THP MISSISSAUGA HOSPITAL: PARKING GARAGE EXPANSION

100 QUEENSWAY WEST & 2250 HURONTARIO STREET

MISSISSAUGA, ON

PEDESTRIAN WIND ASSESSMENT

PROJECT #2105462
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SUBMITTED TO

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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 parking garage expansion to the southeast of the Trillium Health Partners – Mississauga Hospital in Mississauga, Ontario. This effort is intended to inform good design and has been conducted in support of the project's application with the City of Mississauga.

The proposed project is located at the northwest side of Bronte College Court, to the southwest of Hurontario Street and southeast of the existing Trillium Health Partners – Mississauga Hospital (Image 1).

The scope of this study covers the proposed Phase 2 expansion to the new 8-storey parking structure (the Phase 1 portion of the parking structure is assessed under separate cover as part of site plan control application (SPA) 21-156 W7). For the purpose of this study, the Phase 1 portion of the parkade is considered to be "existing" even though at the time of writing construction has not yet commenced. This report should be read in conjunction with the separate microclimate study included in this application, which assesses the impact of proposed new hospital tower.

On the project site, there is an 8-storey parking structure currently under construction and has a plan of 105.7 m by 55.5 m, as shown in Image 2. The proposed expansion is 21 m deep on the northwest side, and the assessment focuses on the potential wind impact of the 21 m expansion.

Existing surroundings around the project site include a hospital to the immediate northwest, mid-rise developments across Queensway West and Hurontario Street and low-rise residentials in all other directions. Lake Ontario is located approximately 3.2 km to the southeast.

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

1. INTRODUCTION

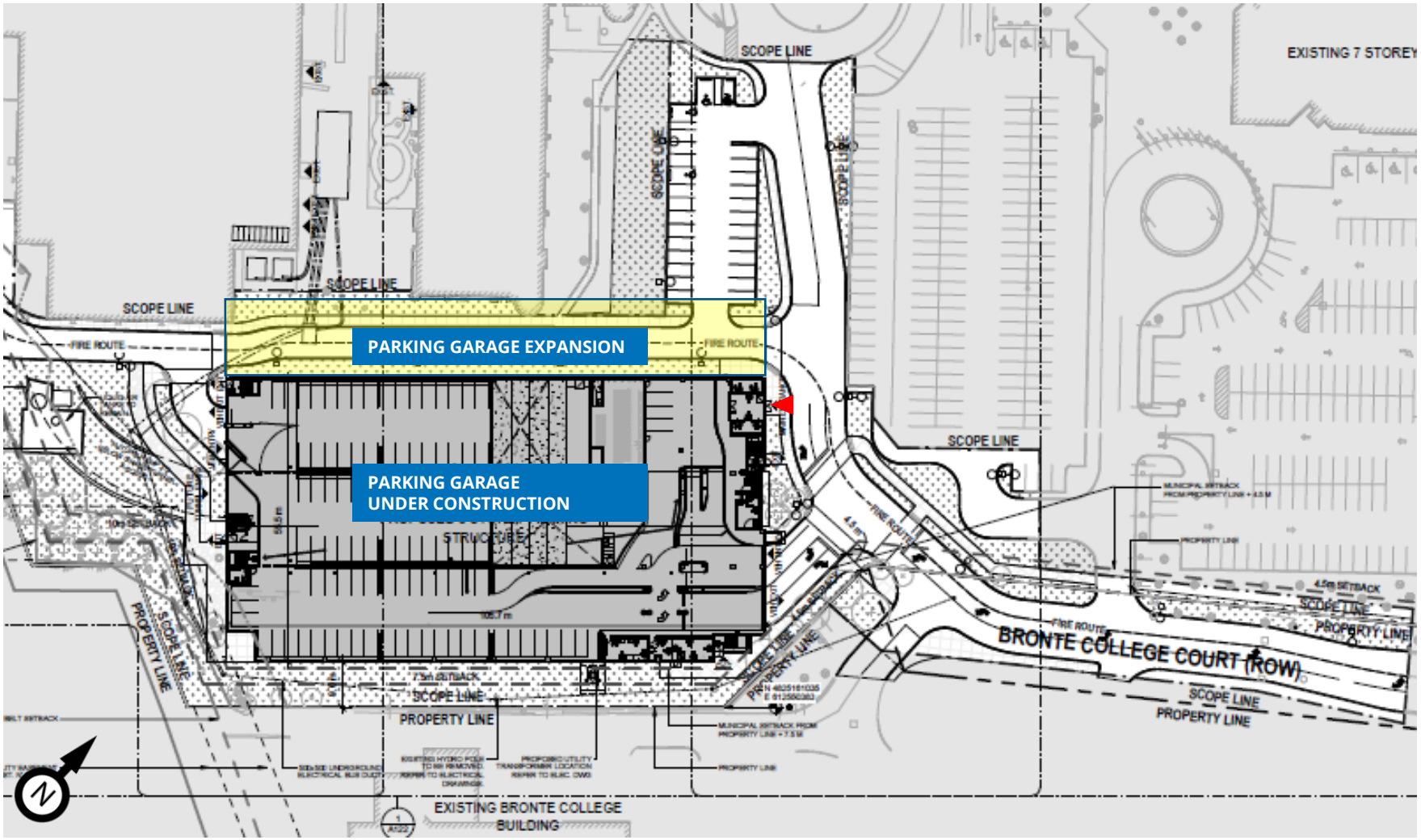


Image 2: Site Plan of Proposed Development

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 would be required.

RWDI's assessment is based on the following:

- Design drawings received on July 16 and 27, 2021;
- 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 Mississauga Area;
- RWDI's engineering judgement and knowledge of wind flows around buildings[2, 3]; and,
- Mississauga 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, 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 1989 to 2019 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.

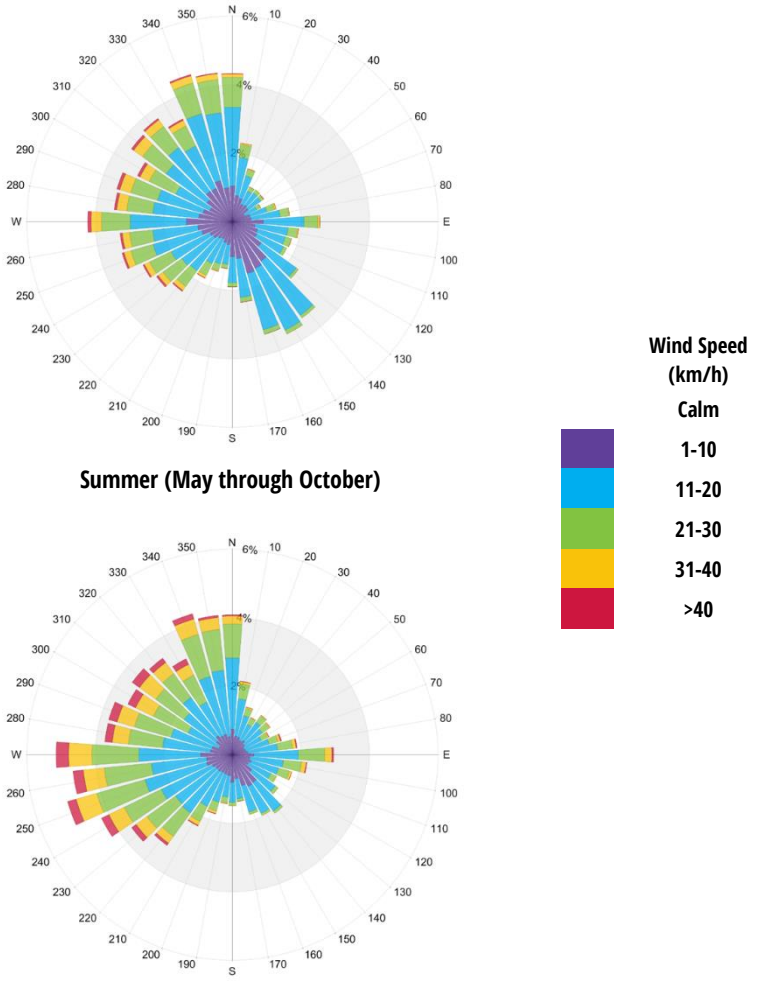


Image 3: Directional Distribution of Winds Approaching Toronto Pearson International Airport (1989 to 2019)

4. WIND CRITERIA

The Mississauga pedestrian wind criteria, developed in June 2014, are specified in the Urban Design Terms of Reference, "Pedestrian Wind Comfort and Safety Studies". The criteria are as follows:

4.1 Safety Criterion

Pedestrian safety is associated 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 (≤ 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 above criteria 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 parking lots.

6. RESULTS AND DISCUSSION

6.1 Existing Scenario

The existing site and surroundings are comprised of low to mid-rise buildings and open parking lots. As such, there are no significant structures that would deflect ambient winds to ground to cause adverse wind impacts. The southwesterly winds could channel between the existing (under-construction) parking garage and the hospital to the northwest at grade level, resulting in accelerated wind speeds. However, this area is sheltered by the existing hospital from the prevailing west and northwest winds. Overall, wind conditions around the existing parking garage are considered comfortable for sitting or standing in the summer and for standing or walking in the winter.

Wind conditions exceeding the safety criterion are not expected.

6.2 Proposed Scenario

With the addition of the proposed parking garage expansion, the parking structure will still be 8 storeys and comparable in height to the neighbouring buildings to the northwest and southeast. In addition, the existing hospital to the northwest and buildings to the north will provide sheltering from the prevailing winds. As a result, adding the proposed garage expansion is not expected to increase wind speeds in the extended surroundings.

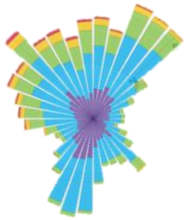
The predicted wind comfort conditions are presented in Images 4a and 4b for the summer and winter seasons, respectively, together with the corresponding wind roses. The following sections provide a discussion of the potential wind conditions around the project.

6.2.1 Project Perimeter and Sidewalks

The impact of the proposed parking garage expansion will be limited to the site and immediate surroundings due to its moderate size. Wind conditions around the garage perimeter and surrounding walkways are expected to remain similar to the existing conditions, and will be suitable for the intended pedestrian use, including sidewalks along Bronte College Court. Wind speeds are not predicted to exceed the safety criterion.

Wind conditions on and around the proposed development are generally expected to be comfortable for sitting or standing during the summer (Image 4a). In the winter, due to seasonally stronger winds, wind conditions are expected to be comfortable for standing or walking (Image 4b). These conditions are considered appropriate for the intended use of walkways and parking spaces. In addition, the garage expansion is predicted to eliminate the channeling effect between the existing parking garage and the hospital to the northwest at grade level.

5. RESULTS AND DISCUSSION

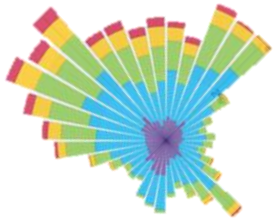


Summer (May through October)

COMFORT CATEGORIES

- Sitting / Standing
- Walking
- Uncomfortable
- Exceeds Safety Criterion

MAIN ENTRANCE



Winter (November through April)

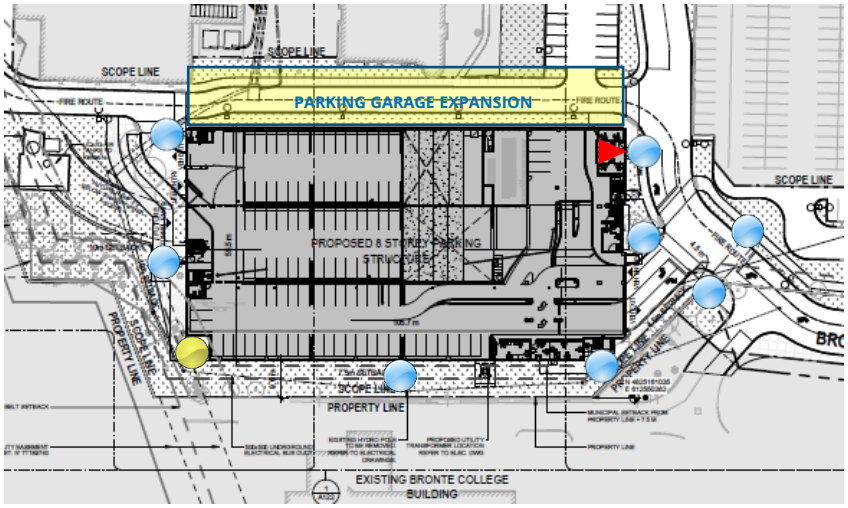


Image 4a: Predicted Wind Conditions - Summer

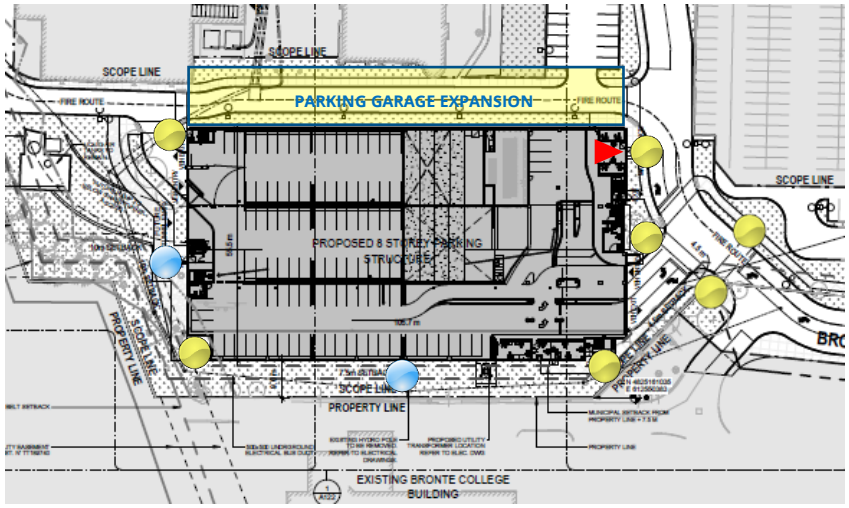


Image 4b: Predicted Wind Conditions - Winter

6.2.2 Main Entrance

The main entrance is located near the north corner of the proposed garage expansion, along the northeast façade (Images 2 and 4). Based on the information provided by the design team, there will be a canopy above the main entrance, which is a positive design feature that is expected to reduce the downwashing effect. In addition, the vestibule at the entrance will provide an area for pedestrian to take shelter on windy days.

Wind conditions at the entrance are expected to be comfortable for sitting or standing in the summer (Image 4a), and for walking during the winter prior to the expansion as it's closer to the building corner (image 4b). With the proposed parking garage expansion, the main entrance will be further away from the building corner and therefore, lower wind speeds are expected at the entrances. In addition, since this entrance is used as a transition point and pedestrians are not expected to linger for a long period of time like they would at an entrance to a building with a lobby, wind conditions at the main entrance are considered appropriate for the intended use throughout the year.

6.3 Future Scenario

It is our understanding that a hospital expansion will be incorporated to the existing hospital location to the northwest of the garage. The placement of this hospital will still afford shelter to the parking garage in general and the future conditions around this site should be investigated throughout the design of that hospital.

7. SUMMARY

RWDI was retained to provide an assessment of the potential pedestrian level wind impact of the proposed parking garage expansion to the southeast of the Trillium Health Partners – Mississauga Hospital in Mississauga in 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, and screening-level modelling of wind flows around buildings.

Our findings are summarized as follows:

- Due to moderate size of the proposed parking garage expansion, its addition to the site is not expected to impact the wind condition on and around the site.
- In general, conditions on sidewalks and other public areas on and around the proposed project are expected to be comfortable for the intended pedestrian use throughout the year.
- The design incorporated a vestibule and a canopy above the main entrance, which are positive wind-responsive features that should be retained in the design.

8. APPLICABILITY OF RESULTS

The assessment presented in this report are for the proposed parking garage expansion to the southeast of the Trillium Health Partners – Mississauga Hospital is 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)
20210716 - Progress Set	PDF	07/16/2021
A120 - SITE PLAN OVERALL NEW CONSTRUCTION - INTERIM	PDF	07/27/2021