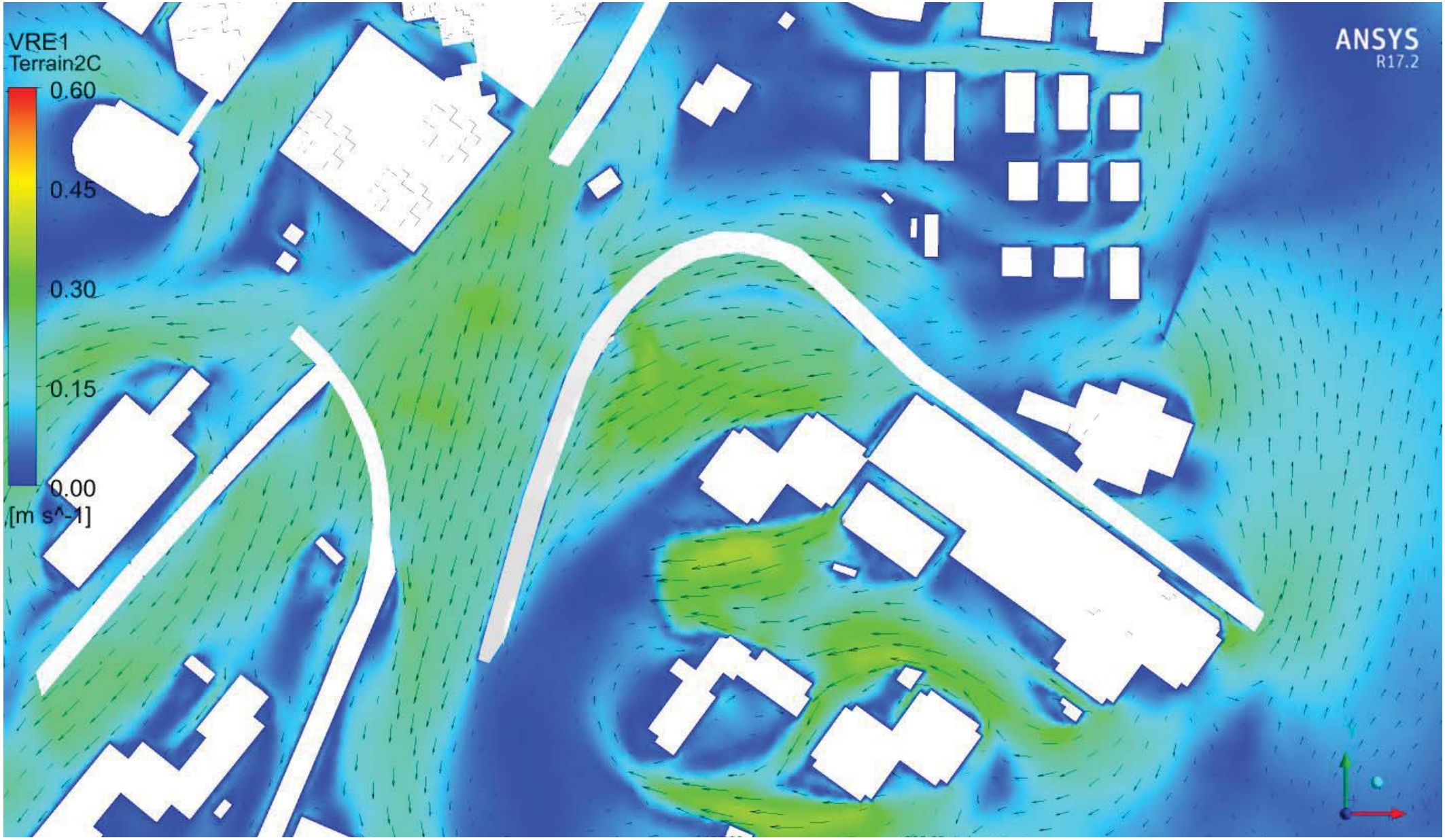
Existing Scenario – Wind VR colour and vector plot at pedestrian level under NE Wind (1H)



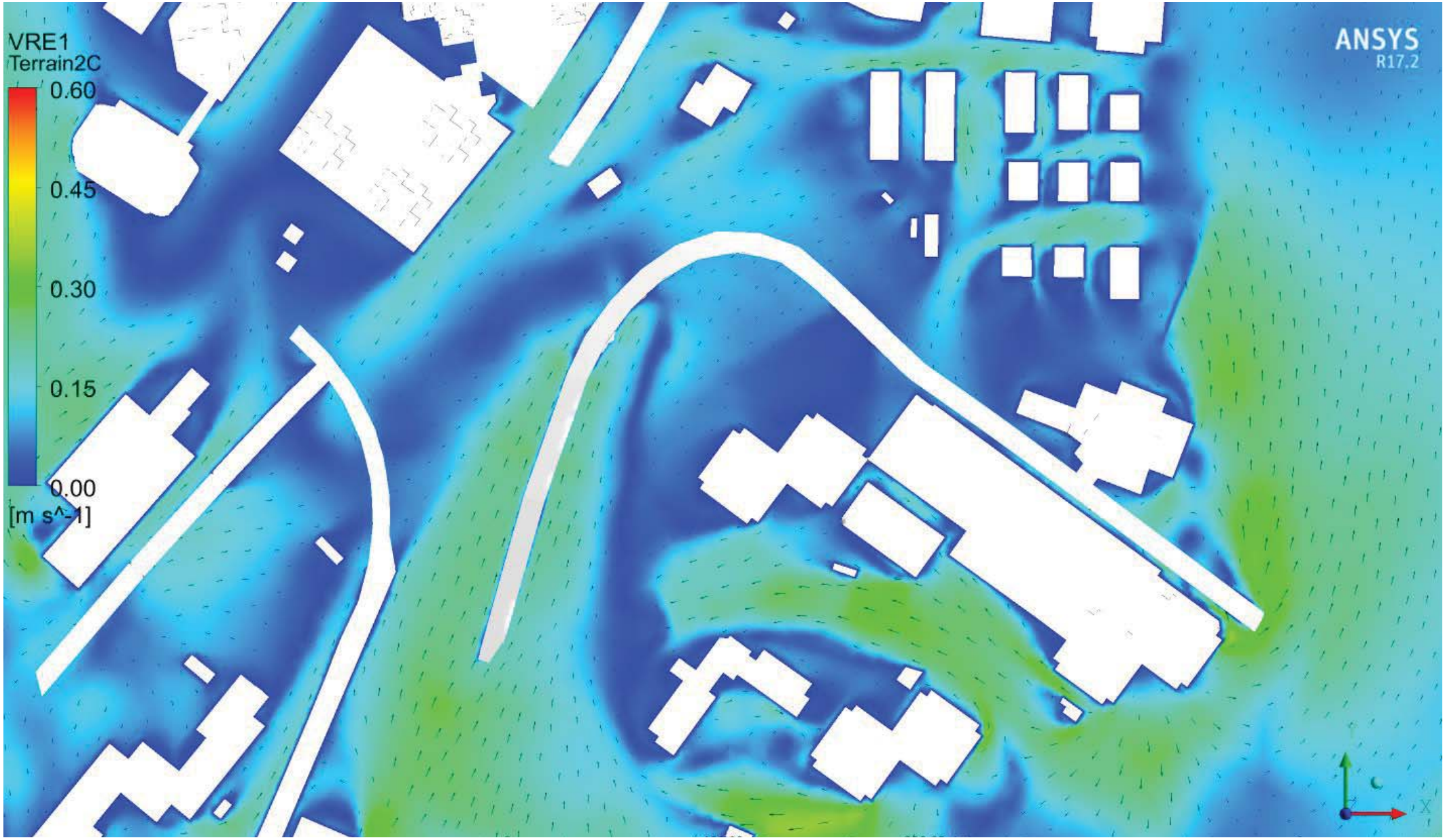
Existing Scenario – Wind VR colour and vector plot at pedestrian level under ENE Wind (1H)



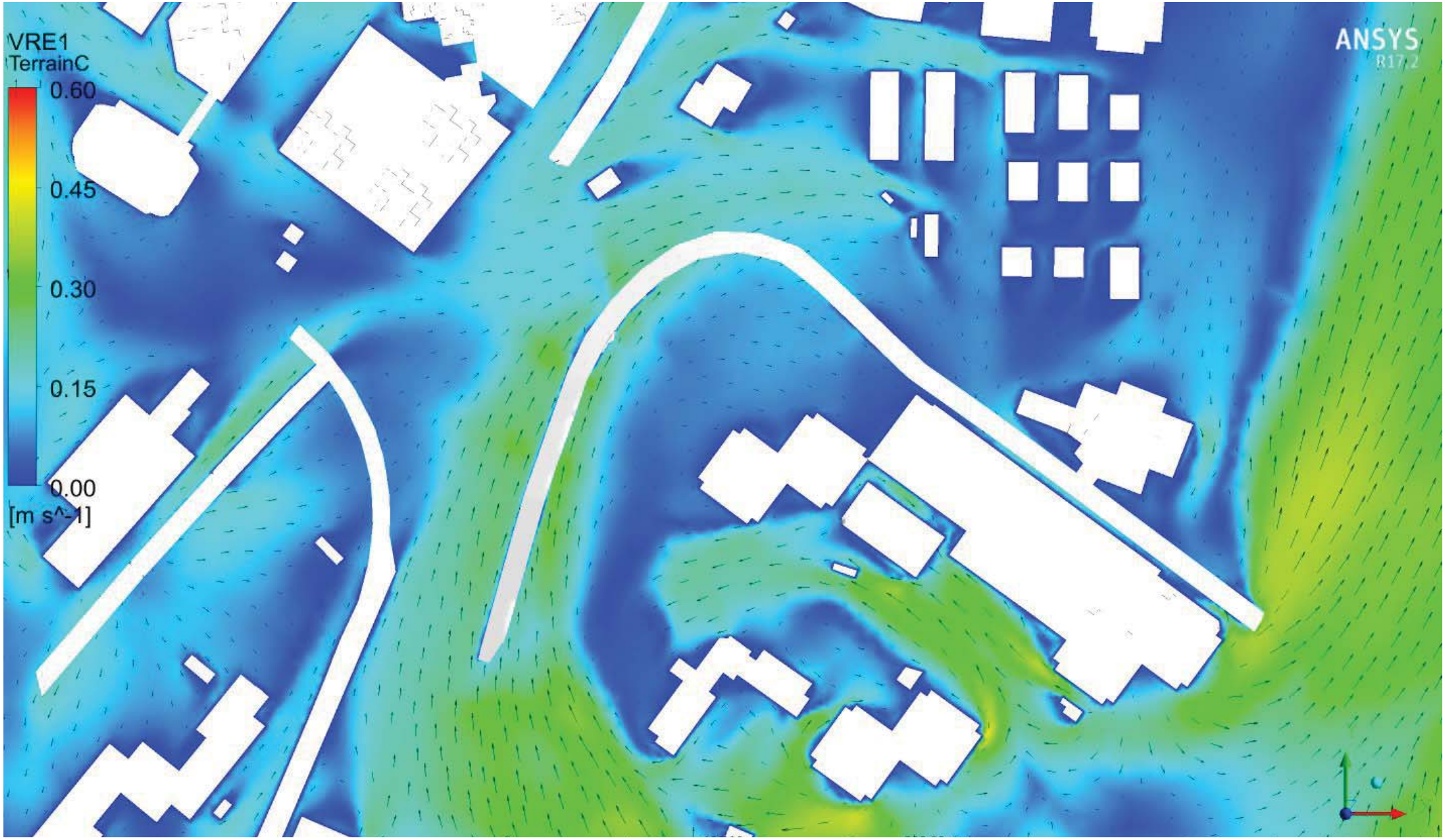
Existing Scenario – Wind VR colour and vector plot at pedestrian level under E Wind (1H)



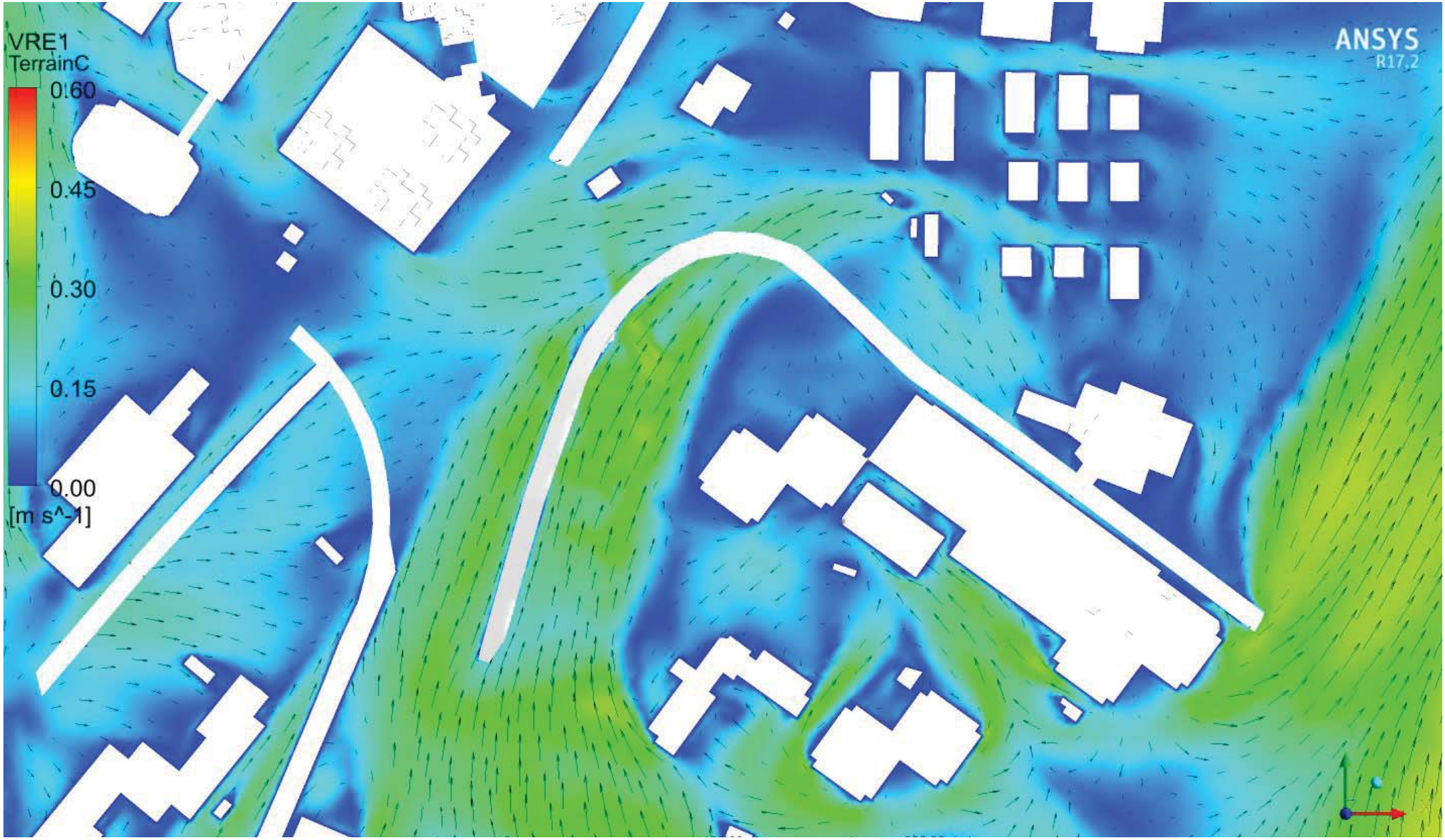
Existing Scenario – Wind VR colour and vector plot at pedestrian level under ESE Wind (1H)



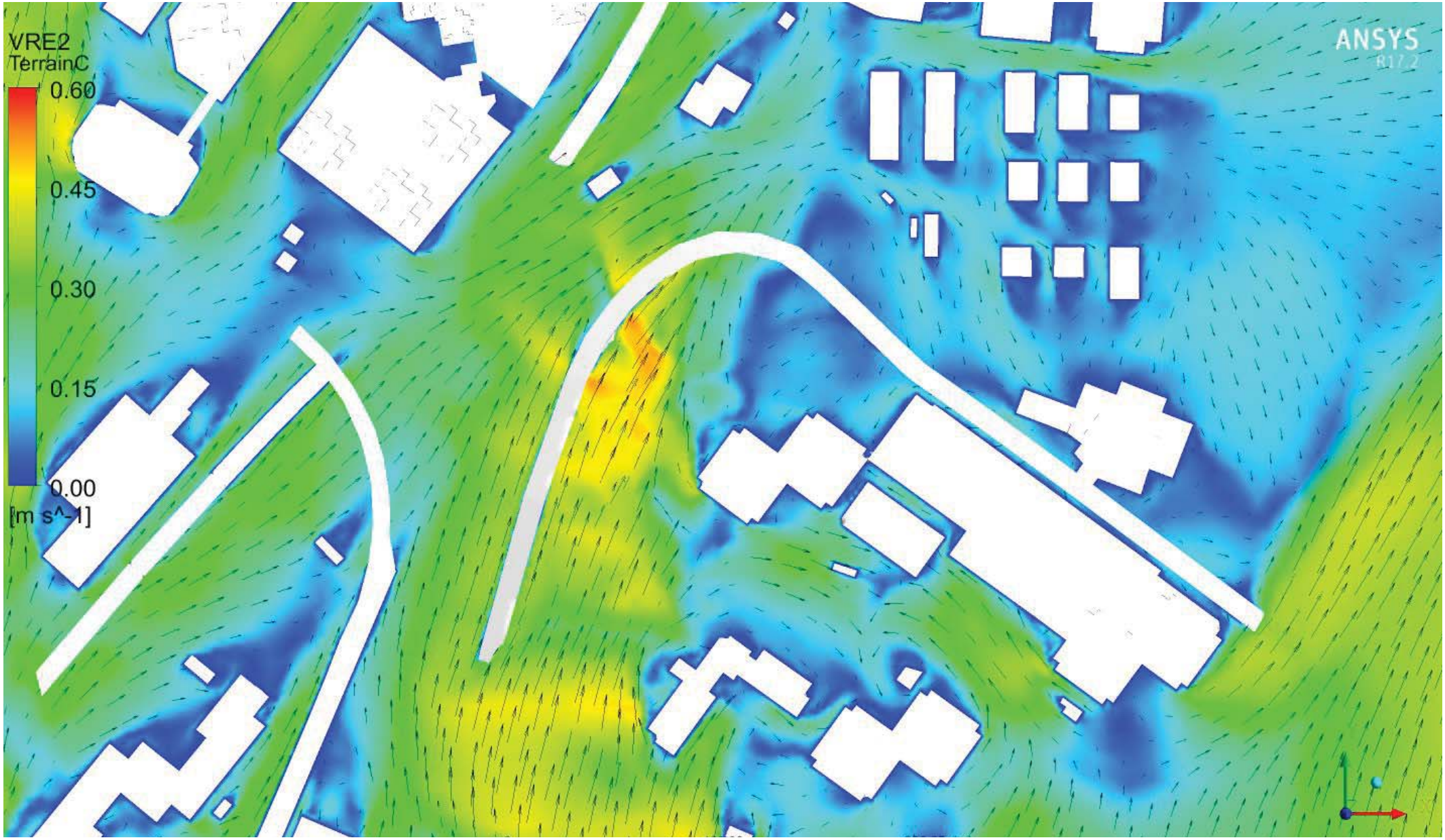
Existing Scenario – Wind VR colour and vector plot at pedestrian level under SE Wind (1H)



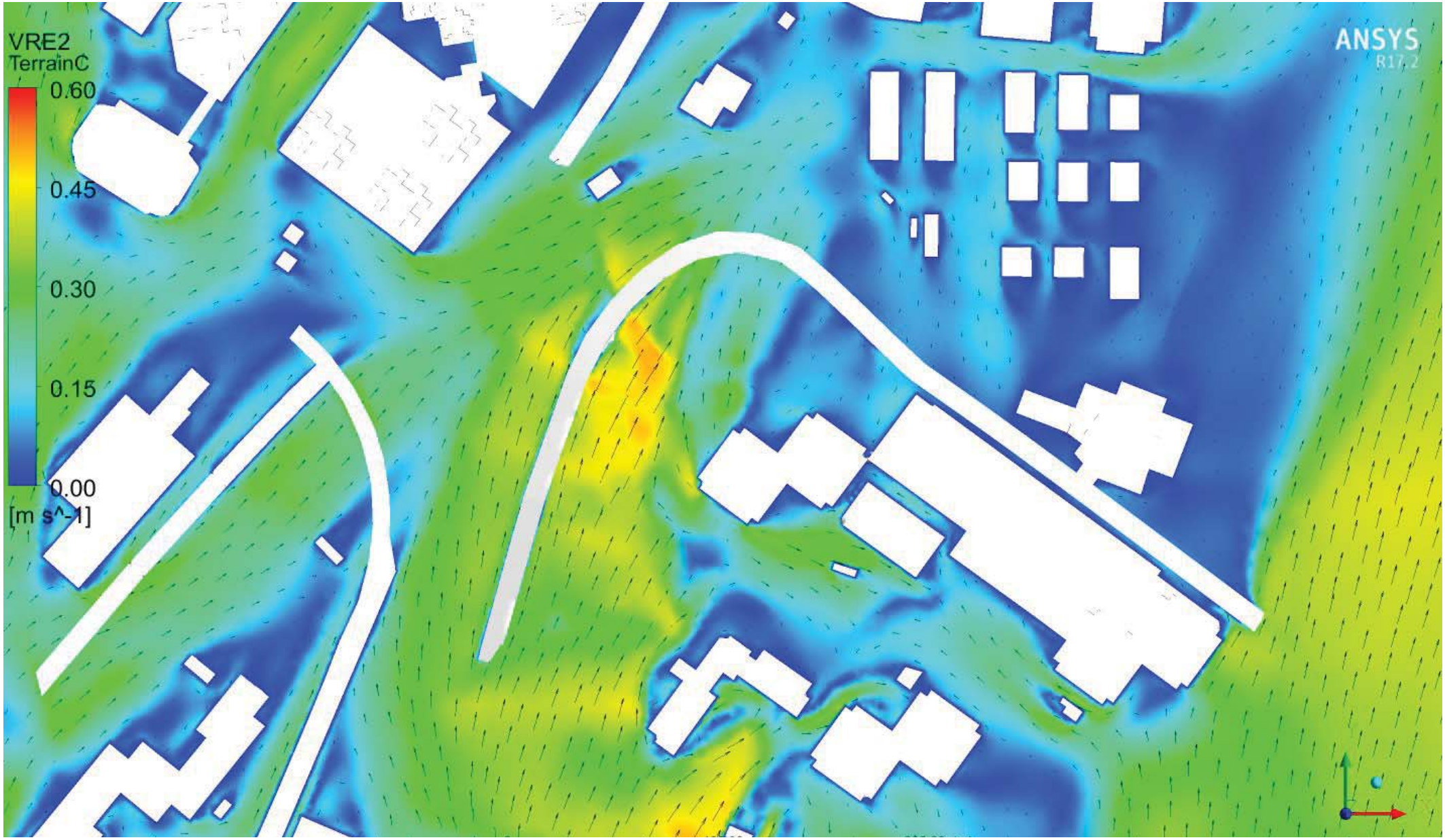
Existing Scenario – Wind VR colour and vector plot at pedestrian level under SSE Wind (1H)



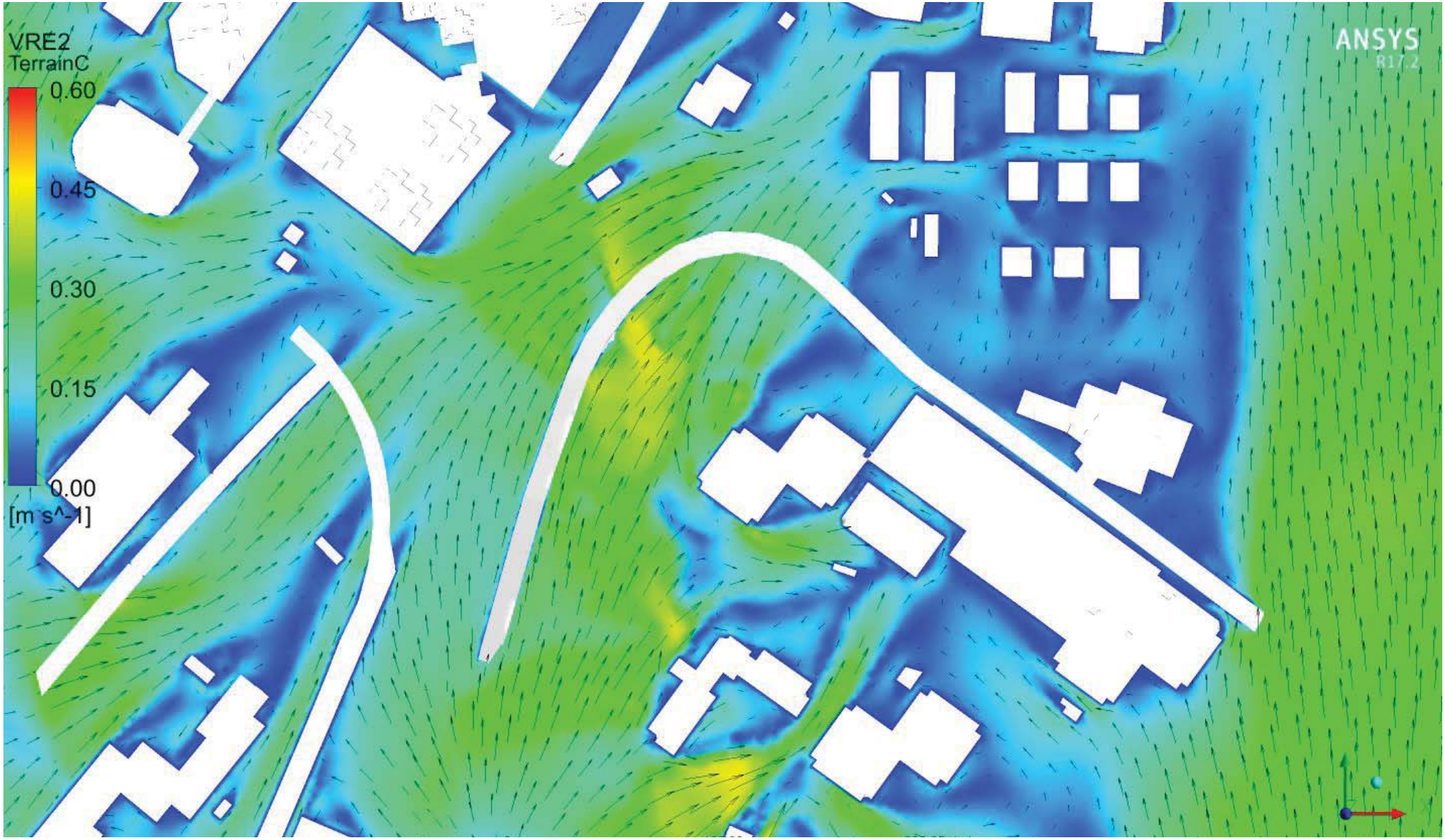
Existing Scenario – Wind VR colour and vector plot at pedestrian level under S Wind (1H)



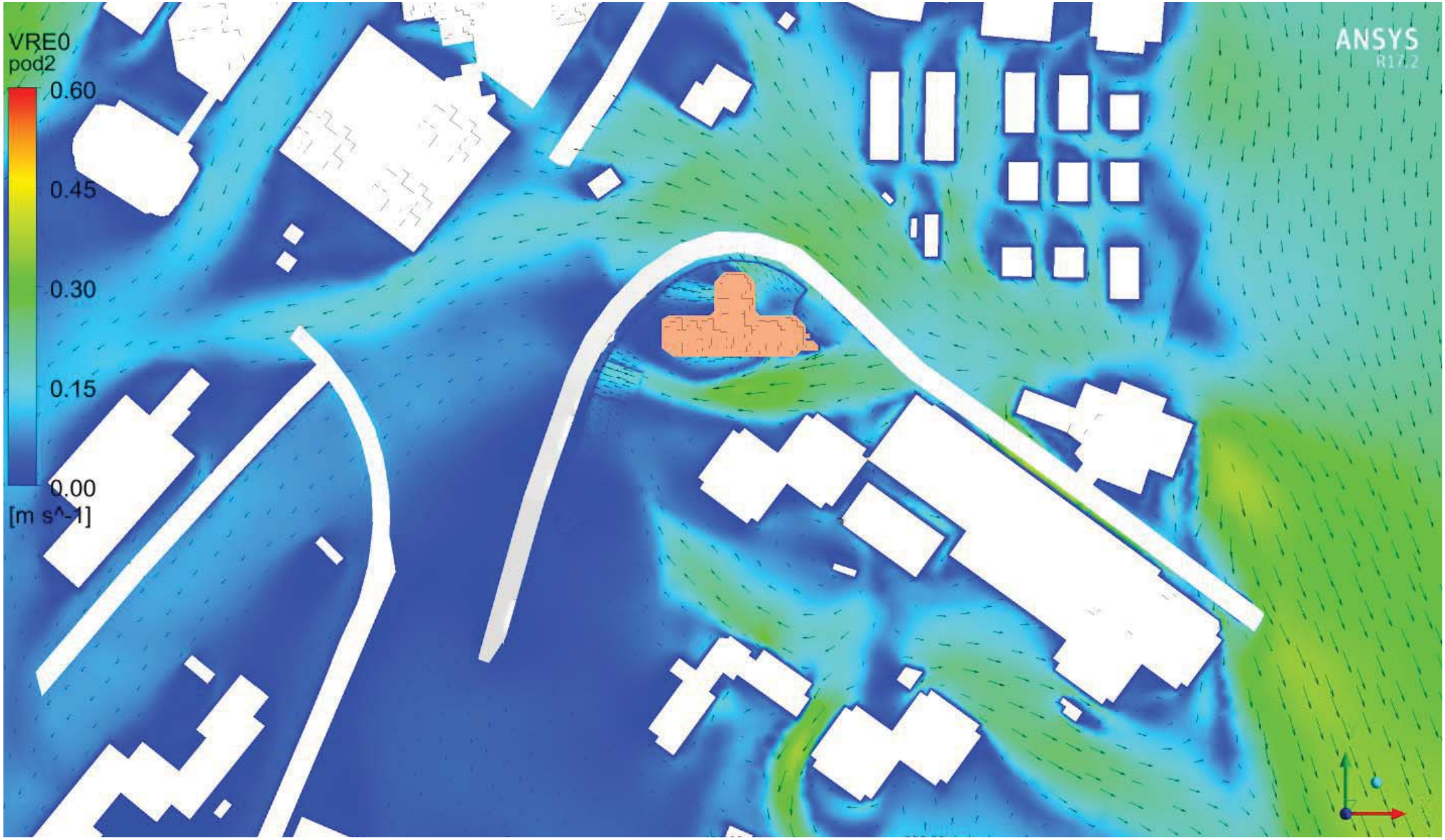
Existing Scenario – Wind VR colour and vector plot at pedestrian level under SSW Wind (1H)



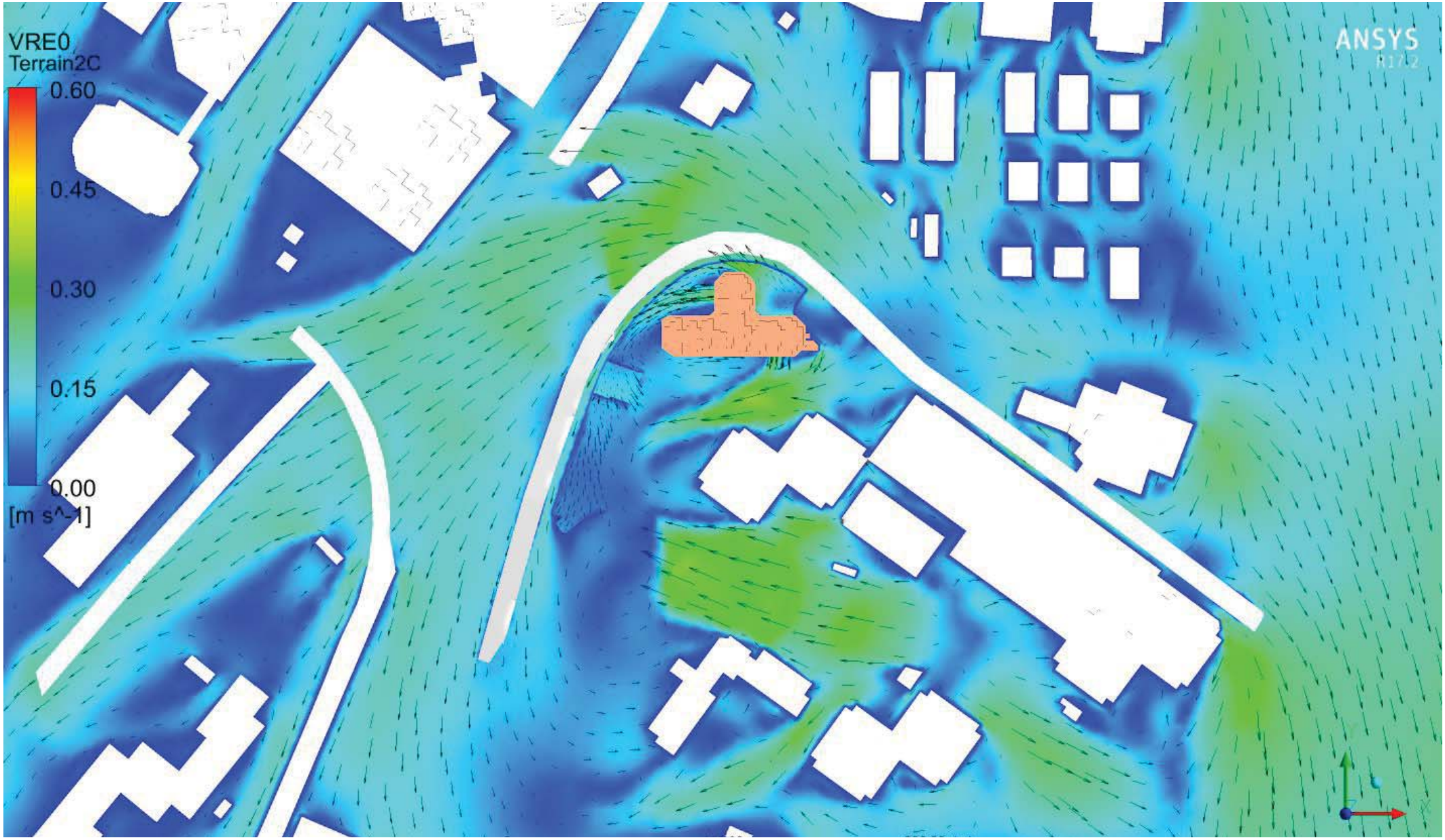
Existing Scenario – Wind VR colour and vector plot at pedestrian level under SW Wind (1H)



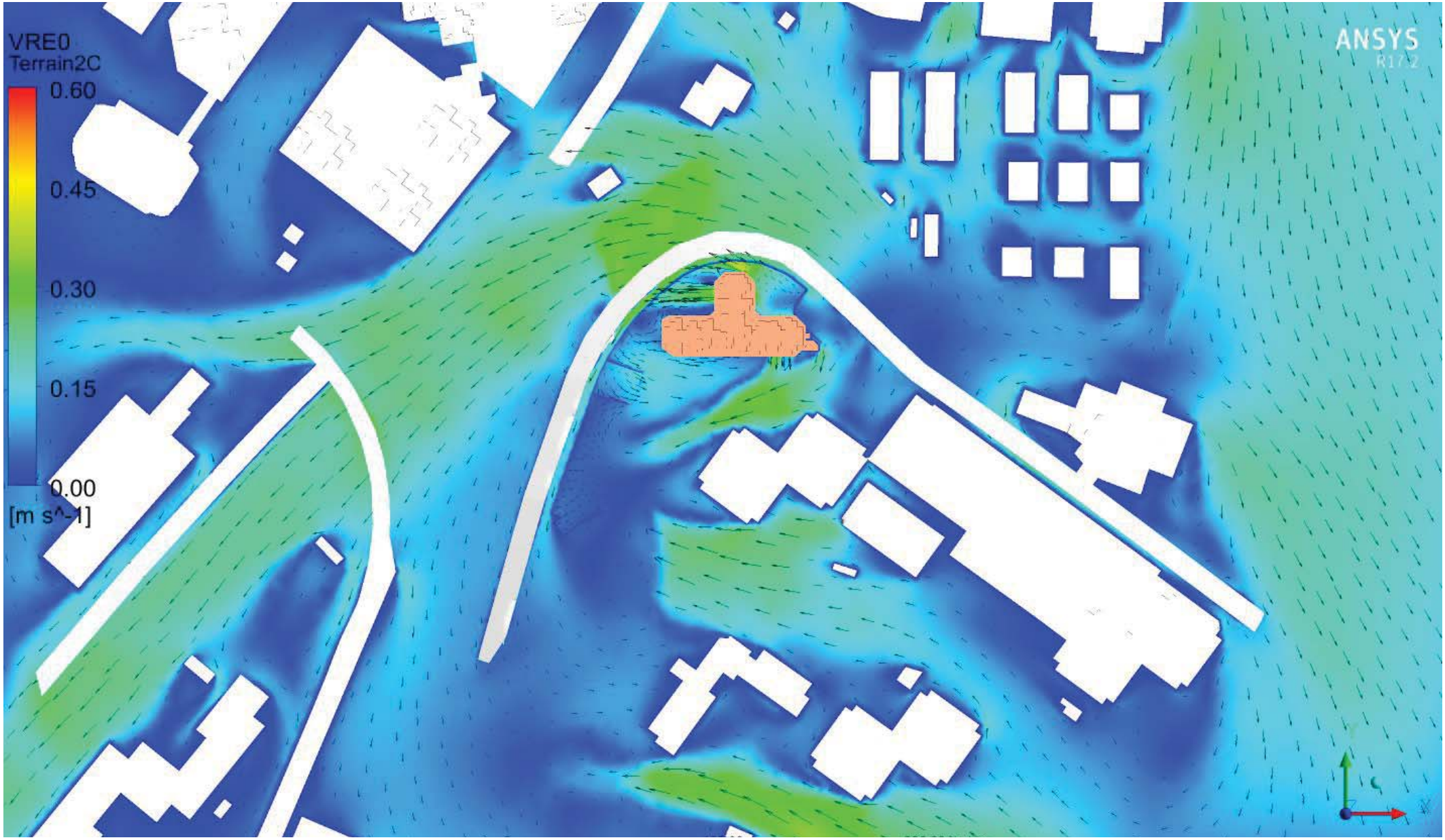
Existing Scenario – Wind VR colour and vector plot at pedestrian level under WSW Wind (1H)



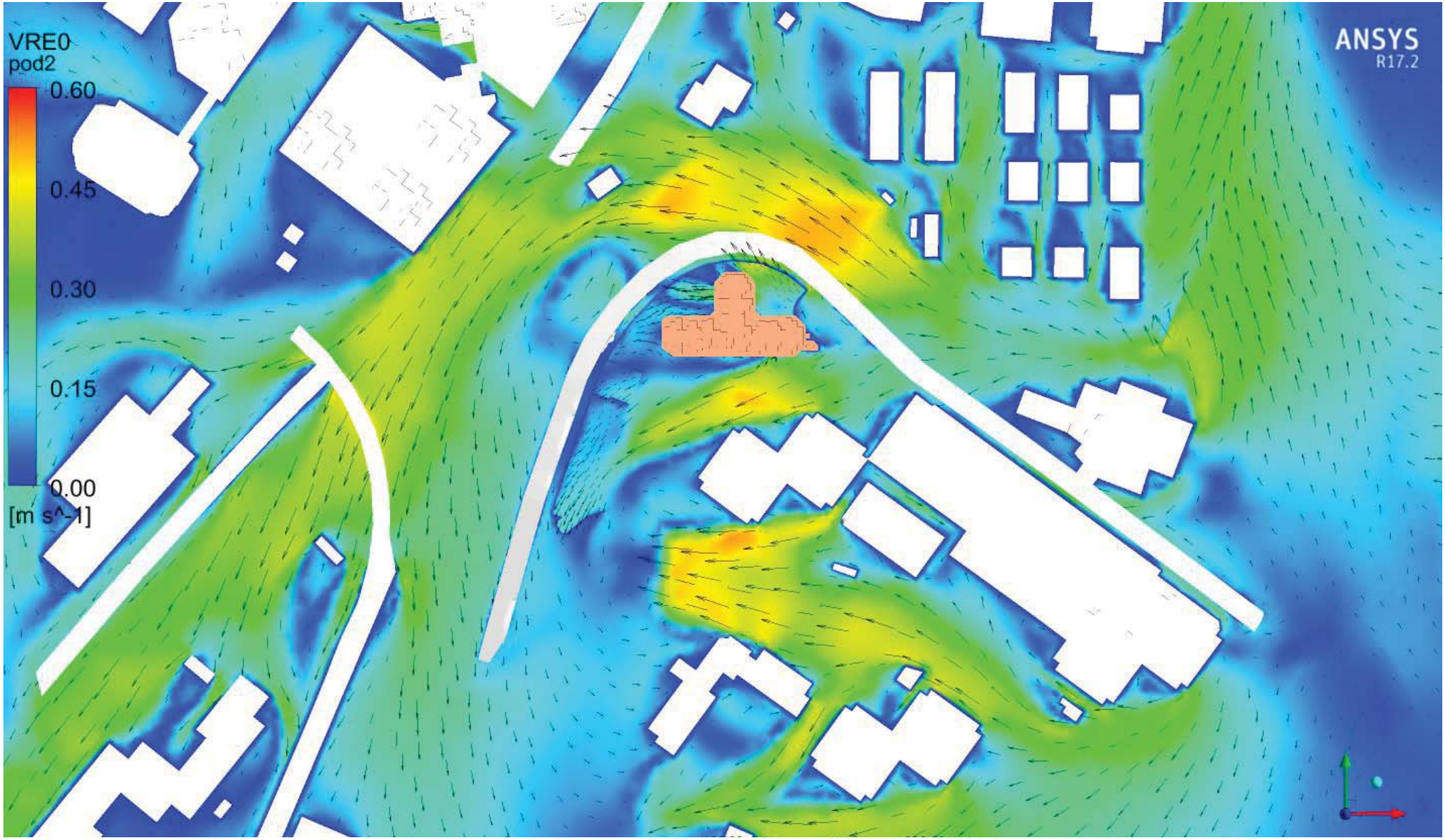
Baseline Scenario – Wind VR colour and vector plot at pedestrian level under NNE Wind (1H)



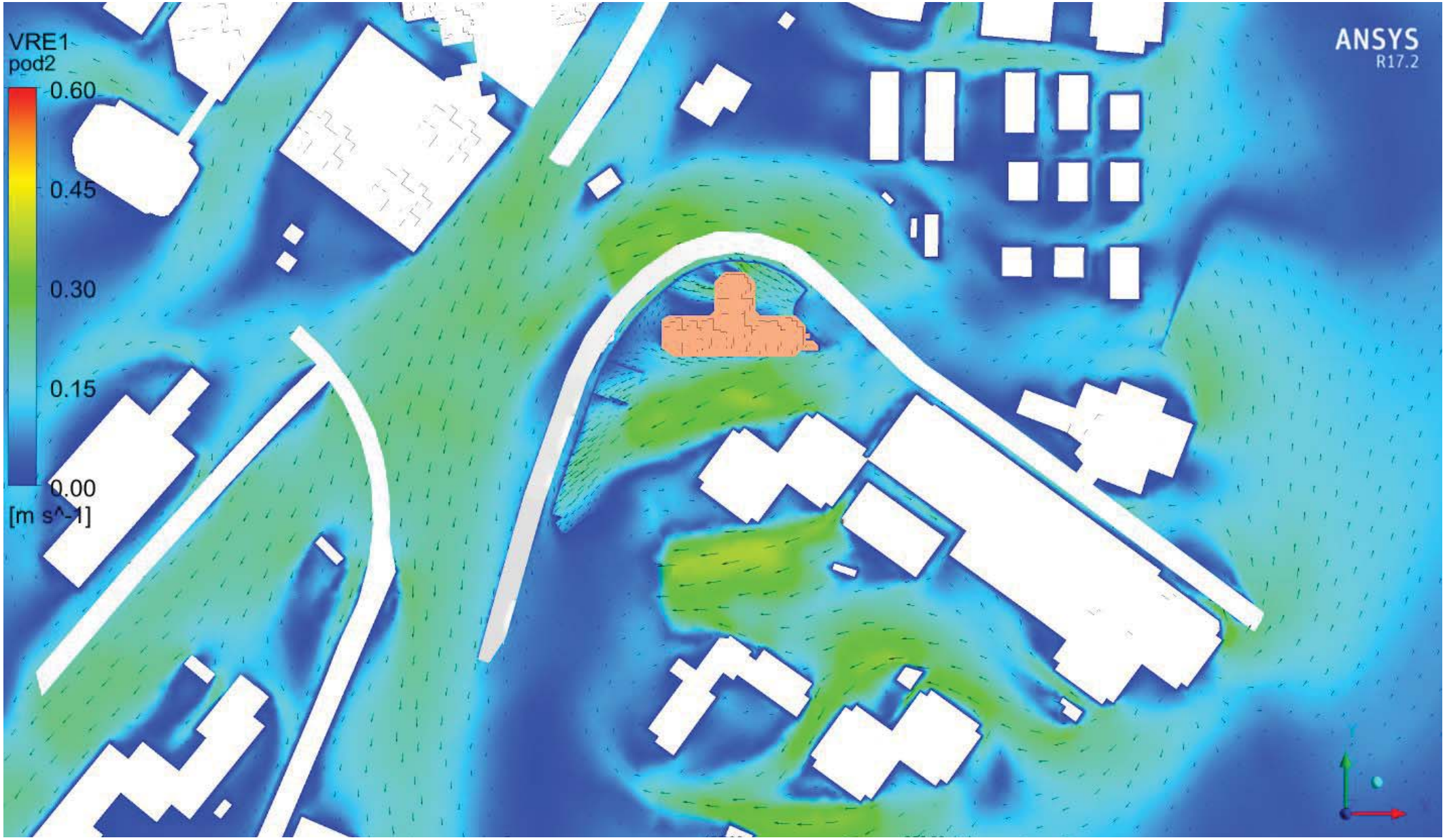
Baseline Scenario – Wind VR colour and vector plot at pedestrian level under NE Wind (1H)



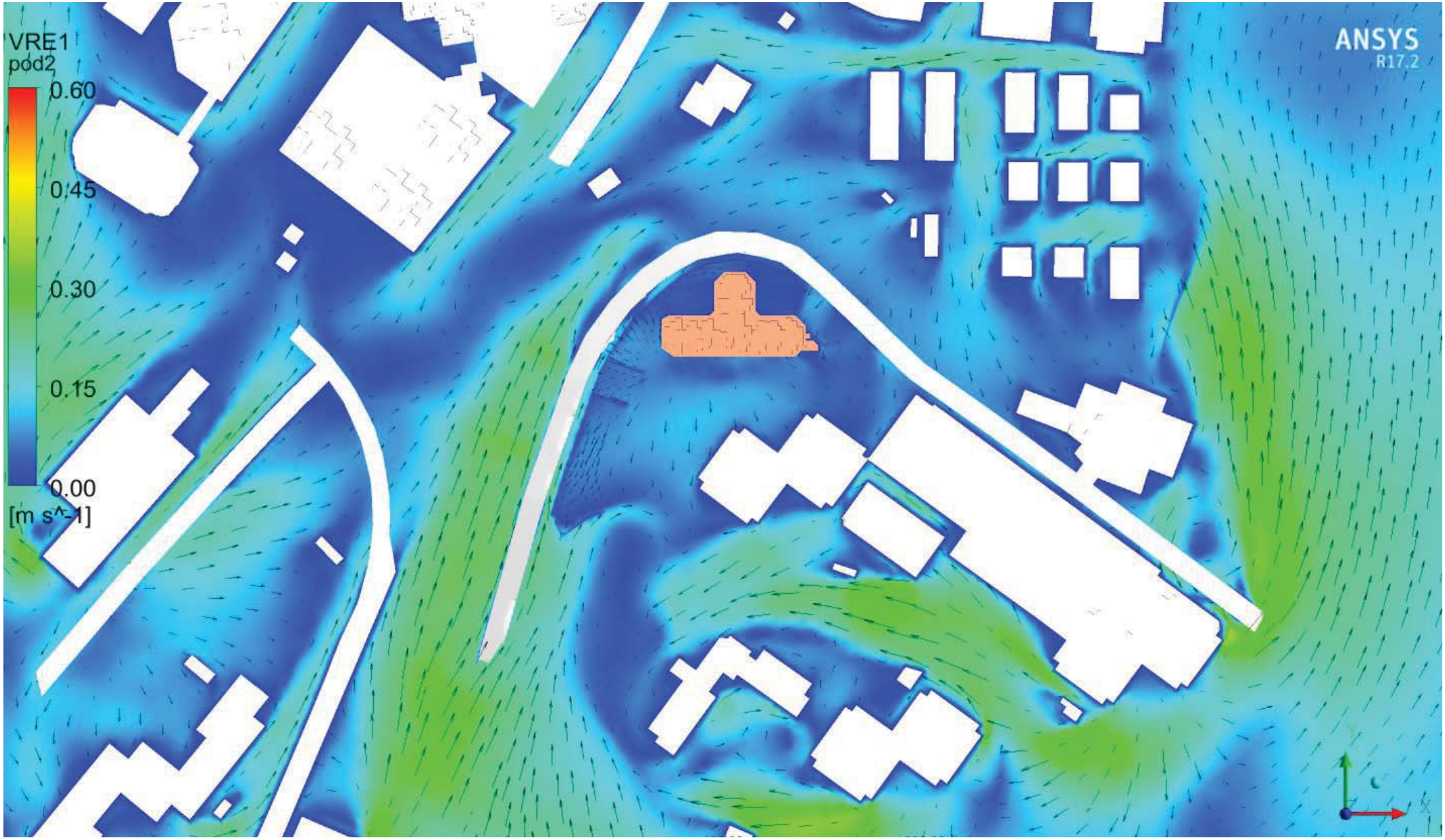
Baseline Scenario – Wind VR colour and vector plot at pedestrian level under ENE Wind (1H)



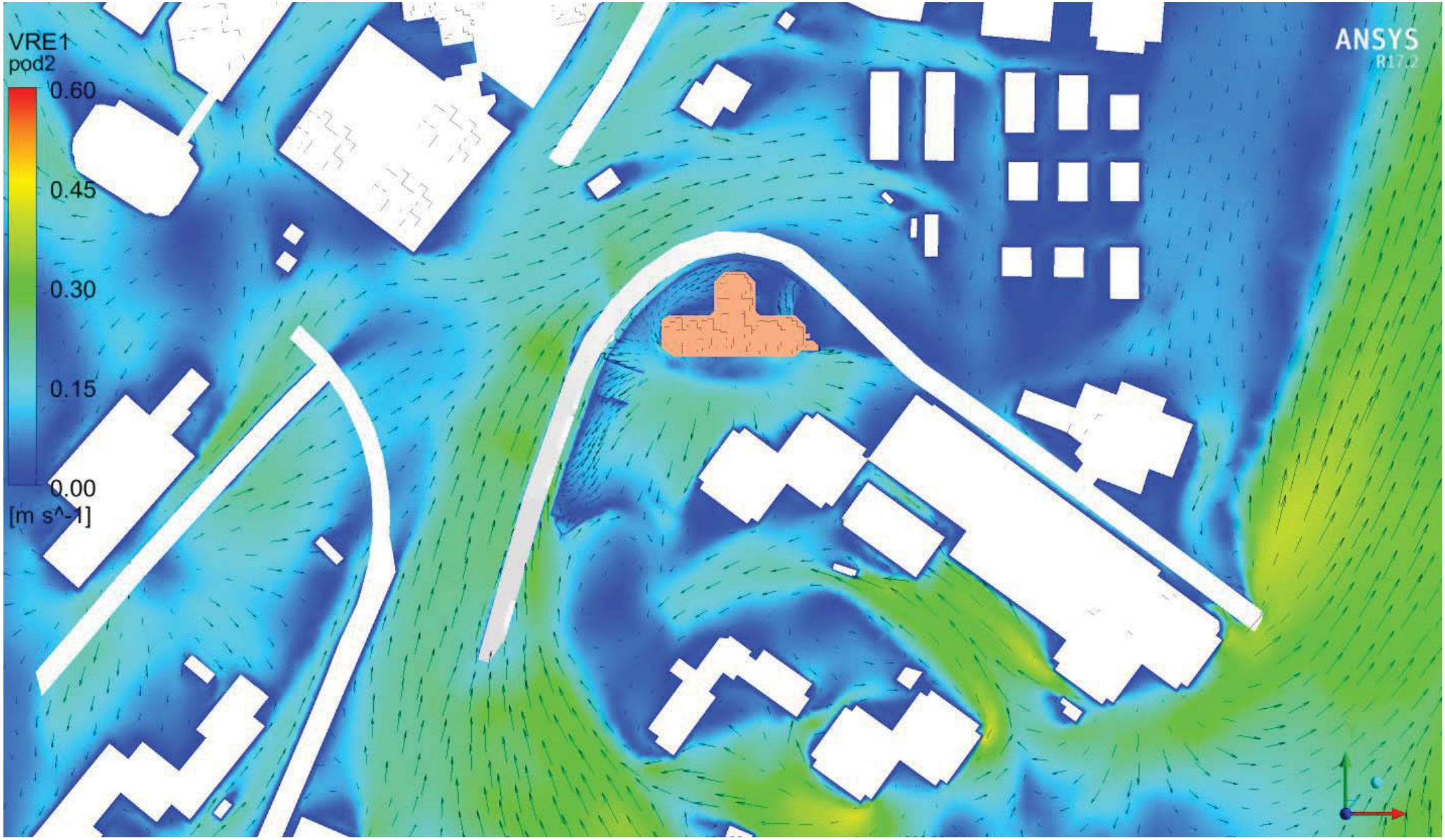
Baseline Scenario – Wind VR colour and vector plot at pedestrian level under E Wind (1H)



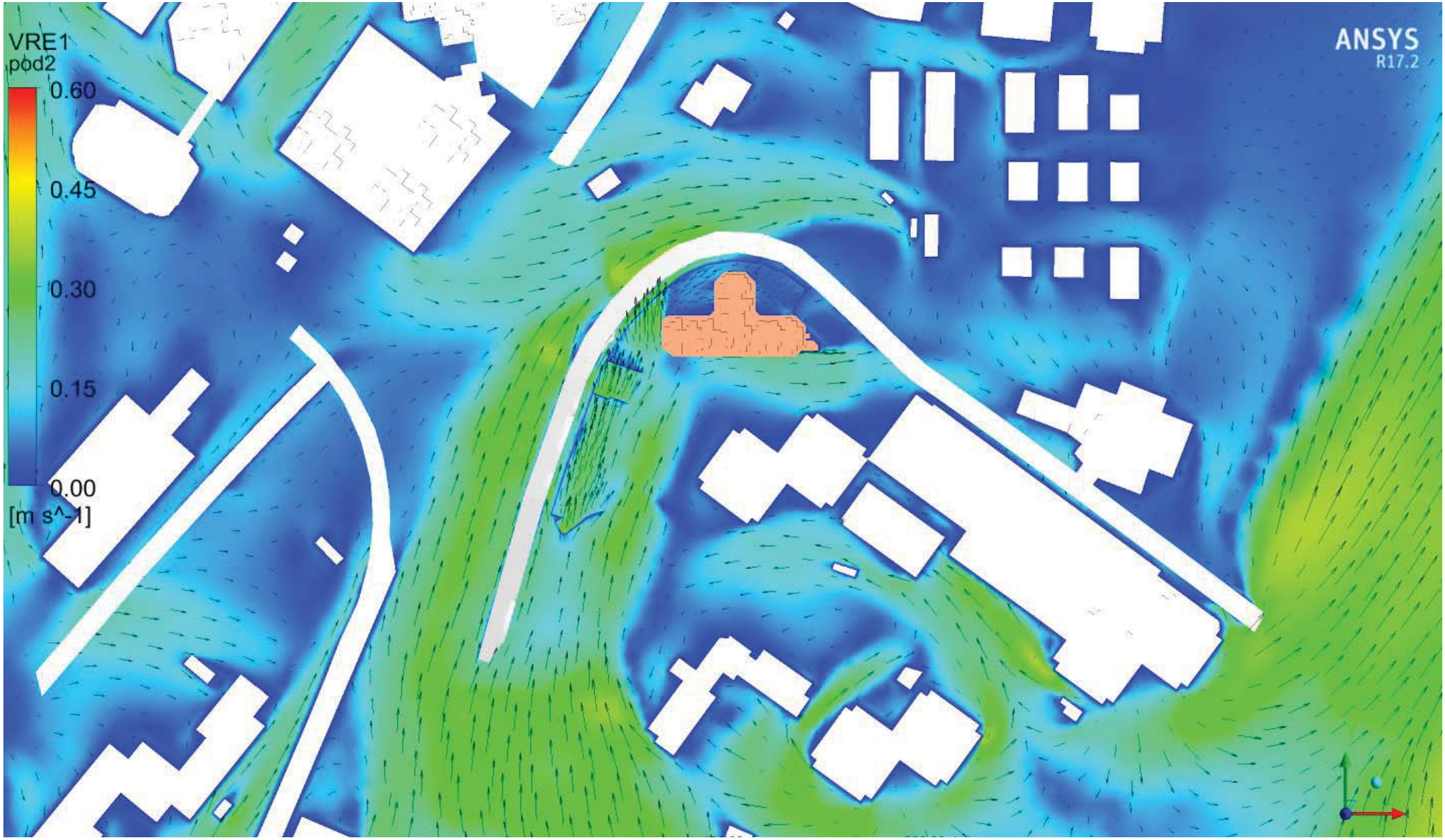
Baseline Scenario – Wind VR colour and vector plot at pedestrian level under ESE Wind (1H)



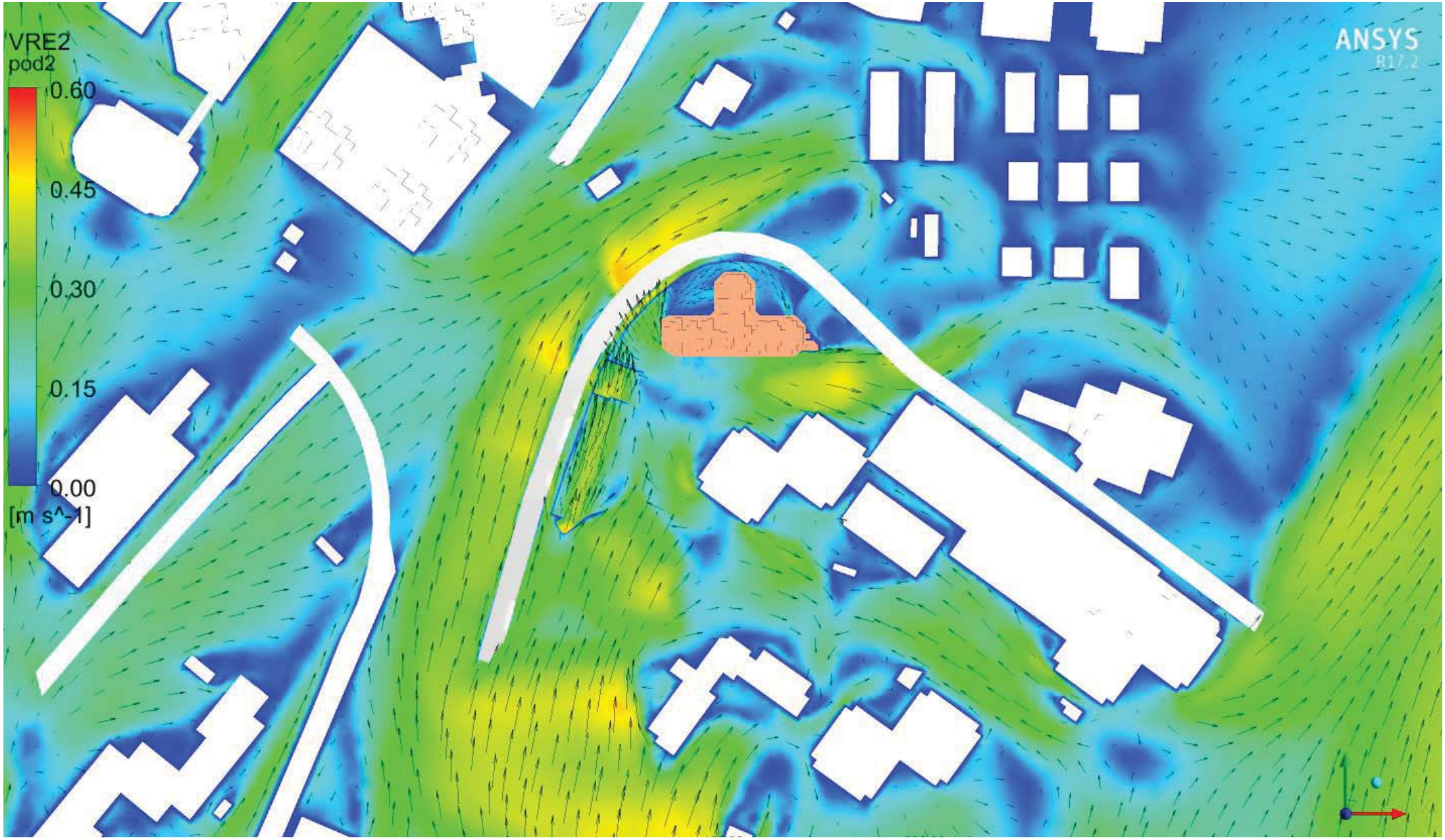
Baseline Scenario – Wind VR colour and vector plot at pedestrian level under SE Wind (1H)



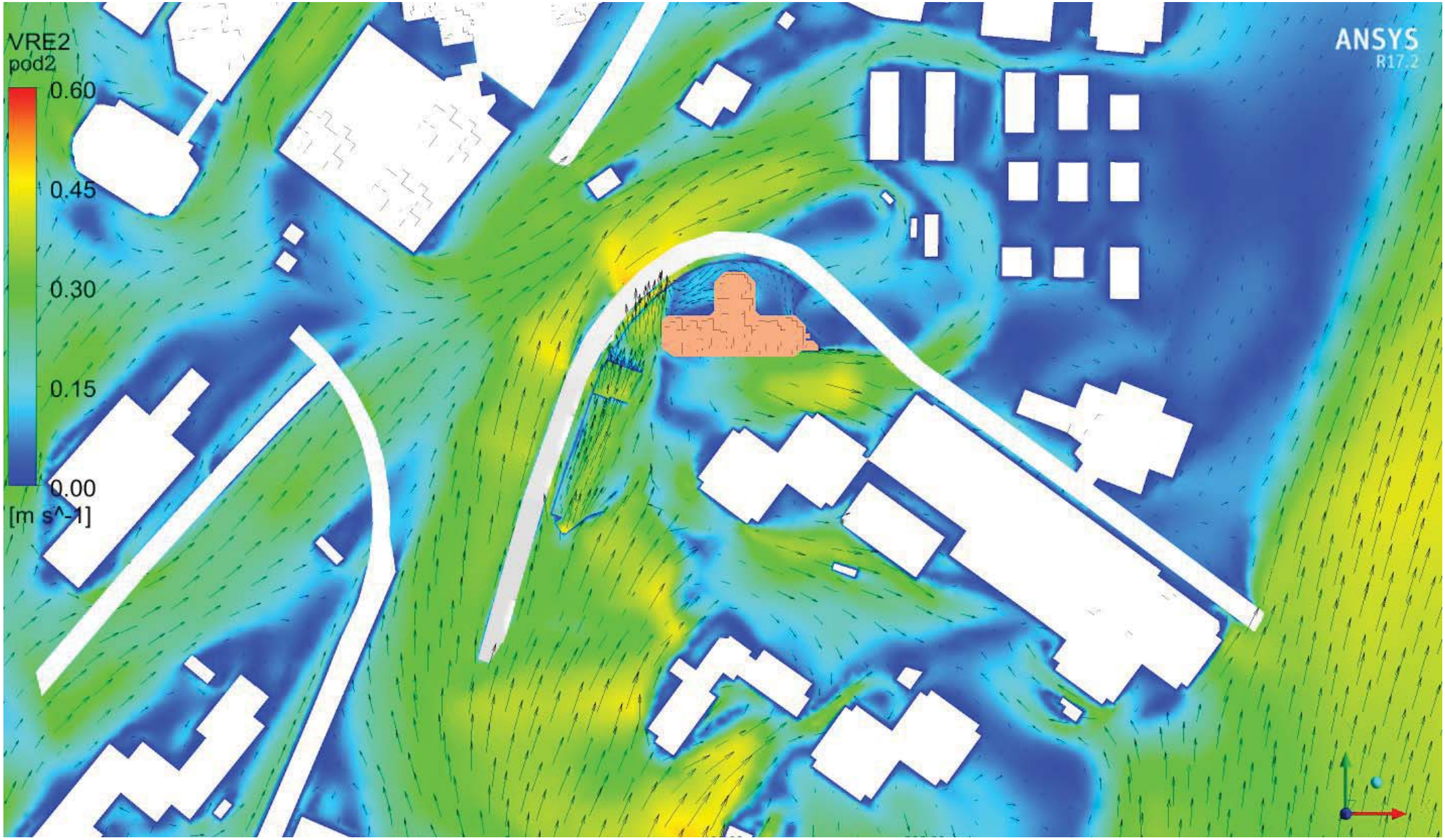
Baseline Scenario – Wind VR colour and vector plot at pedestrian level under SSE Wind (1H)



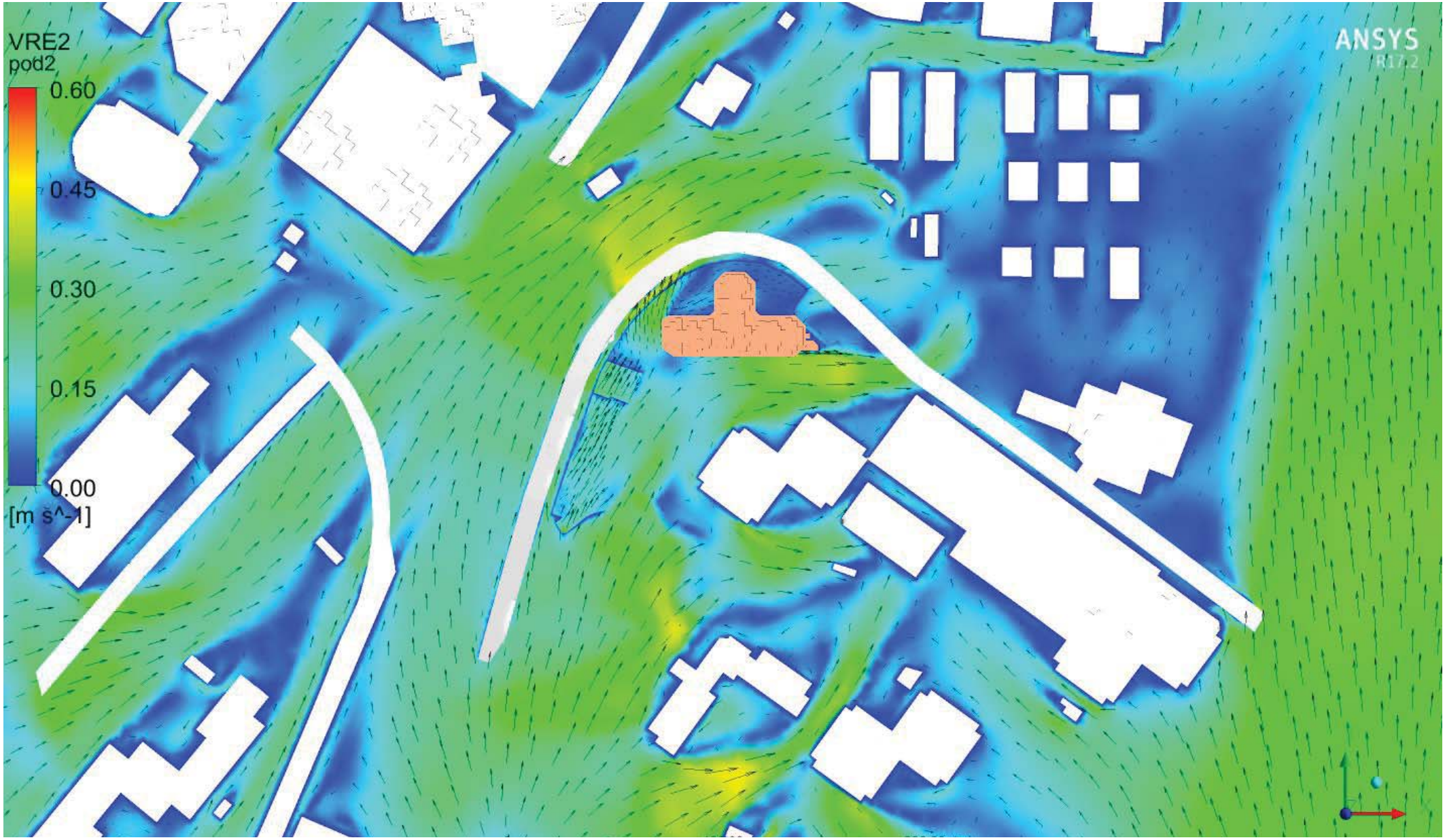
Baseline Scenario – Wind VR colour and vector plot at pedestrian level under S Wind (1H)



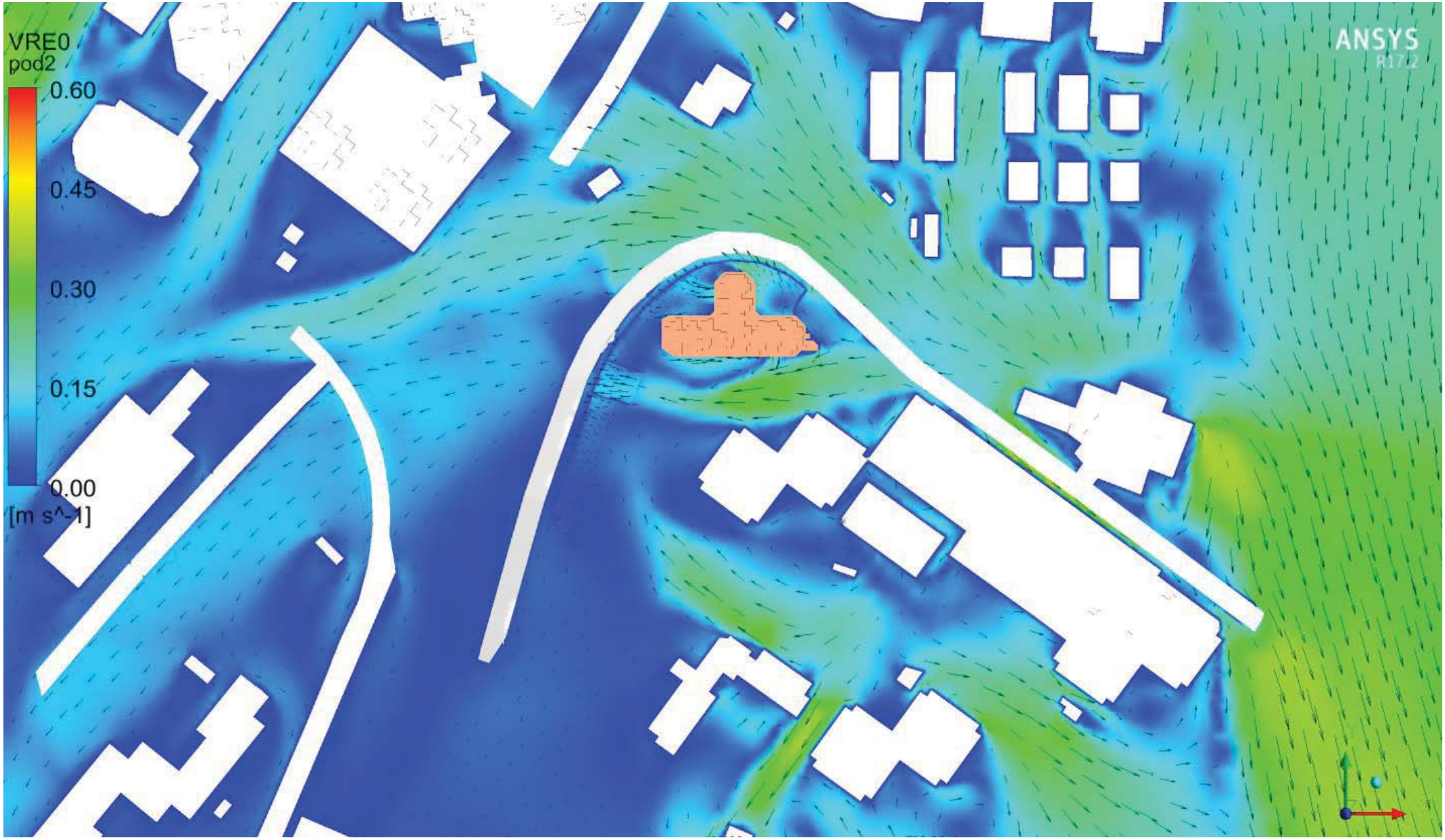
Baseline Scenario – Wind VR colour and vector plot at pedestrian level under SSW Wind (1H)



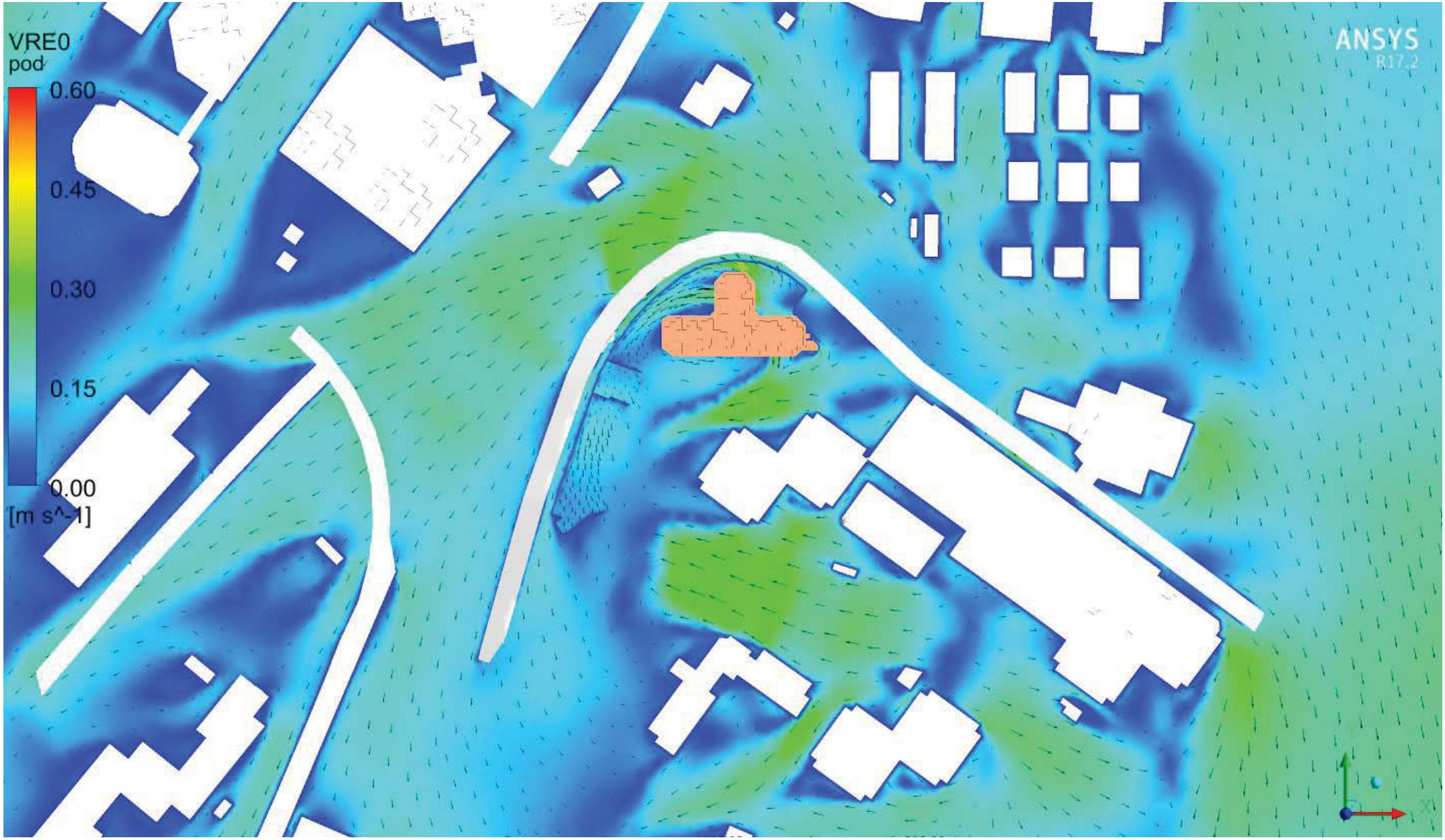
Baseline Scenario – Wind VR colour and vector plot at pedestrian level under SW Wind (1H)



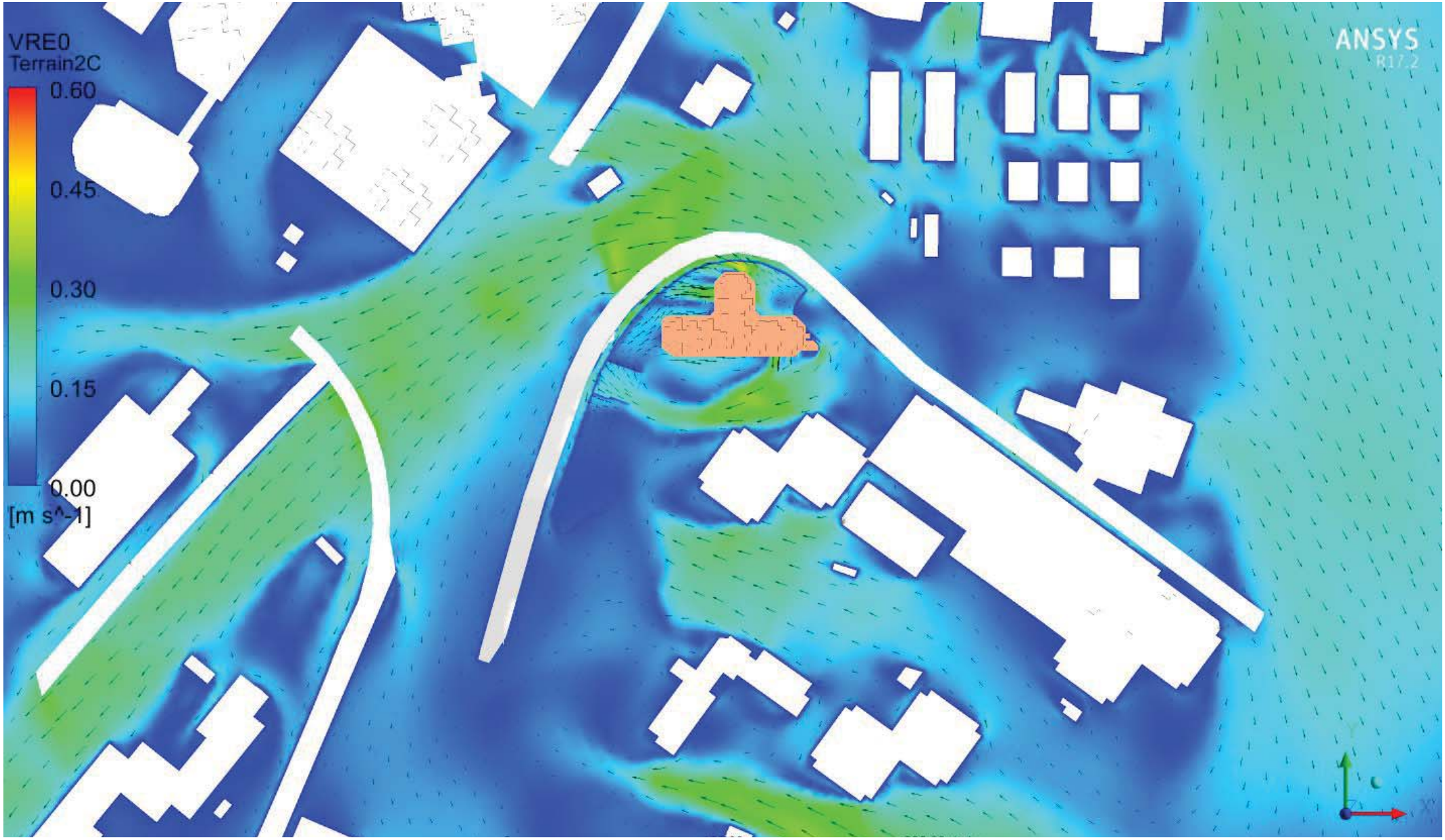
Baseline Scenario – Wind VR colour and vector plot at pedestrian level under WSW Wind (1H)



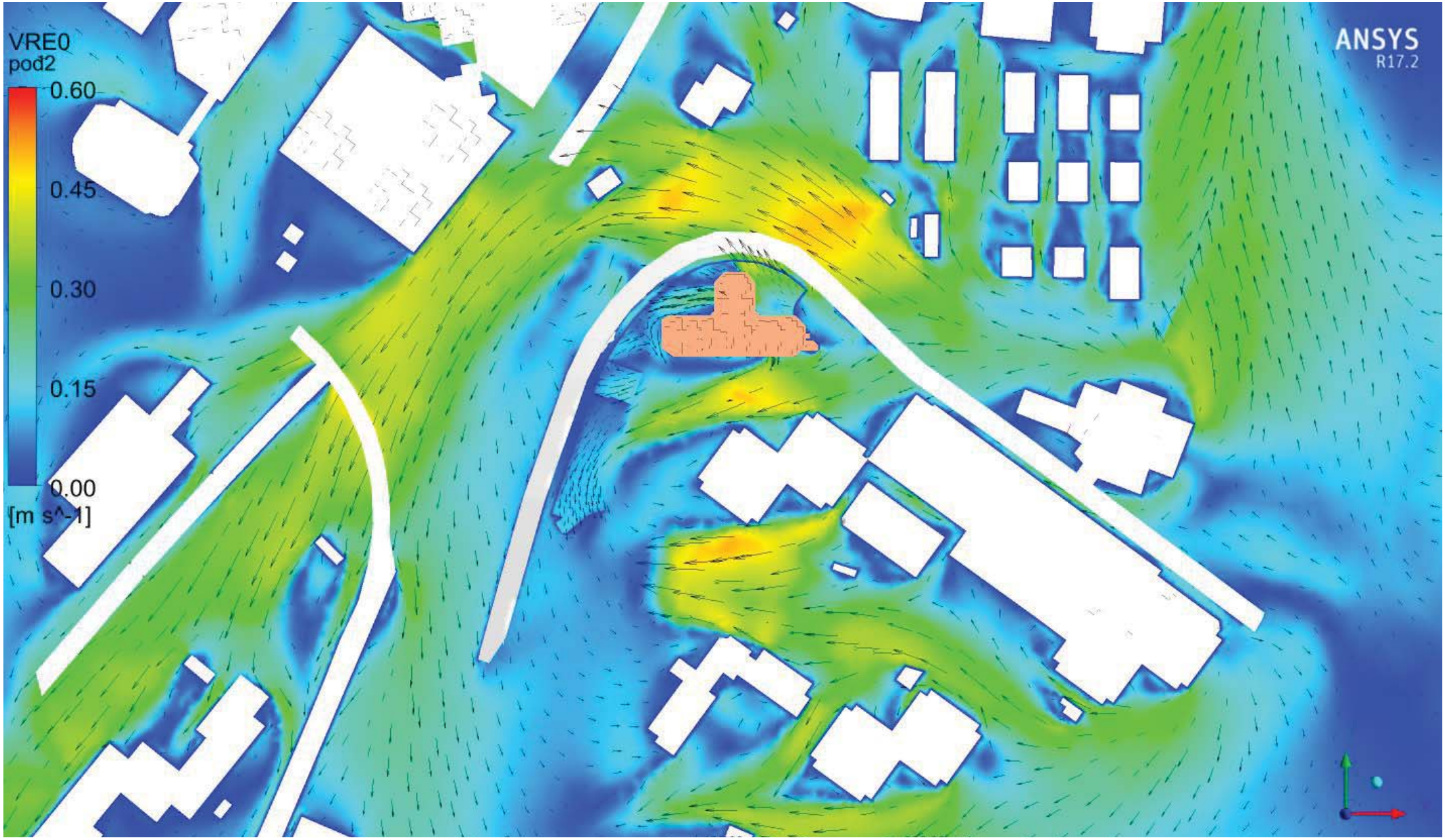
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under NNE Wind (1H)



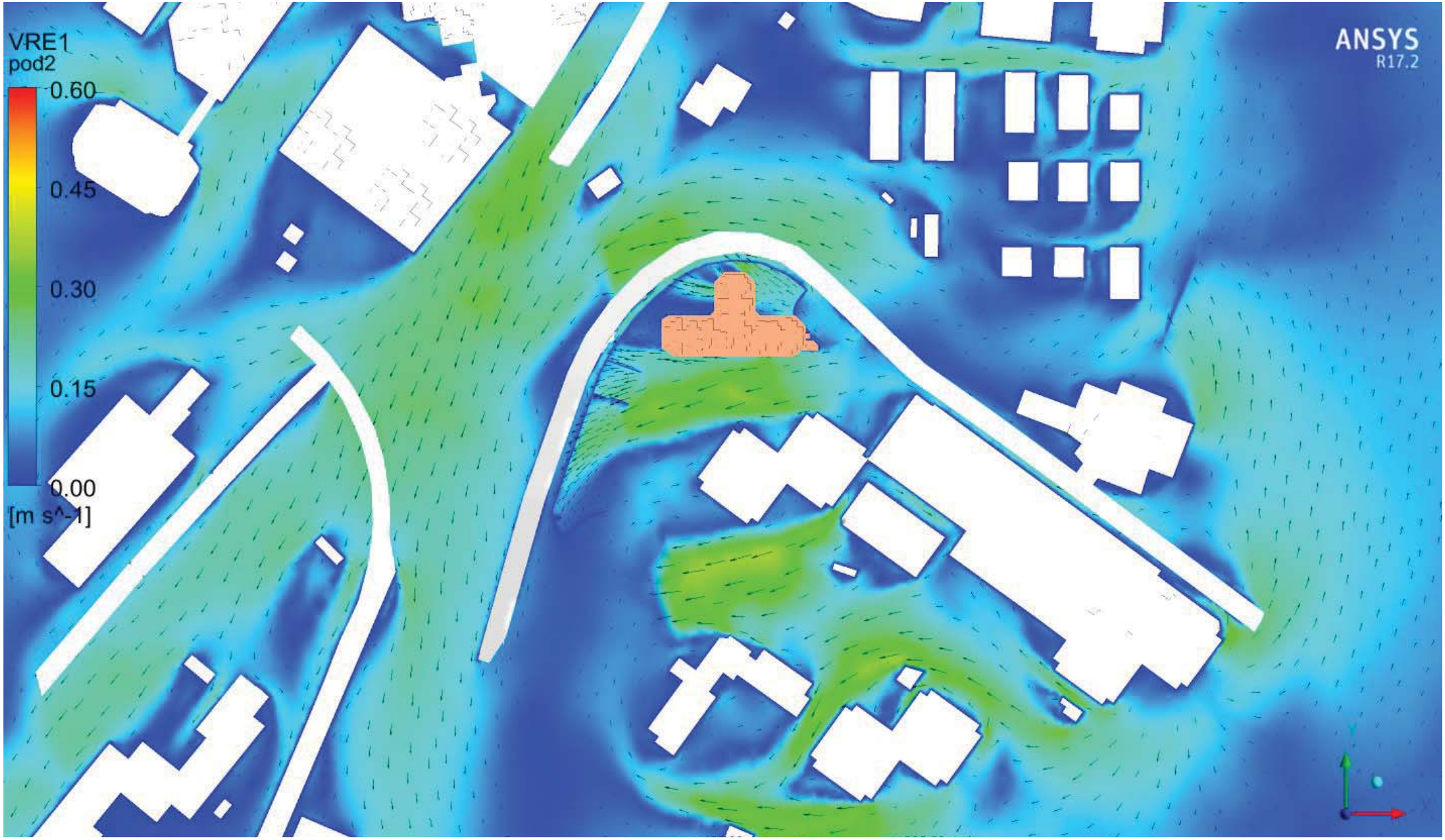
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under NE Wind (1H)



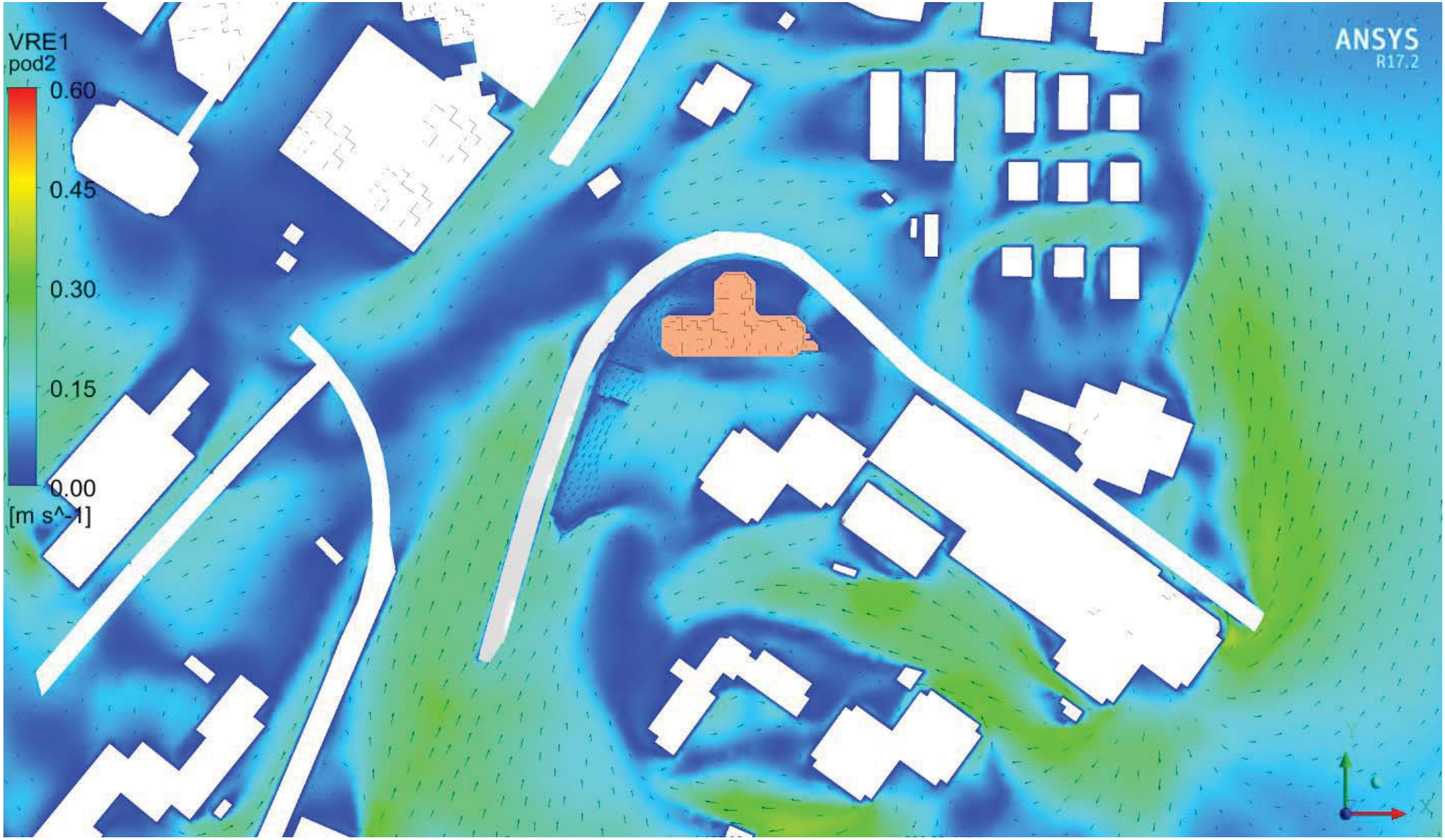
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under ENE Wind (1H)



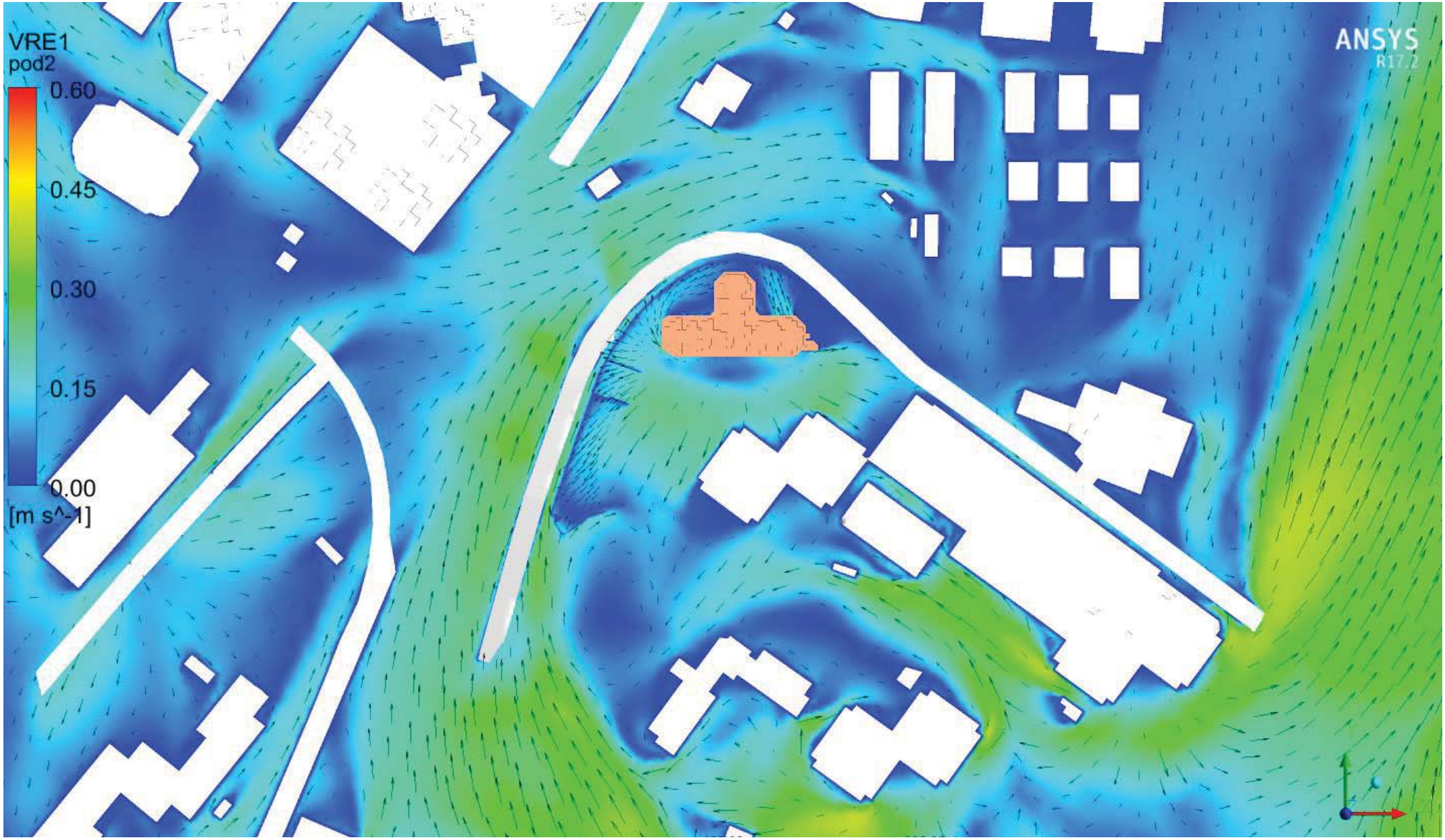
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under E Wind (1H)



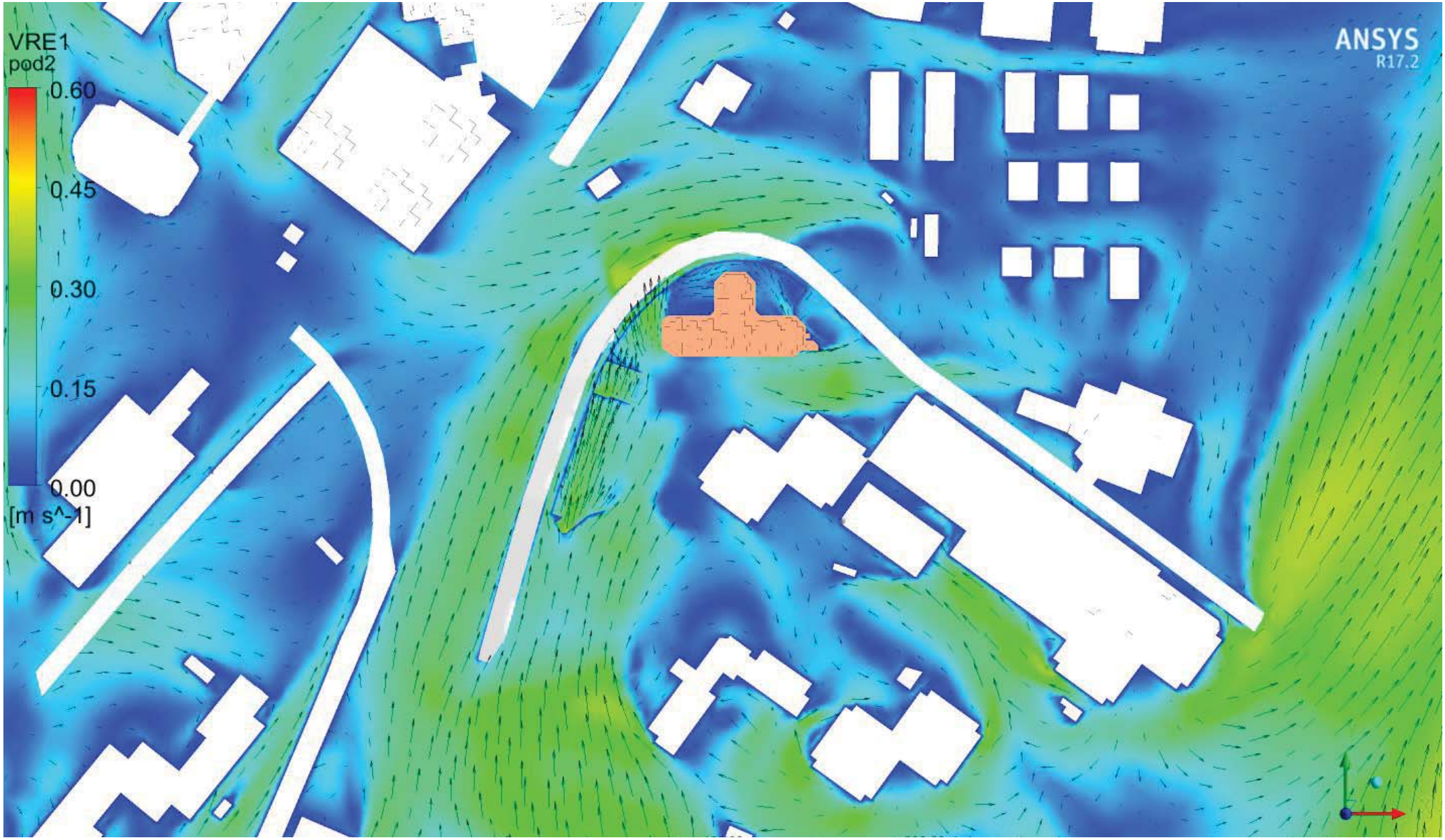
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under ESE Wind (1H)



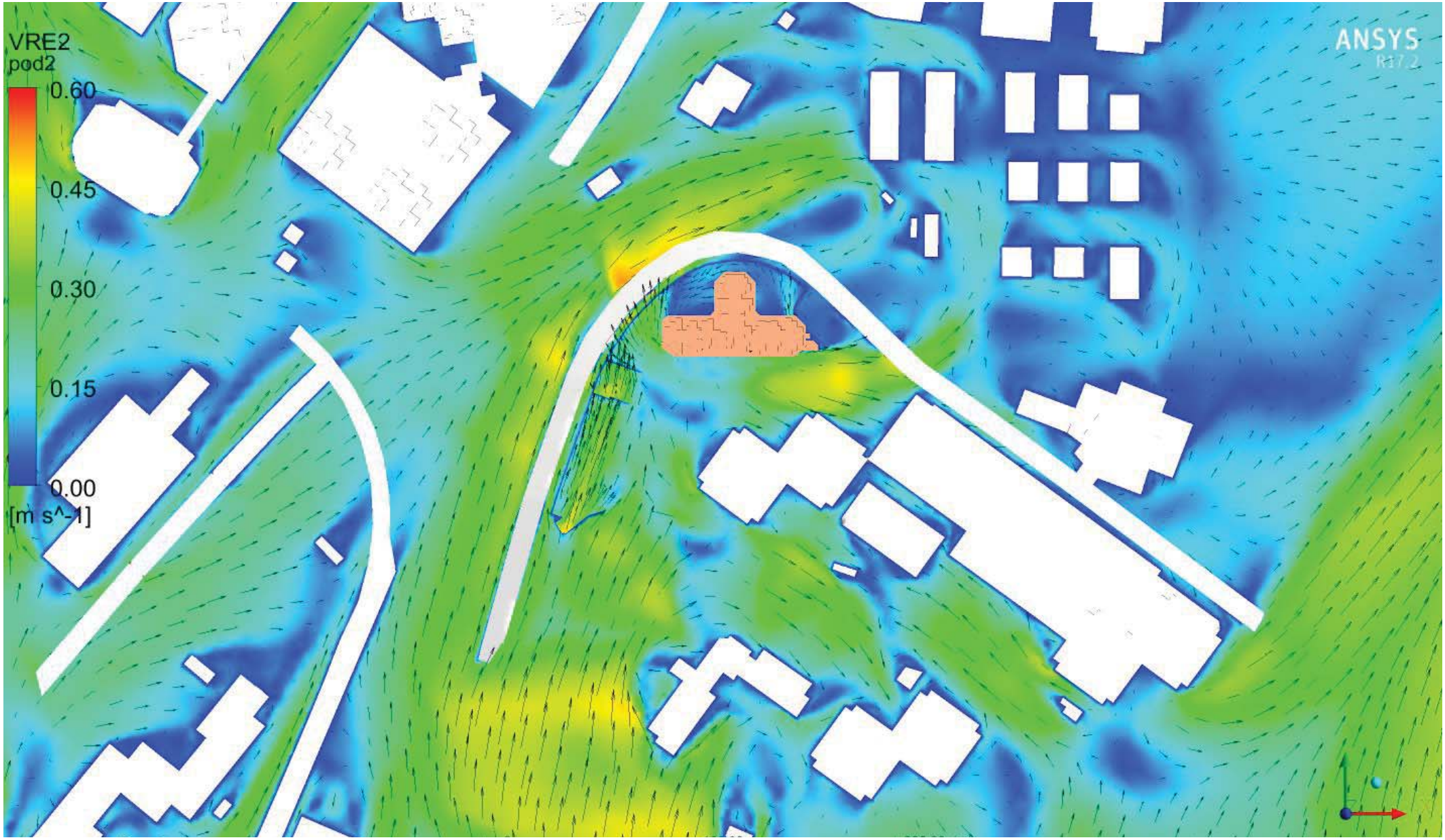
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under SE Wind (1H)



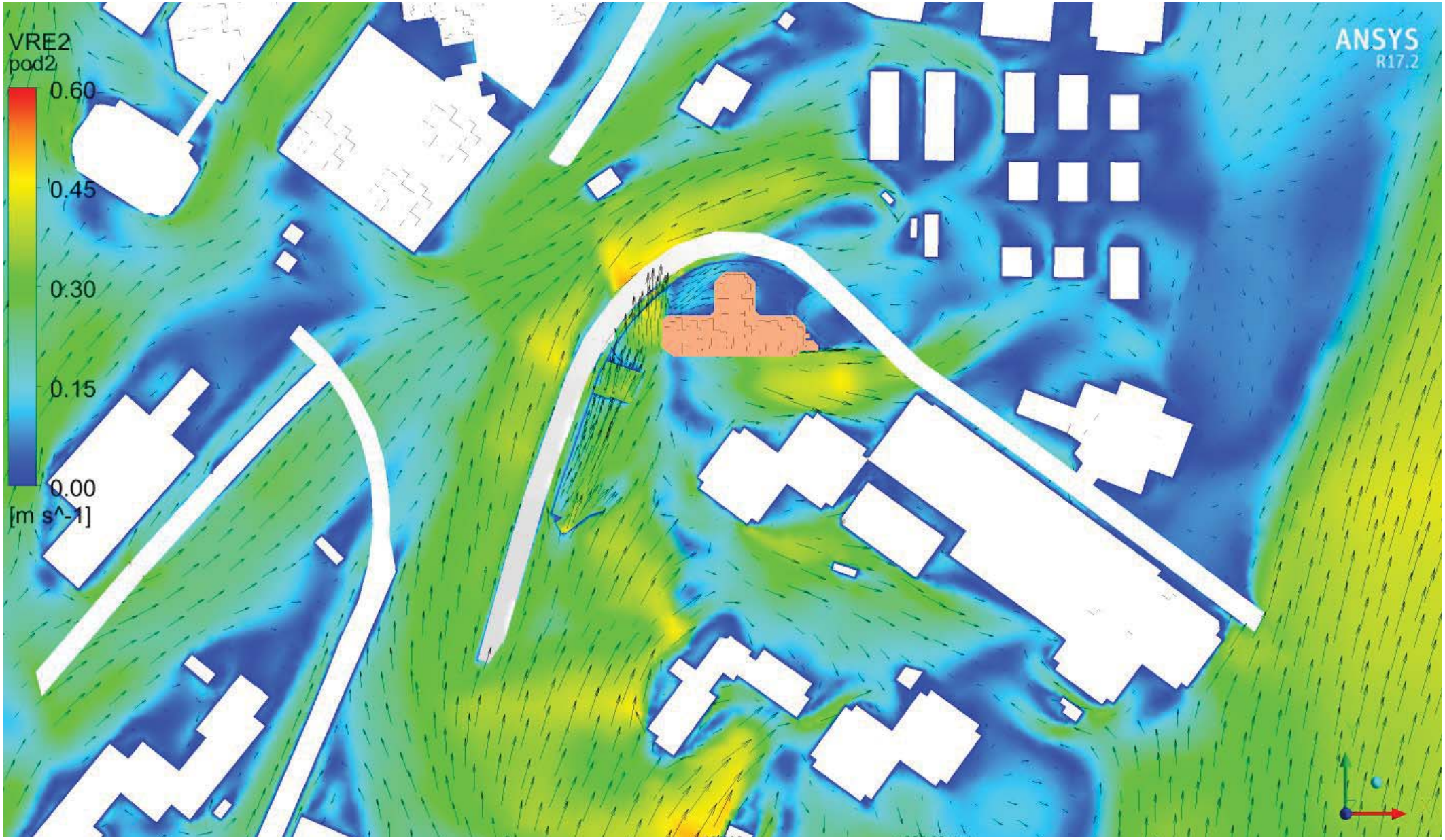
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under SSE Wind (1H)



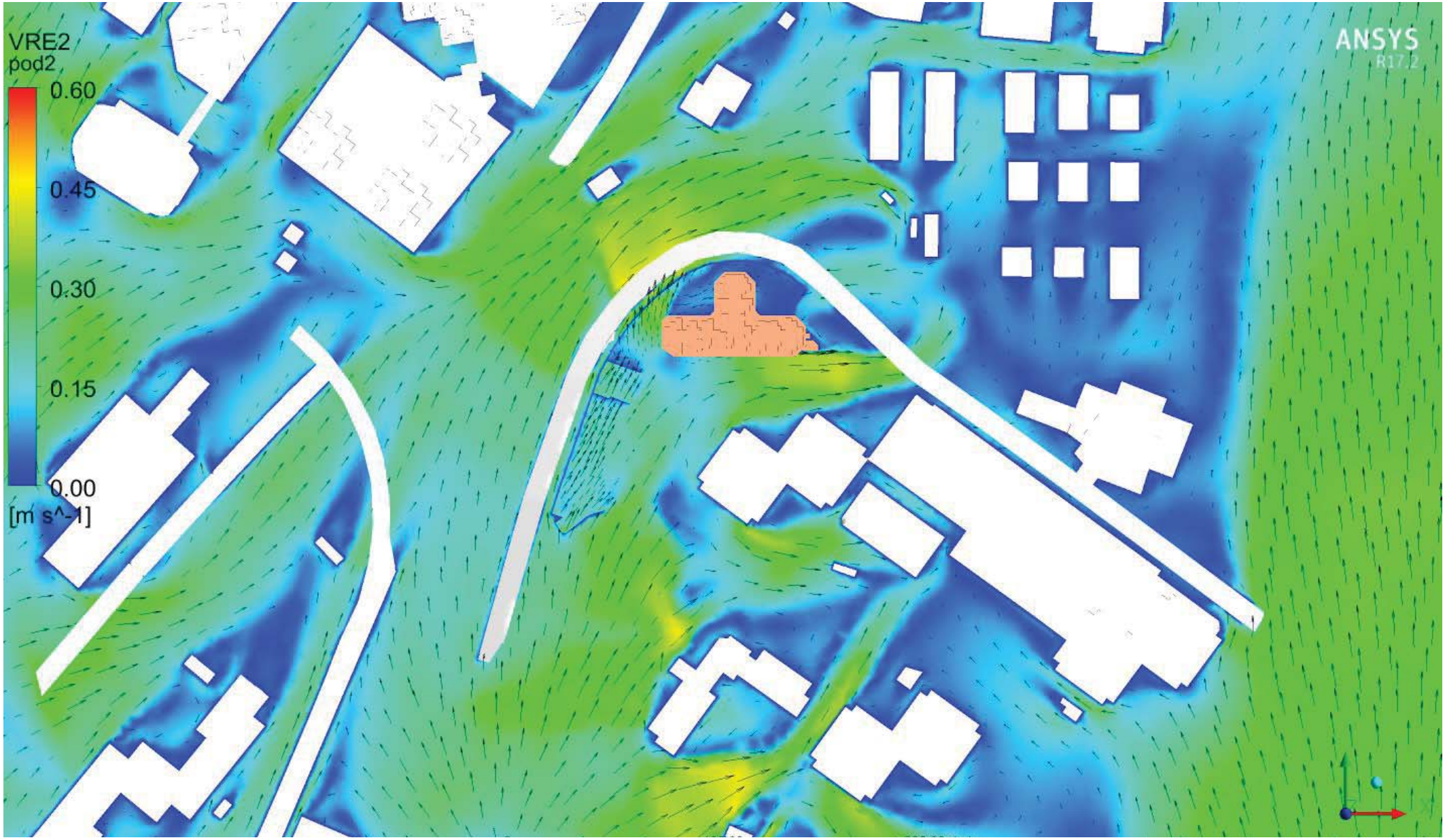
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under S Wind (1H)



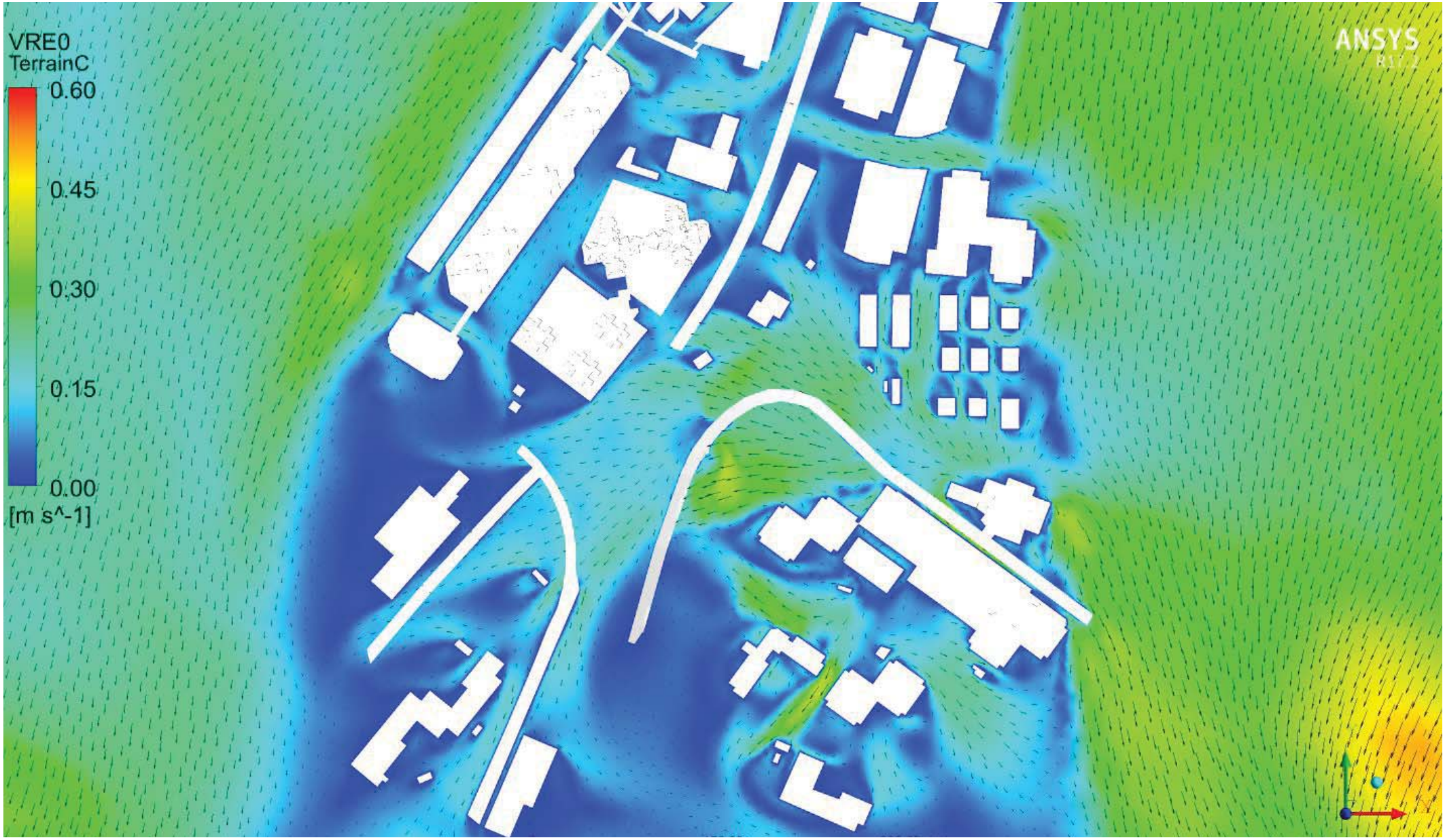
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under SSW Wind (1H)



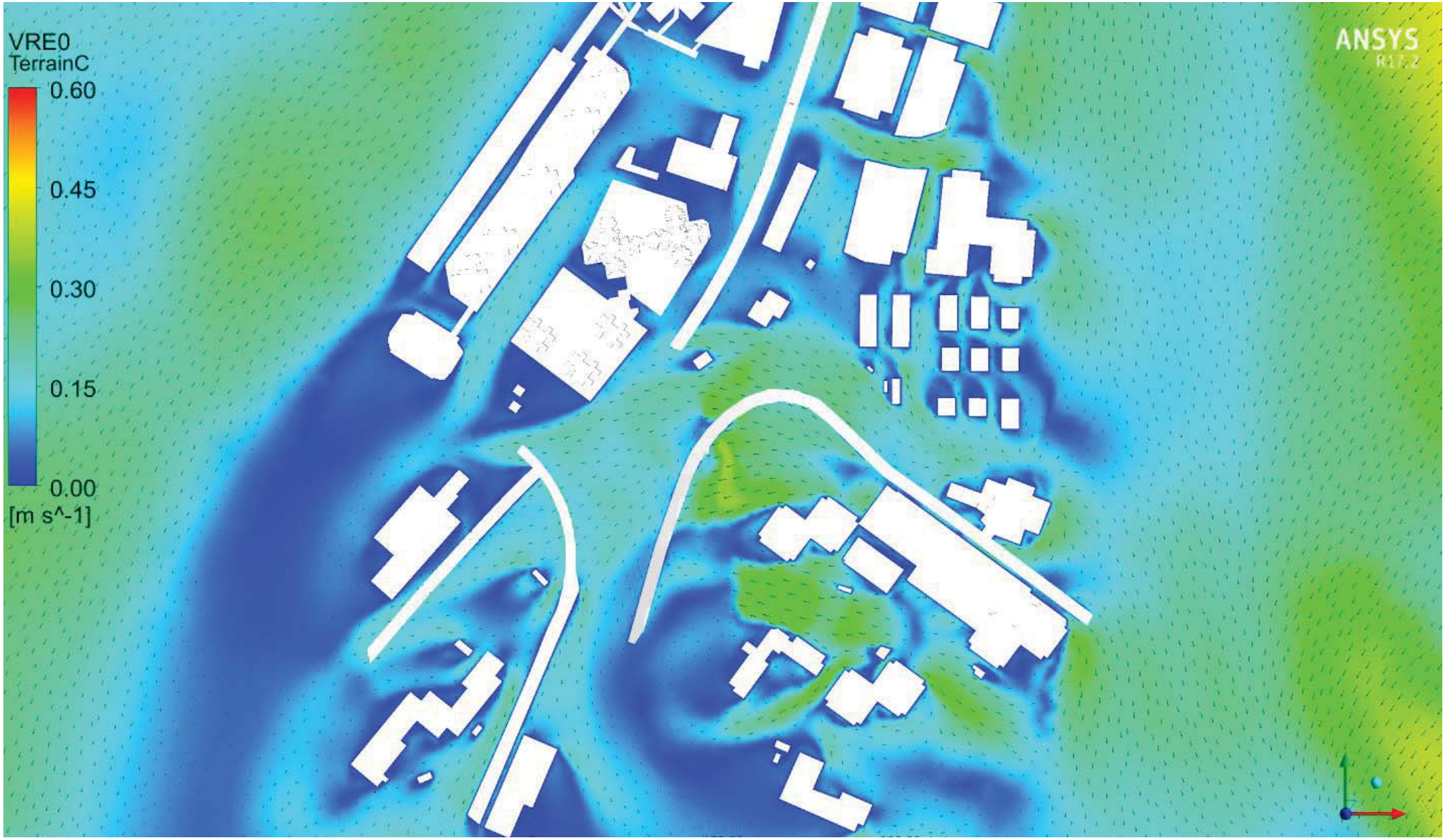
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under SW Wind (1H)



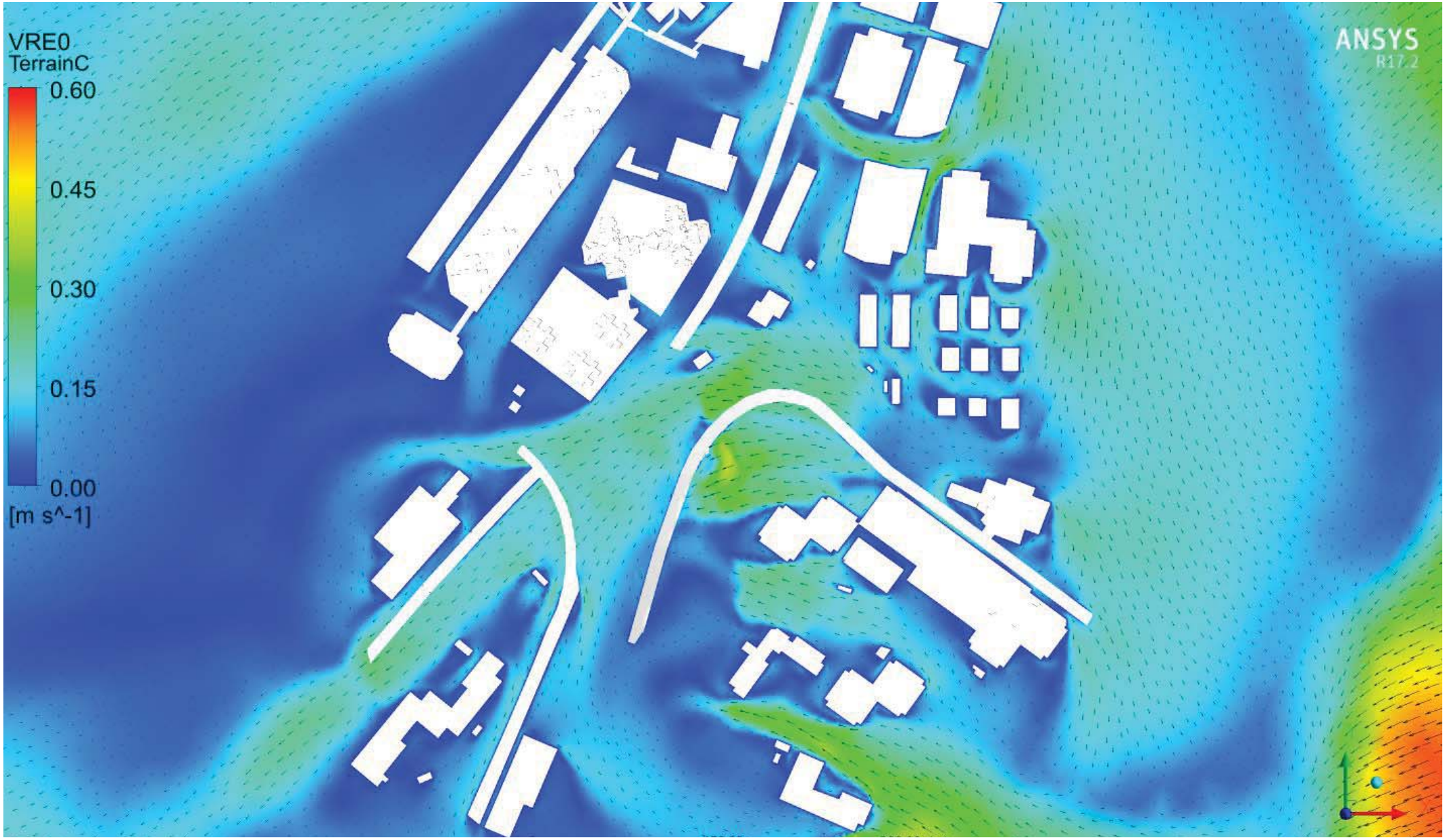
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under WSW Wind(1H)



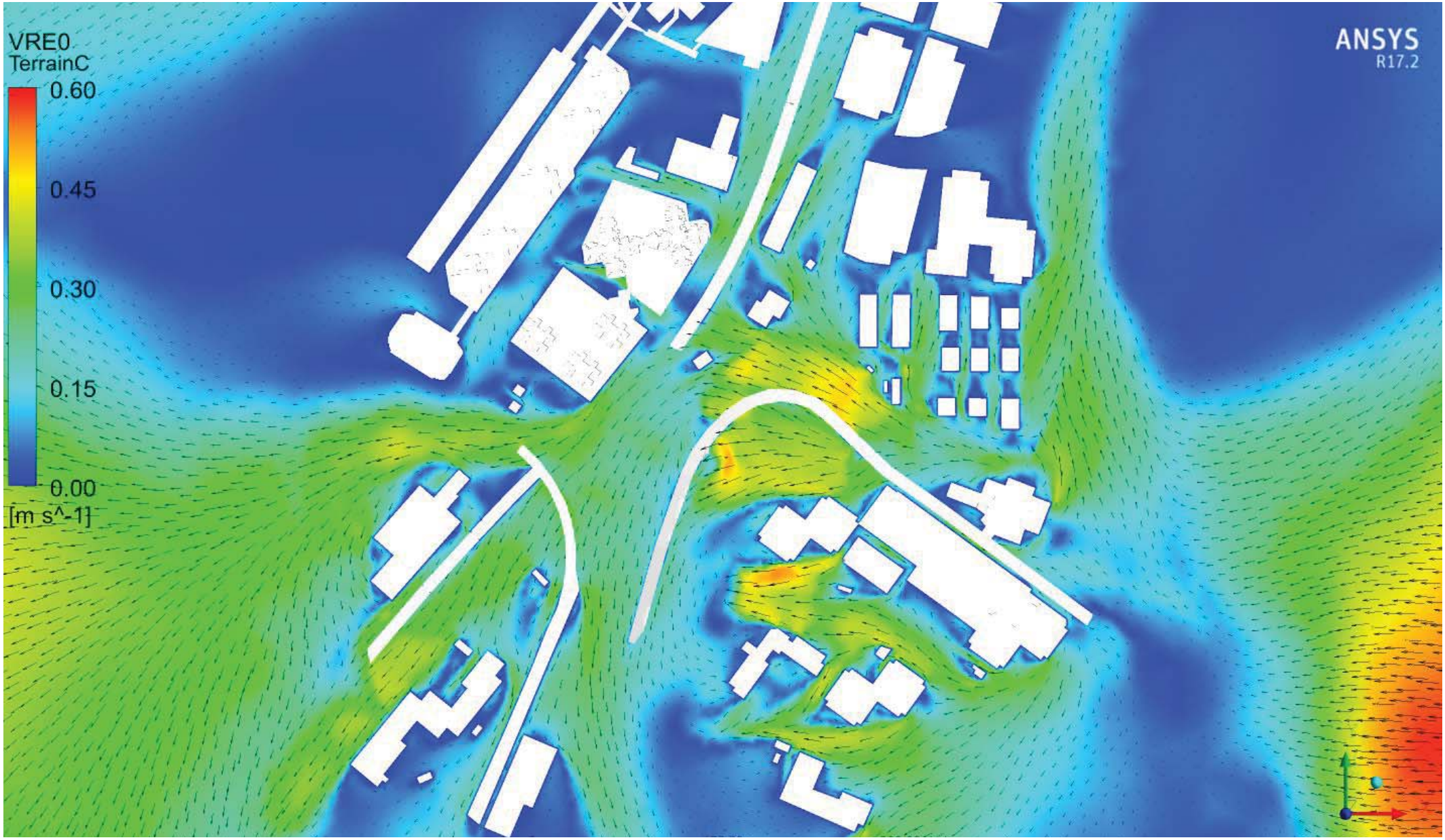
Existing Scenario – Wind VR colour and vector plot at pedestrian level under NNE Wind (2H)



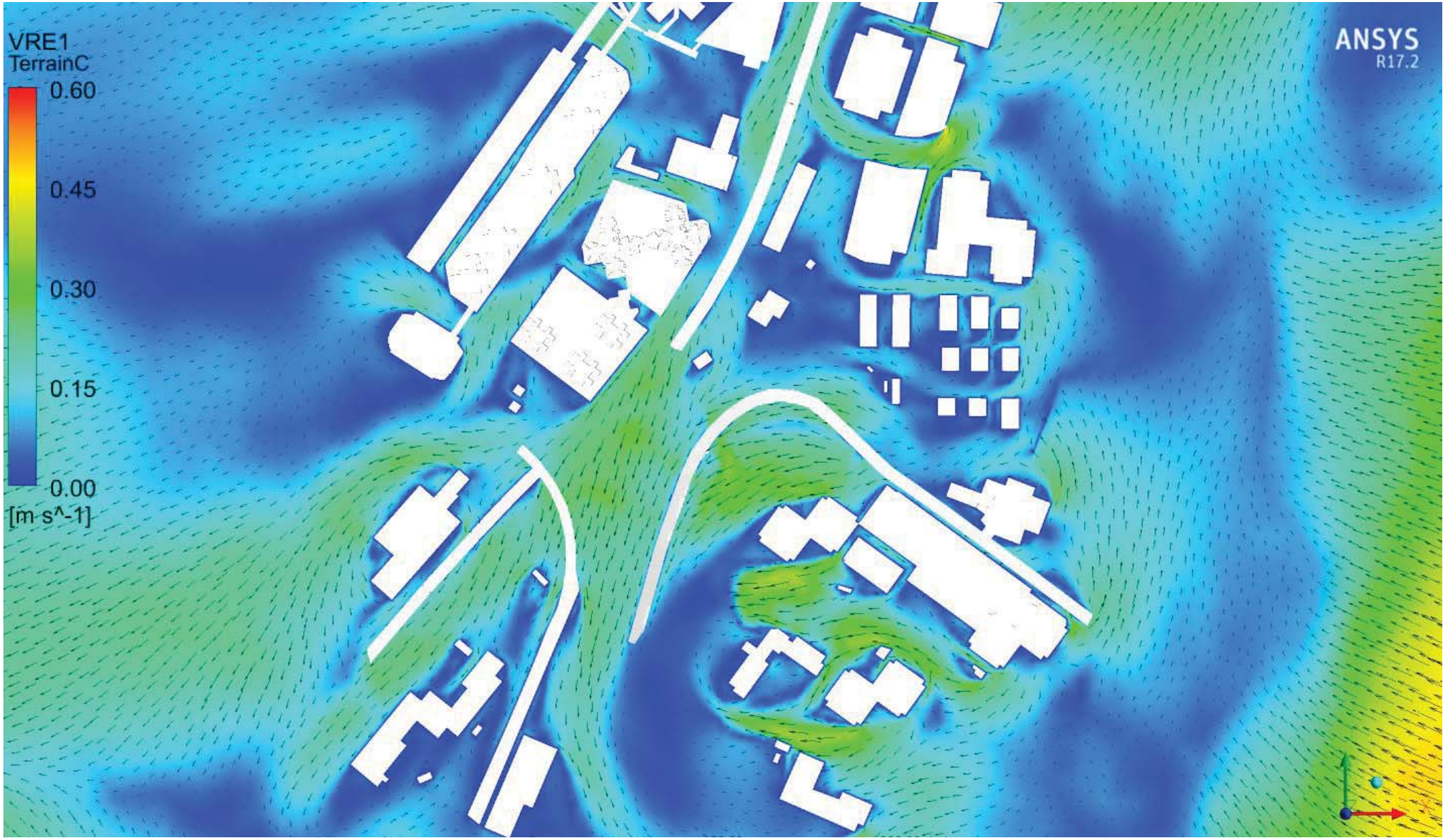
Existing Scenario – Wind VR colour and vector plot at pedestrian level under NE Wind (2H)



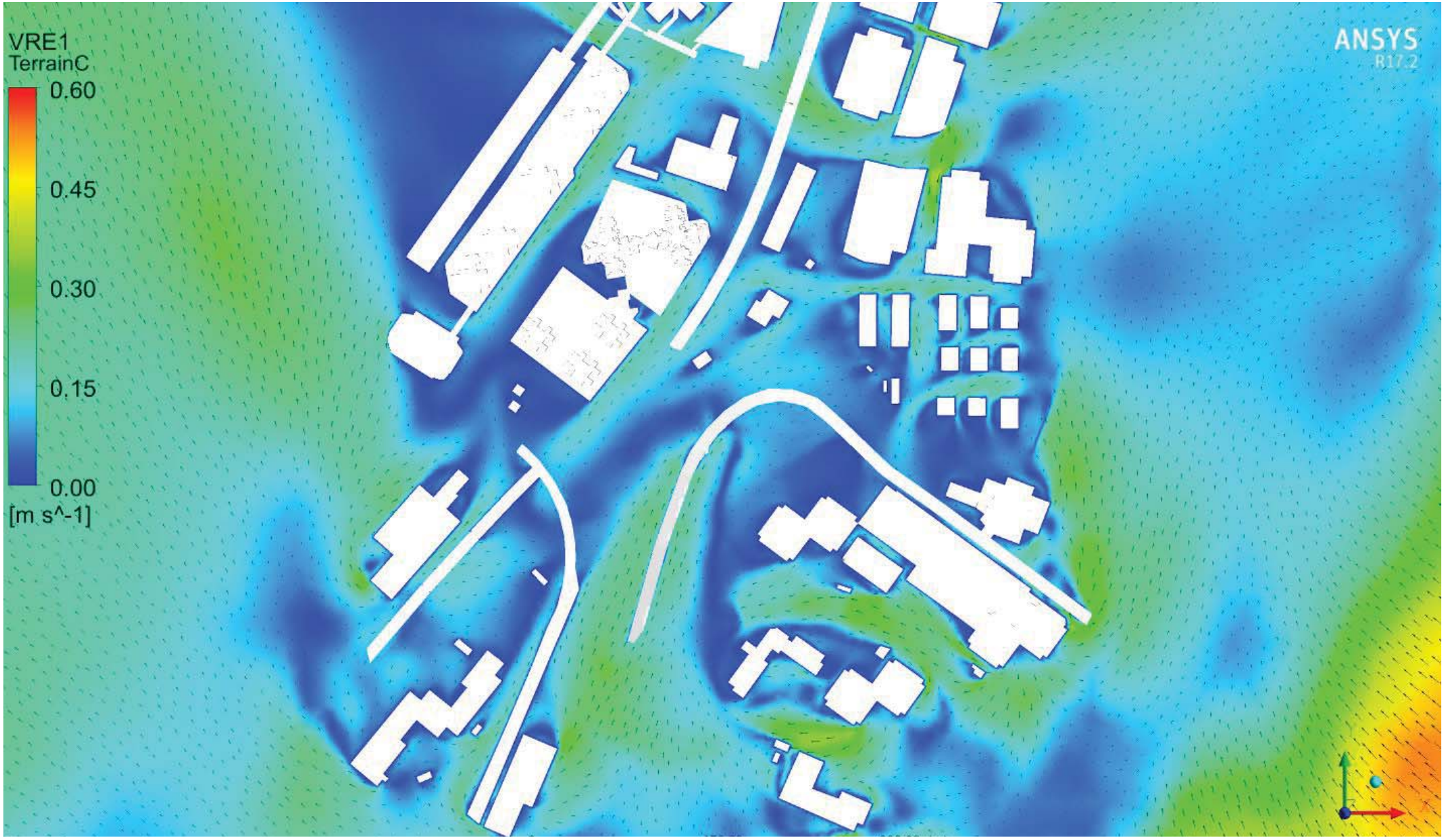
Existing Scenario – Wind VR colour and vector plot at pedestrian level under ENE Wind (2H)



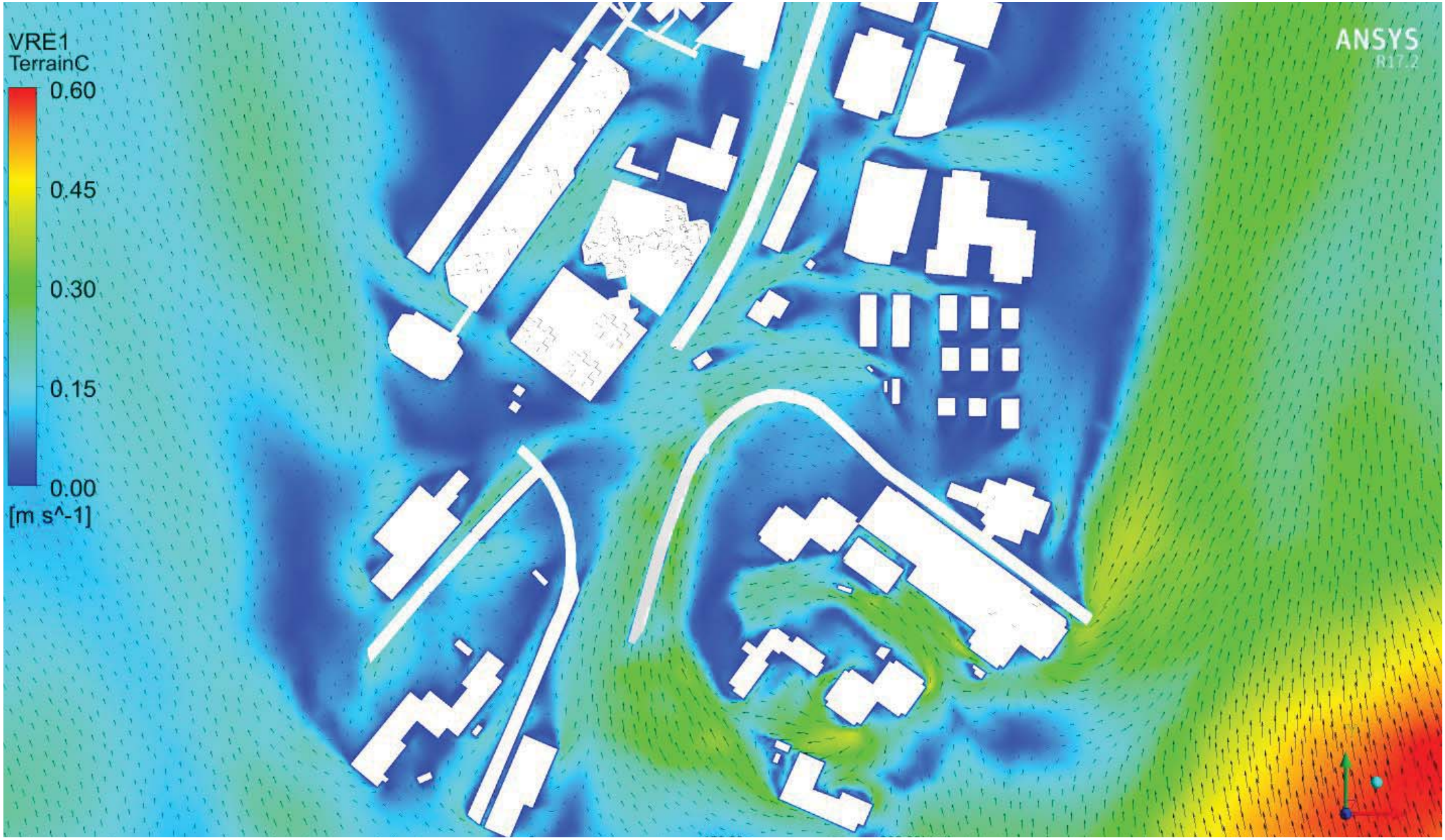
Existing Scenario – Wind VR colour and vector plot at pedestrian level under E Wind (2H)



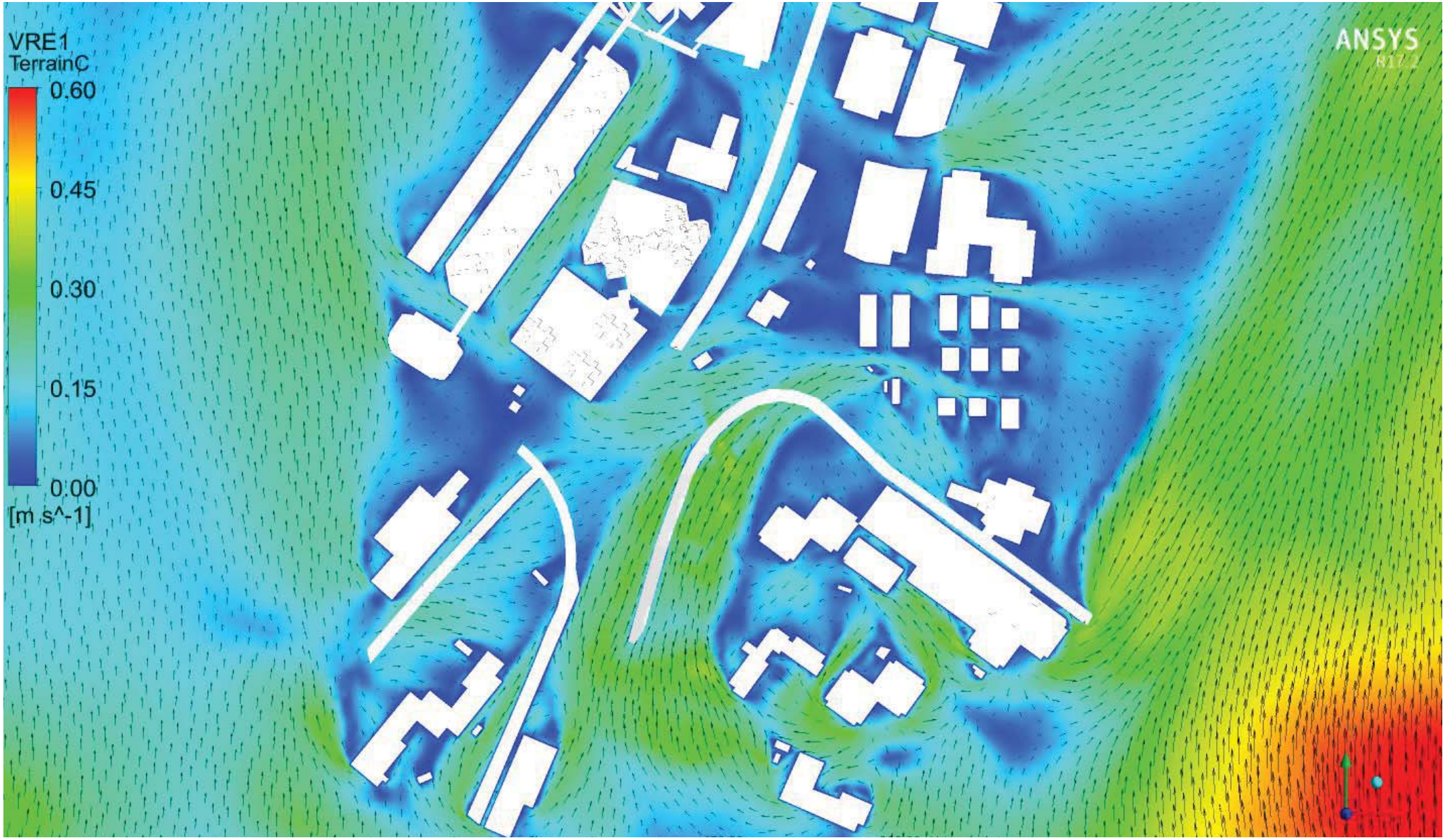
Existing Scenario – Wind VR colour and vector plot at pedestrian level under ESE Wind (2H)



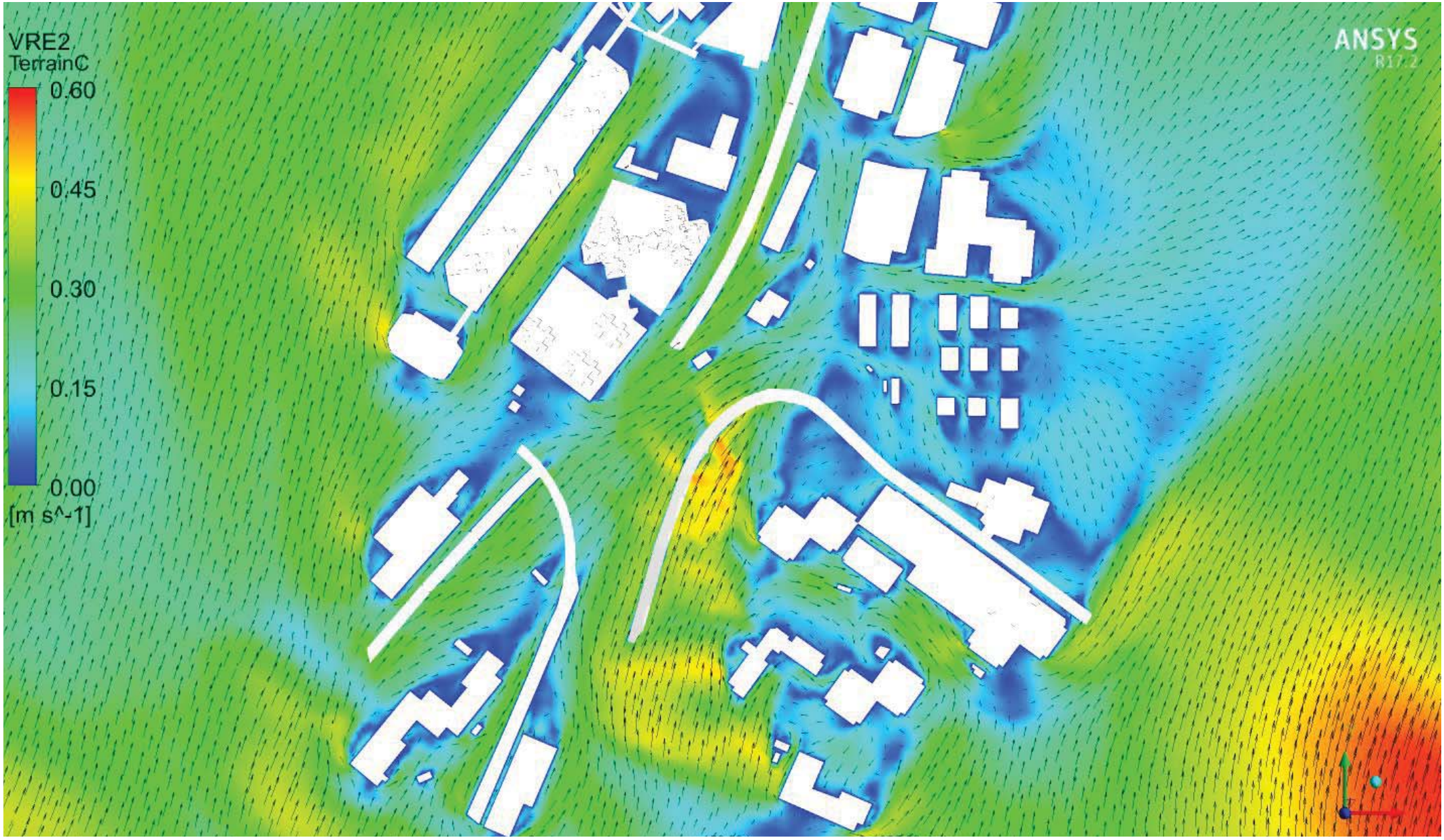
Existing Scenario – Wind VR colour and vector plot at pedestrian level under SE Wind (2H)



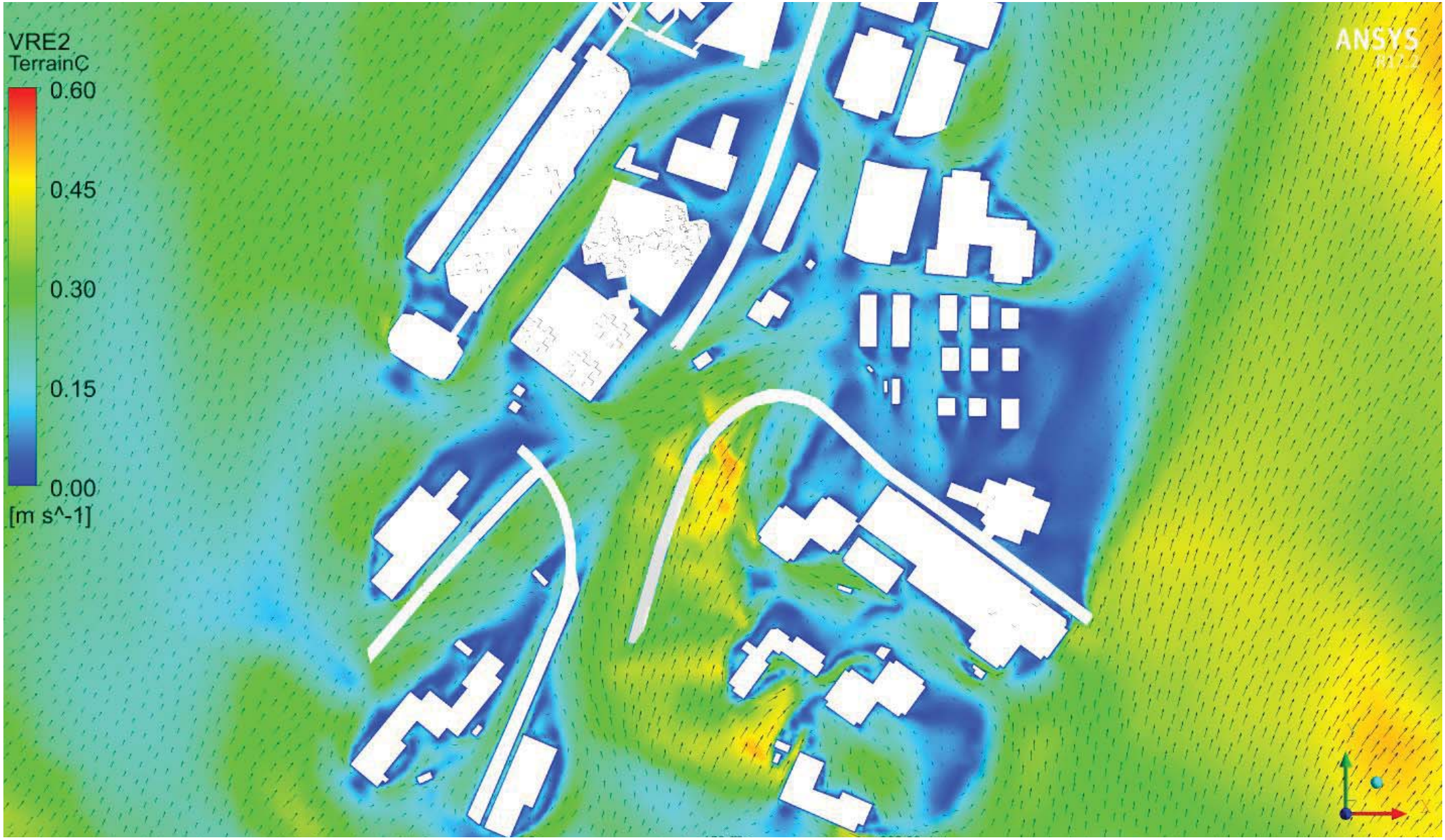
Existing Scenario – Wind VR colour and vector plot at pedestrian level under SSE Wind (2H)



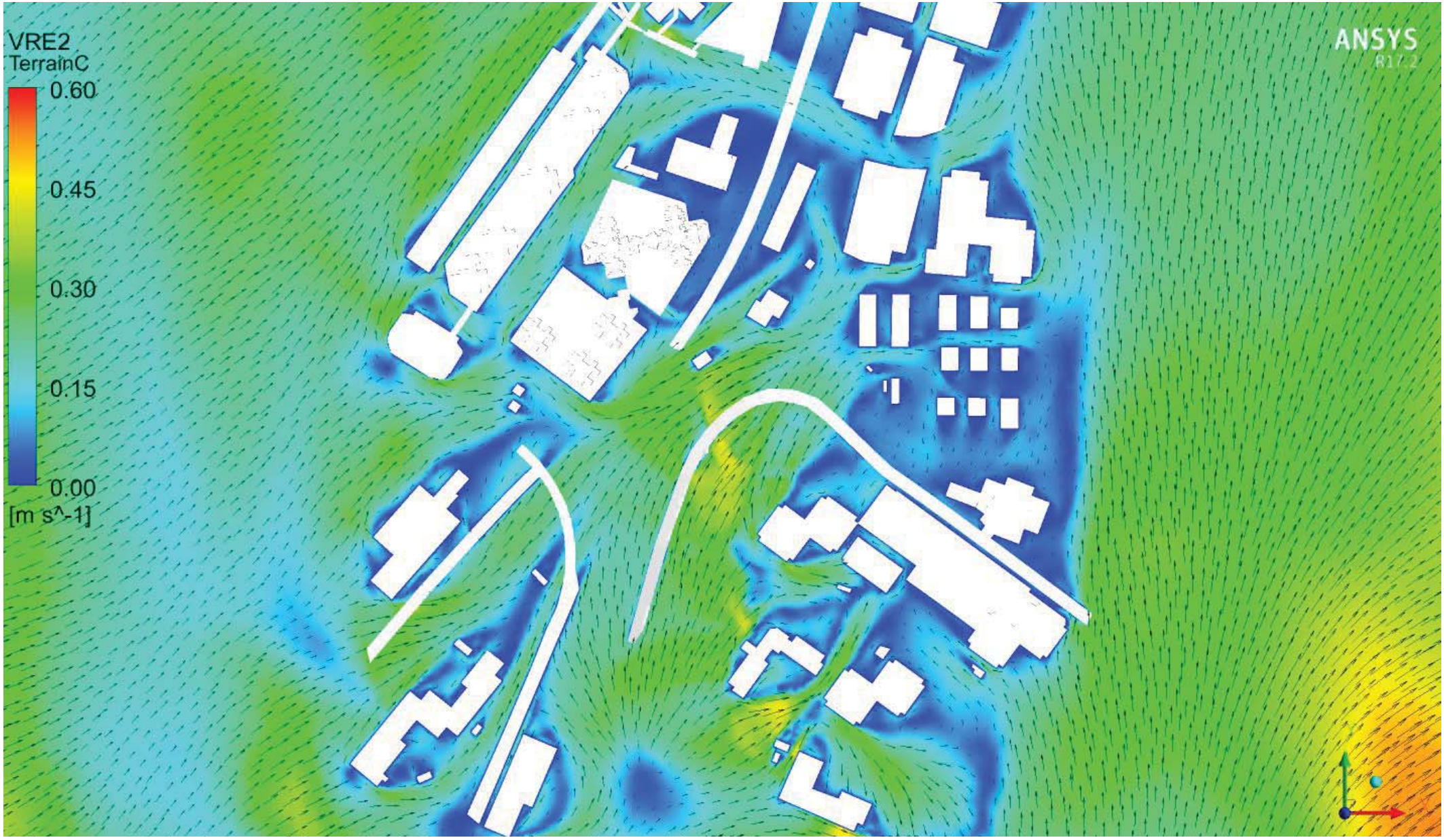
Existing Scenario – Wind VR colour and vector plot at pedestrian level under S Wind (2H)



Existing Scenario – Wind VR colour and vector plot at pedestrian level under SSW Wind (2H)

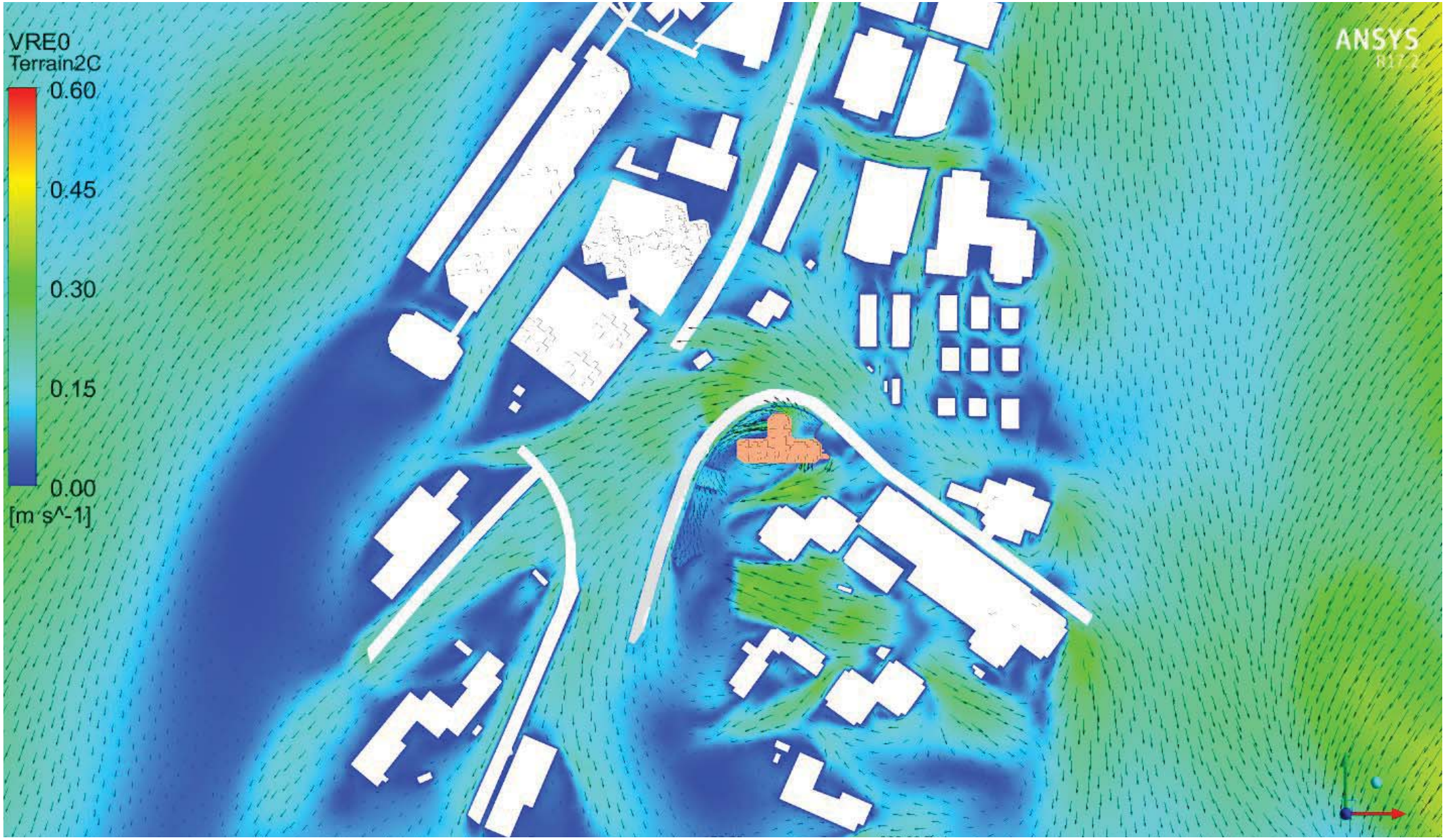


Existing Scenario – Wind VR colour and vector plot at pedestrian level under SW Wind (2H)

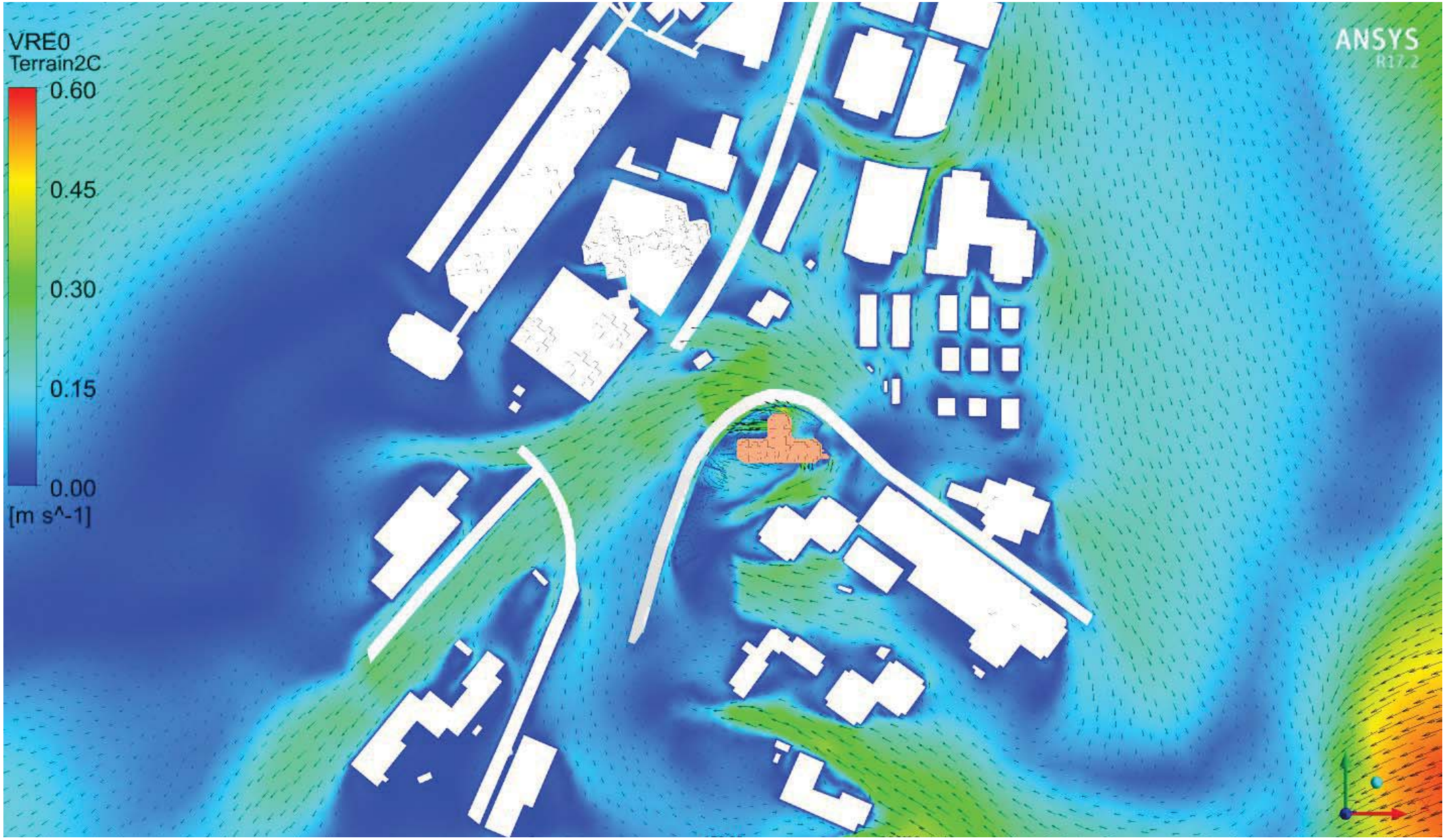


Existing Scenario – Wind VR colour and vector plot at pedestrian level under WSW Wind (2H)

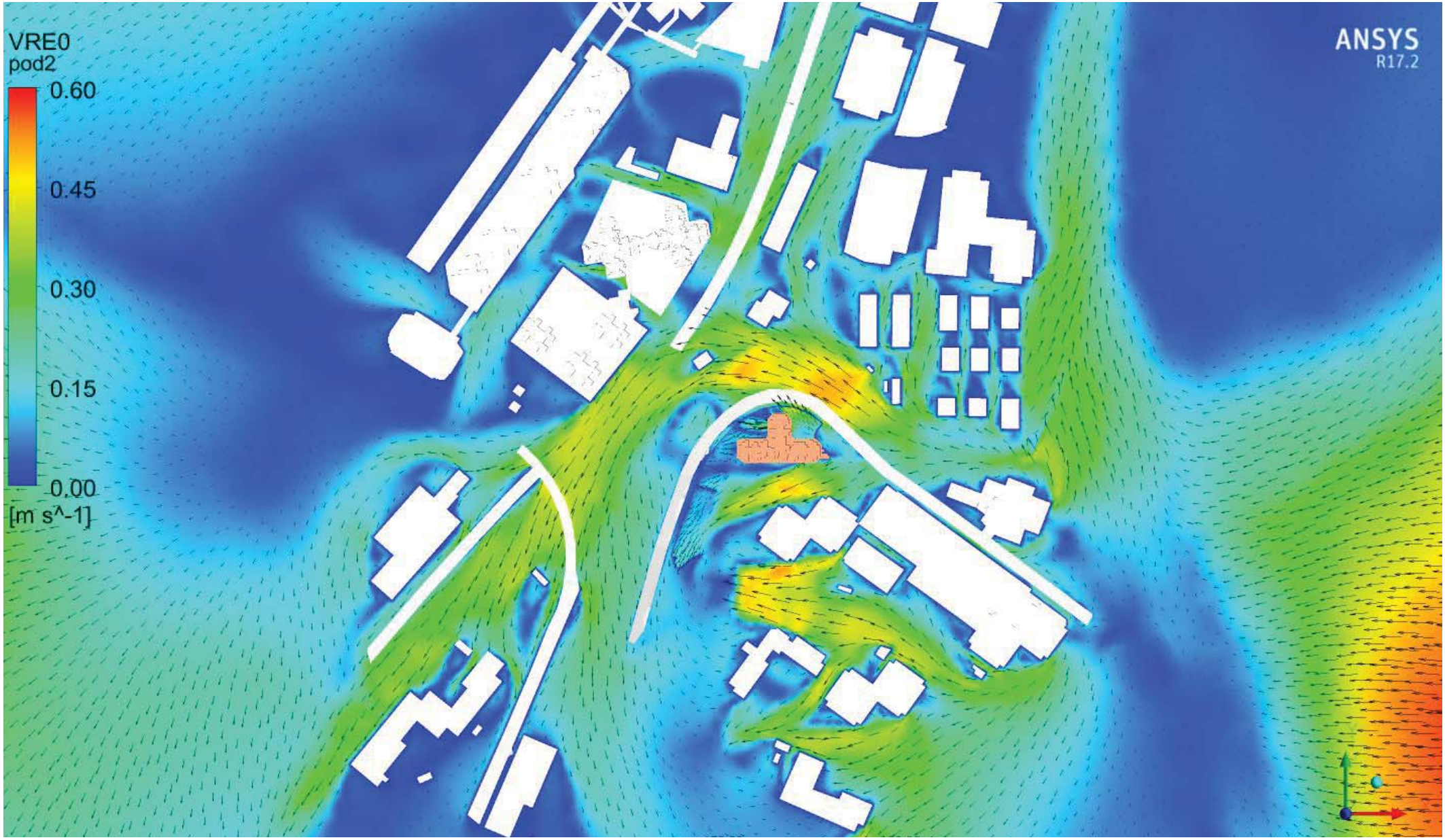
Baseline Scenario – Wind VR colour and vector plot at pedestrian level under NNE Wind (2H)



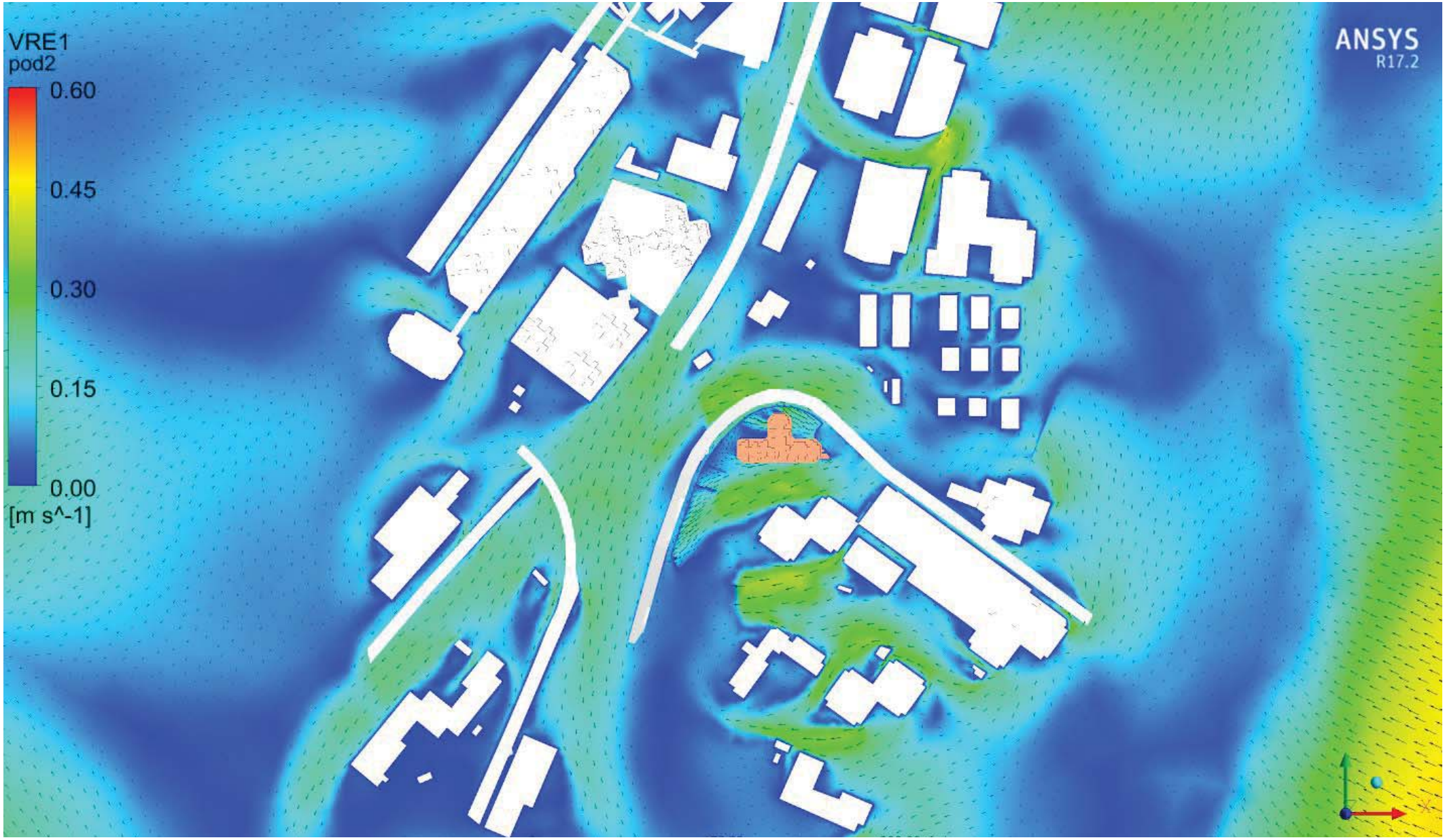
Baseline Scenario – Wind VR colour and vector plot at pedestrian level under NE Wind (2H)



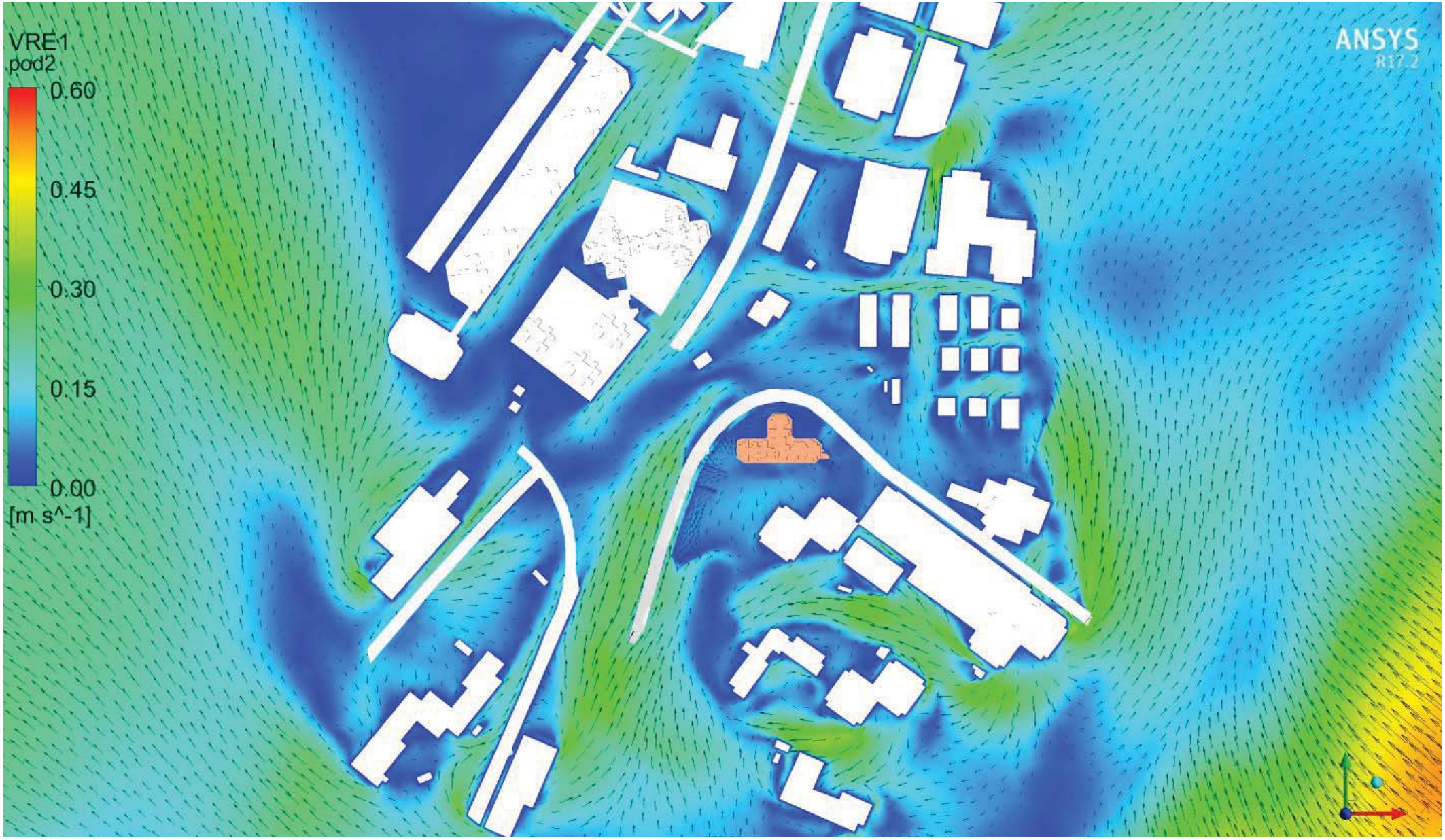
Baseline Scenario – Wind VR colour and vector plot at pedestrian level under ENE Wind (2H)



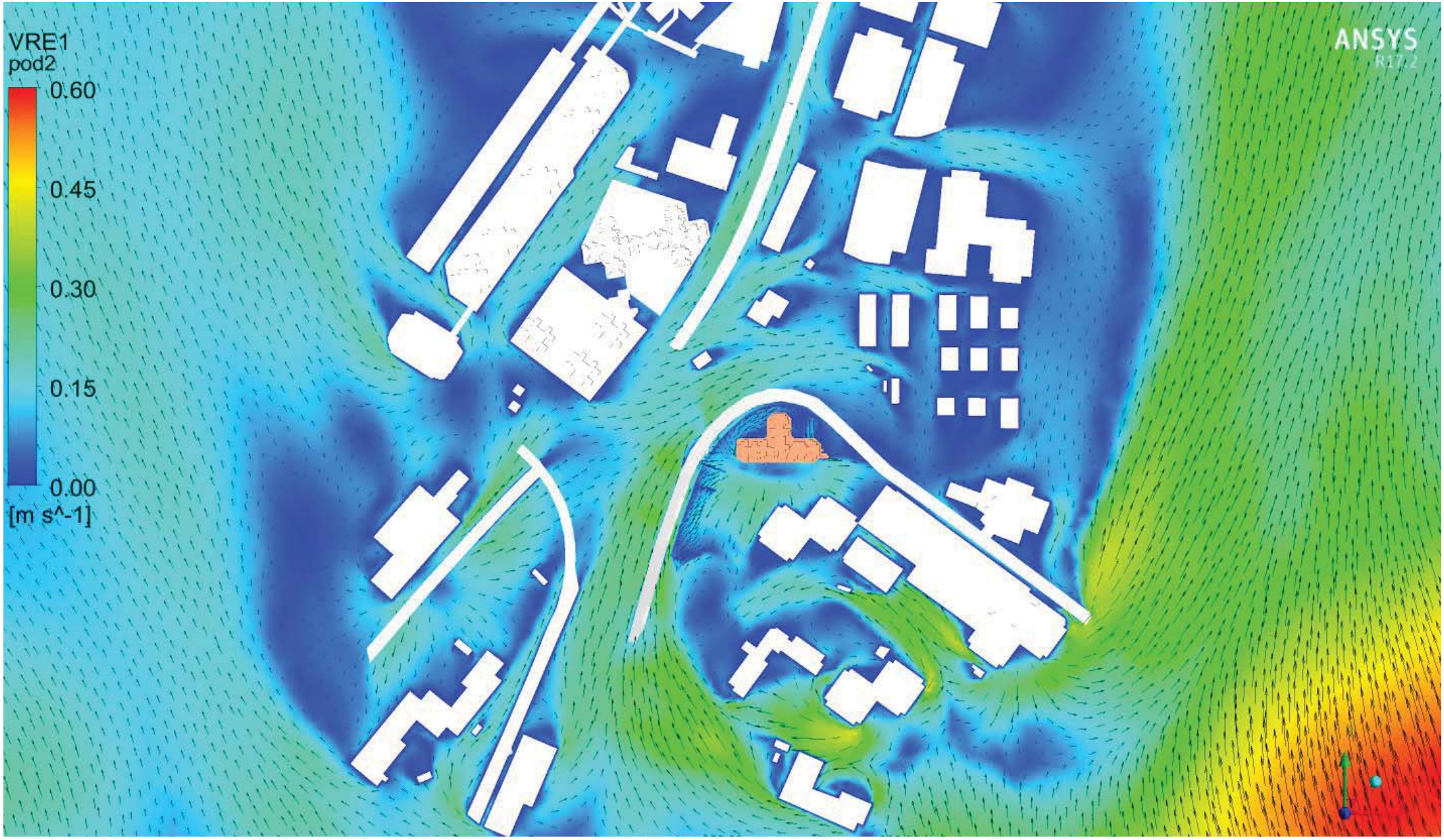
Baseline Scenario – Wind VR colour and vector plot at pedestrian level under E Wind (2H)



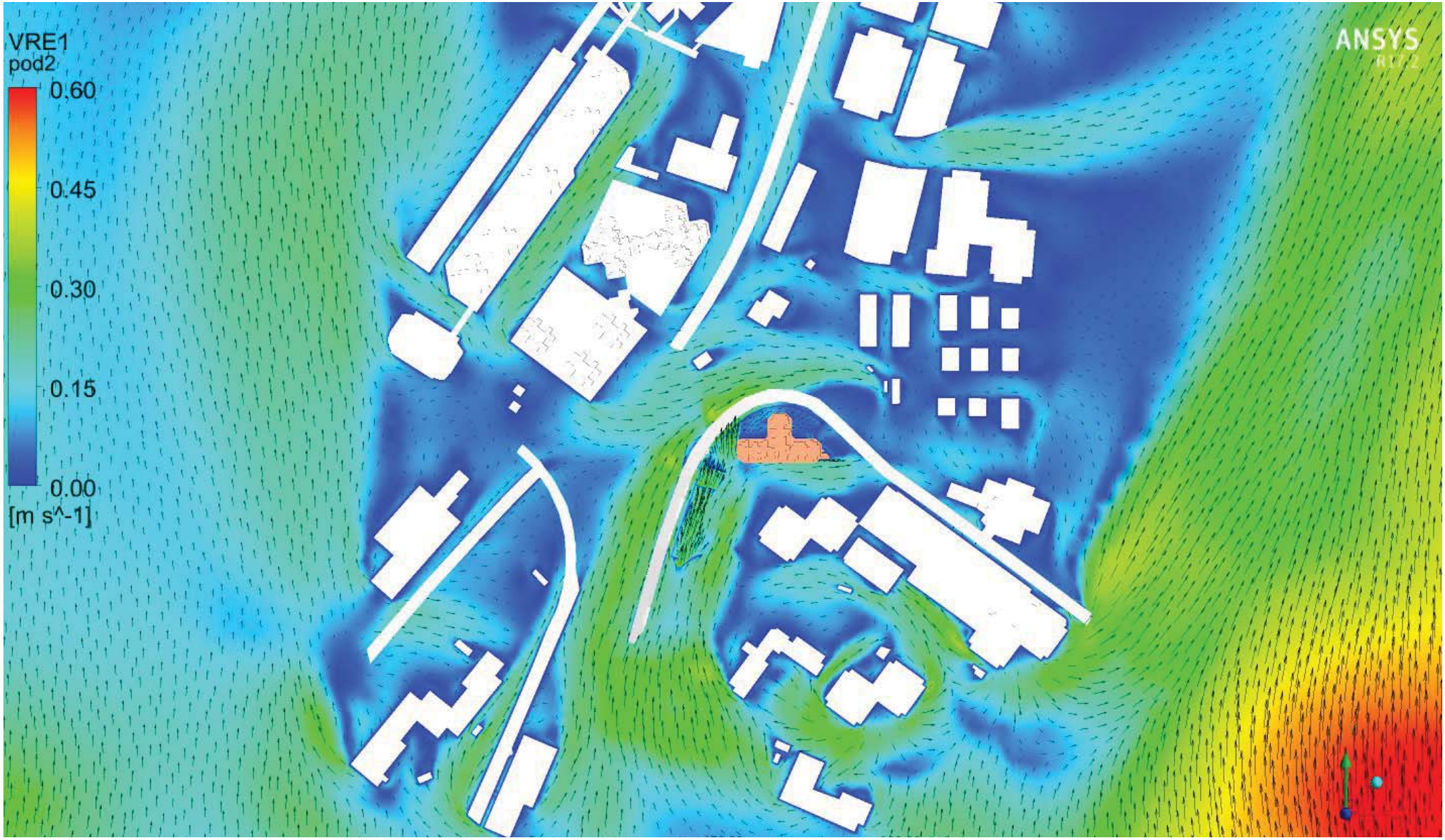
Baseline Scenario – Wind VR colour and vector plot at pedestrian level under ESE Wind (2H)



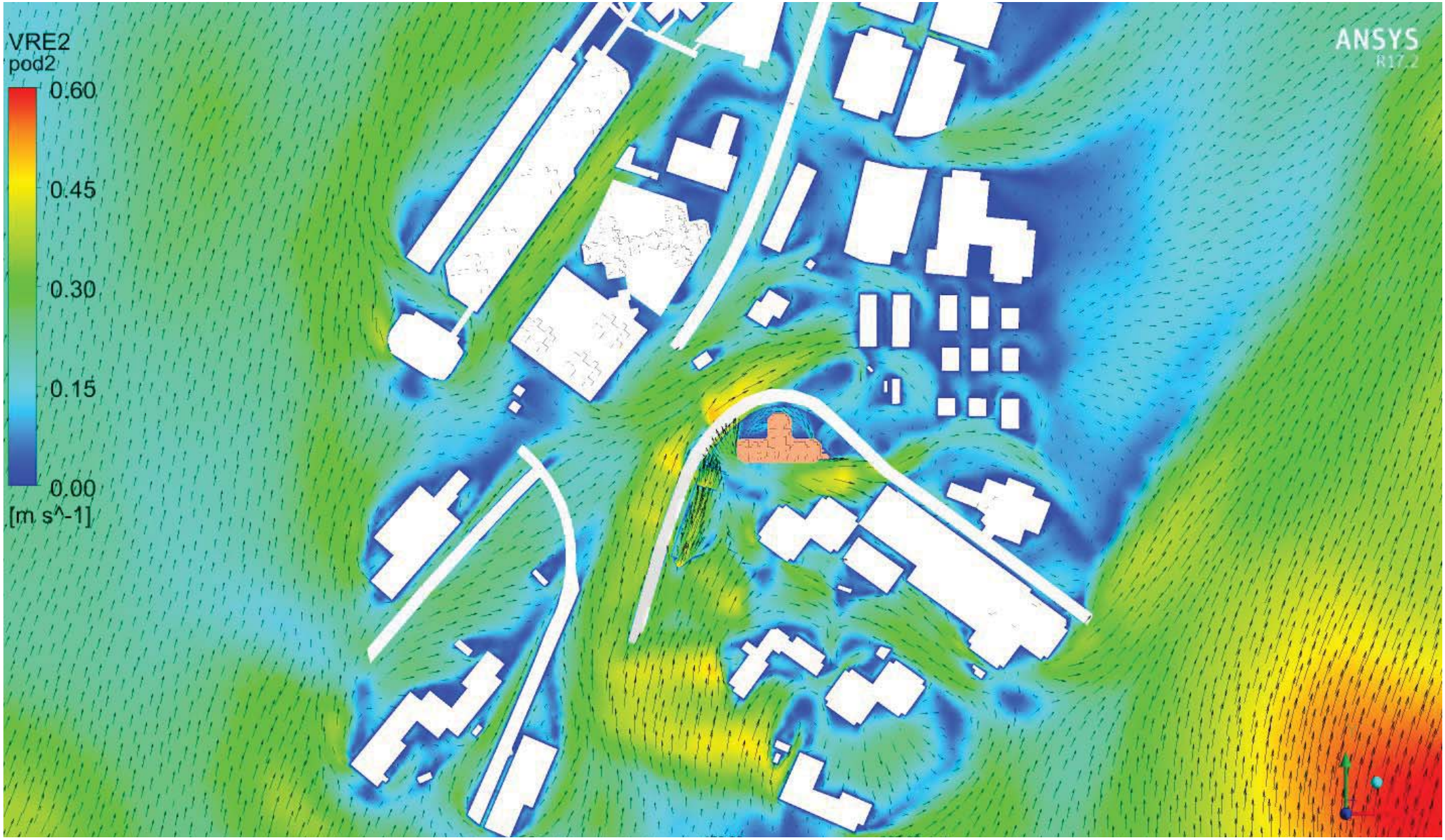
Baseline Scenario – Wind VR colour and vector plot at pedestrian level under SE Wind (2H)



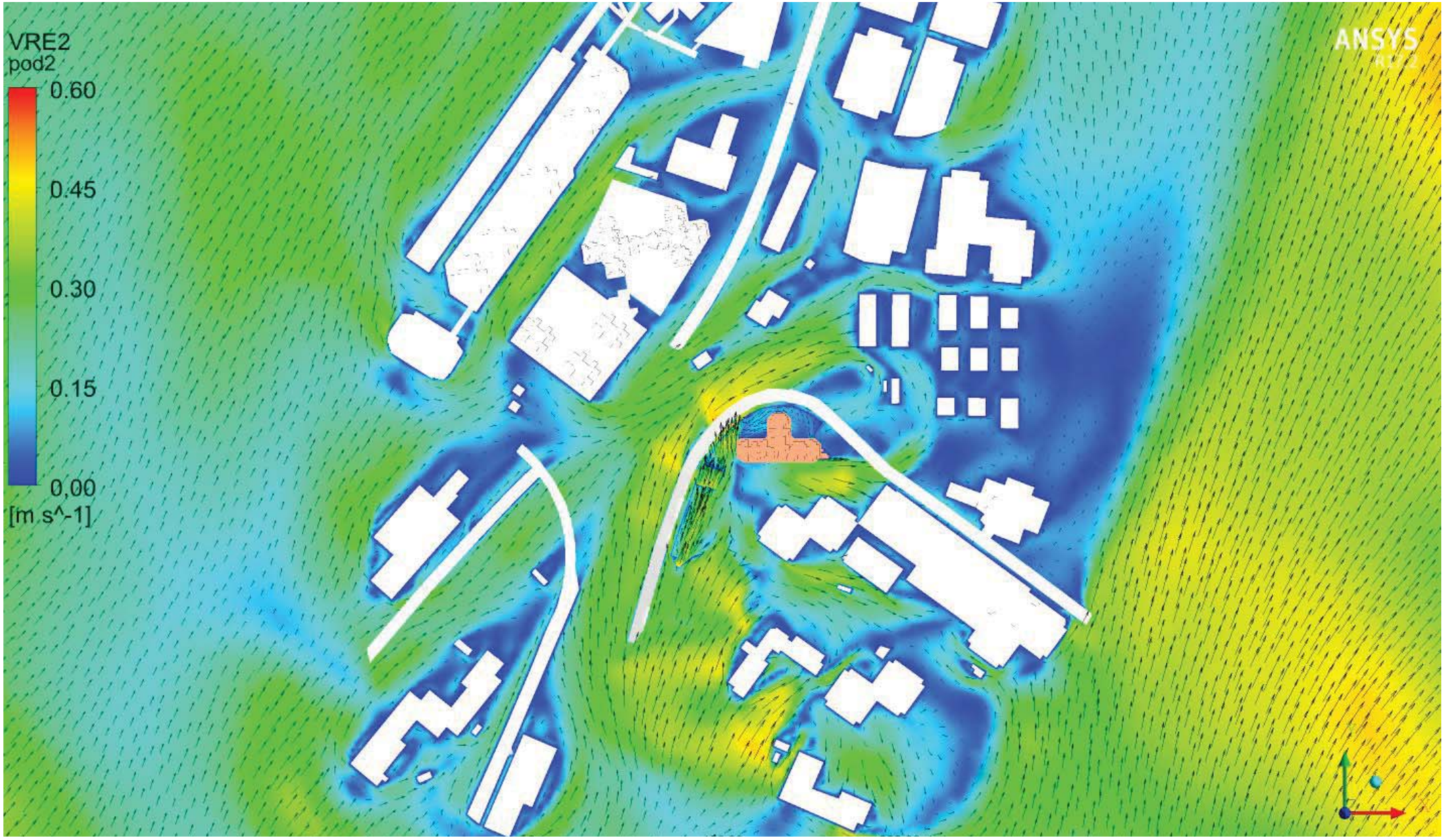
Baseline Scenario – Wind VR colour and vector plot at pedestrian level under SSE Wind (2H)



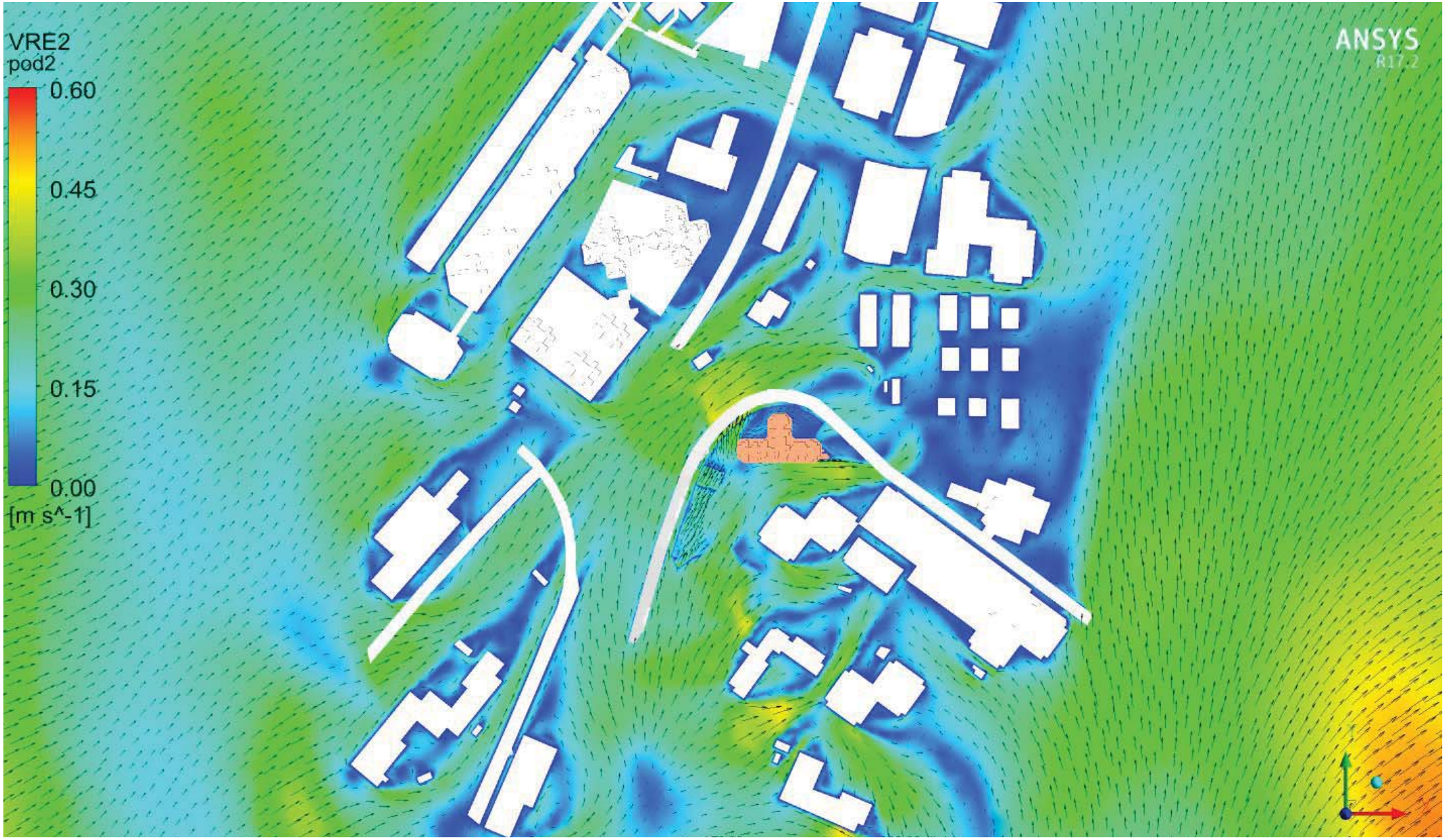
Baseline Scenario – Wind VR colour and vector plot at pedestrian level under S Wind (2H)



Baseline Scenario – Wind VR colour and vector plot at pedestrian level under SSW Wind (2H)

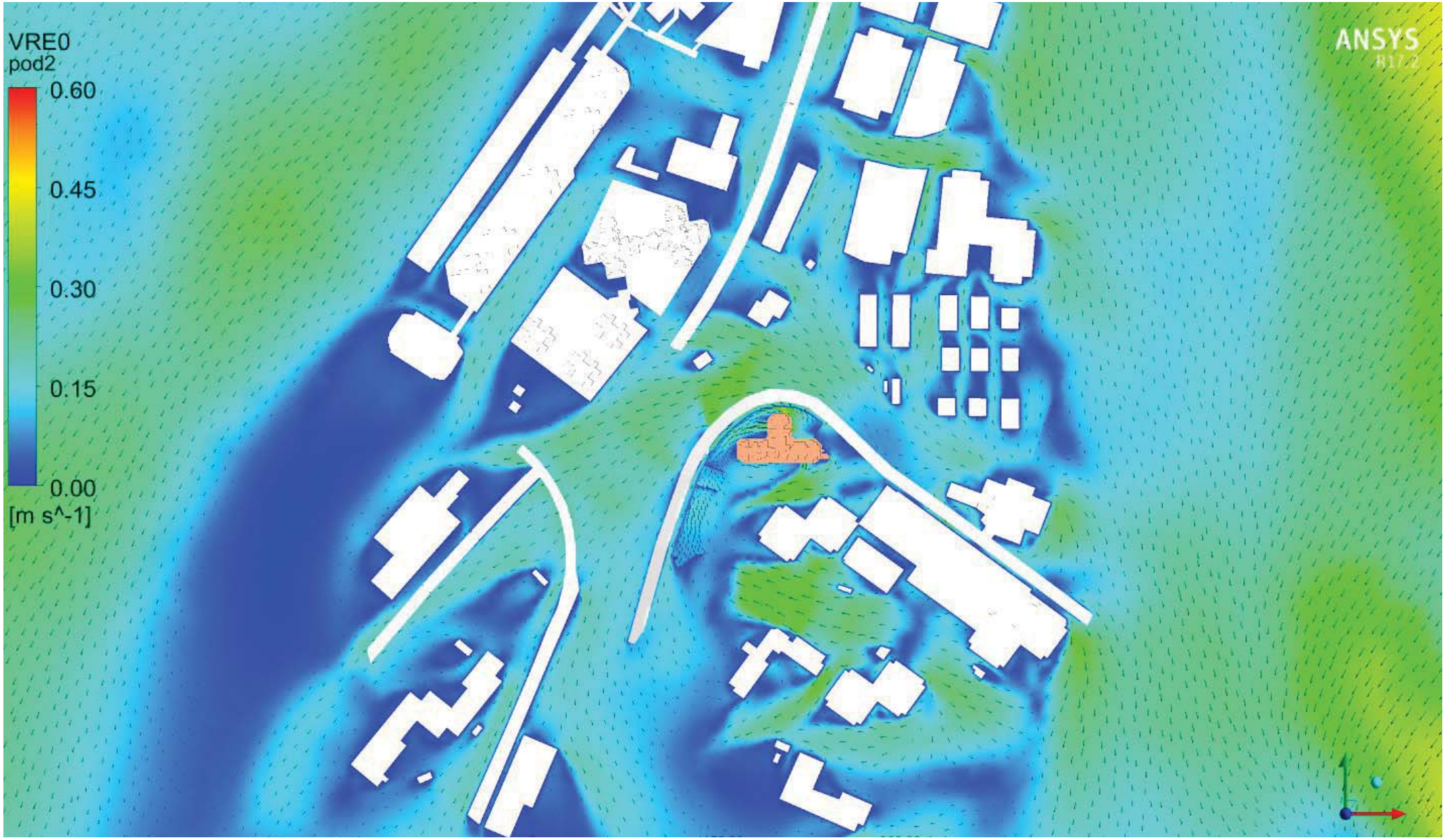


Baseline Scenario – Wind VR colour and vector plot at pedestrian level under SW Wind (2H)

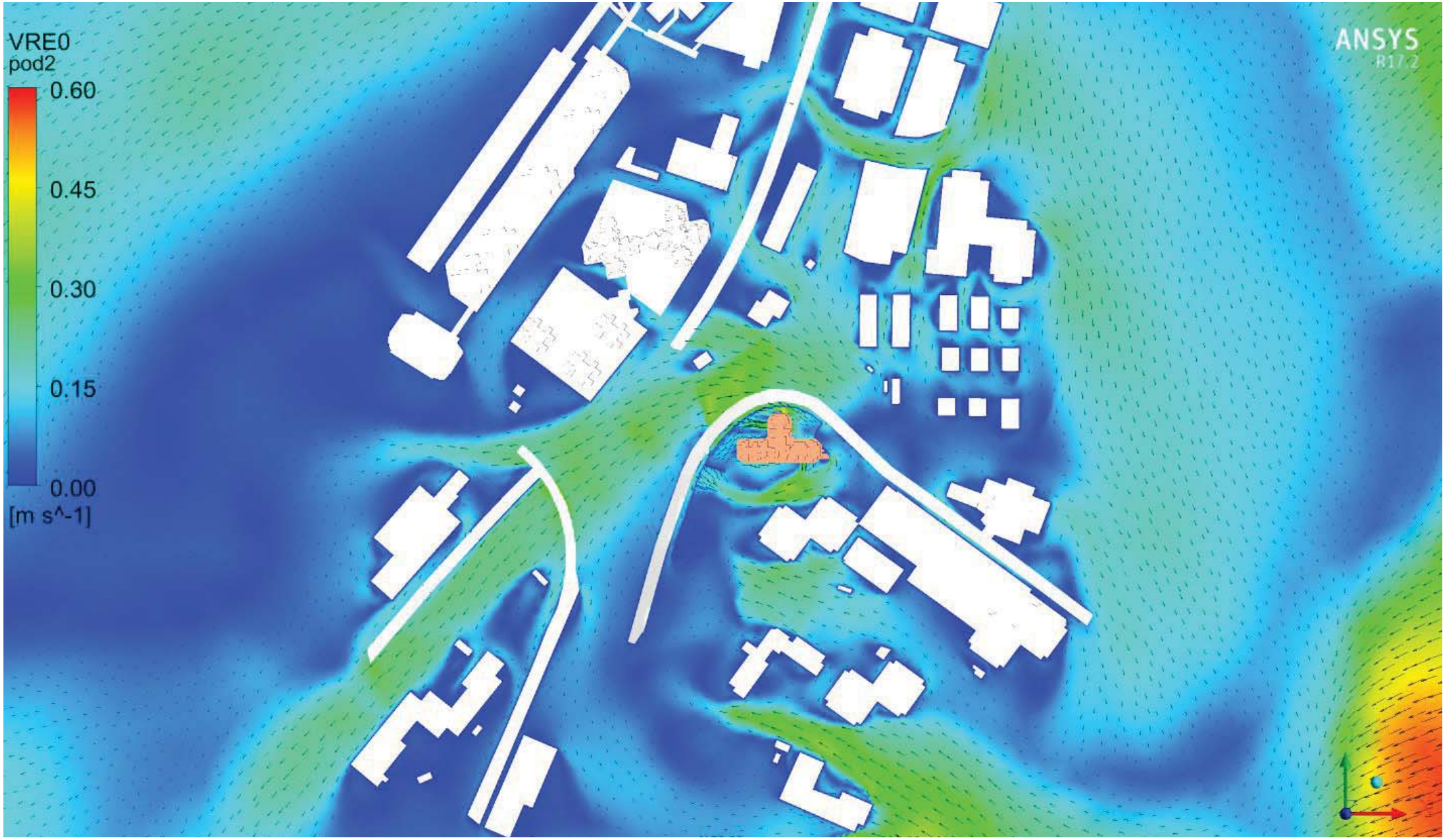


Baseline Scenario – Wind VR colour and vector plot at pedestrian level under WSW Wind (2H)

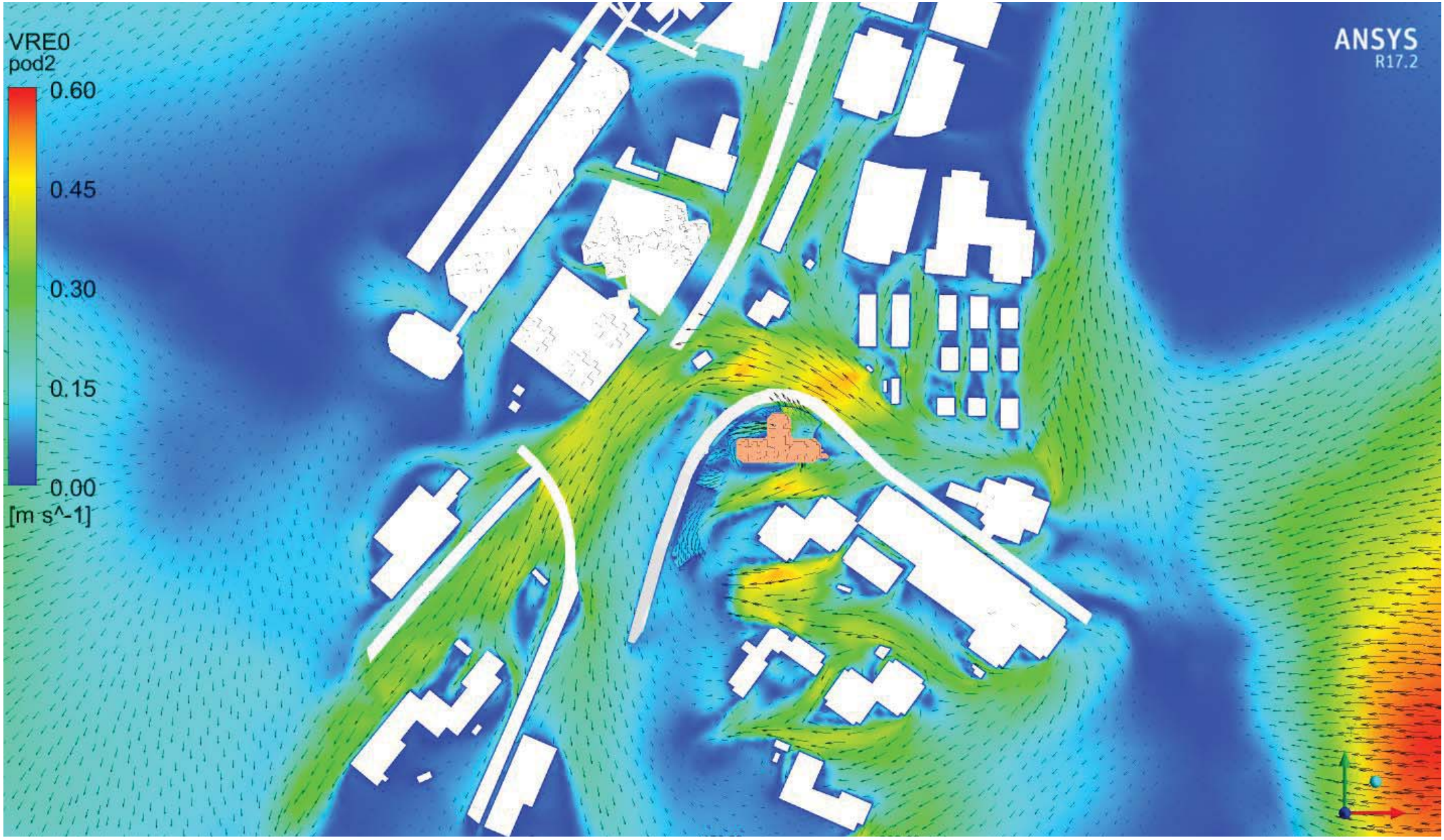
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under NNE Wind (2H)



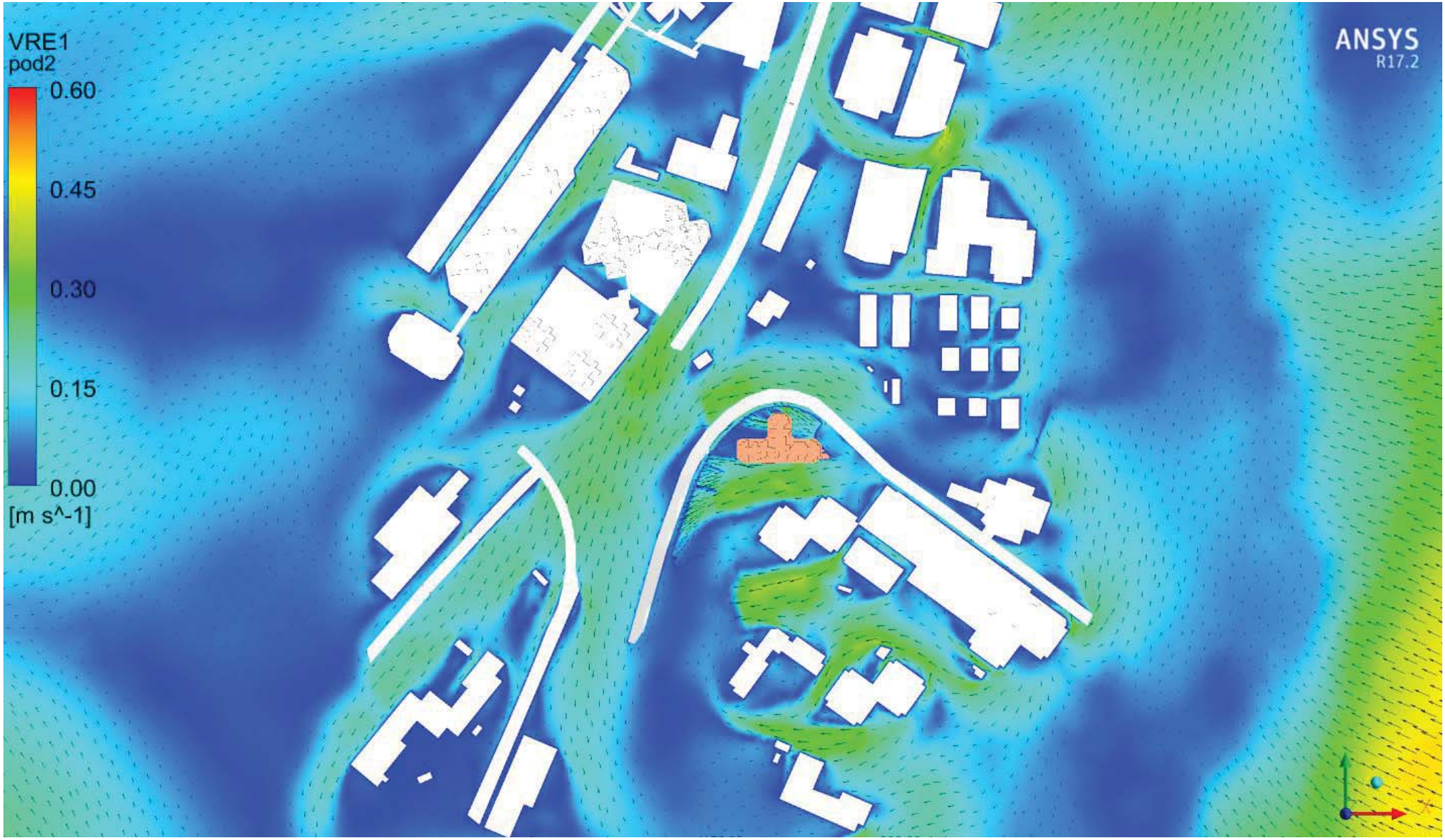
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under NE Wind (2H)



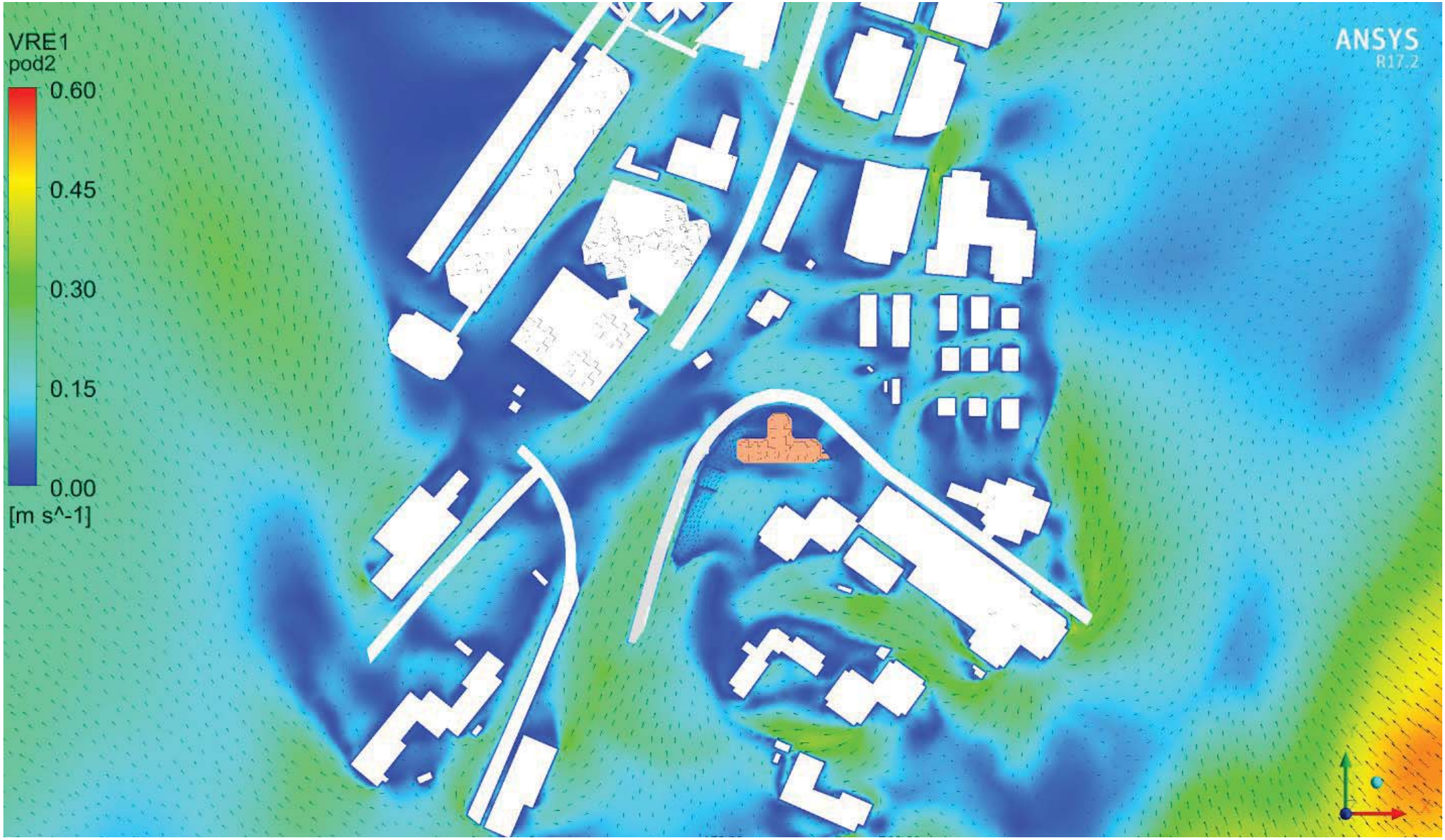
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under ENE Wind (2H)



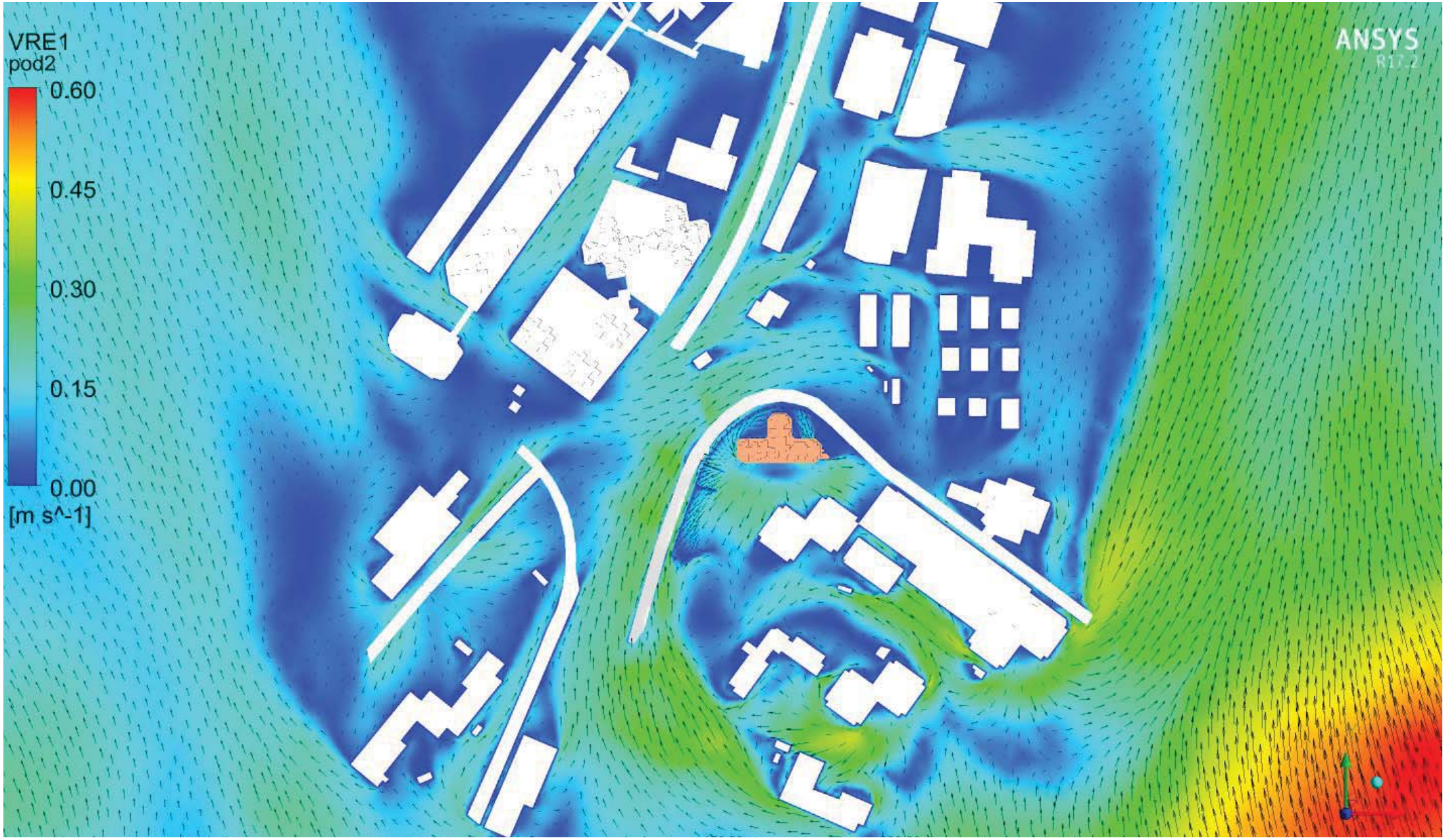
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under E Wind (2H)



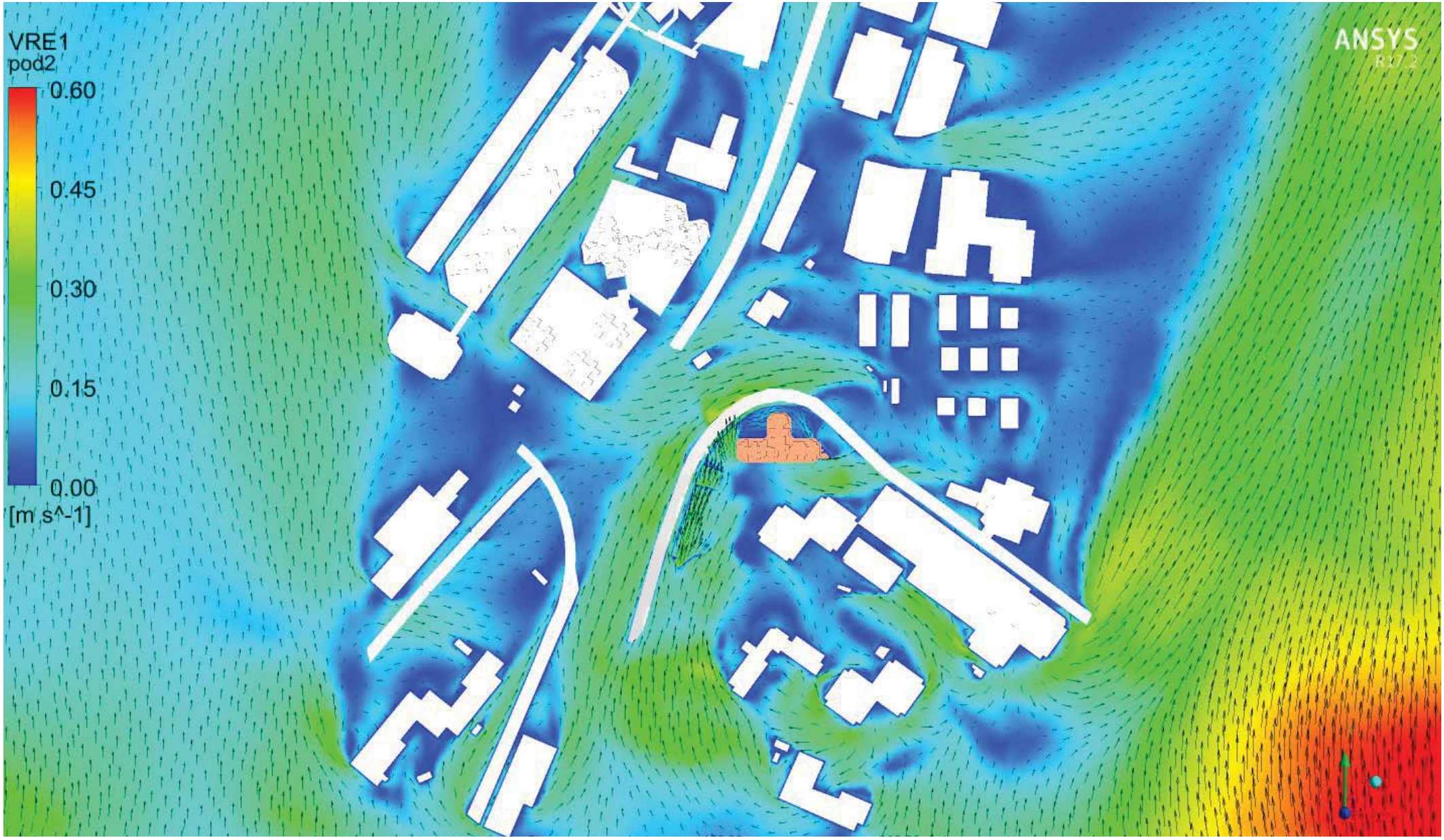
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under ESE Wind (2H)



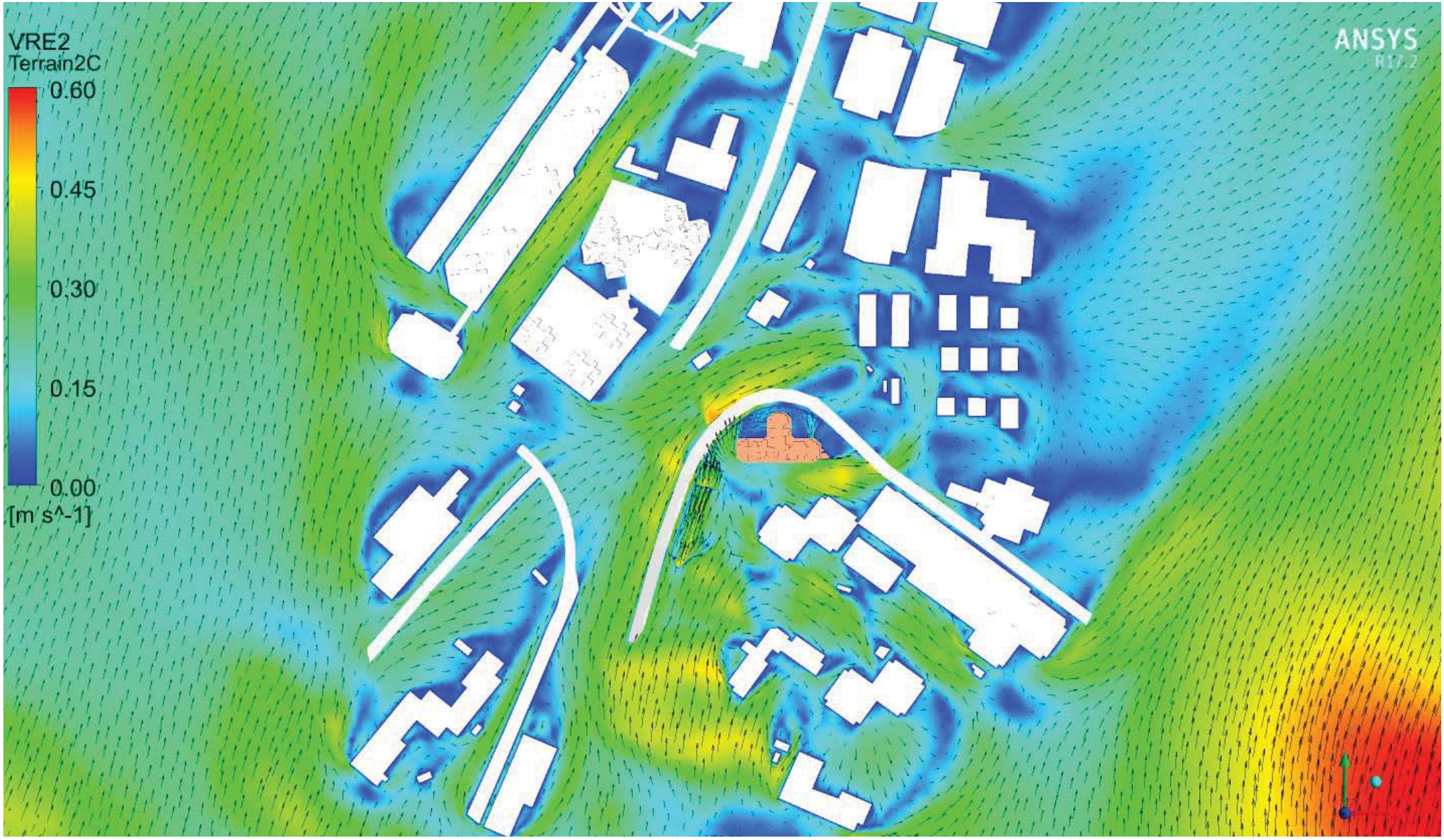
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under SE Wind (2H)



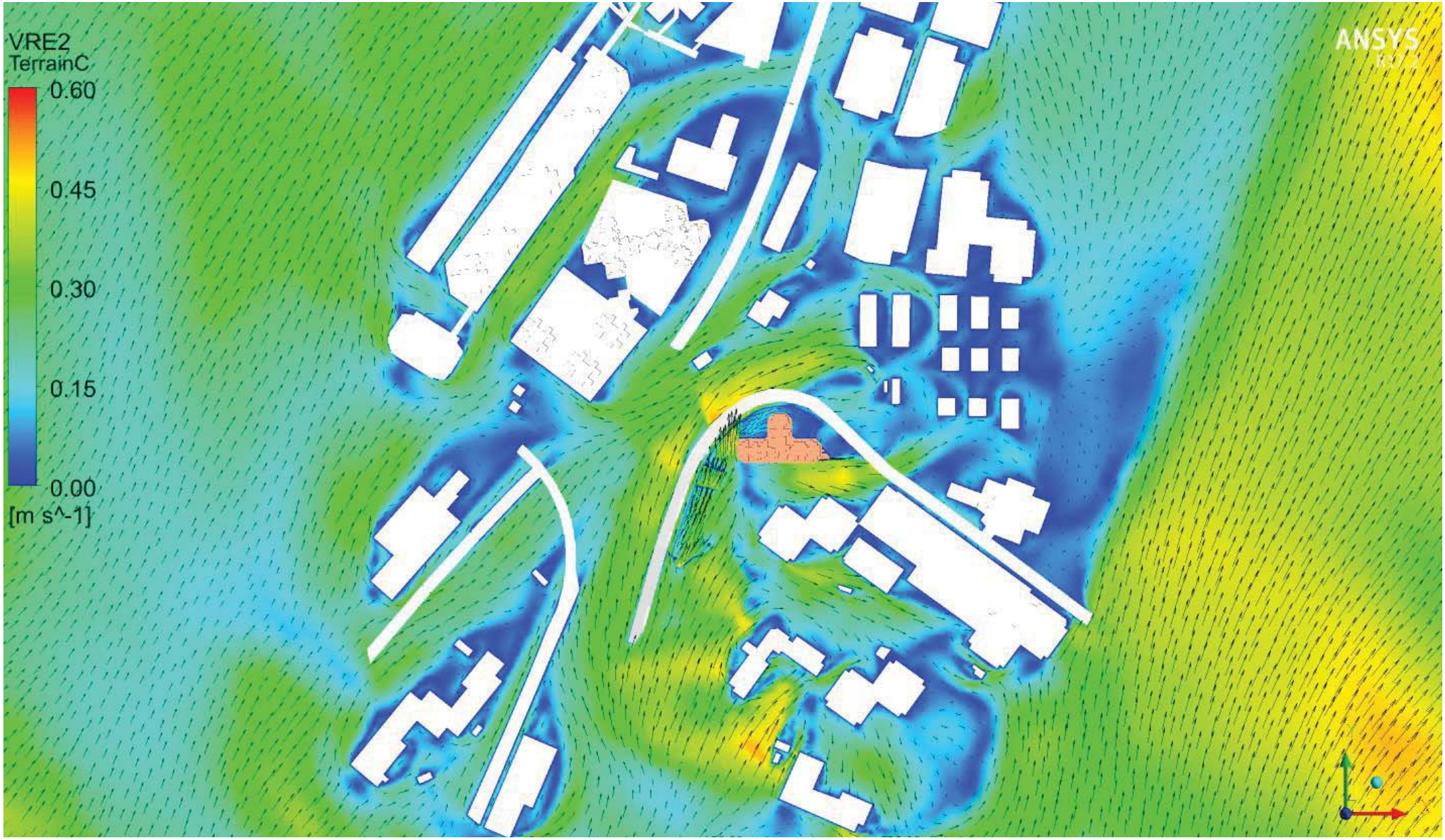
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under SSE Wind (2H)



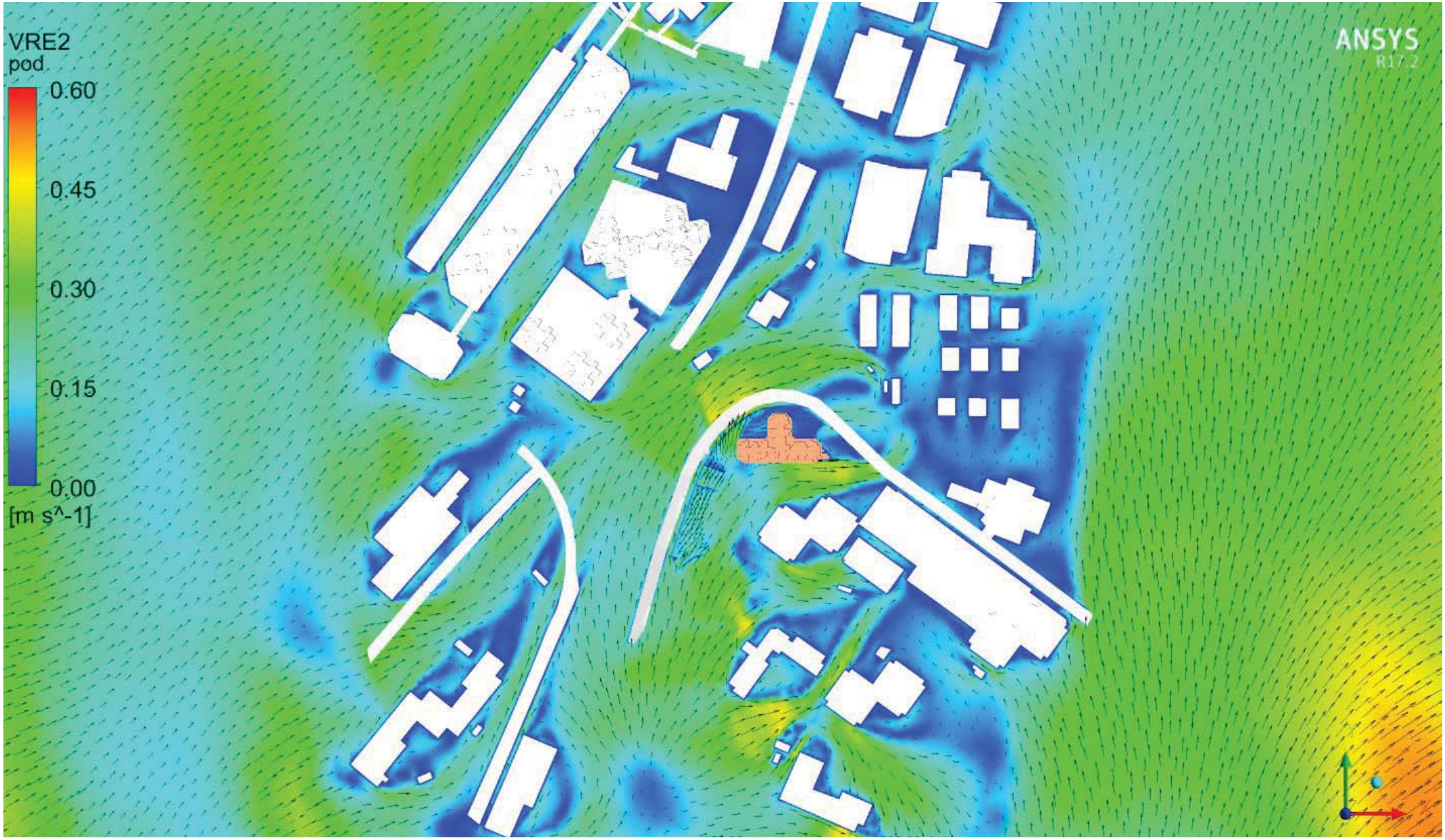
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under S Wind (2H)



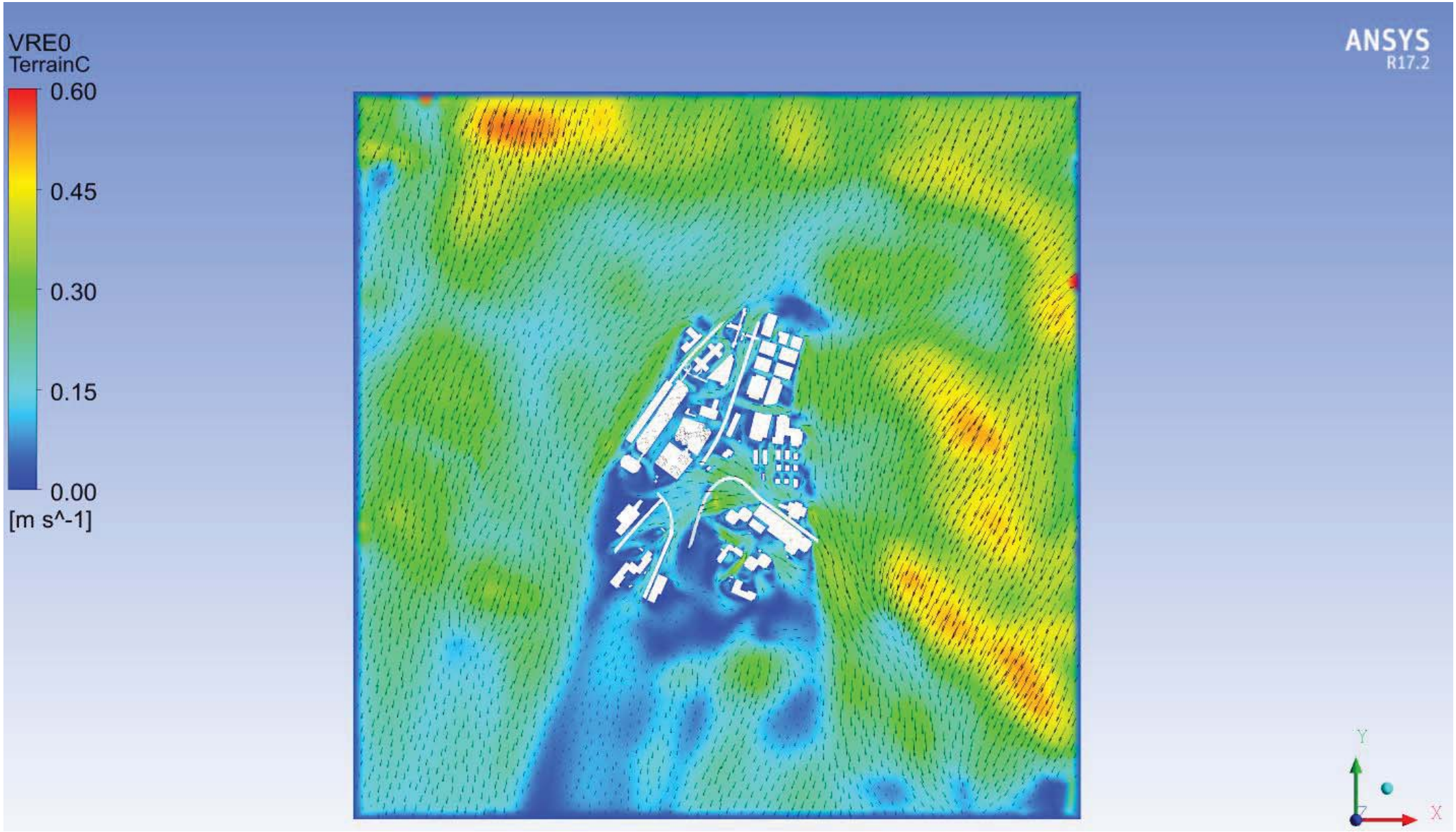
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under SSW Wind (2H)



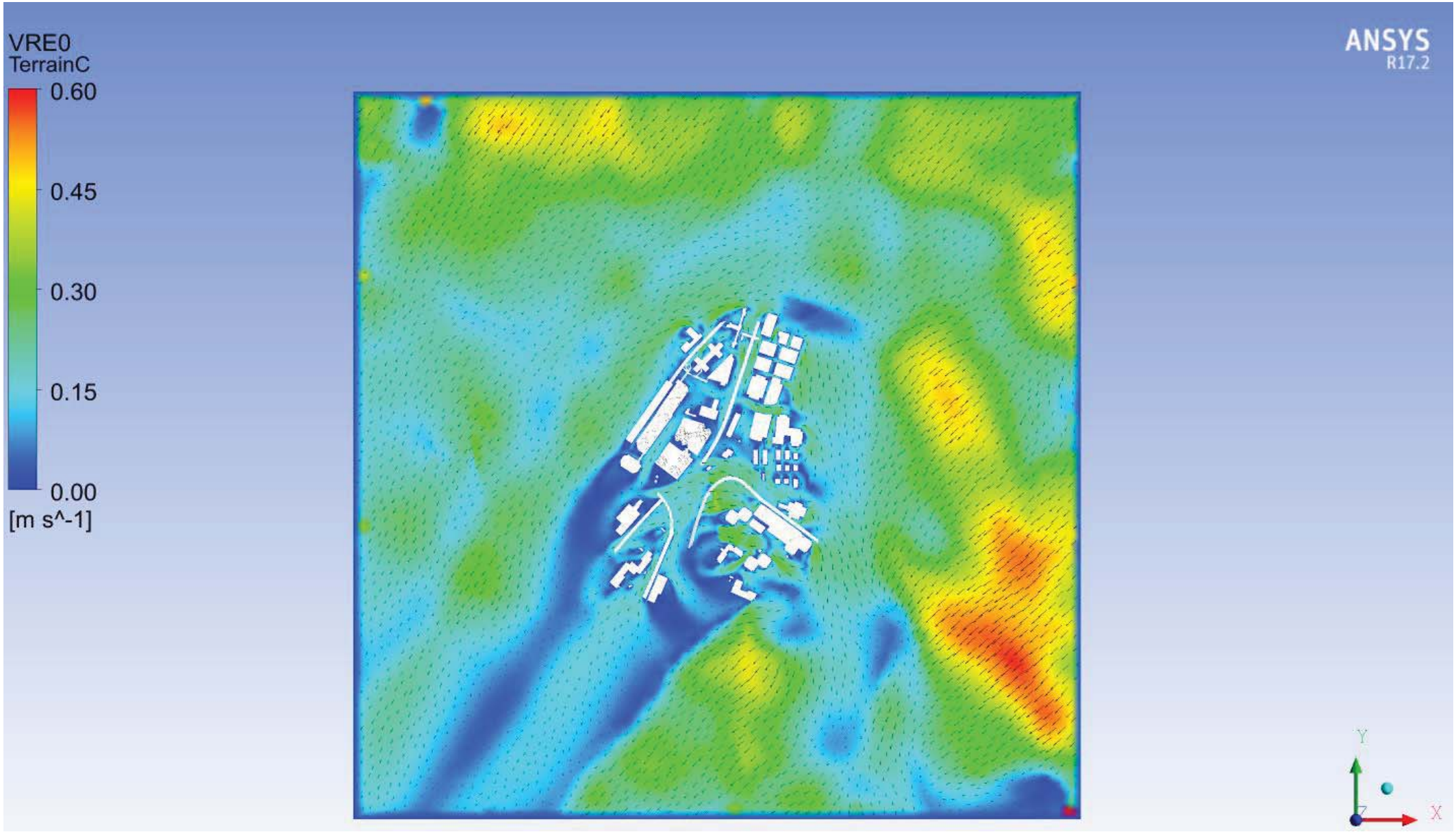
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under SW Wind (2H)



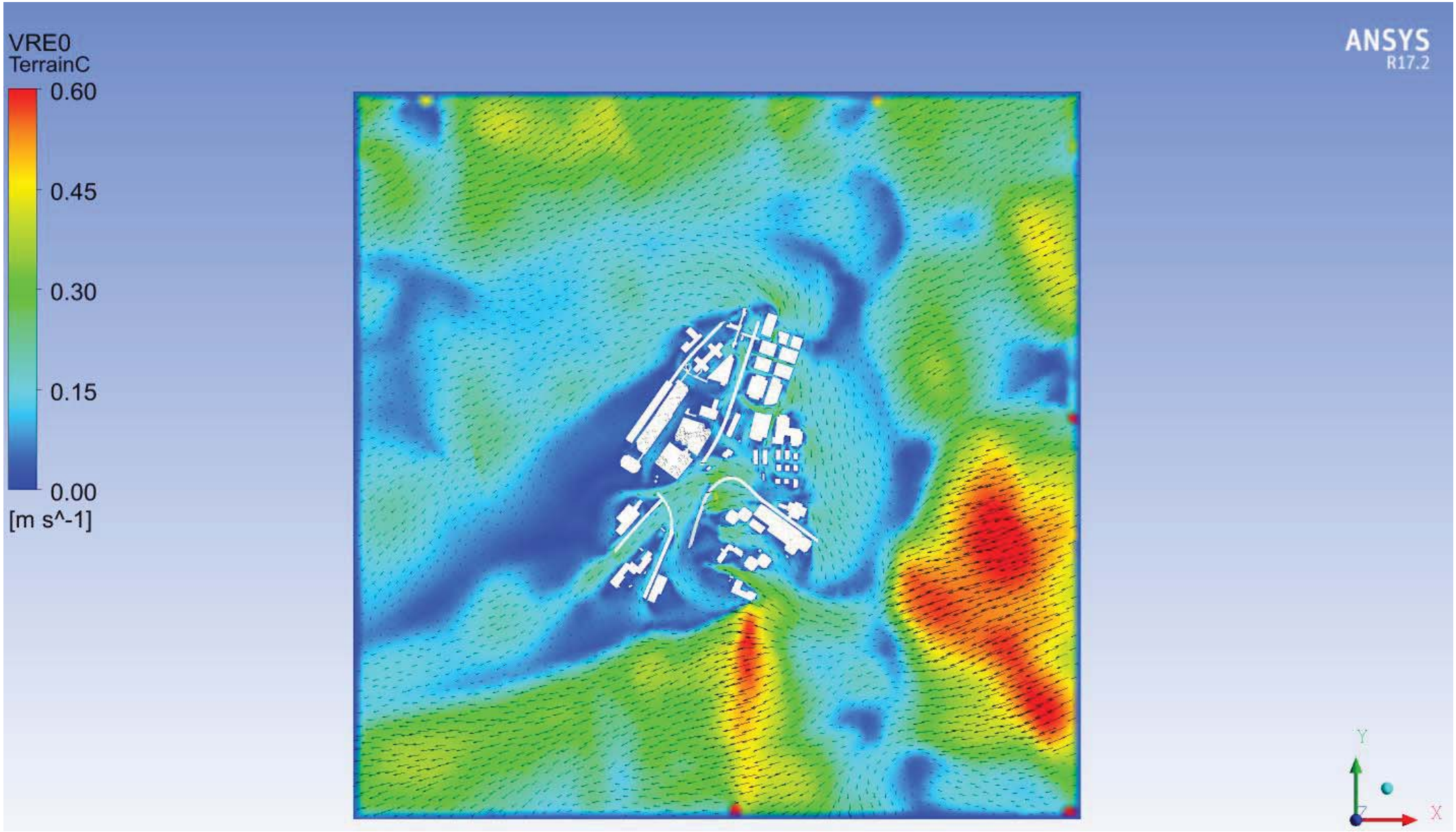
Proposed Scenario – Wind VR colour and vector plot at pedestrian level under WSW Wind(2H)



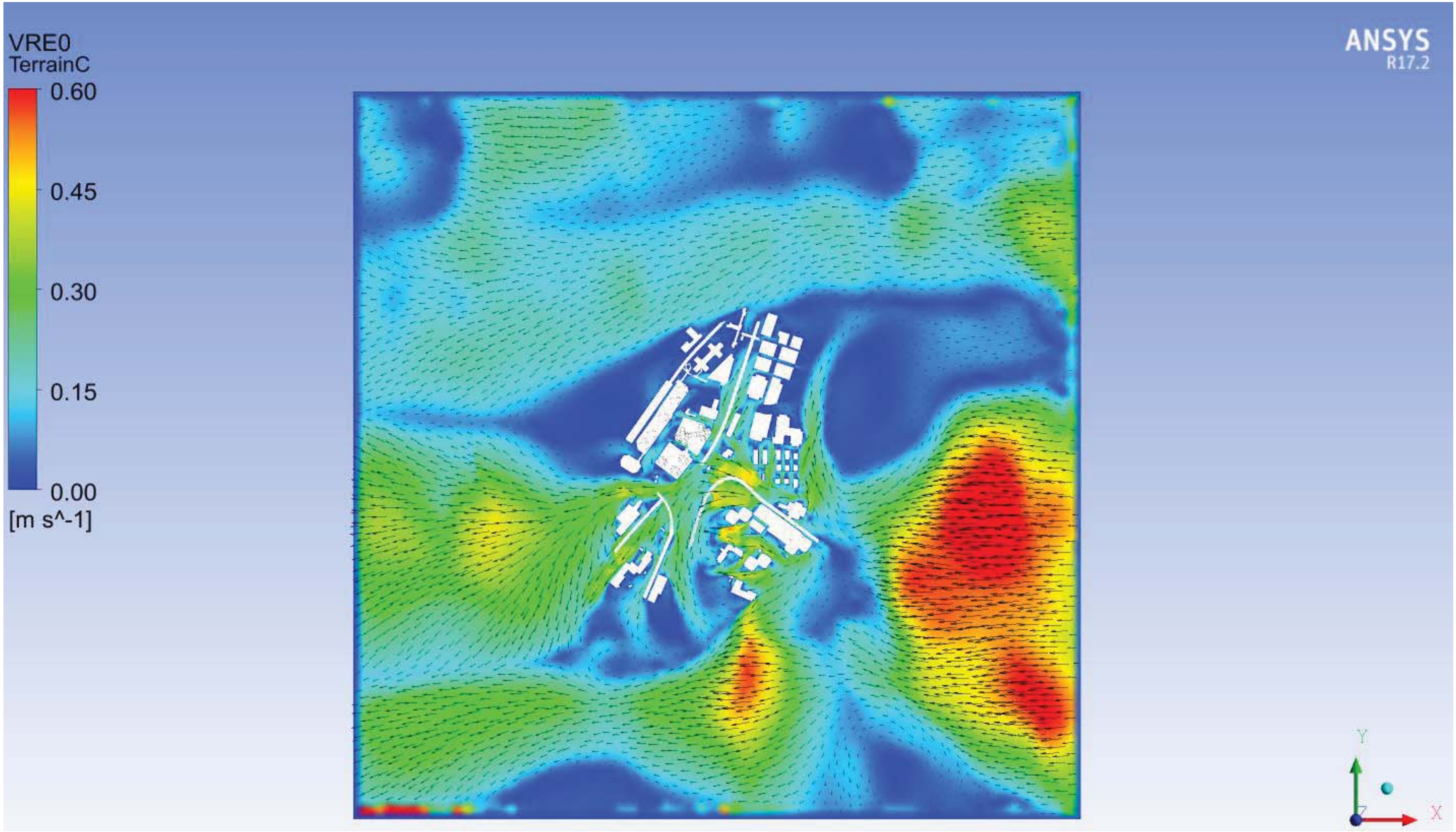
Existing Scenario – Wind VR colour and vector plot at pedestrian level under NNE Wind (Domain)



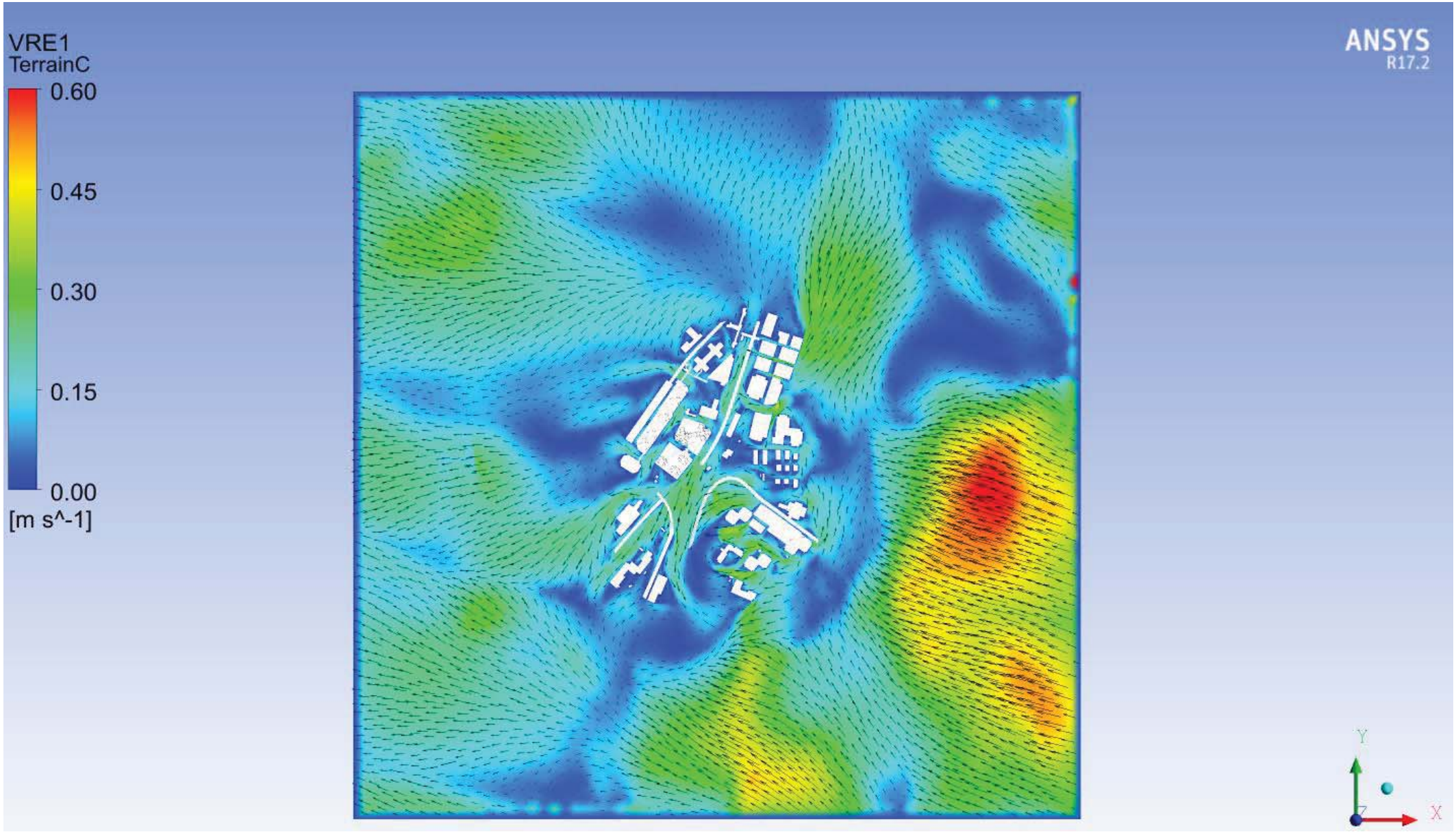
Existing Scenario – Wind VR colour and vector plot at pedestrian level under NE Wind (Domain)



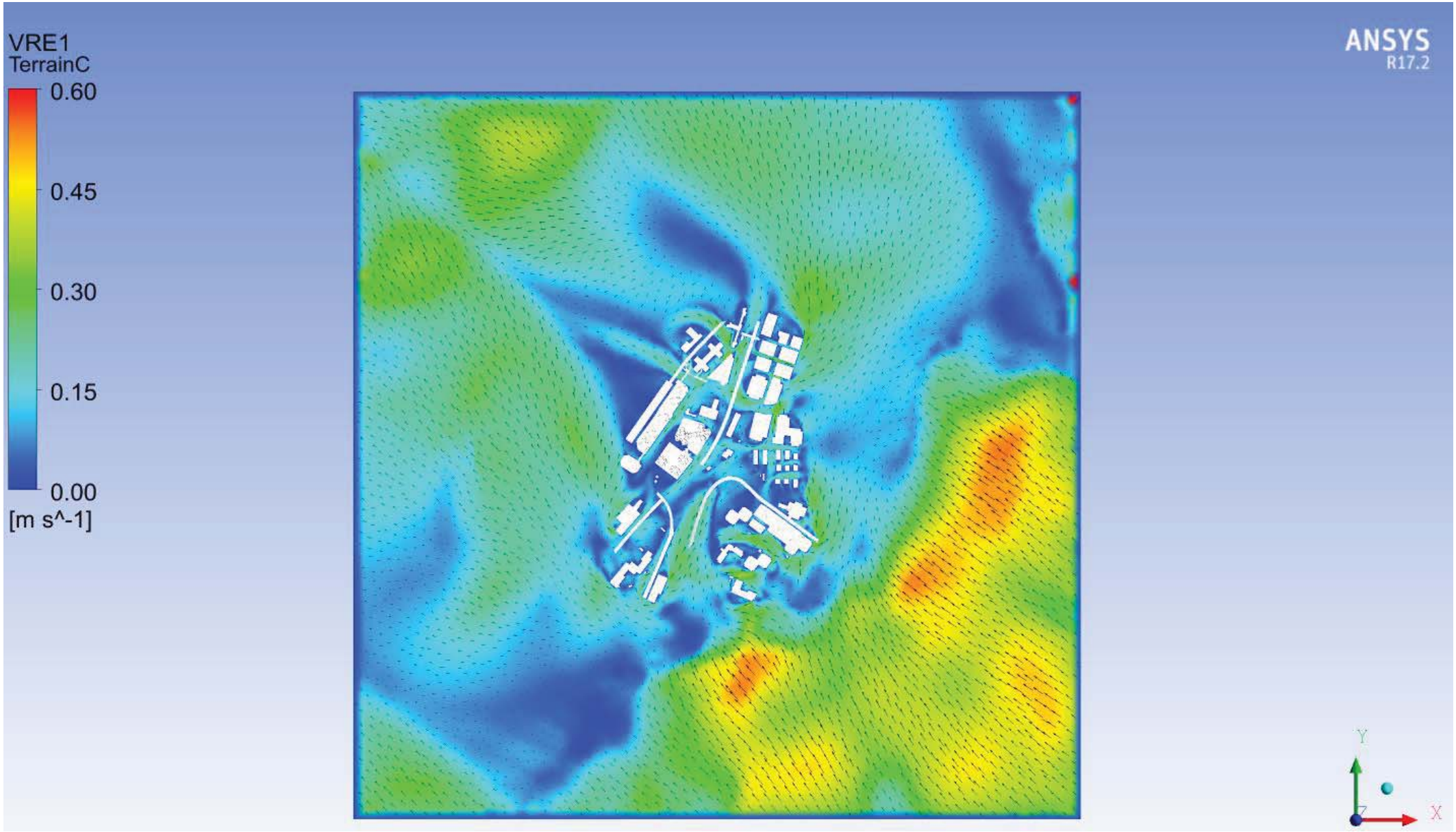
Existing Scenario – Wind VR colour and vector plot at pedestrian level under ENE Wind (Domain)



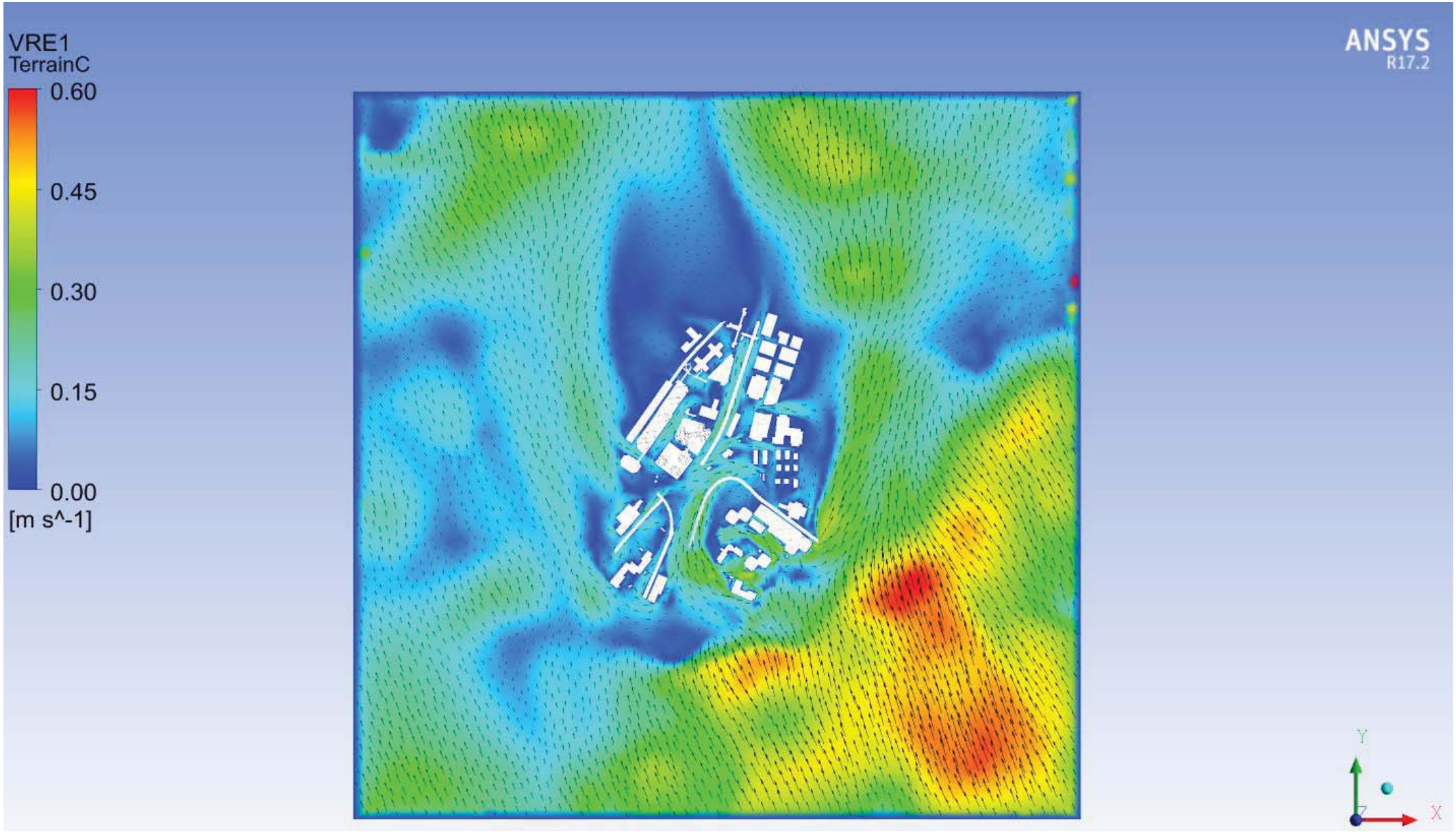
Existing Scenario – Wind VR colour and vector plot at pedestrian level under E Wind (Domain)



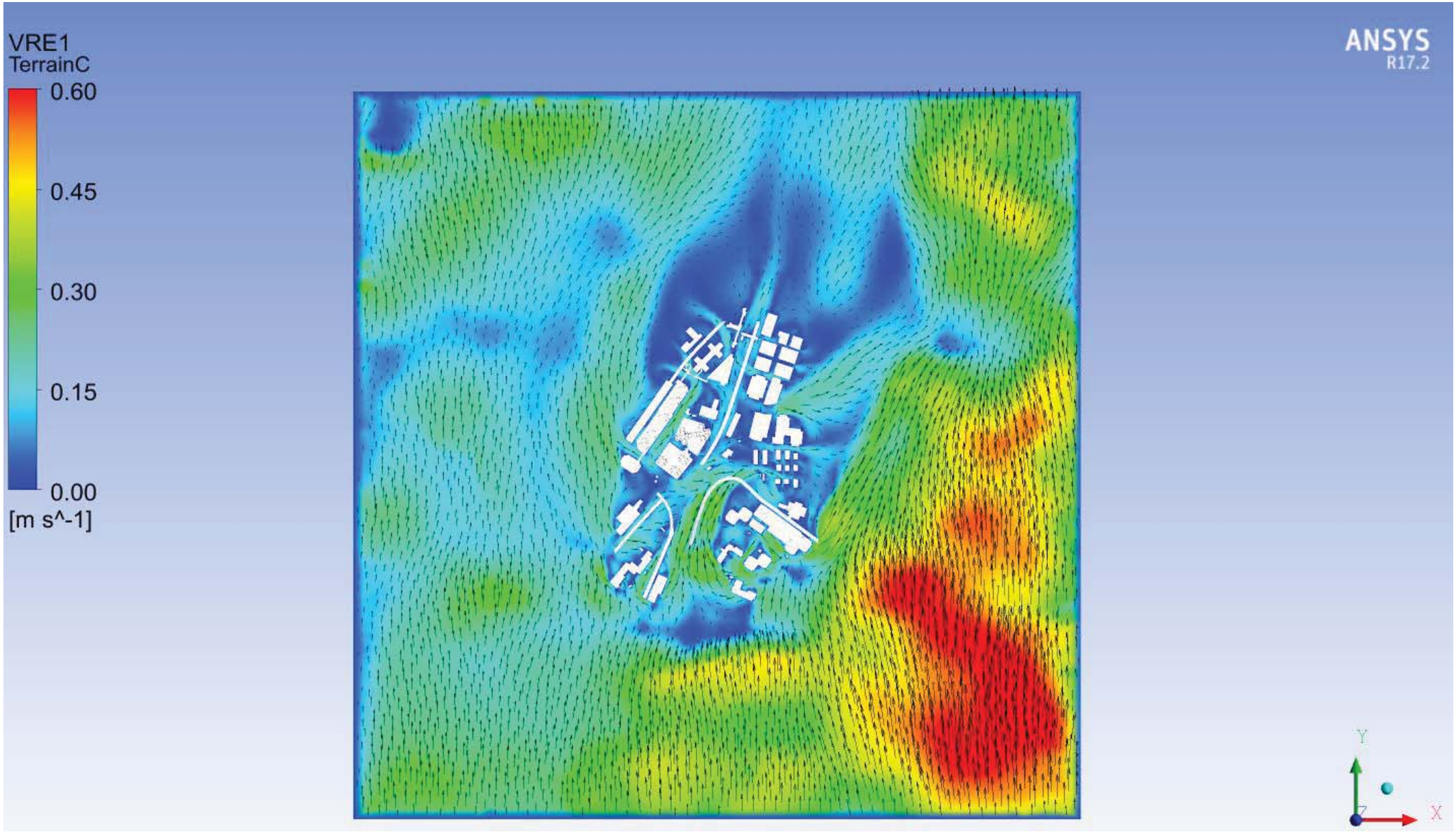
Existing Scenario – Wind VR colour and vector plot at pedestrian level under ESE Wind (Domain)



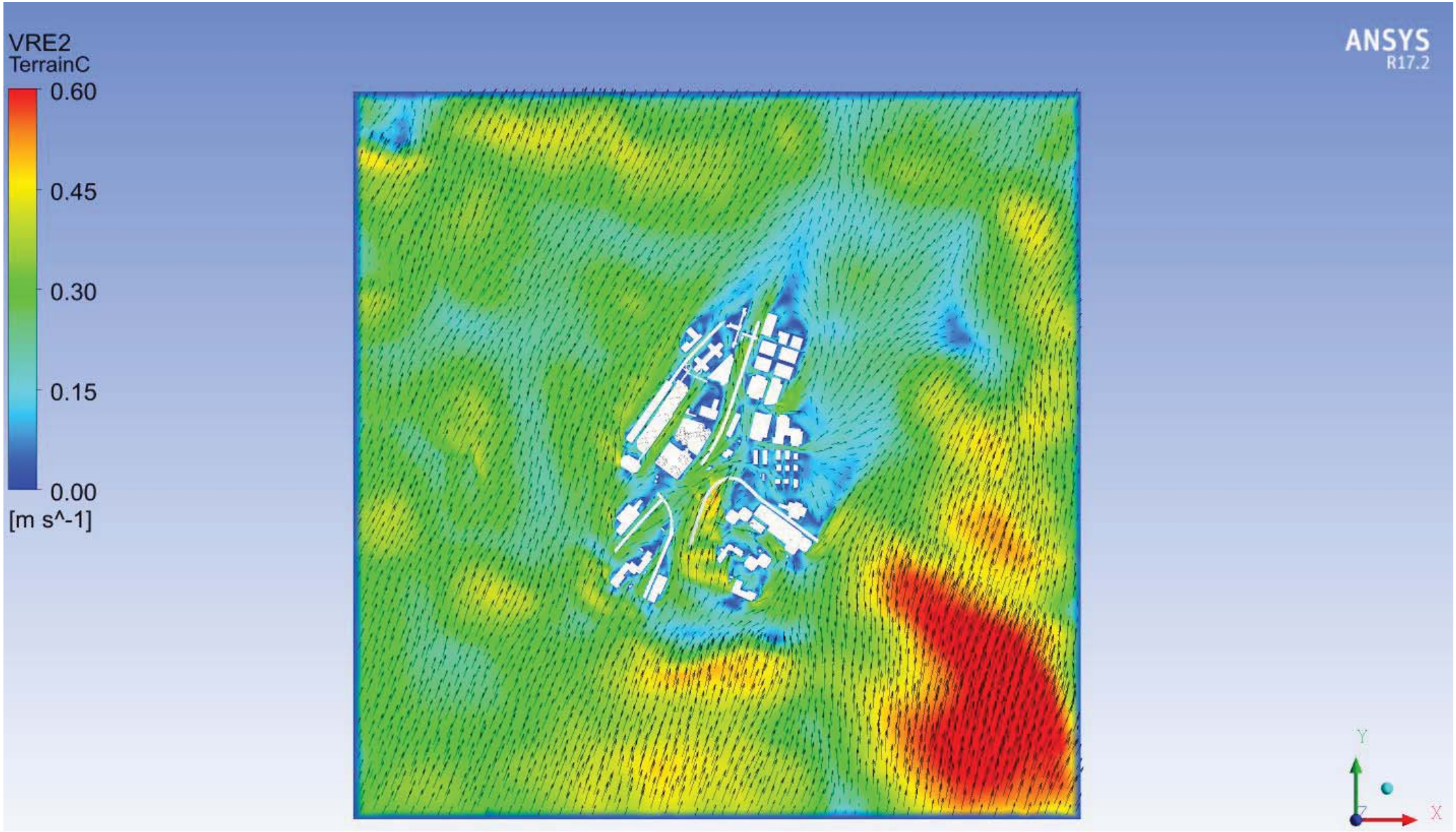
Existing Scenario – Wind VR colour and vector plot at pedestrian level under SE Wind (Domain)



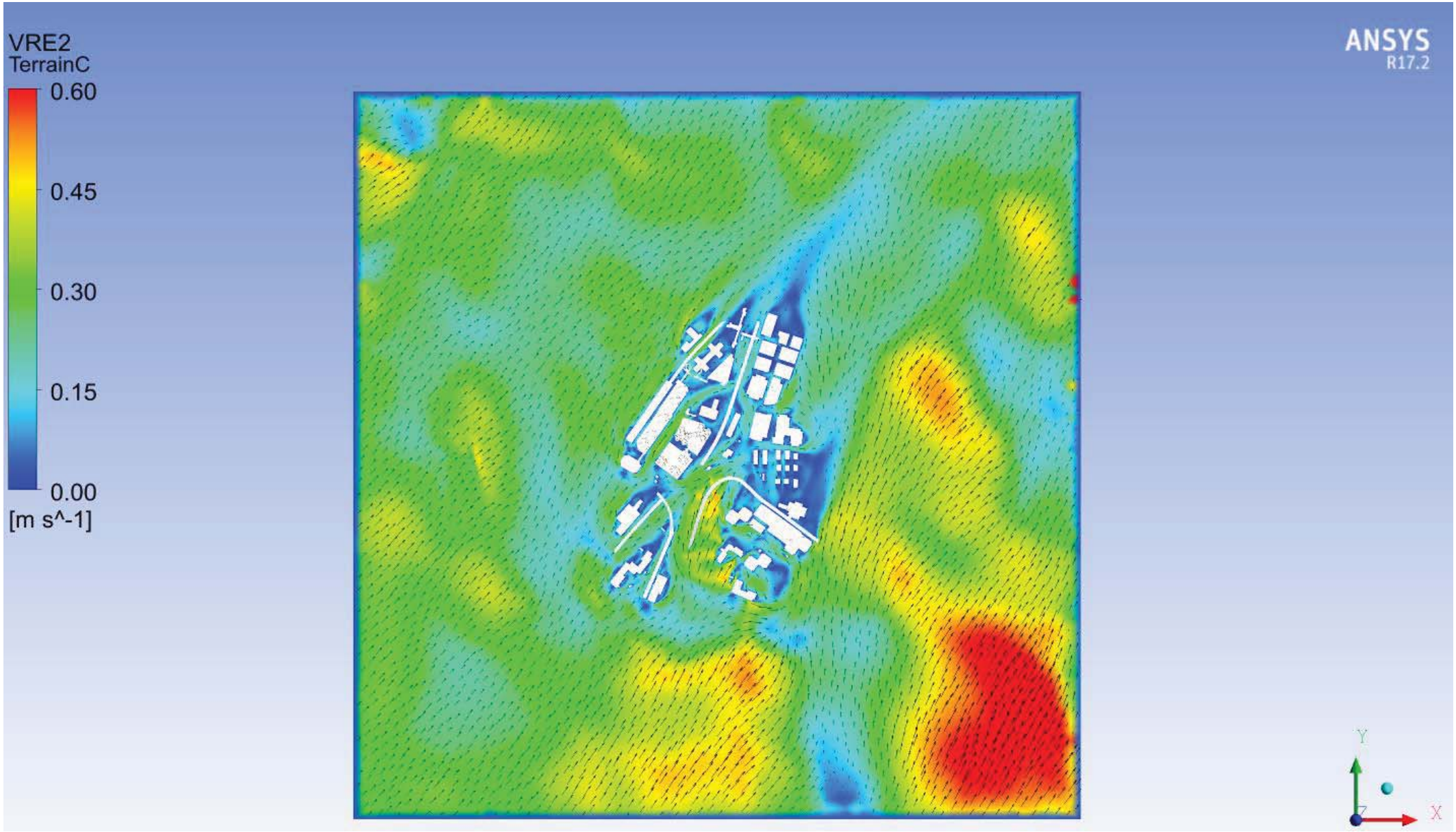
Existing Scenario – Wind VR colour and vector plot at pedestrian level under SSE Wind (Domain)



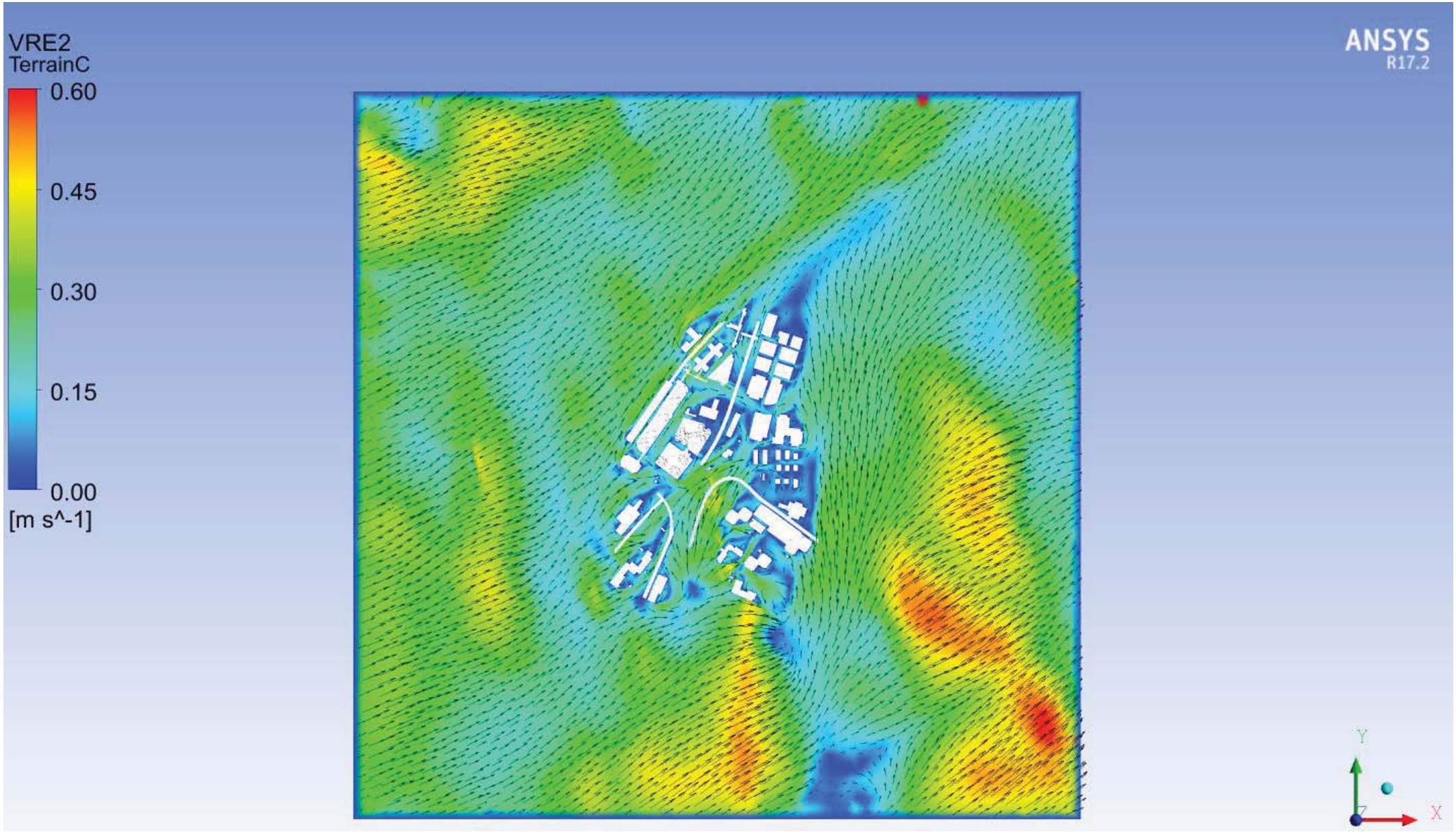
Existing Scenario – Wind VR colour and vector plot at pedestrian level under S Wind (Domain)



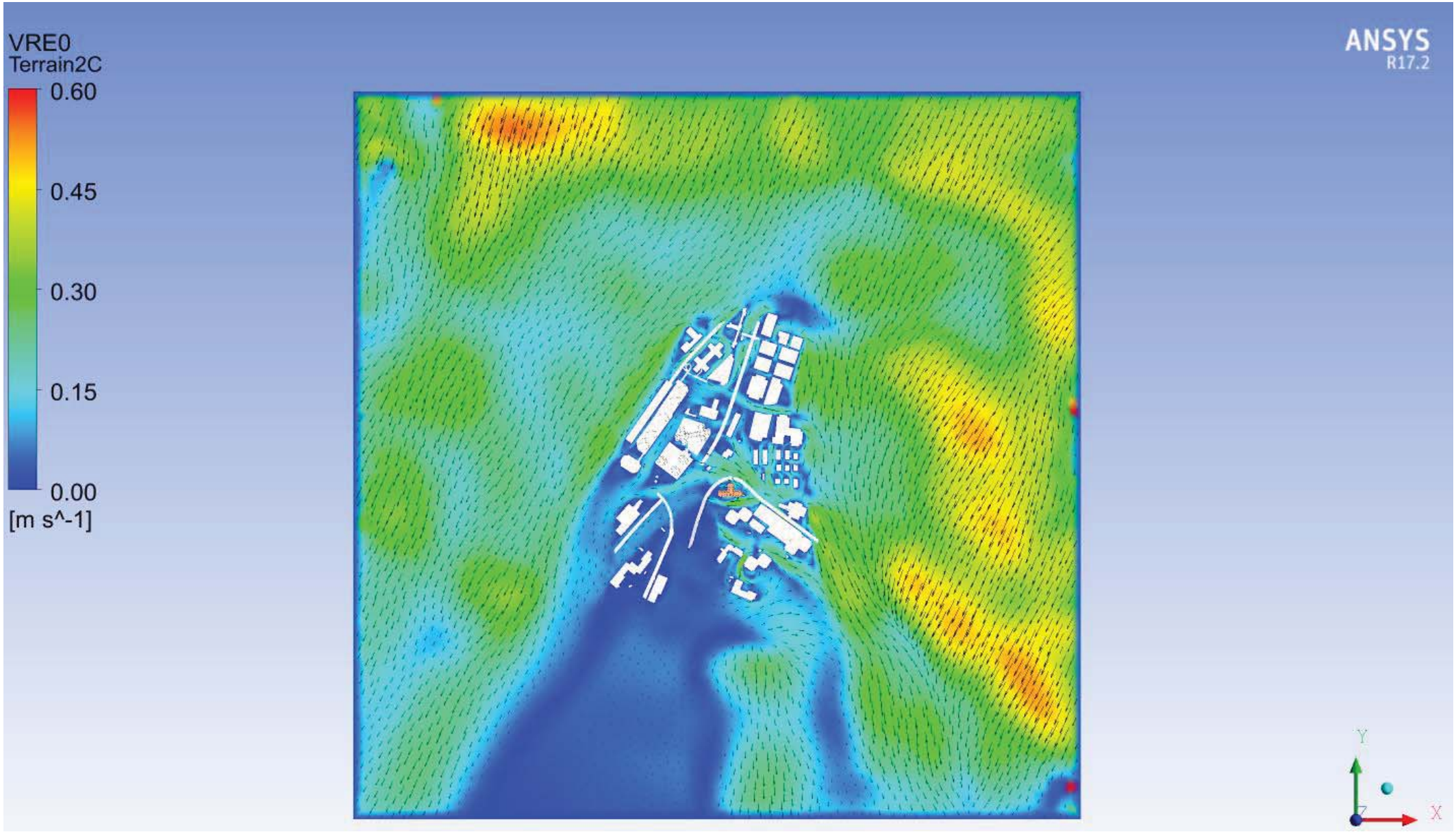
Existing Scenario – Wind VR colour and vector plot at pedestrian level under SSW Wind (Domain)



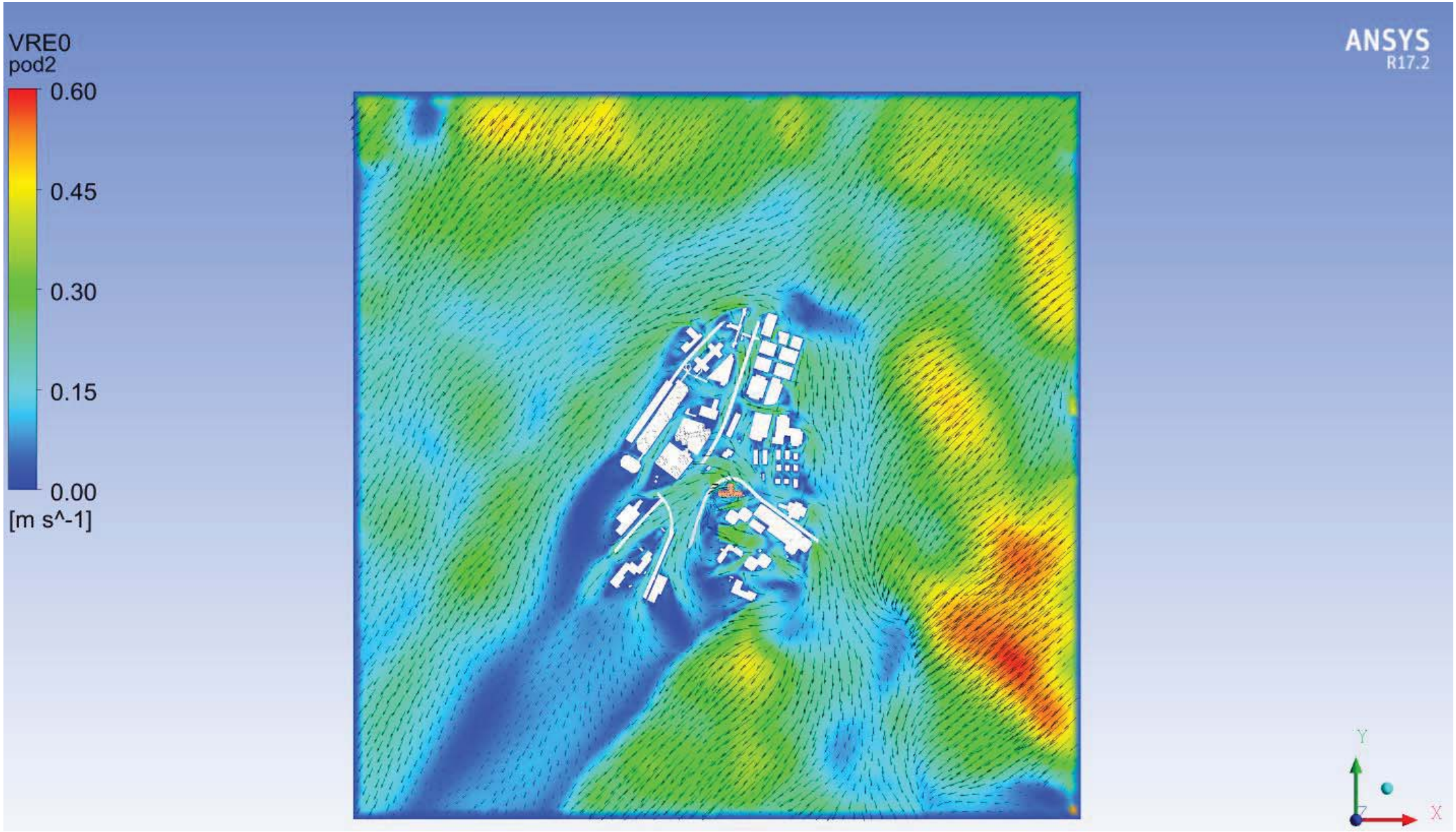
Existing Scenario – Wind VR colour and vector plot at pedestrian level under SW Wind (Domain)



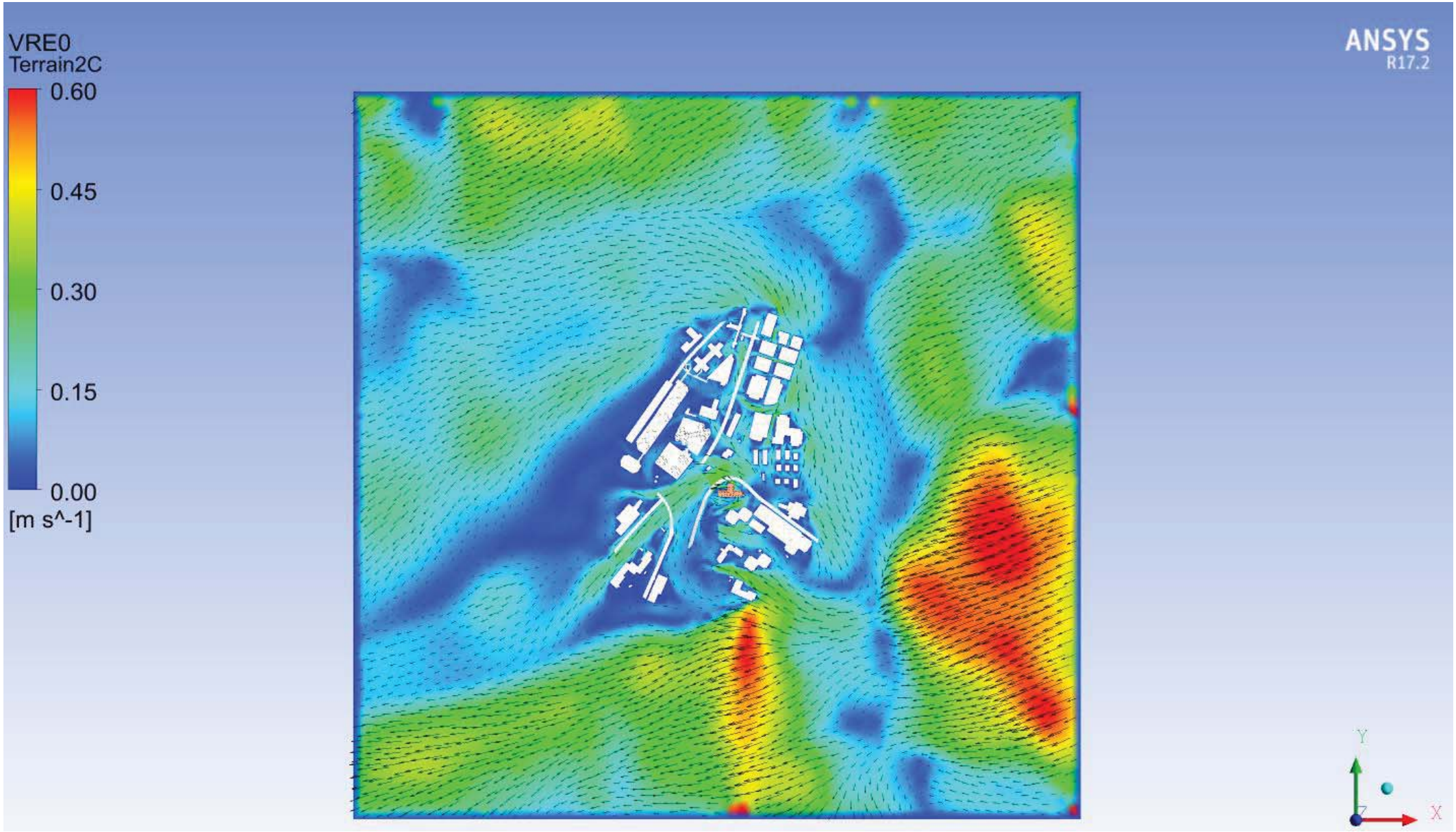
Existing Scenario – Wind VR colour and vector plot at pedestrian level under WSW Wind (Domain)



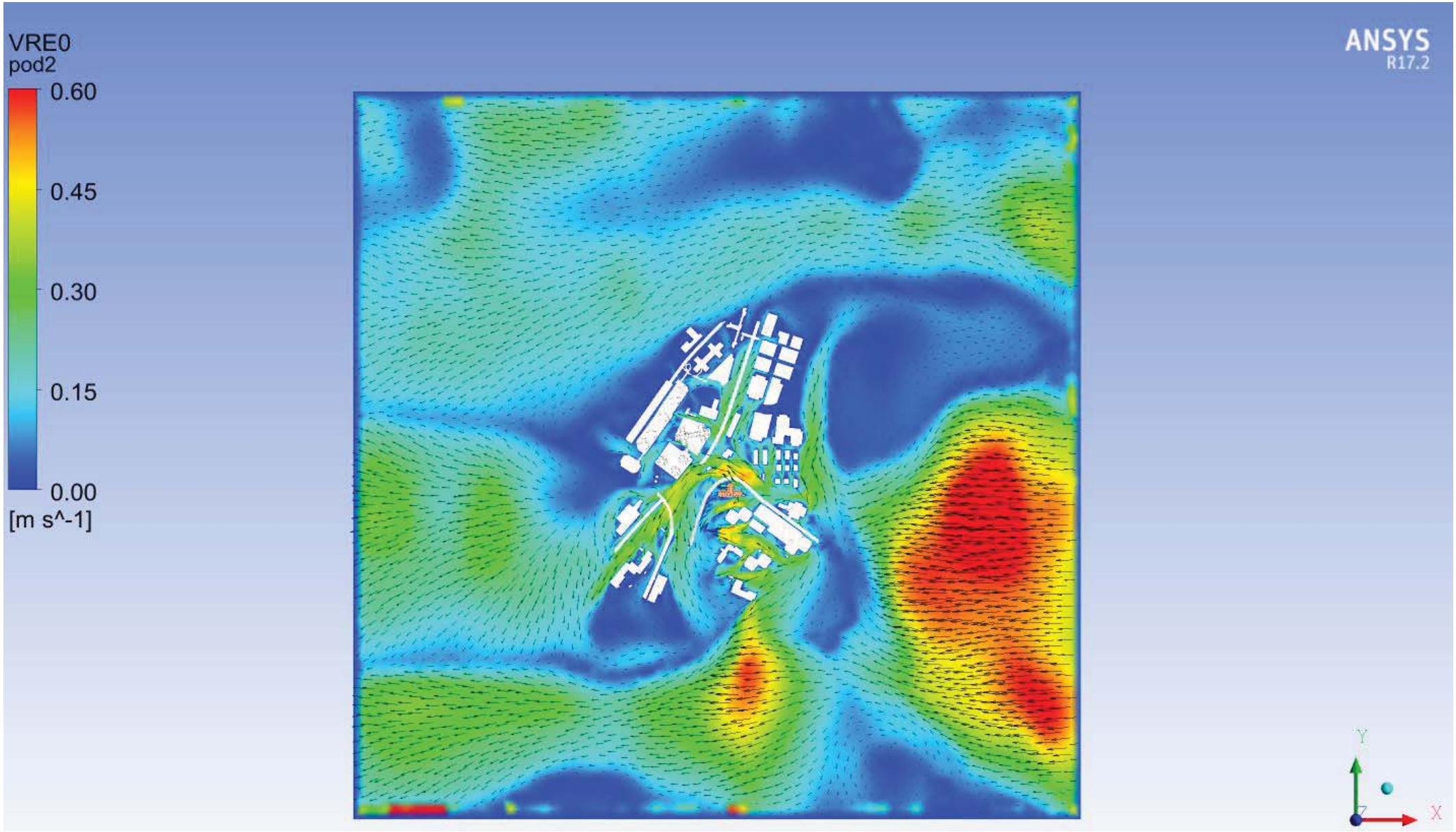
Baseline Scheme – Wind VR colour and vector plot at pedestrian level under NNE Wind (Domain)



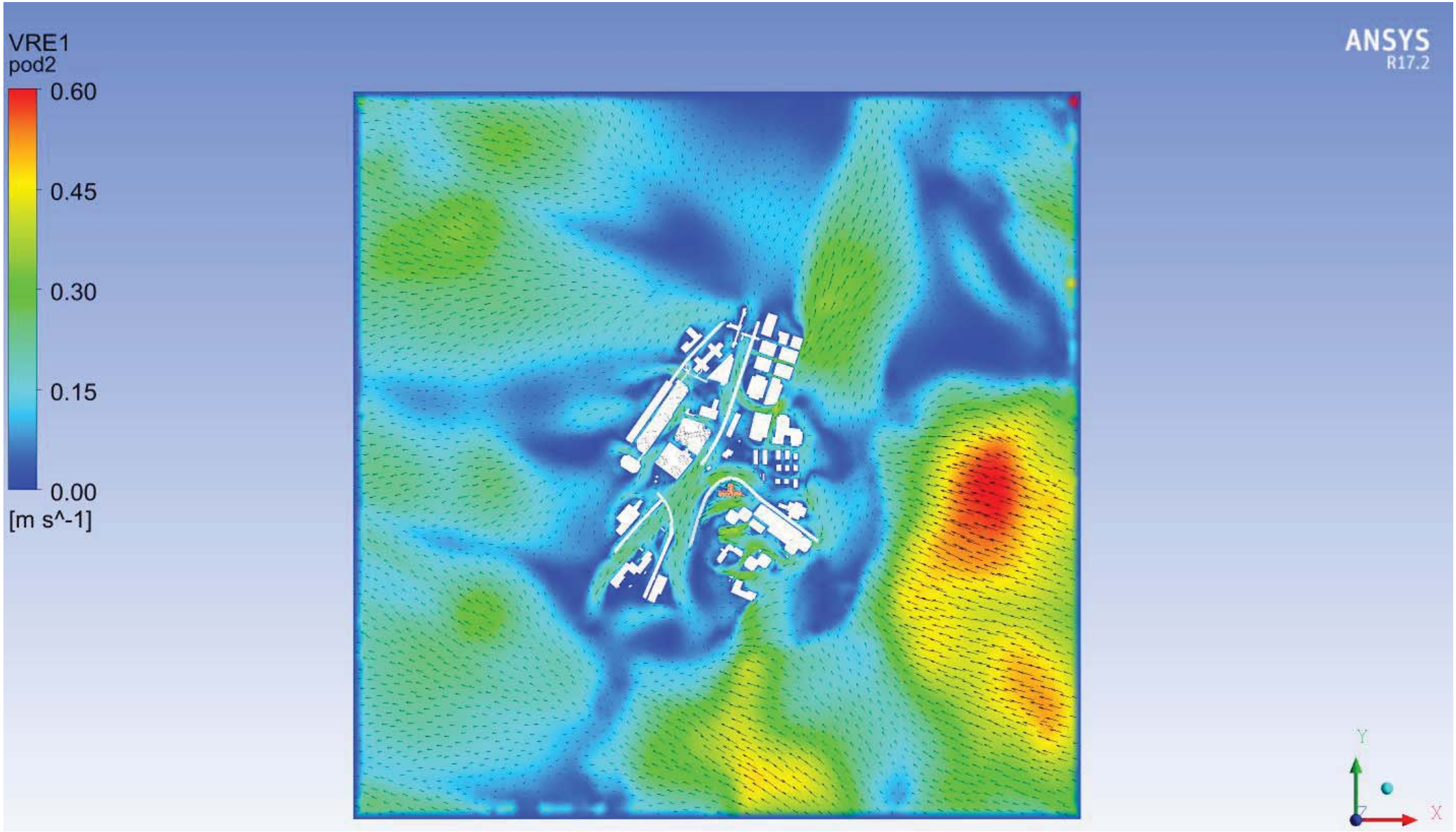
Baseline Scheme – Wind VR colour and vector plot at pedestrian level under NE Wind (Domain)



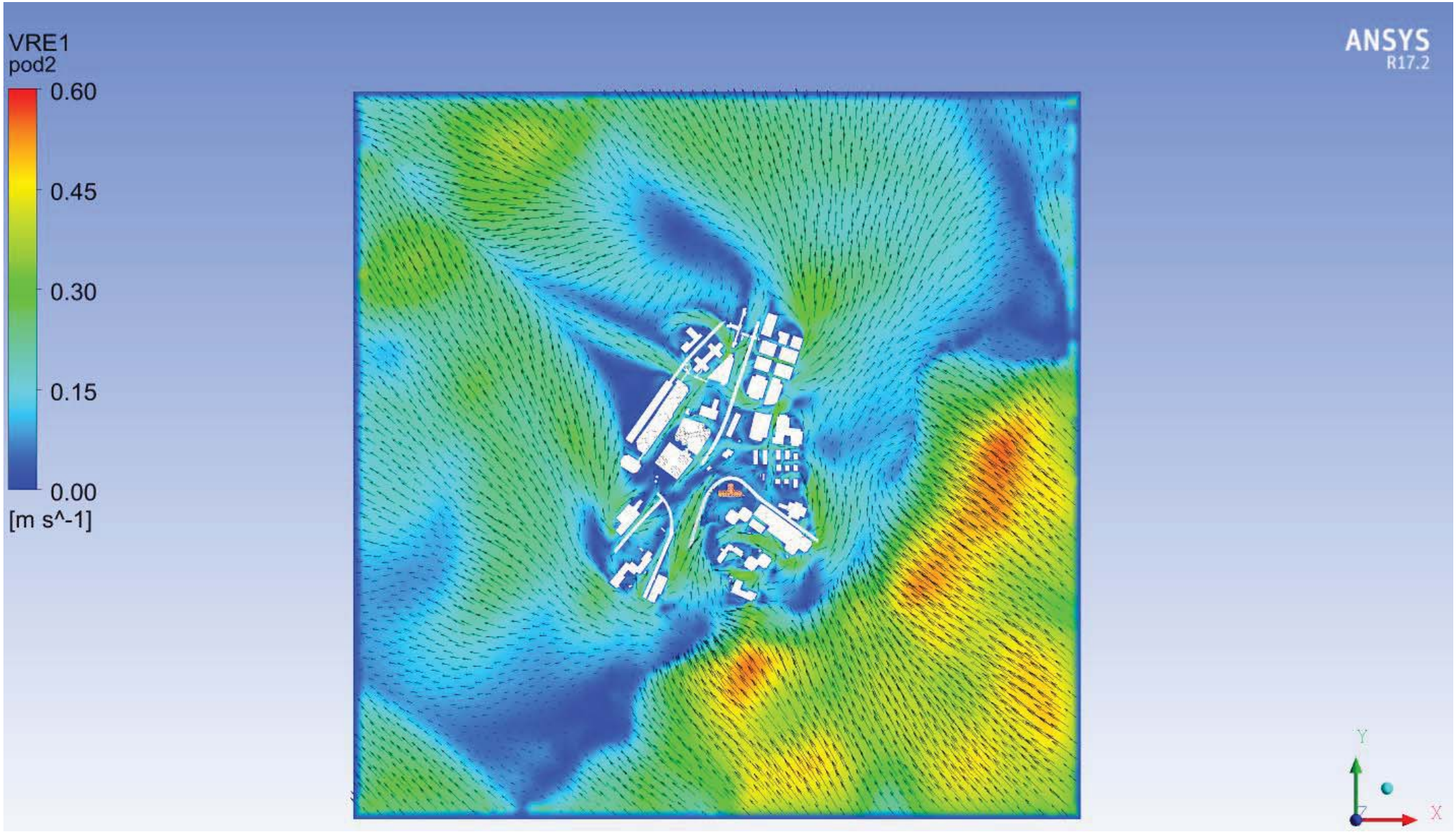
Baseline Scheme – Wind VR colour and vector plot at pedestrian level under ENE Wind (Domain)



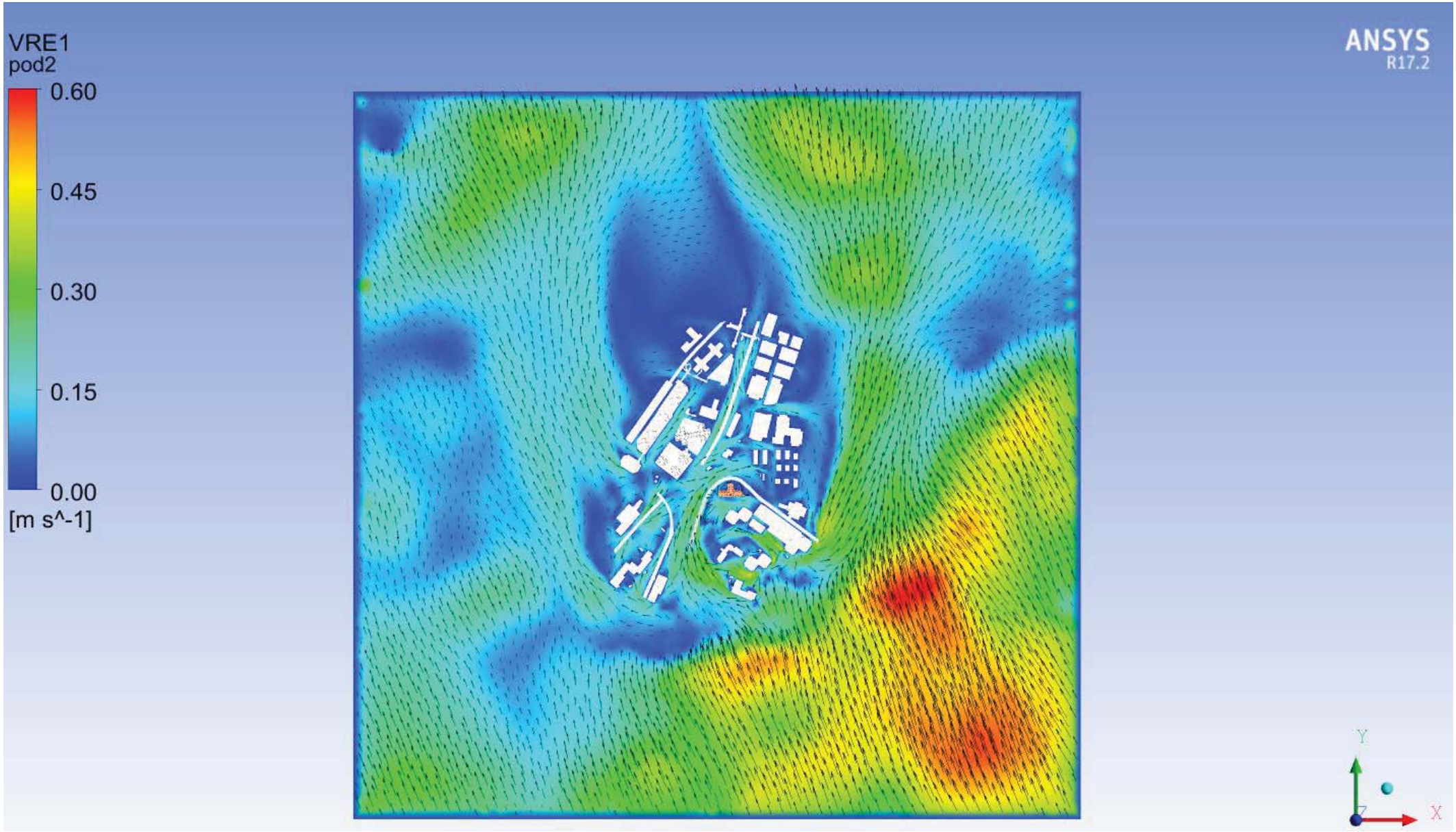
Baseline Scheme – Wind VR colour and vector plot at pedestrian level under E Wind (Domain)



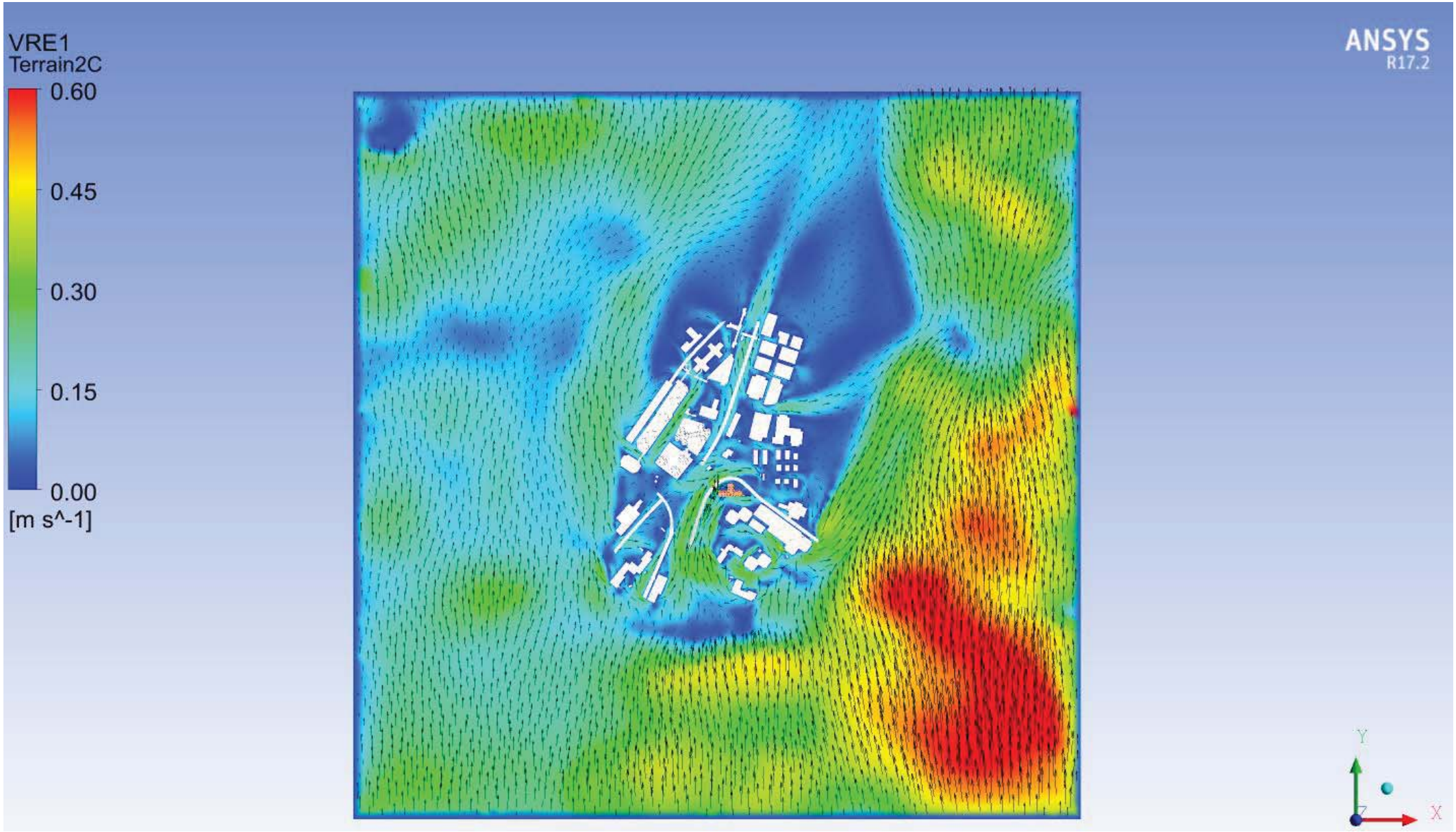
Baseline Scheme – Wind VR colour and vector plot at pedestrian level under ESE Wind (Domain)



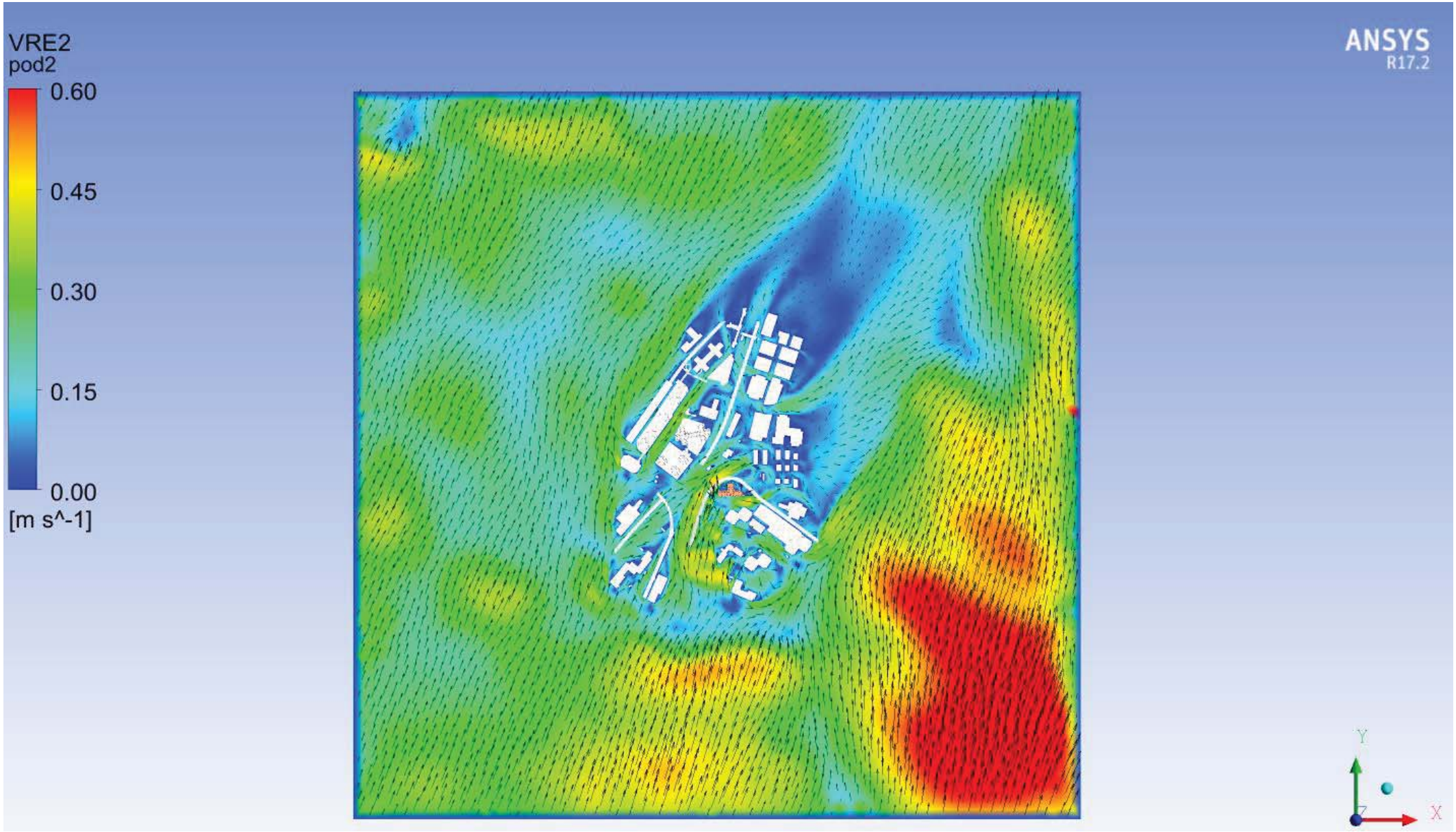
Baseline Scheme – Wind VR colour and vector plot at pedestrian level under SE Wind (Domain)



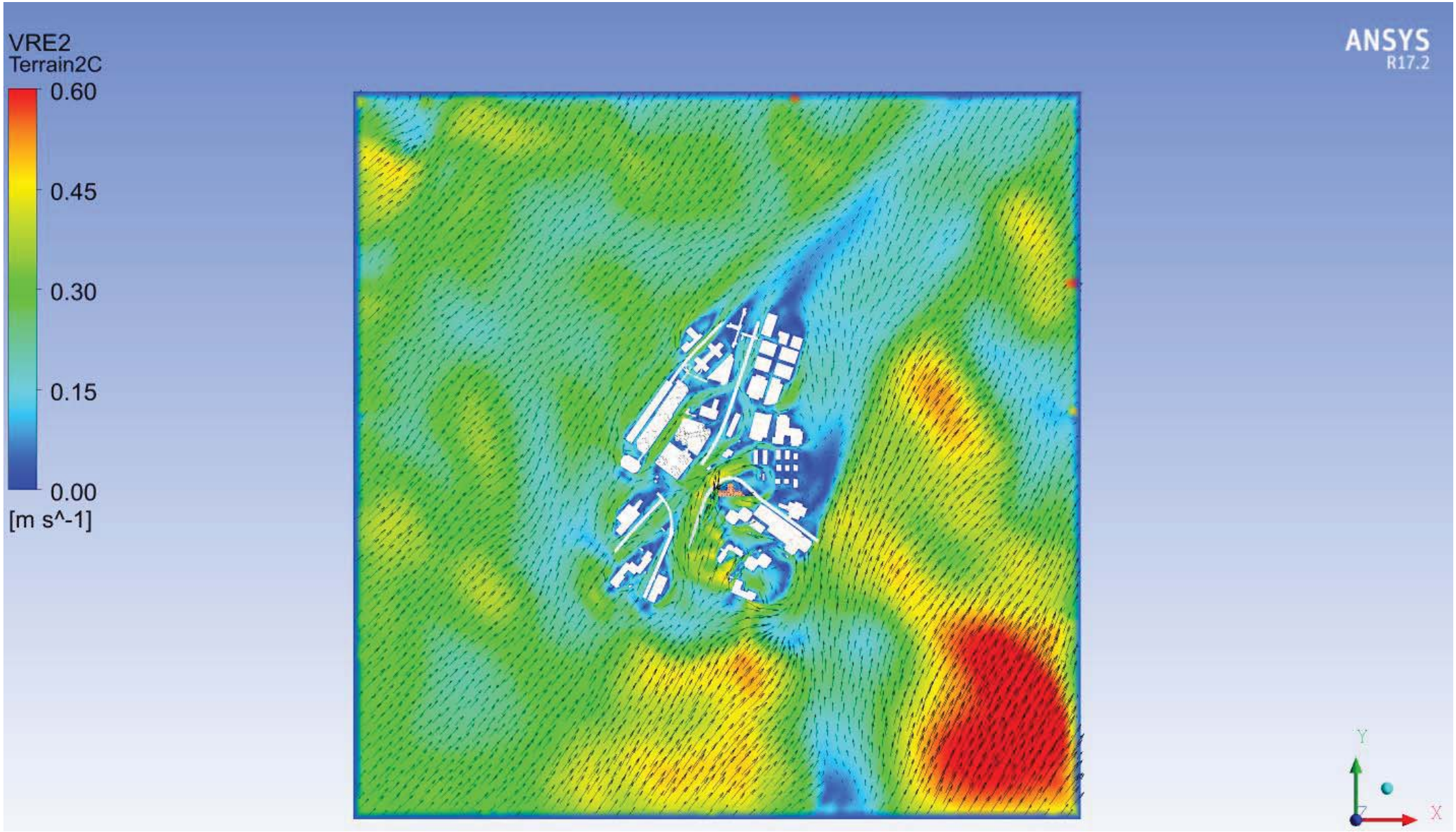
Baseline Scheme – Wind VR colour and vector plot at pedestrian level under SSE Wind (Domain)



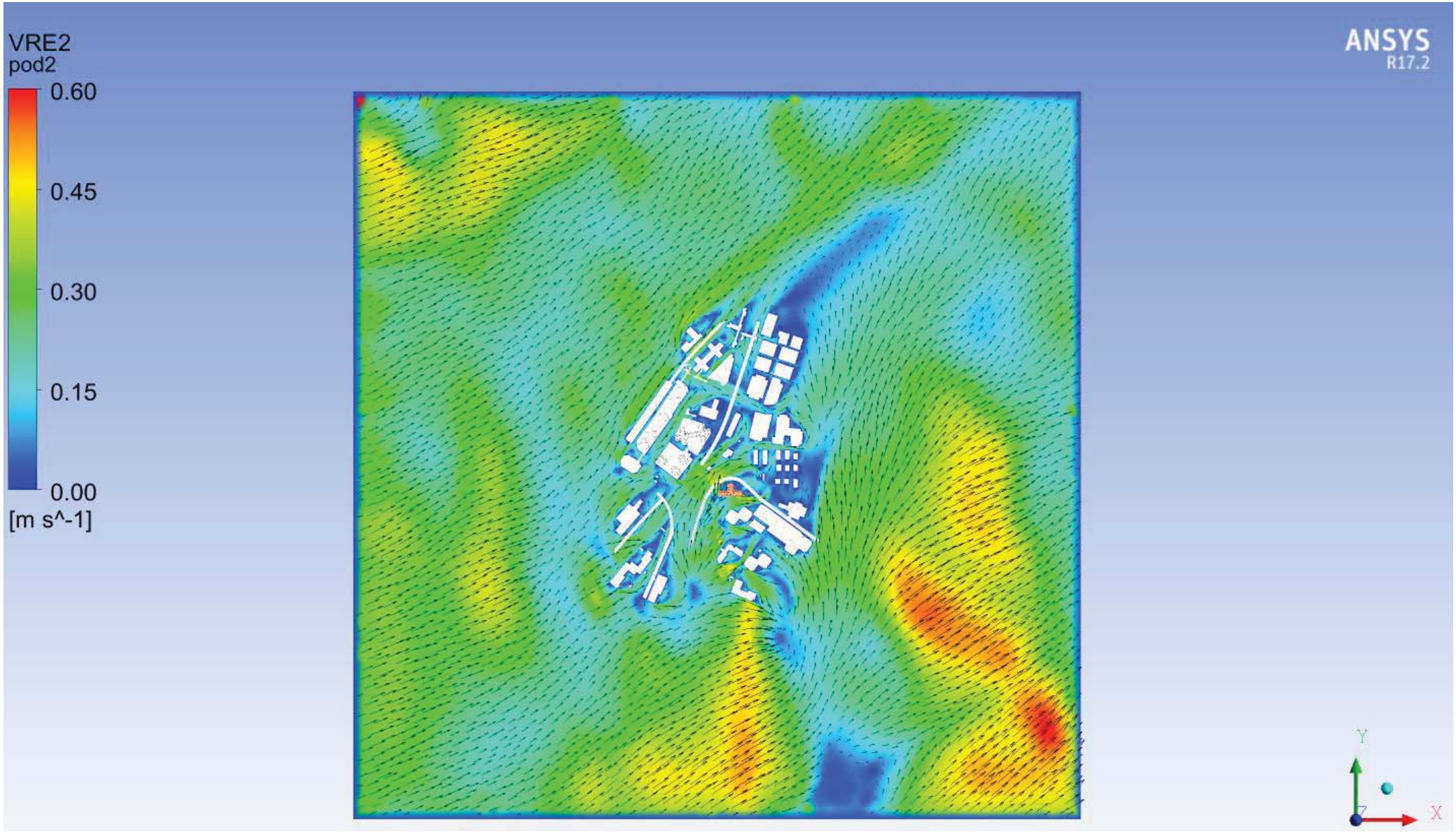
Baseline Scheme – Wind VR colour and vector plot at pedestrian level under S Wind (Domain)



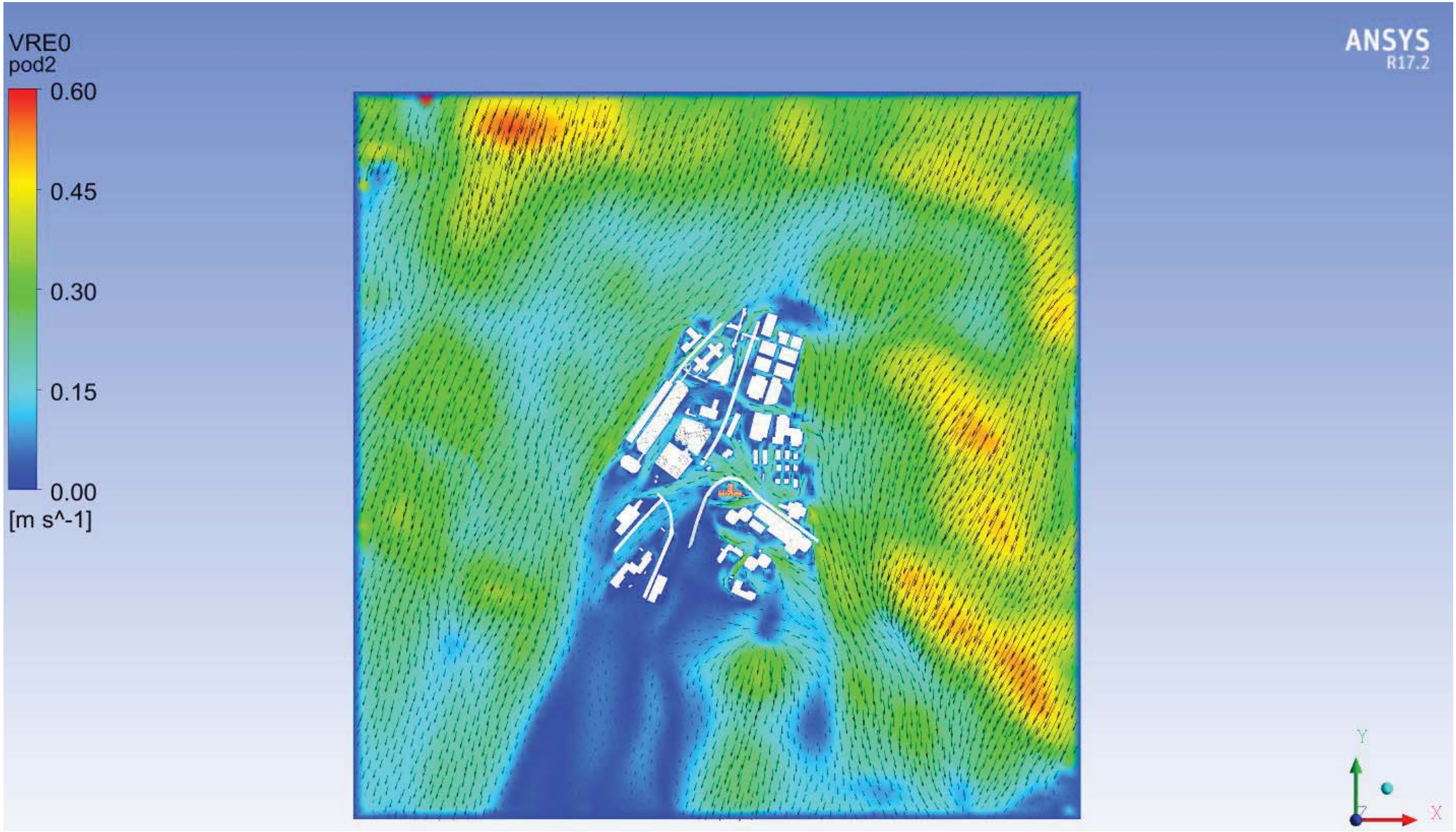
Baseline Scheme – Wind VR colour and vector plot at pedestrian level under SSW Wind (Domain)



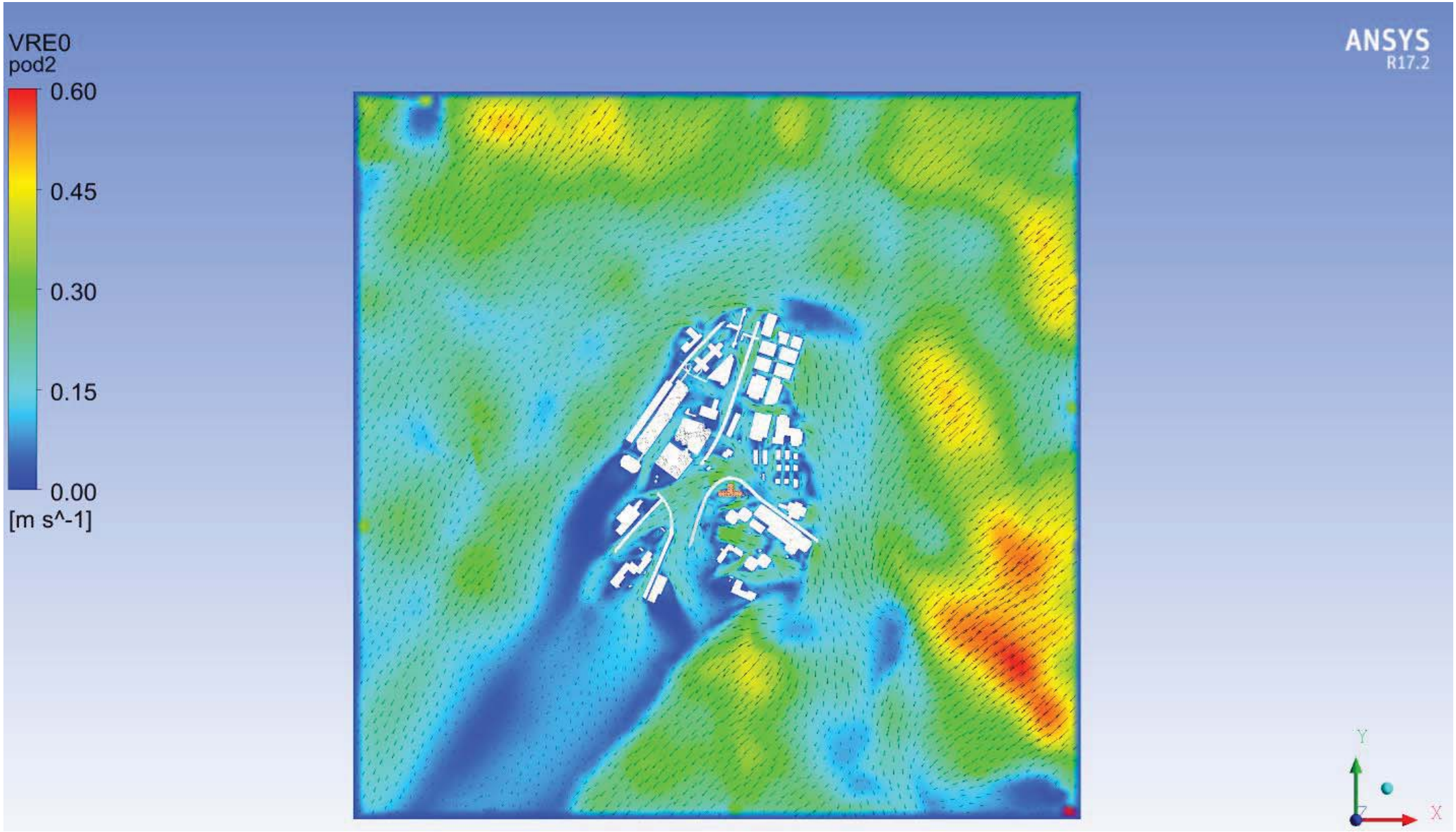
Baseline Scheme – Wind VR colour and vector plot at pedestrian level under SW Wind (Domain)



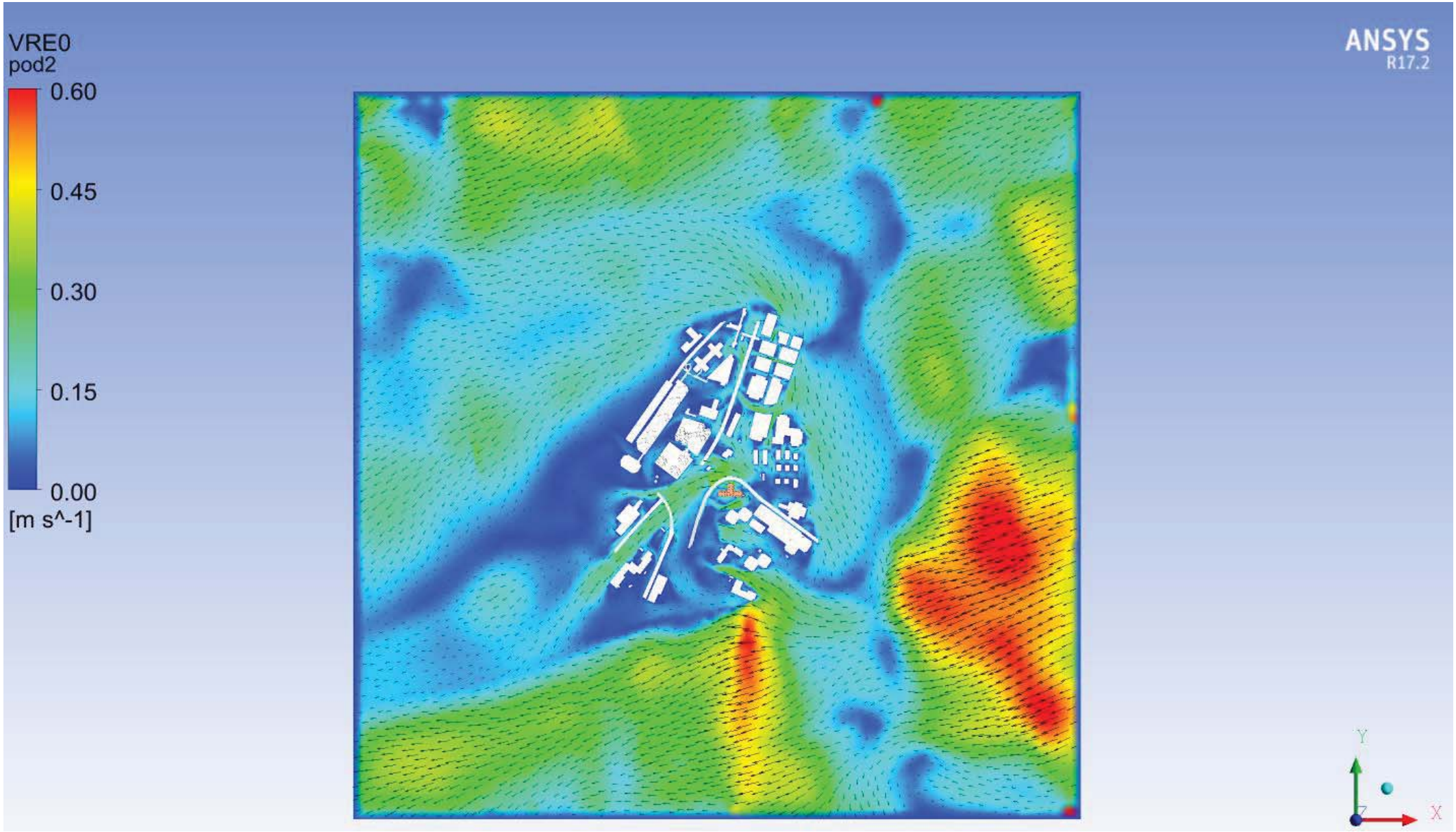
Baseline Scheme– Wind VR colour and vector plot at pedestrian level under WSW Wind (Domain)



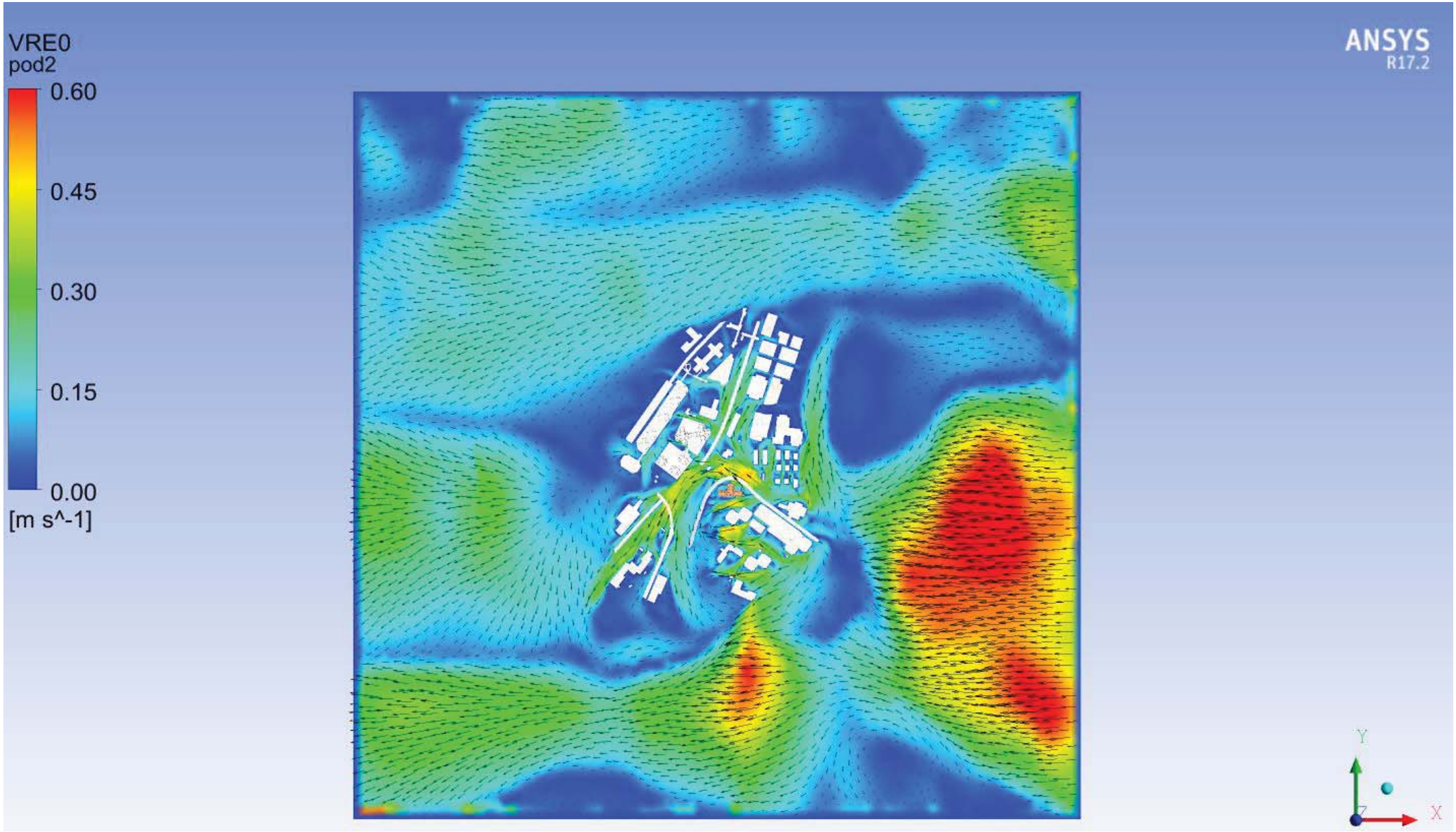
Proposed Scheme – Wind VR colour and vector plot at pedestrian level under NNE Wind (Domain)



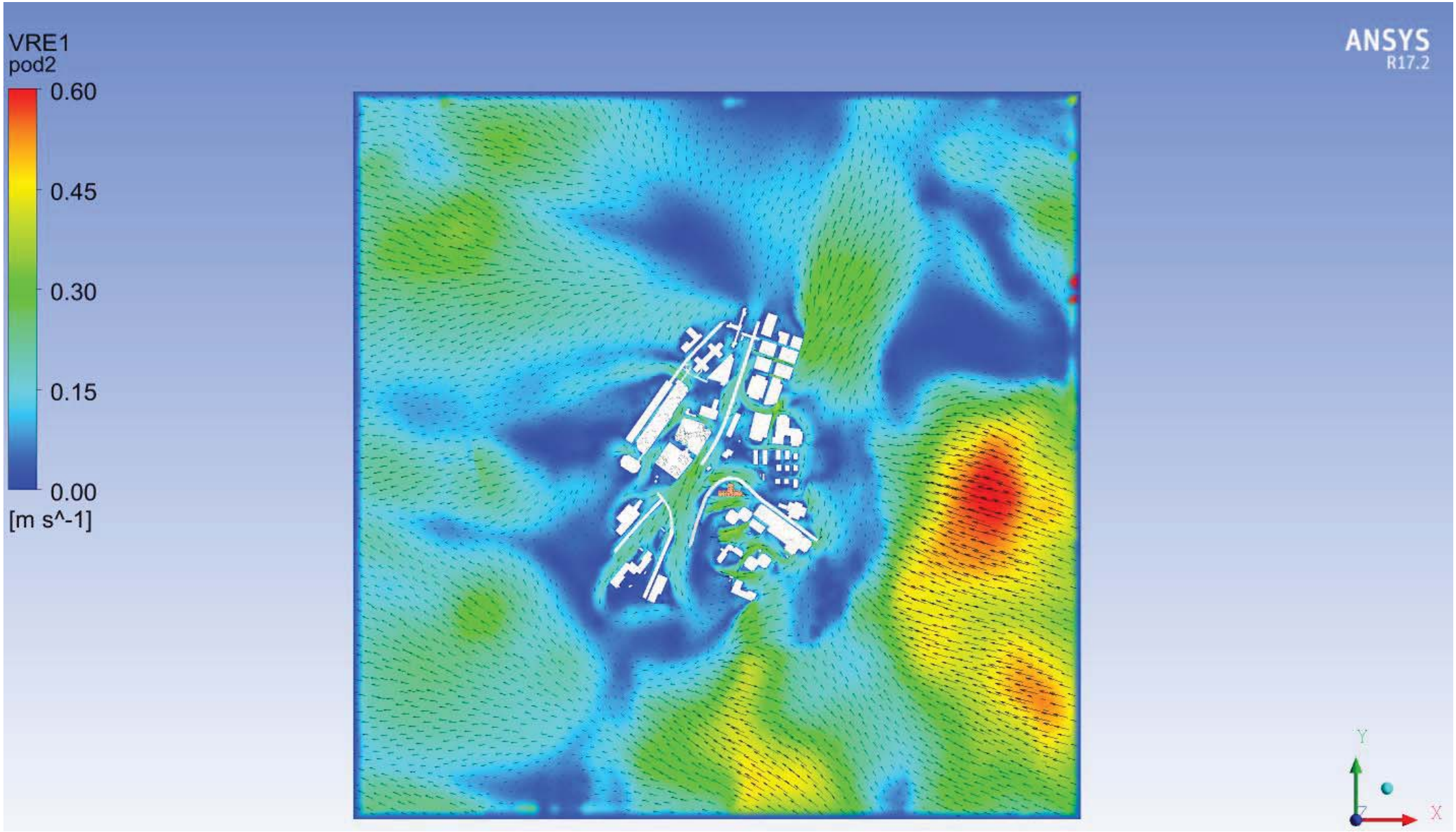
Proposed Scheme – Wind VR colour and vector plot at pedestrian level under NE Wind (Domain)



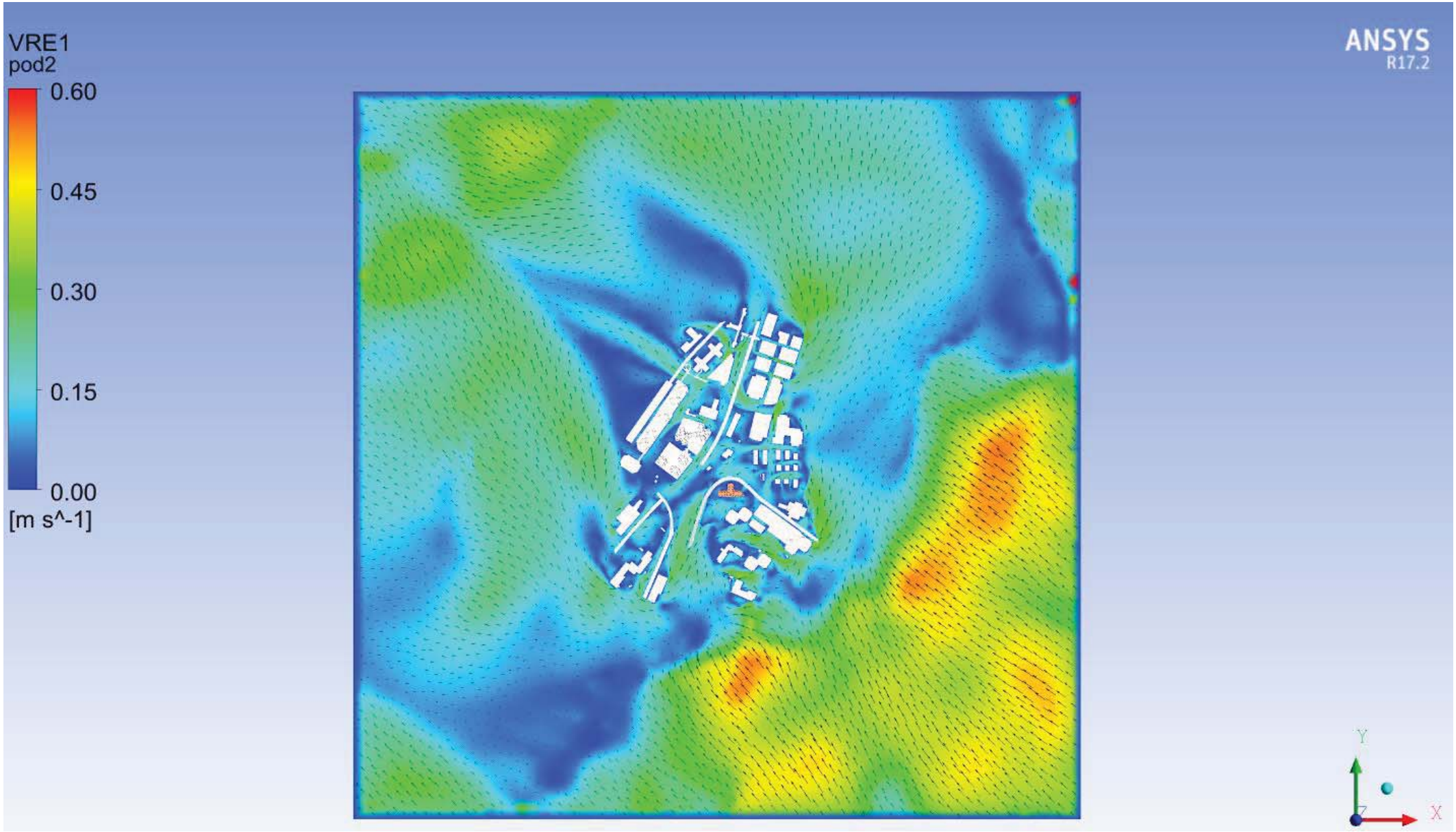
Proposed Scheme – Wind VR colour and vector plot at pedestrian level under ENE Wind (Domain)



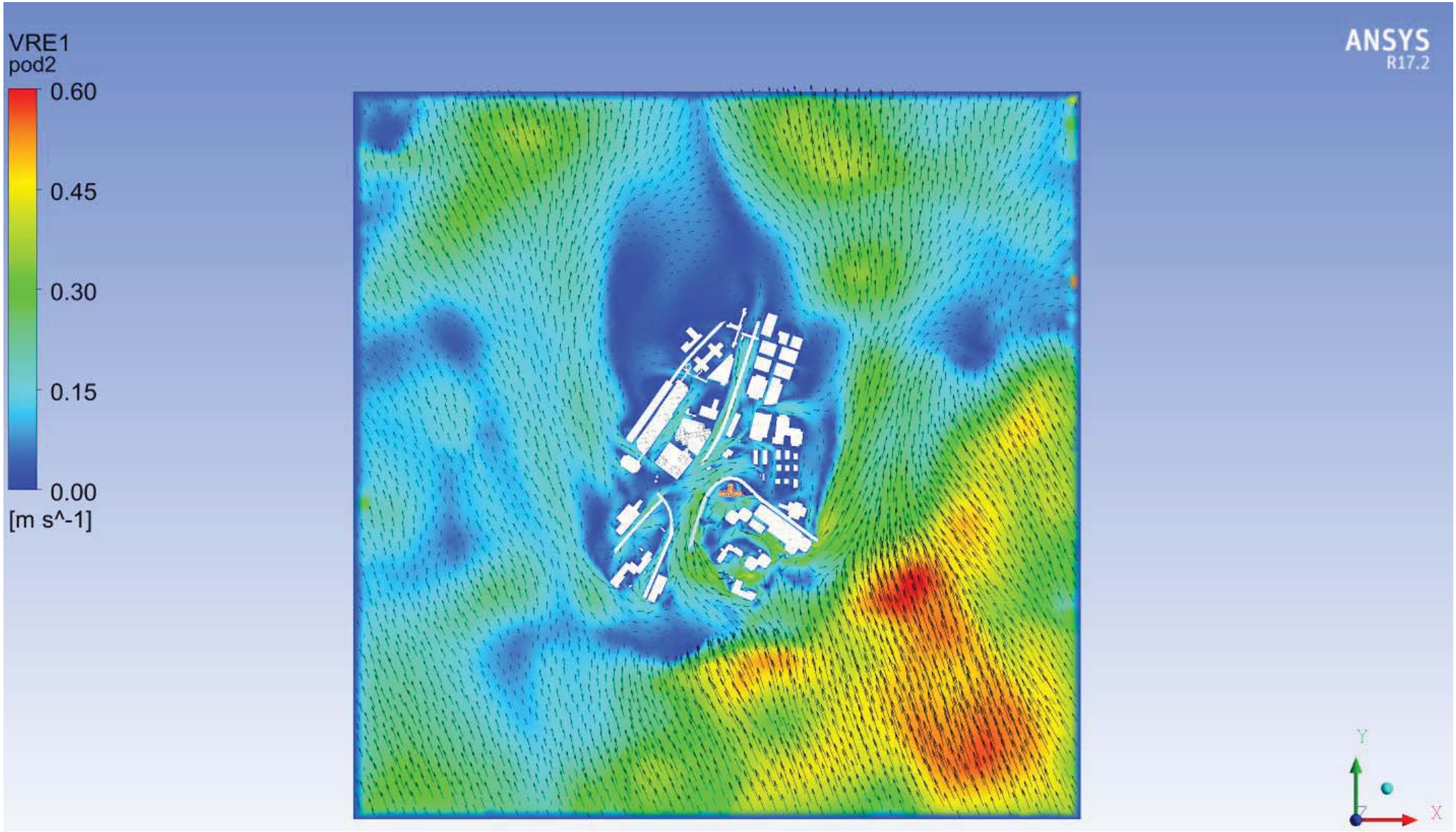
Proposed Scheme – Wind VR colour and vector plot at pedestrian level under E Wind (Domain)



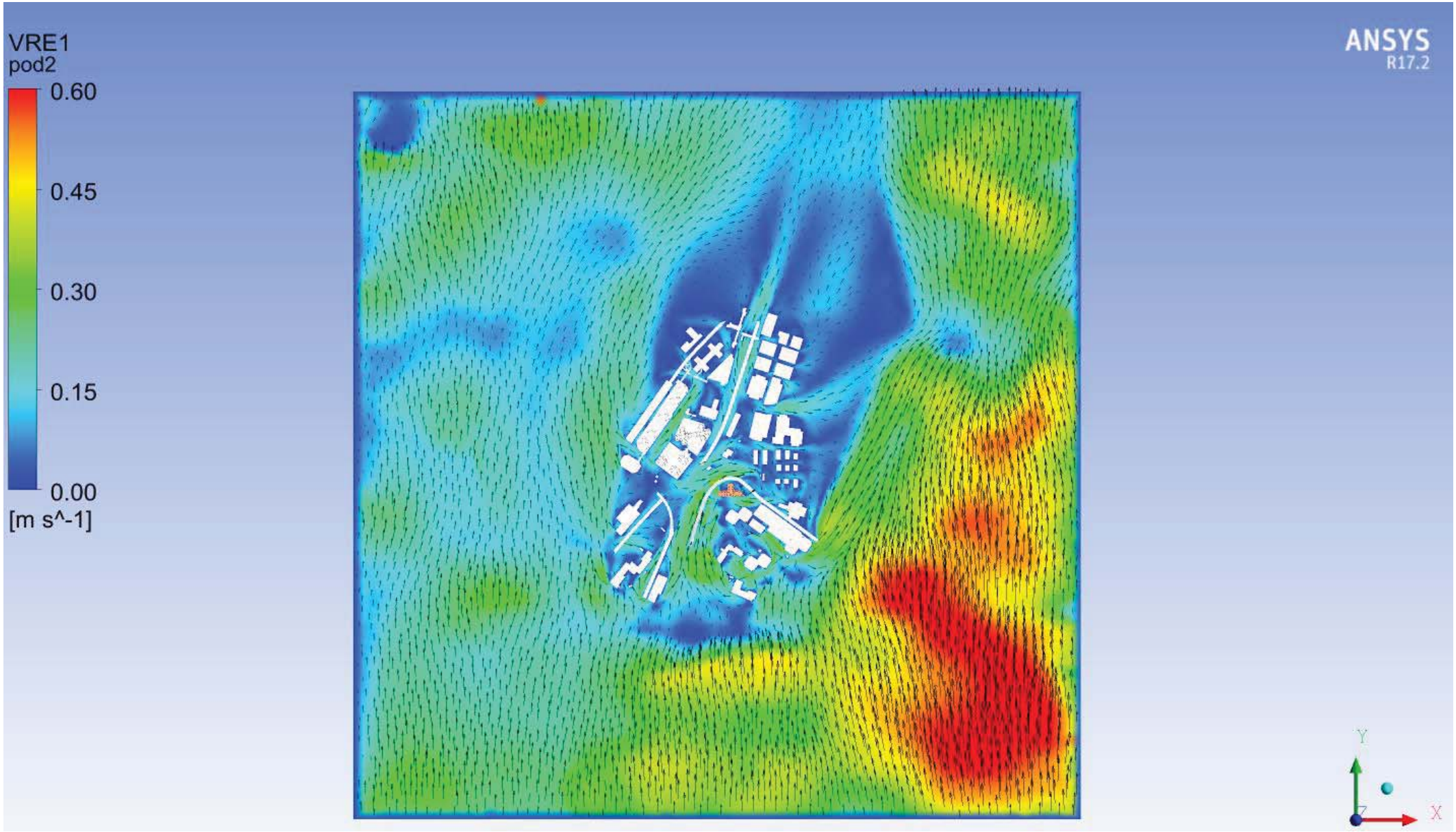
Proposed Scheme – Wind VR colour and vector plot at pedestrian level under ESE Wind (Domain)



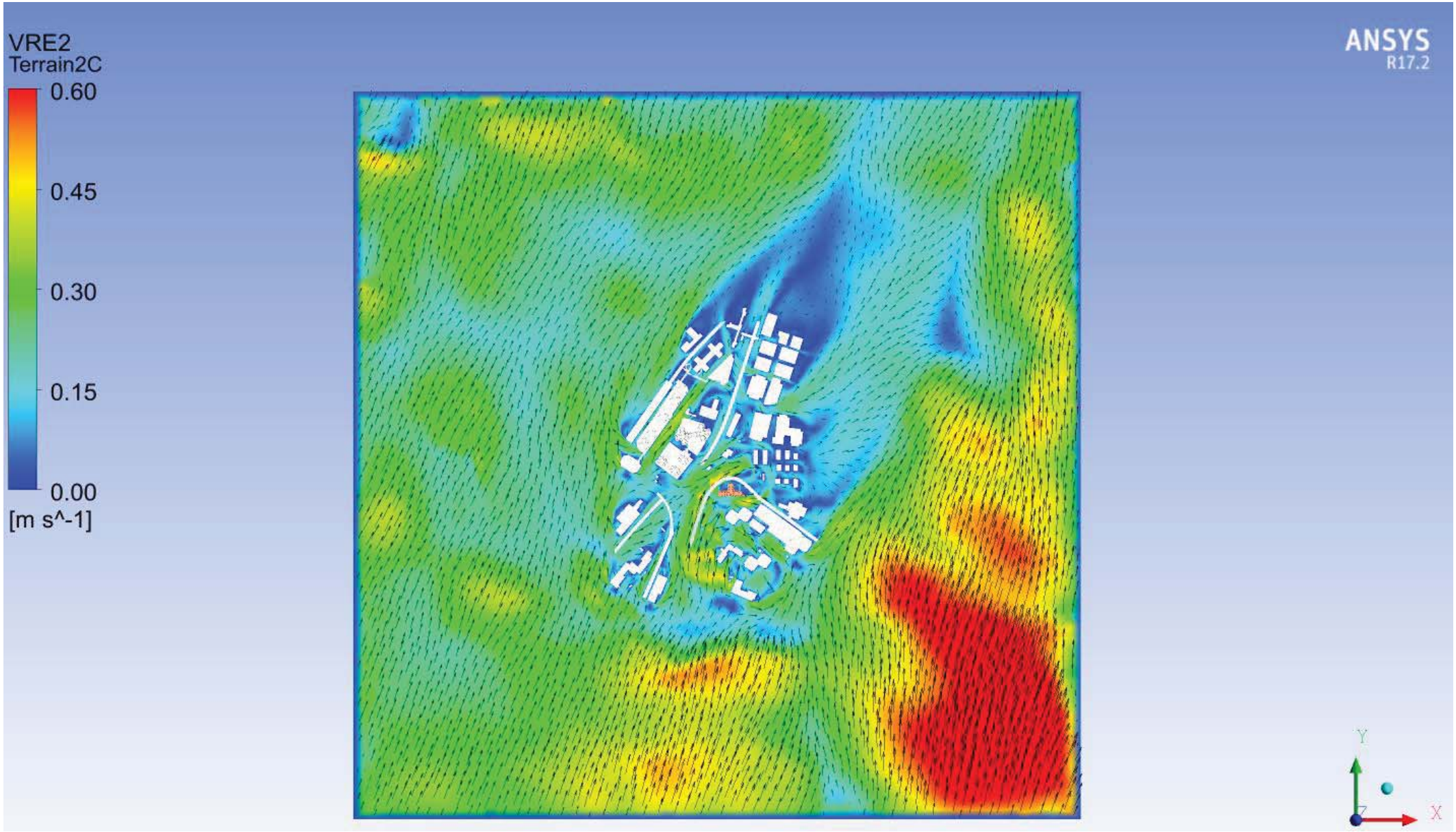
Proposed Scheme – Wind VR colour and vector plot at pedestrian level under SE Wind (Domain)



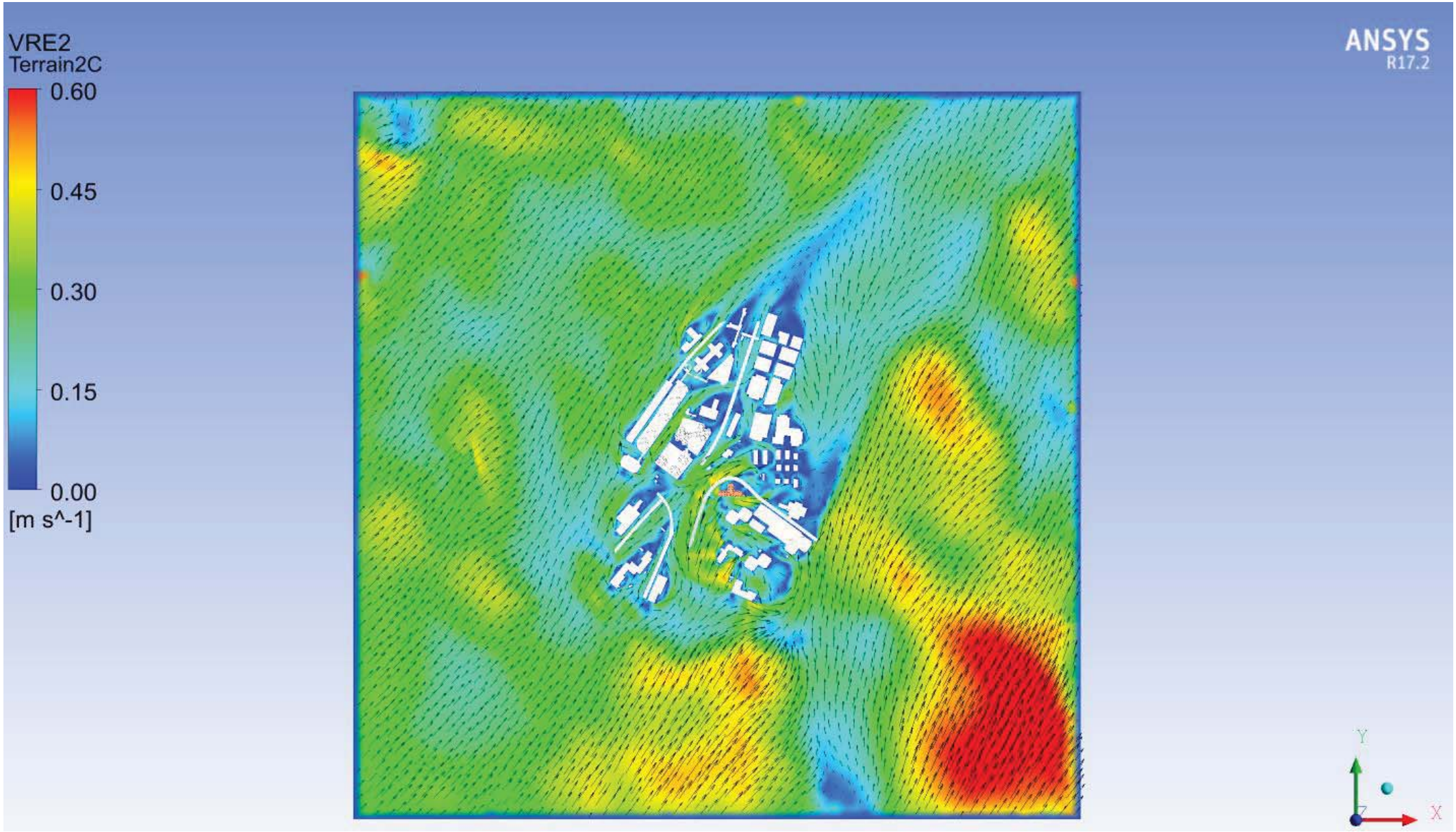
Proposed Scheme – Wind VR colour and vector plot at pedestrian level under SSE Wind (Domain)



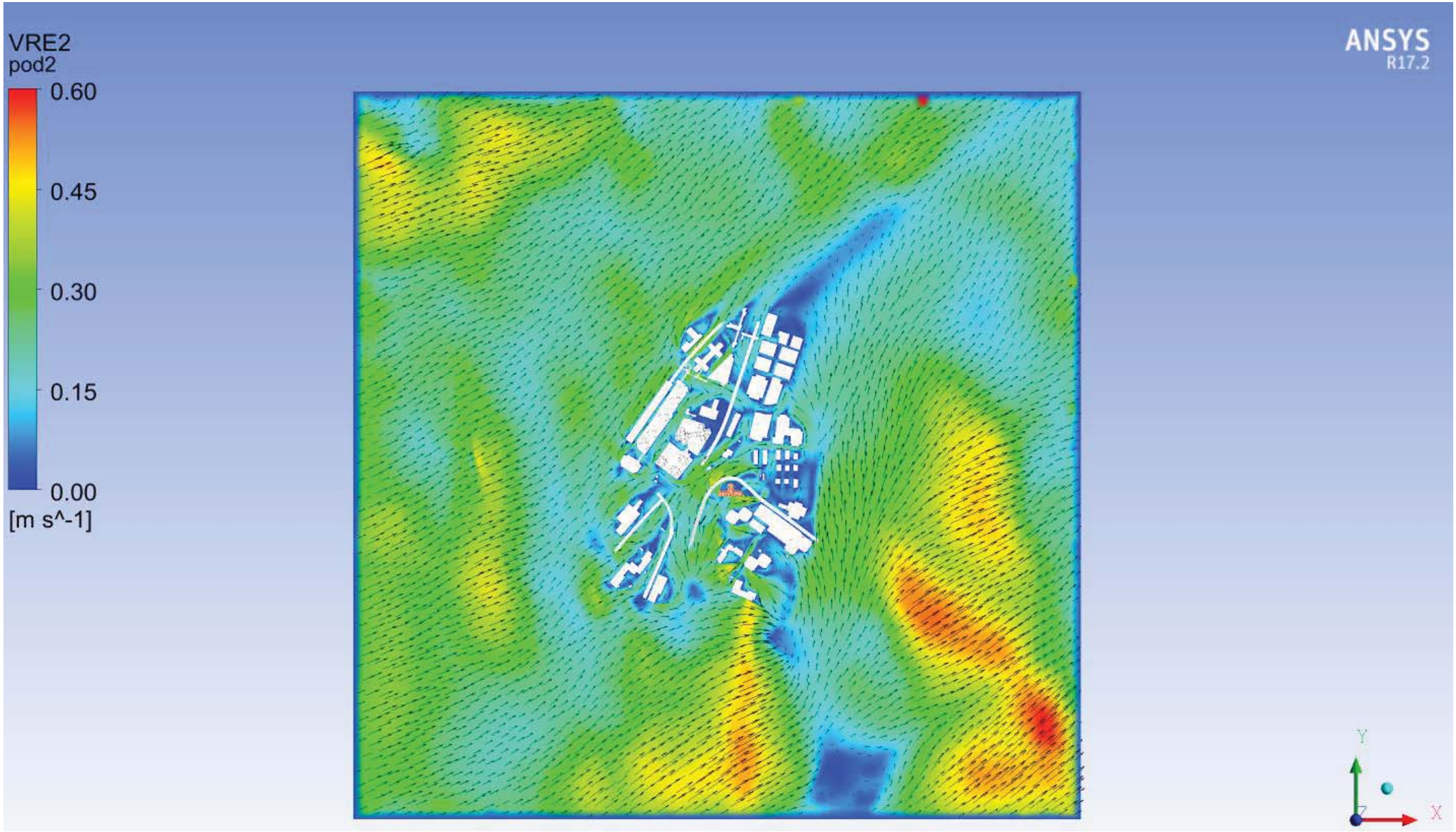
Proposed Scheme – Wind VR colour and vector plot at pedestrian level under S Wind (Domain)



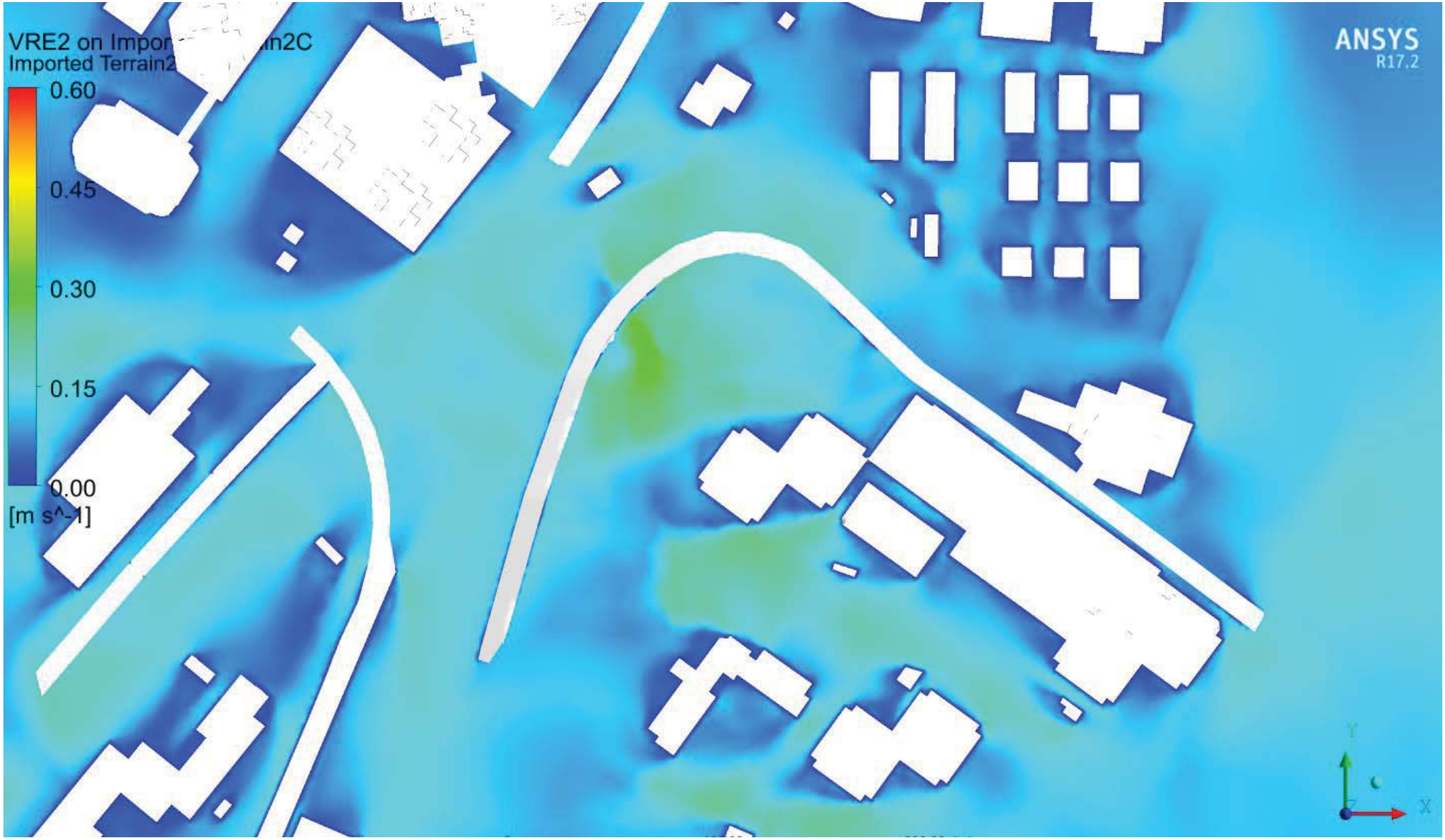
Proposed Scheme – Wind VR colour and vector plot at pedestrian level under SSW Wind (Domain)



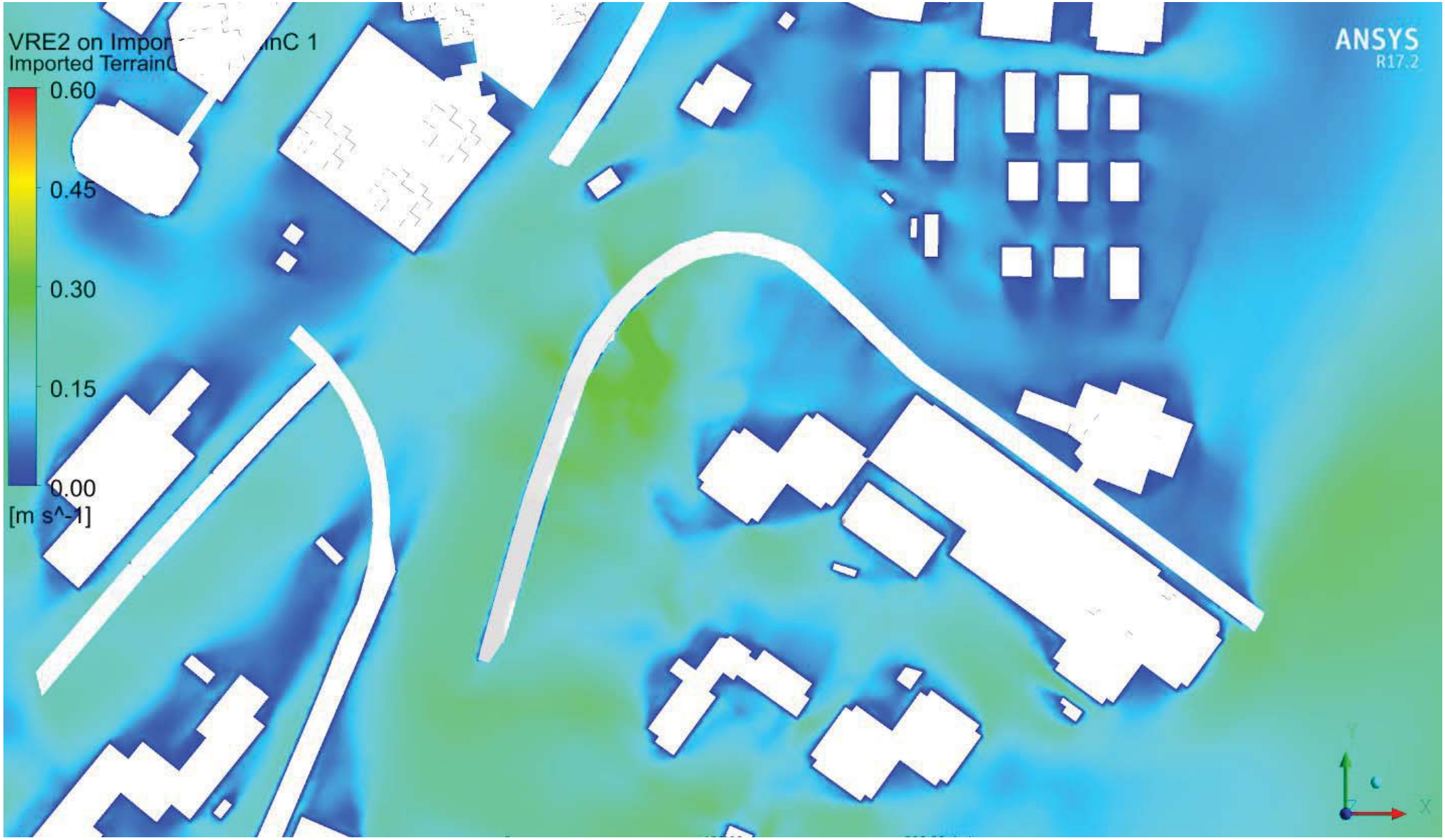
Proposed Scheme – Wind VR colour and vector plot at pedestrian level under SW Wind (Domain)



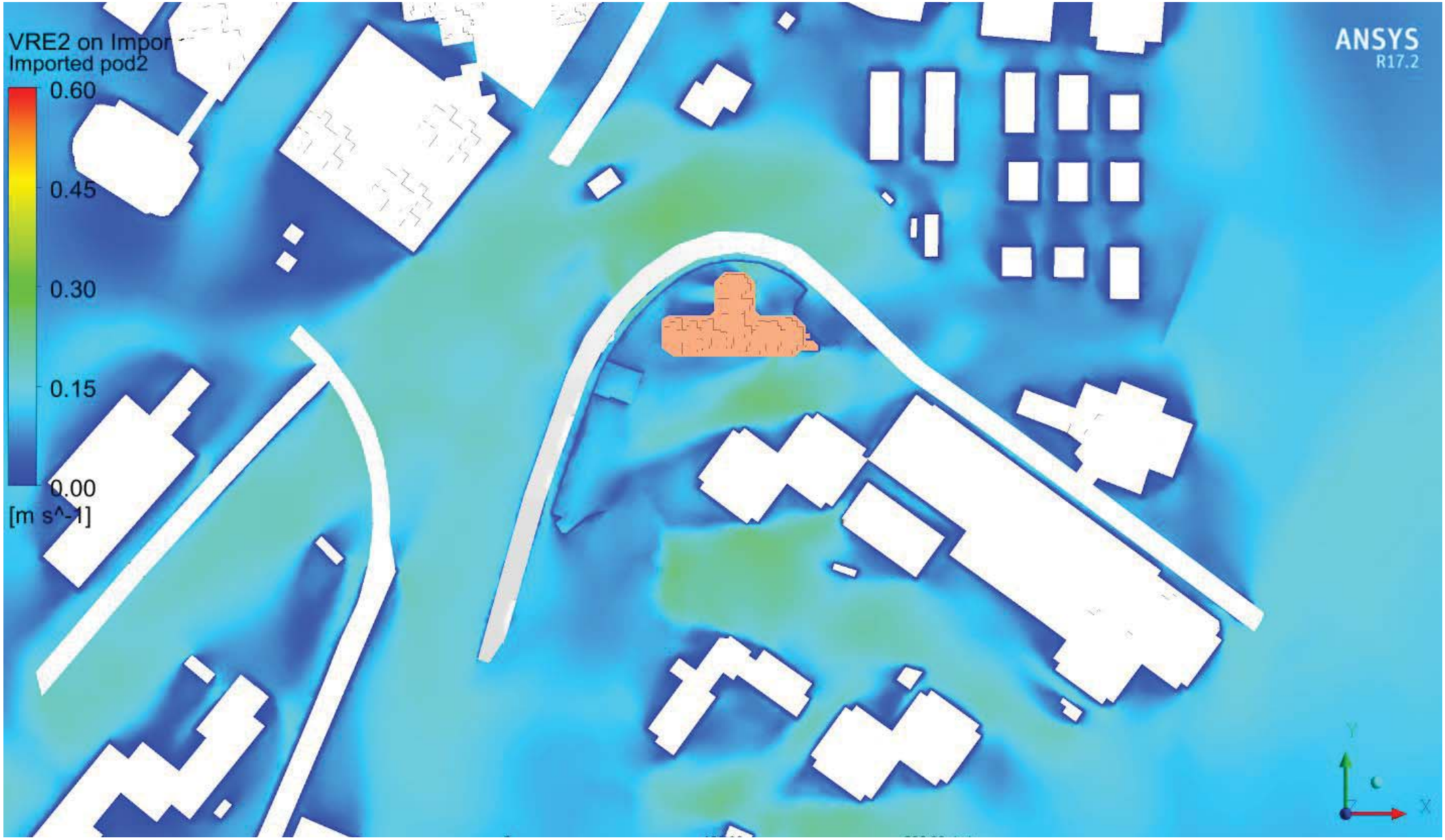
Proposed Scheme – Wind VR colour and vector plot at pedestrian level under WSW Wind (Domain)



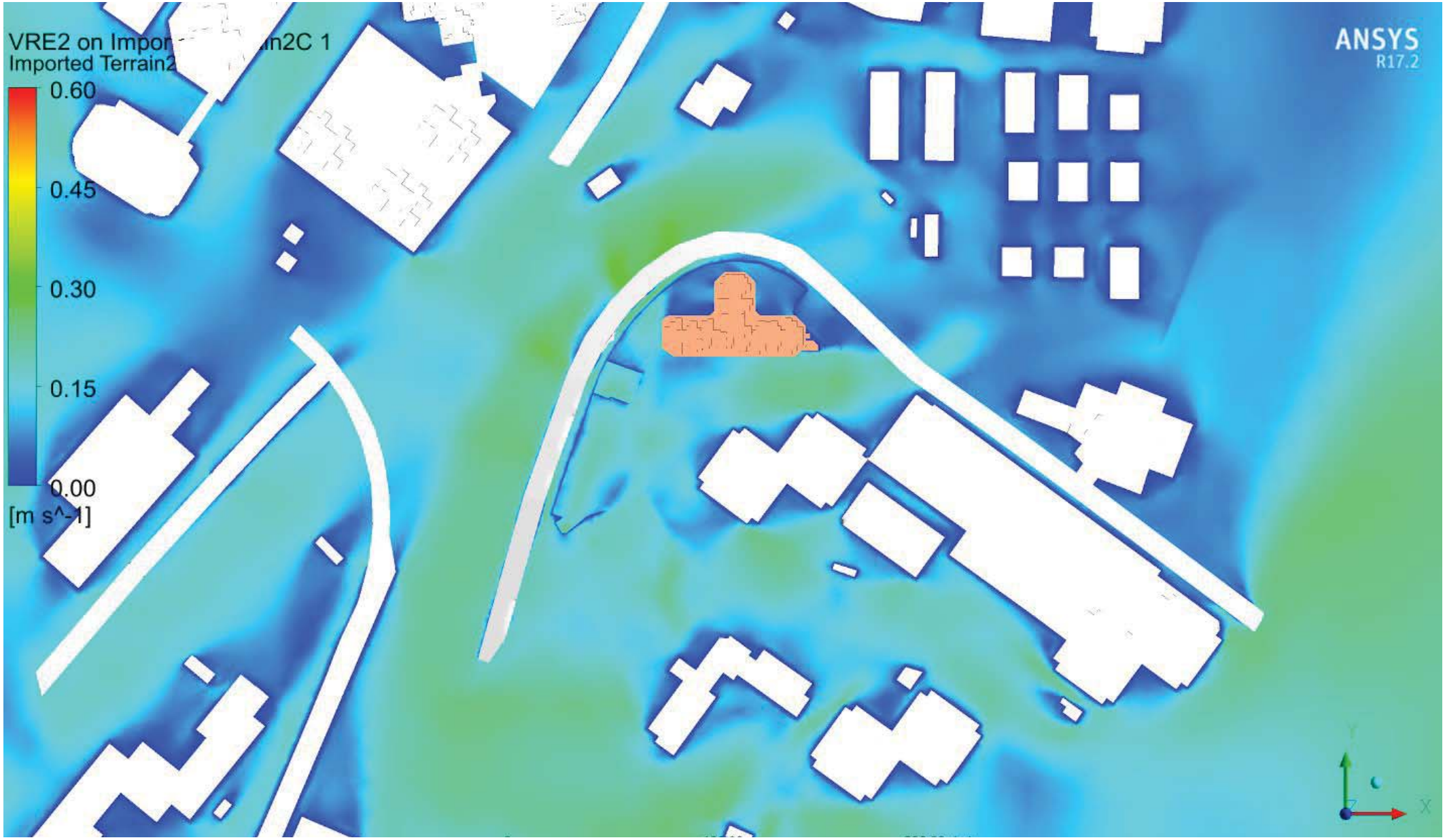
Existing Scenario – Annual weighted average VR colour at pedestrian level (1H)



Existing Scenario – Summer weighted average VR colour at pedestrian level (1H)

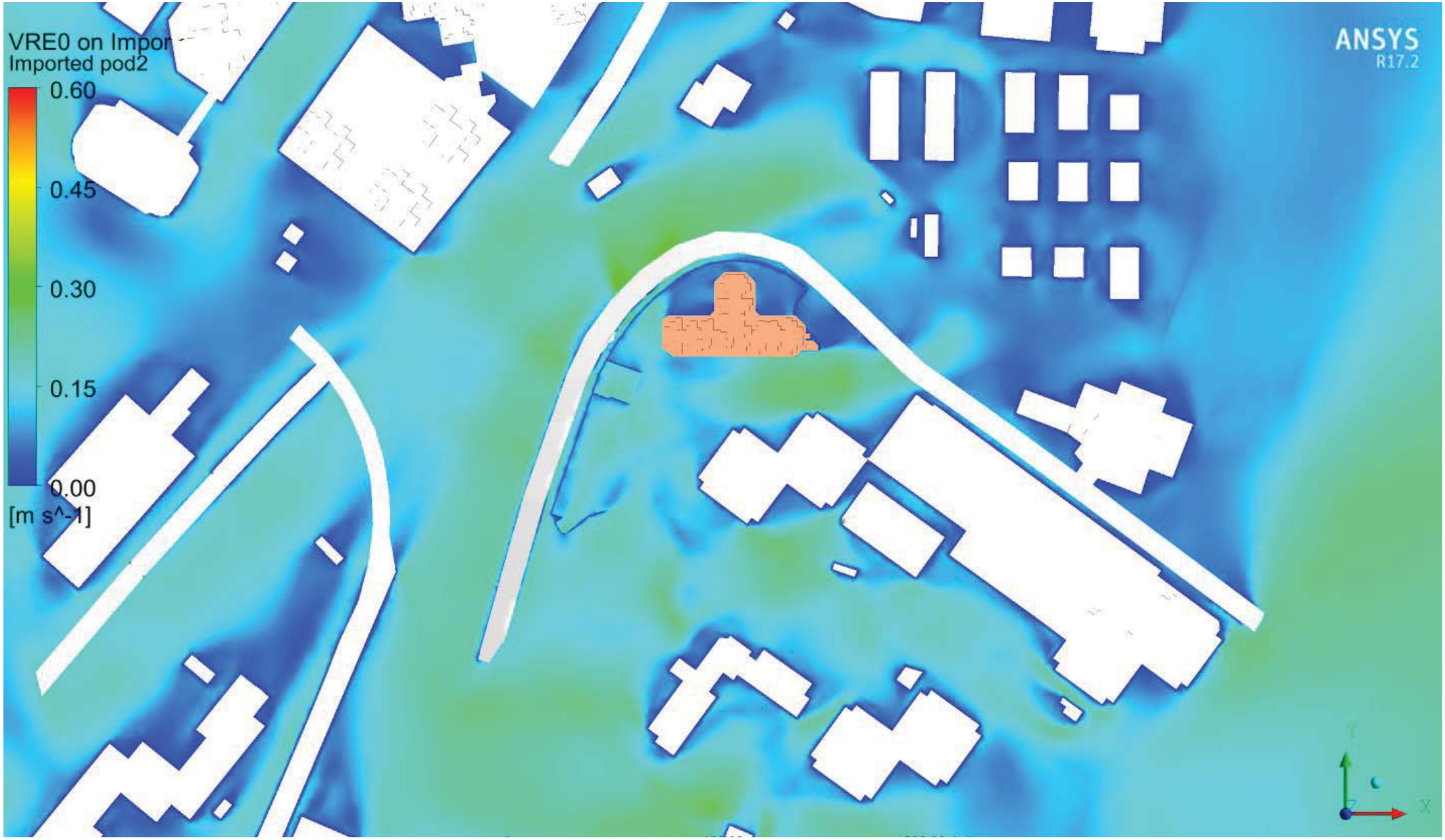


Baseline Scenario – Annual weighted average VR colour at pedestrian level (1H)

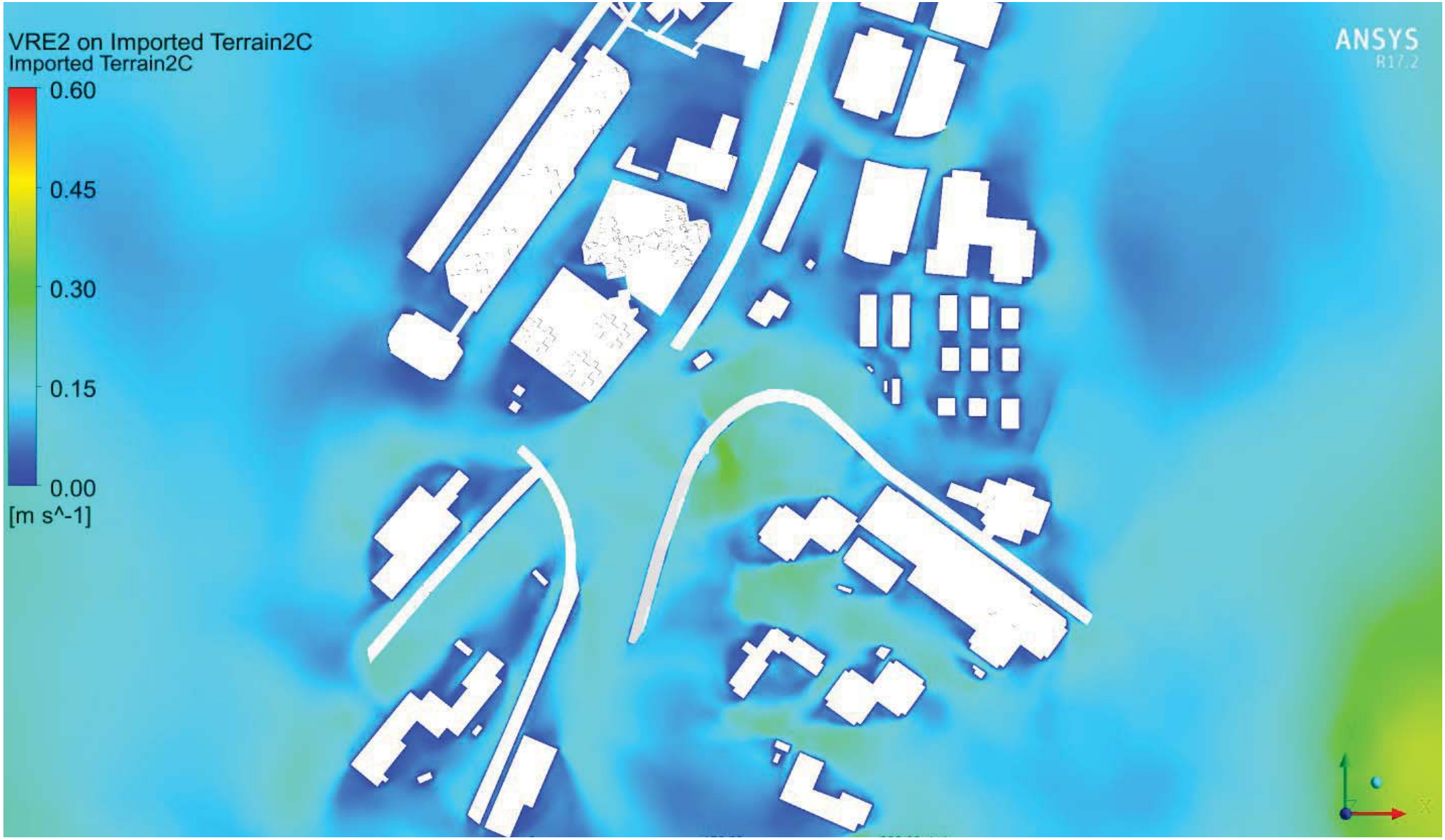


Baseline Scenario – Summer weighted average VR colour at pedestrian level (1H)

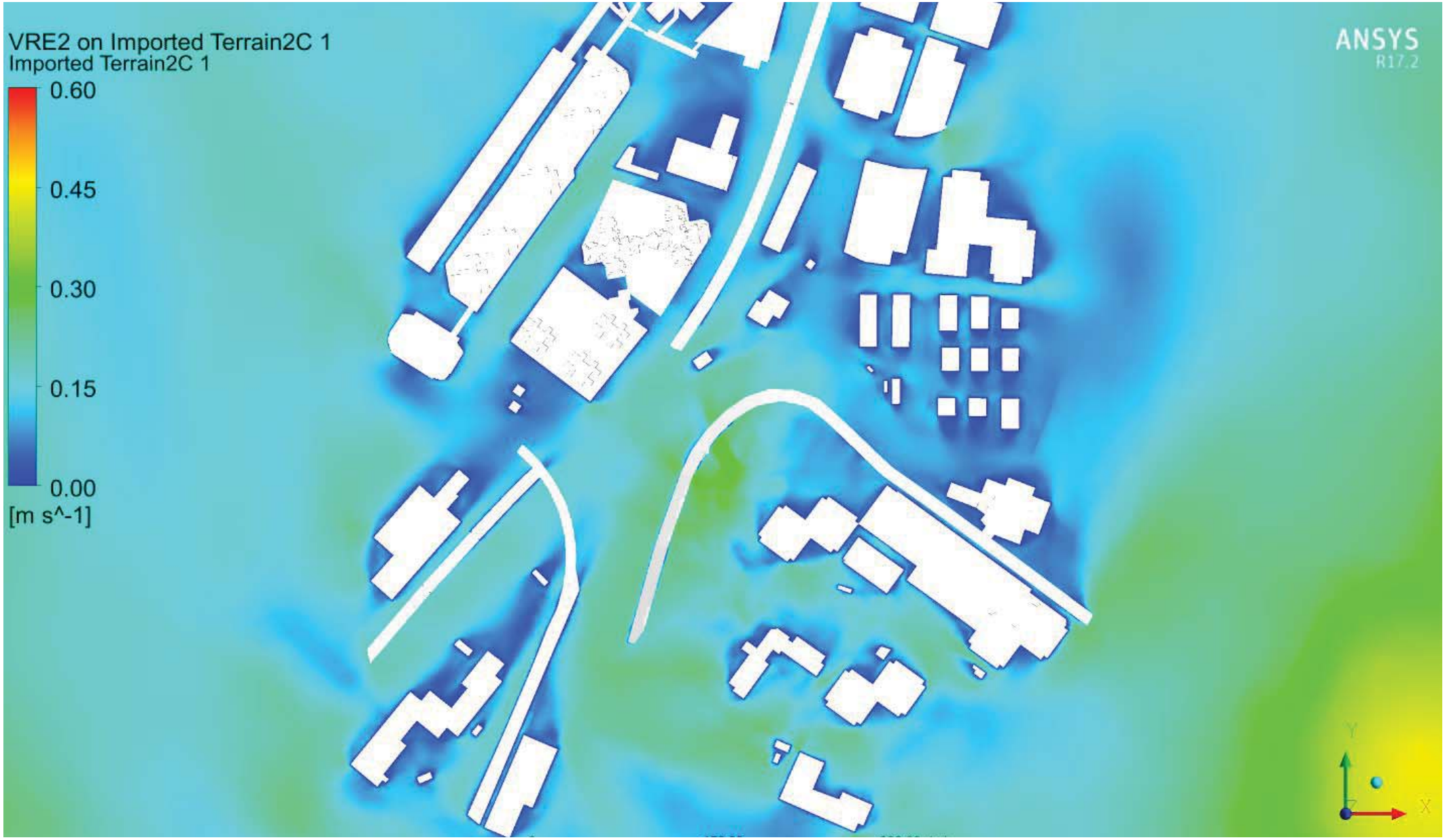
Proposed Scenario – Annual weighted average VR colour at pedestrian level (1H)



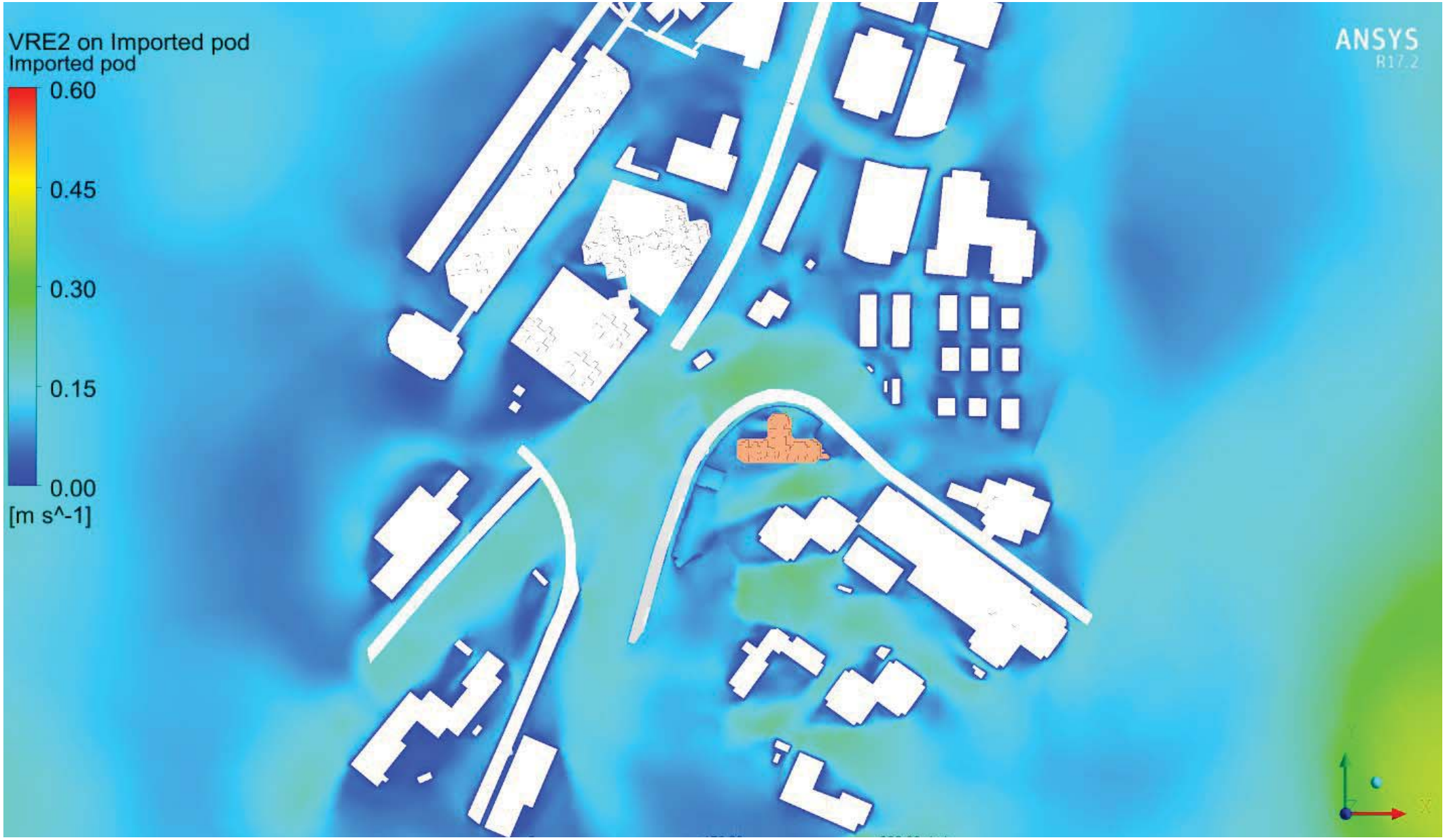
Proposed Scenario –Summer weighted average VR colour at pedestrian level (1H)



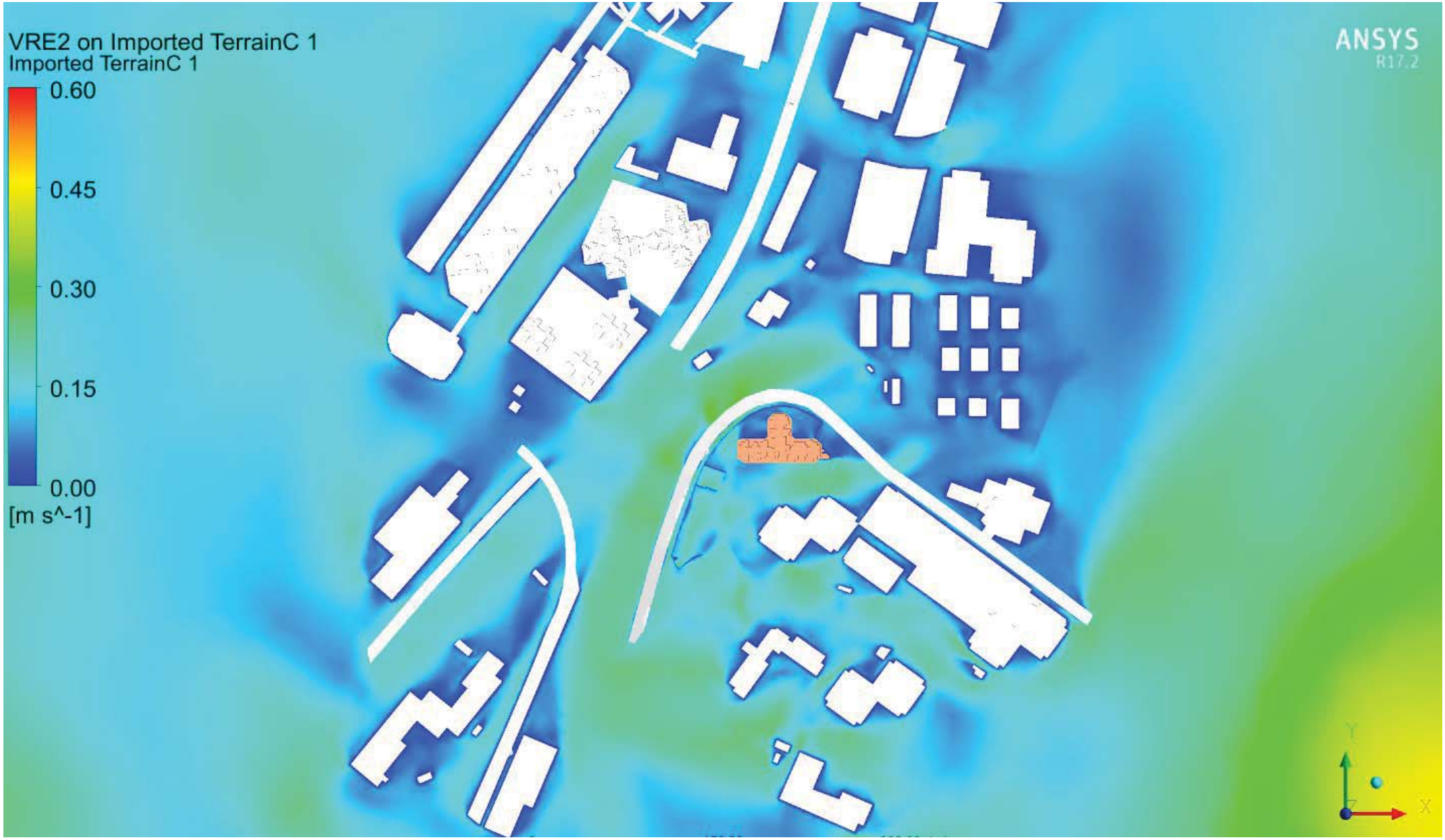
Existing Scenario – Annual weighted average VR colour at pedestrian level (2H)



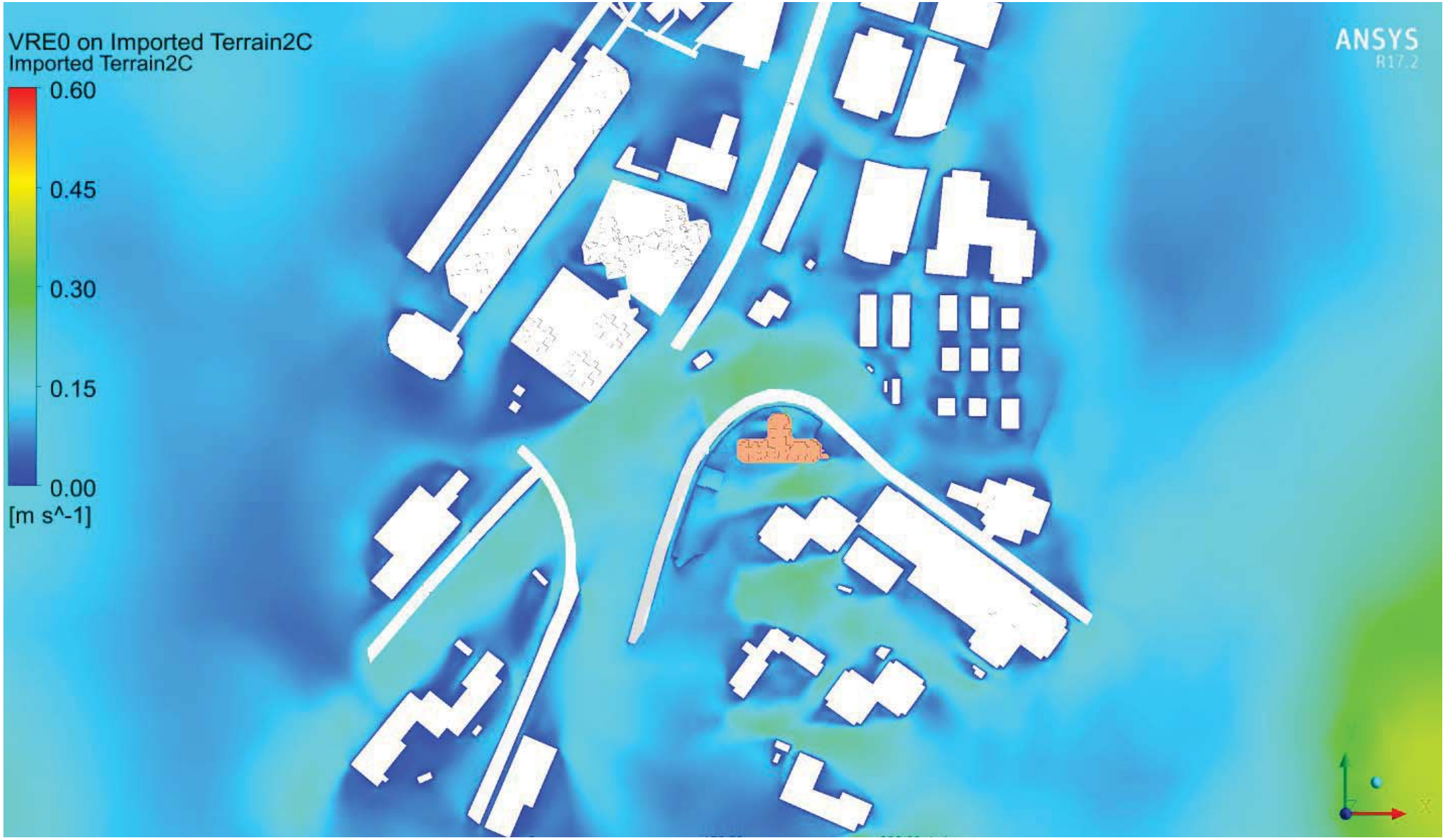
Existing Scenario – Summer weighted average VR colour at pedestrian level (2H)



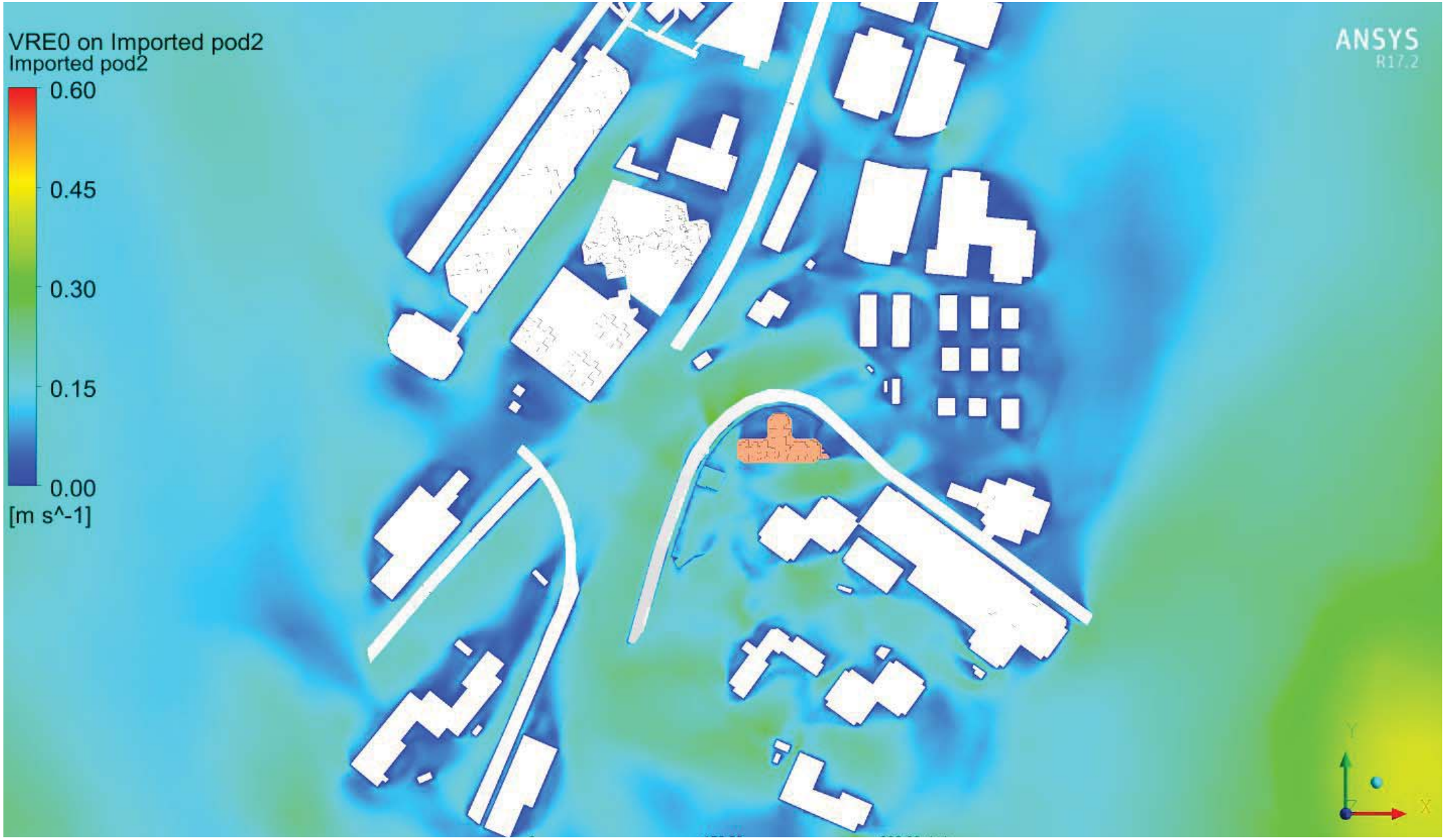
Baseline Scenario – Annual weighted average VR colour at pedestrian level (2H)



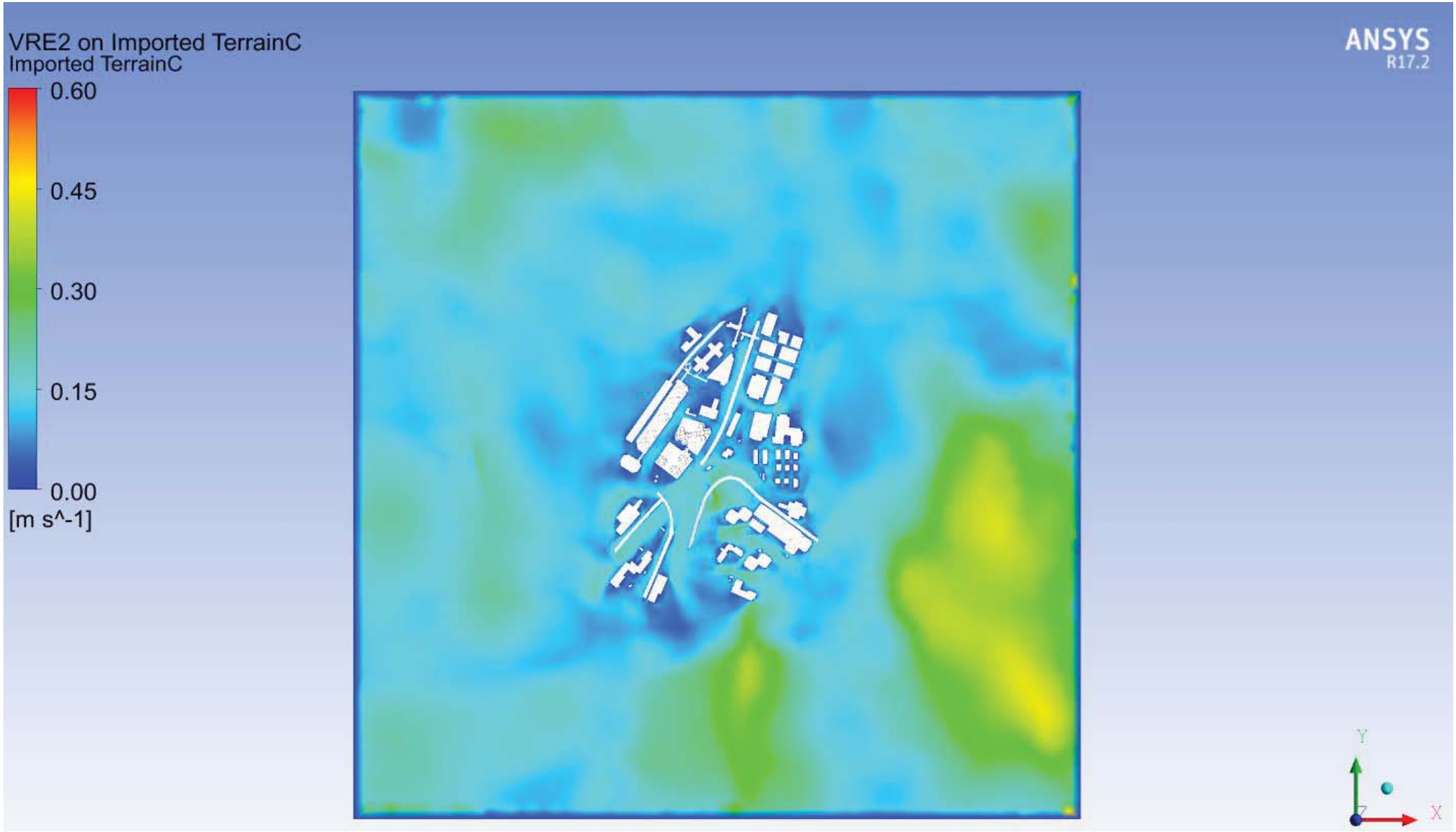
Baseline Scenario –Summer weighted average VR colour at pedestrian level (2H)



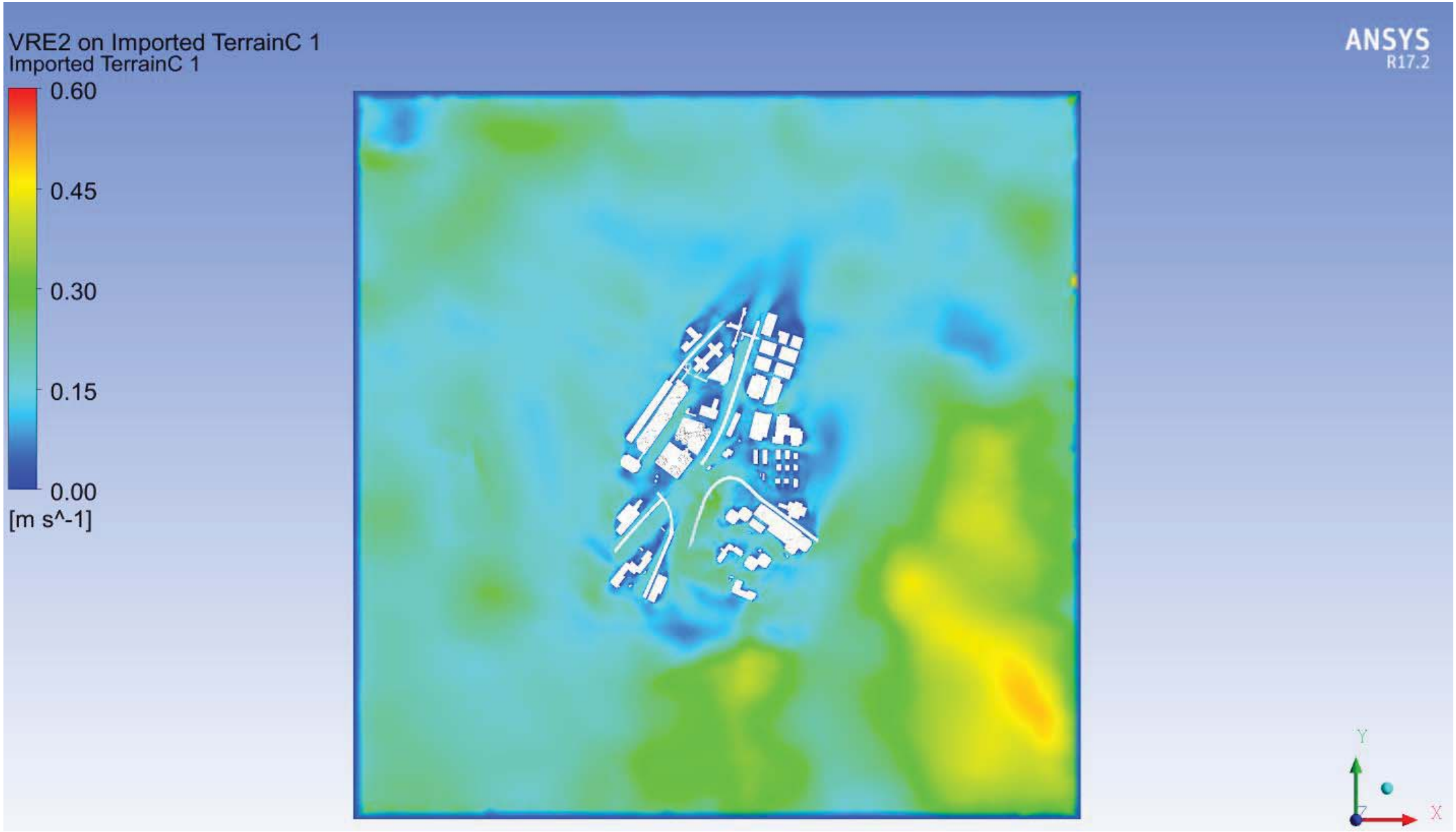
Proposed Scenario – Annual weighted average VR colour at pedestrian level (2H)



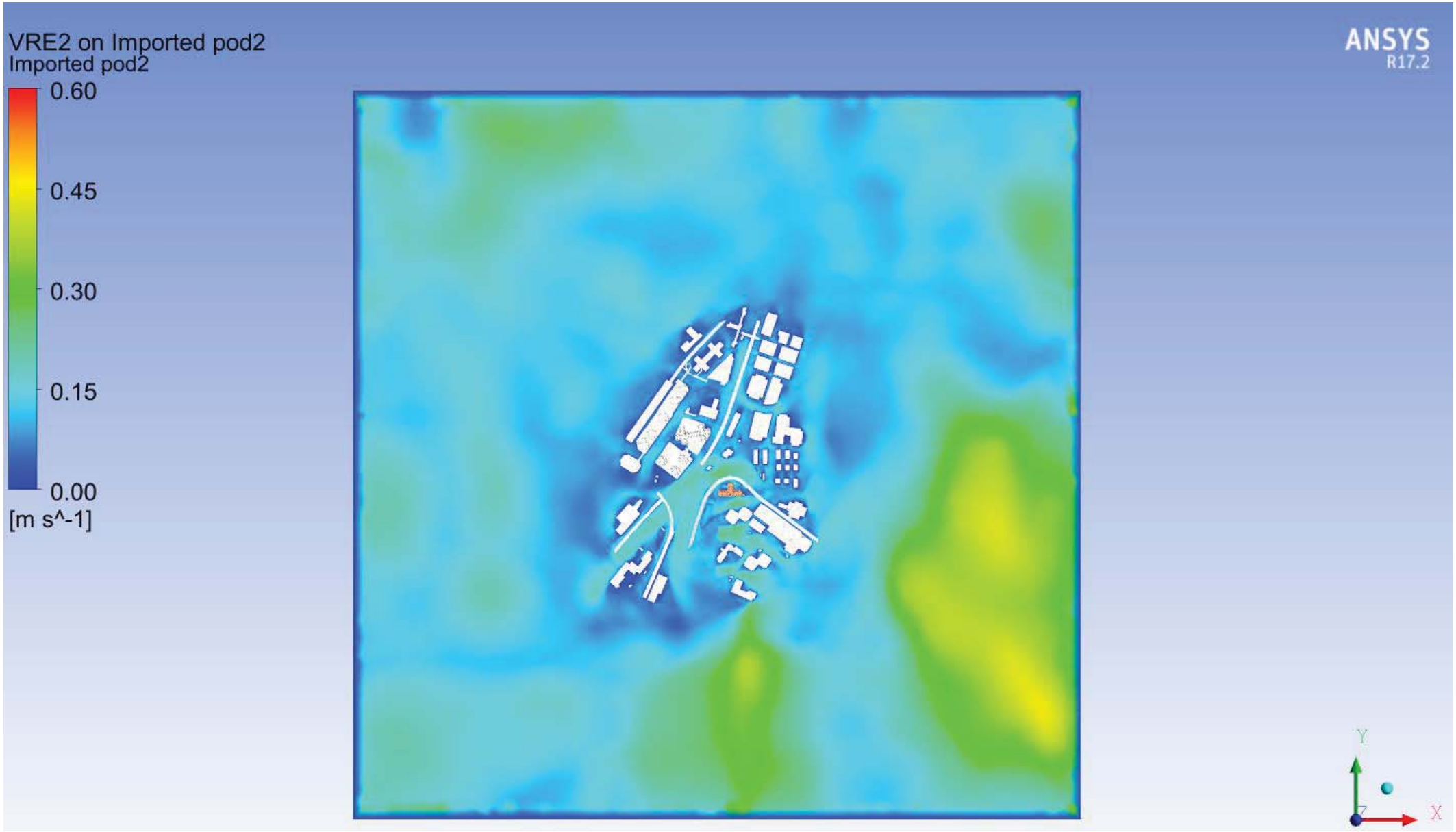
Proposed Scenario –Summer weighted average VR colour at pedestrian level (2H)



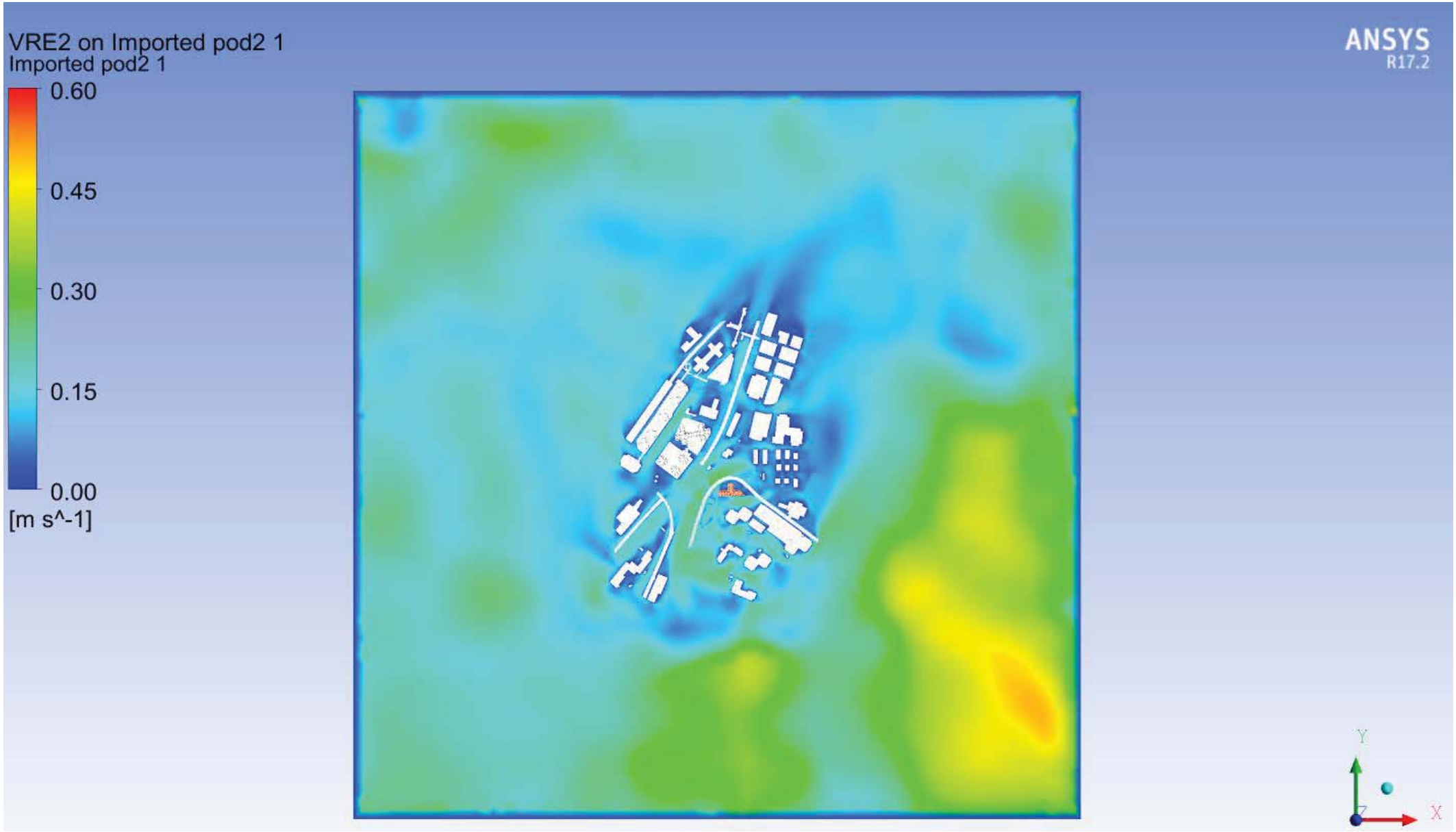
Existing Scenario – Annual weighted average VR colour at pedestrian level (Domain)



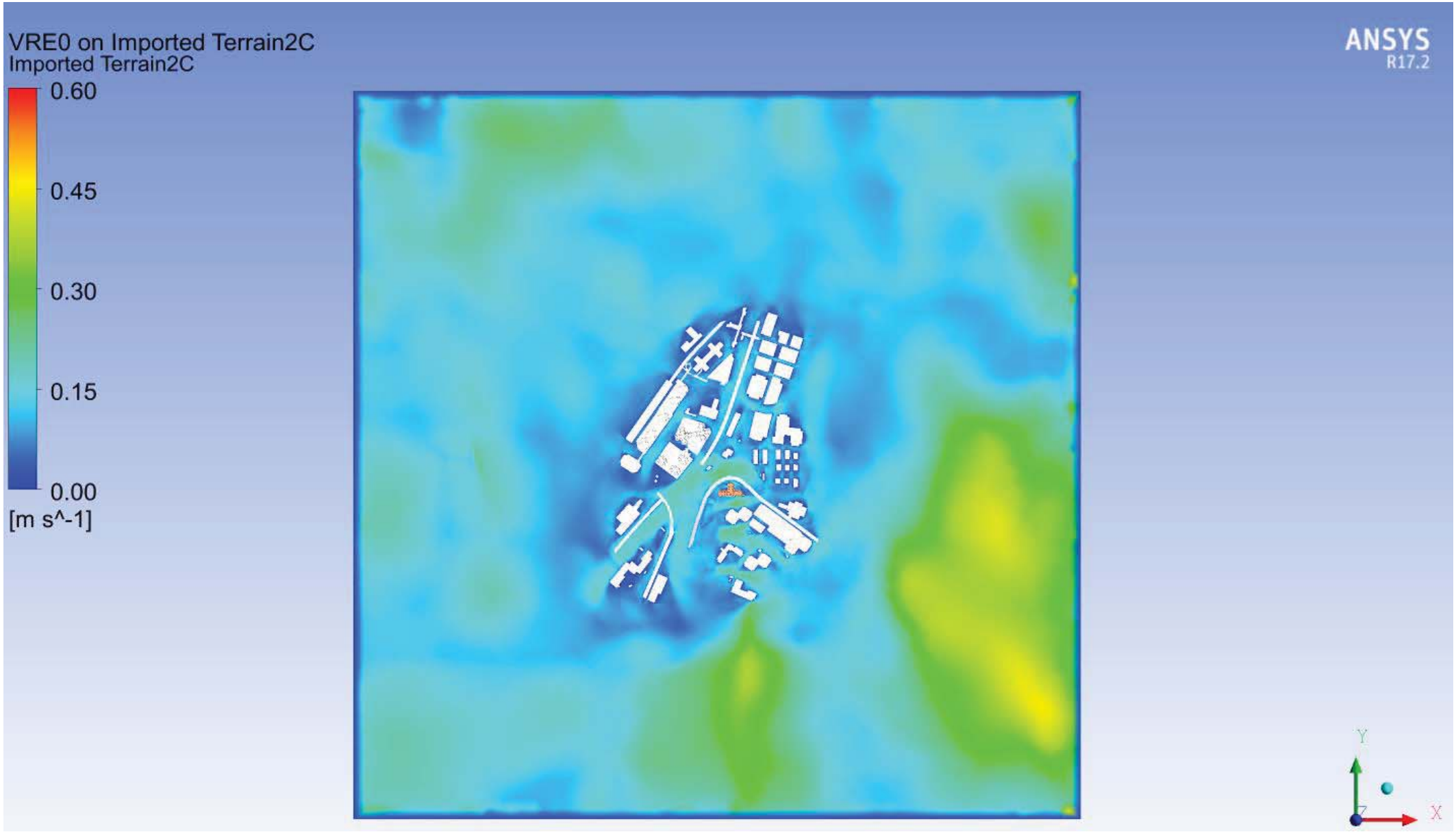
Existing Scenario – Summer weighted average VR colour at pedestrian level (Domain)



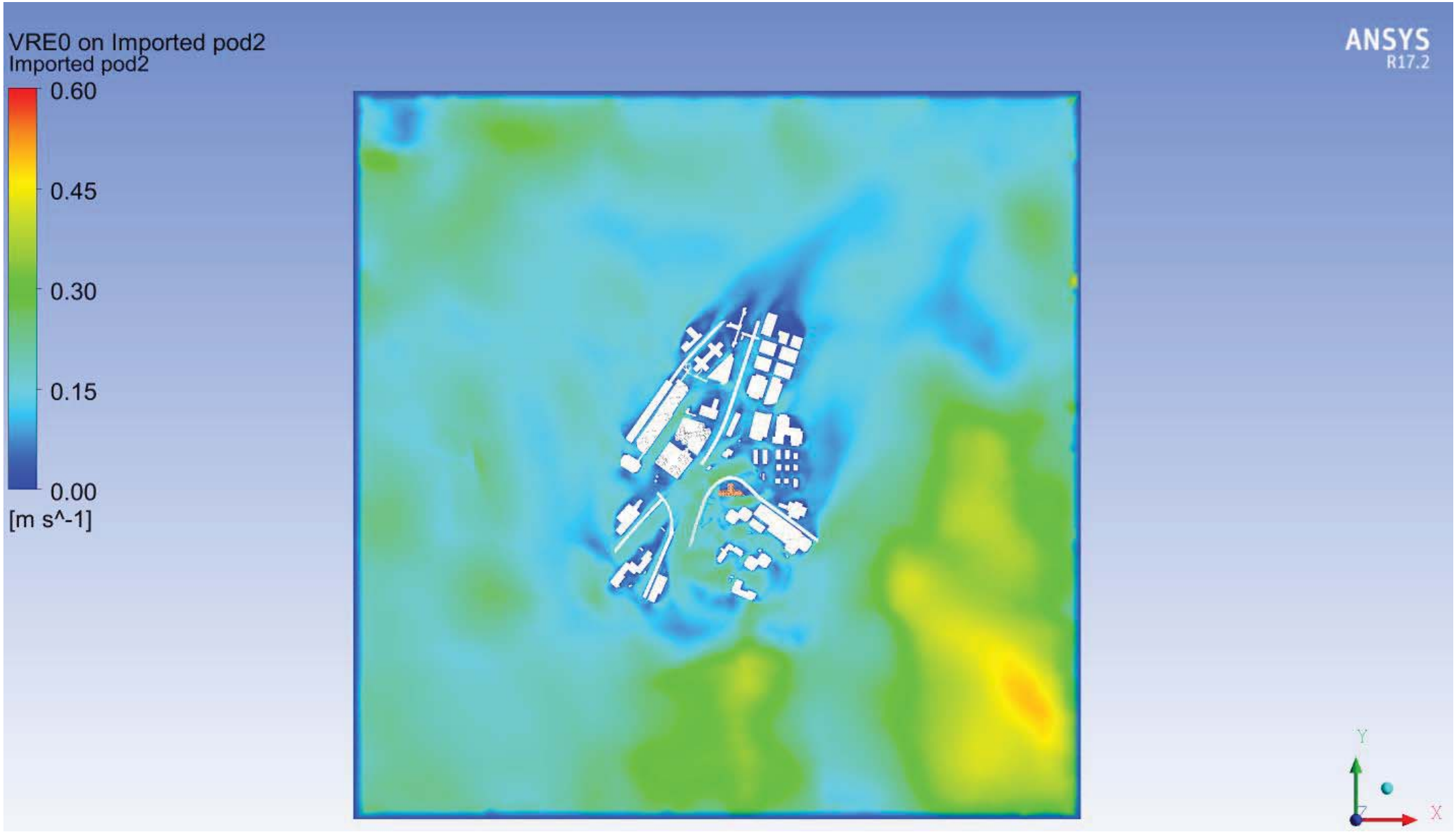
Baseline Scenario – Annual weighted average VR colour at pedestrian level (Domain)



Baseline Scenario – Summer weighted average VR colour at pedestrian level (Domain)



Proposed Scenario – Annual weighted average VR colour at pedestrian level (Domain)



Proposed Scenario – Summer weighted average VR colour at pedestrian level (Domain)

APPENDIX E:
DETAILED WIND VELOCITY RATIOS

	Existing Scenario (VR)												
Test Point	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**Annual**	**Summer**
P01	0.10	0.09	0.08	0.10	0.12	0.07	0.08	0.26	0.38	0.38	0.29	0.15	0.23
P02	0.07	0.11	0.08	0.12	0.12	0.15	0.13	0.24	0.36	0.36	0.27	0.16	0.23
P03	0.03	0.15	0.04	0.18	0.12	0.21	0.23	0.28	0.41	0.39	0.29	0.19	0.27
P04	0.03	0.13	0.05	0.20	0.15	0.22	0.28	0.26	0.39	0.37	0.28	0.20	0.27
P05	0.04	0.09	0.06	0.20	0.17	0.21	0.27	0.24	0.37	0.35	0.27	0.19	0.26
P06	0.10	0.06	0.06	0.21	0.20	0.22	0.29	0.28	0.43	0.41	0.30	0.21	0.30
P07	0.20	0.19	0.12	0.20	0.19	0.20	0.25	0.26	0.41	0.39	0.30	0.23	0.29
P08	0.25	0.18	0.16	0.20	0.21	0.21	0.25	0.28	0.44	0.42	0.33	0.25	0.31
P09	0.19	0.19	0.18	0.25	0.21	0.20	0.25	0.29	0.47	0.43	0.35	0.26	0.32
P10	0.13	0.14	0.13	0.20	0.14	0.12	0.15	0.18	0.30	0.27	0.23	0.18	0.21
P11	0.30	0.33	0.31	0.45	0.28	0.18	0.24	0.32	0.51	0.48	0.40	0.35	0.38
P12	0.17	0.20	0.19	0.30	0.26	0.04	0.21	0.26	0.42	0.37	0.33	0.25	0.29
P13	0.25	0.27	0.21	0.39	0.24	0.09	0.20	0.25	0.42	0.37	0.31	0.28	0.30
P14	0.22	0.23	0.22	0.33	0.21	0.10	0.17	0.26	0.35	0.29	0.27	0.25	0.26
P15	0.21	0.19	0.23	0.27	0.20	0.10	0.14	0.22	0.28	0.21	0.27	0.22	0.22
P16	0.21	0.19	0.23	0.25	0.21	0.09	0.12	0.23	0.15	0.18	0.22	0.20	0.18
P17	0.21	0.19	0.22	0.29	0.23	0.09	0.11	0.08	0.08	0.08	0.22	0.18	0.13
P18	0.22	0.21	0.14	0.30	0.13	0.04	0.09	0.06	0.06	0.05	0.11	0.15	0.10
P19	0.16	0.19	0.12	0.22	0.14	0.01	0.08	0.11	0.07	0.08	0.08	0.13	0.10
P20	0.23	0.09	0.18	0.38	0.24	0.02	0.08	0.08	0.09	0.10	0.04	0.18	0.12
P21	0.23	0.16	0.17	0.37	0.24	0.03	0.09	0.06	0.11	0.09	0.03	0.18	0.13
P22	0.27	0.20	0.20	0.39	0.26	0.05	0.09	0.07	0.06	0.10	0.27	0.20	0.14
P23	0.28	0.23	0.25	0.40	0.27	0.08	0.08	0.02	0.15	0.27	0.24	0.23	0.19
P24	0.30	0.25	0.27	0.41	0.28	0.10	0.07	0.16	0.24	0.18	0.25	0.26	0.21
P25	0.31	0.27	0.30	0.41	0.29	0.13	0.07	0.32	0.40	0.44	0.38	0.31	0.32
P26	0.37	0.34	0.34	0.45	0.32	0.03	0.09	0.32	0.48	0.48	0.39	0.34	0.35
P27	0.35	0.34	0.28	0.37	0.31	0.06	0.08	0.32	0.47	0.47	0.37	0.32	0.33
P28	0.30	0.32	0.24	0.25	0.27	0.10	0.10	0.32	0.46	0.46	0.35	0.28	0.32
P29	0.20	0.18	0.09	0.16	0.25	0.12	0.11	0.32	0.46	0.45	0.33	0.22	0.30
P30	0.11	0.07	0.07	0.10	0.19	0.11	0.10	0.28	0.42	0.42	0.31	0.17	0.26
T01	0.28	0.29	0.16	0.38	0.22	0.10	0.09	0.09	0.10	0.05	0.09	0.20	0.14
T02	0.14	0.27	0.12	0.36	0.33	0.08	0.08	0.21	0.16	0.12	0.23	0.22	0.19
T03	0.30	0.15	0.05	0.29	0.26	0.02	0.07	0.22	0.07	0.08	0.20	0.17	0.14
T04	0.06	0.06	0.02	0.09	0.06	0.13	0.14	0.19	0.19	0.14	0.06	0.09	0.13
T05	0.17	0.12	0.08	0.17	0.13	0.14	0.08	0.05	0.13	0.32	0.16	0.14	0.15
T06	0.07	0.09	0.02	0.14	0.06	0.07	0.15	0.04	0.28	0.08	0.11	0.10	0.13
T07	0.11	0.10	0.05	0.07	0.06	0.10	0.19	0.21	0.16	0.43	0.15	0.12	0.18
T08	0.31	0.18	0.32	0.32	0.33	0.30	0.28	0.20	0.12	0.42	0.44	0.28	0.28
T09	0.11	0.21	0.15	0.26	0.23	0.13	0.18	0.25	0.39	0.43	0.38	0.24	0.29
T10	0.09	0.19	0.13	0.29	0.21	0.25	0.29	0.16	0.24	0.12	0.02	0.20	0.20
T11	0.19	0.27	0.17	0.33	0.22	0.26	0.16	0.09	0.21	0.19	0.08	0.22	0.19
T12	0.16	0.25	0.17	0.21	0.21	0.23	0.22	0.07	0.25	0.22	0.10	0.20	0.19
T13	0.11	0.29	0.22	0.40	0.33	0.18	0.20	0.15	0.26	0.23	0.22	0.26	0.24
T14	0.25	0.29	0.22	0.47	0.30	0.12	0.17	0.08	0.15	0.12	0.12	0.25	0.18
T15	0.11	0.10	0.07	0.12	0.05	0.03	0.03	0.24	0.34	0.36	0.27	0.14	0.20
T16	0.05	0.03	0.03	0.09	0.06	0.04	0.04	0.15	0.20	0.21	0.17	0.09	0.13
T17	0.34	0.35	0.29	0.38	0.31	0.09	0.06	0.29	0.36	0.38	0.35	0.30	0.29
T18	0.27	0.21	0.18	0.39	0.26	0.04	0.08	0.06	0.06	0.06	0.23	0.20	0.13
T19	0.23	0.10	0.17	0.37	0.24	0.02	0.07	0.06	0.09	0.09	0.05	0.17	0.12
T20	0.19	0.13	0.09	0.30	0.20	0.05	0.04	0.06	0.11	0.11	0.11	0.15	0.12
T21	0.06	0.26	0.20	0.44	0.33	0.16	0.18	0.13	0.27	0.31	0.32	0.27	0.26
T22	0.03	0.19	0.13	0.19	0.04	0.06	0.05	0.08	0.10	0.09	0.03	0.11	0.08
T23	0.05	0.27	0.22	0.51	0.36	0.19	0.22	0.15	0.19	0.22	0.24	0.28	0.24
T24	0.05	0.03	0.06	0.10	0.05	0.03	0.06	0.07	0.24	0.25	0.12	0.09	0.13
T25	0.29	0.32	0.27	0.26	0.27	0.07	0.07	0.18	0.27	0.28	0.29	0.24	0.23
T26	0.22	0.25	0.22	0.37	0.32	0.03	0.07	0.09	0.12	0.10	0.08	0.21	0.15
T27	0.18	0.22	0.16	0.19	0.15	0.04	0.02	0.02	0.13	0.10	0.11	0.14	0.10
T28	0.13	0.03	0.02	0.26	0.16	0.16	0.22	0.12	0.20	0.17	0.14	0.15	0.17
T29	0.06	0.13	0.06	0.06	0.04	0.21	0.27	0.25	0.26	0.12	0.03	0.12	0.16
T30	0.06	0.09	0.07	0.08	0.06	0.06	0.10	0.14	0.13	0.27	0.07	0.09	0.12
T31	0.07	0.24	0.18	0.43	0.32	0.09	0.13	0.09	0.22	0.27	0.23	0.24	0.22
T32	0.20	0.11	0.09	0.18	0.11	0.08	0.09	0.08	0.05	0.01	0.03	0.11	0.08
T33	0.09	0.17	0.03	0.08	0.04	0.03	0.04	0.04	0.11	0.03	0.08	0.07	0.06
T34	0.11	0.08	0.07	0.09	0.06	0.01	0.05	0.05	0.06	0.01	0.03	0.06	0.05
T35	0.14	0.13	0.06	0.14	0.07	0.08	0.07	0.12	0.07	0.06	0.06	0.10	0.08
T36	0.22	0.15	0.16	0.32	0.20	0.07	0.06	0.08	0.10	0.13	0.12	0.17	0.13
T37	0.04	0.14	0.02	0.21	0.11	0.21	0.27	0.24	0.36	0.34	0.26	0.18	0.25
T38	0.03	0.04	0.04	0.17	0.04	0.18	0.17	0.19	0.32	0.29	0.25	0.14	0.21
T39	0.03	0.06	0.06	0.17	0.02	0.21	0.27	0.28	0.43	0.37	0.31	0.17	0.27
T40	0.05	0.02	0.07	0.13	0.03	0.22	0.28	0.27	0.41	0.34	0.26	0.16	0.25
T41	0.19	0.16	0.10	0.24	0.13	0.04	0.07	0.03	0.07	0.04	0.06	0.13	0.09
T42	0.17	0.16	0.10	0.17	0.08	0.03	0.07	0.14	0.08	0.10	0.07	0.12	0.10
T43	0.16	0.14	0.05	0.13	0.03	0.02	0.02	0.04	0.03	0.02	0.02	0.07	0.04
T44	0.21	0.20	0.10	0.29	0.07	0.12	0.06	0.08	0.12	0.10	0.07	0.15	0.11

	Existing Scenario (VR)												
Test Point	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**Annual**	**Summer**
T45	0.23	0.19	0.11	0.31	0.08	0.12	0.07	0.15	0.14	0.11	0.07	0.16	0.14
T46	0.15	0.10	0.12	0.17	0.02	0.05	0.03	0.09	0.12	0.09	0.05	0.10	0.09
T47	0.09	0.05	0.09	0.13	0.08	0.07	0.07	0.12	0.13	0.12	0.09	0.10	0.10
T48	0.17	0.13	0.11	0.24	0.02	0.11	0.09	0.03	0.10	0.12	0.07	0.12	0.10
T49	0.20	0.16	0.17	0.22	0.09	0.20	0.06	0.05	0.12	0.12	0.04	0.15	0.12
T50	0.20	0.11	0.12	0.24	0.06	0.10	0.08	0.07	0.09	0.07	0.07	0.12	0.10
T51	0.11	0.10	0.12	0.14	0.11	0.04	0.07	0.09	0.09	0.02	0.13	0.10	0.08
T52	0.17	0.12	0.15	0.21	0.07	0.15	0.08	0.06	0.08	0.08	0.07	0.13	0.10
T53	0.06	0.08	0.07	0.07	0.11	0.15	0.12	0.05	0.09	0.09	0.15	0.09	0.09
T54	0.23	0.20	0.19	0.36	0.15	0.08	0.17	0.15	0.21	0.21	0.24	0.21	0.19
T55	0.23	0.24	0.22	0.32	0.16	0.14	0.18	0.19	0.33	0.28	0.30	0.24	0.24
T56	0.20	0.19	0.14	0.15	0.20	0.06	0.16	0.19	0.31	0.29	0.31	0.19	0.22
T57	0.15	0.19	0.22	0.24	0.28	0.06	0.15	0.19	0.32	0.30	0.30	0.22	0.24
T58	0.16	0.18	0.19	0.26	0.27	0.05	0.10	0.09	0.25	0.19	0.21	0.20	0.19
T59	0.18	0.16	0.15	0.23	0.20	0.10	0.11	0.16	0.19	0.21	0.17	0.18	0.18
T60	0.17	0.19	0.19	0.30	0.24	0.10	0.09	0.08	0.15	0.15	0.20	0.19	0.16
T61	0.08	0.09	0.11	0.18	0.13	0.14	0.11	0.15	0.23	0.21	0.22	0.15	0.17
T62	0.09	0.11	0.01	0.15	0.16	0.15	0.14	0.07	0.20	0.02	0.06	0.11	0.12
T63	0.10	0.11	0.07	0.17	0.25	0.19	0.15	0.09	0.20	0.03	0.16	0.14	0.15
T64	0.10	0.14	0.13	0.19	0.27	0.18	0.14	0.09	0.26	0.16	0.19	0.17	0.18
T65	0.17	0.17	0.15	0.27	0.27	0.17	0.10	0.12	0.25	0.19	0.19	0.20	0.19
T66	0.16	0.21	0.20	0.36	0.26	0.16	0.09	0.15	0.17	0.20	0.19	0.22	0.19
T67	0.15	0.18	0.20	0.27	0.28	0.06	0.07	0.11	0.25	0.23	0.20	0.20	0.19
T68	0.14	0.16	0.19	0.29	0.27	0.04	0.06	0.10	0.23	0.24	0.20	0.19	0.19
T69	0.13	0.16	0.19	0.20	0.10	0.03	0.09	0.13	0.28	0.22	0.20	0.16	0.17
T70	0.11	0.13	0.16	0.26	0.23	0.07	0.10	0.08	0.27	0.22	0.21	0.18	0.18
T71	0.14	0.21	0.24	0.35	0.20	0.07	0.16	0.11	0.19	0.07	0.15	0.20	0.16
T72	0.17	0.20	0.21	0.30	0.26	0.05	0.07	0.10	0.21	0.21	0.13	0.20	0.17
T73	0.22	0.20	0.18	0.28	0.22	0.10	0.09	0.10	0.24	0.19	0.26	0.20	0.19
T74	0.11	0.08	0.08	0.28	0.18	0.09	0.11	0.08	0.13	0.14	0.14	0.14	0.13
T75	0.14	0.09	0.05	0.21	0.12	0.04	0.07	0.16	0.17	0.11	0.07	0.12	0.12
T76	0.12	0.18	0.13	0.27	0.24	0.17	0.17	0.10	0.14	0.14	0.22	0.18	0.17
T77	0.03	0.04	0.06	0.09	0.04	0.03	0.07	0.28	0.24	0.15	0.12	0.10	0.14

	Baseline Scheme (VR)												
Test Point	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**Annual**	**Summer**
P01	0.01	0.05	0.02	0.09	0.02	0.10	0.09	0.21	0.26	0.27	0.22	0.10	0.17
P02	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.03	0.03	0.02	0.01	0.02
P03	0.00	0.01	0.01	0.01	0.00	0.06	0.06	0.05	0.09	0.09	0.07	0.03	0.06
P04	0.02	0.01	0.01	0.05	0.01	0.13	0.13	0.14	0.20	0.22	0.15	0.08	0.13
P05	0.01	0.11	0.08	0.09	0.06	0.16	0.19	0.17	0.23	0.24	0.17	0.12	0.17
P06	0.00	0.14	0.11	0.06	0.09	0.15	0.18	0.16	0.21	0.20	0.18	0.12	0.16
P07	0.01	0.12	0.11	0.03	0.08	0.12	0.17	0.14	0.18	0.18	0.17	0.10	0.14
P08	0.01	0.15	0.15	0.04	0.08	0.15	0.21	0.20	0.27	0.26	0.24	0.14	0.19
P09	0.05	0.19	0.18	0.03	0.10	0.14	0.19	0.25	0.36	0.35	0.29	0.17	0.23
P10	0.04	0.18	0.16	0.04	0.09	0.11	0.14	0.20	0.28	0.27	0.23	0.14	0.19
P11	0.03	0.27	0.31	0.19	0.22	0.08	0.17	0.31	0.46	0.45	0.38	0.25	0.31
P12	0.04	0.26	0.33	0.12	0.27	0.10	0.17	0.33	0.48	0.49	0.44	0.26	0.33
P13	0.08	0.23	0.29	0.09	0.24	0.12	0.14	0.28	0.40	0.42	0.40	0.23	0.28
P14	0.10	0.21	0.26	0.19	0.21	0.05	0.10	0.24	0.31	0.35	0.34	0.21	0.24
P15	0.10	0.18	0.21	0.21	0.16	0.02	0.05	0.15	0.12	0.18	0.17	0.15	0.14
P16	0.13	0.16	0.17	0.25	0.14	0.03	0.03	0.03	0.10	0.07	0.03	0.13	0.09
P17	0.13	0.15	0.15	0.24	0.13	0.04	0.04	0.03	0.05	0.06	0.07	0.12	0.08
P18	0.13	0.07	0.06	0.17	0.08	0.04	0.06	0.07	0.10	0.07	0.06	0.09	0.08
P19	0.14	0.07	0.10	0.13	0.10	0.05	0.02	0.07	0.08	0.04	0.05	0.09	0.07
P20	0.22	0.16	0.13	0.21	0.15	0.04	0.18	0.21	0.35	0.34	0.38	0.20	0.24
P21	0.22	0.11	0.06	0.28	0.22	0.07	0.13	0.21	0.32	0.31	0.36	0.20	0.24
P22	0.07	0.07	0.06	0.16	0.24	0.06	0.11	0.22	0.30	0.31	0.33	0.16	0.22
P23	0.12	0.11	0.08	0.10	0.17	0.07	0.07	0.19	0.21	0.23	0.25	0.13	0.17
P24	0.10	0.13	0.11	0.03	0.20	0.04	0.08	0.15	0.14	0.13	0.18	0.11	0.12
P25	0.03	0.12	0.14	0.05	0.15	0.04	0.08	0.08	0.19	0.07	0.08	0.10	0.10
P26	0.10	0.11	0.13	0.13	0.18	0.07	0.20	0.17	0.14	0.29	0.14	0.14	0.17
P27	0.04	0.09	0.09	0.15	0.27	0.09	0.20	0.21	0.19	0.30	0.21	0.16	0.20
P28	0.05	0.08	0.06	0.10	0.24	0.08	0.16	0.23	0.30	0.35	0.20	0.15	0.22
P29	0.03	0.07	0.05	0.15	0.22	0.08	0.14	0.22	0.29	0.32	0.19	0.15	0.21
P30	0.01	0.05	0.02	0.16	0.07	0.05	0.09	0.17	0.18	0.21	0.14	0.10	0.14
T01	0.25	0.31	0.16	0.44	0.22	0.08	0.05	0.07	0.13	0.13	0.09	0.22	0.15
T02	0.11	0.25	0.13	0.41	0.32	0.11	0.08	0.10	0.08	0.10	0.27	0.21	0.16
T03	0.22	0.15	0.04	0.30	0.27	0.07	0.06	0.15	0.07	0.08	0.17	0.16	0.13
T04	0.07	0.06	0.05	0.10	0.06	0.11	0.12	0.19	0.14	0.19	0.06	0.10	0.13
T05	0.15	0.11	0.08	0.15	0.10	0.20	0.05	0.09	0.11	0.30	0.18	0.13	0.14
T06	0.06	0.05	0.02	0.10	0.06	0.10	0.11	0.03	0.26	0.15	0.12	0.09	0.13
T07	0.10	0.09	0.08	0.06	0.05	0.11	0.19	0.22	0.26	0.42	0.14	0.13	0.20
T08	0.08	0.19	0.32	0.33	0.26	0.27	0.28	0.20	0.14	0.38	0.41	0.26	0.26
T09	0.03	0.20	0.20	0.23	0.24	0.13	0.17	0.23	0.41	0.42	0.37	0.23	0.29
T10	0.14	0.21	0.14	0.36	0.23	0.33	0.37	0.21	0.32	0.22	0.08	0.25	0.26
T11	0.16	0.31	0.19	0.42	0.23	0.34	0.07	0.10	0.18	0.25	0.15	0.25	0.21
T12	0.09	0.28	0.19	0.32	0.24	0.26	0.20	0.18	0.28	0.30	0.12	0.24	0.24
T13	0.10	0.34	0.26	0.46	0.39	0.24	0.23	0.20	0.35	0.36	0.34	0.32	0.32
T14	0.22	0.36	0.28	0.55	0.37	0.08	0.07	0.08	0.19	0.20	0.25	0.29	0.22
T15	0.04	0.04	0.07	0.12	0.09	0.04	0.11	0.32	0.39	0.41	0.32	0.15	0.25
T16	0.08	0.10	0.05	0.13	0.12	0.07	0.13	0.19	0.25	0.17	0.20	0.13	0.16
T17	0.04	0.07	0.13	0.36	0.37	0.12	0.25	0.26	0.15	0.08	0.24	0.21	0.20
T18	0.19	0.09	0.07	0.38	0.32	0.07	0.11	0.24	0.34	0.35	0.38	0.23	0.27
T19	0.27	0.21	0.19	0.27	0.19	0.03	0.21	0.23	0.43	0.39	0.43	0.24	0.29
T20	0.26	0.15	0.10	0.28	0.17	0.09	0.11	0.12	0.37	0.33	0.31	0.20	0.23
T21	0.07	0.27	0.23	0.40	0.34	0.20	0.15	0.16	0.32	0.34	0.32	0.27	0.28
T22	0.07	0.19	0.17	0.19	0.09	0.06	0.05	0.08	0.20	0.09	0.07	0.13	0.12
T23	0.07	0.27	0.24	0.47	0.35	0.20	0.16	0.16	0.24	0.25	0.26	0.28	0.25
T24	0.06	0.10	0.06	0.13	0.10	0.06	0.15	0.03	0.28	0.23	0.06	0.12	0.14
T25	0.04	0.22	0.11	0.38	0.30	0.11	0.22	0.14	0.13	0.06	0.18	0.20	0.17
T26	0.26	0.32	0.30	0.45	0.32	0.09	0.18	0.10	0.29	0.30	0.31	0.29	0.26
T27	0.10	0.09	0.05	0.15	0.12	0.04	0.05	0.01	0.16	0.18	0.09	0.10	0.11
T28	0.13	0.06	0.06	0.23	0.14	0.22	0.21	0.05	0.11	0.09	0.12	0.14	0.13
T29	0.05	0.12	0.05	0.10	0.07	0.20	0.29	0.27	0.24	0.08	0.07	0.13	0.17
T30	0.06	0.08	0.05	0.11	0.05	0.06	0.08	0.16	0.07	0.30	0.07	0.09	0.12
T31	0.07	0.26	0.24	0.41	0.32	0.17	0.10	0.15	0.19	0.25	0.20	0.25	0.22
T32	0.15	0.02	0.08	0.12	0.08	0.02	0.06	0.05	0.03	0.05	0.02	0.07	0.05
T33	0.14	0.19	0.04	0.10	0.06	0.04	0.05	0.21	0.14	0.19	0.11	0.11	0.12
T34	0.26	0.17	0.15	0.20	0.14	0.09	0.10	0.05	0.15	0.13	0.11	0.15	0.13
T35	0.20	0.14	0.09	0.24	0.05	0.12	0.07	0.18	0.13	0.10	0.08	0.14	0.12
T36	0.30	0.17	0.14	0.33	0.21	0.15	0.10	0.21	0.53	0.46	0.36	0.26	0.32
T37	0.03	0.20	0.15	0.17	0.09	0.31	0.34	0.28	0.39	0.41	0.31	0.22	0.29
T38	0.01	0.17	0.08	0.17	0.08	0.28	0.28	0.25	0.38	0.40	0.32	0.19	0.27
T39	0.05	0.16	0.08	0.23	0.08	0.32	0.37	0.40	0.58	0.54	0.40	0.25	0.38
T40	0.06	0.12	0.06	0.21	0.07	0.33	0.37	0.40	0.56	0.48	0.34	0.24	0.36
T41	0.18	0.15	0.09	0.22	0.11	0.05	0.06	0.09	0.09	0.08	0.06	0.12	0.10
T42	0.18	0.14	0.10	0.21	0.09	0.09	0.05	0.09	0.10	0.05	0.05	0.12	0.09
T43	0.16	0.11	0.06	0.17	0.07	0.03	0.01	0.04	0.18	0.08	0.01	0.10	0.09
T44	0.22	0.14	0.07	0.28	0.08	0.12	0.05	0.05	0.09	0.10	0.08	0.13	0.10

	Baseline Scheme (VR)												
Test Point	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**Annual**	**Summer**
T45	0.20	0.16	0.12	0.28	0.07	0.11	0.07	0.05	0.15	0.15	0.10	0.15	0.13
T46	0.17	0.13	0.12	0.13	0.02	0.04	0.02	0.03	0.05	0.02	0.05	0.08	0.05
T47	0.06	0.10	0.08	0.13	0.08	0.10	0.08	0.05	0.11	0.09	0.08	0.09	0.09
T48	0.12	0.16	0.10	0.21	0.04	0.13	0.09	0.07	0.04	0.04	0.12	0.11	0.08
T49	0.17	0.16	0.16	0.23	0.09	0.20	0.05	0.04	0.06	0.05	0.14	0.14	0.10
T50	0.18	0.14	0.15	0.27	0.03	0.12	0.09	0.09	0.13	0.07	0.10	0.14	0.11
T51	0.09	0.10	0.11	0.15	0.10	0.07	0.11	0.06	0.05	0.08	0.10	0.10	0.08
T52	0.14	0.12	0.14	0.23	0.10	0.14	0.08	0.09	0.05	0.02	0.14	0.13	0.10
T53	0.06	0.09	0.06	0.12	0.10	0.17	0.11	0.09	0.12	0.20	0.19	0.11	0.13
T54	0.20	0.22	0.23	0.36	0.11	0.04	0.16	0.15	0.23	0.22	0.24	0.21	0.19
T55	0.19	0.25	0.24	0.36	0.16	0.09	0.18	0.18	0.29	0.32	0.33	0.24	0.24
T56	0.16	0.19	0.17	0.27	0.18	0.04	0.17	0.19	0.28	0.31	0.33	0.21	0.23
T57	0.08	0.22	0.26	0.33	0.25	0.05	0.16	0.18	0.26	0.29	0.29	0.23	0.23
T58	0.08	0.20	0.22	0.33	0.25	0.13	0.12	0.09	0.19	0.18	0.22	0.21	0.18
T59	0.03	0.16	0.11	0.25	0.20	0.15	0.14	0.16	0.20	0.21	0.14	0.17	0.18
T60	0.05	0.18	0.16	0.32	0.22	0.14	0.13	0.14	0.12	0.11	0.19	0.18	0.16
T61	0.04	0.13	0.10	0.18	0.11	0.16	0.16	0.17	0.18	0.16	0.21	0.14	0.16
T62	0.07	0.08	0.05	0.13	0.15	0.15	0.15	0.11	0.13	0.08	0.05	0.11	0.12
T63	0.09	0.11	0.09	0.19	0.21	0.19	0.17	0.11	0.12	0.13	0.13	0.15	0.15
T64	0.08	0.13	0.13	0.30	0.23	0.18	0.13	0.10	0.19	0.23	0.25	0.19	0.19
T65	0.14	0.15	0.16	0.38	0.23	0.14	0.10	0.11	0.19	0.22	0.22	0.21	0.19
T66	0.17	0.21	0.22	0.41	0.21	0.14	0.12	0.15	0.18	0.20	0.19	0.23	0.19
T67	0.08	0.19	0.22	0.35	0.23	0.04	0.11	0.07	0.18	0.23	0.21	0.20	0.17
T68	0.09	0.18	0.23	0.38	0.23	0.08	0.12	0.06	0.19	0.24	0.21	0.21	0.19
T69	0.08	0.18	0.21	0.15	0.08	0.04	0.16	0.08	0.22	0.22	0.19	0.15	0.15
T70	0.09	0.15	0.20	0.32	0.21	0.10	0.17	0.07	0.16	0.24	0.20	0.19	0.18
T71	0.12	0.21	0.25	0.31	0.16	0.12	0.21	0.08	0.17	0.07	0.14	0.19	0.15
T72	0.08	0.19	0.23	0.36	0.22	0.07	0.09	0.04	0.18	0.19	0.13	0.20	0.16
T73	0.04	0.17	0.14	0.28	0.18	0.13	0.12	0.12	0.17	0.15	0.24	0.17	0.16
T74	0.11	0.08	0.07	0.25	0.20	0.10	0.09	0.10	0.15	0.10	0.06	0.14	0.13
T75	0.16	0.07	0.03	0.22	0.14	0.04	0.11	0.19	0.17	0.16	0.06	0.13	0.14
T76	0.07	0.15	0.10	0.27	0.21	0.14	0.10	0.05	0.15	0.18	0.18	0.16	0.15
T77	0.03	0.07	0.05	0.08	0.04	0.03	0.06	0.27	0.24	0.15	0.14	0.09	0.14
S01	0.02	0.06	0.04	0.16	0.11	0.03	0.02	0.27	0.40	0.38	0.20	0.14	0.22
S02	0.02	0.05	0.04	0.12	0.23	0.07	0.11	0.27	0.37	0.32	0.18	0.15	0.23
S03	0.11	0.13	0.09	0.10	0.12	0.06	0.10	0.28	0.38	0.36	0.22	0.16	0.23
S04	0.14	0.12	0.09	0.08	0.14	0.04	0.08	0.15	0.13	0.12	0.17	0.11	0.12
S05	0.08	0.06	0.08	0.22	0.19	0.03	0.12	0.22	0.29	0.31	0.34	0.16	0.22
S06	0.14	0.17	0.17	0.30	0.19	0.02	0.02	0.05	0.09	0.08	0.05	0.15	0.10
S07	0.09	0.11	0.13	0.12	0.18	0.03	0.09	0.08	0.09	0.11	0.04	0.11	0.10
S08	0.02	0.10	0.05	0.10	0.07	0.07	0.08	0.27	0.30	0.37	0.25	0.13	0.20

	Proposed Scheme (VR)												
Test Point	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**Annual**	**Summer**
P01	0.02	0.09	0.03	0.09	0.05	0.09	0.09	0.21	0.26	0.27	0.23	0.11	0.17
P02	0.00	0.01	0.00	0.00	0.01	0.03	0.03	0.04	0.05	0.05	0.03	0.02	0.03
P03	0.00	0.01	0.01	0.01	0.01	0.07	0.08	0.07	0.09	0.09	0.08	0.04	0.06
P04	0.02	0.02	0.01	0.06	0.00	0.11	0.14	0.15	0.18	0.19	0.16	0.08	0.12
P05	0.02	0.11	0.05	0.07	0.04	0.15	0.18	0.17	0.22	0.22	0.17	0.11	0.16
P06	0.01	0.12	0.08	0.04	0.05	0.16	0.18	0.16	0.21	0.20	0.16	0.11	0.15
P07	0.01	0.10	0.10	0.01	0.06	0.15	0.18	0.14	0.18	0.18	0.15	0.10	0.14
P08	0.04	0.14	0.15	0.02	0.08	0.16	0.21	0.19	0.25	0.24	0.20	0.13	0.18
P09	0.06	0.16	0.17	0.01	0.12	0.09	0.17	0.22	0.30	0.29	0.24	0.14	0.20
P10	0.05	0.13	0.14	0.05	0.12	0.05	0.13	0.18	0.24	0.23	0.20	0.13	0.17
P11	0.08	0.27	0.30	0.17	0.23	0.07	0.19	0.34	0.44	0.43	0.37	0.25	0.30
P12	0.09	0.26	0.32	0.16	0.24	0.06	0.17	0.34	0.43	0.44	0.39	0.25	0.30
P13	0.11	0.24	0.29	0.08	0.22	0.07	0.16	0.32	0.38	0.41	0.39	0.22	0.28
P14	0.12	0.21	0.27	0.17	0.20	0.07	0.12	0.27	0.30	0.35	0.35	0.21	0.24
P15	0.13	0.19	0.25	0.24	0.17	0.09	0.05	0.17	0.10	0.22	0.21	0.18	0.16
P16	0.18	0.20	0.25	0.37	0.17	0.08	0.03	0.06	0.07	0.07	0.04	0.18	0.11
P17	0.11	0.11	0.12	0.22	0.11	0.04	0.00	0.03	0.03	0.04	0.07	0.10	0.06
P18	0.09	0.04	0.06	0.17	0.09	0.04	0.01	0.04	0.07	0.05	0.05	0.08	0.06
P19	0.10	0.02	0.10	0.12	0.09	0.04	0.05	0.05	0.15	0.06	0.03	0.08	0.08
P20	0.20	0.13	0.12	0.21	0.14	0.07	0.20	0.29	0.35	0.37	0.38	0.20	0.26
P21	0.18	0.10	0.12	0.29	0.22	0.11	0.13	0.28	0.30	0.35	0.36	0.21	0.26
P22	0.06	0.07	0.09	0.11	0.28	0.09	0.11	0.26	0.26	0.33	0.33	0.16	0.22
P23	0.14	0.11	0.14	0.09	0.23	0.06	0.07	0.20	0.20	0.26	0.25	0.15	0.18
P24	0.15	0.14	0.16	0.03	0.24	0.06	0.09	0.14	0.16	0.18	0.18	0.13	0.14
P25	0.09	0.13	0.12	0.04	0.20	0.07	0.11	0.06	0.19	0.07	0.08	0.11	0.11
P26	0.12	0.11	0.13	0.13	0.23	0.13	0.21	0.20	0.15	0.25	0.16	0.16	0.18
P27	0.03	0.12	0.05	0.13	0.31	0.15	0.22	0.23	0.20	0.29	0.21	0.17	0.21
P28	0.05	0.14	0.04	0.11	0.24	0.13	0.17	0.25	0.29	0.32	0.20	0.16	0.22
P29	0.05	0.12	0.02	0.14	0.09	0.11	0.14	0.24	0.29	0.31	0.19	0.14	0.20
P30	0.03	0.10	0.02	0.12	0.03	0.07	0.09	0.18	0.21	0.23	0.15	0.10	0.14
T01	0.27	0.29	0.18	0.39	0.19	0.03	0.03	0.11	0.24	0.14	0.03	0.21	0.16
T02	0.15	0.23	0.11	0.36	0.31	0.10	0.02	0.12	0.22	0.15	0.23	0.21	0.19
T03	0.24	0.15	0.06	0.27	0.26	0.02	0.05	0.07	0.07	0.09	0.13	0.15	0.11
T04	0.10	0.04	0.05	0.07	0.06	0.10	0.11	0.12	0.17	0.15	0.07	0.09	0.11
T05	0.15	0.12	0.07	0.16	0.10	0.16	0.11	0.21	0.08	0.27	0.15	0.14	0.15
T06	0.02	0.05	0.04	0.13	0.06	0.10	0.14	0.09	0.18	0.11	0.10	0.09	0.11
T07	0.09	0.10	0.07	0.07	0.06	0.08	0.15	0.33	0.19	0.42	0.12	0.13	0.19
T08	0.16	0.23	0.32	0.32	0.27	0.29	0.24	0.32	0.07	0.41	0.44	0.27	0.27
T09	0.09	0.19	0.18	0.26	0.21	0.15	0.14	0.33	0.38	0.42	0.37	0.24	0.29
T10	0.07	0.20	0.15	0.31	0.21	0.26	0.26	0.19	0.25	0.24	0.03	0.21	0.22
T11	0.19	0.29	0.19	0.33	0.22	0.26	0.15	0.18	0.31	0.23	0.05	0.24	0.23
T12	0.11	0.27	0.19	0.28	0.25	0.24	0.18	0.21	0.33	0.27	0.19	0.24	0.25
T13	0.10	0.33	0.26	0.48	0.39	0.20	0.17	0.24	0.32	0.30	0.28	0.31	0.29
T14	0.21	0.34	0.27	0.52	0.27	0.08	0.07	0.12	0.14	0.15	0.15	0.26	0.18
T15	0.07	0.05	0.06	0.14	0.11	0.05	0.10	0.27	0.30	0.35	0.27	0.14	0.21
T16	0.06	0.10	0.08	0.14	0.13	0.07	0.12	0.14	0.18	0.17	0.16	0.12	0.14
T17	0.08	0.08	0.27	0.40	0.38	0.16	0.23	0.12	0.12	0.16	0.20	0.23	0.20
T18	0.10	0.08	0.08	0.38	0.34	0.08	0.09	0.26	0.27	0.33	0.33	0.22	0.25
T19	0.26	0.19	0.18	0.28	0.18	0.08	0.20	0.29	0.37	0.37	0.37	0.24	0.28
T20	0.23	0.11	0.09	0.29	0.16	0.10	0.11	0.25	0.31	0.32	0.20	0.20	0.23
T21	0.05	0.27	0.23	0.44	0.34	0.18	0.13	0.28	0.33	0.36	0.34	0.29	0.30
T22	0.06	0.20	0.17	0.12	0.07	0.07	0.10	0.08	0.19	0.10	0.03	0.12	0.11
T23	0.07	0.27	0.24	0.49	0.31	0.19	0.14	0.20	0.21	0.26	0.26	0.27	0.25
T24	0.01	0.09	0.02	0.13	0.10	0.08	0.14	0.12	0.25	0.15	0.05	0.11	0.14
T25	0.08	0.17	0.23	0.35	0.26	0.15	0.23	0.06	0.10	0.08	0.18	0.20	0.16
T26	0.29	0.30	0.32	0.46	0.31	0.13	0.19	0.24	0.28	0.30	0.32	0.31	0.28
T27	0.10	0.14	0.04	0.09	0.09	0.08	0.07	0.09	0.15	0.11	0.09	0.09	0.10
T28	0.12	0.05	0.05	0.24	0.16	0.21	0.19	0.06	0.13	0.07	0.16	0.13	0.13
T29	0.07	0.12	0.06	0.05	0.07	0.19	0.28	0.05	0.23	0.06	0.03	0.10	0.12
T30	0.07	0.09	0.08	0.06	0.05	0.06	0.06	0.22	0.08	0.28	0.13	0.09	0.12
T31	0.06	0.26	0.23	0.43	0.32	0.16	0.07	0.24	0.24	0.30	0.26	0.26	0.25
T32	0.27	0.08	0.14	0.20	0.14	0.08	0.13	0.06	0.04	0.08	0.04	0.13	0.09
T33	0.27	0.15	0.06	0.10	0.06	0.04	0.07	0.17	0.14	0.22	0.12	0.12	0.13
T34	0.29	0.20	0.16	0.17	0.17	0.15	0.14	0.10	0.21	0.13	0.13	0.17	0.16
T35	0.21	0.15	0.06	0.27	0.07	0.17	0.09	0.07	0.20	0.09	0.10	0.15	0.13
T36	0.25	0.17	0.16	0.38	0.13	0.19	0.15	0.41	0.55	0.52	0.47	0.29	0.37
T37	0.06	0.20	0.06	0.14	0.07	0.28	0.35	0.30	0.37	0.38	0.31	0.20	0.28
T38	0.05	0.18	0.06	0.12	0.07	0.26	0.27	0.29	0.37	0.37	0.31	0.18	0.27
T39	0.07	0.18	0.04	0.17	0.08	0.31	0.37	0.40	0.56	0.51	0.40	0.24	0.36
T40	0.06	0.16	0.07	0.17	0.07	0.32	0.38	0.37	0.54	0.47	0.35	0.23	0.35
T41	0.19	0.18	0.09	0.24	0.09	0.08	0.07	0.08	0.10	0.10	0.06	0.13	0.10
T42	0.18	0.12	0.07	0.20	0.05	0.08	0.06	0.04	0.10	0.05	0.05	0.10	0.08
T43	0.17	0.11	0.04	0.16	0.03	0.03	0.01	0.09	0.14	0.11	0.01	0.09	0.09
T44	0.21	0.14	0.04	0.27	0.07	0.17	0.08	0.06	0.13	0.07	0.03	0.13	0.11

	Proposed Scheme (VR)												
Test Point	**NNE**	**NE**	**ENE**	**E**	**ESE**	**SE**	**SSE**	**S**	**SSW**	**SW**	**WSW**	**Annual**	**Summer**
T45	0.18	0.15	0.10	0.28	0.06	0.11	0.08	0.09	0.17	0.11	0.11	0.15	0.13
T46	0.13	0.10	0.09	0.16	0.03	0.09	0.03	0.01	0.08	0.01	0.07	0.08	0.06
T47	0.07	0.09	0.08	0.07	0.06	0.11	0.10	0.04	0.16	0.05	0.08	0.08	0.09
T48	0.16	0.18	0.15	0.20	0.06	0.10	0.11	0.03	0.13	0.03	0.12	0.13	0.10
T49	0.19	0.18	0.15	0.24	0.09	0.18	0.05	0.05	0.04	0.06	0.14	0.14	0.10
T50	0.19	0.16	0.09	0.25	0.04	0.10	0.11	0.12	0.09	0.15	0.09	0.13	0.12
T51	0.11	0.11	0.13	0.17	0.11	0.08	0.09	0.06	0.05	0.08	0.12	0.11	0.09
T52	0.15	0.12	0.17	0.22	0.10	0.14	0.09	0.03	0.05	0.04	0.13	0.13	0.09
T53	0.06	0.08	0.09	0.08	0.15	0.15	0.11	0.11	0.12	0.14	0.19	0.11	0.13
T54	0.18	0.22	0.24	0.34	0.13	0.08	0.16	0.17	0.21	0.22	0.23	0.21	0.19
T55	0.18	0.24	0.25	0.35	0.16	0.13	0.19	0.23	0.26	0.30	0.31	0.24	0.24
T56	0.15	0.18	0.17	0.27	0.19	0.02	0.17	0.24	0.27	0.30	0.31	0.21	0.23
T57	0.12	0.23	0.27	0.35	0.27	0.05	0.15	0.23	0.26	0.29	0.28	0.24	0.24
T58	0.11	0.21	0.23	0.31	0.24	0.09	0.13	0.15	0.18	0.19	0.22	0.21	0.19
T59	0.05	0.14	0.11	0.22	0.18	0.12	0.11	0.14	0.17	0.17	0.14	0.15	0.15
T60	0.08	0.18	0.17	0.32	0.22	0.11	0.12	0.12	0.14	0.16	0.18	0.19	0.16
T61	0.04	0.11	0.10	0.17	0.13	0.15	0.14	0.16	0.20	0.20	0.21	0.14	0.17
T62	0.04	0.07	0.03	0.09	0.18	0.17	0.15	0.08	0.10	0.10	0.05	0.10	0.11
T63	0.09	0.10	0.12	0.18	0.24	0.21	0.19	0.11	0.12	0.14	0.13	0.15	0.15
T64	0.09	0.12	0.12	0.29	0.26	0.18	0.16	0.19	0.16	0.24	0.23	0.19	0.20
T65	0.13	0.15	0.15	0.36	0.24	0.16	0.12	0.17	0.18	0.22	0.22	0.21	0.20
T66	0.18	0.20	0.21	0.38	0.21	0.19	0.09	0.15	0.18	0.19	0.17	0.22	0.19
T67	0.09	0.18	0.22	0.33	0.23	0.04	0.08	0.16	0.17	0.20	0.19	0.20	0.18
T68	0.10	0.17	0.23	0.35	0.22	0.02	0.07	0.16	0.18	0.20	0.13	0.20	0.17
T69	0.09	0.18	0.22	0.16	0.09	0.03	0.10	0.17	0.18	0.22	0.21	0.15	0.15
T70	0.09	0.15	0.21	0.28	0.17	0.07	0.10	0.17	0.15	0.21	0.21	0.18	0.17
T71	0.14	0.22	0.26	0.33	0.19	0.11	0.17	0.07	0.11	0.09	0.15	0.19	0.14
T72	0.11	0.19	0.24	0.36	0.22	0.07	0.08	0.12	0.15	0.16	0.06	0.20	0.16
T73	0.07	0.16	0.15	0.26	0.18	0.11	0.13	0.15	0.18	0.19	0.25	0.17	0.17
T74	0.14	0.09	0.08	0.27	0.19	0.12	0.12	0.09	0.14	0.12	0.10	0.15	0.14
T75	0.14	0.04	0.04	0.19	0.11	0.05	0.11	0.13	0.16	0.16	0.06	0.11	0.12
T76	0.07	0.16	0.13	0.29	0.26	0.08	0.13	0.18	0.13	0.23	0.25	0.18	0.18
T77	0.03	0.06	0.05	0.08	0.03	0.03	0.07	0.10	0.24	0.13	0.14	0.08	0.12
S01	0.02	0.09	0.02	0.12	0.05	0.06	0.03	0.28	0.39	0.36	0.20	0.13	0.21
S02	0.03	0.12	0.02	0.11	0.16	0.10	0.11	0.21	0.31	0.27	0.17	0.14	0.20
S03	0.12	0.12	0.16	0.13	0.18	0.09	0.13	0.26	0.34	0.33	0.20	0.18	0.23
S04	0.17	0.12	0.16	0.09	0.19	0.07	0.10	0.14	0.17	0.18	0.17	0.14	0.15
S05	0.04	0.06	0.11	0.22	0.20	0.12	0.12	0.29	0.28	0.37	0.36	0.18	0.24
S06	0.14	0.18	0.16	0.31	0.18	0.02	0.09	0.03	0.08	0.04	0.04	0.15	0.10
S07	0.11	0.11	0.16	0.05	0.17	0.04	0.10	0.09	0.08	0.11	0.06	0.10	0.09
S08	0.04	0.13	0.11	0.08	0.05	0.08	0.13	0.31	0.29	0.39	0.26	0.15	0.22