895 LAWRENCE AVENUE EAST

TORONTO, ON

PEDESTRIAN WIND ASSESSMENT

PROJECT #2003091
JUNE 16, 2022

SUBMITTED TO

Joshua Butcher
Director, Development
Joshua.Butcher@fcr.ca

First Capital
85 Hanna Avenue, Suite 400
Toronto, ON, M6K 3S3
T: 416.216.4279

SUBMITTED BY

Dan Bacon
Senior Project Manager | Principal
Dan.Bacon@rwdi.com

Frank Kriksic
Microclimate Consultant | Principal
Frank.Kriksic@rwdi.com

RWDI
600 Southgate Drive
Guelph, ON N1G 4P6
T: 519.823.1311
F: 519.823.1316

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1. INTRODUCTION

Rowan Williams Davies & Irwin Inc. (RWDI) was retained to conduct a qualitative assessment of the pedestrian wind conditions expected around the proposed 895 Lawrence Avenue East development in Toronto (North York), Ontario. This effort is intended to inform good design and has been conducted in support of the Official Plan Amendment (OPA) and Rezoning (RZA) application for the project.

The project site is currently occupied by a low-rise retail plaza and a parking lot. There are some mid-rise buildings located to the south and northeast. To the east of the site are low-rise commercial buildings while the southwest through north is mostly low-rise residential (Image 1). Downtown Toronto is approximately 8 km to the south-southwest of the site, while Toronto Pearson International Airport lies approximately 21 km to the west-southwest.

The redevelopment project features two residential towers. West Tower A will be 22-storeys (82.5 m tall) and East Tower B will be 17-storeys (67.5 m tall). The mixed-use project will include ground floor commercial units and two levels of underground parking. A rendering of the proposed project is provided in Image 2.

Pedestrian areas of interest include building entrances, sidewalks, the grade-level Gateway Plaza and above-grade amenity spaces at Levels 2 and 7.

Image 1: Aerial View of the Existing Site and Surroundings (Credit: Google Maps)

1. INTRODUCTION

Image 2: Project Rendering – View from the North (Credit: WZMH)

2. METHODOLOGY

Predicting wind speeds and occurrence frequencies is complex. It involves the combined assessment of 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 on pedestrian wind conditions around buildings, yielding a broad knowledge base. In some situations, this knowledge and experience, together with literature, allow for a reliable, consistent and efficient desktop estimation of pedestrian wind conditions without wind-tunnel testing. This approach provides a screening-level estimation of potential wind conditions and offers conceptual wind control measures for improved wind comfort, where necessary.

In order to quantify and confirm the predicted conditions or refine any of the suggested conceptual wind control measures, physical scale model tests in a boundary-layer wind tunnel will be carried out.

RWDI's assessment is based on the following:

- Architectural drawings received from WZMH on June 9, 2022;
- A review of the regional long-term meteorological data from Toronto Pearson International Airport;
- Use of RWDI's proprietary software (*WindEstimator*[1]) for providing a screening-level numerical estimation of potential wind conditions around generalized building forms;
- Wind-tunnel studies and desktop assessments undertaken by RWDI for projects in the Toronto area;
- RWDI's engineering judgement and knowledge of wind flows around buildings[2, 3]; and,
- RWDI Criteria for pedestrian wind comfort and safety.

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

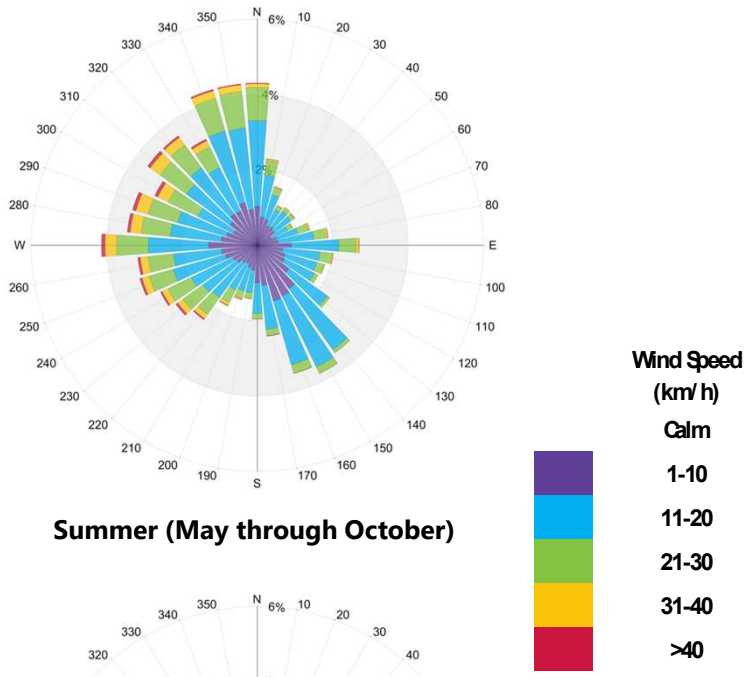
1. H. Wu and F. Kriksic (2012). "Designing for Pedestrian Comfort in Response to Local Climate", *Journal of Wind Engineering and Industrial Aerodynamics*, vol.104-106, pp.397-407.
2. H. Wu, C.J. Williams, H.A. Baker and W.F. Waechter (2004), "Knowledge-based Desk-Top Analysis of Pedestrian Wind Conditions", *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.

3. METEOROLOGICAL DATA

Meteorological data from Toronto Pearson International Airport for the period from 1990 to 2020 were used as a reference for wind conditions in the area as this is the nearest station to the site with long-term, hourly wind data. The distributions of wind frequency and directionality for the summer (May through October) and winter (November through April) seasons are shown in the wind roses in Image 3.

When all winds are considered, winds from the southwest through north directions are predominant throughout the year, with secondary winds from the east year-round and from the southeast in the summer.

Strong winds of a speed greater than 30 km/h measured at the airport (red and yellow bands) occur more often in the winter than in the summer season. Winds from the west-southwest through north-northwest and east directions potentially could be the source of uncomfortable or severe wind conditions, depending upon the site exposure and development design.



Summer (May through October)

Winter (November through April)

Image 3: Directional Distribution of Winds Approaching Toronto Pearson International Airport (1990 to 2020)

4. WIND CRITERIA

The RWDI pedestrian wind criteria are used in the current study. 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 including the City of Toronto. The criteria are as follows:

4.1 Safety Criterion

Pedestrian safety is associate with excessive gust 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 Criteria

Wind comfort can be 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 (≤ 14 km/h): Gentle breezes suitable for main building entrances and bus stops.

Strolling (≤ 17 km/h): Moderate winds that would be appropriate for window shopping and strolling along a downtown street, plaza or park.

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

Uncomfortable: The comfort category for walking is not met.

Wind conditions are considered suitable for sitting, standing, strolling 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.

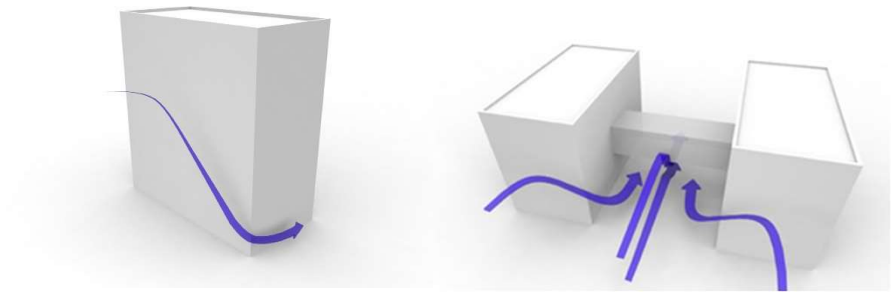
For the current development, wind speeds comfortable for walking or strolling are appropriate for sidewalks; lower wind speeds comfortable for standing are required for building entrances where pedestrians may linger, and calm wind speeds suitable for sitting or standing are desired in areas where passive activities are anticipated, such as the outdoor dining and amenity terraces.

5. RESULTS AND DISCUSSION

5.1 Wind Flow Around Buildings

The proposed re-development will be taller than its immediate surroundings to the west and therefore will tend to intercept the stronger winds at higher elevations and redirect them to the ground level. These winds subsequently move around exposed building corners (Corner Acceleration, Image 4a) and between the gaps and undercuts of adjacent buildings (Channelling Effect, Image 4b) causing a localized increase in wind activity. If these building / wind combinations occur for prevailing winds, there is a greater potential for increased wind activity.

Design details such as stepped massing and wind screens / tall trees with dense underplanting (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.



a) Corner Acceleration **b) Channelling Effect**

Image 4: Generalized Wind Flows

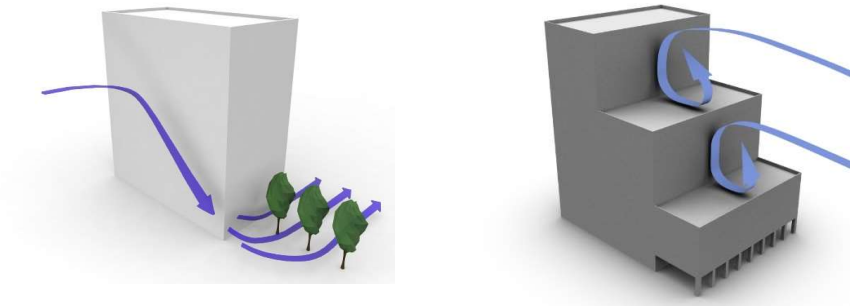


Image 5: Examples of Common Wind Control Measures

5.2 Existing Scenario

As there are no high-rise buildings immediately within the project vicinity light to moderate wind activity would exist. Wind conditions around the site are likely considered comfortable for standing in the summer and strolling or walking in the winter. Wind conditions exceeding the safety criterion are not expected on the existing site.

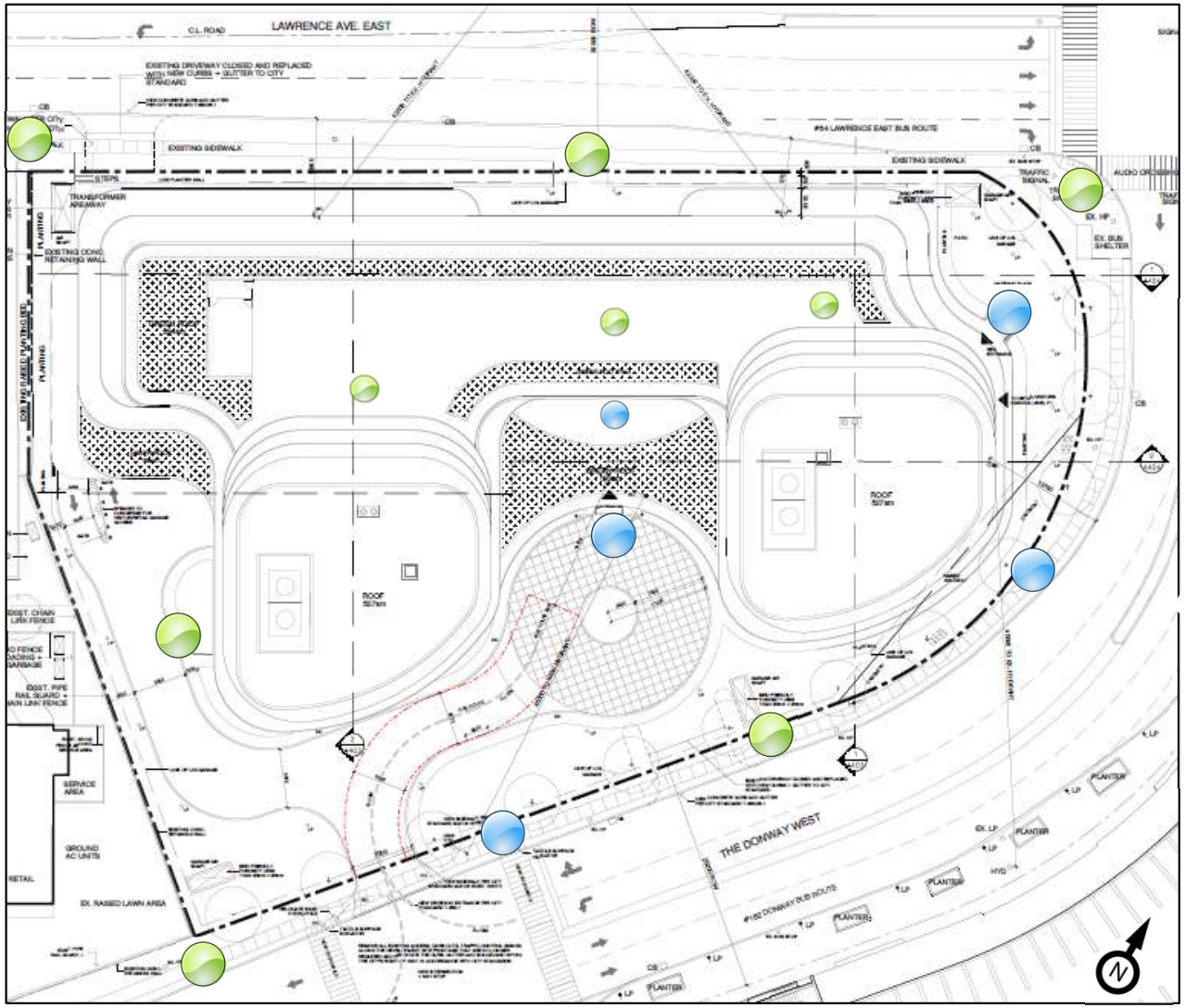
5.3 Proposed Scenario: Wind Flow

The proposed project is taller than most of the immediate surrounding buildings and will therefore be more exposed to prevailing winds. The two-tower design also will promote redirection and channeling of winds. Localized wind flow accelerations are likely to occur near exposed building corners on the west side of the site and on the amenity space between the two towers. However, the proposed stepped massing of the project and the building overhang above grade level are positive features that will help reduce the accelerating wind flows from reaching grade level (as per the example in Image 5) and should be carried forward in the design.

The following sections provide a discussion of the potential wind conditions around the project. The expected wind conditions are shown in Images 6a and 6b for the summer and winter seasons, respectively.

5. RESULTS AND DISCUSSION

5.4 Proposed Scenario: Predicted Wind Conditions - *SUMMER*



WIND CATEGORIES

- Sitting / Standing
- Strolling / Walking
- Uncomfortable
- Safety Exceedance

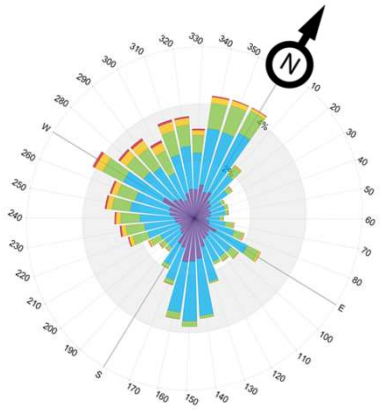
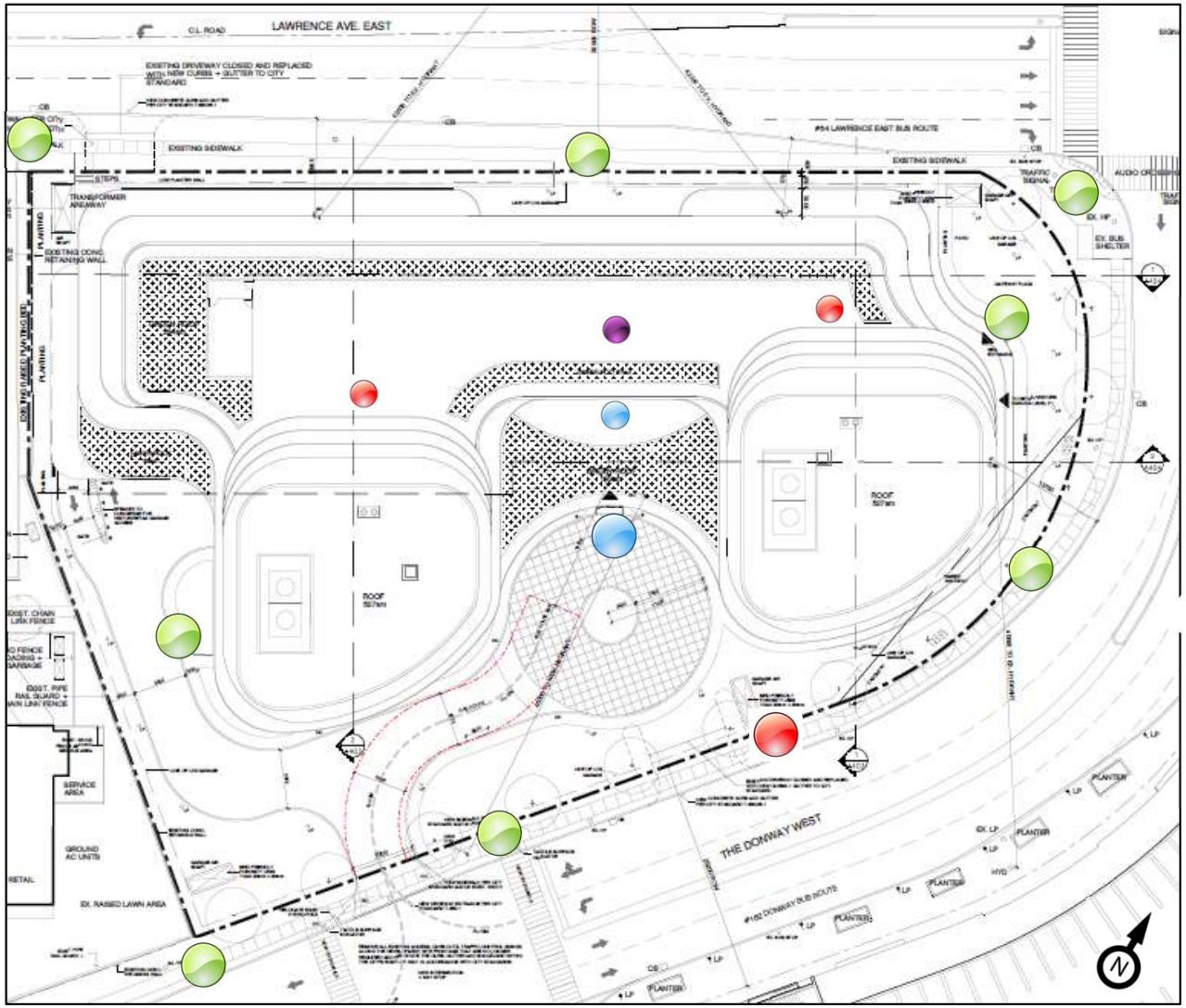


Image 6a: Predicted Wind Conditions - *SUMMER*

5. RESULTS AND DISCUSSION

5.4 Proposed Scenario: Predicted Wind Conditions - *WINTER*



WIND CATEGORIES

- Sitting / Standing
- Strolling / Walking
- Uncomfortable
- Safety Exceedance

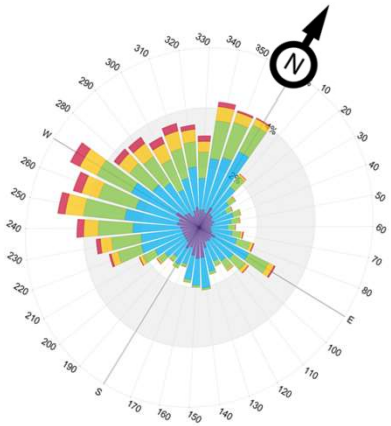


Image 6b: Predicted Wind Conditions - *WINTER*

5.5 Proposed Scenario: Wind Safety

The project site is exposed to westerly prevailing winds and the height of the development is considerable relative to its immediate surroundings. Coupled with the height, the proposed stepped massing reduces the potential for severe gusts. Therefore, the only area where we anticipate a risk of more severe wind conditions is the Level 7 amenity deck where the wind safety criterion could be exceeded.

Wind tunnel testing will be conducted at a later design stage to confirm and quantify these wind conditions.

5.6 Proposed Scenario: Wind Comfort

5.6.1 Entrances

The main entrance to the proposed development is located in a sheltered area on the south side at the proposed drop-off. Wind conditions here are expected to be comfortable for sitting or standing throughout the year (see Images 6a and 6b). These conditions are considered appropriate.

The other residential and retail entrance near the northeast corner of the site provide access from Gateway Plaza. This area will be somewhat windier with conditions comfortable for standing in summer and strolling in winter. These conditions are less-than-ideal and could be addressed by recessing these entrances into the façade at least to the depth of the open doors and/or adding a vertical wind screen / planter on the northwest side of the doors (see Images 7, 8 and 9).

The retail entrances along the north side (with access from Lawrence Avenue East sidewalk) are likely to be comfortable for strolling or walking in winter when standing conditions would be desired. To address this would require recessing the entrances into the façades of the building and/or installing wind screens or planters on the west sides of the entrances (see Images 7, 8 and 9).

Image 7: Examples of Wind Control Measures for Building Entrances

5.6 Proposed Scenario: Wind Comfort

5.6.2 Sidewalks

Wind conditions at most grade level locations around the project, including sidewalks and walkways, are predicted to be comfortable for walking or better on an annual basis (Images 6a and 6b). One exception is expected to the south of the project along The Donway West sidewalk where uncomfortable winter winds are likely. This would be caused by northwesterly winds channeling between the two towers down toward this location. Wind control in the form of coniferous trees to the north of this sidewalk location should mitigate this impact (see Image 7).

The wind impact of the project will be quantified through a wind tunnel study at a later design stage to confirm these predicted conditions and evaluate the level of wind mitigation efforts if required.

5.6.3 Gateway Plaza

This plaza is expected to have wind conditions comfortable for standing and strolling in the summer and winter, respectively (Images 6a and 6b). If more passive activities are planned here (i.e., requiring sitting conditions) then supplementary wind control should be considered in the form of vertical wind screens and/or planters near the NW corner of the plaza (see Image 7, 8 and 9).

5.6.4 Outdoor Amenities

There are outdoor amenity spaces planned at Levels 2 and 7.

The Level 2 terrace will be well protected from prevailing winds providing appropriate wind conditions on a year-round basis. No wind control is required.

The terrace at Level 7 will be exposed to stronger horizontal winds (naturally occurring at this height) as well as the effect of the two towers redirecting and channeling prevailing winds between them as per the examples in Image 4. This is likely to create unsuitable summer conditions for passive activities. During the winter conditions here could be severe however, it is unlikely that the amenity space would be used during the cold months. To improve the summer conditions will require careful consideration for the programming of this space and the implementation of some significant wind control features (e.g., canopies, trellises, vertical wind screens, planters, etc.). Image 8 offers guidelines for the design of vertical wind screens.

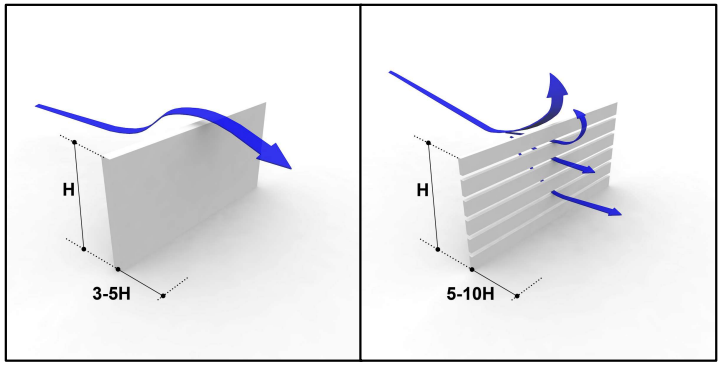


Image 8: Guidelines for Design of Vertical Wind Screens (solid of left and porous on right)

5. RECOMMENDATIONS

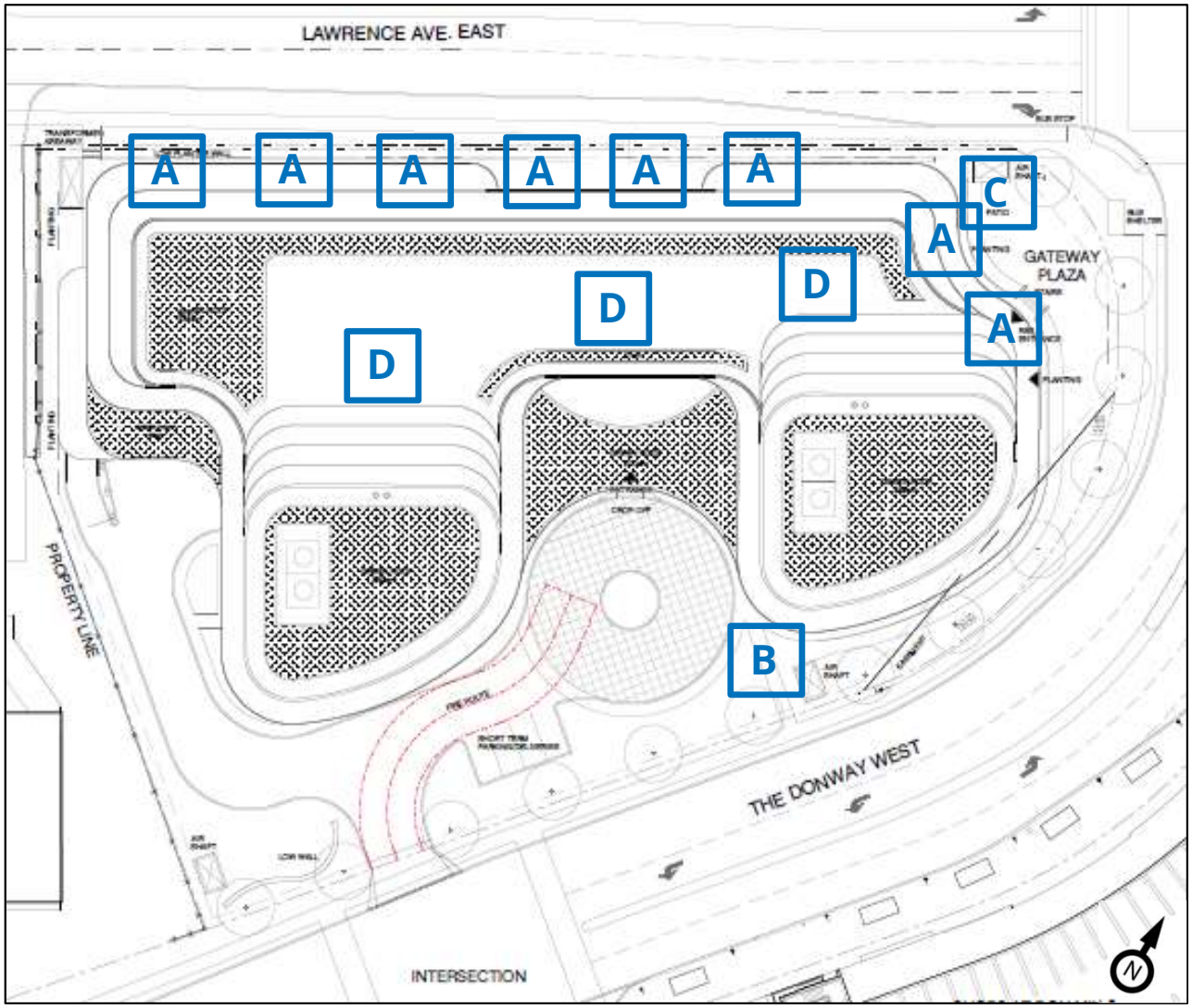


Image 9: Recommended Wind Control Strategies

Legend:

A Recess entrance into the façade at least to the depth of the open doors and/or add a vertical wind screen / planter on W side of door.

B Plant coniferous trees to protect from NW winds.

C Add vertical porous wind screens and/or planters to protect from NW winds.

D Amenity space will require careful programming, vertical wind screens, planters, trellises, canopies, etc.

6. SUMMARY

RWDI was retained to provide an assessment of the potential pedestrian level wind impact of the proposed 895 Lawrence Avenue East development in Toronto (North York), 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, and screening-level modelling.

Our findings are summarized as follows:

- The proposed redevelopment is taller than the existing surroundings to the west and will therefore be more exposed to prevailing winds likely causing an increase in wind activity at this site.
- Wind conditions on and around the proposed project are not expected to exceed the recommended criteria for pedestrian safety at grade level.
- The primary residential entrance will be well sheltered from prevailing winds resulting in appropriate wind conditions on a year-round basis.
- The residential entrance from Gateway Plaza and retail entrances across the north side of the project are expected to have less-than-ideal conditions. Wind control strategies are described.
- In general, wind conditions on sidewalks and walkways are predicted to be comfortable for strolling or walking on an annual basis. One exception is the sidewalk to the south of the project where uncomfortable winter winds are likely. Wind control strategies are suggested.
- The Level 2 amenity space will be well situated and is therefore expected to have appropriate wind conditions.
- The Level 7 amenity space will be exposed to stronger winds naturally occurring at this height and will be strongly influenced by winds being redirected and channeled by the towers. The design team will consider mitigation wind control strategies in their programming of the space.
- Wind tunnel testing of a scale model will be carried out to confirm and quantify these estimated conditions and develop wind control where required. The goal will be to achieve appropriate comfort conditions on and around this project.

7. APPLICABILITY OF RESULTS

The assessment presented in this report are for the proposed 895 Lawrence Avenue East redevelopment based on the information listed in the table below. 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.

File Name	File Type	Date Received (mm/dd/yyyy)
895 Lawrence Ave East_Progress Set_220609	pdf	06/09/2022