8885 – 8911 LUNDY'S LANE

NIAGARA FALLS, ONTARIO

DESKTOP PEDESTRIAN WIND ASSESSMENT

PROJECT #2206394
JUNE 15, 2023

SUBMITTED TO

Linda Ford
M5V Inc.
linda@m5vinc.com

M5V Developments
3 Cultivar Road
Brampton, ON L6P 3M4

SUBMITTED BY

Hanqing Wu, Ph.D., P.Eng.
Senior Technical Director, Principal
Hanqing.Wu@rwdi.com

Rachel Skeoch, B.E., CAPM
Project Manager
Rachel.Skeoch@rwdi.com

RWDI AIR Inc.
600 Southgate Drive
Guelph, ON N1G 4P6
T: 519.823.1311 x2411
F: 519.823.1316

rwdi.com

1. INTRODUCTION

RWDI AIR Inc. (RWDI) was retained to conduct a qualitative assessment of the pedestrian wind conditions expected around the proposed project at 8885-8911 Lundy's Lane in Niagara Falls, Ontario. This effort is intended to inform good design and has been conducted in support of an Official Plan Amendment (OPA), Zoning By-law Amendment (ZBA) application for the project.

The project site is located at the northeast corner of the intersection of Lundy's Lane and Garner Road (Image 1). Located at the west end of the city, the site is surrounded by low buildings and open lands in all directions.

The project consists of a 10-storey residential and commercial building with parking and amenity spaces, as shown in Images 2 and 3. The building is approximately 34 m tall with tower setbacks at various levels.

Potential pedestrian areas of interest to the current wind assessment include public sidewalks along Lundy's Lane and Garner Road, walkways on site, building entrances, parking spaces at grade and amenity areas at and above grade (Images 2 and 3).

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

Image 2: Concept Landscaping Plan

1. INTRODUCTION

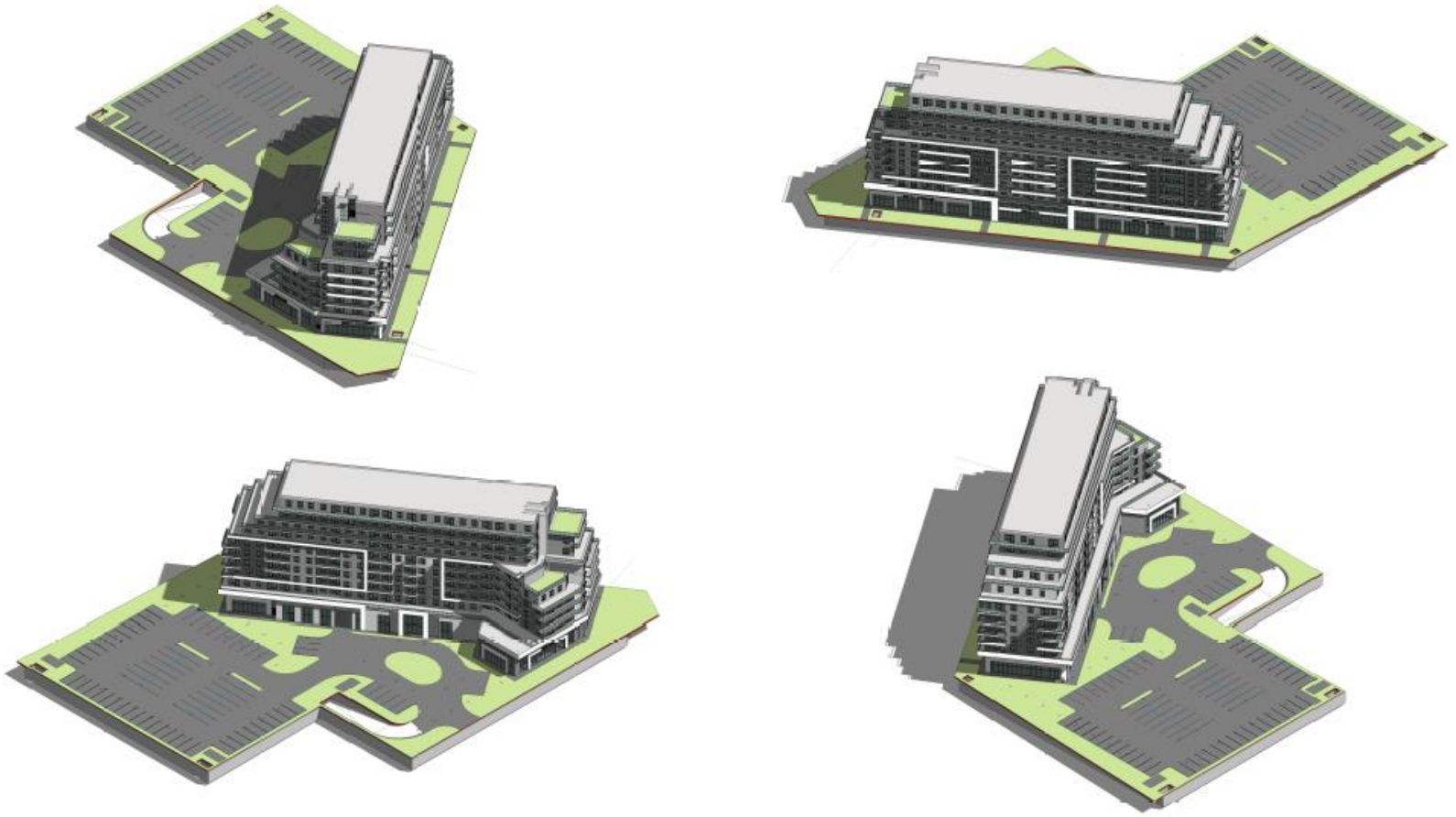


Image 3: 3D Massing Views

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 and information received from M5V Inc. on May 29, 2023;
- A review of the regional long-term meteorological data from the nearby Niagara Falls International Airport in Niagara Falls, NY;
- 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 Niagara Falls 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, 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

Wind data from Niagara Falls International Airport at Niagara Falls, NY for the period from 1992 to 2021 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 quadrant are predominant throughout the year, with secondary winds from the northeast and northwest.

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 southwesterly and westerly directions potentially could be the source of uncomfortable or severe wind conditions, depending upon the site exposure and development design.

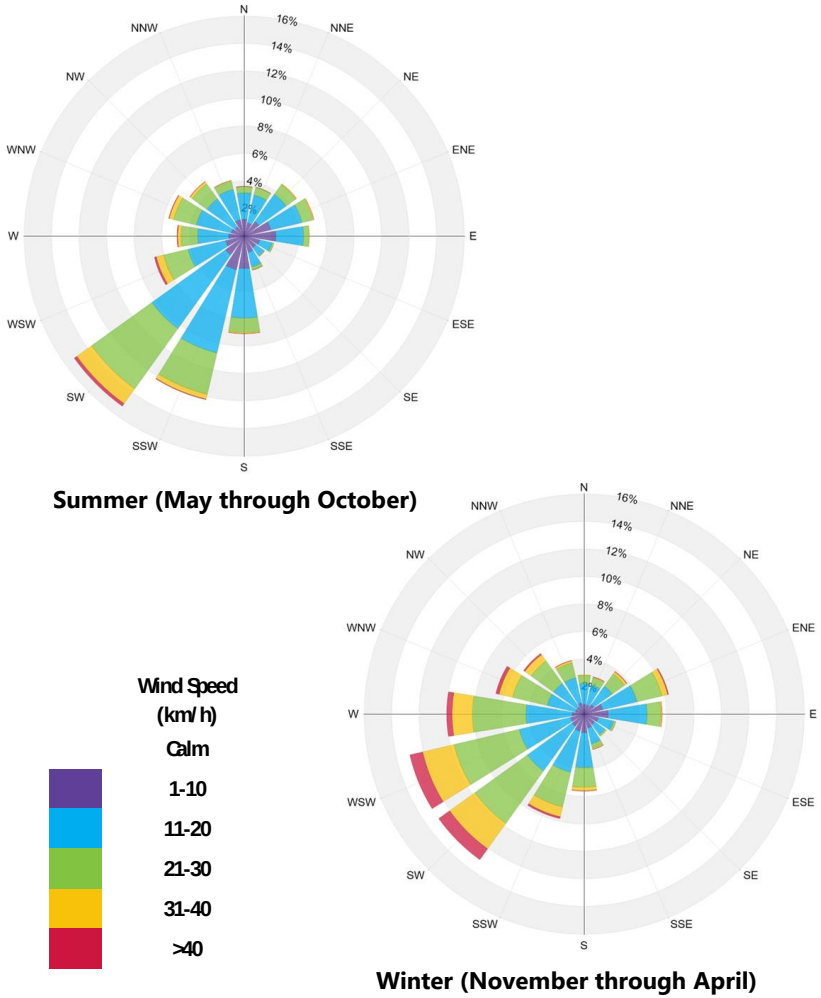


Image 4: Directional Distribution of Winds Approaching Niagara Falls International Airport (1992 to 2021)

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.

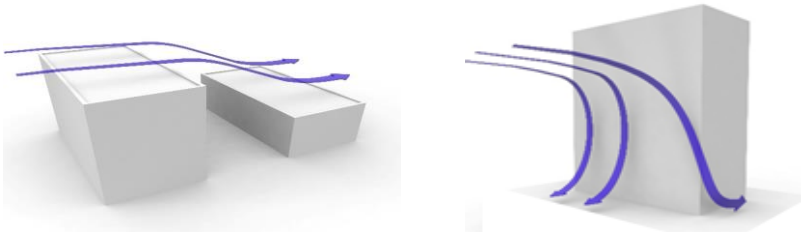
For the current development, wind speeds comfortable for walking or strolling are appropriate for sidewalks, walkways and parking spaces; lower wind speeds comfortable for standing are required for building entrances where pedestrians may linger, and calm wind speeds suitable for sitting or standing are desired for outdoor amenity spaces during the summer when these areas are typically in use.

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 that are taller than surroundings tend to intercept the stronger winds at higher elevations and redirect them to the lower levels (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.

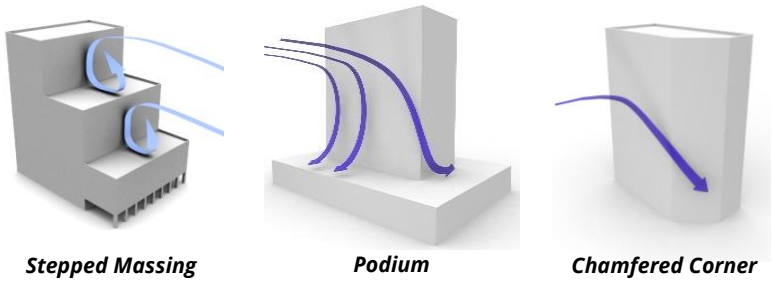
Design details such as stepped massing, tower step-back from a podium edge, deep canopies close to ground level, wind screens / tall trees with dense underplanting, etc. (Image 6) can help reduce wind speeds. The choice and effectiveness of these measures would depend on the exposure and orientation of the site with respect to the prevailing wind directions and the size and massing of the proposed buildings.



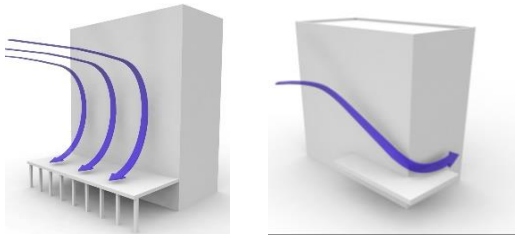
a) Wind Flow over Low Buildings

b) Downwashing and Corner Acceleration

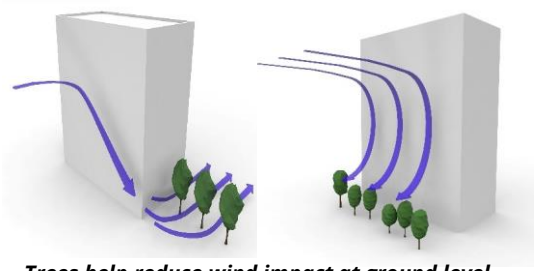
Image 5: Generalized Wind Flows



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



Canopy



Trees help reduce wind impact at ground level

Image 6: Examples of Common Wind Control Measures

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5.2 Existing Scenario

The existing site is unoccupied and surrounded by suburban or rural neighbourhoods, comprising 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 comfortable for standing in the summer and for strolling in the winter.

Wind conditions exceeding the safety criterion are not expected in the existing scenario.

5.3 Proposed Wind Control Features

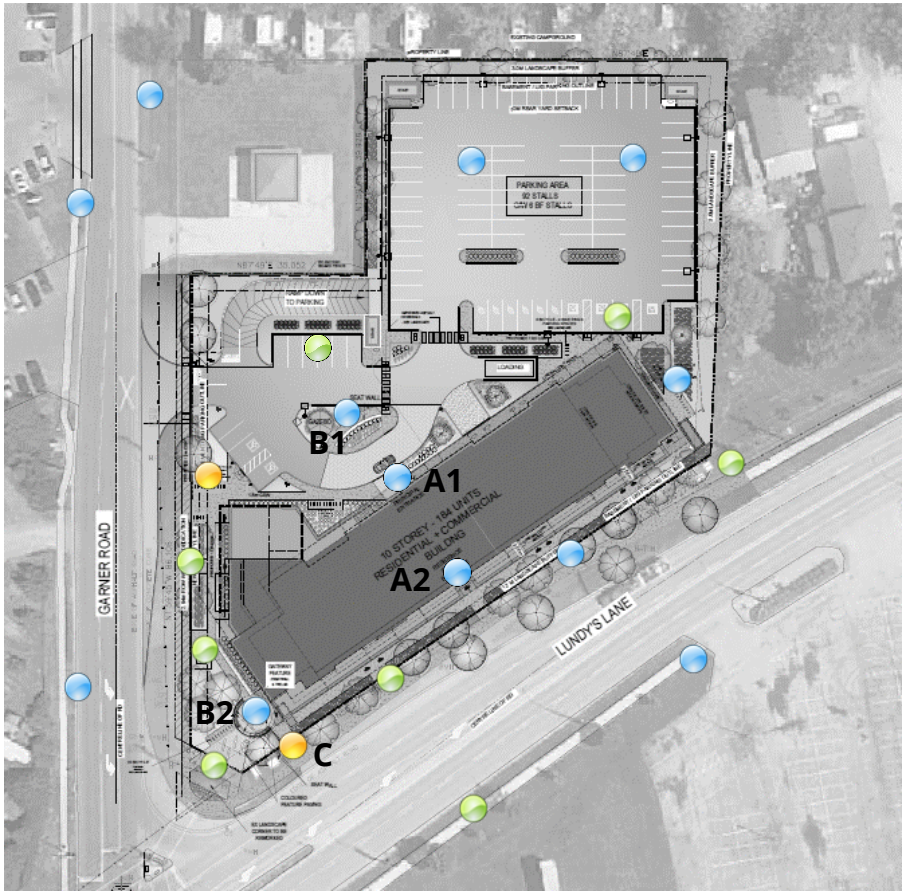
The proposed building, at 10 storeys, is considerably taller than the surroundings and, therefore, will be exposed to the winds from all directions. Strong downwashing and corner accelerating flows are predicted to result in increased wind activity around the building and on nearby sidewalks and other pedestrian areas with the highest speeds expected around the exposed southwest building corners.

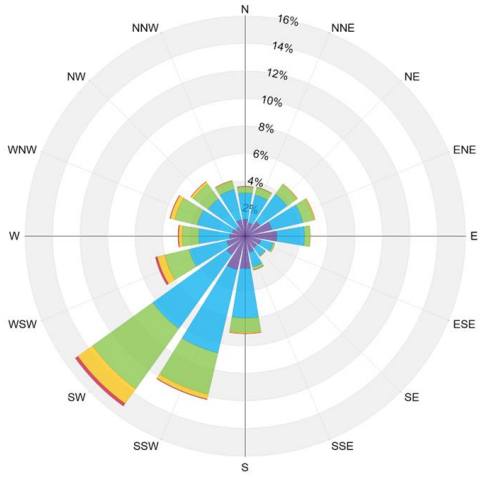
Although the project will increase wind speeds in the immediate surroundings, several features of the building and landscaping design are favourable towards reducing the potential for significant wind impacts. These features include:

- the alignment of the proposed building with the prevailing southwest winds, reducing the potential wind exposure (Images 2 through 4);
- tower setbacks along all four sides of the building at various levels (Image 3);
- the low podium steps along Garner Road, providing sheltering for the main entrance area from the prevailing southwest winds;
- recessed residential entrances and vestibules; and,
- proposed landscaping, including trees, trellises/gazebos and seat walls.

The following sections provide a discussion of the potential wind conditions around the project, taking these features into account. The expected wind conditions at grade are shown in Images 7a and 7b for the summer and winter seasons, respectively.

5.4 Proposed Scenario: Predicted Wind Conditions



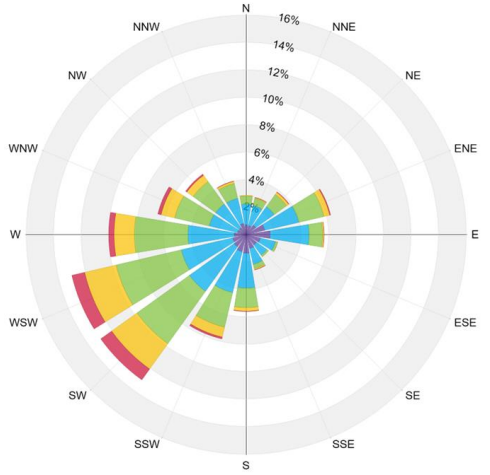


WIND CATEGORIES

- Sitting / Standing
- Strolling
- Walking
- Uncomfortable

Image 7a: Predicted Wind Conditions - Summer

5.4 Proposed Scenario: Predicted Wind Conditions



WIND CATEGORIES

- Sitting / Standing
- Strolling
- Walking
- Uncomfortable

Image 7b: Predicted Wind Conditions - Winter

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5.5 Proposed Scenario: Wind Safety

At 10 storeys, the proposed building is taller than the existing surroundings. The height is, however, considered moderate or low from a wind impact perspective. Given the proposed positive features for wind control as listed in Section 5.3, wind conditions on and around the project are expected to meet the wind safety criterion in general.

5.6 Proposed Scenario: Wind Comfort

5.6.1 Entrances

Both residential entrances are located at the middle of the building facades that are parallel with the prevailing southwest winds (Locations A1 and A2 in Images 7a and 7b). They are recessed from the main façades and designed with vestibules. As a result, suitable wind conditions that are comfortable for sitting or standing are predicted in both the summer and winter seasons (Images 7a and 7b).

Slightly higher wind speeds are expected for commercial entrances that are close to building corners along Lundy's Lane, but they are generally suitable for the intended use throughout the year.

5.6.2 Seating Areas

There are two seating areas identified around the proposed building, one to the northwest of the building (B1) and the other to the immediate southwest (B2). Area B1 includes a gazebo and a seat wall plus landscaping, while Area B2 is designed with a trellis and two seat walls and surrounded by large trees.

These features are positive for wind control. Suitable wind conditions are expected in these areas during the summer (Image 7a), but wind speeds that are higher than desired for passive activities may occur in the winter (Image 7b). This may not be a concern due to reduced outdoor activities in the colder months in this region.

If lower wind speeds or extended uses of the seating areas are desired, larger trellises/gazebos may be considered together with coniferous trees and planters – see Image 8 for examples.

5.6.3 Sidewalks, Walkways and Parking Areas

On sidewalks and walkways as well as parking areas for both vehicles and bicycles, users will be active and can tolerate relatively high wind speeds that are comfortable for walking or strolling. This requirement is expected to be met at all pedestrian areas on and around the site (Images 7a and 7b).

The only exception is the southwest corner of the proposed building in the winter when uncomfortable wind conditions may occur on the adjacent sidewalk (Location C in Image 7b). The proposed and potentially enhanced trellis and landscaping around the seating area B2 will reduce the wind speeds around the corner (Location C). If feasible, a large corner canopy and local wind screens can also be considered for wind control – see examples in Image 8.

5. RESULTS AND DISCUSSION

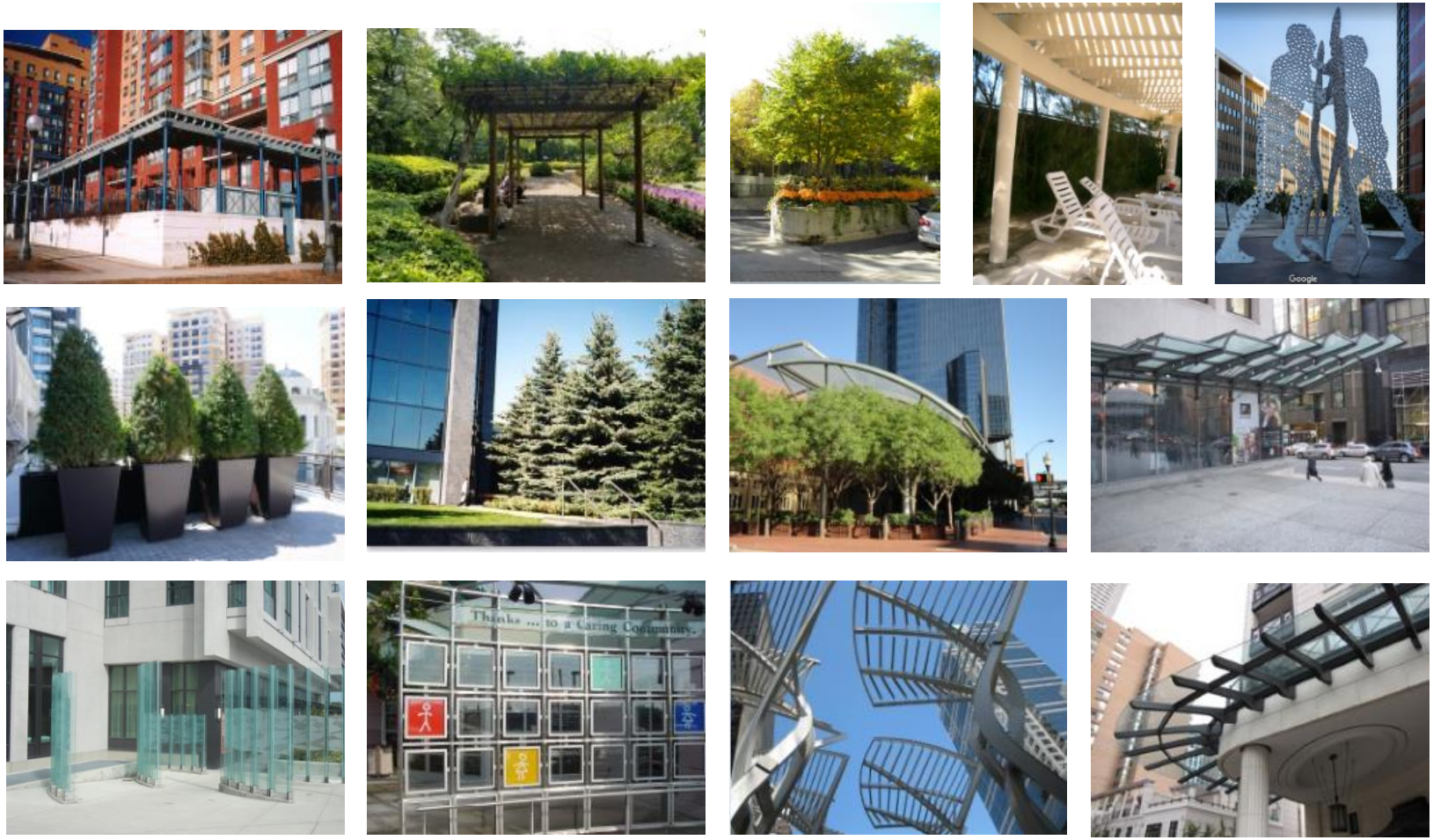

Image 8: Examples of Wind Control Measures for Two Seating Areas and Southwest Building Corner

5.6.4 Above-ground Amenity Terraces

The proposed podiums and tower setbacks are positive design features to reduce the wind activity at grade. However, the downwashing wind will land on these areas, resulting in wind speeds that are higher than desired for the passive use of outdoor terraces.

Image 3 and the current floor plans indicate large outdoor terraces with guardrails at the 6th and 9th floors. Due to the increased elevations and exposure, higher-than-desired wind speeds are predicted in the summer for these areas, especially along the terrace edges and around tower corners. Wind control measures typically include taller guardrails, planters, screens, trellises and so on, as shown in Image 9.

In the winter, conditions are predicted to be too windy for outdoor use in general. These conditions may be acceptable as these areas are not expected to be used for passive activities in the cold months.

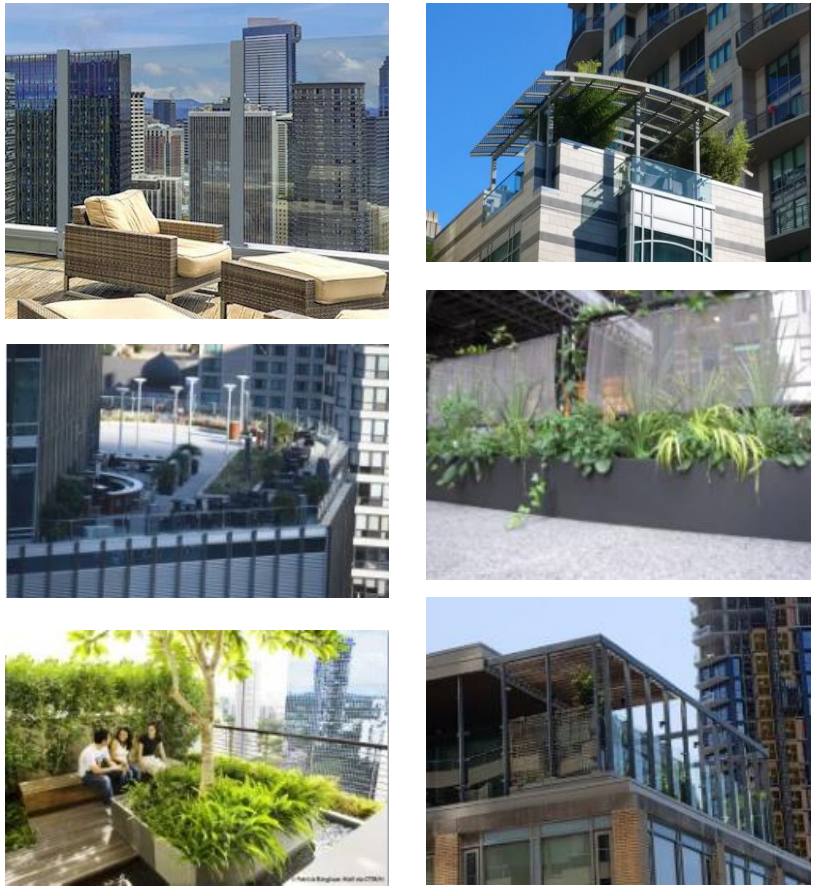

Image 9: Examples of Wind Control Features on Podium Terraces

6. SUMMARY

RWDI was retained to provide an assessment of the potential pedestrian level wind impact of the proposed project 8885-8911 Lundy's Lane in Niagara Falls, Ontario. Our assessment was based on the local wind climate, the current design of the proposed development, the existing surrounding buildings, RWDI's 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 and, therefore, will cause an increase in wind speeds around the building.
- The building design incorporated several wind-responsive features, such as the alignment of the building with the prevailing southwest winds, podiums and tower setbacks as well as landscaping. They will moderate the potential wind impacts on and around the project.
- In general wind conditions at entrances and on sidewalks and other public areas on and around the proposed buildings are expected to be comfortable for the intended use throughout the year. Suitable wind conditions are also expected around the seating areas at grade.
- Uncomfortable wind conditions may occur around the southwest corner of the building in the winter. Higher-than-desired wind speeds are also predicted on above-ground terraces. Conceptual wind control measures and examples have been provided for wind reduction.
- If desired, further wind study can be conducted using wind-tunnel testing or computer simulation at a later design stage to quantify these wind conditions and to determine the need and extent of wind control solutions.

7. STATEMENT OF LIMITATIONS

Design Assumptions

The findings/recommendations in this report are based on the building geometry and architectural drawings communicated to RWDI 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)
A-100r1.4 (Lundy's Lane - Site Plan) - 23-05-25 DRAFT	PDF	05/29/2023
A200 - A207 - BASEMENT - 10th FLoor - Progress Set 23-05-25 - ADDED NOTES	PDF	05/29/2023
L-100r1 (Lundy's Lane - LANDSCAPE PLAN) - 23-05-25 DRAFT	PDF	05/29/2023
8885 & 8911 Lundy's Lane - Pre-Con Checklist	PDF	05/29/2023

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 RWDI AIR Inc. for M5V Inc. (“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.