227 & 229 MAIN STREET S

BRAMPTON, ON

PEDESTRIAN WIND ASSESSMENT

PROJECT #2406921
JUNE 14, 2024

SUBMITTED TO

Wayne Long
Senior Vice President
Development+Architecture+Planning
wlong@nahidcorp.com
T: 647.345.2442 x103

Nahid Corp
31 Scarsdale Road
Unit 2
Toronto, Ontario M3B 2R2

SUBMITTED BY

Neetha Vasan, M.A.Sc., LEED AP
Senior Scientist / Associate
Neetha.Vasan@rwdi.com

Lucas Savedra, B.A.Sc.
Project Manager
Lucas.Savedra@rwdi.com
M: 647.475.1048 x2029

RWDI – Head Office
600 Southgate Drive
Guelph, Ontario, N1G 4P6
T: 519.823.1311
F: 519.823.1316

RWDI – Toronto Office
625 Queen Street West
Toronto, Ontario, M5V 2B7

rwdi.com

1. INTRODUCTION

Rowan Williams Davies & Irwin Inc. (RWDI) was retained to conduct a qualitative assessment of the pedestrian wind conditions expected around the proposed project at 227 & 229 Main Street South in Brampton, Ontario. This effort is intended to inform good design and has been conducted in support of Zoning By-Law Amendment Application for the project.

The proposed site is located at the northwest corner of Main Street South and Charolais Boulevard and currently occupied by two one-storey buildings and parking lots (image 1). The site topography is elevated above the street level. The surroundings comprise low-rise suburban residential areas in most directions, but for a mid-rise building in the adjacent lot to the northwest of the site, and a few mid-rise buildings farther to the northwest. Elgin Woods Park is to the northwest, Charles F. Watson and Family Park is across Main Street to the east, and to the south is a large commercial complex with open parking lots.

The proposed project consists of two 25-storey terraced towers connected at the east end via a 12-storey podium, and two rows of townhomes along the west side of the site as shown on the site plan and section in Image 2. Key areas of interest for this assessment included sidewalks on the streets adjacent to the site and the neighbouring residential lots. Information on the proposed locations of main entrances or outdoor amenity areas were not available at the time of this assessment.

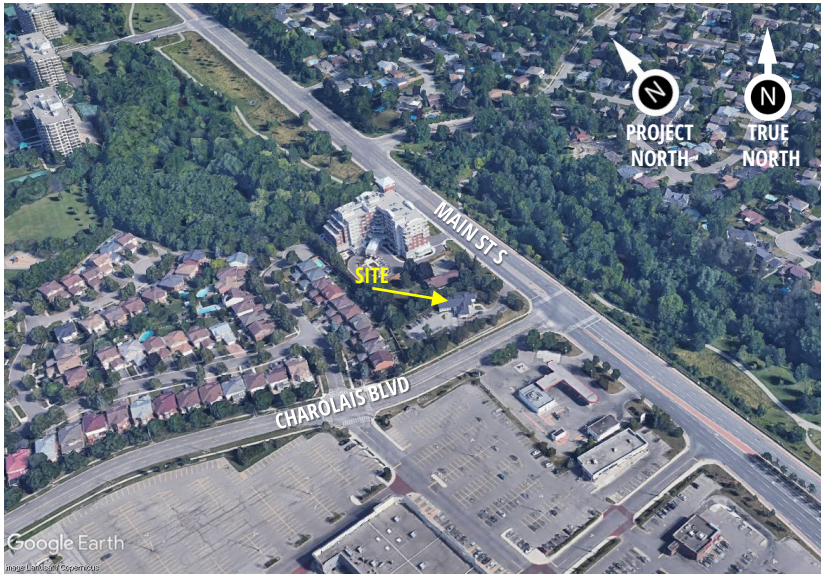


Image 1: Aerial View of the Existing Site and Surroundings (Credit: Google Maps)

1. INTRODUCTION

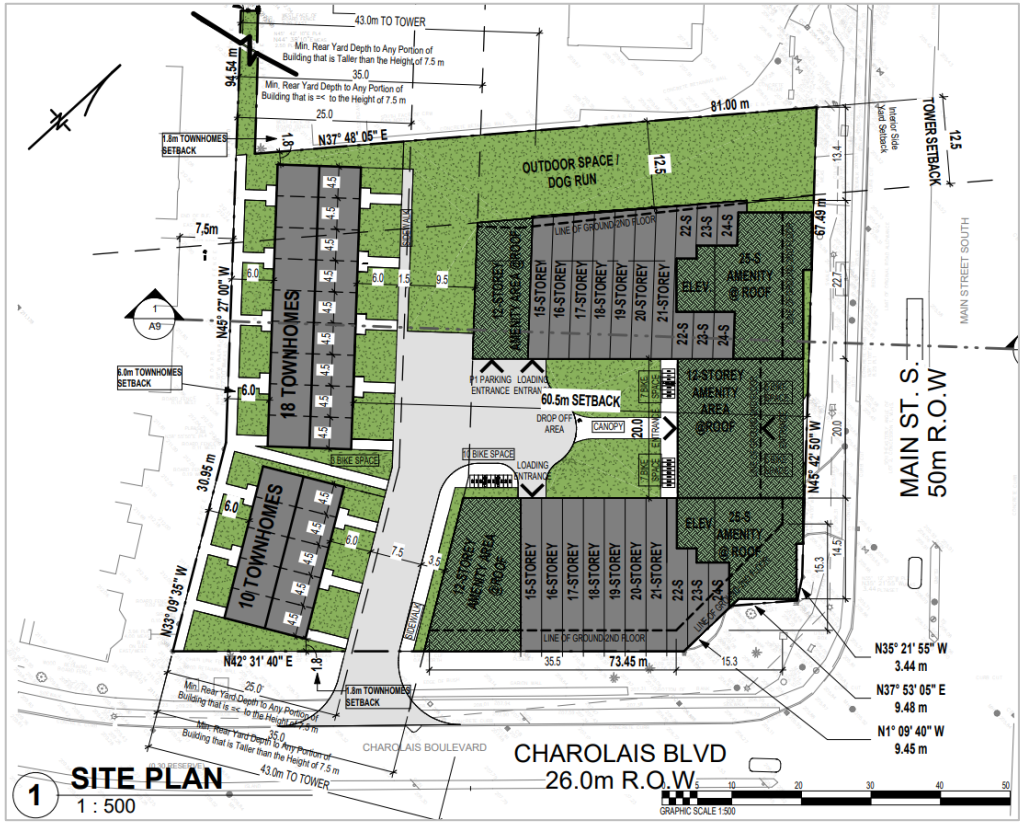


Image 2a: Site Plan

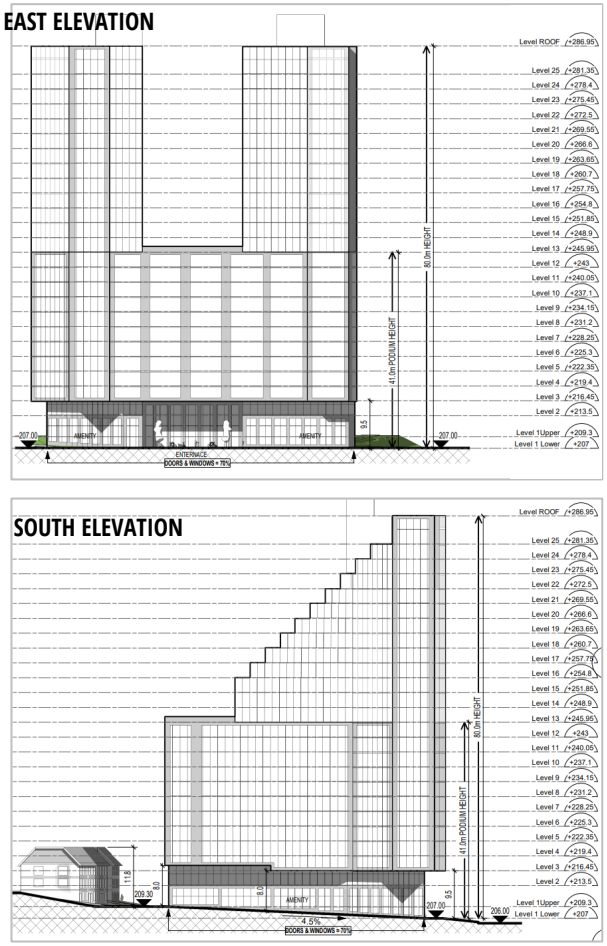


Image 2b: Elevations

2. METHODOLOGY

Predicting wind speeds and occurrence frequencies is complex. It involves a 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 would be required.

RWDI's assessment is based on the following:

- Preliminary site plan and section received from Nahid Corp on May 29, 2024;
- 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 Brampton;
- RWDI's engineering judgement and knowledge of wind flows around buildings[2, 3]; and,
- The criteria for pedestrian wind comfort and safety published by the City of Brampton, Urban Design – Planning & Development.

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.

3. METEOROLOGICAL DATA

Meteorological data from Toronto Pearson International Airport for the period from 1993 to 2023 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 south-southeast in the summer, and from east in the winter.

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.

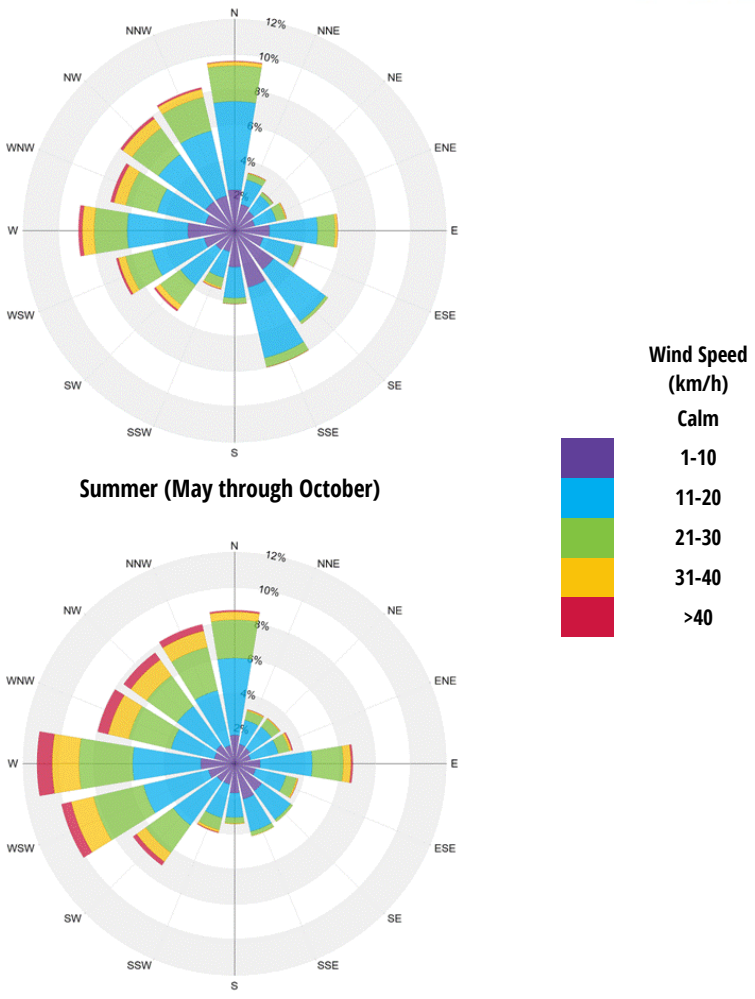


Image 3: Directional Distribution of Winds Approaching Toronto Pearson International Airport (1993 to 2023)

4. WIND CRITERIA

The criteria specified in the Pedestrian Level Wind Study Guidelines and Terms of Reference prepared by the City of Brampton are used in the current study and are presented below.

For the current development, wind speeds comfortable for walking are appropriate for sidewalks and walkways, lower wind speeds comfortable for standing are required for building entrances where pedestrians may linger. Calm wind speeds suitable for sitting are desired on the amenity areas in the seasons that the area will be used frequently. In our opinion, higher wind speeds may be considered appropriate in the winter, when such areas will get little to no use in the severe cold climate in Brampton.

Comfort Category	Speed (km/h)	Description (Based on seasonal compliance of 80%)	Area of Application
Sitting	≤ 10	Light breezes desired for outdoor seating areas where one can read a paper without having it blown away.	Park benches, restaurant seating, balconies, amenity terraces, etc. intended for relaxed, and usually seated activities.
Standing	≤ 15	Gentle breezes suitable for passive pedestrian activities where a breeze may be tolerated.	Main entrances, bus-stops and other outdoor areas where seated activities can be avoided.
Walking	≤ 20	Relatively high speeds that can be tolerated during intentional walking, running and other active movements.	Sidewalks, parking lots, alleyways and areas where pedestrian activity is primarily walking.
Uncomfortable	> 20	Strong winds, considered a nuisance for most activities.	May be accepted in areas not intended for pedestrian access.

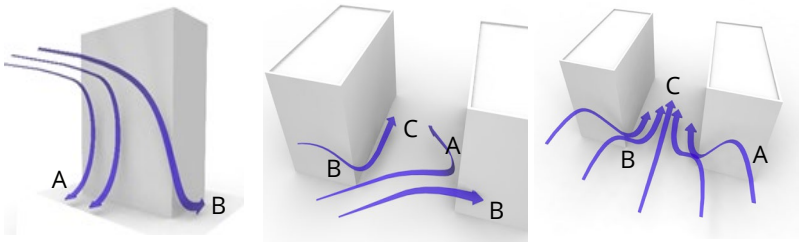
Safety Criterion	Gust (km/h)	Description (Based on annual exceedance of 9 hrs or 0.1% of time)	Area of Application
Exceeded	> 90	Excessive gust speeds that can adversely affect a pedestrian's balance and footing. Wind mitigation is required.	Not acceptable in any area of interest

5. RESULTS AND DISCUSSION

5.1 Wind Flow Around Buildings

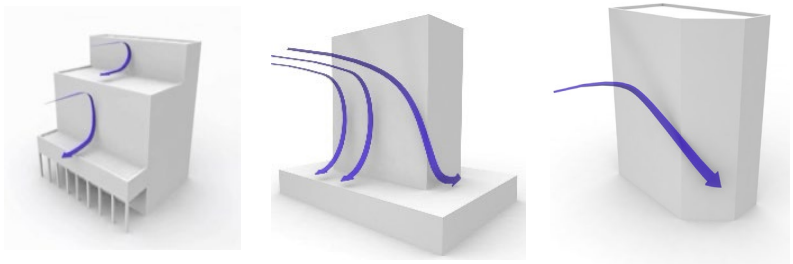
Buildings that are taller than its surrounding structures tend to intercept the stronger winds at higher elevations and redirect them to the ground level (Downwashing). These winds subsequently move around exposed building corners, causing a localized increase in wind activity due to Corner Acceleration. Wind at ground level may also accelerate in canyons or gaps formed by tall buildings such as narrow streets (Channelling flows). These flow mechanisms are illustrated in Image 4. If these building / wind combinations occur for prevailing winds, there is a greater potential for increased wind activity and uncomfortable conditions.

Design details such as stepped massing, significant façade and corner massing articulations, tower step-back from a podium edge, deep canopies close to ground level, wind screens / tall trees with dense underplanting, etc. can help reduce wind speeds around them (Image 5). 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.

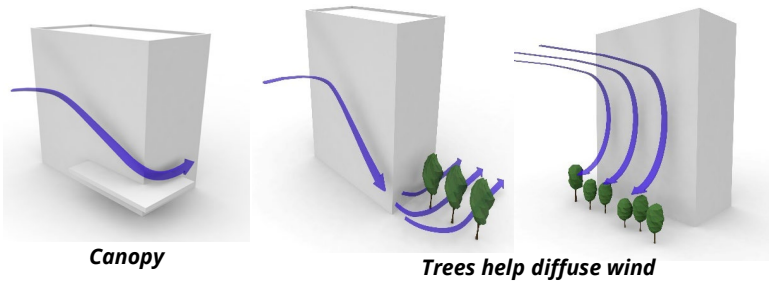


A. Downwashing ***B. Corner Acceleration*** ***C. Channelling***

Image 4: General Wind Flow Mechanisms



Stepped Massing ***Podium*** ***Chamfered Corner***



Canopy ***Trees help diffuse wind***

Image 5: Examples of Common Wind Control Measures

5.2 Existing Scenario

The existing site is occupied and surrounded by low-rise buildings with a taller building to the northwest. The elevation of the site above the immediate surroundings and low-rise or open surroundings would expose the site to the ambient wind, particularly the strong winds in the winter. The site could also be affected by the strong winds in the winter being redirected by the mid-rise building in the neighbouring lot to the northwest.

Currently, wind conditions on and around the site are considered comfortable for standing or strolling in the summer and for strolling or walking in the winter. Wind conditions exceeding the safety criterion are not expected immediately around the site.

5.3 Proposed Scenario

The proposed towers, at 25 storeys, will be taller than buildings in the surrounding area and, therefore, will redirect the prevailing winds to increase the wind activity relative to existing conditions. The tall towers would cause downwashing flows and the windward massing corners would be subject to corner acceleration flows. These accelerated flows could then channel between the existing and proposed buildings and create strong wind activity along the east and north of the main towers.

Positively, the terraced tower design will help moderate some of the downwashing flows; at the same time, the 12-storey podium and the continuous façade above the ground floor on the north side are notably taller than the surroundings and therefore would still result in significant wind redirection on the site. The estimated wind conditions are graphically presented in Images 6a and 6b and are discussed below.

With the increased wind activity, the sidewalks along Main Street and Charolais Boulevard are expected to be comfortable for walking in the summer, which is considered appropriate. In the winter, conditions on the sidewalks would continue to the comfortable for walking most of the time; however, wind activity that exceeds the comfort and safety criteria could occur near and across from the northeast and southwest building corners, which would affect the conditions on the sidewalks nearby.

The corridor between the towers and townhomes and the dog-run area on the north side will be susceptible to downwashing, corner acceleration and channeling flows. Conditions in these areas are likely to be comfortable for strolling or walking in the summer, and potentially uncomfortable in the winter. Lower speeds are expected along the perimeter of the townhomes.

The main entrances to the towers are on the east and west sides of the 12-storey connecting massing. The east entrance would be on a recessed façade and the west entrance is sheltered by the tower massing and proposed canopy on the west side. These locations are favourable for wind protection and conditions are likely to be comfortable for standing in both seasons. Higher wind speeds may occur occasionally at the west drop-off area.

5. RESULTS AND DISCUSSION

RWDI recommends the consideration of wind control measures to reduce the potential high wind activity. Wind control features may take the form of strategic placement and a combination of additional massing steps/articulations to façade and corners of the podium massing, setbacks on the north and west side of the towers above the first few floors, canopies on the main facades, tall wind screens and evergreen trees/hedges (Image 7).

RWDI can guide the selection and incorporation of wind control measures as the design progresses. We recommend quantifying the wind impact of the proposed development through wind tunnel testing to confirm these predictions and to develop wind control measures.

WIND CATEGORIES

- Sitting
- Standing
- Walking
- Uncomfortable
- Potential to Exceed Safety Criterion

Image 6a: Predicted Wind Conditions - Summer

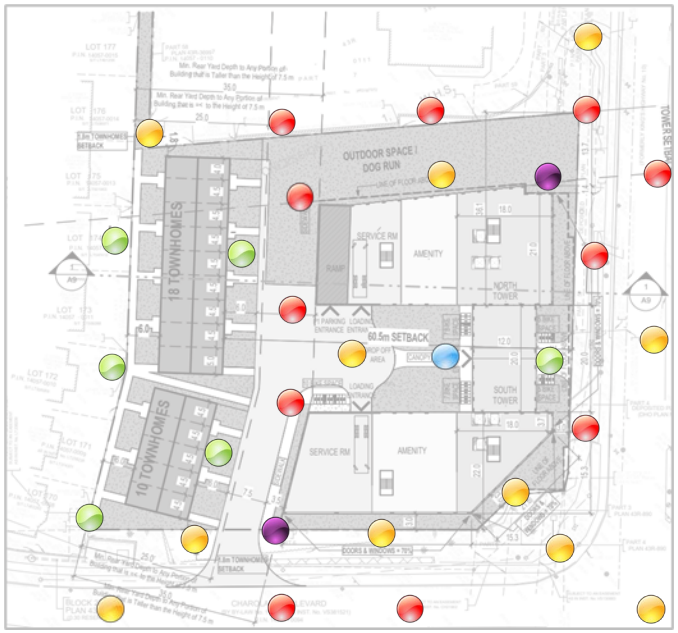
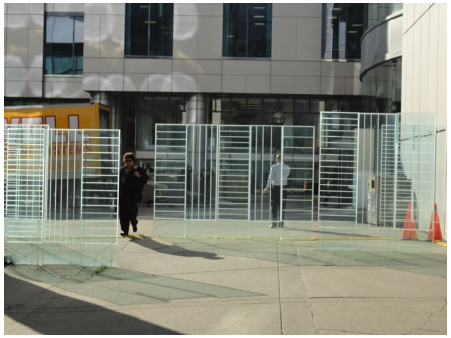
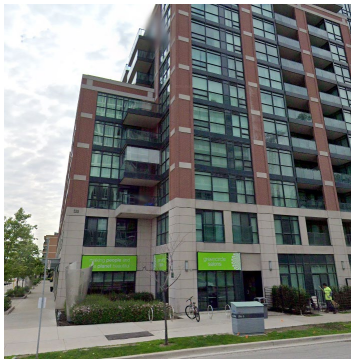


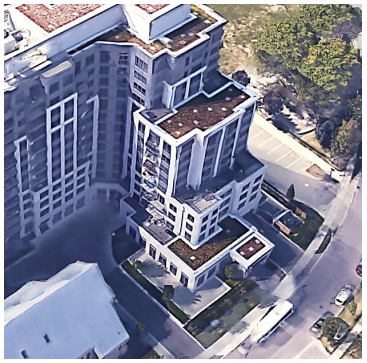
Image 6b: Predicted Wind Conditions - Winter

5. RESULTS AND DISCUSSION



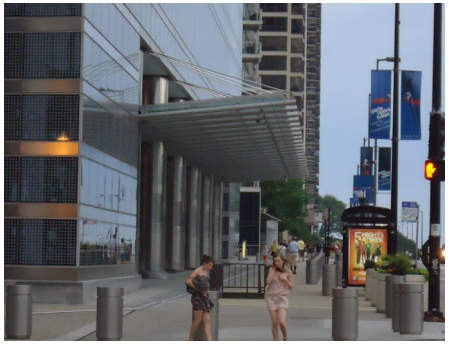
Wind Screens





Massing Steps and Corner Articulations

Evergreen Vegetation



Deep Canopies

Image 7: Examples of Wind Control Measures Applicable to the Site

6. SUMMARY

RWDI was retained to provide an assessment of the potential pedestrian level wind impact of the proposed project at 227 & 229 Main Street South in Brampton, 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 of wind flows around buildings.

Our findings are summarized as follows:

- Given the exposure of this site to prevailing winds, the proposed buildings are likely to increase the level of wind activity on and immediately around the site.
- The project design incorporates some positive features for wind, namely the terraced massing along the wind-exposed sides of the development, and the placement of main entrances in recessed parts of the façade, which will moderate the impact of winds to some extent.
- Wind conditions in the summer are expected to be acceptable for active uses like walking, at most areas. However, in the winter, wind conditions that exceed the comfort and safety criteria are expected at several areas – particularly near the northeast and southwest corners of the main building due to the seasonal strong winds.
- The main entrances are expected to be protected from winds owing to the massing design and wind conditions at the entrances are expected to be appropriate in the summer and winter.
- We recommend the evaluation of the wind impact of the proposed development through wind tunnel testing in order to quantify and confirm the potential wind conditions, and thereby develop appropriate wind control measures.

7. DESIGN ASSUMPTIONS

The findings/recommendations in this report are based on the building geometry and architectural drawings communicated to RWDI on May 29, 2024. Should the details of the proposed design and/or geometry of the building change significantly, results may vary.

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.

8. STATEMENT OF LIMITATIONS

This report was prepared by Rowan Williams Davies & Irwin Inc. for Nahid Corp ("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.