1866 RYMAL ROAD

HAMILTON, ON

PEDESTRIAN WIND ASSESSMENT

PROJECT #2300825
SEPTEMBER 29, 2022

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 retirement home at 1866 Rymal Road East in Hamilton, 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 southeast corner of the intersection of Rymal Road East and Dakota Boulevard (Image 1). The site is currently unoccupied and surrounding by low buildings and open lands in all directions. Hamilton downtown is located to the northwest of the site, Hamilton International Airport to the southwest and Lake Ontario to the northeast.

The proposed building is eight storeys with an L-shaped floor plan (Images 2 and 3). Pedestrian areas of interest for the current wind assessment include building entrances, public sidewalks, parking spaces, a daycare playground and an outdoor terrace at the 2nd floor.

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

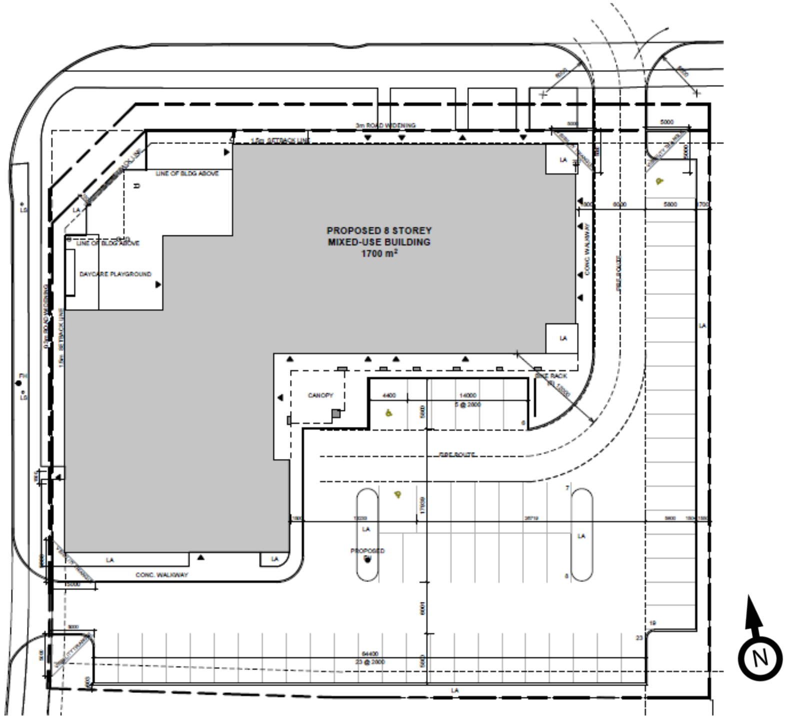

Image 2: Project Site Plan

1. INTRODUCTION

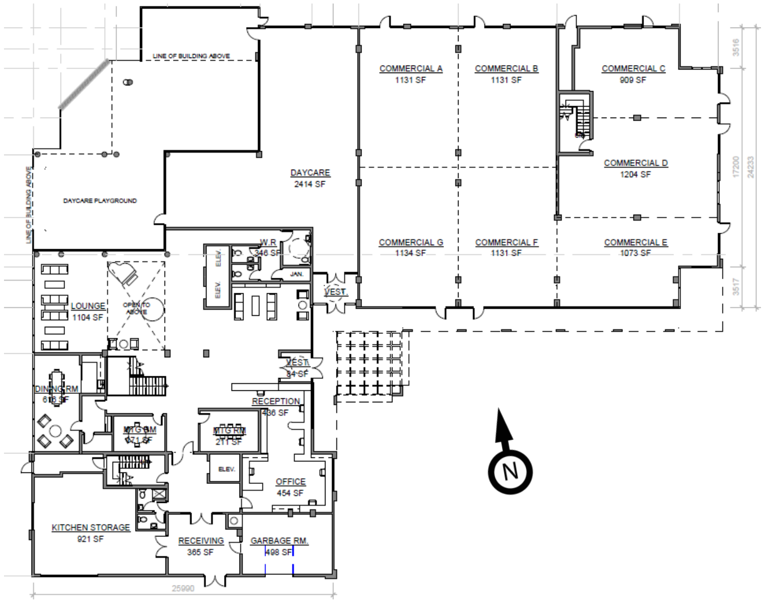

Image 3a: First Floor Plan

Image 3b: West (upper) and North (lower) 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 typically be required.

RWDI's assessment is based on the following:

- Design drawings received from Masri O Inc. Architects on September 16, 2022;
- A review of the regional long-term meteorological data from Hamilton 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 Hamilton 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, snow drifting and loading, door operability, building air quality, noise, vibration, etc. are not part of the scope of this assessment.

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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 Hamilton 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 4.

When all winds are considered, winds from the southwest and northeast directions are predominant in the both the summer and winter, as indicated by the wind roses.

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 southwest through west and northeast directions potentially could be the source of slightly higher wind speeds, depending upon the site exposure and development design.

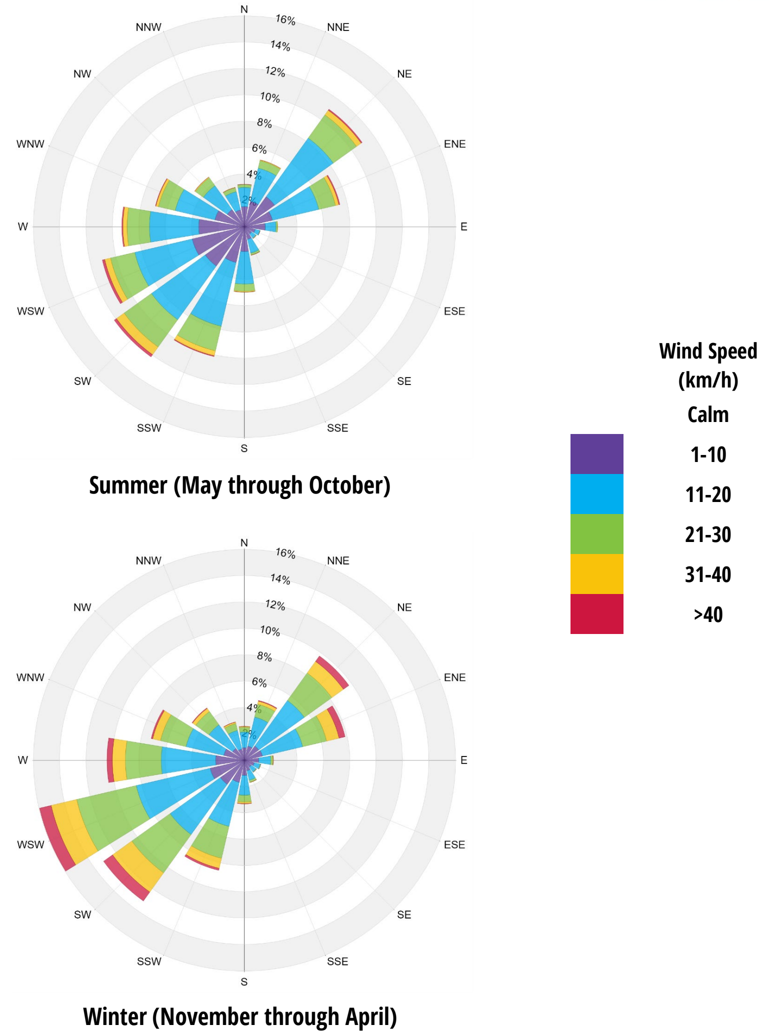


Image 4: Directional Distribution of Winds Approaching Hamilton International Airport (1990 to 2020)

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. 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.

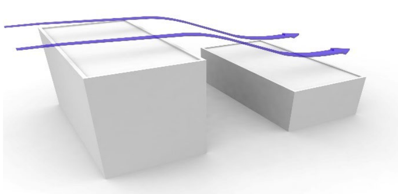
For the current development, wind speeds comfortable for walking or strolling are appropriate for sidewalks and parking spaces; lower wind speeds comfortable for standing are required for building entrances and the outdoor playground where users may linger, and calm wind speeds suitable for sitting are desired in areas where passive activities are anticipated, such as the amenity terrace at the 2nd floor.

5. RESULTS AND DISCUSSION

5.1 Wind Flow Around Buildings

Short buildings do not redirect winds significantly to cause adverse wind conditions at pedestrian areas (Image 5a). Buildings taller than their surroundings 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 (Image 5b). 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, 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. 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 b



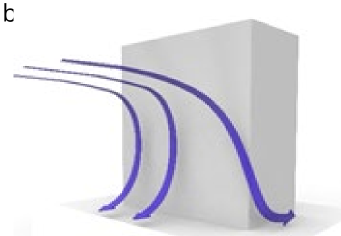


Image 5: Generalized Wind Flows

a) Wind Flow over Low Buildings

b) Downwashing and Corner Acceleration

5.2 Existing Scenario

The existing site is unoccupied and surrounded by suburban or rural neighbourhoods, comprised of low buildings and open fields. As such, there are no significant structures that would deflect ambient winds to ground to cause adverse wind impacts. Currently, wind conditions on sidewalks around the site are considered comfortable for standing in the summer and for strolling or walking in the winter.

Wind conditions exceeding the safety criterion are not expected.

5.3 Positive Building and Site Features

The proposed building, at 8 storeys, is taller than the surroundings and therefore, will be exposed to the prevailing winds. Downwashing and corner acceleration flows are predicted to result in increased wind activity around the building and nearby sidewalks with the highest speeds expected around the northwest corner of the proposed building.

Although the project will increase wind speeds in the immediate surroundings, several site and building features are favourable for reducing the potential for severe wind impacts. These features are:

- Chamfered and re-entrant northwest building corner;
- Partially enclosed daycare playground;
- Well-protected main entrances and the 2nd floor amenity space; and
- Landscaping and future surrounding buildings.

5.4 Predicted Wind Conditions

The following sections provide a discussion of the potential wind conditions around the project, taking the above-mentioned building and site features into account. The expected wind conditions are shown in Images 6a and 6b for the summer and winter seasons, respectively.

5.5 Wind Safety

At 8 storeys, the proposed building is taller than the existing buildings in the surrounding area. However, this height is considered low or moderate from a wind impact perspective. Therefore, wind conditions around the project are expected to meet the wind safety criterion.

5.6 Wind Comfort

5.6.1 Building Entrances

The main entrances to the retirement home and to the daycare are located at an inner building corner. These areas are sheltered by the proposed building from the prevailing winds (Location A in Images 6a and 6b). They are also protected by a large canopy and equipped with vestibules. As a result, suitable wind conditions are predicted for these entrances throughout the year.

There are several commercial entrances along the façade of the north wing of the proposed building (Location B). Wind conditions around these entrances are expected to be comfortable for sitting or standing in the summer (Image 6a) and for strolling in the winter (Image 6b). Considering the reduced lingering time for users around entrances in the colder months, these wind conditions are considered appropriate.

5.6.2 Terrace at 2nd Floor

There is an outdoor terrace at the 2nd floor, located at the same inner corner as the main entrances. Due to its location, low wind speeds comfortable for sitting or standing are expected on the terrace throughout the year.

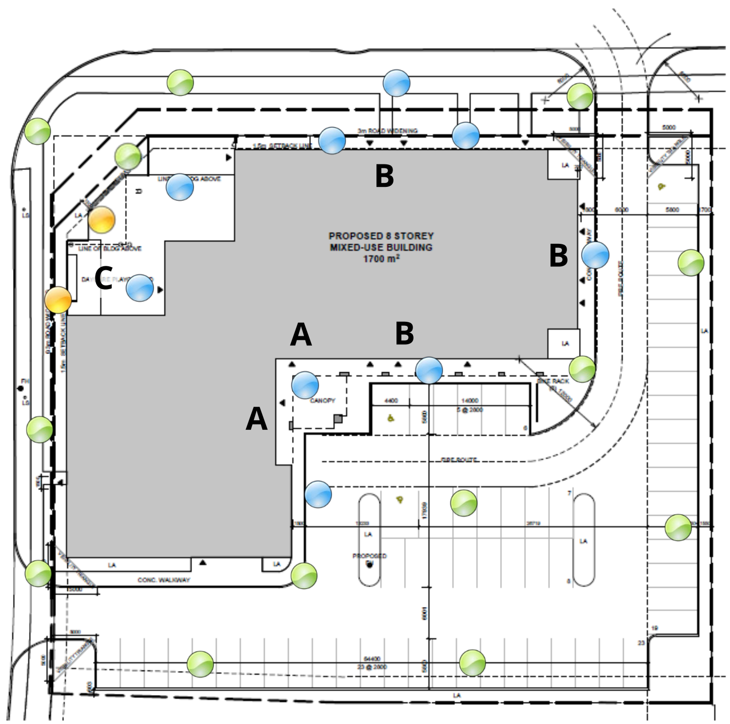
5.6.3 Sidewalks and Parking Spaces

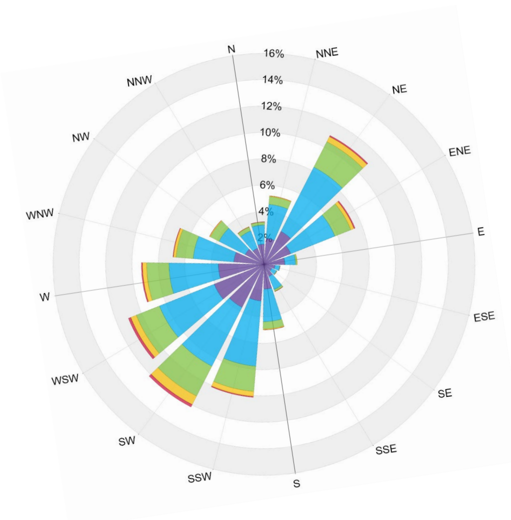
Pedestrians on sidewalks and users of parking spaces are typically active and higher wind speeds comfortable for strolling or walking are acceptable. This requirement is expected to be met at all sidewalk and parking areas for the project, as shown in Images 6a and 6b.

The proposed trees at the northwest building corner (Image 3b) are a positive feature for wind reduction. If feasible, coniferous or marcescent trees should be considered at this location. These types of trees are more effective for mitigating stronger winds during the winter months when they can be uncomfortable from time to time around the northwest corner.

5. RESULTS AND DISCUSSION

5.4 Proposed Scenario: Predicted Wind Conditions





WIND CATEGORIES

- Sitting / Standing
- Strolling
- Walking
- Uncomfortable

Image 6a: Predicted Wind Conditions - Summer

5.4 Proposed Scenario: Predicted Wind Conditions

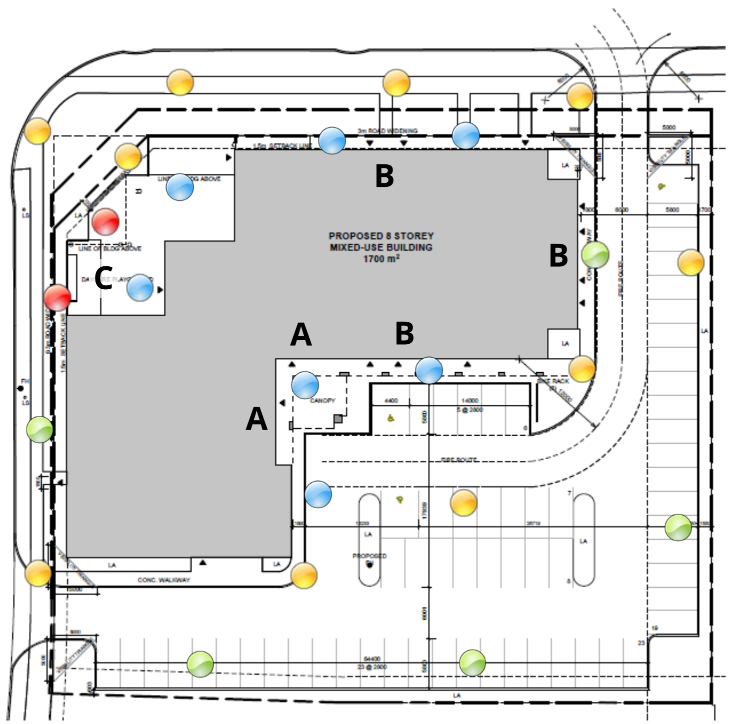
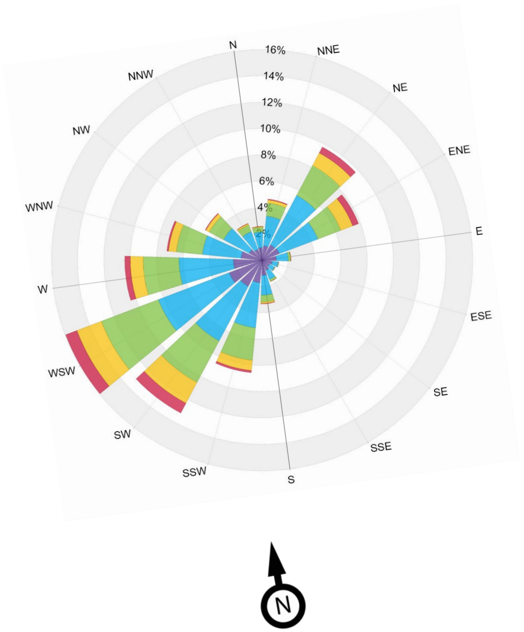


Image 6b: Predicted Wind Conditions - Winter



WIND CATEGORIES

- Sitting / Standing
- Strolling
- Walking
- Uncomfortable

5. RESULTS AND DISCUSSION

5.6 Proposed Scenario: Wind Comfort

5.6.4 Daycare Playground

As shown in Image 7, a daycare playground is planned at the grade level at the northwest corner of the proposed building (Location C in Images 6a and 6b). This building corner is re-entrant, recessed and partially sheltered by the proposed building and walls. However, the prevailing southwesterly winds may flow through the space, causing increased wind speeds on the west portion of the playground (Image 7), while relatively low wind speeds are expected on the east and north portions, as shown in Images 6a and 6b. In the winter, the west portion of the playground may experience uncomfortable wind conditions.

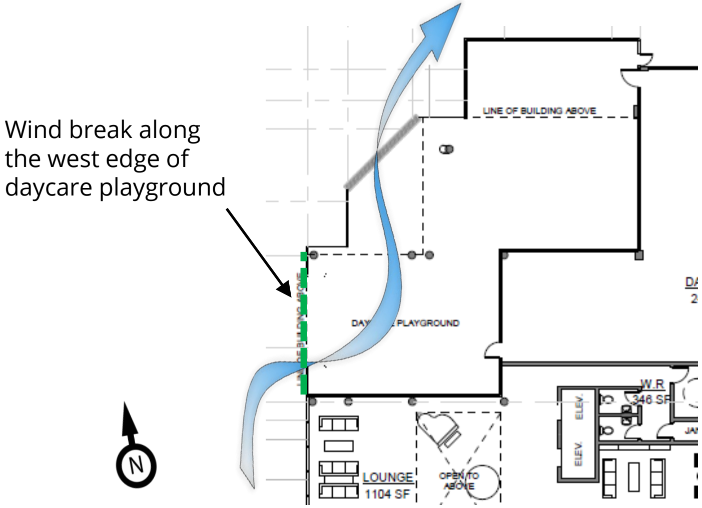


Image 7: Wind Flow through Playground and Wind Screen Recommended

If feasible, a wind break should be considered along the west edge of the playground. It may be operable, at least 70% solid and 2 m or taller. See Image 7 for its location and Image 8 for examples.

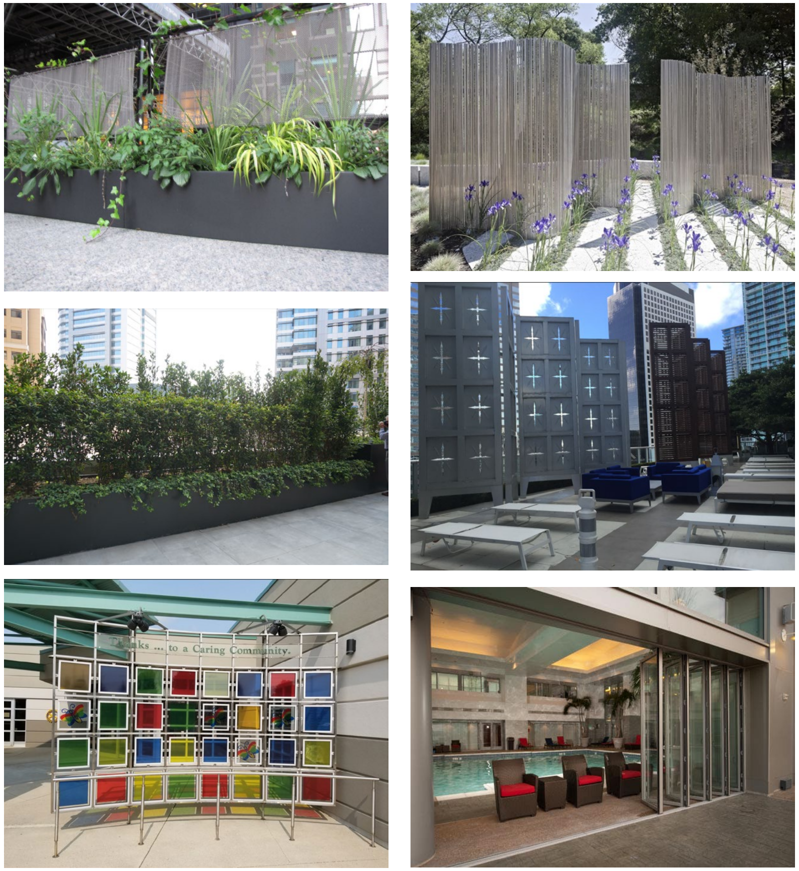


Image 8: Wind Break Examples

6. SUMMARY

RWDI was retained to provide an assessment of the potential pedestrian level wind impact of the proposed project at 1866 Rymal Road East in Hamilton, 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 flow around buildings.

Our findings are summarized as follows:

- The proposed building is taller than the existing surroundings but includes several wind-responsive features which will moderate the potential wind impacts.
- Wind conditions on and around the proposed project are not expected to exceed the recommended criterion for wind safety.
- In general, suitable wind conditions are expected for building entrances, sidewalks, parking spaces and the amenity terrace at the 2nd floor.
- The prevailing southwest winds may cause higher-than-desired wind speeds on the west portion of the daycare playground at the northwest building corner. A wind break is recommended along the west edge of the playground to improve the wind conditions to an appropriate level.

7. STATEMENT OF LIMITATIONS

Design Assumptions

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

File Name	File Type	Date Received (mm/dd/yyyy)
2126-1866RymalRdE_A1-1-SITE PLAN_2022.09.16	PDF	09/16/2022
2126-1866RymalRdE_Elevations_2022.09.16	PDF	09/16/2022
2126-1866RymalRdE_Plans_2022.09.16	PDF	09/16/2022

Changes to the Design or Environment

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.

Limitations

This report was prepared by Rowan Williams Davies & Irwin Inc. for Masri O Inc. Architects ("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.