REPORT

YEE HONG CENTRE FOR GERIATRIC CARE

MISSISSAUGA, ON

QUALITATIVE PEDESTRIAN WIND ASSESSMENT

PROJECT #1801419

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SUBMITTED TO

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1. INTRODUCTION

RWDI was retained by Yee Hong Centre for Geriatric Care to conduct a Desktop Wind Assessment for the proposed Yee Hong Centre for Geriatric Care in Mississauga, ON in support of the Re-Zoning application. This assessment was based on the as-of-right building massing (see Image 1) .

This assessment was based on the following:

- a review of long-term meteorological data from Toronto Pearson International Airport;
- design drawings received from CXT Architects on June 26, 2018 for the as-of-right building massing;
- wind-tunnel studies undertaken by RWDI for similar projects in Mississauga and surrounding area;
- 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. To quantify these conditions or refine any conceptual wind mitigation measures, physical scale-model tests in a boundary-layer wind tunnel would be required.

Image 1: 3D Rendering of As-of-right Massing with Existing 5-storey Building

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. BUILDING AND SITE INFORMATION

The proposed development will be located at the intersection of Father D'Souza Dr. and Mavis Rd. in Mississauga, ON (see Image 2). The site is currently partially occupied by a surface parking lot. For the discussions regarding street and building orientation, the Project North is used, which is 45° counterclockwise rotation of the True North (see Image 2), and reference to wind direction was made using True North.

The site is immediately surrounded by an existing 5-storey long-term care building to the south, a church to the north and low-rise residential buildings in all other directions (see Image 2).

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

Beyond the immediate surroundings, the buildings are generally low rise. Lake Ontario is approximately 11 km to the south and Toronto Pearson International Airport is approximately 9 km to the northeast.

The as-of-right building massing includes a 9-storey building along Father D'Souza Dr., stepping down to 8 and 6 storeys towards the south, plus a 1-storey podium open to the west and enclosed in other directions (Images 1 and 3). Pedestrian accessible areas on and around the site include sidewalks, building entrances, parking space, and potential gardens at and above grade.

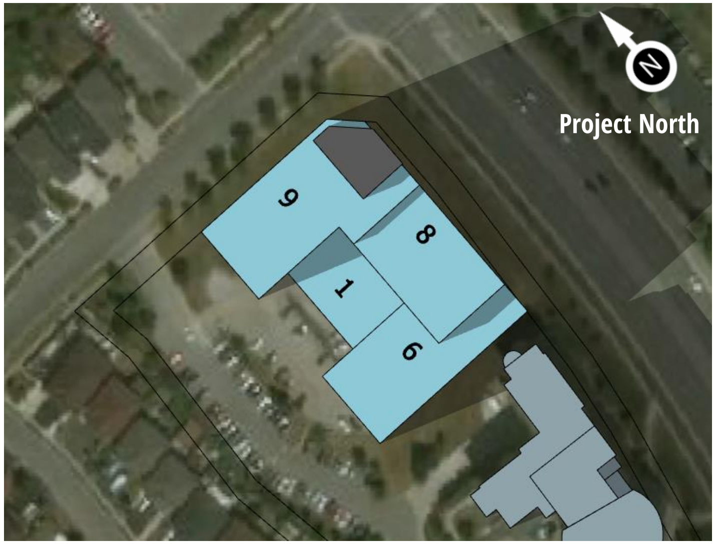

Image 3: Top View of the As-of-right Building Massing

3. METEOROLOGICAL DATA

Wind data from Toronto Pearson International Airport recorded between 1985 to 2015 were used as a reference for the current project. This is the nearest weather station with long-term, reliable wind data.

The distributions of wind frequency and directionality for the summer (May through October) and winter (November through April) seasons are shown by the wind roses in Image 4.

When all winds are considered, winds from the northwest quadrant are predominant during both summer and winter. Secondary winds are from the southeast quadrant in the summer and from the west-southwest, southwest and east directions in the winter.

Strong winds of a mean speed greater than 30 km/h measure at the airport (at an anemometer height of 10m) occur more often in the winter than in the summer.

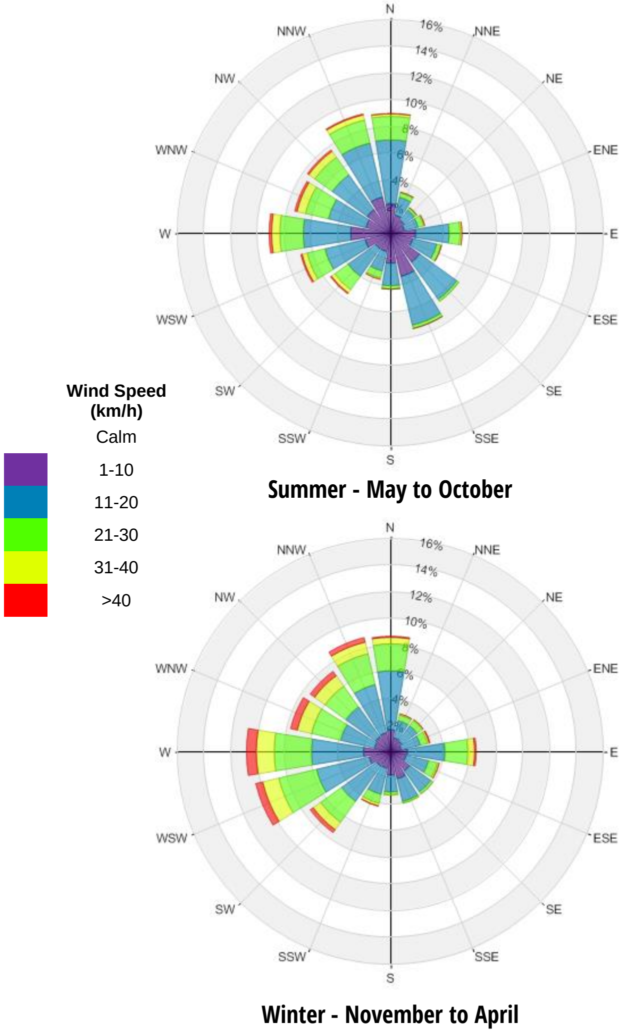

Image 4: Directional Distribution of Winds Recorded at Toronto Pearson International Airport (1985 – 2015)

4. PEDESTRIAN WIND CRITERIA

The City of Mississauga pedestrian wind criteria, as outlined in the City's Urban Design Terms of Reference, were used in the current study. The criteria are 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 levels are 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 associate 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 parking lots, sidewalks and walkways; 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 amenity areas during the summer, when these areas will be mainly used.

5. PEDESTRIAN WIND CONDITIONS

5.1 Background

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 qualitative, screening-level numerical estimation of pedestrian wind conditions without wind tunnel testing.

The proposed building is exposed to the prevailing winds and is taller than its immediate surroundings. Taller buildings tend to intercept the stronger winds at higher elevations and redirect them to the ground level. Such a *Downwashing Flow* (see Image 5a) is the main cause for increased wind activity around tall buildings at the grade level.

When oblique winds are deflected down by a building, a localized increase in the wind activity or *Corner Acceleration* can be expected around the exposed building corners at pedestrian level (see Image 5b). 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 (see Image 5c). If these building/wind combinations occur for prevailing winds, there is a greater potential for increased wind activity.

The stepped façade of buildings and various podiums and building setbacks (see Images 1 and 3) are a positive design feature that will reduce the direct impact of downwashing wind flows at grade (see Image 5d). Detailed discussions on the potential wind comfort conditions at key pedestrian areas are provided in Sections 5.2 to 5.6.

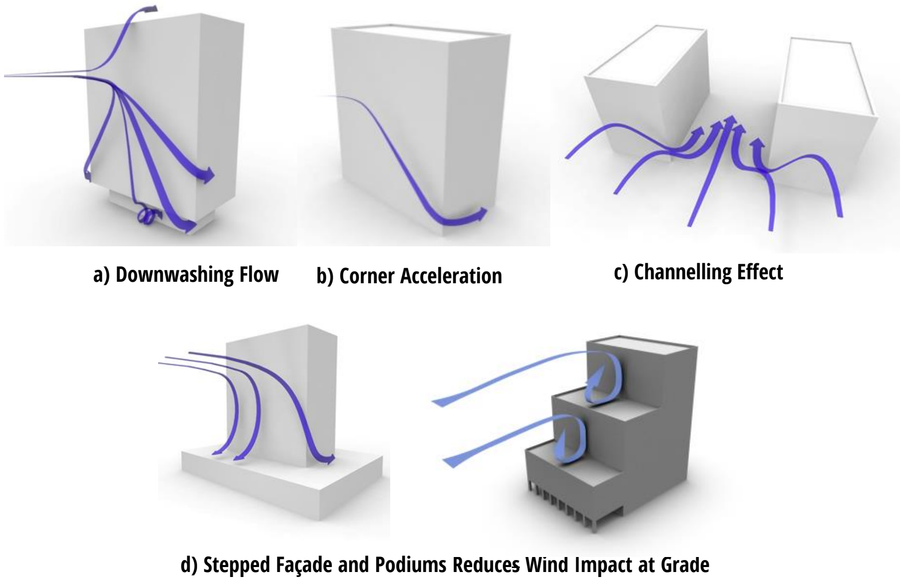

Image 5: General Wind Flow Patterns around Buildings

5. PEDESTRIAN WIND CONDITIONS

5.2 Existing Wind Conditions

The site is exposed to the prevailing winds from all directions since the surrounding buildings are all low rise. The wind conditions on and around the site are likely comfortable for standing or sitting during the summer, and for walking or better during the winter. These conditions are appropriate for active pedestrian use throughout the year.

5.3 General Flow Patterns

The as-of-right massing is taller than its surroundings and fully exposed to the prevailing winds from all directions. It has its taller elements (9 and 8 storeys) facing the predominant west through north and east winds. They will intercept these winds and deflect them down to the ground level, causing flow accelerations at the northeast building corner and, to a lesser extent, at the northwest and southwest corners (Image 6). The chamfered northeast building corner is considered as a positive feature for wind control, but its impact is not significant. The east and southwest winds may also channel between the existing and proposed buildings.

High wind speeds are expected on the roof top areas due to increased elevations and exposure. The area on the top of the 1-storey podium is generally sheltered by the building mass, but winds from the west and southwest directions may accelerate around the corners of the 9 and 6-storey elements and downwash off the 8-storey building, resulting in wind activity that may not be appropriate for sitting all the time (Image 6).

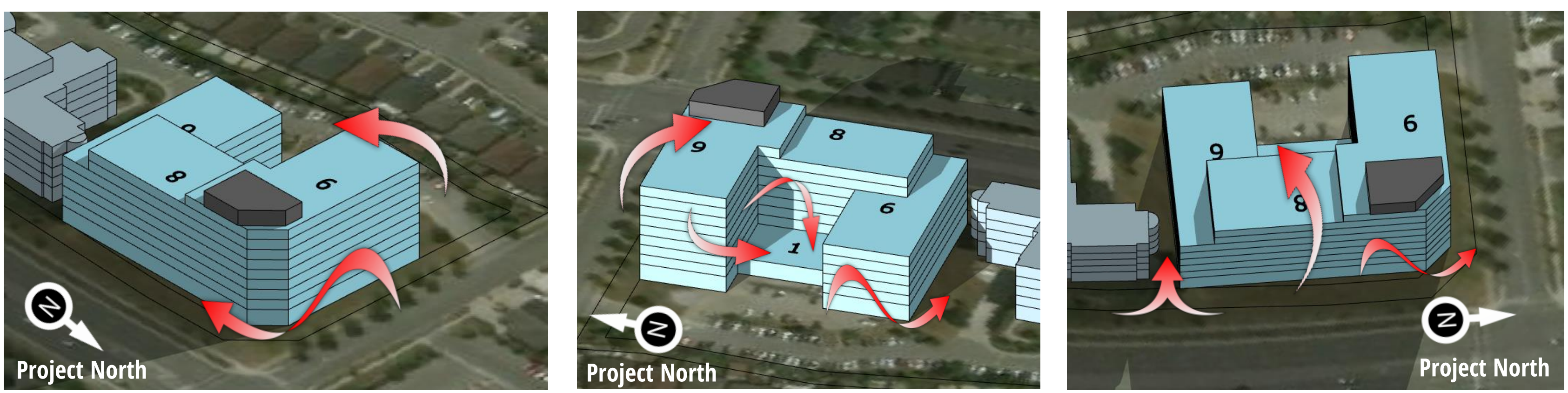

Image 6: General Flow Patters

5. PEDESTRIAN WIND CONDITIONS

5.4 Sidewalks

The tallest element is 9 storeys and the resultant wind conditions on sidewalks along Father D'Souza Dr. and Mavis Rd. are expected to meet the wind safety criterion and be comfortable for walking or better throughout the year. The only exception is the northeast corner of the building at the intersection, where winds may become uncomfortable from time to time in the winter.

This is typical for similar buildings in Mississauga. Lower wind speeds can be achieved by tower setbacks along the north and east facades, additional corner chamfering and/or sidewalk landscaping/screens during the building design process.

Slightly lower wind speeds are expected on the west and south sides of the building massing. They are expected to be suitable for walkways and parking spaces. Without wind control measures, they are not suitable for passive pedestrian activities such as sitting or standing.

5.5 Main Entrances

As a general guideline, main entrances should not be placed at building corners. The mid building façade typically has lower wind activity. For further wind protection, entrances should be recessed from the main façade, protected by canopies, wind screens and/or planters, and designed with vestibules, Image 7 provided several examples for consideration.

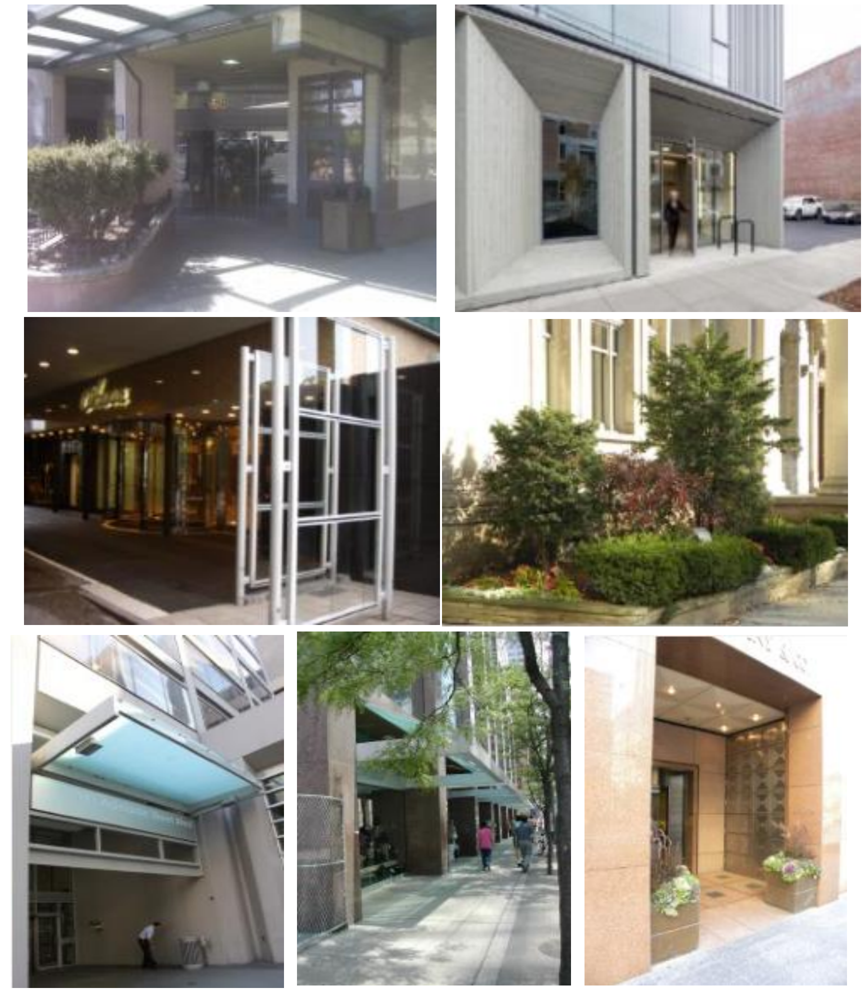

Image 7: Wind Control Examples for Main Entrances

5.6 Gardens at Grade and on Roofs

Potentially, there could be many gardens and terraces at and above grade for the development. Rooftop areas are typically windy due to their elevation and exposure. The most common wind control measures are tall guardrails and parapets.

Areas at grade and on lower podiums may be affected by both the horizontal and vertical wind flows. The actual speeds and exceeding frequencies vary with the exposure, locations, sizes and elevations of these areas. In the event that undesirable conditions occur, taller guardrails, windscreens, privacy fences and landscaping may be incorporated to provide sheltering for amenity users. Terraces may also be affected by vertical winds that are deflected down by the building elements above. Therefore, wind control measures may also include overhead protection provided by trellises and canopies.

Photos in Image 8 are provided for reference.

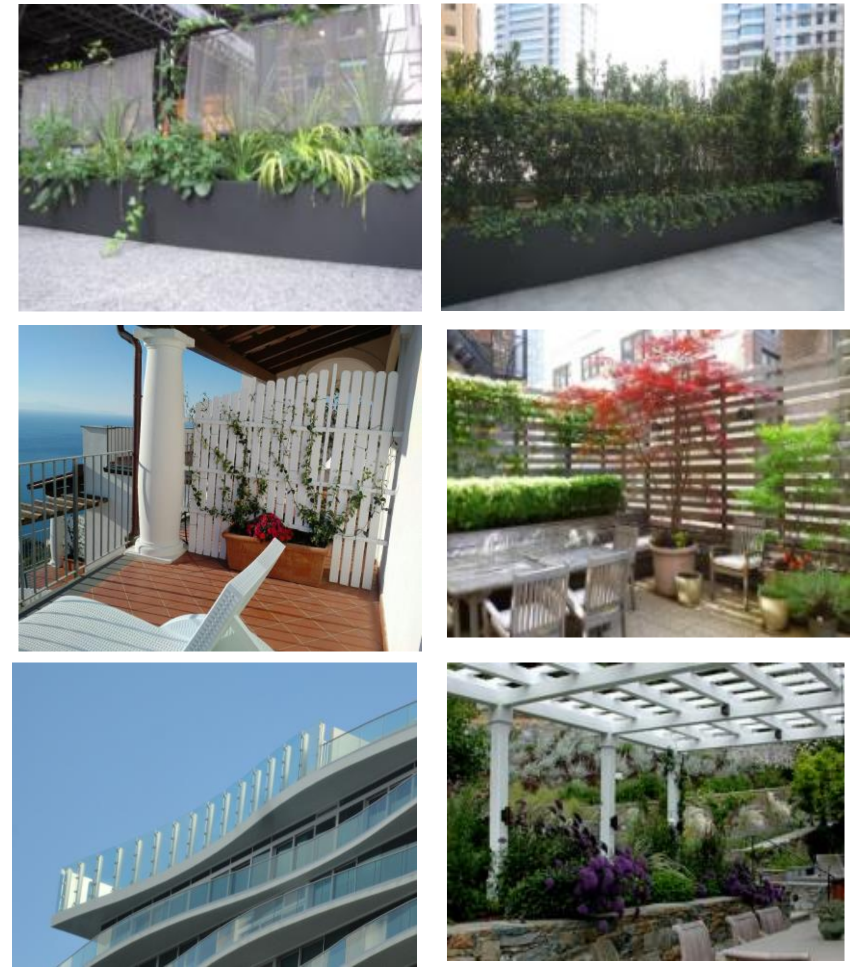

Image 8: Examples of Wind Control for Gardens at and above Grade

6. SUMMARY

Wind conditions on and around the as-of-right massing of the proposed Yee Hong Centre for Geriatric Care in Mississauga, ON are discussed in this report, based on the local wind climate, surrounding buildings and our past experience with wind tunnel testing of similar buildings. This Desktop Wind Study was conducted in support of the RZA application, as required by the City of Mississauga.

The massing is 9 storeys in height at the north end, steps to 8 and 6 storeys towards the south, with a partially enclosed podium at 1 storey. Appropriate wind conditions are expected at sidewalks and parking space throughout the year.

Guidance for entrance location and wind protection is provided in the report. Also provided are wind control examples for potential gardens and terraces on and around the proposed building.

7. APPLICABILITY OF RESULTS

The assessment presented in this report are for proposed Yee Hong Centre for Geriatric Care in Mississauga, ON based on the design drawings and documents received from CXT Architects on June 26, 2018.

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.