

REPORT

MAPLEVIEW ESSA

BARRIE, ON

PEDESTRIAN WIND COMFORT ASSESSMENT

PROJECT #2206007

DECEMBER 7, 2022



SUBMITTED TO

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1. INTRODUCTION



Rowan Williams Davies & Irwin Inc. (RWDI) was retained to conduct a pedestrian wind assessment for the proposed Maplevue Essa development in Barrie, Ontario. The objective of this assessment is to provide an evaluation of the potential wind conditions in the key pedestrian areas at and around the proposed development.

The project site is located on the north side of Maplevue Drive West between Essa Road and Hollyholme Farm Road. The site is surrounded by low-rise suburban neighbourhoods to the west, north, and east directions, whereas open areas exist on the south side (Image 1). Further from the site, open farmland is present to the North, West and South, with Lake Simcoe to the east side.

The project will comprise of 25 townhouse structures intended for residential, commercial, retail, and recreational community purposes. The proposed developments along Maplevue Drive West will include four mid-rise buildings with retail, community space, daycare facilities, and parking located on the lower podiums. They are separated from the townhouses by Bear Creek. The key pedestrian areas for this assessment include the sidewalks and walkways on and around the site, main entrances to the buildings, grade level outdoor amenity areas, as well as Level 5 amenity terraces (Image 3).



Image 1: Aerial view of the existing site and surroundings
Source: Google Maps

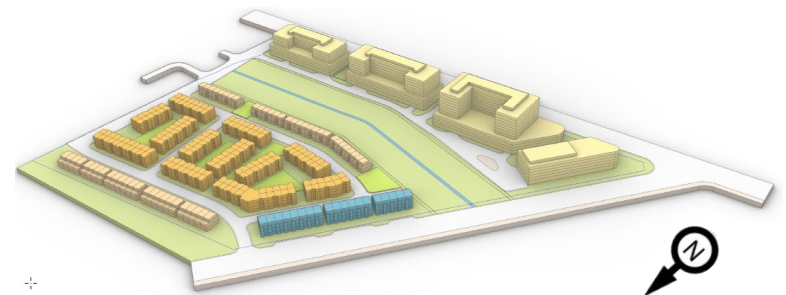
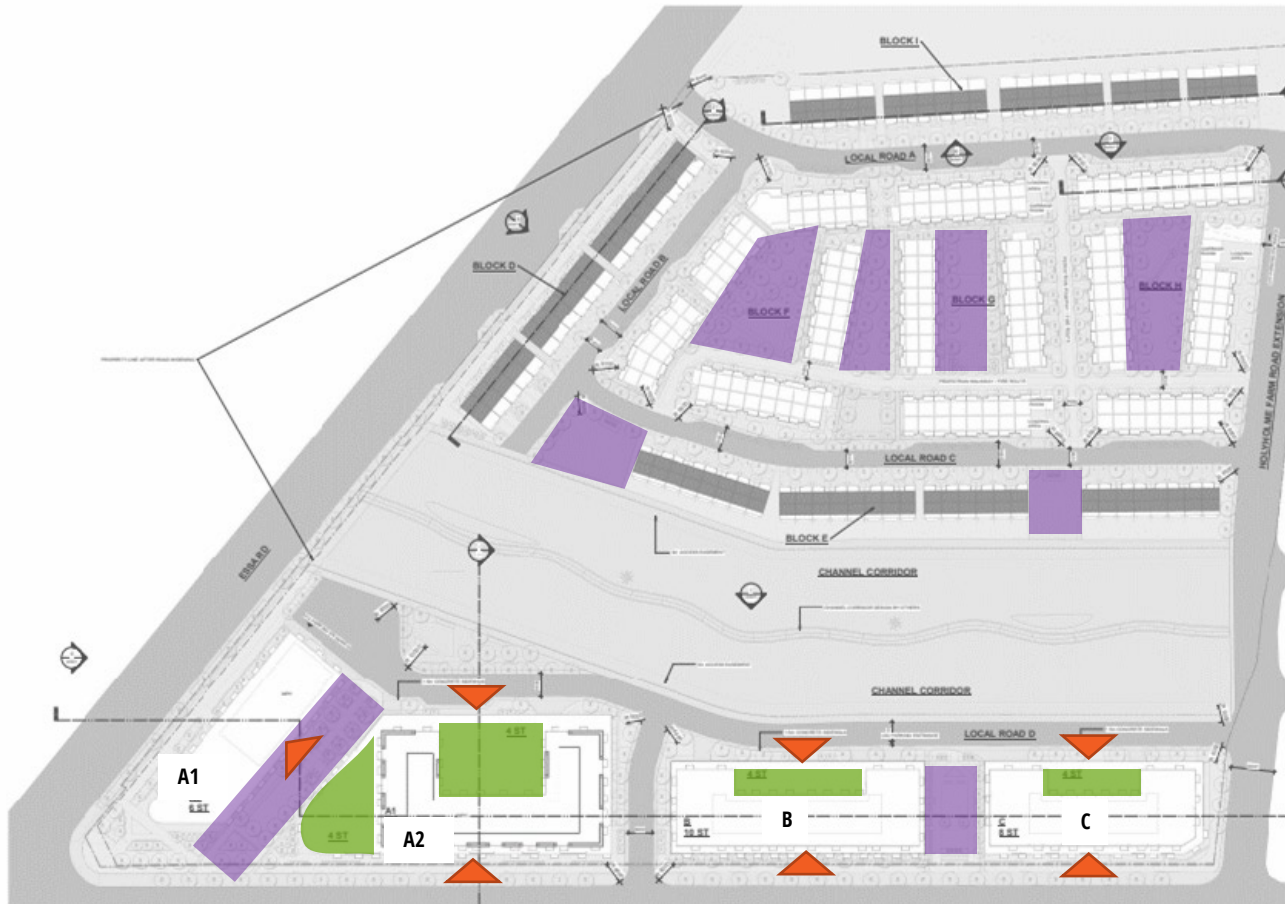


Image 2: Conceptual massing of the proposed project

1. INTRODUCTION






-  ENTRANCE
-  GRADE LEVEL AMENITY
-  ABOVE GRADE LEVEL AMENITY (LEVEL 5)



Image 3: Site Plan identifying Key Outdoor Areas of Interest

2. METHODOLOGY



2.1 Objective

The objective of this assessment is to provide an evaluation of the potential wind conditions and impact of the proposed development on wind conditions in pedestrian areas on and around it based on Computational Fluid Dynamics (CFD) modelling. The assessment is based on the following:

- A review of the regional long-term meteorological data from Egbert Climate Station;
- 3D e-model of the proposed project received on October 18, 2022 and updated plans received on November 30, 2020;
- The use of *Orbital Stack*, an in-house CFD tool;
- RWDI's engineering judgment, experience, and expert knowledge of wind flows around buildings¹⁻³; and,
- The RWDI wind comfort and safety criteria.

Note that other microclimate issues such as those relating to cladding and structural wind loads, door operability, air quality, snow impact, noise, vibration, etc. are not part of the scope of this assessment

2.2 CFD for Wind Simulation

CFD is a numerical technique for simulating wind flow in complex environments. For modelling winds around buildings, CFD techniques are used to generate a virtual wind tunnel where flows around the site, surroundings and the study building are simulated at full scale. The computational domain that covers the site and surroundings are divided into millions of small cells where calculations are performed, which allows for the “mapping” of wind conditions across the entire study domain. CFD excels as a tool for wind modelling and presentation for providing early design advice, comparing different design and site scenarios, resolving complex flow physics, and helping diagnose problematic wind conditions.

Gust conditions are infrequent but deserve special attention due to their potential impact on pedestrian safety. The computational modelling method used in the current assessment does not quantify the transient behaviour of the wind, including wind gusts. The effect of gust, i.e., wind safety, is predicted qualitatively in this assessment using analytical methods and wind-tunnel-based empirical models¹. The assessment has been conducted by experienced microclimate specialists in order to provide an accurate prediction of wind conditions.

In order to quantify the transient behaviour of wind and refine any conceptual mitigation measures, more detailed assessment would be required using either boundary-layer wind tunnel or transient computational modelling.

2. METHODOLOGY



2.3 Simulation Model

CFD simulations were completed for two scenarios:

- Existing: Existing site and surroundings.
- Proposed: Proposed development with the existing surroundings.

The computer model of the proposed building is shown in Image 4, and the Existing and Proposed configurations with the proximity model are shown in Images 5a and 5b, respectively. The 3D models were simplified to include only the necessary building and terrain details that would affect the local wind flows in the area and around the site. Landscaping and other smaller architectural and accessory features were not included in the computer model in order to provide more conservative wind conditions (as is the norm for this level of assessment).

The wind approaching the modelled area were simulated for 16 directions (starting at 0°, at 22.5° increments around the compass), accounting for the effects of the atmospheric boundary layer and terrain impacts. Wind data were obtained in the form of ratios of wind speeds at approximately 1.5m above concerned levels, to the mean wind speed at a reference height. The data was then combined with meteorological records obtained from Egbert Climate Station to determine the wind speeds and frequencies in the simulated areas.

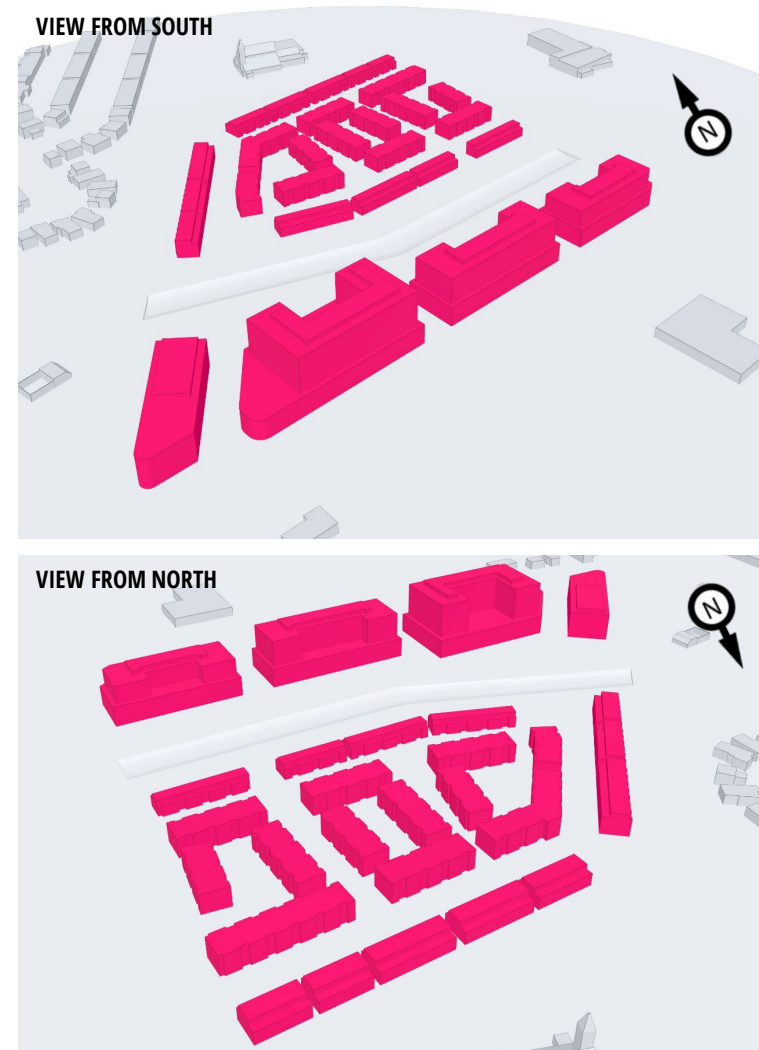


Image 4: Computer model of the proposed project

2. METHODOLOGY

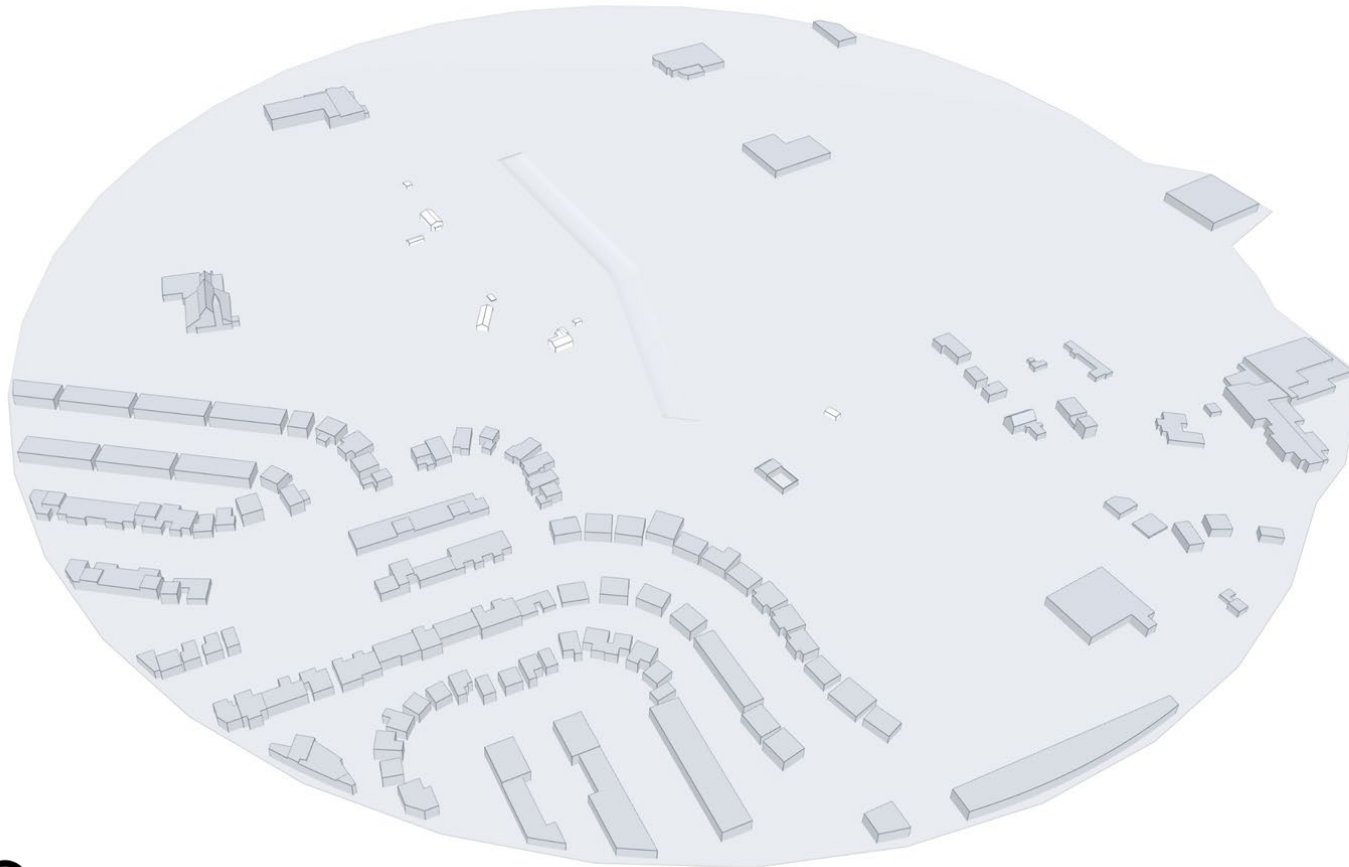


Image 5a: Computer model of the existing site and extended surroundings

2. METHODOLOGY

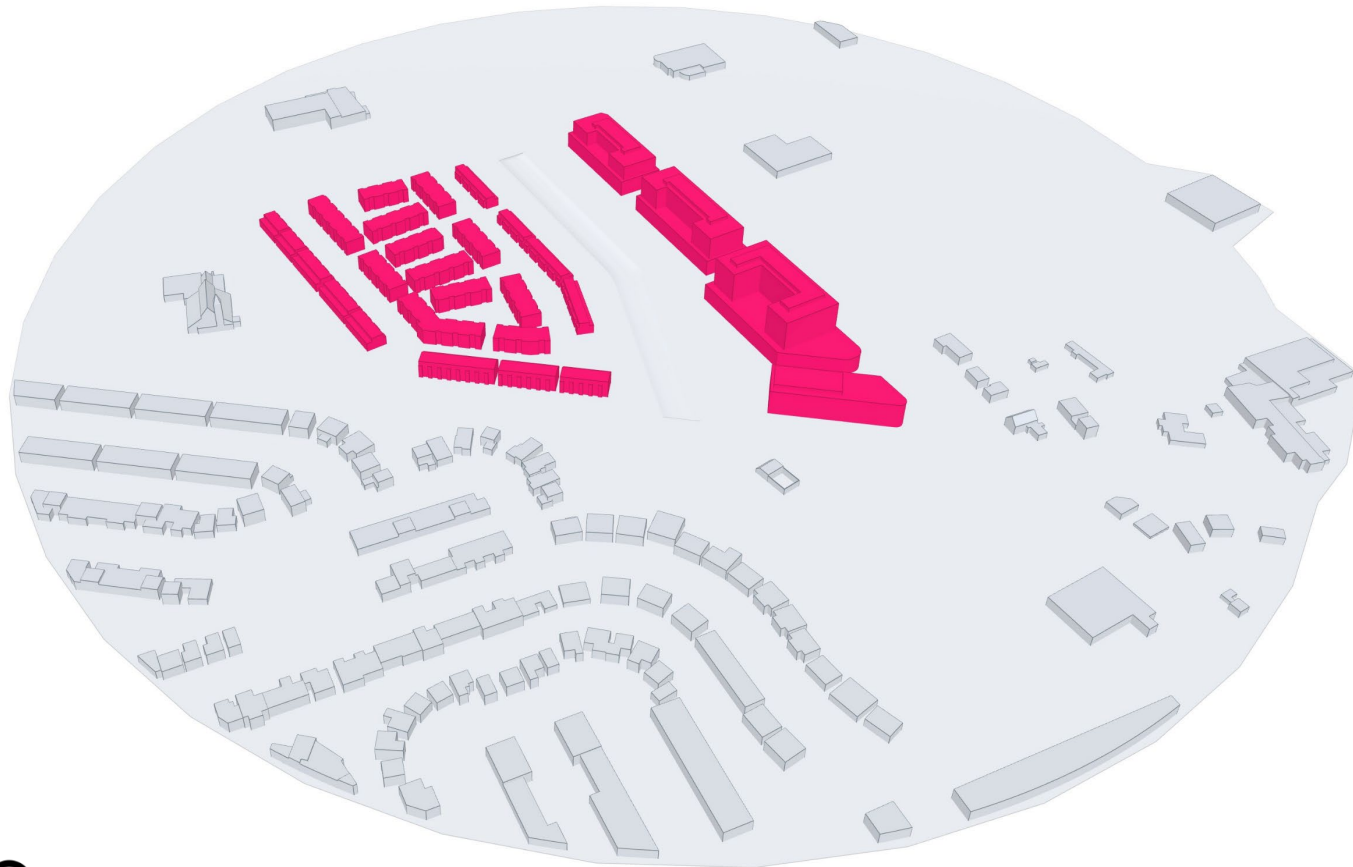


Image 5b: Computer model of the proposed site and extended surroundings

2. METHODOLOGY



Long-term wind data recorded at Egbert Climate Station between 2005 and 2021, inclusive, were analyzed for the summer (May to October) and winter (November to April) months. Image 6 graphically depicts the directional distributions of wind frequencies and speeds for these periods.

In the summer and winter seasons, winds from the north-northwest and southerly directions are predominant. Strong winds of a mean speed greater than 20 km/h measured at the met station (at an anemometer height of 10m) are more frequent in the winter (green and yellow bands in Image 6). These winds potentially could be the source of elevated wind speeds or severe wind conditions, depending on the site exposure and development design.

Wind statistics were combined with the simulated data to predict the wind conditions at the project site and assessed against the wind criteria for pedestrian comfort.

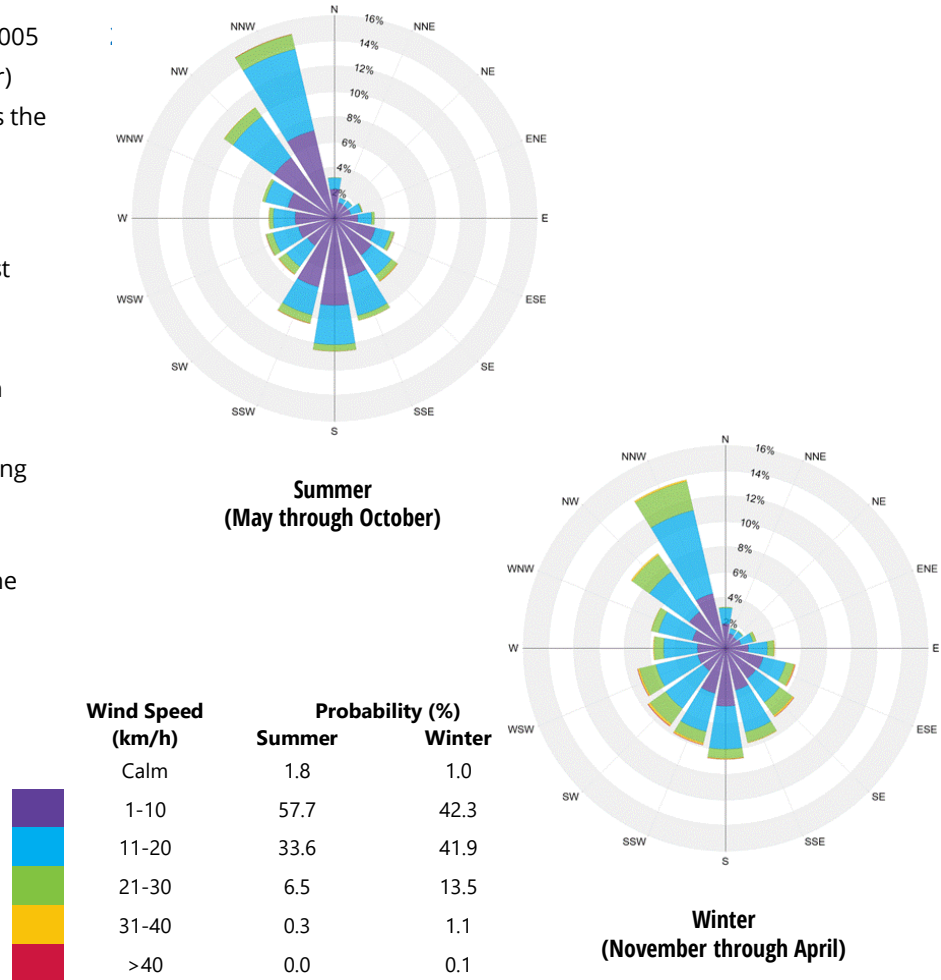


Image 6: Directional distribution of wind approaching Egbert Climate Station (2005 to 2021)

3. WIND CRITERIA



The RWDI pedestrian wind criteria are used in the current study; the criteria presented in the table below, addresses pedestrian safety and comfort. These criteria have been developed by RWDI through research and consulting practice since 1974. They have also been widely accepted by municipal authorities, building designers and the city planning community.

3.1 Pedestrian Comfort

Pedestrian comfort is associated with common wind speeds conducive to different levels of human activity. Wind conditions are considered suitable for sitting, standing, strolling or walking if the associated mean wind speeds (see table) are expected for at least four out of five days (80% of the time). The assessment considers winds occurring between 6 AM and midnight. Limited usage of outdoor spaces is anticipated in the excluded period. Speeds that exceed the criterion for Walking are categorized Uncomfortable. These criteria for wind forces represent average wind tolerance. They are sometimes subjective and regional differences in wind climate and thermal conditions as well as variations in age, health, clothing, etc. can also affect people's perception of the wind climate.

Comfort Category	GEM Speed (km/h)	Description (Based on seasonal compliance of 80%)
Sitting	≤ 10	Calm or light breezes desired for outdoor seating areas where one can read a paper without having it blown away
Standing	≤ 14	Gentle breezes suitable for main building entrances, bus stops, and other places where pedestrians may linger
Strolling	≤ 17	Moderate winds appropriate for window shopping and strolling along a downtown street, plaza or park
Walking	≤ 20	Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering
Uncomfortable	> 20	Strong winds considered a nuisance for all pedestrian activities. Wind mitigation is typically recommended

3.2 Pedestrian Safety

Pedestrian safety is associated with excessive Gust Speeds that can adversely affect a person's balance and footing. These are usually infrequent events but deserve special attention due to the potential impact on pedestrian safety.

Safety Criterion	Gust Speed (km/h)	Description (Based on annual exceedance of 9 hrs or 0.1% of time)
Exceeded	> 90	Excessive gusts that can adversely affect one's balance and footing. Wind mitigation is typically required.

4. RESULTS AND DISCUSSION



4.1 Presentation of Results

The results of the assessment are presented and discussed in detail in Sections 4.3 and 4.4. The graphical presentation is in the form of colour contours of wind speeds calculated based on the wind comfort criteria (Section 3.1), approximately 1.5 m above the concerned level are presented in Images 8, 9, and 10. The assessment against the safety criterion (Section 3.2) was conducted qualitatively based on the predicted wind conditions and our extensive experience with wind tunnel assessments. A detailed discussion of the expected wind conditions with respect to the prescribed criteria and applicability of the results follows in next sections. The discussion includes recommendations for wind control to reduce the potential for high wind speeds for the design team's consideration.

Target Conditions

For the current development, wind speeds comfortable for walking or strolling are appropriate for sidewalks and walkways where pedestrians are likely to be active and moving intentionally. Lower wind speeds comfortable for standing are required for entrances and areas where people are expected to be engaged in passive activities. Calm wind speeds suitable for sitting are desired in areas where prolonged periods of passive activities are anticipated, such as outdoor amenity areas, seating areas etc., especially during the summer when these areas are typically in use.

4.2 Wind Flow around the Project

Buildings that are taller than their surroundings tend to intercept and redirect winds around them. The mechanism in which winds are directed down the height of a building is called *Downwashing*. These flows subsequently move around exposed building corners, causing a localized increase in wind activity due to *Corner Acceleration*. *Podium* massing helps diffuse downwash and reduce the potential wind impact on the ground level. These flow patterns are illustrated in Image 7.

The project contains mid-rise buildings with heights ranging from 4 storeys to 12 storeys that will be taller than the buildings that exist in the surrounding area. The project is expected to redirect winds around it; however, potential wind impacts would be moderated by the podium massing of the mid-rise buildings and dense existing and proposed surroundings.

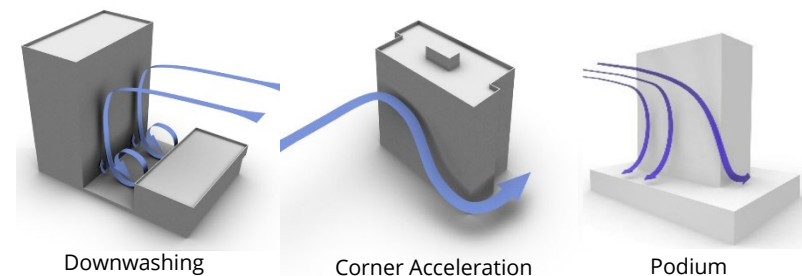


Image 7: General wind flow patterns

4. RESULTS AND DISCUSSION



4.3 Existing Scenario

The existing site includes open fields with a few low-rise residential houses, like the neighbouring buildings, and therefore will not redirect winds to create any notable impact. Wind conditions at all areas in the existing scenario are considered comfortable for standing in the summer (blue regions in Image 8a) and strolling in the winter (green regions in Image 8b). These conditions are expected to be suitable for the intended pedestrian usage of these areas.

Wind conditions at all areas near the project site are expected to meet the safety criterion.

4.4 Proposed Scenario: Safety

The proposed development, owing to its low and moderate height buildings with podium massing, is not expected to alter wind conditions around the site significantly. Wind conditions around the proposed project are predicted to meet the safety criterion at all areas assessed.

4.5 Proposed Scenario: Comfort

4.5.1 Sidewalks and Walkways

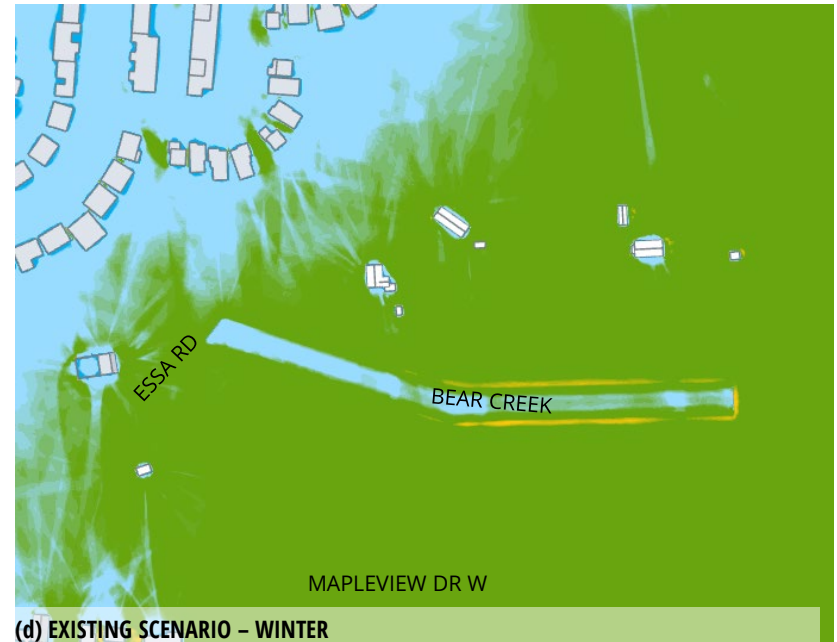
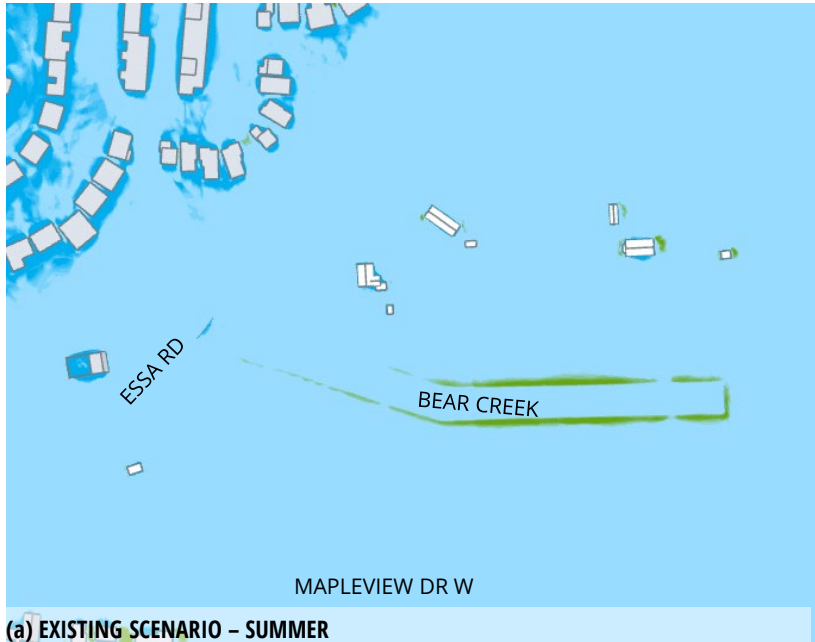
Wind conditions are expected to be comfortable for standing on most sidewalks around the site in the summer and winter; strolling and walking conditions are predicted in the gaps between the Buildings A-C and around building corners during the summer and winter seasons, respectively (see Images 9a and 9b). These wind conditions are appropriate for the intended active pedestrian usage of the sidewalks and walkways.

4.5.2 Building Entrances

The entrances for Buildings A2, B, and C are predicted with wind speeds that are comfortable for sitting in the summer (Image 9a), and comfortable for sitting or standing in the winter season (Image 9b). These predicted wind conditions are ideal for the intended usage of entrance areas.

The entrance for Building A1 along the eastern façade is predicted with strolling conditions during the winter which is slightly higher than desired for entrance usage. Wind control measures such as recessing the entrance into the façade or installing wind screens or planters on both sides of the doors can be considered to create sheltered doorways (see examples in Image 10).

4. RESULTS AND DISCUSSION



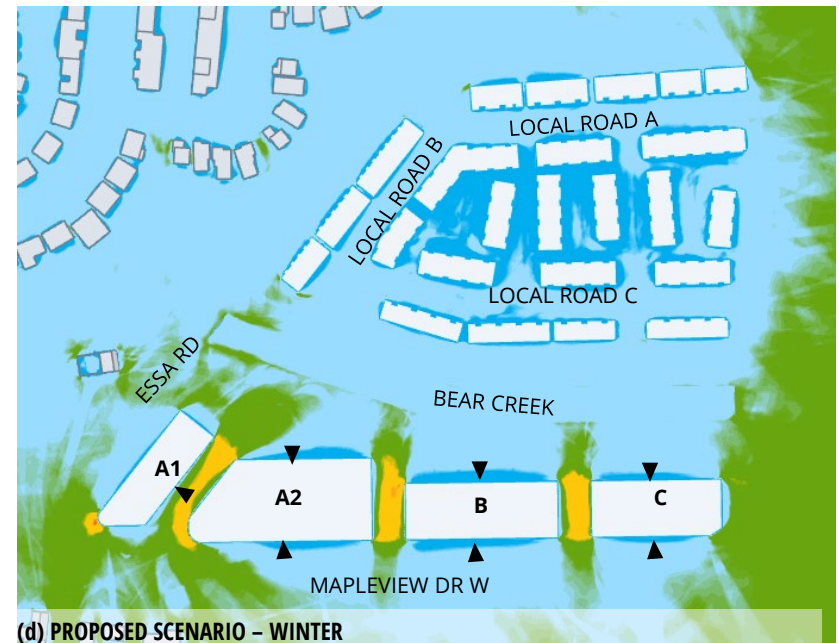
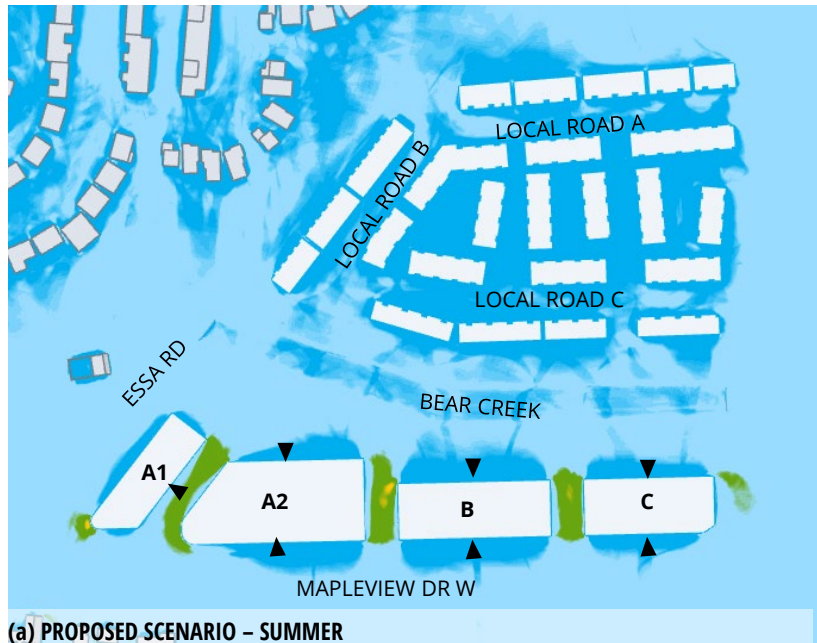
COMFORT: **SITTING** **STANDING** **STROLLING** **WALKING** **UNCOMFORTABLE**

SAFETY: The criterion will be met at all areas.



Image 8: Predicted wind conditions – GROUND LEVEL - EXISTING SCENARIO

4. RESULTS AND DISCUSSION



COMFORT: SITTING STANDING STROLLING WALKING UNCOMFORTABLE

▶ Entrances

SAFETY: The criterion will be met at all areas.



Image 9: Predicted wind conditions – GROUND LEVEL – PROPOSED SCENARIO

4. RESULTS AND DISCUSSION



Image 10: Suggestions for wind control at the entrance for building A1

4. RESULTS AND DISCUSSION



4.5.3 Grade Level Amenity Areas

Wind conditions on the proposed amenity areas between the townhouses located between Local Roads A & C are anticipated with sitting conditions during the summer, which is ideal for the intended passive usage of the space (see Image 9a). The townhouse amenity areas situated on the south side of Local Road C are predicted with wind speeds that are comfortable for standing in the summer. With the planning of inclusion of landscape features as shown in the landscape plan received on November 30, 2022, the wind speeds in these areas will likely be lowered and conditions are expected to be comfortable for passive usage.

The amenity areas located in the gaps between Buildings A1 & A2, and between Buildings B & C are anticipated with wind speeds that are comfortable for strolling in the summer (Image 9a) and for walking in the winter (Image 9b). These wind speeds are higher than desired if passive pedestrian usage is planned in these areas.

If lower wind speeds conducive to passive usage are desired, in addition to the landscape features currently planned, more landscaping elements may be placed around designated seating areas to diffuse winds and create localized low-wind zones. These features can be placed especially on the north and south sides of the seating areas to shelter the spaces from the prevailing winds during the summer season. Also, over head trellises or umbrellas may be used to shelter the seating areas from the winds that are deflected down by the towers (see

examples in Image



Image 11: Suggestions for wind control at the grade level outdoor amenity areas

4. RESULTS AND DISCUSSION



4.5.4 Level 5 Terrace Areas

The wind speeds on these terrace areas located along the northern building façade are expected to be comfortable for sitting or standing in the summer and winter seasons (see Images 12a and 12b) which can be considered appropriate in majority areas.

Wind speed increases with elevation. The above grade amenity terraces will be exposed to the prevailing winds due to their elevations above the low-rise surroundings. Wind speeds on the Level 5 terrace of Building A2 located along the western façade are expected to be comfortable for strolling in the summer and for walking in the winter season. Conditions on this terrace area are expected to be windy for passive use without the use of wind control measures. High wind speeds in the winter may be acceptable as these areas will likely not be occupied frequently in the cold months.

We encourage the design team to consider features like tall guardrails, wind screens, and tall planters at least 2m high to reduce wind speeds in the summer on Level 5 terrace along the west façade of Building A2. These features, when placed along the terrace perimeter, will help reduce the exposure of the terrace to the prevailing winds. In addition, the features may be interspersed throughout the terraces or used to surround designated gathering or seating areas. Some examples of wind control features are shown in Image 13. RWDI can guide the selection and placement of such features for wind control as the design advances.

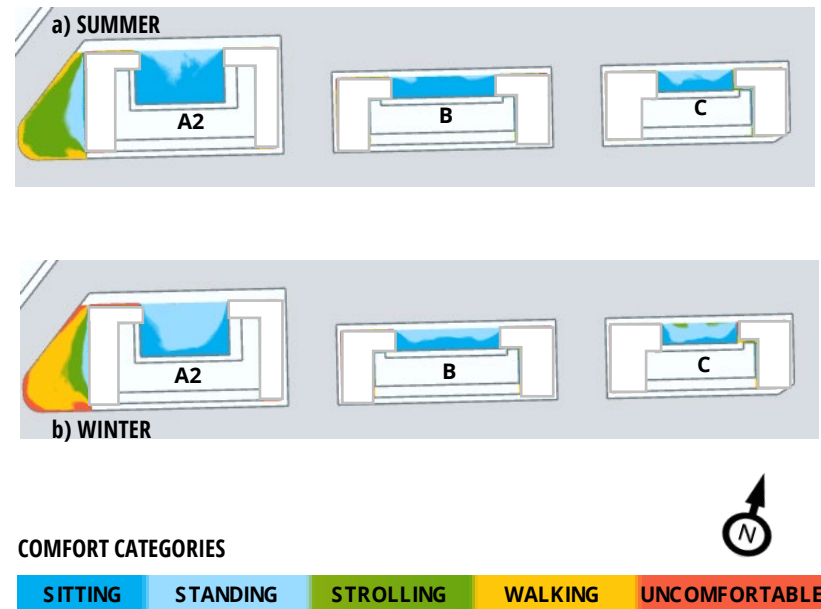


Image 12: Predicted wind conditions – LEVEL 5 TERRACES

4. RESULTS AND DISCUSSION

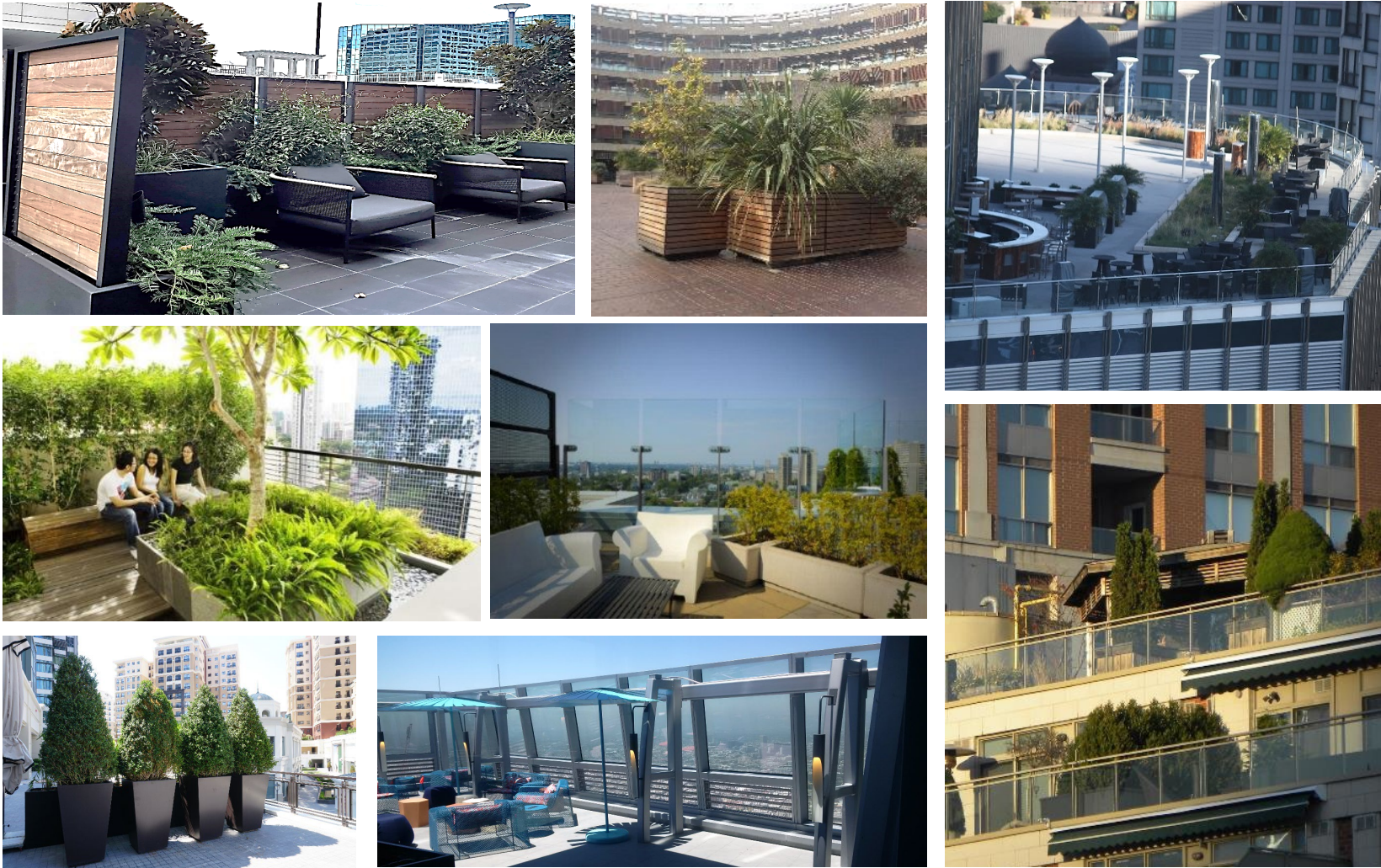


Image 13: Design strategies for wind control on terraces

5. SUMMARY



RWDI was retained to provide an assessment of the potential pedestrian level wind impact of proposed Mapleview Essa development in Barrie, Ontario. Our assessment was based on computational modelling, simulation and analysis of wind conditions for the proposed development design, in conjunction with the local wind climate data and the RWDI wind criteria for pedestrian comfort and safety. Our findings are summarized as follows:

- The proposed buildings are taller than their surroundings, and therefore will redirect wind to ground level. However, the moderate massing height equipped with stepped podiums will help reduce the wind impacts to a large extent. The project is not expected to have a notable influence on wind conditions on other properties.
- Wind conditions at ground level, including the main entrance and sidewalk areas, are expected to be appropriate for the intended usage. The wind speeds at the entrance for Building A1 are expected to be slightly higher than desired for the intended usage in the winter.
- The outdoor grade level amenity areas located on the north side of Local Road C are predicted with calm wind speeds that will be suitable for passive usage over the year. The other amenity spaces between the proposed towers and on the south side of Local Road C are anticipated with wind speeds that are slightly higher than desired for passive usage.
- Wind speeds on the Level 5 terrace areas located along the northern façades of the buildings are predicted to be appropriate for passive usage. Windy for passive in the summer.
- Wind conditions on the Level 5 terrace of Building A2 located along the western façade are anticipated to be higher than desired for passive usage.
- Elevated wind speeds on the grade and above grade level amenities during the winter may be considered acceptable considering limited outdoor usage in colder months.
- For the areas associated with elevated wind activities, wind control measures are provided in the report. RWDI can help guide the placement of wind control features to achieve appropriate levels of wind comfort based on the programming of the various outdoor spaces.

6. DESIGN ASSUMPTIONS



The findings/recommendations in this report are based on the building geometry and architectural drawings communicated to RWDI between in October and November 2022, listed below. Should the details of the proposed design and/or geometry of the building change significantly, results may vary.

File Name	File Type	Date Received (mm/dd/yyyy)
2022-10-11 Mapleview-Essa - Massing	DWG	10/18/2022
2022-11-03 - ROOF PLAN	DWG	11/03/2022
2022-11-18 - 140041-MAPLEVIEW-ESSA - DRAFT SET (COMPRESSED)	PDF	11/30/2022
5832-DRAFT Landscape Masterplan (2022-11-18)	PDF	11/30/2022

Changes to the Design or Environment

It should be noted that wind comfort is subjective and can be sensitive to changes in building design and operation that are possible during the life of a building. These could be, for example: outdoor programming, operation of doors, elevators, and shafts pressurizing the tower, changes in furniture layout, etc.. In the event of changes to the design, construction, or operation of the building in the future, RWDI could provide an assessment of their impact on the discussions included in this report. It is the responsibility of Others to contact RWDI to initiate this process.

7. STATEMENT OF LIMITATIONS



This report was prepared by Rowan Williams Davies & Irwin Inc. for Pearl Builders (“Client”). The findings and conclusions presented in this report have been prepared for the Client and are specific to the project described herein and authorized scope. The conclusions and recommendations contained in this report are based on the information available to RWDI when this report was prepared. Because the contents of this report may not reflect the final design of the Project or subsequent changes made after the date of this report, RWDI recommends that it be retained by Client to verify that the results and recommendations provided in this report have been correctly interpreted in the final design of the Project.

The conclusions and recommendations contained in this report have also been made for the specific purpose(s) set out herein. Should the Client or any other third party utilize the report and/or implement the conclusions and recommendations contained therein for any other purpose or project without the involvement of RWDI, the Client or such third party assumes any and all risk of any and all consequences arising from such use and RWDI accepts no responsibility for any liability, loss, or damage of any kind suffered by Client or any other third party arising therefrom.

Finally, it is imperative that the Client and/or any party relying on the conclusions and recommendations in this report carefully review the stated assumptions contained herein and to understand the different factors which may impact the conclusions and recommendations provided.

7. REFERENCES



1. H. Wu, C.J. Williams, H.A. Baker and W.F. Waechter (2004), "Knowledge-based Desk-Top Analysis of Pedestrian Wind Conditions", *ASCE Structure Congress 2004*, Nashville, Tennessee.
2. H. Wu and F. Kriksic (2012). "Designing for Pedestrian Comfort in Response to Local Climate", *Journal of Wind Engineering and Industrial Aerodynamics*, vol.104-106, pp.397-407.
3. C.J. Williams, H. Wu, W.F. Waechter and H.A. Baker (1999), "Experience with Remedial Solutions to Control Pedestrian Wind Problems", *10th International Conference on Wind Engineering*, Copenhagen, Denmark.