REPORT

YEE HONG CENTRE FOR GERIATRIC CARE

MISSISSAUGA, ON

QUALITATIVE PEDESTRIAN WIND ASSESSMENT

PROJECT #1801419

AUGUST 2, 2018

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 (see Image 1) in support of the Re-Zoning application. This assessment was required by the City of Mississauga as per their Urban Design Terms of Reference (dated June 2014).

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 July 19, 2018;
- 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. The wind tunnel tests will be required in support of the Site Plan Approval (SPA) application for this project.

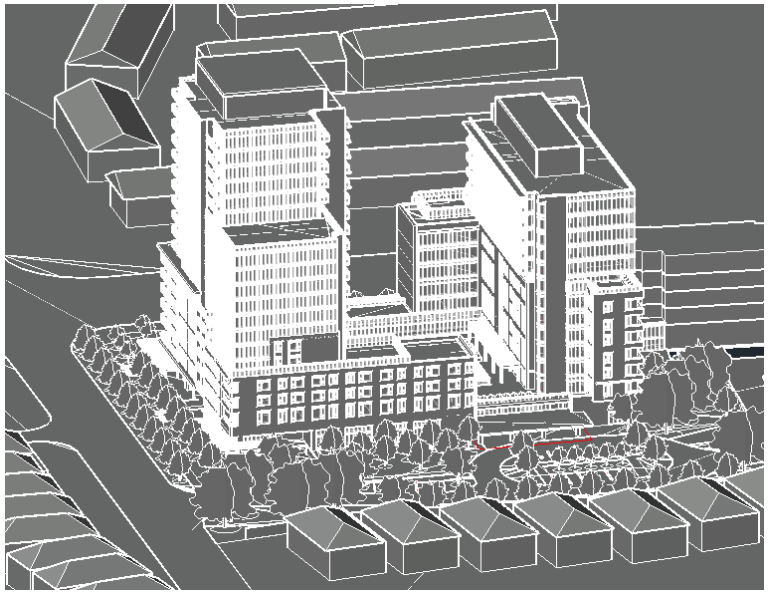

Image 1: 3D Rendering of the Proposed Project – West View

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). 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 proposed development will include two towers of 18 and 13 storeys connected by lower podiums (see Images 1 and 3). Pedestrian accessible areas on and around the site include sidewalks, building entrances, parking space, a grade-level courtyard garden and roof gardens at the 2nd floor and amenity terraces at the 5th and 8th floors.

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

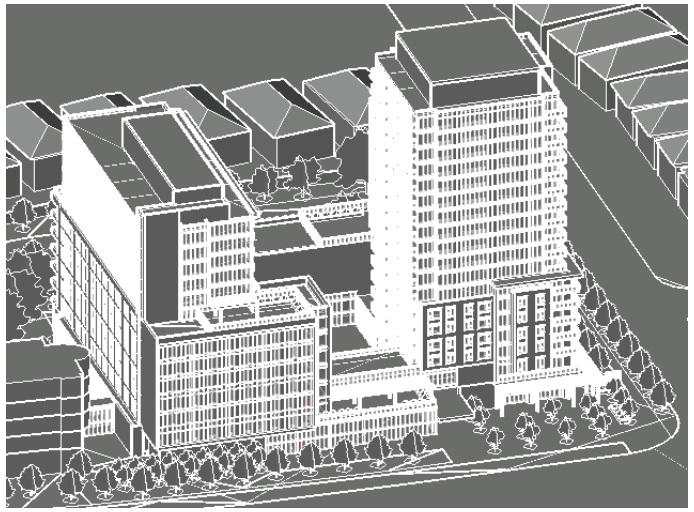

Image 3: East View of the Proposed Development

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.

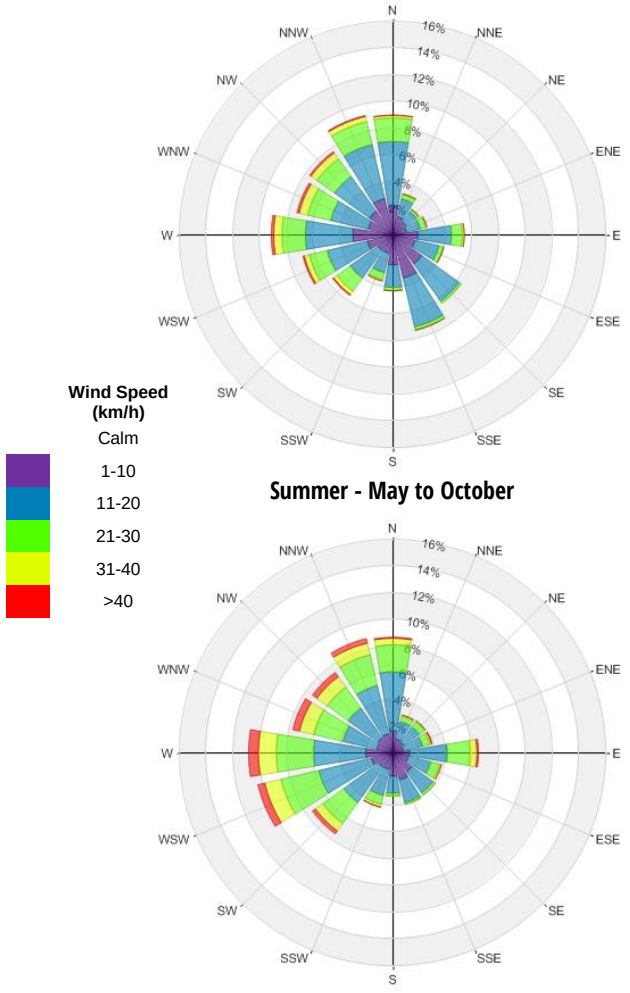

Image 4: Directional Distribution of Winds Recorded at Toronto Pearson International Airport (1985 – 2015)

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.

5.1 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 5.7.

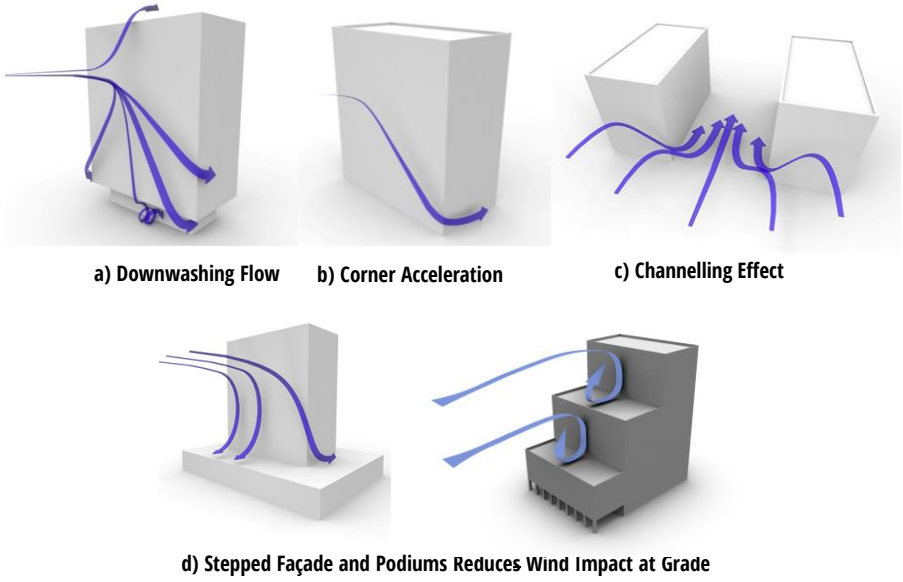

Image 5: General Wind Flow Patterns around Buildings

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 Sidewalks

The proposed tower setbacks, stepped facades and podiums are positive features that will help keep some winds accelerating down the towers away from the ground. However, the tower setbacks on the north side of the north tower are not large enough to be effective. As a result of interaction of the north tower with the prevailing southwest through north winds during the winter, uncomfortable conditions are predicted at the northwest and northeast corners of the north tower. The wind conditions in the summer are predicted to be suitable along sidewalks.

The proposed trees and porous screens along Father D'Souza Dr., the canopies along the north façade and planters with evergreen shrubs at the northeast corner of the north tower (Image 6) will improve the wind conditions throughout the year. The proposed trellises around tower corners will provide an alternative walkway with suitable wind conditions. The elevated wind conditions in unprotected areas may also be improved to an appropriate level if more coniferous or marcescent species can be included. Wind tunnel testing will be conducted in support of the SPA application that will quantify the predicted wind conditions and confirm the effectiveness of the wind mitigation.

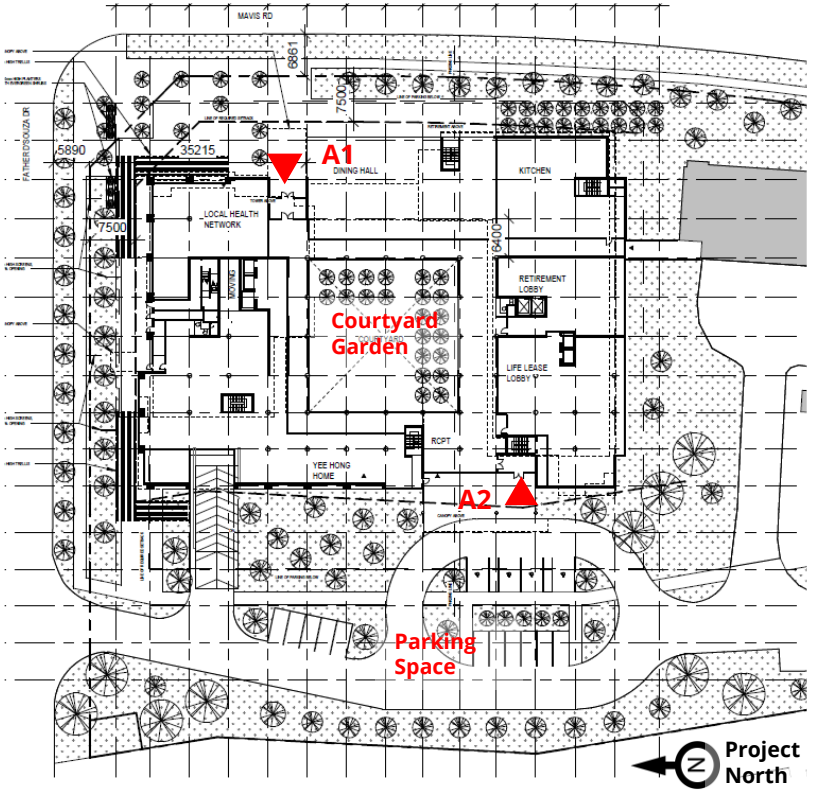

Image 6: Ground Floor Plan Showing Trees, Screens and Trellises

5.4 Main Entrances

The main entrances to the development are located on the east and west sides (Locations A1 and A2, respectively, in Image 6). Both entrances are recessed from the main façade, protected by large canopies and designed with vestibules. These are positive features for wind control. The proposed landscaping west of Entrance A2 (see Image 6) will provide further wind protection. As a result, appropriate wind conditions are expected around these entrances throughout the year.

5.5 Parking Space

The parking space on the west side of the building (see Image 6) will be exposed to the prevailing westerly winds. However, the proposed tower setbacks from the west edge and the separation between the two proposed towers will reduce the wind downwashing off the development towards the parking space and wind conditions are expected to be comfortable for walking or better throughout the year, which is appropriate for the intended use of a parking space.

5.6 Courtyard Garden

The courtyard garden (see Image 6) will be somewhat enclosed by the proposed towers and podiums. The westerly and northwesterly winds, however, may accelerate around the southwest corner of the north building over the 4-storey podium and then downwash off the south building and its podium into the courtyard. The 1-storey building step along the east and south of the courtyard will reduce the winds downwashing to the ground.

Wind conditions in the courtyard are expected to be comfortable for standing during the summer when it will be mainly used. These speeds are generally appropriate, but slightly higher than desired for sitting. The proposed trees along the east and south perimeters of the courtyard garden will improve the wind conditions to be comfortable for sitting during the summer. If extended use of the garden during the shoulder seasons is desired, landscaping examples for wind control are provided in Image 7 on the next page for reference.

5. PEDESTRIAN WIND CONDITIONS

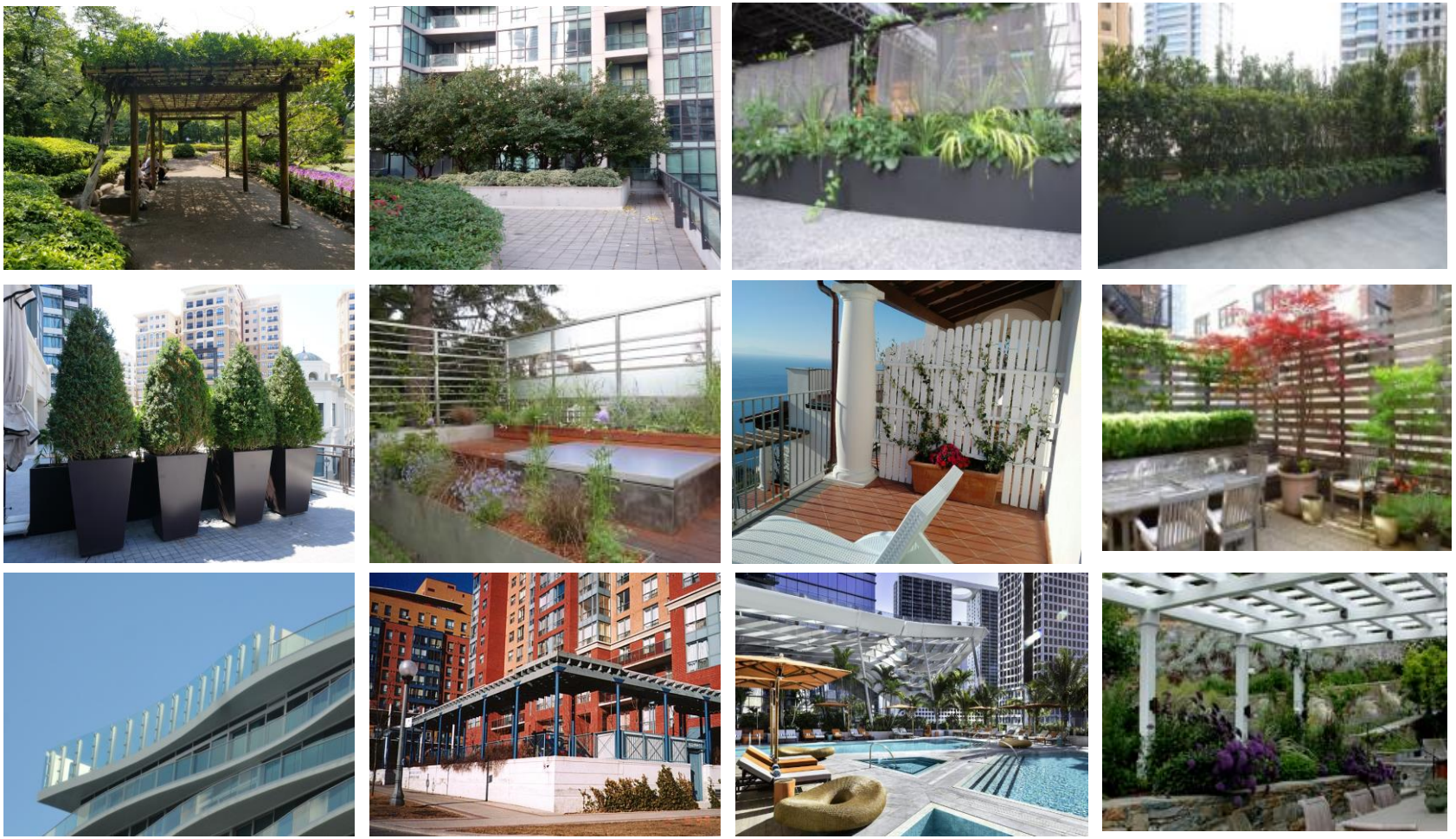

Image 7: Examples of Wind Control Measures for the Courtyard and Roof Gardens

5.7 Roof Gardens and Amenity Terraces

There area roof gardens proposed at the 2nd floor and amenity terrace at the 5th an 8th floors as highlighted in Image 8. They will be protected by trellises and planters with evergreen shrubs. Appropriate conditions are expected at the 2nd floor roof gardens during the summer. Generally suitable wind conditions are also expected at the terraces at Levels 5 and 8 during the summer, since they are protected by trellises, planters and tall fences. Winter wind speeds may be higher than desired due to the local wind climate and increased exposure of the gardens and terraces above ground.

If lower wind speeds and extended use in the shoulder seasons are desired, additional wind screens and landscaping may be considered. Examples of these mitigation features are shown in Image 7.

Wind tunnel testing will be conducted in support of the SPA application, which will quantify the predicted wind conditions and confirm the effectiveness of these proposed mitigation measures.

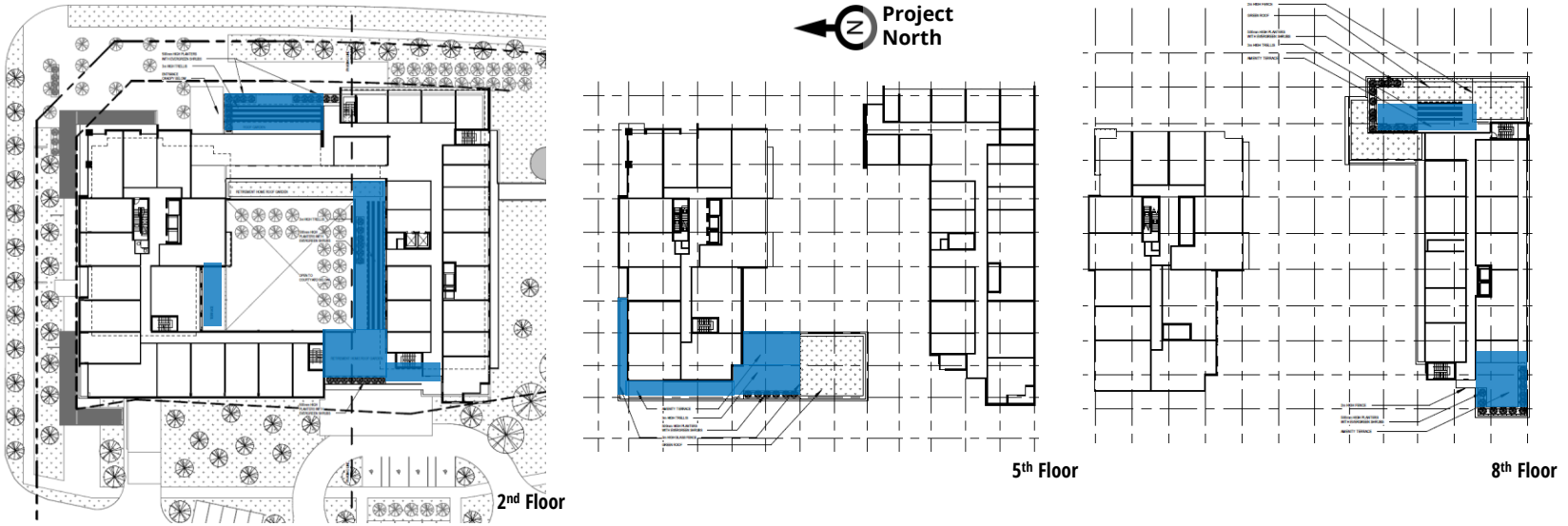

Image 8: Floor Plans for Roof Gardens and Amenity Terraces

6. SUMMARY

Wind conditions on and around 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 proposed development has a number of positive design features such as podiums, stepped facades, recessed areas, canopies and vestibules for entrances, trellises, tall fences and evergreen planters for roof gardens and extensive landscaping, trellises and screens along sidewalks. Appropriate wind conditions are expected at sidewalks, entrances and parking space throughout the year and at the courtyard garden and the roof gardens and terraces above the ground during the summer.

If lower wind speeds and extended use of the gardens/terraces during the shoulder seasons are desired, additional wind control measures may be considered.

Wind tunnel testing will be conducted in support of the SPA application to quantify the predicted wind conditions and optimize the wind control measures presented herein.

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 July 19, 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.