



Old Connaught Phase 1-LRD

Wind Microclimate Study



Report For: Stephen Little & Associates c/o Castlethorn Old Connaught ULC

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1 Development Description

The proposed development comprises 271no. dwellings in a mix of houses and duplex / apartment units, including 103no. 2 to 3-storey houses (22no. 4-bedroom, 68no. 3-bedroom and 13no. 2-bedroom), 162no. apartments (113no. 2-bedroom and 49no. 1-bedroom) across 4no. blocks ranging from 1-5 storeys in building height and 6no. 3-bedroom duplex units; 1no. creche (c. 574 sqm) at ground floor of Apartment Block 3; and all associated and ancillary site development and infrastructural works including on site attenuation, hard and soft landscaping and boundary treatment works, including: public open space; communal open space; components of the regional attenuation pond; public lighting; surface car parking spaces; bicycle parking spaces/stores for houses and duplex / apartment units; 5no. ESB substations; bin stores; vehicular access via existing Old Connaught Avenue and a proposed new primary north-south street into the eastern portion of the Central Character Area. The proposed development also includes the construction of a new pumping station, associated single storey building, twin rising mains extending circa 400m along Old Connaught Avenue under the M11 connecting to the existing gravity foul network on Old Connaught Avenue 125m east of the M11 bridge and associated storage, together with all ancillary site development and reinstatement works required to facilitate these elements.

2 Introduction and Methodology

IES Consulting have been commissioned to investigate the potential impact of wind around the proposed Old Connaught Phase 1 LRD development located within lands north of Connaught Avenue, Dublin 18. The development consists of houses and blocks of 2 to 5 stories high, for a total of 271 units.

The analysis assesses the impact of the building layout on pedestrian comfort and safety for people using public and other amenity spaces around the site. The analysis will look at the air movement around the buildings for eight wind directions (SW, W, NW, N, NE, E, SE and S) with the wind velocity set to the mean value obtained from the weather file.

The following simulation report describes the modelling methodology used in the study, including the assumptions made, the calculations used to determine the boundary conditions, and the results obtained from the simulations.

3 Executive Summary

In summary, the analysis resulted in the following:

1. Sitting and Standing Comfort Criteria
 - a. Balcony Spaces: excellent compliance – No mitigation required
 - b. Open Spaces: excellent compliance – No mitigation required
 - c. Roof level communal open space: excellent compliance – No mitigation required
 - d. Private Amenities of rowhouses: excellent compliance – No mitigation required
2. Walking Comfort Criteria: excellent compliance – No mitigation required.
3. Safety Criteria: excellent compliance with Lawson's Normal and Sensitive Pedestrian Safety Criteria.

4 Key Findings

For the analysis, eight steady-state Computational Fluid Dynamics (CFD) simulations were performed for the main wind directions (N, NE, E, SE, S, SW, W, and NW) and the annual average wind speed obtained from the Dublin Airport weather dataset. The simulation results were extrapolated from annual weather data to obtain the most probable local air speed for each hour of the year. Statistical analysis was performed on this dataset to check compliance against Lawson's Pedestrian Comfort criterion.

The following table provides values for Lawson's Pedestrian Comfort Assessment criteria for various activities.

Category	Pedestrian Activity	Threshold mean hourly wind speed not to be exceeded for more than 5% of the time (m/s)
C1	Business Walking	10
C2	Leisurely Walking	8
C3	Standing	6
C4	Sitting	4

Table 1: Lawson's Pedestrian Comfort Assessment Criteria for various activities

The following table provides values for Lawson's Pedestrian Safety Assessment criteria.

Category	Pedestrian Type	Threshold mean hourly wind speed not to be exceeded more than once per annum (m/s)
S1	Typical Pedestrian	20
S2	Sensitive Pedestrian	15

Table 2: Lawson's Pedestrian Safety Assessment Criteria

The results are presented as false-colour contour images showing the percentage of the year during which the local air speed is likely to exceed a given value at each point in the area of interest. The air speed threshold value is noted in the title of the colour legend in the top-left corner of each image. Note that the comfort criterion results scale ranges from 0.1% to 100% (as a percentage of the year). This is with reference to Table 1 above. The scale for the safety-criteria results images ranges from 0.001% to 1% (as a percentage of the year). This is with reference to Table 2 above. These criteria are explained in detail in [section 6.1](#).

The median wind speed recorded was more than 5 m/s for Dublin's climatic conditions. That means that for 50% of the year, the wind speed in Dublin is above 5.7 m/s. The Lawson's Sitting Criterion requires the local air speed to be no more than 4m/s for 95% of the year. Thus, the Lawson's Sitting Criterion presents the task of improving 10 times over the climatic conditions at the location of interest within Dublin. This can be achieved through appropriate landscaping and wind-mitigation measures.

4.1 Collective Results

[Figure 1](#) shows the collective results for wind comfort at the 5% threshold, as noted above. These results were summed to calculate the total number of hours during which a given pedestrian activity class exceeds the 5% yearly threshold, based on the wind-speed hierarchy. [Figure 1](#) illustrates the collective results of wind comfort for the 5% threshold. These results were summed to calculate the total number of hours that a given pedestrian activity class exceeds the 5% yearly threshold. The sitting comfort indicates that the wind speed was lower than 4m/s, while the rest of the classes were above this threshold. It is worth noting that when a space is classified under a certain activity class, it will also meet the requirements of all activity classes above it in the hierarchy scale. For example, if a space is comfortable for sitting, it will also be comfortable for standing and walking.

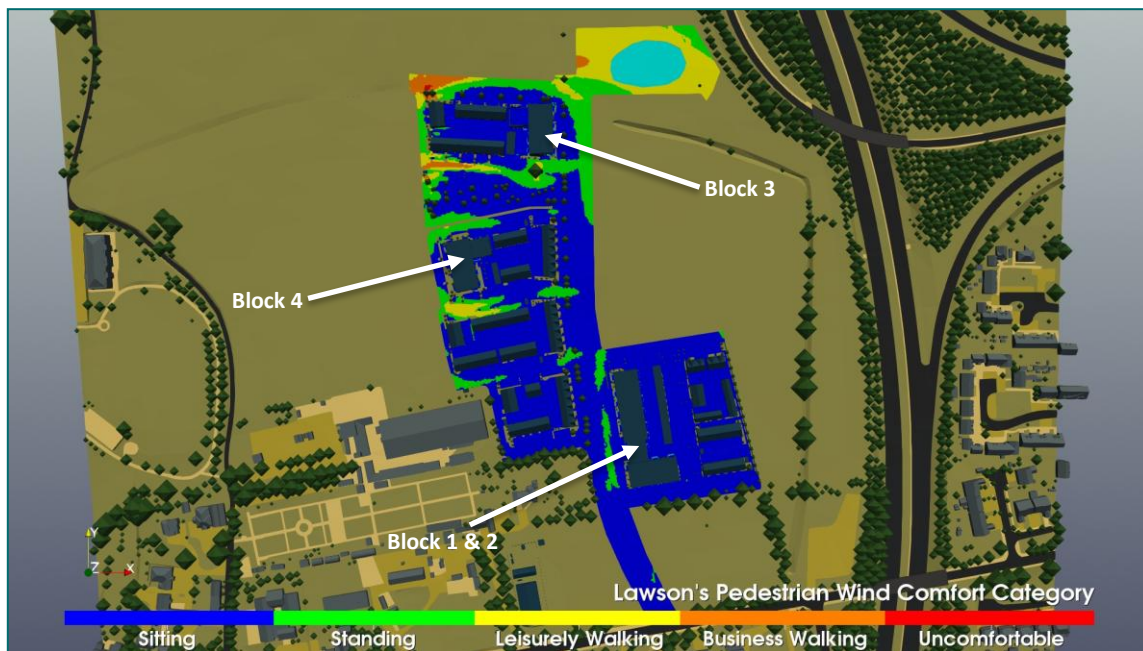


Figure 1: Collective Results: 5% Threshold

The following areas show excellent compliance with Lawson's Sitting and Standing Comfort Criteria:

- All Communal open space.
- All Public open spaces
- Creche area of Block 3
- All Private amenities of rowhouses

The entire site showed excellent compliance with the Walking activities. No location exhibited completely uncomfortable conditions anywhere on the site at the 5% threshold.

It is worth noting that a pedestrian activity class is merely a statistical assessment of the local wind climate. When a region is classified as a certain class, this does not mean that people are prevented from engaging in that activity for an extended period. Rather, it only means that for more than 5% of the time (per year), the wind speed for this activity could result in an uncomfortable environment. However, during the remaining times of the year, this activity can be considered comfortable.

4.2 Sitting and Standing Comfort Results

The Lawson's Sitting Comfort Criterion states that the local air speed at designated locations should not exceed 4 m/s for more than 5% of the duration analysed. The Lawson's Standing Comfort Criterion states that the local air speed at designated locations should not exceed 6 m/s for more than 5% of the duration analysed.

4.2.1 Balconies

4.2.1.1 Block 1 & Block 2

[Figure 2](#) to [Figure 5](#) illustrate Lawson's Sitting and Standing Comfort Criteria results on the balconies of Block 1 & Block 2. All balconies are equipped with railings and do not have a solid wind screen. The results showed excellent compliance and fully met the requirements of Lawson's Sitting and Standing Comfort Criterion for the full year. The local air speed does not exceed 4m/s and 6m/s for more than 5% of the year as per the criterion's requirement. No further mitigation measures are recommended.

No further mitigation measures are recommended.

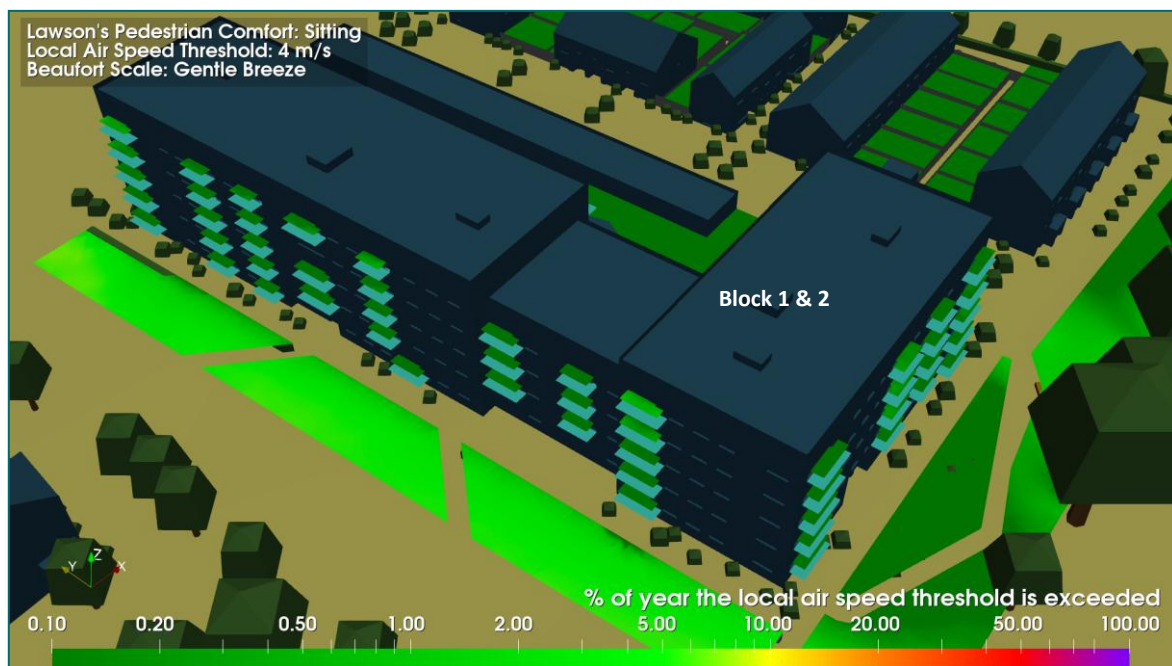


Figure 2: Sitting Comfort Criterion: Balconies: Block 1 & 2: View from the southwest

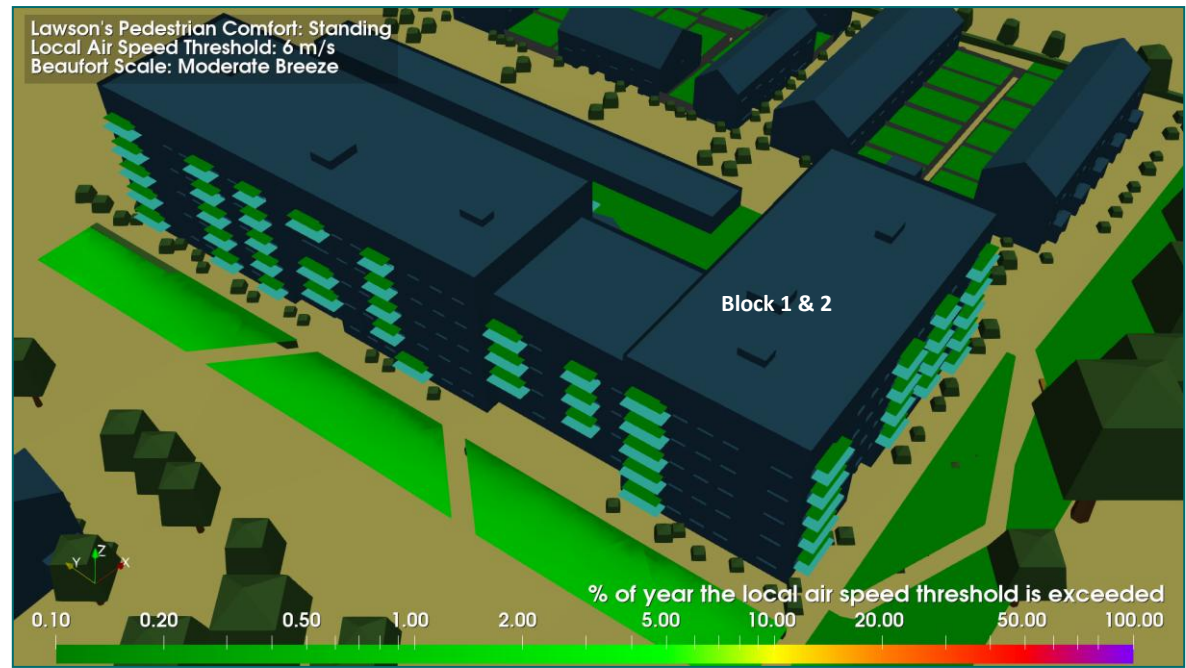


Figure 3: Standing Comfort Criterion: Balconies: Block 1 & 2: View from the southwest



Figure 4: Sitting Comfort Criterion: Balconies: Block 1 & 2: View from the northeast

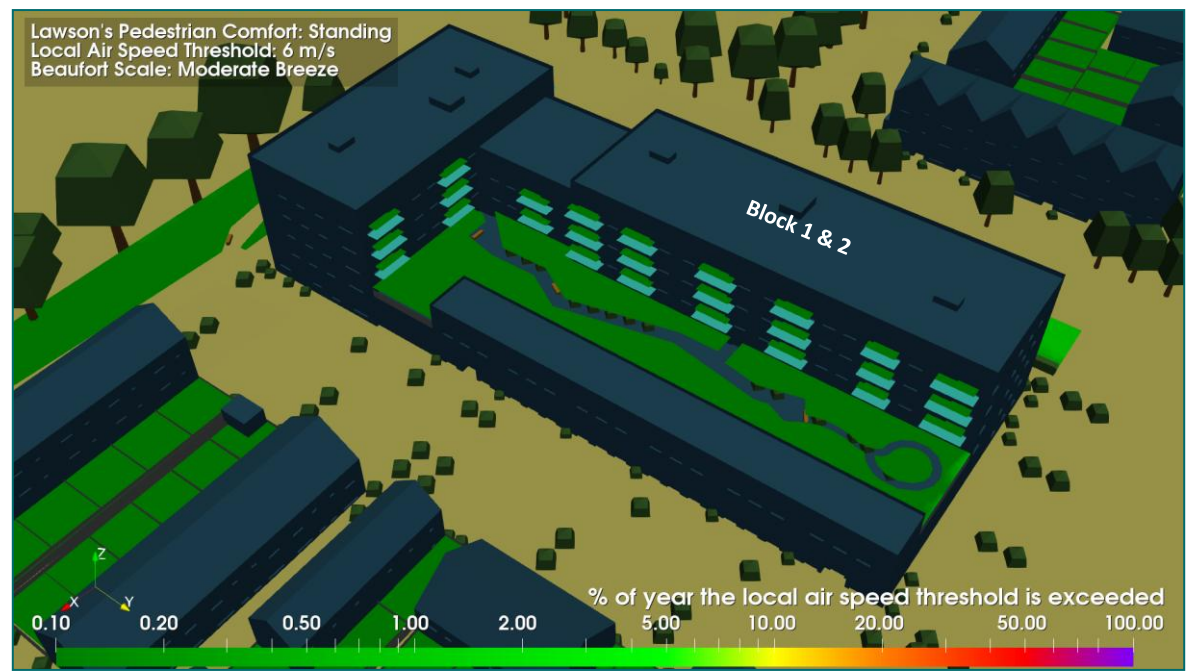


Figure 5: Standing Comfort Criterion: Balconies: Block 1 & 2: View from the northeast

4.2.1.2 Block 3

Figure 6 to Figure 9 illustrate Lawson's Sitting and Standing Comfort Criteria results on the balconies of Block 3. balconies are equipped with railings and do not have a solid wind screen except balconies outlines in white. The results showed excellent compliance and fully met the requirements of Lawson's Sitting and Standing Comfort Criterion for the full year. The local air speed does not exceed 4m/s and 6m/s for more than 5% of the year as per the criterion's requirement.

No further mitigation measures are recommended.

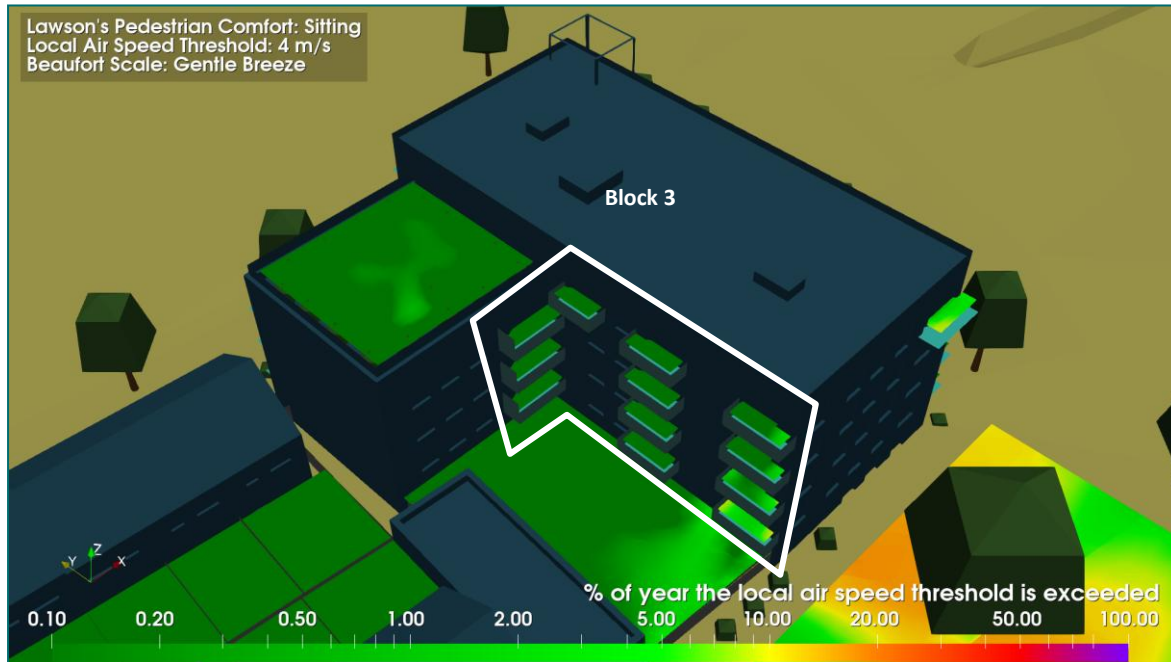


Figure 6: Sitting Comfort Criterion: Balconies: Block 3: View from the southwest

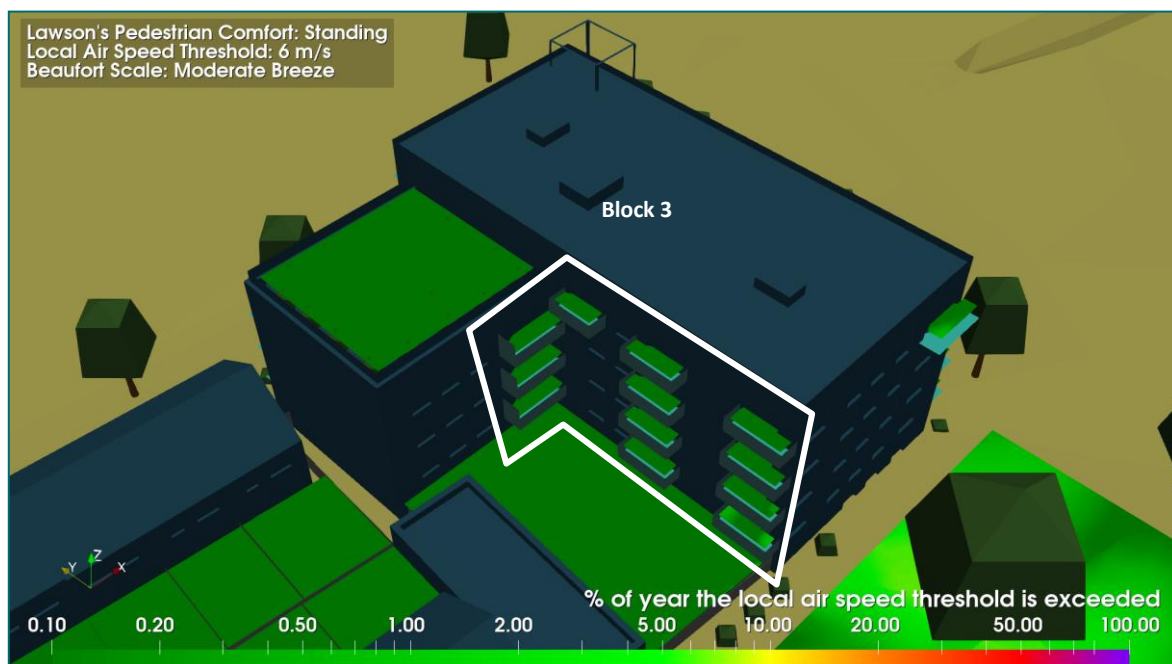


Figure 7: Standing Comfort Criterion: Balconies: Block 3: View from the southwest

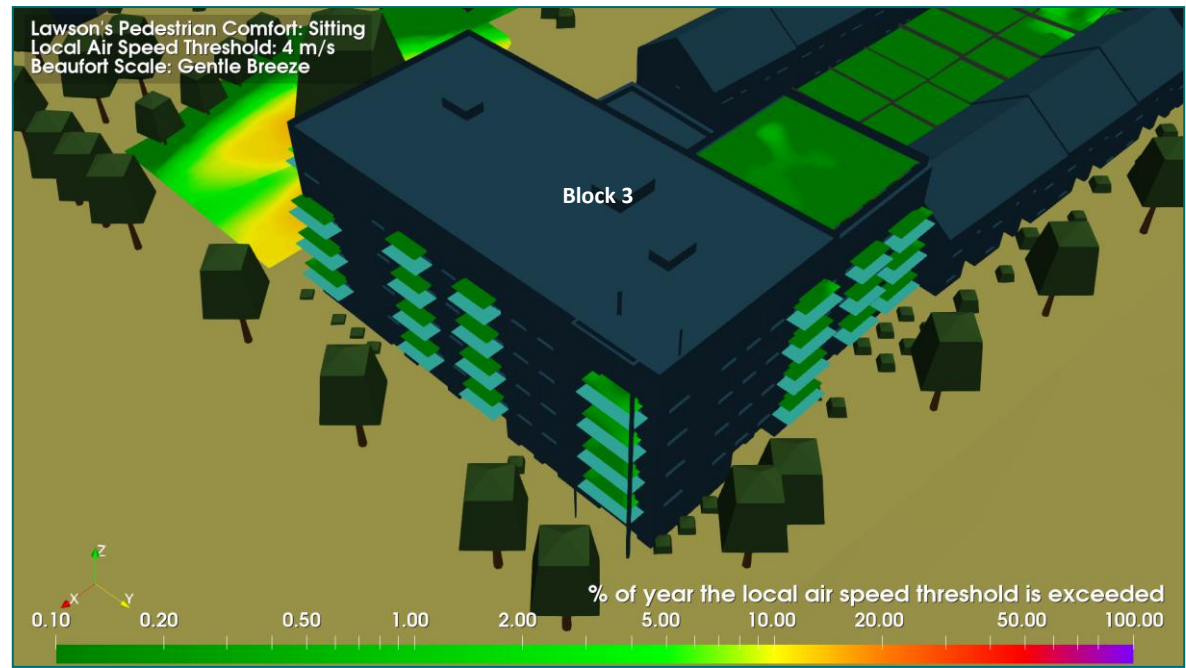


Figure 8: Sitting Comfort Criterion: Balconies: Block 3: View from the northeast

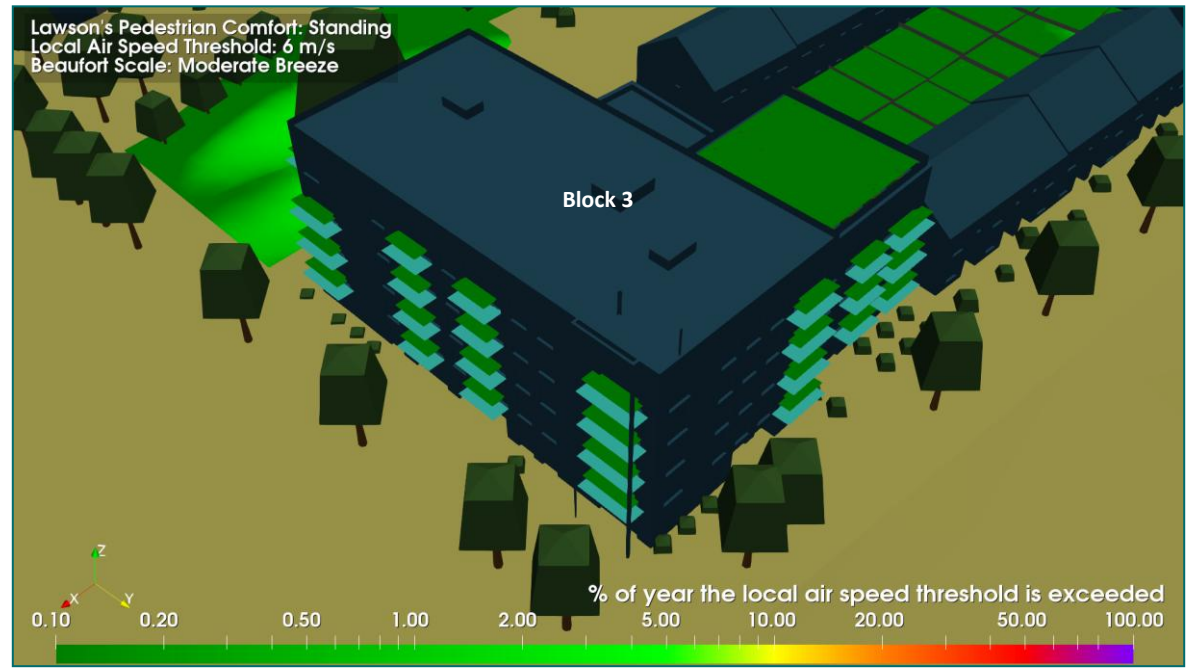


Figure 9: Standing Comfort Criterion: Balconies: Block 3: View from the northeast

4.2.1.3 Block 4

Figure 10 to Figure 13 illustrate Lawson's Sitting and Standing Comfort Criteria results on the balconies of Block 4. All balconies are equipped with railings and do not have a solid wind screen. The results showed excellent compliance and fully met the requirements of Lawson's Sitting and Standing Comfort Criterion for the full year. The local air speed does not exceed 4m/s and 6m/s for more than 5% of the year as per the criterion's requirement.

No further mitigation measures are recommended.

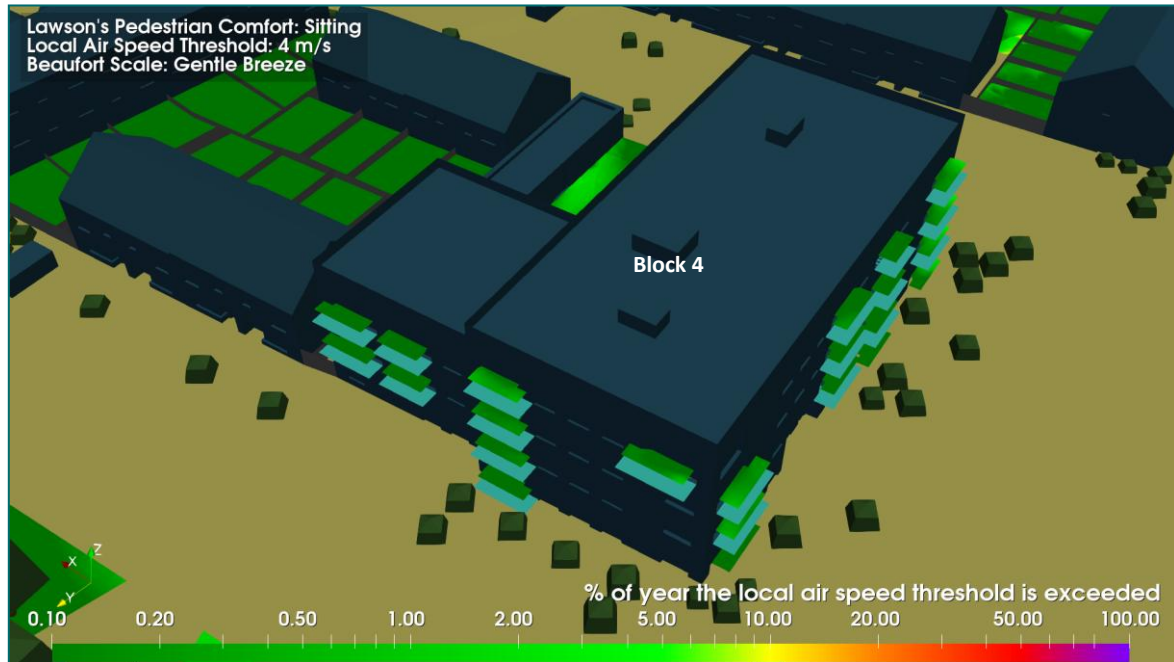


Figure 10: Sitting Comfort Criterion: Balconies: Block 4: View from the northwest

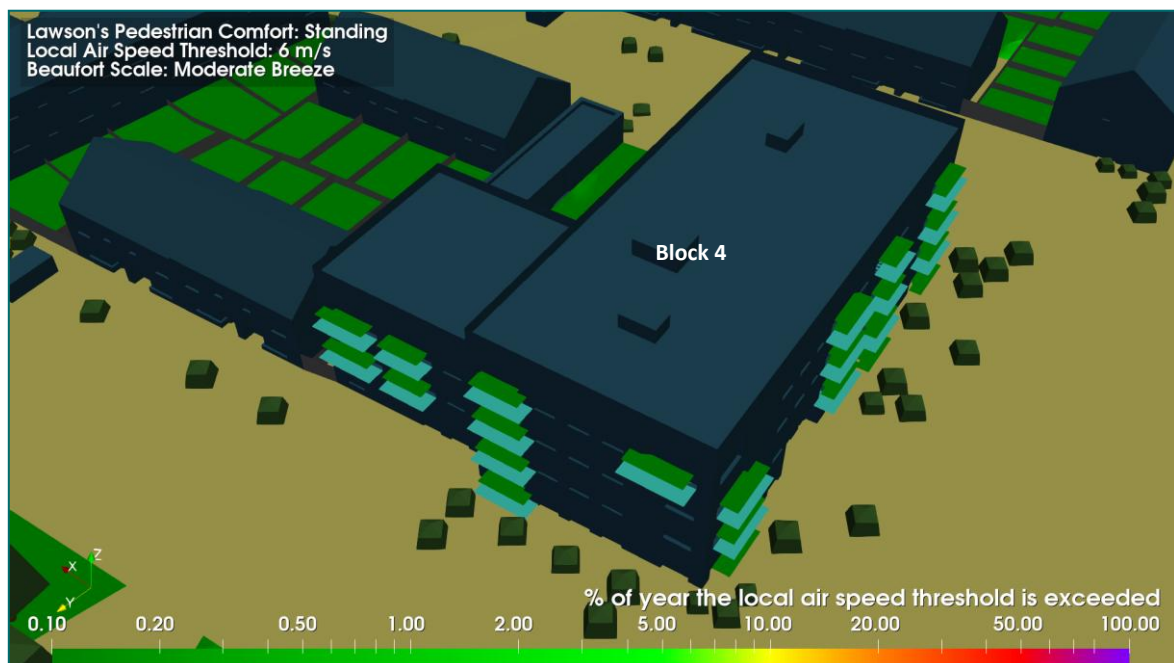


Figure 11: Standing Comfort Criterion: Balconies: Block 4: View from the northwest

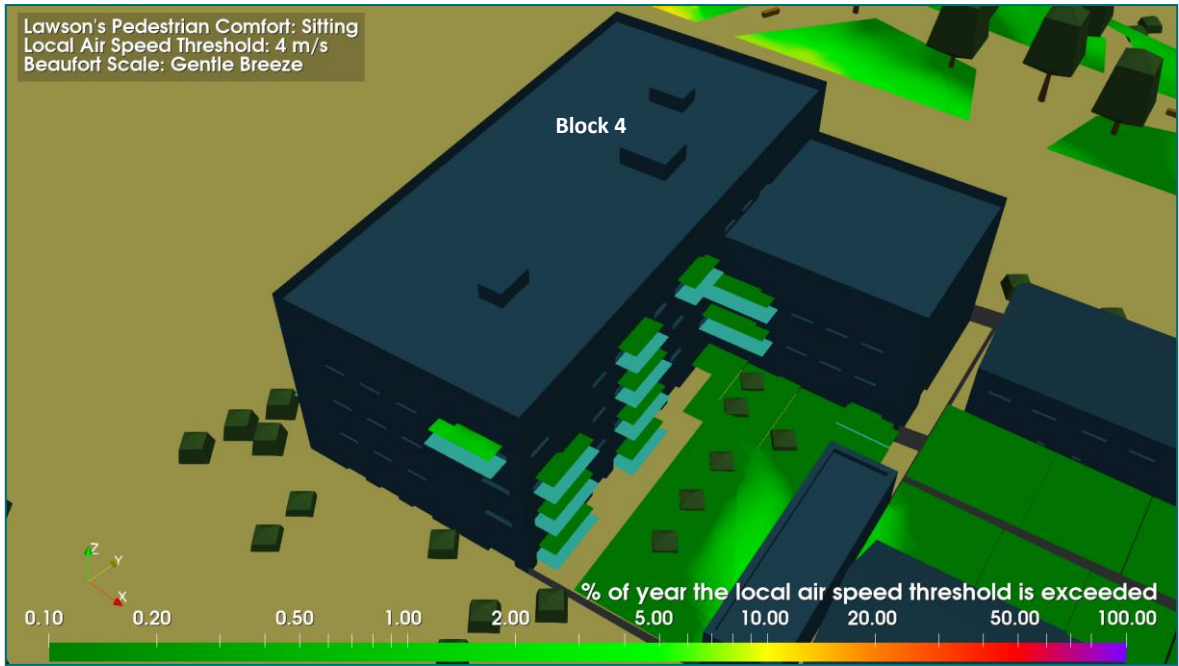


Figure 12: Sitting Comfort Criterion: Balconies: Block 4: View from the southeast

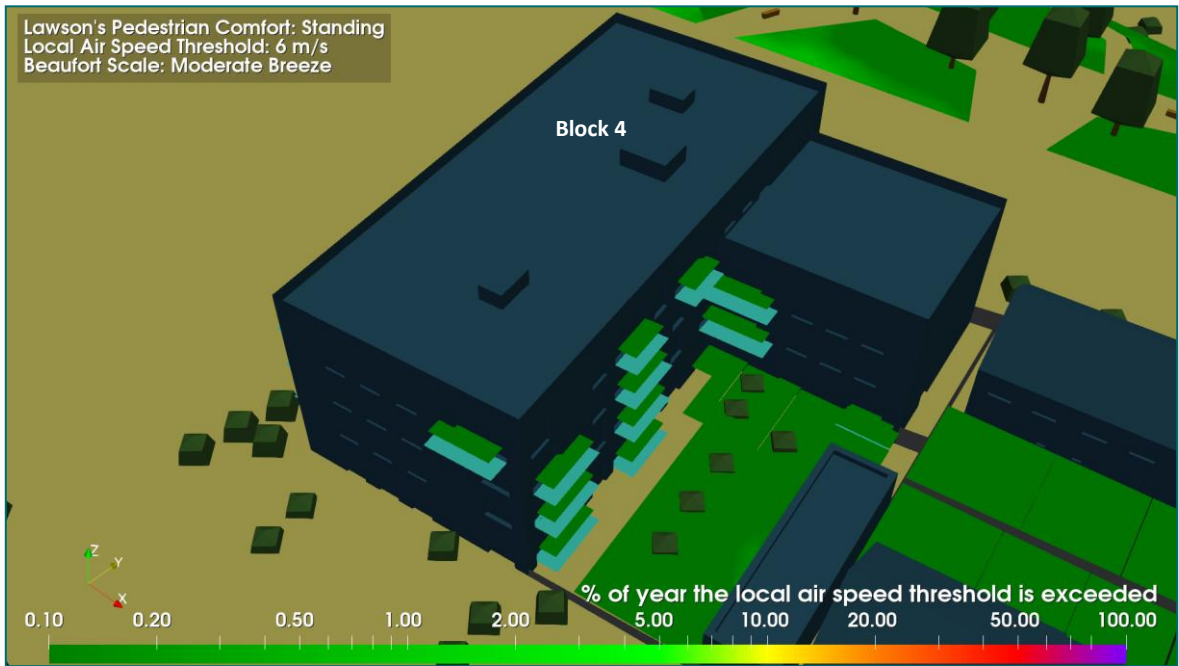


Figure 13: Standing Comfort Criterion: Balconies: Block 4: View from the southeast

4.2.2 Communal open space

4.2.2.1 Communal open space of Blocks 1 & 2

[Figure 14](#) and [Figure 15](#) illustrate Lawson's Sitting and Standing Comfort Criteria results on the Communal open space of Block 1 & Block 2. The results showed excellent compliance and fully met the requirements of Lawson's Sitting and Standing Comfort Criterion for the full year. The local air speed does not exceed 4m/s and 6m/s for more than 5% of the year as per the criterion's requirement.

No further mitigation measures are recommended.

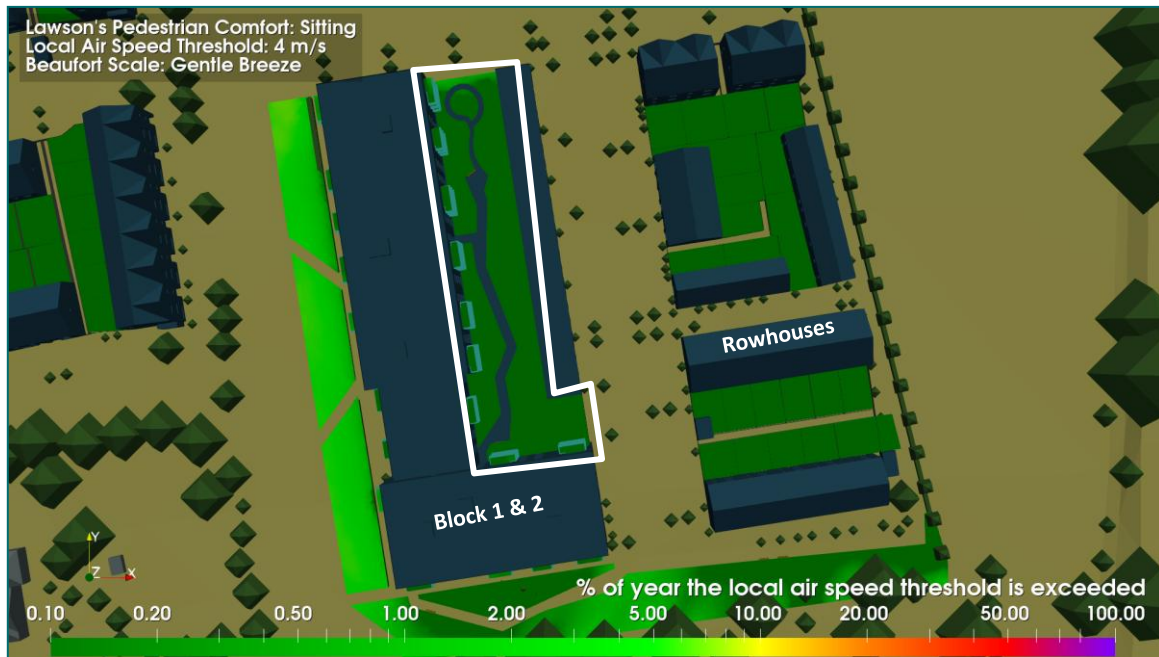


Figure 14: Sitting Comfort Criterion: Communal Open Space

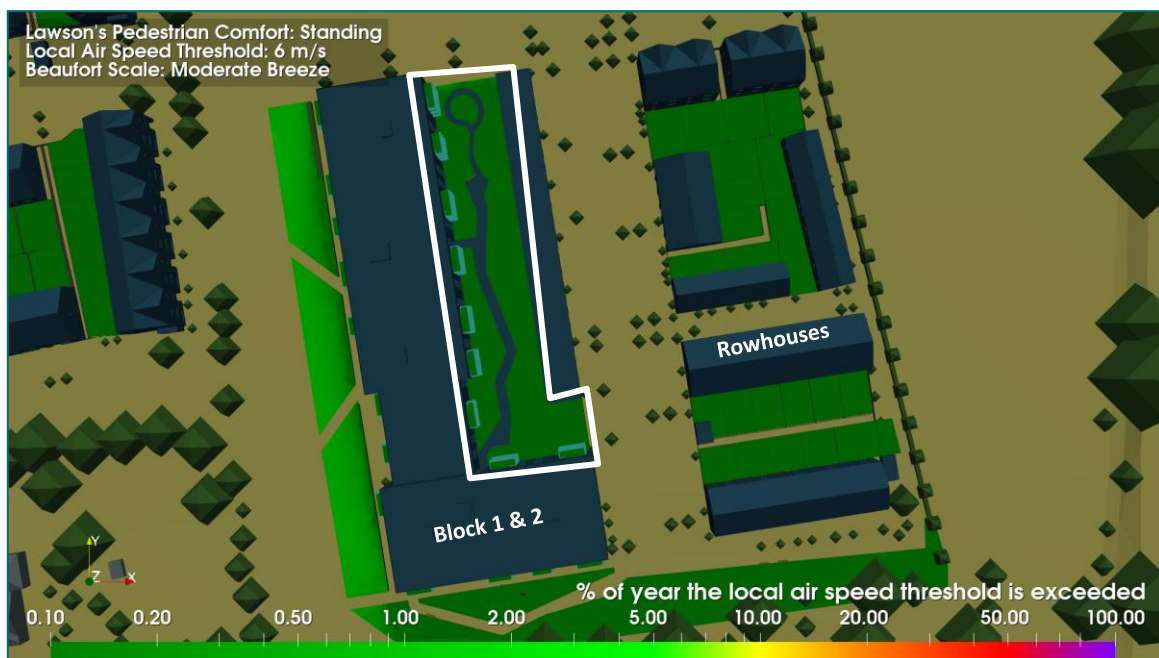


Figure 15: Standing Comfort Criterion: Communal Open Space

4.2.2.2 Terrace amenity of Block 3

[Figure 16](#) and [Figure 17](#) illustrate Lawson's Sitting and Standing Comfort Criteria results on the terrace amenities of Block 3, outlined in white. The results showed excellent compliance and fully met the requirements of Lawson's Sitting and Standing Comfort Criterion for the full year. The local air speed does not exceed 4m/s and 6m/s for more than 5% of the year as per the criterion's requirement.

No further mitigation measures are recommended.



Figure 16: Sitting Comfort Criterion: Terrace amenity of block 3



Figure 17: Standing Comfort Criterion: Terrace amenity of block 3

4.2.2.3 Communal open space near Block 4

[Figure 18](#) and [Figure 19](#) illustrate Lawson's Sitting and Standing Comfort Criteria results on the communal open space of Block 4.

The results showed excellent compliance and fully met the requirements of Lawson's Sitting and Standing Comfort Criterion for the full year. The local air speed does not exceed 4m/s and 6m/s for more than 5% of the year as per the criterion's requirement.

No further mitigation measures are recommended.



Figure 18: Sitting Comfort Criterion: Communal open space near block 4



Figure 19: Standing Comfort Criterion: Communal open space near block 4

4.2.3 Public open space

4.2.3.1 Public open space near Blocks 1 & 2

[Figure 20](#) and [Figure 21](#) illustrate Lawson's Sitting and Standing Comfort Criteria results on the Public open space near Block 1 & Block 2. The results showed excellent compliance and fully met the requirements of Lawson's Sitting and Standing Comfort Criterion for the full year. The local air speed does not exceed 4m/s and 6m/s for more than 5% of the year as per the criterion's requirement.

No further mitigation measures are recommended.

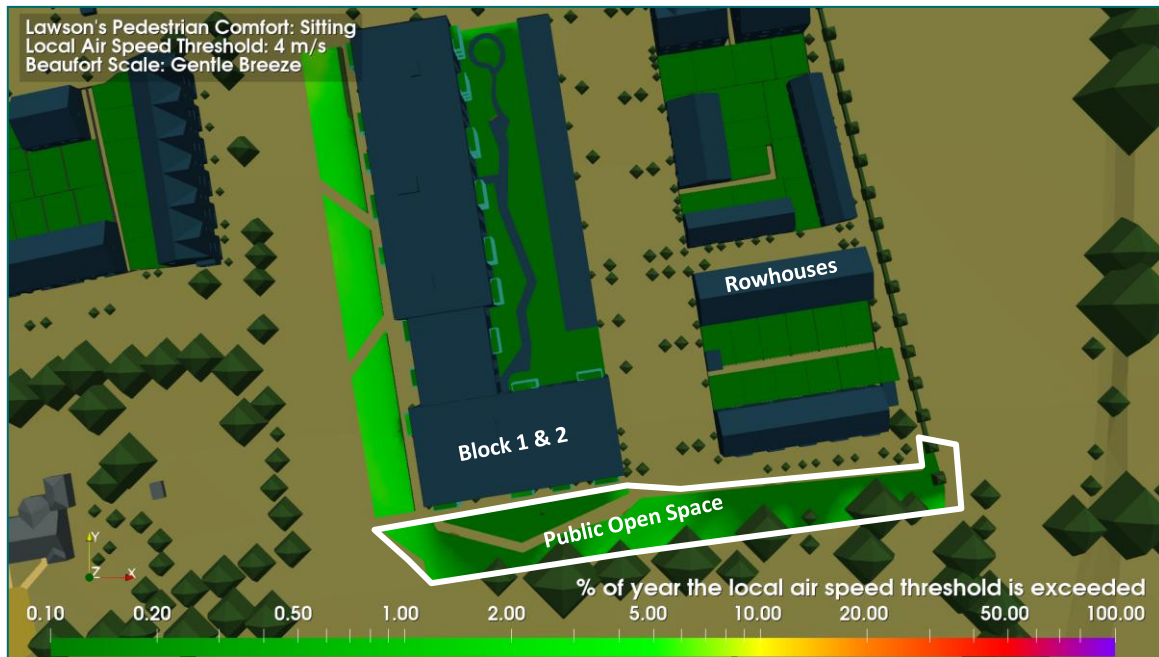


Figure 20: Sitting Comfort Criterion: Public Open Space near block 1 & 2

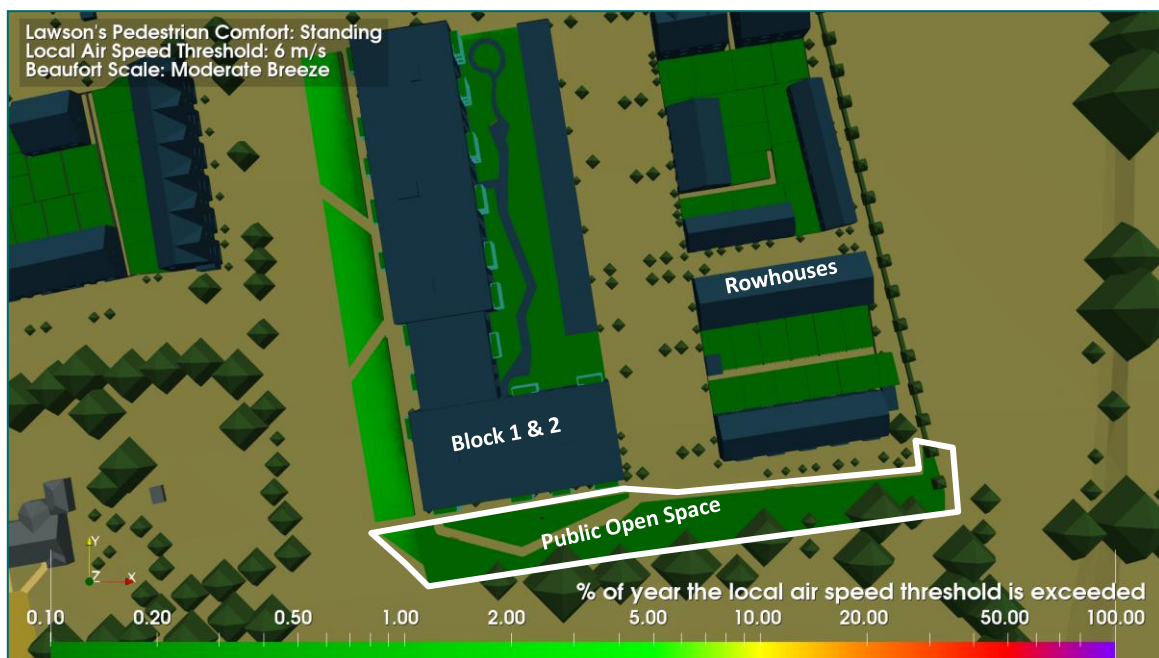


Figure 21: Standing Comfort Criterion: Public Open Space near block 1 & 2

4.2.3.2 Community gardens

[Figure 22](#) and [Figure 23](#) illustrate Lawson's Sitting and Standing Comfort Criteria results on the communal garden outlines in white.

The results showed good compliance and fully met the requirements of Lawson's Sitting and Standing Comfort Criterion for the full year. The local air speed does not exceed 4m/s and 6m/s for more than 5% of the year as per the criterion's requirement.

Some of the locations visible in the yellow and orange contours show limited compliance with the requirements of Lawson's Sitting Comfort Criterion. The local air speed is likely to exceed 4 m/s for up to 15% of the year at these locations. These areas were affected by the prevailing southwesterly and westerly winds. The locations visible in the yellow and orange contours do not contain any seating arrangements.

When comparing the results for these locations to Lawson's Standing Comfort Criterion, the local air speed demonstrates excellent compliance, exceeding 6 m/s for less than 5% of the year. See [Figure 23](#). Of the 15% of the year when the local airspeed exceeds 4 m/s, half of that time it does not exceed 6 m/s. The local air speed in these spaces will be less than 4 m/s for 80% of the year and between 4 and 6 m/s for 15% of the year.

Any noted exceedance can be considered very marginal and will not create an unpleasant environment to use. The local air speed is only going to be greater than a gentle breeze, but frequently less than a moderate breeze. Such conditions are unlikely to affect the usability of this space for personal recreation.

No further mitigation measures are recommended.

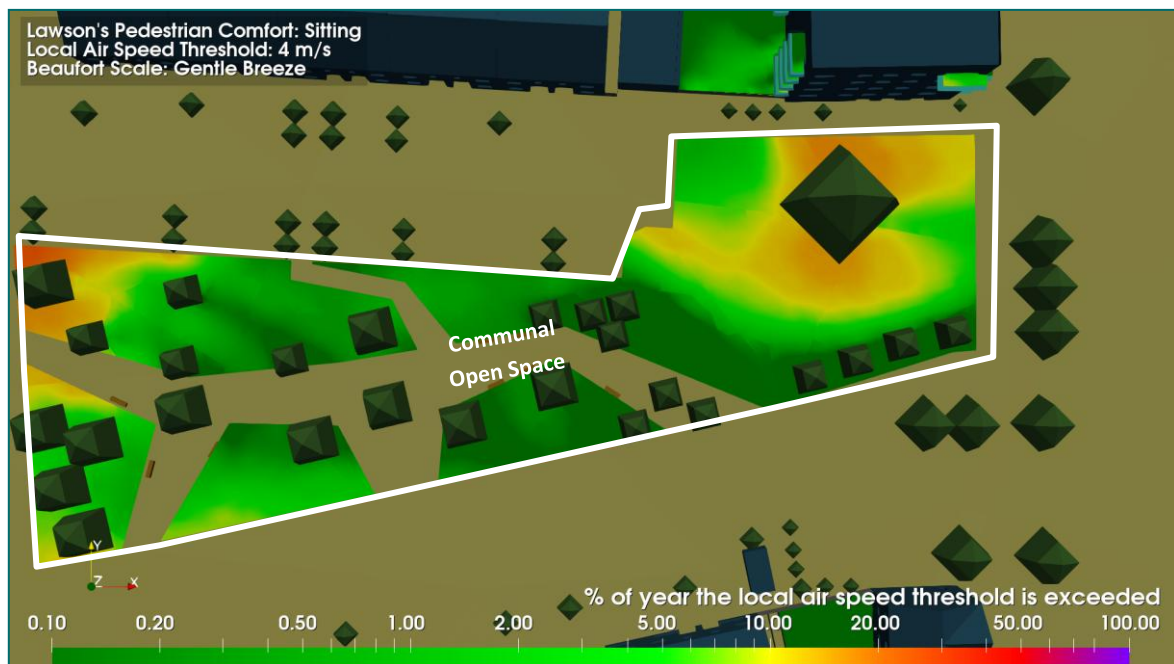


Figure 22: Sitting Comfort Criterion: Community Garden



Figure 23: Standing Comfort Criterion: Community Garden

4.2.4 Creche area of Block 3

[Figure 24](#) and [Figure 25](#) illustrate Lawson's Sitting and Standing Comfort Criteria results on the creche area of Block 3, outlined in white.

The results showed excellent compliance and fully met the requirements of Lawson's Sitting and Standing Comfort Criterion for the full year. The local air speed does not exceed 4m/s and 6m/s for more than 5% of the year as per the criterion's requirement.

No further mitigation measures are recommended.



Figure 24: Sitting Comfort Criterion: Creche area of block 3



Figure 25: Standing Comfort Criterion: Creche area of block 3

4.2.5 Private amenities of rowhouses

[Figure 26](#) and [Figure 35](#) illustrate Lawson's Sitting and Standing Comfort Criteria results on the private amenity of the rowhouses, outlined in white. The results showed excellent compliance and fully met the requirements of Lawson's Sitting and Standing Comfort Criterion for the full year. The local air speed does not exceed 4m/s and 6m/s for more than 5% of the year as per the criterion's requirement.

No further mitigation measures are recommended.

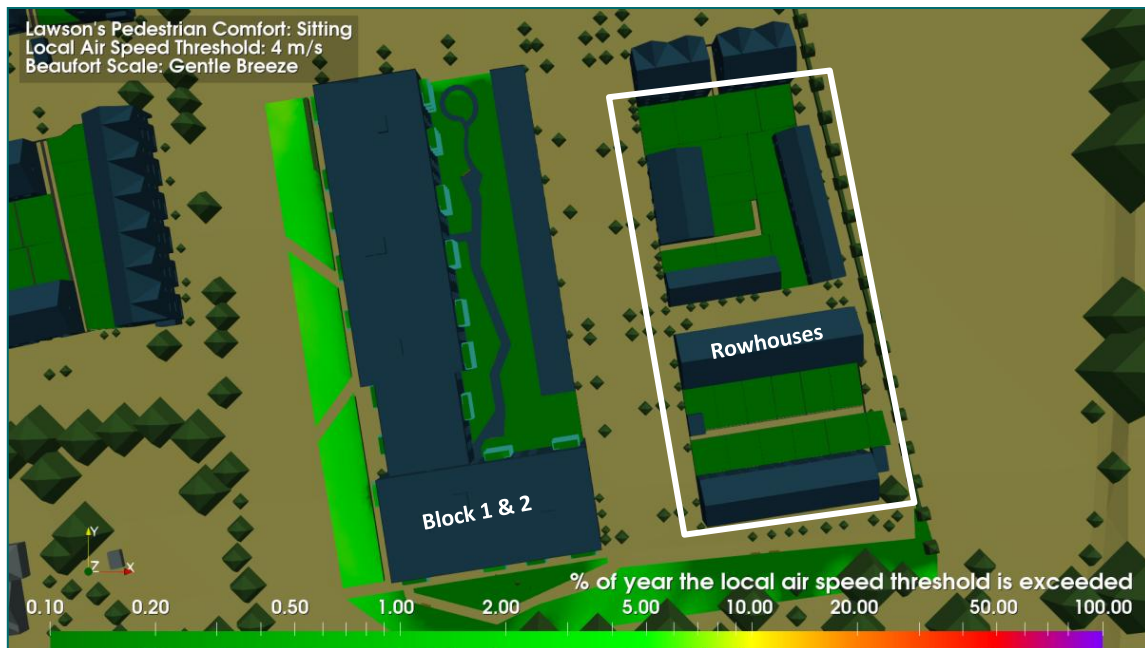


Figure 26: Sitting Comfort Criterion: private amenities space of rowhouses located east of blocks 1 & 2

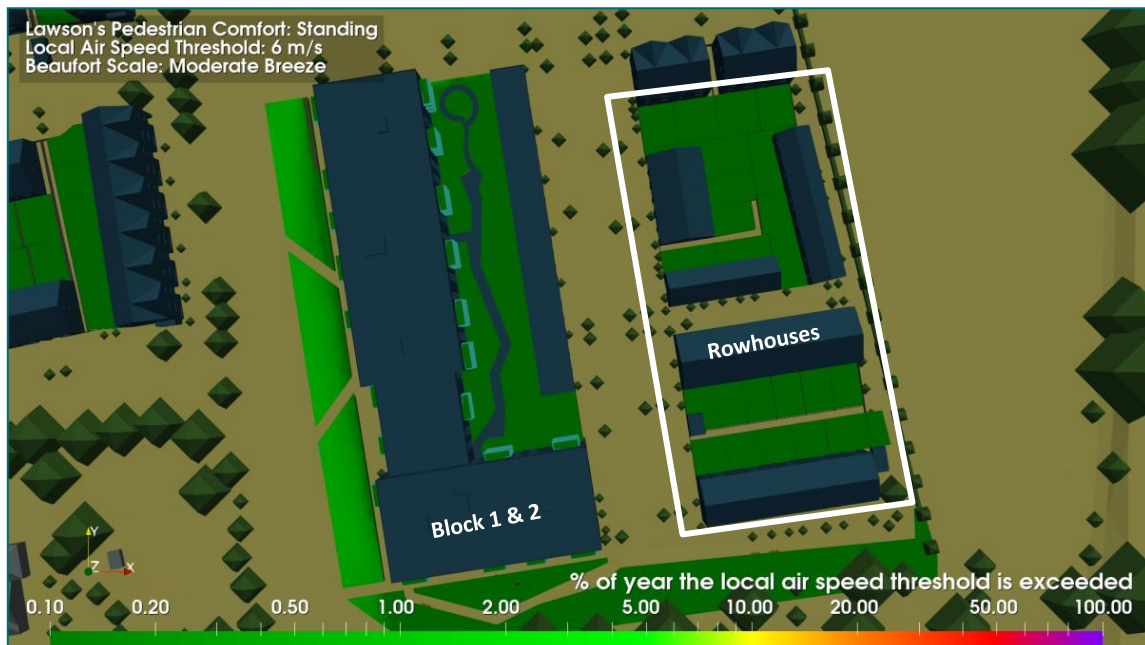


Figure 27: Standing Comfort Criterion: private amenities space of rowhouses located east of blocks 1 & 2

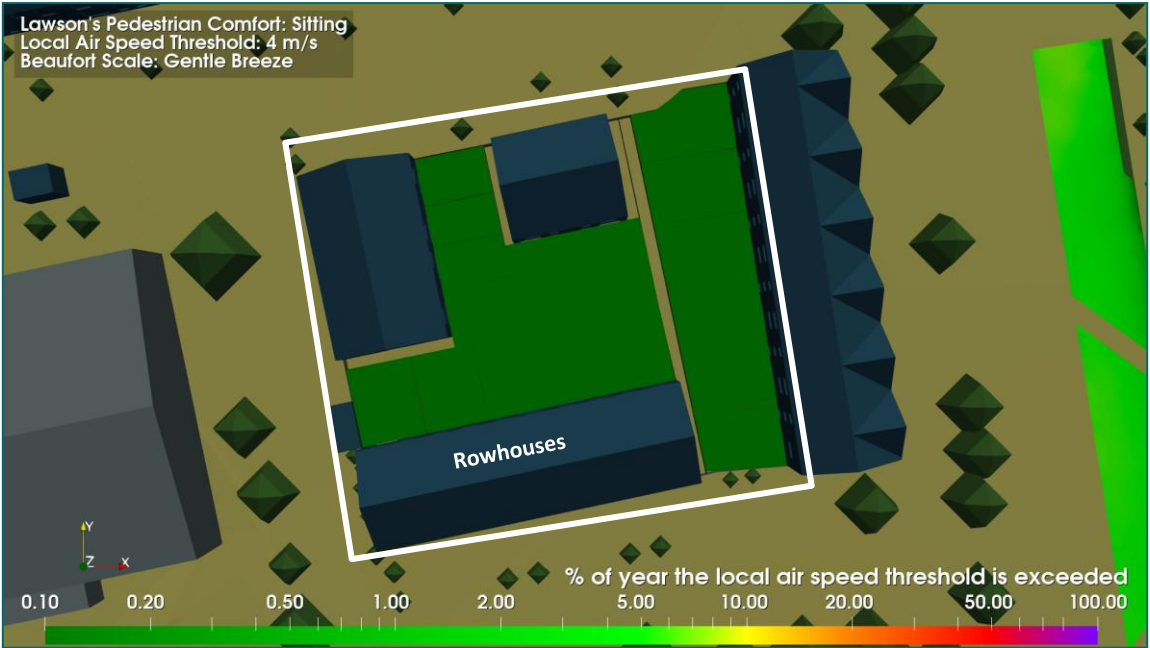


Figure 28: Sitting Comfort Criterion: private amenities space of rowhouses located west of blocks 1 & 2



Figure 29: Standing Comfort Criterion: private amenities space of rowhouses located west of blocks 1 & 2

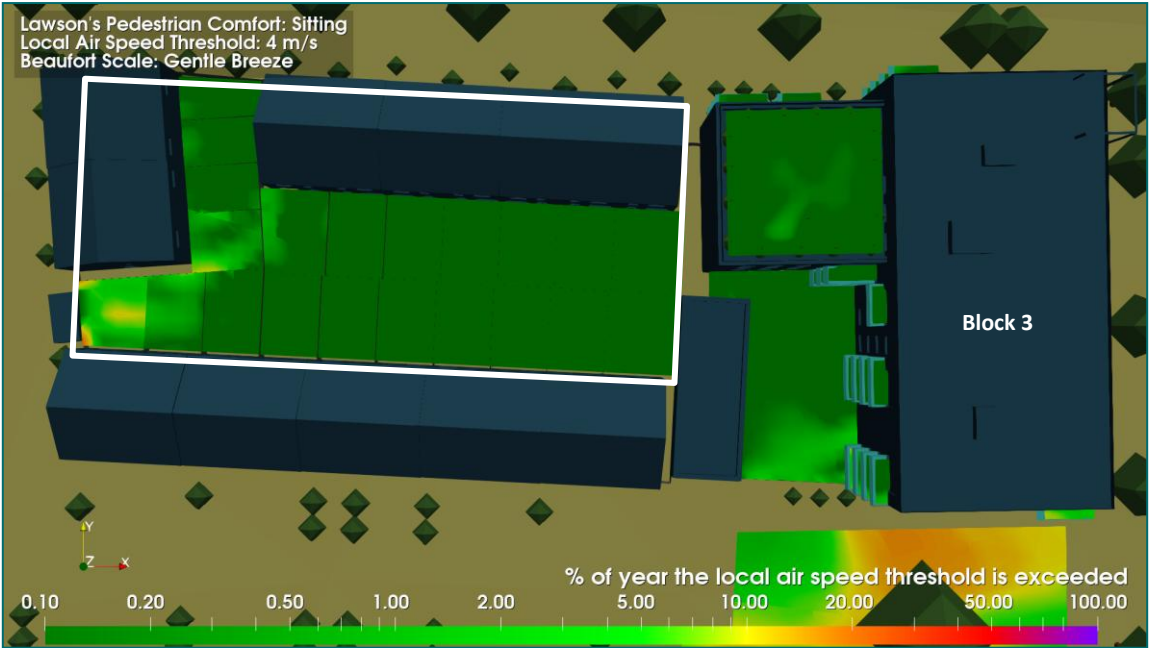


Figure 30: Sitting Comfort Criterion: private amenities space of rowhouses located west of blocks 3

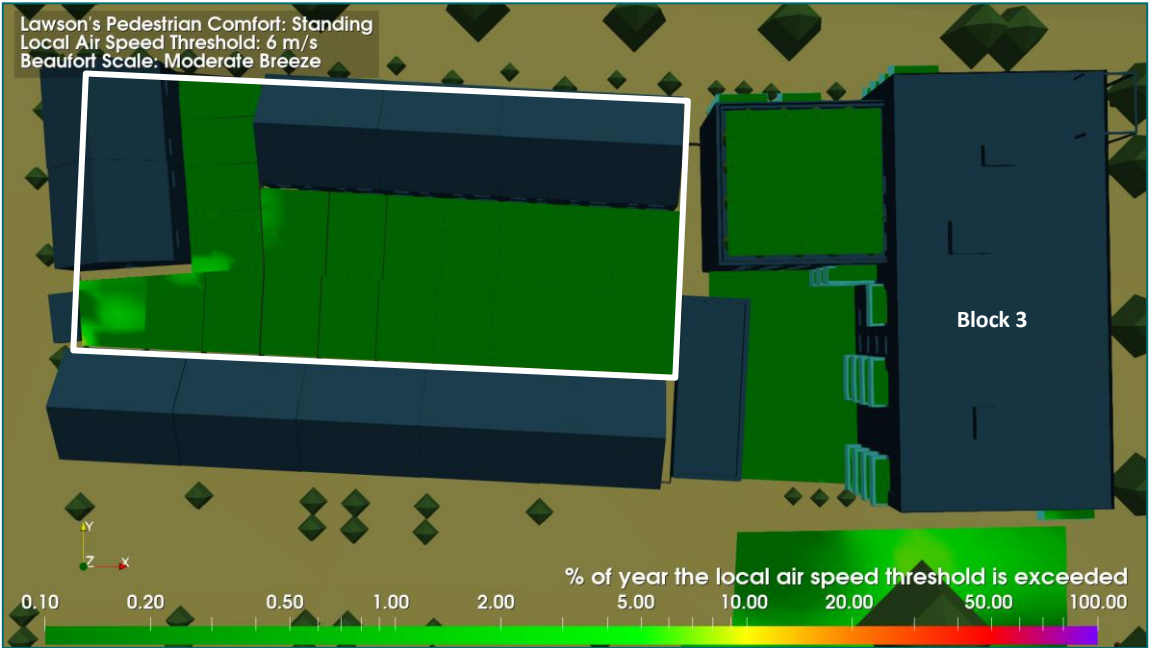


Figure 31: Standing Comfort Criterion: private amenities space of rowhouses located west of blocks 3

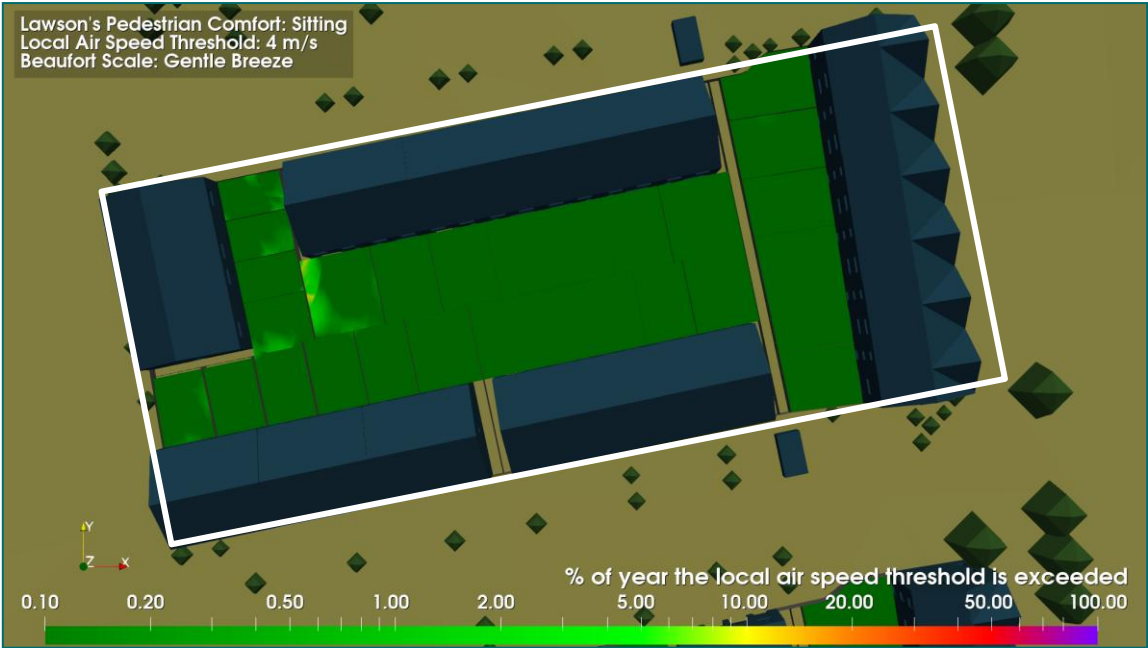


Figure 32: Sitting Comfort Criterion: private amenities space of rowhouses located south of blocks 4

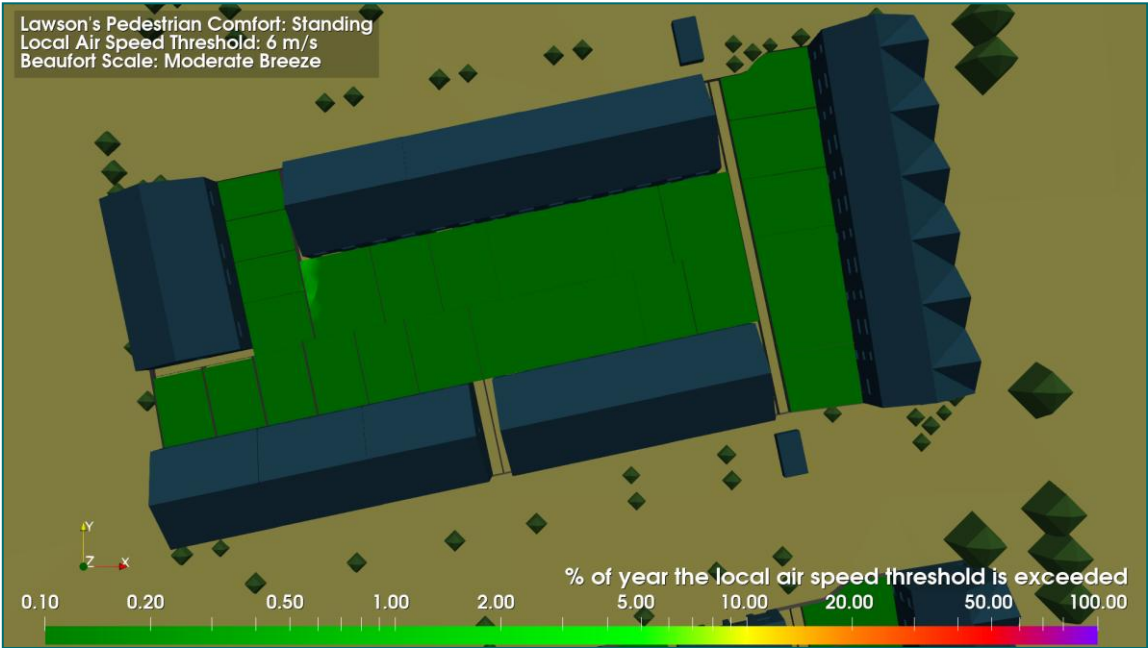


Figure 33: Standing Comfort Criterion: private amenities space of rowhouses located south of blocks 4

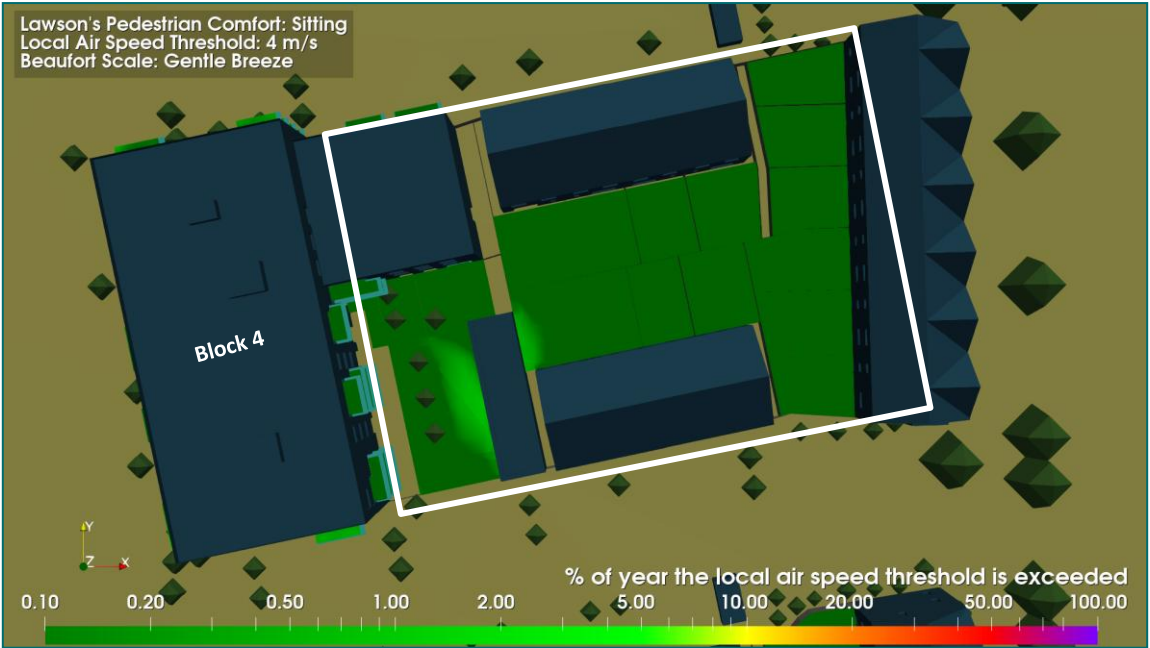


Figure 34: Sitting Comfort Criterion: private amenities space of rowhouses located east of blocks 4

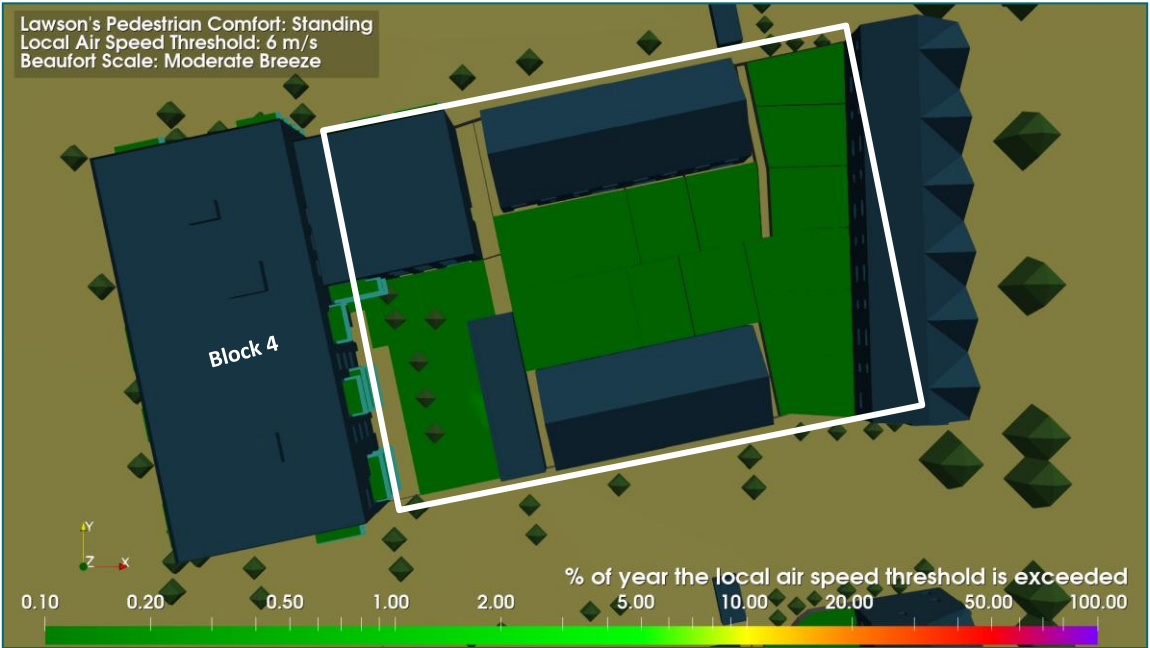


Figure 35: Standing Comfort Criterion: private amenities space of rowhouses located east of blocks 4

4.3 Walking Comfort Results

The Lawson's Leisure Walking Comfort Criterion states that the local air speed at designated locations should not exceed 8 m/s for more than 5% of the analysed duration along the various paths around the development. Additionally, the Lawson's Business Walking Comfort Criterion states that the local air speed at designated locations should not exceed 10 m/s for more than 5% of the analysed duration along the various paths around the development. These show excellent compliance with the requirements of Lawson's Leisure Walking and Business Walking Comfort Criterion. The local air speed does not exceed 8 m/s or 10 m/s for more than 5% of the year, respectively. [Figure 36](#) and [Figure 37](#). The following shows the results of the walking comfort criteria.

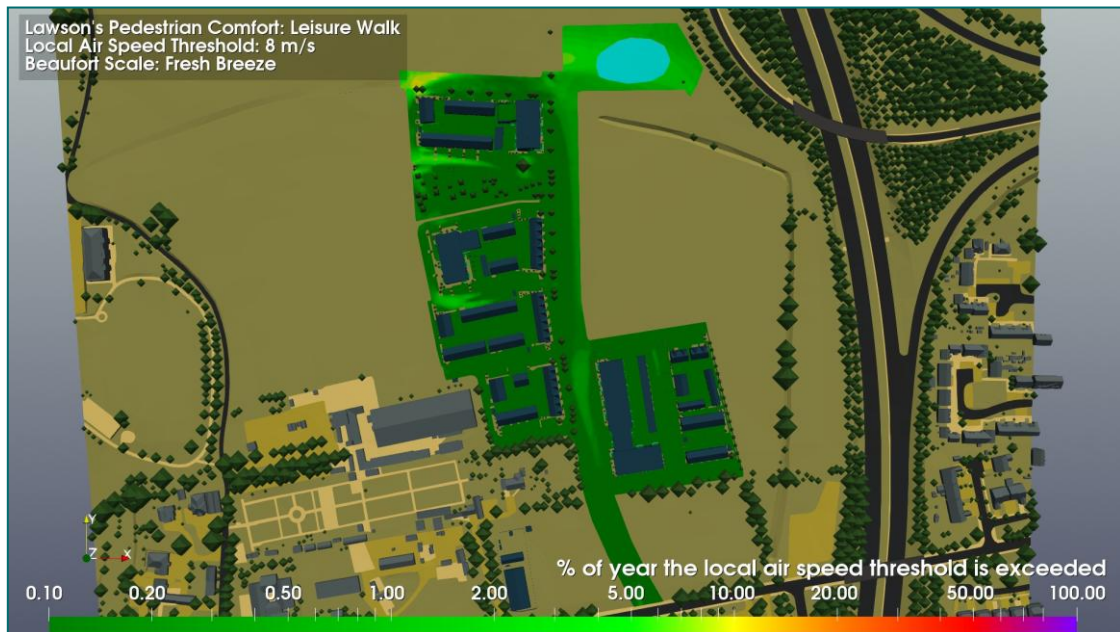


Figure 36: Leisure Walking Comfort Criterion: View from the top



Figure 37: Business Walking Comfort Criterion: view from the top

4.4 Safety Criteria

The Lawson's Normal Pedestrian Safety Criterion states that the local air speed at designated locations should not exceed 20 m/s for more than 0.01% of the duration analysed. Additionally, the Lawson's Sensitive Pedestrian Safety Criterion states the local air speed at designated locations should not exceed 15 m/s for more than 0.01% of the duration analysed. The Sensitive Pedestrian Safety Criterion applies to the vulnerable population, such as pensioners and children. Note the limit of the criterion is 0.01% and not 5% as with the comfort criterion.

These criteria also apply to various paths and grounds around the development, as access to and from the buildings is always required, irrespective of weather conditions. [Figure 38](#) and [Figure 39](#) show the results of the safety criteria assessment. The results for the normal and sensitive pedestrians were generally below 0.01% for the year. A small portion of a street towards the north corner is marked in a white oval in [Figure 38](#) showed an exceedance of the Sensitive Pedestrian Safety Criterion for up to 0.2% of the year.

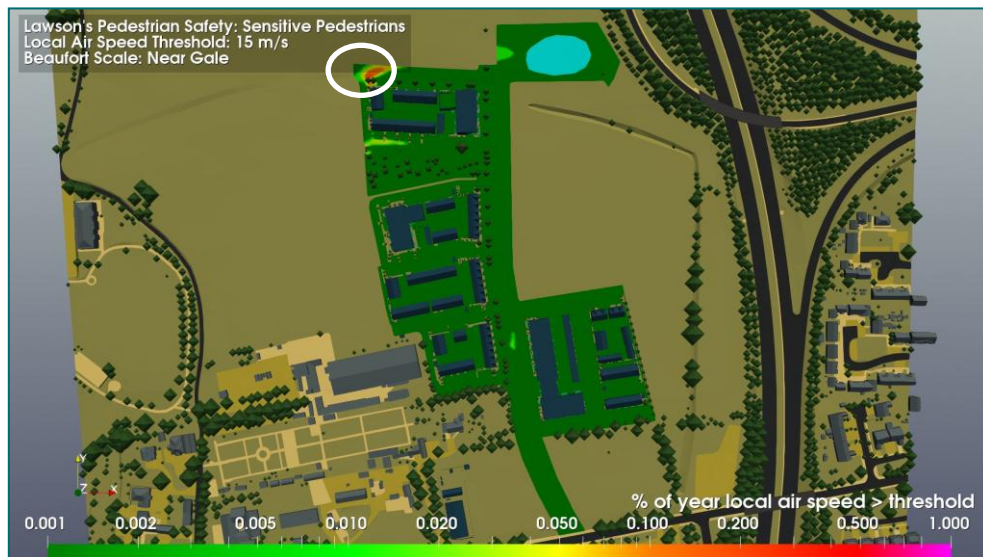


Figure 38: Sensitive Pedestrian Safety Criterion: View from the top



Figure 39: Normal Pedestrian Safety Criterion: View from the top

We note that Lawson’s Sensitive Pedestrian Safety criterion requirements are exceeded on a small portion of a street towards the north corner. This criterion requires that the local air speed does not exceed 15 m/s for more than 0.01% of a year. This is about 1 hour in a year. Our analysis is carried out from statistical analysis of 8760-time data points – hourly time period of the year. Our current analysis shows that the frequency of exceedance is about 15-20 times per year (0.15-0.2%).

As per various data sources, Dublin experiences winds with meteorological wind speeds of 15 m/s or more, for 1% in the year, see Figure 40. So, the frequency of our local observations is 5 times better than the frequency of the weather data observations for the location. Further, this location is exposed to the W, SW, and S winds due to proximity to the sea. So, it is noteworthy that such an exposed location still has observations that are much less frequent than those in the weather data.

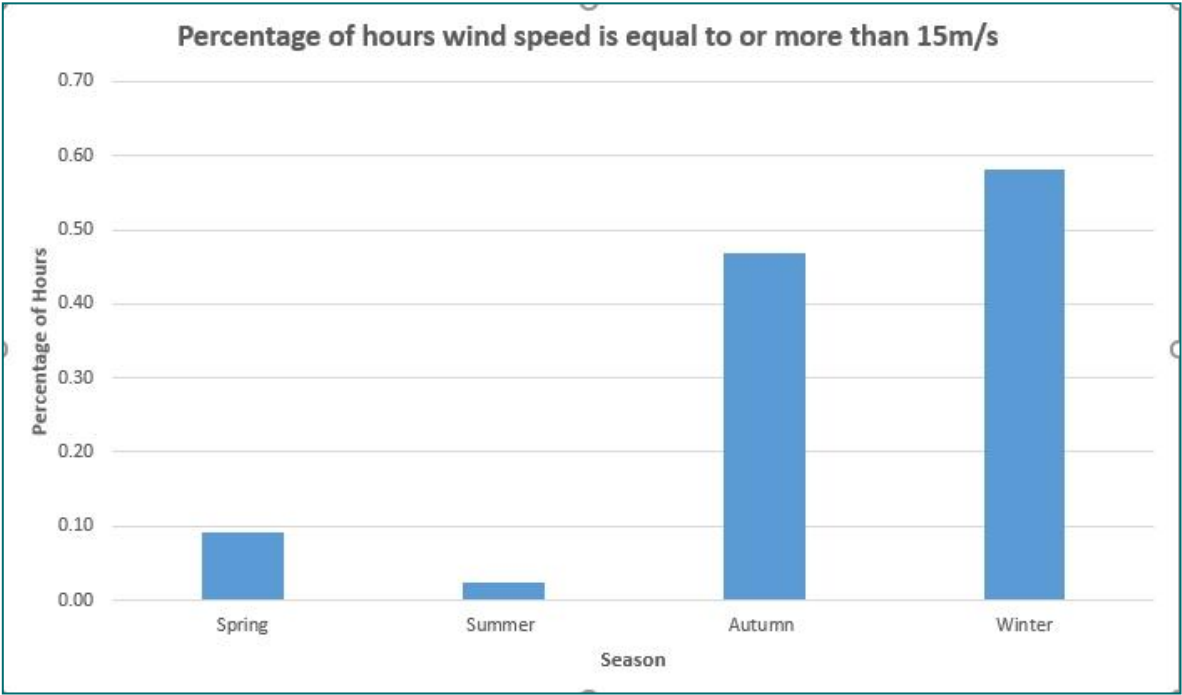


Figure 40: Chart: Percentage of hours wind speed is greater than 15m/s

5 Weather Data

The analysis is based on the 'IRL_ST_Dublin.AP.039620_TMYx.2009-2023.epw' weather file. The variation of wind speed recorded in the weather file is illustrated in [Figure 41](#) below. [Figure 42](#) illustrates the wind direction variation, and [Figure 43](#) illustrates the wind rose.

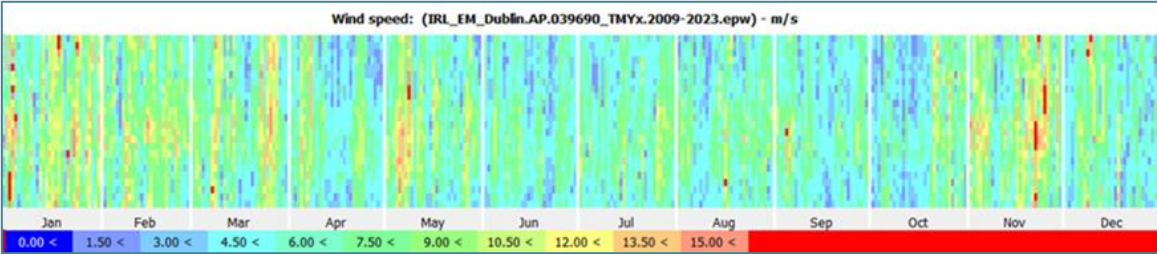


Figure 41: Wind speed variation

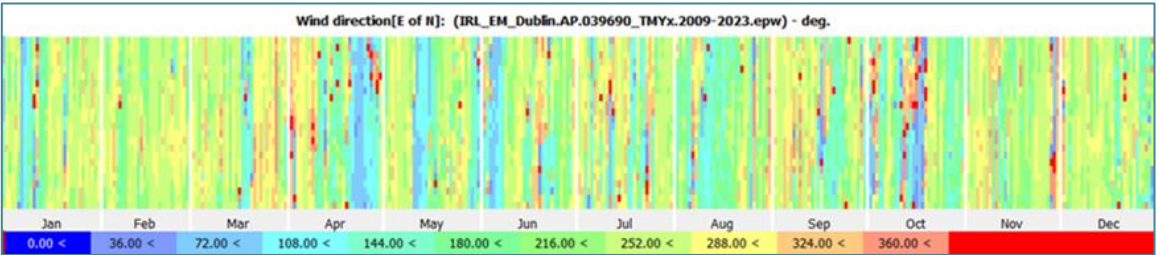


Figure 42: Wind direction variation

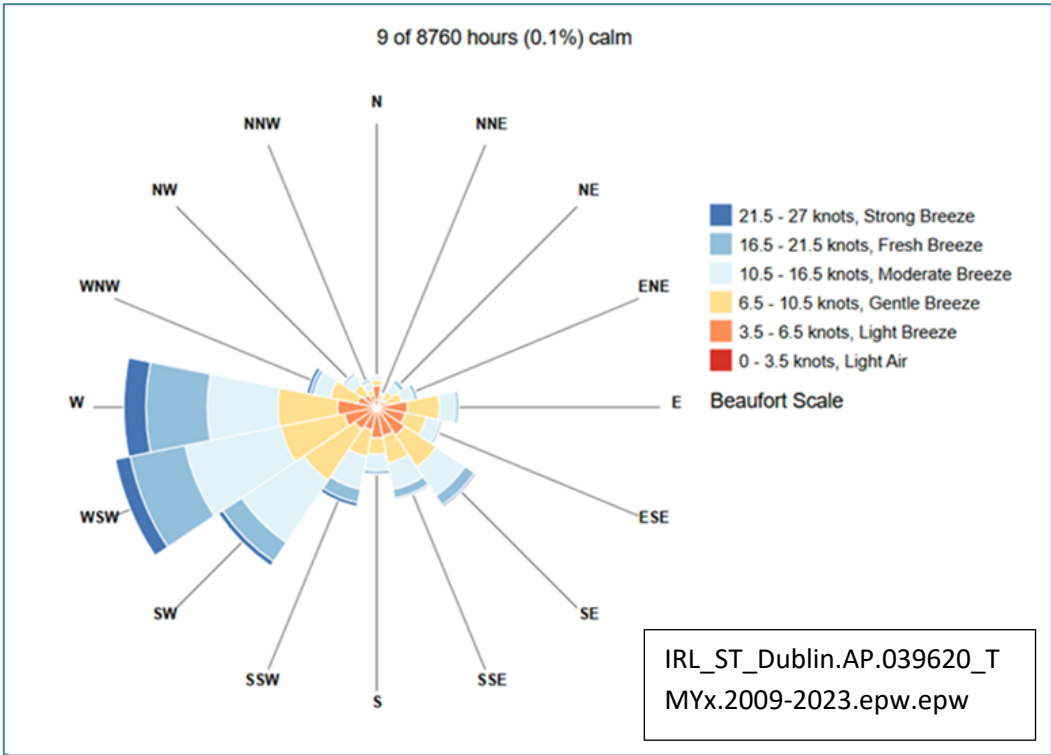


Figure 43: Wind rose

Based on this, the mean wind speed recorded was **5.7m/s** with a westerly prevailing direction.

6 Wind Boundary Layer

In an atmospheric boundary layer, wind speed increases with height due to the influence of surface roughness (i.e. the presence of buildings, trees, roads, etc., on the ground), see [Figure 44](#).

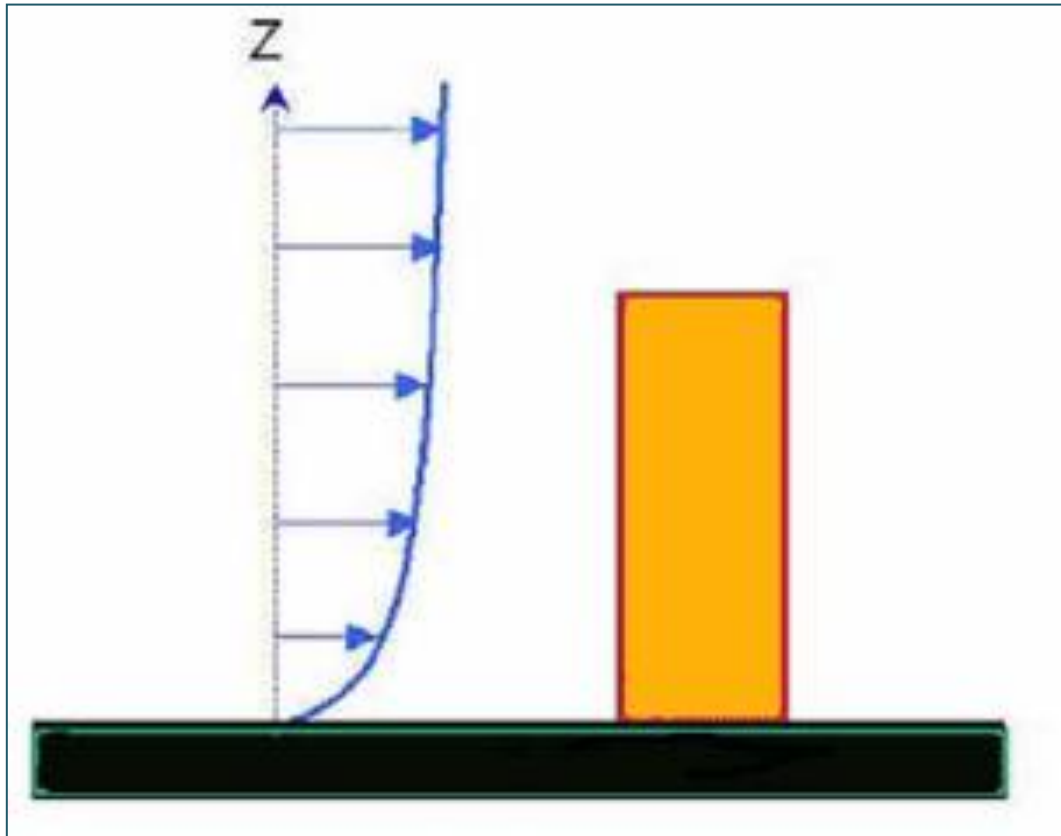


Figure 44: Typical velocity profile of an atmospheric boundary layer

In the current CFD modelling, the velocity profile was generated according to the parameterised ASHRAE methodology described below. This allows for different wind profiles across various terrain types: open country, urban, and city centre.

The wind speed U_H at height H above the ground is given by:

$$U_H = U_{met} \left(\frac{\delta_{met}}{H_{met}} \right)^{a_{met}} \left(\frac{H}{\delta} \right)^a \dots \dots \dots (Eq. 1)$$

Where,

- a** = Exponent in power law wind speed profile for local building terrain
- δ** = fully developed strong wind atmospheric boundary layer thickness (m)
- a_{met}** = Exponent for the meteorological station

δ_{met} = Atmospheric boundary thickness at the meteorological station (m)

H_{met} = Height at which meteorological wind speed was measured (m)

U_{met} = Hourly meteorological wind speed, measured at height H_{met} (m/s)

The parameters for different types of terrain are given in Table 1.

Table 1: Atmospheric boundary layer parameters

Terrain Category	Description	a	δ
1	Large city centres have 50% of buildings above 21m over a distance of at least 2000m upwind.	0.33	460
2	Urban, suburban, wooded areas.	0.22	370
3	Open, with scattered objects generally less than 10m high.	0.14	270
4	Flat, unobstructed areas exposed to wind flowing over a large water body (no more than 500m inland).	0.10	210

For the current project, we used the atmospheric boundary layer corresponding to terrain category 2, i.e., an urban/suburban type of site. The met data was taken on category 3 terrain at a height of 10m.

7 Methodology for Pedestrian Comfort Calculation

The methodology for the analysis was as follows:

- 1) The annual mean wind speed was determined from the 'IRL_ST_Dublin.AP.039620_TMYx.2009-2023.epw' weather file.
- 2) 8 steady state CFD simulations were performed corresponding to the 8 directions – SW, W, NW, N, NE, E, SE and S, respectively.
- 3) The local air speed at various designated locations around the site was recorded for each of the simulations.
- 4) This value was compared to the meteorological wind speed used, and the magnification factor at that location for the corresponding wind direction was determined.
- 5) The magnification factor was used to determine the air speed at the designated locations for the various recorded values of the wind speed and direction in the weather file, thus generating the local air speeds at designated locations for a year.
- 6) These recorded values were compared to the Lawson Pedestrian Comfort/Safety Criteria.

7.1 Lawson Pedestrian Comfort/Safety Criteria

The Lawson Criteria¹ were used as a reference for assessing wind effects. It is the most widely used reference for assessing pedestrian comfort. It considers the air speed at the location as well as the frequency of its occurrence. It consists of two assessment criteria:

1. The first criterion assesses whether the air movement will be comfortable for the pedestrian for different types of activities.
2. The second criterion assesses the feeling of safety or distress by the pedestrian at higher air speeds.

The following table gives the values for Lawson's Pedestrian Comfort Assessment Criteria for various activities.

Category	Pedestrian Activity	Threshold mean hourly wind speed not to be exceeded for more than 5% of the time (m/s)
C1	Business Walking	10
C2	Leisurely Walking	8
C3	Standing	6
C4	Sitting	4

The following table gives the values for Lawson's Pedestrian Safety Assessment criteria.

Category	Pedestrian Type	Threshold mean hourly wind speed not to be exceeded more than once per annum ² (m/s)
S1	Typical Pedestrian	20
S2	Sensitive Pedestrian	15

¹T. V. Lawson (2001) *Building Aerodynamics*, Imperial College Press, London.

²Once per annum means the safety threshold is not to be exceeded more than 0.01% of the year.

The median wind speed recorded was 5.7 m/s for Dublin's climatic conditions. That means, for 50% of the year, the wind speed is higher than 5.7 m/s. The Lawson's Sitting Criterion requires the local air speed to be more than 4 m/s for no more than 5% of the year. Thus, the Lawson's Sitting Criterion presents a task of being 10 times better than the climatic conditions at the location of interest.

8 CFD Model

The CFD model was created based on the CAD drawings provided.

8.1 Model Geometry

[Figure 45](#) to [Figure 60](#) show the geometry as modelled.



Figure 45: Plan view of the site



Figure 46: View of the site from the South

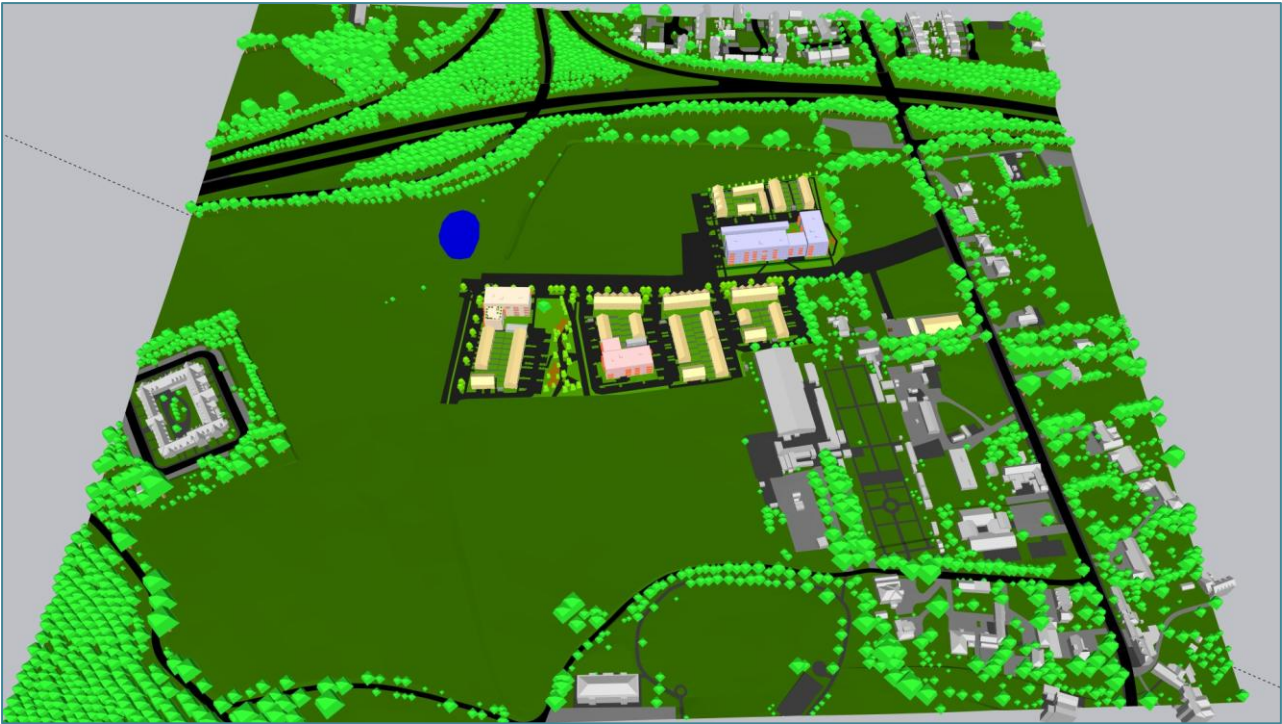


Figure 47: View of the site from the West

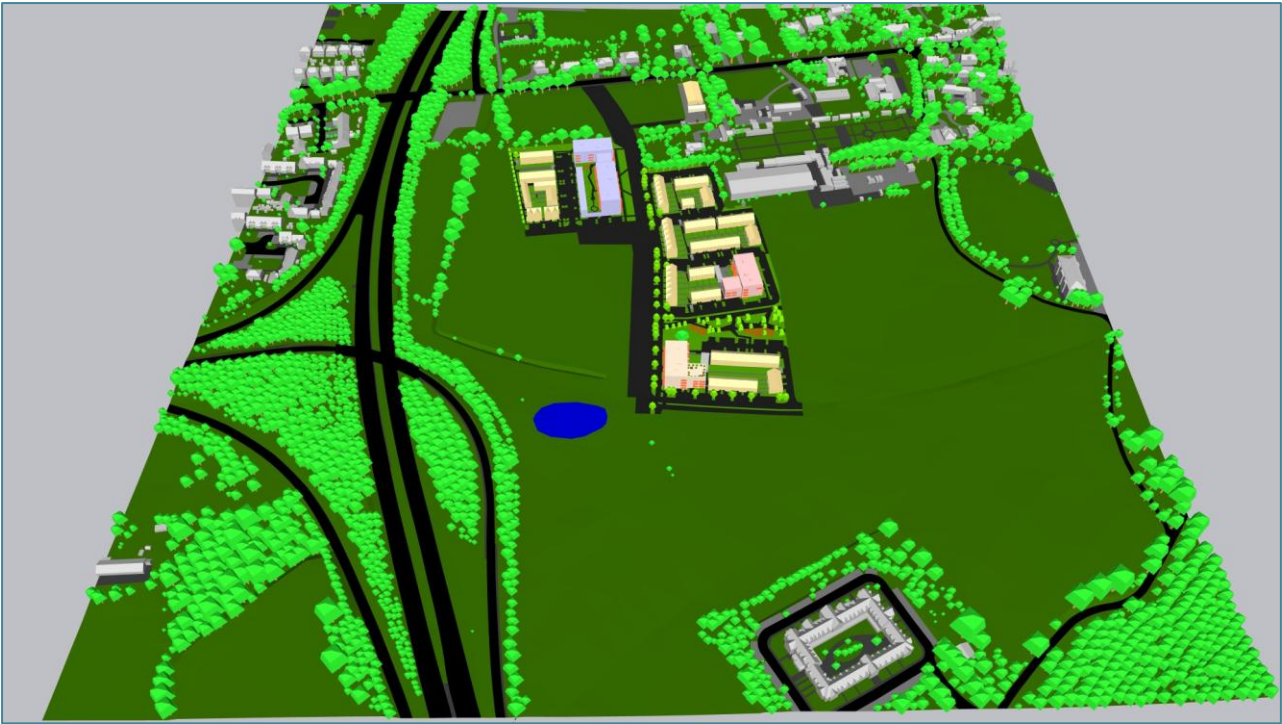


Figure 48: View of the site from the North



Figure 49: View of the site from the East

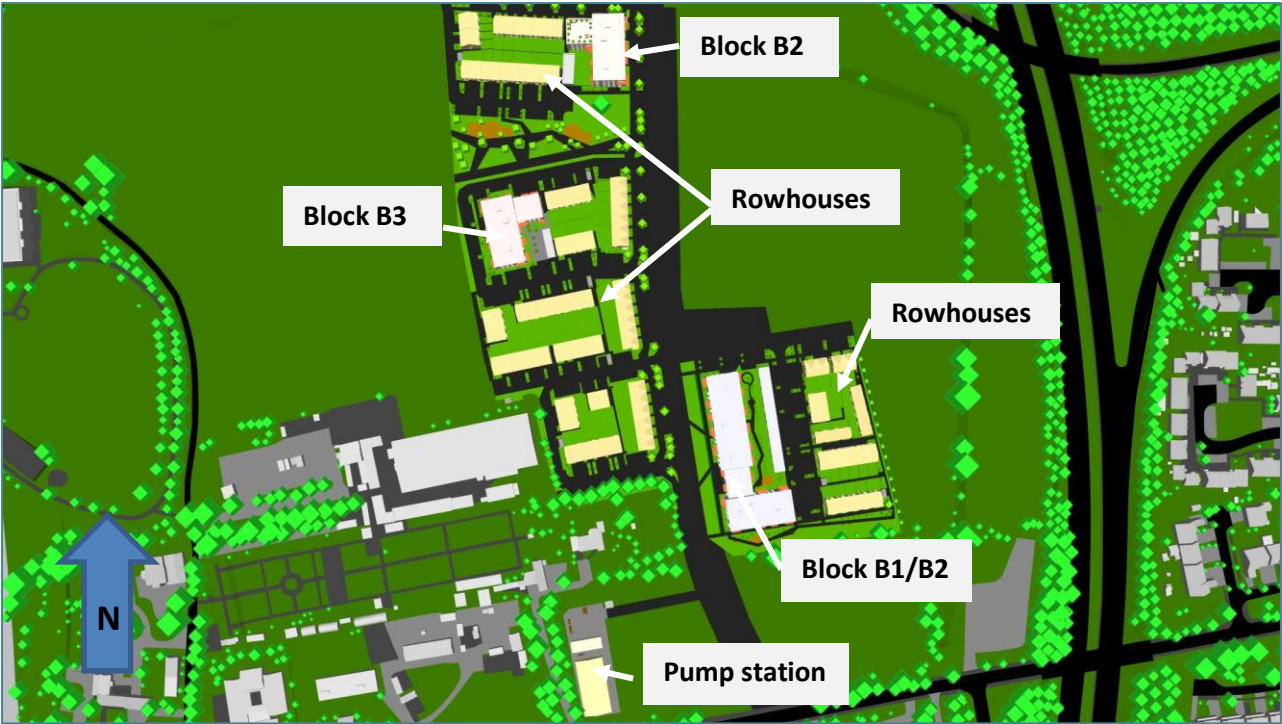


Figure 50: Plan view of the main buildings



Figure 51: Closer view of the site from the south



Figure 52: Closer view of the site from the west



Figure 53: Closer view of the site from the north



Figure 54: Closer view of the site from the east

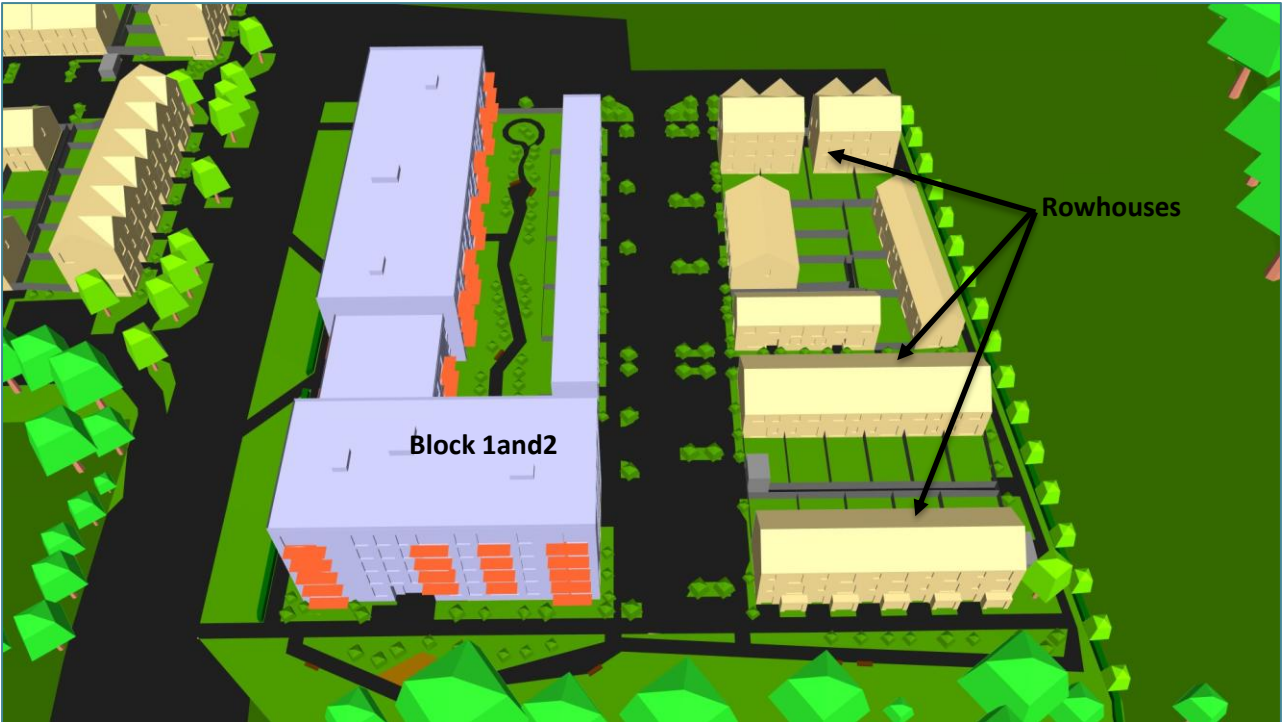


Figure 55: view of the Block 1,2 and Rowhouses from the South



Figure 56: View of the Block 1,2 and Rowhouses from the North



Figure 57: View of the Block 4 & Rowhouses from the south



Figure 58: View of the Block 4 & Rowhouses from the North



Figure 59: View of the Block 3 & rowhouses from the south



Figure 60: View of the Block 3 & rowhouses from the West



Figure 61: View of the Pumping Station



Figure 62: View of the Block 3 terrace amenities from the Northwest

9 Conclusion

The site shows the typical behaviour of any site in Dublin, with direct exposure to the southern-to-western arc of winds, which account for 80% of total winds. The landscape design and site layout result in the site performing well with respect to wind comfort.

It was observed that,

1. The balconies of all blocks showed excellent results and fully met the requirements of the Sitting and Standing Comfort criteria.
2. All communal Open spaces showed excellent results and fully met the requirements of the Sitting and Standing Comfort Criteria.
3. The community garden showed good results and fully met the requirements of the Sitting and Standing Comfort Criteria.
4. All public Open spaces showed excellent results and fully met the requirements of the Sitting and Standing Comfort Criteria.
5. The creche area of Block 3 showed excellent results and fully met the requirements of the Sitting and Standing Comfort Criteria.
6. Overall results of the walking comfort show excellent compliance with Lawson's Leisure Walking and Business Walking Comfort criteria.
7. The Lawson's Normal and Sensitive Pedestrian Safety Criteria are achieved throughout the site.

The site meets Lawson's Standing and Sitting criteria when used together in most amenity spaces. It also meets Lawson's Walking criteria requirements on all pathways.

10 Appendix

10.1 Comfort Criteria

Figure 63 to Figure 71 show the percentage of the year the hourly wind speed exceeds the threshold value for the comfort criteria, such as Sitting, Standing, Leisurely Walking and Business Walking for all seasons. The threshold values are 4 m/s, 6 m/s, 8 m/s and 10 m/s respectively.

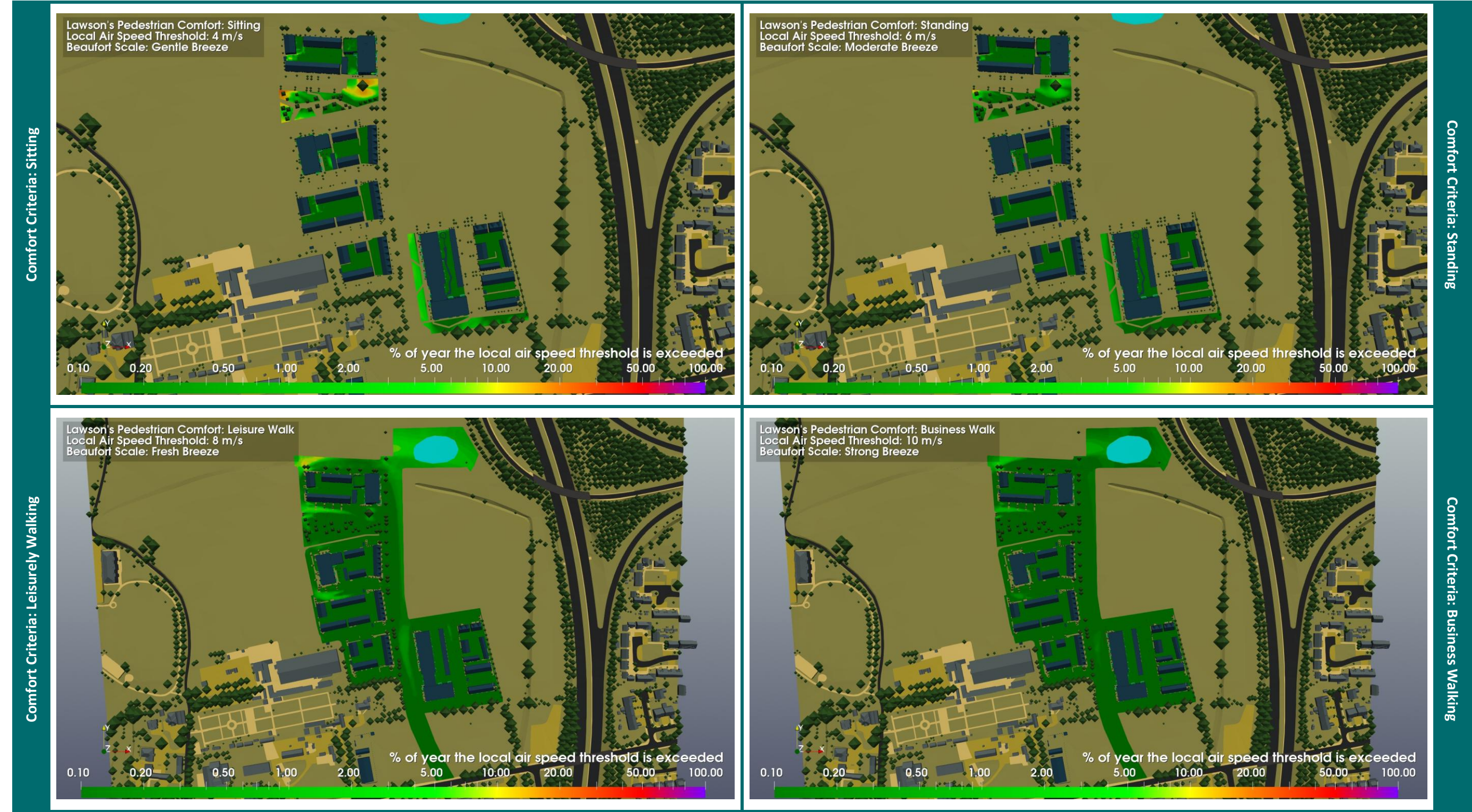


Figure 63: Comfort Criteria: All Seasons: Plan view

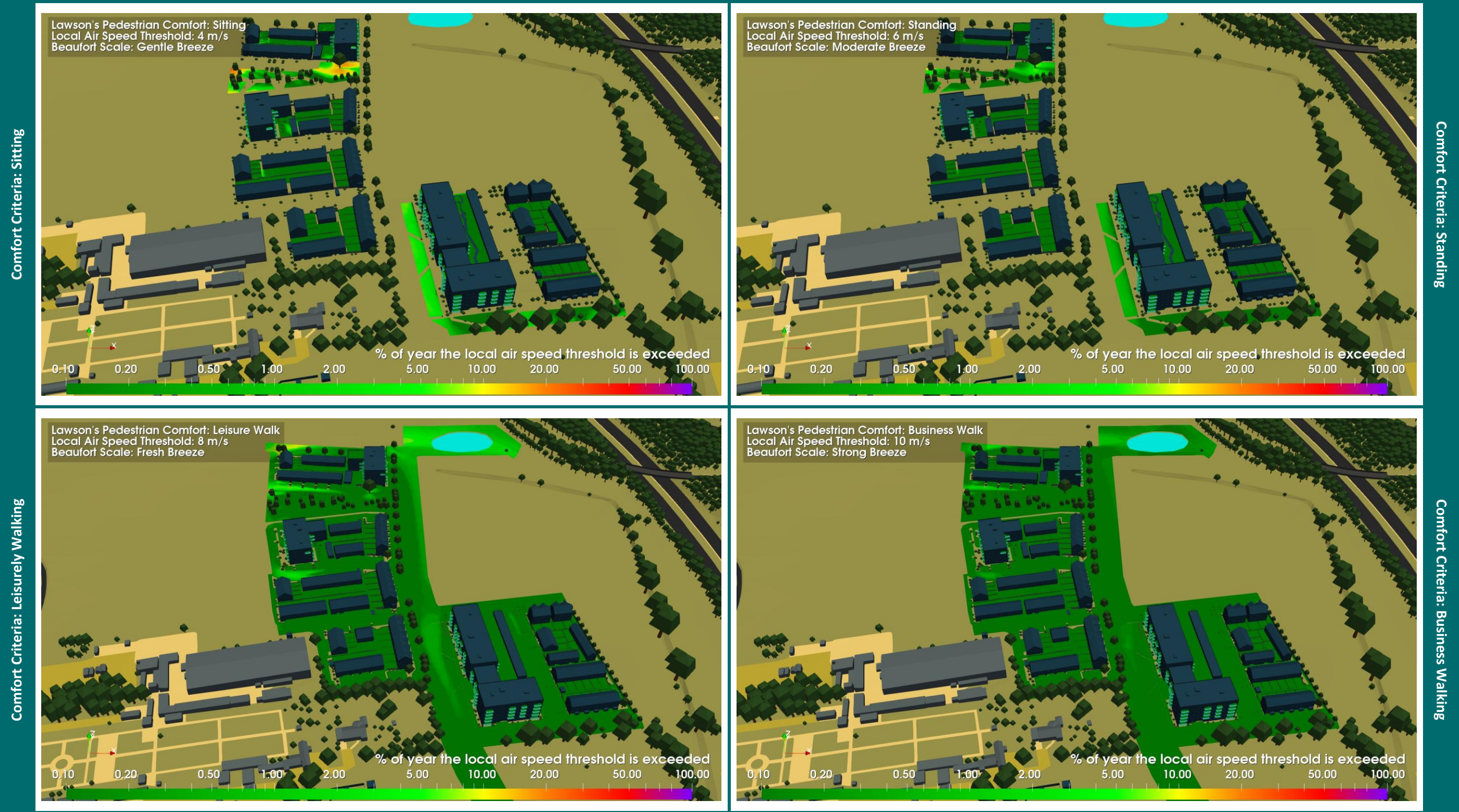


Figure 64: Comfort Criteria: View from the south



Figure 65: Comfort Criteria: View from the southwest

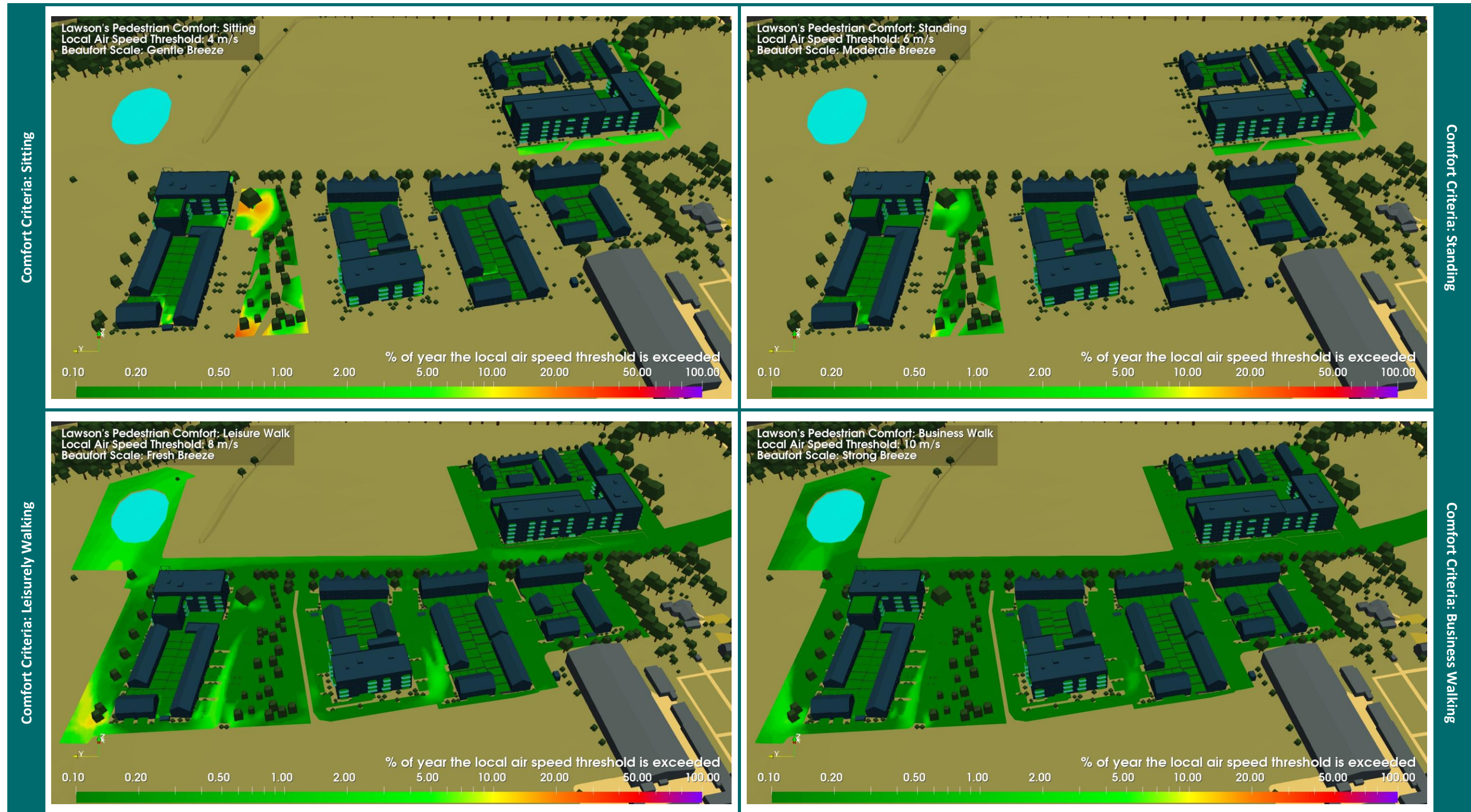


Figure 66: Comfort Criteria: View from the west

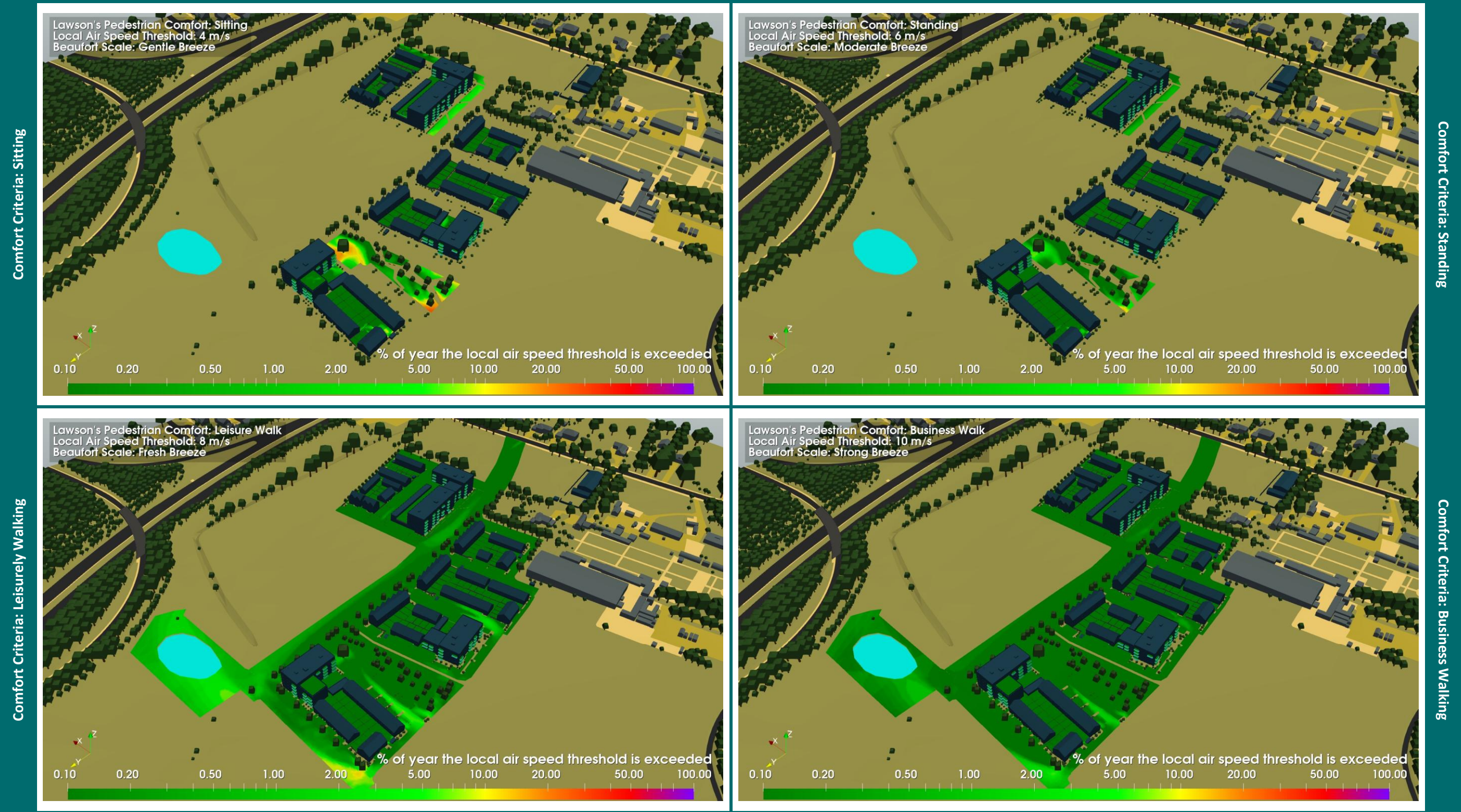


Figure 67: Comfort Criteria: View from the northwest

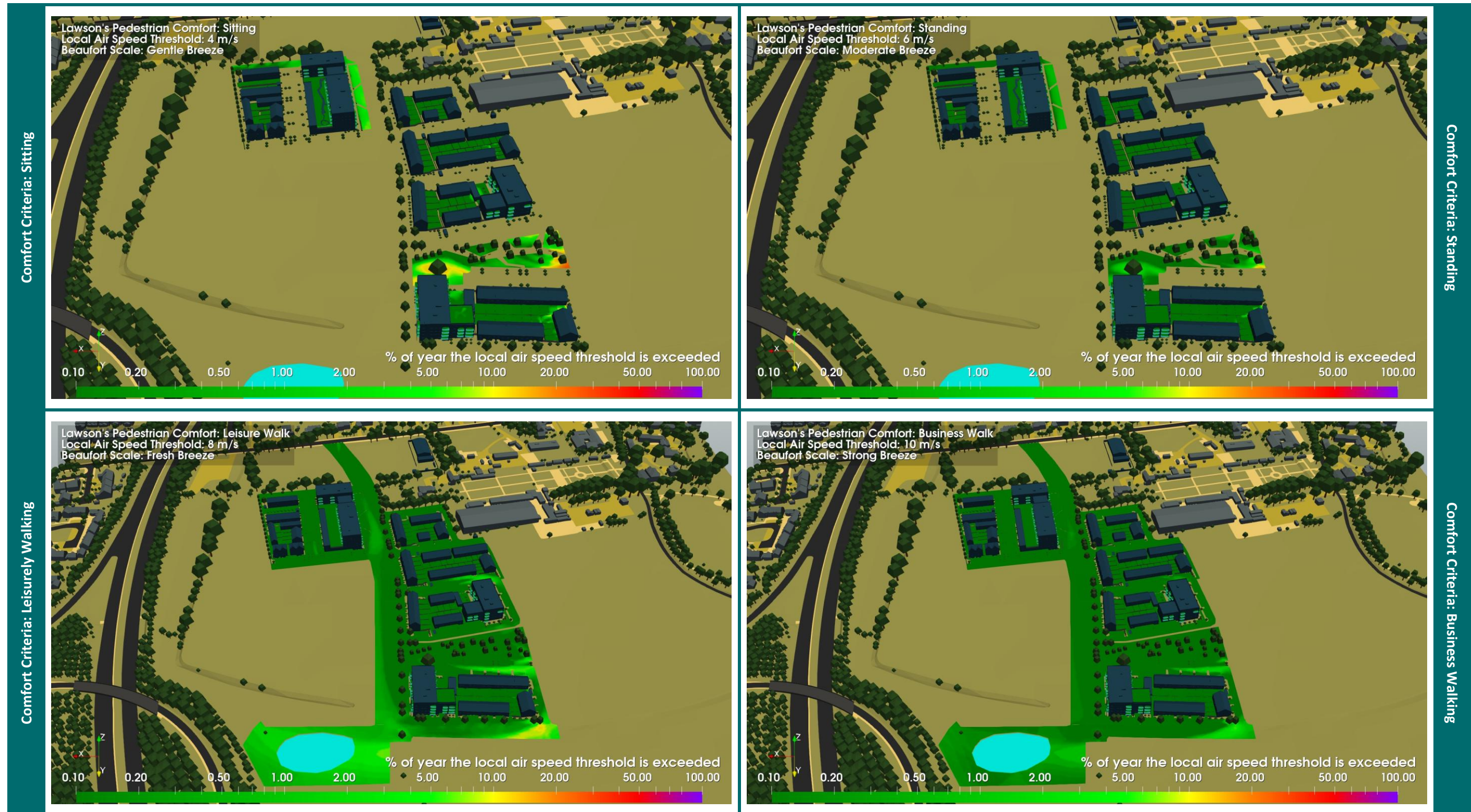


Figure 68: Comfort Criteria: View from the north

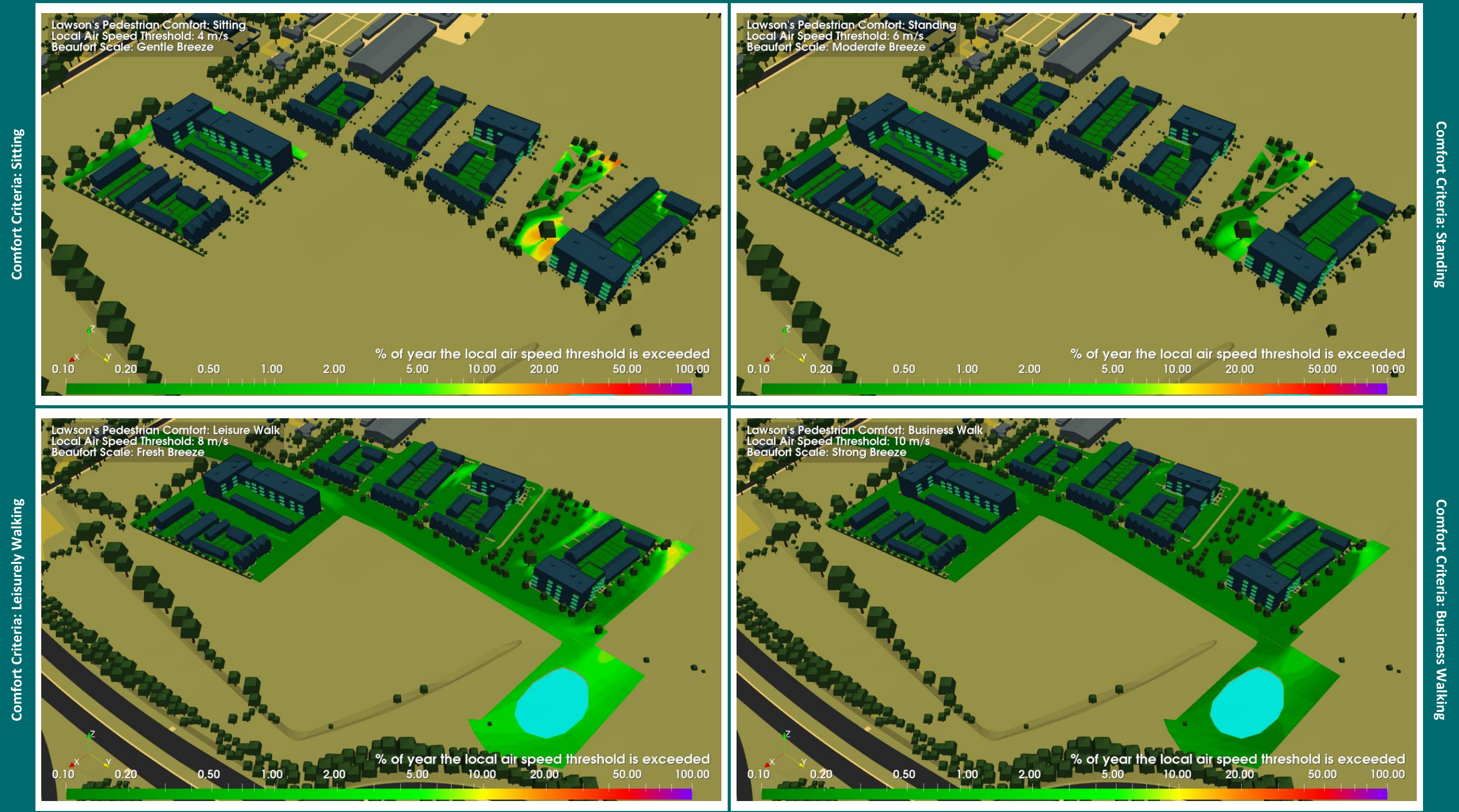


Figure 69: Comfort Criteria: View from the northeast

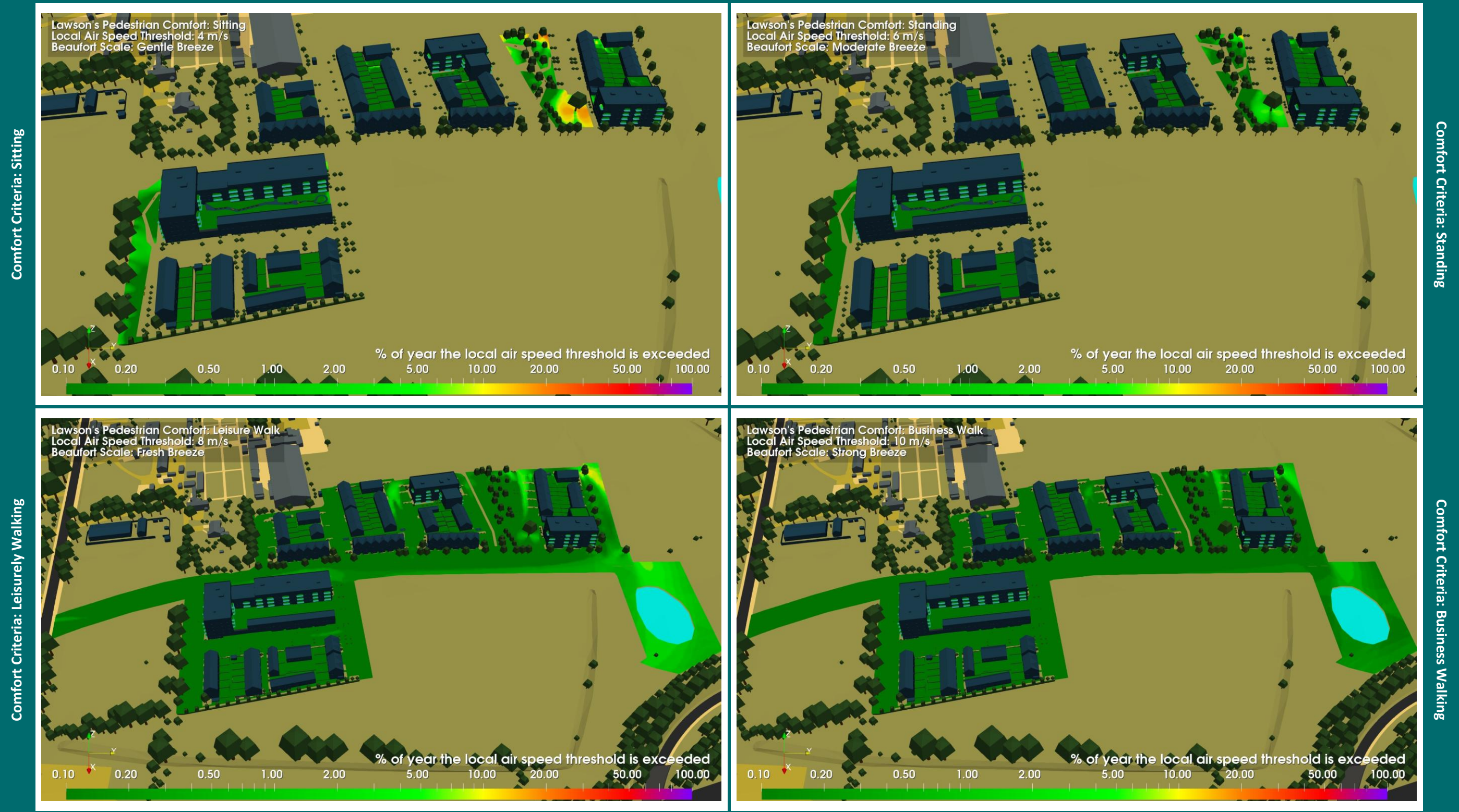


Figure 70: Comfort Criteria: View from the east

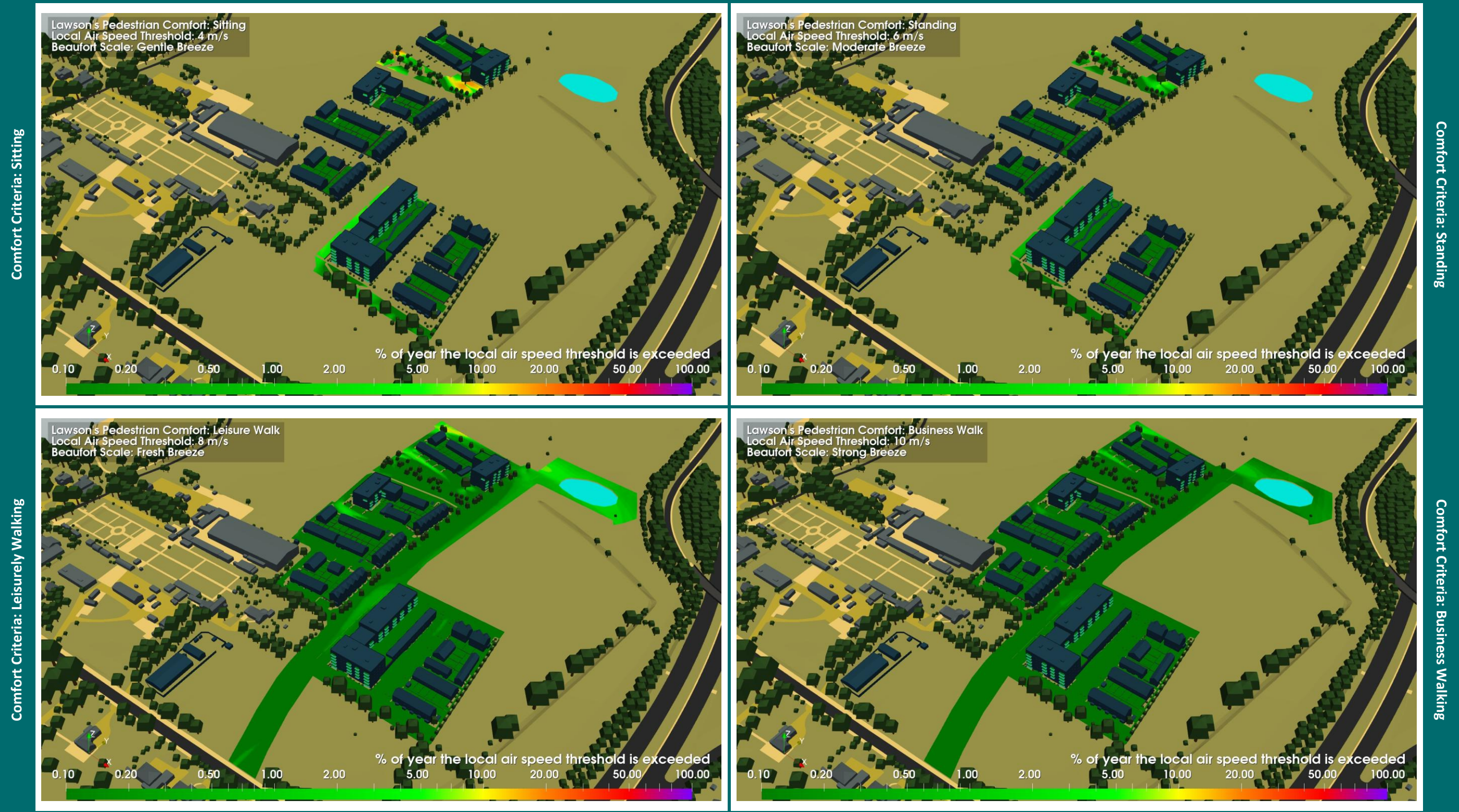


Figure 71: Comfort Criteria: View from the southeast

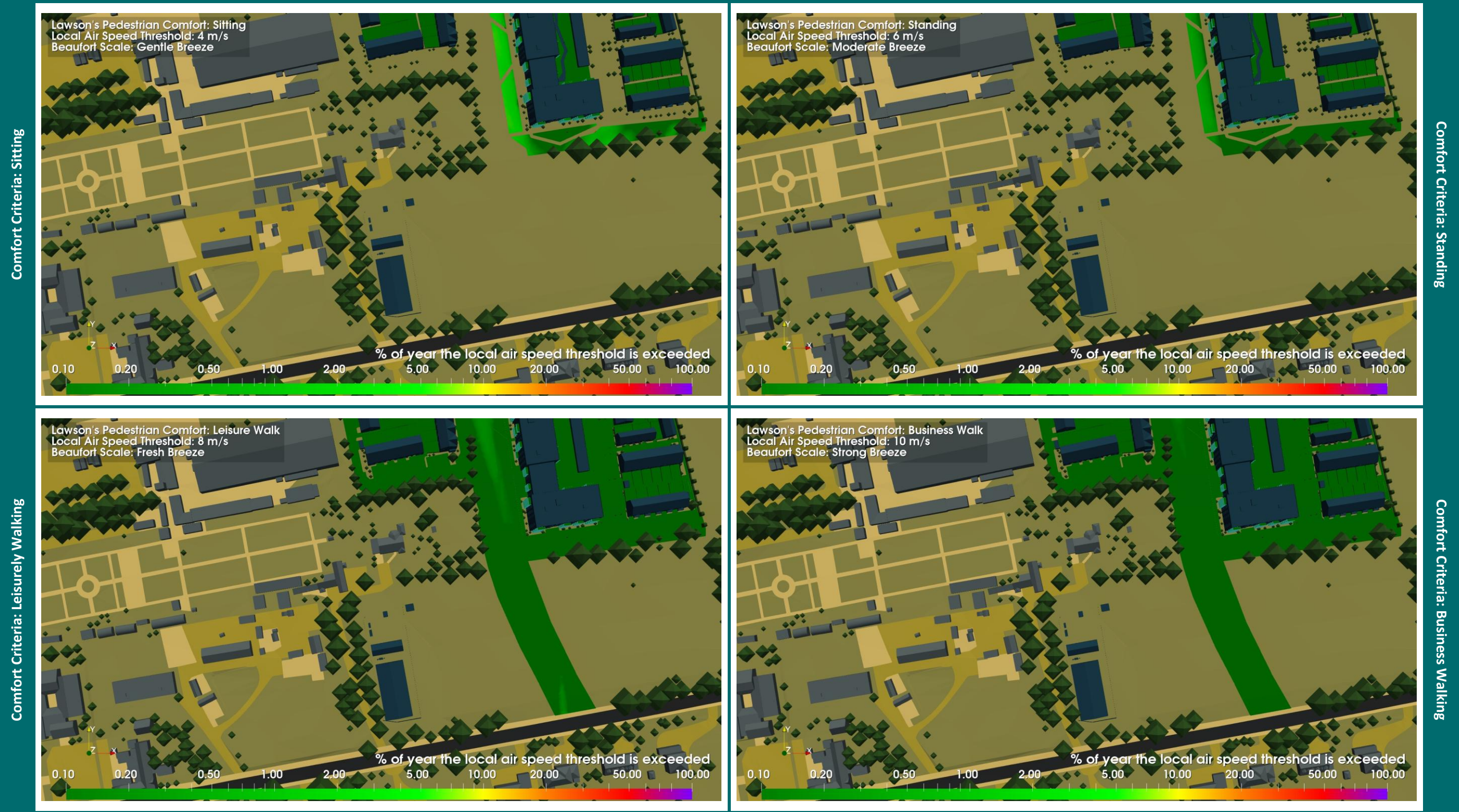


Figure 72: Comfort Criteria: Close view of the Pump station

10.2 Safety Criteria

[Figure 73](#) to [Figure 81](#) show the percentage of the year the hourly wind speed exceeds the threshold value for the safety criteria for all seasons. The threshold values are 20 m/s for a normal pedestrian and 15 m/s for a sensitive pedestrian.

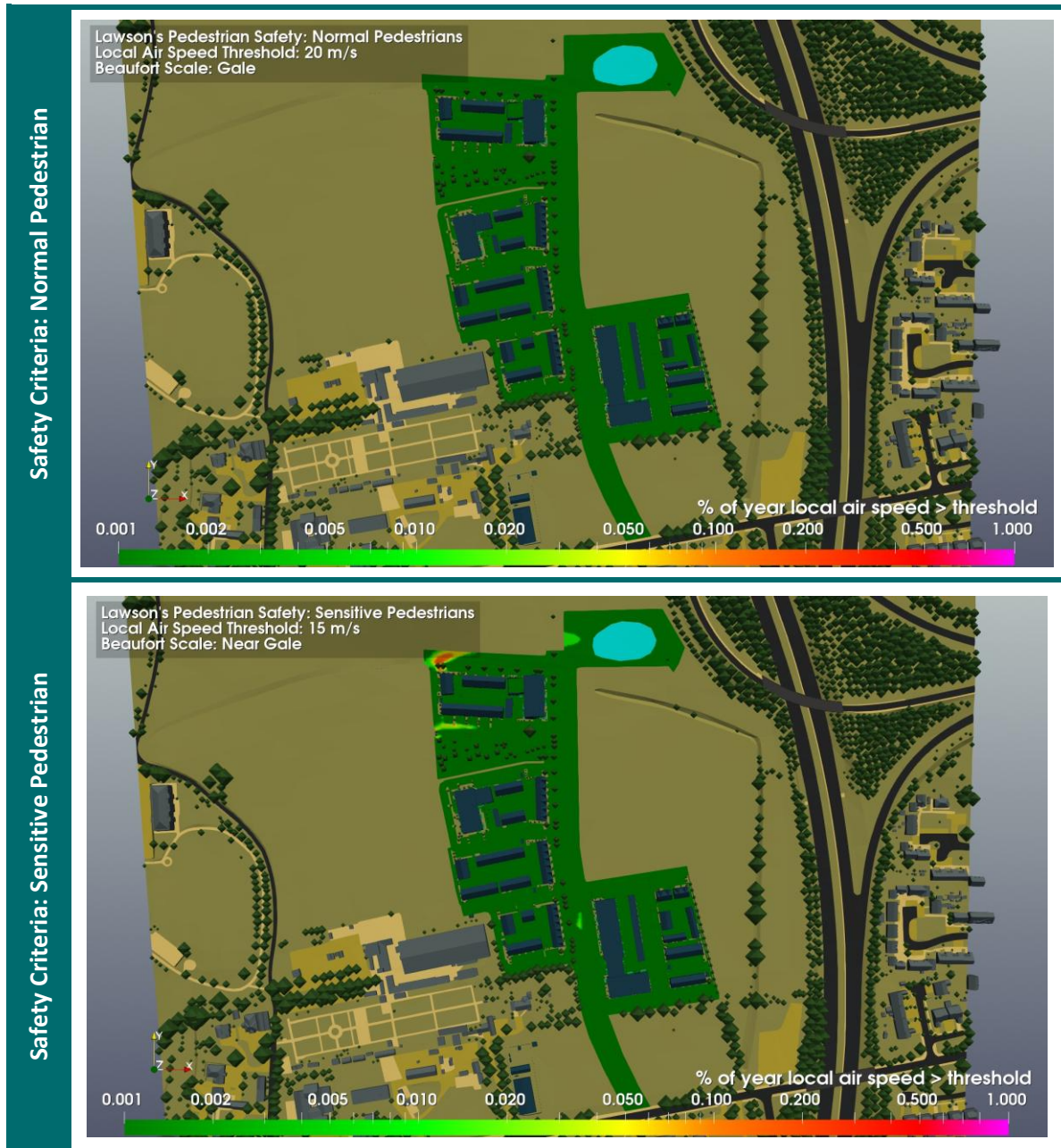


Figure 73: Safety Criteria: Plan view

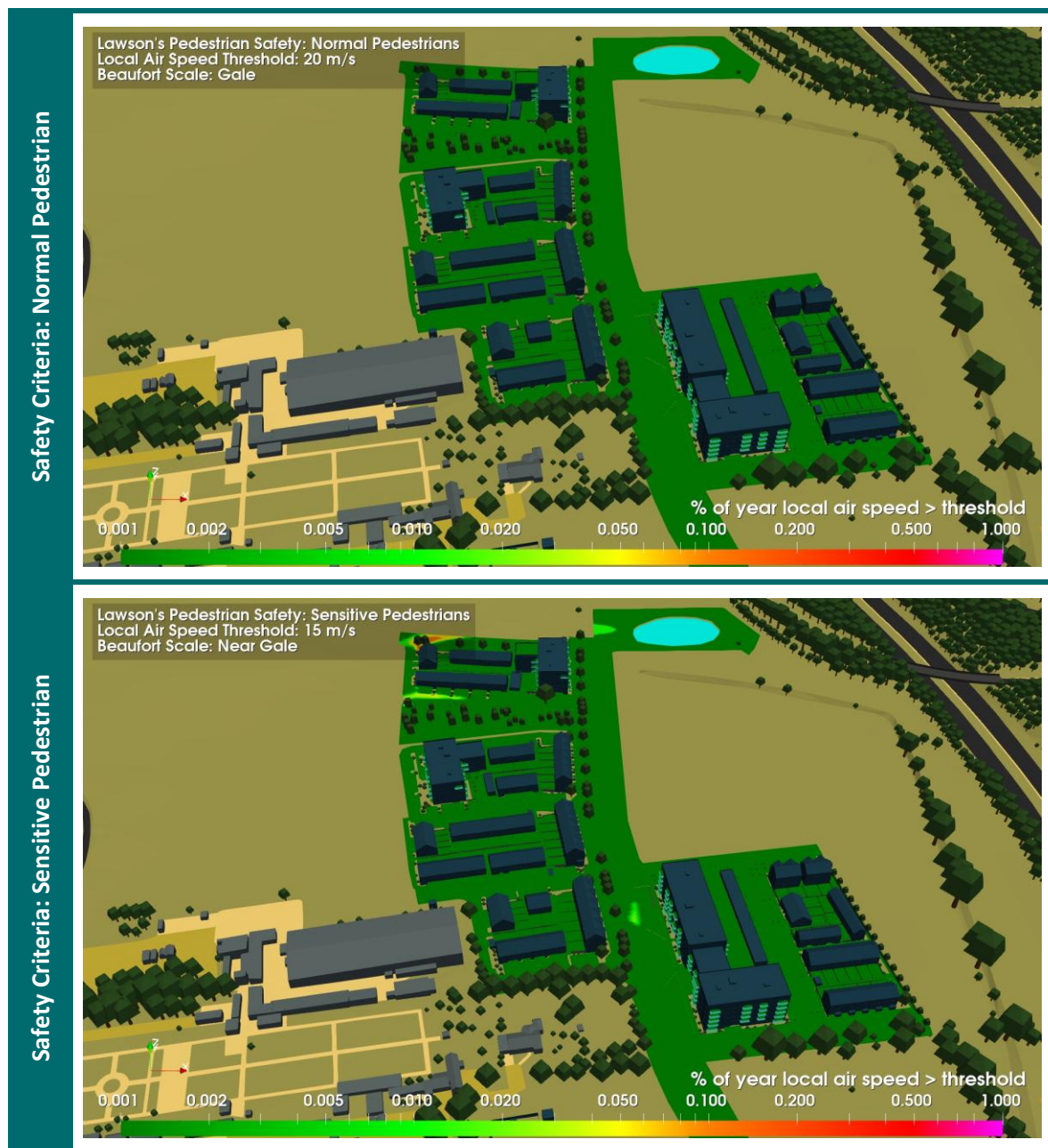


Figure 74: Safety Criteria: View from the south

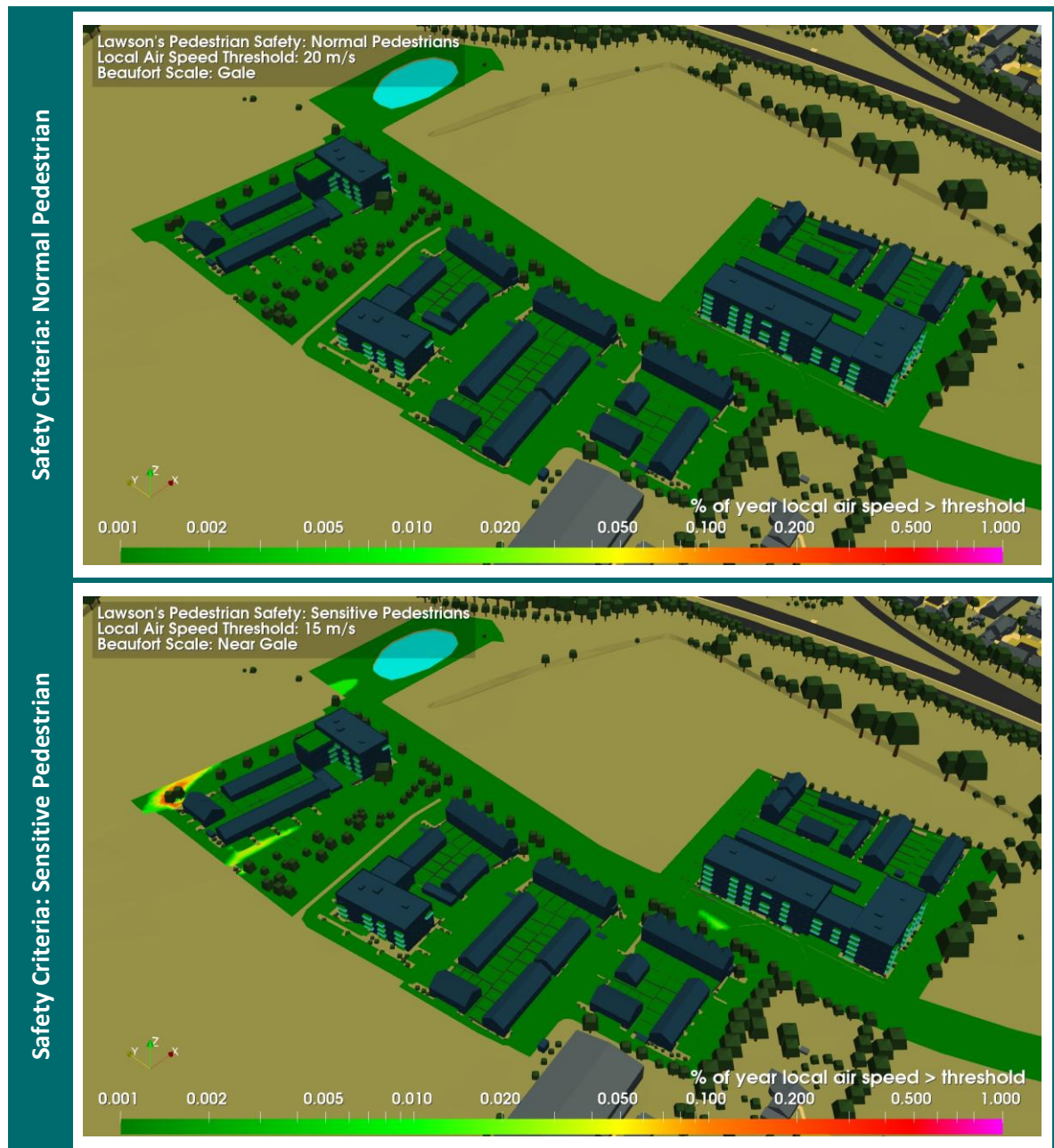


Figure 75: Safety Criteria: View from the southwest

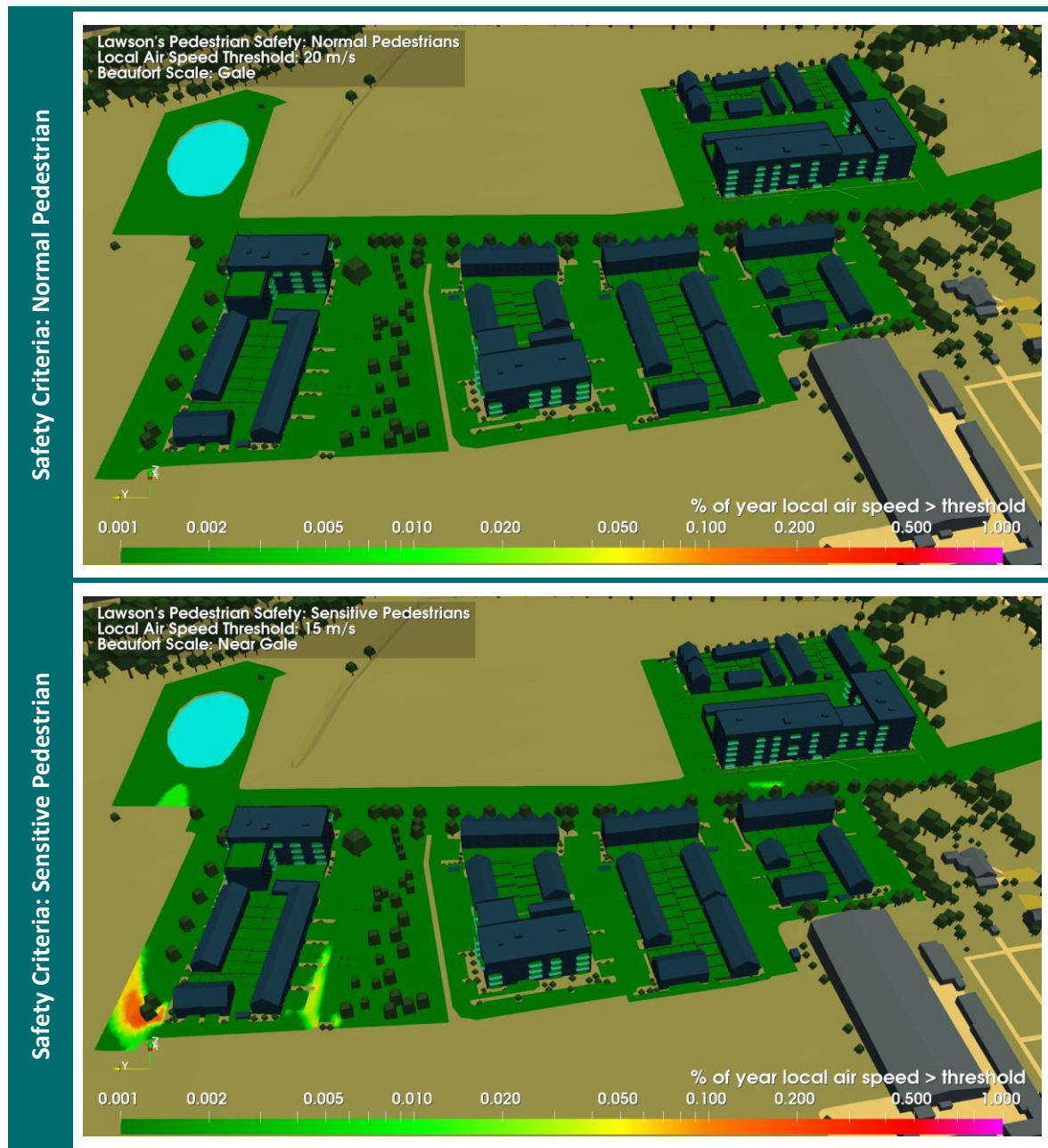


Figure 76: Safety Criteria: View from the west

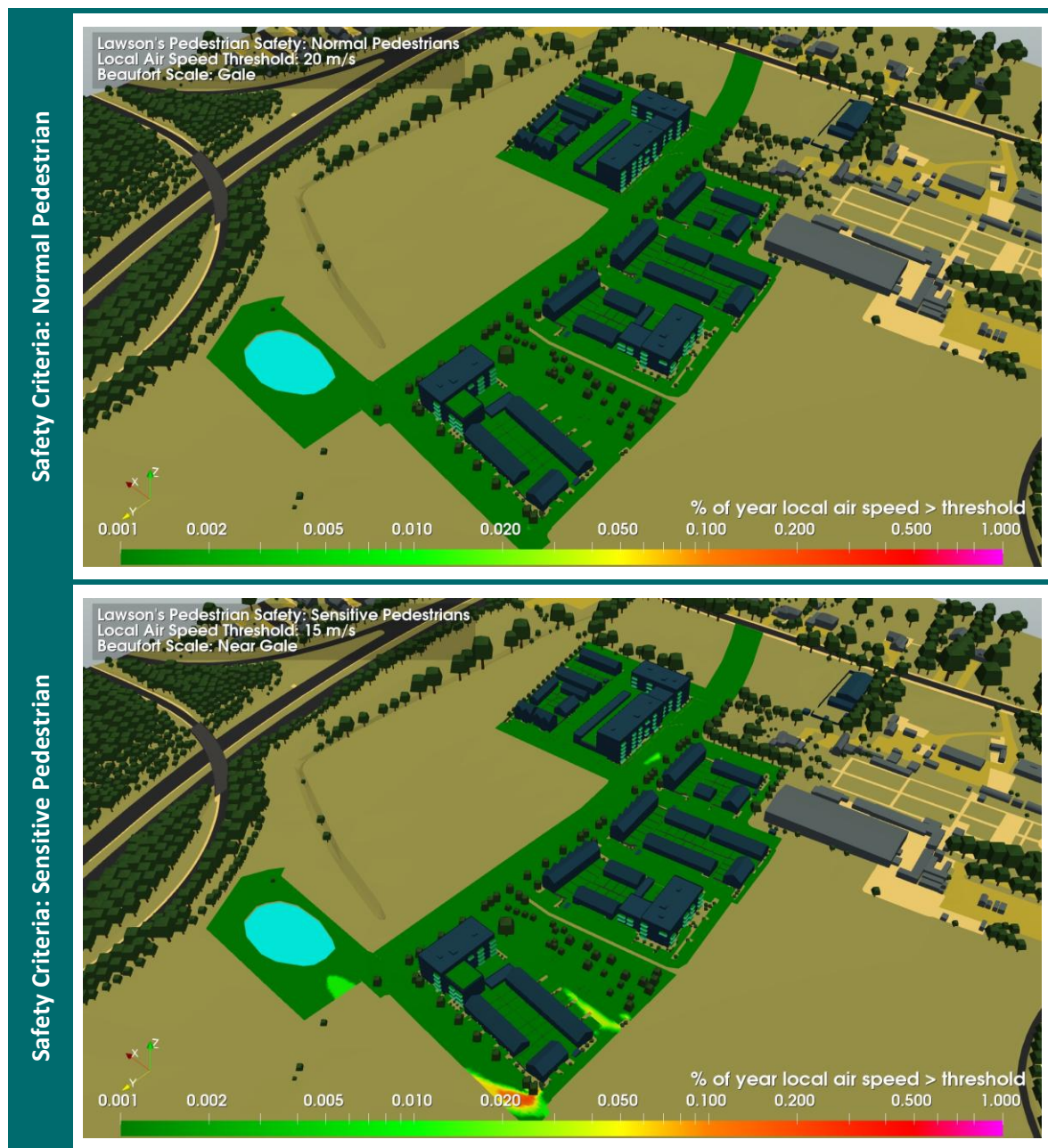


Figure 77: Safety Criteria: View from the northwest

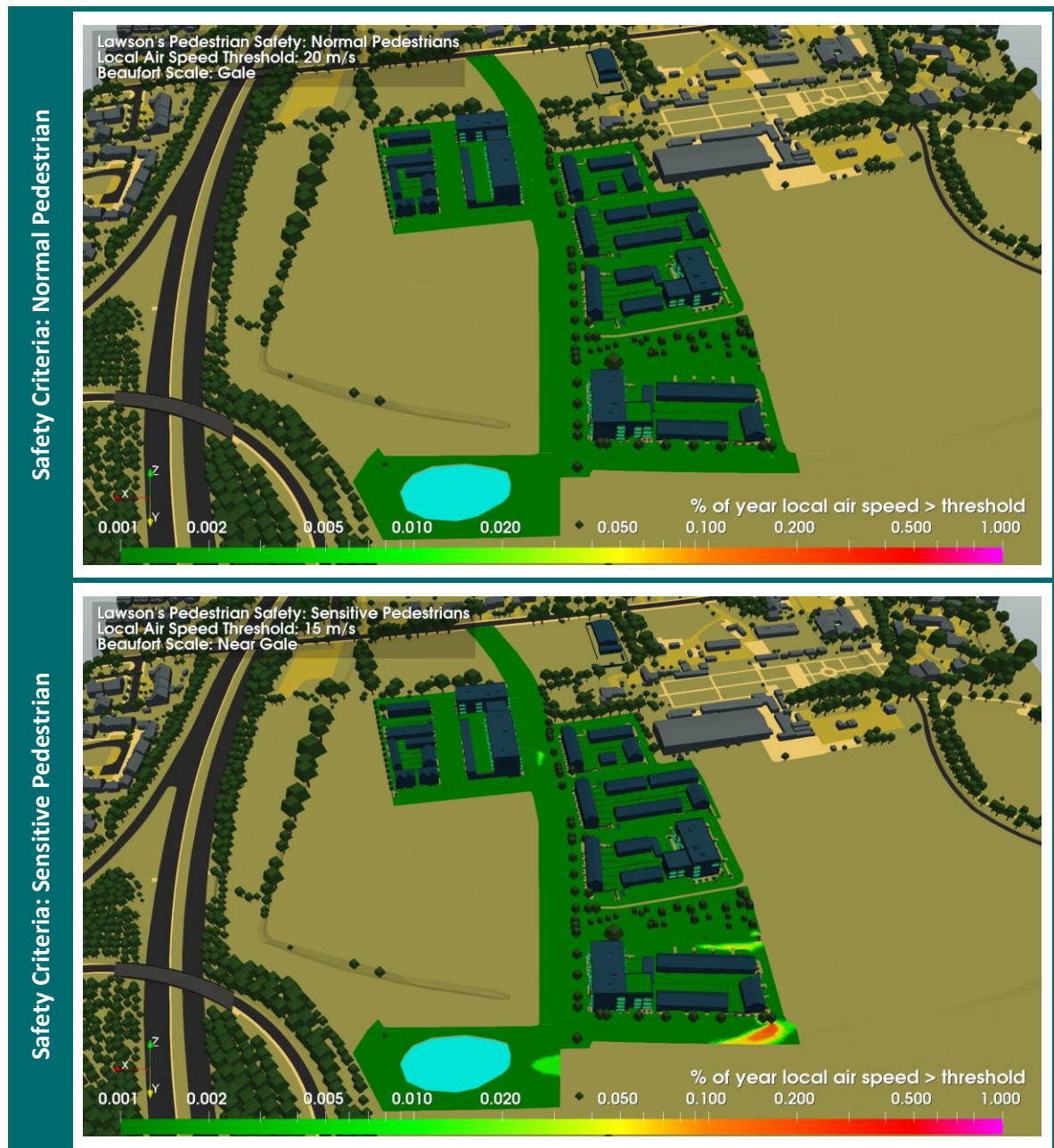


Figure 78: Safety Criteria: View from the north

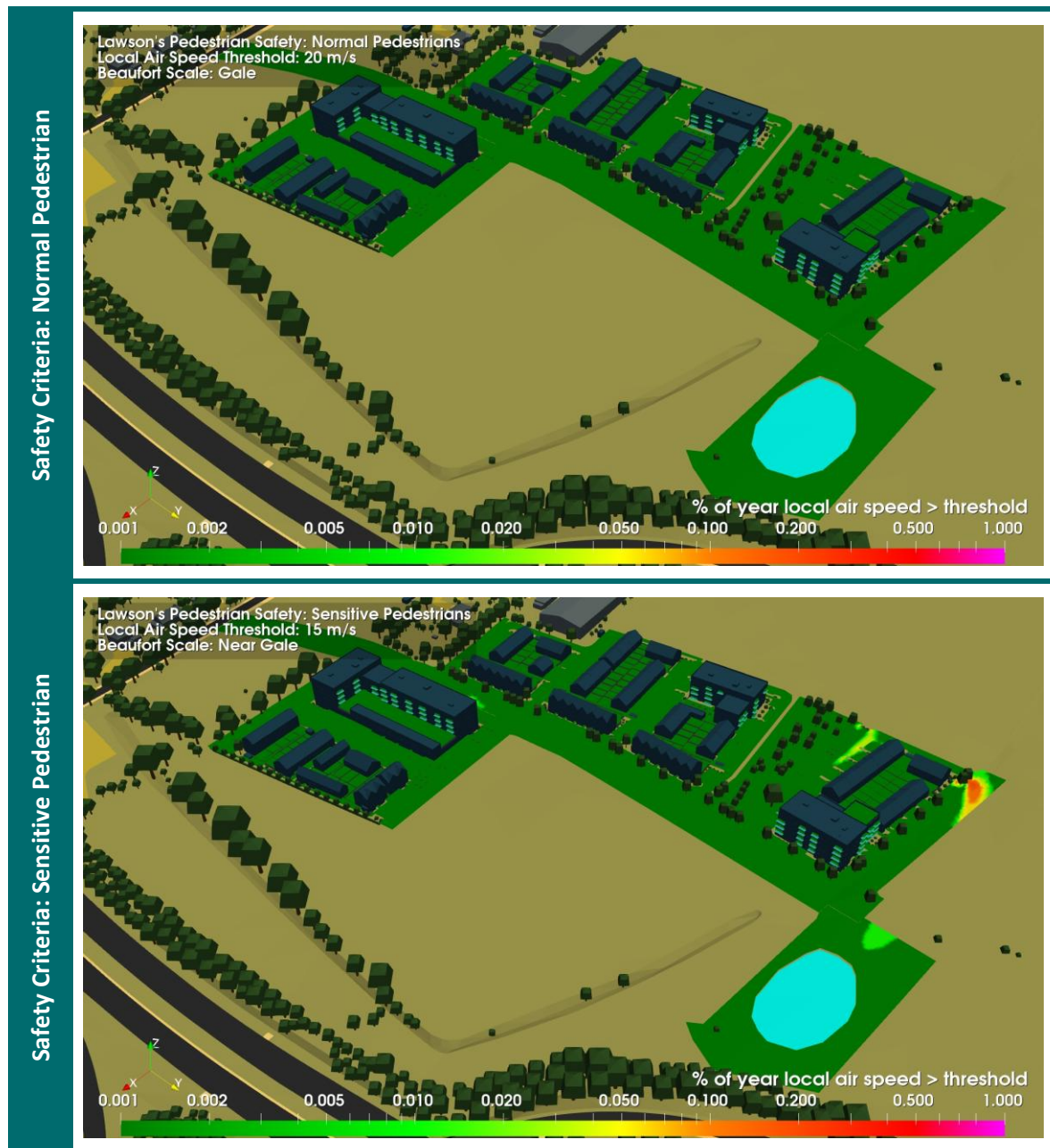


Figure 79: Safety Criteria: View from the northeast

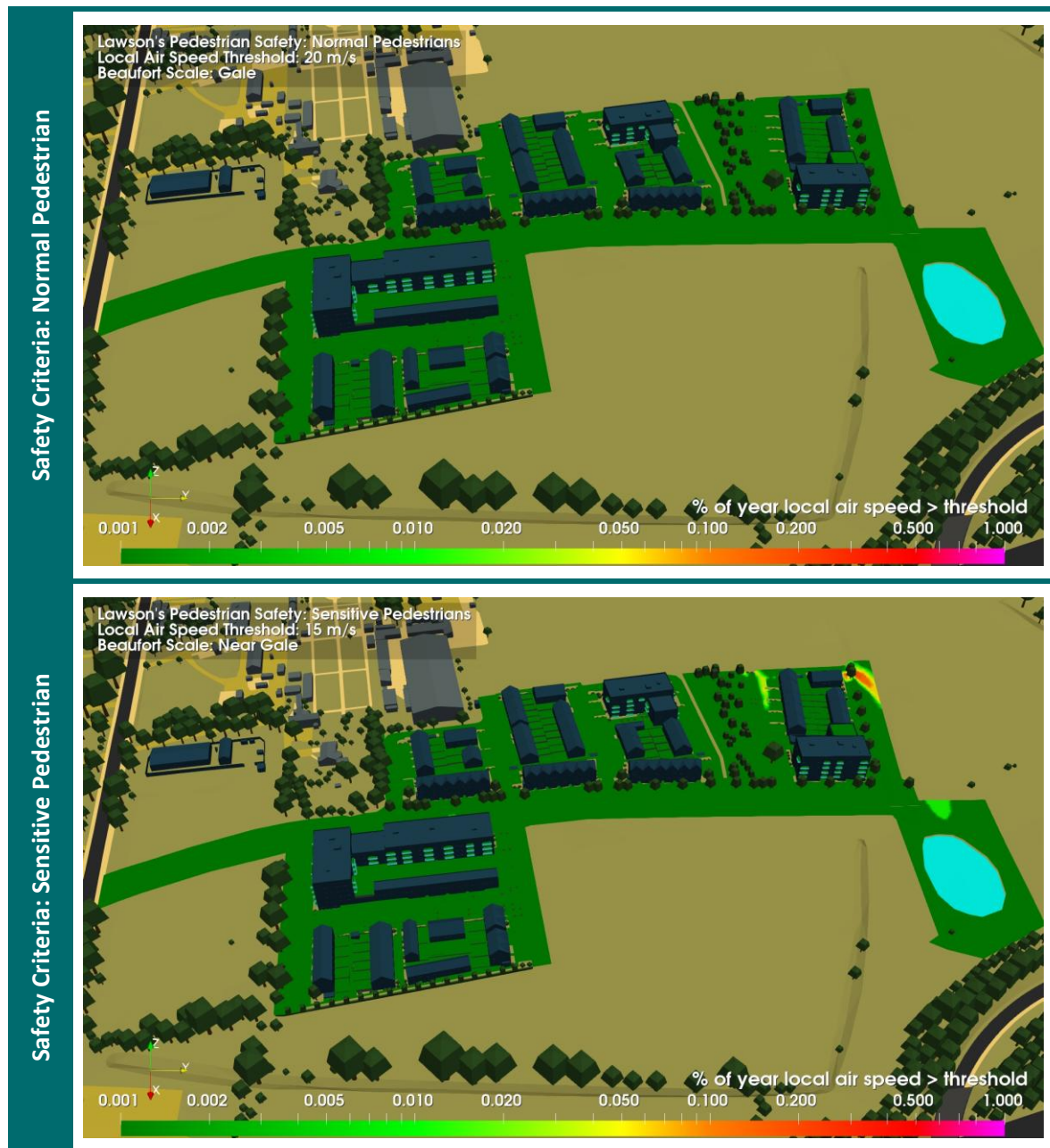


Figure 80: Safety Criteria: View from the east

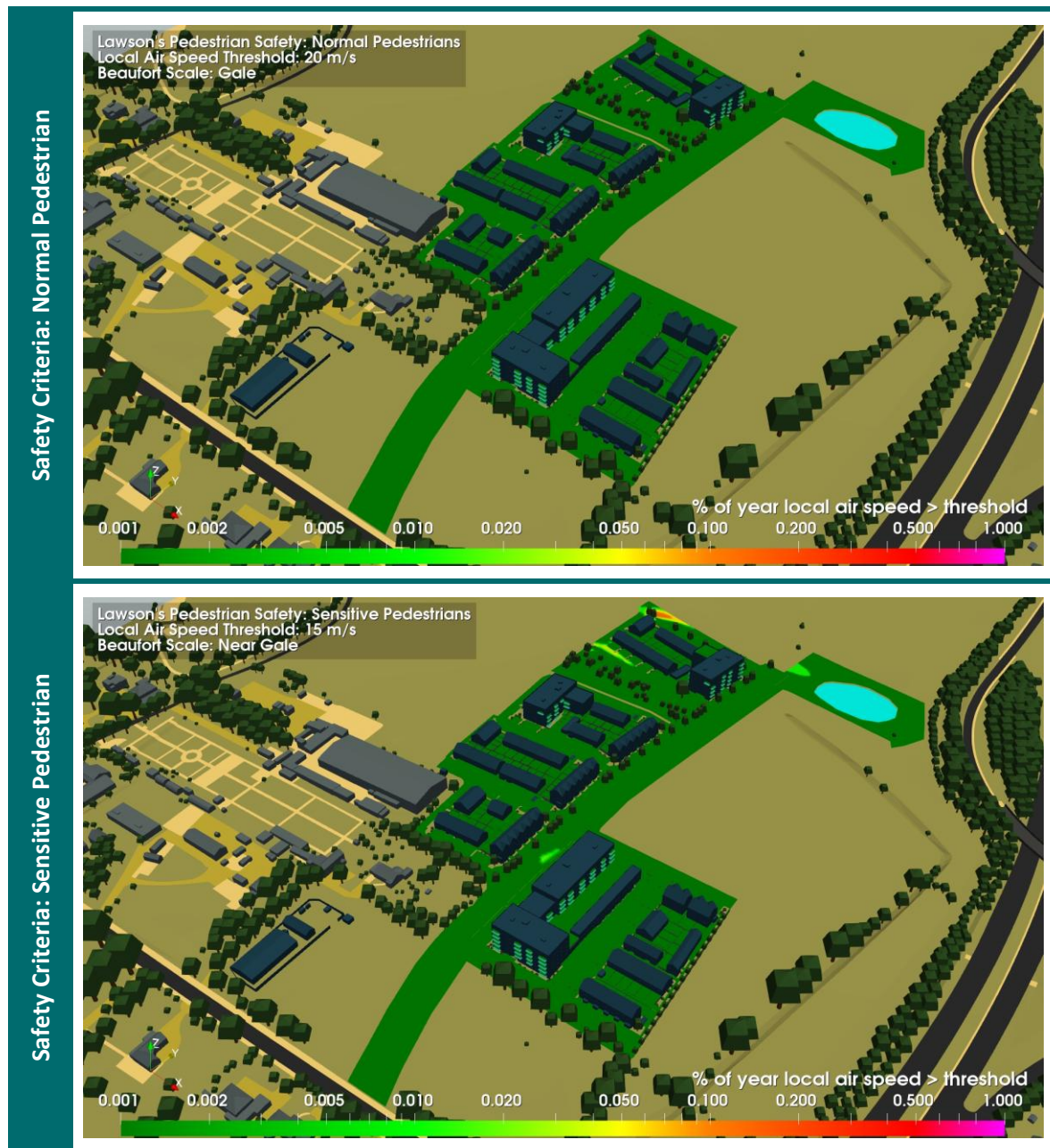


Figure 81: Safety Criteria: View from the southeast

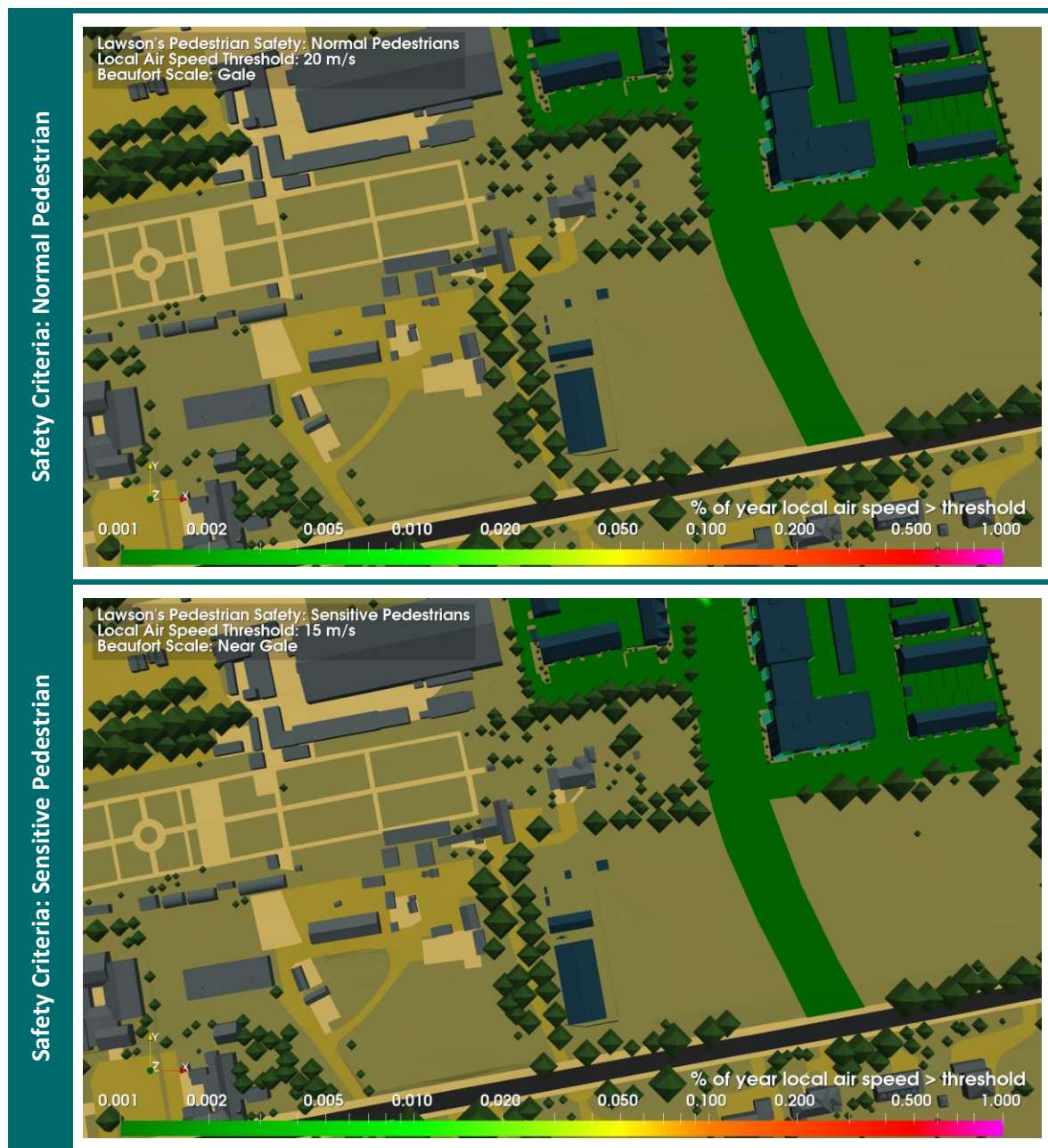


Figure 82: Safety Criteria: Close view of the Pump station

