REPORT

37 JOHNSON STREET

BARRIE, ON

PEDESTRIAN WIND ASSESSMENT

PROJECT #2000996

NOVEMBER 26, 2019

SUBMITTED TO

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1. INTRODUCTION

Rowan Williams Davies & Irwin Inc. (RWDI) was retained by Starlight Investments to conduct a desktop wind study to assess the pedestrian wind conditions for the proposed residential development at 37 Johnson Street in Barrie, Ontario (see Image 1). A wind assessment is required by the City of Barrie for the Zoning By-Law Amendment as per their October 2018 Pedestrian Wind Terms of Reference.

This assessment is based on the following:

- a review of regional long-term meteorological data;
- design drawings received from Innovative Planning Solutions on October 17, 2019;
- wind-tunnel studies undertaken by RWDI for similar projects;
- our engineering judgement and knowledge of wind flows around buildings[1-3]; and
- use of 3D software developed by RWDI (*WindEstimator*[2]) for estimating the potential wind conditions around generalized building forms.

This approach provides a screening-level estimation of potential wind conditions. Conceptual wind control measures to improve wind comfort are recommended, where necessary. Wind tunnel testing may be required to quantify these wind conditions and optimize the wind control measures presented herein.

A complete microclimate assessment adding thermal comfort and urban heat island effects is presented in a separate report. Note that other issues related to wind loads, snow, door operability, etc., are not considered within the scope of this assessment.

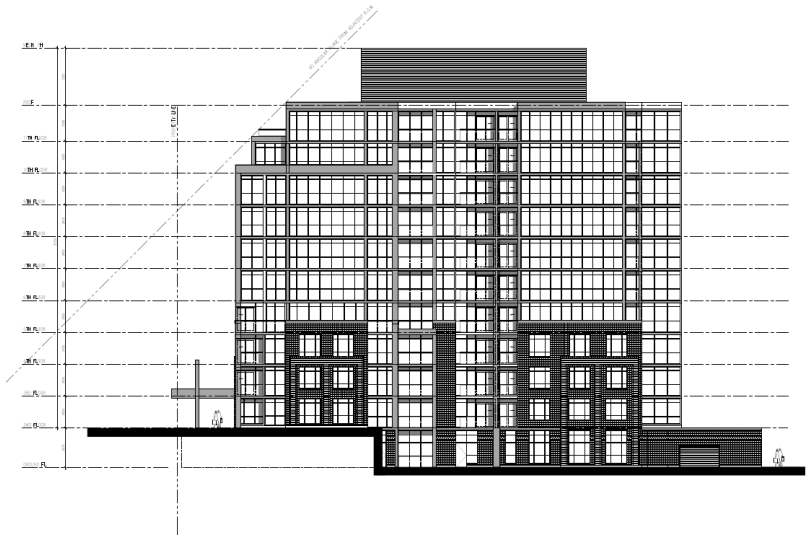


Image 1: Proposed Development – West Elevation
(courtesy of architecture unfolded)

1. 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.
2. 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.
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.

2. SITE INFORMATION

The proposed development is located on Indian Arrow Road just east of Johnson Street (see Image 2). The site is currently occupied by lawn area and trees. The area surrounding the site is primarily low-rise residential buildings in all directions, with taller buildings adjacent and to the southwest, and across the street to the northwest. Lake Simcoe is located approximately 350 m to the south.

The proposed project is a 11-storey residential tower. Key pedestrian areas on and around the site includes the proposed building entrances, public sidewalks, the adjacent Shoreview Park, the parking lot area, and 5th floor terraces.

Image 2: Aerial View of Existing Site and Surrounding
(Courtesy of Google™ Earth)

3. LOCAL WIND CLIMATE

Wind statistic recorded at Lake Simcoe Regional Airport, located approximately 13 km to the northeast, were analyzed for summer and winter seasons to determine the local wind directionality. The results are presented in the form of graphic wind roses in Image 3.

The most frequent winds blow from the west through northwest directions in both the summer and winter seasons. The southeast winds are relatively frequent in the summer and east winds in the winter, but they are of lower wind speeds.

It is our opinion that the most significant winds at the project site for comfort would be from the northwest and east, although all directions are considered in this assessment.

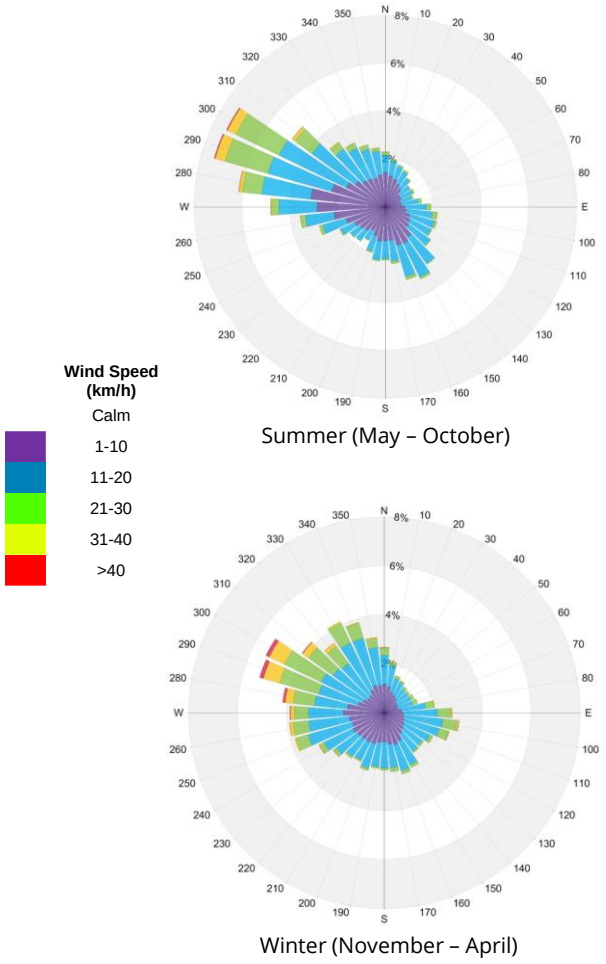


Image 3: Directional Distribution of Winds Recorded at Lake Simcoe Regional Airport 2003 - 2016

4. CRITERIA

The pedestrian wind criteria used in the current study are based on those referenced in the City of Barrie's Terms of Reference. The criteria are outlined below.

4.1 Pedestrian Safety

Pedestrian safety is associated with excessive gust wind speeds that can adversely affect a pedestrian's balance and footing. If strong winds that can affect a person's balance (**90 km/h**) occur more than 0.1% of the time or 9 hours per year, the wind conditions are considered severe.

4.2 Pedestrian Comfort

Sitting (≤ 10 km/h): Calm or light breezes desired for outdoor seating areas where one can read a paper without having it blown away.

Standing (≤ 15 km/h): Gentle breezes suitable for main building entrances and bus stops.

Walking (≤ 20 km/h): Relatively high speeds that can be tolerated if one's objective is to walk, run or cycle without lingering.

Uncomfortable: None of the comfort categories are met.

Wind conditions are considered suitable for *sitting, standing* or *walking* if the associated mean wind speeds are expected for at least four out of five days (80% of the time). Wind control measures are typically required at locations where winds are rated as *uncomfortable* or they exceed the wind safety criterion.

Note that these wind speeds are assessed at the pedestrian height (i.e., 1.5 m above grade or the concerned floor level), typically lower than those recorded in the airport (10 m height and open terrain).

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.

For the current development, wind speeds comfortable for *walking* are appropriate for sidewalks and lower wind speeds comfortable for *standing* are required for building entrances where pedestrians may linger. Wind speeds comfortable for *sitting* are appropriate for outdoor dining terraces and roof terrace during the summer, when these areas will be mainly used.

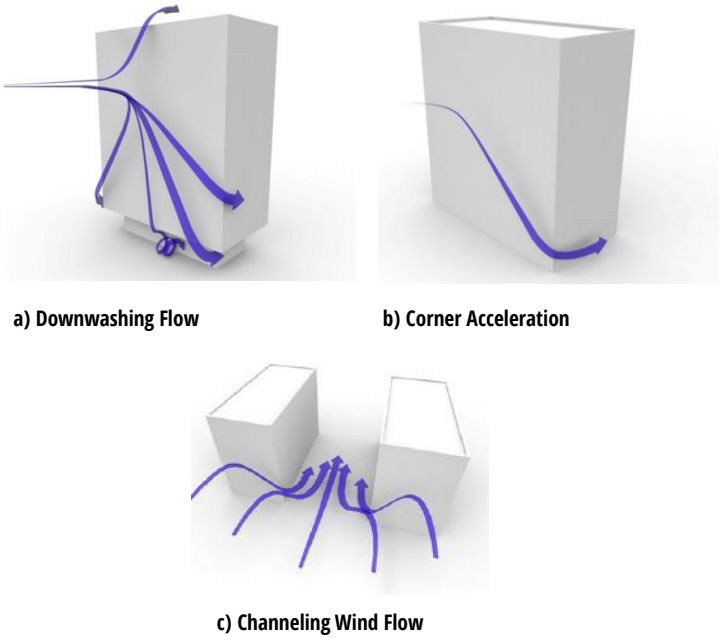
5. PEDESTRIAN WINDS

Predicting wind speeds and occurrence frequencies is complicated. It involves building geometry, orientation, position and height of surrounding buildings, upstream terrain and the local wind climate. Over the years, RWDI has conducted thousands of wind-tunnel model studies regarding pedestrian wind conditions around buildings, yielding a broad knowledge base. This knowledge has been incorporated into RWDI's proprietary software that allows, in many situations, for a screening-level numerical estimation of pedestrian wind conditions without wind tunnel testing.

Since the surrounding buildings are shorter than the proposed project, the proposed building will be fully exposed to winds from all directions. Taller buildings tend to intercept the stronger winds at higher elevations and redirect them to the ground level. Such a *Downwashing Flow* (see Image 4a) is the main cause for increased wind activity around taller buildings at the grade level. When oblique winds are deflected down by a building, a localized increase in wind activity or *Corner Acceleration* can be expected around the downwind building corner at pedestrian level (see Image 4b). If these building/wind combinations occur for prevailing winds, there is a greater potential for increased wind activity.

Building setbacks and podiums will reduce the direct impact of downwashing wind flows at grade (see Image 4c); however, higher wind activities are expected on the podium itself.

Given the local wind climate and the conceptual building design, the wind safety criteria is expected to be met at all locations on and around the development. Detailed discussions on the potential wind conditions at key pedestrian areas are provided in the following sections.



a) Downwashing Flow

b) Corner Acceleration

c) Channeling Wind Flow

Image 4: General Wind Flow Patterns around Taller Buildings

6. ANTICIPATED WIND CONDITIONS

6.1 Existing Wind Conditions

The existing wind conditions on-site are likely to be comfortable for *sitting* / *standing* during the summer and *walking* during the winter. No wind safety exceedances are expected on or around the site in the existing configuration.

6.2 Proposed Wind Conditions

6.2.1 Building Entrances

The proposed building is expected to be exposed to the prevailing winds from northwest and east. The building's main entrance is on the south façade and the second floor entrance from Indian Arrow Road is on the north façade (see gold arrows in Image 5). These entrances are well situated with respect to winds. The main entrance is predicted to have appropriate wind conditions year-round (i.e., comfortable for *sitting* in summer and *standing* in winter, as shown on Images 6 and 7). The winds outside the second floor entrance will be comfortable for *walking* however, the entrance itself is recessed into the north façade and is therefore expected to have appropriate wind conditions. This recess is a positive design feature for wind and should be preserved.

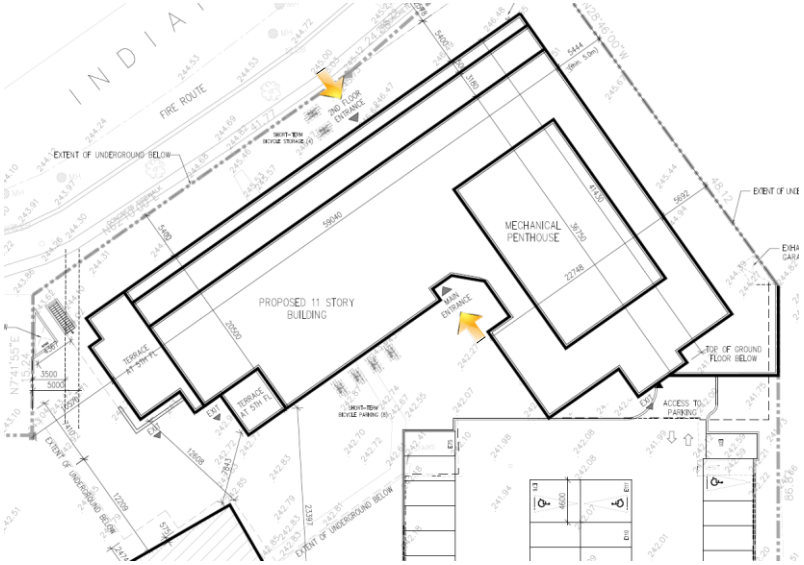
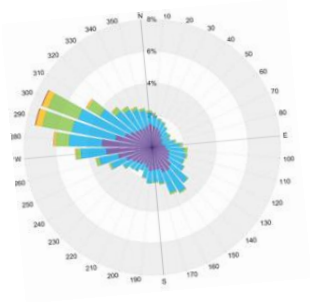


Image 5: Roof Plan with Entrances and Terraces Shown

6. ANTICIPATED WIND CONDITIONS

Predicted
SUMMER
Wind Comfort Conditions

- Sitting / Standing
- Strolling / Walking
- Potentially Uncomfortable



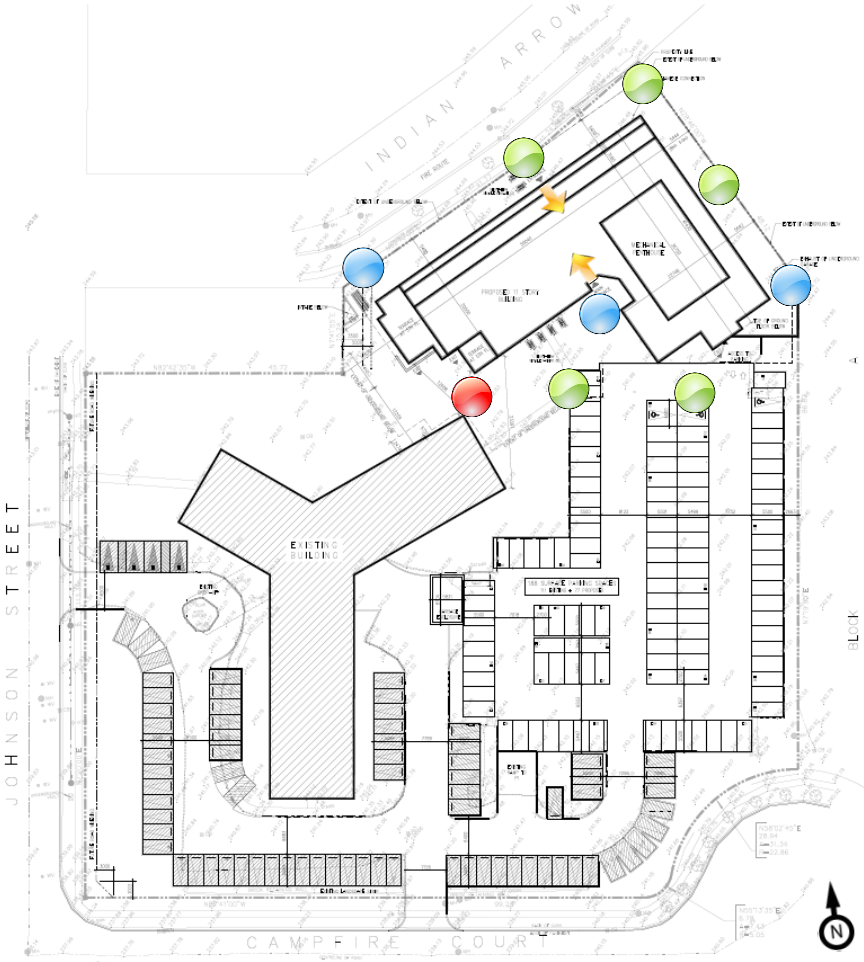
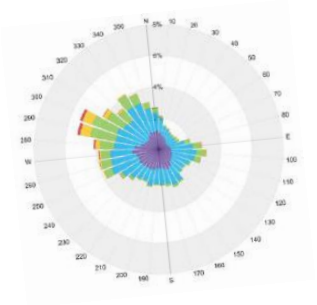


Image 6: Predicted *SUMMER* Wind Comfort Conditions

6. ANTICIPATED WIND CONDITIONS

Predicted
WINTER
Wind Comfort Conditions

- Sitting / Standing
- Strolling / Walking
- Potentially Uncomfortable



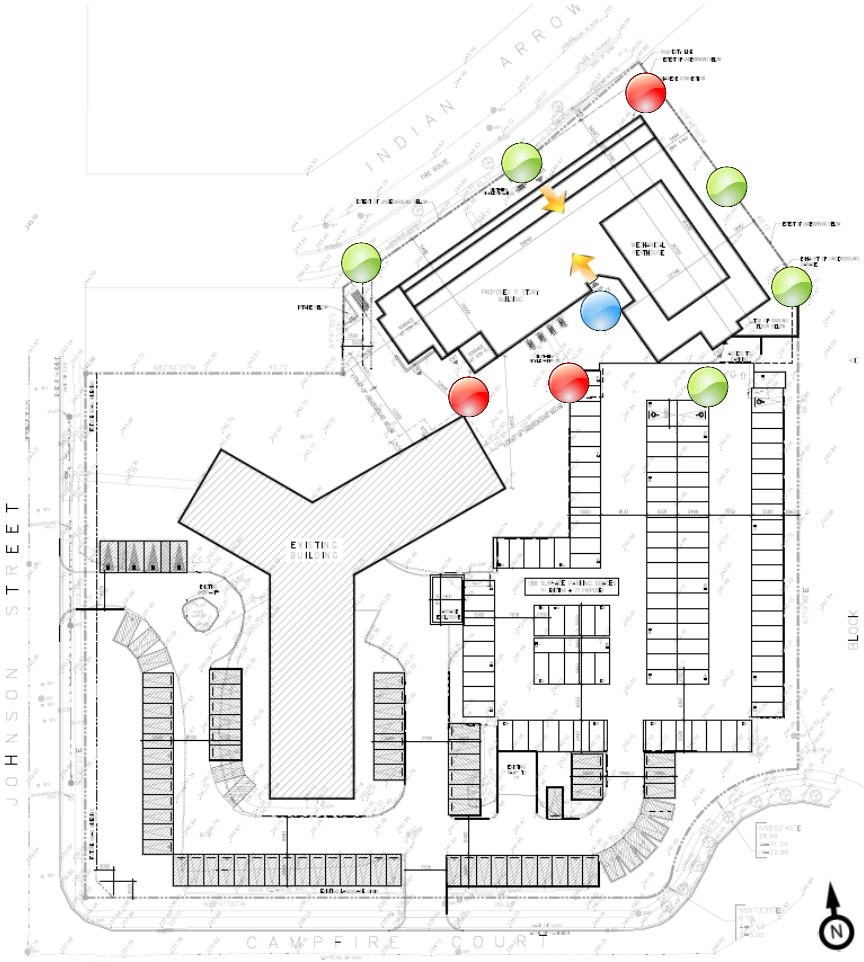


Image 7: Predicted *WINTER* Wind Comfort Conditions

6.2.2 Public Sidewalks

The public sidewalk along Indian Arrow Road is for the most part expected to have acceptable wind conditions. The exception is the sidewalk area near the northeast corner of the building during the winter (see Image 7), where *uncomfortable* conditions are possible. These could be caused by northwesterly winds being redirected by the north building façade and accelerating around the building corner (see Image 4b). Planting coniferous trees in the this corner area between the building and sidewalk should help avoid this potential impact on the sidewalk.

6.2.3 Shoreview Park

This project is not expected to have a detrimental impact on winds in the adjacent park.

6.2.4 Parking Lot

As can be seen in Image 6, westerly winds will be channeled (see Image 4c) between the proposed building and the existing tower resulting in potentially *uncomfortable* winter winds in the north end of the parking lot. This impact can be mitigated by planting a significant number of coniferous trees between the two buildings.

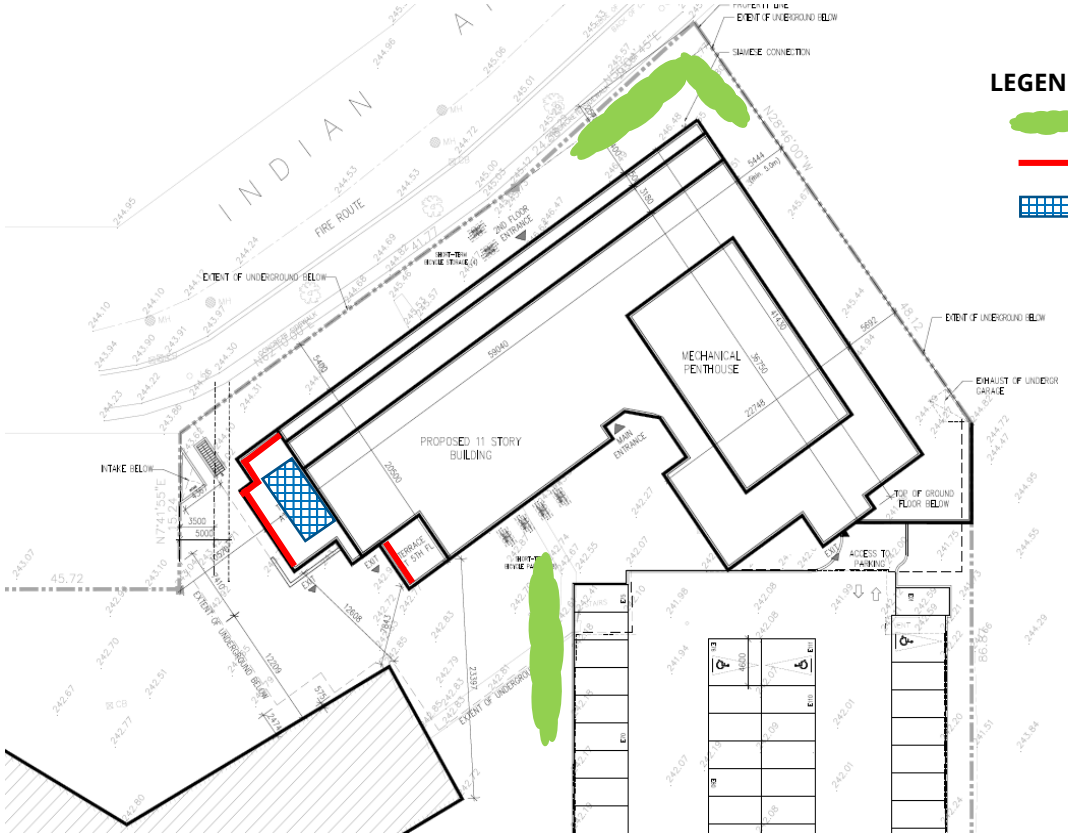
6.2.5 5th Floor Terraces

Due to the channeling of winds between the proposed and existing buildings (as described in section 6.2.4) we believe that the 5th floor terraces will be significantly windier than desired for passive pedestrian use. In fact, there is a risk they could be *uncomfortable* in the summer. Given this prediction we recommend the following:

1. The team reconsider the programming and not include amenity terraces in this area between the two buildings; or,

2. The team consider significant wind control measures on these terraces to make them usable. These would have to include perimeter wind screens and overheard trellises as shown in Image 8.

7. RECOMMENDATIONS



LEGEND:

- 5m tall, coniferous trees, tightly spaced
- 3m tall vertical wind screens >70% solid
- >50% solid overhead trellis

Image 8: Recommended Wind Control

8. EXAMPLES OF WIND CONTROL

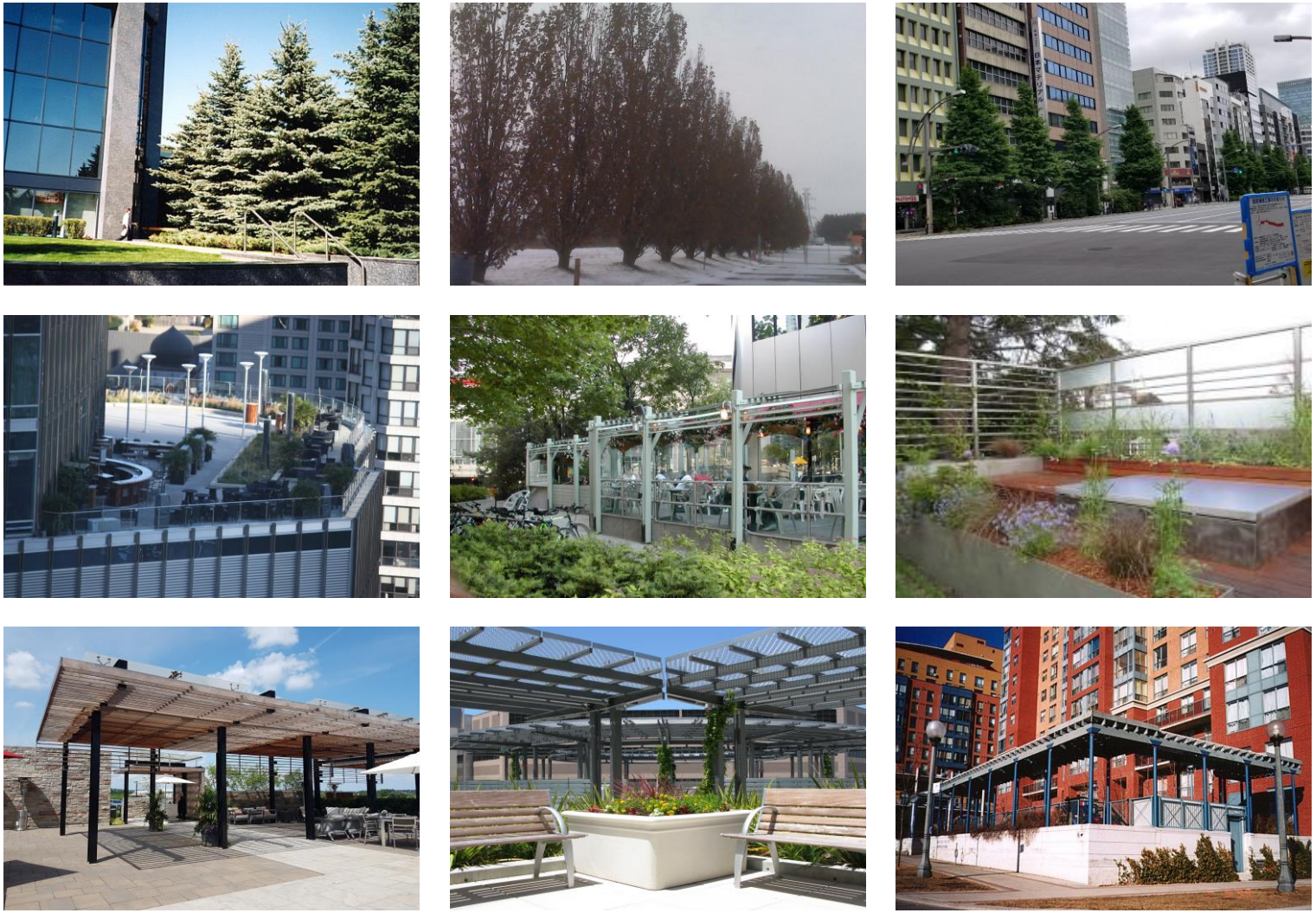


Image 9: Examples of Wind Control

9. SUMMARY

Wind conditions on and around the proposed residential development at 37 Johnson Street in Barrie, ON are discussed in this report and our assessment is based on the local wind climate, surrounding buildings and our past experience with wind tunnel testing of similar buildings.

The proposed development has several positive design features such as well situated entrances. Suggestions for improving wind conditions on an adjacent sidewalk, parking lot and 5th floor terraces are provided in the report.

Wind tunnel testing may be required at a later design stage, as per the City's Terms of Reference, to quantify the wind conditions at the site and optimize the wind control measures presented herein.

10. APPLICABILITY OF RESULTS

The assessment presented in this report for the proposed 37 Johnson Street residential development are based on the design drawings and documents received from Starlight Investments on October 16, 2019.

In the event of any significant changes to the design, construction or operation of the building or addition of surroundings in the future, RWDI could provide an assessment of their impact on the pedestrian wind conditions discussed in this report. It is the responsibility of others to contact RWDI to initiate this process.