REPORT

ELIZABETH & PARK STREETS

MISSISSAUGA, ONTARIO

PEDESTRIAN WIND ASSESSMENT

RWDI PROJECT # 2001111
APRIL 29, 2020

SUBMITTED TO

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EXECUTIVE SUMMARY

RWDI was retained to provide a pedestrian wind assessment for a proposed development at 42-46 Park Street East and 23 Elizabeth Street North in the Port Credit neighborhood of Mississauga, Ontario.

Our assessment was based on the local wind climate, the current design of the proposed development, the existing surrounding buildings, our experience with wind tunnel testing of similar buildings in the Toronto area, and screening-level modelling.

Wind conditions can be summarized as follows:

- Wind conditions on the existing site are most likely to be considered comfortable for standing in the summer and walking in the winter. No exceedances of the wind safety criterion are likely to exist.
- With the introduction of the proposed project, wind speeds along the perimeter sidewalks will increase to standing / walking in summer and walking / uncomfortable in winter. Wind control strategies are described in this report.
- We do not expect winds to be unsafe with the proposed development in place.
- The main building entrance and townhouse entrances are expected to be less than ideal, requiring some localized design modifications and/or wind control strategies.
- The service access area is predicted to have uncomfortable winds in the winter. Given that pedestrian use here is unlikely this may be considered acceptable. If not, wind control suggestions have been made.
- The elevated amenity deck at Level 7 are predicted to be less than ideal for passive summer use. Conceptual wind control suggestions have been made.
- As per the Urban Design Terms of Reference, wind tunnel testing of a scale model will be required for this project to confirm these predictions and develop appropriate wind control strategies.

1. INTRODUCTION

Rowan Williams Davies & Irwin Inc. (RWDI) was retained by Edenshaw Elizabeth Developments Limited to assess the wind comfort conditions for the proposed project at 42-46 Park Street East and 23 Elizabeth Street in the Port Credit neighborhood of Mississauga, Ontario. This report was prepared in support of the project application with the City under their Urban Design Terms of Reference for Wind Comfort and Safety Studies dated June 2014. The qualitative assessment is based on the following:

- a review of the long-term meteorological data from Billy Bishop Toronto City Airport ;
- design drawings and documents received from the design team between April 7 and April 15, 2020;
- wind tunnel studies undertaken by RWDI for similar projects in the Greater Toronto Area;
- our engineering judgment, experience, and expert knowledge of wind flows around buildings[1-3]; and,
- use of software developed by RWDI (*WindEstimator*[2]) for estimating the potential wind conditions around generalized building forms.

Predicting wind speeds and frequencies of occurrence is complicated. This qualitative approach provides a screening-level estimation of potential wind conditions. Conceptual wind control measures to improve wind comfort are recommended, where necessary. As per the Urban Design Terms of Reference, wind tunnel testing of a scale model will be required for this project at a later design stage to confirm these predictions and develop appropriate wind control strategies.

Note that other wind issues, such as those related to cladding and structural loads, air quality, stack effect, door operability, snow, etc., are not considered in the scope of this assessment.

Image 1 – Aerial View of the Existing Site *(Courtesy of Google™ Earth)*

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 & BUILDING INFORMATION

The proposed development is located at the northeast corner of the intersection of Park Street East and Elizabeth Street North. The GO Train railway corridor is located less than 100 m to the north of this site (**Image 1)**. The current site is occupied by four single family homes.

The site is immediately surrounded by mid-rise residential buildings to the west, north and east with some single family homes to the south. Lake Ontario is located approximately 500m to the south, and Billy Bishop Toronto City Airport is located approximately 17 km to the southeast.

The proposed project consists of a 22-storey residential tower with townhomes on the ground floor, and an amenity deck at Level 7. Key pedestrian areas at grade include the residential tower entrance off Park Street and entrances to the townhouses off Elizabeth Street, adjacent public sidewalks and the outdoor amenity deck.

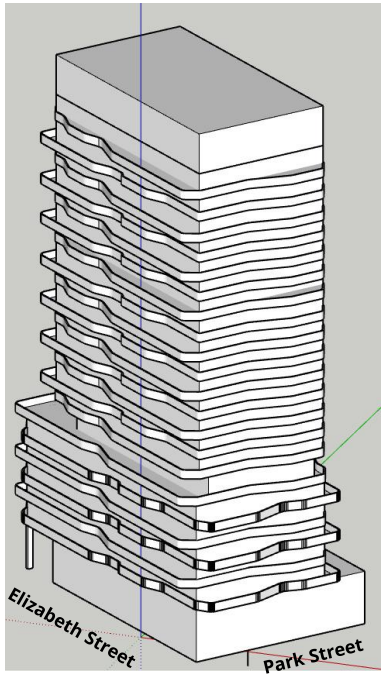


Image 2 – 3D View of the Proposed Project Looking North
(courtesy of IBI Architects)

3. WIND DATA

Wind statistics recorded at Billy Bishop Toronto City Airport between 1987 and 2017, inclusive, were analyzed for the summer (May to October) and winter (November to April) seasons. **Image 3** graphically depicts the directional distributions of wind frequencies and speeds for the two seasons.

Winds are predominant from the northwest through to the southwest, and northeast directions throughout the year, as indicated by the wind roses.

Strong winds of a mean speed greater than 30 km/h measured at the airport (at an anemometer height of 10 m) occur more often in the winter than in the summer. Strong winds from the southwest and east-northeast directions may be the source of potentially *uncomfortable* or even severe wind conditions, depending upon the site exposure or development design.

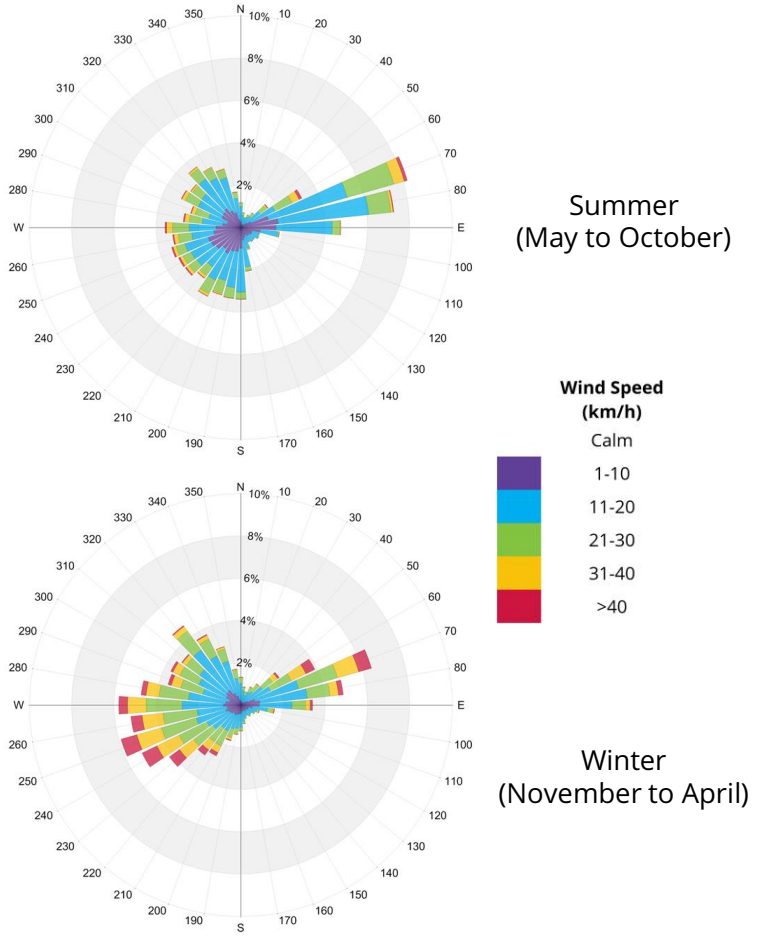


Image 3 – Directional Distribution of Winds Approaching Billy Bishop Toronto City Airport from 1987 to 2017

4. CRITERIA

The City of Mississauga pedestrian wind criteria were used in the current assessment and are presented as follows:

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

Wind comfort is categorized by typical pedestrian activities:
***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 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*, they exceed the wind safety criterion or they are not compatible with the intended pedestrian use.

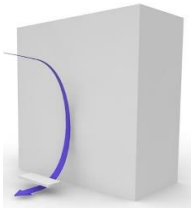
Note that these wind speeds are assessed at pedestrian height (i.e., 1.5 m above grade or the concerned floor level), typically lower than those recorded in the airport (10 m height and open terrain).

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 would be appropriate for sidewalks and service areas, and lower speeds comfortable for standing are required for building entrances where pedestrians may linger. Wind speeds comfortable for sitting are appropriate for outdoor amenity areas during the summer, when these areas will be mainly used.

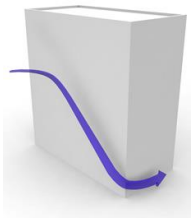
5.1 Wind Flow around Buildings

In our discussion of wind conditions on and around the proposed Project, reference may be made to the following generalized wind flows (see **Image 4**). If these building / wind combinations occur for prevailing winds, there is a greater potential for increased wind activity and *uncomfortable* conditions.



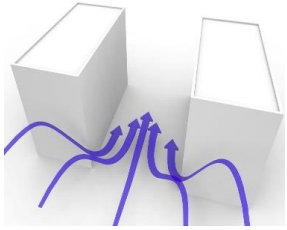
Downwashing

Tall buildings tend to intercept the stronger winds at higher elevations and redirect them to the ground level. This is often the main cause for wind accelerations around large buildings at the pedestrian level.



Corner Acceleration

Winds approach at an oblique angle to a tall façade and are deflected down causing a localized increase in the wind activity or corner acceleration around the exposed building corner(s) at pedestrian level.

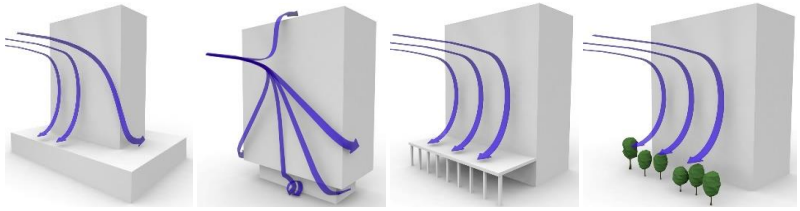


Channelling

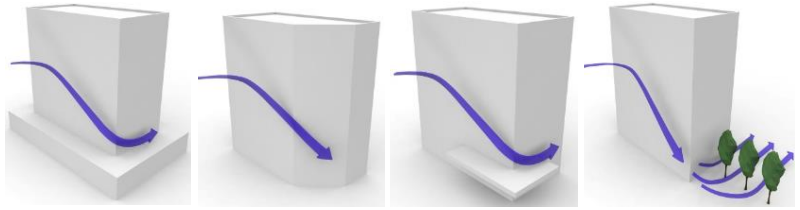
When two buildings are situated side by side, wind flow tends to accelerate through the space between the buildings due to channelling effect caused by the narrow gap.

Image 4: Generalized Wind Flows

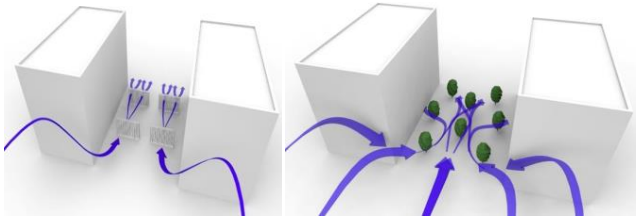
Design details such as; setting back a tall tower from the edges of a podium, deep canopies close to ground level, wind screens / tall trees with dense landscaping, etc. (**Image 5**) can help reduce wind speeds. The choice and effectiveness of these measures would depend on the exposure and orientation of the site with respect to the prevailing wind directions and the size and massing of the proposed buildings.



Podium ***Undercut*** ***Canopy*** ***Landscaping***



Podium ***Chamfer*** ***Canopy*** ***Landscaping***



Screens ***Landscaping***

Image 5: Examples of Common Wind Control Measures

5.2 Existing

Wind conditions on the existing site are most likely to be considered comfortable for standing in the summer and walking in the winter. No exceedances of the wind safety criterion are likely to exist on this site.

5.3 Proposed

The proposed project has a couple of very positive design features from a wind perspective. One is the inclusion of a podium with a tower setback along the north side at Level 7 and on the east side at Level 2 (see **Image 6**). This will help to reduce wind speeds at grade level by disrupting downwashing winds that are likely to be redirected down by the tower (as per **Images 4 and 5**). The other positive design aspect is the fact that the balconies have a significant cantilever and vary both in size and plan at different floor levels. Having said this, the proposed project is of significant scale relative to the surroundings, so the building will intercept stronger winds at higher elevations, causing downwashing flows, corner accelerations and channelling between the towers as per **Image 4**. All of these flow phenomena will render the site subject to windier conditions than currently exist throughout the year. As such, Edenshaw will be working to further develop wind control mitigation measures to improve wind comfort conditions in these areas.

Predicted wind comfort conditions are presented in **Images 7 and 8** for summer and winter, respectively.

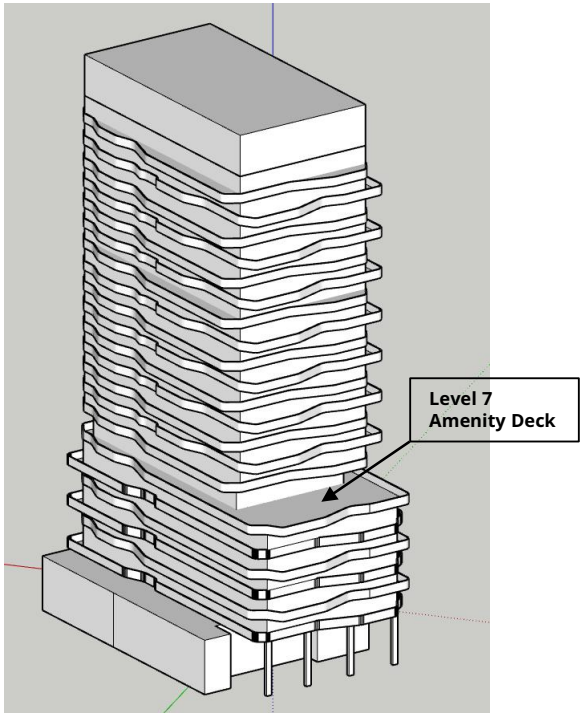
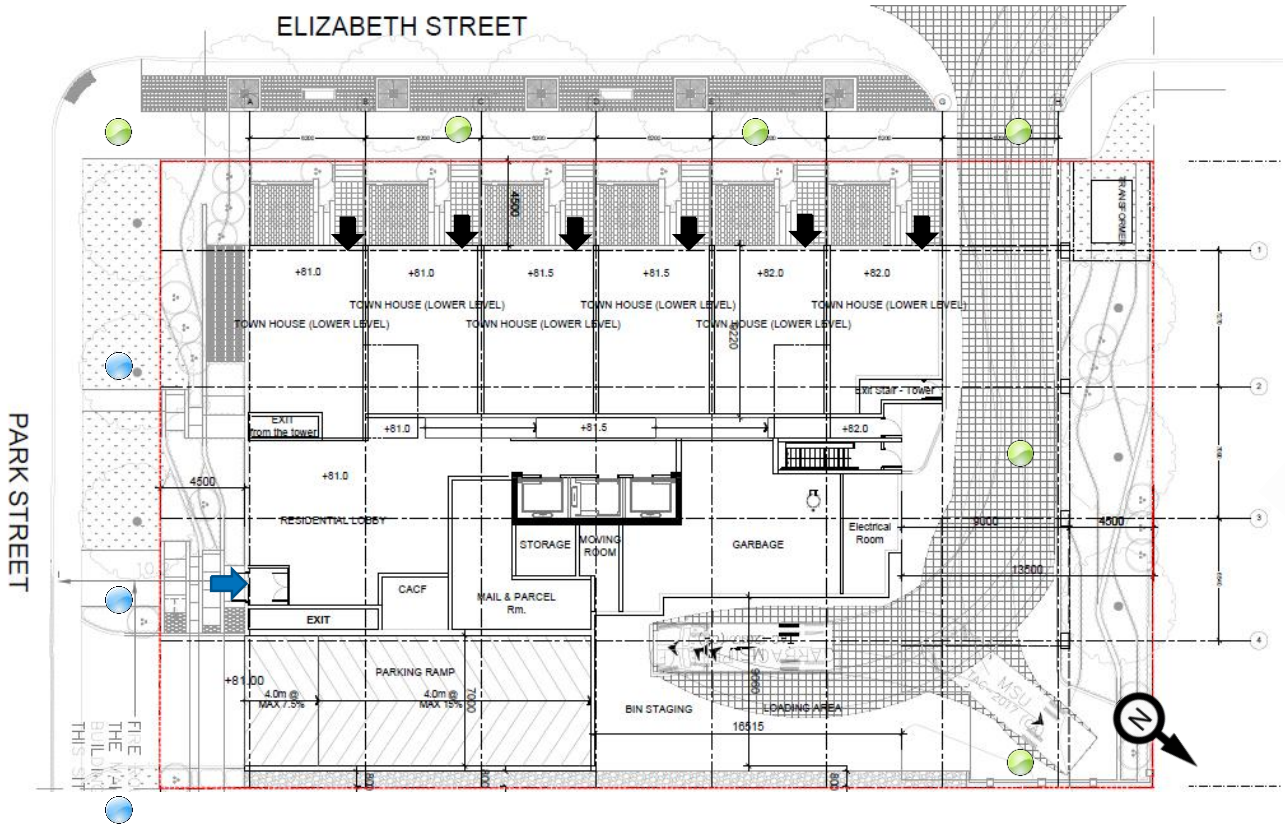


Image 6: 3D View of Project Looking South
(*courtesy of IBI Architects*)

5. PREDICTED WIND CONDITIONS



Predicted *SUMMER* Wind Comfort and Safety Conditions

- Sitting / Standing
- Walking
- Uncomfortable

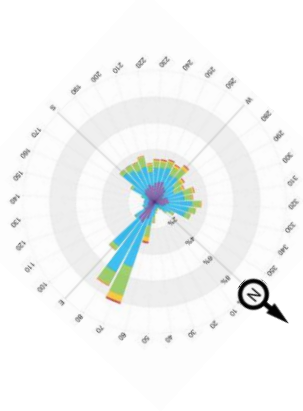
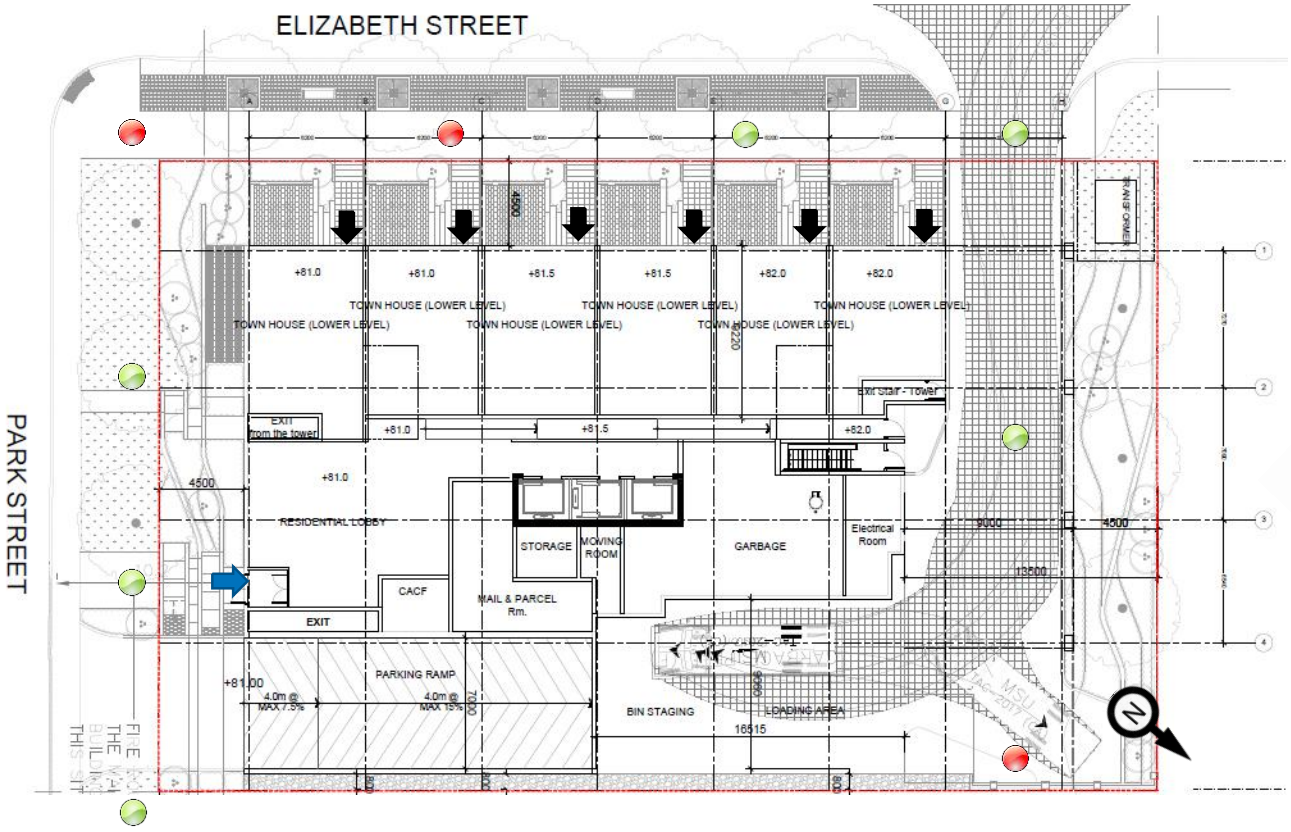


Image 7: Predicted Wind Comfort and Safety Conditions *(SUMMER)*

5. PREDICTED WIND CONDITIONS



Predicted *WINTER* Wind Comfort and Safety Conditions

- Sitting / Standing
- Walking
- Uncomfortable

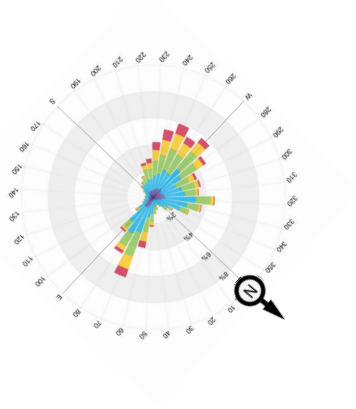


Image 8: Predicted Wind Comfort and Safety Conditions *(WINTER)*

5.3.1 Public Sidewalks

As shown in **Image 7**, summer wind speeds are expected to be comfortable for walking or better on sidewalks on and around the project site. These conditions should, for the most part, be considered acceptable for the intended pedestrian use. During the winter months (see **Image 8**), seasonally higher wind speeds are expected to result in windier conditions around the site that will be comfortable for walking or uncomfortable on sidewalks around the site. No exceedances of the safety criterion are anticipated. Planting coniferous or marcescent street trees along the Elizabeth Street sidewalk would help improve these uncomfortable conditions (see **Image 10)**. Please note that these mitigations strategies are only suggestions at this point and alternative mitigation strategies can also be explored at a later stage.

5.3.2 Residential Entrances

The main residential tower entrance, as indicated by the blue arrow in **Images 7 and 8,** is expected to be appropriate in the summer. The townhouse entrances off of Elizabeth Street (black arrows in **Images 7 and 8**), will be suitable for walking or better in the summer. These are less than ideal for the entrance to the townhouses so conceptual wind control options are suggested below.

Winter winds are expected to be less comfortable at both the tower entrance and the entrances to the townhouses (especially those closest to the intersection) requiring wind control in the form of recessing the entrances and/or incorporating architectural wind screens / canopies to provide better wind protection. See **Images 10 and 12.** Please note that these mitigations strategies are only suggestions at this point and alternative mitigation strategies can also be explored at a later stage.

5.3.3 Elevated Amenity Deck

The proposed amenity deck at Level 7 will likely be appropriate for walking in summer and uncomfortable in winter. As the amenity deck will not likely be used in the winter, the summer conditions are the important ones. The predicted walking conditions are not appropriate for passive use of an amenity deck and would require some form of wind control which could include the addition of architectural wind screens and/or an overheard trellis. The precise configuration of wind control will depend on the intended use and extent of the passive use areas. **Image 9** offers some guidelines for the installation of screens for wind control which can be in the form of architectural features or planters with landscaping. See **Images 11 and 13**. Please note that these mitigations strategies are only suggestions at this point and alternative mitigation strategies can also be explored at a later stage.

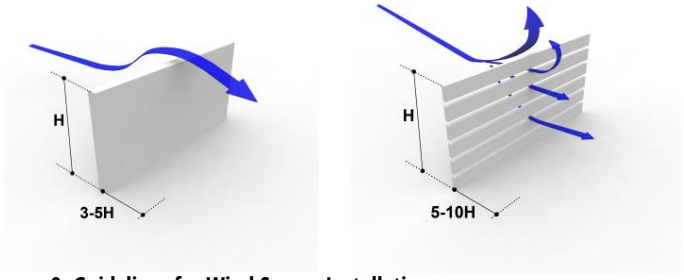


Image 9: Guidelines for Wind Screen Installation

5.3.4 Service Access Area

As shown in **Image 7**, summer wind speeds are expected to be comfortable for walking in this area. These conditions should, for the most part, be considered acceptable.

During the winter months (see **Image 8**), seasonally higher wind speeds are expected to result in uncomfortable winds toward the east end of this service access area. Given the limited pedestrian activity expected in this area this may be considered acceptable. If not, then a wind control strategy is suggested in **Image 10**. We do not anticipate any unsafe winds in this area or anywhere else on this site.

6. WIND CONTROL RECOMMENDATIONS

A – Building Entrances

- Recess building entrances AND/OR
- Add canopies AND/OR
- Add architectural screens / planters on both sides.

B – Public Sidewalk

- Plant coniferous or marcescent trees to provide more winter wind protection.

C – Service Access Area

- If winter wind conditions prove unacceptable here then add a perimeter wind screen / landscaping.

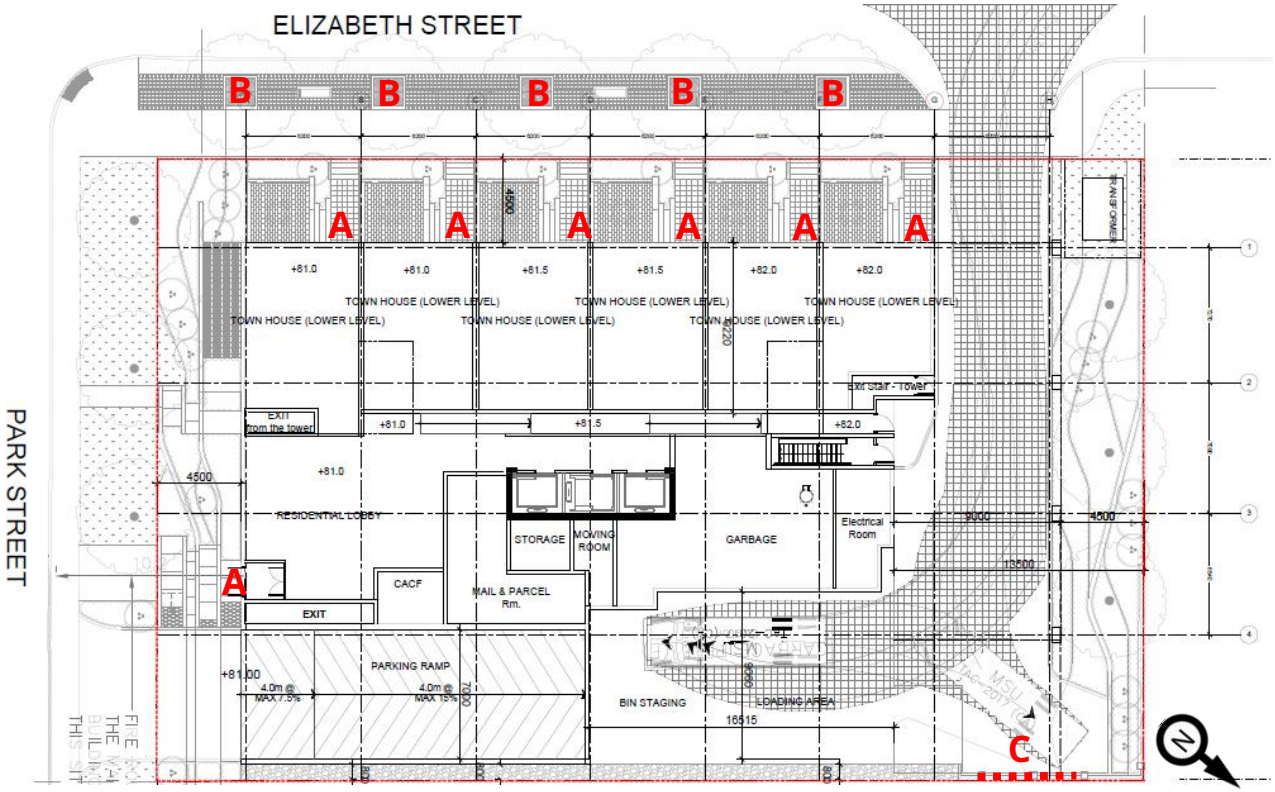


Image 10: Conceptual Wind Control Recommendations

Please note the final wind mitigation strategies will be defined at a later stage when results from wind tunnel test are available. For now, these are only suggestions.

6. WIND CONTROL RECOMMENDATIONS

D – Amenity Deck

- Perimeter wind screens / landscaping AND/OR
- Overhead canopy / trellis

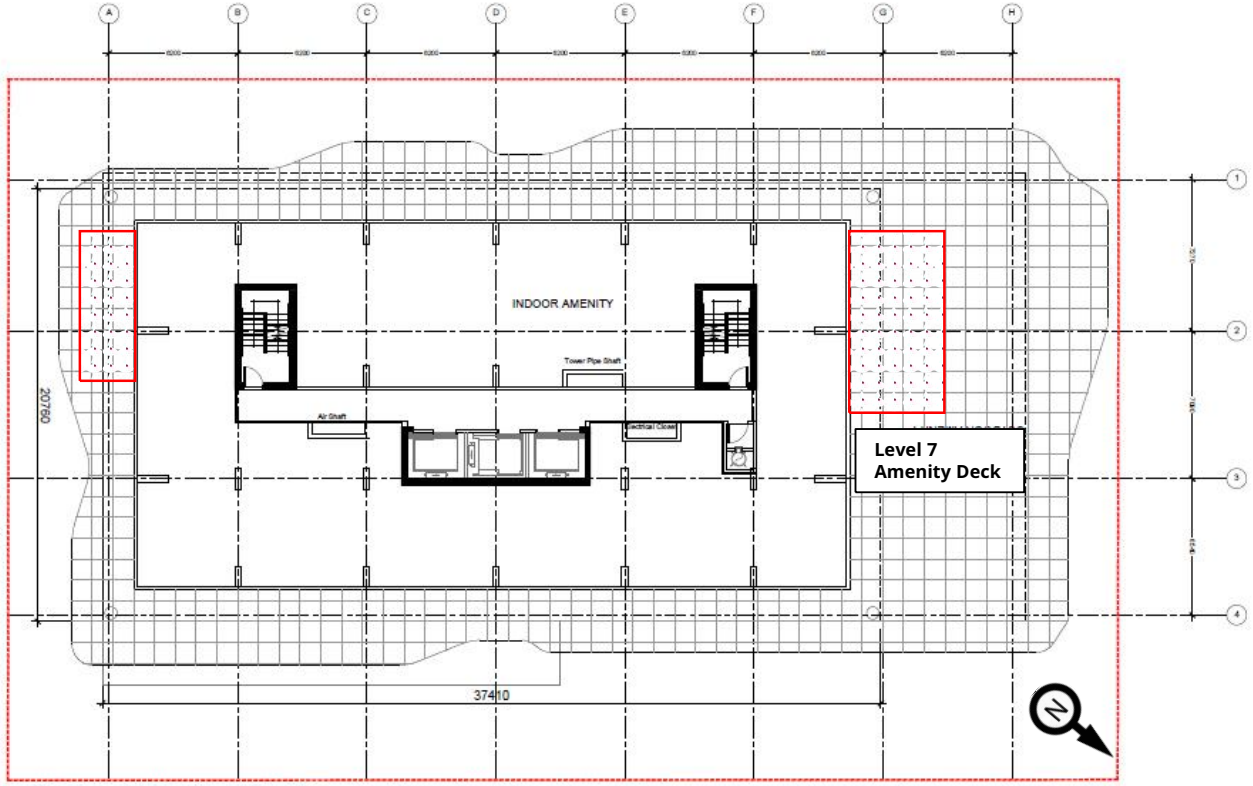


Image 11: Conceptual Wind Control Recommendations

The final wind mitigation strategies will be defined at a later stage when results from wind tunnel test are available. For now, these are only suggestions.

7. EXAMPLES OF WIND CONTROL STRATEGIES






Image 12 – Canopies and Recessed Entrances

7. EXAMPLES OF WIND CONTROL STRATEGIES

Image 13 – Screens and Trellises on Amenity Decks

8. APPLICABILITY OF RESULTS

The assessment presented in this report are for the proposed Elizabeth and Park Streets development project in Mississauga, Ontario. The drawings and information listed in the table below were used for our assessment.

File Name	File Type	Date Received (mm/dd/yyyy)
2020-04-17 - ROWE - DRAFT rezoning	.pdf	04/17/2020
Elizabeth and Park Street	.skp	04/14/2020

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.