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Date: December 16, 2022

To: Ms. Anissa Alami Merrouni
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Re: **Pedestrian Wind Assessment**
630 Montreal Road
Ottawa, Ontario
SLR Project #241.30241.00000

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1.0 INTRODUCTION

SLR Consulting (SLR) was retained by MB Groupe & Associées to conduct a pedestrian wind assessment for the 630 Montreal Road development in Ottawa, Ontario. This report is in support of the Site Plan Control (SPC) application for the development.

1.1 Existing Development

The proposed development is located at 630 Montreal Road, on the south side of Montreal Road, between Borthwick Avenue and Cummings Avenue. The site is currently occupied by an empty lot. Figure 1 provides an aerial view of the immediate study area. A virtual site visit was conducted by SLR using Google Earth images dated October 2020; some of these images are included in Figures 2a through 2d.

Immediately surrounding the site are low-rise commercial developments in all directions. Typically, developments with Site Plan Control approval and/or those currently under construction within a 500 radius are included as existing surroundings. For the current assessment, the following future developments were included: 765 Montreal Road, 603 Cummings Avenue, and 638 Center Street.

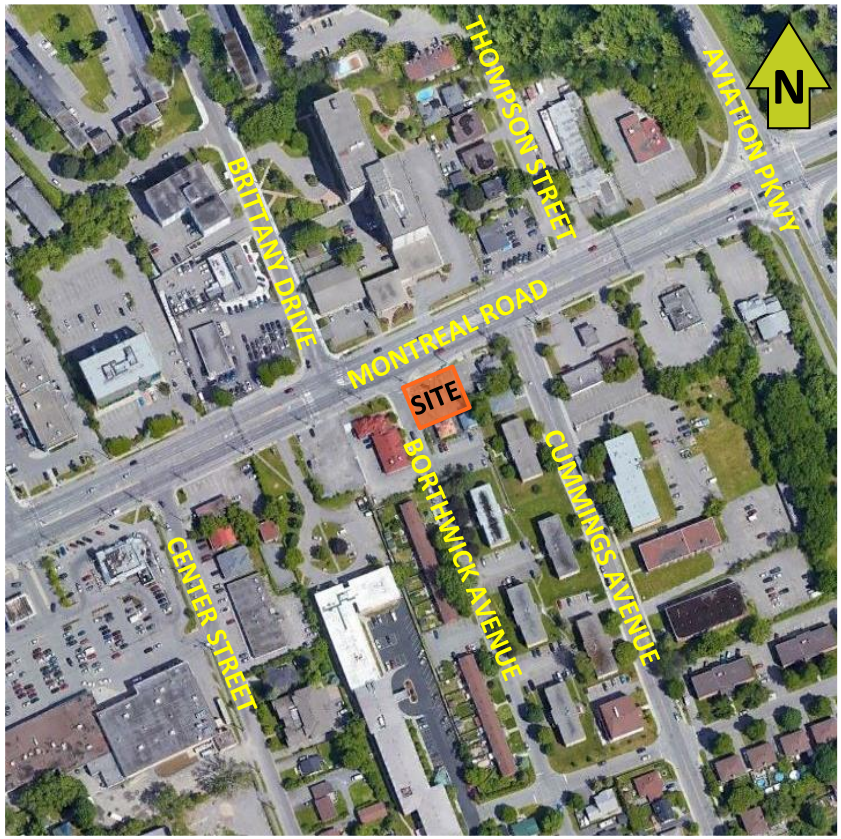


Figure 1: Aerial view of existing site & surroundings
Credit: Google Earth Pro, dated 06/08/2018

Figure 2a: Montreal Road looking east (site to the right)

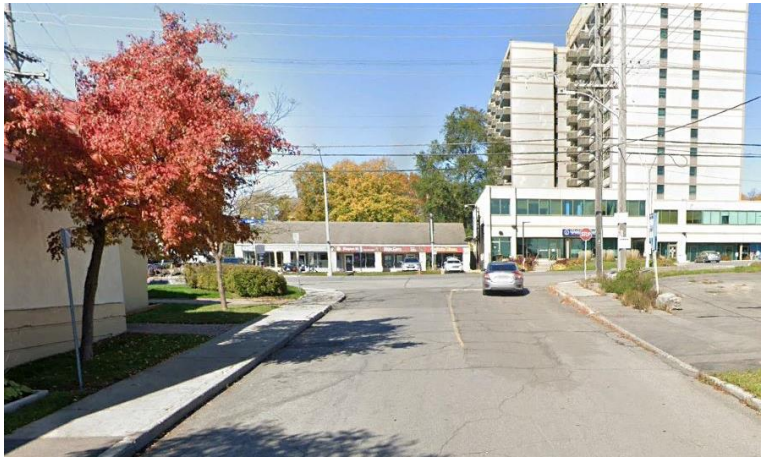


Figure 2b: Borthwick Avenue looking north (site to the right)

Figure 2c: Montreal Road looking west (site to the left)

Figure 2d: Montreal Road looking at site to the south

1.2 Proposed Development

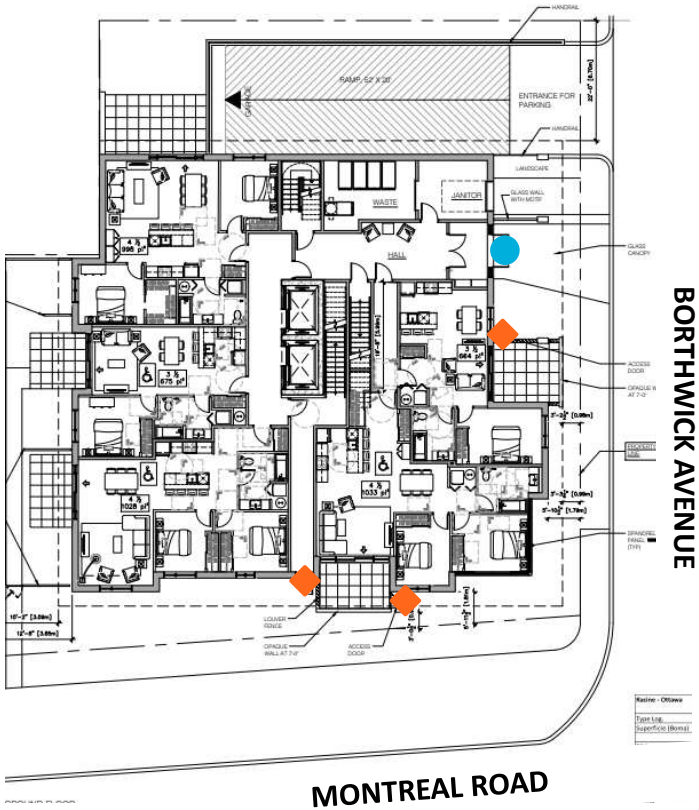
The proposed development is nine-storey tall and approximately 31m in height. The west elevation of the building is shown in Figure 3.

1.3 Areas of Interest

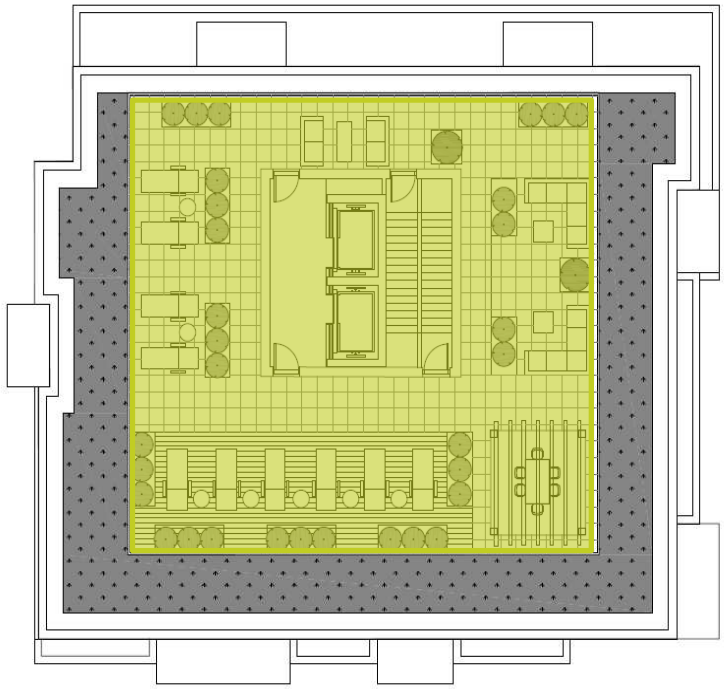
Areas of interest for pedestrian wind conditions include those areas which pedestrians are expected to use on a frequent basis. Typically these include sidewalks, main entrances, transit stops, plazas and parks. There are several transit stops along Montreal Road, Brittany Drive, Cummings Avenue and Borthwick Avenue in the vicnity of the development.

The main entrance of the proposed development is located on the west facade, along Borthwick Avenue. There are some secondary entrances and exits along the north and west facades. Amenity space associated with the new development is located at the rooftop, as shown in Figure 4.

Figure 3: West Elevation of Proposed Development
Credit: Caroline Denommeee Architects Inc.



Ground Floor Plan



Roof Terrace

LEGEND

- Main Entrance
- Secondary Entrance / Exit
- Outdoor Amenity Space

Figure 4: Areas of Interest

2.0 APPROACH

A screening-level assessment was conducted using computational fluid dynamics (CFD). As with any simulation, there are some limitations with this modeling technique, specifically in the ability to simulate the turbulence, or gustiness, of the wind. Nonetheless, CFD analysis remains a useful tool to identify potential wind issues, especially when assessing mean wind speeds. This CFD-based mean wind speed assessment employs a comparable analysis methodology to that used in wind tunnel testing. The results of CFD modeling are also an excellent means of readily identifying relative changes in wind conditions associated with different site configurations or with alternative built forms.

2.1 Methodology

Wind comfort conditions for areas of interest were predicted on and around the development site to identify potentially problematic windy areas. A 3D model of the proposed development as well as floor plans and elevations were provided by Caroline Denommeee Architects Inc. on July 5 and 12th, 2021. A view of the 3D model used in the computer wind comfort analysis is shown in **Figure 5**. This model included surrounding buildings within 500 m from the study site centre. The simulations were performed using CFD software by Meteodyn Inc.

The entire 3D space throughout the modeled area is filled with a three-dimensional grid. The CFD virtual wind tunnel calculates wind speed at each one of the 3D grid points. The upstream "roughness" for each test direction is adjusted to reflect the various upwind conditions and wind characteristics encountered around the actual site. Wind flows for a total of 16 compass directions were simulated. Although wind speeds are calculated throughout the entire modeled area, wind comfort conditions were only plotted for a smaller area immediately surrounding the proposed development.

Wind flows were predicted for both the existing site, as well as with the proposed development for comparison purposes. The CFD-predicted wind speeds for all test directions and grid points were then combined with historical wind climate data for the region to predict the occurrence of wind speeds in the pedestrian realm, and to compare against wind criteria for comfort and safety; these results are shown in the various wind flow images. The analysis of wind conditions is undertaken for four seasons: Winter (January to March), Spring (April to June), Summer (July to September), and Autumn (October to December). However, only the seasonal extremes of summer and winter are discussed within the report. The results of the analysis for spring and autumn can be found in **Appendix A**.

Results are presented through discussion of the wind conditions along major streets and the areas of interest. The comfort criteria are based on predictions of localized wind forces combined with frequency of occurrence. Climate issues that influence a person's overall "thermal" comfort, (e.g., temperature, humidity, wind chill, exposure to sun or shade, etc.) are not considered in the comfort rating.

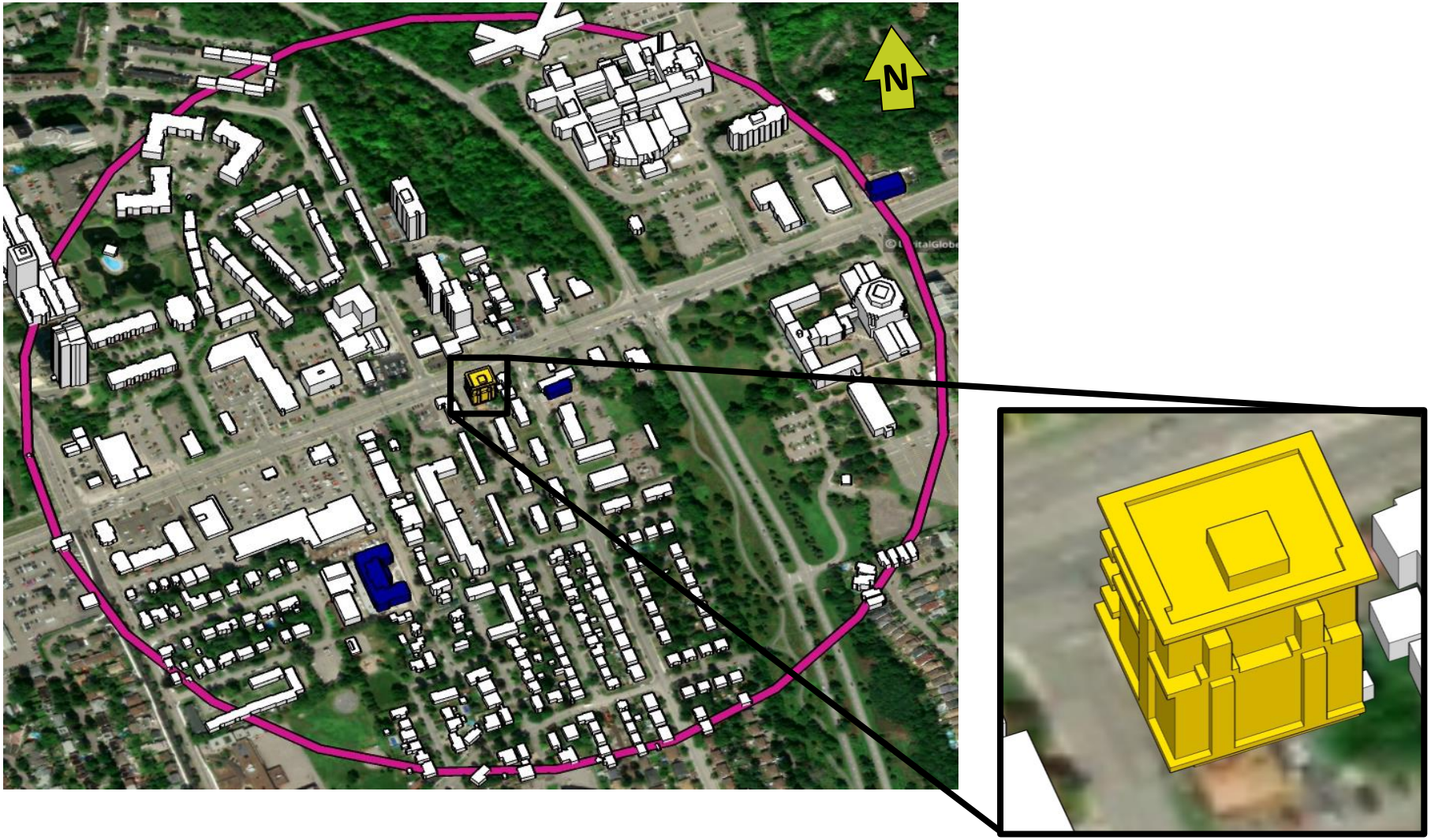


Figure 5: Massing Model

2.2 Wind Climate

Wind data recorded at Ottawa MacDonald-Cartier International Airport for the period of 1991 to 2020 were obtained and analysed to create a wind climate model for the region. Annual and seasonal wind distribution diagrams ("wind roses") are shown in Figure 6. These diagrams illustrate the percentage of time wind blows from the 16 main compass directions. Of main interest are the longest peaks that identify the most frequently occurring wind directions. The annual wind rose indicates that wind approaching from the southwest through northwest directions are most prevalent, with secondary winds from the northeast. The seasonal wind roses readily show how the prevalent winds shift throughout the year.

The directions from which stronger winds (e.g., > 30 km/h) approach are also of interest as they have the highest potential of creating problematic wind conditions, depending upon site exposure and the building configurations. The wind roses in Figure 6 also identify the directional frequency of these stronger winds, as indicated in the figure's legend colour key. On an annual basis, strong winds occur from the west-northwest, west and northwest directions. All wind speeds and directions were included in the wind climate model.

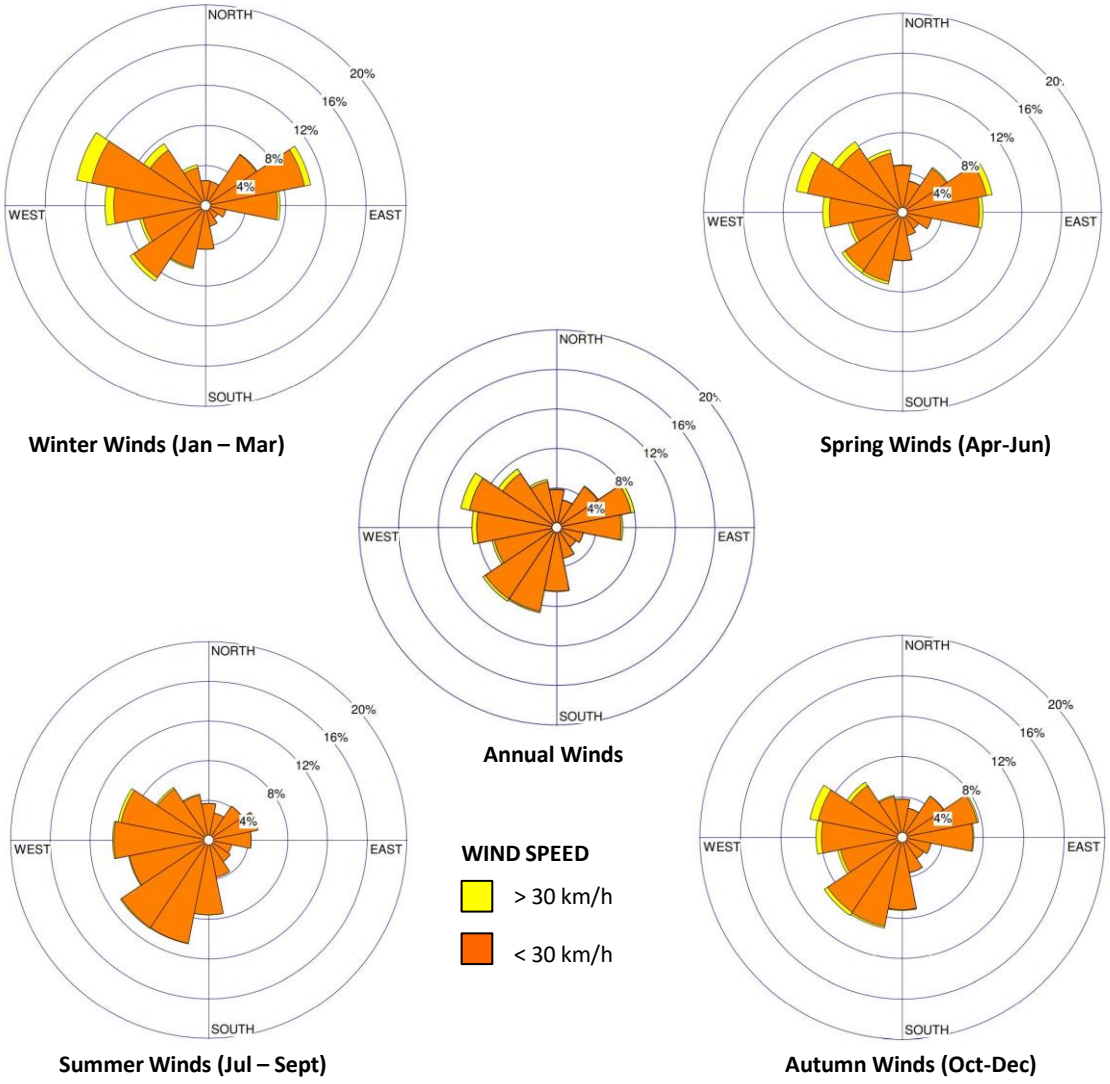


Figure 6: Wind Roses for Ottawa MacDonald-Cartier International Airport (1991-2020)

3.0 PEDESTRIAN WIND CRITERIA

Wind comfort conditions are discussed in terms of being acceptable for certain pedestrian activities and are based on predicted wind force and the expected frequency of occurrence. Wind chill, clothing, humidity and exposure to direct sun, for example, all affect a person's thermal comfort; however, these influences are not considered in the wind comfort criteria.

The criteria utilized for this analysis is provided by the City of Ottawa, in the document *Terms of Reference – Wind Analysis* The comfort criteria, which is based on certain predicted hourly gust-equivalent mean (GEM) wind speeds being exceeded 20% of the time, are summarized in **Table 1**. By allowing for a 20% exceedance, it assumes wind speeds will be comfortable for the corresponding activity at least four out of five days. The comfort criteria consider only daytime hours, between 6:00am and 11:00pm. GEM is defined as the maximum mean wind speed or the gust wind speed divided by 1.85.

The criterion for wind safety in the table is based on hourly gust wind speeds that are exceeded nine hours per year (approximately 0.1% of the time). When more than one event is predicted annually, wind mitigation measures are then advised. The wind safety criterion is shown in **Table 2**.

Table 1: Wind Comfort Criteria

Activity	Comfort Ranges for GEM Wind Speed Exceeded 20% of the Time		Description of Wind Comfort
Sitting	0 to 10 km/h	0 to 2.8 m/s	Calm or light breezes desired for outdoor restaurants and seating areas where one can read a paper comfortably.
Standing	0 to 14 km/h	0 to 3.9 m/s	Gentle breezes suitable for main building entrances and transit stops.
Strolling	0 to 17 km/h	0 to 4.7 m/s	Moderate breezes suitable for walking along pedestrian thorough fares.
Walking	0 to 20 km/h	0 to 5.6 m/s	Strong breezes that can be tolerated if one's objective is to walk, run or cycle without lingering.
Uncomfortable	> 20 km/h	> 5.6 m/s	Strong winds of this magnitude are considered a nuisance for most activities, and wind mitigation is typically recommended.

Table 2: Wind Safety Criterion

Activity	Safety Criterion Gust Wind Speed Exceeded Once Per Year (0.1%)		Description of Wind Effects
Any	90 km/h	25 m/s	Excessive gust speeds that can adversely affect a pedestrian's balance and footing. Wind mitigation is typically required.

4.0 RESULTS

Figures 7a through 10b present graphical images of the wind comfort conditions for the summer and winter months around the proposed development. The "comfort zones" shown are based on an integration of wind speed and frequency for all 16 wind directions tested with the seasonal wind climate model. The assessment does not account for the presence of mature trees, thus wind comfort conditions for months when foliage is present could be better than those predicted.

Appendix A includes graphical images of the annual wind safety for the Existing and Proposed Configurations. Appendix B includes vertical slices of the wind flows around the building.

There are generally accepted wind comfort levels that are desired for various pedestrian uses. For example, for public sidewalks, wind comfort suitable for walking would be desirable year-round. For main entrances and transit stops, wind conditions conducive to standing would be preferred throughout the year but can be difficult to achieve in regions where winter winds are inherently harsh. For amenity spaces, wind conditions suitable for sitting and/or standing are generally desirable during the summer months. The most stringent category of sitting is considered appropriate for cafes and dedicated seating areas, while for parks sitting and/or standing would be appropriate in the summer.

4.1 Building Entrances & Walkways

Existing wind conditions on the site are expected to be comfortable for sitting throughout the year (Figures 7a and 8a).

For the Proposed Configuration, wind conditions are generally predicted to be similar to the existing conditions. The exceptions are expected at the northeast and southwest corners of the proposed development, where wind conditions are predicted to be comfortable for standing in the winter season. Wind conditions near the main entrance and at all secondary entrances and exits are predicted to be comfortable for sitting year-round. These wind conditions are considered suitable for the intended use (Figures 7b, 8b, 9a and 9b).

4.2 Amenity Rooftop Terrace

In the Proposed Configuration, wind conditions on the rooftop terrace are expected to be comfortable for sitting or standing in the summer (Figure 9a). During the winter, wind conditions are anticipated to be suitable for leisurely walking or better(Figure 9b). If the terrace is to be used during the winter months, then we recommend adding tall screens (i.e,. minimum 2.2 m) along the edges of the terrace.

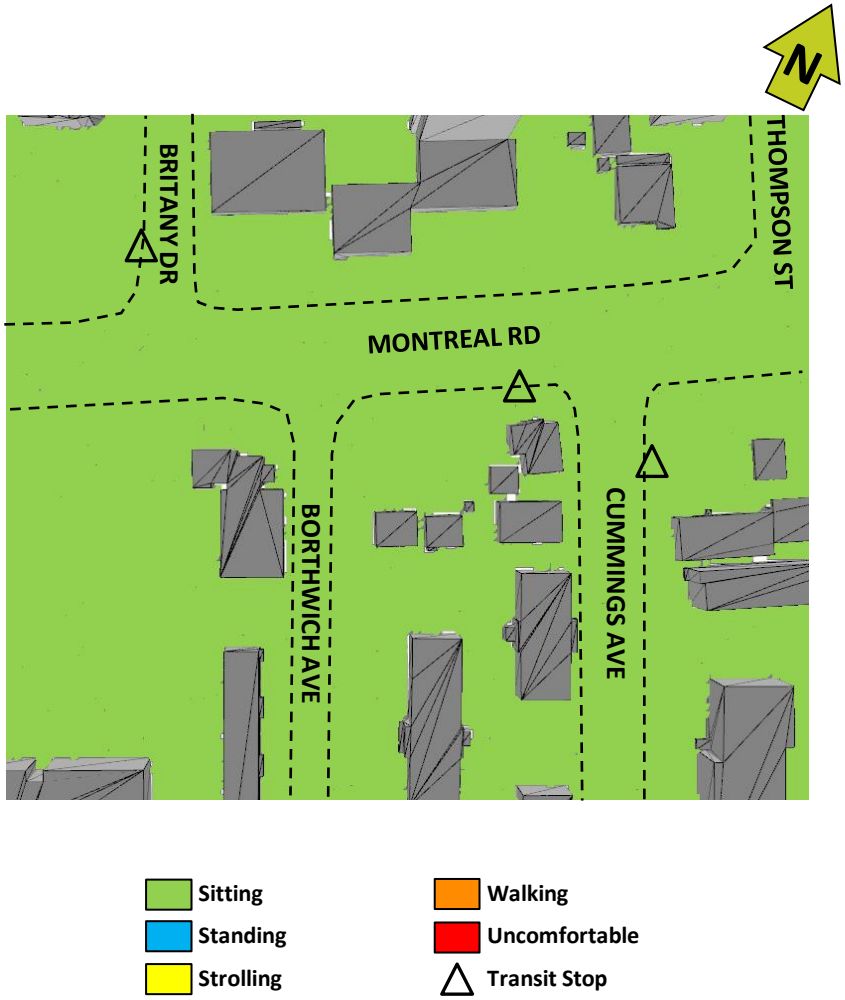


Figure 7a: Existing Configuration – Pedestrian Wind Comfort – Summer

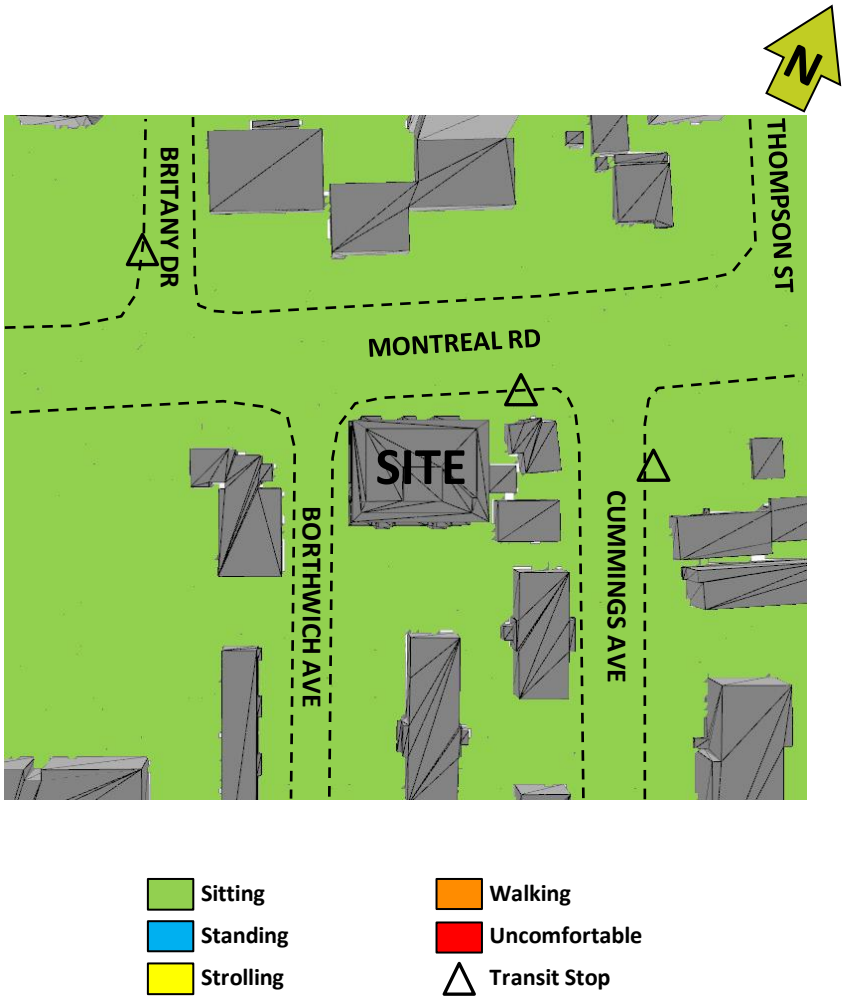


Figure 7b: Proposed Configuration – Pedestrian Wind Comfort – Summer

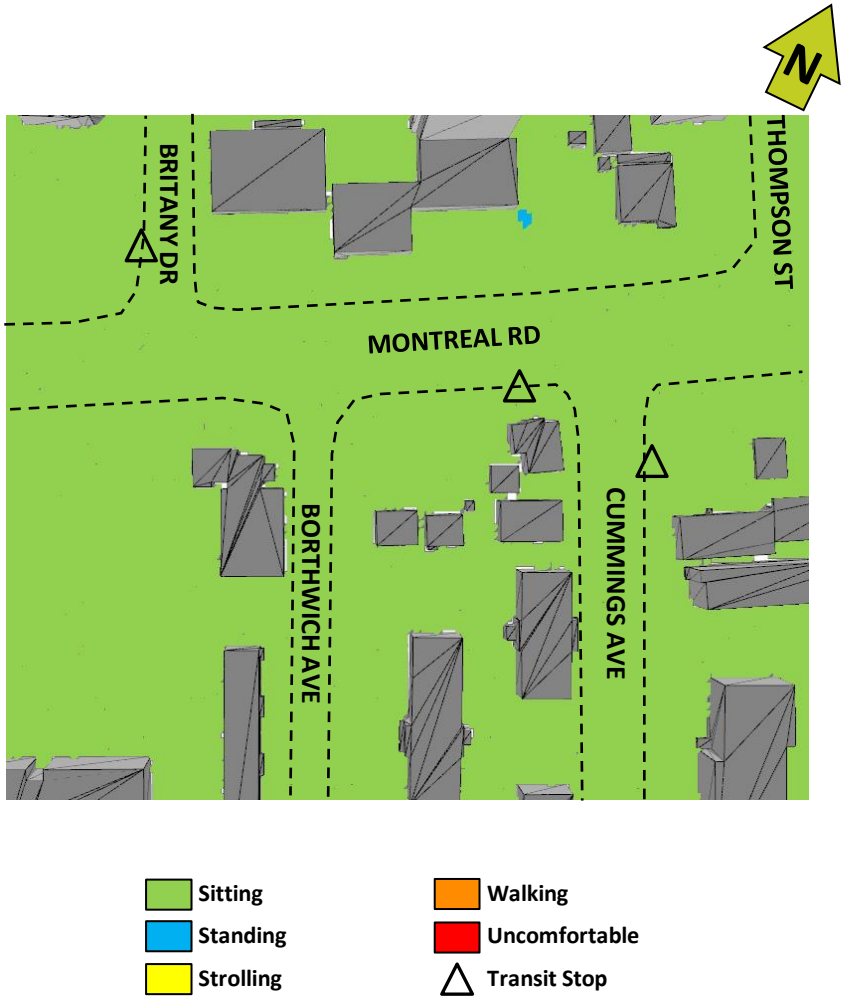


Figure 8a: Existing Configuration – Pedestrian Wind Comfort – Winter

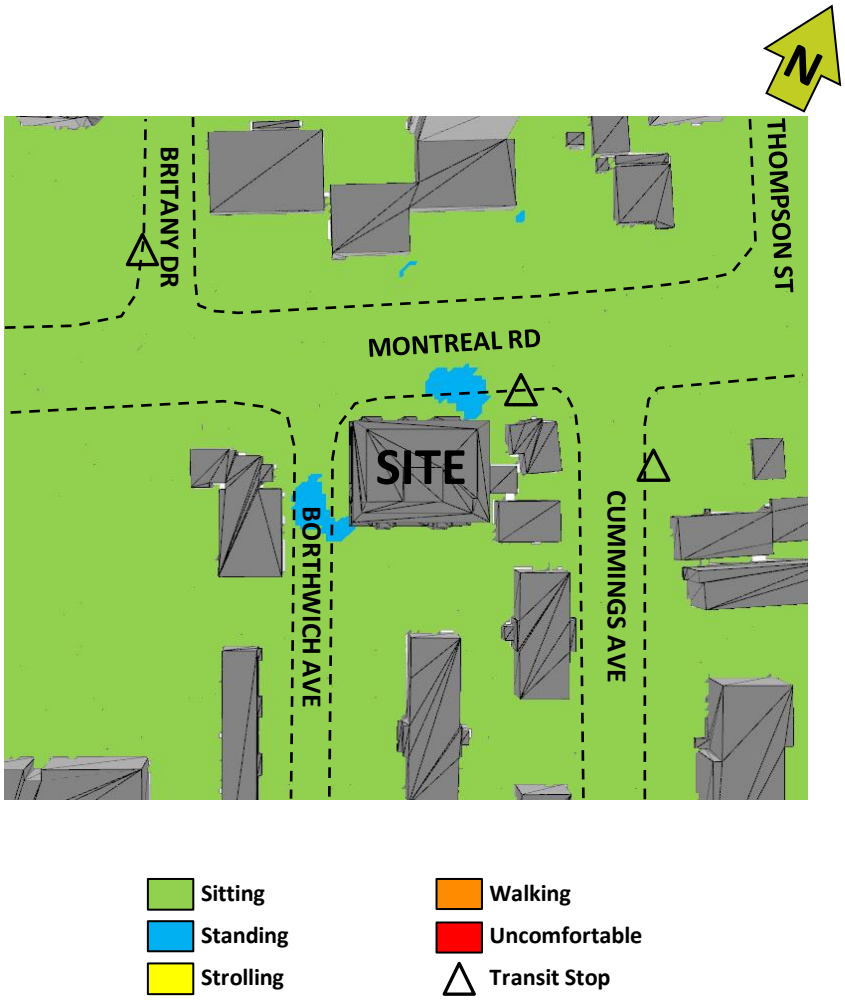


Figure 8b: Proposed Configuration – Pedestrian Wind Comfort – Winter

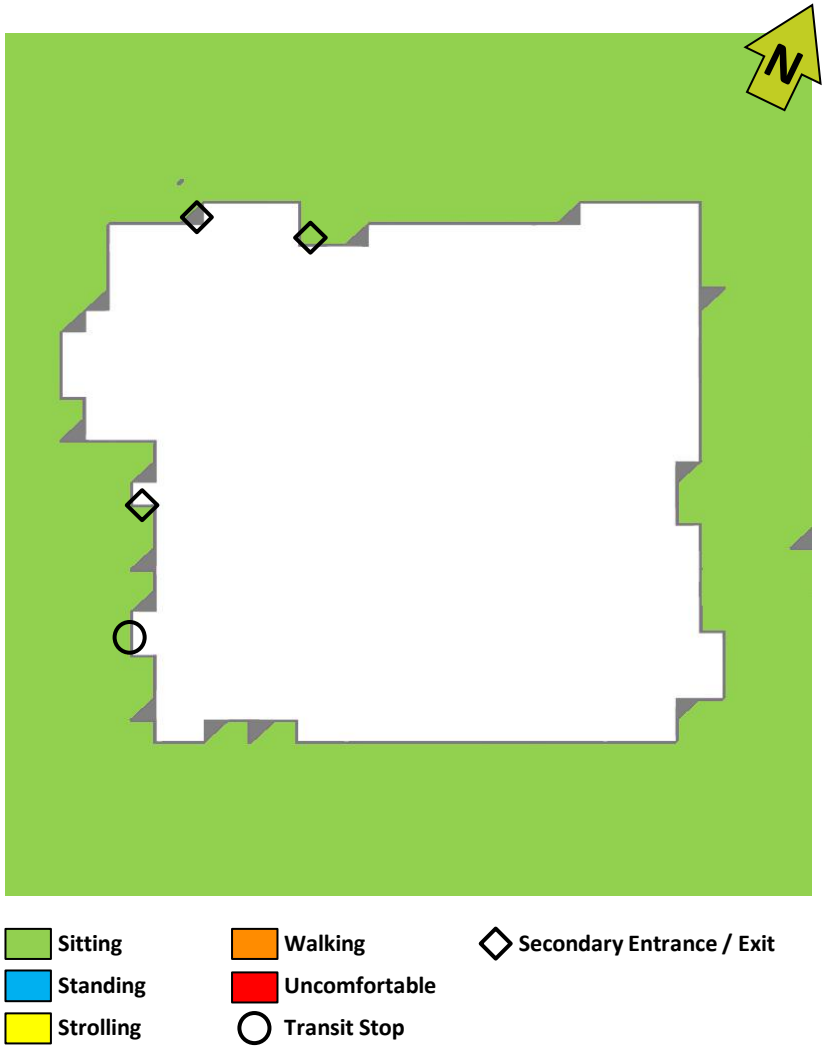


Figure 9a: Proposed Configuration – Pedestrian Wind Comfort – At Grade – Summer

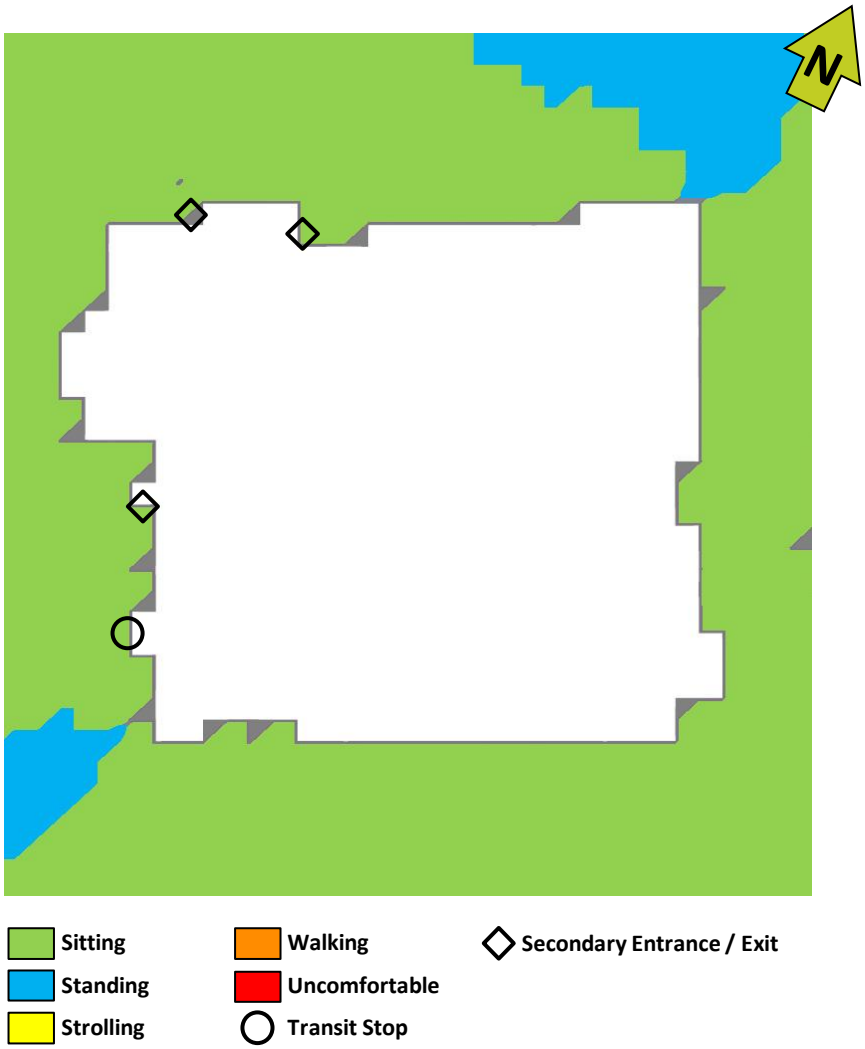


Figure 9b: Proposed Configuration – Wind Comfort – At Grade – Winter

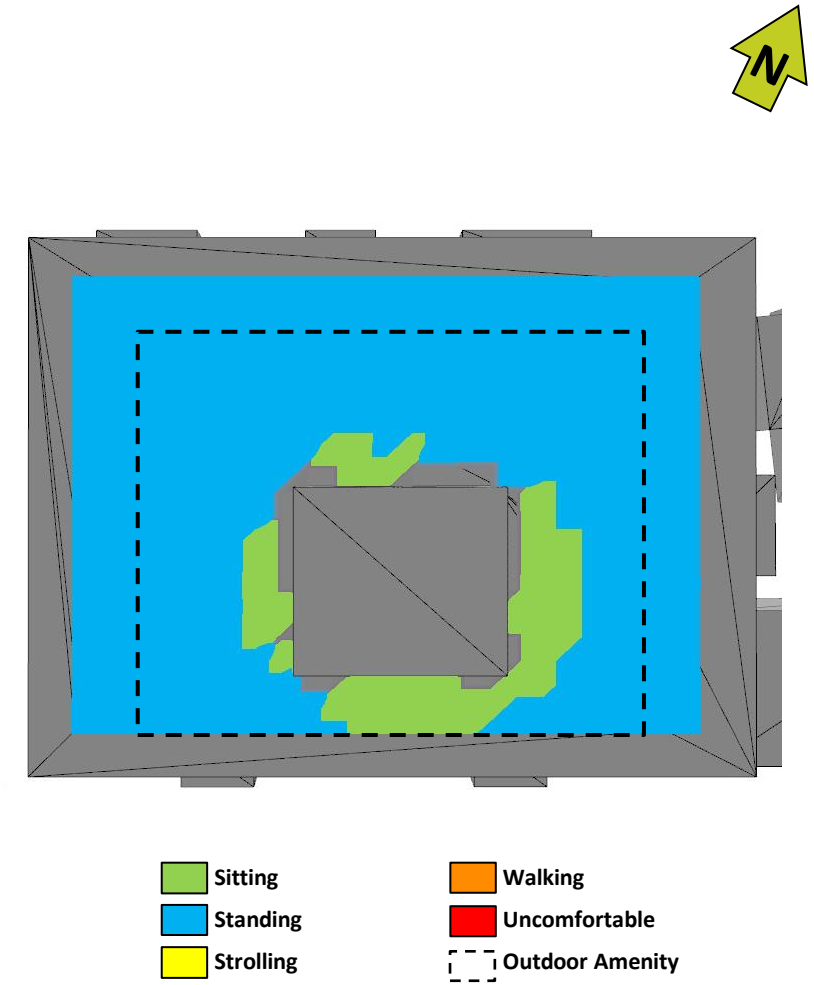


Figure 10a: Proposed Configuration – Pedestrian Wind Comfort – Rooftop – Summer

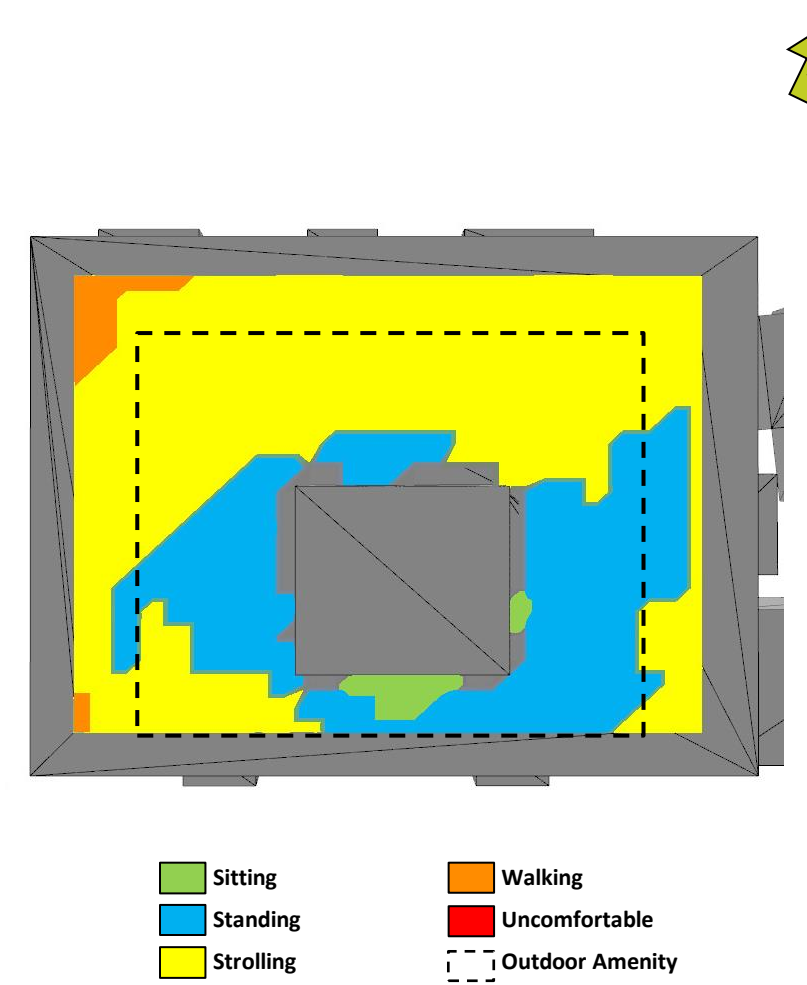


Figure 10b: Proposed Configuration – Pedestrian Wind Comfort – Rooftop – Winter

4.3 Surrounding Sidewalks

Existing wind conditions along the sidewalks surrounding the proposed development are expected to be comfortable for sitting throughout the year (Figures 7a and 8a). Wind conditions at the transit stops along Montreal Road, Cummings Avenue and Britany Road are also anticipated to be suitable for sitting year-round (Figures 7a and 8a).

With the addition of the proposed development, wind conditions along the sidewalks are predicted to be comfortable for standing or better year-round. Wind conditions at the transit stops are expected to remain similar to the existing wind conditions (Figures 7b and 8b).

These wind conditions are considered suitable for the anticipated usage.

5.0 UPDATED ARCHITECTURAL INFORMATION

Updated architectural drawings were received by SLR on December 13, 2022. A review of the information shows the height and footprint of the overall development is similar to what was initial analysed. The following differences are noted (Figure 11):

- The main entrance is now in the middle of the west facade.
- The secondary entrances / exits have adjusted locations.
- The mechanical penthouse massing is slightly altered and shifted closer to the south edge of the tower.
- The rooftop terrace footprint is slightly altered.

These design changes are minor in nature, and will have negligible influence on the wind conditions presented in Section 4.0. Thus, at grade level, wind conditions at the new main entrance location and at secondary entrances are expected to be comfortable for sitting or standing year-round, which is considered suitable for the intended use.

At the rooftop terrace, the changes to the penthouse massing will have negligible influence on wind conditions. Thus, wind conditions are expected to be suitable for sitting or standing in the summer. During the winter months, wind conditions are predicted to be comfortable for leisurely walking or better. Wind control measures previously mentioned in Section 4.2 will be applicable for the updated terrace.

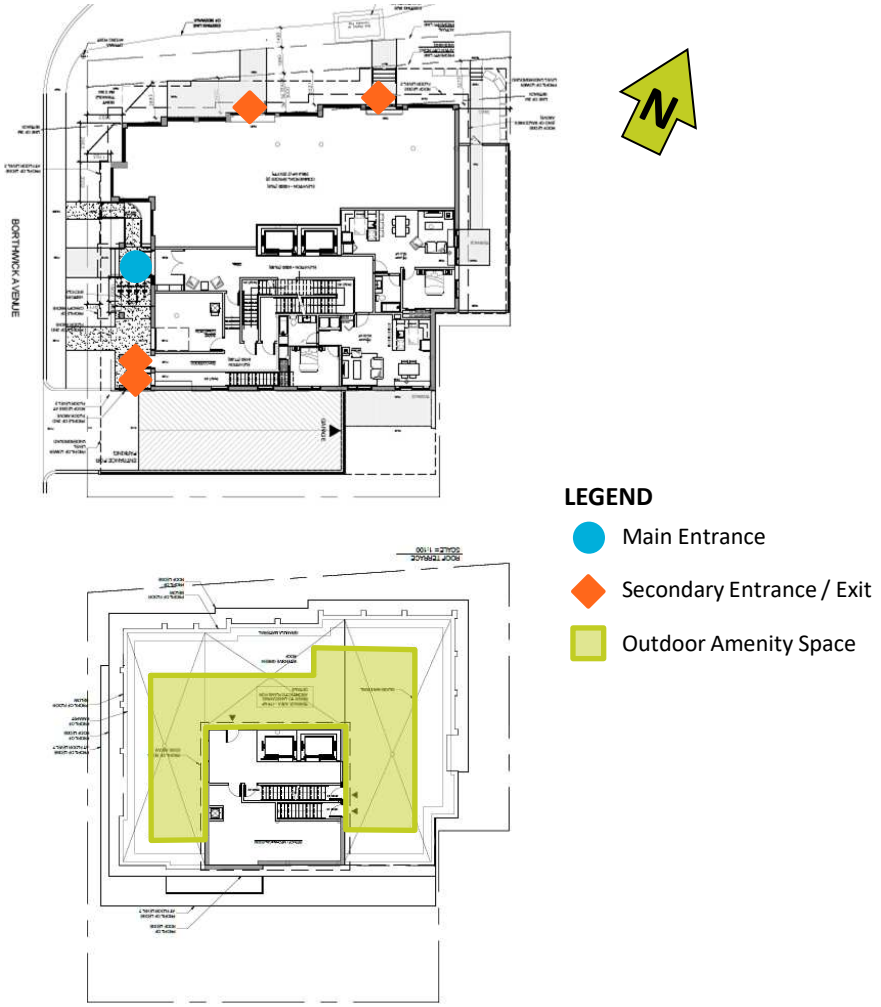


Figure 11: Updated ground floor plan (top) and roof plan (bottom)
Credit: Yves Lubber Architect, received December 13, 2022

6.0 CONCLUSIONS & RECOMMENDATIONS

The pedestrian wind conditions predicted for the proposed development at 630 Montreal Road in Ottawa, Ontario have been assessed through computational fluid dynamics modeling techniques. Based on the results of our assessment, the following conclusions have been reached:

- The wind safety criterion is expected to be met at all areas in both the Existing and Proposed Configurations.
- Wind conditions on-site are expected to be calm and suitable for the intended use of entrances, walkways, and for passive activities.
- On the outdoor rooftop amenity terrace, wind conditions are expected to be suitable for sitting or standing during the summer season. Wind mitigation measures are suggested if the terrace is to be used during the winter months.
- On the sidewalks and at the transit stops surrounding the proposed development, wind conditions remain similar between the two configurations, and are suitable for the intended usage.

7.0 ASSESSMENT APPLICABILITY

This assessment is based on computer modeling techniques and provides a qualitative overview of the pedestrian wind comfort conditions on and surrounding the proposed development site. Any subsequent alterations to the design may influence these findings, possibly requiring further review by SLR.

Should you have any questions or concerns, please do not hesitate to contact the undersigned.

Sincerely,

SLR Consulting (Canada) Ltd.

Nishat Nourin, M.Eng., P. Eng.
Microclimate Engineer

Tahrana Lovlin, MAES, P.Eng.
Principal, Microclimate

8.0 REFERENCES

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Appendix A

Pedestrian Wind Comfort Analysis

Spring (April – June) and Autumn (October – December)

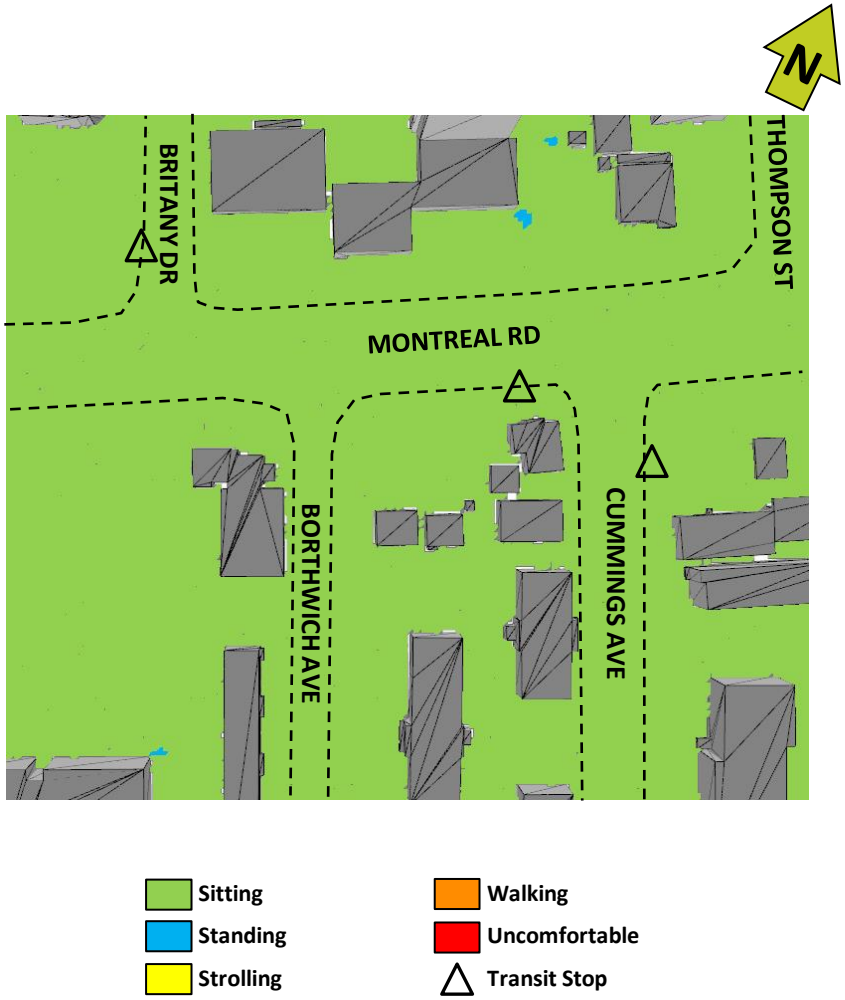

Figure A1a: Existing Configuration – Pedestrian Wind Comfort – Spring – Grade

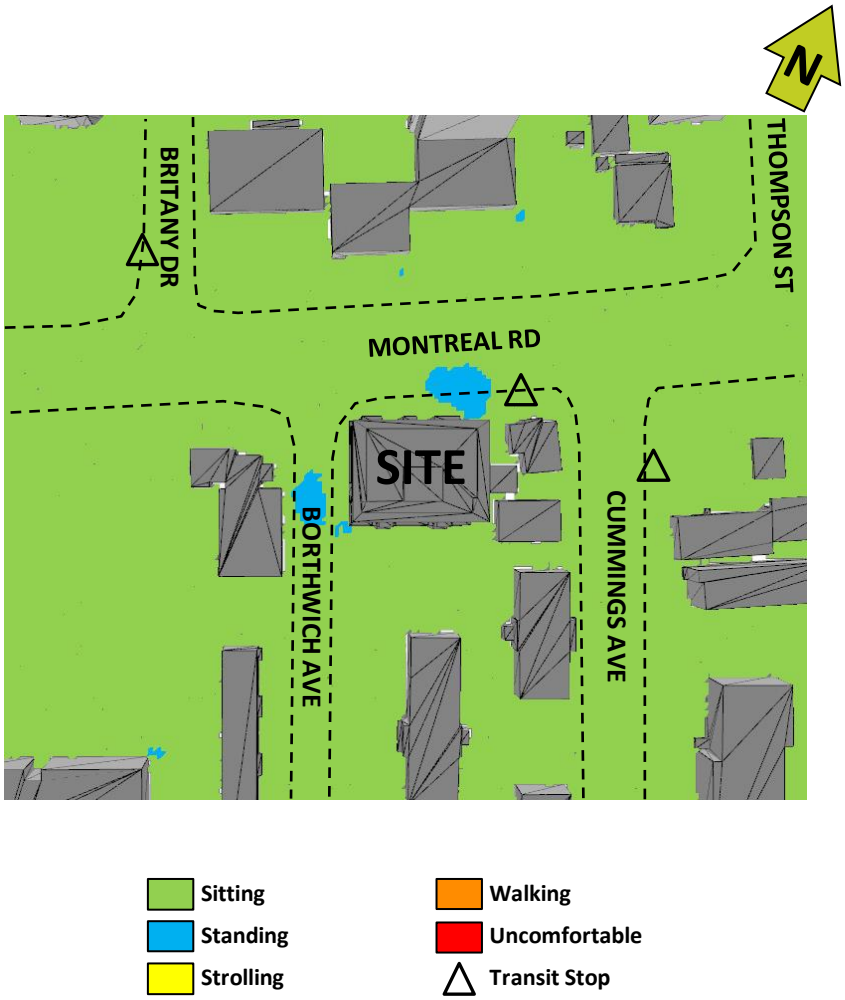

Figure A1b: Proposed Configuration – Pedestrian Wind Comfort – Spring – Grade

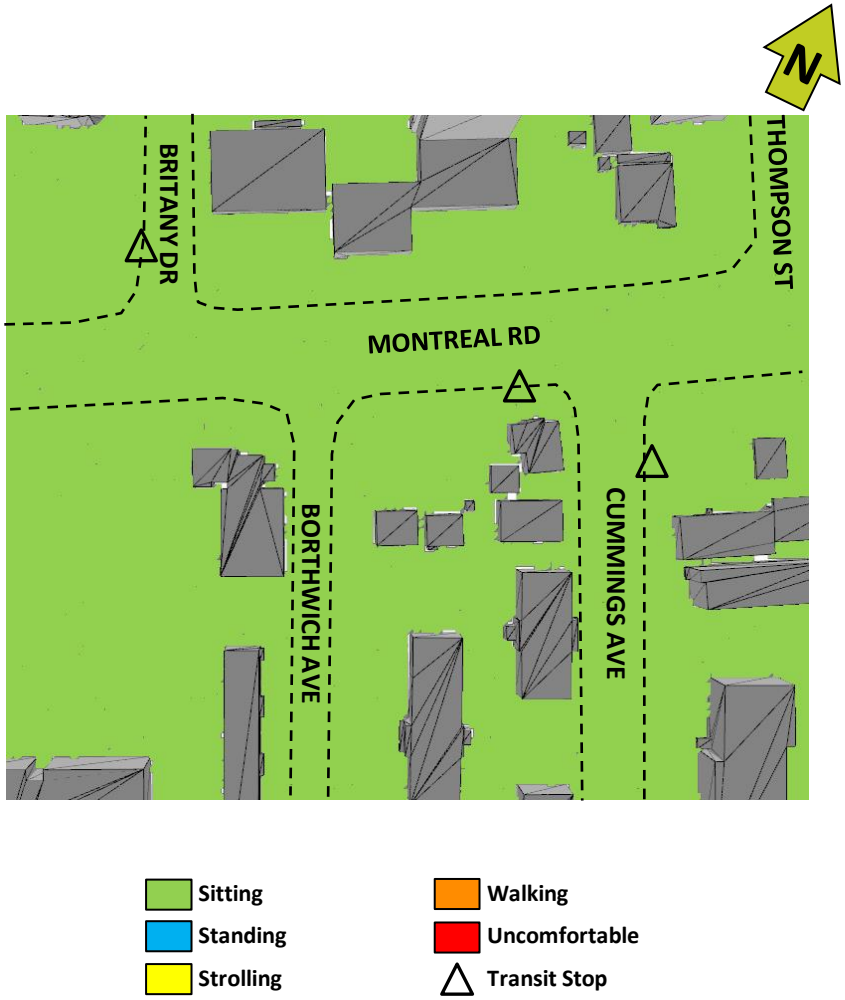

Figure A2a: Existing Configuration – Pedestrian Wind Comfort – Autumn – Grade

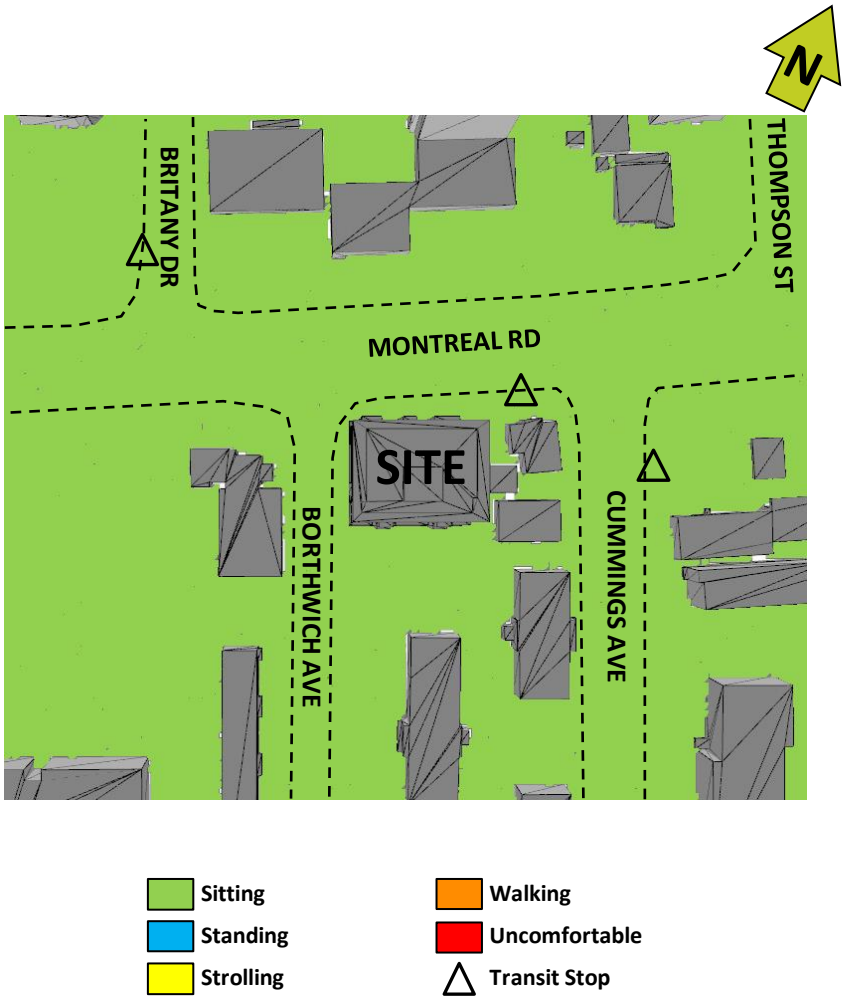

Figure A1b: Proposed Configuration – Pedestrian Wind Comfort – Autumn – Grade

Appendix B

Pedestrian Wind Safety Analysis

Annual

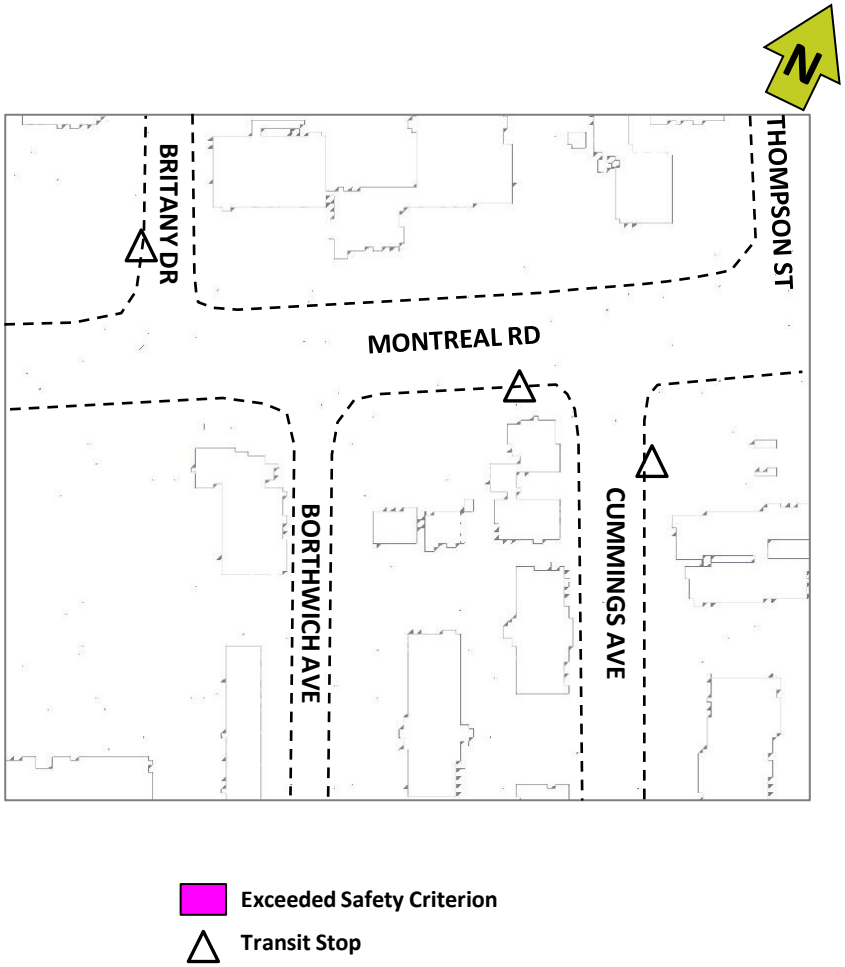

Figure B1a: Existing Configuration – Safety – Annual

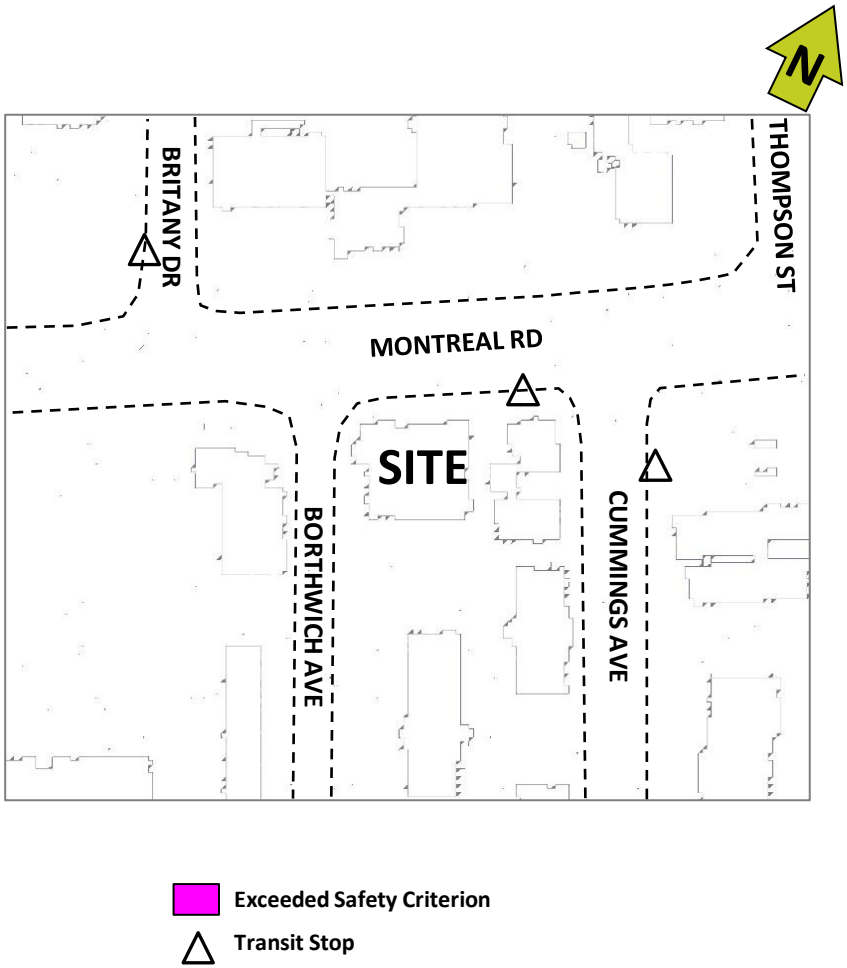

Figure B1b: Proposed Configuration – Safety – Annual

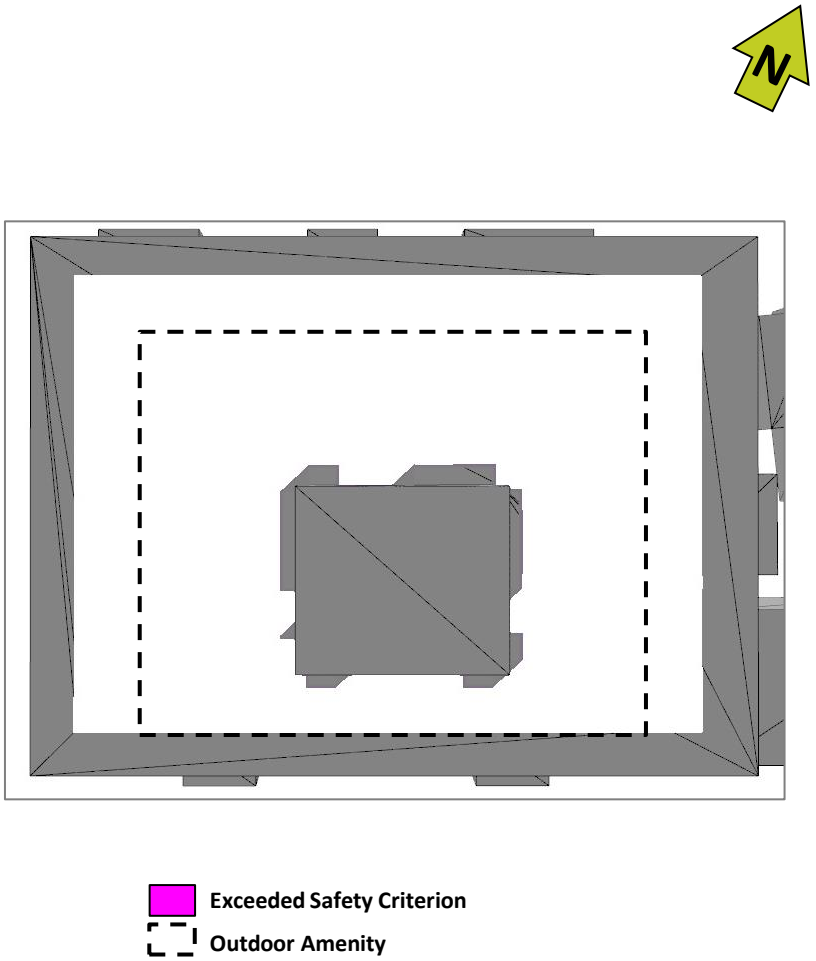

Figure B2a: Proposed Configuration – Safety – Annual – Rooftop